

COMBUSTION RESEARCH ASSOCIATES A-52, SECTOR-83, PHASE-2, NOIDA-201305

O & M MANUAL FOR

BIO GAS OPEN FLARE UNIT

Project	:	Bio Gas Flare Unit
Contractor	:	GMMCO Limited
Client	:	SMC Infrastructure Pvt. Ltd., Goa
Doc. Title	:	O&M Manual for Bio Gas Open Flare Unit
Doc. No.	:	CRA- 15P0068-BGOFL-O&M, Rev. No. 00



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Introduction

The main purpose of the biogas flare is burn off as much of the gas produced from the proposed water treatment plant, as possible. The production of the gas is continuous biological process, the intensity of which cannot be influenced or controlled.



The necessary monitoring is guaranteed by an efficient safety techniqueof the complete system.

In order to ensure trouble free and safe operation of the plant it must be professionally installed, commissioned and operated, as well as carefully maintained in accordance with the operating instructions.

The main supply to the system, as well as between electrical control between the control panel and individual plant components may only be carried out by professional electrician and in accordance with the plant electrical specifications.

Only persons who are well acquainted with the installation, commissioning, operation and maintenance and have the necessary qualifications may operate the system.

Should the information in these operating instructions not be clear or insufficient, the manufacturer (representative) will be only too pleased to give you further information.

Documentation

The technical documentation consists of 1 file containing 10 chapters.

Abbreviations and symbols used in the technical documentation are explained in the following list.



Indication of a source of danger.



Indication of danger related to current.



Indication of heat related to heat.

2. ABOUT BIOGAS FLARE

General Description

Biogas is in the group of combustible gases which must, in accordance with the clean air act, be rendered harmless. This can be done in different ways. We differentiate between biogas flaring off in an open flare or high temperature enclosed flare and biogas utilization in furnace burners & gas engines for power generation.

Also the gas composition must be continuously monitored, in order to prevent the buildup of explosive gas mixtures.

Main components of biogas	
Methane CH4	60-70%
Carbon Di-Oxide	30-40%
H2S	up to 1%
Water vapor	
Trace Elements	
H2S, Nitrogen	

Flare Burner

The flare burns off the biogas at apox.1000°C various safety devices such as shut off valve with butterfly valves for closing gas flow when the gas pressure gets low, pilot flame temperature monitoring for open the main flare etc. guaranteed the safe operation and combustion of biogas.

Main line gas train

Flare system consists of one gas train for the safe operation of flare system consists of one flame arrestor for preventing any flash back, one pressure gauge for monitoring biogas pressure locally, one pressure transmitter to sense the biogas pressure status (low & healthy), one pneumatically operated butterfly valve for the sudden closing at any alarm condition.

Pilot Line

Pilot line with flare system provides the pilot flame to the main burner ignition. The safe operation of the pilot burner guaranteed by sudden shut off one sol. Valve, pilot thermocouple for monitoring the pilot flame temperature and one flame arrestor for preventing any flash back.

Pilot Ignition system

For igniting the pilot burner one auto ignition system equipped with the pilot burner. It consists of two electrodes on pilot burner and one high voltage HT transformer at the top of the platform. The transformer connected to the HT electrodes with high tension silicon cable.

3.0. SAFETY SPECIFICATIONS

General Safety Aspects

Responsibility for plant maintenance & operation

Specification for installation and operation of the flare system has been derived from different stipulations.

The following principles are however today generally acknowledged.

The plant operator must ensure that the flare is being operated and maintained in accordance with the safety requirements.

Everyone concerned with bio gas must realize that there are hidden dangers. It is therefore important that the system is operated and maintained only by trained, reliable personnel.

Persons who operate the flare system must be given the necessary specialized training and be acquainted with the relevant regulations for prevention of accidents as well as directives and general technical regulations.

They must be able to judge the condition of the flare system.

Technical documentation for flare containing.

- A) Safety specifications
- B) System technical specification and description.
- C) Operating philosophy and operating instructions
- D) Maintenance & trouble shooting procedures.
- E) Servicing.

Must always be available on location of flare or control room and the responsible person acquainted with the same.

Operating specification of flare, including maintenance plan are included in this documentation supplied by the manufacturer. Other regulations in respect of gas collection, gas pipeline etc. as well as the regulations for the prevention of accidents must be set up according to local conditions.

<u>Technical Safety</u>

- In case of backfire of the flame-if any-, it is stopped by a flame arrestor preventing dam-age of other parts of the plant.
- The pilot gas valve is equipped with solenoid valve which closes automatically incase of power failure (closingtimelessthan1seconds).
- The biogas gas valve is equipped with shut off valve which closes automatically in case of power failure (closingtimelessthan1seconds).

Danger by current impulse



- During works on the ignition electrodes the mains on/ off switch has to be actuated respite power supply has safely to be interrupted.
- Before executing works on the control panel, power supply has to be interrupted.

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Dangerby heat



- Attention! Methane flames are invisible!
- Before working on the burner or the ignition electrodes, the plant has to be turned off. Make sure that all parts are cool down.

Danger for surroundings



- No flammable objects may be positioned within a safe distance from the flame.
- Minimumsafetydistanceis5m– if no other local requirements!

Important safety preventive measures

- Before checking the ignition electrodes / igniter put off the mains on off switch.
- Before starting of burner cleaning close the manual valve put off the control panel mains before carrying out any maintenance /remedy work on the system.
- The work management must give permission for carrying any type of maintenance work on flare components or gas pipe line.
- A safety belt must be worn when working on the flare burner at the top of the flare structure.

Safety equipment for maintenance personal.

- 1. Rescue belt with rope, approved by applicable standards.
- 2. Safety helmet, approved by applicable standards.
- 3. Fresh air Breathing mask



Equipment is only reliable when it is in perfect condition and when

Personnel know how to use it in practice. Training in the use of the

Equipment is imperative for effective accident prevention.

Safety measures

- Check & ensure periodically the pilot burner igniting electrodes & HT cable in good condition.
- Check & ensure periodically the pilot burner thermocouple & compensating cable in good condition.
- Clean the flare burner injector block 1-3 working months.

4.0. PRODUCT DESCRIPTION

4.1 Technical Specification

Biogas open flare

Model no. -----OF-A-F3-S-M5-H1-PS

Type-----Aspirator

Capacity-----500m3/hr

Working Pressure-----3-150mBar

Media-----Biogas

Mounting------Vertical flange mounted

Line size-----200 NB

Location-----On elevated structure [mounted on top platform with nut bolts].

Ignition-----Pilot burner (Automatic).

Pilot burner Ignition-----Spark igniter.

Pilot gas-----LPG

Pilot flame sensing------Thermocouple provided

Operation -----Auto / manual.

4.2 <u>Basic Equipment</u>

Pilot line gas train:

- 20 NB piping in SS304.
- Isolation Ball valve and ON/off sol. valve.
- Pilot burner in SS316, aspirator type.

Pilot Ignition system:

- 2No. HT electrode.
- 2no. HT cable connected between HT Electrodes & Ht transformer in Junction box.
- Thermo couple for monitoring the pilot flame temperature.

Flare burner:

- Flare tip made of SS316.
- Combustion chamber (retainer) made of SS316.
- Wind shield made of SS 316.
- Flare stack for mounting the burner on structure, pipe & Burner mounting flange made of SS304 & stack mounting flange.
- Combustion air intake by natural draft principle, provided on the burner mounting flange on flare stack.
- Igniting pilot burner in SS316.

Control panel:

- Wall mounting type with all necessary control and safety elements.
- Weather proof made of steel sheet.

Components-

- Temperature controller for monitoring the pilot flame temperature.
- Selector switch for system auto/manual.
- Selector switch for safety shut off valve auto/manual.
- Selector switch for Pilot solenoid valve auto/manual
- Push buttons to reset/stop & manual ignition of the flare.
- Main MCB for at 230 VAC on/off.
- Remote PLC signal to control the auto operation.
- Status indicators for monitoring the alarm & instrument on/off status.
- Relays & contactors.

4.3 Flare Description:

Flare burner	Aspirator type, fitted on flare stack at the top of flare structure, suitable windshield made of stainless steel provided at the top of combustion chamber [retainer].					
Pilot burner	Aspirator type, mounted directly on Flare burner for igniting the main burner with LPG as pilot fuel					
Ignition system and pilot burner,	Igniting the pilot burner By means of ignition transformer, HT electrodes					
	Ignition voltage	15kv				
	Intensity of current	20mA				
Pilot flame sensing	By means of temp. Sens pilot burner head.	sing by K-type thermo couple provided on				
Pilot sol. Valve	Sudden opening and clo	osing, operating in 230 VAC.				
Shut down valve	for the automatic ope Pneumatic air at 4 bar 8	ration one Shut down valve which operated by & 230 VAC				
Control panel	Cabinet from steel sheet, RAL7032 powder coated, weather proof, components like on/off switch, selector switches, temperature controller, operating and failure lamps mounted front door of panel.					
Electrical control	As per scheme, mains c	onnection 230 VAC at 50 Hz @ 1kw.				

4.4. P&ID drawing Part Description & Analysis

Part. No.	Description	Function	Equipment Data/	Location	Туре	Make	Model no. /	Qty	Remarks
			Operating Data				Protection		
S-001	Solenoid valve	Automatic on/off of pilot burner	Line size—20 NB, Type2/2 way, operating pressure0-10 bar, Coil enclosure ex proof, end connection –1/2" BSPF Scwd Coil voltage 220-230 VAC, Coil enclosureFlameproof, Power consumption30 W, MOC- BodyCF8 SealNBR	On pilot line	2/2 way solenoid	Rotex	20172/ Flame proof	1	Refer P&ID Drawing
TIC-001	Temp. digital controller	Providing pilot flame high (healthy) & high- high signal [relay activated signal ,above the set point]	Inputk-type thermocouple Output2set point with relay output Relay contact rating— 2A@230vaC Indication—4digit, 0.56" Red LED display Accuracy±0.25% FS Rated power supply110- 240vac@ 50 HZ/ 24 VDC Power consumption—less than 10VA	Mounted in front of control panel	Digital controller	Masibus	5006-RN	1	Refer control panel drawing

Part. No.	Description	Function	Equipment Data/	Location	Туре	Make	Model no. /	Qty	Remarks
			Operating Data				Protection		
IT-001	HT Transformer	Igniting the pilot burner.	Primary voltage230 VAC. Output voltage2 x 7.5 Kv Max. current20mA	Inside the junction box	Electronic	Danfoss		1	Refer P&ID Drawing.
IE-001	HT-Electrodes	Spark the pilot gas	Size Ceramic- Dia14mm, length200mm. Extra Wire length3mtr Wire dia3mm Wire MOCSS316	Two working in pilot burner	Mechanical		E-4-200	2	Refer P&ID Drawing.
PG001	Pressure gauge	For monitoring the Biogas pressure	Range0-600mmwc Dial Size6'' Process connection15NB BSPM MOCWetted parts- SS316 CasingSS304. PointerMicro zero adjustable	On biogas inlet line	Diaphragm type	Baumer		1	Refer P&ID Drawing.
PT001	Pressure Transmitter	To sense the biogas pressure and provide signal to pressure indicator controller	Range0-200 mmwc Process connection1/4''NPT(F) Cable entry1/2" NPTF HousingCast Aluminum Alloy ProtectionEx-proof	On biogas inlet line		Yokogawa		1	Refer P&ID drawing.

Part. No.	Description	Function	Equipment Data/ Operating Data	Location	Туре	Make	Model no. / Protection	Qty	Remarks
PIC-001	Pressure digital controller	Providing pilot flame high (healthy) & high-high signal [relay activated signal ,above the set point]	Operating Data Input4-20mA Output2set point with relay output Relay contact rating— 2A@230vaC Indication—4digit, 0.56" Red LED display Accuracy±0.25% FS Rated power supply110- 240vac@ 50 HZ/ 24 VDC Power consumption—less than 10VA	Mounted in front of control panel	Digital controller	Masibus	Protection 5006-RN	1	Refer control panel drawing
FA-001	Flame arrestor	Prevent the anti flash back	Size200NB End connectionflange IS1538 Design data Mediumbiogas Test pressure2kg/cm2 Body SS304 Inlet/ outlet flangeSS304 Max. gas flow450 cum/hr Operating pressure80-200 mmWC ElementSS316	On main line		CRA		1	Refer P&ID Drawing.

Part. No.	Description	Function	Equipment Data/	Location	Туре	Make	Model no.	Qty	Remarks
			Operating Data				/		
							Protection		
FA-002	Flame arrestor	Prevent the anti flash back	Size20NB End connectionflange IS1538 <u>Design data</u> MediumLPG	On pilot line		CRA		1	Refer P&ID Drawing.
	Butterfly valve	Opening/ Closing	Size—200NB TypeWafer			Bray		1	
SDV-001	Pneumatic Actuator	Automatic operation	Working Press. –4 BAR ANGLE OF ROTATION 90 DEG	On Butterfly valve	Single Acting	Rotex	ECF-200E-74	1	Refer P&ID Drawing.
	Solenoid Valve	Provide pneumatic air to actuator	Working Voltage230 VAC ,50Hz Operating pressure0-10bar Body Moc—Aluminium Manual override—Push & Type	On actuator	3/2way Namur	Rotex	Ex proof	1	
	Limit Switch box & Limit switch		NO. OF CONTACTS1 NO + 1NC Cable connection –1/2 " Local indicationDome	On actuator	V15S05- CZ100A05-01	L.SHoney well Enclosure Rotex	Ex proof	1	



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5.0. Function / Control description

Reference document ---control panel circuit diagram---See in sec.4.6

5.1. Function

The flare Auto/Manual operation is selected by flare selection selector switch 'A/M-101.

5.1.1. Auto /Manual switch (AM 101)

AM101 in Auto modus provide the automatic operating signal from PLC to the system for the automatic operation of pilot ignition via AM-103 / SDV via A/M102

AM-001 in Manual modus will operate the pilot ignition & SDV from local panel A/M switches

AM103 & 102

5.1.2. Auto /Manual switch (AM 102)

AM102 in auto position will operate the shut down valve automatically according to the pilot flame healthy signal.

AM102 in Manual position will operate the SDV directly from Local panel when the Mains ON/OFF switch is on.

5.1.3. Auto /Manual switch (AM 103)

AM103 in auto position will operate the pilot sol. Valve when the System in auto position & PLC start command is active.

AM103 in manual position will operate the Pilot sol. valve directly from Local panel when the Mains ON/OFF switch is on.

5.1.4. Push Button (PB-01)

Ignition reset button for resetting the pilot flame fail alarm during the automatic Ignition.

5.1.5. Push Button (PB-02)

Ignition manual button for igniting the pilot ignition during the manual modus operation

5.2.Control Description

5.2.1. Auto modus

BIO GAS RESSURE HIGH SIGNAL SET POINT (SET POINT SHOULD BE SPECIFIED BY CLIENT) INTERLOCKED TO PROVIDE THE FLARE AUTO START SIGNAL VIA PLC.

BIOGAS LOW PRESSURE SET POINT (3MBAR) WILL STOP THE FLARE DURING RUNNING.

The start signal from PLC panel operates the pilot sol. Valve & ignition by putting the AM-101 AM102 & AM103 to auto position (1).

Ignition gets off after the ignition time (25 seconds) programmed in timer.

Within the set time of 25 sec. ignition if the temp. Attain the set point 60 Deg the Pilot flame indication gets glowing

When the temp. Reaches the second set point of 100Deg.c, SDV-001 gets activated automatically for the main flare.

If the pilot flame on indication is not gets within the ignition time of 25 sec. one alarm initiated for reset the ignition for another 25 sec. again the pilot flame gets not healthy repeat one more cycle / Check the ignition system for trouble shooting.

5.2.2. Manual modus

In this mode, the start signal for flare is set by the auto manual selection switch 'AM-101' to manual modus (2), Operates the pilot solenoid valve by putting 'AM103' selector switch to manual.

For ignition push the manual ignition push button PB-02 only for 10 seconds.

Check the pilot temperature on temperature controller, if it get rising then open the main line shut off valve SDV001 by putting 'AM102' selector switch to manual for operating the main flare.

Check the main flame visually.

If temp not rising push the manual ignition push button again for pilot ignition.

5.2.3. Interlocks-

- 1. Biogas pressure High set point interlocked to provide the auto start command from PLC.
- 2. Bio gas pressure low set point interlocked to cuts the auto start command from PLC.
- 3. Pilot flame Second set point interlocked to operate the SDV-001 when the flare operating Auto modus via Start command from PLC

5.2.4. Alarms-

1. If the pilot flame healthy will not appear within set time, then it will activate an alarm.

5.2. Faulty Conditions

5.2.1. General

a) Power supply to flare cut

Possible reasons:

- General power failure.
- MCB tripped.
- Power supply cable defective.
- Mains on/off switch in off position.

b) Pilot sol. Valve not working.

Possible reasons:

- General power failure to sol. Valve.
- Valve internal gets blocked.
- Valve coil not working.

c) Shutdown Valve not working.

Possible reasons:

- General power failure to shutdown Valve.
- Valve internal gets blocked.
- Valve coil not working.

d) No ignition.

Possible reasons:

- General power failure to HT Transformer.
- HT transformer failure.
- Ear thing failure.
- Spark plug failure.
- Spark electrode carbon scaling.

d) Fault of pilot flame temp. Controller.

Possible reasons:

- General mains power failure to temperature controller.
- Field instrument [thermo couple] connected to the temperature controller not working.
- Temperature controller defective.

e) Fault of biogas pressure. Controller.

Possible reasons:

- General mains power failure to pressure controller.
- Field instrument [pressure transmitter] connected to the pressure controller not working.
- Pressure controller defective.

f) Alarm.

Possible reasons:

• Pilot flame not healthy after the pilot ignition cycle.

5.2.2. Flame faults

- 1. Pilot flame not detected.
 - Poor gas quality.
 - Damaged ignition cables or damaged HT plug.
 - The distance between the electrodes is too large.
 - Damaged ignition transformer.
 - Pilot flame temperature controller defective.
 - Damaged thermo couple.
 - Damaged compensating cable.
 - Pilot sol. Valve /connecting cable defective.
 - Blockage in pilot burner injecting nozzle.

2. No Pilot flame alarm during start up.

- Poor gas quality.
- Pilot sol. Valve not working
- Ignition not working.
- Blockage pilot burner injector.

6. OPERATION

6.1. Commissioning & start up of flare.

Preliminary Checks

All piping has to be checked for gas tightness.

The cable passages have to be fixed tight.

Check all the cables connection to the instruments according to the control circuit diagram.

Check the distance between the ignition electrodes [Approx. 3mm].

Check position of electrodes (required to fit at the centre of pilot burner head).

Ensure the hand valves on pressure gauge in open position.

Ensure the hand valves on pressure transmitter in open position.

Ensure the pilot solenoid isolation ball valve in open position.

<u>Checks on control panel.</u>

The selection switch (SS-001) on control panel must be in off (0) position.

The selection switch (AM-101, 102, 103) on control panel must be in off (0) position.

Check the Pilot flame temp. High indication, if it illuminates wait for the process value [temperature] comes down below the Set point value on Pilot flame temperature controller.

6.2 Instruments set point parameter

DISPLAY	CALIBRATED RANGE	DESCRIPTION		SET RANGE		FIELD INSTRUMENT	
TAG NO.			LOW	HEALTHY	HIGH-HIGH		
				(HIGH)			
TIC-001	0-1200	PILOT FLAME		60 deg. C	100 deg. C	TE-001	
	DEG.C	ON & SDV-001		(Pilot flame	(SDV-001		
		OPEN		on)	open	MANIFOLD	
		COMMAND			command)		
PIC-001	0-200 mmwc	BIOGAS	30	Client to		PT-001	
		PRESSURE	mmwc	specify			
		HEALTHY &				ON DIOGAS WAIN LINE	
		LOW					
NOTE- IF THE	PILOT FLAMES	HIGH TEMP. SI	ET POINT	NOT ATTAININ	IG IN SET TIME	DOWN THE SET POINT	

ACCORDINGLY AND SAME FOR PRESSURE.

6.3 Operating procedure.

OPERATING SEQUENCE IN SYSTEM AUTO MODUS.

- Complete all the preliminary checks.
- Put ON/OFF switch 'SS-01' to on position.
- Put the MCB-001 for 230 VAC in control circuit in 'on' position.
- Check the pilot flame on indication -----not glowing.
- Shutdown valve close status indication -----glowing.
- Check BG pressure healthy (high) indication ------glowing.
- Put auto manual selector switch 'AM-101' to auto (1) position.
- It operates the pilot sol. Valve & ignition system automatically.
- The pilot flame healthy & high-high signal comes through the thermocouple. The shut off valves in main line will open automatically.
- If pilot flame healthy not attains within set time, then alarm gets initiates for the system reset push button PB-01.

Note- the BG pressure low will cut off the running flare & BG pressure high (healthy) starts the flare again automatically.

OPERATING SEQUENCE IN SYSTEM MANUAL MODUS.

(Note---use this mode only during the auto ignition through PLC failure)

- Complete all the preliminary checks.
- Select the flare to be run by flare selection switch 'SS-01'.
- Put the MCB-001 for 230 VAC in control circuit in 'on' position.
- Check the proper biogas pressure on pressure gauge.
- Put auto manual selector switch 'AM-101' to manual (2) position.
- Put auto manual selector switch 'AM-103' to manual (2) position, to operate the pilot sol. Valve.
- Push the ignition manual push button PB-02 for 10 seconds & check the pilot flame temperature rising on controller.
- If temperature rises, put selector switch A/M-102 to manual position (2) to open shut off valve SDV001.

FLARE SHUTTING DOWN PROCEDURE.

- 1. Put the MCB-001 to off position.
- 2. Push the selector switch SS-001 at 0.
- 3. Put auto manual selector switch AM-101,102,103 to 0.



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7.0. FAULT ANALYSIS & TROUBLE SHOOTING

Sr. no.	Tag No.	Component	Function	Failure mode	Aspect of damage, possible cause	Failure recognition	Available measures	Failure effect of the system	Effect remarks
1	PG-001	Pressure gauge	Monitoring the biogas pressure	Wrong reading	Condensate, measuring range exceeded	Wrong display, Impossible pointer position	Replacement unit for exchange	None	Only reading, no other function
2	PT-001	Pressure Transmitter	To sense the biogas pressure	Does not sens	Corrosion, sensor failure	No pressure signal	If necessary clean the sensor element or exchange the unit	Shutdown of system or does not start the system in auto	Exchange immediately
3	S-001	Pilot sol. Valve	Open & close of the gas through pilot line.	Valve not opening.	Corrosion, contamination inside valve housing, coil not working	No pilot flame	Clean valve, if necessary change the internal or change the coil.	Main burner ignition failure	Exchange immediately.
4	IT-001	HT Transformer	Providing High voltage to electrode sparking	No secondary voltage	Defect in primary supply, transformer defective	No sparking during the ignition time	Check the primary supply, replace the defective piece	Pilot burner inactive	Exchange immediately.
5	IE-001	HT Electrode	Converting the high voltage from HT transformer to spark	No sparking	Electrodes defective/ connecting HT cable defective	No sparking during the ignition time	Check the electrodes and cable ,if defective replace immediately	Pilot burner inactive	Exchange immediately.
6	TE-001	Thermo couple	Sensing the pilot flame temperature	Input fail on temperature controller	Cable defective, thermo couple defective	Pilot flame temp. monitoring failed	Anyone found defective change it immediately.	unable to monitoring the pilot flame temperature	Exchange immediately.

7	TIC-001	Temperature Indicating controller	Monitoring the pilot flame temperature	Instrument fail /relay defective	Operating supply failure ,input thermo couple failure, relay contacts failure	Unable to providing the pilot flame on signal.	check the connection intact or change it immediately	no pilot flame healthy signal	Exchange immediately.
8	PIC-001	Pressure indicating controller	Monitoring the Bio gas pressure	Instrument fail /relay defective	Operating supply failure ,input thermo couple failure, relay contacts failure	Unable to providing the pilot flame on signal.	check the connection intact or change it immediately	no pilot flame healthy signal	Exchange immediately.

8.0. MAINTENANCE & SERVICING

8.1. General Maintenance Instructions

As previously mentioned for the good working & long life of the flare achievement it required to service all the components regularly/frequently

The term 'service' covers the following activities

Maintenance

- general servicing such as cleaning of equipment parts
- Carry out function controls.
- Replace wear and tear parts. The most important parts must be kept in stock.

Corrective Maintenance

• Detect and replace faulty parts.

Operation Reliability

- Control and calibrate the measuring instruments.
- Check safety technique.
- Judge the system condition.

Reporting

- Make a measuring report & report of the plant condition.
- Log the works carried out noting deficiencies and particular incidents.

8.2. Maintenance plan

<mark>Equipment</mark>	Nature of maintenance	<mark>weekly</mark>	<mark>monthly</mark>	<mark>Quarter</mark> yearly	<mark>Half yearly</mark>	<mark>Spare List</mark>
Flame arrestor	Element cleaning				х	
Flare burner	Injector cleaning			х		
Pilot Ignition system	Checking	х				HT Electrode,
	Cleaning of electrode tips		х			Thermo couple, HT
	Changing of HT cable				x	cable
	Changing of HT electrode				х	
Pilot sol. valve	Internals cleaning			x		Sol. Valve
Shutdown valve	Checking of actuator	x				Sol. valve
	Butter fly valve seal cleaning				х	
Control panel	Checking of instruments	x				Temp. controller,
	Cleaning / servicing		x			Pressure controller Relays & relay card, Selector switches etc
Control	Lamp control	x				
	Recording of operating hours	x				
	File fault report	x				
General	Keep operational record	x				
	Clean and maintain	x				

9.0. SPARE PART LIST

9.1. Field items								
S.NO.	ITEM DESCRIPTION	RATING/MODEL	RECOMMENDED MAKE	MIN STOCK				
1	THERMOCOUPLE TE-001	Refer P &ID Part Description	TEMPSENS	1				
2	PRESSURE TRANSMITTER PT-001	Refer P &ID Part Description	YOKOGAVA	1				
3	PILOT SOL. VALVE S-001	Refer P &ID Part Description	ROTEX	1				
4	IGNITION TRANSFORMER IT-001	Refer P &ID Part Description	DANFOSS	1				
5	HT ELECTRODE	Refer P &ID Part Description	ANY AVAILABLE MAKE WITH SAME SPEC.	2				
7	HT CABLE	Refer P &ID Part Description	DO	10 MTR				
8	SOLENOID VALVE ON SHUT OFF VALVE	Refer P &ID Part Description	ROTEX	1				
	9.2. C	ontrol panel mate	erial					
1	RELAY CARD 8C. 2C/O	230VAC	PHOENIX	1				
2	DIGITAL CONTROLLER (FOR TEMPERATURE & PRESSURE)	Refer P &ID Part Description	MASIBUS	1 EACH				
3	DELAY TIMER	PNEUMATIC	SCHNEIDER	1				
4	GLASS RELAY2C/0	230VAC	OMRON	2				
5	ON/OFF SELECTOR SWITCH	6A,1POLE	SALZER	1				
6	A/M SELECTOR SWITCH	6A,1POLE	SALZER	2				



		1		2	3		4		5			6		7		
			FLARE	EQUIPMENT & IN	STRUMENTS LIST									ABBREVIATION		
	TAG. NO.	DESCRIPTION		PART DESCRIPTION	мос	MAK	E	QTY.		-						
Α	FB001	FLARE BURNER 500) Nm3/hr.	REFER ATTACHED DRG	REFER FLARE BURNER GA DRG.	CRA		01	_	H			UAL IONIT			
	FA001	FLAME ARRESTOR 2	OONB	REFER ATTACHED DRG	REFER FLAME ARRESTOR GA DRG.	CRA		01	_	- <i>'</i>				TON		
	FA002	PILOT FLAME ARRES	STOR 20NE	ELEMENT	SS316	CRA		01		L	PB	PUSH BUI	ION			
	SDV001	SHUT DOWN VALVE	200NB	REFER DATA SHEET	REFER DATA SHEET	ACTU	JATOR & ACCESSORIES-ROTEX	(01		Ŀ	ZSC	POSITION L	IMIT SWIT	CH CLOSE		
	IT001	IGNITION TRANSF	ORMER	REFER DATA SHEET	REFER DATA SHEET	DANF	OSS	01	-		zso	POSITION L	IMIT SWIT	CH OPEN		
	TE001	PILOT THERMOCO	DUPLE	REFER DATA SHEET	REFER DATA SHEET	TEMP	SENS	01	-		IT	IGNITION T	RANSFORM	MER		
B	S001	PILOT SOLENOID V	ALVE 20N	REFER DATA SHEET	REFER DATA SHEET	ROTE	Х	01	1		DT	DELAY TIM	FR			
	PT001	PRESSURE TRAN	SMITTER	REFER DATA SHEET	REFER DATA SHEET		GAWA	01								
	PG001	PRESSURE GAUG	ε	REFER DATA SHEET	REFER DATA SHEET	BAUM	IER	01			5	SOLENOID	VALVE			
	-	CONTROL PANEL			CRCA, POWDER COATED	BCH		01	_		SDV	SHUT DOW	HUT DOWN VALVE (PNEUMATIC TYPE)			
		BALL VALVES 15	NB/20NE		CS	AUDO	0	03	_	F			TRANAL	· /		
		MAIN LINE 200N	B	PIPE & FLANGE	SS304	REPU	JTED	REG	2.			PRESSURE	IRANSMI	IIER		
C		PILOT LINE 20NE	3	PIPE & FLANGE	\$\$304	REPU	JTED	REG	<u>}.</u>		PI	PRESSURE	INDICATO)R		
				I							PG	PRESSURE	GAUGE			
											FA	FLAME ARF	RESTOR			
D	2. 3. 4. 5. 7. 8. 9.	MODEL TYPE IGNITION FLOW RATE WORKING PRES INLET GAS PR PILOT GAS IGNITION	SS. ESS.	: OF- : : : : : :	-A-F3-S-M5-H1-PS ASPIRATOR PILOT 500Nm3/hr. 3-150mbar 3-5mbar LPG AUTOMATIC							SOLENOI FIELD I INSTRUI	D VALVE NSTRUMEI MENT INFF MENT BEH	NT RONT OF DOOR HIND DOOR		
F	s drawing c	ONTENTS CONFIDE	NTIAL PR	OPRIETARY INFORMA	TION OF COMBUSTION REV.	DES	CRIPTION DATE	REV.	JOB		D	ATE CONTRACTO	GMMCO LIMIT	TED		
RE	SEARCH ASSO	DCIATES AND IS	NOT TO	BE DISCLOSED TO	THE PUBLIC OR TO	_		00	DRAWN	SA	12.1	2.2015 CLIENT	INTERGO SOL	LID WASTE MANAGEMENT, MUME	3AI	
co	MPETITORS WI	THOUT PRIOR PE	RMISSION	IN WRITING FROM		_			APPR'D.	BPS	5	PROJECT	SMC INFRAST	IRUCTURE PVT. LTD., GOA		
OF	COMBUSTION	RESEARCH ASS	DCIATES.	ALL RIGHTS RESER	RVED AND CONTAINS)etails:-	-AS BUILT				COMBUS A-52,	TION RESEARCH ASSO SEC-83, PHASE-II, NOIDA, I	CIATES INDIA	
MA	Y CHANGE FO	or improvement	OF PE	RFORMANCE OF EQ	UIPMENTS.							TITLE	PRID FOR BG			

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JOB NO. 15P068

PLOT SCALE / CRA-15P068-OFL-PID-01

 DRAWN
 SA
 01.10.2015

 APPR'D.
 BPS
 01.10.2015

 SHEET 2 OF 2
 DRAWN SCALE
 NTS

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A																									ł
В				R			F			2.6		R1.8				R1.3								- - -	F
С	i	FEEDBACK 302		303	N FEEDBACK 304		305	306	307	308	309	310	311	312	313	314	11	GH 316		317 JW	319 319 319	O MODE 320			(
D		OLENOID VALVE ON F			INITION TRANSFORMER			DV CLOSE FEEDBACK		DV OPEN FEEDBACK		ARM		LOT FLAME ON		LOT FLAME OFF		O GAS PRESSURE HI		O GAS PRESSURE LC		are system in aut]
E	TBAC-	б (-F-03а тва	S C-F-04A TE	MAC-F-05	54 TBAC-) F-06a Ti	BAC-F-0	DA TBAC-F-10A	TBAC-F-11/	A TBAC-F-12	A TBAC-F-1	₹ 3 TBAC-F-14	D TBAC-F-1	E 5 TBAC−F	-16 TBAC-F-	а) 17 твас) -F-18 TBAC:	б (-F-19 ТВА	р с-F-20 тва	С-F-21 ТВ	О ас-F-22 твас-F	-23 TBAC-	F-24		E
F	SIGNALS TO PLC PANEL																								
REV	JOB		DATE	RE	EV. J	IOB		DATE	REV.	DESCR	RIPTION	DATE	CONTRA	CTOR	GMMCC) LIMI	TED					JOB	15P068	ـــــــــــــــــــــــــــــــــــــ	
	DRAWN				D	RAWN	PY	29.10.2015	00	PRELIMINARY	SUBMISSION	01.10.2015	CLIENT									DRAWN	PY	01.10.20	15
	APPR'D.				A	PPR'D.	BPS	29.10.2015	01	REVISED		29.10.2015	PROJEC	T	SMC IN	FRAS	TRUCT	URE P	/T. LTD	•		APPR'D.	BPS	01.10.20	15
DET	AILS:-			DI	ETAILS:	_			U2 DETAILS:-	KEVISED				RA		BUS' -52, S	TION] EC-83,]	RESE.	ARCH -II, NO	ASSC IDA, IN	OCIATES IDIA	DRAWN PLOT S	SCALE	NTS A4	\exists
								NEVISED	AJ FER U	UTOWER (TIT	LE	CONT	ΓROL	PANEL	WIRIN	G DIAC	RAM (SLD)	CRA-15F	068-OFL-1	CPSLD-0	ĸ	

		1			2			3		4		5	6	7		8			
A																	Α		
В						TA	G NO.	DES	TERMINAL DETAILS										
				TBAC-	F-01 &	CTBAC-	-F-02	SYS.	TEM START COMM	AND FROM	PLC PANEL TO	FLARE PANEL							
\square				TBAC-	F-03 &	CTBAC-	-F-04	SOL	ENOID VALVE ON	COMMAND	FROM FLARE PA	ANEL TO SOV							
				TBAC-	F-05 &	TBAC-	-F-06	IGNI	TION TRANSFORME	R ON COM	MAND FROM FL	ARE PANEL TO	SOV						
c				TBAC-	F-07 &	TBAC-	-F-08	SDV	ON COMMAND F	ROM FLARE	PANEL TO SDV	,							
				TBAC-	F-09 &	CTBAC-	-F-10	SDV	CLOSE FFEDBCA	K FROM SD	V TO FLARE PA	NEL							
				TBAC-	F-11 &	CTBAC-	-F-12	SDV	OPEN FFEDBCAK	FROM SDV	TO FLARE PAN	IEL							
\mathbb{H}				TBAC-	F-03A	& TBAC	-F-04A	SOL	ENOID VALVE ON	FEEDBCAK	FROM FLARE P	ANEL TO PLC	PANEL						
				TBAC-	F-05A	& TBAC	-F-06A	IGNI	TION TRANSFORME	R ON FEED	BACK FROM FL	ARE PANEL TO	PLC PANEL						
D				TBAC-	F-09A	& TBAC	-F-10A	SDV	CLOSE FFEDBCA	K FROM FLA	ARE PANEL TO	PLC PANEL					D		
				TBAC-	F-11A	& TBAC	-F-12A	SDV	OPEN FFEDBCAK	FROM FLA	RE PANEL TO P	LC PANEL							
				TBAC-	F-13 &	CTBAC-	-F-14	ALAI	RM SIGNAL FROM	FLARE PAN	EL TO PLC PAN	NEL							
H				TBAC-	F-15 &	TBAC-	-F-16	PILO	T FLAME ON SIG	NAL FROM	FLARE PANEL TO	O PLC PANEL							
	TBAC-F-17 & TBAC-F-18							PILO	T FLAME OFF SIG	NAL FROM	FLARE PANEL								
E	TBAC-F-19 & TBAC-F-20						-F-20	BIO	GAS PRESSURE H	IIGH SIGNAI	FROM FLARE	PANEL				E			
				TBAC-	F−21 &	CTBAC-	-F–22	BIO	GAS PRESSURE L	OW SIGNAL	FROM FLARE	PANEL							
				TBAC-	F-23 &	TBAC-	-F-24	SYS	TEM IN AUTO MOI	DE SIGNAL	FROM FLARE PA	ANEL TO PLC	PANEL						
[-1]																			
F																	F		
REV.	JOB		DATE	REV.	JOB		DATE	REV.	DESCRIPTION	DATE	CONTRACTOR	GMMCO LI	MITED		JOB	15P068	3		
	DRAWN				DRAWN	PY	29.10.2015	00	PRELIMINARY SUBMISSION	01.10.2015	CLIENT				DRAWN	PY	01.10.2015		
	APPR'D.				APPR'D.	BPS	29.10.2015	01	REVISED	29.10.2015	PROJECT	SMC INFR/	ASTRUCTURE P	/T. LTD.	APPR'D.	BPS	01.10.2015		
								02	REVISED	17.12.2015		COMBU	ISTION RESE	ARCH ASSOCIATE	S s	HEET 4 0	F 5		
DETA	AILS:-			DETA	LS:-			DETAILS:-	-		CRA	A-52	, SEC-83, PHASE	2-II, NOIDA, INDIA	DRAWN	SCALE			
								REVISED	AS PER CUTOMER (COMMENTS	TITLE	CONTRO	DL PANEL WIRIN	G DIAGRAM (SLD)	CRA-15	P068-OFL-	LCPSLD-001		
				1							I	1			1				

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	CONTROL PANEL BILL OF	MATERIAL	
TAG NO.	DESCRIPTION	MAKE	Rating/ Working Vol
SS01	MAINS ON/OFF SWITCH	SALZER	6A
AM01, 02, 03	AUTO/ MANUAL SLECTOR SWITCH	SALZER	6A
MCB01	230 V AC INPUT MAINS SUPPLY BEAKER	MOELLER / L&T	DP-6A
R1.1 to R1.8	RELAY CARD 8 CHANNEL, 2 CHANGE OVER	OMRON	230VAC
R2.1 to R2.6	RELAY CARD 8 CHANNEL, 2 CHANGE OVER	OMRON	230VAC
CR-01	CONTROL RELAY	SCHNEIDER	230VAC
DT-01	DELAY TIMER	SCHNEIDER	PNEUMATIC
L1	230 VAC MAINS INDICATOR	ESBEE	230VAC
L2	PILOT SOL. VALVE ON INDICATOR	ESBEE	230VAC
L3	BIOGAS PRESSURE HIGH INDICATOR	ESBEE	230VAC
L4	BIOGAS PRESSURE LOW INDICATOR	ESBEE	230VAC
L5	PILOT FLAME ON INDICATOR	ESBEE	230VAC
L6	SHUT DOWN VALVE CLOSE INDICATOR	ESBEE	230VAC
L7	SHUT DOWN VALVE OPEN INDICATOR	ESBEE	230VAC
PB01	IGNITION RESET PUSH BUTTON IN AUTO MODUS	ESBEE	6A
PB02	MANUAL IGNITION PUSH BUTTON	ESBEE	6A
TIC01	TEMP. INDICATOR CONTROLLER	MASIBUS	230VAC
BICO1	PRESSURE INDICATOR CONTROLLER	MACIDUC	2301/40

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BOM FOR FEILD INSTRUMENT

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TAG NO.	ITEM DESCRIPTION	MAKE	RATING/RANGE	QTY
TE-01	PILOT TEMP.CONTROLLER ELEMENT	TEMPSENS	K-TYPE	01
PT-01	BIOGAS PRESSURE TRANSMITTER	EMERSON	0-300MMWC	01
S-01	PILOT SOL VALVE	ROTEX	230 VAC	01
IT-01	IGINITION TRANSFORMER	DENDFOS	230 VAC	01
SDV-01	SHUT DOWN VALVE	ROTEX	230 VAC	01

REV.	JOB		DATE	REV.	JOB		DATE	REV.	DESCRIPTION	DATE	CONTRACTOR	GMMCO LIMITED	JOB	15P068	
	DRAWN				DRAWN	PY	29.10.2015	00	PRELIMINARY SUBMISSION	01.10.2015	CLIENT		DRAWN	PY	01.10.2015
	APPR'D.				APPR'D.	BPS	29.10.2015	01	REVISED	29.10.2015	PROJECT	SMC INFRASTRUCTURE PVT. LTD.	APPR'D.	BPS	01.10.2015
								02	REVISED	17.12.2015		COMBUSTION RESEARCH ASSOCIATES	Sł	HEET 5 OF	5
		DETAILS									CRA	COMD OF HOLY REDEAMCHT ABDOCH THE	DRAWN	DRAWN SCALE NTS	
DETAI	DETAILS:-			DETAILS:-				REVISED	- AS PER CUTOMER (OMMENTS		A-52, SEC-83, PHASE-II, NOIDA, INDIA	PLOT S	CALE	A4
									TITLE	CONTROL PANEL WIRING DIAGRAM (SLD)	CRA-15P068-OFL-LCPSLD-001				