EPCC Contractor :	HENGAM FERTILIZER PROJECT		Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit			
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01		

COVER SHEET OF

CAUSE AND EFFECT DIAGRAMS

FOR

UREA SYNTHESIS UNIT

TOTAL PAGES : **41**

DE	EXT	AFC	A
Eng. Phase	**Purpose Of Distribution (POD)**	**Purpose Of Issue (POI)**	**Owner's Action**

01	17.07.2023	APPROVED FOR CONSTRUCTION	M.Fakhraei	A.Azma	A.Azma	M.R.Saremi
00	01.11.2017	ISSUED FOR ENGINEERING	M.Yazdanpanahi	A.Azma	A.Azma	M.R.Saremi
Rev.	**Date**	**Description**	**Prepared by**	**Checked by**	**Approved by**	**Project**

EPCC Contractor :	HENGAM FERTILIZER PROJECT		Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit			
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01		

Sheet No.	Internal Issue	Change Index During Formal Issues						Reason of Latest Change
		First Issue	Second Issue	Third Issue	Fourth Issue	Fifth Issue	Sixth Issue	
	Rev. 0A	Rev.00	Rev.01	Rev.02	Rev.03	Rev.04	Rev.05	
1		✓	✓					Detail engineering modification
2		✓	✓					
3		✓	✓					
4		✓						
5		✓						
6		✓	✓					
7		✓	✓					
8		✓	✓					
9		✓	✓					
10		✓	✓					
11		✓	✓					
12		✓	✓					
13		✓	✓					
14		✓	✓					
15		✓						
16		✓						
17		✓	✓					
18		✓						
19		✓	✓					
20		✓						
21		✓	✓					
22		✓						
23		✓						
24		✓						
25		✓						
26		✓	✓					
27		✓						
28		✓	✓					
29		✓	✓					
30		✓						
31		✓						
32		✓	✓					
33		✓						
34		✓	✓					
35		✓	✓					
36		✓	✓					
37		✓	✓					
38		✓						
39		✓						
40		✓						
41		✓	✓					

1- GENERAL NOTES:

1-1 This specification gives the general criteria for the design of the Urea Unit Trip & Interlock Logic System. The interlock system shall be designed in accordance with a fail-safe criteria in order to provide plant or equipment protection in case of system failure or power supply failure.

1-2 Shutdown resetting shall normally be possible by manual means only. Reset push-button is to be provided on DCS. Reset will be possible only after concerned variables are within normal limits. Normal limits shall be confirmed automatically by system itself. After the shutdown acknowledgement, green light will indicate that reset is possible and light be off when reset has been actuated.

1-3 When a device to bypass shutdown causes in the system is provided (Process Override Switch - POS), it shall be on hardwired console and a warning indication (red light) will be displayed on hardwired console and DCS video when the bypass is actuated. An independent key to actuate the bypass shall be provided. When an Hand Switch Forced (HSF) or an Enable Switch are provided they will be on DCS (software only).

1-4 All shutdown causes must be alarmed with red light and horn on DCS only. The alarm contacts shall be closed during normal plant operation.

1-5 The emergency push-button for plant shutdown shall be protected by cover cap from accidental operation and located on hardwired console. No exceptions are allowed.

1-6 All emergency push-buttons shall be located on hardwired console. No exemptions are allowed.

1-7 Individual alarm of interlock actuated will be shown on dedicated Interlock graphic page. If the shutdown system have two or more trip out devices, they shall be provided with a "first-out" sequence to identify the trip-out device which actuated first. For each 2oo3 ("two out of three") logic in case of activation, the first out of the transmitter shall be displayed.

1-8 For each logic a graphic page on DCS shall be provided. These pages shall show all the trip causes and all the interlock actions as per diagrams included in this document.

1-9 All DCS stop push button or physical push button, shall be always active regardless the position of local remote selector (if any).

1-10 For all the machineries trip & interlock logics, refer also to the MFR documentation (where available and applicable, during Detailed Engineering phase by engineering Contractor).

1-11 All motors are provided with dedicated stop function on DCS system. 01

1-12 Some interlocks that stop pumps / closed valves have been deleted from cause and effect diagram because each of pumps / valves stop / close command device already are existed in graphic display face plate. It means all pumps can be stopped from DCS and all control valves and on / off valves also can be opened / closed from DCS by operator. There is no need to introduce separate interlocks for these commands.

1-13 Motor start by faceplate will be possible for all motors having remote start capability.

2- LOGIC SEQUENCE FLOW DIAGRAM

The flow diagrams listed herebelow describe the Trip and the Interlock provision required by process.
They have to be integrated with the requirements of the machineries or package units, which have been summarized as "internal trip".

3-TRIP LIST: (please make reference also to Urea Unit Trip and Interlock Logic Diagrams, doc. n. ZA-E-06075)

IS-1101	Trip of CO2 Compressor and CO2 Compressor Steam Turbine (Typical, only for reference)
IS-1102	Trip of High Pressure Synthesis Loop
IS-1103	High Pressure Ammonia Pumps (P-101 A/B) Trip
IS-1104	High Pressure Carbamate Pumps (P-102 A/B) Trip
IS-1105	Hydrolyzer Feed Pumps (P-115 A/B) Trip
IS-1106	Instrument air, Cooling Water and Emergency Shutdown
IS-1107	Stripper Steam Condensate Separator very low Level (V-109) & Stripper (E-101) shell side very high Temperature
IS-1108	Superheated MS Steam to E-102B very high temperature
IS-1109	Close Drain Recovery Pumps (P-116 A/B) Start/Stop and Trip
IS-1110	Hydrolyzer (R-102) very high temperature
IS-1111	Ammonia Booster Pumps (P-105 A/B) Trip
IS-1112	Stripper Passivation Air Compressors (C-102 A/B) Trip
IS-1113	Closed Circuit Demineralized Water Pumps (P-170 A/B) Trip
IS-1114	Permissive to open HV-1005 (on CO2 line to Reactor R-101)
IS-1115	HP Flushing Pumps (P-111A/B) Trip
IS-1116	Urea Solution Recovery pumps (P-109A/B) Trip
IS-1117	Process Condensate Recovery Pumps (P-114 A/B) Trip
IS-1118	Process Off-Spec Recovery Pumps (P-125 A/B) Trip
IS-1119	Nitrogen injection to TK-125
IS-1120	Nitrogen injection to TK-101
IS-1121	Nitrogen injection to TK-102
IS-1122	Nitrogen injection to TK-104
IS-1123	Urea Solution Pumps (P-106A/B) Trip
IS-1124	Granulation Feed Pumps (P-108A/B) Trip
IS-1125	M.P. Carbonate Pumps (P-103 A/B) Trip

IS-1126	Steam Condensate Pumps (P-113 A/B) Trip
IS-1127	Process Condensate Pumps (P-120 A/B) Trip
IS-1128	Ammonia Solution Pumps (P-107 A/B) Trip
IS-1129	MP Inerts Washing Tower gas outlet diverted to Continuous Flare FL-112
IS-1130	Steam Condensate Flushing Pumps (P-110A/B) Trip

4-DCS INTERLOCK LOGIC LIST: (please make reference also to Urea Unit Trip and Interlock Logic Diagrams, doc. n. ZA-E-06075)

I-1101	Medium Pressure and Low Pressure Decomposer Level Control Valves closing
I-1102	High Temperature on MLS Steam header
I-1103	Closed Circuit Demineralized Water Pumps (P-170 A/B) Autostart
I-1104	Automatic damping of Process Condensate from PCT Section
I-1105	Steam condensate Flushing pumps (P-110A/B) Autostart
I-1106	Close Drain Recovery Pumps (P-116 A/B) start/stop

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1101 CO2 COMPRESSOR and CO2 COMPRESSOR STEAM TURBINE (Typical, Only for reference) (1)

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	XS-1013		(1)	Internal machine Trip of C-101 (CO2 Compressor)	X	X											1	Trip command to compressor -(XS-1016)	**11-CT-101**			
2	IS-1106			Urea Unit - Emergency Shut Down	X	X											2	CO2 feed to reactor valve HV-1005 close	**11-HV-1005**	053	(2) (3)	01
3	PSLL-1594A/B/C	011	2oo3	C-101 1st stage suction low low pressure	X	X																01
4	PSLL-1595 A/B/C	011	2oo3	C-101 4th stage discharge low low pressure (5)	X	X																01
5	PSHH-1595 A/B/C	011	2oo3	C-101 4th stage discharge high high pressure	X	X																01
																						01

NOTES:
1- Refer to CO2 compressor vendor cause and effect diagram DOC.Number: "VD-1208-301B-DIG-457"
2-Forcing the relevant controller (HIC-1005) to zero output, in order to avoid undesired opening of the valve during the logic reset. When the logic is resetted, the bypass shall switch OFF automatically.
3- A by-pass HSF-1005 has been provided in order to operate this valve even in presence of shut-down events for washing purposes. It is any way clarified that even if the by-pass is actuated, in order to allow manual operation on the valve, the new possible incoming interlock of resetted logic shall close the valve. Moreover when the bypass is not actuated (automatic operation) manual control on HV-1005 shall be active. When IS-1101 is actuated HIC-1005 is forced to close the valve (zero signal), in order to avoid that during the logic reset the valve will open.
4- Logic reset push button shall be provided for IS-1101
5- One switch on HW3 (PSLL-1595-POS) has been considered for override the PSLL-1595 in start up. 01

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1102 (Trip of High Pressure Synthesis Loop)

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**IS-1106**			Urea Unit - Emergency Shut down	X	X	X	X	X	X	X	X					1	IS-1103 (H.P. Ammonia Pumps (P-101 A/B) Trip)	**11-P-101 A/B**	051		
2	**IS-1107**	054/075		Stripper steam condensate separator (V-109) low low level & stripper (E-101) shell side high high temperature	X	X	X	X	X	X	X	X					2	IS-1112 (Stripper Passivation Air Compressor (C-102 A/B) Trip)	**11-C-102 A/B**	054		01
3	**PSHH-1018 A/B/C**	053	2oo3	high high pressure at Urea Reactor (11-R-101) Bottom	X	X	X	X	X	X	X	X					3	11-XV-1008 -close (carbamate sol. To carbamat ejector)	**11-XV-1008**	056	(2)	
4	**XP-101A/B-M-RE**	051	(1)	Simultaneous not running of HP Ammonia Pumps11-P-101A/B (EL-PM-101A/B)	X	X	X	X	X	X	X	X					4	11-XV-1010 - close (Ammonia to carbamat ejector)	**11-XV-1010**	056	(3)	
																	5	(P-102 A/B) minimum flow recycle control valves open	**11-FV-1005A/B**	052	(4)	
																	6	FV-1041 close (carbamat to E-105 A)	**11-FV-1041**	055	(5)	
																	7	HV-1005 closed (CO2 to R-101)	**11-HV-1005**	053	(6)	
																	8	PV-1017 Open (CO2 to silencer)	**11-PV-1017**	053	(7)	

NOTES: 1-By-pass, HSF-PM-101A/B, has to be provided to allow the start-up of P-101A/B. This bypass must be automatically switched off when one of the pumps is started-up and is running with a time delay adjustable in the range 0-5s.

2-Carbamate solution to Carbamate Ejector (L-101) shut-off valve XV-1008 shall get closed (signal to solenoid valve). A Hand Switch forced HSF-1008 is provided in order to operate this valve even in presence of shut-down events, for washing purpose, with the logic not resetted. It is anyway clarified that even if the bypass (HSF-1008) is actuated (to allow manual operation of the valve or because forgotten) the new possible incoming Interlock of resetted logic shall close the valve. It has to be clarified that, when the logic has been resetted the valve must remain closed; therefore an enable open/close pushbutton XHS-1008 (by operator's decision only) shall be provided for the XV-1008 valve (the valve can be opened only when there is NH3 flowing to the Carbamate Ejector (L-101) and the Urea Reactor is ready to receive carbamate solution).
Moreover when the enable button is not actuated (automatic operation) manual control on XV-1008 is not active: it means that the enable is necessary to operate the valve. This is to be sure that the action is an operator decision. It is pointed out that in case the logic is not actuated the by-pass is not necessary to operate the valve.

3- Close action shall be with an adjustable delay of 0-45s, to avoid problems at pumps during P-101A/B shutdown. A Hand Switch forced HSF-1010 is provided in order to operate this valve even in presence of shut-down events, for washing purpose, with the logic not resetted. When the logic is resetted, the bypass shall switch OFF automatically. It is anyway clarified that even if the bypass (HSF-1010) is actuated (to allow manual operation of the valve or because forgotten) the new possible incoming Interlock of resetted logic shall close the valve. It has to be clarified also that, when the logic has been resetted the valve must remain closed because the opening of the valve must be an operator's decision; therefore an enable open/close pushbutton XHS-1010 shall be provided for the valve.
Moreover when the enable button is not actuated (automatic operation) manual control on XV-1010 is not active: it means that the enable is necessary to operate the valve. This is to be sure that the action is an operator decision.

4-HP Carbamate Pumps (P-102 A/B) minimum flow recycle control valves (FV-1005A if P-102A is running and FV-1005B if P-102B is running) shall get opened (signal to solenoid valve) and relevant controller (FIC-1005A if P-102A is running and FIC-1005B if P-102B is running) forced in manual mode at 100% output.

5-Control valve FV-1041 (signal to solenoid valve) shall get closed with a delay of 0-30 s (adjustable) to avoid problems at P-102 A/B pumps. When I-1102 is actuated, FIC-1041 is forced to close the valve (zero output) in order to avoid that during the logic reset the valve will open. The Hand Switch forced HSF-1041 has been provided in order to operate FV-1041 even in presence of shut-down events for washing purposes with the logic not resetted. When the logic is resetted, the bypass shall switch OFF automatically. It is anyway clarified that even if the by-pass (HSF-1041) is actuated (in order to allow manual operation of the valves or because forgotten) the new possible incoming interlock of resetted logic shall close the valve FV-1041. Moreover when the by-pass is not active manual control on FV-1041 shall be active (valve is normally controlled by FIC-1041).

6-CO2 feed to Urea Reactor valve HV-1005 shall get closed with a ramp after a delay adjustable in the range 0-120s to prevent problems at C-101 which can lead to its trip. A bypass HSF-1005 shall be provided in order to operate this valve even in presence of shutdown events for washing purposes. When the logic is resetted, the bypass shall switch OFF automatically. When IS-1102 is actuated HIC-1005 is forced to zero output in order to avoid opening of valve during the logic reset. It is anyway clarified that even if the by-pass (HSF) is actuated (in order to allow manual operation of the valves or because forgotten) the new possible incoming interlock of resetted logic shall close the valve HV-1005.

7-A signal is sent to PIC-1017: the CO2 feed vent valve PV-1017 on 4th stage discharge of CO2 compressor shall be opened as fast as possible till a prefixed value (20% opening adjustable) and put in automatic mode. 01

8-Logic Reset push button shall be provided for IS-1102 logic.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1103 High Pressure Ammonia Pumps (P-101 A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**IS-10116A**		(1)	Internal Trip of P-101A	X		X										1	PM-101 A trip	**PM-101 A**	051		
2	**IS-1102**			High Pressure Synthesis Loop Trip	X	X	X	X									2	PM-101 B trip	**PM-101 B**	051		
3	**HS-1103A**	051		Manual Trip push-button	X		X										3	XV-1044 close	**XV-1044**	051	(4)(7)	
4	**ISLL-101A-P**	051	(2)	low low current absorption at motor PM-101A/B	X		X										4	XV-1045 close	**XV-1045**	051	(5)(7)	
5	**PSLL-1002A /B**	051	2oo2	low low pressure at P-101A/B pump suction	X	X	X	X														
6	**XP-105A-M-RE and XP-105B-M-RE**	059	2oo2	Simultaneous not running of both P-105 A/B Ammonia Booster Pumps	X	X	X	X														
7	**IS-10116B**		(1)	Internal Trip of P-101B		X		X														
8	**HS-1103B**			Manual Trip push-button		X		X														
9	**ISLL-101B-P**		(2)	low low current absorption at motor PM-101B		X		X														

NOTES: 1- Refer to Roodhart cause and sffect document number:VD-1208-307A-DIG-131. 01

2- With a time delay (in normal running) in the range 0-5sec in order to avoid false trip due to possible current variation (time set delay to be adjustable), see note3;

3-When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).

4-If P-101A is not running, signal from IS-1103 is sent so that isolation valve XV-1044 shall automatically get closed. A hand switch forced (HSF-1044) is provided for washing/purging purpose. When the logic IS-1103 is resetted, the bypass (HSF-1044) shall switch OFF automatically. It is anyway clarified that even if the bypass (HSF-1044) is actuated (to allow manual operation on the valve or because forgotten), the new possible incoming interlock IS-1103 of resetted logic shall close the valve XV-1044. It has to be clarified also that, when the logic IS-1103 has been resetted the valve XV-1044 must remain closed because the opening of the valve must be an operator's decision; therefore an enable open/close pushbutton shall be provided for the valve. Moreover when the enable button is not actuated (automatic operation) manual control on valve through HSF-1044 is not active: it means that the enable is necessary to operate the valve. This is to be sure that the action is an operator decision.

5-If P-101B is not running, signal from IS-1103 is sent so that isolation valve XV-1045 shall automatically get closed. A hand switch forced (HSF-1045) is provided for washing/purging purpose. When the logic IS-1103 is resetted, the bypass HSF-1045 shall switch OFF automatically. It is anyway clarified that even if the bypass HSF-1045 is actuated (to allow manual operation on the valve or because forgotten), the new possible incoming interlock IS-1103 of resetted logic shall close the valve XV-1045. It has to be clarified also that, when the logic IS-1103 has been resetted the valve XV-1045 must remain closed because the opening of the valve must be an operator's decision; therefore an enable open/close pushbutton shall be provided for the valve. Moreover when the enable button is not actuated (automatic operation) manual control on valve through HSF-1045 is not active: it means that the enable is necessary to operate the valve. This is to be sure that the action is an operator decision.

6-Logic Reset push button shall be provided for IS-1103 logic.

7-Effects are not simultaneous. The XV-1044/XV-1045 valve closure is allowed only after pump stop: the back signal of NOT running status from pumps close the valve after a delay time adjustable.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1104 High Pressure Carbamate Pumps (P-102 A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**IS-10216A**		(1)	Internal Trip of P-102A	X		X										1	PM-102 A trip	**PM-102 A**	052		
2	**IS-1106**			Urea Unit Emergency Shut down	X	X	X	X									2	PM-102 B trip	**PM-102 B**	052		
3	**HS-1104A**	052		Manual Trip push-button	X		X										3	XV-1048 close	**XV-1048**	052	(4) (7)	01
4	**ISLL-102A-P**	052	(2)	low low current absorption at motor PM-102A	X		X										4	XV-1049 close	**XV-1049**	052	(5) (7)	01
5	**IS-10216B**		(1)	Internal Trip of P-102B		X		X														01
6	**HS-1104B**	052		Manual Trip push-button		X		X														01
7	**ISLL-102B-P**	052	(2)	low low current absorption at motor PM-102B		X		X														01

NOTES:
1- Refer to Roodhart cause and sffect document number:VD-1208-307A-DIG-231. 01

2-With a time delay (in normal running) in the range 0-5 sec, timer set to be adjustable (see note 3)

3-When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).

4-If P-102A is not running, signal from IS-1104 is sent so that isolation valve XV-1048 shall automatically get closed. A hand switch forced (HSF-1048) is provided for washing purpose. When the logic IS-1104 is resetted, the bypass HSF-1048 shall switch OFF automatically. It is anyway clarified that even if the bypass HSF-1048 is actuated (to allow manual operation on the valve or because forgotten), the new possible incoming interlock IS-1104 of resetted logic shall close the valve XV-1048. It has to be clarified also that, when the logic IS-1104 has been resetted the valve XV-1048 must remain closed because the opening of the valve must be an operator's decision; therefore an enable open/close pushbutton shall be provided for the valve.
Moreover when the enable button is not actuated (automatic operation) manual control on valve through HSF-1048 is not active: it means that the enable is necessary to operate the valve. This is to be sure that the action is an operator decision.

5-If P-102B is not running, signal from IS-1104 is sent so that isolation valve XV-1049 shall automatically get closed. A hand switch forced (HSF-1049) is provided for washing purpose. When the logic IS-1104 is resetted, the bypass HSF-1049 shall switch OFF automatically. It is anyway clarified that even if the bypass HSF-1049 is actuated (to allow manual operation on the valve or because forgotten), the new possible incoming interlock IS-1104 of resetted logic shall close the valve XV-1049. It has to be clarified also that, when the logic IS-1104 has been resetted the valve XV-1049 must remain closed because the opening of the valve must be an operator's decision; therefore an enable open/close pushbutton shall be provided for the valve.
Moreover when the enable button is not actuated automatic operation) manual control on valve through HSF-1049 is not active: it means that the enable is necessary to operate the valve. This is to be sure that the action is an operator decision.

6-Logic Reset push button shall be provided for IS-1104 logic.

7- Effects are not simultaneous. The XV-1048/XV-1049 valve closure is allowed only after pump stop: the back signal of NOT running status from pumps close the valve after a delay time adjustable.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1105 Hydrolyzer Feed Pumps (P-115 A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**VAHH-11591A/11592A**	VD-1208-307C2A-PID-010		Internal machine Trip of P-115A	x												1	PM-115 A trip	**PM-115 A**	069		
2	**ISLL-115A-P**	069	(1)	low low current absorption at motor PM-115A	x												2	PM-115 B trip	**PM-115 B**	069		01
3	**LSLL-1029**	069	(3)	low low Level in T-102 chimney tray	x	x																01
4	**VAHH-11591B/11592B**	VD-1208-307C2A-PID-010		Internal machine Trip of P-115B		x																
5	**ISLL-115B-P**	069	(1)	low low current absorption at motor PM-115B		x																01

NOTES: 1- with a time delay (in normal running) in the range 0-5 sec.timer set to be adjustable (see note 2).

2-When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON).When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).

3-The action of level transmitter shall be delayed of in the range of 0-5 sec., timer set to be adjustable.

4-Logic Reset push button shall be provided for IS-1105 logic.The pumps can only be restarted after logic reset, when the level has been brought back to normal condition.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1106 Emergency Shutdown

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**HS-1106**			Emergency pushbutton activation	X	X	X	X	X	X	X						1	IS-1101 (CO2 compressor C-101 /Steam Turbine CT-101 Trip)	**C-101**			
																	2	IS-1102 (High Pressure Synthesis Loop Trip)	**IS-1102**			
																	3	IS-1104 A/B (H.P. Carbamate Pumps P-102 A/B Trip)	**PM-102 A/B**	052		
																	4	IS-1129 (MP Inerts Washing Tower gas outlet diverted to Continuous Flare FL-112)	**IS-1129**			
																	5	Motorized valve MOV-1007 closed	**MOV-1007-ESD**	054		
																	6	XV-1021 on Ammonia Receiverliquid outlet line close	**XV-1021**	059	(2)	
																	7	Stop (not lock-out) of all remaining electrical process users of Urea Unit (excepted their auxiliaries).			(3)	

NOTES: 1- Emergency pushbutton activation located on hardwired console in main control room.

2- A Hand switch forced HSF-1021 shall be provided. in order to operate the valve during shutdown. It is anyway clarified that a new possible incoming interlock of resetted logic shall close the valve XV-1021. It has to be also clarified that, when the logic IS-1106 has been resetted the valve XV-1021 must remain closed because the opening of the valve must be an operator's decision; therefore an enable open/close push button shall be provided for the valve. Moreover when the enable button is not actuated (automatic operation) manual control on valve through HSF-1048 is not active: it means that the enable is necessary to operate the valve. This is to be sure that the action is an operator decision.

3- The motors listed below shall be under emergency power network: the operator shall be able to restart the single user with normal power network or with emergency power network, for shutdown operations, if necessary.
- PM-105 A/B, PM-110 A/B, PM-111 A/B, PM-116 A/B;
- All Motorized valves: MOV-1007, MOV-1050, MOV-1055, MOV-1059, MOV-1111;
- Machine Auxiliaries: Emergency lube oil pump of 11-C-101, Min. turbine turning device.

01

4- The emergency push button must be properly protected to avoid any possible accidental misoperation.

01

5- First out signal shall be displayed until disacknowledge.

6- Logic Reset push button shall be provided for IS-1106 logic.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1107 Stripper Steam Condensate Separator low low Level (V-109) & Stripper (E-101) shell side high high Temperature

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**TSHH-1011**	054	(1)	high high temperature on MSS steam to Stripper	X	X	X	X									1	High Pressure Synthesis Loop Trip	**IS-1102**			
2	**LSLL-1010**	075	(1)	low low level at V-109 Stripper Steam saturator	X	X	X	X									2	IS-1108 (MP decomposer Lower part (E-102B) high high temperature Trip)	**IS-1108**			
																	3	XV-1120 close	**XV-1120**	075		01
																	4	PV-1020 close and the relevant controller shall get forced in manual mode at zero output.	**PV-1020**	075		01

NOTES: 1- With a time delay in the range 0-5 sec (time set delay to be adjustable)

2-Logic Reset push button shall be provided for IS-1107 logic. The reset of the logic IS-1107 can be done by means of the reset push button only when level and temperature have been brought back to normal condition.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1108 Superheated MS steam to E-102B high high Temperature

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**IS-1107**	054		Stripper (E-101) shell side high high temperature Trip	X	X												XV-1211 close	**XV-1211**	057		
2	**TSHH-1022**	057		high high temperature on E-102B shell side inlet line	X	X												HV-1011 close and the relevant controller shall get forced at zero output	**HV-1011**	057		01

NOTES: 1-Logic Reset push button shall be provided for IS-1108 logic.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1109 Close Drain Recovery Pumps (P-116 A/B) Start/Stop and trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**LSLL-1034**	072		low low level	X												1	Both pumps stop	**P-116 A/B**	072	(1)	
2	**ISLL-116A-P**	072	(4)	low low current absorption at motor PM-116A		X											**2**	Pump trip	**PM-116 A**	072	(4) (5)	
3	**ISLL-116B-P**	072	(4)	low low current absorption at motor PM-116B			X										**3**	Pump trip	**PM-116 B**	072	(4) (5)	
4	**LSHH-1034**	072		high high level				X									**4**	Both pumps start	**P-116 A/B**	072		01

NOTES: 1-Both Main and Stand-by pumps stop with a time delay in the range 0-5sec (timer X.X set to be adjustable).

2- The supply of cold steam condensate sensed by the pressure transmitter PT-1090 for the pump P-116A and PT-1091 for the pump P-116B, operates as permissive to start the both P-116A/B pumps.

3-Logic Reset push button shall be provided for IS-1109 logic. The pumps can only be restarted after logic reset, when the level has been brought back to normal condition.

4- with a time delay (in normal running) in the range 0-5 sec in order to avoid false trip due to possible current variation (time set delay to be adjustable), see note 5

5- 'When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1110 Hydrolyzer (R-102) high high temperature

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**TSHH-1072.**	070		high high temperature in Hydrolyzer R-102	X	X											1	XV-1216 close	**XV-1216**	070		
																	2	FV-1016 clos	**FV-1016**	070	(2)	

NOTES: 1- Logic Reset push button shall be provided for IS-1110 logic.

2- Signal to solenoid valve and relevant controller shall get forced at zero output.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1111 Ammonia Booster Pumps (P-105 A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**ISLL-105A-P**	059	(1)	low low current absorption at motor PM-105A	X												1	PM-105 A trip	**PM-105 A**	059	(1)	
2	**LSLL-1115**	059	(4)	low low Level in V-105 Ammonia Receiver	X	X											2	PM-105 B trip	**PM-105 B**	059	(1)	
3	**ISLL-105B-P**	059	(1)	low low current absorption at motor PM-105B		X																

NOTES:

1- With a time delay (in normal running) in the range 0-5 sec in order to avoid false trip due to possible current variation (time set delay to be adjustable), see note2.

2- When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).

3-Logic Reset push button shall be provided for IS-1111 logic. The pumps can only be restarted after logic reset, when the level has been brought back to normal condition.

4-The action of level transmitter shall be delayed of in the range of 0-5 sec. timer set to be adjustable.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1112 Stripper Passivation Air Compressors (C-102 A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**IS-10222A**	VD-1208-302-PID-006	(1)	Internal Trip of C-102A: to be defined by Machines Manufacturer.	X												1	CM-102 A Trip	**CM-102 A**	054		01
2	**IS-1102**			High Pressure Synthesis Loop Trip.	X	X											2	CM-102B Trip	**CM-102 B**	054		
3	**PSHH-1053**	054		High High pressure of C-102A/B discharge	X	X																01
4	**IS-10222B**	VD-1208-302-PID-006	(1)	Internal Trip of C-102B: to be defined by Machines Manufacturer.		X																

NOTES:
1- Internal machine trip to be defined by C-102A/B MFR. Refer to VD-1208-302-DIG-008.
2- Logic Reset push button shall be provided for IS-1112 logic.

01

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1113 Closed Circuit Demineralized Water Pumps (P-170 A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**IALL-170A-P**		(1)	low low current absorption at motor PM-170A	X												1	PM-170 A Trip	**PM-170 A**	078		
2	**LSLL-1210B**			low low Level in Closed Circuit Demineralized water expansion drum V-170	X	X											2	PM-170 B Trip	**PM-170 B**	078		
3	**IALL-170B-P**		(1)	low low current absorption at motor PM-170B		X																

NOTES:
1- with a time delay (in normal running) in the range 0-5 sec in order to avoid false trip due to possible current variation (time set delay to be adjustable), see note2.
2-When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).
3-Logic Reset push button shall be provided for IS-1113 logic. The pumps can only be restarted after logic reset, when the level has been brought back to normal condition.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1114 Permissive to open HV-1005 (on CO2 line to Reactor R-101)

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**FZSL-10131A**	VD-1208-301B-PID-401	(1),(2)		X												1	HV-1005 permissive to open	**HV-1005**	053	(1),(2)	

NOTES:
1- HV-1005 valve (CO2 feed to Urea Reactor) shall get a permissive to be opened only if FV-10131 located on line of passivation air to CO2 compressor (C-101) is not closed (signal from ZSL-FV-10131).(Operator could not to reset the solenoid valve HY-1005)
2- A by-pass switch HSF-1005 of the not closed position of the valve has to be provided to open HV-1005 for draining operation during shut-down of the plant.

01

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1115 HP Flushing Pumps (P-111A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	XP-110A-M-RE & XP-110B-M-RE		(1)	simultaneous not running. of P-110A/B	X	X											1	PM-111 A Trip	PM-111 A	074		
2	PM-111 A	074	(4)	Internal Trip of P-111A	X												2	PM-111 B Trip	PM-111 B	074		
3	PM-111 B	074	(4)	Internal Trip of P-111B		X																

NOTES:
1- By Machines Manufacturer.
2- The P-111 A/B pumps can only be restarted by means logic reset when causes of trip has been brought back to normal condition.
3- Logic Reset push button shall be provided for IS-1115 logic.
4-Tag number will be defined later by pump vendor

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1116 Urea Solution Recovery pumps (P-109A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**ISLL-109A-P**	068	(1)	low low current absorption at motor PM-109A	X												1	PM-109 A Trip	**PM-109 A**	068	(3)	01
2	**LSLL-1027A**	068	(3)	low low Level in Urea Solution Tank TK-101	X	X											2	PM-109 B Trip	**PM-109 B**	068	(3)	01
3	**ISLL-109B-P**	068	(1)	low low current absorption at motor PM-109B		X																

NOTES: 1-with a time delay (in normal running) in the range 0-5 sec in order to avoid false trip due to possible current variation (time set delay to be adjustable), see note2.
2- When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).
3-The action of level transmitter shall be delayed of in the range of 0-5 sec. timer set to be adjustable.
4-Logic Reset push button shall be provided for IS-1116 logic.The pumps can only be restarted after logic reset, when the level has been brought back to normal condition.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1117 Process Condensate Recovery Pumps (P-114 A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**ISLL-114A-P**	067	(1)	low low current absorption at motor PM-114A	X												1	Trip the electric motors PM-114 A	**PM-114 A**	067	(3)	
2	**LSLL-1026B**	067	(3)	low low Level in Process Condensate Tank TK-102	X	X											2	Trip the electric motors PM-114 B	**PM-114 B**	067	(3)	
3	**ISLL-114B-P**	067	(1)	low low current absorption at motor PM-114B		X																

NOTES:
1-With a time delay (in normal running) in the range 0-5 sec in order to avoid false trip due to possible current variation (time set delay to be adjustable), see note2.
2-When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).
3-The action of level transmitter shall be delayed in the range of 0-5 sec. timer set to be adjustable.
4- Logic Reset push button shall be provided for IS-1117 logic. The pumps can only be restarted after logic reset, when the level has been brought back to normal condition.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1118 Process Off-Spec Recovery Pumps (P-125 A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**ISLL-125A-P**	077	(1)	low low current absorption at motor PM-125A	X												1	PM-125 ATRIP	**PM-125 A**	077	(4)	
2	**LSLL-1125B**	077		low low Level in Off Spec. Process Condensate Tank TK-125	X	X											2	PM-125 B TRIP	**PM-125 B**	077	(4)	
3	**ISLL-125B-P**	077	(1)	low low current absorption at motor PM-125B		X																

NOTES:
1-with a time delay (in normal running) in the range 0-5 sec in order to avoid false trip due to possible current variation (time set delay to be adjustable), see note2.
2-When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).
3- Logic Reset push button shall be provided for IS-1118 logic. The pumps can only be restarted after logic reset, when the level has been brought back to normal condition.
4-The action of level transmitter shall be delayed of in the range of 0-5 sec. timer set to be adjustable.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1119 Nitrogen injection to TK-125

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**PSLL-1162**	077		Low low pressure in the Process Off Spec Tank	X												1	XV-1082 open	**XV-1082**	077	(1)	

NOTES: 1- When the pressure increases to normal condition sensed by PT-1162 the valve XV-1082 shall get closed with a time delay 15sec. in oder to avoid signals oscillations.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1120 Nitrogen injection to TK-101

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**PSLL-1051**	068		Low low pressure in the Urea Solution Tank TK-101	X												1	XV-1016 open	**XV-1016**	068	(1)	

NOTES: 1- When the pressure increases to normal condition sensed by PT-1051 the valve XV-1016 shall get closed with a time delay 15sec. in oder to avoid signals oscillations.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1121 Nitrogen injection to TK-102

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**PSLL-1093**	067		Low low pressure in the Process Condensate Tank TK-102	X													XV-1013 open	**XV-1013**	067	(1)	

NOTES: 1-When the pressure increases to normal condition sensed by PT-1093 the valve XV-1013 shall get closed with a time delay 15sec. in oder to avoid signals oscillations.

01

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1122 Nitrogen injection to TK-104

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**PSLL-1039**	072		Low low pressure in the Close Drain Tank TK-104	X												1	XV-1118 open	**XV-1118**	072	(1)	

NOTES: 1- When the pressure increases to normal condition sensed by PT-1039 the valve XV-1118 shall get closed with a time delay 15sec. in oder to avoid signals oscillations.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1123 Urea Solution Pumps (P-106A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**ISLL-106A-P**	064	(1)	low low current absorption at motor PM-106A	X		X										1	PM-106 A TRIP	**PM-106 A**	064	(1)	01
2	**LSLL-1021**	064	(3)	low low Level in bottom of Vacuum Preconcentrator	X	X	X										2	PM-106 B TRIP	**PM-106 B**	064	(1)	01
3	**ISLL-106B-P**	064	(1)	low low current absorption at motor PM-106B		X	X										3	LV-1023 closed	**LV-1023**	065	(5)	01

NOTES:
1-with a time delay (in normal running) in the range 0-5 sec in order to avoid false trip due to possible current variation (time set delay to be adjustable), see note2.
2-When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).
3- The action of level transmitter shall be delayed of in the range of 0-5 sec. timer set to be adjustable.
4-Logic Reset push button shall be provided for IS-1123 logic. The pumps can only be restarted after logic reset, when the level has been brought back to normal condition.
5-The controller LIC-1023 is forced to manual mode to close the LV-1023 valve (zero signal).

EPCC Contractor :	HENGAM FERTILIZER PROJECT		Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit			
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01		

IS-1124 Granulation Feed Pumps (P-108A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**ISLL-108A-P**	066	(1)	low low current absorption at motor PM-108A	X												1	PM-108 A TRIP	**PM-108 A**	066	(1)	
2	**LSLL-1112**	065	(3)	low low Level in bottom of Vacuum Preconcentrator	X	X											2	PM-108 B TRIP	**PM-108 B**	066	(1)	01
3	**ISLL-108B-P**	066	(1)	low low current absorption at motor PM-108B		X																

NOTES: 1-with a time delay (in normal running) in the range 0-5 sec in order to avoid false trip due to possible current variation (time set delay to be adjustable), see note2.
2-When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).
3- The action of level transmitter shall be delayed of in the range of 0-5 sec. timer set to be adjustable.
4-Logic Reset push button shall be provided for IS-1124 logic.. The pumps can only be restarted after logic reset, when the level has been brought back to normal condition.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1125 M.P. Carbonate Pumps (P-103 A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**ISLL-103A-P**	063	(1)	low low current absorption at motor PM-103A	X												1	PM-103 A TRIP	**PM-103 A**	063	(1)	
2	**LSLL-1129**	063	(3)	low low Level in bottom of Carbonate Solution Accumulator V-106	X	X											2	PM-103 B TRIP	**PM-103 B**	063	(1)	
3	**ISLL-103B-P**	063	(1)	low low current absorption at motor PM-103B		X																

NOTES:

1-with a time delay (in normal running) in the range 0-5 sec in order to avoid false trip due to possible current variation (time set delay to be adjustable), see note2.
2-When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).
3-The action of level transmitter shall be delayed of in the range of 0-5 sec. timer set to be adjustable.
4-Logic Reset push button shall be provided for IS-1125 logic. The pumps can only be restarted after logic reset, when the level has been brought back to normal condition.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1126 Steam Condensate Pumps (P-113 A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**ISLL-113A-P**	073	(1)	low low current absorption at motor PM-113A	X												1	PM-113 A TRIP	**PM-113 A**	073	(1)	
2	**LSLL-1051**	073	(3)	low low Level in bottom of Steam Condensate Accumulator V-110	X	X											2	PM-113 B TRIP	**PM-113 B**	073	(1)	
3	**ISLL-113B-P**	073	(1)	low low current absorption at motor PM-113B		X																

NOTES:
1-with a time delay (in normal running) in the range 0-5 sec in order to avoid false trip due to possible current variation (time set delay to be adjustable), see note2.
2-When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).
3-The action of level transmitter shall be delayed of in the range of 0-5 sec. timer set to be adjustable.
4-Logic Reset push button shall be provided for IS-1126 logic. The pumps can only be restarted after logic reset, when the level has been brought back to normal condition.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1127 Process Condensate Pumps (P-120 A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**ISLL-120A-P**	071	(1)	low low current absorption at motor PM-120A	X												1	PM-120 A TRIP	**PM-120 A**	071	(1)	
2	**LSLL-1043**	069	(3)	low low Level in bottom of Distillation Tower T-102	X	X											2	PM-120 B TRIP	**PM-120 B**	071	(1)	01
3	**ISLL-120B-P**	071	(1)	low low current absorption at motor PM-120B		X																

NOTES:

1-with a time delay (in normal running) in the range 0-5 sec in order to avoid false trip due to possible current variation (time set delay to be adjustable), see note2.
2-When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).
3-The action of level transmitter shall be delayed of in the range of 0-5 sec. timer set to be adjustable.
4-Logic Reset push button shall be provided for IS-1127 logic.The pumps can only be restarted after logic reset, when the level has been brought back to normal condition. 01

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1128 Ammonia Solution Pumps (P-107 A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**ISLL-107A-P**	060	(1)	low low current absorption at motor PM-107A	X												1	PM-107 A TRIP	**PM-107 A**	060	(1)	
2	**LSLL-1116**	060	(3)	low low Level in bottom of MP Washing Tower T-103	X	X											2	PM-107 B TRIP	**PM-107 B**	060	(1)	
3	**ISLL-107B-P**	060	(1)	low low current absorption at motor PM-107B		X																

NOTES:

1-with a time delay (in normal running) in the range 0-5 sec in order to avoid false trip due to possible current variation (time set delay to be adjustable), see note2.
2-When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).
3-The action of level transmitter shall be delayed of in the range of 0-5 sec. timer set to be adjustable.
4- Logic Reset push button shall be provided for IS-1128 logic. The pumps can only be restarted after logic reset, when the level has been brought back to normal condition.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1129 MP Inerts Washing Tower gas outlet diverted to Ammonia vent flare (97-FL-972)

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**IS-2204**			Granulation Unit Emergency Trip	X												1	XV-1015 close	**XV-1015**	060	(2)(3)	01
2	**IS-2206C**			Granulator Scrubber Exhaust fan process Trip	X																	01
3	**IS-1106**			Urea Unit Emergency Shut down	X																	01

NOTES:
1-Logic Reset push button shall be provided for IS-1129 logic.
2-Hand Switch forced HSF-1015 is provided in order to operate this valve even in presence of shut-down events, for operation purpose, with the logic not resetted.When the logic is resetted, the bypass shall switch OFF automatically.
It is anyway clarified that even if the bypass (HSF-1015) is actuated (to allow manual operation of the valve or because forgotten) the new possible incoming Interlock of resetted logic shall close the valve. It has to be clarified also that, when the logic has been resetted the valve must remain closed because the opening of the valve must be an operator's decision; therefore an enable open/close pushbutton XHS-1015 shall be provided for the valve. Moreover when the enable button is not actuated (automatic operation) manual control on XV-1015 is not active: it means that the enable is necessary to operate the valve. This is to be sure that the action is an operator decision.
3-MP Inerts Washing Tower gas outlet is diverted towards ammonia vent flare (97-FL-972).

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

IS-1130 Steam Condensate Flushing Pumps (P-110 A/B) Trip

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**ISLL-110A-P**	074	(1)	low low current absorption at motor PM-110A	X												1	PM-110 A TRIP	**PM-110 A**	074	(1)	01
2	**LSLL-1051**	073	(3)	low low Level in Steam condensate accumulator V-110	X	X											2	PM-110 B TRIP	**PM-110 B**	074	(1)	01
3	**ISLL-110B-P**	074	(1)	low low current absorption at motor PM-110B		X																01

NOTES:

1-with a time delay (in normal running) in the range 0-5 sec in order to avoid false trip due to possible current variation (time set delay to be adjustable), see note2.
2-When motor is OFF (not running) the low low current trip shall be automatically bypassed (bypass ON). When the motor is started, the bypass will remain active for 0-5s (adjustable). Only at the end of countdown timer, the low low current trip shall be automatically restored (bypass OFF).
3-The action of level transmitter shall be delayed of in the range of 0-5 sec. timer set to be adjustable.
4-Logic Reset push button shall be provided for IS-1130 logic. The pumps can only be restarted after logic reset, when the level has been brought back to normal condition.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

I-1101 Medium Pressure and Low Pressure Decomposer Level Control Valves closing

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**HZSL-HV-1005**	053		HV-1005 in closed position	X	X											1	Controller LIC-1014 force in manual mode at zero output	**LIC-1014**	057		
2	**MZSC-HV-1007**	054		HV-1007 in closed position	X	X											2	Controller LIC-1022 force in manual mode at zero output	**LIC-1022**	061		

NOTES:

1- The signals that activate I-1101 shall be impulsive type in order to allow the operation of the valves without the causes brought back to normal condition. 01

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

I-1102 High Temperature on MLS Steam header

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**TAH-1076 A/B/C**	076		high temperature of MLS header	X													PIC-1059 force at its minimum output signal to close the control valve PV-1059A.	**PV-1059A**	076	(2)	01

NOTES:

1- Deleted. 01

2-controller PIC-1059 shall be forced at its minimum output signal to close the control valve PV-1059A.

3- A discrepancy alarm for high differential temperature beetwen the readings (10°C) shall be provided.

4-manual selector HS-1076 on DCS permits to exclude one of the three temperature transmitters in case of failure itself.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

I-1103 Closed Circuit Demineralized Water Pumps (P-170 A/B) Autostart

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**PAL-1210**	078		low pressure on P-170A/B discharge	X													Start Stand-by pump.	**P-170 A/B**	078	(1)	
2	**XP-170A/B-M-R**	078		not running signal from Closed Circuit Demineralized water MAIN pump (EL-PM-170A or B).	X																	

NOTES: 1-The system is completed by:
Main / Stand-by selector for pump to be provided on DCS.
• Automatic / Manual selector switch to be provided on DCS.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

I-1104 Automatic damping of Process Condensate from PCT Section

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**AAH-1006**	071		high conductivity	X												1	HV-1051B Force to open position	**HV-1051B**	071	(1)	
					X												2	HV-1051A force to close position	**HV-1051A**	071	(1)	

NOTES:

1- When the signal from the analyzer AT-1006 senses high conductivity (max 55 µS/cm) due to presence of ammonia traces, the valve HV-1051B, to convey the process condensate to process Off Spec. tank (TK-125) shall get forced in open position, and then the valve HV-1051A, to send the condensate to Utility Units shall get forced in The system is completed by: closed position

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

I-1105 Steam Condensate Flushing Pumps (P-110A/B) Autostart

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO. 1	2	3	4	5	6	7	8	9	10	11	12	ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
1	**PAL-1057**	074		low pressure on P-110A/B discharge	X												1	Start Stand-by pump.	**P-110 A/B**	074	(1)	
2	**XP-110A/B-M-R**	074		not running signal from Steam Condensate Flushing MAIN pump (EL-PM-110A or B).	X																	

NOTES:

1-The system is completed by:
Main / Stand-by selector for pump to be provided on DCS.
• Automatic / Manual selector switch to be provided on DCS.

EPCC Contractor :	HENGAM FERTILIZER PROJECT	Owner :	MC:
PIDEC	Cause and Effect Diagrams for Urea Synthesis Unit		
Project No. : 1208	Doc. No. : 1208-11-PR-DIG-051	Rev. : 01	

I-1106 Close Drain Recovery Pumps (P-116 A/B) start/stop

ITEM NO	ACTUATED BY	P&ID NO.	NOTES	CAUSE	EFFECT NO.												ITEM NO	EFFECT	ACTUATES ON	P & ID NO.	NOTES	REV.
					1	2	3	4	5	6	7	8	9	10	11	12						
1	**LT-1033**	072		High level	X												1	Main/Stand-by pump starts	**P-116 A OR B**	072	(1)	01
2	**LT-1033**	072		Low level		X											2	Main pump starts and Stand-by pump stops	**P-116 A OR B**	072	(2)	01

NOTES

1- Stand-by pump starts with a time delay in the range 0-5sec (timer X.X set to be adjustable).

2- Main pump starts and Stand-by pump stops with a time delay in the range 0-5sec (timer X.X set to be adjustable)

3- Both Main and Stand-by pumps stop with a time delay in the range 0-5sec (timer X.X set to be adjustable).

4- The system is completed by:
-Main/Stand-by pump selector is provided at DCS (HS-116A/B)
-Automatic/Manual selector switch shall be provided at DCS.