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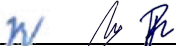




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RP-ETS-INS-GS-0031-01-2021

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GENERAL SPECIFICATION

FIRE AND GAS SYSTEM (FGS)

ENGINEERING TECHNICAL STANDARDS & PROCEDURES PT KILANG PERTAMINA INTERNASIONAL DIREKTORAT PROYEK INFRASTRUKTUR

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1. INTRODUCTION

1.1 The purpose of this specification is to provide a safe and reliable Fire and Gas Detection System (FGS) that meets the needs of the Project.

2. SCOPE

2.1 This specification, together with its attachments, defines the minimum technical requirements for engineering, selection, inspection, testing, supply, and installation of Fire and Gas Detection System (FGS) for the Project.

3. CONFLICTS AND DEVIATIONS

3.1 Any conflicts between this standard and other applicable Engineering Technical Standards & Procedures (ETSP), or OWNER standard, codes, and forms shall be resolved in writing by OWNER.

3.2 All direct requests to deviate from this standard (ETSP) in writing to OWNER, who shall follow internal OWNER procedure and forward such requests to OWNER for approval.

4. ABBREVIATIONS

4.1 Abbreviations used for this specification shall have the following definitions:

BPCS	Basic Process Control System
CPU	Central Processing Unit
EWS	Engineering Workstation
FAT	Factory Acceptance Test
FACP	Fire Alarm Control Panel
FGS	Fire and Gas System

1. PENGANTAR

1.1 Tujuan dari spesifikasi ini adalah untuk menyediakan *Fire and Gas Detection System* (FGS) yang aman dan andal yang memenuhi kebutuhan Proyek.

2. LINGKUP

2.1 Spesifikasi ini, beserta lampirannya, menetapkan persyaratan teknis *minimum* untuk *engineering*, seleksi, inspeksi, pengujian, suplai, dan instalasi dari *Fire and Gas Detection System* (FGS) untuk kebutuhan Proyek.

3. KONFLIK DAN DEVIASI

3.1 Apabila terdapat konflik antara standar ini dengan *Engineering Technical Standards & Procedures* (ETSP) yang berlaku lainnya, atau standar PEMILIK, *codes* dan formulir, maka harus diselesaikan secara tertulis oleh PEMILIK.

3.2 Semua permintaan penggunaan standar yang berbeda dari standar ini (ETSP), harus diajukan kepada PEMILIK secara tertulis dengan mengikuti prosedur *internal* PEMILIK untuk mendapatkan persetujuan.

4. SINGKATAN

4.1 Singkatan yang digunakan untuk spesifikasi ini harus memiliki definisi sebagai berikut:

BPCS	<i>Basic Process Control System</i>
CPU	<i>Central Processing Unit</i>
EWS	<i>Engineering Workstation</i>
FAT	<i>Factory Acceptance Test</i>
FACP	<i>Fire Alarm Control Panel</i>
FGS	<i>Fire and Gas System</i>

HART	Highway Addressable Remote Transducer	HART	<i>Highway Addressable Remote Transducer</i>
HMI	Human Machine Interface	HMI	<i>Human Machine Interface</i>
HSE	Health, Safety, and Environment	HSE	<i>Health, Safety, and Environment</i>
HVAC	Heating, Ventilation, and Air Conditioning	HVAC	<i>Heating, Ventilation, and Air Conditioning</i>
I/O	Input/Output	I/O	<i>Input/Output</i>
IP	Ingress Protection	IP	<i>Ingress Protection</i>
IS	Intrinsically Safe	IS	<i>Intrinsically Safe</i>
ISBL	Inside Battery Limit	ISBL	<i>Inside Battery Limit</i>
ISH	Instrument Satellite House	ISH	<i>Instrument Satellite House</i>
JB	Junction Box	JB	<i>Junction Box</i>
LED	Light Emitting Diode	LED	<i>Light Emitting Diode</i>
LEL	Lower Explosive Limit	LEL	<i>Lower Explosive Limit</i>
MCR	Main Control Room	MCR	<i>Main Control Room</i>
OSBL	Outside Battery Limit	OSBL	<i>Outside Battery Limit</i>
PLC	Programmable Logic Controller	PLC	<i>Programmable Logic Controller</i>
RAM	Random Access Memory	RAM	<i>Random Access Memory</i>
ROM	Read Only Memory	ROM	<i>Read Only Memory</i>
SAT	Site Acceptance Test	SAT	<i>Site Acceptance Test</i>
SIS	Safety Instrumented System	SIS	<i>Safety Instrumented System</i>
SWA	Steel Wire Armoured	SWA	<i>Steel Wire Armoured</i>
TLV-TWA	Threshold Limit Value/Time Weighted Average	TLV-TWA	<i>Threshold Limit Value/Time Weighted Average</i>
TCP/IP	Transmission Control Protocol/Internet Protocol	TCP/IP	<i>Transmission Control Protocol/Internet Protocol</i>
UV/IR	Ultraviolet/Infra-Red	UV/IR	<i>Ultraviolet/Infra-Red</i>
VDC	Voltage Direct Current	VDC	<i>Voltage Direct Current</i>

5. DEFINITIONS

5.1 The following words shall have these special meanings when used herein:

OWNER Owner of the Plant is defined as PT Kilang Pertamina Internasional

CONTRACTOR/CONSULTANT Defined as the Organization to which PT Kilang Pertamina Internasional assign the work

shall Indicates that the statement is mandatory

should Indicates a recommendation

VENDOR Defined as the company selected to supply the equipment and service detailed in this specification.

SUB CONTRACTOR Any person or persons, firm, partnership, corporation or combination thereof engaged by Contractor for supplying services to Contractor for the performance of services.

SUB VENDOR Any supplier of equipment and support services for a particular piece of equipment/package to a VENDOR.

5. DEFINISI

5.1 Penggunaan kata-kata berikut harus memiliki arti khusus sebagai berikut:

PEMILIK Pemilik Kilang didefinisikan sebagai PT Kilang Pertamina Internasional

KONTRAKTOR/KONSULTAN Didefinisikan sebagai Organisasi yang ditunjuk oleh PT Kilang Pertamina Internasional untuk melakukan suatu pekerjaan


shall Menunjukkan bahwa pernyataan itu wajib

should Menunjukkan rekomendasi

VENDOR Didefinisikan sebagai perusahaan yang dipilih untuk memasok peralatan dan *service* yang dirinci dalam spesifikasi ini.

SUB KONTRAKTOR Setiap orang atau beberapa orang, firma, kemitraan, korporasi atau kombinasi daripadanya yang dipekerjakan oleh Kontraktor untuk memasok servis kepada Kontraktor untuk pelaksanaan servis.

SUB VENDOR Setiap pemasok peralatan dan servis penyangga untuk peralatan/ paket tertentu ke VENDOR.

 Engineering Technical Standards & Procedures	SUBHOLDING REFINING & PETROCHEMICAL	Doc. No. : RP-ETS-INS-GS-0031-01-2021
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May	The word 'may' is to be understood as indicating a possible course of action.	Mungkin	Kata 'mungkin' harus dipahami sebagai indikasi kemungkinan tindakan.
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6. CODES AND STANDARDS

The following Codes, Standard and Specifications apply to this specification. When an edition date is not indicated for a code or standard or any update in codes and standards in this specification document, the latest edition and addendum in force at the time of purchase shall apply. Material & equipment shall be as a specification or an equal approved by OWNER.

6.1 American Petroleum Institute (API)


API RP 505	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1 and Zone 2
API RP 752	Management of Hazards Associated with Location of Process Plant Buildings.
API 2510A	Fire Protection Considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities

6. CODE DAN STANDAR

Code, standar, dan spesifikasi berikut berlaku untuk spesifikasi ini. Code dan standar harus menggunakan edisi yang terbaru atau edisi yang berlaku pada saat pembelian. Material & peralatan harus sesuai spesifikasi atau setara dengan yang disetujui oleh PEMILIK.

6.1 American Petroleum Institute (API)


API RP 505	<i>Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1 and Zone 2</i>
API RP 752	<i>Management of Hazards Associated with Location of Process Plant Buildings.</i>
API 2510A	<i>Fire Protection Considerations for the Design and Operation of Liquefied Petroleum Gas (LPG) Storage Facilities</i>

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<p>API RP 753</p> <p>6.2 American Society of Mechanical Engineers (ASME)</p> <p>ASME B16.10</p> <p>ASME B16.34</p> <p>6.3 International Electrotechnical Commission (IEC)</p> <p>IEC 60079-0</p> <p>IEC 60079-1</p> <p>IEC 60079-2</p> <p>IEC 60079-7</p>	<p>Management of Hazards Associated with Location of Process Plant Portable Buildings</p> <p>Face-to-Face and End-to-End Dimensions of Valves</p> <p>Valves – Flanged, Threaded, and Welding End</p> <p>Electrical Apparatus for Potentially Explosive Atmospheres - (EN50 014) General Requirements</p> <p>Electrical Apparatus for Potentially Explosive Atmospheres - (EN50 018) Flameproof enclosure “d”</p> <p>Electrical Apparatus for Potentially Explosive Atmospheres - (EN50 018) Pressurized enclosure “p”</p> <p>Electrical Apparatus for Potentially Explosive Atmospheres - (EN50 018) Increased safety “e”</p>	<p>API RP 753</p> <p>6.2 American Society of Mechanical Engineers (ASME)</p> <p>ASME B16.10</p> <p>ASME B16.34</p> <p>6.3 International Electrotechnical Commission (IEC)</p> <p>IEC 60079-0</p> <p>IEC 60079-1</p> <p>IEC 60079-2</p> <p>IEC 60079-7</p>	<p><i>Management of Hazards Associated with Location of Process Plant Portable Buildings</i></p> <p><i>Face-to-Face and End-to-End Dimensions of Valves</i></p> <p><i>Valves – Flanged, Threaded, and Welding End</i></p> <p><i>Electrical Apparatus for Potentially Explosive Atmospheres - (EN50 014) General Requirements</i></p> <p><i>Electrical Apparatus for Potentially Explosive Atmospheres - (EN50 018) Flameproof enclosure “d”</i></p> <p><i>Electrical Apparatus for Potentially Explosive Atmospheres - (EN50 018) Pressurized enclosure “p”</i></p> <p><i>Electrical Apparatus for Potentially Explosive Atmospheres - (EN50 018) Increased safety “e”</i></p>
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IEC 60079-10-1	Electrical Apparatus for Potentially Explosive Atmospheres - (EN50 018) Classification of areas – Explosive gas atmospheres	IEC 60079-10-1	<i>Electrical Apparatus for Potentially Explosive Atmospheres - (EN50 018) Classification of areas – Explosive gas atmospheres</i>
IEC 60079-14	Electrical Apparatus for Potentially Explosive Atmospheres - Electrical installations design, selection and erection	IEC 60079-14	<i>Electrical Apparatus for Potentially Explosive Atmospheres - Electrical installations design, selection and erection</i>
IEC 60079-15	Electrical Apparatus for Potentially Explosive Atmospheres - Equipment protection by type of protection “n”	IEC 60079-15	<i>Electrical Apparatus for Potentially Explosive Atmospheres - Equipment protection by type of protection “n”</i>
IEC 60079-17	Electrical Apparatus for Potentially Explosive Atmospheres - Electrical installations inspection and maintenance	IEC 60079-17	<i>Electrical Apparatus for Potentially Explosive Atmospheres - Electrical installations inspection and maintenance</i>
IEC 60079-18	Electrical Apparatus for Potentially Explosive Atmospheres - Equipment protection by encapsulation “m”	IEC 60079-18	<i>Electrical Apparatus for Potentially Explosive Atmospheres - Equipment protection by encapsulation “m”</i>
IEC 60079-20-1	Electrical Apparatus for Potentially Explosive Atmospheres - Material characteristics for gas and vapour classification – Test methods and data	IEC 60079-20-1	<i>Electrical Apparatus for Potentially Explosive Atmospheres - Material characteristics for gas and vapour classification – Test methods and data</i>

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IEC 60079-29-1	Electrical Apparatus for Potentially Explosive Atmospheres - Gas detectors - Performance requirements of detectors for flammable gases	IEC 60079-29-1	<i>Electrical Apparatus for Potentially Explosive Atmospheres - Gas detectors – Performance requirements of detectors for flammable gases</i>
IEC 60079-29-2	Electrical Apparatus for Potentially Explosive Atmospheres - Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen	IEC 60079-29-2	<i>Electrical Apparatus for Potentially Explosive Atmospheres - Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen</i>
IEC 60364	Electrical Installation Requirement	IEC 60364	<i>Electrical Installation Requirement</i>
IEC 61131-1	Programmable Controllers	IEC 61131-1	<i>Programmable Controllers</i>
IEC 60331	Test for Electric Cables Under Fire Conditions	IEC 60331	<i>Test for Electric Cables Under Fire Conditions</i>
IEC 600529	Specification for Degrees of Protection Provided by Enclosures (IP Code).	IEC 600529	<i>Specification for Degrees of Protection Provided by Enclosures (IP Code).</i>

6.4	National Fire Protection Association (NFPA)	6.4	<i>National Fire Protection Association (NFPA)</i>
	NFPA 1		<i>NFPA 1</i>
	Fire Code		<i>Fire Code</i>
	NFPA 12		<i>NFPA 12</i>
	Carbon Dioxide Extinguishing Systems		<i>Carbon Dioxide Extinguishing Systems</i>
	NFPA 20		<i>NFPA 20</i>
	Standard for The Installation of Stationary Pump for Fire Protection		<i>Standard for The Installation of Stationary Pump for Fire Protection</i>
	NFPA 30		<i>NFPA 30</i>
	Flammable and Combustible Liquids Code		<i>Flammable and Combustible Liquids Code</i>

NFPA 72	National Fire Alarm Code and Signalling Code	NFPA 72	<i>National Fire Alarm Code and Signalling Code</i>
NFPA 90A	Installation of Air-Conditioning and Ventilating Systems	NFPA 90A	<i>Installation of Air-Conditioning and Ventilating Systems</i>
NFPA 101	Life Safety Code	NFPA 101	<i>Life Safety Code</i>
NFPA 307	Marine Terminals, Piers, and Wharves	NFPA 307	<i>Marine Terminals, Piers, and Wharves</i>
NFPA 2001	Clean Agent Fire Extinguishing Systems	NFPA 2001	<i>Clean Agent Fire Extinguishing Systems</i>
6.5	Factory Manual (FM)	6.5	<i>Factory Manual (FM)</i>
FM 6310	Combustible Gas Detector	FM 6310	<i>Combustible Gas Detector</i>
FM 3260	Radiant Energy-Sensing Fire Detectors for Automatic Fire Alarm Signalling	FM 3260	<i>Radiant Energy-Sensing Fire Detectors for Automatic Fire Alarm Signalling</i>
6.6	Reference Documents	6.6	<i>Dokumen Referensi</i>
RP-ETS-INS-DC-0001	Control System Design Criteria	RP-ETS-INS-DC-0001	<i>Control System Design Criteria</i>
RP-ETS-INS-GS-0020	General Instrumentation	RP-ETS-INS-GS-0020	<i>General Instrumentation</i>
RP-ETS-INS-GS-0019	Instrumentation Cable	RP-ETS-INS-GS-0019	<i>Instrumentation Cable</i>
RP-ETS-INS-GS-0013	Control Panel	RP-ETS-INS-GS-0013	<i>Control Panel</i>
RP-ETS-INS-GS-0005	Safety Instrumented System (SIS)	RP-ETS-INS-GS-0005	<i>Safety Instrumented System (SIS)</i>
RP-ETS-INS-DP-0001	Alarm Management System	RP-ETS-INS-DP-0001	<i>Alarm Management System</i>
RP-ETS-INS-GS-0032	Fire Alarm Control Panel (FACP)	RP-ETS-INS-GS-0032	<i>Fire Alarm Control Panel (FACP)</i>
RP-ETS-INS-GS-0004	Programmable Logic Controllers (PLC)	RP-ETS-INS-GS-0004	<i>Programmable Logic Controllers (PLC)</i>

7. SYSTEM REQUIREMENT

7.1 System Overview

- a. Fire and Gas Detection System (FGS) will be installed in the Project. The system shall comply with NFPA 72 and IEC 60079 as applicable.
- b. The system shall consist of field device detectors including fire detectors, gas detectors, audible alarm horns, visible strobes light/beacon lamp, junction box complete with terminal block, marshalling panel, FGS control panel, EWS, HMI Console, and Mimic LED Screen.
- c. Fire and gas detection equipment that will be installed in the existing facility shall follow the API 505 hazardous area classification criteria, meanwhile fire and gas detection equipment that will be installed in the new facility shall follow the IEC 60079 criteria for hazardous area classification.
- d. Sensors should be located so that they are accessible for calibration and cleaning.
- e. Junction boxes shall be suitable to be installed in the electrical hazardous area classification and 20% installed spare terminal blocks shall be provided in the junction box.
- f. The FGS shall be designed such that any single fault within its hardware, software shall not cause a system shutdown, nor prohibit system safety or system performance or impact operation of the controlled process. The system shall protect the controlled process from intermittent, transient and permanent system faults.
- g. Failures shall be identified by means of

7. PERSYARATAN SISTEM

7.1 System Overview

- a. *Fire and Gas Detection System (FGS)* akan dipasang di Proyek. Sistem harus mematuhi NFPA 72 dan IEC 60079 sebagaimana berlaku.
- b. Sistem harus terdiri dari *field device detector* termasuk *fire detector, gas detector, klakson alarm* yang dapat didengar, lampu sorot/ lampu suar yang terlihat, *junction box* lengkap dengan *terminal block, panel marshalling*, panel kontrol FGS, EWS, HMI Console, dan layar LED *Mimic*.
- c. Alat pendeteksi kebakaran dan gas yang akan dipasang di fasilitas yang ada harus mengikuti kriteria klasifikasi *hazardous area* API 505, sedangkan alat pendeteksi kebakaran dan gas yang akan dipasang di fasilitas baru harus mengikuti kriteria klasifikasi *hazardous area* IEC 60079.
- d. Sensor harus ditempatkan sedemikian rupa sehingga dapat diakses untuk kalibrasi dan pembersihan.
- e. *Junction box* harus sesuai untuk dipasang di klasifikasi *electrical hazardous area* dan 20% *terminal block* cadangan yang terpasang harus disediakan di *junction box*.
- f. FGS harus didesain sedemikian rupa sehingga setiap kesalahan tunggal dalam perangkat keras, perangkat lunak harus tidak boleh menyebabkan sistem *shutdown*, tidak mengganggu keselamatan sistem atau performa sistem atau dampak operasi dari proses kontrol. Sistem harus memproteksi proses kontrol dari gangguan sistem yang terputus-putus, sementara dan permanen.
- g. Kegagalan harus diidentifikasi melalui

a fault status indicator on the failed module. The FGS shall have the ability to recognize and detect the fault, locate the source of that fault, contain and isolate the fault to a specific module or modules of the system, and be able to recover or maintain operational status in the presence of a fault.

- h. The FGS shall have the ability to monitor analog and digital signal wiring open, short and grounding circuit faults from and to field devices.
- i. The FGS shall have the ability to detect the system failure from a self-diagnostic program. The self-diagnostic program separately from application program and cover the following as the minimum:
 - 1. CPU failure
 - 2. Watchdog failure
 - 3. Power supply failure
 - 4. I/O module failure
 - 5. Communication module failure
 - 6. Internal/external communication failure
 - 7. Map and verify all RAM and ROM content
 - 8. Check the operating and application program
 - 9. Ground fault
 - 10. Field devices failure
 - 11. Battery backup/charge failure
 - 12. Printer failure
 - 13. Low level processor battery backup

indikator status kesalahan pada modul yang gagal. FGS harus memiliki kemampuan untuk mengenali dan mendeteksi kesalahan, menemukan sumber kesalahan itu, menahan dan mengisolasi kesalahan ke modul atau modul tertentu dari sistem, dan dapat memulihkan atau mempertahankan status operasional jika ada kesalahan.

- h. FGS harus memiliki kemampuan untuk *monitor* kabel sinyal *analog* dan *digital* yang terbuka, gangguan hubung singkat dan *grounding* dari dan ke *field device*.
- i. FGS harus memiliki kemampuan untuk mendeteksi kegagalan sistem dari program *self-diagnostic*. Program *self-diagnostic* secara terpisah dari program aplikasi dan mencakup *minimum* hal-hal berikut sebagai :
 - 1. Kegagalan CPU
 - 2. Kegagalan pengawas (*Watchdog*)
 - 3. Kegagalan *power supply*
 - 4. Kegagalan modul I/O
 - 5. Kegagalan modul komunikasi
 - 6. Kegagalan komunikasi *internal* /eksternal
 - 7. Pemetaan dan verifikasi semua konten RAM dan ROM
 - 8. Periksa program operasi dan aplikasi
 - 9. *Ground fault*
 - 10. Kegagalan *field device*/ perangkat lapangan
 - 11. Cadangan baterai/ kegagalan pengisian *power*
 - 12. Kegagalan *printer*
 - 13. Cadangan baterai *processor* tingkat rendah

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| <p>j. The FGS shall have the ability to send sensor alarms to BPCS HMI console inside MCR, to BPCS HMI console inside utilities control room, to FGS HMI console inside MCR, to FGS HMI console in utilities control room, and FGS HMI console in HSE building. All HMI consoles shall be integrated to Mimic LED screen (Wide screen FGS display).</p> <p>k. Sensor alarm to BPCS HMI consoles shall come from BPCS panel and are limited to alarm from each operation area. Meanwhile system failure alarm (i.e. CPU failure, I/O module failure, communication module failure, etc.) and sensor alarms from the overall area shall be sent to the dedicated FGS HMI console in MCR, to the dedicated FGS HMI console in the utilities control room, and to the dedicated FGS HMI console in the HSE building. The system failure alarm and sensor alarm to all FGS HMI consoles shall come directly from the FGS panel.</p> <p>l. Online removal/replacement of any FGS module shall be possible without having to reconfigure system software, alter system wiring or cabling, de-energize system or module power, or compromise FGS safety functions. The system failed module should be able take over by the healthy module automatically. No operator action shall be required to restore the system to normal operation other than simple replacement of modules.</p> <p>m. The plant warning system shall be provided. The plant warning system shall consist of a number of sirens situated around the plant. The siren shall cover all areas of the plant. The</p> | <p>j. FGS harus memiliki kemampuan untuk mengirimkan <i>alarm</i> sensor ke BPCS HMI Console di dalam MCR, ke BPCS HMI Console di dalam <i>control room</i> utilitas, ke FGS HMI Console di dalam MCR, ke FGS HMI Console di <i>control room</i> utilitas, dan FGS HMI Console di bangunan HSE. Semua HMI Console harus terintegrasi dengan layar LED <i>Mimic</i> (Tampilan FGS layar lebar).</p> <p>k. <i>Alarm</i> sensor ke BPCS HMI Console harus berasal dari <i>panel</i> BPCS dan dibatasi untuk <i>alarm</i> dari setiap <i>area</i> operasi. Sementara itu <i>alarm</i> kegagalan sistem (yaitu kegagalan CPU, kegagalan modul I/O, kegagalan modul komunikasi, dll) dan <i>alarm</i> sensor dari keseluruhan <i>area</i> harus dikirim ke FGS HMI Console khusus di MCR, ke FGS HMI Console khusus di <i>control room</i> utilitas, dan ke FGS HMI Console khusus di bangunan HSE. <i>Alarm</i> kegagalan sistem dan <i>alarm</i> sensor ke semua FGS HMI Console harus datang langsung dari <i>panel</i> FGS.</p> <p>l. Penghapusan/ penggantian modul FGS secara <i>online</i> harus dimungkinkan tanpa harus mengkonfigurasi ulang perangkat lunak sistem, mengubah <i>wiring</i> atau <i>cabling</i> sistem, menonaktifkan sistem atau <i>power module</i>, atau mengganggu fungsi keselamatan FGS. Modul sistem yang gagal harus dapat diambil alih oleh modul yang sehat secara otomatis. Tidak ada tindakan <i>operator</i> yang diperlukan untuk mengembalikan sistem ke operasi <i>normal</i> selain penggantian sederhana modul.</p> <p>m. Sistem peringatan instalasi kilang harus disediakan. Sistem peringatan kilang harus terdiri dari sejumlah sirene yang ditempatkan di sekitar kilang. Sirene harus mencakup semua area kilang.</p> |
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warning system shall be manually activated from the fire station.

- n. FGS shall also integrate with the automatic water deluge system. In case the activation of water deluge system FGS shall send the alarm to BPCS HMI console in MCR, BPCS HMI console in utilities control room, FGS HMI console in MCR, FGS HMI console in utilities control room and FGS HMI console in HSE building.
- o. Manual activation panels shall also be provided to activate water deluge systems.
- p. FGS shall have a data protection system for the preservation of all data during planned or unplanned turn-around. The entire software shall be backup, including database, system configuration, user built program, source code, data files using CD ROM (read/write type drive shall be provided).

7.2 Field Device Detector

- a. FGS field devices shall be suitable for process installation, and rated for the electrical hazardous area classification. Detector housing shall be stainless steel or copper free aluminium and environmentally rated to minimum IP65, unless specified as other. Coatings shall be non-degradable and non-chipping. Multiple coats of epoxy resin paint base and polyurethane resin paint finish of minimum 100 microns total thickness are preferred.
- b. Diagnostic features shall be provided to detect fault status of the detector.
- c. Field detectors shall have the required accessories (e.g., rain shield, dust

Sistem peringatan harus diaktifkan secara *manual* dari *fire station*.

- n. FGS juga harus terintegrasi dengan *water deluge system* otomatis. Dalam hal aktivasi *water deluge system* FGS harus mengirimkan *alarm* ke BPCS HMI Console di MCR, BPCS HMI Console di *control room* utilitas, FGS HMI Console di MCR, FGS HMI Console di *control room* utilitas dan FGS HMI Console di bangunan HSE.
- o. Aktivasi *manual panel* juga harus disediakan untuk mengaktifkan *water deluge system*.
- p. FGS harus memiliki sistem proteksi data untuk menjaga semua data selama *turn-around* yang direncanakan atau tidak direncanakan. Seluruh perangkat lunak harus dicadangkan, termasuk *database*, konfigurasi sistem, program yang dibuat pengguna, *code* sumber, file data menggunakan CD ROM (*drive* tipe baca/tulis harus disediakan).

7.2 Field Device Detector

- a. FGS *field device* harus sesuai untuk instalasi proses, dan *rating* untuk klasifikasi *electrical hazardous area*. *Detector housing* harus dari *stainless steel* atau *copper free aluminium* serta memiliki *environmentally rated minimum IP65*, kecuali ditentukan lain. Pelapisan harus *non-degradable* dan *non-chipping*. Lebih diutamakan beberapa lapis dasar cat *resin* epoksi dan cat resin *polyurethane* dengan ketebalan total minimal 100 mikron.
- b. Fitur diagnosa harus disediakan untuk mendeteksi status kesalahan *detector*.
- c. *Field detector* harus memiliki aksesoris yang diperlukan (misalnya, *rain shield*,

guard) appropriate for the site installation and environmental conditions. The VENDOR/CONTRACTOR shall confirm with installation requirements for given site conditions before finalizing detector make/model selection with suitable available options for purchase.

- d. Wiring from field device to ISH shall be red jacketed fire resistant, galvanized steel wire armoured (SWA) instrumentation cable. As well as shielded twisted pair or triad annealed copper conductors, the cable shall be rated for electrical signal integrity for a prescribed period during a fire event according to IEC 60331 or other internationally recognized cable integrity testing under fire conditions standard. Field device detectors implemented for this project are as follows:

7.2.1. Gas Detector

- a. Gas detectors shall satisfy the performance requirements of IEC 60079-29-1 and the design and installation criteria of IEC 60079-29-2. Gas detectors shall be factory calibrated to the gas specified on the issued instrument data sheet.
- b. All gas detectors must have explosion proof/ gas proof certification, based on hazardous area classification.
- c. Location and orientation of gas detectors shall be determined to provide maximum coverage of the risk area to prevent the

dust guard) yang sesuai untuk instalasi di lokasi proyek dan kondisi lingkungan. VENDOR/ KONTRAKTOR harus mengkonfirmasi dengan persyaratan instalasi untuk kondisi lokasi tertentu sebelum menyelesaikan pemilihan model/ *detector* dengan opsi yang tersedia untuk pembelian yang sesuai.

- d. *Wiring* dari *field device* ke ISH harus dengan *red jacketed fire resistant*, kabel *instrument* dilapisi/ diselimuti kawat baja galvanis/ *steel wire armoured* (SWA). Seperti halnya *shielded twisted pair* atau *triad annealed copper conductor*, kabel harus memiliki *rating* integritas sinyal listrik untuk periode yang ditentukan selama peristiwa kebakaran menurut IEC 60331 atau pengujian integritas kabel lain yang diakui secara internasional di bawah standar kondisi kebakaran. *Field device detector* yang diterapkan untuk proyek ini adalah sebagai berikut:

7.2.1. Gas Detector

- a. *Gas detector* harus memenuhi persyaratan kinerja IEC 60079-29-1 dan kriteria desain dan instalasi IEC 60079-29-2. *Gas detector* harus dikalibrasi di pabrik sesuai spesifikasi gas yang dicantumkan dalam *data sheet*.
- b. Semua *gas detector* harus memiliki sertifikasi *explosion proof/ gas proof*, berdasarkan klasifikasi *hazardous area*.
- c. Lokasi dan orientasi *gas detector* harus ditentukan untuk memberikan cakupan maksimum *area* risiko untuk mencegah

possibility of false alarm.

- d. Location of gas detectors shall be selected in such a way, that they will fully cover the fire zone area to be protected.
- e. Voting systems will be applied for gas detectors following the result of individual risk assessment of each protected area.
- f. Transmitters for gas detectors shall have HART enabled 4-20 mA analog for indicating alarm level and diagnostic information of detector faults. Gas detectors shall be capable of being calibrated from a handheld HART communicator.
- g. Detection of gas shall be warned by audible alarms (horns, loudspeakers, sirens or equivalent) in the outdoor facilities.

7.2.1.1 Flammable Gas Detector

- a. Flammable gas/vapour detectors shall be applied in areas handling flammable substances with special care for equipment and storage handling hydrocarbon gas (including hydrogen) or liquid.
- b. Flammable gas detectors shall be distributed taking into considerations the prevailing wind direction and density of the gas to be detected.
- c. Flammable gas detectors shall be individually wired to and monitored by the FGS Control Panel.

kemungkinan *alarm* palsu.

- d. Lokasi *gas detector* harus dipilih sedemikian rupa, sehingga akan sepenuhnya menutupi *area* zona kebakaran yang akan diproteksi.
- e. Sistem *voting* akan diterapkan untuk *gas detector* mengikuti hasil penilaian risiko individu dari setiap kawasan lindung.
- f. *Transmitter* untuk *gas detector* harus memiliki *analog* 4-20 mA yang diaktifkan HART untuk menunjukkan *level alarm* dan informasi diagnostik kesalahan *detector*. *Gas detector* harus mampu dikalibrasi dari *handheld HART communicator*.
- g. Hasil deteksi gas harus diperingatkan dengan *alarm* yang dapat didengar (klakson, *loudspeaker*/ pengeras suara, sirene atau sejenisnya) di fasilitas luar ruangan.

7.2.1.1 Flammable Gas Detector

- a. *Flammable gas/ vapour detector* harus diterapkan di *area* yang menangani zat-zat yang mudah terbakar dengan perhatian khusus untuk peralatan dan penanganan penyimpanan gas *hydrocarbon* (termasuk *hydrogen*) atau cairan.
- b. *Flammable gas detector* harus didistribusikan dengan mempertimbangkan arah angin yang berlaku dan *density* gas yang akan dideteksi.
- c. *Flammable gas detector* harus *individually wired* ke dan di-*monitor* oleh *Control Panel* FGS.

- d. Flammable gas detectors shall be of catalytic combustion type with output signal of 4-20 mA and be certified for use at hazardous areas. Flammable gas detectors shall have performance to detect the presence of flammable gas at concentrations from 0 to 100 % of the LEL of the gas being detected.
- e. Flammable gas detectors shall be provided for the following locations:
1. Near seal of pump handling C4 or lighter hydrocarbons in process area, excluding non-seal pump. For economical reasons, one detector may be provided between the pumps if the pump has a spare pump.
 2. Near each seal of the compressor handling C4 or lighter hydrocarbons in the process area.
 3. Near loading arm handling C4 or lighter hydrocarbons.
 4. Around the fire heater in the process area for which detectors to be distributed at the maximum interval of 20 m along the perimeter.
 5. Near air intake of instrument & tool air compressor.
 6. One detector each on ground level of and on top platform of sphere tank storing C4 or lighter
- d. *Flammable gas detector* harus dari jenis pembakaran *catalytic* dengan sinyal keluaran 4-20 mA dan disertifikasi untuk digunakan di *hazardous area*. *Flammable gas detector* harus memiliki performa untuk mendeteksi keberadaan gas yang mudah terbakar pada konsentrasi dari 0 hingga 100% dari LEL gas yang terdeteksi.
- e. *Flammable gas detector* harus disediakan untuk lokasi berikut:
1. Di dekat *seal* pompa yang menangani C4 atau *lighter hydrocarbon* di *area* proses, tidak termasuk pompa *non-seal*. Untuk alasan ekonomis, satu *detector* dapat disediakan di antara pompa jika pompa memiliki pompa cadangan.
 2. Di dekat setiap *seal compressor* yang menangani C4 atau *lighter hydrocarbon* di *area* proses.
 3. Di dekat *loading arm* yang menangani C4 atau *lighter hydrocarbon*.
 4. Di sekitar *fire heater* di *area* proses yang *detector*-nya akan didistribusikan pada *interval* maksimum 20 m di sepanjang *perimeter*.
 5. Di dekat udara instrumen *intake* & perkakas *air compressor*
 6. Satu *detector* masing-masing di permukaan tanah dan di atas *platform sphere tank* yang menyimpan C4 atau *lighter*

hydrocarbons.

7. Two detectors at air Intake of the building pressurized by HVAC system.
8. In enclosed space where the equipment handling C4 or lighter hydrocarbons are located, such as an analyzer shed, for which detectors to be distributed so that the travel distance to the nearest detector from the equipment does not exceed 10 m measured horizontally on the same floor.

7.2.1.2 Hydrogen Gas Detector


- a. Hydrogen gas detectors shall be provided for the compressor handling rich hydrogen and be positioned at the upper portion of each seal as close as possible.
- b. Hydrogen gas detectors shall be individually wired to and monitored by the FGS Control Panel.
- c. Hydrogen gas detector shall be of catalytic combustion type with output signal of 4-20 mA with 24V DC supply voltage requirement. Hydrogen gas detectors shall have performance to detect the presence of hydrogen gas at concentrations from 0 to 100 % of the LEL.
- d. Hydrogen gas detectors shall be provided based on the risk assessment for equipment and piping handling hydrogen.

hydrocarbon.

7. Dua *detector* di *air intake* dari bangunan bertekanan oleh sistem HVAC.
8. Dalam ruang tertutup di mana peralatan yang menangani C4 atau *lighter hydrocarbon* berada, seperti *analyzer shed*, yang *detector*-nya didistribusikan sedemikian rupa sehingga jarak tempuh ke *detector* terdekat dari peralatan tidak melebihi 10 m yang diukur secara *horizontal* pada lantai yang sama.

7.2.1.2 Hydrogen Gas Detector

- a. *Hydrogen gas detector* harus disediakan untuk *compressor* yang menangani *rich hydrogen* dan ditempatkan di bagian atas setiap *seal* sedekat mungkin.
- b. *Hydrogen gas detector* harus *individually wired* dan di-*monitor* oleh *Control Panel* FGS.
- c. *Hydrogen gas detector* harus tipe *catalytic combustion* dengan sinyal keluaran 4-20 mA dengan kebutuhan tegangan suplai 24V DC. *Hydrogen gas detector* harus memiliki *performa* untuk mendeteksi keberadaan *hydrogen gas* pada konsentrasi dari 0 sampai 100% dari LEL.
- d. *Hydrogen gas detector* harus disediakan berdasarkan penilaian risiko untuk peralatan dan pipa yang menangani *hydrogen*.

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7.2.1.3 Toxic Gas Detector

- a. Toxic gas detectors for H₂S, CO and SO₂ shall be applied to Gas Processing Facilities which are handling toxic gas.
- b. Toxic gas detectors shall be of electrochemical cell type, semiconductor type or infrared type, with output signal of 4-20 mA with 24VDC supply voltage requirement, and be certified for use at hazardous areas. Toxic gas detectors shall have performance to detect the presence of H₂S vapour at concentration from 0 to 3 times of TLV-TWA of H₂S (10 ppm) as minimum.
- c. Toxic gas detectors shall be distributed taking into consideration the prevailing wind direction and density of the gas to be detected.
- d. Gas detectors continually monitoring toxic gas concentration in air if H₂S contain exceeds 5 ppm and SO₂ contain exceed 2 ppm.
- e. CO gas detector provides warning of the presence of potential hazards in the concentration ranges up to 1000 ppm.
- f. All CO gas detection instruments shall meet the minimum construction and test requirements contained in ISA-RP92.02.01-1998.
- g. CO meter must be kept calibrated and in accessible locations, in order to have a

7.2.1.3 Toxic Gas Detector

- a. *Toxic gas detector* untuk H₂S, CO dan SO₂ harus diterapkan pada fasilitas pengolahan gas yang menangani gas beracun.
- b. *Toxic gas detector* harus dari jenis *electrochemical cell*, jenis *semiconductor* atau jenis inframerah, dengan sinyal keluaran 4-20 mA dengan persyaratan tegangan suplai 24VDC, dan disertifikasi untuk digunakan di *hazardous area*. *Toxic gas detector* harus memiliki kinerja untuk mendeteksi keberadaan uap H₂S pada konsentrasi 0 sampai 3 kali TLV-TWA H₂S (10 ppm) *minimum*.
- c. *Toxic gas detector* harus didistribusikan dengan mempertimbangkan arah angin yang berlaku dan *density* gas yang akan dideteksi.
- d. *Gas detector* terus *monitoring* konsentrasi gas beracun di udara jika kandungan H₂S melebihi 5 ppm dan SO₂ melebihi 2 ppm.
- e. *Gas detector* CO akan memberikan peringatan adanya potensi bahaya pada rentang konsentrasi hingga 1000 ppm.
- f. Semua instrumen pendeteksi gas CO harus memenuhi persyaratan konstruksi dan pengujian *minimum* yang tercantum dalam ISA-RP92.02.01-1998.
- g. Pengukur CO harus tetap terkalibrasi dan berada di lokasi yang mudah dijangkau, agar

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safe, uniform response to a CO detector activation. CO detectors are set to alarm at 30 ppm.

- h. The location of CO detectors shall be based on an evaluation of potential ambient sources and flows of carbon monoxide, moisture, temperature, dust, or fumes and of electrical or mechanical influences to minimize nuisance alarms.
- i. CO detection system components shall be permitted to share control equipment or shall be able to operate as stand-alone subsystems, but, in any case, they shall be arranged to function as a single system.
- j. Toxic (H₂S) gas detectors shall be provided for the following:
- k. H₂S detectors shall be installed approximately 1 m above grade level. One H₂S detector shall be installed in one of the air intake ducts in the Control building. The sensor will shut down the HVAC system at 10 ppm and send an alarm signal to the Fire and Gas Detection System.
- l. Toxic gas detectors shall be individually wired to and monitored by the FGS Control Panel.

7.2.2. Fire Detector

Fire detector equipment utilized for this project will consist of:

7.2.2.1 Flame Detector

- a. Flame detector shall be applied to all outdoor areas, at all

memiliki respons yang aman dan seragam terhadap aktivasi *detector CO*. *Detector CO* disetel ke *alarm* pada 30 ppm.

- h. Lokasi *detector CO* harus didasarkan pada evaluasi potensi sumber *ambient* dan aliran karbon monoksida, kelembaban, suhu, debu, atau asap dan pengaruh listrik atau mekanik untuk meminimalkan *alarm* gangguan.
- i. Komponen sistem deteksi CO dapat menggunakan peralatan kontrol bersama atau harus dapat beroperasi sebagai subsistem yang berdiri sendiri, tetapi, bagaimanapun, mereka harus diatur untuk berfungsi sebagai satu sistem.
- j. *Toxic (H₂S) gas detector* harus disediakan untuk hal-hal berikut :
- k. *H₂S detector* harus dipasang kira-kira 1 m di atas permukaan tanah. Satu *H₂S detector* harus dipasang di salah satu *air intake duct* di bangunan kontrol. Sensor akan *shut down* sistem HVAC pada 10 ppm dan mengirimkan sinyal *alarm* ke *Fire and Gas Detection System (FGS)*.
- l. *Toxic gas detector* harus *individually wired* dan di-monitor oleh *Control Panel FGS*.

7.2.2. Fire Detector

Peralatan *fire detector* yang digunakan untuk proyek ini terdiri dari:

7.2.2.1 Flame Detector

- a. *Flame detector* harus diterapkan pada semua area *outdoor*, pada

equipment which handle gas or liquid hydrocarbon or utility equipment using gas or liquid hydrocarbon such as gas engine generator, vessels and storages.

- b. Flame detectors must be able to operate in all-weather conditions such as windy, rainy and high humidity.
- c. Flame detectors shall be individually wired to and monitored by the FGS Control Panel.
- d. All flame detectors must have explosion proof/ gas proof certification, based on hazardous area classification.
- e. Flame detectors shall be of IR sensing type with diagnostic capability and be certified for use at hazardous areas. The standard signal range shall be 4-20 mA, with 24V DC supply voltage requirement.
- f. Location and orientation of detectors shall be determined to provide maximum coverage of the risk area to reduce the possibility of false alarm.
- g. Location of flame fire detectors shall be selected in such a way, that they will fully cover the fire zone area to be protected, with consideration of the size of the fire that is to be detected, fuels involved, sensitivity of the detectors (shall be adjustable), field of view of the detectors. Intersection between the field of

semua peralatan yang menangani gas atau *hydrocarbon* cair atau peralatan utilitas yang menggunakan gas atau *hydrocarbon* cair seperti *gas engine generator*, *vessel* dan penyimpanan.

- b. *Flame detector* harus dapat beroperasi di segala kondisi cuaca seperti berangin, hujan dan kelembaban tinggi.
- c. *Flame detector* harus *individually wired* ke dan di-monitor oleh *Control Panel* FGS.
- d. Semua *flame detector* harus memiliki sertifikasi *explosion proof/ gas proof* berdasarkan klasifikasi *hazardous area*.
- e. *Flame detector* harus dari jenis penginderaan IR dengan kemampuan diagnosa dan disertifikasi untuk digunakan di *hazardous area*. Rentang sinyal standar harus 4-20 mA, dengan persyaratan tegangan suplai 24V DC.
- f. Lokasi dan orientasi *detector* harus ditentukan untuk memberikan cakupan maksimum *area* risiko untuk mengurangi kemungkinan *alarm* palsu.
- g. Lokasi *flame fire detector* harus dipilih sedemikian rupa, sehingga akan sepenuhnya menutupi *area* zona kebakaran yang akan dilindungi, dengan pertimbangan ukuran api yang akan dideteksi, bahan bakar yang digunakan, sensitivitas *detector* (harus disesuaikan), bidang pandang *detector*. Persimpangan antara

view of flame detectors shall be utilized for covering the fire zone area.

- h. Voting system will be applied for gas detectors following the result of individual risk assessment of each protected area.
- i. Blockage on flame detectors field of view shall be prevented, i.e. from structural members, cable trays, etc. Direct sunlight which exposes the fire flame detectors shall be minimized by installing sunshade on them.

7.2.2.2 Manual Alarm Call Point

- a. Manual alarm call points (MAC) shall be distributed along the roads or access way with the maximum interval given in the table below:

Area <i>Area</i>	Maximum Interval between MACs <i>Interval Maksimum antar MAC</i>
Process Area <i>Area proses</i>	60 m 60 m
Atmospheric Storage Tank Area <i>Area storage tank atmosfer</i>	60 m 60 m
Pressurized Storage Tank Area <i>Area storage tank bertekanan</i>	60 m 60 m
Utility/Offsite Area <i>Area utilitis/ offsite</i>	90 m (not required for building area) 90 m (tidak diperlukan untuk area bangunan)

- b. The Manual Alarm Call points shall be individually wired to and monitored by the FGS Control Panel. Diagnostic features shall be provided to distinct

bidang pandang *flame detector* harus digunakan untuk menutupi *area* zona kebakaran.

- h. Sistem *voting* akan diterapkan untuk *gas detector* mengikuti hasil penilaian risiko individu dari setiap *area* proteksi.
- i. Penyumbatan pada *flame detector field* harus dicegah, yaitu dari komponen struktur, kabel *tray*, dll. Sinar matahari langsung yang memaparkan *fire flame detector* harus diminimalkan dengan memasang *sunshade* di atasnya.

7.2.2.2 Titik Manual Alarm Call

- a. Titik *Manual Alarm Call* (MAC) harus didistribusikan di sepanjang jalan atau jalan akses dengan *interval* maksimum yang diberikan dalam tabel di bawah ini:

- b. Titik *Manual Alarm Call* (MAC) harus *individually wired* ke dan di-*monitor* oleh *Control Panel* FGS. Fitur diagnosa harus disediakan untuk kondisi yang berbeda: *loop*

conditions: open loop, short connection, normal condition, and activated condition.

- c. Audible and visual alarm shall be provided in the area where manual alarm call points are provided.
- d. The manual alarm call points shall be break glass type, certified for use at hazardous areas and fully weatherproof.
- e. Manual call points shall be suitable for the environmental conditions (IP65 minimum) and electrical area classification and shall conform to the requirements of NFPA 72 as applicable.

7.2.3. Heat Detector


- a. Heat detectors shall be applied specifically based on the area under protection. Fusible plug and linear heat detector may be utilized.
- b. Fusible plug is installed for the storage and equipment with highly flammable fluid.
- c. Fusible plug shall have plug designed to melt at predetermined temperature with results of automatic activation of deluge system.
- d. Fusible plug shall be located close to probable sources of hydrocarbon release.
- e. Linear heat detector is used for the tank roof. Detection of heat in the tank roof by linear heat detector shall give the alarm

terbuka, koneksi pendek, kondisi *normal*, dan kondisi aktif.

- c. *Alarm* suara dan *visual* harus disediakan di *area* di mana titik *Manual Alarm Call* (MAC) disediakan.
- d. Titik *Manual Alarm Call* (MAC) harus jenis *break glass*, bersertifikat untuk digunakan di *hazardous area* dan sepenuhnya *weatherproof*.
- e. Titik *Manual Alarm Call* (MAC) harus sesuai dengan kondisi lingkungan (minimal IP65) dan klasifikasi *area* kelistrikan dan harus sesuai dengan persyaratan NFPA 72 yang berlaku.

7.2.3. Heat Detector

- a. *Heat detector* harus diterapkan secara khusus berdasarkan *area* yang dilindungi. *Fusible plug* dan *linear heat detector* dapat digunakan.
- b. *Fusible plug* dipasang untuk tempat penyimpanan dan peralatan dengan cairan yang sangat mudah terbakar.
- c. *Fusible plug* harus memiliki *plug* yang dirancang untuk meleleh pada suhu yang telah ditentukan dan secara otomatis akan mengaktifkan *deluge system*.
- d. *Fusible plug* harus ditempatkan dekat dengan kemungkinan sumber pelepasan *hydrocarbon*.
- e. *Linear heat detector* digunakan untuk *tank roof*. Deteksi panas di *tank roof* dengan *linear heat detector* harus memberikan

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indication to the operator.

indikasi *alarm* kepada *operator*.

7.3 Marshalling Panel

- a. All wiring from detectors and junction box at field to FGS control panel shall be via marshalling panel. Marshalling panels will be located inside ISH (Instrument Satellite House) standard industrial enclosure shall be applied for the panels.
- b. Each cable shall be clearly identified at each end and 20% installed spare terminal blocks shall be provided in panel.
- c. The marshalling cabinets shall contain all the necessary non-incendive hardware (to achieve hazardous area protection) for terminating incoming field cables, internal wiring, termination panels, interconnecting cables, and cable accessories. The terminal size shall be able to accommodate the cable.
- d. The marshalling cabinets shall have front and rear entry accessibility.

7.4 FGS Control Panel

- a. **VENDOR** shall supply a FGS Control Panel consisting of SIL 3 Programmable Logic Controller (PLC) including hardware and system software.
- b. All the field devices such as fire and gas detectors distributed outdoors shall be hardwired to a dedicated FGS panel.
- c. The FGS control panel and associated hardware and circuitry shall be designed so as to be segregated from the BPCS and SIS.

7.3 Marshalling Panel

- a. Semua *wiring* dari *detector* dan *junction box* di lapangan ke *control panel* FGS harus melalui *marshalling panel*. *Marshalling panel* akan ditempatkan di dalam *industrial enclosure* standar ISH (*Instrument Satellite House*) yang harus diterapkan untuk *panel*.
- b. Setiap kabel harus diidentifikasi dengan jelas di setiap ujungnya dan 20% *terminal block* cadangan yang dipasang harus disediakan di *panel*.
- c. *Marshalling cabinet* harus berisi semua perangkat keras *non-incendive* yang diperlukan (untuk mendapatkan proteksi *hazardous area*) untuk terminasi kabel *field* yang masuk, *wiring internal*, *panel terminasi*, kabel interkoneksi, dan aksesoris kabel. Ukuran *terminal* harus dapat mengakomodasi kabel.
- d. *Marshalling cabinet* harus memiliki jalan masuk dari depan dan dari belakang.

7.4 Control Panel FGS

- a. **VENDOR** harus menyediakan *Control Panel* FGS yang terdiri dari SIL 3 *Programmable Logic Controller (PLC)* termasuk sistem perangkat keras dan sistem perangkat lunak.
- b. Semua *field device* seperti *fire* dan *gas detector* yang didistribusikan di luar ruangan harus disambungkan ke *panel* FGS khusus.
- c. *Control Panel* FGS dan perangkat keras serta *circuit* terkait harus didesain sedemikian rupa sehingga terpisah dari BPCS dan SIS.

Dokumen sesuai dengan aslinya, dicetak pada tanggal 11/06/2026 17:23:15 oleh

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| <p>d. The FGS shall have the capabilities to communicate with BPCS through Modbus TCP/IP. The FGS shall also have the capabilities to communicate directly with HMI Console in MCR, utilities control room, and in HSE building through fiber optic cables.</p> <p>e. FGS panels will be installed inside the ISH and the standard industrial enclosure shall be applied for the panels.</p> <p>f. Front doors shall be equipped with a transparent glass window to allow direct view of the gas monitoring unit, maintenance switches position, alarms status of input/output modules and tag number list of detectors/instruments.</p> <p>g. Panels shall have bottom cable entries with supporting bars and sealing plate.</p> <p>h. FGS control panel shall consist of:</p> <ol style="list-style-type: none"> 1. redundant power supply units 2. battery backup 3. redundant processor module (CPU) 4. redundant communication module 5. redundant I/O modules 6. interface terminals for BPCS 7. interface terminals for HMI and Mimic panel 8. lightning protection modules <p>i. System components shall be modular design with rack mounting and plug in type assemblies. The modules shall be replaceable without requiring special tools.</p> | <p>d. FGS harus memiliki kemampuan untuk berkomunikasi dengan BPCS melalui <i>Modbus TCP/ IP</i>. FGS juga harus memiliki kemampuan untuk berkomunikasi langsung dengan HMI <i>Console</i> di MCR, <i>control room</i> utilitas, dan di bangunan HSE melalui kabel <i>fiber</i> optik.</p> <p>e. <i>Panel</i> FGS akan dipasang di dalam ISH dan <i>industrial enclosure</i> standar harus diterapkan untuk <i>panel</i>.</p> <p>f. Pintu depan harus dilengkapi dengan <i>transparent glass window</i> untuk memungkinkan pandangan langsung ke <i>unit monitoring</i> gas, posisi <i>switch</i> pemeliharaan, status <i>alarm</i> modul <i>input/output</i> dan daftar nomor <i>tag detector/instrumen</i></p> <p>g. <i>Panel</i> harus memiliki entri kabel dari bawah dengan <i>bar</i> penyangga dan <i>sealing plate</i>.</p> <p>h. <i>Control panel</i> FGS terdiri dari :</p> <ol style="list-style-type: none"> 1. <i>unit redundant power supply</i> 2. baterai cadangan 3. modul <i>redundant processor (CPU)</i> 4. modul komunikasi <i>redundant</i> 5. modul <i>redundant I/O</i> 6. <i>terminal interface</i> untuk BPCS 7. <i>terminal interface</i> untuk <i>panel</i> HMI dan <i>mimic</i> 8. modul <i>lightning protection</i> <p>i. Komponen sistem harus desain modular dengan pemasangan <i>rack</i> dan rakitan tipe <i>plug in</i>. Modul harus dapat diganti tanpa memerlukan perkakas khusus.</p> |
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- j. Replacement of failed modules shall not degrade the system. No additional steps should be required such as forcing from the workstation to transfer from the failed module to a healthy one.

7.4.1 Power Supply Unit

- a. Power supply modules supplied by *VENDOR* shall be suitable for operation in facility UPS systems operating at an output voltage 110 VAC, 50 Hz, single phase.
- b. The redundant power supply modules shall be equipped with over-temperature protection, overvoltage and overcurrent protection, isolation diode and fuses.
- c. Redundant power supplies shall be sized and networked such that a failure or online replacement of power supply module will not disrupt the system operation, impact processor functionality, or upset the process.
- d. Failure of the power supply unit shall cause an alarm. Power supply status (health/fault) shall be indicated on its faceplate and be externally communicated to BPCS HMI console and FGS HMI console in MCR, FGS HMI console utilities control room, and FGS HMI in HSE building.
- e. The system power supply units shall include 40% spare capacity over and above the

- j. Penggantian modul yang gagal tidak akan menurunkan performa sistem. Tidak ada langkah tambahan yang diperlukan untuk memaksa *workstation* berpindah dari modul yang gagal ke modul yang sehat.

7.4.1 Unit *Power Supply*

- a. Modul *power supply* yang disuplai oleh *VENDOR* harus sesuai untuk pengoperasian di fasilitas sistem UPS beroperasi pada tegangan *output* 110 VAC, 50 Hz, fase tunggal.
- b. Modul *redundant power supply* harus dilengkapi dengan proteksi *over-temperature*, proteksi tegangan dan arus lebih, dioda isolasi dan *fuse*.
- c. *Redundant power supply* harus ditetapkan besar *power*-nya dan didistribusikan melalui jaringan sehingga kegagalan atau penggantian modul *power supply* secara *online* tidak akan mengganggu operasi sistem, tidak mempengaruhi fungsionalitas *processor*, atau tidak menyebabkan proses *upset*.
- d. Kegagalan unit *power supply* harus menyebabkan alarm. Status *power supply* (*normal*/ gangguan) harus ditunjukkan pada *interface* dan dikomunikasikan secara eksternal ke BPCS HMI Console dan FGS HMI Console di MCR, FGS MHI Console di *control room* utilitas, FGS HMI Console di bangunan *HSE*.
- e. *Unit power supply* sistem harus mencakup 40% kapasitas cadangan melebihi dan diatas

required loading (including the spare capacities).

A transient power interruption shall have no effect on the equipment or system performance.

beban yang dibutuhkan (termasuk kapasitas cadangan)

Gangguan *transient power* harus tidak boleh berpengaruh terhadap performa peralatan atau sistem.

7.4.2 Processor Module (CPU)

- a. The CPU shall continuously scan the control program stored in memory, along with the status of all inputs, and execute specified commands to appropriate outputs.
- b. Automatic transfer shall be made in case of the failure of the primary CPU module without affecting the system operation. Hot replacement of a CPU shall not require any process interruption or system re-initialization.
- c. Failure of CPU module shall cause an alarm shall be indicated on its faceplate and be externally communicated to BPCS HMI console and FGS HMI console inside MCR, utilities control room, and FGS HMI console inside HSE building.
- d. Online replacement of failed CPU modules shall be capable without affecting the overall system operation. Replacing the failed CPU module shall not shutdown any I/O modules.
- e. The processor shall have battery backup of all memory contents for six (6) months. Low battery level alarm shall be

7.4.2 Processor Module (CPU)

- a. CPU harus terus memindai program kontrol yang disimpan dalam memori, bersama dengan status semua *input*, dan menjalankan perintah yang ditentukan ke *output* yang sesuai.
- b. *Transfer* otomatis harus dilakukan jika terjadi kegagalan pada modul CPU utama tanpa mempengaruhi operasi sistem. *Hot replacement* dari CPU harus tidak boleh mengganggu proses atau memerlukan inisialisasi ulang system.
- c. Kegagalan modul CPU harus menyebabkan *alarm* yang harus ditunjukkan pada *faceplate* dan dikomunikasikan secara eksternal ke HMI BPCS *Console* dan FGS HMI *Console* di dalam MCR, *control room* utilitas, dan FGS HMI *Console* di dalam bangunan HSE.
- d. Penggantian *online* modul CPU yang gagal harus dapat dilakukan tanpa mempengaruhi operasi sistem secara keseluruhan. Mengganti modul CPU yang gagal harus tidak boleh *shutdown* modul I/O apa pun.
- e. *Processor* harus memiliki baterai cadangan dari semua isi memori selama enam (6) bulan. *Alarm level* baterai rendah harus

included as part of the diagnostic alarm.

- f. A key lock switch or password protection shall be provided to prevent memory modification from any outside source. Operating mode selections shall remain openly accessible.
- g. It shall be possible to load programs locally or remotely; create, modify, or delete function blocks and data files; download to a memory module and save and restore programs. It shall be possible, through the use of special commands, to disable selected inputs and outputs.
- h. In the ON-LINE/RUN mode, normal operation shall occur with the inputs and outputs active as well as the CPU and the program running.
- i. CPU shall have 20% installed spare capacity for expansion purpose.

7.4.3 I/O Module

- a. I/O modules shall be solidly constructed and shall be capable of being inserted into or removed from their chassis without disturbing external wiring as applicable.
- b. **VENDOR/CONTRACTOR** shall determine the quantities of input and output modules required for the project. Twenty percent (20%) I/O installed spare from the total I/O points of each above panel shall be provided. The installed I/O spares have

disertakan sebagai bagian dari alarm diagnosa.

- f. *Key lock switch* atau proteksi *password* harus disediakan untuk mencegah modifikasi memori dari sumber luar. Pilihan mode pengoperasian harus tetap dapat diakses secara terbuka.
- g. Dimungkinkan untuk memuat program secara lokal atau jarak jauh; membuat, memodifikasi, atau menghapus *block* fungsi dan file data; unduh ke modul memori dan simpan serta pulihkan program. Akan dimungkinkan, melalui penggunaan perintah khusus, untuk menonaktifkan *input* dan *output* yang dipilih.
- h. Dalam mode *ON-LINE/ RUN*, operasi *normal* harus terjadi dengan *input* dan *output* aktif serta *CPU* dan *program running*.
- i. CPU harus memiliki 20% kapasitas cadangan terpasang untuk tujuan ekspansi.

7.4.3 Modul I/O

- a. Modul I/O harus dikonstruksi dengan kokoh dan harus mampu dimasukkan ke dalam atau dilepas dari *chassis* tanpa mengganggu *wiring* eksternal sebagaimana berlaku.
- b. **VENDOR/ KONTRAKTOR** harus menentukan jumlah modul *input* dan *output* yang diperlukan untuk proyek. Harus disiapkan dua puluh persen (20%) I/O cadangan terpasang dari total titik I/O masing-masing *panel* di atas. Modul I/O cadangan terpasang

been included in the above I/O count. All installed I/O points including spares shall be terminated to the terminal in each control panel.

- c. All I/O modules or their associated termination panels shall include local status indicators to monitor communication and I/O faults.
- d. The I/O modules shall be at working state and remain at healthy state. Fail safe position shall be maintained in case redundant modules fail.
- e. I/O modules and wiring shall be partitioned such that modules and wiring for a specific process area are grouped together. I/O assignments will be developed and submitted by the **VENDOR/CONTRACTOR**.
- f. All the status changes of the FGS, such as fire and gas detection, report from other systems, operation of firefighting, abnormal fault condition, etc., shall be logged with the printer.

7.4.4 Communication Module

- a. The communication module shall have the capabilities to communicate FGS control panel to FGS HMI console MCR and utilities control room, and to FGS HMI console inside HSE building and to communicate

sudah termasuk/ terhitung dalam jumlah total kebutuhan modul I/O untuk proyek ini. Semua titik I/O yang terpasang termasuk modul I/O cadangan harus diterminasi ke *terminal* di setiap *control panel*.

- c. Semua modul I/O atau *panel* terminasi terkait harus menyertakan indikator status lokal untuk *monitor* komunikasi dan gangguan I/O.
- d. Modul I/O harus tetap dalam keadaan bekerja dan tetap dalam keadaan *normal*. Posisi aman gagal harus dipertahankan jika terjadi kegagalan pada modul cadangan.
- e. Modul I/O dan *wiring* harus dipartisi sedemikian rupa sehingga modul dan *wiring* untuk *area* proses tertentu dikelompokkan bersama. I/O *assignment* akan dikembangkan dan diserahkan oleh **VENDOR/ KONTRAKTOR**.
- f. Semua perubahan status FGS, seperti *fire* dan *gas detection*, laporan dari sistem lain, pengoperasian pemadam kebakaran, kondisi kesalahan *abnormal*, dan lain-lain harus dicatat dengan *printer*.

7.4.4 Modul Komunikasi

- a. Modul komunikasi harus memiliki kemampuan untuk mengomunikasikan *Control panel* FGS ke FGS HMI *Console* MCR dan *control room* utilitas, dan ke FGS HMI *Console* di dalam bangunan HSE dan untuk

FGS control panel to the BPCS HMI console.

- b. The redundant communication modules shall be provided. Transfer to the backup communication channel shall be automatically without affecting the overall system operation and communication.
- c. **VENDOR** is responsible for the supply of communication hardware, software, and also the communication cables to BPCS panel, to FGS HMI consoles inside MCR and utilities control room, FGS HMI console inside HSE building, and Mimic LED screen.
- d. The communication between FGS and HMI console inside the HSE building will use the fiber optic cable. The communication between FGS and BPCS shall be through modbus TCP/IP. The communication from FGS to BPCS shall be independent from the communication from FGS to HMI console in HSE building.

mengomunikasikan *control panel* FGS ke BPCS HMI *Console*.

- b. Modul komunikasi *redundant* harus disediakan. *Transfer* ke saluran komunikasi cadangan harus secara otomatis tanpa mempengaruhi operasi sistem dan komunikasi secara keseluruhan.
- c. **VENDOR** bertanggung jawab atas penyediaan perangkat keras komunikasi, perangkat lunak, dan juga kabel komunikasi ke *panel* BPCS, ke FGS HMI *Console* di dalam *control room* MCR dan utilitas, FGS HMI *Console* di dalam bangunan HSE, dan layar LED *Mimic*.
- d. Komunikasi antara FGS dan HMI *Console* di dalam bangunan HSE akan menggunakan kabel *fiber* optik. Komunikasi antara FGS dan BPCS harus melalui *modbus* TCP/IP. Komunikasi dari FGS ke BPCS harus independen dari komunikasi FGS ke HMI *Console* di bangunan HSE.

7.5 FGS Mimic LED Screen (Wide Screen Display)

- a. The 70 inch LED screen mimics shall be provided. The mimic will be installed ceiling mounted and located inside MCR, utilities control room, and inside the HSE building. The Mimic shall contain simplified geographical layouts of the plant area to be monitored, showing the buildings and sub-area subdivided by process unit or by plant or access roads.

7.5 Layar LED *Mimic* untuk FGS (Tampilan Layar Lebar)

- a. Layar LED *Mimic* ukuran 70 inci harus disediakan. *Mimic* akan dipasang di ceiling/ langit-langit dan terletak di dalam MCR, *control room* utilitas, dan di dalam bangunan HSE. *Mimic* harus berisi *layout* geografis yang disederhanakan dari area kilang yang akan di-*monitor*, menunjukkan bangunan dan *sub-area* yang dibagi oleh *unit* proses atau oleh kilang atau jalan akses.

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| <p>b. Graphics display generation and modification in Mimic LED screen shall be done via EWS FGS in MCR and utilities control room. Mimic LED screen shall be integrated with FGS HMI.</p> <p>c. When the fire incident is detected by the field detector, LED Mimic shall have the capabilities to indicate the information of type alarm and location at plant area.</p> <p>d. LED Mimic screens shall also have the capabilities to capture data from FACP to indicate the location of the building where detectors (smoke detectors, heat detector, or manual call point) initiate.</p> <p>e. Graphic displays of Mimic LED screen in HSE building shall have the similar display with Mimic LED screen in MCR and utilities control room.</p> <p>f. For each area, 'zoned' indications shall be provided for fire, flammable gas and toxic gas alarms by means of LED monitor with colour code below:</p> <ol style="list-style-type: none"> 1. Fire occurrence: red 2. Flammable gas including hydrogen release: blue 3. Toxic gas release: yellow <p>7.6 Human Machine Interface (HMI) / Operator Console</p> <p>a. The FGS HMI console shall be provided inside MCR, inside utilities control room and inside the HSE building, same console furniture type as BPCS including for printer console where applicable.</p> <p>b. The operator consoles shall consist of CPU(s), monitor display, keyboard, pointing device, printers, software and all necessary accessories shall be</p> | <p>b. Pembuatan dan modifikasi tampilan grafis di layar LED <i>Mimic</i> harus dilakukan melalui EWS FGS di MCR dan <i>control room</i> utilitas. Layar LED <i>Mimic</i> harus terintegrasi dengan FGS HMI.</p> <p>c. Ketika insiden kebakaran terdeteksi oleh <i>field detector</i>, LED <i>Mimic</i> harus memiliki kemampuan untuk menunjukkan informasi jenis <i>alarm</i> dan lokasi di <i>area</i> kilang.</p> <p>d. Layar LED <i>Mimic</i> juga harus memiliki kemampuan untuk menangkap data dari FACP untuk menunjukkan lokasi bangunan di mana <i>detector</i> (<i>smoke detectors</i>, <i>heat detector</i>, atau <i>manual call point</i>) dimulai</p> <p>e. Tampilan grafis layar LED <i>Mimic</i> di bangunan HSE harus memiliki tampilan yang sama dengan layar LED <i>Mimic</i> di MCR dan ruang kendali utilitas.</p> <p>f. Tampilan grafis layar <i>Mimic LED</i> di gedung <i>HSE</i> harus memiliki tampilan yang sama dengan layar <i>Mimic LED</i> di <i>MCR</i> dan <i>control room</i> utilitas.</p> <ol style="list-style-type: none"> 1. Kejadian kebakaran: merah 2. <i>Flammable gas</i> termasuk pelepasan <i>hydrogen</i>: biru, 3. Pelepasan gas beracun: kuning <p>7.6 <i>Human Machine Interface (HMI) / Operator Console</i></p> <p>a. FGS HMI <i>Console</i> harus disediakan di dalam MCR, di dalam <i>control room</i> utilitas dan di dalam bangunan HSE, jenis <i>console furniture</i> yang sama dengan BPCS termasuk untuk <i>printer console</i> jika ada.</p> <p>b. <i>Operator console</i> harus terdiri dari CPU, <i>monitor display</i>, <i>keyboard</i>, perangkat penunjuk, <i>printer</i>, perangkat lunak dan semua aksesori yang diperlukan harus</p> |
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provided for FGS operation. The following function shall be provided as minimum in the HMI / operator consoles:

1. Display fire protection unit status
 2. Display alarm status of fire and gas detector
 3. Display system alarm
 4. Acknowledge and reset fire and gas alarm
 5. Maintenance bypass facility through software switch
 6. Activation of firefighting equipment
 7. Logging and printing of alarms, status or event
 8. Printing of graphic display
 9. Display diagnostic of the system
- c. HMI FGS in MCR, utility control room, and in HSE building shall also have the capability and enough capacity to accept the signal information from each FACP in the building inside the plant area.
- d. The online replacement of printers, monitors unit, keyboards, pointing devices (mouse) shall be possible without affecting the overall system.
- e. The operating displays shall be structured and organized in a hierarchical arrangement starting from overview, group, detail display, etc.
- f. In case of fire incident, the operator in HSE building shall be able to access the information of the detailed location of incident of each area in the plant.

disediakan untuk operasi FGS. Fungsi berikut harus disediakan minimal di HMI / *operator console*:

1. Tampilan status *unit* proteksi kebakaran
 2. Tampilan status *alarm* dari *fire* dan *gas detector*
 3. Tampilkan *alarm* sistem
 4. *Acknowledge* dan setel ulang *alarm fire* dan *gas detector*
 5. Fasilitas *bypass* pemeliharaan melalui *software switch*
 6. Aktivasi peralatan pemadam kebakaran
 7. Mencatat dan mencetak *alarm*, status, atau kejadian
 8. Pencetakan tampilan grafis
 9. Tampilan sistem diagnosa
- c. HMI FGS di MCR, *control room* utilitas, dan di bangunan HSE juga harus memiliki kemampuan dan kapasitas yang cukup untuk menerima informasi sinyal dari setiap FACP pada bangunan di dalam area kilang.
- d. Penggantian *printer* secara *online*, *unit monitor*, *keyboard*, perangkat penunjuk (*mouse*) harus dilakukan tanpa mempengaruhi sistem secara keseluruhan.
- e. Tampilan pengoperasian harus terstruktur dan terorganisir dalam susunan hierarkis mulai dari gambaran umum, *group*, tampilan *detail*, dll.
- f. Jika terjadi kebakaran, *operator* di bangunan HSE harus dapat mengakses informasi *detail* lokasi kejadian dari setiap *area* di kilang.

- g. Interactive graphic builder package shall be user friendly and shall not require any special programming.
- h. Graphic displays shall be assigned to a dedicated display call-up key.

7.7 Engineering Workstation (EWS)

- a. **VENDOR** shall provide dedicated EWS for FGS to be located inside the Engineering Room in MCR and utilities control room. EWS should be utilized to generate graphic displays in all FGS HMI consoles and Mimic LED screens.
- b. The engineering workstation shall consist of CPU(s), monitor display, keyboard, pointing device, printers, software and all necessary accessories. **VENDOR** shall provide EWS completed with all necessary accessories for system programming purpose.
- c. **VENDOR** shall provide all specification data for console design including, equipment list, dimensions, weight, colour.
- d. The minimum functions to be provided in engineering station are the following:
 1. Configuration
 2. Database generation
 3. Graphics display generation and modification
 4. Control algorithm generation and modification
 5. Report generation and modification
 6. System access configuration
 7. Modification of operational data

- g. *Package* pembangun grafis interaktif harus ramah pengguna/ *user friendly* dan harus tidak memerlukan pemrograman khusus.
- h. Tampilan grafis harus ditetapkan ke tombol panggil tampilan khusus.

7.7 *Engineering Workstation (EWS)*

- a. **VENDOR** harus menyediakan EWS khusus untuk FGS untuk ditempatkan di dalam *Engineering Room* di MCR dan *control room* utilitis. EWS harus digunakan untuk menghasilkan tampilan grafis di semua *Console* FGS HMI dan layar LED *Mimic*.
- b. *Engineering workstation* harus terdiri dari CPU, *monitor display*, *keyboard*, perangkat penunjuk, *printer*, perangkat lunak, dan semua aksesori yang diperlukan. **VENDOR** harus menyediakan EWS lengkap dengan semua aksesori yang diperlukan untuk tujuan pemrograman sistem.
- c. **VENDOR** harus menyediakan semua data spesifikasi untuk desain *console* termasuk, daftar peralatan, dimensi, berat, warna.
- d. Fungsi yang harus disediakan di dalam *engineering station minimum* sebagai berikut:
 1. Konfigurasi
 2. Pembuatan *database*
 3. Pembuatan dan modifikasi *graphic display*
 4. Pembuatan dan modifikasi *control algorithm*
 5. Pembuatan dan modifikasi laporan
 6. Konfigurasi akses sistem
 7. Modifikasi data operasi

8. Diagnostics

9. Station/monitors and keyboard plant section assignments.

e. Logic shall be able to be monitored through EWS and logic modification can be done during normal operation without interrupting the field devices. Simulation test shall be able to be executed by the programming unit without any additional hardware or tools.

f. The engineer shall have total access to all alarm and system data, configuration data and engineering files resident in all devices connected to the control network.

7.8 Audible and Visible Alarm

a. Audible alarms (horns, sirens, etc.) utilized in the areas where ambient noise is significant.

b. The audible zone shall be assigned for sub-area subdivided by process unit or by plant or access roads.

c. Alarm strobe light/beacon lamp and horns shall be minimally rated IP65 environment.

d. Quantities and locations of these audible and visual alarm field devices shall be as indicated on location plan drawings provided by **VENDOR/CONTRACTOR**. Combination strobe/horn fire or gas alarm assembly units may be used where indicated by location.

e. The loudspeakers shall generate distinctive tones for the fire occurrence, the flammable gas including hydrogen release and the toxic (H₂S) gas release. The sound level of loudspeakers shall be at least 6 dBA above the normal

8. Diagnosa

9. Sebagai *station/ monitor* dan *keyboard*

e. *Logic* harus dapat di-*monitor* melalui EWS dan untuk modifikasi *logic* dapat dilakukan selama operasi normal tanpa mengganggu *field device*. Uji simulasi harus dapat dilakukan oleh *unit* pemrograman tanpa perangkat keras atau perkakas tambahan.

f. *Engineer* harus memiliki akses total ke semua *alarm* dan data sistem, data konfigurasi dan *file engineering* yang ada di semua perangkat yang terhubung ke jaringan kontrol.

7.8 Alarm Suara/ *Audio* dan *Visual*

a. *Alarm* suara (klakson, sirene, dll) digunakan di *area* yang bising

b. Zona suara harus ditetapkan untuk *sub-area* yang dibagi oleh *unit* proses atau oleh kilang atau jalan akses.

c. Lampu sorot/ lampu suar *alarm* dan klakson harus memiliki *rating* minimal lingkungan IP65.

d. Jumlah dan lokasi dari *field device alarm* suara dan *visual* ini harus seperti yang ditunjukkan pada gambar denah lokasi yang disediakan oleh **VENDOR/ KONTRAKTOR**. *Unit* rakitan strobo/ klakson kebakaran atau *alarm* gas dapat digunakan jika ditunjukkan oleh lokasi.

e. Pengeras suara harus menghasilkan nada khusus untuk terjadinya kebakaran, gas yang mudah terbakar termasuk pelepasan *hydrogen* dan pelepasan gas beracun (H₂S). Tingkat suara pengeras suara harus paling sedikit 6 dBA di atas

ambient noise level.

- f. Where ambient noise level is greater than 105 dBA, the visible alarm sign, e.g., stroboscopic beacon, shall be provided in addition to the loudspeakers, with the following colour code:

1. flammable gas including hydrogen release: blue
2. toxic gas release: yellow
3. fire occurrence: red

- g. The visible alarm sign shall be provided at the location visible from normal path way, and outside the entrance in case of the enclosed building.

8. POWER SUPPLY REQUIREMENT

- a. All FGS shall be suitable for operation on Uninterruptible Power Supply (UPS) operating at an output voltage 220/110 VAC, 50 Hz, single phase.
- b. **VENDOR** shall provide all filters, transformers, rectifiers, etc. to convert the above power supply to the level acceptable to the FGS equipment.
- c. FGS shall be equipped with a battery back-up system for maintaining normal operation for 24 hours for each panel.
- d. The power supply shall provide a very low frequency sweep earth detect circuit, capable of detecting earth faults.
- e. The power supply shall be power-limited per UL1481 requirements.
- f. Power demand of the FGS equipment shall be minimized, by the use of low power consumption electronics throughout. **VENDOR** shall furnish the

level kebisingan lingkungan *normal*.


- f. Jika *level* kebisingan sekitar lebih besar dari 105 dBA, maka tanda *alarm* yang terlihat (*visual alarm*), misalnya, suar stroboskopik/ *stroboscopic beacon*, harus disediakan selain pengeras suara, dengan *code* warna berikut:

1. *flammable gas* termasuk pelepasan *hydrogen*: biru
2. pelepasan gas beracun: kuning
3. terjadi kebakaran: merah

- g. Tanda *alarm* yang terlihat harus disediakan di lokasi yang terlihat dari jalur *normal*, dan di luar pintu masuk dalam hal bangunan tertutup.

8. PERSYARATAN POWER SUPPLY

- a. Semua FGS harus sesuai untuk operasi pada *Uninterruptible Power Supply* (UPS) yang beroperasi pada tegangan *output* 220/ 110 VAC, 50 Hz, fase tunggal.
- b. **VENDOR** harus menyediakan semua *filter*, *transformator*, *rectifier*, dan lain-lain untuk mengubah *power supply* di atas ke *level* yang dapat diterima oleh peralatan FGS.
- c. FGS harus dilengkapi dengan sistem cadangan baterai untuk mempertahankan operasi *normal* selama 24 jam untuk setiap *panel*.
- d. *Power supply* harus menyediakan *very low frequency sweep earth detect circuit*, yang mampu mendeteksi *earth fault*.
- e. *Power supply* harus dibatasi *power* sesuai persyaratan UL1481.
- f. Permintaan *power* untuk peralatan FGS harus diminimalkan, dengan cara sebanyak mungkin menggunakan peralatan listrik yang mengkonsumsi

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total power consumption figures with a detailed break up.

daya rendah. *VENDOR* harus memberikan angka konsumsi *power* total dengan *detail*.

9. TESTING AND INSPECTION

9.1 Internal Test and Inspection by Vendor

VENDOR shall carry out internal tests and inspections in accordance with *VENDOR*'s requisition and this specification. The internal performance test certificate & report shall be provided also.

9.2 Factory Acceptance Test (FAT)

- a. *VENDOR* shall carry out Factory Acceptance Test with *CONTRACTOR* and *OWNER* at *VENDOR*'s factory. *VENDOR* shall demonstrate and confirm all functions working as per requirement.
- b. *VENDOR* shall provide the detailed procedure and shall be submitted to *OWNER* for review and approval.
- c. All the tools during the test shall be provided by *VENDOR*.
- d. Deficiencies and errors encountered during the test shall be corrected by *VENDOR/CONTRACTOR*. Any damaged component of the system (hardware and software) shall be repaired and/or replaced by *VENDOR/CONTRACTOR* and tested prior to shipment.

9.3 Site Acceptance Test (SAT)

- a. *VENDOR/CONTRACTOR* shall assign qualified personnel to supervise and assist installation of FACP equipment.
- b. *CONTRACTOR/VENDOR* shall carry out Site Acceptance Test with *OWNER* for all FGS equipment after installation.

9. PENGUJIAN DAN INSPEKSI

9.1 Inspeksi dan Pengujian *Internal* oleh *Vendor*

VENDOR harus melakukan pengujian dan inspeksi *internal* sesuai dengan permintaan *VENDOR* dan spesifikasi ini. Sertifikat & laporan uji performa *internal* harus disediakan juga.

9.2 *Factory Acceptance Test* (FAT)

- a. *VENDOR* harus melakukan *Factory Acceptance Test* dengan *KONTRAKTOR* dan *PEMILIK* di pabrik *VENDOR*. *VENDOR* harus mendemonstrasikan dan mengkonfirmasi semua fungsi yang bekerja sesuai kebutuhan.
- b. *VENDOR* harus memberikan prosedur *detail* dan harus diserahkan kepada *PEMILIK* untuk *review* dan persetujuan.
- c. Semua perkakas yang digunakan selama pengujian disediakan oleh *VENDOR*.
- d. Kekurangan dan kesalahan yang ditemui selama pengujian harus diperbaiki oleh *VENDOR/ KONTRAKTOR*. Semua komponen dari sistem yang rusak (*hardware* dan *software*) harus diperbaiki dan/ atau diganti oleh *VENDOR/ KONTRAKTOR* dan pengujian dilakukan sebelum pengiriman.

9.3 *Site Acceptance Test* (SAT)

- a. *VENDOR/ KONTRAKTOR* harus menugaskan personil yang memenuhi syarat untuk mengawasi dan membantu instalasi peralatan FACP.
- b. *KONTRAKTOR/ VENDOR* harus melakukan *Site Acceptance Test* dengan *PEMILIK* untuk semua peralatan *FGS*

- c. **VENDOR** shall provide the detailed procedure and shall be submitted to **OWNER** for review and approval.
- d. All the tools during the test shall be provided by **VENDOR**.
- e. Deficiencies and errors encountered during the test shall be corrected by **VENDOR/CONTRACTOR**. Any damaged component of the system (hardware and software) shall be repaired and/or replaced and tested.

10. WARRANTY

- 10.1 **VENDOR** shall specify the warranties for the system. The system shall be warranted for all parts and shipment/travel and for a period of one (1) year from plant start- up or eighteen (18) months after receipt, whichever occurs first.

11. DOCUMENTATION

- 11.1 **VENDOR/CONTRACTOR** shall provide a satisfactory and complete drawings and documents package of FGS hardware and software including as minimum:

1. Technical specification
2. Dimensional and arrangement drawing
3. Architecture drawing
4. List of device and accessories details including manufacturer's name, part number, together with drawing showing location of device
5. Wiring connection and loop diagram
6. Power supply line diagrams

setelah instalasi.

- c. **VENDOR** harus memberikan prosedur *detail* dan harus diserahkan kepada **PEMILIK** untuk *review* dan persetujuan.
- d. Semua perkakas yang digunakan selama pengujian disediakan oleh **VENDOR**.
- e. Kekurangan dan kesalahan yang ditemui selama pengujian harus diperbaiki oleh **VENDOR/ KONTRAKTOR**. Semua komponen dari sistem yang rusak (*hardware dan software*) harus diperbaiki dan/ atau diganti oleh **VENDOR/ KONTRAKTOR** dan di uji.

10. GARANSI

- 10.1 **VENDOR** harus menentukan garansi untuk sistem. Sistem harus di garansi untuk semua suku cadang dan pengiriman/ perjalanan serta untuk jangka waktu satu (1) tahun sejak kilang dimulai atau delapan belas (18) bulan setelah diterima, mana yang lebih dulu.

11. DOKUMENTASI

- 11.1 **VENDOR/ KONTRAKTOR** harus menyediakan gambar-gambar yang memuaskan dan lengkap serta dokumen *package* FGS, *hardware* dan *software*, termasuk *minimum* hal hal sebagai berikut:

1. Spesifikasi teknis
2. *Arrangement drawing* dan dimensinya
3. Gambar arsitektur
4. Daftar perangkat dan aksesori lengkap, termasuk nama pembuat, *part number*, serta gambar yang menunjukkan lokasi perangkat
5. Koneksi kabel dan *loop diagram*
6. Diagram alur *power supply*

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|--|--|
| 7. Logic diagram | 7. <i>Diagram logic</i> |
| 8. Installation manual | 8. Petunjuk instalasi |
| 9. Commissioning and testing procedure | 9. <i>Commissioning</i> dan prosedur pengujian |
| 10. Material certification | 10. Sertifikasi <i>material</i> |
| 11. Operation and maintenance manual | 11. Petunjuk operasi dan pemeliharaan |
| 12. Factory Acceptance Test (FAT) procedure and test record | 12. Prosedur <i>Factory Acceptance Test (FAT)</i> dan catatan/ rekaman pengujian |
| 13. Site Acceptance Test (SAT) procedure and test record | 13. Prosedur <i>Site Acceptance Test (SAT)</i> dan catatan/ rekaman pengujian |
| 14. Spare parts requirements, | 14. Kebutuhan <i>spare part</i> |
| 15. Any other details supporting documents to support compliance statements. | 15. Rincian lainnya dokumen pendukung untuk mendukung pernyataan kepatuhan/
<i>compliance statement</i> |