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SIS LIFECYCLE PLAN

ENGINEERING TECHNICAL STANDARDS & PROCEDURES

PT KILANG PERTAMINA INTERNASIONAL

DIREKTORAT PROYEK INFRASTRUKTUR

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1. INTRODUCTION

1.1 Introduction

This Pertamina Engineering Standards and Procedures (ETSP) SIS Lifecycle Plan (SLP) defines the technical and management activities to be performed at all phases of the development and use of Safety Instrumented Systems (SIS) in Pertamina Refining & Petrochemicals Subholding (PT.KPI and its subsidiaries) (henceforth “COMPANY”) throughout facility lifecycle to reduce process safety risks to tolerable levels. The activities include planning, competency, selection, design, verification, implementation, and independent functional safety assessment of SIS.

This SIS Lifecycle Plan is based on, and aims to comply with, IEC 61511-1:2016 Functional Safety – Safety Instrumented Systems for the Process Industry Sector.

1.2 Purpose

The objective of this document is to specify Pertamina Refining & Petrochemicals Subholding (PT.KPI and its subsidiaries) (henceforth “COMPANY”) corporate approach of adopting IEC 61511-1:2016 for specifying the SIS lifecycle phases and management activities that are necessary to ensure the functional safety objectives of all projects are met throughout their lifecycle from design to decommissioning; it also specifies the use of COMPANY’s corporate risk matrix as the risk tolerance criteria for SIL classification, in terms of personnel, environment, asset (optional) protection to prevent major accident events.

1. PENGANTAR

1.1 Pengantar

Pertamina Engineering Standards and Procedures (ETSP) SIS Lifecycle Plan (SLP) ini mendefinisikan kegiatan teknis dan manajemen yang akan dilakukan pada semua fase pengembangan dan penggunaan Safety Instrumented Systems (SIS) di Pertamina Refining & Petrochemicals Subholding (PT.KPI and its subsidiaries), [yang untuk selanjutnya disebut “COMPANY”] di seluruh lifecycle fasilitas untuk mengurangi risiko keselamatan proses ke tingkat yang dapat ditoleransi. Kegiatannya meliputi perencanaan, kompetensi, seleksi, desain, verifikasi, implementasi, dan penilaian keselamatan fungsional independen SIS

Rencana Lifecycle SIS ini didasarkan pada dan bertujuan untuk mematuhi, IEC 61511-1:2016 Keselamatan Fungsional – Sistem Instrumentasi Keselamatan untuk Sektor Industri Proses

1.2 Tujuan

Tujuan dari dokumen ini adalah untuk menentukan pendekatan korporat Pertamina Refining & Petrochemicals Subholding (PT.KPI and its subsidiaries),[yang untuk selanjutnya disebut “COMPANY”] dalam mengadopsi IEC 61511-1:2016, untuk menentukan fase lifecycle SIS dan aktivitas manajemen yang diperlukan untuk memastikan tujuan keselamatan fungsional dari semua proyek terpenuhi sepanjang lifecycle mereka dari desain hingga dekomisioning, dan juga menentukan penggunaan matriks risiko korporat PERUSAHAAN sebagai kriteria toleransi risiko untuk klasifikasi SIL, dalam hal perlindungan personel, lingkungan, aset (opsional), untuk mencegah kecelakaan besar.

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This applies for all projects within COMPANY, unless a different approach is specified in project contract.

The SIS Lifecycle planning requirements are covered in Clause 6 of IEC 61511-1:2016. The objectives of the safety lifecycle plan are:

- To define the phases and establish the requirements of the safety lifecycle activities, including the required inputs, outputs and verification activities;
- To organize the technical activities into a safety lifecycle;
- ensure that adequate planning exists (or is developed) that makes certain that the safety instrumented To system shall meet the safety requirements

Dokumen ini berlaku untuk semua proyek dalam PERUSAHAAN, kecuali pendekatan yang berbeda ditentukan dalam kontrak proyek.

Persyaratan perencanaan Lifecycle SIS tercakup dalam Klausul 6 IEC 61511-1:2016. Tujuan dari rencana lifecycle keselamatan adalah:

- Untuk menentukan fase dan menetapkan persyaratan kegiatan lifecycle keselamatan, termasuk input, output, dan kegiatan verifikasi yang diperlukan;
- Untuk mengatur kegiatan teknis ke dalam lifecycle keselamatan;
- Memastikan bahwa ada perencanaan yang memadai (atau pengembangan) yang memastikan bahwa sistem instrumentasi keselamatan memenuhi persyaratan keselamatan

2. SCOPE

The IEC 61511-1:2016 sets out a typical lifecycle in Figure 7 and Table 2 of the standard, while the requirements for each lifecycle phase is given in Clauses 8 through 16 of the same standard.

The standard recognizes that the specified activities which form the basis of Safety Lifecycle may be structured in different ways and allows flexibility for restructure to suit the user's specific processes provided that all the requirements are complied with.

Activities in the project lifecycle will be mapped to align with the appropriate phases of the safety lifecycle and the relevant clauses in IEC 61511-1:2016.

This SIS Lifecycle Plan is the result of

2. LINGKUP

IEC 61511-1:2016 menetapkan lifecycle standar pada Gambar 7 dan Tabel 2, sedangkan persyaratan untuk setiap fase lifecycle diberikan dalam Klausul 8 hingga 16 dari standar yang sama.

Standar ini mengakui bahwa aktivitas tertentu yang membentuk dasar Lifecycle Keselamatan dapat disusun dengan cara yang berbeda dan memungkinkan fleksibilitas untuk direstrukturisasi agar sesuai dengan proses spesifik pengguna asalkan semua persyaratan dipatuhi.

Aktivitas dalam lifecycle proyek akan dipetakan agar selaras dengan fase lifecycle keselamatan yang sesuai dan klausul yang relevan dalam IEC 61511-1:2016.

Rencana Lifecycle SIS ini merupakan hasil

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Phase 11 (safety lifecycle structure and planning).

2.1 Applicability

The focus of this SIS Lifecycle Plan is prevention SIFs rather than mitigation SIFs, in line with IEC 61511:2016 approach. As a mitigation IPL, fire and gas system (FGS) is excluded from SIL classification. Nonetheless, FGS system design, installation, operation, testing and maintenance are subject to international code & standards (e.g. NFPA). If implemented as part of SIS, the FGS system's logic, time delay, voting, reset and test intervals will be specified in the Safety Requirement Specifications (SRS).

This plan excludes packaged equipment which are subject to prescriptive standards for their application e.g. NFPA85 and class requirements for Burner Management System (BMS) or proprietary systems e.g. equipment health or vibration monitoring system.

2.2 Functional Safety Management Plan

This SIS Lifecycle Plan (SLP) presents the general plan of activities to be performed at each phase of the SIS lifecycle, to prevent or reduce systematic and random failures of the SIS. In general, SIS lifecycle is synonymous with functional safety lifecycle, or simply safety lifecycle; these terms are used interchangeably within this document

The SLP is aimed to be generic and applicable to each Bid, pre-FEED/BED, FEED or EPC capital projects, although not all Safety Lifecycle phases are applicable. Depending on the project's scope of work,

dari Fase 11 (struktur dan perencanaan lifecycle keselamatan).

2.1 Penerapan

Fokus dari Rencana Lifecycle SIS ini adalah lebih mengarah ke SIF pencegahan daripada SIF mitigasi, sejalan dengan pendekatan IEC 61511:2016. Sebagai IPL mitigasi, fire and gas system (FGS) tidak termasuk dalam klasifikasi SIL. Meskipun demikian, desain, pemasangan, pengoperasian, pengujian, dan pemeliharaan sistem FGS tunduk pada kode & standar internasional (misalnya NFPA). Jika diimplementasikan sebagai bagian dari SIS, system's logic FGS, waktu tunda, voting, reset, dan interval pengujian akan ditentukan dalam Spesifikasi Persyaratan Keselamatan (SRS).

Perencanaa ini tidak termasuk *packaged equipment* yang tunduk pada standar preskriptif untuk aplikasinya, mis. NFPA85 dan persyaratan kelas untuk Burner Management System (BMS) atau sistem berpemilik, mis. peralatan kesehatan atau sistem pemantauan getaran.

2.3 Rencana Manajemen Keselamatan Fungsional

Rencana Lifecycle SIS (SLP) ini menyajikan rencana umum kegiatan yang akan dilakukan pada setiap fase lifecycle SIS, untuk mencegah atau mengurangi kegagalan sistematis dan acak dari SIS. Secara umum, lifecycle SIS dikenal dengan istilah lifecycle keselamatan fungsional, atau disederhanakan dengan istilah lifecycle keselamatan; istilah-istilah ini digunakan secara bergantian dalam dokumen ini

SLP ditujukan untuk umum dan berlaku untuk setiap tahapan proyek modal yaitu prose *bidding*, pra-*FEED/BED, FEED* atau *EPC,* meskipun tidak semua fase Safety Lifecycle dapat diterapkan. Berdasarkan

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CONTRACTOR develop a FSMP specific for the project. The remaining Safety Lifecycle phases are the responsibility of COMPANY (facility operating entity).

A Functional Safety Management Plan (FSMP) shall be developed specifically for each capital project and include Phases 1 to 5, 9 and 10. Subsequently, a separate FSMP shall be developed for the Operations phase. Both the Project FSMP and the Operations FSMP may refer to the relevant parts of this SIS Lifecycle Plan.

lingkup pekerjaan proyek, KONTRAKTOR dapat mengembangkan FSMP khusus untuk proyek tersebut. Fase Lifecycle Keselamatan yang tersisa adalah tanggung jawab PERUSAHAAN (entitas pengoperasian fasilitas).

Rencana Manajemen Keselamatan Fungsional (FSMP) harus dikembangkan secara khusus untuk setiap proyek modal dan mencakup Fase 1 hingga 5, 9 dan 10. Selanjutnya, FSMP terpisah harus dikembangkan untuk fase Operasi. Baik FSMP Proyek maupun FSMP Operasi dapat merujuk ke bagian yang relevan dari Rencana Lifecycle SIS ini.

3. CONFLICTS AND DEVIATIONS

3.1 Any conflicts between this standard and other applicable Pertamina Engineering Technical Standards and Procedures (ETSP), or industry standards, codes, and forms shall be resolved in writing by the Vendor/Consultant/Contractor through to PT Kilang Pertamina Internasional (PT KPI)

.

Where two or more references define requirements for the same subject, the more restrictive reference shall govern

3.2 This document is made in the Indonesian language and the English language. Both texts are equally original. In the event of any inconsistency or different interpretation or conflict between the Indonesian text and English text, the English text shall prevails and the relevant Indonesian text shall be deemed to be automatically amended to conform with and to make the relevant Indonesian text consistent with the relevant English text.

3. KONFLIK DAN DEVIASI

3.1 Setiap konflik antara standar ini dengan *Engineering Technical Standards and Procedures (ETSP)* Pertamina lain yang berlaku, atau standar, kode, dan formulir industri harus diselesaikan secara tertulis oleh Vendor/Konsultan/Kontraktor melalui PT Kilang Pertamina Internasional (PT KPI).

Jika dua atau lebih referensi menentukan persyaratan untuk subjek yang sama, referensi yang lebih ketat akan berlaku

3.2 Dokumen ini dibuat dalam bahasa Indonesia dan bahasa Inggris. Baik teks bahasa Indonesia ataupun teks Bahasa Inggris kedua-duanya adalah asli (original). Jika terdapat ketidaksesuaian atau perbedaan interprestasi atau pertentangan antara teks bahasa Indonesia dan teks bahasa Inggris, maka teks bahasa Inggris akan menjadi acuan dan kemudian teks bahasa Indonesia harus dianggap sudah diubah secara otomatis sehingga menjadi sesuai dengan teks bahasa Inggris.

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4. ABBREVIATIONS

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

BPCS	Basic Process Control System
C&E	Cause and Effects (Diagram)
CCF	Common Cause Failure
CMF	Common Mode Failure
CMMS	Computerized Maintenance Management System (e.g. example tools are SAP, MAXIMO, AMOS)
DC	Diagnostic Coverage
DCS	Distributed Control System
DCPST	Diagnostic Coverage for Partial Stroke Testing
DED	Detailed Engineering Design
DTT	De-energize To Trip
E/E/PE	Electrical/ Electronic/ Programmable Electronic (Logic Device)
EIV	Emergency Isolation Valve
EPC	Engineering Procurement Construction
ESD	Emergency Shutdown
ETT	Energize to Trip
FAT	Factory Acceptance Test
FGS	Fire and Gas (Detection) System
FIT	Failure in Time per billion hours (per 10^9 hours)

4. ABBREVIATIONS

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

BPCS	*Basic Process Control System*
C&E	*Cause and Effects (Diagram)*
CCF	*Common Cause Failure*
CMF	*Common Mode Failure*
CMMS	*Computerized Maintenance Management System (e.g. example tools are SAP, MAXIMO, AMOS)*
DC	*Diagnostic Coverage*
DCS	*Distributed Control System*
DCPST	*Diagnostic Coverage for Partial Stroke Testing*
DED	*Detailed Engineering Design*
DTT	*De-energize To Trip*
E/E/PE	*Electrical/ Electronic/ Programmable Electronic (Logic Device)*
EIV	*Emergency Isolation Valve*
EPC	*Engineering Procurement Construction*
ESD	*Emergency Shutdown*
ETT	*Energize to Trip*
FAT	*Factory Acceptance Test*
FGS	*Fire and Gas (Detection) System*
FIT	*Failure in Time per billion hours (per 10^9 hours)*

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FMEDA	Failure Modes Effects and Diagnostic Analysis	FMEDA	*Failure Modes Effects and Diagnostic Analysis*
FSA	Functional Safety Assessment	FSA	*Functional Safety Assessment*
FSMP	Functional Safety Management Plan	FSMP	*Functional Safety Management Plan*
HAZOP	Hazard and Operability Study	HAZOP	*Hazard and Operability Study*
HFT	Hardware Fault Tolerance	HFT	*Hardware Fault Tolerance*
HIPPS	High Integrity Pressure Protection System	HIPPS	*High Integrity Pressure Protection System*
HMI	Human Machine Interface	HMI	*Human Machine Interface*
ICSS	Integrated Control and Shutdown (or Safety) System	ICSS	*Integrated Control and Shutdown (or Safety) System*
IFSA	Independent Functional Safety Assessment	IFSA	*Independent Functional Safety Assessment*
IP	Ingress Protection	IP	*Ingress Protection*
IPL	Independent Protection Layer	IPL	*Independent Protection Layer*
I/O	Inputs / Outputs	I/O	*Inputs / Outputs*
IS	Intrinsically Safe	IS	*Intrinsically Safe*
LOPA	Layer of Protection Analysis	LOPA	*Layer of Protection Analysis*
MC	Mechanical Completion	MC	*Mechanical Completion*
MCC	Motor Control Centre	MCC	*Motor Control Centre*
MOC	Management of Change	MOC	*Management of Change*
MPRT	Maximum Permitted Repair Time	MPRT	*Maximum Permitted Repair Time*
MRT	Mean Repair Time	MRT	*Mean Repair Time*
MT	Mission Time	MT	*Mission Time*
MTBF	Mean Time Between Failures	MTBF	*Mean Time Between Failures*
MTTF	Mean Time to Failure	MTTF	*Mean Time to Failure*
MTTR	Mean Time to Restoration	MTTR	*Mean Time to Restoration*

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P&ID	Process and Instrumentation Diagram	P&ID	*Process and Instrumentation Diagram*
PCS	Process Control System	PCS	*Process Control System*
PFD	Probability of Dangerous Failure on Demand	PFD	*Probability of Dangerous Failure on Demand*
PFDavg	Average Probability of Dangerous Failure on Demand	PFDavg	*Average Probability of Dangerous Failure on Demand*
PFH	Probability of dangerous failure per hour	PFH	*Probability of dangerous failure per hour*
PHA	Process Hazard Analysis	PHA	*Process Hazard Analysis*
PLC	Programmable Logic Controller	PLC	*Programmable Logic Controller*
PSD	Process Shutdown	PSD	*Process Shutdown*
PST	Partial Stroke Testing	PST	*Partial Stroke Testing*
PTC	Proof Test Coverage	PTC	*Proof Test Coverage*
PTI	Proof Test Interval	PTI	*Proof Test Interval*
RRF	Risk Reduction Factor	RRF	*Risk Reduction Factor*
SAT	Site Acceptance Test	SAT	*Site Acceptance Test*
SFF	Safe Failure Fraction	SFF	*Safe Failure Fraction*
SIF	Safety Instrumented Function	SIF	*Safety Instrumented Function*
SIL	Safety Integrity Level	SIL	*Safety Integrity Level*
SIS	Safety Instrumented System	SIS	*Safety Instrumented System*
SLC	Safety Lifecycle	SLC	*Safety Lifecycle*
SLP	Safety Lifecycle Plan	SLP	*Safety Lifecycle Plan*
SOE	Sequence Of Event (Recorder)	SOE	*Sequence Of Event (Recorder)*
SRS	Safety Requirements Specification	SRS	*Safety Requirements Specification*
ToR	Terms of Reference	ToR	*Terms of Reference*

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5. DEFINITIONS

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

Company	Pertamina Refining & Petrochemicals Subholding (PT.KPI and its subsidiaries)
Contractor/ Consultant	FEED/EPC Contractor or independent third party consultant selected/awarded to conduct and engage works within the SIS Lifecycle phases for all projects under PT Pertamina (Persero) – Refining & Petrochemicals Subholding

5. DEFINISI

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

Company	Pertamina Refining & Petrochemicals Subholding (PT.KPI and its subsidiaries)
Contractor/ Consultant	Kontraktor FEED/EPC atau konsultan pihak ketiga independen yang dipilih/diberikan untuk melakukan dan melakukan pekerjaan dalam fase Lifecycle SIS untuk semua proyek di bawah PT Pertamina (Persero) – Subholding Refining & Petrochemicals

6. CODES AND STANDARDS

The reference documents listed below form an integral part of this ETSP.

1.	RP-ETS-PSE-EG-0001-02	Engineering Guideline Project Risk Matrix and Tolerance Criteria
2.	RP-ETS-PSE-EG-0005-01	Engineering Guideline HAZOP Procedure
3.	RP-ETS-PSE-EG-0003-00	SIL Classification using LOPA Procedure
4.	RP-ETS-PSE-EG-0008-00	SIL Verification Procedure
5.	Project Document	HSSE Design Philosophy
6.	Project Document	Maintenance Philosophy

6. KODE DAN STANDAR

Dokumen referensi yang tercantum di bawah ini merupakan bagian yang tidak terpisahkan dari ETSP ini.

1.	RP-ETS-PSE-EG-0001-02	*Engineering Guideline Project Risk Matrix and Tolerance Criteria*
2.	RP-ETS-PSE-EG-0005-01	*Engineering Guideline HAZOP Procedure*
3.	RP-ETS-PSE-EG-0003-00	*SIL Classification using LOPA Procedure*
4.	RP-ETS-PSE-EG-0008-00	*SIL Verification Procedure*
5.	Project Document	*HSSE Design Philosophy*
6.	Project Document	*Maintenance Philosophy*

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7.	Project Document	Mechanical Completion, Commissioning and Handover Management Procedure	7.	Project Document	*Mechanical Completion, Commissioning and Handover Management Procedure*
8.	IEC 61508 Parts 1-7:2010	Functional Safety of Electrical/ Electronic/ Programmable Electronic Safety-Related Systems	8.	IEC 61508 Parts 1-7:2010	*Functional Safety of Electrical / Electronic / Programmable Electronic Safety-Related Systems*
9.	IEC 61511 Parts 1-3:2016	Functional Safety – Safety Instrumented Systems for the Process Industry Sector	9.	IEC 61511 Parts 1-3:2016	*Functional Safety – Safety Instrumented Systems for the Process Industry Sector*
10.	OLF 070:2018	Application of IEC 61508 and IEC 61511 in the Norwegian Petroleum Industry	10.	OLF 070:2018	*Application of IEC 61508 and IEC 61511 in the Norwegian Petroleum Industry*
11.	EEMUA 222:2009	Guide to the application of IEC 61511 to safety instrumented systems in the UK process industries	11.	EEMUA 222:2009	*Guide to the application of IEC 61511 to safety instrumented systems in the UK process industries*

7. RESPONSIBLITIES

Position	Responsibilitiy
Project Manager or his/her delegate Operations Manager or his/her delegate	Ensure the resources are provided to meet the requirements defined in this lifecycle plan for the relevant phases
Project Engineering Manager or his/her delegate	Ensures that the required discipline engineers are allocated to provide the necessary inputs and outputs defined for the relevant phases
Business Unit	Ensures this plan is

7. TANGGUNGJAWAB

Posisi	Tanggungjawab
Manajer Proyek atau yang diberi mandat Manajer Operasi atau yang diberi mandat	Memastikan sumber daya disediakan untuk memenuhi persyaratan yang ditentukan dalam rencana lifecycle untuk fase yang relevan
Project Engineering Manager atau yang diberi mandat	Memastikan bahwa *engineer* dengan disiplin yang diperlukan sudah dialokasikan untuk memberi masukkan guna mendefinisikan input dan output pada setiap fase yang relevan
Manajer Unit Bisnis	Memastikan semua

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Manager	followed so that the planning activities and objectives as defined in IEC 61511 are met		rencana dijalankan sehingga kegiatan perencanaan dan tujuan seperti yang didefinisikan dalam IEC 61511 terpenuhi
Discipline Engineers	Provide design and engineering inputs and output deliverables for the relevant phases. Implement the requirements of SLP, refer to RACI Chart Participate in FSA as necessary	Engineers dari disiplin ilmu tertentu	Memberikan masukan untuk untuk mendefinisikan input dan output kegiatan desain dan *engineering* pada setiap fase yang relevan. Menerapkan persyaratan SLP, berdasarkan RACI Chart Berpartisipasi di FSA seperlunya
Operations Team (including Pre-Operations)	Ensure the plan is followed for phases 6 and 7 so the activities during the operational phase of the lifecycle are fulfilled. Phase 8 to be developed prior to de-commissioning of the facility	Tim Operasi (termasuk pra operasi)	Memastikan semua rencana untuk fase 6 dan 7 diikuti sehingga aktivitas selama fase operasional dari lifecycle terpenuhi. Fase 8 akan dikembangkan sebelum de-commissioning fasilitas
ICSS Contractor or System Integrator	Provide evidence that a FS management system is in place and followed, PLC and application programs are designed, developed, built, tested and validated in compliance with IEC 61508, and provide relevant information such as FAT report, SAT report, punch list close-out, etc. as and when required to support this SLP	Kontraktor ICSS atau Integrator Sistem	Menyediakan bukti untuk menyatakan bahwa sistem manajemen FS sudah ada dan dijalankan, PLC dan program aplikasi sudah didesain, dikembangkan, dibangun, diuji, dan divalidasi sesuai dengan IEC 61508, dan memberikan informasi yang relevan seperti laporan FAT, laporan SAT, menyelesaikan semua item yang ada di

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			dalam *punch list*, dll. sebagaimana diperlukan untuk mendukung SLP ini
Maintenance Manager	Provide resources i.e. manpower and workshop facilities and tools are provided to enable testing, repair, and revalidation in accordance with the SIS SRS	Manajer Pemeliharaan	Menyediakan sumber daya yaitu tenaga kerja dan fasilitas *workshop*/lokakarya dan perlengkapannya untuk keperluan pengujian, perbaikan, dan validasi ulang sesuai dengan SIS SRS
Package Responsible Engineer (PRE)	Ensure that the project requirements related to implementation of IEC 61511 have been included in the Sub-Contracts	*Engineer* Penanggung Jawab Paket (PRE)	Memastikan bahwa persyaratan proyek yang terkait dengan penerapan IEC 61511 telah dimasukkan dalam Sub-Kontrak
Lead Process Safety Engineer	Provide advice and guidance on tolerable risk criteria and process hazard analysis Participate in HAZOP and LOPA workshops, and provide advice to project team members to ensure compliance to Corporate SIL Classification procedure Review and amend the SIS Lifecycle Plan when necessary e.g. after revision of IEC 61511.	Koordinator Engineer Keselamatan Proses	Memberikan saran dan panduan tentang kriteria risiko yang dapat ditoleransi dan analisis bahaya proses Berpartisipasi dalam lokakarya HAZOP dan LOPA, dan memberikan saran kepada anggota tim proyek untuk memastikan kepatuhan terhadap prosedur Klasifikasi SIL Perusahaan Melakukan tinjauan dan perubahan rencana lifecycle SIS bila diperlukan, mis. setelah revisi IEC 61511.
Functional Safety/SIS Specialist – Could be Instrument &	Review and validate SIL Certificates / SIL assessment reports, confirm the failure rate data provided is	Spesialis Keselamatan/SIS Fungsional – sebagai Engineer Instrumen &	Meninjau dan memvalidasi Sertifikat SIL / laporan penilaian SIL, mengkonfirmasi

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Control Engineer (Projects) or I&C Superintendent (Operations)	representative for the equipment and verify the dangerous failure rates are within upper and lower bound norms based on generic data. Review and validate SIL Verification (reliability analysis) calculations and produce report. Review and validate Safety Requirement Specification (SRS) during SIL Verification development. Review and amend the SIS Lifecycle Plan when necessary e.g. after revision of IEC 61511.	Kontrol (Proyek) atau Pengawas I&C (Operasi)	data tingkat kegagalan yang disediakan dapat mewakili semua peralatan dan memverifikasi bahwa tingkat kegagalan berbahaya berada dalam norma batas atas dan bawah berdasarkan data umum. Meninjau dan memvalidasi perhitungan Verifikasi SIL (analisis keandalan) dan membuat laporannya. Meninjau dan memvalidasi Spesifikasi Persyaratan Keselamatan (SRS) selama pengembangan Verifikasi SIL. Meninjau dan merevisi Rencana Lifecycle SIS bila perlu, mis. setelah revisi IEC 61511.
Contractors, Vendors and Consultants	Perform the functional safety tasks assigned to them, refer to RACI Chart	Kontraktor, Vendor dan Konsultan	Melakukan tugas keselamatan fungsional yang diberikan kepada mereka, lihat *RACI Chart*

8. MANAGEMENT OF FUNCTIONAL SAFETY

8.1 The Safety Lifecycle

COMPANY will adopt the Safety Lifecycle in IEC 61511-1:2016 for implementation. Figure 7 from IEC 61511-1 defines the phases of the safety lifecycle. This lifecycle plan identifies the requirements to satisfy each specified clause, the required inputs, outputs and verification activities for Phases 1 to 5 for project activities (typically DED/ EPC), Phases 6 to 8 for Operational activities, and Phases 9 to 11 for common

8. MANAJEMEN KESELAMATAN FUNGSIONAL

8.1 *Lifecycle* Keselamatan

PERUSAHAAN akan mengadopsi Lifecycle Keselamatan di IEC 61511-1:2016 untuk implementasi. Gambar 7 dari IEC 61511-1 mendefinisikan fase lifecycle keselamatan. Rencana lifecycle ini mengidentifikasi persyaratan guna memenuhi setiap klausa yang ditentukan, input, output, dan kegiatan verifikasi yang diperlukan untuk Fase 1 hingga 5 untuk kegiatan proyek (biasanya DED/EPC), Fase 6 hingga 8 untuk kegiatan

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activities throughout the lifecycle.

The safety lifecycle is represented in **Figure 1.** in this document.

Figure 1. provides the links between the safety lifecycle phases, IEC 61511 requirements and the tasks within COMPANY.

Operasional, dan Fase 9 hingga 11 untuk umum aktivitas sepanjang lifecycle.

Lifecycle keselamatan disajikan dalam Gambar **1.** di dokumen ini.

Gambar 1. memperlihatkan hubungan antara fase lifecycle keselamatan, persyaratan IEC 61511, dan tugas dalam PERUSAHAAN

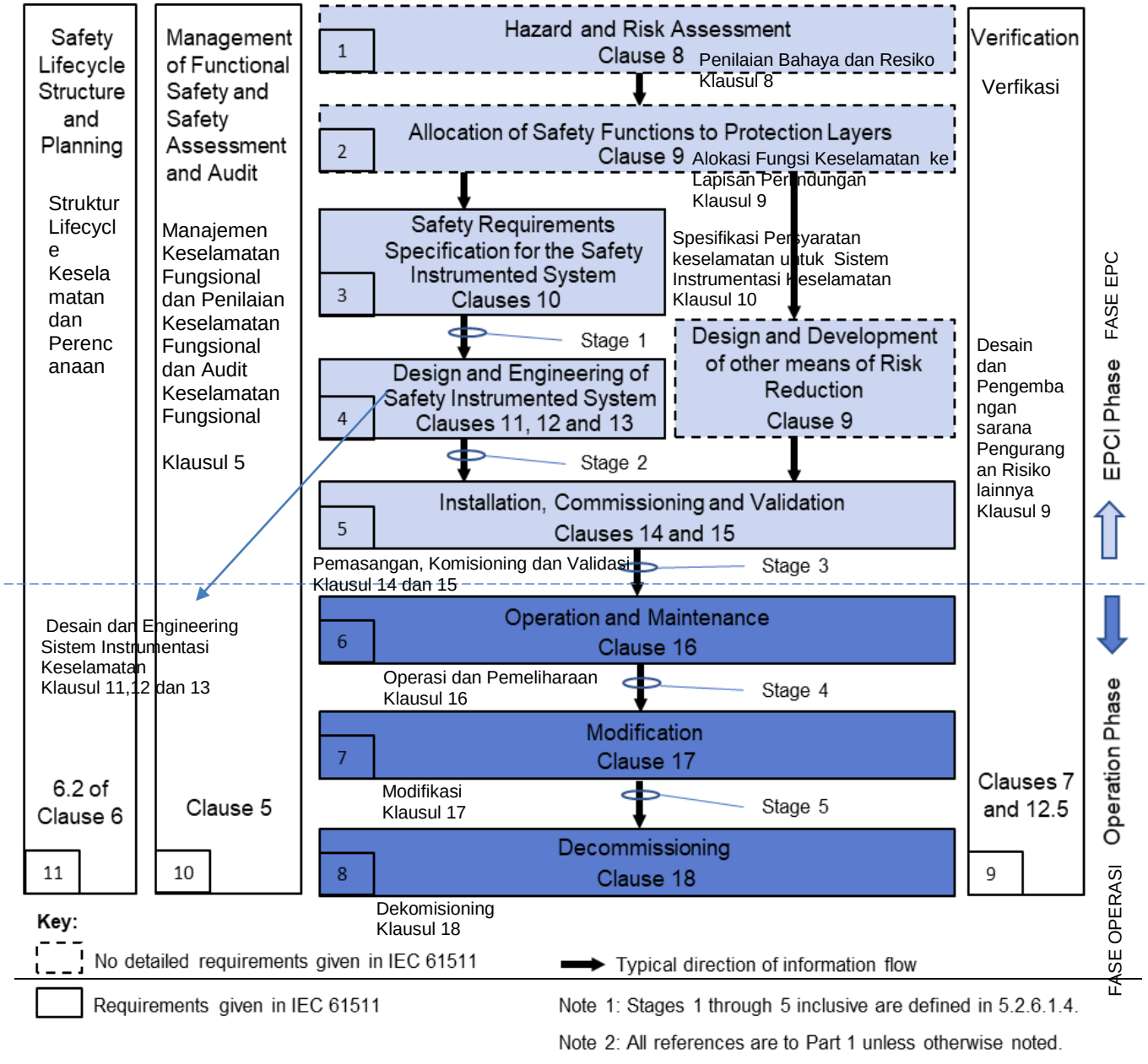

Figure 1.0 Safety Lifecycle

Figure 1.0 *Safety Lifecycle*

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The figure below lists each Safety Lifecycle Phase against its clauses in IEC 61511 and the details presented in this document.

Gambar di bawah menunjukkan setiap Fase Lifecycle Keselamatan berdasarkan klausulnya dalam IEC 61511 dan rincian yang disajikan dalam dokumen ini.

Table 1. SIS Lifecycle Phases and FSA Stages

Tabel 1. Fase Lifecycle SIS dan Tahapan FSA

Phase (typical) *Fase tipikal*	**SIS Lifecycle Phases** ***Fase*** *Lifecycle SIS*	**Descriptions** *Uraian*	**IEC 61511-1 :2016 Clauses** *Klausul IEC 61511-1 :2016*	**Detailed in the following tables in this document** *Selengkapnya dalam tabel berikut didokumen ini*	**Responsible Entity** *Entitas yang Bertanggung Jawab*	
					Contractor *Kontraktor*	**Company (Operation)** *Perusahaan (Operasional)*
	Phase 1 *Fase 1*	Hazard and Risk Assessment *Penilaian Bahaya dan Risiko*	8	Table 1	√	
	Phase 2	Allocation of Safety Functions to *Protection Layers* Alokasi Fungsi Keselamatan ke *Lapisan Perlindungan*	9	Table 2	√	
	Phase 3 Fase 3	Safety Requirement Specification *Spesifikasi Persyaratan Keselamatan*	10	Table 3	√	
FEED EPC	Phase 4 Fase 4 Phase 5 *Fase 5*	**FSA Stage 1 (Optional)** ***FSA Tahap 1 (Opsional)*** Design and Engineering of SIS *Desain dan Engineering SIS* **FSA Stage 2 (Optional)** *FSA Tahap 2 (Opsional)* Installation, Commissioning and Validation *Instalasi,Komisioning dan validasi* **FSA Stage 3 (Required)** ***FSA tahap 3(diperlukan)***	11, 12 and 13 14 and 15	Table 4 Table 5	√ √	
	Phase 6 *Fase 6*	Operation and Maintenance *Operasi dan Pemeliharaan* **FSA Stage 4 (Required)** *FSA tahap 4(diperlukan)*	16	Table 6 *Table 6*		√

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Operations	Phase 7 *Fase 7*	Modification *Modifikasi* **FSA Stage 5 (If required)** **FSA tahap 5 (jika diperlukan)**	17	Table 7 *Table 7*		√
	Phase 8 *Fase 8*	Decommissioning *Dekomisioning*	18	Table 8 Table 8		√
	Phase 9	Verification *Verfikasi*	7 and 12.5	Table 9 Table 9	√	√
Common	Phase 10 *Fase 10*	Functional Safety Assessment (FSA) and Audit *Penilaian Keselamatan Fungsional (FSA) dan Audit* **[FSA Stages are indicated above in EPC and Operations]** ***[Tahapan FSA ditunjukkan di atas dalam EPC dan Operasi]***	5	Table 10 Table 10	√	√
	Phase 11 *Fase 11*	Safety Planning *Perencanaan Keselamatan*	5.2.4	Table 11 Table 11	√	√

The safety lifecycle activities are presented below for phases 1 to 5 inclusive.

Lifecycle activities are defined in Figure 7 of IEC 61511-1:2016 and summarized below including the respective IEC clause and lifecycle table:

8.2 Safety Lifecycle Phases 1 to 5 (Project Scope)

The safety lifecycle activities are presented below for phases 1 to 5 inclusive.

Lifecycle activities are defined in **Table 1.** of IEC 61511-1:2016 and summarized below including the respective IEC clause and lifecycle table:

8.2.1. Phase 1 – Hazard and Risk Assessment

- IEC 61511-1:2016 Clause 8
- Table 1 in this document

Kegiatan lifecycle keselamatan disajikan di bawah ini untuk fase 1 sampai dengan 5

Aktivitas lifecycle didefinisikan dalam Gambar 7 dari IEC 61511-1:2016 dan diringkas di bawah ini termasuk klausul IEC dan tabel lifecycle masing-masing:

8.2 Lifecycle Keselamatan Fase 1 hingga 5 (Lingkup Proyek)

Kegiatan lifecycle keselamatan disajikan di bawah ini untuk fase 1 sampai dengan 5

Aktivitas lifecycle didefinisikan dalam **Tabel 1.** dari IEC 61511-1:2016 dan diringkas di bawah ini termasuk klausul IEC dan tabel lifecycle masing-masing:

8.2.1. Fase 1 – Penilaian Bahaya dan Risiko

- IEC 61511-1:2016 Klausul 8
- Tabel 1 dalam dokumen ini

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8.2.2. Phase 2 – Allocation of Safety Functions to Protection Layers

- IEC 61511-1:2016 Clause 9
- Table 2 in this document

8.2.3. Phase 3 – Safety Requirements Specification

- IEC 61511-1:2016 Clause 10
- Table 3 in this document

8.2.4. Phase 4 – Design and Engineering of the SIS

- IEC 61511-1:2016 Clause 11, 12 and 13
- Table 4 in this document

8.2.5. Phase 5 – Installation, Commissioning and Validation

- IEC 61511-1:2016 Clause 14 and 15
- Table 5 in this document

8.3 Safety Lifecycle Phases 6 To 8 (Operations Scope)

The safety lifecycle activities are presented below for phases 6, 7 and 8.

Lifecycle activities are defined in **Table 1.0** of IEC 61511-1:2016 and summarized below including the respective IEC cause and lifecycle table:

8.3.1. Phase 6 – Operation and Maintenance

- IEC 61511-1:2016 Clause 16
- Table 7. in this document

8.3.2. Phase 7 – Modification

- IEC 61511-1:2016 Clause 17
- Table 8. in this document

8.3.3. Phase 8 – Decommissioning

8.2.2. Fase 2 – Alokasi Fungsi Keselamatan ke Lapisan Proteksi

- IEC 61511-1:2016 Klausul 9
- Tabel 2 dalam dokumen ini

8.2.3. Fase 3 – Spesifikasi Persyaratan Keselamatan

- IEC 61511-1:2016 Klausul 10
- Tabel 3 didalam dokumen ini

8.2.4. Fase 4 – Desain dan Engineering SIS

- IEC 61511-1:2016 Klausul 11, 12 dan 13
- Tabel 4 dalam dokumen ini

8.2.5. Fase 5 – Instalasi, Komisioning and Validasi

- IEC 61511-1:2016 Klausul 14 dan 15
- Table 5 didalam dokumen

8.3 Fase Lifecycle Keselamatan 6 Sampai 8 (Lingkup Operasi)

Kegiatan lifecycle keselamatan disajikan di bawah ini untuk fase 6, 7 dan 8.

Aktivitas lifecycle didefinisikan dalam **Tabel 1.** dari IEC 61511-1:2016 dan diringkas di bawah ini termasuk penyebab IEC dan tabel lifecycle masing-masing:

8.4.1. Fase 6 – Operasi dan Pemeliharaan

- IEC 61511-1:2016 Klausul 16
- Tabel 7. didalam dokumen

8.4.2. Fase 7 – Modifikasi

- IEC 61511-1:2016 Klausul 17
- Tabel 8. didalam dokumen ini

8.4.3. Fase 8 - Dekomisioning

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- IEC 61511-1:2016 Clause 18
- Table 9. in this document

8.4 Safety Lifecycle Phases 9 To 11 (Common Activities)

8.4.1. Phase 9 – Verification

- IEC 61511-1:2016 Clause 7
- Table 10. in this document

8.4.2. Phase 10 – Safety Planning

- IEC 61511-1:2016 Clause 5.2.4
- Table 11. in this document

8.4.3. Phase 11 – Functional Safety Assessment and Audit

- IEC 61511-1:2016 Clause 5
- Table 12. in this document

The Functional Safety Assessment (FSA) stages for the EPC phases of the project are:

- FSA Stage 1 - Completion of SLP Phase 3 (optional)
- FSA Stage 2 - Completion of SLP Phase 4 (optional)
- FSA Stage 3 - Completion of SLP Phase 5 (required)
- The Functional Safety Assessment (FSA) stages for the Operation phases of the facility are:
- FSA Stage 4 - Completion of SLP Phase 6 (required)
- FSA Stage 5 - Completion of SLP Phase 7 (determined by impact or risk assessment)

- IEC 61511-1:2016 Klausul 18
- Tabel 9. didalam dokumen ini

8.4 Lifecycle Keselamatan Fase 9 Sampai 11 (Aktivitas Umum)

8.4.1. Fase 9 – Verifikasi

- IEC 61511-1:2016 Klausul 7
- Tabel 10. didalam dokumen ini

8.4.2. Fase 10 – Perencanaan Keselematan

- IEC 61511-1:2016 Klausul 5.2.4
- Tabel 11. didalam dokumen ini

8.4.3. Fase 11 – Penilaian dan Audit Keselamatan Fungsional

- IEC 61511-1:2016 Klausul 5
- Tabel 12. didalam dokumen ini

Tahapan Penilaian Keselamatan Fungsional (FSA) untuk fase EPC proyek adalah:

- FSA Tahap 1 - Penyelesaian SLP Tahap 3 (opsional)
- FSA Tahap 2 - Penyelesaian SLP Tahap 4 (opsional)
- FSA Tahap 3 - Penyelesaian SLP Tahap 5 (diperlukan)
- Tahapan Penilaian Keselamatan Fungsional (FSA) untuk fase Operasi fasilitas nya adalah:
- FSA Tahap 4 - Penyelesaian SLP Tahap 6 (diperlukan)
- FSA Tahap 5 - Penyelesaian SLP Tahap 7(ditentukan oleh penilaian dampak atau risiko)

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Table 2. Safety Lifecycle Plan Phase 1 – Hazard and Risk Assessment

Tabel 2. Rencana Lifecycle Keselamatan Fase 1 – Penilaian Bahaya dan Resiko

Phase 1 – Hazard and Risk Assessment *Fas 1 - Penilaian Bahaya dan Resiko*						
Safety Lifecycle Phase or Activity ***Fase Lifecycle Keselamatan atau Kegiatan***		**Objectives** ***Tujuan***	**IEC 61511 Clause** ***IEC 61511 Klausul***	**Tasks Identified** ***Identifikasi Tugas***	**Input(s)** ***Input(s)***	**Output(s)** ***Output(s)***
Phase ***Fase***	**Title** ***Judul***					
As defined in IEC 61511-1 ***Seperti yang didefinisikan didalam IEC 61511-1***				**by CONTRACTOR** ***oleh KONTRAKTOR***		
1	Hazard and risk assessment *Penilaian Bahaya dan Resiko*	[IEC 61511-1: 8.1] To determine the hazards and hazardous events of the process and associated equipment, the sequence of events leading to the hazardous event, the process risks associated with the hazardous event, the requirements for risk reduction and the safety functions required to achieve the necessary risk reduction, if any *of the safety functions are SIFs. [IEC 61511-1: 8.1] Untuk menentukan bahaya dan kejadian berbahaya dari proses dan peralatan terkait, urutan kejadian yang mengarah ke kejadian berbahaya, risiko proses yang terkait dengan kejadian berbahaya, persyaratan pengurangan risiko dan fungsi keselamatan*	8	1. Prepare HAZOP & SIL Classification Procedures. 2. Prepare HAZOP Terms of Reference. 3. Prepare SIL Classification Terms of Reference. 4. Conduct multi-discipline HAZOP Study Workshop. *1. Menyiapkan Prosedur Klasifikasi HAZOP & SIL.* *2. Siapkan Kerangka Acuan HAZOP.* *3. Menyusun Kerangka Acuan Klasifikasi SIL.* *4. Mengadakan Lokakarya Studi HAZOP multi-disiplin.*	Plot plan drawing PFDs P&ID's Scope / basis of design Process description Control / operating philosophy Shutdown Philosophy Environmental studies Cause and Effect Diagrams I/O Schedules *Gambar Plot Plan* *PFD* *P&ID* *Lingkup / dasar desain* *Deskripsi proses* *Kontrol / filosofi operasi* *Filosofi Shutdown* *Studi lingkungan* *Diagram Sebab dan Akibat*	*HAZOP report, containing:* *A description of each hazard and consequence* *A detailed description of all the initiating causes and any assumptions associated with each hazard* *A description of the consequence of the hazard Identification of the safety functions covering mechanical and safety instrumented functions which prevent or mitigate the hazard* *A list of recommendations for further actions.* *Laporan HAZOP, yang berisi:* *Deskripsi setiap bahaya dan konsekuensinya*

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		diperlukan untuk mencapai pengurangan risiko yang diperlukan, jika salah satu fungsi keselamatan adalah SIF.			*I/O Schedules*	*Deskripsi rinci tentang semua penyebab awal dan asumsi apa pun yang terkait dengan:* *setiap bahaya* *Uraian konsekuensi bahaya* *Identifikasi fungsi keselamatan yang mencakup fungsi mekanis dan instrumen keselamatan yang mencegah atau mengurangi bahaya* *Daftar rekomendasi untuk tindakan lebih lanjut.*

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Table 3. Safety Lifecycle Plan Phase 2 – Allocation of SIFs to Protection Layers

Tabel 3. Rencana Lifecycle Keselamatan Fase 2 – Alokasi SIF ke Lapisan Perlindungan

Phase 2 – Allocation of SIFs to protection layers ***Fase 2 – Alokasi SIF ke Lapisan Perlindungan***						
Safety Lifecycle Phase or Activity ***Fase Lifecycle Keselamatan atau Kegiatan***		**Objectives** ***Tujuan***	**IEC 61511 Clause** ***IEC 61511 klausul***	**Tasks Identified** ***Identifikasi tugas***	**Input(s)** ***Input(s)***	**Output(s)** ***Output(s)***
Phase	**Title**					
As defined in IEC 61511-1 ***Seperti yang didefinisikan didalam IEC 61511-1***				**by CONTRACTOR** ***oleh KONTRAKTOR***		
2	Allocation of safety functions to protection layers *Alokasi fungsi keselamatan ke lapisan perlindungan*	[IEC 61511-1: 9.1] To allocate safety functions to protection layers. To determine the required SIFs. To determine for each SIF the associated safety integrity requirements. *[IEC 61511-1: 9.1]* *Untuk mengalokasikan fungsi keselamatan ke lapisan perlindungan.* *Untuk menentukan SIF yang dibutuhkan.* *Untuk menentukan persyaratan integritas keselamatan terkait untuk setiap SIF*	9	1. Conduct SIL Classification Study Workshop. *1. Mengadakan Workshop Studi Klasifikasi SIL*	SIL Classification Terms of Reference HAZOP report P&ID's Cause and Effect Diagrams I/O Schedules *Persyaratan Klasifikasi SIL dari Referensi* *laporan HAZOP* *P&ID* *Diagram Sebab dan Akibat* *I/O Schedules*	SIL Classification Report, containing schedule of all safety functions, with tag number and name, description and target safety integrity level and the required executive action detailing the primary final elements required to bring the process to a safe state *Laporan Klasifikasi SIL, berisi jadwal semua fungsi keselamatan, dengan nomor dan nama tag, deskripsi dan target tingkat integritas keselamatan dan tindakan eksekutif yang diperlukan yang merinci elemen akhir utama yang diperlukan untuk membawa proses ke keadaan aman*

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Table 4. Safety Lifecycle Plan Phase 3 – Safety Requirements Specification (SRS)

Tabel 4. Rencana Lifecycle Keselamatan Fase 3– Spesifikasi Persyaratan Keselamatan

Phase 3 – Safety Requirements Specification (SRS)						
Safety Lifecycle Phase or Activity ***Fase Lifecycle Keselamatan atau Kegiatan***		**Objectives** *Tujuan*	**IEC 61511 Clause** ***IEC 61511 Klausul***	**Tasks Identified** ***Identifikasi Tugas***	**Input(s)** ***Input(s)***	**Output(s)** **Output(s)**
Phase	**Title**					
As defined in IEC 61511-1 ***Seperti yang didefinisikan didalam IEC 61511-1***				**by CONTRACTOR** ***oleh KONTRAKTOR***		
3	SIS safety requirements specification (SRS) *Spesifikasi Persyaratan Keselamatan SIS (SRS)*	[IEC 61511-1: 10.1] To specify the requirements for the SIS, including any application programs and the architecture of the SIS. *Untuk menentukan persyaratan untuk SIS, termasuk program aplikasi dan arsitektur SIS.*	10	1. Prepare SIL Verification Procedure. 2. Perform SIL Verification and issue report. 3. Develop Safety Requirement Specifications (SRS). 1. *Menyiapkan Prosedur Verifikasi SIL.* *2. Melakukan Verifikasi SIL dan mengeluarkan laporan.* *3. Mengembangkan Spesifikasi Persyaratan Keselamatan (SRS).*	SIL Classification Report ICSS Philosophy P&ID's Cause and Effect Diagrams Process Safety Time Targets *Laporan Klasifikasi SIL* *Filosofi ICSS* *P&ID* *Diagram Sebab dan Akibat* *Target Waktu Keamanan Proses*	SIS Safety Requirement Specifications (SRS) *Spesifikasi Persyaratan Keselamatan SIS (SRS)*

Note: Phase 1 and 2 may be combined under a combined "HAZOP & SIL Classification Study" which requires a combined HAZOP & SIL Classification Terms of Reference
.Catatan: Fase 1 dan 2 dapat digabungkan dalam "Studi Klasifikasi HAZOP & SIL" yang memerlukan gabungan Kerangka Acuan Klasifikasi HAZOP & SIL.

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Table 5. Safety Lifecycle Plan Phase 4 – Design and Engineering of SIS

Tabel 5. Rencana Lifecycle Keselamatan Fase 4 - Desain dan Engineering SIS

Phase 4 – Design and Engineering of the SIS ***Fase 4 – Desain dan Engineering SIS***						
Safety Lifecycle Phase or Activity ***Fase Lifecycle Keselamatan atau Kegiatan***		**Objectives** ***Tujuan***	**IEC 61511 Clause** *IEC 61511 Klausul*	**Tasks Identified** ***Identifikasi Tugas***	**Input(s)** ***Input(s)***	**Output(s)** ***Output(s)***
Phase **Fase**	**Title** ***Judul***					
As defined in IEC 61511-1 *Seperti yang didefinisikan didalam IEC 61511-1*				**by CONTRACTOR** ***oleh KONTRAKTOR***		
4	SIS design and engineering *Desain dan Engineering SIS*	[IEC 61511-1: 11.1] To design one or multiple SIS to provide the SIF and meet the specified integrity requirements (e.g. SIL, associated risk reduction, PFD and/or PFH) *[IEC 61511-1: 11.1]* *Untuk mendesain satu atau beberapa SIS untuk menyediakan SIF dan memenuhi persyaratan integritas yang ditentukan (misalnya SIL, pengurangan risiko terkait, PFD dan/atau PFH).* [IEC 61511-1: 12.1] To define the requirements for the development of the application program. [IEC 61511-1: 12.1] *Untuk menentukan persyaratan untuk pengembangan program aplikasi.*	11, 12 and 13	ICSS Vendor 1. Prepare ICSS / Logic Solver Safety Validation Plan (SVP). 2. Prepare ICSS / Logic Solver Functional Design Specification (FDS). 3. Develop SIS FAT Procedure. 4. Perform SIS FAT at SIS manufacturer's premises. *Vendor ICSS* *1. Siapkan ICSS / Logic Solver Safety Validation Plan (SVP).* *2. Siapkan ICSS / Logic Solver Functional Design Specification (FDS).* *3. Menyusun Prosedur SIS FAT.* *4. Lakukan SIS FAT di tempat pabrikan SIS.* CONTRACTOR 5. Undertake Electrical Engineering and design activities ensuring the SIL is	P&ID's including Instrument Hook-up details *P&ID termasuk rincian Instrument Hook-up* Safety Requirements Specification *Spesifikasi Persyaratan Keselamatan* Cause and Effect Diagrams *Diagram sebab-akibat* Preferred supplier list *Daftar pemasok pilihan* ICSS vendor design proposal / Functional Design Specification (FDS)	A full and comprehensive detailed design including but not limited to: □ Instrument Index • Cable Schedules • Block Diagrams • I/O Schedules • Cabinet GA's • Wiring and termination drawings • Distribution and earthing drawings • Loop Diagrams • Instrument Hookup drawings Desain detail yang lengkap dan komprehensif termasuk namun tidak terbatas pada: • *Indeks Instrumen* • *scheduls kabel* • *Diagram Blok* • *Schedule I/O* • *Kabinet GA*

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		[IEC 61511-1: 13.1] To test the devices of the SIS to ensure that the requirements defined in the SRS are met. *[IEC 61511-1: 13.1]* *Untuk menguji perangkat SIS untuk memastikan bahwa persyaratan yang ditentukan dalam SRS terpenuhi.* Note: Clause 12.3 of IEC 61511 details the logic solver vendor requirements for the application software safety validation planning. It is normal for the logic solver vendor to design, develop, build, test and validate the system to IEC 61508. The application software safety validation planning is covered under Clause 7.3.2 of IEC 61508-3:2010. This is the responsibility of ICSS Vendor . Catatan: Klausul 12.3 dari IEC 61511 merinci persyaratan vendor *logic solver* untuk perencanaan validasi aplikasi perangkat lunak keselamatan. Suatu hal yang biasa bagi vendor logic solver untuk mendesain , mengembangkan, membangun, menguji, dan memvalidasi sistem ke IEC 61508. Perencanaan validasi aplikasi perangkat lunak keselamatan tercakup dalam Klausul 7.3.2 dari IEC 61508-3:2010. Ini adalah tanggung jawab Vendor ICSS		addressed accordingly as specified in SRS. 6. Undertake Instrumentation Engineering and design activities ensuring the SIL is addressed accordingly as specified in SRS. 7. Undertake Controls Engineering and design activities ensuring the SIL is addressed accordingly as specified in SRS. KONTRAKTOR 5. Melakukan kegiatan *Electrical Engineering* dan desain untuk memastikan SIL ditangani sesuai dengan yang ditentukan dalam SRS. 6. Melakukan kegiatan *Instrumentation Engineering* dan desain untuk memastikan SIL ditangani sesuai dengan yang ditentukan dalam SRS. 7. Melakukan Kegiatan Controls Engineering dan desain untuk memastikan SIL ditangani sesuai dengan yang ditentukan dalam SRS.	Proposal desain vendor ICSS / Spesifikasi Desain Fungsional (FDS) Third party SIS interface Drawings Gambar interface SIS pihak ketiga Equipment location General arrangement drawings *Gambar pengaturan umum* *Lokasi peralatan* Electrical distribution and earthing distribution drawings *Distribusi listrik dan gambar distribusi pembumian* FAT Test procedure (of all sub-systems) Prosedur Tes FAT (dari semua subsistem) SIS Validation Plan (of ICSS vendor) *Rencana Validasi SIS (dari vendor ICSS)*	• *Gambar pengkabelan dan terminasi* • *Gambar distribusi dan pembumian* • *Diagram loop* • *Gambar Hookup Instrumen* Completion of the FAT (with test report) comprising: • Hardware inspection results • Hardware test results • Software test results • Verification information, e.g. Yellow line C&E, SOE reports etc. • Verified and tested software system If applicable any carry over work clearly identified and documented by punch lists for carry over to the next phase. *Penyelesaian FAT (dengan laporan pengujian) terdiri dari:* *• Hasil pemeriksaan perangkat keras* *• Hasil pengujian perangkat keras* *• Hasil pengujian perangkat lunak* *• Informasi verifikasi, misalnya Yellow line C&E, laporan BUMN dll.* *• Verifikasi dan pengujian sistem perangkat lunak* *Jika berlaku, setiap pekerjaan carry over diidentifikasi dengan jelas dan didokumentasikan dengan daftar punch untuk dibawa ke fase berikutnya.*

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Table 6. Safety Lifecycle Plan Phase 5 – Installation and Commissioning

Tabel 6. Rencana Lifecycle Keselamatan Fase 5 – Instalasi dan Komisioning

Phase 5 – Installation and Commissioning ***Phase 5 – Instalasi dan Komisioning***						
Safety Lifecycle Phase or Activity **Fase Lifecycle Keselamatan atau Kegiatan**		**Objectives** *Tujuan*	**IEC 61511 Clause** *Klausul IEC 61511*	**Tasks Identified** ***Identifikas Tugas***	**Input(s)** ***Input(s)***	**Output(s)** ***Output(s)***
Phase ***Fase***	**Title** ***Judul***					
As defined in IEC 61511-1 ***Seperti yang didefinisikan dalam IEC 61511-1***				**by CONTRACTOR** ***oleh KONTRAKTOR***		
5	SIS installation, commissioning, and validation *Instalasi, komisioning dan validasi SIS*	[IEC 61511-1: 14.1] *[IEC 61511-1: 14.1]* To install the SIS according to the specifications and drawings; *Memasang SIS sesuai spesifikasi dan gambar*; To commission the SIS so that it is ready for final system validation. *Untuk menugaskan SIS sehingga siap untuk validasi sistem akhir.* [IEC 61511-1: 15.1] To validate, through inspection and testing, that the installed and commissioned SIS and its associated SIF(s) achieve the requirements as stated in the S *[IEC 61511-1: 15.1]* *Untuk memvalidasi, melalui inspeksi dan pengujian, bahwa*	14, 15, 12.3	ICSS Vendor 1. Develop SIS SAT Procedure. 2. Perform SIS SAT on the facility. *Vendor ICSS* *1. Menyusun Prosedur SAT SIS.* *2. Melakukan SAT SIS di fasilitas* CONTRACTOR 3. Install SIS in accordance with design specifications and drawings. 4. Confirm the mechanical installation is completed and Discipline or Mechanical Completion Acceptance Certificate is available and signed off. 5. Confirm the pre-commissioning activities are completed and the Pre-Commissioning Acceptance Certificate is available and signed off. 6. Confirm the commissioning is completed for all parties and the System Completion Acceptance Certificate is available, signed off and handed over to Operations.	Installation and commissioning plan *Perencanaan instalasi dan komisioning* Installation specifications *Spesifikasi Instalasi* Detailed design deliverable documentation and drawings *Dokumentasi gambar dan detil desain* Completions management Systems: *Sistem manajemen penyelesaian pekerjaan*: Inspection procedure *Prosedur inspeksi*	Raise any deviations between the design specification and the installation for engineering review to ensure the design requirements are still satisfied Punch list status report Red-line mark-up “As-Built” Drawings *Kemukakan setiap deviasi antara spesifikasi desain dan instalasi untuk tinjauan teknik guna memastikan persyaratan desain masih terpenuhi. Punch list status laporan Red line mark up “As-built drawings”* – Discipline Completion Acceptance Certificate Sertifikat Penyelesaian multi disiplin – Mechanical Completion Acceptance Certificate

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		SIS yang dipasang dan ditugaskan dan SIF terkaitnya mencapai persyaratan sebagaimana dinyatakan dalam SRS.RS. Note: Clause 12.3 of IEC 61511 details the logic solver vendor requirements for the application software safety validation planning. It is normal for the logic solver vendor to design, develop, build, test and validate the system to IEC 61508. The application software safety validation planning is covered under Clause 7.3.2 of IEC 61508-3:2010. This is the responsibility of ICSS Vendor. *Catatan: Klausul 12.3 dari IEC 61511 mendetilkan persyaratan vendor logic solver untuk perencanaan validasi keamanan perangkat lunak aplikasi. Adalah normal bagi vendor logic solver untuk mendesain, mengembangkan, membangun, menguji, dan memvalidasi sistem ke IEC 61508. Perencanaan validasi keamanan perangkat lunak aplikasi tercakup dalam Klausul 7.3.*2 dari IEC 61508-3:2010. Ini adalah tanggung jawab Vendor ICSS.		7. Prior to introduction of hydrocarbons, perform Independent Functional Safety Assessment (FSA) Stage 3. [Part of Phase 10 FSA] *KONTRAKTOR* *3. Memasang SIS sesuai dengan desain spesifikasi dan gambar.* *4. Mengkonfirmasikan bahwa instalasi mekanik telah selesai dan Sertifikat Penyelesaian Mekanik siap ditanda tangani* *5. Mengkonfirmasikan bahwa kegiatan pra-komisioning telah selesai dan Sertifikat Pra-Komisioning siap ditandatangani.* *6. Mengkonfirmasikan bahwa komisioning sudah selesai untuk semua pihak dan Sertifikat Penerimaan Sistem siap ditandatangani dan sistem siap diserahkan kepada Operasi.* *7. Sebelum hidrokarbon dimasukkan ke dalam sistem lakukan Penilaian Keselamatan Fungsional Independen(FSA) Tahap 3. [Bagian dari FSA Tahap 10]*	Testing procedure *Prosedur pengujian* Commissioning procedure *Prosedur komisioning* Punch list procedure – Construction inspection test record worksheets – Pre-commissioning inspection test record worksheets *Prosedur punch list* – *Konstruksi* *Lembar kerja catatan pengujian dan inspeksi* - *Pra commissioning* *Lembar kerja catatan pengujian dan inspeksi*	*Sertifikat penyelesaian Mekanik* Pre-commissioning Acceptance Certificate *Sertifikat Pra-Komisioning* System Completion Acceptance Certificate *Sertifikat penyelesaian Sistem* Facilities handover Acceptance Certificate *Sertikat serah teriama fasilitas* Mechanical Completion dossier *Dokumen penyelesain pekerjaan mekanik* Systems Completion Dossier *Dokumen penyelesaian pekerjaan kesisteman* Fully functioning SIS in conformance with the SIS safety design specification *SIS berfungsi secara penuh /utuh sesuai dengan spesifikasi desain keselamatan SIS*

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Table 7. Safety Lifecycle Plan Phase 6 – Operation and Maintenance

Tabel 7. Rencana Lifecycle Keselamatan Fase 6 - Operasi dan Pemeliharaan

Phase 6 – Operation and Maintenance ***Fase 6 – Operasi dan Pemeliharaan***						
Safety Lifecycle Phase or Activity *Fase Lifecycle Keselamatan atau Kegiatan*		**Objectives** Tujuan	**IEC 61511 Clause** ***Klausul IEC 61511***	**Tasks Identified** *Identifikasi Tugas*	**Input(s)** *Input*	**Output(s)** ***Output***
Phase Fase	**Title** Judul					
As defined in IEC 61511-1 ***Seperti yang didefinisikan dalam IEC 61511-1***				**by COMPANY (OPERATIONS)** ***oleh Perusahaan (Operasi)***		
6	SIS operation and maintenance *Operasi dan Pemeliharaan SIS*	[IEC 61511-1: 16.1] *[IEC 61511-1: 16.1]* To ensure that the required SIL of each SIF is maintained during operation and maintenance. *Untuk memastikan bahwa SIL yang diperlukan dari setiap SIF dipertahankan selama operasi dan pemeliharaan.* To ensure that the SIS is operated and maintained in a way that sustains the required safety integrity. *Untuk memastikan bahwa SIS dioperasikan dan dipelihara dengan cara yang mendukung integritas keselamatan yang disyaratkan.*	16	1. Perform routine maintenance in accordance with manufacturers' recommendations and as prescribed by the Asset Management System.*Lakukan perawatan rutin sesuai dengan rekomendasi pabrikan dan seperti yang ditentukan oleh Sistem Manajemen Aset.* 2. Perform proof testing in accordance with prescribed proof test procedures and at a test interval as defined in the SRS. *Lakukan proof testing sesuai dengan prosedur proof testing yang ditentukan dan pada interval pengujian sebagaimana ditentukan dalam SRS.* 3. Repair / replace faulty equipment within the MTTR time for dangerous faults revealed by diagnostic tests or proof tests. *Perbaiki / ganti peralatan yang rusak dalam waktu MTTR untuk kesalahan berbahaya yang diungkapkan oleh tes diagnostik atau proof test.* 4. Refurbish / replace sensors and final elements at the end of the "useful life" of the equipment as defined in the manufacturers' safety manual. *Perbaharui / ganti sensor dan elemen akhir pada akhir " masa pakai" peralatan seperti*	Process Units' operation procedures *Prosedur Operasi Unit Proses* ICSS operation procedure *Prosedur Operasi ICSS* ICSS maintenance procedure *Prosedur Pemeliharaan ICSS*	Incident and process trip records. Catatan Insiden dan Trip proses SIF inhibit log. *Log Penghalang SIF* Maintenance records. *Catatan Pemeliharaan* Proof test records *Catatan Proof Test*.

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				yang didefinisikan dalam manual keselamatan pabrikan. 5. Identify and implement compensating measures for degraded SIFs *Mengidentifikasi dan menerapkan langkah-langkah kompensasi untuk SIF yang terdegradasi*. 6. Maintain, monitor and report SIF inhibit log Memelihara, memantau dan melaporkan log penghambatan SIF		

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Table 8. Safety Lifecycle Plan Phase 7 – Modification

Tabel 8. Rencana Lifecycle Keselamatan Fase 7 - Modifikasi

Phase 7 – Modification ***Fase 7 - Modifikasi***						
Safety Lifecycle Phase or Activity ***Fase Lifecycle Keselamatan atau Kegiatan***		**Objectives** ***Tujuan***	**IEC 61511 Clause** ***Klausul IEC 61511***	**Tasks Identified** ***Identifikasi Tugas***	**Input(s)** ***Input***	**Output(s)** **Output**
Phase ***Fase***	**Title** ***Judul***					
As defined in IEC 61511-1 *Seperti yang didefinisikan dalam IEC 61511-1*				**by COMPANY (OPERATIONS)** ***oleh PERUSAHAAN (OPERASI)***		
7	SIS Modification Modifikasi SIS	[IEC 61511-1: 17.1] *[IEC 61511-1: 17.1]* To ensure that modifications to any SIS are properly planned, reviewed, approved and documented prior to making the change. *Untuk memastikan bahwa sebelum dilakukan, modifikasi pada SIS sudah direncanakan, ditinjau, disetujui, dan didokumentasikan dengan benar* To ensure that the required safety integrity of the SIS is maintained despite of any changes made to the SIS. *Untuk memastikan bahwa integritas keselamatan yang dibutuhkan dari SIS dipertahankan meskipun ada*	17	se MOC which clearly defines the modification with necessary supporting documentation and drawing mark-ups. Issue for review and approval. 2.Carry out impact analysis and/or risk assessment for the modification to be undertaken. 3.Implement the change by qualified and competent person(s). This may involve a multi-discipline team subject to the scope of work. 4.Perform pre-commissioning function testing for the field sensors, final elements and the logic solver. 1. 5.Test and verify the change has been implemented correctly and has no adverse impact on other parts of the SIS not modified. 2. 6. Commission the modified system. 7. Update all necessary documentation including red-line mark-ups. Update Asset Management System.	MOC procedure Risk assessment procedure Detailed design changes required to implement the change Proof test procedures Test procedures	Approved MOC Impact analysis and/or risk assessment if applicable Updated Documentation Completed and signed test procedures and documentation

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		perubahan yang dilakukan pada SIS.		*1. Tampilkan MOC yang mendefinisikan modifikasi secara jelas dengan dokumen pendukung yang diperlukan dan mark-up drawing, untuk ditinjau dan proses persetujuan.* *2. Melakukan analisis dampak dan/atau penilaian risiko terhadap modifikasi yang akan dilakukan.* *3. Mengimplementasikan perubahan oleh orang-orang yang memiliki kualifikasi dan kompetensi dengan melibatkan tim multi-disiplin yang sesudengan lingkup pekerjaan.* *4. Lakukan pengujian fungsional pra Komisioning untuk sensor lapangan, elemen akhir, dan logic solver.* *5. Menguji dan memverifikasi perubahan yang telah diterapkan dengan benar dan tidak berdampak buruk pada bagian lain dari SIS yang tidak dimodifikasi.* *6. Proses Komisioning sistem yang dimodifikasi.* *7.Perbarui semua dokumentasi yang diperlukan termasuk red line mark-up. Perbarui Sistem Manajemen Aset.*		

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Table 9. Safety Lifecycle Plan Phase 8 – Decommissioning

Tabel 9. Rencana Lifecycle Keselamatan Fase 8 – Decommissioning

Phase 8 – Decommissioning ***Fase 8 - Decommissioning***						
Safety Lifecycle Phase or Activity ***Fase Lifecycle Keselamatan atau Kegiatan***		**Objectives** ***Tujuan***	**IEC 61511 Clause** ***Klausul IEC 61511***	**Tasks Identified** ***Identifikasi Tugas***	**Input(s)** ***Input***	**Output(s)** ***Output***
Phase ***Fase***	**Title** ***Judul***					
As defined in IEC 61511-1 *Seperti yang didefinisikan dalam IEC 61511-1*				**by CONTRACTOR** **oleh KONTRAKTOR**		
8	Decommissioning	[IEC 61511-1: 18.1] *[IEC 61511-1: 18.1]* To ensure that prior to decommissioning any SIS from active service, a proper review is conducted and required authorization is obtained. *Untuk memastikan bahwa sebelum menonaktifkan SIS telah dilakukan tinjauan sebagaimana mestinya dan sudah diperoleh persetujuan dari yang memiliki otorisasi* To ensure that the required SIF(s) remain operational during decommissioning activities. *Untuk memastikan bahwa SIF yang dibutuhkan tetap beroperasi selama kegiatan dekomisioning*	18	1. Define scope of decommissioning work, follow MOC procedure, and organize risk assessment workshop if required. *Tetapkan ruang lingkup pekerjaan dekomisioning, ikuti prosedur MOC, dan atur lokakarya penilaian risiko jika diperlukan.*	As built safety requirements, process information, and risk assessment. *Persyaratan keselamatan yang dibangun, informasi proses, dan penilaian risiko*	Decommissioning Report (if any) *Laporan dekomisioning (jika ada)*

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Table 10. Safety Lifecycle Plan Phase 9 – Verification

Tabel 10. Rencana Lifecycle Keselamatan Fase 9 – Verifikasi

Phase 9 – Verification ***Fase 9 – Verifikasi***						
Safety Lifecycle Phase or Activity ***Fase Lifecycle Keselamatan atau Kegiatan***		**Objectives** ***Tujuan***	**IEC 61511 Clause** *Klausul IEC 61511*	**Tasks Identified** ***Identifikasi Tugas***	**Input(s)** ***Input***	**Output(s)** ***Output***
Phase ***Fase***	**Title** ***Judul***					
As defined in IEC 61511-1 ***Seperti yang didefinisikan dalam IEC 61511-1***				**by CONTRACTOR** oleh KONTRAKTOR		
	SIL Verification (EPC) *Verifikasi SIL (EPC)*	[IEC 61511-1: 7.1] *[IEC 61511-1: 7.1]* To demonstrate by review, analysis and/or testing that the required outputs satisfy the defined requirements for the appropriate phases as identified by the verification planning. *Untuk membuktikan bahwa dengan tinjauan, analisis dan/atau pengujian, keluaran yang dibutuhkan akan memenuhi persyaratan yang ditentukan untuk fase yang sesuai seperti yang diidentifikasi oleh perencanaan verifikasi*	7	1. Perform reliability analysis, architectural constraints and systematic capability evaluation to verify that SIFs meet their SIL targets. Carry out SIL Verification and issue report. Refer to Phase 3. *Lakukan analisis keandalan, kendala arsitektur dan evaluasi kemampuan sistematis untuk memverifikasi bahwa SIF memenuhi target SIL nya. Melaksanakan Verifikasi SIL dan menerbitkan laporan. Lihat Fase 3.*	IEC 61508 product certificates with failure rates*Sertifikat produk IEC 61508 dengan tingkat kegagalan* Safety manuals *Panduan keselamatan*	SIL Verification Report Verifikasi Laporan SIL
	Verification of SLC activities (EPC) *Verfikasi kegiatan SLC (EPC)*			2. Perform verification of SIS Lifecycle phases (1 to 5, 9 and 10) using the verification checklists in this document. *Lakukan verifikasi fase Lifecycle SIS (1 hingga 5, 9 dan 10) menggunakan daftar periksa verifikasi dalam dokumen ini*.	Inputs of the respective phases being verified. Masukan dari masing-masing fase sedang diverifikasi.	SIS Verification or Validation Report. *Verifikasi atau Validasi Laporan SIS*

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	Verification of SLC activities (EPC) – Software *Verifikasi kegiatan SLC (EPC) – Perangkat lunak*	[IEC 61511-1: 7.1] To demonstrateby review, analysis andor testing that the required outputs satisfy the defined requirements for the appropriate phases as identified by the verification planning. *Untuk membuktikan bahwa dengan tinjauan, analisis dan/atau pengujian, keluaran yang dibutuhkan akan memenuhi persyaratan yang ditentukan untuk fase yang sesuai seperti yang diidentifikasi oleh perencanaan verifikasi* [IEC 61511-1: 12.5] [for Application Program] Verification planning shall be carried out in accordance with Clause 7. *[IEC 61511-1: 12.5] [untuk Program Aplikasi] Perencanaan verifikasi harus dilakukan sesuai dengan Klausul 7.*	7, 12.5	1. ICCS Vendor to perform SIS Validation Plan (SVP). Refer to Phase 5. *Vendor ICCS melakukan perencanaan Vakidasi SIS (SVP).* *Lihat Fase 5*	Inputs of the respective phases being verified. Masukan dari masing-masing fase sedang diverifikasi..	ICSS Vendor SIS Validation Report. *Validasi Laporan ICSS Vendor SIS*
	Verification of SLC activities (Operations) *Verfikasi kegiatan SLC (Operasi)*	[IEC 61511-1: 7.1] To demonstrate by review, analysis and/or testing that the required outputs satisfy the defined requirements for the appropriate phases as identified by the verification planning. *Untuk membuktikan bahwa dengan tinjauan, analisis dan/atau pengujian, keluaran yang dibutuhkan akan memenuhi persyaratan yang ditentukan untuk fase yang sesuai seperti yang diidentifikasi oleh perencanaan verifikasi*	7	1. Perform verification of SIS Lifecycle phases (6 to 8) using the verification checklists in this document. *Lakukan verifikasi fase Lifecycle SIS (6 hingga 8) menggunakan daftar periksa verifikasi dalam dokumen ini*.	Inputs of the respective phases being verified. *Masukan dari masing-masing fase sedang diverifikasi*.	SIS Verification or Validation Report. *Verifikasi atau Validasi Laporan SIS*

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Table 11. Safety Lifecycle Plan Phase 10 – Functional Safety Assessment and Audit

Tabel 11. Rencana Lifecycle Keselamatan Fase 10 – Penilaian Keselamatan Fungsional dan Audit

Phase 10 – Functional Safety Assessment and Audit ***Fase 10 - Penilaian Keselamatan Fungsional dan Audit***						
Safety Lifecycle Phase or Activity ***Fase Lifecycle Keselamatan atau Kegiatan***		**Objectives** ***Tujuan***	**IEC 61511 Clause** **Klausul IEC 61511**	**Tasks Identified** ***Identifikasi Tugas***	**Input(s)** ***Input***	**Output(s)** ***Output***
Phase ***Fase***	**Title** ***Judul***					
As defined in IEC 61511-1 ***Seperti yang didefinisikan dalam IEC 61511-1***				**by CONTRACTOR** ***oleh KONTRAKTOR***		
10	SIS FSA (EPC) *SIS FSA (EPC)*	[IEC 61511-1: Table 2] To investigate and arrive at a judgement on the functional safety and safety integrity achieved by each SIF of the SIS *[IEC 61511-1: Tabel 2]* *Untuk menginvestigasi dan memberi penilaian tentang keselamatan fungsional dan integritas keselamatan yang dicapai oleh setiap SIF dari SIS*	5	1. Independent consultant to perform FSA Stage 1, Stage 2 and Stage 3. Konsultan independen untuk melakukan FSA Tahap 1, Tahap 2 dan Tahap 3.	Planning for SIS FSA *Perencaan untuk SIS FSA* SIS safety requirement *Persyaratan Keselamatan SIS*	Results of SIS FSA; SAT Report FSA Stage 1, 2 or 3 Report. *Hasil dari SIS FSA* *Laporan SAT* *Laporan FSA tahap 1,2 atau 3*
	SIS FSA (Operations)	[IEC 61511-1: Table 2] To investigate and arrive at a judgement on the functional safety and safety integrity achieved by each SIF of the SIS [IEC 61511-1: Tabel 2] Untuk menginvestigasi dan memberi penilaian tentang keselamatan fungsional dan integritas keselamatan yang dicapai oleh setiap SIF dari SIS	5	1. Periodic SIS Audits *Audit SIS secara berkala*	Planning for SIS FSA *Perencanaa untuk SIS FSA* SIS safety requirement Persyaratan Keselamatan SIS	FS Audit report; *Laporan Audit FS* FSA Stage 4 or 5 Report. *Laporan FSA tahap 4 atau 5*

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Table 12. Safety Lifecycle Plan Phase 11 – Safety Planning

Tabel 12 Rencana Lifecycle Keselamatan Fase 11 – Perencanaan Keselamatan

Phase 11 – Safety Planning ***Fase 11- Perencanaan Keselamatan***						
Safety Lifecycle Phase or Activity ***Fase Lifecycle Keselamatan atau Kegiatan***		**Objectives** ***Tujuan***	**IEC 61511 Clause** ***Klausul IEC 61511***	**Tasks Identified** ***Identifikasi Tugas***	**Input(s)** ***Input***	**Output(s)** ***Output***
Phase ***Fase***	**Title** **Judul**					
As defined in IEC 61511-1 ***Seperti yang didefinisikan dalam IEC 61511-1***				**by CONTRACTOR** ***oleh KONTRAKTOR***		
11	Safety Lifecycle Structure and Planning *Perencanaan dan Struktur Lifecycle Keselamatan*	[IEC 61511-1: Table 2] To establish how the lifecycle steps are accomplished *[IEC 61511-1: Tabel 2]* *Untuk menetapkan langkah-langkah pencapaian lifecycle*	5.2.4 6.2	1. Develop SIS lifecycle plan 2. Develop project/facility-specific FSMP *1. Mengembangkan rencana lifecycle SIS* *2. Mengembangkan FSMP khusus proyek/fasilitas*	IEC 61511 SIS Lifecycle Plan (this document) *IEC 61511* *Rencan lifecycle SIS (dokumen ini)*	SIS Lifecycle Plan (this document) *Rencana lifecycle SIS (dokumen ini)* Project/Facility specific FSMP *Spesifikasi proyek /fasilitas FSMP*

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8.5 Roles And Accountability

The SLP is owned and maintained by COMPANY's Process Safety group/discipline. It shall be reviewed, amended and approved when required, to ensure it remains relevant to COMPANY's business operations and is still in agreement with other COMPANY procedures. Review and amendments of SLP are the responsibility of Functional Safety/SIS Specialist. Implementation of the SLP shall be by the relevant disciplines or entities.

For each project, a project organization chart shall be developed indicating the various appointments and to whom the individual reports.

A Functional Safety Management Plan (FSMP) shall be developed specifically for each capital project and include Phases 1 to 5, 9 and 10. Subsequently, a separate FSMP shall be developed for the Operations phase. Both the Project FSMP and the Operations FSMP may refer to the relevant parts of this SIS Lifecycle Plan.

All persons who carry out any SIS-related work shall be made aware of this SLP and shall follow its requirements. Refer to Section 4. This applies to all stakeholders involved, including COMPANY personnel, contractors, vendors and consultants.

A Responsible, Accountable, Consulted and Informed (RACI) matrix illustrates the interaction between different roles and responsibilities for the various tasks that make up the SIS Lifecycle. Refer to Appendix B for the RACI Matrix to be applied in COMPANY projects.

8.5 Peran dan Akuntabilitas

SLP dimiliki dan dikelola oleh grup/disiplin Keselamatan Proses PERUSAHAAN. SLP ini harus ditinjau, diubah dan disetujui bila diperlukan, untuk memastikan tetap relevan dengan operasi bisnis PERUSAHAAN dan masih sesuai dengan prosedur PERUSAHAAN lainnya. Peninjauan dan perubahan SLP adalah tanggung jawab Fungsi keselamatan/ Spesialis SIS. Pelaksanaan SLP dilakukan oleh disiplin ilmu atau entitas terkait.

Untuk setiap proyek, bagan organisasi proyek harus dibuat untuk menunjukkan berbagai jabatan dan hierarki organisasi

Rencana Manajemen Keselamatan Fungsional (FSMP) harus dikembangkan secara khusus untuk setiap proyek modal dan mencakup Fase 1 hingga 5, 9 dan 10. Selanjutnya, FSMP terpisah harus dikembangkan untuk fase Operasi. Baik FSMP Proyek maupun FSMP Operasi dapat merujuk ke bagian yang relevan dari Rencana Lifecycle SIS ini.

Semua orang yang melakukan pekerjaan terkait SIS harus diberi tahu tentang SLP ini dan harus mengikuti persyaratannya. Lihat Bagian 4. Ini berlaku untuk semua *stakeholders* yang terlibat, termasuk personel PERUSAHAAN, kontraktor, vendor, dan konsultan.

Matriks Tanggung jawab, Akuntabel, Konsultasi dan Informasi (RACI) menggambarkan interaksi antara peran dan tanggung jawab yang berbeda untuk berbagai tugas yang membentuk Lifecycle SIS. Lihat Lampiran B untuk Matriks RACI yang akan diterapkan dalam proyek PERUSAHAAN.

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8.6 Competency and Training

Persons, departments or organizations involved in SIS safety life-cycle activities shall be competent to carry out the activities for which they are accountable. All activities affecting the SIS lifecycle shall be managed and performed by persons who are competent to do so in accordance to the relevant requirements in IEC 61508:2010 and IEC 61511:2016. As far as possible, the same persons should be available throughout the phase for which they are made responsible.

Appendix C provides an overview of personnel who have the main roles and responsibilities for managing the overall project functional safety. It also includes the minimum knowledge or skills and competency required for performing the respective roles in accordance to IEC 61508:2010 and IEC 61511:2016.

Competency evaluation for the roles should be conducted initially and as an ongoing process or when there is any change in individuals' roles and responsibilities. Where competency gaps are identified, development plans such as training should be established to enable the required competency levels to be achieved in a timely manner. This may involve referring to a nominated person to check or approve an activity or to be supervised by a competent person.

8.6 Kompetensi dan Pelatihan

Orang, departemen atau organisasi yang terlibat dalam kegiatan Lifecycle keselamatan SIS harus kompeten untuk melaksanakan kegiatan yang menjadi tanggung jawabnya. Semua aktivitas yang mempengaruhi lifecycle SIS harus dikelola dan dilakukan oleh orang yang kompeten untuk melakukannya sesuai dengan persyaratan yang relevan dalam IEC 61508:2010 dan IEC 61511:2016. Sejauh mungkin, orang yang sama harus tersedia selama fase dimana mereka bertanggung jawab.

Lampiran C memberikan gambaran tentang personel yang memiliki peran dan tanggung jawab utama untuk mengelola keselamatan fungsional proyek secara keseluruhan. Ini juga mencakup pengetahuan atau keterampilan dan kompetensi minimum yang diperlukan untuk menjalankan peran masing-masing sesuai dengan IEC 61508:2010 dan IEC 61511:2016.

Evaluasi kompetensi untuk jabatan/peran harus dilakukan di awal dan sebagai proses yang berkelanjutan atau ketika ada perubahan jabatan/peran dan tanggung jawab individu. Ketika kesenjangan kompetensi diidentifikasi, rencana pengembangan seperti pelatihan harus ditetapkan untuk memungkinkan tingkat kompetensi yang dibutuhkan dapat dicapai secara tepat waktu. Ini mungkin ditujukan pada orang yang dinominasikan untuk memeriksa atau menyetujui suatu kegiatan atau untuk diawasi oleh orang yang kompeten.

8.7 Safety Requirements Specification

Each SIF shall be defined in an SRS. The SRS shall be used:

- as the design basis of the SIF;
- for validation of the as-built SIF;
- as an input to Management of Change

8.7 Spesifikasi Persyaratan Keselamatan

Setiap SIF harus didefinisikan dalam SRS. SRS harus digunakan:

- sebagai dasar desain SIF;
- untuk validasi SIF yang sudah dibangun;
- sebagai masukan untuk kegiatan

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activities;

- As a baseline for comparison of designed and as-built SIF performance.

The SRS shall contain all the information listed in IEC 61511 Part 1, Clause 10.3.2. The application program safety requirements (e.g. logic diagrams) shall be provided by the SIS vendor and derived from the SRS.

The SRS shall be developed by the project execution entity, i.e. CONTRACTOR

8.8 Coordination And Interfaces

Coordination between disciplines and between stakeholders shall be facilitated by Projects.

8.8.1. Pre-Operations

Knowledge continuity will be assured (i.e. during handover from EPC to Operations, and thereafter) by the Pre-Operations personnel. To achieve this objective, Pre-Operations personnel are required to participate in Project activities e.g. HAZID, HAZOP, SIL Classification.

8.8.2. ICSS Vendor

The ICSS vendor will be responsible for application programming as proprietary software are often used. However, CONTRACTOR will verify that the SIS logics are correctly programmed against logic diagrams, cause and effect diagrams, or other relevant documents, typically performed at FAT and SAT.

The ICSS vendor shall have a functional safety management

Manajemen Perubahan;

- Sebagai dasar untuk perbandingan performa SIF yang didesain dan dibangun.

SRS harus berisi tentang semua informasi yang tercantum dalam IEC 61511 Bagian 1, Klausul 10.3.2. Persyaratan Keselamatan program aplikasi (misalnya diagram logika) harus disediakan oleh vendor SIS dan diturunkan dari SRS.

SRS harus dikembangkan oleh entitas pelaksana proyek, yaitu KONTRAKTOR

8.8 Koordinasi dan Interface

Koordinasi antar disiplin dan antar *stakeholders* harus difasilitasi oleh proyek

8.8.1. Pra-Operasi

Kesinambungan pengetahuan akan dipastikan (yaitu selama serah terima dari EPC ke Operasi, dan setelahnya) oleh personel Pra-Operasi. Untuk mencapai tujuan ini, personel Pra-Operasi diminta untuk berpartisipasi dalam kegiatan Proyek, mis. Klasifikasi HAZID, HAZOP, SIL.

8.8.2. Vendor ICSS

Vendor ICSS akan bertanggung jawab untuk pemrograman aplikasi karena perangkat lunak berpemilik sering digunakan. Namun, KONTRAKTOR akan memverifikasi bahwa logika SIS diprogram dengan benar terhadap diagram logika, diagram sebab dan akibat, atau dokumen lain yang relevan, biasanya dilakukan saat FAT dan SAT.

Vendor ICSS harus memiliki sistem manajemen keselamatan fungsional.

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system. Procedures shall be in place to demonstrate the adequacy of the functional safety management system. The functional safety management system shall meet the requirements of the basic safety standard IEC 615081:2010, Clause 6, or the functional safety management requirements of IEC 61511:2016 to which functional safety claims are made.

Note that in some projects, independent DCS and SIS are used. In this case, the requirements for ICSS vendor shall apply to the SIS vendor

Prosedur harus ada untuk menunjukkan kecukupan sistem manajemen keselamatan fungsional. Sistem manajemen keselamatan fungsional harus memenuhi persyaratan standar keselamatan dasar IEC 615081:2010, Klausul 6, atau persyaratan manajemen keselamatan fungsional IEC 61511:2016 di mana klaim keselamatan fungsional dibuat.

Agar diperhatikan bahwa di beberapa proyek, DCS dan SIS independen digunakan. Dalam hal ini, persyaratan untuk vendor ICSS akan berlaku untuk vendor SIS

8.9 Maintenance

All SIFs listed in the SRS will be inspected for physical integrity and to ensure the equipment is operational.

SIF proof testing will be conducted in line with the schedule defined in the SIL Verification Report.

8.9 Pemeliharaan

Semua SIF yang terdaftar di SRS akan diperiksa integritas fisiknya dan untuk memastikan peralatan beroperasi

Proofing test SIF akan dilakukan sesuai dengan jadwal yang ditetapkan dalam Laporan Verifikasi SIL.

8.10 Sis Performance Data Collection

Collection and review of data related to the SIS performance is essential, in order to confirm that (1) the assumptions made during the risk analysis and design phases are valid, and (2) functional safety is achieved and sustained during the operation phase.

The field data collected can be analysed per type of technology used, per model, per manufacturer, etc. and used to establish corporate database and technical memory. It may also be used for proven in use justification for some equipment without a product certificate.

Registration and counting of dangerous

8.10 Pengumpulan Data Performa SIS

Pengumpulan dan peninjauan data yang terkait dengan kinerja SIS sangat penting, untuk memastikan bahwa (1) asumsi yang dibuat selama fase analisis dan desain risiko adalah valid, dan (2) keselamatan fungsional dicapai dan dipertahankan selama fase operasi

Data lapangan yang dikumpulkan dapat dianalisa per jenis teknologi yang digunakan, per model, per produsen, dll. dan digunakan untuk membangun database perusahaan dan memori teknis. Ini juga dapat digunakan untuk justifikasi penggunaan yang sudah terbukti untuk beberapa peralatan tanpa sertifikat produk.

Pendaftaran dan penghitungan kegagalan

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undetected (DU) failures will be the main integrity performance indicator during operation.

Assume that equipment failure data has been collected as part of the periodic testing activities on a facility. For a specific type of equipment, e.g. ESD valve/ EIVs:

n components (e.g. ESD valves/EIVs) have been tested with respect to their ability to close on demand,

t is the observation period (or the testing interval),

x is the number of DU failures which have been observed either due to functional testing or as a consequence of other demands.

$$\lambda_{DU} = \frac{Number\ of\ failures}{Aggregated\ time\ in\ service} = \frac{x}{n \cdot t} = \frac{x}{t_n}$$

tn is the total aggregated time in operation. If all components have been in operation, then $tn = t \cdot n$

Having obtained an estimate of the failure rate, then Mean Time To Failure (MTTF) can be calculated by:

$$MTTF = \frac{1}{\lambda_{DU}}$$

The MTTF calculated is conservative considering that some components (e.g. ESD valves/ EIVs) could be put on standby, out of service, or have not been proof tested.

8.10.1. Key Performance Indicators

The following KPIs can be provided by Operating entities on

berbahaya yang tidak terdeteksi (DU) akan menjadi indikator kinerja integritas utama selama operasi.

Asumsikan bahwa data kegagalan peralatan telah dikumpulkan sebagai bagian dari aktivitas pengujian berkala pada fasilitas. Untuk jenis peralatan tertentu, mis. valve ESD/EIV:

n komponen (misalnya valve ESD/EIV) telah diuji sehubungan dengan kemampuannya untuk menutup sesuai permintaan,

t adalah periode pengamatan (atau interval pengujian),

x dalah jumlah kegagalan DU yang telah diamati baik karena pengujian fungsional atau sebagai konsekuensi dari tuntutan lainnya.

$$\lambda_{DU} = \frac{Number\ of\ failures}{Aggregated\ time\ in\ service} = \frac{x}{n \cdot t} = \frac{x}{t_n}$$

tn adalah total waktu agregat dalam operasi. Jika semua komponen telah beroperasi, maka $tn = t \cdot n$

Setelah diperoleh perkiraan tingkat kegagalan, maka Mean Time To Failure (MTTF) dapat dihitung dengan:

$$MTTF = \frac{1}{\lambda_{DU}}$$

Perhitungan MTTF bersifat konservatif mengingat beberapa komponen (misalnya valve ESD/EIV) dapat disiagakan, tidak dapat digunakan, atau belum proof tested.

8.10.1. Key Performance Indicators

KPI berikut dapat diberikan oleh entitas Operasi secara teratur.

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a regular basis

- Percentage of Critical Function Testing (CFT) Completed

- Persentase Pengujian Fungsi Kritis (CFT) Selesai

$$\% \ CFT \ Completed = \frac{Number \ of \ CFTs \ scheduled - Number \ of \ overdue \ CFTs}{Number \ of \ CFTs \ scheduled} x100\%$$

Objective: a measure of effectiveness of preventive maintenance plan

Tujuan: ukuran efektivitas rencana pemeliharaan preventif

Target: to be decided later after collecting sufficient data

Target: akan diputuskan nanti setelah mengumpulkan data yang cukup

Type of indicator: Leading indicator

Jenis indikator: Indikator utama

Note:

Catatan :

CFT includes proof-testing of SIS & FGS.

CFT termasuk proof-testing SIS & FGS

Operation entities should state clearly what systems are included e.g. PSD / ESD.

Entitas operasi harus menyatakan dengan jelas sistem apa yang disertakan, mis. PSD/ESD.

Overdue plans from previous months shall be included in the calculation for current month as long as they have not been completed.

Rencana-rencana yang terlambat realisasi nya dari bulan-bulan sebelumnya dimasukkan dalam perhitungan bulan berjalan selama belum selesai.

- Longstanding SIF Inhibits

- Hambatan SIF yang sudah berlangsung lama

Longstanding SIF Inhibits

Hambatan SIF yang sudah berlangsung lama

= *Number of SIF Inhibits exceeding MPRT* (max permitted repair time)

= Jumlah Hambatan SIF yang melebihi MPRT (waktu perbaikan maksimum yang diizinkan)

Objective: a measure of effectiveness of breakdown maintenance; a measure of degradation in emergency safeguarding systems.

Tujuan: ukuran efektivitas breakdown maintenance; ukuran degradasi dalam sistem pengamanan darurat.

Target: to be decided later after

Target: akan diputuskan nanti setelah

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collecting sufficient data

Type of indicator: Lagging indicator

Note:

This information may be obtained from studying the daily SIF Bypass Logs generated by DCS over a period of time. However, consider only corrective maintenance (unplanned) where instrument has become faulty. It does not include SIFs that are inhibited due to process being offline. For example, if MPRT is 72 hours, a SIF that appears on four consecutive days of SIF Bypass Logs is considered to be a longstanding SIF inhibits, provided that the hazard it is protecting against is still present e.g. the process is not offline.

SIF inhibits are sometimes referred to as MOS (maintenance override switch). Longstanding MOS from previous months shall be included in the calculation for current month as long as the equipment is still under repair and the MOS not removed yet.

mengumpulkan data yang cukup

Jenis indikator: Indikator lagging

Catatan:

Informasi ini dapat diperoleh dari mempelajari Log Bypass SIF harian yang dihasilkan oleh DCS selama periode waktu tertentu. Akan tetapi hanya memperhitungkan *corrective maintenance* (tidak terencana) karena kerusakan instrumen. Itu tidak termasuk SIF yang terhambat karena proses sedang offline. Misalnya, jika MPRT adalah 72 jam, SIF yang muncul pada Log Bypass SIF empat hari berturut-turut dianggap sebagai penghambat SIF yang berlangsung lama, asalkan bahaya yang dilindunginya masih ada mis. prosesnya tidak offline

Penghambat SIF kadang-kadang disebut sebagai MOS (maintenance override switch). MOS yang berlangsung dari bulan-bulan sebelumnya dimasukkan dalam perhitungan bulan berjalan selama peralatan masih dalam perbaikan dan MOS belum dibongkar.

8.11 Failure Event And Incident Investigation

All SIS failure events shall be investigated and closed out to ensure (1) the SIS is fully functional as per SRS, and (2) the assumptions made during SIS design remain valid, or the design is re-assessed as required.

COMPANY's existing incident investigation procedure should be

8.11 Peristiwa Kegagalan Dan Investigasi Insiden

Semua kejadian kegagalan SIS harus diselidiki dan diselesaikan untuk memastikan (1) SIS berfungsi penuh sesuai SRS, dan (2) asumsi yang dibuat selama desain SIS tetap valid, atau desain dinilai ulang sesuai kebutuhan.

Prosedur investigasi insiden yang ada di PERUSAHAAN harus diikuti.

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followed.

8.12 Documentation Management

All functional safety related documents shall be managed within COMPANY existing document management systems. This includes plan and procedures, drawings, reports and records. Functional safety related records shall be made available to all persons whose duties require them. Typically, Computerized Maintenance Management System (CMMS) such as SAP, MAXIMO or AMOS is used for the Maintenance activities.

9. APPENDIX

- APPENDIX A – VERIFICATION CHECKLISTS
- APPENDIX B – RACI MATRIX
- APPENDIX C – COMPETENCY REQUIREMENT

8.12 Manajemen Dokumentasi

Semua dokumen terkait keselamatan fungsional harus dikelola dalam sistem manajemen dokumen PERUSAHAAN yang ada. Ini termasuk rencana dan prosedur, gambar, laporan dan catatan. Catatan terkait keselamatan fungsional harus tersedia bagi semua orang yang tugasnya membutuhkannya. Biasanya, Computerized Maintenance Management System (CMMS) seperti SAP, MAXIMO atau AMOS digunakan untuk kegiatan Pemeliharaan.

9. LAMPIRAN

- LAMPIRAN A – DAFTAR PERIKSA VERIFIKASI
- LAMPIRAN B - MATRIX RACI
- LAMPIRAN C – PERSYARATAN KOMPETENSI

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APPENDIX A – VERIFICATION CHECKLISTS

LAMPIRAN A – DAFTAR PERIKSA VERIFIKASI

Table A-1: Phase 1 – Verification Checklist

Tabel A-1: Fase 1 – DAFTAR PERIKSA VERIFIKASI

Phase 1 – Verification Checklist (Hazard and Risk Assessment) ***Fase 1 – Daftar Periksa Verifikasi (Bahaya dan penilaian Resiko)***						
#	**Requirement** ***Persyaratan***	**IEC 61511 Specific Clause** ***IEC 61511 Klausul Khusus***	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Tindakan / Oleh***	**Status** ***Status***	**Recommendation** ***Rekomendasi***
1.1	A description of each identified hazardous event and the factors that contribute to it (including human errors) *Deskripsi setiap peristiwa berbahaya yang teridentifikasi dan faktor-faktor penyebabnya (termasuk kesalahan manusia)*	8.2.1				
1.2	A description of the likelihood and consequences of each hazardous event (assuming no safeguards are in place when considering consequences) *Deskripsi kemungkinan dan konsekuensi dari setiap peristiwa berbahaya (dengan asumsi tidak ada pengamanan yang diterapkan saat mempertimbangkan konsekuensi)*	8.2.1				
1.3	*Consideration of process operating modes such as normal operation, start-up, shutdown, maintenance, process upset, emergency shutdown* *Pertimbangan mode operasi proses seperti operasi normal, start-up, normal shutdown, pemeliharaan, gangguan proses, shutdown darurat*	8.2.1				

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Phase 1 – Verification Checklist (Hazard and Risk Assessment)
Fase 1 – Daftar Periksa Verifikasi (Bahaya dan penilaian Resiko)

#	Requirement *Persyaratan*	IEC 61511 Specific Clause *IEC 61511 Klausul Khusus*	Supporting Evidence *Bukti Pendukung*	Action / By *Tindakan / Oleh*	Status *Status*	Recommendation *Rekomendasi*
1.4	The determination of additional risk reduction necessary to achieve the required functional safety *Penentuan pengurangan risiko tambahan yang diperlukan untuk mencapai keselamatan fungsional yang dibutuhkan*	8.2.1				
1.5	A description of, or references to information on, the measures taken to reduce or remove hazards and risk *Deskripsi, atau referensi informasi tentang tindakan yang diambil untuk mengurangi atau menghilangkan bahaya dan risiko*	8.2.1				
1.6	A detailed description of the assumptions made during the analysis of the risks including demand rates on the protection layers and the average frequency of dangerous failures of the initiating sources, and of any credit taken for operational constraints or human intervention *Penjelasan rinci tentang asumsi yang dibuat selama analisis risiko termasuk tingkat permintaan pada lapisan perlindungan dan frekuensi rata-rata kegagalan berbahaya dari sumber awal, dan kredit yang diambil untuk kendala operasional atau intervensi manusia*	8.2.1				
1.7	Identification of those safety function(s) applied as safety instrumented function(s) *Identifikasi fungsi keselamatan yang diterapkan sebagai fungsi instrumen keselamatan*	8.2.1				

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Phase 1 – Verification Checklist (Hazard and Risk Assessment)
Fase 1 – Daftar Periksa Verifikasi (Bahaya dan penilaian Resiko)

#	Requirement *Persyaratan*	IEC 61511 Specific Clause *IEC 61511 Klausul Khusus*	Supporting Evidence *Bukti Pendukung*	Action / By *Tindakan / Oleh*	Status *Status*	Recommendation *Rekomendasi*
1.8	Confirm the appropriate tools have been used for the hazard and risk assessment. *Pastikan alat yang sesuai telah digunakan untuk penilaian bahaya dan risiko.*	---				
1.9	The appropriate terms of reference have *Kerangka acuan yang tepat*	---				
1.10	Team member suitability check *Pemeriksaan kesesuaian anggota tim*	---				
1.11	Confirm recommendations arising from the HAZOP have been tracked and addressed adequately *Pastikan rekomendasi yang diperoleh dari HAZOP telah ditelusuri dan ditangani secara memadai*	---				

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Table A 2: Phase 2 – Verification Checklist

Tabel A 2: Fase 2 – Daftar Periksa Verifikasi

Phase 2 – Verification Checklist (Allocation of SIFs to Protection Layers) *Fase 2 – Daftar Periksa Verifikasi (Alokasi SIF ke Lapisan Perlindungan)*						
#	**Requirement** ***Persyaratan***	**IEC 61511 Specific Clause** ***IEC 61511 Klausul Khusus***	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Tindakan/Oleh***	**Status** ***Status***	**Recommendation** ***Rekomendasi***
2.1	Confirm the SIF functionality is defined on the P&ID as a SIS shutdown function using the correct legend to be configured in the SIS and is not dependent on any control system or non-SIS functionality or hardware *Pastikan fungsionalitas SIF yang ditentukan pada P&ID sebagai fungsi penonaktifan SIS menggunakan legend yang benar untuk dikonfigurasikan di SIS dan tidak bergantung pada sistem kontrol atau fungsionalitas atau perangkat keras non-SIS*	---				
2.2	A detailed description of the assumptions made during the analysis of the risks including probable demand rates and equipment failure rates, and of any credit taken for operational constraints or human intervention *Penjelasan rinci tentang asumsi yang dibuat selama analisa risiko termasuk kemungkinan tingkat permintaan dan tingkat kegagalan peralatan, dan setiap kredit yang diambil untuk kendala operasional atau intervensi manusia*	8.2.1				
2.3	Confirm that for all low demand mode SIFs (demand less than once per year) that the Target SIL value and the PFDavg (or RRF) is specified for each SIF *Pastikan bahwa untuk semua SIF mode permintaan rendah (permintaan kurang dari sekali per tahun) , nilai Target SIL dan PFDavg (atau RRF) ditentukan untuk setiap SIF*	9.2.3				

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Phase 2 – Verification Checklist (Allocation of SIFs to Protection Layers)
Fase 2 – Daftar Periksa Verifikasi (Alokasi SIF ke Lapisan Perlindungan)

#	Requirement *Persyaratan*	IEC 61511 Specific Clause *IEC 61511 Klausul Khusus*	Supporting Evidence *Bukti Pendukung*	Action / By *Tindakan/Oleh*	Status *Status*	Recommendation *Rekomendasi*
2.4	Confirm that where the demand rate is significantly more than once per year (high demand), that the SIF has been determined by an appropriate method and the target SIL and PFH is specified for each SIF. Note: LOPA is not suitable for high demand or continuous mode. *Apabila tingkat permintaan secara signifikan lebih dari sekali per tahun (permintaan tinggi), pastikan bahwa SIF telah ditentukan dengan metode yang sesuai dan target SIL dan PFH ditentukan untuk setiap SIF. Catatan: LOPA tidak cocok untuk modus permintaan tinggi atau kontinu.*	9.2.4				
2.5	Confirm for each SIF the executive action is identified for operation of the primary final elements which remove the source of the hazard (used for SIL verification) *Pastikan untuk setiap tindakan eksekutif SIF diidentifikasi untuk pengoperasian elemen akhir utama yang menghilangkan sumber bahaya (digunakan untuk verifikasi SIL)*	---				
2.6	Confirm no safety instrumented function has an integrity level higher than SIL 3. *Pastikan tidak ada fungsi keamanan yang memiliki tingkat integritas lebih tinggi dari SIL 3.*	9.2.5				
2.7	Confirm that where a BPCS control function is the initiating source of the demand on the SIF that the frequency assumed for the demand is not less than 1.0E-5 per hour (not less than 0.1 per year or one demand per 10 years) *Pastikan bahwa fungsi kontrol BPCS adalah sumber awal permintaan pada SIF dengan frekuensi yang diasumsikan untuk permintaan tidak kurang dari 1,0E-5 per jam (tidak kurang dari 0,1 per tahun atau satu permintaan per 10 tahun)*	8.2.2				

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Phase 2 – Verification Checklist (Allocation of SIFs to Protection Layers)
Fase 2 – Daftar Periksa Verifikasi (Alokasi SIF ke Lapisan Perlindungan)

#	Requirement *Persyaratan*	IEC 61511 Specific Clause *IEC 61511 Klausul Khusus*	Supporting Evidence *Bukti Pendukung*	Action / By *Tindakan/Oleh*	Status *Status*	Recommendation *Rekomendasi*
2.8	Confirm that where one or more SIFs have been credited as a protection layer that the executive action of each protection layer is independent from each other and from the SIF being determined by LOPA *Pastikan bahwa satu atau lebih SIF telah dikreditkan sebagai lapisan perlindungan dimana tindakan eksekutif dari setiap lapisan perlindungan independen satu sama lain dan dari SIF yang ditentukan oleh LOPA*	9.2.6				
2.9	Confirm that any safety functions determined as SIL 3 have been considered for further quantitative analysis, e.g. by fault tree analysis (FTA). Note: this may also apply to SIL 2 which has been identified as potentially difficult to achieve. *Pastikan bahwa setiap fungsi keselamatan yang ditentukan sebagai SIL 3 telah dipertimbangkan untuk analisis kuantitatif lebih lanjut, mis. dengan analisis pohon kesalahan (FTA). Catatan: ini mungkin juga berlaku untuk SIL 2 yang telah diidentifikasi berpotensi sulit untuk dicapai*.	9.2.7				
2.10	Confirm the risk reduction credit for a BPCS protection layer is less than 10. *Pastikan kredit pengurangan risiko untuk lapisan perlindungan BPCS kurang dari 10.*	9.3.2				
2.11	Confirm that where a BPCS control function is the initiating source of the demand on the SIF that no more than one BPCS protection layer has been credited *Pastikan bahwa fungsi kontrol BPCS adalah sumber awal permintaan pada SIF dan tidak lebih dari satu lapisan perlindungan BPCS telah dikreditkan*	9.3.4				

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Phase 2 – Verification Checklist (Allocation of SIFs to Protection Layers)
Fase 2 – Daftar Periksa Verifikasi (Alokasi SIF ke Lapisan Perlindungan)

#	Requirement *Persyaratan*	IEC 61511 Specific Clause *IEC 61511 Klausul Khusus*	Supporting Evidence *Bukti Pendukung*	Action / By *Tindakan/Oleh*	Status *Status*	Recommendation *Rekomendasi*
2.12	Confirm that where a BPCS control function is the initiating source of the demand on the SIF that the same BPCS function has not been credited as a protection layer. For example, where a control valve fails this may be due to sensor or controller malfunction so an alarm from the same controller shall not be credited. *Pastikan bahwa fungsi kontrol BPCS adalah sumber awal permintaan pada SIF dan fungsi BPCS yang sama belum dikreditkan sebagai lapisan perlindungan.* *Misalnya, ketika control valve gagal yang mungkin disebabkan oleh kerusakan sensor atau pengontrol maka alarm dari pengontrol yang sama tidak akan dikreditkan.*	9.3.5				

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Table A-3: Phase 3 – Verification Checklist

Tabel A-3: Fase 3 – Daftar Periksa Verifikasi

Phase 3 – Verification Checklist (Safety Requirements Specification) *Fase 3 - Daftar periksa Verifikasi (Spesifikasi Persyaratan Keselamatan)*						
#	**Requirement** **(note – where "[Bullet n]" is used - Refer to IEC 61511-1 sec. 10.3.2)** Persyaratan (catatan – di mana "[Butir n]" digunakan - Lihat IEC 61511-1 bagian 10.3.2)	**IEC 61511 Specific Clause** *IEC 61511 Klausul Spesifik*	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Aksi/Oleh***	**Status** ***Statuts***	**Recommendation** ***Rekomendasi***
3.1	[Bullet 1] A description of all the safety instrumented functions necessary to achieve the required functional safety *[Butir 1] Deskripsi semua fungsi instrumen keselamatan yang diperlukan untuk mencapai keselamatan fungsional yang diperlukan*	10.3.2				
3.2	[Bullet 2] A list of plant input and output devices related to each SIF which is clearly identified by the plant means of equipment identification *[Butir 2] Daftar perangkat input dan output pabrik yang terkait dengan setiap SIF yang secara jelas diidentifikasi dengan alat identifikasi peralatan pabrik*	10.3.2				
3.3	[Bullet 3] Requirements to identify and take account of common cause failures *[Butir 3] Persyaratan untuk mengidentifikasi dan memperhitungkan kegagalan penyebab umum*	10.3.2				
3.4	[Bullet 4] A definition of the safe state of the process for each identified SIF, such that a stable state has been achieved and the specified hazardous event has been avoided or sufficiently mitigated *[Butir 4] Definisi keadaan aman proses yang teridentifikasi oleh masing masing SIF, adalah Ketika keadaan stabil telah dicapai dan kejadian berbahaya tertentu telah dihindari atau cukup dimitigasi*	10.3.2				

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Phase 3 – Verification Checklist (Safety Requirements Specification)
Fase 3 - Daftar periksa Verifikasi (Spesifikasi Persyaratan Keselamatan)

#	**Requirement** **(note – where "[Bullet n]" is used - Refer to IEC 61511-1 sec. 10.3.2)** Persyaratan (catatan – di mana "[Butir n]" digunakan - Lihat IEC 61511-1 bagian 10.3.2)	**IEC 61511 Specific Clause** *IEC 61511 Klausul Spesifik*	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Aksi/Oleh***	**Status** ***Statuts***	**Recommendation** ***Rekomendasi***
3.5	[Bullet 5] A definition of any individually safe process states which, when occurring concurrently create a separate hazard (for example, overload of emergency storage, multiple relief to flare system) *[Butir 5] Definisi status aman secara individu dari setiap proses dinyatakan saat suatu peristiwa terjadi bersamaan, bahaya yang ditimbulkan terpisah (misalnya, overload of emergency storage, pembuangan gas bersamaan ke flare)*	10.3.2				
3.6	[Bullet 6] The assumed sources of demand and demand rate on the safety instrumented function *[Butir 6] Asumsi sumber permintaan dan tingkat permintaan pada fungsi instrumentasi keselamatan*	10.3.2				
3.7	[Bullet 7] Requirement for proof-test intervals *Butir 7] Persyaratan interval untuk proof test*	10.3.2				
3.8	[Bullet 8] Requirements relating to proof test implementation *[Butir8] Persyaratan yang berkaitan dengan pelaksanaan proof test*	10.3.2				
3.9	[Bullet 9] Response time requirements for the SIS to bring the process to a safe state within the process safety time *[Butir 9] Persyaratan waktu respons bagi SIS untuk membawa proses ke status aman dalam waktu keselamatan proses*	10.3.2				
3.10	[Bullet 10] The required safety integrity level and mode of operation (demand/ continuous) for each SIF *[Butir 10] Tingkat integritas keselamatan yang diperlukan dan mode operasi (permintaan/ berkelanjutan) untuk setiap SIF*	10.3.2				
3.11	[Bullet 11] A description of SIS process measurements, range, accuracy and their trip points	10.3.2				

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Phase 3 – Verification Checklist (Safety Requirements Specification)
Fase 3 - Daftar periksa Verifikasi (Spesifikasi Persyaratan Keselamatan)

#	**Requirement** **(note – where "[Bullet n]" is used - Refer to IEC 61511-1 sec. 10.3.2)** Persyaratan (catatan – di mana "[Butir n]" digunakan - Lihat IEC 61511-1 bagian 10.3.2)	**IEC 61511 Specific Clause** *IEC 61511 Klausul Spesifik*	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Aksi/Oleh***	**Status** ***Statuts***	**Recommendation** ***Rekomendasi***
	[Butir 11] Deskripsi pengukuran proses SIS, jangkauan, akurasi, dan trip point					
3.12	[Bullet 12] A description of SIS process output actions and the criteria for successful operation, for example, leakage rates for valves (requirements for full stroke or tight shut-off) *[Butir 12] Deskripsi output proses SIS dan kriteria keberhasilannya misalnya, tingkat kebocoran valve (persyaratan untuk full stroke atau tertutup rapat)*	10.3.2				
3.13	[Bullet 13] The functional relationship between process inputs and outputs, including logic, mathematical functions and any required permissives for each SIF *[Butir 13] Hubungan fungsional antara input dan output proses, termasuk logika, fungsi matematika, dan izin yang diperlukan untuk setiap SIF*	10.3.2				
3.14	[Bullet 14] Requirements for manual shutdown for each SIF *[Butir 14] Persyaratan untuk shutdown manual untuk setiap SIF*	10.3.2				
3.15	[Bullet 15] Requirements relating to energize or de-energize to trip for each SIF *[Butir 15] Persyaratan yang berkaitan dengan energize atau de-energize trip untuk setiap SIF*	10.3.2				
3.16	[Bullet 16] Requirements for resetting each SIF after a shutdown (for example, requirements for manual, semi-automatic, or automatic final element resets after trips) *[Butir16] Persyaratan untuk mereset setiap SIF setelah shutdown (misalnya, persyaratan untuk reset elemen akhir manual, semi-otomatis, atau otomatis setelah trip)*	10.3.2				

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Phase 3 – Verification Checklist (Safety Requirements Specification)
Fase 3 - Daftar periksa Verifikasi (Spesifikasi Persyaratan Keselamatan)

#	**Requirement** **(note – where "[Bullet n]" is used - Refer to IEC 61511-1 sec. 10.3.2)** Persyaratan (catatan – di mana "[Butir n]" digunakan - Lihat IEC 61511-1 bagian 10.3.2)	**IEC 61511 Specific Clause** *IEC 61511 Klausul Spesifik*	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Aksi/Oleh***	**Status** ***Statuts***	**Recommendation** ***Rekomendasi***
3.17	[Bullet 17] Maximum allowable spurious trip rate for each SIF *[Butir 17] Rate maksimum yang diizinkan untuk trip karena sinyal palsu untuk setiap SIF*	10.3.2				
3.18	[Bullet 18] Failure modes for each SIF and desired response of the SIS (for example, alarms, automatic shutdown) *[Butir 18] Mode kegagalan untuk setiap SIF dan respons SIS yang diinginkan (misalnya, alarm, shutdown otomatis)*	10.3.2				
3.19	[Bullet 19] Any specific requirements related to the procedures for starting up and restarting the SIS *[Butir 19] Persyaratan khusus yang terkait dengan prosedur untuk start-u dan re-start SIS*	10.3.2				
3.20	[Bullet 20] All interfaces between the SIS and any other system (including the BPCS and operators *[Butir 20] Semua interface antara SIS dan sistem lainnya (termasuk BPCS dan operator)*	10.3.2				
3.21	[Bullet 21] A description of the modes of operation of the plant and requirements relating to SIF operation within each mode *[Butir21] Deskripsi mode operasi pabrik dan persyaratan yang berkaitan dengan operasi SIF dalam setiap mode*	10.3.2				
3.22	[Bullet 22] The application program safety requirements as listed in IEC 61511-1, clause 10.3.3 *[Butir 22] Persyaratan keselamatan program aplikasi seperti yang tercantum dalam IEC 61511-1, klausul 10.3.3*	10.3.2				

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Phase 3 – Verification Checklist (Safety Requirements Specification)
Fase 3 - Daftar periksa Verifikasi (Spesifikasi Persyaratan Keselamatan)

#	**Requirement** **(note – where "[Bullet n]" is used - Refer to IEC 61511-1 sec. 10.3.2)** Persyaratan (catatan – di mana "[Butir n]" digunakan - Lihat IEC 61511-1 bagian 10.3.2)	**IEC 61511 Specific Clause** *IEC 61511 Klausul Spesifik*	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Aksi/Oleh***	**Status** ***Statuts***	**Recommendation** ***Rekomendasi***
3.23	[Bullet 23] Requirements for bypasses including written procedures to be applied during the bypassed state which describe how the bypasses will be administratively controlled and then subsequently cleared *[Butir 23] Persyaratan untuk bypass termasuk prosedur tertulis yang akan diterapkan selama keadaan bypass yang menjelaskan bagaimana bypass akan dikontrol secara administratif dan kemudian dibebaskan dari mode bypass*	10.3.2				
3.24	[Bullet 24] The specification of any action necessary to achieve or maintain a safe state of the process in the event of fault(s) being detected in the SIS, taking into account of all relevant human factors *[Butirt 24] Spesifikasi tindakan apa pun yang diperlukan untuk mencapai atau mempertahankan status proses yang aman jika kesalahan terdeteksi di SIS, dengan mempertimbangkan semua faktor manusia yang relevan*	10.3.2				
3.25	*[Bullet 25] The mean time to repair which is feasible for the SIS, taking into account the travel time, location, spares holding, service contracts, environmental constraints* *[Butirt 25] Rata-rata waktu perbaikan yang layak untuk SIS, dengan mempertimbangkan waktu tempuh, lokasi, penyimpanan suku cadang, kontrak servis, kendala lingkungan*	10.3.2				
3.26	[Bullet 26] Identification of the dangerous combinations of output states of the SIS that need to be avoided *[Butir26] Identifikasi kombinasi berbahaya dari status output SIS yang perlu dihindari*	10.3.2				
3.27	[Bullet 27] Identification of the extremes of all environment conditions that are likely to be encountered by the SIS durung shipping, storage,	10.3.2				

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Phase 3 – Verification Checklist (Safety Requirements Specification)
Fase 3 - Daftar periksa Verifikasi (Spesifikasi Persyaratan Keselamatan)

#	**Requirement** **(note – where "[Bullet n]" is used - Refer to IEC 61511-1 sec. 10.3.2)** Persyaratan (catatan – di mana "[Butir n]" digunakan - Lihat IEC 61511-1 bagian 10.3.2)	**IEC 61511 Specific Clause** *IEC 61511 Klausul Spesifik*	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Aksi/Oleh***	**Status** ***Statuts***	**Recommendation** ***Rekomendasi***
	instalation and operation. This may require consideration of the following: temperature, humidity, contaminants, grounding, electromagnetic interference/radio frequency interference (EMI/RFI), shock/vibration, electrostatic discharge, electrical area classification, flooding, lightning and other related factors. *[Butir 27] Identifikasi ekstrem dari semua kondisi lingkungan yang mungkin dihadapi oleh SIS selama pengiriman, penyimpanan, instalasi dan operasi. Ini mungkin memerlukan pertimbangan berikut: temperatur, kelembaban, kontaminan, grounding, interferensi elektromagnetik/interferensi frekuensi radio (EMI/RFI), kejutan/getaran, pelepasan muatan listrik statis, klasifikasi area listrik, banjir, petir, dan faktor terkait lainnya.*					
3.28	[Bullet 28] Identification of normal and abnormal process operating modes for both the plant as a whole (e.g., plant start-up) and individual plant operating procedures (e.g., equipment maintenance, sensor calibration or repair). Additional SIFs may be required to support these process operating modes *[Butir 28] Identifikasi mode operasi proses normal dan abnormal baik untuk prosedur operasi pabrik secara keseluruhan (misalnya, pabrik start-up) maupun untuk prosedur operasi pabrik individu (misalnya, pemeliharaan peralatan, kalibrasi sensor atau perbaikan). SIF tambahan mungkin diperlukan untuk mendukung mode operasi proses ini*	10.3.2				
3.29	[Bullet 29] Definition of the requirements for any safety instrumented function necessary to survive a major accident event, for example, time required for a valve to remain operational in the event of a fire.	10.3.2				

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Phase 3 – Verification Checklist (Safety Requirements Specification)
Fase 3 - Daftar periksa Verifikasi (Spesifikasi Persyaratan Keselamatan)

#	**Requirement** **(note – where "[Bullet n]" is used - Refer to IEC 61511-1 sec. 10.3.2)** Persyaratan (catatan – di mana "[Butir n]" digunakan - Lihat IEC 61511-1 bagian 10.3.2)	**IEC 61511 Specific Clause** *IEC 61511 Klausul Spesifik*	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Aksi/Oleh***	**Status** ***Statuts***	**Recommendation** ***Rekomendasi***
	[*Butir 29] Definisi persyaratan untuk setiap fungsi instrumen keselamatan yang diperlukan untuk bertahan dari peristiwa kecelakaan besar, misalnya, waktu yang dibutuhkan valve untuk tetap beroperasi jika terjadi kebakaran.*					
3.30	Verify that ICSS vendor has a Functional Safety Management Plan, certified by an independent third party, that covers application programs and their validation, configuration management, etc. *Verifikasi bahwa vendor ICSS memiliki Rencana Manajemen Keselamatan Fungsional, disertifikasi oleh pihak ketiga yang independen, yang mencakup program aplikasi dan validasinya, manajemen konfigurasi, dll*	10.3.3 – 10.3.6				

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Table A-4: Phase 4 – Verification Checklist

Tabel A-4: Fase 4 – Daftar Periksa Verifikasi

Phase 4 – Verification Checklist (Design and Engineering of the SIS) *Fase 4 – Daftar Periksa Verifikasi (Engineering dan Desain SIS)*						
#	**Requirement** ***Persyaratan***	**IEC 61511 Specific Clause** *IEC 61511 Klausul Spesifik*	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Tindakan/ Oleh***	**Status** ***Status***	**Recommendation** ***Rekomendasi***
4.1	Confirm the selection of sensors, logic solver, final elements and all associated mechanical, electromechanical and electronic components for each safety function are the same as assumed in the SRS for SIL verification. *Pastikan pemilihan sensor, logic solver, elemen akhir dan semua komponen mekanis, elektromekanis, dan elektronik terkait untuk setiap fungsi keselamatan sama seperti yang diasumsikan dalam SRS untuk verifikasi SIL.*	11.2.1				
4.2	Confirm that for SIL certified equipment safety manuals are available for all safety related equipment used to perform a safety instrumented function. *Pastikan bahwa manual keselamatan peralatan bersertifikat SIL tersedia untuk semua peralatan yang terkait dengan keselamatan yang akan digunakan untuk melakukan fungsi instrumen keselamatan.*	11.2.13				

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4.3	Confirm the FAT has been carried out in accordance with the FAT procedure and there are no outstanding punch list items. If any carry over work is required in the next phase confirm this has been clearly identified and documented *Pastikan FAT telah dilakukan sesuai dengan prosedur FAT dan tidak ada item didalam punch list yang belum terselesaikan. Jika ada pekerjaan carry over yang diperlukan pada waktu yang akan datang* *fase konfirmasi ini telah diidentifikasi dan didokumentasikan dengan jelas*	‘ S’;’13.2				
4.4	Confirm adequate spare allowance for I/O and wiring has been provided in accordance with the design specification. *Pastikan ada allowance yang memadai untuk cadangan I/O dan kabel dengan spesifikasi sesuai desain*	---				
4.5	Confirm the alarm management system has been tested during the FAT and that it is robust and stable. *Pastikan sistem manajemen alarm telah diuji selama FAT dan kokoh serta stabil.*	15.2.4				
4.6	Confirm the alarm management system has been subjected to an alarm prioritization / rationalization workshop and has been optimized accordingly. *Pastikan bahwa sistem manajemen alarm telah menjadi topik dalam lokakarya prioritas/rasionalisasi alarm dan telah dioptimalkan sebagaimana mestinya.*	12.3.4				
4.7	Confirm that where deviation alarms have been specified between the SIS and PCS for analogue transmitter measurements on the same duty that the correct alarm limit, dead	---				

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	band and delay time has been correctly configured. *Pastikan bahwa deviasi alarm telah ditetapkan antara SIS dan PCS untuk pengukuran transmitter analog, pada tugas yang sama batas alarm yang benar, pita mati dan waktu tunda telah dikonfigurasi dengan benar.*					
4.8	Confirm the SIF logic cannot be undermined or adversely affected by any interaction with the control system. *Pastikan bahwa logika SIF tidak dapat dirusak atau dipengaruhi secara negatif oleh interaksi apa pun dengan sistem kontrol.*	11.2.9 11.2.10				
4.9	Confirm for fault tolerant voted sensors (1oo2, 2oo3) that the inputs have been allocated to different input modules to minimize the probability of failure due common mode faults. *Pastikan untuk sensor fault tolerant voted (1oo2, 2oo3) bahwa input telah dialokasikan ke modul input yang berbeda untuk meminimalkan kemungkinan kegagalan karena kesalahan mode umum.*	9.4				
4.10	Confirm where a SIF has been credited as an independent protection layer for another SIF that the respective sensors have been allocated to different input modules to minimize the probability of failure due common mode faults. Refer to HAZOP and SIL reports for details. *Pastikan sebuah SIF telah dikreditkan sebagai lapisan perlindungan independen untuk SIF lain, dimana masing-masing sensor telah dialokasikan ke modul input*	9.4				

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	yang berbeda untuk meminimalkan kemungkinan kegagalan karena kesalahan mode umum. Untuk perinciannya dapat dilihat laporan HAZOP dan SIL .					
4.11	Confirm the logic solver supplier has provided a SIS Safety Validation Plan and the verification confirms the Logic Solver is compliant for a SIL 3 application in accordance with the TÜV (or equivalent) certificate. *Pastikan bahwa pemasok logic Solver telah memberikan Rencana Validasi Keselamatan SIS dan verifikasi, guna memastikan bahwa logic solver sesuai untuk aplikasi SIL 3 berdasarkan sertifikat TÜV (atau yang setara).*	15.2.2 15.2.5				
4.12	Confirm power and heat load calculations have been carried out for all the SIS cabinets and that the maximum internal cabinet temperature does not exceed the design rating for the equipment installed. The maximum ambient temperature shall be assumed including flare radiation contribution for remote located cabinets. *Pastikan perhitungan daya dan beban panas telah dilakukan untuk semua kabinet SIS dan temperatur kabinet internal maksimum tidak melebihi nilai desain untuk peralatan yang dipasang. Temperatur ambien maksimum harus diasumsikan termasuk kontribusi radiasi flare untuk cabinet yang lokasinya jauh.*	13.2.2				
4.13	Confirm SIS sensors and final elements are independent of the BPCS and the SIS signals are not shared with the BPCS by any direct hard-wired connection.	11.2.4 11.2.9				

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	Pastikan sensor SIS dan elemen akhir tidak bergantung pada BPCS dan sinyal SIS tidak dibagikan dengan BPCS melalui koneksi kabel langsung apa pun.					
4.14	Confirm that where a SIS excecutive action requirement is IL 1 or higher. The action on the final element is not dependent on any control system functionality or hardware. For example, where a SIF excecutive action requirement is to trip a gas compressor, this shall be achieved by a direct hard-wired connection from the SIS to the MCC via the package vendor PLC (UCP) is unlikely to meet the required safety integrity. Furthermore, the initiating cause placing a demand on the SIF may be due to a failure of the PLC and this same failure may have the potential of preventing the SIF form performing its safety function. *Pastikan bahwa persyaratan tindakan eksekutif SIS adalah IL 1 atau lebih tinggi. Tindakan pada elemen terakhir tidak bergantung pada fungsionalitas sistem kontrol atau perangkat keras apa pun. Misalnya, persyaratan tindakan eksekutif SIF untuk mengetripkan kompresor gas harus dicapai dengan koneksi kabel langsung dari SIS ke MCC, apabila melalui vendor paket PLC (UCP) integritas keselamatan yang diinginkan tidak mungkin dicapai. Selanjutnya, penyebab awal yang menempatkan permintaan pada SIF mungkin disebabkan oleh kegagalan PLC dan kegagalan yang sama ini dapat berpotensi mencegah formulir SIF melakukan fungsi keamanannya.*	11.2.4 11.2.9 11.2.10				

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	The only exception to this is where an independent safety rated PLC has been provided for SIS functionality, where the hardware and software have been designed, configured verified, validated and certified to IEC 61508. Kecuali untuk PLC dengan rated keselamatan independent yang telah dilengkapi fungsionalitas SIS, yaitu perangkat keras dan perangkat lunak telah didesain, dikonfigurasi diverifikasi, divalidasi dan disertifikasi untuk IEC 61508. Notes: *Catatan:* 1. To simply provide SIL 2 rated PLC hardware alone does not fulfil this requirement; refer to special conditions in the PLC safety manual for hardware and software configuration requirements and IEC 61508 for verification and validation activities. *Penyediaan perangkat keras PLC dengan peringkat SIL 2 saja tidak memenuhi persyaratan ini; Persyaratan konfigurasi perangkat keras dan perangkat lunak untuk kegiatan verifikasi dan validasi dapat dilihat dalam manual keselamatan PLC dan IEC 61508* 2. The PLC supplier / Integrator typically provide a single PLC system to perform both control and shutdown functionality. For SIL compliance the common mode failure of the shared parts must be addressed to ensure that the failure rate					

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	is sufficiently low to ensure the overall risk reduction target is achieved. This would normally require Fault Tree Analysis. *Pemasok / Integrator PLC biasanya menyediakan sistem PLC tunggal untuk melakukan fungsi kontrol dan shutdown. Untuk kepatuhan SIL, kegagalan mode umum dari bagian bersama harus diatasi, untuk memastikan bahwa tingkat kegagalan cukup rendah sehingga dapat dipastikan target pengurangan risiko keseluruhan tercapai. Ini biasanya membutuhkan Fault Tree Analysis.*					

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Table A-5: Phase 5 – Verification Checklist

Tabel A-5: Fase 5 – Daftar Periksa Verifikasi

Phase 5 – Verification Checklist (Installation and Commissioning) *Fase 5 – Daftar Periksa Verifikasi (Installation and Commissioning)*						
#	**Requirement** **Refer to Mechanical Completion, Commissioning and Handover Management Procedure [8]** ***Persyaratan*** ***Berdasarkan prosedur manajemen Penyelesaian pekerjaan konstruksi, Komisioning, Serah terima pekerjaan [8]***	**IEC 61511 Specific Clause** ***IEC 61511 Klausul Khusus***	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Tindakan/Oleh***	**Status** ***Status***	**Recommendation** ***Rekomendasi***
5.1	Confirm the mechanical completion acceptance certificate is available and signed off. *Pastikan Sertifikat penerimaan penyelesaian pekerjaan konstruksi tersedia dan siap ditanda tangani*	14.2.4 15.2.7				
5.2	Confirm the pre-commissioning certificate is available and signed off. *Pastikan sertifikat pra-komisoning tersedia dan siap ditandatangani.*	14.2 15.2				
5.3	Confirm the system completion certificate is available and signed off. *Pastikan sertifikat penyelesaian sistem tersedia dan siap ditandatangani.*	14.2 15.2				
5.4	Verify that the trip set-points configured in the logic solver are correct and in accordance with the master alarm and trip schedule. *Pastikan konfigurasi trip set-points yang dikonfigurasi dalam logic solver sudah benar*	15.2.4				

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	dan sesuai dengan alarm utama dan trip schedule.					
5.5	Confirm Safety Related Alarms (SRA) are configured in a manner which is clearly presented to the operator and that the correct alarm priority and appropriate operator action has been assigned *Pastikan konfigurasi Alarm Terkait Keselamatan (SRA) telah disampaikan kepada operator dengan cara yang jelas dan tepat dan pastikan bahwa prioritas alarm sudah benar dan apa tindakan yang harus dilakukan oleh operator telah ditetapkan*	15.2.4				
5.6	Confirm on Energize To Trip (ETT) safety functions that the final trip coil contains a trip coil health monitoring circuit which is enabled and initiates an alarm which is clearly presented to the operator, that the correct alarm priority and appropriate operator action has been assigned *Pastikan Final trip coil pada Energize To Trip (ETT) fungsi keselamatan memiliki sirkuit pemantau 'kesehatan' trip coil yang mengaktifkan dan menginsisasi alarm yang dengan jelas didengar oleh operator dan pastikan bahwa prioritas alarm sudah benar dan apa tindakan yang harus dilakukan oleh operator telah ditetapkan*	15.2.4				
5.7	Where partial stroking has been implemented on a valve and used for SIL verification, confirm the partial stroke test interval has been scheduled correctly and the test procedure is clear and understood.	15.2.4				

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	Apabila untuk verifikasi SIL sudah ditetapkan menggunakan uji stroke valve parsial (PVST) maka pastikan jadwalnya sudah benar dan prosedurnya jelas dan dimengerti .					
5.8	Ensure the proof test interval has been scheduled correctly and the proof test procedure is clear and understood. *Pastikan interval proof test telah dijadwalkan dengan benar dan prosedur proof test jelas dan dipahami*.	15.2.4				
5.9	Confirm the SAT has taken place and has been signed off. *Pastikan bahwa SAT telah dilakukan dan telah ditandatangani*.	15.2.4				
5.10	Verify that every safety transmitter has fault detection, enabled (HIGH / LOW alarm) which will be initiated on a transmitter diagnosed fault and is set correctly. Note that for some transmitters this is a factory setting and there is no switch inside the transmitter. Pastikan bahwa setiap transmitter keselamatan memiliki deteksi kesalahan, pengaktifan (alarm TINGGI / RENDAH) dimulai pada kesalahan yang didiagnosis transmitter yang ditetapkan dengan akurat . Perhatikan bahwa untuk beberapa transmitter, deteksi kesalahan ini adalah pengaturan pabrik dan tidak ada sakelar di dalam transmitter.	15.2.4				

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5.11	Verify the logic solver configuration has sensor fault configured for HIGH and LOW thresholds to detect transmitter faults as specified in the SRS *Agar diverifikasi bahwa konfigurasi logic solver memiliki sensor kesalahan konfigurasi untuk ambang TINGGI dan RENDAH yang dipakai mendeteksi kesalahan transmitter seperti yang ditentukan dalam SRS*	15.2.4				
5.12	Verify that the SIF test procedure includes issuing a HART command to the transmitter to initiate and test the fault HIGH and LOW signals *Agar diverifikasi bahwa prosedur pengujian SIF termasuk mengeluarkan perintah HART ke transmitter untuk memulai dan menguji sinyal kesalahan TINGGI dan RENDAH 14.2.1*	14.2.1				
5.13	Confirm that end-to-end SIS testing has been performed and signed off without any punch list items. *Pastikan bahwa pengujian SIS secara menyeluruh telah dilakukan dan ditandatangani tanpa item punch list*	15.2.4				
5.14	Verify that the Maintenance Override Switch (MOS) “key-enable” hard-wired circuit is active and is functioning correctly. *Agar diverifikasi bahwa sirkuit berkabel “key-enable” Maintenance Override Switch (MOS) aktif dan berfungsi dengan benar*.	15.2.4				
5.15	If configured, verify the remove ALL FORCES hard-wired circuit is enabled active and is functioning correctly. Jika dikonfigurasi, pastikan sirkuit kabel lepas ALL FORCES diaktifkan dan berfungsi dengan benar.	15.2.4				

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5.16	Confirm all ESD manual buttons are active and are functioning correctly. *Pastikan semua tombol manual ESD aktif dan berfungsi dengan benar.*	15.2.4				
5.17	Confirm End of Line (EOL) resistors are installed at the field device for all SIS digital inputs as defined in the I/O schedule and the logic solver has been configured correctly to detect open circuit and/or short circuit as appropriate. *Konfirmasi resistor End of Line (EOL) dipasang pada perangkat lapangan untuk semua input digital SIS sebagaimana didefinisikan dalam jadwal I/O dan logic solve telah dikonfigurasi dengan benar untuk mendeteksi sirkuit terbuka dan/atau hubung singkat yang sesuai.*	15.2.4				

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Table A-6: Phase 6 – Verification Checklist

Tabel A-6: Fase 6 – Daftar Periksa Verifikasi

Phase 6 – Verification Checklist (Operations and Maintenance) ***Fase 6 – Daftar Periksa Verifikasi (Operasi dan Pemeliharaan)***						
#	**Requirement** ***Persyaratan***	**IEC 61511 Specific Clause** ***IEC 61511 Klausul Khusus***	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** *Tindakan/Oleh*	**Status** ***Status***	**Recommendatio** ***Rekomendasi***
6.1	Operations and maintenance personnel should be aware of the SIL for each SIF and specified setpoints should be readily accessible. [An up-to-date SIF list is available] Personil operasi dan pemeliharaan harus mengetahui SIL untuk setiap SIF dan setpoint tertentu harus mudah diakses. [Daftar SIF terbaru tersedia]	16.1 16.2.6 16.2.8				
6.2	Test equipment should be calibrated in accordance with manufacturer's recommendations. *Peralatan uji harus dikalibrasi sesuai dengan rekomendasi pabrikan*.	16.2.2				
6.3	Modifications to maintenance and proof testing procedures should be in accordance with the site MOC procedure. *Modifikasi prosedur pemeliharaan dan proof testing harus sesuai dengan prosedur MOC dilapangan*	16.2.10				
6.4	Operations and maintenance personnel should have received sufficient training such that they understand the significance and limitations of the protection provided by the SIS. In addition to the requirements of the standard, the following should be understood:	-				

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	• Current SIS status – this can be particular issue for shift workers returning after time off; • Implications of overriding a SIF; • How to check for correct operation of SIFs after they have operated; • How to respond in event of failure of key SIFs to operate on demand; • Recognize fault conditions that could impair the functionality and integrity of SIFs. *Personil operasi dan pemeliharaan harus telah menerima pelatihan yang memadai sehingga mereka memahami pentingnya dan batasan perlindungan yang diberikan oleh SIS. Selain persyaratan standar, berikut ini harus dipahami:* • *Status SIS saat ini – ini bisa menjadi masalah khusus bagi pekerja shift yang kembali setelah waktu istirahat;* • *Implikasi meng override SIF;* • *Bagaimana cara memeriksa operasi SIF yang benar setelah dioperasikan;* • *Bagaimana merespons jika terjadi kegagalan SIF utama untuk beroperasi sesuai permintaan;* • *Mengenali kondisi kesalahan yang dapat merusak fungsionalitas dan integritas SIF.*					
6.5	*Management of Overrides. Use of overrides or inhibits for maintenance activities should be kept to a minimum. It is vital they are managed by procedural controls to ensure the safety objectives are not compromised. These controls should include requirements for:*	11.7.2.3 16.2.6				

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	• *Compensating measures to be put in place commensurate with the risk reduction offered by the SIFs to be overridden;* • *Authorization commensurate with the SIL;* • *Specified time limit for application of any override or inhibit;* *Consideration of the cumulative effects of multiple SIFs being overridden.* *Manajemen Override. Penggunaan override atau penghalang untuk kegiatan pemeliharaan harus dijaga seminimal mungkin. Sangat penting diperhatikan bahwa override harus dikontrol dengan procedure yang ketat untuk memastikan tujuan keselamatan tidak terganggu. Kontrol ini harus mencakup persyaratan untuk:* *• Langkah-langkah kompensasi yang harus dilakukan sepadan dengan pengurangan risiko yang ditawarkan oleh SIF.* *• Otorisasi yang sepadan dengan SIL;* *• Batas waktu yang ditentukan untuk penerapan override atau penghalang* *Pertimbangan efek kumulatif dari beberapa SIF yang dioverride.*					
6.6	Application of overrides should be recorded in an overrides log that is reviewed by oncoming operations personnel at shift handover *Penerapan override harus dicatat dalam log override yang ditinjau oleh personel operasi yang akan datang pada saat serah terima shift*	-				
6.7	The overrides log should be reviewed regualrly (e.g. weekly) by operations management.	-				

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	Overrides log harus ditinjau secara berkala (misalnya mingguan) oleh manajemen operasi.					
6.8	Overrides and inhibits that need to be in place for longer periods (e.g. 72 hours) should be subject to MOC procedure. *Overrides and penghalang yang perlu dilakukan untuk waktu yang lebih lama (misalnya 72 jam) harus tunduk pada prosedur MOC.*	-				
6.9	Proof Testing and Inspection. Proof test procedures (method statements) should be written to cover proof testing of all credible hidden failure modes whilst the process is operational. Pass/fail criteria should be clearly defined. Special precautionsshould be specified where failure of a device under test could cause a hazardous event. *Proof Test dan Inspeksi. Prosedur Proof test (pernyataan metode) harus tertulis karena akan digunakan sebagai referensi untuk Proof test dari semua mode kegagalan tersembunyi yang kredibel saat proses beroperasi. Kriteria lulus/gagal harus didefinisikan dengan jelas. Tindakan pencegahan khusus harus ditentukan di mana kegagalan perangkat yang diuji dapat menyebabkan kejadian berbahaya.*	16.2.11				
6.10	Sensors, logic solver (all logic paths and the voting mechanism) and final elements should all be tested for all potential failure modes. All paths through redundant architectures should be proof tested.	16.3.1.2				

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	Sensor, logic solver (semua jalur logika dan mekanisme voting) dan elemen akhir semuanya harus diuji untuk semua mode kegagalan potensial. Semua jalur melalui arsitektur redundan harus proof test.					
6.11	Equipment should be replaced or overhauled as per manufacturer's recommendation. *Peralatan harus diganti atau dioverhaule sesuai rekomendasi pabrikan.*	-				
6.12	Proof test should be conducted at intervals determined in the PFD reliability calculation for each SIF detailed in the SIL Verification report. *Proof test harus dilakukan pada interval yang telah ditentukan dalam perhitungan keandalan PFD untuk setiap SIF yang dirinci didalam laporan Verifikasi SIL.*	16.3.1.3				
6.13	Faults identified during proof testing should be repaired as soon as practicable. The proof test should be repeated after the repair. *Kesalahan yang teridentifikasi selama proof test harus diperbaiki sesegera mungkin. Proof test harus diulang setelah perbaikan.*	16.3.1.4				
6.14	Periodic visual inspection should also be carried out to identify any physical or mechanical deterioration. *Inspeksi visual berkala juga harus dilakukan untuk mengidentifikasi kerusakan fisik atau mekanis.*	16.3.2				
6.15	Credit can be taken for successful activation of SIFs, for those elements that have been fully proven and all necessary data including response time has been recorded.	-				

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	Kredit dapat diambil untuk aktivasi SIF yang berhasil, untuk elemen-elemen yang telah sepenuhnya terbukti dan semua data yang diperlukan termasuk waktu respons telah dicatat.					
6.16	Results of proof testing should be clearly recorded. If a test identifies faults, the cause and any other relevant data should be recorded. The down time for all repairs should be recorded. *Hasil proof test harus dicatat dengan jelas. Jika tes mengidentifikasi adanya kesalahan, penyebab dan data lain yang relevan harus dicatat. Waktu stop operasi untuk semua perbaikan harus dicatat.*	16.3.3				
6.17	Discrepancies between expected and observed SIS behavior should be reviewed and appropriate corrective action taken. *Perbedaan antara perilaku SIS yang diharapkan dan yang diamati harus ditinjau dan diambil tindakan koreksi yang tepat*	16.2.6 16.2.9				
6.18	Results of proof tests should be periodically reviewed to ensure that integrity specifications (SIL or PFD) are being satisfied. Where improvement is necessary, test frequencies should be increased, or equipment or configuration changes made to reduce undetected dangerous failure rate. *Hasil proof test harus ditinjau secara berkala untuk memastikan bahwa spesifikasi integritas (SIL atau PFD) dipenuhi. Jika perbaikan diperlukan, frekuensi pengujian harus ditingkatkan, atau dilakukan perubahan peralatan atau konfigurasi untuk mengurangi tingkat kegagalan berbahaya yang tidak terdeteksi.*	16.2.9				

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6.19	Functional and integrity specifications of SIFs should be reviewed and revalidated periodically so that their ongoing suitability, including where there may be creeping changes in process hazards, can be examined. End users should set an appropriate interval dependent on the nature of their processes. *Spesifikasi fungsional dan integritas SIF harus* ditinjau dan divalidasi ulang secara berkala *sehingga diperoleh kesesuaian yang berkelanjutan, termasuk di mana mungkin ada perubahan secara perlahan dalam bahaya proses, dapat diperiksa. Pengguna akhir harus menetapkan interval yang sesuai tergantung pada sifat proses mereka.*	5.2.5.3 5.2.6.2				

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Table A-7: Phase 7 – Verification Checklist

Tabel A-7: Fase 7 – Daftar Periksa Verifikasi

Phase 7 – Verification Checklist (Modification) ***Fase 7 – Daftar Periksa Verifikasi (Modifikasi)***						
#	**Requirement** ***Persyaratan***	**IEC 61511 Specific Clause** *IEC 61511 Klausul Khusus*	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Tindakan/Oleh***	**Status** ***Status***	**Recommendations** ***Rekomendasi***
7.1	Any proposed modification should be addressed from the earliest relevant phase of the safety lifecycle dependent on the scope and complexity of the proposed change. *Setiap modifikasi yang diusulkan harus ditangani dari fase relevan paling awal dari lifecycle keselamatan tergantung pada ruang lingkup dan kompleksitas perubahan yang diusulkan*.	17.2.3				
7.2	Modifications to existing facilities should consider not only the direct scope of the change, but also the full extent to which existing facilities may be impacted. For example, addition of new hardware to an existing SIF may affect the PFD of the SIF and more frequent testing or changes to existing systems may be required to maintain the SIL or PFD of the SIF. *Modifikasi fasilitas eksisting harus mempertimbangkan tidak hanya ruang lingkup langsung dari perubahan, tetapi juga sejauh mana fasilitas eksisting dapat terpengaruh. Misalnya, penambahan perangkat keras baru ke SIF eksisting dapat mempengaruhi PFD SIF dan menambah frekuensi pengujian atau mungkin diperlukan perubahan pada sistem eksisting untuk mempertahankan SIL atau PFD SIF.*	17.2.3				

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7.3	Where changes to operating conditions e.g. to product or fluid properties, were not clearly defined or understood during design phase or subsequently found to be necessary, risk assessments should be carried out to understand the impact and to follow up with any necessary changes to ensure that hazards are appropriately managed. Any risk assessments, method statements and operational mitigation techniques to manage abnormal operating conditions should be clearly documented. Changes to design should follow a formal MOC procedure. Also refer to Phase 7 - Modification. *Apabila terjadi perubahan kondisi operasi misalnya sifat produk atau fluida, yang sebelumnya tidak didefinisikan atau tidak dipahami dengan jelas selama fase desain dan kemudian dianggap perlu maka penilaian risiko harus dilakukan untuk memahami dampaknya dan untuk menindaklanjuti setiap perubahan yang diperlukan untuk memastikan bahwa bahaya dikelola dengan tepat. Setiap penilaian risiko, pernyataan penggunaan metode dan teknik mitigasi operasional untuk mengelola kondisi operasi yang tidak normal harus didokumentasikan dengan jelas. Perubahan desain harus mengikuti prosedur MOC formal. Lihat juga Fase 7 - Modifikasi*	16.2.1 17				
7.4	Proposed modifications should be reviewed and authorized in accordance with a formal MOC procedure that requires approval from all relevant disciplines. This may include an impact or risk assessment. *Modifikasi yang diusulkan harus ditinjau dan disahkan sesuai dengan prosedur MOC formal yang memerlukan persetujuan dari semua disiplin ilmu yang relevan. Ini mungkin termasuk penilaian dampak atau risiko.*	17.2.1				

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7.5	Documentation and asset management system should be updated. *Dokumentasi dan sistem manajemen aset harus diperbarui*.	17.2.5				
7.6	The validation with proper authorization is completed before any modification activity. *Validasi dengan otorisasi yang tepat diselesaikan sebelum aktivitas modifikasi apa pun.*	17.2.6				
7.7	Operations and maintenance personnel should be advised of changes and training should be provided as necessary. Personil operasi dan pemeliharaan harus diberitahu tentang perubahan dan pelatihan harus diberikan jika diperlukan.	16.2.4				

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Table A-8: Phase 8 – Verification Checklist

Tabel A-8: Fase 8 – Daftar Periksa Verifikasi

Phase 8 – Verification Checklist (Decommissioning) *Fase 8 – Daftar Periksa Verifikasi (Dekomisioning)*						
#	**Requirement** ***Persyaratan***	**IEC 61511 Specific Clause** ***IEC 61511 Klausul Khusus***	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Tindakan/Oleh***	**Status**	**Recommendations** **Rekomendasi**
8.1	Decommissioning of facilities involving SIS should be managed as a modification. See Phase 7 above. Penonaktifan fasilitas yang melibatkan SIS harus dikelola sebagai modifikasi. Lihat Fase 7 di atas	18.2				
8.2	Particular attention should be paid during the planning and execution of decommissioning to the sequencing of activities, so that protection against process hazards is always provided. *Urutan Kegiatan selama perencanaan dan pelaksanaan dekomisioning harus diperhatikan secara khusus , agar perlindungan terhadap bahaya proses selalu tersedia.*	18.2				
8.3	Where decommissioning is for part of the plant and parts of the logic in the logic solver, the retained functions in the logic solver should be proven. *Apabila dekomisioning dilakukan untuk bagian dari pabrik dan bagian dari logika dalam logic solver, fungsi yang*	12.6 16.3.1.6				

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	dipertahankan dalam pemecah logika harus proven					

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Table A-9: Phase 9 – Verification Checklist

Tabel A-9: Fase 9 – Daftar Periksa Verifikasi

Phase 9 – Verification Checklist ***Fase 9 – Daftar PeriksaVerifikasi (Verfikasi)***						
#	**Requirement** Persyaratan	**IEC 61511 Specific Clause** *IEC 61511 Klausul Khusus*	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Tindakan/Oleh***	**Status** ***Status***	**Recommendation** ***Rekomendasi***
9.1	Verification planning are carried out throughout the SIS lifecycle and shall define all activities required for the appropriate phase of the Safety Lifecycle. *Perencanaan verifikasi dilakukan di seluruh lifecycle SIS dan harus menetapkan semua aktivitas yang diperlukan untuk fase Lifecycle Keselamatan yang sesuai.*	7.2				
9.2	Verify the use and reporting of the verification checklists in this document. *Verifikasi penggunaan dan pelaporan daftar periksa verifikasi dalam dokumen ini*	-				
9.3	For each SIF, a calculation shall be performed to show that the expected failure rate of the as-designed SIF is within the range allowed for the SIF's target SIL. *Untuk setiap SIF, perhitungan harus dilakukan untuk menunjukkan bahwa tingkat kegagalan yang diperkirakan dari SIF yang didesain berada dalam kisaran yang diizinkan untuk target SIF,SIL*	11.9.1 11.9.2				

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	It shall be confirmed that the as-designed SIF meets the architectural constraints defined in either IEC 61508:2010 or IEC 61511:2016. *Harus dipastikan bahwa SIF yang dirancang sesuai dengan batasan arsitektur yang ditentukan dalam IEC 61508:2010 atau IEC 61511:2016.* The failure rate calculation results and architectural constraints evaluation shall be documented in a SIL verification report. *Hasil perhitungan tingkat kegagalan dan evaluasi kendala arsitektur harus didokumentasikan dalam laporan verifikasi SIL.*					

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Table A-10: Phase 10 – Verification Checklist

Tabel A-10: Fase 10 – Daftar Periksa Verifikasi

Phase 10 – Verification Checklist (FSA and Audit) Fase 10 – Daftar Periksa Verifikasi (FSA dan Audit)						
#	**Requirement** *Persyaratan*	**IEC 61511 Specific Clause** ***IEC 61511 Klausul Khusus***	**Supporting Evidence** ***Bukti Pendukung***	**Action / By** ***Tindakan/Oleh***	**Status** ***Status***	**Recommendation** ***Rekomendasi***
10.1	A FSA is executed in such a way that a judgement can be made as to the functional safety and safety integrity achieved by every SIF of the SIS. *FSA dilaksanakan agar penilaian keselamatan fungsional dan pencapaian integritas keselamatan oleh setiap SIF dari SIS dapat dibuat*	5.2.6				
10.2	Confirm the following aspects: *Pastikan aspek berikut:* • a standard-compliant FSMP is in place; *FSMP yang memenuhi standar tersedia;* • the FSMP is being implemented and followed (this can be done by referring to the results of FS auditing, see below); *FSMP dilaksanakan dan diikuti (dapat dilakukan dengan mengacu pada hasil audit FS, lihat di bawah);* • *each lifecycle phase has been completed, including any follow-up actions, and verification done;* *setiap fase lifecycle telah selesai, termasuk tindak lanjut, dan verifikasi sudah dilakukan;* • SIS validation has been completed successfully, including any follow-up and close-out actions; *Validasi SIS telah berhasil diselesaikan, termasuk tindak lanjut dan penutupan;* • Documentation management procedures are adhered to; *Prosedur manajemen dokumentasi dipatuhi;* • Configuration management procedures are adhered to; *Prosedur manajemen konfigurasi dipatuhi;*	5.2.6 16.2.4				

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	• Competency requirements are met; *Persyaratan kompetensi terpenuhi*; • External parties (e.g. suppliers, contractors) are being properly assessed for their compliance with FS requirements; *Pihak eksternal (misalnya pemasok, kontraktor) dinilai dengan benar kepatuhannya terhadap persyaratan FS* • SIS-related operator training and information is in place (see IEC 61511 Part 1, Clause 16.2.4); *Pelatihan operator dan informasi yang terkait dengan SIS tersedia (lihat IEC 61511 Bagian 1, Klausul 16.2.4);* • Future FSA and auditing activities are planned. *FSA dan kegiatan audit berikutnya direncanakan*					

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APPENDIX B – RACI MATRIX

LAMPIRAN B – MATRIKS RACI

A Responsible, Accountable, Consulted and Informed (RACI) matrix illustrates the interaction between different roles and responsibilities for the various tasks that make up the safety life cycle process. The RACI matrix process requires that all the steps in a process are mapped out and that each role that undertakes an element of the process is identified. Then the appropriate RACI assignments are allocated to the fields in the matrix by combining these two factors.

Matriks Tanggung jawab, Akuntabel, Konsultasi dan Informasi (RACI) menggambarkan interaksi antara peran dan tanggung jawab yang berbeda untuk berbagai tugas yang membentuk proses lifecycle keselamatan. Proses matriks RACI mensyaratkan bahwa semua langkah dalam suatu proses dipetakan dan setiap peran yang melakukan elemen proses diidentifikasi. Kemudian penugasan RACI yang sesuai dialokasikan ke bidang dalam matriks dengan menggabungkan dua faktor ini.

Refer to Table B-1 for the interpretation of each RACI assignment.
Lihat Tabel B-1 untuk interpretasi setiap penugasan RACI.

Table B-1: RACI Assignment Interpretation

Tabel B-1: Interpretasi Penugasan RACI

Assignment	Interpretation
Responsible (R) *Tanggung Jawab (R)*	This person is responsible for action / implementation and typically the individual(s) who actually complete the task. However, in some circumstances this person may delegate parts of the work to others, including other organizations. Under these circumstances they retain responsibility for ensuring that the task is completed. Responsibility can be shared, with the degree of responsibility on each person determined by the 'Accountable' person. *Orang yang bertanggung jawab atas tindakan / implementasi dan biasanya individu yang bertanggung jawab atas penyelesaian pekerjaan. Namun, dalam beberapa keadaan yang bersangkutan dapat mendelegasikan sebagian pekerjaan kepada orang lain, termasuk organisasi lain dengan tetap memegang tanggung jawabnya agar dapat memastikan bahwa tugas dapat diselesaikan Tanggung jawab dapat dibagi, dengan tingkat tanggung jawab tertentu pada setiap orang yang ditentukan oleh orang yang bertanggung jawab*
Accountable (A) Akuntabel (A	The individual or group who is ultimately answerable for the function/activity. Includes 'yes' or 'no' authority and veto power. Only one 'A' can be assigned to a function and this accountability cannot be delegated to another role. *Individu atau kelompok yang bertanggung jawab atas fungsi/kegiatan tersebut. Termasuk otoritas untuk menyatakan 'ya' atau 'tidak' dan hak veto. Hanya satu 'A' yang dapat ditugaskan ke suatu fungsi dan akuntabilitas ini tidak dapat didelegasikan ke peran lain*

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Consulted (C) *Konsultasi ©*	The individual(s) to be consulted prior to a final decision/action. Communication should be two way, there being a requirement on whoever is consulted to respond to the information provided. *Individu yang akan menjadi tempat untuk berkonsultasi sebelum keputusan/tindakan akhir. Komunikasi harus dua arah, ada persyaratan siapa yang akan menjadi tempat konsultasi untuk menanggapi informasi yang diberikan*.
Informed (I) *Informasi (I*	The individual(s) who needs to be informed after a decision/action is taken. The communication is one way. There is no requirement for an informed person to respond. *Individu yang perlu diberi tahu setelah keputusan/tindakan diambil. Komunikasinya satu arah. Tidak ada persyaratan bagi orang yang mendapat informasi untuk merespons*.

Refer to the following table for sample RACI Matrix
Tabel tersebut dibawah ini sebagai contoh Matrik RACI

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Table B-2: Sample RACI Matrix

Tabel B-2: Contoh Matriks RACI

SIS LIFECYCLE RACI MATRIX
Matrix RACI Lifecycle SIS

R – Responsible (Doing the task)
Bertanggung jawab (Melakukan tugas)
A – Accountable (Approver)
Akuntabilitas (yang Memberi persetujuan)
C – Consulted (Provide input)
Berkonsultasi (memberi masukkan)
I – Informed (Communicated to)
Informasi (Berkomunikasi kepada)

Safety Lifecycle Phase or Activity *Lifecycle Keselamatan Fase atau Kegiatan*		Objectives *Tujuan*	IEC 61511 Clause *IEC 61511 Klausul*	Tasks Identified *Identifikasi Tugas*	HAZOP Facilitator	HAZOP Scribe	SIL Facilitator	SIL Scribe	Process Safety Lead	Process Safety Engineer	Process Lead	Process Engineer	Functional Safety	Instrument & Controls Manager	Instrumentation Lead	Instrumentation Engineer	Electrical Lead	Electrical Engineer	Controls Lead	Controls Engineer	SIS Logic Solver Supplier	Installation Contractor	Construction Manager	MC & Commissioning Manager	MC Lead	Commissioning Lead	Independent FSA Facilitator	Operations Manager/Superintel	Site Manager	Discipline Supervisor	Maintenance Engineer	Maintenance Technician	Independent Inspection Auth
Figure 7 Box No.	Title																																
1	Hazard and risk assessment *Bahaya dan Penilaian Resiko*	[IEC 61511-1: 8.1] To determine the hazards and hazardous events of the process and associated equipment, the sequence of events leading to the hazardous event, the process	8	1. Review HAZOP and SIL Classification Procedures. *Prosedur tinjauan HAZOP dan Klasifikasi SIL*	I	I	I	I	A	R	C	I	C	I	I	I	I	I	I	I	-	-	-	-	-	-	I	I					
				2. Review HAZOP Terms of Reference. *Kerangka Acuan Tinjauana Hazop*	R	I	I	I	A	I	I	I	I	I	I	I	I	I	I	I	-	-	-	-	-	-	I	I					

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		risks associated with the hazardous event, the requirements for risk reduction and the safety functions required to achieve the necessary risk reduction, if any of the safety functions are SIFs *Untuk menentukan bahaya dan kejadian berbahaya dari proses dan peralatan terkait, urutan kejadian yang mengarah ke kejadian berbahaya, risiko proses yang terkait dengan kejadian berbahaya, persyaratan pengurangan risiko dan fungsi keselamatan diperlukan untuk mencapai pengurangan risiko yang diperlukan, jika salah satu fungsi keselamatan adalah SIF.*		3. Review SIL Classification Terms of Reference. *Kerangka Acuan Klasifikasi Tinjauan SIL*	-	-	R	I	A	I	I	I	I	I	I	I	I	I	I	I	I	-	-	-	-	-	-	I	I										
				4. Conduct/attend multi-discipline HAZOP Study Workshop. *Mengadakan/menghadiri Lokakarya Studi HAZOP multi-disiplin*	R	C	-	-	A	C	C	C	C	C	C	C	C	C	C	C	C	-	-	-	-	-	-	I	C										

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2	Allocation of safety functions to protection layers Alokasi fungsi keselamatan ke lapisan perlindungan	[IEC 61511-1: 9.1] To allocate safety functions to protection layers. To determine the required SIFs. To determine for each SIF the associated safety integrity requirements. *IEC 61511-1: 9.1]* *Untuk mengalokasikan fungsi keselamatan ke lapisan perlindungan.* *Untuk menentukan SIF yang dibutuhkan.* *Untuk menentukan persyaratan integritas keselamatan terkait untuk setiap SIF*	9	1. Conduct/attend SIL Classification Study Workshop. *Mengadakan/menghadiri Workshop Studi Klasifikasi SIL.*	-	-	R	C	A	C	C	C	C	C	C	C	C	C	C	C	C	-	-	-	-	-	-	I	C					
3	SIS safety requirements specification (SRS) Spesifikasi *Persyaratan keamanan SIS*	[IEC 61511-1: 10.1] To specify the requirements for the SIS, including any application programs and the	10	1. Review SIL Verification Procedure. *Prosedur Tinjauan Verifikasi SIL*	-	-	-	-	R	I	I	I	RA	I	I	I	I	I	I	I	I	-	-	-	-	-	-	-	-					
				2. Review SIL Verification report.	-	-	-	-	R	I	I	I	RA	I	C	I	I	I	I	I	I	-	I	-	-	-	I	I					

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	(SRS)	architecture of the SIS. *[IEC 61511-1: 10.1]* *Untuk menentukan persyaratan SIS, termasuk program aplikasi dan arsitektur SIS.* Prepare SIL Verification Procedure. Perform SIL Verification and issue report. *Develop Safety Requirement pecifications (SRS)* *. Siapkan Prosedur Verifikasi SIL.* *Lakukan Verifikasi SIL dan terbitkan laporan.* *Kembangkan spesifikasi Persyaratan Keamanan (SRS)*		*Laporan Tinjauan Verifikasi SIL* 3. Review Safety Requirement Specifications (SRS). *Spesifikasi Persyaratan Tinjauan Keselamatan*	-	-	-	-	I	I	C	I	C	A	R	I	C	I	I	I	C	I	-	-	-	-	-	-					
4	SIS design and engineering *Desain dan Engineering SIS*	[IEC 61511-1: 11.1] To design one or multiple SIS to provide the SIF and meet the	11, 12.4, and 13	ICSS Vendor: 1. Prepare ICSS / Logic Solver Safety Validation Plan (SVP).	-	-	-	-	-	-	-	-	C	I	I	-	I	I	I	I	RA	-	-	-	-	-	-	-					

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		specified integrity requirements (e.g. SIL, associated risk reduction, PFD and/or PFH). *IEC 61511-1: 11.1*] *Untuk mendesain satu atau beberapa SIS guna menyediakan SIF dan memenuhi persyaratan integritas yang ditentukan (misalnya SIL, pengurangan risiko terkait, PFD dan/atau PFH).* [IEC 61511-1: 12.1] To define the requirements for the development of the application program. *Untuk menentukan persyaratan guna pengembangan program aplikasi.*		*Mempersiapkan Rencana Validasi ICSS/Logic Solver(SVP)*																													
				2. Prepare ICSS / Logic Solver Functional Design Specification (FDS). *Mempersiapkan Spesifikasi desain Fungsional ICSS/Lgic Solver*	-	-	-	-	-	-	-	-	C	I	I	-	I	I	I	C	RA	-	-	-	-	-	-	-						
				3. Develop SIS FAT Procedure *Prosedur FAT Pengembangan SIS*	-	-	-	-	-	-	-	-	C	I	C	-	I	I	I	I	RA	-	-	-	-	-	-	-						
				4. Perform SIS FAT at SIS manufacturer's premises. *Melakukan FAT SIS di lokasi manufaktur SIS*	-	-	-	-	-	C	-	C	C	C	C	C	C	C	C	A	C	R	-	-	-	-	-	-	I						
				CONTRACTOR: KONTRAKTOR 5. Undertake Electrical engineering and design activities ensuring the SIL is addressed accordingly as specified in the SRS 5.Undertake Electrical engineering and design activities ensuring the SIL is addressed accordingly as specified in the SRS *Melakukan kegiatan Engineering dan desain kelistrikan untuk*	-	-	-	-	-	-	C	I	C	A	I	I	R	C	C	I	C	I	I	I	I	-	I	I						

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				memastikan bahwa SIL ditangani sesuai dengan ketentuan dalam SRS																												
				6. Undertake Instrumentation engineering and design activities ensuring the SIL is addressed accordingly as specified in the SRS *Melakukan kegiatan Engineering dan desain Instrumen untuk memastikan bahwa SIL ditangani sesuai dengan ketentuan dalam SRS*	-	-	-	-	-	-	C	I	C	A	R	C	I	I	C	I	C	I	I	I	I	-	I	I					
				7. Undertake Controls engineering and design activities ensuring the SIL is addressed accordingly as specified in the SRS *Melakukan kegiatan Engineering dan desain Kontrol untuk memastikan bahwa SIL ditangani sesuai dengan ketentuan dalam SRS*	-	-	-	-	-	-	C	I	C	A	C	I	C	I	R	C	C	I	I	I	I	-	I	I					
5	SIS installation commissioning and validation	[IEC 61511-1: 14.1] To install the SIS according to the specifications and drawings;	12.3, 14, 15	ICSS Vendor: *Vendor ICSS:* 1. Develop SIS FAT Procedure *Prosedur FAT Pengembangan SIS*	-	-	-	-	-	-	-	-	C	I	C	-	I	I	I	I	RA	-	-	-	-	-	-	-					

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		Menginstal SIS sesuai spesifikasi dan gambar; . To commission the SIS so that it is ready for final system validation. *Untuk menugaskan SIS sehingga siap untuk validasi akhir sistem* [IEC 61511-1: 15.1] To validate, through inspection and testing, that the installed and commissioned SIS and its associated SIF(s) achieve the requirements as stated in the SRS. *[IEC 61511-1: 15.1]* *Memvalidasi SIS melalui inspeksi dan pengujian, untuk memastikan bahwa SIS yang dipasang dan ditugaskan beserta SIF yang*		

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		sistem ke IEC 61508. The application software safety validation planning is covered under Clause 7.3.2 of IEC 61508-3:2010. *Perencanaan validasi aplikasi perangkat lunak keselamatan tercakup dalam Klausul 7.3.2 dari IEC 61508-3:2010* This is the responsibility of ICSS Vendor. *Ini adalah tanggung jawab Vendor ICSS.*																																			
				2. Perform SIS FAT on the facility. *Lakukan FAT SIS pada lokasi fasilitas tersebut.*	-	-	-	-	-	C	-	C	C	C	C	C	C	C	A	C	RA	-	-	-	-	-	-	I											
				CONTRACTOR: *KONTRAKTOR:* 3. Install SIS in accordance with design specifications and drawings.	-	-	-	-	-	-	-	C	I	C	C	I	C	I	C	C	I	R	A	I	C	I	I	I											

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				Instal SIS sesuai dengan spesifikasi desain dan gambar.																														
				4. Confirm the mechanical installation is completed and Discipline or Mechanical Completion Acceptance Certificate is available and signed off *Pastikan pekerjaan pemasangan mekanis selesai. Sertifikat penerimaan penyelesaian pekerjaan displin mekanik tersedia dan siap ditanda tangani*	-	-	-	-	I	I	I	I	I	I	I	I	I	I	I	I	I	C	C	A	R	C	I	I					
				5. Confirm the pre-Commissioning activities are completed and the PreCommissioning Acceptance Certificate is available and signed off. Pastikan Kegiatan pra-komisioning selesai dan Sertifikat Penerimaan Pra-Komisioning Commissioning tersedia dan siap ditanda tangani	-	-	-	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	A	C	R	I	I					

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				6. Confirm the commissioning is completed for all parties and the System Completion Acceptance Certificate is available, signed off and handed over to Operations. *Pastikan tahapan komisioning sudah diselesaikan oleh k semua pihak dan Sertifikat Penerimaan Penyelesaian Sistem tersedia, ditandatangani dan diserahkan ke Operasi.*	-	-	-	-	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	I	A	C	R	I	I					
				7. Prior to introduction of hydrocarbons, perform Independent Functional Safety Assessment (FSA) Stage 3. [Part of Phase 10 FSA] *Sebelum memasukkan hidrokarbon, lakukan penilaian keselamatan Fungsional Independen(FSA) tahap 3* *[Bagian dari Tahap 10 FSA]*	-	-	-	-	A	I	C	I	C	C	C	I	C	I	C	I	C	-	I	I	C	C	R	I					
6	SIS operation and maintenance	[IEC 61511-1: 16.1] To ensure that the required SIL of each SIF is	16	1. Perform routine maintenance in accordance with manufacturers																								C	A	C	C	R	I

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				Lakukan proof testing sesuai dengan prosedur proof test yang ditentukan dan pada interval pengujian sebagaimana didefinisikan dalam SRS																											
				3. Repair / replace faulty equipment within the MTTR time for dangerous faults revealed by diagnostic tests or proof tests. *Perbaiki / ganti peralatan yang rusak dalam waktu MTTR untuk kesalahan berbahaya yang diungkapkan oleh tes diagnostik atau tes bukti.*																									C	A	C	C	R	I
				4. Refurbish / replace sensors and final elements at the end of the “useful life” of the equipment as defined in the manufacturers’ safety manual. *Perbaharui / ganti sensor dan elemen akhir di akhir "masa pakai" peralatan seperti yang didefinisikan dalam manual keselamatan pabrikan*.																									C	A	C	C	R	I

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				5. Identify and implement compensating measures for degraded SIFs. *Mengidentifikasi dan menerapkan langkah-langkah kompensasi untuk SIF yang terdegradasi.*																				C	A	C	C	R	I
				6. Maintain, monitor and report SIF inhibit log. *Merawat, memantau, dan melaporkan log penghambatan SIF*																				C	A	C	C	R	I
7	SIS Modification *Modifikasi SIS*	*[IEC 61511-1: 17.1]* To ensure that modifications to any SIS are properly planned, reviewed, approved and documented prior to making the change. *Untuk memastikan bahwa modifikasi pada SIS direncanakan, ditinjau, disetujui, dan didokumentasikan dengan benar sebelum perubahan dilakukan*	17	1. Raise MOC which clearly defines the modification with necessary supporting documentation and drawing markups. Issue for review and approval. *Tampilkan MOC yang mendefinisikan modifikasi secara jelas dengan dokumen pendukung yang diperlukan dan mark-up drawing, untuk ditinjau dan proses persetujuan*.	It may be necessary to perform part or all of verification phases 1 to 4 subject to the complexity / extent of the modification being undertaken. *Mungkin perlu untuk melakukan sebagian atau seluruh verifikasi fase 1 sampai 4 tergantung pada kompleksitas/tingkat modifikasi yang dilakukan*.																	C	I	I	-	-	-	-	R	A	I	I	C	C

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		To ensure that the required safety integrity of the SIS is maintained despite of any changes made to the SIS. *Untuk memastikan bahwa integritas keselamatan yang dibutuhkan dari SIS dipertahankan meskipun ada perubahan yang dilakukan pada SIS*																	
				2. Carry out impact analysis and/or risk assessment for the modification to be undertaken. *Melakukan analisis dampak dan/atau penilaian risiko terhadap modifikasi yang akan dilakukan*.	It may be necessary to perform part or all of verification phases 1 to 4 subject to the complexity / extent of the modification being undertaken. *Mungkin perlu untuk melakukan sebagian atau seluruh verifikasi fase 1 sampai 4 tergantung pada kompleksitas/tingkat modifikasi yang dilakukan*.	C	C	R	-	-	-	-	A	C	C	R	C	C
				3. Implement the change by qualified and competent person(s). This may involve a multi-discipline team subject to the scope of work. *Mengimplementasikan perubahan oleh orang-orang yang memiliki*	It may be necessary to perform part or all of verification phases 1 to 4 subject to the complexity / extent of the modification being undertaken.	C	-	R	-	-	-	-	I	-	A	C	R	C

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				kualifikasi dan kompetensi dengan melibatkan tim multi-disiplin yang sesuai dengan lingkup pekerjaan.															
				4. Perform pre-commissioning function testing for the field sensors, final elements and the logic solver. *Lakukan pengujian fungsional pra Komisioning untuk sensor lapangan , elemen akhir, dan logic solver.*	It may be necessary to perform part or all of verification phases 1 to 4 subject to the complexity / extent of the modification being undertaken. *Mungkin perlu untuk melakukan sebagian atau seluruh verifikasi fase 1 sampai 4 tergantung pada kompleksitas/tingkat modifikasi yang dilakukan.*	C	-	R	-	-	-	-	I	-	A	C	R	C
				5. Test and verify the change has been implemented correctly and has no adverse impact on other parts of the SIS not modified. *Menguji dan memverifikasi perubahan yang telah diterapkan dengan benar dan tidak berdampak buruk pada bagian lain dari SIS yang tidak dimodifikasi.*	It may be necessary to perform part or all of verification phases 1 to 4 subject to the complexity / extent of the modification being undertaken.	C	-	R	-	-	-	-	I	-	C	A	R	C

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				6. Commission the modified system. *Proses komisioning system yang dimodifikasi*	It may be necessary to perform part or all of verification phases 1 to 4 subject to the complexity / extent of the modification being undertaken. *Mungkin perlu melakukan sebagian atau seluruh verifikasi fase 1 sampai 4 tergantung pada kompleksitas/tingkat modifikasi yang dilakukan*.	R	-	I	-	-	-	-	C	-	C	A	R	C
				7. Update all necessary documentation including red-line mark-ups. Update Asset Management System. *Perbarui semua dokumentasi yang diperlukan termasuk red line mark-up. Perbarui Sistem* Manajemen Aset.	It may be necessary to perform part or all of verification phases 1 to 4 subject to the complexity / extent of the modification being undertaken. *Mungkin perlu melakukan sebagian atau seluruh verifikasi fase 1 sampai 4 tergantung pada kompleksitas/tingkat modifikasi yang dilakukan.*	R	-	I	-	-	-	-	C	-	C	A	R	C
8	Decommissioning *Dekomisioning*	[IEC 61511-1: 18.1] To ensure that prior to decommissioning any SIS from active service, a proper review is conducted and required authorization is obtained. *Untuk memastikan bahwa sebelum menonaktifkan SIS telah dilakukan tinjauan sebagaimana*	18	1. Define scope of Decommissioning work, follow MOC procedure, and organize risk assessment workshop if required. *Tetapkan ruang lingkup pekerjaan dekomisioning, ikuti prosedur MOC, dan atur lokakarya penilaian risiko jika diperlukan*	It may be necessary to perform part or all of verification phases 1 to 4 subject to the complexity / extent of the modification being undertaken.	I	I	I	-	-	-	-	C	A	I	I	C	C

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	Verification of SLC activities (EPC) – Software	[IEC 61511-1: 7.1] To demonstrate by review, analysis and/or testing that the required outputs satisfy the defined requirements for the appropriate phases as identified by the verification planning. *Untuk membuktikan bahwa dengan tinjauan, analisis dan/atau pengujian, keluaran yang dibutuhkan akan memenuhi persyaratan yang ditentukan untuk fase yang sesuai seperti yang diidentifikasi oleh perencanaan verifikasi* [IEC 61511-1: 12.5] [for Application Program] Verification planning shall be carried out in accordance with Clause 7.	7, 12.5	3. ICCS Vendor to perform SIS Validation Plan (SVP). Refer to Phase 5. *Vendor ICCS menjalankan rencana Validasi SIS (SVP). Lihat Fase 5*.					-	C	-	C	C	C	C	C	C	C	A	C	RA	-	-	-	-	-	-	I	-	-	-	-	-

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		[*untuk Program Aplikasi] Perencanaan verifikasi dilakukan sesuai dengan Klausul 7.*																																		
	Verification of SLC activities (Operations)	[IEC 61511-1: 7.1] To demonstrate by review, analysis and/or testing that the required outputs satisfy the defined requirements for the appropriate phases as identified by the verification planning. *Untuk membuktikan bahwa dengan tinjauan, analisis dan/atau pengujian, keluaran yang dibutuhkan akan memenuhi persyaratan yang ditentukan untuk fase yang sesuai seperti yang diidentifikasi oleh perencanaan verifikasi*	7	4. Perform verification of SIS Lifecycle phases (6 to 8) using the verification checklists in this document. *Lakukan verifikasi fase Lifecycle SIS (6 hingga 8) menggunakan daftar periksa verifikasi dalam dokumen ini*.					-	-	-	-	C	-	-	-	-	-	-	-	C	-	-	-	-	-	R	I	A	R	C	C	I

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10	SIS FSA (EPC)	[IEC 61511-1: Table 2] To investigate and arrive at a judgement on the functional safety and safety integrity achieved by each SIF of the SIS *Untuk menginvestigasi dan memberi penilaian tentang keselamatan fungsional dan integritas keselamatan yang dicapai oleh setiap SIF dari SIS*	5	1. Independent consultant to perform FSA Stage 1, Stage 2 and Stage 3 *Konsultan independen melakukan FSA tahap 1 tahap 2 dan tahap3 .*	-	-	-	-	A	I	C	I	C	C	C	I	C	I	C	I	C	-	I	I	C	C	R	I	-	-	-	-	-
	SIS FSA (Operations)	[IEC 61511-1: Table 2] To investigate and arrive at a judgement on the functional safety and safety integrity achieved by each SIF of the SIS *Untuk menginvestigasi*	5	2. Periodic SIS Audits *Audit SIS secara berkala*					-	-	-	-	R	-	-	-	-	-	-	-	C	-	-	-	-	-	R	I	A	R	C	C	I

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		dan memberi penilaian tentang keselamatan fungsional dan integritas keselamatan yang dicapai oleh setiap SIF dari SIS																																
11	Safety Lifecycle Structure and Planning *Perencanaan dan Struktur Lifecycle Keselamatan*	*[IEC 61511-1: Table 2]* *To establish how the lifecycle steps are accomplished* *Untuk menetapkan langkah-langkah pencapaian lifecycle*	*5.2.4 6.2*	1. Develop SIS lifecycle Plan *Mengembangkan rencana lifecycle SIS*					C	-	-	-	R A	C	C	-	C	-	C	-	I	-	-	-	-	-	-	-	I	I	I	I	I
				2. Develop project/facility specific FSMP *Mengembangkan FSMP khusus proyek/fasilitas*					A	R	-	-	C	C	C	-	C	-	C	-	I	-	-	-	-	-	-	-	I	I	I	I	I

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APPENDIX C – COMPETENCY REQUIREMENTS

LAMPIRAN C – PERSYARATAN KOMPENTENSI

Table C-1: Sample Competency Requirements
Tabel C-1: Contoh Persyaratan Kompetensi

No.	Safety Lifecycle Phase	Competence Standard	Technical Advisor/Manager	Lead Engineer	Intermediate Engineer	Engineer
1	Hazard and Risk Analysis Analisa Bahaya dan Resiko	Can fully participate in hazard identification, hazard analysis, and hazard and operability (HAZOP) studies *Dapat berpartisipasi penuh dalam identifikasi bahaya, analisis bahaya, dan bahaya serta pengoperasian (HAZOP) studi*	1.1 Understands principles of hazard identification, hazard analysis and HAZOP studies. *Memahami prinsip identifikasi bahaya, Analisa bahaya dan studi HAZOP* 1.2 Has experience of participating and coordinating HAZID and/or HAZOP studies. 1.3 Understands where hazards may be introduced by SIS	1.1 Understands principles of hazard identification, hazard analysis and HAZOP studies. *Memahami prinsip identifikasi bahaya, Analisa bahaya dan studi HAZOP* 1.2 Has experience of participating and coordinating HAZID and/or HAZOP studies. *Memiliki pengalaman berpartisipasi dan mengkoordinasikan studi Hazid atau/dan Hazop*	1.1 Understands principles of hazard identification, hazard analysis and HAZOP studies. *Memahami prinsip identifikasi bahaya, Analisa bahaya dan studi HAZOP* 1.2 Has experience of participating in HAZID and/or HAZOP studies. *Memiliki pengalaman berpartisipasi dan mengkoordinasikan studi Hazid atau/dan Hazop*	1.1 Understands principles of hazard identification, hazard analysis and HAZOP studies. *Memahami prinsip identifikasi bahaya, Analisa bahaya dan studi HAZOP*
2	Allocation of Safety Functions to Protection Layers *Alokasi dari Fungsi Keamanan untuk Lapisan Perlindungan*	Can effectively allocate safety functions to SIS, other technology and procedural protection layers. *Dapat secara efektif mengalokasikan fungsi keselamatan ke SIS, ke teknologi lain, dan lapisan perlindungan prosedural.*	2.1 Understands the effectiveness of different types of protection layers *Memahami efektivitas berbagai jenis lapisan perlindungan* 2.2 Has experience of allocating safety functions to protection layers. *Memiliki pengalaman mengalokasikan fungsi keselamatan ke lapisan pelindung*. 2.3 Has experience of participating or leading SIL classification studies.	2.1 Understands the effectiveness of different types of protection layers *Memahami efektivitas berbagai jenis lapisan perlindungan* 2.2 Has experience of allocating safety functions to protection layers. *Memiliki pengalaman mengalokasikan fungsi keselamatan ke lapisan pelindung* 2.3 Has experience of	2.1 Understands the effectiveness of different types of protection layers *Memahami efektivitas berbagai jenis lapisan perlindungan* 2.2 Understands the principles of allocating safety functions to protection layers. *Memahami dasar pengalokasian fungsi*	2.1 Understands the different types of protection layers. *Memahami efektivitas berbagai jenis lapisan perlindungan*

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			2.4 Is familiar with use of SIL classification software, if appropriate.	participating in SIL classification studies. *Memiliki pengalaman berpartisipasi dalam studi klasifikasi SIL*	*keselamatan ke lapisan pelindung*	
3	Safety Requirements Specification for the SIS *Spesifikasi persyaratan keselamatan SIS*	Can develop SRS for the SIS. *Mampu mengembangkan SRS untuk SIS*.	3.1 Has experience of developing functional specifications. *Memiliki pengalaman mengembangkan spesifikasi fungsional.* 3.2 Has experience of developing integrity specifications. *Memiliki pengalaman mengembangkan spesifikasi integritas.* 3.3 Has experience of developing role statements and functional and integrity specifications for SIS. *Memiliki pengalaman mengembangkan spesifikasi role statements serta spesifikasi fungsional dan integritas SIS*	3.1 Has experience of developing functional specifications. *Memiliki pengalaman dalam mengembangkan spesifikasi fungsional* 3.2 Has experience of developing integrity specifications. *Memiliki pengalaman dalam mengembangkan spesifikasi integritas* 3.3 Knows and understands of developing role statements and functional and integrity specifications for SIS *Memiliki pengalaman mengembangkan spesifikasi role statements serta spesifikasi fungsional dan integritas SIS*	3.1 Knows and understands how to develop functional specifications. *Mengetahui dan memahami bagaimana cara mengembangkan spesifikasi fungsional* 3.2 Knows and understands how to develop integrity specifications. *Memiliki pengalaman dalam mengembangkan spesifikasi integritas* 3.3 Understands of developing role statements and functional and integrity specifications for SIS. *Memiliki pengalaman mengembangkan spesifikasi role statements serta spesifikasi fungsional dan integritas SIS*	3.1 Understands functional specifications. *Memahami spesifikasi fungsional* 3.2 Understands integrity specifications. *Memahami spesifikasi integritas*
4	Design and Engineering of SIS *Engineering dan Desain SIS*	Can manage and/or undertake detailed specification, procurement, assembly and factory testing of SIS systems and equipment hardware and software and prepare associated documentation.	4.1 Knows and understands how to select the most appropriate sensors and final elements to meet the safety requirements. *Mengetahui dan mengerti cara memilih sensor dan elemen akhir yang paling tepat untuk memenuhi* persyaratan keselamatan 4.2 Knows and understands how to select an appropriate logic solver to meet the safety requirements.	4.1 Knows and understands how to select the most appropriate sensors and final elements to meet the safety requirements. *Mengetahui dan mengerti cara memilih sensor dan elemen akhir yang paling tepat untuk memenuhi persyaratan keselamatan* 4.2 Knows and understands how to select an appropriate logic solver to meet the safety requirements.	4.1 Knows and understands how to select the most appropriate sensors and final elements to meet the safety requirements. *Mengetahui dan mengerti cara memilih sensor dan elemen akhir yang paling tepat untuk memenuhi persyaratan keselamatan*	4.1 Understands the working principles of most sensors and final elements and logic solvers. *Memahami prinsip kerja sebagian besar sensor dan elemen akhir serta logic solvers.*

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		Dapat mengelola dan/atau melakukan detil spesifikasi, pengadaan, perakitan dan pengujian pabrik sistem SIS yang meliputi perangkat keras dan perangkat lunak dan menyiapkan dokumentasi terkait.	*Mengetahui dan mengerti cara memilih logic solver yang tepat untuk memenuhi persyaratan keselamatan.* 4.3 Has experience of selecting sensors and final elements for SIS applications at the required SILs. *Memiliki pengalaman memilih sensor dan elemen akhir untuk aplikasi SIS pada SIL yang dibutuhkan* 4.4 Has experience of specifying a logic solver for SIS application at the required SILs. *Memiliki pengalaman dalam menentukan logic solver untuk aplikasi SIS pada SIL yang dibutuhkan.* 4.5 Has experience of configuring a logic solver for SIS application at the required SILs. *Memiliki pengalaman mengonfigurasi logic solver untuk aplikasi SIS pada SIL yang dibutuhkan*. 4.6 Has experience of performing SIL verification (reliability analysis) calculations. *Memiliki pengalaman melakukan perhitungan verifikasi SIL (analisis keandalan)* 4.7 Has experience of integrating and factory testing a logic solver to meet specified functional requirements. *Memiliki pengalaman mengintegrasikan dan pengujian pabrik logic solver untuk memenuhi*	*Mengetahui dan mengerti cara memilih logic solver yang tepat untuk memenuhi persyaratan keselamatan.* 4.3 Has experience of selecting sensors and final elements for SIS applications at the required SILs. *Memiliki pengalaman memilih sensor dan elemen akhir untuk* aplikasi SIS pada SIL yang diperlukan. 4.4 Has experience of specifying a logic solver for SIS application at the required SILs. *Memiliki pengalaman dalam menentukan logic solver untuk aplikasi SIS pada SIL yang dibutuhkan.* 4.5 Has experience of witnessing factory testing of a logic solver to meet specified functional requirements. *Memiliki pengalaman dalam witnessing factory testing logic solver untuk memenuhi persyaratan fungsional yang telah ditentukan* 4.6 Has experience of reviewing documentation for SIS including factory and site acceptance test procedures. *Memiliki pengalaman meninjau dokumentasi SIS termasuk prosedur factory and site acceptance test.*	4.2 Knows and understands how to select an appropriate logic solver to meet the safety requirements. *Mengetahui dan mengerti cara memilih logic solver yang tepat untuk memenuhi persyaratan keselamatan*.	

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			persyaratan fungsional yang ditentukan. 4.8 Has experience of developing or reviewing documentation for SIS including factory and site acceptance test procedures. *Memiliki pengalaman mengembangkan atau meninjau dokumentasi SIS termasuk prosedur factory and site acceptance test.*			
4a	Realization of SIS – Project Management *Realisasi SIS – Manajemen Proyek*	Can manage and/or undertake, design of assembly and factory testing of SIS systems and equipment hardware and software and prepare associated documentation. *Dapat mengelola dan/atau melakukan, desain untuk perakitan (DFA) dan pengujian pabrik sistem SIS dan peralatan perangkat keras dan perangkat lunak serta mempersiapkan dokumentasi terkait*	4a.1 Knows and understands principles of IEC 61508 and IEC 61511 and their application to the process industry sector. *Mengetahui dan memahami prinsip-prinsip IEC 61508 dan IEC 61511 dan aplikasinya ke sektor industri proses.* 4a.2 Knows and understands company's project lifecycle and associated procedures. *Mengetahui dan memahami lifecycle proyek perusahaan dan prosedur terkait.* 4a.3 Knows and understands company's quality system and, where appropriate, the additional quality requirement for standard conformance. *Mengetahui dan memahami sistem mutu perusahaan dan,*	4a.1 Knows and understands principles of IEC 61508 and IEC 61511 and their application to the process industry sector. *Mengetahui dan memahami prinsip-prinsip IEC 61508 dan IEC 61511 dan aplikasinya ke sektor industri proses* 4a.2 Knows and understands company's project lifecycle and associated procedures. *Mengetahui dan memahami lifecycle proyek perusahaan dan prosedur terkait.* 4a.3 Knows and understands company's quality system and, where appropriate, the additional quality requirement for standard conformance. *Mengetahui dan memahami sistem mutu perusahaan dan,*	4a.1 Knows and understandscompany's project lifecycle and associated procedures. *Mengetahui dan memahami lifecycle proyek perusahaan dan prosedur terkait.* 4a.2 Knows and understandscompany's quality system and, where appropriate, the additional quality requirementfor standard conformance. *Mengetahui dan memahami sistem mutu perusahaan dan, persyaratan kualitas tambahan lain yang relevan untuk kesesuaian standar*	4a.2 Understands company's project lifecycle and associated procedures *Memahami lifecycle proyek Perusahaan dan prosedur terkait* 4a.3 Understands company's quality system. *Memahami sistem mutu Perusahaan*

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			persyaratan kualitas tambahan lain yang relevan untuk kesesuaian standar	*persyaratan kualitas tambahan lain yang relevan untuk kesesuaian standar*		
4b	Realization of SIS – Technical Expertise *Realisasi SIS – Keahlian Teknis*	Can technically review specifications, design and test of SIS systems and equipment hardware and software and associated documentation. *Secara teknis mampu melakukan tinjauan spesifikasi, desain dan uji sistem SIS beserta peralatan perangkat keras dan perangkat lunak dan dokumentasi terkait*.	4b.1 Knows, understands and has experience of SIS software and hardware technology in a similar application. *Mengetahui, memahami dan memiliki pengalaman tentang perangkat lunak SIS dan teknologi perangkat keras pada aplikasi serupa.* 4b.2 Experience of performing SIL verification (reliability analysis) calculations. *Memiliki pengalaman melakukan perhitungan verifikasi SIL (analisis keandalan* 4b.3 Experience of participating in at least one Functional Safety Assessment. *Pengalaman berpartisipasi setidaknya dalam satu Penilaian keselamatan Fungsional*	4b.1 Knows, understands and has experience of SIS software and hardware technology in a similar application. *Mengetahui, memahami dan memiliki pengalaman tentang perangkat lunak SIS dan teknologi perangkat keras pada aplikasi serupa.* 4b.2 Experience of performing SIL verification (reliability analysis) calculations. *Memiliki pengalaman melakukan perhitungan verifikasi SIL (analisis keandalan*	4b.1 Knows and understands SIS software and hardware technology in a similar application. *Mengetahui, memahami dan memiliki pengalaman tentang perangkat lunak SIS dan teknologi perangkat keras pada aplikasi serupa.*	Nil

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4c	Realization of SIS – Implementation and testing *Realisasi SIS – Implementasi dan Pengujian*	Can undertake generation of specifications, design and test SIS systems an equipment hardware and software and prepare associatdocumentation aappropriate to the area of responsibility. *Dapat melakukan generasi spesifikasi, desain dan sistem pengujian SIS serta perangkat keras dan perangkat lunak dan menyiapkan dokumen terkait yang sesuai dengan area tanggung jawab.*	4c.1 Implementation experience of several SIS with at least the same SIL (same as the highest SIL in the current project). *Memiliki pengalaman dalam mengimplementasikan beberapa SIS dengan setidaknya pada SIL yang sama (sama dengan SIL tertinggi dalam proyek saat ini).*	4c.1 Has assisted in the implementation of at least one SIS. *Sudah pernah membantu mengimplementasikan setidaknya satu SIS.*	4c.1 Understands the implementation of a SIS *Memahami proses implementasi SIS*	Nil
5	Installation, commissioning and validation Instalasi, komisioning dan validasi	Can manage site installation, commissioning and testing of SIS systems and *Mampu mengelola instalasi di lapangan, komisioning dan pengujian sistem SIS*	5.1 Knows and understands installation and commissioning issues with SIS field equipment and logic solvers. *Mengetahui dan memahami masalah instalasi dan komisioning dengan peralatan lapangan SIS dan logic solver.* 5.2 Knows and understand site *Mengetahui dan memahami kondisi di lapangan*	5.1 Knows and understands installation and commissioning issues with SIS field equipment and logic solvers. *Mengetahui dan memahami masalah instalasi dan komisioning dengan peralatan lapangan SIS dan logic solver* 5.2 Knows and understand site *Mengetahui dan memahami kondisi di lapangan*	5.1 Understands installation and commissioning issues with SIS field equipment and logic solvers. *Mengetahui dan memahami masalah instalasi dan komisioning dengan peralatan lapangan SIS dan logic solver*	Nil

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6	Operation and Maintenance *Operasi dan Pemeliharaan*	Can manage operation, maintenance and proof testing of SIS equipment and systems to ensure functional and integrity specifications are Achieved. *Mampu mengelola operasional, pemeliharaan dan proof testing peralatan dan sistem SIS untuk memastikan spesifikasi fungsional dan integritas tercapai.*	6.1 Knows and understands how to manage SIS to ensure functional and integrity requirements are achieved. *Mengetahui dan memahami cara mengelola SIS untuk meyakinkan bahwa persyaratan fungsional dan integritas dapat di capai* 6.2 Has developed procedures for maintenance and testing of SIS. Sudah mengembangkan/membuat prosedur untuk pemeliharaan dan pengujian SIS 6.3 Has reviewed testing results to ensure that functional and integrity requirements are achieved and amended testing scopes and test intervals as necessary. *Sudah melakukan tinjauan hasil pengujian untuk memastikan bahwa fungsional dan persyaratan integritas tercapai dan mampu mengubah/mengembangkan lingkup dan interval pengujian bila diperlukan* 6.4 Has developed and implemented procedural controls for management of overrides and inhibits.	6.1 Knows and understands how to manage SIS to ensure functional and integrity requirements are achieved. *Mengetahui dan memahami cara mengelola SIS untuk meyakinkan bahwa persyaratan fungsional dan integritas dapat di capai* 6.2 Knows and understands procedures for maintenance and testing of SIS. *Mengetahui dan memahami prosedur untuk pemeliharaan dan pengujian SIS* 6.3 Has reviewed testing resultsto ensure that functional and integrity requirements are achieved and amended testing scopes and test intervals as necessary. *Sudah melakukan tinjauan hasil pengujian untuk memastikan bahwa fungsional dan persyaratan integritas tercapai dan mampu mengubah/mengembangkan lingkup dan interval pengujian bila diperlukan*	6.1 Knows and understands how to manage SIS to ensure functional and integrity requirements are achieved *Mengetahui dan memahami cara mengelola SIS untuk meyakinkan bahwa persyaratan fungsional dan integritas dapat di capai* 6.2 Knows and understands procedures for maintenance and testing of SIS. *Mengetahui dan memahami prosedur untuk pemeliharaan dan pengujian SIS*	6.1 Understands how to manage SIS to ensure functional and integrity requirements are achieved.

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			Sudah pernah mengembangkan dan mengimplementasikan prosedur pengendalian untuk pengelolaan override dan penghambatan			
7	Modification *Modifikasi*	Can manage and/or undertake modifications affecting safety functionality from requirements definition through implementation and testing to producing revised documentation. *Bisa mengelola dan/atau melakukan modifikasi untuk mengubah batasan persyaratan fungsionalitas keselamatan melalui implementasi dan pengujian yang akan menghasilkan revisi dokumentasi.*	7.1 Knows and understands how to modify SIS to achieve required revised functionality and integrity and implications of the changes. *Mengetahui dan memahami Bagaimana cara memodifikasi SIS untuk mendapatkan perubahan fungsionalitas dan integritas yang diinginkan dan bagaimana implikasi nya* 7.2 Has developed a requirements definition for a modification affecting safety functionality. *Telah mengembangkan/membuat definisi persyaratan/batasan batasan untuk suatu modifikasi yang mempengaruhi/ menyebabkan perubahan fungsionalitas keselamatan*. 7.3 Has managed and/or implemented modifications to SIS involving changes to field sensors, final elements and/or logic solver hardware and software. *Telah mengelola dan/atau Menerapkan modifikasi*	7.1 Knows and understands how to modify SIS to achieve required revised functionality and integrity and implications of the changes. *Mengetahui dan memahami Bagaimana cara memodifikasi SIS untuk mendapatkan perubahan fungsionalitas dan integritas yang diinginkan dan bagaimana implikasi nya* 7.2 Has developed a requirements definition for a modification affecting safety functionality. *Telah mengembangkan/membuat definisi persyaratan/batasan batasan untuk suatu modifikasi yang mempengaruhi/ menyebabkan perubahan fungsionalitas keselamatan*. 7.3 Has assisted in modificationsto SIS involving changes to field sensors, final elements and/or logic solver hardware and software. *Telah membantu dalam kegiatan modifikasi*	7.1 Knows and understands how to modify SIS to achieve required revised functionality and integrity and implications of the changes. *Mengetahui dan memahami Bagaimana cara memodifikasi SIS untuk mendapatkan perubahan fungsionalitas dan integritas yang diinginkan dan bagaimana implikasi nya* 7.2 Has developed a requirements definition for a modification affecting safety functionality. *Telah mengembangkan/membuat definisi persyaratan/batasan batasan untuk suatu modifikasi yang mempengaruhi/ menyebabkan perubahan fungsionalitas keselamatan*.	7.1 Knows and understands how to modify SIS to achieve required revised functionality and integrity and implications of the changes.

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			SIS yang meliputi perubahan pada sensor lapangan, elemen akhir dan/atau perangkat keras dan perangkat lunak logic solver 7.4 Has managed and/or carried out testing of modified SIS against an agreed test procedure. *Telah mengelola dan/atau melaksanakan/mengimlementasikan prosedur pengujian SIS yang dimodifikasi menggantikan prosedur pengujian yang disepakati* 7.5 Has managed and/or developed revised documentation and procedures associated with SIS modifications. *Telah mengelola dan/atau mengembangkan/membuat dokumentasi dan prosedur yang terkait dengan modifikasi SIS*	*SIS yang meliputi perubahan pada sensor lapangan, elemen akhir dan/atau perangkat keras dan perangkat lunak logic solver* 7.4 Has assisted in carrying out testing of modified SIS against an agreed test procedure. *Telah membantu melaksanakan/mengimlementasikan prosedur pengujian SIS yang dimodifikasi menggantikan prosedur pengujian yang disepakati*		
8	Decommissioning *Dekomisioning*	*Can manage and/or undertake decommissioning activities from planning to equipment removal and update of documentation.* *Dapat mengelola*	8.1 Knows and understands how to decommission SIS while ensuring hazards are managed. *Mengetahui dan mengerti cara menonaktifkan SIS dengan tetap memastikan bahaya dapat dikelola dengan baik* memastikan bahaya dikelola	8.1 Knows and understands how to decommission SIS while ensuring hazards are managed. *Mengetahui dan mengerti cara menonaktifkan SIS dengan tetap memastikan bahaya dapat dikelola dengan baik*	8.1 Understands the principles of SIS decommissioning while ensuring hazards are managed. *Mengetahui dan mengerti cara menonaktifkan SIS dengan tetap memastikan*	Nil

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		dan/atau melakukan kegiatan mulai dari perencanaan penonaktifan sampai penggantian peralatan dan pembaruan dokumentasi	8.2 Has experience of decommissioning SIS in a safe manner. *Memiliki pengalaman menonaktifkan SIS dengan cara yang aman*		*bahaya dapat dikelola dengan baik*	
9	Verification *Verifikasi*	Can carry out verification of all lifecycle phases to establish that outputs achieved meet expected requirements and objectives. *Dapat melaksanakan verifikasi pada semua fase lifecycle dengan target output yang dihasilkan sesuai dengan kebutuhan/persyaratan dan tujuan*	9.1 Knows how to carry out verification reviews. *Mengetahui bagaimana cara melakukan tinjauan atas verifikasi* 9.2 Has experience of verifying two or more lifecycle activities. *Memiliki pengalaman memverifikasi dua atau lebih lifecycle*	9.1 Knows how to carry out verification reviews. *Mengetahui bagaimana cara melakukan tinjauan atas verifikasi* 9.2 Has experience of verifying two or more lifecycle activities. *Memiliki pengalaman memverifikasi dua atau lebih lifecycle*	9.1 Knows how to carry out verification reviews. *Mengetahui bagaimana cara melakukan tinjauan atas verifikasi*	Nil
10	10 Management of functional safety. Functional Safety Assessment and Auditing *Manajemen keselamatan fungsional. Penilaian dan Audit keselamatan fungsional*	10.1 Can select people with the competencies to meet the requirements of each lifecycle phase. *Mampu memilih/menentukan orang yang memiliki kompetensi untuk pencapaian persyaratan lifecycle pada setiap fase.*	personnel to meet competence requirements to work on SIS activities. *Orang yang memenuhi persyaratan kompetensi untuk bekerja pada kegiatan SIS*	Nil	Nil	Nil

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		10.2 Can effectively manage SIS activities including clients, suppliers and subcontractors. *Mampu mengelola kegiatan SIS secara efektif termasuk klien,pemasok dan subkontraktor*	10.2.1 Has experience of project management involving people, and resources including financialresources. *Memiliki pengalaman mengelola proyek yang melibatkan orang, dan sumber daya termasuk sumber daya keuangan.* 10.2.2 Has experience of carrying out reviews and incorporating recommendations into action plans. *Memiliki pengalaman melakukan tinjauan dan mengkonsolidasikan rekomendasi rekomendasi ke dalam rencana tindak lanjut.* 10.2.3 Has experience of managing clients, suppliers or sub-contractors. *Mempunyai pengalaman mengelola klienpemasok dan subkontraktor*	10.2.1 Has experience of project management involving people, and resources including financialresources. *Memiliki pengalaman mengelola proyek yang melibatkan orang, dan sumber daya termasuk sumber daya keuangan*. 10.2.2 Has experience of carrying out reviews and incorporating recommendations into action plans. *Memiliki pengalaman melakukan review dan memasukkan rekomendasi ke dalam rencana aksi.* 10.2.3 Has experience of managing clients, suppliers or sub-contractors. *Mempunyai pengalaman mengelola klien,pemasok dan subkontraktor*	10.2.1 Has experience of carrying out reviews and incorporating recommendations into action plans. *Memiliki pengalaman melakukan tinjauan dan mengkonsolidasikan rekomendasi rekomendasi ke dalam rencana tindak lanjut* 10.2.2 Has experience of managing clients, suppliers or sub-contractors. *Mempunyai pengalaman mengelola klien,pemasok dan subkontraktor*	Nil
		10.3 Can carry out functional safety assessment and audit of SIS. *Mampu melakukan penilaian dan audit keelamatan fungsional SIS*	10.3.1 Has experience of carrying out functional safetyassessment or audit of SIS. *Memiliki pengalaman melaksanakan penilaian keselamatan fungsional atau audit SIS.*	Nil	Nil	Nil
11	Safety Lifecycle Structure and	Can create an appropriate lifecycle structure and	11.1 Knows and understands how to create a lifecycle structure and planning process with defined	11.1 Knows and understands how to create a lifecycle structure and planning process with defined	11.1 Understands the SIS lifecycle structure.	Nil

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	Planning *Perencanaan dan struktur Lifecycle Keselamatan*	implement a planning process for all lifecycle activities. *Mampu membuat struktur lifecycle yang sesuai dan menerapkan proses perencanaan untuk semua aktivitas lifecycle.*	inputs, outputs and verification requirements for each activity. *Mengetahui dan memahami cara membuat struktur lifecycle dan proses perencanaan dengan input, output, dan persyaratan verifikasi yang ditentukan untuk setiap aktivitas.* 11.2 Has experience of creating a SIS lifecycle structure for planning and project management purposes. *Memiliki pengalaman membuat struktur lifecycle SIS untuk tujuan perencanaan dan pengelolaan proyek*. 11.3 Has experience of successfully implementing a lifecycle planning process. *Memiliki pengalaman yang berhasil menerapkan proses perencanaan lifecycle.*	inputs, outputs and verification requirements for each activity. *Mengetahui dan memahami cara membuat struktur lifecycle dan proses perencanaan dengan input, output, dan persyaratan verifikasi yang ditentukan untuk setiap aktivitas*. 11.2 Has experience of assisting to create a SIS lifecycle structure for planning and project management purposes. *Memiliki pengalaman membantu membuat struktur lifecycle SIS untuk tujuan perencanaan dan pengelolaan proyek*	*Memahami struktur lifecycle SIS*	

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