Design Specification for Process and Piping

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REVISION INDEX

PAGE \ REV.	A	0				PAGE \ REV.	A	0				PAGE \ REV.	A	0				PAGE \ REV.	A	0			
1	X																						
2	X																						
3	X																						
4	X																						
5	X																						
6	X																						
7	X																						
8	X																						
9	X																						
10	X																						

1. Project Description

The flare system is to be designed for collecting all combustible gases which are discharged in case of emergencies, equipment malfunctions, etc.

Release to flare may be expected during plant start-up, plant shut-down or during an upset

According to TOPSOE documents, the max discharging flowrate to flare is 510000kg/hr.

The direct routing distance between the tie-in point location of the methanol plant and the actual flare site is about 1600 m. The elevation change between the tie-in point location of the methanol plant and the actual flare site is 111m.

2. Definitions and Abbreviations

TCC	China Tianchen Engineering Corporation
P&ID	Piping & Instrumentation Diagram
MoM	Minutes of Meeting
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
FFG	Flame Front Generator
LCP	Local Control Panel
PLC	Program Logic Controller
PWHT	Post-Welding Heat Treatment
RT	Radiographic Testing
OSBL	Outside of Battery Limit
ISBL	Inside of Battery Limit

3. References

Reference is made to following Documents:

Document No.	Document Title
MKP-11-DE-9000-FE-REQ-237	Material Requisition for Flare System

MKP-11-BE-9000-PR-DBC-001	Process Design Basis
MKP-11-BE-9000-PI-SPC-005	Engineering Standard Specification for Pipe Stress Analysis
MKP-11-BE-9000-PI-SPC-006	Piping Material Class
MKP-11-BE-9000-PI-SPC-009	Engineering Standard Specification for Pipe Insulation Design
MKP-11-BE-9000-PI-SPC-010	Engineering Standard Specification for Painting
MKP-11-BE-9000-PI-SPC-012	Engineering Standard Specification for Piping Material
MKP-11-BE-9000-PI-SPC-014	Engineering Standard Specification for Vessel Insulation Design
MKP-11-DE-8500-PR-PID-004	P&ID Flare Stack I
MKP-11-DE-8500-PR-PID-005	P&ID Flare Stack II
MKP-VD-8500-237-303-A4	Utility Consumption
MKP-VD-8500-237-304-A4	Flare Radiation Study Report
MKP-VD-8500-237-305-A4	Flare Noise Level Datasheet
MKP-VD-8500-237-502-A4	Line List
MKP-VD-8500-237-504-A3	Tie-in List
MKP-VD-8500-237-505-A1	Piping Arrangement Drawing
MKP-VD-8500-237-506-A3	Isometric Drawing
MKP-VD-8500-237-507-A3	Pipe Support List
MKP-VD-8500-237-508-A3	Pipe Insulation List
MKP-VD-8500-237-509-A3	Equipment Insulation List
MKP-VD-8500-237-510-A3	Pipe Painting List
MKP-VD-8500-237-511-A1	General Assembly Drawing of Flare
MKP-VD-8500-237-512-A4	Comprehensive Materials
MKP-VD-8500-237-306-A1	Flare Stack Drawing
MKP-VD-8500-237-307-A1	KO Drum Drawing
MKP-VD-8500-237-308-A1	Molecular Seal Drawing
MKP-VD-8500-237-309-A1	Flare Tip Drawing
MKP-VD-8500-237-310-A1	Fuel Gas Buffer Drum Drawing
MKP-VD-8500-237-105-A4	Certificates of Materials & Material Test

	Certificates
MKP-VD-8500-237-805-A4	Operation & Maintenance Manual
API RP 520	Sizing, Selection, and Installation of Pressure-Relieving Devices in Refineries
API RP 521	Guide for Pressure Relieving and Depressurizing Systems
API Std 537	Flare Details for General Refinery and Petrochemical Service
ASME B31.3	Process Piping
ASME B36.10M	Weld and Seamless Wrought Steel Pipe
ASME B36.19M	Stainless Steel Pipe
ASME B16.5	Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard
ASME B16.9	Factory-Made Wrought Buttwelding Fittings
ASME B16.11	Forged Fittings, Socket-Welding Threaded
ASME B16.20	Metallic Gaskets for Pipe Flanges Ring-Joint Spiral-Wound and Jacketed
ASME B16.21	Nonmetallic Flat Gaskets for Pipe Flanges
ASME B18.2.1	Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws(Inch Series)
ASME B18.2.2	Nuts for General Applications: Machine Screw Nuts, Hex, Square, Hex Flange, and Coupling Nuts (Inch Series)
API Std 602	Steel Gate, Globe, and Check Valves for Sizes NPS 4 (DN 100) and Smaller for the Petroleum and Natural Gas Industries
API Std 608	Metal Ball Valves—Flanged, Threaded, and Welding Ends
	MoM and Clarification

4. Scope of Design

The scope of design and supply for flare system are shown in “P&ID” indicated by battery limit wireframe “BY VENDOR”, including:

Knock-Out Drum(D-8501), Fuel Gas Buffer Drum(D-8502), Flare Stack(FL-8501), Flare Tip (FL-8502), Molecular Seal(FL-8503), Flame Front Generator(X-8501) (Skid, LCP included), Derrick(X-8502) and other materials supplied loosely.

Detail information for equipment is listed in “Equipment List”.

Detail information for interface of piping is listed in “Tie-in List”.

Sunpower are responsible for the design of the equipments, skid and other material supplied loosely within the scope of supply.

Sunpower are also responsible for the work as listed below:

Flare radiation study (the results are shown in “Flare Radiation Study Report”).

Analysis of noise level (the results are shown in “Flare Noise Level Datasheet”).

5. Flare System Information

There is one set of elevated flare in Flare system which is supported by derrick. The total height of the flare is 70m (Flare Stack & Knock-out Drum/60m (including 0.3m for foundation), Molecular/5m, tip/5m). Detail system description is shown as follows:

5.1 Flare Gas Discharge System

Process flare gas from OSBL shall go through flare gas header (64"-FLG-85-200-B24-P8) to the Knock-out Drum(D-8501), then to Flare Stack (FL-8501), Molecular Seal (FL-8503) and combust at Flare Tip (FL-8502).

The material of flare gas ISBL is ASTM A672 Gr. B60 CL.12.

Piping and insulation material of flare gas ISBL shall be provided by TCC.

5.2 Fuel Gas System

Natural gas from OSBL shall go through fuel gas header (4"-NG-85-200-B24-N) to the Fuel Gas Buffer Drum (D-8502), then separated into four streams.

The first stream (1"-NG-85-205-B50-N) goes to the FFG(X-8501) as the ignition source.

The second stream (2"-NG-85-301-B50-N) goes to the pilots (PIL-8501A/B/C/D) as the gas source.

The third stream (2"-NG-85-203-B24-N) goes to stack (bottom) as the normal purge gas.

The last stream (1"-NG-85-202-B24-N) goes to stack (top) as the anti-fire protection for flare.

The natural gas discharging from safety valve installed on the Fuel Gas Buffer Drum (D-4602) will be vent to the flare header (64"-FLG-85-200-B24-P8) at 45 degrees to header axis in direction of flow.

The material of natural gas pipe ISBL is ASTM A106 Gr. B (before Y type filter)/ASTM A312 TP304 (after Y type filter).

5.3 Instrument Air System

Instrument air from OSBL shall go through instrument air header (2"-IA-85-200-B50-N) to FFG (X-8501) for ignition source, as well as for air driven instrument.

The material of instrument air pipe ISBL is ASTM A312 TP304.

5.4 Steam System

HP steam from OSBL shall go through HP steam header (2"-HPS-85-200-F24-H6), then reduced pressure by pressure regulating valve (PCV-8550), to Flare Tip (FL-8502) for smoke elimination and Anti-fire protection, as well as for steam coil of Knock-Out Drum (D-8501).

The steam discharging from safety valve installed on the steam header shall be to safety location.

5.5 Condensate

Condensate of flare gas in Knock-Out Drum (D-8501) shall be heated, vaporized, then combust at Flare Tip (FL-8502).

Condensate of Molecular Seal (FL-8501) shall connect into Knock-Out Drum (D-8501).

Condensate of HP steam shall discharge locally.

5.6 Flashback Prevention Measure

As a safe equipment for flare unit, Molecular Seal (FL-8502) prevents the air from entering the stack when occurring the flare gas interruption, and guarantees no flashback or explosion when emission again to ensure the safety of flare facilities, as well as the production units.

5.7 Control Description

PLC shall be used for the automatic control of flare system. PLC is in the scope of Sunpower and the field instrument signals of flare system shall be connected to PLC.PLC communicate with FCS by MODBUS.

The control principle is shown as below:

a) Pressure Warning of Instrument Air and Fuel Gas

The ignition system backs up the safe running of the flare system. Warning against pressure (PT-8551) of instrument air header, pressure (PT-8553) of Fuel Gas Buffer Drum (D-8502) and pressure (PT-8552) of Pilot fuel gas main header are set for the indication of emergency.

b) Anti-flashback Protection control

When flare gas pressure (PT-8550A/B) is higher than the set value during discharging primary stage, the emergency purge gas on-off valve (UV-8550) will be interlocked to open, which will close in 5 minutes. When flare gas pressure (PT-8550A/B) is lower than the set value during discharging terminal stage, the emergency purge gas on-off valve (UV-8550) will be interlocked to open again, which will close in 5 minutes too.

When temperature (TT-8555) of Flare Tip (FL-8502) is higher than 230℃ (adjustable), the fuel gas regulator valve (TV-8551) will be interlocked to open

c) Smokeless and Anti-fire Protection control

When observing smoke in flare, open the steam on-off valve (TV-8550) in control room for smokeless. Besides, when temperature (TT-8550) in flare stack is higher than the set value, the steam regulator valve (TV-8550) will be interlocked to open for fire protection.

d) Knock-out Drum Level Control

When the liquid level (LT-8551) of condensate in the Knock-out Drum (D-8501) is higher than the set value, the steam on-off valve (UV-8551) will be interlocked to open. When the liquid level (LT-8551) of condensate in the Knock-out Drum (D-8501) is lower than the set value, the steam on-off valve (UV-8551) will be interlocked to close.

e) Operation Status Indication of Pilots and Warning

The 4sets of Pilots (PIL-8501A~D) will remain continuously ignited on normal operation. Each pilot will equipped with dual sheathe thermocouple for pilot flame detection. The signals are transmitted to the PLC through the temperature transmitters (TT-8551A ~TT-8554A) for indication and alarm. When the pilot temperature (TE-8551A/B~TE-8554A/B) is less than 230℃ (adjustable), HEI will be automatically interlocked for ignition. Ignition may be realized through local control panel or automatic/manual operation in the central control room for the safe running purpose of the flare system.

Detail refer to “Operation & Maintenance Manual”.

6. Utility Consumption

Utility consumption for flare system is listed in “Utility Consumption”.

7. Material Purchase

Specification and quantity of equipment refer to “Equipment List”.

Specification and quantity of pipe, valve, fitting, flange, gasket, stud bolt/nut, piping support and coating material refer to “Comprehensive Materials”.

8. Piping Installation

In flare system, only piping in FFG are installed in skid, other remaining piping shall be installed at site.

Detail information of Piping Installation refer to “Piping Arrangement Drawing” and “Isometric Drawing”.

9. Equipment Assembly

Refer to equipment assembly drawings. Related drawings for equipment assembly are list below:

a. General Assembly Drawing of Flare

b. Flare Stack Drawing

c. Knock-Out Drum Drawing

d. Molecular Seal Drawing

e. Flare Tip Drawing

f. Fuel Gas Buffer Drum Drawing

10. Insulation, Coating and Surface Color

Design of insulation, coating and surface color for pipe and equipment will be in accordance with “Engineering Standard Specification for Pipe Insulation Design”, “Engineering Standard

Specification for Vessel Insulation Design" and "Engineering Standard Specification for Painting".

The detail information for pipe refers to "Pipe Insulation List" and "Pipe Painting List".

The detail information for equipment refers to each equipment drawing and "Equipment Insulation List".

11. Pipe Support

Pipe supports refer to "Pipe Support List".

Detail information of Installation location refer to "Piping Arrangement Drawing" and "Isometric Drawing".

12. Pipe Stress Analysis

Design of pipe stress analysis (flare gas line and HP steam) will be in accordance with "Engineering Specification for Pipe Stress Analysis".

13. Piping Quality Acceptance

All piping design and quality acceptance will be in accordance with ASME B31.3.

Detail information of pressure test, leak test, PWHT, purge and RT requirement refer to "Line List".

Detail information of piping material certification refer to "Certificates of Materials & Material Test Certificates".