

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	1 of 146	

Los Angeles Refinery (LAR) #3 Project
Automation Modernization Program (AMP)
Definition
Basis of Design
For 2025 TAR Equipment

LA-200048

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	2 of 146	

Table of Contents

1.	Introduction	5
1.1	Background	5
1.2	Project Objectives	5
1.3	Abbreviations, Acronyms and Definitions	6
1.4	Design Philosophy	7
1.4.1	Applicable Standards.....	7
1.4.2	Common / General.....	10
1.4.3	BPCS – Console & Network Virtualization.....	11
1.4.4	BPCS – DCS Controllers	11
1.4.5	BPCS – PLC Controllers	12
1.4.6	Heaters & Boilers	15
1.4.7	RTE Compressors.....	17
1.5	Project Scope Summary.....	17
1.5.1	Refinery Areas and Units.....	17
1.5.2	Equipment & Systems List.....	19
1.5.3	TAR Alignment	22
2.	Project Roles & Responsibilities.....	23
3.	Design Basis	25
3.1	Design Conditions	25
3.2	Equipment Selection.....	25
3.3	Standards and Specifications.....	25
3.3.1	Industry Codes	25
3.3.2	Project Specifications.....	26
3.4	Engineering Drawings and Documents	27
3.4.1	P&IDs.....	27
3.4.2	Construction Work Packages.....	29
3.4.3	Loop Diagrams & Loop Folder	30
3.4.4	Instrument Datasheets	31
3.4.5	New Tag Request	31

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	3 of 146	

3.5	BPCS – Console & Network Virtualization.....	32
3.5.1	Architecture.....	32
3.5.2	Virtualization.....	32
3.5.3	Console Migration	34
3.5.4	Console Furniture.....	35
3.5.5	Console Station Hardware	35
3.5.6	Console Furniture Power	36
3.5.7	Console Communications.....	36
3.5.8	Console Lighting	36
3.5.9	Console Furniture Structural / Seismic Reinforcement.....	37
3.5.10	Console Room Flooring	37
3.5.11	Future Console Consolidation Considerations.....	37
3.5.12	Control Room - Floorplan Layout.....	38
3.5.13	Console Shutdown Buttons.....	40
3.6	BPCS – Hiway Migration Scope	40
3.6.1	Hiway Migration Sequence	40
3.6.2	Out of Service Tag Evaluation	40
3.6.3	Additional IO.....	42
3.6.4	C300 Controller Sizing.....	44
3.6.5	Phase 1 Migration - LCR6 to C300 (LCN3 Hiway 3)	46
3.6.6	Phase 2 Migration – LCR6 Demolition	47
3.6.7	Phase 3 Migration - LCR4 to C300 (LCN3 Hiway 2)	47
3.6.8	Phase 4 Migration – Hiway 1 (SFIA) Tag Migration.....	47
3.6.9	DCS Communication Tag Migration.....	48
3.6.10	Field Work.....	50
3.7	BPCS – PLC Controllers	53
3.7.1	BPCS PLC Scope Boundary	53
3.7.2	BPCS PLC Scope Summary	53
3.7.3	BPCS PLC Scope Detail.....	55
3.7.4	BPCS PLCs not in Scope.....	66
3.7.5	Safety PLCs	68
3.8	Heaters & Boilers	71
3.8.1	Mechanical & Piping.....	79

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	4 of 146	

3.8.2	Electrical – Power	88
3.8.3	Electrical – Instrument Signal Cable Routing.....	88
3.8.4	Electrical - Motor Controls.....	92
3.8.5	Instrumentation	92
3.8.6	O2 Analyzers, Stack Damper Position	93
3.8.7	Control Systems – SIS.....	94
3.8.8	Control Systems – DCS	96
3.8.9	Civil/Structural Infrastructure.....	96
3.8.10	Demolition	96
3.8.11	Operator Interface	97
3.9	RTE Compressors.....	98
3.9.1	Mechanical & Piping.....	100
3.9.2	Electrical – Power	100
3.9.3	Electrical – Instrument Signal Cable Routing.....	101
3.9.4	Electrical – Compressor Motor Controls	102
3.9.5	Steam – Compressor Turbine Controls.....	103
3.9.6	Instrumentation	103
3.9.7	Control Systems - SIS	103
3.9.8	Control Systems - DCS.....	104
3.9.9	Civil/Structural Infrastructure.....	104
3.9.10	Operator Interface	104
3.10	Buildings.....	106
3.10.1	Buildings In Scope	106
3.10.2	Fire Protection and Gas Detection.....	107
3.11	Fiber Infrastructure	107
3.11.1	LAR Carson	111
3.11.2	LAR Wilmington.....	113
3.12	Demolition, Major.....	113
3.13	Out-of-Scope.....	113
4.	Engineering Deliverables.....	114
5.	Training Requirements.....	115
6.	Appendix I – Reference Drawings & Documents.....	119
7.	Revision History.....	146

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	5 of 146	

1. Introduction

The Los Angeles Refinery (LAR) #3 Automation Modernization Program (AMP) project intends to upgrade the following equipment types:

- BPCS Consoles and Process Control Networks
- BPCS Controllers
- Programmable Logic Controllers (PLCs)
- Heater and Boilers Safety Instrumented System (SIS)
- RTE Compressor protection systems

As part of this effort various infrastructure and field instrumentation upgrades to meet the identified Heater and Compressor RSP compliance and/or the related LOPA Gaps using the RSP recommendations. The timing of this project is tied to 2025 & 2026 Turnarounds (TARs) and the NCE Outage in the #1 Reformer scheduled for 2025.

This project covers scope at both the Carson and Wilmington sites in Los Angeles, CA.

1.1 Background

BPCS – some components of the BPCS at LAR consist of legacy Honeywell TDC platforms which are considered end of life, technically obsolete, and unsupported.

PLCs – at LAR numerous PLCs from varying OEMs are technically obsolete and/or communicate to the DCS using legacy protocols requiring the maintenance of obsolete communication hardware.

Heater & Boiler SIS – at LAR, this equipment currently has identified LOPA gaps with California PSM compliance deadlines, gaps with MPC RSP compliance and are located in Safety PLCs that are completely or partially technically obsolete and unsupported.

Compressors – at LAR, this equipment currently has identified gaps in MPC RSP compliance and are located on Safety PLCs that are completely or partially technically obsolete.

1.2 Project Objectives

Primary project objectives are:

- Upgrade obsolete BPCS hardware and software for LCN3 Hiways 2 and 3.
- Heater Layers of Protection Analysis (LOPA) gap closure and RPS-1172-020 rev. 14, RSP-1172-024 rev. 13 and RSP-1139-010 rev. 11 compliance.
- Boiler Layers of Protection Analysis (LOPA) gap closure and RPS-1172-020 rev. 14 and RSP-1172-025 rev. 12 compliance
- Compressor (RTE) RSP-1172-031 rev. 5 compliance.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	6 of 146	

1.3 Abbreviations, Acronyms and Definitions

Term	Description	AMP Scope Specific Notes
CCB	Central Control Building	
BPCS	Basic Process Control System	
DCS	Distributed Control System	
DCP	DC Power Distribution Panel	24 or 125 VDC power panel
EIM	Ethernet Interface Module	
PLC	Programmable Logic Controller	
SPLC	Safety Programmable Logic Controller	
GP PLC	General Purpose Programmable Logic Controller	
SIS	Safety Instrumented System	
SIF	Safety Instrumented Function	
IPF	Instrumented Protective Function	
SPLC	Safety PLC	aka Logic Solver
UPC	Unit Control Panel	Houses a Triconex for RTE controls
LCP	Local Control Panel	
LOPA	Layer of Protection Analysis	
LEPIU	Low Energy Peripheral Interface Unit	TDC2000 Thermocouple / RTD Input Boxes
LLPIU	Low Level Peripheral Interface Unit	TDC2000 24VDC Discrete and 4-20 Ma Analog Input Boxes
N&V	Network and Virtualization	
HAZOP	Hazard and Operability Analysis	
PHA	Process Hazard Assessment	
PCN	Process Control Network	
PCDI	Peer Communication Data Interface	
RSP	Marathon Refining Standard Practices	
RTE	Rotating Turbomachinery Equipment	Compressors
Compr.	Compressor	
Htr.	Heater	
AMP	Automation Modernization Program	
FG	Fuel Gas	
PG	Pilot Gas	
AML	Approved Manufactures List	
CWP	Construction Work Package	
EWP	Engineering Work Package	Non-construction or Indirect construction impacting deliverables (i.e., P&IDs, Test procedures, graphics, configuration)
SI	SMART Instrument applications	Formerly SPI, repository for loop, wiring diagrams and instrument datasheets

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	7 of 146	

1.4 Design Philosophy

1.4.1 Applicable Standards

All applicable MPC standards and specifications will apply to the project design, as defined in the AMP Required Project Documents list (AMP-GBL-PM-LST-0002, Rev 6, Dated 01 Feb 21). Table 1 defines items not covered by this list, including industry and project-specific and site-specific standards and specifications. Following project design basis approval, all specification and standard changes, additions, or deletions are subject to change management and applicable levels of approval.

Table 1.4.1 Applicable standards and specifications

Document Number	Document Title	Rev.
TES-015LLA	LA Refinery Non-Process Basis of Design	0
TENV-113	SCAQMD Best Available Control Technology (BACT) Guidelines and Requirements	04/21/2020
TENV-207	Fugitive Emissions	03/27/2019
AMP-LAR-AUT-BOD-0001	LAR Fiber Optic Basis of Design	3
AMP-LAR-AUT-BOD-0002	LAR PLC/UPC Panel UPS Basis of Design	2
RPS-1172-020	MPC SIS General Application Standard	14
RSP-1172-024	MPC Heater Application Standard	13
RSP-1172-025	MPC Fired Boiler Application Standard	11
RSP-1172-031	MPC Minimum Protective Systems for Compressor Application Standard	5
LAR-00-040	Tesoro LAR Engineering Specification	2
HSS-203	LAR Demo Procedure	-
DCS Demo	DCS Demo Procedure	-

The following RSP waivers apply to the LAR3 project. These waivers are necessary based on scope reductions and design constraints in the LAR3 project.

Table 1.4.2. RSP Waivers

Equipment Description	Reason for waiver	RSP Section waived
RW-0004.087.06 REF#1 Reformer Recycle Compressor (Turbine Centrifugal)	Existing KO drum level switch is at high alarm level. Shutdown level needs to be as high as possible to give operations more time to empty the vessel. Current new installation only has 1 new level transmitter being installed to cover the shutdown level. Per Robby Jackson 2002D is not required captured in meeting minutes from the RTE descope meeting.	RSP 1172-031 Section 5.6 High Liquid Level Trip

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	8 of 146	

Equipment Description	Reason for waiver	RSP Section waived
RW-0005.087.03 Desulf#1 Desulfurizer Feed Gas Compressor (Turbine Reciprocating)	Existing KO drum level switch is at high alarm level. Shutdown level needs to be as high as possible to give operations more time to empty the vessel. Current new installation only has 1 new level transmitter being installed to cover the shutdown level. Per Robby Jackson 2002D is not required captured in meeting minutes from the RTE descope meeting.	RSP 1172-031 Section 5.6 High Liquid Level Trip
RW-0006.087.03 Desulf#1 Desulfurizer Common Spare Compressor (Turbine Reciprocating)	Existing KO drum level switch is at high alarm level. Shutdown level needs to be as high as possible to give operations more time to empty the vessel. Current new installation only has 1 new level transmitter being installed to cover the shutdown level. Per Robby Jackson 2002D is not required captured in meeting minutes from the RTE descope meeting.	RSP 1172-031 Section 5.6 High Liquid Level Trip
RW-0022.087.06 Desulf#1 Desulfurizer Recycle Compressor (Motor Centrifugal)	Existing KO drum level switch is at high alarm level. Shutdown level needs to be as high as possible to give operations more time to empty the vessel. Current new installation only has 1 new level transmitter being installed to cover the shutdown level. Per Robby Jackson 2002D is not required captured in meeting minutes from the RTE descope meeting.	RSP 1172-031 Section 5.6 High Liquid Level Trip
RW-0004.087.06 REF#1 Reformer Recycle Compressor (Turbine Centrifugal)	No new Tricon using relay logic	RSP 1172-031 Section 5.1 General
RW-0005.087.03 Desulf#1 Desulfurizer Feed Gas Compressor (Turbine Reciprocating)	No new Tricon using relay logic	RSP 1172-031 Section 5.1 General
RW-0006.087.03 Desulf#1 Desulfurizer Common Spare Compressor (Turbine Reciprocating)	No new Tricon using relay logic	RSP 1172-031 Section 5.1 General

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	9 of 146	

Equipment Description	Reason for waiver	RSP Section waived
RW-0022.087.06 Desulf#1 Desulfurizer Recycle Compressor (Motor Centrifugal)	No new Tricon using relay logic	RSP 1172-031 Section 5.1 General
RW-0047.087.06 Alky Refrigerant Compressor (Turbine Centrifugal)	No new Tricon using relay logic	RSP 1172-031 Section 5.1 General
RW-0053.087.06 FCC Pignone 1st Stage Compressor (Turbine Centrifugal)	No new Tricon using non SIL PLC	RSP 1172-031 Section 5.1 General
RW-0057.087.32 FFHDS Prism Compressor (Motor Reciprocating)	No new Tricon using relay logic	RSP 1172-031 Section 5.1 General
RW-0047.087.06 Alky Refrigerant Compressor (Turbine Centrifugal)	EIV Position Shutdown not required, valve not an EIV. Existing valve can still cause a blocked compressor case.	RSP 1172-031 Section 5.8 EIV position
Alky FTE Network	Complete fiber diversity is not feasible near LCR-6 building. There is only one viable path to approach the building (from the west). Plan is to run A/B fiber in separate conduits, maximizing the separation both horizontally and vertically (approximately 60ft).	AMP-LAR-AUT-BOD-0001
Site-to-Site fiber	Site-to-site A/B fiber diversity – the LARIC route and LASR route cross in Wilmington near the LARIC tunnel at the road crossing between the fiber box and the piperack near the LARIC skid.	AMP-LAR-AUT-BOD-0001

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	10 of 146	

1.4.2 Common / General

The following are non-Equipment or System specific design philosophy items. If not specifically stated, "Control System" refers to BPCS, SIS and RTE controls and/or protection equipment.

Control System Cabinets / Enclosures

- Will not be designed or built to withstand a significant seismic event. The civil / structural building supporting the control system cabinets will meet seismic requirements. The AMP project made this determination based on the assumption that a catastrophic seismic event will affect the process equipment and piping in a more significant way than control equipment and also because control systems are configured and wired to fail to a safe state.
- Will meet UL508A certification and labeling requirements.
 - Honeywell Experion cabinets will meet the UL508A but may be labeled by an alternate NRTL (Honeywell currently uses CSA US/CA certification) for Experion C300 controller cabinets.

Control System Signal Wiring

- All control systems (BPCS, SIS, RTE, and PLC) will use 24VDC I/O.
 - Existing SIS & RTE wiring at LAR-W is often 120VAC.
 - WHCU Safety Manager is currently 120VAC and the new installations will follow suit.
 - HGU-2 shutdown relays are currently 120VAC and will be replaced with 24VDC SIS systems.
- New SIS and BPCS signals will be segregated from each other in junction boxes, cable tray and home run cables
- Cable tray dividers will be used between SIS and BPCS homerun cables when being run in the same cable tray
- When connecting to an existing junction box, follow current LAR standards for separation of digital and analog cables. Newly installed analog and discrete signals may share junction boxes and home run cabling for like systems with approval from LAR Stakeholders.

Control System Cabinet Power

- Per SP-60-30 Section 2.4 Only 1 UPS is required when a single process unit is affected.
- DCS & PCN – all new DCS and PCN cabinets will be powered with one UPS source and one Instrument power source. DCS cabinets will utilize redundant Honeywell 20A/24VDC power supplies per each side of a DCS cabinet.
- SIS - all new SIS cabinets will be powered with one UPS source and one Instrument power source. A 3rd utility power feed will be provided to power lamps and other utilities (including a laptop receptacle).
- Remote SIS cabinets will be powered by either 24/125VDC power from a DCP panel inside the rackroom, or from two lighting panels fed from separate feeders. If the lighting panel option is used a UPS battery system will be added to the Remote SIS cabinets or a separate cabinet. Light off panels will follow the same philosophy.
- RTE – all RTE cabinets will be powered with one UPS source and one Instrument power source.
- PLCs – Except as noted otherwise, power for PLC's will follow AMP-LAR-AUT-BOD-0002, which specifically addresses this topic.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	11 of 146	

1.4.3 BPCS – Console & Network Virtualization

- AMP LAR Fiber Optic Basis of Design (AMP-LAR-AUT-BOD-0001)
- Console segregation, quantity, and capacity
 - Crude 1 & 2 – To maintain the same operator control capabilities, the existing US/GUS OEP Keyboards will be replaced with a virtual ESC complete with Thin Client (quad monitor). One physical rack-mount ESC complete with Thin Client (quad monitor) will be installed to mitigate the potential for total virtual host failure. Crude 1 and 2 will each utilize 1 physical quad and 1 virtual quad station. They are on the same FTE and can therefore back one another up in the event of a failure or during preventative maintenance of the thin clients.
 - ISOM, ALKY, and SRU - To maintain the same operator control capabilities, the existing US/GUS OEP Keyboards will be replaced with virtual ESCs with Thin Client (dual monitor). A single Tower PC based console station (quad monitor) will be installed to mitigate the potential for total virtual host failure. ISOM, ALKY, and SRU will utilize 2 dual screen virtual stations and one physical quad station to ensure at least 2 machines are available in case of station outage or maintenance.
 - Each operating console is its own Experion cluster which shall be validated as part of the Network & Virtualization Community Roadmap.
 - Higher Honeywell annual license costs
 - Simpler and lower cost long term maintenance
- While it is understood that in the future LAR may decide to implement a Central Control Building (CCB) in/near the Campus One building, the process control network and virtualization design has been developed with a scope independent of a CCB while infrastructure to support future integration of a CCB is considered as part of the design (i.e. attempt to minimize re-work should a CCB be implemented in the future).

1.4.4 BPCS – DCS Controllers

- Control Firewalls (CF9) will be shared for up to three (3) C300 controllers, after which a new control firewall will be installed. This leaves at least one spare port on each control firewall for a future C300.
- DCS Controller – C300 capacity and segregation
 - 50% maximum processor loading
 - C300(s), and DCS points assigned to it, will be segregated by unit based on turnaround block. This will allow the C300 to be taken down during a major turnaround, if ever necessary.
 - Separate C300 for PCDI/EIM interface – PCDI/EIM connections when needed will be done using a separate C300 from those already used for hard-wired I/O. PCDI/EIM communication that requires control logic interaction with control modules located on hard-wired C300s will be evaluated during detail design and implementation phases of the project based on potential for peer-to-peer communication saturation to determine if the PCDI/EIM connection needs to be assigned to a particular hard-wired I/O C300.
- DCS I/O Spare Capacity:
 - 40% installed spare I/O per I/O type
 - 50% cabinet I/O expansion capacity
- Hiway 2 LEPIU field located Mux Signals
 - These signals will be converted to 4-20 Ma with new transmitters installed in the field and migrate to standard AI modules.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	12 of 146	

- Hiway 3 LLPIU signals located in rack rooms
 - These signals will be converted to 4-20 Ma with new transmitters installed in the marshalling rack and migrate to standard AI modules.
- I/O module types.
 - Series C dedicated signal type I/O (AI, AO, DI, DO, etc.) will be used.
- Migration of HPM controllers is excluded from this project scope.

1.4.5 BPCS – PLC Controllers

BPCS PLCs are segregated into three types:

- General Purpose PLCs
- 3rd Party Device Communications
- Safety PLCs

BPCS PLCs are designated with the following migration status:

- Migrate to DCS – Remote I/O
- Migrate to DCS – Hardwired
- Upgrade PLC hardware & firmware, communications migrate to Modbus Ethernet
- Migrate communications only to Modbus Ethernet via protocol converter

Unless otherwise notes, power for PLCs will follow the AMP LAR PLC/UPC Panel UPS Basis of Design (AMP-LAR-AUT-BOD-0002)

3rd Party Device Critical & Non-Critical Soft Points

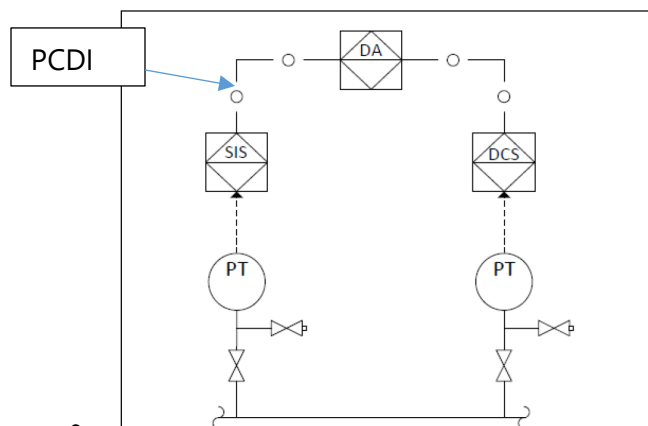
- **3rd Party Device *Critical* Soft Points:**
 - Definition: any point used in a DCS control module
 - Communication Protocol to DCS:
 - Primary: PCDI
 - Alternate: SCADA (only if 3rd party device is not capable of PCDI)

Exceptions may be granted using proper change management to the AMP specifications.

- Examples:
 - 1oo1D Deviation Alarm – analog signal coming from the SPLC to the DCS to allow the DCS to perform the deviation alarm calculation is to be sent to the DCS via PCDI

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	13 of 146	

3.13.2.2 Common Applications: Most safety interlock applications



- Trip Response signal to a control valve – SPLC trip alarm signal is sent to the DCS, to be used with the Experion PID function block “Safety Interlock pin” to set an control valve to MAN and 0%. This trip indication would sent to DCS via PCDI.
- DCS Calculation Point from Analyzer PLC – Analyzer PLC sends soft analog signal from an analyzer or Analyze PLC that is used as a variable in a calculation point in the DCS. This soft analog signal would be PCDI.

• 3rd Party Device **Non-Critical** Soft Points

- Definition: any point used only for indication and alarm on DCS (not used in a DCS control module)
- Communication Protocol to DCS: SCADA

General Purpose PLCs - BPCS General Purpose PLC scope is defined by any existing PLC residing in or communicating with DCS units/consoles being migrated as part of the LAR AMP Project. PLC outside of these areas are not included in that LAR AMP project. These are most often Allen Bradley family PLCs, but other manufactures could be encountered.

Objective is to upgrade the functionality performed in the PLC to non-Obsolete equipment and migrate communication to the DCS (when applicable) to Modbus Ethernet TCP/IP protocol allowing for the demolishing of legacy TPS communications interfaces (e.g., PLCG, EPLCG, DHPs)

The following are the General-Purpose PLC standard models LAR3 will migrate hardware and firmware for standardization (which are based on LARB 2021 scope):

Description	Device Type	Firmware	Notes
AB MicroLogix 1400	1766-L32 ML-1400	SLC500 V 12	Hardware models and version to be confirm at Implementation following OEM product roadmap and in consultation with MPC
AB Control Logix Control Processor	1756-L81E	Studio5000 V 32.014	
AB Control Logic Ethernet	1756-EN2T	V 11.003	
AB Control Logix Modbus RTU	Prosoft MVI56-MCM		
AB Control Logix	Prosoft MVI56-MNETC		

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	14 of 146	

Description	Device Type	Firmware	Notes
Modbus TCP			

3rd Party Devices Communications – 3rd Party Devices are any item communicating with the DCS that are not a General Purpose PLC or Safety PLC (i.e. Bentley Nevada system, Electrical Relay with communications capacity, etc.). The scope is defined by any existing 3rd Party Device communicating with DCS units/consoles being migrated as part of the LAR AMP Project. 3rd party devices outside of these areas and not communicating with the DCS are not included in that LAR AMP project.

Objective is to migrate communication to the DCS to Modbus Ethernet TCP/IP protocol allowing for the demolishing of legacy TPS communications interfaces (e.g. PLCG, EPLCG, DHPs)

Communications to DCS for GP PLCs & 3rd Party Devices – Each PLC and 3rd Party Devices needs to be evaluated on a case-by-case basis to determine the best approach to communicating with an Experion platform, considering migration cost, reliability and consistency and long-term maintenance. The following is the prefer priority for communications with the DCS and is largely dependent on the communication protocol currently being used (although if PLC hardware is being upgraded, a case may be made for changing protocols based on the evaluation of an individual PLC):

1. Direct Modbus TCP from PLC currently using Modbus RTU – Connection from PLC or 3rd Party Device Ethernet communications modules direct to a 3rd Party Switch / Firewall / FTE Switch. Use redundant ports/network connections where supported.
2. Indirect Modbus TCP from PLC currently using Modbus RTU – Connection from legacy PLC or 3rd Party Device serial communication modules, through a Serial-to-Ethernet Modbus protocol converter to a 3rd Party Switch / Firewall / FTE Switch. Use this method when outage is not permitted or hardware upgrade is not included in scope and/or comm module cannot be added on the run.
3. Direct Ethernet IP from PLC currently using legacy PLC-2 A-B communications – Connection from PLC comm module directly to 3rd party switch and EIM module. Use redundant communication where possible.
4. Indirect Ethernet IP from PLC currently using legacy PLC-2 A-B communications – Connection from legacy PLC or 3rd party device serial communication module through a serial-to-ethernet protocol converter to a 3rd party and EIM module. Use redundant communications if possible.

Safety PLCs – AMP is responsible for migration of existing SPLC software and hardware when the SPLC is used (or will be used via AMP project scope) for Heater and/or Compressors SIF and/or IPF functions, as AMP is responsible for LOPA Gap Closure and RSP compliance for Heaters (RSP-1172-021) and Compressors (RSP-1172-028). AMP scope does not include addressing software and hardware obsolesces for SPLCs that are not used for Heaters or Compressors except for communication to the BPCS.

For SPLCs that have soft communication connection to the DCS, AMP is responsible for migrating that communication to Experion as part of the BPCS obsolescence objectives (i.e., migrating off of EPLCG, PLCGs, DHPs).

HPM migrations have been deferred for AMP until 2026. Therefore, for Units/Consoles that are HPMs and have a SPLC associated with them (i.e. Heater TMR and Heater control points are on an HPM) the migration of the

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	15 of 146	

SPLC communication from the legacy TPS system (i.e., PLCG/ EPLCG) to Experion (PCDI & SCADA) will occur at the same time as the HPM migration, not by default when the associated Unit/Console front end is being migrated to Experion unless there is existing Experion infrastructure and/or there are known quantifiable issues that have impact on Operability and require migration earlier to resolve the issues.

New Triconex Safety PLCs are being installed or existing ones upgraded by AMP to accommodate Heater and RTE equipment protection scope. Due to nature of that scope, installation and commissioning of these SPLC's may be done before a Console/Unit has been migrated to Experion.

When tying in a Triconex to a Console/Unit that is controlling from legacy Honeywell TPS DCS communications should be established via the following:

- Primary – EPLCG or PLCG
- Secondary - Modbus TCP (SCADA) to existing Experion Server (ESVT). This is used to simplify passing information to Level 3 applications, such as Historian (PI / PhD).

When tying in a Triconex to a Console/Unit that is controlling from an Experion DCS platform communication should be established via the following:

- Primary – Redundant Modbus TCP or Ethernet IP (C300 PCDI/EIM and SCADA)
 - See section 1.4.4 for philosophy regarding PCDI vs. SCADA and required BPCS hardware.

CEMS PLCs – upgrade of CEMS Analyzer Shelter PLC hardware is excluded from AMP scope as the Refinery already has another CEMS Upgrade program addressing these devices. AMP will treat CEMS PLCs as 3rd Party devices, therefore only addressing their soft communications with the DCS.

1.4.6 Heaters & Boilers

- Fuel Gas & Pilot Gas Piping
 - MPC constructability preference is to install new FG/Pilot valve skids to reduce TAR effort and cost. LAR is typically congested making installation of new FG skids a case-by-case basis. The considerations for a new FG skid are:
 - Available plot space to install skid
 - Proximity of identified plot space to FG header and burners, therefore determining the amount of piping required to tie-in FG skid.
 - Availability and loading of structural steel for routing new FG piping tie-in segments.
 - The Definition design basis for FG & PG piping design is:
 - All chopper stations will be stick built. Congestion around the chopper valves makes skid building impractical or impossible for most units. Skids were considered for Carson #1 Reformer heaters RW-0025 & RW-0026, but budgetary estimates show that stick building is the more cost-effective option.
 - Valve selection for fuel gas chopper stations will be in accordance with TENV-113 standard for bellows sealed gate valves.
 - Piping design will consider valve handwheel operability and accessibility. Operation's agreement of valve accessibility will be reviewed and approved during implementation 60% and 90% model reviews.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	16 of 146	

- All new fuel gas chopper stations will be designed to include a bypass lineup per MPC RSD-1172-024-01 to enable easy maintenance of chopper valves outside a TAR.
- Flange bolt holes shall straddle the North-South and/or East-West vertical center lines.
- X-Ray 5% of all New pipe to New pipe welds.
- X-Ray 100% of all New pipe to Old pipe welds
- 100% visual inspection of all welds
- Painting, Coating, Insulation Requirements
 - Primarily associated with Heater Fuel Gas and Pilot Gas piping modifications.
 - Pipe to be coated per SP-80-20, coating systems to be determined for each equipment installation during Detailed Engineering.
 - Piping to be replaced in-kind with existing insulation shall be re-insulated per SP-80-40
- Electrical
 - Motor Controls – Motor control related I/O (e.g., digital output trip signal to FD Fan motor start/stop circuit) will be 24VDC loop from the Safety PLC to an interposing relay located at the MCC or an adjacent relay panel. 120VAC CPT power or 125VDC control power will remain in the MCC area to meet NFPA 70e personal safety criteria.
 - Cable Tray will be used to route new SIS home run cables over long distances. Fiber routed in tray will be armored, loose fill.
 - Light off panels for heaters/boilers with forced draft (FD) or induced draft (ID) will house the ignitor and flame detector transmitters. Dual power circuits from either rackroom 24/125VDC DCP fed from a UPS, or dual lighting panel circuits fed from separate feeder with a battery UPS backup are required as flame detection is a SIF.
- Heaters – FFHDS, LHU, FCC, NHDS
 - In situations of dual solenoid panels, one will be demolished, and air piping from the available valve will be routed to the remaining solenoid panel. Software verification or configuration will be made for a 2oo2D trip of both valves.
- Logic Solver
 - Qualified existing logic solvers can be used for the new/modified GAP instrumentation and logic. This includes existing Triconex version 4.9 or greater and Safety Manager expansion if the existing install currently has a Safety Manager.
 - New logic solvers will be Schneider Electric Tricon CX in UL508A cabinets.
 - Existing IPF only functions (i.e., non-SIF) currently wired to the existing Safety PLC will remain in the SPLC to allow for comprehensive First Out diagnostic capabilities
 - Existing relay logic systems will be migrated to Tricon CX in their entirety to avoid mix-and-match systems and preserve existing startup and shutdown logic that does not require modification per RSP requirements.
 - Any existing I/I signal splitter used for wiring a single field transmitter to both the BPCS and IPF will also be demolished.
 - If the field transmitter is used for both an IPF trip function and BPCS control function (most common case), then a new field transmitter will be installed. An evaluation will need to be performed on a case-by-case basis to determine if additional taps/nozzle is required
 - If the field transmitter is used for both a trip function and BPCS indication only or calculation, then the hardwired signal will be moved to the SIS and passed across 'soft' to replicate the signal in the BPCS

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	17 of 146	

1.4.7 RTE Compressors

- Motor Controls – motor control related I/O (e.g., digital output trip signal to Compressor motor start/stop circuit) will be 24VDC loop from the Safety PLC / Unit Control Panel (UPC) to an interposing relay located at the MCC or an adjacent relay panel. 120VAC CPT power or 125VDC control power will remain in the MCC area to meet NFPA 70e personal safety criteria.
- Vibration Monitoring Panel - Location – these will be located on existing compressor decks, whenever possible.
 - BN1900/65 Panel (RSD-43-01-01) – vendor velometer armored cables are limited to 99FT in length, therefore that sets the maximum distance that a panel can be located away from the compressor.
- Vibration Monitoring Panel - Power (BN1900/65) – since these are field mounted and 120VAC UPS power circuits are not to leave the Rackroom / RIE, the following are options for providing redundant power to these devices:
 - Rackroom/RIE 24V /125VDC DCP – redundant 24V /125VDC power supply panel with primary feed as a 120Vac UPS circuit and secondary feed with 120Vac UPS or other circuit (i.e., lighting panel, instrument panel).
 - Field 24V DCP w/ Battery Back-Up – redundant 24V power supply panel with primary feed from a 120Vac field lighting panel circuit with battery backup and secondary feed from a 120Vac field lighting panel circuit.
 - Field 24V DCP w/ diverse sources – redundant 24V power supply panel with primary feed from a 120Vac field lighting panel circuit and secondary feed from a 120Vac field lighting panel circuit that is fed from a different MCC bus than the primary Lighting panel.
- KO Drum nozzles and Level Bridle piping modifications
 - Flange blot holes shall straddle the North-South and/or East-West vertical center lines.
 - X-Ray 5% of all New pipe to New pipe welds.
 - X-Ray 100% of all New pipe to Old pipe welds
 - 100% visual inspection of all welds
- Painting, Coating, Insulation Requirements
 - KO Drum nozzles and Level Bridle piping modifications
 - Pipe to be coated per SP-80-20, coating systems to be determined for each equipment installation during Detailed Engineering.

1.5 Project Scope Summary

1.5.1 Refinery Areas and Units

The project scope will take place in the following process units / locations:

Site	Area Team	Console / Operating Group	Unit Description / Location
Carson	1	#1 Reformer	#1 Reformer / Desulfurizer
Carson	1	#1 Reformer	LHU
Carson	1	#1 Reformer	FFHDS
Carson	2	FCC	FCC Reaction
Carson	2	FCC	FCC Gas Compression
Carson	N/A	N/A, South Area	SACCR

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	18 of 146	

Site	Area Team	Console / Operating Group	Unit Description / Location
Carson	3	1CRUDE	1 Crude
Carson	3	1CRUDE	51 Vac
Carson	3	1CRUDE	1&2 Dehex
Carson	3	2CRUDE	2 Crude
Carson	5	Alky	Alky
Carson	5	Alky	Butamer
Carson	5	ISOM	NHDS
Carson	9	SRU	
Wilmington	7	HPD West (HCU)	HCU
Wilmington	7	HPD West (HTU4)	HGU1
Wilmington	7	HPD West (HTU4)	HGU2

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	19 of 146	

1.5.2 Equipment & Systems List

Table 1 lists all the systems and equipment that are part of project scope.

Table 2. Equipment list

- Equipment in ***italics*** is part of BPCS console in LAR3 scope, but associated controllers removed from LAR3, as they will be addressed when the associated units HPM's are migrated to C300 in a future LAR AMP project. Portions of the soft tags will be migrated as part of LAR3.

Site	Area Team	Console	Unit	Equipment Type	Equipment / System Description	Ctrl Net	Sub Ctrl Net	Equipment #	Location Vernacular (Official)
LARC	1	1REF	1REF	HEATER	#1 Desulfurizer Heater			RW-0026-214.09	
LARC	1	1REF	1REF	HEATER	#1 Reformer Heater			RW-0025-214.09	
LARC	1	1REF	1REF	RTE-C	#1 Ref Recycle Reciprocating Compressor			RW-0004.087.06	
LARC	1	1REF	1REF	RTE-R	#1 Ref/Desulfurization Feed Reciprocating Compressor			RW-0005.087.03	
LARC	1	1REF	1REF	RTE-R	#1 Ref/Desulf. Common Spare Reciprocating Compressor			RW-0006.087.03	
LARC	1	1REF	1REF	RTE-C	#1 Desulf. Recycle Centrifugal Compressor			RW-0022.087.06	
LARC	1	1REF	FFHDS	HEATER	Reactor Feed Heater			RW-0048	
LARC	1	1REF	FFHDS	RTE-R	Prism Compressor			RW-0057.087.32	
LARC	1	1REF	LHU	HEATER	Feed Heater			RW-0028-214.09	
LARC	2	FCC	FCC	HEATER	Fresh Feed Born Heater			RW-0023	
LARC	2	FCC	FCC	RTE-C	Pignone 1st stage compressor			RW-0053.087.06	
LARC	3	1CRUDE	1CRUDE	CONSOLE / NET	1CRUDE Console / Server	LCN05		US1-3,7-8	SACCR (B1085)
LARC	3	1CRUDE	1CRUDE	CONSOLE / NET	1CRUDE Console (Ops Shelter)	LCN05		US13	LCR-3
LARC	3	1CRUDE	1CRUDE	BPCS PLC	South Area CEMS Data Concentrator (PLC5)	LCN05	HWY04	31PLC-9036	SACCR (B1085)
LARC	3	1CRUDE	1CRUDE	BPCS PLC	South Area CEMS Data Concentrator (CLX)	LCN05	HWY04	31PLC-xxxx	SACCR (B1085)

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	20 of 146	

Site	Area Team	Console	Unit	Equipment Type	Equipment / System Description	Ctrl Net	Sub Ctrl Net	Equipment #	Location Vernacular (Official)
LARC	3	1CRUDE	51VAC	BPCS PLC	1CRUDE Unit Alarm PLC			51PLC-9910	LCR-3 Ops Shelter
LARC	3	1CRUDE	NESHAPS	BPCS PLC	NESHAPS Kemp Air Dryer			35PLC-9901A	NESHAPS
LARC	3	1CRUDE	DEHEX	BPCS PLC	Dehex Kemp Air Dryer			38PLC-9901D	Dehex
LARC	3	1CRUDE	1CRUDE	BPCS PLC	Crude Heater 31H-1 TMR			RW-0001-214.09	LAR2 RIE (New)
LARC	3	1CRUDE	51VAC	BPCS PLC	#51 Vacuum Heater TMR			RW-0052-214.09	LAR2 RIE (New)
LARC	3	2CRUDE	2CRUDE	CONSOLE / NET	2CRUDE CONSOLE / Server	LCN05		US4-6,9,10	SACCR (B1085)
LARC	3	2CRUDE	2CRUDE	CONSOLE / NET	2CRUDE CONSOLE (OPS SHELTER)	LCN05		US11	CRUDE ROW OP SHELTER
LARC	5	ALKY-C	ALKY-C	CONSOLE / NET	ALKY-C Console / NET / VIRTUALIZATION	LCN03		US5,9,11-16	SACCR (B1085)
LARC	5	ALKY-C	ALKY-C	VIRT	NET / VIRTUALIZATION			NEW VIRT	LCR-7
LARC	5	ALKY-C	ALKY-C	UPS	UPS			NEW UPS	LCR-7
LARC	5	ALKY-C	ALKY-C	CONSOLE / NET	ALKY-C Console (Ops Shelter)	LCN03		US01	LCR-6 (B529)
LARC	5	ALKY-C	ALKY-C	CONSOLE / NET	ALKY-C Console (Ops Shelter) (Demo Only)	LCN03		US07	LCR-4 (B426)
LARC	5	ALKY-C	ALKY-C	BPCS DCS	DCS Controllers	LCN03	HWY03	CBs/HLPIU & LEPIU	LCR-6 (B529)
LARC	5	ALKY-C	ALKY-C	BPCS DCS	3rd Party Device(s)	LCN03	HWY03	DHP-B10	LCR-6 (B529)
LARC	5	ALKY-C	ALKY-C	BPCS PLC	PLC - Alky Ref Compressor	LCN03	HWY03	DHP-B10	Alky. Compressor LCP
LARC	5	ALKY-C	MEROX	BPCS DCS	DCS Controllers	LCN03	HWY02	CBs/HLPIU & LEPIU	LCR-4 (B426)
LARC	5	ALKY-C	BUTAMER	BPCS DCS	3rd Party Device(s)	LCN03	HWY10	DHP-B13	LCR-7 (B1086)
LARC	5	ALKY-C	BUTAMER	BPCS DCS	3rd Party Device(s)	LCN03	HWY10	DHP-B14	LCR-7 (B1086)
LARC	5	ALKY-C	BUTAMER	BPCS DCS	3rd Party Device(s)	LCN03	HWY10	DHP-B15	LCR-7 (B1086)
LARC	5	ALKY-C	BUTAMER	BPCS DCS	3rd Party Device(s)	LCN03	HWY10	PLCG##	LCR-7 (B1086)
LARC	5	ALKY-C	MEROX	BPCS PLC	Unit Alarm PLC			44LCP911	Merorx - Old Brick bldg
LARC	5	ALKY-C	ALKY-C	BPCS PLC	Alky Kemp Air Dryer			44PLC-9901E	Alky
LARC	5	ALKY-C	BUTAMER	BPCS PLC	Butamer Triconex	LCN03	HWY10		LCR-7 (B1086)

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	21 of 146	

Site	Area Team	Console	Unit	Equipment Type	Equipment / System Description	Ctrl Net	Sub Ctrl Net	Equipment #	Location Vernacular (Official)
LARC	5	ALKY-C	BUTAMER	BPCS PLC	Butamer Dryer PLC AB	LCN03	HWY10		Butane Shelter/SACCR
LARC	5	ALKY-C	ALKY-C	RTE-C	Refrigerant Compressor			RW-0047.087.06	
LARC	5	ISOM	NHDS	HEATER	Reactor Feed Heater			RW-0053	
LARC	5	ISOM	ISOM	CONSOLE / NET	CONSOLE / NET	LCN06		US1-8	SACCR (B1085)
LARC	5	ISOM	ISOM	CONSOLE / NET	CONSOLE / NET (OPS SHELTER)	LCN06		US09, 10	LCR-7
LARC	5	SRU	SRU	CONSOLE / NET	Console & PCN - Sulphur Plant (SRU)	LCN05		US35-39	SACCR (B1085)
LARC	5	SRU	SRU	CONSOLE / NET	SRU Console (Ops Shelter)	LCN06		US46,58	SRU Ops Shelter (B106)
LARC	5	SRU	SRU	BPCS PLC	Unit Alarm PLC				SRU Ops Shelter (B106)
LARC	5	SRU	SRU	BPCS PLC	TRS Process Analyzer				NE of Sulfur plant
LARW	7	HPDW	HCU	RTE-C	Recycle Gas Compressor			C-93	
LARW	7	HPDW	HCU	HEATER	Reactor No. 1 H2 Heater			H-300	
LARW	7	HPDW	HCU	HEATER	Reactor No. 2 H2 Heater			H-301	
LARW	7	HPDW	HCU	HEATER	Reactor No. 3 H2 Heater			H-302	
LARW	7	HPDW	HCU	HEATER	2nd stage charge heater			H-303	
LARW	7	HPDW	HCU	HEATER	Reboiler Heater			H-304	
LARW	7	HPDW	HGU2	HEATER	Reformer Heater			H-42	
LARW	7	HPDW	HGU2	BOILER	Auxiliary Boiler			H-43	
LARW	7	HPDW	HGU2	RTE-R	Feed Gas Compressor "A"			C-146	
LARW	7	HPDW	HGU2	RTE-R	Feed Gas Compressor "B"			C-147	
LARW	7	HPDW	HGU2	RTE-R	H2 Product Compressor			C-148	
LARW	7	HPDW	HGU1	RTE-R	H2 Offsite Reciprocating Compressor			C-84	

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	22 of 146	

1.5.3 TAR Alignment

The following table outlines the expected turnarounds that the LAR3 project will be commissioning scope in. This information is based on the Econ and Planning Long Range Plan – September 2022.

TAR Block	Unit	Start Date	Duration [Days]	Type	Heater/Boiler	RTE	DCS (Cold)	PLC	Notes
Other	#1REF	10/1/2025	21	NRE	X	X			
Other	NHDS	1/1/2026	14	NRE	X				
FCC Block	FCC	10/1/2025	52	TAR	X	X			
	Alky-C	10/1/2025	52	TAR		X	X	X	
	Butamer-C	10/1/2025	52	TAR				X	
	FFHDS	10/1/2025	40	TAR	X	X			
	LHU	10/1/2025	52	TAR	X				
	Sulfur Plant Claus A	10/1/2025	38	TAR					TMR Comms Migration w/ HPM (Future)
	Sulfur Plant Claus D	10/1/2025	38	TAR					TMR Comms Migration w/ HPM (Future)
HGU-2	HGU-2	6/29/2025	30	TAR	X	X			
HCU-W Block	HCU-W	10/1/2026	36	TAR	X	X			

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	23 of 146	

2. Project Roles & Responsibilities

The table below outlines the expected different roles on the LAR AMP project. Depending on the qualifications of the Engineering Firm some of these roles may be fill by the same company:

Role Name	Department / Company	Responsibility Description	Notes
General			
LAR AMP PM	MPC MPO	Overall project management	
Eng. Contractor	Paton	Project Management Project Schedule Project Controls CWP development Eng. Item Specification Requisition Engineering	
Procurement	TBD	RFQ Process Procurement Status Expediting Receiving & Inspection	
Construction	MPC Construction	Constructability Review Construction Execution	
BPCS			
DCS Hardware /Software Supplier	Honeywell	Supply DCS hardware & software base load/configuration Supply DCS licenses DCS FAT procedures DCS FAT execution DCS hardware SAT (Power-Up)	Equipment quantity and names provided by DCS Integrator
PCN Hardware / Software Supplier	Honeywell/TBD	Supply PCN hardware & firmware load/configuration Virtualization system configuration Supply PCN licenses PCN FAT procedures PCN FAT execution PCN hardware SAT (Power-Up)	Equipment names provided by DCS Integrator
BPCS Integrator	Xenon	DCS Hardware equipment list & specification DCS Graphic configuration DCS Controller configuration* Complex loop narratives	*Controller Config includes C300, SCADA, ACE points & schemes, non-base load server configuration
Cutover Contractor		Planning Hot Cutovers Hot Cutover Risk assessments Executing Hot Cutover	
SIS / RTE Gap Closure			

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	24 of 146	

Role Name	Department / Company	Responsibility Description	Notes
Heater & Boiler SIS Hardware Supplier & Integrator	Horizon	SIS Hardware specification SIS Hardware SIS Hardware FAT procedure SIS Hardware FAT execution SIS C&E & Logic Diagrams SIS software/program configuration SIS software/program FAT Modbus tag addresses	Spec based on I/O list provided by Eng. Contr. C&E based on P&ID & I/O list provided by Eng. Contr.
RTE-R Hardware Supplier & Integrator	Petrotech	SIS Hardware specification SIS Hardware SIS Hardware FAT procedure SIS Hardware FAT execution SIS C&E & Logic Diagrams SIS software/program configuration SIS software/program FAT Modbus tag addresses	Spec based on I/O list provided by Eng. Contr. C&E based on P&ID & I/O list provided by Eng. Contr.
RTE-C Hardware Supplier & Integrator	Schneider Electrical (Triconex)	SIS Hardware specification SIS Hardware SIS Hardware FAT procedure SIS Hardware FAT execution SIS C&E & Logic Diagrams SIS software/program configuration SIS software/program FAT Modbus tag addresses	Spec based on I/O list provided by Eng. Contr. C&E based on P&ID & I/O list provided by Eng. Contr.
SIS Lifecycle Contractor	Mangan	SRS SIL Calcs FSA Verification Activities	

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	25 of 146	

3. Design Basis

Because the scope is broken out by equipment and systems, this section addresses each applicable discipline design basis by equipment/system type

3.1 Design Conditions

Design conditions are defined in the LA Refinery Non-Process Basis of Design (TES-015LLA).

3.2 Equipment Selection

All equipment purchased by the project will be selected using the MPC and LAR AML. If the AML-specified vendor is unable to meet delivery due to global supply chain issues, alternatives will be considered and presented.

3.3 Standards and Specifications

Standards are listed in this section and were frozen at the beginning of Definition phase.

3.3.1 Industry Codes

Design and Equipment Supply shall conform to applicable local, state and federal codes and the standards and applicable codes issued by the following associations. Where a date or edition of a reference document is shown, this defines the version applicable to the Project. Where no date or edition is shown, the latest version approved by the issuing authority as of the date of the award of the contract shall be the version applicable to the Project.

Number	Description
American Petroleum Institute (API)	
API RP 500 (1997)	Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class 1, Division 1 and Division 2
API RP 551 (1993)	Process Measurement Instrumentation
API RP 556 (2011)	Instrumentation, Control, and Protective Systems for Gas Fired Heaters
International Electrotechnical Commission (IEC)	
IEC/ISA 61511-1, 2, & 3 -2003	Functional safety – Safety instrumented systems for the process industry sector, Parts 1, 2, and 3
IEC 61508-1, 2, 3 - 2010	Functional safety of electrical/electronic/programmable electronic safety-related system – Parts 1, 2 and 3
Institute of Electrical and Electronic Engineers (IEEE)	
IEEE 518-1982	Guide for the Installation of Electrical Equipment to Minimize Electrical Noise Inputs to Controllers from External Sources.
Instrumentation, Systems and Automation Society (ISA)	
ISA-5.1-1984 (R1992)	Instrumentation Symbols and Identification

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	26 of 146	

Number	Description
ISA-5.2-1976 (R1992)	Binary Logic Diagrams for Process Operations
ISA-5.3-1983	Graphic Symbols for Distributed Control/Shared Display Instrumentation, Logic and Computer Systems
ANSI/ISA-12.12.01- 2002	Nonincendive Electrical Equipment for Use in Class I and II, Division 2 and Class III, Divisions 1 and 2 Hazardous (Classified) Locations
ISA-18.1-1979 (R1992)	Annunciator Sequences and Specifications
ISA 71.01	Environmental Conditions for Process Measurement and Control Systems: Temperature and Humidity
ISA-71.04	Environmental Conditions for Process Measurement and Control Systems: Airborne Contaminants
National Electrical Manufacturers Association (NEMA)	
NFPA 70	National Electrical Code
NFPA 85 (2015)	Boiler and Combustion Systems Hazards Code
NFPA 85 (2015)	Standard for Ovens and Furnaces
Occupational, Safety and Health Administration (OSHA)	
29 CFR 1910.119	Process Safety Management Regulation
Environmental Protection Agency (EPA)	
40 CFR 68	Risk Management Plan Regulation

3.3.2 Project Specifications

In addition to the Codes and Standards, design shall also conform to the applicable Project Specifications and the following list of additional Marathon specification documents including revision numbers:

Number	Description	Rev
--	AMP LAR1 Rescoping 210816 Rev 1	1
RRD-1173-030	Digital Control System (DCS) Design	1
RRD-1908-000	Project Quality Assurance (PQA) Process	0
RRD-1910-001	Constructability Review Process	0
RSD-60-38-005	ELECTRICAL GROUNDING FIREPROOFED/INSULATED STEEL COLUMN GROUND ASSEMBLY	0
RSD-60-38-006	ELECTRICAL GROUNDING STEEL COLUMN OR EQUIPMENT GROUND ASSEMBLY	0
RSD-60-38-007	ELECTRICAL GRONDING CONCTETE COLUMN RISER GROUND ASSEMBLY	0
RSD-60-38-009	ELECTRICAL GROUNDING GROUND BUS CONCRETE MOUNT	0
RSD-60-38-010	ELECTRICAL GROUNDING GROUND BUS STEEL COLUMN MOUNTING ASSEMBLY	0
RSD-60-38-024	ELECTRICAL GROUNDING MISCELLANEOUS EQUIPMENT, PANEL OR ENCLOSURE	0
RSD-60-38-025	ELECTRICAL GROUNDING POWER TRANSFORMER SWITCH GEAR AND MCC	0

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	27 of 146	

Number	Description	Rev
RSD-60-38-030	ELECTRICAL GROUNDING CONDUIT STUP-UP/TERMINATION BONDING JUMPER	0
RSD-60-38-111	ELECTRICAL - PANELBOARDS COLUMN MOUNT TRANSFORMER/PANELBOARD CASS 1, DIVISION 2, RGS CONDUIT	0
RSD-60-38-113	ELECTRICAL - MISCELLANEOUS SUPPORTS COLUMN MOUNT TRANSFORMER	0
RSD-70-07-05	INSTRUMENT - LEVEL GUIDED WAVE RADAR - CHAMBER	0
RSP-1171-010	Emergency Isolation Valves	12
RSP-1172-020	Safety Instrumented Systems	14
RSP-1172-024	Heater Application Standard	13
RSP-1172-025	Fired Boiler Application Standard	12
RSP-1172-028	Reverse Flow to Vessel Application Standard	2
RSP-1172-031	Minimum Protection System for Compressor Application Standard	5
SP-60-30	Uninterruptible Power Supply (UPS)	5
SP-43-01	Selection and Acquisition of Monitoring and Trending Systems for API STD 618 Reciprocating Compressors	4
SP-43-05	Centrifugal Compressor - General	22
SP-43-05.5	Rotating Equipment Instrumentation	24
SP-43-05.6	Centrifugal Compressor – Control System	22
SP-43-05.6	Centrifugal Compressor – Gear Unit	21
SP-43-05.2	Centrifugal Compressor – Gear Unit	21
AMP-LAR-AUT-BOD-0001	AMP Los Angeles Refinery (LAR)Fiber Optic Basis of Design	5
AMP-LAR-AUT-BOD-0002	AMP Programmable Logic Controller (PLC)/Universal Process Cabinet (UPC) Panel Uninterruptible Power Supply (UPS)Basis of Design(BOD)	3
AMP-LAR-PM-INS-0001	AMP LAR SPI Documentation Instructions	1
AMP-LAR3-PM-PLN-0001	AMP LAR3 Project Execution Plan	1

3.4 Engineering Drawings and Documents

3.4.1 P&IDs

P&IDs will be developed with the following submittals and review activities. Drawing comments will be noted and the drawings will be revised to reflect comments.

Project Phase	Submittal / Activity	Notes / Comments
Feasibility	IFR (Informal)	Hand / PDF
	IFR – Review	

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	28 of 146	

Project Phase	Submittal / Activity	Notes / Comments
	IFF	Hand / PDF, Issue for Feasibility
Definition	IFR	CAD, temporary tags, formal check out
	IFR – Review	CAD, temporary tags
	IFH	CAD, permanent tags
	HAZOP/LOPA	
	IFD	CAD, permanent tags, Issue for Design, pick up comments from HAZOP
Implementation	IFA	CAD, permanent tags
	IFA – Review	Engineering Review
	HAZOP/LOPA	For any added scope
	IFC	CAD, permanent tags, includes

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	29 of 146	

3.4.2 Construction Work Packages

Construction Work Packages (CWPs) will be developed to maximize Pre-TAR construction.

Quality Assurance

CWPs will follow the MPMP process, with the following Quality Assurance gates:

Project Phase	Status	Notes / Comments
Feasibility	IFR	Redlines / Sketches / Photo Sketches
	Scope Review Mtg	
	IFF	Issue for Feasibility
Definition	IFR	
	Constructability Review & Walk	
	IFD	Issue for Definition
Implementation	IFR	Overall CWP development
	IFR – Review	Engineering drawing review (Bluebeam?)
	IFA	Includes CWP Narrative, incorporate IFR comments
	IFA – Review	Construction / Operations Review
	IFC	

Due Dates

CWPs will be issued for construction (IFC) based on the following:

CWP Type	Months Prior to Event	Event	Notes
TAR	12	End of cycle turnaround	Final installation to occur during TAR
Non-TAR Construction	3	Start of construction	Final installation to occur prior to TAR
Post- TAR Construction	3	Start of construction	Final installation to occur after to TAR / Outage
Hot Cutover	3	Start of Hot Cutover	Construction during Hot Cutover (i.e., rackroom cabinet 'shell game')
Pre-Cutover Construction	3	Start of construction	Low risk construction required prior to BPCS Hot cutover
Cutover Prep	3	Start of construction	E.g., Final penetrations of live cabinets requiring risk assessment prior to Hot Cutover

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	30 of 146	

CWP Type	Months Prior to Event	Event	Notes
Control Room	3	Start of construction	CWP can include multiple stages of work, as long as clearly defined in CWP narrative

3.4.3 Loop Diagrams & Loop Folder

All loop diagrams will be developed in SI, following the appropriate LAR-C or LAR-W specifications. They are to be developed during Implementation phase and are to follow the normal IFA/IFC engineering review cycle.

Loop Diagrams are to be issued as part of loop folder and are not required to be issued as part of a CWP.

Loop Folder are to be issued in two formats:

- Hardcopy Loop Folder – hard copy folders. Labeled by loop number. Organized by commissioning event (i.e. Loop for a single unit and TAR are all in the same box)
- eLoop folder – compiled PDF file per loop of all the required loop folder content, in correct order. (issued in case hard copy is lost/damaged so construction can easily recreate the hardcopy loop folder). File title should be the loop #

Loop Folder Content

Item	Description	Note
Field		
1	Loop Folder Content Checklist	
2	Scope of Work	
3	Loop Diagram	
4	P&ID (Section)	
5	Loop Buy-Off	
6	Location Plan	
7	MAPV	
8	Datasheet	
9	Installation/Mounting Details	
10	Nameplate schedule	
Console / DCS		
1	Loop Diagram	
2	P&ID (Section)	
3	Loop Buy-Off	
4	IDF	
5	CPF / MAPV	
6	Datasheet	

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	31 of 146	

Due Dates

Event	Months Prior to Event	Description / Examples	Notes
TAR Loop Sell	3	New loop to be sold during TAR	
Pre-TAR Loop Sell	3	System diagnostic alarms	
Hot Cutover	3		If only a wire migration (i.e. no field device modification), then only the loop diagram and signoff sheet is needed, not full loop folder.

3.4.4 Instrument Datasheets

All instrument datasheets will be done in SI, following the appropriate LAR-C or LAR-W specification.

3.4.5 New Tag Request

New tag requests are typically part of the P&ID work process and done through the LAR SPI Administrator. New tag requests require:

- Redlined P&IDs approved by MPC Instrument Engineer
- Completed New Tag/Loop request form

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	32 of 146	

3.5 *BPCS – Console & Network Virtualization*

3.5.1 **Architecture**

Each operating unit will consist of its own Experion Cluster (Servers, Server License, FTE Community, Control Hardware, etc.). To support this architecture, existing consoles will remain tied into existing LCNs and be segregated from each other as they are fully migrated from TDC to Experion. The desired result is network and system segregation of each console and associated control hardware from other consoles. This trades a certain amount of additional server license and infrastructure cost for ease and flexibility of management and maintenance.

See Section 1.4.3 for additional Design Philosophy details.

One existing LCN Bridge (LAR2) on LCN3 will be utilized for Alky until the TDC2000 is cut over to C300.

New LCN Bridges for each LCN will be installed in the SACCR Engineering Room server cabinets to allow for ethernet based connections to the LCN5, and LCN6 network(s) needed for virtualization of these systems. Existing LCN/UCN fiber extensions/coaxial cable connections that extend to local control rooms, rack rooms, and remote instrumentation enclosures, and operator shelters will remain in place and be gradually removed as console hardware is migrated to Experion as part of this project phase and in the future.

Control room and operator shelter console station LCN coaxial cables will be removed once US hardware has been migrated to new console stations and US station hardware has been removed.

3.5.2 **Virtualization**

Virtualized server host hardware for LAR3 will consist of a single "Enhanced" virtual server installation (as detailed in the Amp vCluster Standard Builds Global Specification (AMP-GBL-PM-SPC-0019 Rev. A1). The server rack will be temporarily installed in LCR7 until a centralized datacenter for the Carson plant can be established, at which time the server rack will be relocated.

Based on rough resource and sizing calculations, the LAR3 virtualized server hardware will accommodate all Experion virtual systems needed for the Carson south area.

The server rack will be mounted with reinforcement hardware to a subfloor frame.

Power for Virtualization Cabinet

Redundant 240VAC power feeds will be provided as a single UPS fed primary and clean power secondary. New instrument power panel, isolation transformer, UPS/battery rack, manual bypass, and UPS panel will be installed in the LCR7 rack room to support this installation.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	33 of 146	

Removal of existing fire brigade operator equipment along the west wall of the rack room will be required to make room for the new UPS and associated power distribution panel hardware. Thermostats, gas detector etc. that are mounted on the wall where the UPS will be must be relocated.

See drawing SKI-MPLA22001-LAR3-040 LCR7 V-Server Power Block Diagram

See drawing SKI-MPLA22001-LAR3-041 LCR7 V-Server & Network A/B Floor Plan

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	34 of 146	

3.5.3 Console Migration

Project will migrate the following consoles from US stations to Experion in a phased approach per table 3.5.3a. The graphics will be updated from native windows to ASM compliant HMI Web Graphics.

Table 3.5.3a - LAR3 Consoles

Site	Control Room	LCN / FTE Network	Operating Console	Existing	LAR3 Migration
LAR-C	SACCR	LCN3 / ALKY	ALKY Complex	US Station	Experion Console Station
LAR-C	SACCR	LCN5 / 1CRD	1 Crude / 51 VAC	US Station	Honeywell ESC Web Graphics Console
LAR-C	SACCR	LCN5 / 2CRD	2 Crude	US Station	Honeywell ESC Web Graphics Console
LAR-C	SACCR	LCN5 / SRU	Sulfur	US Station	Honeywell ESC Web Graphics Console
LAR-C	SACCR	LCN6	ISOM	US Station	Honeywell ESC Web Graphics Console
LAR-C	LCR-3	LCN5	#1 Crude	US Station	Honeywell ESC Web Graphics Console
LAR-C	LCR-7	LCN6	ISOM	US Station	Honeywell ESC Web Graphics Console
LAR-C	SRU Ops Shelter	LCN5	Sulfur	US Station	Honeywell ESC Web Graphics Console
LAR-C	LCR-6	LCN3	Alky	US Station	Honeywell ESC Web Graphics Console

Project will migrate the following consoles from US stations to Experion in a phased approach per table 3.5.3b

Table 3.5.3b - LAR3 Consoles migration steps

Phase	Control Room	Operating Console	LCN / FTE Network	Description	Drawing
1	SACCR	ISOM	NA	Demo old ISOM Section 1 & 2	SKI-MPLA22001-137-DEMO
		2 Crude	FTE-A	Install 2 Crude Console	
	Crude Row Ops Shelter	2 Crude	LCN-5	Demo 2 Crude Operator Station	SKI-MPLA22001-044-DEMO
			FTE-A	Install 2 Crude Ops Desks	SKI-MPLA22001-044
2	SACCR	2 Crude	LCN-5	Demo old 2 Crude Console	SKI-MPLA22001-138-DEMO
		1 Crude	FTE-A	Install 1 Crude Console	SKI-MPLA22001-138
	LCR-3	1 Crude	LCN-5	Demo 1 Crude US Station/Desk	SKI-MPLA22001-045-DEMO
		1 Crude	FTE-A	Install 1 Crude Ops Desks	SKI-MPLA22001-045
3	SACCR	2 Crude	LCN5	Demo old 1 Crude Console	SKI-MPLA22001-139-DEMO
		Alky	FTE-B	Install Alky Console	SKI-MPLA22001-139
	LCR-6	Alky	LCN-3	Install new Alky Ops Desk	SKI-MPLA22001-047
			FTE-B	Demo Old Alky US Console	SKI-MPLA22001-047-DEMO
4	SACCR	Alky	LCN-3	Demo old Alky Console	SKI-MPLA22001-140-DEMO
		ISOM	FTE-A	Install ISOM Console	SKI-MPLA22001-140
	LCR-7	ISOM	LCN-6	Demo Old Alky US Console	SKI-MPLA22001-041-DEMO
			FTE-C	Install new ISOM Ops Desk	SKI-MPLA22001-041
5	SACCR	ISOM	LCN-6	Demo old ISOM Console	SKI-MPLA22001-141-DEMO
		2 Crude		Move 2 Crude Business Section	
6	SACCR	1/2 Crude SRU	FTE-C	Install 1/2 Crude Desk	SKI-MPLA22001-141
		SRU	LCN-5	Demo Old Sulfur Console	SKI-MPLA22001-143-DEMO
		SRU	NA	Install Sulfur Desk	SKI-MPLA22001-143

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	35 of 146	

3.5.4 Console Furniture

Console furniture will consist of a minimum of four (4) console station sections for 2 operating units with mounting hardware for 24" DCS monitors as well as 55" overhead large screen displays for associated operator reporting, KPI (Key Performance Indication), and business displays. On each end of the console there will be a section for operator business PCs and monitors will be mounted and have space for phone and radios. Since floorspace is limited in the SACCR; console station furniture will be modularized such that individual sections can be installed as US console station sections are removed as part of a gradual transition to new hardware (if needed). Temporary console hardware will be installed for operator training and relocation of console operators while old US station hardware can be removed, and new permanent Experion console furniture and hardware can be installed. Early rendering of typical console furniture shown below.

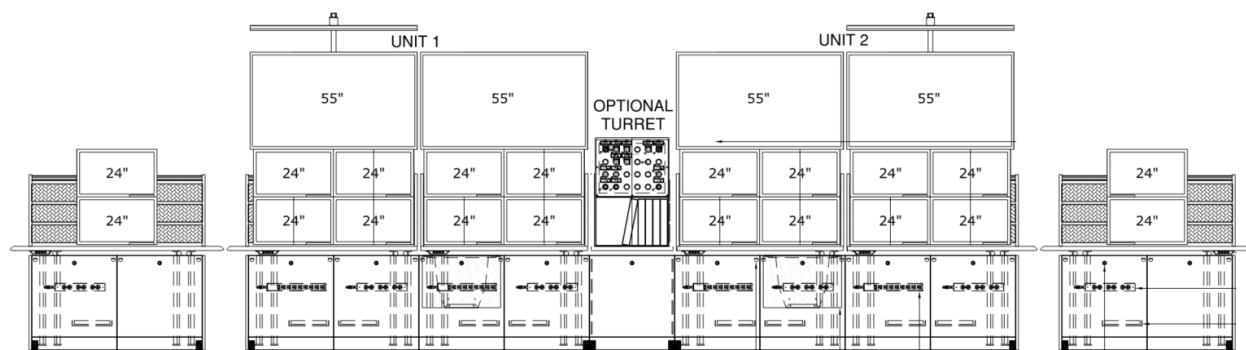


Figure 3.5.3 - Typical Console Furniture (Front)

3.5.5 Console Station Hardware

The console stations (and associated servers) installed to support new Experion consoles will be highly virtualized. Each console station will have console station hardware consisting of a thin client that uses a remote connection to a virtual console station residing on a virtual host. The implementation of each virtual host system will be redundant and therefore highly reliable; however, one thin client will be used to remote into one physical console station ESC to mitigate a complete failure of the virtual server system or interconnecting fiber between the console and server hardware. The assumption for this phase of the LAR3 project scope is that each console includes one (1) physical console station and one (1) thin client / VM based console stations.

Alternatively, ISOM, Crude 1, Crude 2, and Sulfur can be non-virtualized systems with two (2) thin clients per unit will be used to remote into one physical console station ESC.

ISOM, ALKY, and SRU will utilize two dual screen virtual thin clients and one quad screen physical ESC per unit.

Crude 1 and 2 will utilize one quad screen virtual thin client and one quad screen physical ESC per unit. This arrangement allows for each unit to back up the other unit in the event of a station failure or maintenance event.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	36 of 146	

Console Station Keyboard and Mouse

Genovation KB170 desktop keyboards will be provided to allow for console station navigation and hot key functionality.

Non-DCS Console Hardware

Operator business PCs, pushbuttons, lights, radios, and other hardware will be relocated to the new console furniture as needed.

3.5.6 Console Furniture Power

New under floor 120VAC UPS receptacles will be installed to support the new console furniture. A minimum of two diverse sources of power will be used to power each units console stations.

Non-UPS power will be provided for non-critical devices at the console.

3.5.7 Console Communications

Three (3) new FTE cabinets will be installed in SACCR Engineering Room to facilitate communication to new HMI screens.

- One existing (LAR2) FTE A/B Cabinet will be used for the Alky Unit
- One (1) New FTE A/B Network Cabinet will be installed for Crude 1 and 2
- One (1) New FTE A/B Cabinet for ISOM.

New copper Ethernet (Honeywell Cat5) cabling from respective FTE-x-A/B switches in the SACCR Engineering Room will be run to each furniture installation. A minimum of one (1) spare Ethernet cable of each type (FTE-A / FTE-B) will be installed.

Communication cabling will be installed in innerduct or existing wireways underneath the existing computer flooring.

3.5.8 Console Lighting

SACCR

Existing ceiling mounted task lighting will be modified to accommodate the new console furniture layout. Existing circuits and lighting control hardware are to be re-used. New lighting fixtures and power/signal wiring are to be installed.

Alky LCR6

Operator room lighting will need to be replaced. Since the Operator room will be divided into an equipment room and an operator room the lighting and lighting controls will need replacement. Four (4) new lights will be installed in the equipment room extension with a wall switch. Two (2) new lights will be installed in the operator room with a new wall switch.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	37 of 146	

3.5.9 Console Furniture Structural / Seismic Reinforcement

Hilti reinforcement hardware will be used to anchor the console furniture to the concrete slab below the existing computer floor tiles.

3.5.10 Console Room Flooring

SACCR

Existing computer floor tiles will be modified (cut) as needed to accommodate the installation of the new console furniture. Existing computer floor tiles will be replaced if they are excessively worn or damaged. If the computer floor tiles are still in good condition, they will be re-used.

Alky LCR6

Existing computer floor tiles will be modified (cut) as needed to accommodate the installation of the new console furniture. Existing computer floor tiles will be replaced if they are excessively worn or damaged. If the computer floor tiles are still in good condition, they will be re-used.

3.5.11 Future Console Consolidation Considerations

The new SACCR console arrangement will facilitate a future 3 section console adjacent to Sulfur Console.

Table 3.5.11 - Stated Consolidation Goals

Site	Control Room	Primary		Secondary	
		LCN / FTE Network	Operating Console	LCN / FTE Network	Operating Console
LAR-C	SACCR	LCN3 / ALKY	ALKY Complex		NA
LAR-C	SACCR	LCN5 / SRU	SRU		NA
LAR-C	SACCR	LCN6 / ISOM	ISOM		NA
LAR-C	SACCR	LCN5 / 1CRD	1 Crude / 51 VAC	LCN5	2 Crude / 52 VAC
LAR-C	SACCR	LCN5 / 2CRD	2 Crude / 52 VAC	LCN5	1 Crude / 51 VAC

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	38 of 146	

3.5.12 Control Room - Floorplan Layout

SACCR

The existing floorplan in the SACCR is highly impacted and the installed furniture will need to be migrated in stages to accommodate things from a floor space standpoint as well as from an LCN loading standpoint.

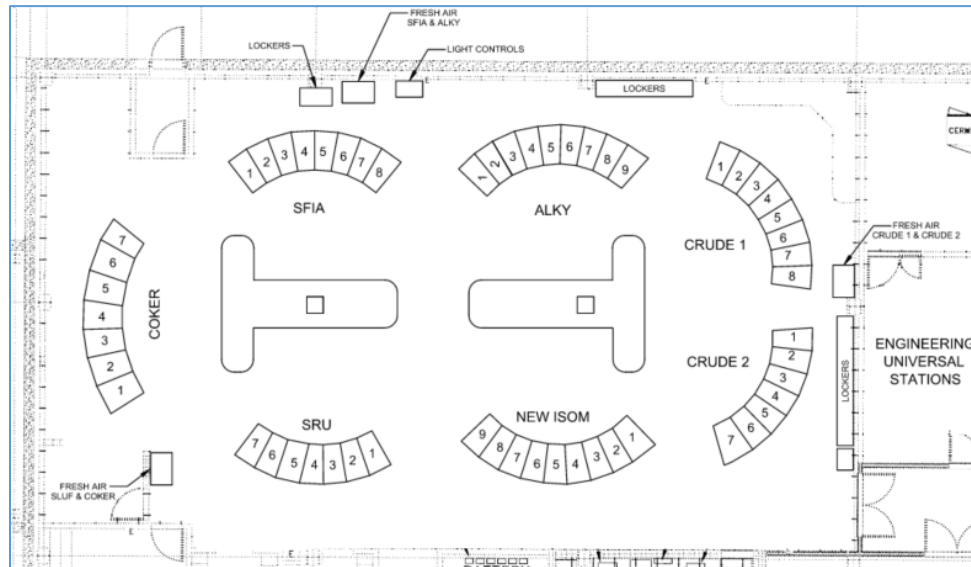


Figure 3.5.12a SACCR Existing floor plan

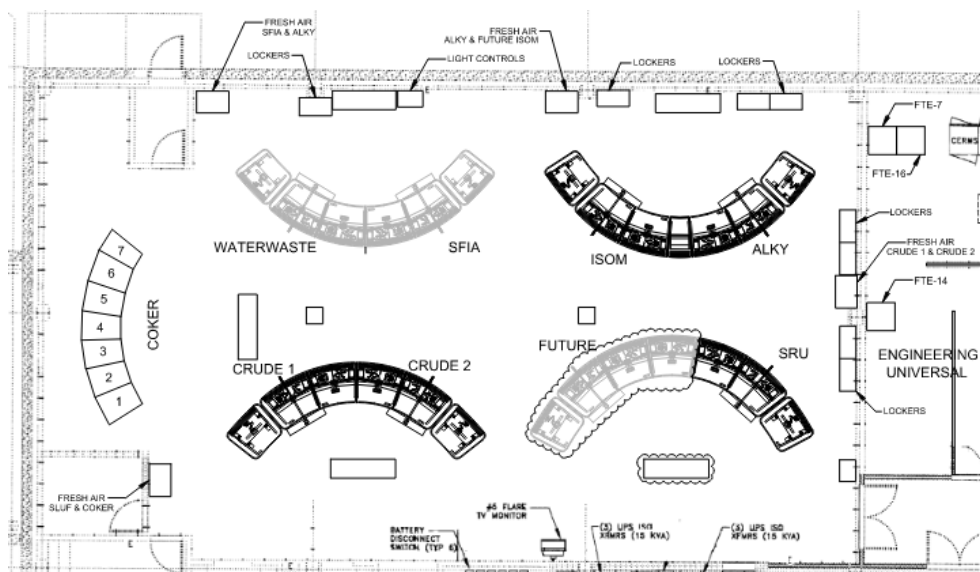


Figure 3.5.12b SACCR final layout

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	39 of 146	

Alky LCR6

The existing floorplan in the LCR6 is impacted and the installed furniture will need to be migrated in stages to accommodate things from a floor space standpoint. A new wall partition will be installed to split the existing operator room into 2 halves. One half will become an extension of the equipment room and one half will be for operations use.

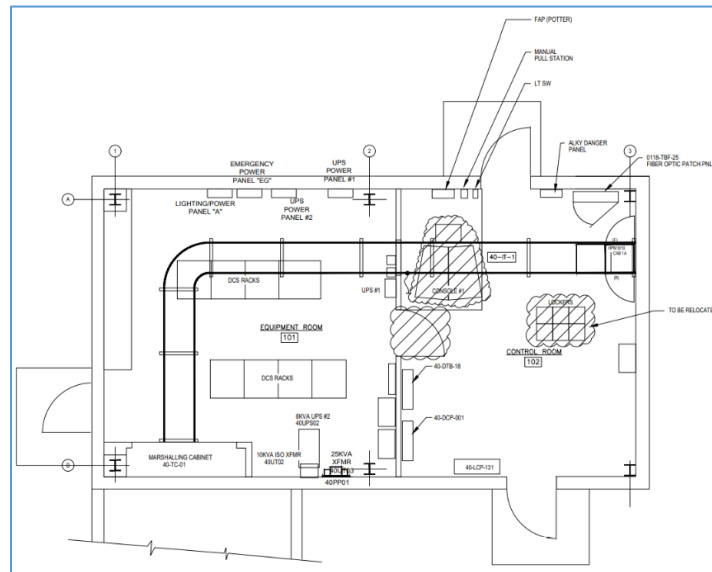


Figure 3.5.12C LCR6 existing layout

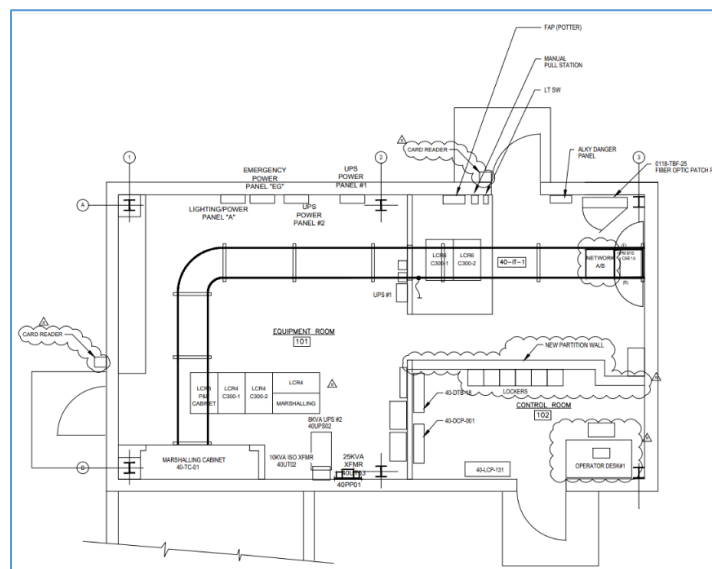


Figure 3.5.12C LCR6 final layout

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	40 of 146	

3.5.13 Console Shutdown Buttons

ISOM and Alky will have a new shutdown panel turret between the two console groups. Currently there are 4 buttons on the Alky Console and 14 on the ISOM Console. These 18 buttons will need to be migrated to a new console section. Alky will migrate first followed by ISOM as these two consoles are migrated.

A new JBOX will be installed before migration as a junction point for these new buttons. A new 36 pair cable will need to be installed from inside SACCR from the new Junction Box to a new Junction bot near the conduit stub up. A new 8PR Cable will be installed from the new Junction Box outside SACCR to 82-ATB-8. A new 16PR and 12 PR Cable will be installed from the new Junction Box outside SACCR to LCR7 MP5 and 6.

New 125VDC to 24VDC power supplies will be added to the C3 Splitter Compressor Starter Controls Compartment along with interposing relays. Two (2) single pair cables installed to the new Junction Box for ISOM SD Panel.

See drawing SKI-MPLA22001-LAR3-100 and SKI-MPLA22001-LAR3-014

3.6 **BPCS – Hiway Migration Scope**

3.6.1 Hiway Migration Sequence

1. Phase 1 - Hiway 3 boxes, currently located in LCR6 will be migrated to two (2) new C300 cabinets in existing empty space in LCR6.
2. Phase 2 - Once Hiway 3 has been migrated, the old Hiway 3 TDC2000 cabinets and underfloor conduits will be demolished to make room for Hiway 2 migration.
3. Phase 3 – Install two (2) new C300 cabinets and a new marshalling cabinet in LCR6. Migrate Hiway 2 boxes, currently located in LCR4 to new C300s in LCR6.
4. Phase 4 – Migrate two control loops (45P0402 and 45P0409) from SFIA to the new C300s in LCR6. These loops are currently wired to LCR5 and will need minor cable and conduit additions to accommodate them.

3.6.2 **Out of Service Tag Evaluation**

- Migration IO List
 - An initial IO list was obtained from a Hiway 2 and 3 System EB file dump provided by Marathon.
 - This list was entered into a database and the associated loop drawings and P&IDs were entered for each tag.
 - A review of the P&IDs and loops revealed a group of tags that were indicated on the PID, loop drawing or both as being out of service.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	41 of 146	

- Additionally, the drawings indicated a group of CB controller inputs and outputs that were only software configurations – they had no wired connection from the IO point to the field. An example of this would be a cascade loop located within one CB box that uses software configuration to connect the output of one loop to the setpoint of the second.
- Finally, a group of tags were identified to be Demolished. An example of this would be the system alarms for the TDC2000 system which will not be required post migration.
- All suspected Out of Service, Not wired, and Demo tags were identified as such in the database.
- A series of meetings was held to validate the preliminary Out of Service, Not Wired and Demo tags which were then removed from the IO count. (23 Demo, 225 Out of Service and 55 Not Wired)
- Refer to MPLA22001-61-100 for an Excel list of all tags. The table has filters which allow focusing on one type of action.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	42 of 146	

3.6.3 Additional IO

- 44-LCP-911 Unit Danger Alarm PLC Migration
 - This PLC will be migrated to the new C300. Two additional IO points are required for this.
- New C300 System Alarms
 - Each new C300 will have 4 alarms (1 Temperature, 2 Power Supply and 1 Battery Charger). There will be 4 C300 systems, so 16 new IO points are required.
- Split Range additional output
 - Loop 40P0505 requires an additional AO output to drive the second valve.
- Removal of field selector switch
 - Loop 48F0106 requires an additional AI for the second transmitter – two transmitters were wired to a field selector switch which will be removed and both transmitters hard wire to inputs.
- HPM tags
 - 20 Tags currently wired to HPM in LCR6 will be migrated to the new C300 system.
- Table 3.6.3A – HPM Tag Migration List

Tag	Service	Control System	Network	Node	Module	Channel	IO_TYPE
40FI110	C4 OLEFIN TO ALKY (S)	LCN3 (HPM)	5	9	1	7	AI
40FO110	C4 OLEFIN TO ALKY (S)	LCN3 (HPM)	5	9	7	6	AO
40FI111	NET EFFL TO C5 FD/EFF EX	LCN3 (HPM)	5	9	1	5	AI
40FO111	NET EFFL TO C5 FD/EFF EX	LCN3 (HPM)	5	9	7	5	AO
40FI114	RCY IC4 TO CONT FEED (S)	LCN3 (HPM)	5	9	1	1	AI
40FO114	RCY IC4 TO CONT FEED (S)	LCN3 (HPM)	5	9	7	6	AO
40FI123	150# STEAM TO DEBUT TWR	LCN3 (HPM)	5	9	2	5	AI
40FO123	150# STEAM TO DEBUT TWR	LCN3 (HPM)	5	9	8	1	AO
40FI127	C5 OLEFIN TO ALKY	LCN3 (HPM)	5	9	2	2	AI
40FO127	C5 OLEFIN TO ALKY	LCN3 (HPM)	5	9	7	11	AO
40FI217	NET EFFL TOT/MIN FLOW	LCN3 (HPM)	5	9	1	9	AI
40FO217	NET EFFL TOT/MIN FLOW	LCN3 (HPM)	5	9	7	7	AO
40FI287	NET EFF PMP MIN FLW RATE	LCN3 (HPM)	5	9	1	11	AI
40LI350	SUCTION TRAP EAST	LCN3 (HPM)	5	9	1	10	AI
40LO350	SUCTION TRAP EAST	LCN3 (HPM)	5	9	7	8	AO
40PI492	DEBUTANIZER OVHD ACCUM	LCN3 (HPM)	5	9	2	6	AI
40PO492A	DEBUTANIZER OVHD ACCUM	LCN3 (HPM)	5	9	8	2	AO
40PO492B	DEBUTANIZER OVHD ACCUM	LCN3 (HPM)	5	9	8	3	AO
40TI600	DEBUT TOWER TRAY 4 TEMP	LCN3 (HPM)	5	9	2	4	AI
40TI726	DEBUT TOWER REB RTRN TC	LCN3 (HPM)	5	9	2	7	AI

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	43 of 146	

Table 3.6.3B – Migration and New Tag Summary by Hiway and Unit

Hiway	Location	Unit	IO Type	Tag Count	OOS / Demo	Migrate	New
2	LCR4	40	ALL	218	33	185	14
2	LCR4	44	ALL	183	175	8	
2	LCR4	45	ALL	133	35	98	1
2	LCR4	47	ALL	20	0	20	1
2	LCR4	48	ALL	98	8	90	4
2	LCR4	49	ALL	8	0	8	
2	LCR4	55	ALL	2	0	2	
2	LCR4	ALL	ALL	665	251	414	20

Hiway	Location	Unit	IO Type	Tag Count	OOS / Demo	Migrate	New
3 + HPM	LCR6	40	ALL	408	42	366	12

Hiway	Location	Unit	IO Type	Tag Count	OOS / Demo	Migrate	New
1	LCR5	ALL	ALL	8	4	4	0

ALL	ALL	ALL	ALL	1081	297	784	32
-----	-----	-----	-----	------	-----	-----	----

Refer to MPLA22001-61-100 for an Excel list of all tags. The table has filters which allow focusing on one Hiway or Unit.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	44 of 146	

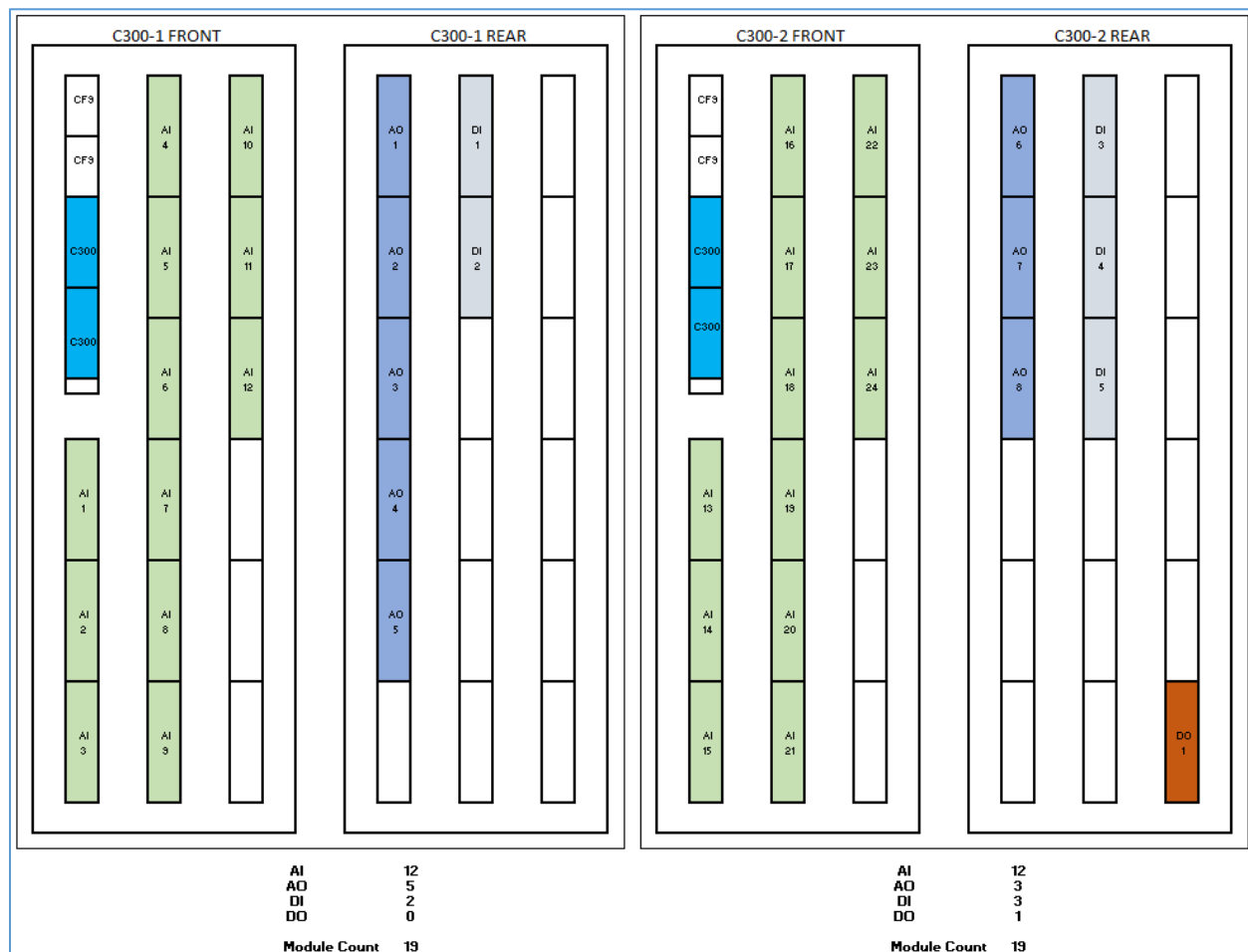
3.6.4 C300 Controller Sizing

- All Hiway 3 IO points will be migrated to new C300 controllers.
- Table 3.6.4A shows the C300 module counts required for 40% spare.

Table 3.6.4A – Hiway 3 Migration C300 Sizing

IO Type	IO COUNT	IO MODULE TYPE	IO TERMINATION ASSEMBLY	CARD COUNT	INSTALLED IO	% SPARE IO
AI	223	CC-PAIH02	CC-TAID11	24	384	42%
AO	69	CC-PAOH01	CC-TAOX11	8	128	46%
DI	81	CC-PDIL01	CC-TDIL11	5	160	49%
DO	5	CC-PDOB01	CC-TDOB11	1	32	84%

- Due to the total module count of 38, there will be Two (2) C300 Controllers installed in Two (2) cabinets, each with front and rear access. These will be referred to as C300-1 and C300-2. See below for a preliminary cabinet layout.



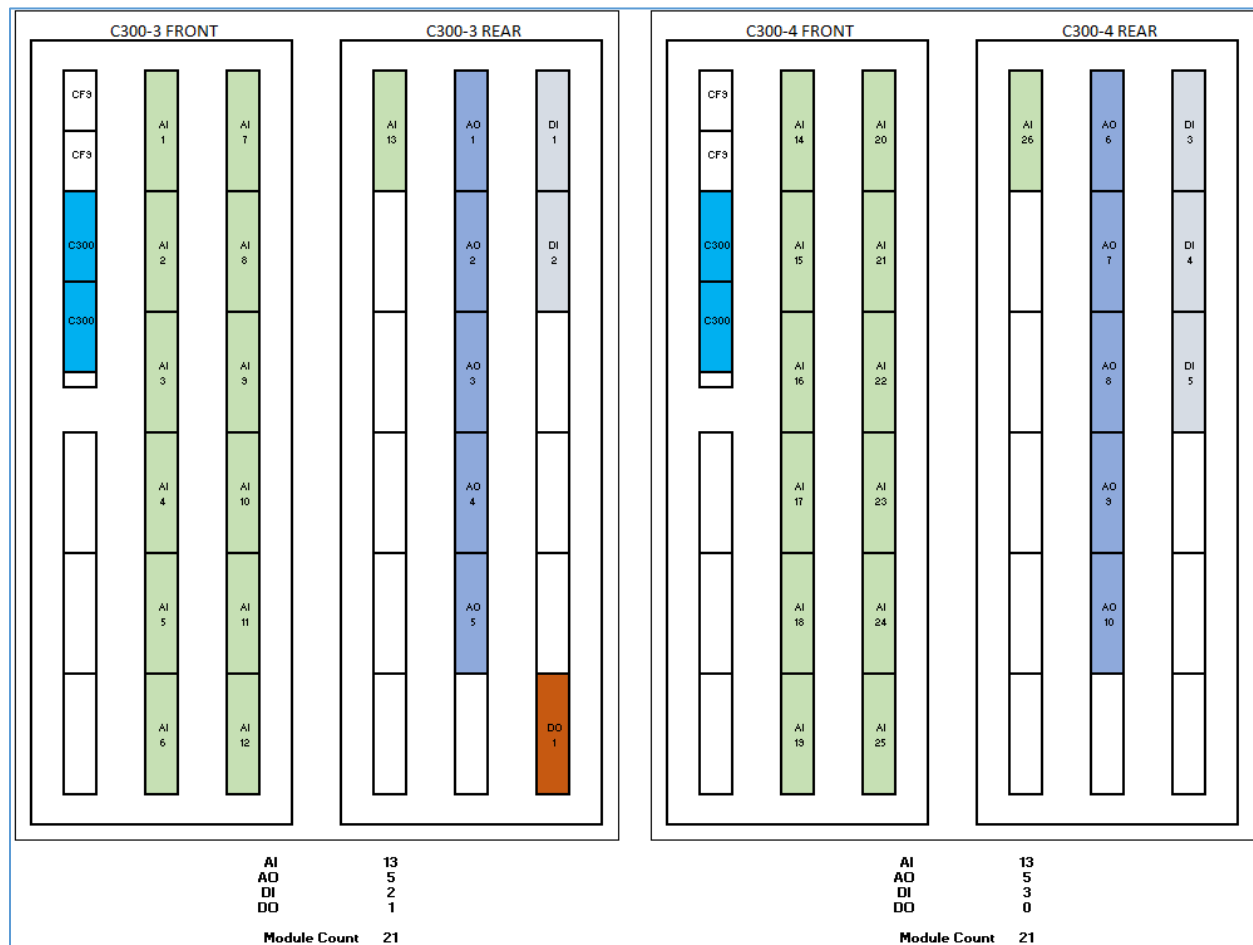
	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	45 of 146	

- All Hiway 2 IO points will be migrated to new C300 controllers installed in LCR6 space made available after LCR6 migration.
- Table 3.6.4B shows the C300 module counts required for 40% spare.

Table 3.6.4B – Hiway 2 Migration C300 Sizing

IO Type	IO COUNT	IO MODULE TYPE	IO TERMINATION ASSEMBLY	CARD COUNT	INSTALLED IO	% SPARE IO
AI	252	CC-PAIH02	CC-TAID11	26	416	39%
AO	91	CC-PAOH01	CC-TAOX11	10	160	43%
DI	87	CC-PDIL01	CC-TDIL11	5	160	46%
DO	8	CC-PDOB01	CC-TDOB11	1	32	75%

- Due to the total module count of 42, Two (2) C300 Controllers will be installed in two (2) cabinet, front and rear access. These will be referred to as C300-3 and C300-4.



	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	46 of 146	

3.6.5 Phase 1 Migration - LCR6 to C300 (LCN3 Hiway 3)

- Overview
 - Hiway 3 tags will be migrated to new C300 controllers.
 - Two new C300 Controllers will be installed in LCR6 existing open space.
 - All Hiway 3 Thermocouple inputs will be converted to standard 4-20Ma signals with PR Electronics transmitters installed in existing LCR6 marshalling rack.
- Cabinet Installation
 - Two (2) new C300 cabinets (C300-1 and C300-2) will be installed in LCR6 existing open space.
 - One (1) new cabinet will be installed to house the Pepperl+Fuchs HART Termination Boards.
 - Existing UPS 1 and UPS 2 will be used to power the new C300 cabinets.
 - 2 UPS 1 circuits, 1 per C300 cabinet will be used for the Primary supplies of C300-1 and C300-2
 - 2 UPS 2 circuits, 1 per C300 cabinet will be used for the Secondary supplies of C300-1 and C300-2
- Migration & Marshalling
 - Pepperl+Fuchs HART Termination boards will be installed for all analog IO cards.
 - Each HART board will accommodate two (2) AI or AO IO cards. Each IO card will be wired using a 16 pair cable to the input of the HART board. Each HART board (outputs) will be wired with two (2) 16 pair cables to the existing marshalling rack 40-TC-01.
 - All Hiway 3 tags will be cutover to C300-1 and C300-2 at existing marshalling rack 40-TC-01.
 - New temporary DIN rail terminal strips will be installed in front of the existing terminal strips in marshaling rack 40-TC-01. The existing terminal strips are wired in the same order as the existing CB termination panels (1 CB wires to 1 section of the terminal strips). The new temporary terminal strips will be wired as complete IO module groups. New Hiway 3 IO assignments will be made to locate the IO close to its existing field wire location.
 - When migration is complete, the old marshalling rack terminal strips will be demolished, and the new strips will be mounted in their place.
 - New PR Electronics Temperature Transmitters will be installed in existing marshalling rack 40-TC-01 to convert all Hiway 3 thermocouple signals to 4-20Ma.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	47 of 146	

3.6.6 Phase 2 Migration – LCR6 Demolition

- Demo all out of service TDC2000 cabinets, cables and underfloor conduits in preparation for Phase 3

3.6.7 Phase 3 Migration - LCR4 to C300 (LCN3 Hiway 2)

- Overview
 - All Hiway 2 in service IO points will be migrated to new C300 controllers.
 - Two new C300 Controllers will be installed in LCR6 space made available after Phase 1.
 - All Hiway 2 Thermocouple inputs be converted to standard 4-20Ma signals by installing new transmitters in the existing junction boxes or new adjacent boxes.
 - New home run cables will be installed from the existing field junction boxes to LCR4 via conduit, new and existing tray. Refer to section 3.6.10 for more information.
- Cabinet Installation
 - Install Two (2) new C300 cabinets (C300-3 and C300-4) will be installed in LCR6. Refer to SKI-MPLA22001-LAR3-131 for location.
 - Install One (1) Marshalling Panel in LCR6. Refer to SKI-MPLA22001-LAR3-131 for location.
 - Existing UPS 1 and UPS 2 will be used to power the new C300 cabinet.
 - 2 UPS 1 circuits will be used for the Primary supply of C300-3 and C300-4.
 - 2 UPS 2 circuit will be used for the Secondary supply of C300-3 and C300-4.
- Migration & Marshalling
 - Pepperl+Fuchs HART Termination boards will be installed for all analog IO cards.
 - Each HART board will accommodate two (2) AI or AO IO cards. Each IO card will be wired using a 16 pair cable to the input of the HART board. Each HART board (outputs) will be wired with two (2) 16 pair cables to the new marshalling rack.
 - New PR Electronics Temperature Transmitters will be installed in existing marshalling rack 40-TC-01 to convert all Hiway 3 thermocouple signals to 4-20Ma.
 - Cutover for all tags in this phase will be made at the existing field junction boxes.

3.6.8 Phase 4 Migration – Hiway 1 (SFIA) Tag Migration

- Install ¾" conduit from SFIA Terminal box 55-TB-40 to LCR5-MP-1.
- Re-wire loop 74P409 (input and output) direct to LCR6 using existing cable run between 48-TBE-3 and LCR5-MP-1. 48-TBE-3 already has a new project home run cable to LCR6.
- Re-wire loop 74P402 (input and output) direct to LCR6 from junction box 48-TBE-3 to LCR6. 48-TBE-3 already has a new project home run cable to LCR6.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	48 of 146	

3.6.9 DCS Communication Tag Migration

- RW-0047.87.06 ALKY Refrigeration Compressor
 - Currently wired to DHP on Hiway 3 located in LCR6.
 - Relocate existing serial cable to the new LCR6 P&F Cabinet
 - Install a new RS422 to Ethernet Moxa and install Ethernet Cable to new Network Cabinet in LCR6.
- Applied Automation Network (Analyzers 40-A-959 and 40-A-961)
 - Currently wired to DHP on Hiway 3 located in LCR6.
 - Install a new RS422 to Ethernet Moxa in the LCR6 UCN Cabinet Applied Automation Panel and install Ethernet Cable to new Network Cabinet in LCR6.

Table 3.6.7 – Software Tag additions, deletions, and migrations

Unit	Equipment	System	Action	IO Type	Count
1 REF	RW-0004.087.06	Bently	New	Soft Analog	17
1 REF	RW-0004.087.06	Bently	New	Soft Discrete	72
1 REF	RW-0005.087.03	Bently	New	Soft Analog	3
1 REF	RW-0005.087.03	Bently	New	Soft Discrete	11
1 REF	RW-0006.087.03	Bently	New	Soft Analog	3
1 REF	RW-0006.087.03	Bently	New	Soft Discrete	8
1 REF	RW-0022.087.06	Bently	Migrate	Soft Analog	28
1 REF	RW-0022.087.06	Bently	New	Soft Analog	3
1 REF	RW-0022.087.06	Bently	New	Soft Discrete	100
1 REF	RW-0025	21SPLC0035	New	Soft Analog	57
1 REF	RW-0025	21SPLC0035	New	Soft Discrete	157
1 REF	RW-0026	21SPLC0035	Demo	Soft Analog	1
1 REF	RW-0026	21SPLC0035	Migrate	Soft Analog	1
1 REF	RW-0026	21SPLC0035	New	Soft Analog	28
1 REF	RW-0026	21SPLC0035	New	Soft Discrete	96
ALKY	Applied Automation		Migrate	Soft Analog	9
ALKY	RW-0047.87.06		Migrate	Soft Analog	25
ALKY	RW-0047.87.06		Migrate	Soft Discrete	33
FCC	RW-0023	11SPLC0008	New	Soft Discrete	8
FFHDS	RW-0048	23SPLC0009	New	Soft Analog	4
FFHDS	RW-0048	23SPLC0009	New	Soft Discrete	30

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	49 of 146	

Unit	Equipment	System	Action	IO Type	Count
FFHDS	RW-0057.087.3	XXX	New	Soft Analog	4
FFHDS	RW-0057.087.3	XXX	New	Soft Discrete	5
HCU	H-300	05-IPS-01	Demo	Soft Analog	6
HCU	H-300	05-IPS-01	New	Soft Analog	12
HCU	H-300	05-IPS-01	Demo	Soft Discrete	21
HCU	H-300	05-IPS-01	New	Soft Discrete	104
HCU	H-301	05-IPS-01	Demo	Soft Analog	3
HCU	H-301	05-IPS-01	New	Soft Analog	15
HCU	H-301	05-IPS-01	Demo	Soft Discrete	13
HCU	H-301	05-IPS-01	New	Soft Discrete	77
HCU	H-302	05-IPS-01	New	Soft Analog	11
HCU	H-302	05-IPS-01	Demo	Soft Discrete	1
HCU	H-302	05-IPS-01	New	Soft Discrete	79
HCU	H-303	05-IPS-01	Demo	Soft Analog	6
HCU	H-303	05-IPS-01	New	Soft Analog	31
HCU	H-303	05-IPS-01	Demo	Soft Discrete	21
HCU	H-303	05-IPS-01	New	Soft Discrete	129
HCU	H-304	05-IPS-01	Demo	Soft Analog	15
HCU	H-304	05-IPS-01	New	Soft Analog	54
HCU	H-304	05-IPS-01	Demo	Soft Discrete	60
HCU	H-304	05-IPS-01	New	Soft Discrete	187
HGU	C-146	06-IPS-01	New	Soft Analog	3
HGU	C-146	06-IPS-01	New	Soft Discrete	5
HGU	C-147	06-IPS-01	New	Soft Analog	3
HGU	C-147	06-IPS-01	New	Soft Discrete	5
HGU	C-148	06-IPS-01	New	Soft Analog	3
HGU	C-148	06-IPS-01	New	Soft Discrete	5
HGU	C-84	06-IPS-01	New	Soft Analog	3
HGU	C-84	06-IPS-01	New	Soft Discrete	5
HGU	H-42	61-IPS-01	Demo	Soft Analog	3
HGU	H-42	61-IPS-01	Migrate	Soft Analog	7

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	50 of 146	

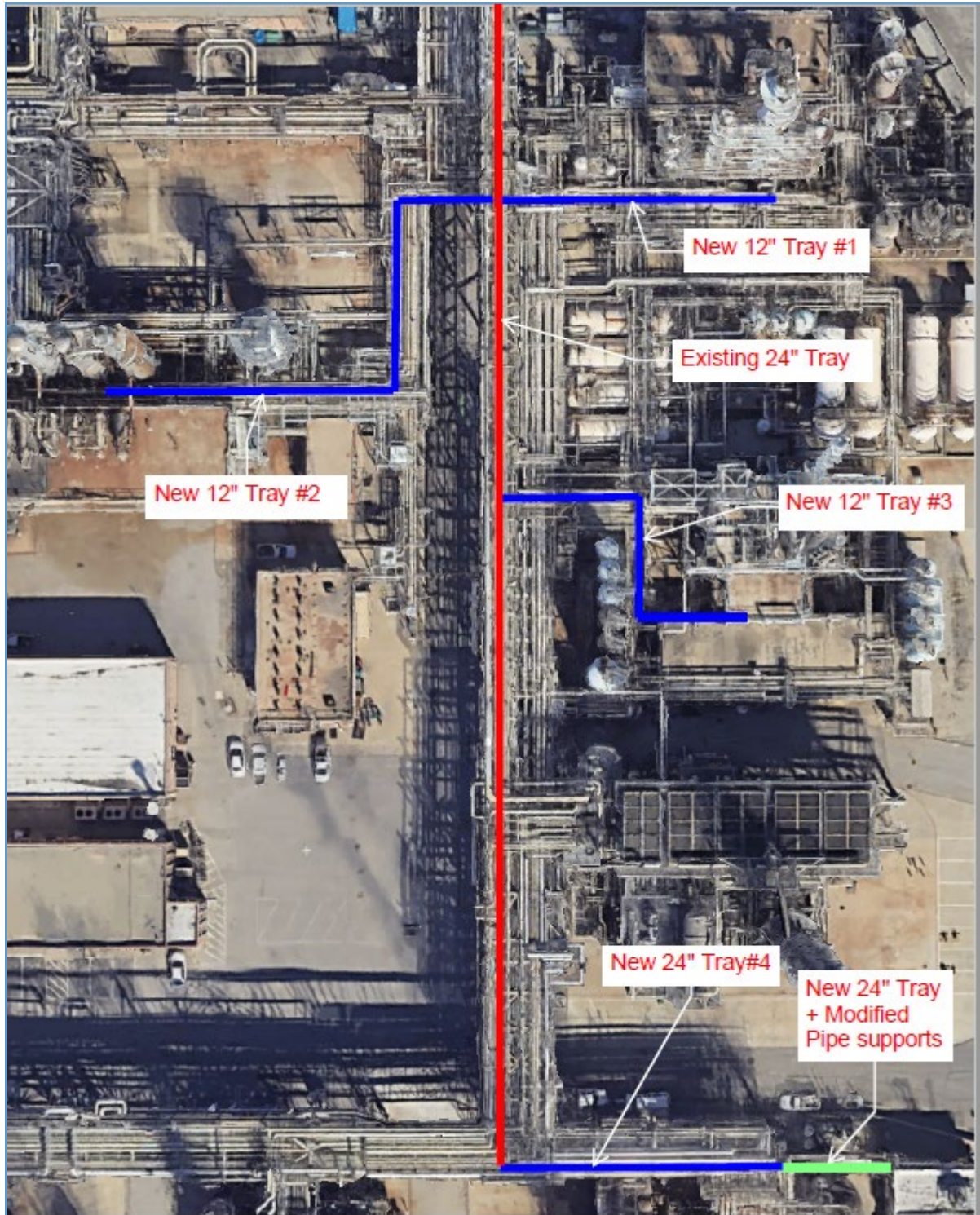
Unit	Equipment	System	Action	IO Type	Count
HGU	H-42	61-IPS-01	New	Soft Analog	60
HGU	H-42	61-IPS-01	Demo	Soft Discrete	26
HGU	H-42	61-IPS-01	Migrate	Soft Discrete	6
HGU	H-42	61-IPS-01	New	Soft Discrete	234
HGU	H-43	61-IPS-02	New	Soft Analog	4
HGU	H-43	61-IPS-02	New	Soft Analog	35
HGU	H-43	61-IPS-02	New	Soft Discrete	28
HGU	H-43	61-IPS-02	Demo	Soft Discrete	1
HGU	H-43	61-IPS-02	New	Soft Discrete	170
LHU	RW-0028	25SPLC025	New	Soft Analog	5
LHU	RW-0028	25SPLC025	Demo	Soft Discrete	10
LHU	RW-0028	25SPLC025	New	Soft Discrete	27
NHDS	RW-0053	81SPLC0019	New	Soft Analog	2
NHDS	RW-0053	81SPLC0019	New	Soft Discrete	9

3.6.10 Field Work

Refer to drawings SKI-MPLA22001-LAR3-106 and 107 for the following tray and conduit installations.

- New Tray #1
 - Install 180 feet of new 12" Tray from existing North / South Tray close to Junction box 45TB82. This will eliminate approximately 1980 feet of 2" conduit.
- New Tray #2
 - Install 270 feet of new 12" Tray from existing North / South Tray Close to Junction Box 49TB76. This will eliminate approximately 1620 feet of 2" conduit.
- New Tray #3
 - Install 210 feet of new 12" Tray from existing North / South Tray Close to Junction Box 41TB86. This will eliminate approximately 2500 feet of 2" conduit.
- New Tray #4
 - Install new 24" Tray from existing North / South Tray to LCR6
 - The existing pipe supports running West out of LCR6 will need to be modified to accommodate the new tray.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	52 of 146	



	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	53 of 146	

3.7 BPCS – PLC Controllers

3.7.1 BPCS PLC Scope Boundary

A BPCS PLC is within the scope boundary if one of the following statements is true:

- The BPCS PLC is associated with DCS units/consoles being migrated as part of the LAR AMP Project.
- The BPCS PLC is affected by other LAR AMP Project scope, e.g., compressor or heater modifications.

3.7.2 BPCS PLC Scope Summary

3.7.2.1 DCS Communications

Where a PLC is LCN connected, a media and/or protocol converter will be installed to facilitate communication to the area Experion server. Communication protocol to the Experion server will be Modbus TCP in all cases.

3.7.2.2 Power

From AMP-LAR-AUT-BOD-0002 (AMP LAR PLC/UPC Panel UPS BOD):

"PLCs where AMP's scope is to upgrade obsolete controllers (e.g., upgrade ControlLogix PLC controllers) will not modify the existing power supply design. Site will review the power feed for each controller."

As LAR3 is only performing general purpose PLC upgrades due to obsolescence, no power supply design changes will be made.

Information regarding each PLC's power sources is provided in the subsequent detail sections. Where the information is not specific or missing, e.g., panel source and circuit number, more field verification will be needed if the site wishes to review for possible changes.

3.7.2.3 CEMS PLCs

All the CEMS data for the LARC South Area comes to the DCS and Environmental PI via the two data concentrator PLCs in the SACCR Engineering room. As part of the CEMS upgrade program, CEMS field PLCs are migrated from the old PLC 5 to the CLX. LAR3 scope basis is that Dual Communication interface devices (MOXA device used on LARB) will be installed, allowing for these signals to be directed to both the PLCG/LCN and Experion. As each South Area console performs its Experion Console/Server upgrade, the points associated with those related units will be migrated off the PLCG to the Experion via SCADA. Once the last console is migrated, the PLCG can be demolished.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	54 of 146	

3.7.2.4 Unit Alarm PLCs

There are three unit alarm PLCs that fit withing the scope boundary of the LAR3 project which are located in the following locations:

- 1CRUDE – LCR-3 Ops Shelter (B-1066)
- MEROX – LCR-4 (B-426)
- SRU – Ops Shelter (B-106)

All three PLCs are a MicroLogix 1000 which are obsolete. The MEROX unit alarm PLC in LCR-4 will be migrated to the DCS as opposed to upgrading the PLC itself as there will be a new C300 installed in that building. The 1CRUDE and SRU unit alarm PLCs will be upgraded to a MicroLogix 1400.

3.7.2.5 Air Dryer PLCs

There are three instrument air dryers located in the following units:

- DEHEX
- NESHAPS
- ALKY

All three dryer PLCs are a MicroLogix 1100 which are obsolete. These PLCs are OEM packaged units that are not connected to the existing DCS network. These PLCs will not be modified or upgraded.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	55 of 146	

3.7.3 BPCS PLC Scope Detail

3.7.3.1 South Area CEMS Data Concentrator (PLC5)

Unit	1CRUDE
Name	31PLC-9036
Description	South Area CEMS Data Concentrator
DCS Connection	LCN05/HWY04
Manufacturer	Rockwell/AB
Model	PLC-5
Location	South Area SACCR-B1085
Cabinet No.	LCN 5 – CERMS CAB. (F)
AC Source - Primary	120 VAC (Existing)
AC Source - Secondary	120 VAC (Existing)
Comm. Link A	RS-232 Connection to PLCG NODE 24 Port 1
Comm. Link B	Does not exist

Migration Plan

- No changes to power design
- No changes to PLC hardware
- Install DH+ to Modbus TCP protocol converter in LCN 5 CERMS Environmental Cabinet (F) to facilitate Modbus TCP to Experion server. The protocol converter will tie into the existing DH+ network but will not remove the existing RS-232 connection to the TDC. After installation, the DH+ to Modbus TCP protocol converter will allow communications to the TDC and Experion systems to exist simultaneously such that points can be cut over from TDC to Experion point-by-point with minimal data interruption.
 - This PLC does not have a redundant connection to the existing DCS. The project does not plan on providing a new redundant connection.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	56 of 146	

- Install Ethernet patch cable from new DH+ to Modbus TCP protocol converter to DCS 3rd party switch.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	57 of 146	

3.7.3.2 South Area CEMS Data Concentrator (CLX)

Unit	1CRUDE
Name	31PLC-XXXX
Description	South Area CEMS Data Concentrator
DCS Connection	LC05/HWY04
Manufacturer	Rockwell/AB
Model	CLX – Logix5571
Location	South Area SACCR-B1085
Cabinet No.	LCN 5 – CERMS CAB. ®
AC Source – Primary	120 VAC (Existing)
AC Source – Secondary	Available, not used
Comm. Link A	RS-232 Connection to PLCG NODE 24 Port 2
Comm. Link B	Does not exist

Migration Plan

- No changes to power design
- Upgrade L71 processor to L81E
- Install MOXA MB3270 protocol converter in LCN 5 CERMS Environmental Cabinet (F) to facilitate Modbus TCP to Experion server. MOXA MB3270 will allow communications to the TDC and Experion systems to exist simultaneously such that points can be cut over from TDC to Experion point-by-point with minimal data interruption.
 - This PLC does not have a redundant connection to the existing DCS. The project does not plan on providing a new redundant connection.
- Install Ethernet patch cable from new MOXA MB3270 to DCS 3rd party switch.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	58 of 146	

3.7.3.3 MEROX Unit Alarm PLC

Unit	MEROX
Name	44PLC-911
Description	MEROX Unit Alarm PLC
DCS Connection	Does not exist
Manufacturer	Rockwell/AB
Model	MicroLogix 1000
Location	LCR-4, B-426
Cabinet No.	44-LCP-911
AC Source - Primary	120 VAC FROM PANEL EC, CKT#6
AC Source - Secondary	Does not exist
Comm. Link A	Does not exist
Comm. Link B	Does not exist

Migration Plan

- Migrate PLC logic to C300 and cutover PLC I/O to Series C I/O. DCS to provide power to all loops. Existing panel, switches and 120VAC power in LCR4 will be re-used to terminate DCS loops and power the 120VAC solenoids for the horns
- Demo MicroLogix 1000 PLC

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	59 of 146	

3.7.3.4 SRU Unit Alarm PLC

Unit	SRU
Name	
Description	SRU Unit Alarm PLC
DCS Connection	Does not exist
Manufacturer	Rockwell/AB
Model	MicroLogix 1000
Location	SRU OPS Shelter (B-106)
Cabinet No.	67-LCP-11
AC Source - Primary	67-EE-213 POW. PNL "F" CKT#17
AC Source - Secondary	Does not exist
Comm. Link A	Does not exist
Comm. Link B	Does not exist

Migration Plan

- No changes to existing power design.
- Upgrade MicroLogix 1000 to MicroLogix 1400.
- No communications link to the DCS exists today. Project will not install one.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	60 of 146	

3.7.3.5 1CRUDE Unit Alarm PLC

Unit	1CRUDE
Name	51PLC-9910
Description	1CRUDE Unit Alarm PLC
DCS Connection	Does not exist
Manufacturer	Rockwell/AB
Model	MicroLogix 1000
Location	LCR-3 OPS Shelter (B-1066)
Cabinet No.	51-LCP-906
AC Source - Primary	120 VAC EP-C EMERG. PANEL CKT#28
AC Source - Secondary	Does not exist
Comm. Link A	Does not exist
Comm. Link B	Does not exist

Migration Plan

- No changes to existing power design.
- Upgrade MicroLogix 1000 to MicroLogix 1400.
- No communications link to the DCS exists today. Project will not install one.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	61 of 146	

3.7.3.6 BUTAMER Dryer PLC

Unit	BUTAMER
Name	82PLC-XXXX
Description	BUTAMER Dryer PLC
DCS Connection	LCN03/HWY10
Manufacturer	Rockwell/AB
Model	Logix5572
Location	Butane Shelter / SACCR B-1089
Cabinet No.	82-LCP-07
AC Source - Primary	120 VAC FROM PANEL 82-LP-02 CKT#8
AC Source - Secondary	120 VAC FROM PANEL 82-LP-02 CKT#10
Comm. Link A	Modbus RS-232
Comm. Link B	Does not exist

Migration Plan

- No changes to power design
- Upgrade L72 to L82E
- Upgrade ProSoft-MCM (RS-232) to Prosoft MVI56E-MNETC with Modbus TCP Client/Server support.
- Install Ethernet to Fiber converter for DCS communication link. This will require a 24 VDC power supply in the PLC panel.
 - MOXA ethernet to fiber converter model IMC-101G
 - MOXA SFP model SFP-1GLXLC
 - Fiber will need to be run to this remote PLC to support this communication link. The project plans to provide only non-redundant communications to this PLC. If redundant communications is required, a second MVI56E-MNETC card and Ethernet to fiber convert will need to be added.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	62 of 146	

3.7.3.7 Alky Refrigeration Compressor CCC Controllers

Unit	ALKY-C
Name	
Description	Alky Refrigeration Compressor CCC Controllers
DCS Connection	LCN03/HWY03
Manufacturer	CCC
Model	Series 3+ +
Location	ALKY
Cabinet No.	40-LCP-056
AC Source - Primary	120 VAC FROM PANEL EG, CKT#25
AC Source - Secondary	120 VAC FROM PANEL PA, CKT#2
Comm. Link A	RS-485
Comm. Link B	Does not exist

Migration Plan

- No changes to power design
- No changes to controller hardware
- Install MOXA MB3270 protocol converter in LCR-6 (B-529) west side of north wall. This will convert the common RS-485 network to Modbus TCP. No new fiber will be installed.
 - The RS-485 network is non-redundant. Redundant communication may not be achievable with this controller type.
- Install Ethernet patch cable from new MOXA MB3270 to DCS 3rd party switch.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	63 of 146	

3.7.3.8 Pignone 1st Stage FCC Compressor PLC

Unit	FCC
Name	TBD
Description	Pignone 1st Stage FCC Compressor PLC
DCS Connection	TBD
Manufacturer	Rockwell/AB
Model	SLC 5/03
Location	TBD
Cabinet No.	TBD
AC Source - Primary	TBD
AC Source - Secondary	TBD
Comm. Link A	Tie in to existing switch in NACCR for SCADA comms. Use LASR HR fiber to get back to FCC Rack Room. Use new HMI Web graphics to display information from this PLC, as part of the FCC console migration.
Comm. Link B	Does not exist

Migration Plan

- No changes to power design
- Upgrade PLC hardware to CLX with L81E and Prosoft MVI56-MNETC to support Modbus TCP to the area Experion server.
 - Existing PLC has simplex architecture and does not currently have redundant DCS communications. Project does not currently plan on providing a redundant link. A redundant link would require a second MVI56-MNETC card.
 - An analog input card will also be added.
- Install Ethernet to Fiber converter for DCS communication link. This will require a 24 VDC power supply in the PLC panel.
 - MOXA ethernet to fiber converter model IMC-101G

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	64 of 146	

- MOXA SFP model SFP-1GLXLC

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	65 of 146	

3.7.3.9 SRU Loading Rack PLC

Unit	SRU
Name	TBD
Description	SRU Loading Rack PLC
DCS Connection	Does not exist
Manufacturer	Rockwell/AB
Model	SLC 5/04
Location	67-LCP-SLR01
Cabinet No.	TBD
AC Source - Primary	TBD
AC Source - Secondary	TBD
Comm. Link A	Does not exist
Comm. Link B	Does not exist

Migration Plan

- No changes to power design
- Upgrade SLC PLC hardware to CLX with L81E.
- Upgrade existing control panel HMI with new AB PanelView HMI
- No communications link to the DCS exists today. Project will not install one.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	66 of 146	

3.7.4 BPCS PLCs not in Scope

The following table lists the BPCS PLCs that are within the LAR3 scope boundary that will not be part of LAR3 scope.

Item	Unit	Description	Platform	Reason not in Scope
1	ALKY	Alky Refrigerant Compr. Vibration Monitoring	Bently Nevada	This device does not currently have communication to the DCS.
2	1CRUDE	Unit alarm	MicroLogix 1000	This PLC has no communication to the existing DCS but is still obsolete. Upgrading the PLC hardware to a MicoLogix 1400 is an option but the preferred course of action is to migrate the logic and I/O to the DCS. The HPM upgrade to C300 has been deferred to 2026. Recommendation is to not upgrade the PLC in LAR3 in favor of migrating to the C300 in 2026.
3	1CRUDE	CEMS	PLC-5	Individual CEMs PLCs are not in AMP scope.
4	1CRUDE	CEMS	PLC-5	Individual CEMs PLCs are not in AMP scope.
5	1CRUDE	51 VAC Heater Stack Damper control	PLC-5/11	PLC be demolished as part of LAR2 51VAC heater upgrade.
6	1CRUDE	Spent Acid pumps	PLC-5	LARB scope
7	SRU	Unit Alarm	MicroLogix 1000	This PLC has no communication to the existing DCS but is still obsolete. Upgrading the PLC hardware to a MicoLogix 1400 is an option but the preferred course of action is to migrate the logic and I/O to the DCS. The HPM upgrade to C300 has been deferred to 2026. Recommendation is to not upgrade the PLC in LAR3 in favor of migrating to the C300 in 2026.
8	ISOM	Isom Dryer PLC	Modicon	This PLC is connected to LCN6 which is dedicated to the Isom console. A future AMP phase is addressing this PLC.
9	SRU	#1 & #1 Incinerator CEMS	CLX	Individual CEMs PLCs are not in AMP scope.
10	SRU	TGU2 CEMS	PLC-5	Individual CEMs PLCs are not in AMP scope.
11	SRU	H2S (FOUL AIR)	SLC5/04	PLC is out of service
12	DEHEX	DEHEX Kemp Air Dryer PLC	MicroLogix 1100	This device does not currently have communication to the DCS. Part of a vendor OEM package.
13	NESHAPS	NESHAPS Kemp Air Dryer PLC	MicroLogix 1100	This device does not currently have communication to the DCS. Part of a vendor OEM package.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	67 of 146	

Item	Unit	Description	Platform	Reason not in Scope
14	ALKY	ALKY Kemp Air Dryer PLC	MicroLogix 1100	This device does not currently have communication to the DCS. Part of a vendor OEM package.
15	S&H	Intrac PLC	CLX	Not a part of LAR3 PLC upgrades - LARB scope to migrate communications to LARB Experion Listed only because they communicate with LCN3 and are in the SCCAR. LAR3 assumption is that LARB will migrate these to the LARB Experion system.
16	S&H	S&H LARIC Data Concentrator	CLX	Not a part of LAR3 PLC upgrades - LARB scope to migrate communications to LARB Experion Listed only because they communicate with LCN3 and are in the SCCAR. LAR3 assumption is that LARB will migrate these to the LARB Experion system.
17	<i>S&H</i>	<i>S&H LARIC Data Concentrator</i>	CLX	Not a part of LAR3 PLC upgrades - LARB scope to migrate communications to LARB Experion Listed only because they communicate with LCN3 and are in the SCCAR. LAR3 assumption is that LARB will migrate these to the LARB Experion system.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	68 of 146	

3.7.5 Safety PLCs

BPCS SPLC scope is defined by the DCS units/consoles being migrated as part of the LAR AMP Project. The following table outlines the SPLCs in this units and the LAR3 scope associated with them.

PLC #	Description	As Found PCN	Logic Systems	LAR3 Scope
81SPLC0005	Isom / Butamer SPLC	LCN 3 / HWY 10 (PLCG24) located in LCR7	Butamer Reactor Feed and Butamer Reactor Feed/600# Steam Exchanger Shutdown	While this PLC communicate to LCN3, it contains logic systems associated with both the Butamer (which is part of the Alky console on LCN3) and Isom/NHDS (which is on a different LCN). LAR3 scope will be to leave the connection to the DCS As Found. Communications to be migrated to Modbus TCP when associated Butamer HPMs (11/12 and 13/14) are migrated to Experion.
			Chloride Injection East/West Pump Suction Disaster Valve Shutdown	
			Isom Dryer Regenerator (Electric)	
			[ISOM] Pumpout Pump, Flare KO Drum Pump, and Flare KO Drum Liquid to Pumpout	
			Isom Reactor Feed and Isom Reactor Feed/600# Steam Exchanger Shutdown	
			Naphtha Feed Shutdown to Bensat Feed Surge Drum	
67SPLC0006	SRU TMR SYS1 (A/B/TGU2)	LCN 5 / HWY 8 (PLCG49) located in SRU Rackroom	A Claus	LAR3 scope will be to leave the connection to the DCS As Found. Communications to be migrated to Modbus TCP when associated SRU HPMs (9/10 – 15/16) are migrated to Experion.
			B Claus	
			TGU2	
67SPLC0007	SRU TMR SYS2 (C/D/TGU1)	LCN 5 / HWY 8 (PLCG49)	C Claus (See Note 1)	LAR3 scope will be to leave the connection to the DCS As Found.
			D Claus	
			TGU1	

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	69 of 146	

PLC #	Description	As Found PCN	Logic Systems	LAR3 Scope
		located in SRU Rackroom		Communications to be migrated to Modbus TCP when associated SRU HPMs (9/10 – 15/16) are migrated to Experion.
67SPLC[NEW]	SRU TMR SYS3 (C Claus)	Planned to be installed by Mid-Cap SRU Gap Closure project in 2024 LCN5 / HWY[NEW] (PLCG[NEW]) located in SRU Rackroom	C Claus (other systems TBD)	LAR3 scope will be to leave the connection to the DCS As Found. Communications to be migrated to Modbus TCP when associated SRU HPMs (9/10 – 15/16) are migrated to Experion.
31PLC[NEW]	1Crude Heater	Planned to be installed by LAR2 AMP in 2024 LCN5 / HWY[NEW] (PLCG[NEW]) located in new LAR2 RIE Rackroom	1Crude Heater	LAR3 scope will be to leave the connection to the DCS As Found. Communications to be migrated to Modbus TCP when associated SRU HPMs (9/10 – 15/16) are migrated to Experion.
51PLC[NEW]	51Vac Heater		51Vac Heater	
21SPLC-[NEW-A]	#1 Reformer/ Desulfurizer Heater SPLC	N/A, new	#1 Reformer Heater #1 Desulfurizer Heater	New Tricon CX, tie-in to existing #1 Reformer Experion network
11SPLC-[NEW]	FCC Second Stage Compressor UPC	LCN04	FCC Second Stage Compressor	By LASR project
11SPLC-0008	FCC and #4 Steam Plant TMR	LCN04	Born Heater and others	Communications connection to DCS will remain As Found. BPCS scope is limited to new Modbus
23SPLC-0009	FFHDS Heater and Reactors TMR	LCN01	FFHDS Heater	

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	70 of 146	

PLC #	Description	As Found PCN	Logic Systems	LAR3 Scope
25SPLC-0025	LHU Heater TMR	LCN01	LHU Heater	point associated with the heater upgrades scope, as defined in section 3.8.
81SPLC-0019	NHDS Unit TMR	LCN06	NHDS Heater and others	

Note 1 – C Claus is expected to be migrated out of this TMR into the third TMR by the time LAR3 is performing the Experion Console/Network upgrade.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	71 of 146	

3.8 Heaters & Boilers

For additional details on each piece of equipment, see also LAR3 Heater Gap Report [AMP-LAR3-SIS-RPT-0001](#).

Scope overview for each heater is as follows:

Carson Heaters

RW-0023 – FCC Born Feed Heater

- Demo 11XY-082A/B 2oo2 SOV panel and tube 11XY-083A/B 2oo2 SOV panel to both fuel gas chopper valves. Re-tag fuel gas chopper valves to 11XV-083A & 11XV-083B
- Add RSP-1172-024 standard piping bypass around fuel gas chopper valves
- Add 2nd pilot gas chopper valve 11XV-081B. Re-tag existing pilot gas chopper valve to 11XV-081A.
- Convert pilot gas supply to natural gas
 - Pipe natural gas to pilot gas station
 - Demo existing redundant pilot gas regulator 11PCV-4654
 - Rebuild pilot gas station to move remaining pilot gas regulator 11PCV-4653 downstream of pilot gas chopper valves and add bypass around regulator.
- Add interlock to de-energize O2 analyzer 11AT-905 probe heater on full heater trip
- Add light-off panel with ESD pushbutton
- Modify existing SIS logic to reflect changes/additions to inputs and outputs
- Route a new natural gas supply line to pilot gas chopper valves. Fuel gas supply will be reconnected to the new natural gas service line as a backup fuel source and will be normally closed (NC).

RW-0025 – 1REF #1 Reformer Heater

- Install new Tricon CX SIS for RW-0025 & RW-0026 in 1REF rack room
- Demo existing pilot gas regulator 21PCV-4304 shared by RW-0025 & RW-0026
- Demo existing pilot gas and fuel gas piping to install new piping routes to supply services to the new station location
- Demo existing PCV 4305 and install new with bypass at new location.
- Add chopper valve station for RW-0025 that includes the following:
 - RSP-1172-024 standard fuel gas chopper valve station with 2 valves (21XV-846A & 21XV-846B), bypass, and ASCO RCS 2oo2 SOV panel
 - 2 pilot gas chopper valves 21XV-847A & 21XV-847B
 - 1 pilot gas regulator 21PCV-4109 downstream of new pilot gas chopper valves w/ bypass per site's request
 - 1 instrument air header
 - 1 SIS pilot gas pressure transmitter 21PT-507 downstream of new pilot gas PCV
- Field route instrument air (screw piping) from source to new station

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	72 of 146	

- Add 2 SIS fuel gas pressure transmitters downstream of the fuel gas control valve on the fuel gas line to each cell (4 cells total – 21PT-503A&B, -504A&B, -505A&B, and -506A&B)
- Add 2nd SIS DP flow transmitter for low flow trips on the following:
 - Existing BFW flows 21FE-183 & 21FE-184
 - Existing superheated steam flow 21FE-130
 - Existing liquid HC feed / Naphtha flow 21FE-110
- Modify piping to move RW-0004 compressor spillback line tee-off upstream on discharge line to install new v-cone flow meter in discharge line downstream of spillback line tee-off to directly measure recycle gas flow to RW-0025 passes. Install 1 SIS (21FT-177A) & 1 BPCS (21FT-177) flow transmitter on new flow meter for 1oo1D low flow trip
- Add interlocks to de-energize O2 analyzers 21AT-945/946/947/948/991/992 probe heaters on full heater trip
- Add light-off panel with ESD pushbutton
- Add console ESD pushbutton
- Add remote ESD pushbutton >50ft from heater

RW-0026 – 1REF #1 Desulfurizer Heater

- Add chopper valve station for RW-0026 that includes the following:
 - RSP-1172-024 standard fuel gas chopper valve station with 2 valves (21XV-886A & 21XV-886B), bypass, and ASCO RCS 2oo2 SOV panel
 - 2 pilot gas chopper valves 21XV-887A & 21XV-887B
 - 1 pilot gas regulator 21PCV-4101 downstream of new pilot gas chopper valves with new bypass per site's request
 - 1 instrument air header
 - 1 SIS pilot gas pressure transmitter 21PT-502 downstream of new pilot gas PCV
- Demo existing pilot gas and fuel gas piping to install new piping routes to supply services to the new station location
- Field route instrument air (screw piping) from source to new station
- Add 2 SIS fuel gas pressure transmitters 21PT-501A & 21PT-501B downstream of the fuel gas control valve
- Add 2nd SIS DP flow transmitter for low flow trips on the following:
 - Existing BFW flow 21FE-150
 - Existing liquid HC feed / Naphtha flow 21FE-105
- Add 1 new V-cone flow meter 21FE-176 downstream of desulfurizer recycle compressor spillback line tee-off on the discharge line, with 1 new BPCS transmitter 21FT-176 and 1 new SIS transmitter 21FT-176A to measure recycle gas / H₂ flow to RW-0026 for low flow trip
- Add interlocks to de-energize O2 analyzer 21AT-993 probe heater on full heater trip
- Add light-off panel with ESD pushbutton
- Add console ESD pushbutton
- Add remote ESD pushbutton >50ft from heater

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	73 of 146	

RW-0028 – LHU Feed Heater

- Demo 25XY-912A/B 2oo2 SOV panel and tube 25XY-913A/B 2oo2 SOV panel to both fuel gas chopper valves. Re-tag fuel gas chopper valves to 25XV-913A & 25XV-913B
- Add RSP-1172-024 standard piping bypass around fuel gas chopper valves
- Add 2nd SIS fuel gas pressure transmitter 25PT-423B for 2oo2D voting. Re-tag existing SIS fuel gas pressure transmitter to 25PT-423A
- Add 2 pilot gas chopper valves 25XV-917A & B
- 1 pilot gas regulator PCV-4001 downstream of new pilot gas chopper valves with new bypass per site's request
- Add 1 SIS pilot gas pressure transmitter 25PT-424
- Add interlock to de-energize O2 analyzer 25AT-900 probe heater on full heater trip
- Add light-off panel with ESD pushbutton
- Modify existing SIS logic to reflect changes/additions to inputs and outputs

RW-0048 – FFHDS Reactor Feed Heater

- Demo 23XY-036A/B 2oo2 SOV panel and tube 23XY-037A/B 2oo2 SOV panel to both fuel gas chopper valves. Re-tag fuel gas chopper valves to 23XV-037A & 23XV-037B
- Add RSP-1172-024 standard piping bypass around fuel gas chopper valves
- Add 2nd SIS fuel gas pressure transmitter on each cell for 2oo2D voting (23PT-567B & 23PT-568B). Re-tag existing SIS fuel gas pressure transmitters to 23PT-567A & 23PT-568A
- Add 2 pilot gas chopper valves 23XV-634A & B
- 1 pilot gas regulator PCV-4021 downstream of new pilot gas chopper valves with new bypass per site's request
- Add 1 SIS pilot gas pressure transmitter 23PT-502
- Add interlock to de-energize O2 analyzers 23AT-916 & 23AT-949 probe heaters on full heater trip
- Add light-off panel with ESD pushbutton
- Modify existing SIS logic to reflect changes/additions to inputs and outputs

RW-0053 – NHDS Reactor Feed Heater

- Demo 81XY-908A/B 2oo2 SOV panel and tube 81XY-907A/B 2oo2 SOV panel to both fuel gas chopper valves. Re-tag fuel gas chopper valves to 81XV-907A & 81XV-907B
- Add RSP-1172-024 standard piping bypass around fuel gas chopper valves
- Add interlock to de-energize O2 analyzer 81AT-969 probe heater on full heater trip
- Add light-off panel with ESD pushbutton
- Modify existing SIS logic to reflect changes/additions to inputs and outputs
- Add 2nd SIS fuel gas pressure transmitter for 2oo2D voting (23PT-435B). Re-tag existing SIS fuel gas pressure transmitters to 23PT-435A

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	74 of 146	

Wilmington Heaters & Boilers

H-300 – HCU Reactor #1 Hydrogen Heater

- Demo existing fuel gas chopper valve 05PV-3301A and latching solenoids on chopper valve and control valve.
- Install RSP-1172-024 standard fuel gas chopper valve station with 2 valves (05XV-3443A & B), bypass, and ASCO RCS 2002 SOV panel
- Add 2nd SIS fuel gas pressure transmitter 05PT-3301B downstream of control valve
- Add 2 pilot gas chopper valves 05XV-3448A & B
- Modify pilot gas regulator PCV-4021 downstream of new pilot gas chopper valves with new bypass per site's request
- Add 1 SIS pilot gas pressure transmitter 05PT-3405 downstream of existing 05PCV-3340
- Add interlock to de-energize O2 analyzer 05AT-3810 probe heater on full heater trip
- Install relay to trip SCR ammonia valve 05FV-3821 on loss of ID fan or loss of fuel gas to both H-300 & H-301
- Install 6 flame scanners
- Field route instrument air (screw piping) from source to Rotameters for new flames
- Install light-off panel (common to H-300 & H-301) with local ESD pushbuttons for both H-300 & H-301
- Install remote ESD pushbutton >50ft from heater
- Update Honeywell Safety Manager logic to add/modify alarms per LAR Carson soft tag convention (1 program common to all heaters H-300/301/302/303/304)

H-301 – HCU Reactor #2 Hydrogen Heater

- Demo existing fuel gas chopper valve 05PV-3305A and latching solenoids on chopper valve and control valve.
- Install RSP-1172-024 standard fuel gas chopper valve station with 2 valves (05XV-3444A & B), bypass, and ASCO RCS 2002 SOV panel
- Add 2nd SIS fuel gas pressure transmitter 05PT-3305B downstream of control valve
- Add 2 pilot gas chopper valves
- Modify pilot gas regulator PCV-4021 downstream of new pilot gas chopper valves with new bypass per site's request
- Add 1 SIS pilot gas pressure transmitter 05PT-3406 downstream of existing 05PCV-3339
- Add interlock to de-energize O2 analyzer 05AT-3811 probe heater on full heater trip
- Install 3 flame scanners
- Field route instrument air (screw piping) from source to Rotameters for new flames
- Install remote ESD pushbutton >50ft from heater

H-302 – HCU Reactor #3 Hydrogen Heater

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	75 of 146	

- Demo existing fuel gas chopper valve 05PV-3312A and latching solenoids on chopper valve and control valve.
- Install RSP-1172-024 standard fuel gas chopper valve station with 2 valves (05XV-3445A & B), bypass, and ASCO RCS 2002 SOV panel
- Add 2nd SIS fuel gas pressure transmitter 05PT-3312B downstream of control valve
- Add 2 pilot gas chopper valves 05XV-3449A & B
- Modify pilot gas regulator PCV-4021 downstream of new pilot gas chopper valves with new bypass per site's request
- Add 1 SIS pilot gas pressure transmitter 05PT-3407 downstream of existing 05PCV-3357
-
- Add interlock to de-energize O2 analyzer 05AT-3812 probe heater on full heater trip
- Install relay to trip SCR ammonia valve 05FV-3843 on loss of ID fan or loss of fuel gas to both H-302 & H-303
- Install 6 flame scanners
- Field route instrument air (screw piping) from source to Rotameters for new flames
- Install light-off panel (common to H-302 & H-303) with local ESD pushbuttons for both H-302 & H-303
- Install remote ESD pushbutton >50ft from heater

H-303 – HCU 2nd Stage Charge Heater

- Demo existing fuel gas chopper valve 05PV-3311A and latching solenoids on chopper valve and control valve.
- Install RSP-1172-024 standard fuel gas chopper valve station with 2 valves (05XV-3446A & B), bypass, and ASCO RCS 2002 SOV panel
- Add 2nd SIS fuel gas pressure transmitter 05PT-3311B downstream of control valve
- Add 2 pilot gas chopper valves
- Modify pilot gas regulator PCV-3365 downstream of new pilot gas chopper valves with new bypass per site's request
- Add 1 SIS pilot gas pressure transmitter 05PT-3408 downstream of existing 05PCV-3365
- Add interlock to de-energize O2 analyzer 05AT-3813 probe heater on full heater trip
- Install 4 flame scanners
- Field route instrument air (screw piping) from source to Rotameters for new flames
- Install remote ESD pushbutton >50ft from heater

H-304 – HCU Fractionator Reboiler Heater

- Demo existing fuel gas chopper valve 05PV-3323B and latching solenoids on chopper valve and control valves.
- Install RSP-1172-024 standard fuel gas chopper valve station with 2 valves (05XV-3447A & B), bypass, and ASCO RCS 2002 SOV panel

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	76 of 146	

- Add 2nd SIS fuel gas pressure transmitter downstream of control valve on fuel gas line to each cell (2 cells – 05PT-3323B & 05PT-3325B)
- Add 2 pilot gas chopper valves 05XV-3473A & B
- Modify pilot gas regulator PCV-3375 & PCV-3372 downstream of new pilot gas chopper valves with new bypass per site's request
- Add 1 SIS pilot gas pressure transmitter downstream of existing PCV on pilot gas line to each cell (2 cells – 05PT-3409 & 05PT-3410)
- Add interlock to de-energize O2 analyzers 05AT-3814A & 05AT-3814C probe heaters on full heater trip
- Install relay to trip SCR ammonia valve 05FV-3865 on loss of ID fan or loss of fuel gas
- Install 6 flame scanners
- Field route instrument air (screw piping) from source to Rotameters for new flames
- Install light-off panel with local ESD pushbutton
- Install remote ESD pushbutton >50ft from heater

H-42 – HGU-2 Reformer Heater

- Install new Tricon CX SIS for H-42 in HPD Rack Room (front of cabinet shared with new H-43 Tricon CX SIS)
- Migrate existing field instruments associated with H-42 wired to existing relay logic inputs & outputs to new H-42 Tricon CX SIS. Demo relay logic system (except for fan turbine HOA switches).
 - Replace any affected 120VAC solenoids with 24VDC solenoids (excluding turbine auto-start SOVs). All new solenoids to be non-latching
 - Replicate startup and shutdown relay logic in new SIS program
- Demo existing fuel gas chopper valve 61XV-389 and vent-to-flare valve 61XV-395 and trip solenoid on control valve.
- Install RSP-1172-024 standard fuel gas chopper valve station with 2 valves (61XV-389A & B), bypass, and ASCO RCS 2002 SOV panel
- Demo existing fuel gas pressure switches 61PSH-386, 61PSL-387, & 61PSLL-388.
- Install 1 new BPCS pressure transmitter 61PT-388 and 2 new SIS pressure transmitters 61PT-388A & B for 2002D voting on high & low fuel gas pressure trip
- Install RSP-1172-024 standard bypass around existing purge gas chopper valves 61XV-355 & 399 and add limit switches to both valves.
- Demo existing purge gas chopper valve trip solenoids and add ASCO RCS.
- Demo existing purge gas pressure switches 61PSH-396, 61PSL-397, & 61PSLL-398.
- Install 1 new BPCS pressure transmitter 61PT-398 and 2 new SIS pressure transmitters 61PT-398A & B for 2002D voting on high & low purge gas pressure trip
- Demo existing pilot gas chopper valve 61XV-381 and vent-to-flare valve 61XV-385.
- Install 2 new pilot gas chopper valves 61XV-381A & B

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	77 of 146	

- Demo existing pilot gas pressure switches 61PSH-378, 61PSL-379, & 61PSLL-380. Re-wire existing pilot gas pressure transmitter 61PT-380 to new SIS
- Add interlock to de-energize O2 analyzer 61AT-125 probe heater on full heater trip
- Install relay to trip SCR ammonia valve 61HV-1113 on loss of ID fan or full trip of both H-42 & H-43
- Install 9 flame scanners
- Field route instrument air (screw piping) from source to Rotameters for new flame scanners
- Install light-off panel on handrail outside penthouse on top of H-42 structure. Relocate existing ESD pushbutton at top of reformer to new light-off panel
- Wire induced draft fan B-140 speed 61ST-117 and motor status to new SIS. Wire trip output from SIS to ID fan motor.
- Demo existing GWR transmitters 61LT-143 & 61LT-145 and "Christmas Tree" / LED local level indicator. Install piping bridle using LED local level indicator high and low nozzles with connections for 2 new GWR LT chambers to allow both LT's to measure full span. Re-use LT tags and wire for 2oo2 low steam drum level trip.
- Re-tag existing steam drum pressure transmitter 61PT-151 to 61PT-151A, rewire to new SIS, and add 2nd SIS pressure transmitter 61PT-151B for 2oo2 high steam drum pressure trip

H-43 – HGU-2 Auxiliary Boiler

- Install new Tricon CX SIS for H-43 in HPD Rack Room (rear of cabinet shared with new H-42 Tricon CX SIS)
- Migrate existing field instruments associated with H-43 wired to existing relay logic inputs & outputs to new H-43 Tricon CX SIS. Demo relay logic system (except for fan turbine HOA switches).
 - Replace any affected 120VAC solenoids with 24VDC solenoids (excluding turbine auto-start SOVs). All new solenoids to be non-latching
 - Replicate startup and shutdown relay logic in new SIS program
- Demo existing fuel gas chopper valve 61XV-636 and vent-to-flare valve 61XV-639 and trip solenoid on control valve. Install 2 fuel gas chopper valves 61XV-636A & B and ASCO RCS 2oo2 SOV panel
- Demo existing fuel gas pressure switches 61PSH-638, 61PSL-637, & 61PSLL-634. Install 1 new SIS pressure transmitter 61PT-638 1oo1D voting on high & low fuel gas pressure trip
- Add limit switches to existing pilot gas chopper valve 61XV-640 and vent-to-flare valve 61XV-641
- Demo existing instrument air supply pressure switch 61PSL-608 and replace with SIS pressure transmitter 61PT-608
- Install forced-draft fan speed sensor 61ST-309 and wire to SIS. Wire fan status to SIS and trip output from SIS to FD fan motor.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	78 of 146	

- Add 1 new SIS flow transmitter on FD fan inlet flow 61FE-644
- Replace FD fan duct pressure 61PSLL-609 with new SIS pressure transmitter 61PT-609
- Wire FGR fan B-146 motor status to SIS and trip output from SIS to FGR fan motor. Wire FGR fan damper position to SIS and trip output from SIS to FGR fan damper SOV.
- Demo existing steam drum level switches 61LSLL-601 & 61LSHH-602 and LED local level indicator on south end of steam drum. Install piping bridle using local level indicator high and low nozzles to install 2 new guided-wave radar level transmitters 61LT-601 & 61LT-602 measuring the full level span for 2oo2 low steam drum level trip
- Re-tag existing steam drum pressure transmitter 61PT-649 to 61PT-649A, rewire to new SIS, and add 2nd SIS pressure transmitter 61PT-649B for 2oo2 high steam drum pressure trip
- Install 2 new windbox O2 analyzers wired to DCS, with 2oo2 voting trip signal from DCS hardwired to SIS
- Demo low-side tubing on existing firebox pressure transmitter 61PDT-676 to vent low side to atmosphere. Add 2nd firebox pressure transmitter 61PDT-676A using spare connection at existing tap and wire to SIS
- Demo existing 120VAC boiler control panel and replace with new boiler light-off panel with ESD pushbuttons for H-42 & H-43
- Install remote ESD pushbutton >50ft from boiler
- Upgrade existing obsolete flame scanners to Fireye Insight flame scanners. Replace existing ignitors.

H-43 – HGU2 Auxiliary Boiler Trim Burners

- Demo trip solenoid 61XY-629 on trim burner fuel gas chopper valve 61XV-629 and vent-to-flare valve 61XV-630. Replace with ASCO RCS 2oo2 SOV panel
- Replace 120VAC solenoids on all other fuel gas and pilot gas chopper valves with 24VDC solenoids
- Add limit switches to all existing fuel gas and pilot gas chopper valves and vent-to-flare valves
- Demo existing fuel gas pressure switches 61PSH-626, 61PSL-627, & 61PSLL-628. Install 1 new SIS pressure transmitter 61PT-628 1oo1D voting on high & low fuel gas pressure trip
- Demo existing pilot gas pressure switches 61PSH-617, 61PSL-616, & 61PSLL-615. Install 1 new SIS pressure transmitter 61PT-615 for low pilot gas pressure trip
- Demo existing trim burner ignition panel and replace with new trim burner light-off panel with local ESD pushbutton
- Install remote ESD pushbutton >50ft from boiler and soft ESD on console
- Upgrade existing obsolete flame scanners to Fireye Insight flame scanners. Replace existing ignitors.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	79 of 146	

3.8.1 Mechanical & Piping

All mechanical and piping modifications are associated with new instrumentation needed to address LOPA and/or RSP gaps.

All new piping installations are to be designed using the latest revision of MPC's piping specifications.

Pilot Gas Piping

Same considerations and design basis as Fuel Gas piping. When possible, ideally FG and PG piping are combined onto a single skid to maximize non-TAR construction.

- Each pilot gas regulator station will be modified/replaced to include the necessary two (2) chopper valves, upstream of the regulating valve. The project will confirm pilot gas supply is natural gas, and making piping modifications to convert supply to natural gas if it is not already.
- Any regulator station that is replaced or moved as part of the project scope will be replaced or moved to provide the same functionality after the project, i.e., existing regulator bypasses will be kept but new ones will not be added unless specifically requested and approved.

Definition design basis for heater fuel gas and pilot gas installations are as follows:

LARC – FCC – RW-0023

- Existing:
 - 2 fuel gas valves, separate 2oo2 SOV panels, no bypass
 - 1 pilot gas valve, 2oo2 SOV panel, fuel gas to pilots
- Definition design basis:
 - Fuel gas: Stick build; demo 1 SOV panel, tube remaining panel to both valves. Add bypass, block valves, & blind.
 - Pilot gas: Rebuild pilot gas station, eliminate redundant upstream pilot gas PCV, add 2nd chopper valve and move remaining PCV downstream of chopper valves, include bypass around PCV. Install piping to route natural gas to pilot gas station.

LARC – 1REF – RW-0025

- Existing:
 - No fuel gas or pilot gas chopper valves
- Definition design basis:
 - Stick build chopper valve station for both fuel gas and pilot gas. Includes 2 FG chopper valves with ASCO RCS nearby and bypass piping, 2 PG chopper valves, 1 PG PCV, and 1 PG PT.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	80 of 146	

LARC – 1REF – RW-0026

- Existing:
 - No fuel gas or pilot gas chopper valves
- Definition design basis:
 - Stick build chopper valve station for both fuel gas and pilot gas. Includes 2 FG chopper valves with ASCO RCS nearby and bypass piping, 2 PG chopper valves, 1 PG PCV, and 1 PG PT.

LARC – LHU – RW-0028

- Existing:
 - 2 fuel gas valves, separate 2oo2 SOV panels, no bypass
 - No pilot gas chopper valves
- Definition design basis:
 - Fuel gas: Stick build; demo 1 SOV panel, tube remaining panel to both valves. Add bypass, block valves, & blind.
 - Pilot gas: Stick build; add 2 chopper valves with individual SOVs, relocate PCV to grade. Add root valve for PG PT

LARC – FFHDS – RW-0048

- Existing:
 - 2 fuel gas valves, separate 2oo2 SOV panels, no bypass
 - No pilot gas chopper valves
- Definition design basis:
 - Fuel gas: Stick build; demo 1 SOV panel, tube remaining panel to both valves. Add bypass, block valves, & blind.
 - Pilot gas: Stick build; add 2 chopper valves with individual SOVs. Add root valve for PG PT

LARC – NHDS – RW0053

- Existing:
 - 2 fuel gas valves, separate 2oo2 SOV panels, no bypass
 - 2 pilot gas valves, separate 2oo2 SOV panels
- Definition design basis:
 - Fuel gas: Stick build; demo 1 SOV panel, tube remaining panel to both valves. Add bypass, block valves, & blind.
 - Pilot gas: Leave as-is

LARW – HCU – H-300

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	81 of 146	

- Existing:
 - 1 fuel gas chopper valve with latching SOV, and trip solenoid on control valve
 - No pilot gas chopper valves
- Definition design basis:
 - Fuel gas: Stick build; demo existing chopper valve, bypass, and SOV. Add 2 new chopper valves, bypass, and ASCO RCS
 - Pilot gas: Pilot gas station with 2 chopper valves. Modify regulator station to add bypass and SIS pressure transmitter downstream of regulator

LARW – HCU – H-301

- Existing:
 - 1 fuel gas chopper valve with latching SOV, and trip solenoid on control valve
 - No pilot gas chopper valves
- Definition design basis:
 - Fuel gas: Stick build; demo existing chopper valve, bypass, and SOV. Add 2 new chopper valves, bypass, and ASCO RCS
 - Pilot gas: Pilot gas station with 2 chopper valves. Modify regulator station to add bypass and SIS pressure transmitter downstream of regulator

LARW – HCU – H-302

- Existing:
 - 1 fuel gas chopper valve with latching SOV, and trip solenoid on control valve
 - No pilot gas chopper valves
- Definition design basis:
 - Fuel gas: Stick build; demo existing chopper valve, bypass, and SOV. Add 2 new chopper valves, bypass, and ASCO RCS
 - Pilot gas: Pilot gas station with 2 chopper valves. Modify regulator station to add bypass and SIS pressure transmitter downstream of regulator

LARW – HCU – H-303

- Existing:
 - 1 fuel gas chopper valve with latching SOV, and trip solenoid on control valve
 - No pilot gas chopper valves
- Definition design basis:
 - Fuel gas: Stick build; demo existing chopper valve, bypass, and SOV. Add 2 new chopper valves, bypass, and ASCO RCS
 - Pilot gas: Pilot gas station with 2 chopper valves. Modify regulator station to add bypass and SIS pressure transmitter downstream of regulator

LARW – HCU – H-304

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	82 of 146	

- Existing:
 - 1 fuel gas chopper valve with latching SOV, and trip solenoid on control valve
 - No pilot gas chopper valves
- Definition design basis:
 - Fuel gas: Stick build; demo existing chopper valve, bypass, and SOV. Add 2 new chopper valves, bypass, and ASCO RCS
 - Pilot gas: Stick build; add 2 chopper valves with individual SOVs; modify regulator station to add bypass and SIS pressure transmitter downstream of regulator

LARW – HGU2 – H-42

- Existing:
 - 1 fuel gas chopper valve, vent-to-flare valve, and trip solenoid on control valve
 - 1 pilot gas chopper valve and vent-to-flare valve
 - 2 purge gas chopper valves with individual solenoids, no bypass
- Definition design basis:
 - Fuel gas: Demo existing chopper valve and vent to flare, add 2 chopper valves, bypass piping, and ASCO RCS
 - Pilot gas: Pilot gas: Stick build; demo existing chopper valve and vent to flare and add 2 chopper valves with individual SOVs
 - Purge gas: Keep existing valves, add bypass, replace individual SOVs with common ASCO RCS

LARW – HGU2 – H-43

- Existing:
 - 1 main burner fuel gas chopper valve and vent-to-flare valve, common 120VAC trip SOV
 - 1 main burner pilot gas chopper valve and vent-to-flare valve, common 120VAC trip SOV
 - 1 trim burner fuel gas header chopper valve and vent-to-flare valve, 1 chopper valve at each of 4 burners
 - 1 trim burner pilot gas header chopper valve and vent-to-flare valve, 1 chopper valve at each of 4 burners
- Definition design basis:
 - Main burner fuel gas: Demo existing chopper valve and vent to flare. Add 2 chopper valves and ASCO RCS
 - Main burner pilot gas: Re-use existing valves; add limit switches and replace SOV with 24VDC SOV
 - Trim burner fuel gas: Keep single chopper valve on fuel gas header, replace trip SOV with ASCO RCS. Re-use burner chopper valves, add limit switches and replace SOVs with 24VDC SOVs

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	83 of 146	

- Add two new connections on the boiler windbox for 2 new O2 analyzers
- Trim burner pilot gas: Re-use existing valves; add limit switches and replace SOV with 24VDC SOV

Below are the design basis for feed pass and BFW flow taps for each heater:

LARC – FCC – RW-0023

- Existing:
 - Total pass flow 11FE-157; individual pass flows 11FE-158/159/160/161
- Definition design basis:
 - No Change

LARC – 1REF – RW-0025

- Existing:
 - Feed – HC: 21FE-110
 - Feed – H₂: 21FE-125 on compressor discharge, 21FE-122 on spillback
 - BFW: 21FE-183/184
 - Steam: 21FE-130
- Definition design basis:
 - Feed – HC: Replace orifice flange pair with 2-tap flange, add 2nd flow transmitter and wire to SIS
 - Feed – H₂: Add new V-cone flow meter on recycle compressor discharge downstream of spillback line tee-off with 1 new BPCS transmitter and 1 new SIS transmitter to directly measure recycle gas / H₂ flow to RW-0025 for low flow trip
 - BFW: Replace orifice flange pairs on 21FE-183 & 184 with 2-tap flange, add 2nd flow transmitter and wire to SIS
 - Steam: Replace orifice flange pair with 2-tap flange, add 2nd flow transmitter and wire to SIS

LARC – 1REF – RW-0026

- Existing:
 - Feed – HC: 21FE-105
 - Feed – H₂: 21FE-xxx
 - BFW: 21FE-150
- Definition design basis:
 - Feed – HC: Replace orifice flange pair with 2-tap flange, add 2nd flow transmitter and wire to SIS
 - Feed – H₂: Add new V-cone flow meter on recycle compressor discharge downstream of spillback line tee-off with 1 new BPCS transmitter and 1 new SIS transmitter to directly measure recycle gas / H₂ flow to RW-0026 for low flow trip

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	84 of 146	

- BFW: Replace orifice flange pair on 21FE-150 with 2-tap flange, add 2nd flow transmitter and wire to SIS

LARC – LHU – RW-0028

- Existing:
 - Feed – HC: 25FE-103
 - Feed – H₂: 25FE-102
- Definition design basis:
 - No change

LARC – FFHDS – RW-0048

- Existing:
 - Feed – HC: 23FE-110A/B/C, 23FE-111A/B/C
 - Feed – H₂: 23FE-120A/B/C, 23FE-125A/B/C
- Definition design basis:
 - No change

LARC – NHDS – RW0053

- Existing:
 - Feed – HC: 81FE-133
 - Feed – H₂: 81FE-142
- Definition design basis:
 - No change

LARW – HCU – H-300

- Existing:
 - Pass flow 05FE-3105
- Definition design basis:
 - No change

LARW – HCU – H-301

- Existing:
 - Pass flow 05FE-3107
- Definition design basis:
 - No change

LARW – HCU – H-302

- Existing:
 - Pass flow 05FE-3123

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	85 of 146	

- Definition design basis:
 - No change

LARW – HCU – H-303

- Existing:
 - Pass flow coils 05FE-3115/3116/3117/3118
- Definition design basis:
 - No change

LARW – HCU – H-304

- Existing:
 - Pass flow coils 05FE-3136/3137/3138/3139/3140/3141/3142/3143
- Definition design basis:
 - No change

LARW – HGU2 – H-42

- Existing:
 - Feed – HC: 61FE-109
 - Feed – Steam: 61FE-110
 - BFW: 61FE-198
- Definition design basis:
 - Feed HC/steam: No change
 - BFW: No change

LARW – HGU2 – H-43

- N/A

Below are the design basis for flame scanners requirements for each heater:

Site	Unit	Equipment	Scope	Notes
LARC	FFHDS	RW048	None	Natural Draft, no flame detectors req'd. No ignitors req'd.
LARC	LHU	RW028	None	Natural Draft, no flame detectors req'd. No ignitors req'd.
LARC	FCC	RW023	None	Natural Draft, no flame detectors req'd. No ignitors req'd.
LARC	NHDS	RW053	None	Natural Draft, no flame detectors req'd. No ignitors req'd.
LARC	1REF	RW025	None	Natural Draft, no flame detectors req'd. No ignitors req'd.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	86 of 146	

Site	Unit	Equipment	Scope	Notes
LARC	1REF Desulf	RW026	None	Natural Draft, no flame detectors req'd. No ignitors req'd.
LARW	HCU	H-300	6 flame detectors req'd	Recommend using existing ports on burner plates
LARW	HCU	H-301	3 flame detectors req'd	Recommend using existing ports on burner plates
LARW	HCU	H-302	6 flame detectors req'd	Recommend using existing ports on burner plates
LARW	HCU	H-303	4 flame detectors req'd	Recommend using existing ports on burner plates
LARW	HCU	H-304	East 3 required, West 3 required	Recommend using existing ports on burner plates
LARW	HGU-2	H-42	Add 9 new flame detectors	Recommend using existing ports on burner plates
LARW	HGU-2	H-43	Main Burner – Demo existing 2 flame detectors, ignitor, demo Coen lightoff panel. Trim Burners – Demo existing 4 flame detectors, 4 pilot ignitors, demo 2 lightoff panels	Add 2 new flame detectors, 1 ignitor, 1 lightoff panel. Lightoff logic in Tricon CX Add 4 new flame detectors, 4 ignitors, 1- Lightoff panel. Lightoff logic in Triconex

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	87 of 146	

Below are the design basis for arch pressure nozzles & PTs for each heater:

Site	Unit	Equipment	Tag	Scope	Notes
LARC	FFHDS	RW048	23-PT-446	Use existing	Verify a high draft pressure alarm
LARC	LHU	RW028	25-PT-421	Use existing	Verify a high draft pressure alarm
LARC	FCC	RW023	11-PT-481	Use existing	Verify a high draft pressure alarm
LARC	NHDS	RW053	81-PDT-412	Use existing	Verify a high draft pressure alarm
LARC	1REF	RW025	21-PT-427, 428	Use existing	Verify a high draft pressure alarm
LARC	1REF Desulf	RW026	21-PT-481	Use existing	Verify a high draft pressure alarm
LARW	HCU	H-300	5-PT-3838	Use existing	Common with H-301
LARW	HCU	H-301	5-PT-3838	Use existing	Common with H-300
LARW	HCU	H-302	5-PT-3899	Use existing	Common with H-303
LARW	HCU	H-303	5-PT-3899	Use existing	Common with H-302
LARW	HCU	H-304	5-PT-3883	Use existing	
LARW	HGU-2	H-42	61-PT-119	Use existing	
LARW	HGU-2	H-43	61-PDT-676	Add new SIS xmtr	Spare tap available at 61-PDT-676 high side. Need new SIS xmtr, independent isolation

Below are the design basis for new O2 analyzers on H-43 Aux Boiler:

Site	Unit	Equipment	Tags	Scope	Notes
LARW	HGU2	H-43	61-PT-609	Add pressure transmitter to existing tap for O2 compensation in windbox	
LARW	HGU2	H-43	61-AT-207A	Add new nozzle	Windbox O2 Analyzer, install in forced draft fan duct to burner.
LARW	HGU2	H-43	61-AT-207B	Add new nozzle	Windbox O2 Analyzer, install in forced draft fan duct to burner.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	88 of 146	

3.8.2 Electrical – Power

LARW

New H-42 & H-43 Tricon CX cabinets in HPD rack room will require 2 UPS 120VAC sources and 1 120VAC utility power source. Existing UPS PNL R will provide 1 source, and UPS-2 panel installed by AMP LAR2 will provide the 2nd source. Existing power Panel E will provide utility power.

H-42/43 require UPS 24VDC power for the flame scanners in the light-off panels, which will be provided by existing 61-DCP-100 in Sub #9.

H-42/43 light-off panel lamps require 24VDC from their respective Tricon CX cabinets. 1 24VDC circuit will be pulled from the H-42 Tricon CX cabinet to the H-42 light-off panel. 2 24VDC circuits will be pulled from the H-43 Tricon CX cabinet; 1 to the main burner control/light-off panel, and 1 to the trim burner ignition/light-off panel.

H-300/1/2/3/4 require UPS 24VDC power for the flame scanners in the light-off panels. A new 24V DCP will be purchased and installed in HPD rack room.

H-300/301, H-302/303, & H-304 light-off panel lamps require 24VDC from the 05-IPS-01 Safety Manager cabinet. 3 24VDC circuits will be provided from the Safety Manager cabinet, 1 to each light-off panel.

LARC

New #1 Reformer Heater Tricon CX for RW-0025 & RW-0026 will require 2 UPS 120VAC sources and 1 120VAC utility power source. 1 circuit each from existing UPS panels 2101UP01 & 2101UP02 in the 1REF rack room (B-1019) will provide the UPS power sources. Existing lighting panel LP-A in the 1REF rack room will provide the utility power source.

RW-0023, RW-0025, RW-0026, RW-0028, RW-0048, & RW-0053 heaters will need UPS 24VDC for the Light off panel lamps from their respective Triconex/Trident cabinets. 1 24VDC circuit will be provided from the Triconex/Trident cabinet to the light-off panel in each case.

3.8.3 Electrical – Instrument Signal Cable Routing

All new SIS instruments will be wired back to new SIS junction boxes installed by this project if existing junction boxes do not have the available spares required. This shall be achieved by using IS/OS (Individual Shield/Overall Shield) multipair instrument cables. The homerun cables back to the SIS location will be run in tray and/or conduits. Existing pipe racks and major support structure will be utilized to support new conduits and cable trays to the extent possible.

Sharing of cable tray with BPCS cables is allowed as long as a divider is installed. Marshalling panels for the SIS logic solvers will be provided if existing rackroom wall space is limited.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	89 of 146	

Carson Heaters

Re-use existing infrastructure for the new instrument signals.

Site	Unit	Equipment	Scope	Notes
LARC	FFHDS	RW048	Existing J-Boxes and Marshalling panel	Use existing SIS J-boxes and marshalling panel.
LARC	LHU	RW028	Existing J-Boxes and Marshalling panel	Use existing SIS J-boxes and marshalling panel.
LARC	FCC	RW023	Existing J-Boxes and Marshalling panel	Use existing SIS J-boxes and marshalling panel.
LARC	NHDS	RW053	Existing J-Boxes and Marshalling panel	Use existing SIS J-boxes and marshalling panel.
LARC	1REF	RW025	Existing Outdoor Marshalling panel	Use existing SIS marshalling panel.
LARC	1REF Desulf	RW026	Existing Outdoor Marshalling panel	Use existing SIS marshalling panel.

New infrastructure is needed for the 1 Reformer Reactor and Desulfurizer Heaters

Site	Unit	Equipment	Notes
LARC	All Carson Heaters	Relay Panels for O2 analyzer probe heater power interlock cut-out relays	1 panel per unit (5 total)
LARC	1 REF RW025 RW026	SIS Digital Junction Box	2 – 150 terminals, standard J-box detail
LARC	1 REF RW025 RW026	Digital Output 37/c = #14 homerun cable type AM	2 cables required
LARC	1 REF RW025 RW026	Digital Input type AF Homerun cables	2 cables required
LARC	1 REF RW025 RW026	SIS Analog Junction Box	1 – 100 terminals, standard J-box detail
LARC	1 REF RW025 RW026	Analog Input type AF Homerun cables	2 cables required
LARC	1 REF RW025 RW026	16 pair cables type AG, Tricon CX FTA to Outdoor Marshalling panel	12 cables, terminated both ends

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	90 of 146	

Wilmington Heaters

HCU complex heaters H-300/1, H-302/3, H-304 will need new SIS junction boxes and homerun cables routed in a new cable tray to a new outdoor marshalling panel. The marshalling panel will be located on the southwest side of the HPD rackroom, adjacent to new AMP LAR2 DCS outdoor marshalling panel. 2 new Roxtec cable entries will be added to the HPD west wall. Additional tray will be routed inside the HPD rackroom to the new Safety Manager FTA cabinet. There will be 115 new digital inputs, 48 digital outputs and 12 analog inputs.

Site	Unit	Equipment	Notes
LARW	Common	Outdoor SIS marshalling panel	
LARW	Common	Instrument tray	Marshalling panel to SM FTA cabinet and H-42 & H-43 Tricon CX cabinet
LARW	All HCU Heaters	Digital Junction Box	2 new JB's, 1 - 150 terminals, standard J-box detail
LARW	All HCU Heaters	Digital Outputs 37/c - #14 homerun cable type AU	2 cables required
LARW	All HCU Heaters	Digital Inputs 36pr - #18 homerun cables type AG	3 cables required
LARW	All HCU Heaters	Digital Inputs/Outputs 36pr - #18 homerun cables type AG (light-off panel I/O)	3 cables required (1 per light-off panel)
LARW	All HCU Heaters	12/c - #12 power cables type BG (light-off panel flame scanner power)	5 cables (1 per heater)
LARW	All HCU Heaters	16pr - #18 FTA to Marshalling panel	15 cables, terminated both ends

HGU2 complex heater H-42 and Auxiliary boiler H-43 will each need new Triconex SIS systems installed in the HPD rack room. The Logic solvers will replace the Sub 9 relays used to trip both units.

LAR3 will install new SIS junction boxes and homerun cables in an LAR2 installed and partitioned cable tray. LAR3 has issued tray space requirements to LAR2.

Site	Unit	Equipment	Notes
LARW	H-42 H-43	Analog Junction Box	1 – 220 terminal box
LARW	H-42 H-43	Analog Inputs 36pr - #18 homerun cable type AP	2 cables required (segregated by heater/boiler)
LARW	H-42 H-43	Digital Junction box	1 – 150 terminal box, standard detail
LARW	H-42 H-43	Digital 36pr - #18 homerun cable type AG	2 cables required
LARW	H-42	Digital Junction Box	1 – 150 terminal box, standard detail

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	91 of 146	

Site	Unit	Equipment	Notes
LARW	H-42	Digital 36pr - #18 homerun cable type AG	1 cable required
LARW	H-42	Digital Outputs 37/c - #14 homerun cable type AU	2 cables required
LARW	H-43	Digital Junction Box	1 – 150 terminal box, standard detail
LARW	H-43	Digital 36pr - #18 homerun cable type AG	1 cable required
LARW	H-43	Digital Outputs 37/c - #14 homerun cable type AU	2 cables required
LARW	H-42	Homerun from light-off panel to HPD marshalling panel – 36pr - #18	1 cable required
LARW	H-43	Homerun from main burner light-off panel to HPD marshalling panel – 36pr - #18	1 cable required
LARW	H-43	Homerun from trim burner light-off panel to HPD marshalling panel – 36pr - #18	1 cable required
LARW	H-43	Fiber cable – 12 strand, 2 cables	To main burner light-off panel HMI
LARW	H-42	Flame scanner power cables from Sub #9 (SIH) – 12/c - #12 type BG	2 cables required
LARW	H-43	Flame scanner power cables from Sub #9 (SIH) – 12/c - #12 type BG	2 cables required (1 per light-off panel)
LARW	H-42 H-43	Relay Panel for turbine auto-starts (fan & pump backup)	1 common panel
LARW	H-42 H-43	24VDC control power 12/c - #12 type BG	1 cable required
LARW	H-42	Relay Panel for O2 analyzer probe heater power interlock cut-out relay	1 panel
LARW	H-43	120VAC Ignitor power (main burner) 3-1/c - #12	From field power panel PPM-1297
LARW	H-43	120VAC Ignitor power (trim burners) 3-1/c - #12	From field power panel PPM-1297
LARW	H-42 H-43	Motor status & NACCR ESD digital inputs 36pr - #18 type AG	1 cable required
LARW	H-42 H-43	Motor controls & penthouse alarms/strobes/horn digital output 37/c - #14 type AU	1 cable required

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	92 of 146	

3.8.4 Electrical - Motor Controls

LARW

H-42 – ID Fan motor status from MCC and trip to MCC (new)

H-43 – FD Fan speed and trip to MCC (new)

H-43 – FGR Fan motor status from MCC and trip to MCC (new)

H-43 – Boiler Feed Pump M-2955 trip (new)

H-300/1 – ID Fan motor status from MCC and trip to MCC currently, no change

H-302/3 – ID Fan motor status from MCC and trip to MCC currently, no change

H-304 – ID Fan motor status from MCC and trip to MCC currently, no change

LARC

No motor controls

3.8.5 Instrumentation

All instruments requiring routine maintenance will be located in a place where they are accessible via platform or from the ground.

Exception to this will be any remote mounted analyzers that need to go on top of heater roofs.

The following table outlines the instrumentation basis for each typical heater function:

Service	Function	Type/Tech	Mfgr	Model	Notes
Inputs					
Fuel Gas	Pressure	Transmitter	Rosemount	3051S	
Pilot Gas	Pressure	Transmitter	Rosemount	3051S	
Firebox	Pressure	Transmitter	Rosemount	3051S	
Comb. Air	Flow	Transmitter	Rosemount	3051SFA	
FD Fan	Run Status	Contact	N/A	N/A	Need interposing relay
ID Fan	Run Status	Contact	N/A	N/A	Need interposing relay
Stack Damper	Position	Transmitter			Induced, forced draft only
Burner	Flame Detection	UV/IR	Fireye	Insight II	
Outputs					
Fuel Gas	S/D Valve(s)		Jamesbury		Class VI, Firesafe
Pilot Gas	S/D Valve(s)		Jamesbury		Class VI
Fuel Gas	S/D SOV(s)	2oo2 Pnl	ASCO	RCS	

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	93 of 146	

Service	Function	Type/Tech	Mfgr	Model	Notes
Pilot Gas	S/D SOV(s)	Single SOV	ASCO	EF8321	
Boiler Feed Pump	Mtr Trip	Relay, Interposing	AB	700R	
ID Fan	Mtr Trip	Relay, Interposing	AB	700R	
Stack Damper	Trip to ND	Solenoid	ASCO	EF8321	
O2	Analyzer Power	Relay, Interposing	AB	700R	
NH3	S/D SOV(s)	Solenoid	ASCO	EF8321	

Carson Triconex systems have HART MUX currently installed for connection to AMS. No changes required.

Wilmington – New Triconex SIS - AMP will install HART MUX AMS per LAR requirements and the connection to the AMS system will be provided.

3.8.6 O2 Analyzers, Stack Damper Position

The new SIS in multiple units in both the Carson and Wilmington sites will shut down power going to in-situ O2 analyzer probes equipped with a heating element via interposing relays, in order to prevent providing a source of ignition should the burners flame out. If any of the existing O2 analyzers are of extractive type equipped with flame arrestors, these would not be de-energized upon a master fuel trip.

This project will also add two (2) new O2 analyzers to H-43. Two O2 in-situ analyzers will be installed in the H-43 windbox. A new analyzer calibration rack with remote calibration unit and HMIs will be provided for maintaining these analyzers.

All zirconium oxide O2 analyzers not equipped with flame arrestors will be modified to cut out the heater circuit of the probe via a relay controlled by the SIS during a master fuel trip.

- LAR Carson
 - Each combustion in-situ O2 analyzer will have an Allen Bradley relay installed in a panel near the Zircomat analyzer. The 120VAC between the O2 heater and the Zircomat panel will be intercepted and run through the new relay panel.
 - Stack damper position for startup will remain procedural. No instrument additions.
- Wilmington
 - H300/1/2/3/4 will remove the in-situ O2 analyzer heater power from the central O2 cabinet at grade. 6 Allen Bradley R700 relays will be installed inside the central O2 cabinet.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	94 of 146	

- H-42 will remove power from 2 in-situ O2 analyzer heaters, 61-AT-125 and 61-AT-182. One at duct midpoint and one at the stack.
- H-43 will not remove O2 power as it is not required in the RSP.
- Stack position is currently wired to DCS and/or SIS logic solvers.

3.8.7 Control Systems – SIS

- Carson heaters
 - FCC Born Heater – Use existing Logic solver FCC_11SPLC0008

	AI	DI	DO	RO
Existing Spare %	27%	20%	17%	0%
Points Added	0	9	6	0
Points Demo'd	0	6	4	0
New Spare %	27%	19%	15%	0%

- FFHDS Heater – Use existing Logic solver FFHDS_23SPLC0009

	AI	DI	DO	RO
Existing Spare %	60%	47%	55%	84%
Points Added	3	11	9	0
Points Demo'd	0	4	3	0
New Spare %	57%	43%	45%	84%

- LHU Heater – Use existing Logic solver LHU_25SPLC0025

	AI	DI	DO	RO
Existing Spare %	91%	73%	88%	84%
Points Added	2	11	8	0
Points Demo'd	0	4	3	0
New Spare %	84%	63%	72%	84%

- NHDS Heater – Use existing Logic solver NDS_81SPLC0019

	AI	DI	DO	RO
Existing Spare %	84%	50%	50%	
Points Added	1	7	7	
Points Demo'd	0	5	4	
New Spare %	81%	48%	44%	

- 1 REF Reformer Heater – 1 new Tricon CX Logic solver 21SPLC0035 installed in 1 Ref Rackroom or equipment room. System will utilize baseplate I/O modules mounted on a back plate and will occupy the front side of a standard Rittal cabinet, leaving the rear empty for future use. 2 ethernet connections will be connected to an L-3 switch. Power for the SIS cabinet will be 120VAC. 2 UPS

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	95 of 146	

systems will provide 1 – 20amp circuit each. Main cabinet modules: 2 analog input, 2 digital input, 2 digital output, 3 processors, 2 TCM communication. I/O modules will have 1 hot spare installed of each type.

	AI	DI	DO	RO
Modules Add (pts)	2 (64)	2 (64)	2 (64)	
Points Used	20	46	31	
New Spare %	69%	28%	52%	

- 1 REF Desulf Reactor Heater – Included in 1REF Reformer Heater Tricon CX 21SPLC0035
- Wilmington heaters
 - H-300/1/2/3/4 - Use existing Safety Manager Logic solver 05-IPS-01. Purchase 1 new cabinet with FTA assemblies, 2 chassis, I/O modules from Honeywell. Honeywell representative to modify hardware configuration. Modules include 1 analog, 8 digital input, 8 digital output

	AI	DI	DO	RO
Existing Spare %	2%	29%	28%	
Modules Add (pts)	2 (32)	9 (144)	8 (64)	
Points Added	12	123	52	
Points Demo'd	0	6	0	
New Spare %	9%	22%	15%	

- H-42 – Purchase 1 new Tricon CX system to be located in HPD rackroom. System will utilize baseplate I/O modules mounted on a back plate and will occupy the front side of a standard Rittal cabinet, leaving the rear space for the new H-43 Tricon CX. 2 ethernet connections will be connected to an L-3 switch. Power for the SIS cabinet will be 120VAC. 2 UPS systems (one existing and one installed by LAR2) will provide 1 – 20amp circuit each. Main cabinet modules: 2 analog input, 3 digital input, 2 digital output, 3 processors, 2 TCM communication. I/O modules will have 1 hot spare installed of each type.

	AI	DI	DO	RO
Modules Add (pts)	2 (64)	3 (96)	2 (64)	
Points Added	19	57	33	
New Spare %	70%	41%	48%	

- H-43 – Purchase 1 new Tricon CX system to be located in HPD rackroom. System will utilize baseplate I/O modules mounted on a back plate and will occupy the rear side of the H-42 Tricon CX cabinet. 2 ethernet connections will be connected to an L-3 switch. Power for the SIS will be 120VAC. 2 UPS systems (one existing

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	96 of 146	

and one installed by LAR2) will provide 1 – 20amp circuit each. Main cabinet modules: 2 analog input, 3 digital input, 3 digital output, 3 processors, 2 TCM communication. I/O modules will have 1 hot spare installed of each type.

	AI	DI	DO	RO
Modules Add (pts)	2 (64)	3 (96)	3 (96)	
Points Added	17	71	47	
New Spare %	73%	22%	51%	

- NOTE: Existing HGU2 Events Monitor will not be maintained, and signals will not be replicated. AMP LAR3 assumes AMP LAR2 will demo Events Monitor and all connections to it.

3.8.8 Control Systems – DCS

- Carson – Use existing DCS hardware/software. DCS configuration for new/demo points and Operator Graphics
- Wilmington – Use existing DCS hardware/software - Purchase additional SCADA tags for all new soft tags as required.
- Modify existing SIS graphics for 4 existing Carson heater SIS
- Create new SIS graphics for #1 Ref / Desulf SIS system
- Modify existing SIS graphics for WHCU heaters
- Create new SIS graphics for H-42 and H-43 SIS systems.

3.8.9 Civil/Structural Infrastructure

- HPD SIS Outdoor marshalling panel support steel/foundation/grounding

3.8.10 Demolition

- Solenoids currently tripping BPCS control valves in fuel gas lines will be demolished as the new chopper valves will serve that functionality in the future.
- In cases where fuel gas chopper valves have individual 2oo2 solenoid panels, one panel will be demolished, and the remaining panel will be tubed to both valves.
- Existing fuel gas piping will be demolished during turnaround activities, to allow for bolt-up connections at existing flange pairs/valves.
- Pressure switches being replaced by transmitters.
- Demo Coen light off panel and Trim burner light off panels in H-43.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	97 of 146	

3.8.11 Operator Interface

Burner Management & Alarm Panel (Light off Panel) for Flame Detector and Ignitors

Light off panels for Heaters will be located at grade level within line of sight of the heater and shutdown valves – with the exception of H-42, where the panel will be located on the upper deck near the burners. All proposed locations will be reviewed and approved by operations.

Site	Unit	Equipment	Scope	Notes
LARC	FFHDS	RW048	Add new lightoff panel per LAR1 design	
LARC	LHU	RW028	Add new lightoff panel per LAR1 design	
LARC	FCC	RW023	Add new lightoff panel per LAR1 design	
LARC	NHDS	RW053	Add new lightoff panel per LAR1 design	
LARC	1 REF	RW0025	Add new lightoff panel per LAR1 design	
LARC	1 REF Desulf	RW0026	Add new lightoff panel per LAR1 design	
LARW	HCU	H-300	Add flame detectors with transmitters inside new lightoff panel	Shared light-off panel for H-300 & H-301
LARW	HCU	H-301		
LARW	HCU	H-302	Add flame detectors with transmitters inside new lightoff panel	Shared light-off panel for H-302 & H-303
LARW	HCU	H-303		
LARW	HCU	H-304	Add flame detectors with transmitters inside new lightoff panel	
LARW	HGU-2	H-42	Add new lightoff panel	Panel to be located on handrail outside penthouse, near burners
LARW	HGU-2	H-43	Add new lightoff panel w/ field HMI for main burner to replace Coen panel Add new lightoff panel to replace trim burner ignition panel	Demo existing Coen lightoff panel. Demo existing trim lightoff & valve control panel

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	98 of 146	

3.9 RTE Compressors

For scope details on each piece of equipment, see also LAR3 Compressor Gap Report [AMP-LAR3-RTE-RPT-0004](#).

Scope overview for each compressor is as follows:

Carson Compressors

RW-0004.087.06 – Reformer Recycle Compressor (Turbine Centrifugal)

- Utilize existing flanges for new level instrument on RPV-2756.
- Add surge trip by calculating Suction Flow FT-120; Suction / Discharge Pressure PT-434 / PT-435; Suction/Discharge Temperature TT-779/TT-885. Surge Trip will reside in a new shared (RW4 & RW22) DCS C300 (20 mS) housed in the REF#1 Rack Room.
- Upgrade existing Dymac vibration monitoring system to Bently Nevada Orbit 60. Share Bently Nevada Orbit 60 with RW-0005.
- No Turbine governor/overspeed scope for RW-0004.

RW-0005.087.03– Desulf Feed Gas Compressor (Turbine Recip)

- Utilize new KO Drum level transmitter on Reformer Recycle Compressor RPV-2756 suction KO drum. Add trip S/D output to Desulf Feed Compressor.
- Use new RW-0004 Bently Orbit 60 vibration system (3 probes) for vibration shutdown.

RW-0006.087.03– Desulf Desulf Common Spare Compressor (Turbine Recip)

- Utilize new KO Drum level transmitter on Reformer Recycle Compressor RPV-2756 suction KO drum and Desulf Recycle Compressor RPV-2755 suction KO Drum. Add trip S/D output to Desulf Common Spare Compressor. Add selector switch to pick lined up KO drum for shutdown.
- Use new RW0006 and RW0022 Bently Orbit 60 vibration system (3 probes) for vibration shutdown.

RW-0022.087.06– Desulf Recycle Compressor (Motor Centrifugal)

- Utilize existing flanges for new level instrument on RPV-2755.
- Add surge trip by calculating Suction Flow FT-174; Suction / Discharge Pressure PT-479 / PT-472; Discharge Temperature TT-927. Surge Trip will reside in a new shared (RW4 & RW22) DCS C300 (20 mS) housed in the REF#1 Rack Room.
- Upgrade existing Bently 7200 vibration monitoring system to Bently Nevada Orbit 60 share with RW0006.

RW-0047.087.06– Alky Refrigeration Compressor (Turbine Centrifugal)

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	99 of 146	

- Add surge trip from existing CCC controller to relay logic in local panel.

RW-0053.087.06– FCC Pignone 1st Stage Compressor (Turbine Centrifugal)

- Add surge trip from existing CCC controller to PLC in local panel.
- Add existing LT-352A & B on KO Drum RPV-5518 to 2oo2D High Level S/D to PLC
- Add existing ZT-993 on suction MOV HV-993 to S/D, Add new suction PT-436 as secondary variable voted 2oo2 for shutdown.
- Add existing ZT-994 on discharge MOV HV-994 to S/D, Add new discharge PT-437 as secondary variable voted 2oo2 for shutdown.
- See 3.7.3.8 for PLC upgrade scope.

RW-0057.087.32– FFHDS Prism Compressor (Motor Recip)

- Add Bently Nevada 1900 vibration system (4 probes) for vibration shutdown interfacing with existing relay logic in local panel.

Wilmington Compressors

C-84– HGU2 Hydrogen Compressor (Motor Recip)

- Add Bently Nevada 1900 vibration system (3 probes) for vibration shutdown interfacing with existing Safety Manager 06-IPS-01 in HPD rack room.

C-93– HCU Recycle Gas Compressor (Motor Centrifugal)

- Add surge trip from existing C300 based surge controller to safety manager 05-IPS-01 in HPD rack room.

C-146– HGU2 Feed Gas Compressor "A" (Motor Recip)

- Add Bently Nevada 1900 vibration system (3 probes) for vibration shutdown interfacing with existing Safety Manager 06-IPS-01 in HPD rack room.

C-147– HGU2 Feed Gas Compressor "B" (Motor Recip)

- Add Bently Nevada 1900 vibration system (3 probes) for vibration shutdown interfacing with existing Safety Manager 06-IPS-01 in HPD rack room.

C-148– HGU2 H2 Product Compressor (Motor Recip)

- Add Bently Nevada 1900 vibration system (3 probes) for vibration shutdown interfacing with existing Safety Manager 06-IPS-01 in HPD rack room.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	100 of 146	

RSP Waivers required based off of RTE scope reductions

See Table 1.4.2 in the standards section for RSP 1172-031 waivers required based on scope reductions from the RTE SMEs.

3.9.1 Mechanical & Piping

All mechanical and piping modifications are associated with new instrumentation needed to address LOPA and/or RSP gaps.

KO Drum Nozzle and Level Bridle Piping

- At #1 Reformer, Reformer Recycle Compressor KO drum RPV-2756, no new nozzles required. Add additional level transmitter to existing nozzles. This requires removing the level site glass to install a new piping spool that will accommodate both the new level transmitters and the existing level site glass on the same taps.
- At #1 Reformer, Desulfurizer Recycle Compressor KO drum RPV-2755, no new nozzles required. Add additional level transmitter to existing nozzles. This requires removing the level site glass to install a new piping spool that will accommodate both the new level transmitters and the existing level site glass on the same taps.

Lube Oil & Seal Oil

- All compressors comply with the RSP-1172-031 for Lube Oil and Seal Oil requirements.

Velometer Mounting

- At HGU1 C-84, HGU-2 C-146, C147, C148, FFHDS Prism compressor, #1 Reformer Desulfurizer Feed Compressor and Desulfurizer Spare Compressor, install velometer for High vibration trip and alarm. Velometer to be installed opposite of each throw with a minimum of 3 velometers per compressor. Combination of flexible conduit and hard conduit to be used to connect wires from velometers to Bently Nevada Panels. Bently Nevada panel to be mounted on the compressor deck or surrounding area.

3.9.2 Electrical – Power

- 1 Reformer Primary Power
 - Install New DCP panel in the 1 Reformer Switchgear Building. The DCP Power supplies will be powered from Panel 2101UP03. The DCP panel will have (6) 120VAC to 125VDC power supplies for the 1 Reformer compressors and (1) 120VAC to 125VDC power supply for RW-0057 Bently Nevada.
- 1 Reformer Secondary Power

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	101 of 146	

- Install 480VAC circuit from 1JMCC4813 in the 1 Reformer Switchgear building to the 1 Reformer Compressor deck where a new transformer and 208/120VAC panel will be installed.
- From the new panel secondary power circuits will be run to the LCP's and Bently Nevada's.
- FFHDS Primary Power
 - Primary power to be fed from DCP panel in 1 Reformer Switchgear building.
- FFHDS Secondary Power
 - Secondary power to be fed from panel 2300PP08.
- HGU Primary Power
 - Install New DCP panel in the HPD Rackroom. The DCP Power supplies will be powered from Panel 67-EE-26. The DCP panel will have (4) 120VAC to 125VDC power supplies for 06-LCP-84A, 61-LCP-146A, 61-LCP-147A and 61-LCP-148A, being installed.
- HGU Secondary Power
 - Install (1) 120VAC power circuit from 05-PPE-1291 to LCP's 06-LCP-84A, 61-LCP-146A, 61-LCP-147A and 61-LCP-148A.

3.9.3 Electrical – Instrument Signal Cable Routing

All new instruments will be wired back to existing junction boxes and routed back to the control system location using existing / new home run cables run in tray and/or conduits. Existing pipe racks and major support structure will be utilized to support new conduits and cable trays to the extent possible. Fireproofing will be used where paths cannot avoid nearby potential fire hazards.

Site	Unit	Equipment	Scope	Notes
LARW	HGU2	C-84 C-146 C-147 C-148	New 24PR homerun cable from 61CP-146/147 to marshalling panel New 24PR homerun cable from 61LCP-148 to marshalling panel	Use existing J-boxes and marshalling panel.
LARW	HCU	C-93	N/A	Use existing J-boxes and marshalling panel.
LARC	FFHDS	Prism Compressor	N/A	Use existing J-boxes and marshalling panel.
LARC	Alky	Refrigerant Compressor	N/A	Use existing J-boxes and marshalling panel.
LARC	FCC	1 st stage Pignone Comp	Upgrade SLC 05/3 in existing local panel to Control Logix. Add analog input card to upgraded PLC for KO drum levels and EIV position.	Use existing J-boxes and marshalling panel.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	102 of 146	

LARC	#1 REF	Reform Recycle Comp Desulf Recycle Comp Desulf Feed Comp Desulf Spare Comp	N/A	Use existing J-boxes and marshalling panel.
------	--------	---	-----	---

3.9.4 Electrical – Compressor Motor Controls

The following compressor are motor driven.

- HGU-1 C-84
- HGU-2 C-146, C-147, C-148
- HCU C-93
- FFHDS Prism Compressor
- #1 Reformer Desulf Recycle Compressor

The Bently 1900 shutdown contacts will interface with existing relay logic schematics for systems without a logic controller.

Systems with a Triconex / Safety manager will utilize existing shutdown wiring to motor shutdown relays.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	103 of 146	

3.9.5 Steam – Compressor Turbine Controls

The Turbine trip on the following compressors exist and will not be modified.

- Alky Refrigerant Compressor
- FCC 1st stage Pignone compressor
- Reformer Recycle Compressor
- Desulf Feed compressor, Desulf Spare compressor

3.9.6 Instrumentation

The following table outlines the instrumentation basis for each typical compressor function:

Service	Function	Type/Tech	Mnfr	Model	Notes
Reciprocating					
Inputs					
Vibration	Vibration	Velometer	Bently Nevada		
Outputs					
NA					
Centrifugal					
Inputs					
Liquid Impact	Level	DP Transmitter	Rosemount	3051S	
EIV Closed	Valve Position	Position Transmitter	Topworx	DXP	
EIV Closed	2 nd variable Pressure	Pressure Transmitter	Rosemount	3051S	
Signal Splitter	Signal Splitter	Signal Splitter	Moore	STA	
Outputs					
Surge	Spillback control loop	Control Valve	Fisher	TBD	
Surge	Spillback control loop	Valve positioner	Fisher	DVC	

While all field transmitters will be purchased with smart technology (like HART). AMP will install HART MUX AMS per LAR requirements and the connection to the AMS system will be provided.

3.9.7 Control Systems - SIS

- No new Tricon CX in #1 Reformer.

Carson Compressors

- Reformer #1 / Desulf #1 – No New Triconex CX Logic solver required.

Wilmington Compressors

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	104 of 146	

- HGU1/2 – Existing Safety Manager Logic solver 06-IPS-01

	AI
Existing Spare %	53%
Modules Add (pts)	1 (16)
Points Added	12
New Spare %	43%

The table below outlines new control systems equipment to be installed by the project by unit and type for each compressor:

Unit	Tricon CX (UPC & LCP)	Woodward TPS	Bently Nevada 1900/65A	Bently Nevada Orbit 60	Relay Panel
HGU2			C-84 C-146 C-147 C-148		
HCU					
FFHDS			Prism Compr		
Alky					
1 REF				2 Orbit 60 racks, REF Recycle Compr & Feed Compr, Spare Compr & Desulf Recycle Compr,	

3.9.8 Control Systems - DCS

- No new DCS hardware is anticipated. All new RTE control systems will require new tags built on existing / new DCS platforms.

3.9.9 Civil/Structural Infrastructure

- Reformer #1 local panel foundation/grounding for Reformer Recycle and Desulf Recycle compressors.

3.9.10 Operator Interface

Local Control Panels

Local Control Panels for Compressors will be located off the compressor deck at grade level.

The following compressors will have new LCPs:

- 1 Reformer
 - REF Recycle Compr

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	105 of 146	

- Desulf Recycle Compr
- Feed Compr
- Spare Compr

DCS Graphics

- New standard MPC RTE Controls graphics will be developed for compressors with new UCP installations.
- For all other compressors, existing graphics will be updated for new shapes associated with new I/O.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	106 of 146	

3.10 Buildings

Building Penetrations for Cables

Preferred method of building penetration for cables will be using cable transit windows (aka Roxtec blocks). Core drilling will be utilized if installation of cable transit windows is not feasible or is cost prohibitive.

3.10.1 Buildings In Scope

The project scope will impact the following buildings. A brief explanation of the associated scope for each building is described in the table below. For more details see scope descriptions in sections 3.5, 3.5.13, 3.7, 0, and 3.9

Site	Building # / Name	Status	Scope Description
LARC	B1085 SACCR	Existing	<u>BPCS</u> : Demo ISOM, Alky Complex, 1Crude/51VAC, and SRU US station console hardware and install new console furniture with Experion based console station hardware and associated network hardware. Migration of (2) CEMS Data Concentrator PLC comms to Experion.
LARC	LCR4/B426 IC8/Merox Rack Rm.	Existing	<u>BPCS</u> : MPC Process control to decommission and air-gap LCR4 TDC cabinets once all related DCS points have been migrated to C300s to be located in LCR6.
LARC	LCR5 SFIA Rack Rm	Existing	<u>BPCS</u> : Hard-wire 74-P402/74-P409 control loops back to LCR-6. This avoids installation of a UPC enclosure remote UIO I/O for the same points.
LARC	LCR6 Alky Ops Shelter	Existing	<u>BPCS</u> : Demo existing US station operator console hardware and install new Experion console station. Segregate operator station area from rack room with new wall. Repair ceiling and modify/replace lighting as required for the new room layout. Fire protection system may need minor modifications to suit the new room layout. New exterior marshalling and cable tray for new field homerun cabling. Locate new (2) C300 cabinets in existing operator shelter area for LCR6 signals. Migrate Refrigeration Comp PLC comms to Experion. Demo existing LCR6 Hiway & LCN cabinets. Locate new (2) C300 cabinets and (1) new network cabinet in LCR6 rack room to accommodate migration of I/O from LCR4. Migrate ~20 points from HPM to C-300 within LCR-6 due to applications constraints.
LARC	LCR7 Isom Ops Shelter & Rack Rm.	Existing	<u>BPCS</u> : Migrate existing US station operator station to Experion console station. Install new network cabinets (A and B) for existing TMR comms migration to Experion. Temporary install virtual server cabinet and Instrument Power Panel, UPS, Bypass Switch, Battery Rack, UPS Distribution panel(s), and Isolation Transformers to support virtual server cabinet.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	107 of 146	

Site	Building # / Name	Status	Scope Description
LARC	B-118 SRU Rack Rm	Existing	<u>BPCS</u> : Install new network cabinet for TMR comms migration to Experion.
LARC	SRU Ops Shelter	Existing	<u>BPCS</u> : Installation of wall mounted network cabinet. Removal of existing US station operator console hardware and installation of new Experion console station.
LARC	LCR3/B1066 1Crude/51VAC Ops Shelter	Existing	<u>BPCS</u> : Demo existing US station operator console hardware and install new Experion console station.
LARC	Crude Row Ops Shelter	Existing	<u>BPCS</u> : Installation of wall mounted network cabinet. Removal of existing US station operator console hardware and installation of new Experion console station.
LARC	B-1019 #1 Reformer Rack Room	Existing	<u>SIS</u> : Install 1 C300 cabinet for 1REF compressors. Tie-in to existing UPS. Tie-in to existing FTE network
LARC	B-1027 #1 Reformer Switchgear Room	Existing	<u>SIS</u> : Install 1 Tricon CX cabinet for 1REF heaters. Tie-in to existing UPS. Tie-in to existing FTE network
LARW	B-290 HPD Rack Room	Existing	<u>SIS</u> : Install 1 new Tricon CX cabinet to house H-42 Tricon CX SIS (front) and H-43 Tricon CX SIS (rear). Tie-in to existing UPS (As Found or upgraded as part of LAR2). Tie-in to FTE Network cabinet installed as part of LAR2. Install 1 new Honeywell SM SIS cabinet for 05-IPS-01 I/O additions to support HCU Heaters. Install new 24 VDC DCP in the HPD rackroom. Install new 125 VDC DCP in the HPD rackroom.

3.10.2 Fire Protection and Gas Detection

Minor modifications may be required for the LCR-6 building fire protection system due to the new wall being installed. Design criteria are provided in the AMP RIE Specification (AMP-GBL-PM-SPC-0010). Final design will be in alignment with LAR Fire Marshall.

3.11 Fiber Infrastructure

This fiber will be designed to the MPC Fiber Optics Cables & Accessories Specification (SP-70-26 Rev. 7).

- Divergent and redundant paths is the preferred method and will be applied for all BPCS & SIS system fiber. MPC Corporate SME and site approval will be required in situations where divergent paths are not attainable.
- When divergent paths are not achievable the redundant fibers will be installed as far apart as physically possible.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	108 of 146	

- Single mode (OS1/OS2) fiber will be installed.
- Fireproofing will be used where paths cannot avoid nearby potential fire hazards.
- When possible, existing fiber infrastructure will be used. This will require verification of fiber spares and condition.

3.11.1 LAR Carson to Wilmington

New fiber infrastructure will be installed between Carson and Wilmington to support future separation of A and B networks geographically by Refinery. This will provide an additional level of network resilience in the event of a catastrophic event in one area.

The project will leverage new site-to-site fiber installed by the LASR project. It will also leverage the LARIC tunnel, which can be used to route new fiber between Carson and Wilmington

"A" Link (LARIC Tunnel)

- Install new F.O. patch panel on the East side of the Alky unit.
- Install conduit with 7 tube cable and 2 – 48ST SM blown from the new Alky F.O. patch panel to LCR-7 building.
- Install 2 U/G conduits from new F.O. patch panel to the U/G
- Install conventional 96ST fiber optic cable from new F.O. patch panel through the existing LARIC tunnel conduit to new F.O. patch panel located on the North End of Wilmington.
- Install 2 – 48ST SM fiber from new fiber patch panel at the North end of Wilmington to the Blending RIE.
- Install 1 – 48ST SM fiber from NACR to the Blending RIE to complete the primary path

"B" Link (LASR)

- Sepulveda road crossing provided by the LASR project
- Install 2 – 48ST SM fiber from new LASR provided fiber patch panel at pole LA27 at the Northeast corner of Wilmington and PCH1 to NACR.
- Install 1 – 48ST SM fiber from NACR to the Blending RIE to complete the secondary path

The table below show the new installation requirements for LAR-3.

From	To	Fiber A	Fiber B	Use
NACR	LASR FTB 88-FTB-217 (South of East Coast Hwy)		2 New 48 Strand SM	Wilmington Secondary path
NACR	Blending RIE	New 48 Strand SM	New 48 Strand SM	Wilmington Primary/Secondary Paths between NACR and Blending RIE
Blending RIE	LARIC FTB	2 New 48 Strand SM		Wilmington Primary path

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	109 of 146	

From	To	Fiber A	Fiber B	Use
LARIC Pull Box	New FTB	New 96 Strand SM conventional cable		Carson Primary path
New FTB	LCR-7	2 New 48 Strand SM		Carson Primary path
LASR P5-FO-A	0108-TBF-03	2 New 48 Strand SM		Carson Secondary path
0108-TBF-03	NA RIE	1 New 48 Strand SM		Carson Secondary path
0108-TBF-03	Blending RIE	1 New 48 Strand SM		Carson Secondary path
LCR-7	NA RIE		1 New 48 Strand SM	Carson Secondary path
NA RIE	Blending RIE		1 New 48 Strand SM	Carson Secondary path
LCR-7	Blending RIE	1 New 48 Strand SM		Carson Primary path

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	110 of 146	

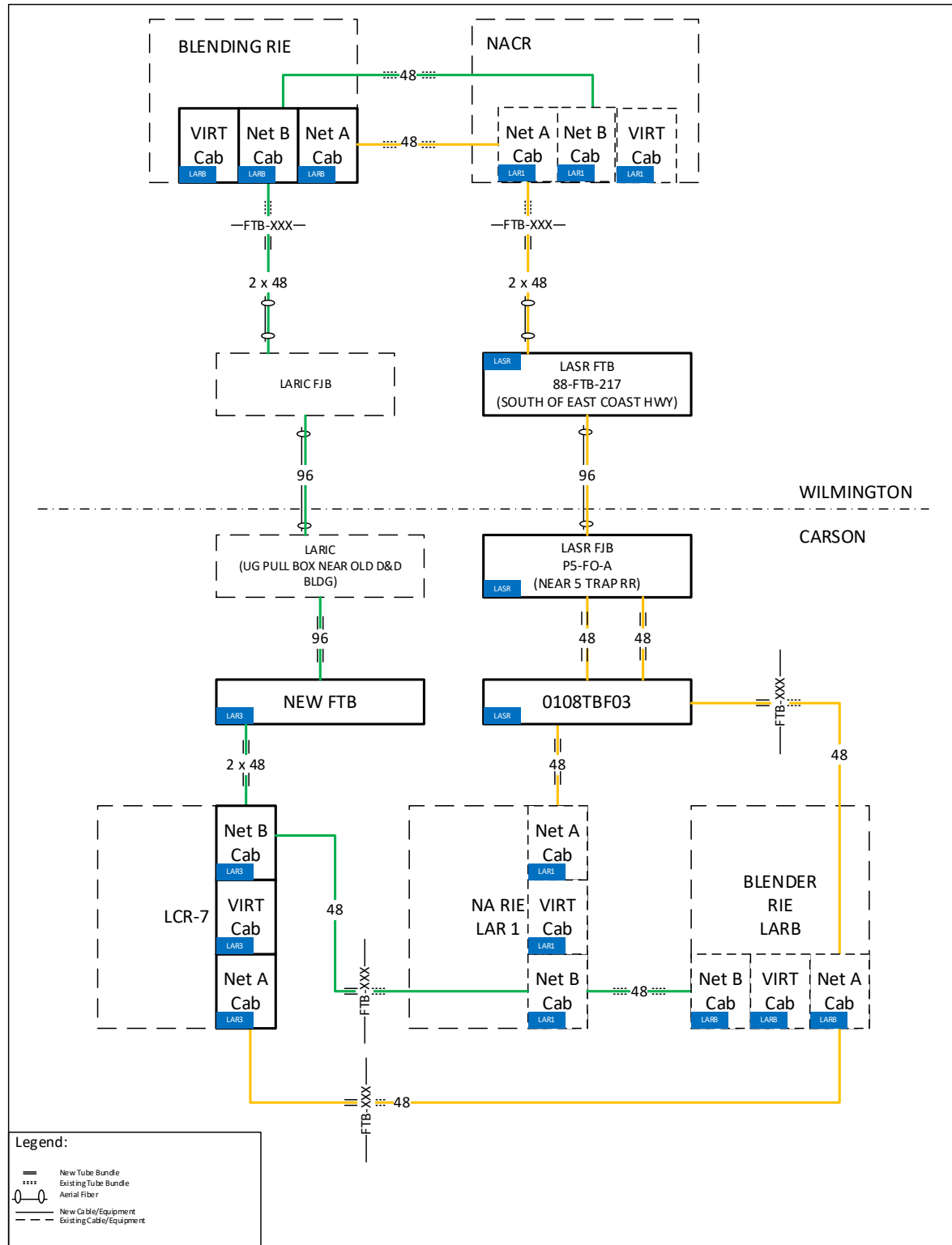


Figure 3.11.1.1 – Carson-to-Wilmington Fiber

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	111 of 146	

3.11.2 LAR Carson

Backbone Fiber

SACCR

- Install two new F.O. patch panels southwest of SAPO adjacent to existing fiber distribution box (FDB) # 0116-FDB-01. One F.O. patch panel will be for "A" Link and the other F.O. Patch panel will be for the "B" link. These patch panels will be used to patch new backbone fibers between SACCR and the following buildings: Crude RIE (LCR-1), LCR-5, LCR-6, LCR-7, Sulfur OPS Shelter (B-106), Sulfur Rack Room (B-118), Coker RIE (B-XXX), Crude Ops Shelter (B1094), North Area RIE (B-1139)
- Install F.O. cable to connect new patch panels to the existing patch panel 0103-TBF-25 and utilize existing blown fiber installed in LAR#1 to SACCR.

Building to Building Fiber

- New fiber cabling will be routed between buildings using redundant and diverse paths. All building-to-building fiber will utilize SM 24 ST.

From	To	Fiber A	Fiber B	Use
SACCR	Crude RIE (LCR-1)	New 24 Strand SM	New 24 Strand SM	For Operator Console in Crude 2 Operator Shelter
Crude RIE (LCR-1)	Crude OPS Shelter	New 24 Strand SM	New 24 Strand SM	For Operator Console
SACCR	LCR-3	New 24 Strand SM	New 24 Strand SM	For Operator Console in LCR-3 (May need to move to BRM instead of LCR-3)
SACCR	LCR-6	New 24 Strand SM	New 24 Strand SM Will need fireproofing	For new A/B Network Cabinet / C-300s / Operator Console
SACCR	LCR-7	New 24 Strand SM	New 24 Strand SM	For new Network A, Network B, Virtualization Cabinet and Operator Console
SACCR	Sulfur OPS Shelter B-106	New 24 Strand SM	New 24 Strand SM	For Operator Console
SACCR	Sulfur Rack Room B-118	New 24 Strand SM	New 24 Strand SM	To support future SRU DCS upgrade and SRU PLCs
SACCR	Coker RIE	New 24 Strand SM	New 24 Strand SM	To support future Coker DCS upgrade
SACCR	NA RIE	Patch using existing fibers	Patch using existing fibers	To support SFIA connection to SACCR

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	112 of 146	

Equipment Specific Fiber

1 Reformer Compressors and Heaters

- Install 2 new 24 strand SM fiber cables from 1 Reformer Rack Room and the North Area RIE. Install new patch panels in the 1Reformer Rack Room to support the new cables.
- Since the new SIS logic solver for the 1 Reformer/1 Desulf Heaters is located in the 1Reformer Rack Room, no new field fiber is required.

FCC Compressors and Heaters

- Install 1 new 12 strand SM fiber cables from 12-LCP-20 and the 2nd stage compressor new LCP (installed by LASR) to support DCS communication to the 1st Stage Pignone Compressor RW-0053.087.06 PLC
- Since the new SIS logic solver for the FCC Fresh Feed Born Heater RW-0023 exists, no new field fiber is required.

FFHDS Compressors and Heaters

- Since the new SIS logic solver for the Reactor Feed Heater RW-0048 exists, no new field fiber is required
- The Prism Compressor RW-0057 utilizes relay logic. Therefore, no new field fiber is required.

LHU Heater

- Since the new SIS logic solver for the LHU Feed Heater RW-0028-214.09 exists, no new field fiber is required

NHDS Heater

- Since the new SIS logic solver for the NHDS Feed Heater RW-0053 exists, no new field fiber is required

PLC Fiber

- New fiber cabling associated with PLCs will be routed using redundant and diverse paths unless otherwise notes. All new fiber for PLC installations will utilize SM 12 ST.

From	To	Fiber A	Fiber B	Use
Butamer Dryer PLC	SACCR	New 12 Strand SM	New 12 Strand SM	DCS communications

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	113 of 146	

3.11.3 LAR Wilmington

Backbone Fiber

Building to Building Fiber

- The following new cabling will be provided buildings using redundant and diverse paths.

From	To	Fiber A	Fiber B	Use
NACR	HPD Rack Room	Patch using existing fibers	Patch using existing fibers	To support SIS and XPN switch connections to H-42/H43 logic solvers

Equipment Specific Fiber

HCU Compressors and Heaters

- Since the new SIS logic solver for the HCU Heaters H-3001/301/302/303/304 exists, no new field fiber is required. Fiber jumpers may be required to support new I/O racks.
- The Recycle Gas Compressor C-93 trip logic resides in an existing logic solver in the HPD rack room. No new field fiber is required.

HGU2 Compressors and Heaters

- Two new SIS logic solvers will be installed for Reformer Heater H-42 and Aux. Boiler H-43. No new field fiber is required. However, new SIS/XPN switches will be installed c/w new patch cabling to support connection of these SIS logic solvers to the SIS and XPN switch pairs in NACR.

3.12 Demolition, Major

There is no major demolition of buildings, large equipment, piping, etc. in this project scope.

Demolition of old instruments and TDC cabinets is discussed in the corresponding sections above.

3.13 Out-of-Scope

The following are general items not included in the AMP LAR3 scope.

- Relief valve modification
- RSP-1172-021 SRU Application Standard
- HPM Controller upgrades and migration to eHPM and/or C300s.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	114 of 146	

4. Engineering Deliverables

The Engineering Deliverables for this phase will meet the requirements of LAR-00-040.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	115 of 146	

5. Training

5.1 *Training Milestones*

Training Topic	Milestone
Operating Procedures	T-9
Heater IPF Test Procedures	T-6
RTE Offline Test Procedures	T-6
Engineering Org Charts (to support TAR)	T-3

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	116 of 146	

5.2 Training Milestones

Table 9. Training Requirements

Training Topic	Trainees	Trainer	Frequency	Training Materials	Duration	Shifts	Training Completion Timing
Experion Consoles & HMIWeb Graphics Non-Project Specific Changes	Operators	Honeywell	Per Console	Classroom Written manuals Competency Testing	3 Days	4, 1-day class sessions plus 1 make-up session	4-6 weeks prior to hot cutover
Operating Procedures Project Specific modifications to BPCS, Heaters and RTE's as appropriate	Operators	Engineering Contractor	Per Unit	Redline existing procedures. Ops will provide existing procedures that need to be updated due to changes made by the Project. Also, any new procedures will need to be created by the Project.	N/A	N/A	6 months prior to hot cutover [note – as soon as the design is finalized, the Eng. contractor should redline the procedures]. Operations will then need to finalize the redline markups and circulate and/or have all Operators review the changes.
Operator Training Manuals Project Specific modifications to BPCS, Heaters and RTE's as appropriate	Operators	Engineering Contractor	Per Unit	Update, redline, existing operator manuals.	N/A	N/A	6 months prior to hot cutover. [note – as soon as the design is finalized, the Eng. contractor should redline the training manuals]. Operations will then need to finalize the redline markups and circulate and/or have all Operators review the changes.

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	117 of 146	

Training Topic	Trainees	Trainer	Frequency	Training Materials	Duration	Shifts	Training Completion Timing
Operator Classroom Training (Project Specific modifications to BPCS, Heaters and RTE's as appropriate)	Operators	Lead: Engineering Contractor Support: DCS Integrator, SIS Integrator, RTE Integrator	Per Unit & Per TAR / Cutover	CBT (MS Teams) PowerPoint • Photos • Field mods • Graphics • Alarm alarms • Local Panels	TBD (Depending on quantity of changes)	4, class sessions plus 1 make-up session	6-8 weeks prior to commissioning
Triconex Hardware Maintenance Manuals Software Manuals Architecture of CX I/O Card Hot replacement (online) Diagnostics (Local LED meaning) Remote I/O if used Power supply replacement (Hot) Software CX Vendor Software CX Manual Migration of Legacy to current supplied hardware Diagnostics (SOE) Logic Solver Designated Laptop connection (how)	MPC Maintenance Shop and Electrical Area Engineer for Logic Solvers at LAR facility	Triconex	LAR-C Once LAR-W Once	CBT Written manuals Competency Testing Include LAR site specific training at facility	1 Day	4, class sessions plus 1 make-up session	6-8 weeks prior to start of SAT and Loop checks. Training will include New CX and for legacy Triconex modifications
Instruments	Instrument and/or electrical as applicable	Engineering Contractor or Vendor	First initial installation of a new type / technology @	Written manuals Competency Testing Interface with LAR Site Instrument/ Electrical	TBD (Depending on quantity)	4 Includes 1 make-up session	6-8 weeks prior to commissioning

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	118 of 146	

Training Topic	Trainees	Trainer	Frequency	Training Materials	Duration	Shifts	Training Completion Timing
			LAR-C or LAR-W	Trainers on delivery of training.	& complexity)		
RTE Controls	Rotating Equip. Tech Millwright I&E Craft	RTE-R: Petrotech RTE-C: Schneider Electric	Per Unit	Written manuals Competency Testing	TBD (Depending on quantity & complexity)	4 Includes 1 make-up session	6-8 weeks prior to commissioning
DCS Hardware ELCN	Process Control Techs & Eng	Honeywell	First initial installation of a new type / technology @ LAR-C or LAR-W	Written manuals Competency Testing	1 Day	4 Includes 1 make-up session	3-6 months prior to console commissioning

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	119 of 146	

6. Appendix I – Reference Drawings & Documents

6.1 Reference Drawings

Item	#	File Name	Description	WBS
1	BF-2101-31016-S1	3004606	NO.1 REFORMER PROCESS P&ID	1 REF – P&ID
2	BF-2101-59676-73-S1	3004608	1 REFORMER PROJECT AUXILIARY P&ID	1 REF – P&ID
3	BF-2102-36649-S1	3004609	NO. 1 DESULFURIZER PROCESS P&ID	1 REF – P&ID
4	BF-2102-59675-78-S1	3004610	NO. 1 DESULFURIZER PROJECT AUXILIARY P&ID	1 REF – P&ID
5	8600-11100867	11100867	FUEL GAS (PLT BLKT SO. CAL) SYS NORTH AREA 2 UTILITY SYSTEM P&ID	1 REF – P&ID
6	8605-11100872	11100872	FLARE SYSTEM NORTH AREA 2 UTILITY SYSTEM P&ID	1 REF – P&ID
7	8600-11100867-DEMO	11100867-DEMO	FUEL GAS (PLT BLKT SO. CAL) SYS NORTH AREA 2 UTILITY SYSTEM P&ID	1 REF – P&ID
8	BF-2101-31016-S1-DEMO	3004606-DEMO	NO.1 REFORMER PROJECT PROCESS P&ID	1 REF – P&ID
9	BF-2102-36649-S1-DEMO	3004609-DEMO	NO.1 DESULFURIZER PROJECT PROCESS P&ID	1 REF – P&ID
10	BF-0109-37690-S2	3004380	OFFPLOT AREA 9 PROCESS P&ID	ALKY – P&ID
11	BF-0111-37694-S1	3004400	OFFPLOT AREA 11 PROCESS P&ID	ALKY – P&ID
12	BF-4000-60006-S1	3004449	ALKY DEISOBUTANIZER/DEBUTANIZER PROCESS P&ID	ALKY – P&ID
13	BF-4000-60006-S2	3004450	ALKY FEED SYSTEM & EFFLUENT TREATING PROCESS P&ID	ALKY – P&ID
14	BF-4000-60006-S3	3004451	ALKY FEED SURGE & REFRIGERATION PROCESS P&ID	ALKY – P&ID
15	BF-4000-60009-S1	3004452	ALKY ACID STORAGE PROCESS P&ID	ALKY – P&ID
16	BF-4000-60009-S2	3004453	ALKY CAUSTIC STORAGE/ACID BLOWDOWN PROCESS P&ID	ALKY – P&ID
17	BF-4000-60012-45-S1	3004454	ALKY PROJECT AUXILIARY P&ID	ALKY – P&ID
18	BF-4400-60020-S1	3004458	ISO-OCTENE PROCESS P&ID	ALKY – P&ID
19	BF-4400-60028-S1	3004459	ISO OCTENE AUXILIARY P&ID	ALKY – P&ID
20	BF-4500-60014-S1	3004460	ALKY COKER/FAC/MEROX OLEFIN FEED/ COKER DEPROP PROCESS P&ID	ALKY – P&ID
21	BF-4700-21294-S1	3004461	SOUTH SOUR WATER DRUM PROCESS P&ID	ALKY – P&ID
22	BF-4800-43075-S1	3004462	COKER GASOLINE FRACTIONATION PROCESS P&ID	ALKY – P&ID
23	BF-4000-60006-S4	3004706	ALKY CONTACTORS & SETTLERS PROCESS P&ID	ALKY – P&ID
24	BF-4500-60014-S2	10030571	ALKY COKER/FAC/MEROX OLEFIN FEED MEROX PROCESS P&ID	ALKY – P&ID

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	120 of 146	

Item	#	File Name	Description	WBS
25	BF-0118-59680-S2	10200303	OFFPLOT AREA 18 AUXILIARY P&ID	ALKY – P&ID
26	0119-10223874	10223874	OFFPLOT AREA 19 INSTRUMENT AIR DRYER SKID AUX. SYSTEM P&ID	ALKY – P&ID
27	BF-4000-60006-S5	11060745	ALKY EMERGENCY ALKYLATE SYSTEM PROCESS P&ID	ALKY – P&ID
28	8600-11100869	11100869	FUEL GAS (PILOT, BLKT, SO.CAL) SYSTEM SOUTH AREA 2 UTILITY SYSTEM P&ID	ALKY – P&ID
29	8601-11100884	11100884	AMMONIA SYSTEM SOUTH AREA 2 UTILITY SYSTEM P&ID	ALKY – P&ID
30	8603-11100905	11100905	STEAM (150#, 175#) SYSTEM SOUTH AREA 3 UTILITY SYSTEM P&ID	ALKY – P&ID
31	8611-11100925	11100925	CAUSTIC (FRESH, SPENT, SOUR) SYSTEM SOUTH AREA 3 UTILITY SYSTEM P&ID	ALKY – P&ID
32	8616-11100950	11100950	CONDENSATE SYSTEM SOUTH AREA 3 UTILITY SYSTEM P&ID	ALKY – P&ID
33	8621-11100974	11100974	POTABLE/DOMESTIC WATER SYSTEM SOUTH AREA 2 UTILITY SYSTEM P&ID	ALKY – P&ID
34	8628-11101010	11101010	NITROGEN SYSTEM SOUTH AREA 3 UTILITY SYSTEM P&ID	ALKY – P&ID
35	8629-11101015	11101015	STEAM (560#, 600#) SYSTEM SOUTH AREA 3 UTILITY SYSTEM P&ID	ALKY – P&ID
36	BF-4500-60014-S2-DEMO	10030571-DEMO	ALKY COKER/FAC/MEROX OLEFIN FEED MEROX PROCESS P&ID	ALKY – P&ID
37	BF-4000-60006-S1-DEMO	3004449-DEMO	ALKY DEISOBUTANIZER/DEBUTANIZER PROCESS P&ID	ALKY – P&ID
38	BF-4000-60006-S2-DEMO	3004450-DEMO	ALKY FEED SYSTEM & EFFLUENT TREATING PROCESS P&ID	ALKY – P&ID
39	BF-4000-60006-S3-DEMO	3004451-DEMO	ALKY FEED SURGE & REFRIGERATION PROCESS P&ID	ALKY – P&ID
40	BF-4000-60009-S2-DEMO	3004453-DEMO	ALKY CAUSTIC STORAGE/ACID BLOWDOWN PROCESS P&ID	ALKY – P&ID
41	BF-4000-60012-45-S1-DEMO	3004454-DEMO	ALKY AUXILIARY P&ID	ALKY – P&ID
42	BF-4400-60020-S1-DEMO	3004458-DEMO	ISO-OCTENE PROCESS P&ID	ALKY – P&ID
43	BF-4400-60028-S1-DEMO	3004459-DEMO	ISO OCTENE AUXILIARY P&ID	ALKY – P&ID
44	BF-4500-60014-S1-DEMO	3004460-DEMO	ALKY COKER/FAC/MEROX OLEFIN FEED/ COKER DEPROP PROCESS P&ID	ALKY – P&ID
45				
46	BF-1200-10005-150-S1	3004689	FCC COMPRESSION PROCESS P&ID	FCC – P&ID
47	BF-1101-10004-S1	3004685	FCC FAC PROJECT FRESH FEED PREHEAT PROCESS P&ID	FCC – P&ID

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	121 of 146	

Item	#	File Name	Description	WBS
48	BF-1101-10004-S1-DEMO	3004685-DEMO	FCC FRAC FRESH FEED PREHEAT DEMO PROCESS P&ID	FCC – P&ID
49	BF-2300-92831-36-S1	11060936	FLUID FEED HDS PRISM COMPRESSOR PROJECT AUXILIARY P&ID	FFHDS – P&ID
50	BF-2300-47000-100-S1	3004617	FLUID FEED HDS REACTOR FEED HEATER & EXCHANGERS PROCESS P&ID	FFHDS – P&ID
51	BF-2300-47000-S1-DEMO	3004617-DEMO	FLUID FEED HDS REACTOR FEED HEATER & EXCHANGERS PROCESS DEMO P&ID	FFHDS – P&ID
52	BF-2500-20001-S2	3004628	1 REFORMER LIGHT HYDRO PROCESS P&ID	LHU – P&ID
53	BF-2500-20001-S2-DEMO	3004628-DEMO	1 REFORMER LIGHT HYDRO PROJECT PROCESS DEMO P&ID	LHU – P&ID
54	BF-8100-88349-84-S1	10032635	C3 SPLITTER PROJECT C3 SPLITTER O/H COMPRESSOR AUXILIARY P&ID	NHDS – P&ID
55	BF-8000-91116-S4	11060953	OFFPLOT AREA 16 PROJECT LCR #7 - HVAC/GAS/FIRE AUXILIARY P&ID	NHDS – P&ID
56	8200-11097089	11076214	NAPHTHA ISOM UNIT ISOMERIZATION PROCESS P&ID	NHDS – P&ID
57	BF-8102-91621-S1	11076218	NAPHTHA ISOM PROJECT ISOMERIZATION PROCESS P&ID	NHDS – P&ID
58	8200-11097090	11076220	NAPHTHA HDS UNIT REACTOR & DEA CONTACTOR PROCESS INFORMATION	NHDS – P&ID
59	BF-0116-98747-S1	11086523	NO.2 HYDROGEN PLANT FEED SYSTEM PROCESS P&ID	NHDS – P&ID
60	7600-10032635	11086524	NO.2 HYDROGEN PLANT REFORMER HEATER PROCESS P&ID	NHDS – P&ID
61	BF-8102-91621-S2	11086526	NO. 2 HYDROGEN PLANT PROJECT PSA UNIT PROCESS P&ID	NHDS – P&ID
62	BF-8000-91116-S2	11097089	BUTAMER UNIT PROJECT ISOMERIZATION-FEED SECTION PROCESS P&ID	NHDS – P&ID
63	BF-8000-91116-S1	11097090	BUTAMER UNIT PROJECT ISOMERIZATION FEED SECTION PROCESS P&ID	NHDS – P&ID
64	BF-8100-88349-S1-DEMO	11076220-DEMO	NAPHTHA HDS UNIT REACTOR & AMINE CONTACTOR PROCESS P&ID	NHDS – P&ID
65	250-R-140-C-1	B05U0016-1	HCU UTILITY FLOW DIAGRAM GAS UTILITIES: AMMONIA, FLARE, NITROGEN, AIR	HCU – P&ID
66	250-R-140-C-1-DEMO	B05U0016-1-DEMO	UTILITY FLOW DIAGRAM HCU GAS UTILITIES: AMMONIA, FLARE, NITROGEN, AIR	HCU – P&ID
67	D05A0203-1	D05A0203-1	HCU - UNIT 05 PIPING & INSTRUMENT DIAGRAM 2ND STAGE REACTION SECTION	HCU – P&ID
68	D05A0302-1	D05A0302-1	HCU - UNIT 05 PROJECT PIPING & INSTRUMENT DIAGRAM 2ND STAGE REACTION SECTION	HCU – P&ID
69	D05A0302-1-DEMO	D05A0302-1-DEMO	HCU - UNIT 05 PIPING & INSTRUMENT DIAGRAM 2ND STAGE REACTION SECTION	HCU – P&ID
70	D05A1603-1	D05A1603-1	HCU - UNIT 05 PIPING & INSTRUMENT DIAGRAM 1ST STAGE REACTION SECTION	HCU – P&ID
71	D05A1603-1-DEMO	D05A1603-1-DEMO	HCU - UNIT 05 PIPING & INSTRUMENT DIAGRAM 1ST STAGE REACTION SECTION	HCU – P&ID

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	122 of 146	

Item	#	File Name	Description	WBS
72	D05A1605-1	D05A1605-1	HCU - UNIT 05 PROJECT PIPING & INSTRUMENT DIAGRAM 1ST STAGE REACTION SECTION	HCU – P&ID
73	D05A1605-1-DEMO	D05A1605-1-DEMO	PIPING & INSTRUMENT DIAGRAM HCU - UNIT 05 1ST STAGE REACTION SECTION	HCU – P&ID
74	D05A1903-1	D05A1903-1	HCU - UNIT 05 PIPING & INSTRUMENT DIAGRAM 2ND STAGE REACTION SECTION	HCU – P&ID
75	D05A1903-1-DEMO	D05A1903-1-DEMO	HCU - UNIT 05 PIPING & INSTRUMENT DIAGRAM 2ND STAGE REACTION SECTION	HCU – P&ID
76	D05A1904-1	D05A1904-2	HCU - UNIT 05 PIPING & INSTRUMENT DIAGRAM 2ND STAGE REACTION SECTION	HCU – P&ID
77	D05A1904-2-DEMO	D05A1904-1-DEMO	HCU - UNIT 05 PIPING & INSTRUMENT DIAGRAM 2ND STAGE REACTION SECTION	HCU – P&ID
78	D05A1905-1	D05A1905-1	HCU - UNIT 05 PROJECT PIPING & INSTRUMENT DIAGRAM 2ND STAGE REACTION SECTION	HCU – P&ID
79	D05A1905-1-DEMO	D05A1905-1-DEMO	HCU - UNIT 05 PIPING & INSTRUMENT DIAGRAM 2ND STAGE REACTION SECTION	HCU – P&ID
80	D05A2501-1	250-R-150-G-1	HCU - UNIT 05 PROJECT AUXILIARY FLOW DIAGRAM SCR SYSTEM FOR H-300 & H-301	HCU – P&ID
81	D05A2501-1-DEMO	D05A2501-1-DEMO	HCU - UNIT 05 AUXILIARY FLOW DIAGRAM SCR SYSTEM FOR H-300 & H-301	HCU – P&ID
82	D05A2502-1	250-R-150-H-1	HCU - UNIT 05 PROJECT AUXILIARY FLOW DIAGRAM SCR SYSTEM FOR H-302 & H-303	HCU – P&ID
83	D05A2502-1-DEMO	D05A2502-1-DEMO	HCU - UNIT 05 AUXILIARY FLOW DIAGRAM SCR SYSTEM FOR H-302 & H-303	HCU – P&ID
84	D05A2503-3	250-R-150-J-3	HCU - UNIT 05 PROJECT AUXILIARY FLOW DIAGRAM SCR SYSTEM FOR H-304	HCU – P&ID
85	D05A2503-3-DEMO	D05A2503-3-DEMO	HCU - UNIT 05 AUXILIARY FLOW DIAGRAM SCR SYSTEM FOR H-304	HCU – P&ID
86	D05A2504-1	D05A2504-1	HCU - UNIT 05 PROJECT PIPING & INSTRUMENT DIAGRAM FRACTIONATION SECTION	HCU – P&ID
87	D05A2504-1-DEMO	D05A2504-1-DEMO	PIPING & INSTRUMENT DIAGRAM HCU - UNIT 05 FRACTIONATION SECTION	HCU – P&ID
88	D05A2505-1	D05A2505-1	HCU-2 - UNIT 05 PIPING & INSTRUMENT DIAGRAM FRACTIONATION SECTION	HCU – P&ID
89	D05A2505-1-DEMO	D05A2505-1-DEMO	HCU - UNIT 05 PIPING & INSTRUMENT DIAGRAM FRACTIONATION SECTION	HCU – P&ID
90	SKP-MPLA22001-LAR3-001	SKP-MPLA22001-LAR3-001	HCU - UNIT 05 PROJECT PIPING & INSTRUMENT DIAGRAM HEATER, H-300	HCU – P&ID
91	SKP-MPLA22001-LAR3-002	SKP-MPLA22001-LAR3-002	HCU - UNIT 05 PROJECT PIPING & INSTRUMENT DIAGRAM HEATER, H-301	HCU – P&ID

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	123 of 146	

Item	#	File Name	Description	WBS
92	SKP-MPLA22001-LAR3-003	SKP-MPLA22001-LAR3-003	HCU - UNIT 05 PROJECT PIPING & INSTRUMENT DIAGRAM HEATER, H-302	HCU - P&ID
93	SKP-MPLA22001-LAR3-004	SKP-MPLA22001-LAR3-004	HCU - UNIT 05 PROJECT PIPING & INSTRUMENT DIAGRAM HEATER, H-303	HCU - P&ID
94	SKP-MPLA22001-LAR3-005	SKP-MPLA22001-LAR3-005	HCU - UNIT 05 PROJECT PIPING & INSTRUMENT DIAGRAM HEATER, H-304	HCU - P&ID
95	260-R-150-D-1	B06A0041-1	HGU-1 AUXILIARY FLOW DIAGRAM C-84/85 HYDROGEN COMPRESSORS	HGU - P&ID
96	261-D-150-L-2	B61A0300-2	HGU-2 AUXILIARY FLOW DIAGRAM B-140 VIB/TEMP MONITOR SYSTEM	HGU - P&ID
97	261-D-150-L-2-DEMO	B61A0300-2-DEMO	HGU-02 AUXILIARY FLOW DIAGRAM B-140 VIB/TEMP MONITOR SYSTEM	HGU - P&ID
98	261-R-150-K-7	B61A0500-7	HGU-2 UNIT-61 AUXILIARY FLOW DIAGRAM AUXILIARY BOILER	HGU - P&ID
99	261-R-150-K-7-DEMO	B61A0500-7 DEMO	HGU-2 UNIT-61 AUXILIARY FLOW DIAGRAM AUXILIARY BOILER	HGU - P&ID
100	G61A1401-2	G61A1401-2	HGU-2 - UNIT 61 PROJECT PIPING & INSTRUMENT DIAGRAM FEED DESULFURIZATION	HGU - P&ID
101	G61A1401-2-DEMO	G61A1401-2-DEMO	PIPING & INSTRUMENT DIAGRAM HGU-2 FEED DESULFURIZATION	HGU - P&ID
102	G61A1501-3	G61A1501-3	HGU-2 - UNIT 61 PROJECT PIPING & INSTRUMENT DIAGRAM REFORMER & CONVECTION SECTION	HGU - P&ID
103	G61A1501-3-DEMO	G61A1501-3-DEMO	PIPING & INSTRUMENT DIAGRAM HGU-2 UNIT 61 REFORMER & CONVECTION SECTION	HGU - P&ID
104	G61A1502-3	G61A1502-3	HGU-2 - UNIT 61 PROJECT PIPING & INSTRUMENT DIAGRAM REFORMER & CONVECTION SECTION	HGU - P&ID
105	G61A1502-3-DEMO	G61A1502-3-DEMO	PIPING & INSTRUMENT DIAGRAM HGU-2 REFORMER & CONVECTION SECTION	HGU - P&ID
106	G61A1602-2	G61A1602-2	HGU-2 - UNIT 61 PIPING & INSTRUMENT STEAM DRUM & PROCESS GAS BOILER	HGU - P&ID
107	G61A1602-2-DEMO	G61A1602-2-DEMO	PIPING & INSTRUMENT HGU-2 STEAM DRUM & PROCESS GAS BOILER	HGU - P&ID
108	G61A1702-2	G61A1702-2	HGU-2 PROJECT PIPING & INSTRUMENT DIAGRAM HIGH TEMPERATURE SHIFT	HGU - P&ID
109	G61A1702-2-DEMO	G61A1702-2-DEMO	PIPING & INSTRUMENT HGU-2 STEAM DRUM & PROCESS GAS BOILER	HGU - P&ID
110	G61A1801-2	G61A1801-2	HGU-2 PIPING AND INSTRUMENT DIAGRAM FINAL COOLING/CONDENSATE DEGASSING	HGU - P&ID
111	G61A1802-3	G61A1802-3	HGU-2 PIPING AND INSTRUMENT DIAGRAM FINAL COOLING/CONDESATE DEGASSING	HGU - P&ID
112	G61A1802-3-DEMO	G61A1802-3-DEMO	HGU-2 PIPING AND INSTRUMENT DIAGRAM FINAL COOLING/CONDESATE DEGASSING	HGU - P&ID
113	G61A1901-2	G61A1901-2	HGU-2 PIPING AND INSTRUMENT DIAGRAM DEAERATOR	HGU - P&ID
114	G61A1902-3	G61A1902-3	HGU-2 PIPING & INSTRUMENT DIAGRAM BFW PUMPS	HGU - P&ID

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	124 of 146	

Item	#	File Name	Description	WBS
115	G61A2001-3	G61A2001-2	HGU-2 PIPING & INSTRUMENT DIAGRAM PSA UNIT	HGU - P&ID
116	G61A2201-3	G61A2201-3	HGU-2 PIPING & INSTRUMENT DIAGRAM FUEL SYSTEM	HGU - P&ID
117	G61A2201-3-DEMO	G61A2201-3 DEMO	HGU-2 PIPING & INSTRUMENT DIAGRAM FUEL SYSTEM	HGU - P&ID
118	G61A2202-2	G61A2202-2	HGU-2 PIPING & INSTRUMENT DIAGRAM FUEL SYSTEM	HGU - P&ID
119	G61A2301-2	G61A2301-2	HGU-2 - UNIT 61 PIPING & INSTRUMENT DIAGRAM SCR UNIT	HGU - P&ID
120	G61A2301-2-DEMO	G61A2301-2-DEMO	HGU-2 - UNIT 61 PIPING & INSTRUMENT DIAGRAM SCR UNIT	HGU - P&ID
121	G61A2402-1	G61A2402-1	HGU-2 PIPING & INSTRUMENT DIAGRAM FEED GAS COMPRESSION TRAIN A	HGU - P&ID
122	G61A2402-2-DEMO	G61A2402-1-DEMO	HGU-2 PIPING & INSTRUMENT DIAGRAM FEED GAS COMPRESSION TRAIN A	HGU - P&ID
123	G61A2502-1	G61A2502-1	HGU-2 PIPING & INSTRUMENT DIAGRAM FEED GAS COMPRESSION TRAIN B	HGU - P&ID
124	G61A2502-2-DEMO	G61A2502-1-DEMO	HGU-2 PIPING & INSTRUMENT DIAGRAM FEED GAS COMPRESSION TRAIN B	HGU - P&ID
125	G61A2602-1	G61A2602-1	HGU-2 PIPING & INSTRUMENT DIAGRAM HYDROGEN PRODUCT COMPRESSION	HGU - P&ID
126	G61A2602-2-DEMO	G61A2602-1-DEMO	HGU-2 PIPING & INSTRUMENT DIAGRAM HYDROGEN PRODUCT COMPRESSION	HGU - P&ID
127	E-2101-47020D	8802	1 REFORMER PROJECT CONDUIT AND CABLE TRAY AREA F PLAN	1 REF – I&E
128	E-0104-56329D	11218	1 REFORMER PROJECT EQUIPMENT ROOM B-1019-LIGHTING AND GROUNDING-PLANS	1 REF – I&E
129	E-2102-35868D-9-S1	67573	OFF-PLOT AREA 4 HAZARDOUS AREA CLASSIFICATION PLAN	1 REF – I&E
130	E-2500-35845D-14-S1	80453	1 REFORMER DESULF PROJECT CONDUIT AND CABLE TRAY AREA J PLAN	1 REF – I&E
131	E-2500-35849D	89111	1 REFORMER LIGHT HYDRO PROJECT CONDUIT AND CABLE TRAY AREA A PLAN (4-57)	1 REF – I&E
132	E-2101-35864D	94540	1 REFORMER LIGHT HYDRO PROJECT CONDUIT AND CABLE TRAY AREA "E" PLAN	1 REF – I&E
133	E-2101-35865D-16-S1	97267	1 REFORMER PROJECT CONDUIT AND CABLE TRAY AREA K PLAN	1 REF – I&E
134	E-2500-35846D-10-S1	97270	1 REFORMER CONDUIT AND CABLE TRAY AREA L PLAN	1 REF – I&E
135	E-2500-35847D-9-S1	201645	1 REFORMER LIGHT HYDRO CONDUIT AND CABLE TRAY AREA B PLAN	1 REF – I&E
136	E-2500-35848D-9-S1	201646	LIGHT HYDRO UNIT PROJECT CONDUIT AND CABLE TRAY AREA C PLAN (4-57)	1 REF – I&E
137	E-2101-35862D-18-S1	201647	1 REFORMER LIGHT HYDRO CONDUIT AND CABLE TRAY AREA D PLAN	1 REF – I&E
138	E-2101-35860D-9-S1	202252	1 REFORMER PROJECT AREA E, ELECT COND & CABLE TRAYS PLAN	1 REF – I&E
139	E-2101-35863D-13-S1	203012	1 REFORMER PROJECT CONDUIT AND CABLE TRAY AREA G PLAN	1 REF – I&E
140	0132-10052953	203013	1 REFORMER PROJECT INSTRUMENT/CONDUIT RTG. AREA "H" PLAN (4-57)	1 REF – I&E
141	2101-10192753	10176035	1 REFORMER PROJECT LIGHTING & EMERGENCY SYSTEM PANEL SCHEDULES	1 REF – I&E
142	E-2101-47020D	10192753	1 REFORMER PROJECT NO 1 REFORMER RACK ROOM UPS PANEL SCHEDULES	1 REF – I&E
143	2101-10192771	10192771	1 REFORMER PROJECT NO 1 REFORMER RACK ROOM ABOVEGROUND POWER CONDUIT PLAN	1 REF – I&E
144	0104-10202523	10202523	OFFPLOT AREA 4 MARSHALLING PANEL 1REFRR-SMP-001 PANEL DRAWINGS	1 REF – I&E

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	125 of 146	

Item	#	File Name	Description	WBS
145	2101-10222523-0	10222523	1 REFORMER PROJECT UPS PANELS (2101UP03 & 2101UP04) PANEL SCHEDULES	1 REF – I&E
146	2101-10225171	10225171	1 REFORMER PROJECT EQUIPMENT ROOM B-1019 NEW GROUNDING PLAN	1 REF – I&E
147	2101-10225186	10225186	1 REFORMER 1REFRR SYSTEM COMMUNICATION CABLES BLOCK DIAGRAM	1 REF – I&E
148	0104-10240090	10240090	OFFPLOT AREA 4 NORTH AREA TMR TRISTATION BLOCK SYSTEM DIAGRAM	1 REF – I&E
149	E-9898-82585D-5-S23	11101533	SUBSTATION 1J PROJECT #1 REFORMER SWRM (1JMCC4805) SINGLE LINE DIAGRAM	1 REF – I&E
150	SKI-MPLA22001-LAR3-019	SKI-MPLA22001-LAR3-019	1 REFORMER PROJECT RW-0025 HEATER SIS BLOCK SYSTEM DIAGRAM	1 REF – I&E
151	SKI-MPLA22001-LAR3-020	SKI-MPLA22001-LAR3-020	1 REFORMER DESULF PROJECT RW-0026 HEATER SIS BLOCK SYSTEM DIAGRAM	1 REF – I&E
152	SKI-MPLA22001-LAR3-021	SKI-MPLA22001-LAR3-021	1 REFORMER PROJECT RW-0025 & RW-0026 HEATER SIS INSTRUMENT CONDUIT PLAN	1 REF – I&E
153	SKI-MPLA22001-LAR3-022	SKI-MPLA22001-LAR3-022	1 REFORMER PROJECT RW-0025 & RW-0026 SIS CABLE/CONDUIT SCHEDULE	1 REF – I&E
154	SKI-MPLA22001-LAR3-023	SKI-MPLA22001-LAR3-023	1 REFORMER PROJECT RW-0025 & RW-0026 SIS CABLE/CONDUIT SCHEDULE	1 REF – I&E
155	SKI-MPLA22001-LAR3-023A	SKI-MPLA22001-LAR3-023A	1 REFORMER PROJECT RW-0025 & RW-0026 HEATER SIS CABLE/CONDUIT SCHEDULE	1 REF – I&E
156	SKI-MPLA22001-LAR3-054	SKI-MPLA22001-LAR3-054	1 REFORMER PROJECT RW0004 (TURBINE DRIVEN COMP) INSTRUMENT BLOCK DIAGRAM	1 REF – I&E
157	SKI-MPLA22001-LAR3-055	SKI-MPLA22001-LAR3-055	1 DESULF PROJECT RW0005 & RW0006 (TURBINE DRIVEN COMP) INSTRUMENT BLOCK DIAGRAM	1 REF – I&E
158	SKI-MPLA22001-LAR3-056	SKI-MPLA22001-LAR3-056	1 DESULF PROJECT RW0022 (MOTOR DRIVEN COMP) INSTRUMENT BLOCK DIAGRAM	1 REF – I&E
159	SKI-MPLA22001-LAR3-057	SKI-MPLA22001-LAR3-057	1 REFORMER PROJECT RW0004 /0005/0006/0022 CONDUIT & CABLE SCHEDULE	1 REF – I&E
160	SKI-MPLA22001-LAR3-058	SKI-MPLA22001-LAR3-058	1 REFORMER PROJECT RW0004 /0005/0006/0022 CONDUIT & CABLE SCHEDULE	1 REF – I&E
161	SKI-MPLA22001-LAR3-059	SKI-MPLA22001-LAR3-059	1 REFORMER PROJECT RW0004/0005/0006/0022	1 REF – I&E
162	SKI-MPLA22001-LAR3-060	SKI-MPLA22001-LAR3-060	INSTRUMENT INSTALLATION DETAIL FLOW TRANSMITTERS V-CONE VAPOR SERVICE BELOW TAPS	1 REF – I&E
163	SKI-MPLA22001-LAR3-061	SKI-MPLA22001-LAR3-061	1 REFORMER PROJECT TYPICAL 21-LCP-RW0005/0006 INSTALLATION DETAIL	1 REF – I&E

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	126 of 146	

Item	#	File Name	Description	WBS
164	SKI-MPLA22001-LAR3-062	SKI-MPLA22001-LAR3-062	1 REFORMER PROJECT 21-LCP-RW0004 & RW5/6/22 FOUNDATIONS	1 REF – I&E
165	SKI-MPLA22001-LAR3-064	SKI-MPLA22001-LAR3-064	1 REFORMER PROJECT RW-0025 & RW-0026 RELAY PANEL INSTALLATION DETAIL	1 REF – I&E
166	SKI-MPLA22001-LAR3-082	SKI-MPLA22001-LAR3-082	1 REFORMER, NAPHTH HDS, FCC PROJECT TYPICAL ASCO PANEL INSTALLATION DETAIL	1 REF – I&E
167	SKI-MPLA22001-LAR3-090	SKI-MPLA22001-LAR3-090	1 REFORMER, NAPHTH HDS, FCC PROJECT TYPICAL LOCAL CONTROL PANEL EQUIPMENT LAYOUT	1 REF – I&E
168	E-4000-56640D-6	153871	ALKY UNIT HAZARDOUS AREA CLASSIFICATION PLAN	ALKY – I&E
169	E-4000-60324D-7-S1	153953	ALKY INSTR LOCATION & COND ROUTING PLAN	ALKY – I&E
170	4000-10154947-0	10154947	ALKY UNIT 40LCP-056 COMPRESSOR CNTL PANEL INTERNAL LAYOUT	ALKY – I&E
171	4000-10154949-0	10154949	ALKY UNIT 40LCP-056 COMPRESSOR CNTL PANEL NAMEPLATE SCHEDULE AND BOM	ALKY – I&E
172	4000-10159612-1	10159612	ALKY UNIT 40LCP-056 COMPRESSOR CNTRL PANEL SHUTDOWN SCHEMATIC DIAGRAM	ALKY – I&E
173	4000-10159613-0	10159613	ALKY UNIT 40LCP-056 COMPRESSOR CNTRL PANEL GOVERNOR AND TRANSFER SCHEMATIC	ALKY – I&E
174	MPLA22001-61-100	MPLA22001-61-100	BPCS Instrument Index	ALKY – I&E
175	SKE-MPLA22001-LAR3-205	SKE-MPLA22001-LAR3-205	ALKY UNIT LCR-6, B-529, CTRL RM 102 LIGHTING PLAN/LAYOUT	ALKY – I&E
176	SKE-MPLA22001-LAR3-205-DEMO	SKE-MPLA22001-LAR3-205-DEMO	ALKY UNIT LCR-6, B-529, CTRL RM 102 LIGHTING PLAN/LAYOUT DEMO	ALKY – I&E
177	SKI-MPLA22001-LAR3-083	SKI-MPLA22001-LAR3-083	ALKY PROJECT RW0047.087.06 CONDUIT & CABLE SCHEDULE	ALKY – I&E
178	SKI-MPLA22001-LAR3-084	SKI-MPLA22001-LAR3-084	ALKY PROJECT RW0047 (TURBINE RECIP) FIBER CONDUIT ROUTING	ALKY – I&E
179	SKI-MPLA22001-LAR3-091	SKI-MPLA22001-LAR3-091	ALKY PROJECT HIWAY 3 MIGRATION BLOCK DIAGRAM	ALKY – I&E
180	SKI-MPLA22001-LAR3-097	SKI-MPLA22001-LAR3-097	ALKY PROJECT HIWAY 2 MIGRATION BLOCK DIAGRAM	ALKY – I&E
181	SKI-MPLA22001-LAR3-106	SKI-MPLA22001-LAR3-106	ALKY PROJECT HIWAY 2 FIELD JUNCTION BOX CONDUIT AND TRAY ROUTING SHEET 1 OF 2	ALKY – I&E
182	SKI-MPLA22001-LAR3-107	SKI-MPLA22001-LAR3-107	ALKY PROJECT HIWAY 2 FIELD JUNCTION BOX CONDUIT AND TRAY ROUTING SHEET 2 OF 2	ALKY – I&E

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	127 of 146	

Item	#	File Name	Description	WBS
183	SKI-MPLA22001-LAR3-126	SKI-MPLA22001-LAR3-126	ALKY PROJECT CONDUIT/CABLE SCHEDULE LCR4 FIELD HOMERUN CABLES AND C300 UPS POWER FEEDS	ALKY – I&E
184	SKI-MPLA22001-LAR3-127	SKI-MPLA22001-LAR3-127	ALKY PROJECT CONDUIT/CABLE SCHEDULE LCR4 C300 IO MODULES TO NEW MARSHALLING RACK	ALKY – I&E
185	SKI-MPLA22001-LAR3-128	SKI-MPLA22001-LAR3-128	ALKY PROJECT CONDUIT/CABLE SCHEDULE LCR6 P&F MUX PANEL CABLES TO EXISTING MARSHALLING RACK	ALKY – I&E
186	SKI-MPLA22001-LAR3-129	SKI-MPLA22001-LAR3-129	ALKY PROJECT CONDUIT/CABLE SCHEDULE LCR 6 C300 IO MODUELS TO P&F MUX PANEL AND NEW MARSHALLING RACK	ALKY – I&E
187	SKI-MPLA22001-LAR3-130	SKI-MPLA22001-LAR3-130	ALKY PROJECT BPCS CONDUIT AND CABLE TRAY ROUTING LCR4	ALKY – I&E
188	SKI-MPLA22001-LAR3-131	SKI-MPLA22001-LAR3-131	ALKY PROJECT BPCS CONDUIT AND CABLE TRAY ROUTING LCR6	ALKY – I&E
189	SKI-MPLA22001-LAR3-145	SKI-MPLA22001-LAR3-145	ALKY PROJECT BPCS LCR5 UPC BLOCK DIAGRAM	ALKY – I&E
190	E-1200-40331D	49864	FCC-COMP AREA CLASSIFICATION PLAN (4-6)	FCC – I&E
191	E-0102-56316D-13	81131	OFFPLOT AREA 2 HAZARDOUS AREA CLASSIFICATION PLAN (4-6)	FCC – I&E
192	1200-10029770-3	10029770	FCC COMP FIG. 1ST STG COMPR PNL 12-LCP-20 ELECT SCHEMATIC DIAGRAM (6-68)	FCC – I&E
193	1200-10029771-3	10029771	FCC COMP FIG. 1ST STG COMPR PNL 12-LCP-20 ELECT SCHEMATIC DIAGRAM (6-68)	FCC – I&E
194	1200-10029772-4	10029772	FCC COMP FIG. 1ST STG COMPR PNL 12-LCP-20 ELECT SCHEMATIC DIAGRAM (6-68)	FCC – I&E
195	1200-10029773-4	10029773	FCC COMP FIG. 1ST STG COMPR PNL 12-LCP-20 ELECT SCHEMATIC DIAGRAM (6-68)	FCC – I&E
196	1200-10029774-1	10029774	FCC COMP FIG. 1ST STG COMPR PNL 12-LCP-20 ELECT SCHEMATIC DIAGRAM (6-68)	FCC – I&E
197	1200-10029775-3	10029775	FCC COMP FIG. 1ST STG COMPR PNL 12-LCP-20 ELECT SCHEMATIC DIAGRAM (6-68)	FCC – I&E
198	1200-10029777-1	10029777	FCC COMP FIG. 1ST STG COMPR PNL 12-LCP-20 ELECT SCHEMATIC DIAGRAM (6-68)	FCC – I&E
199	1200-10029780-4	10029780	FCC COMP FIG. 1ST STG COMPR PNL 12-LCP-20 ELECT SCHEMATIC DIAGRAM (6-68)	FCC – I&E
200	1200-10034506-3	10034506	FCC COMP ELEC A/G POWER PLAN (4-57)	FCC – I&E

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	128 of 146	

Item	#	File Name	Description	WBS
201	SKI-MPLA22001-LAR3-016	SKI-MPLA22001-LAR3-016	FCC CRACKING PROJECT RW-0023 HEATER SIS BLOCK SYSTEM DIAGRAM	FCC – I&E
202	SKI-MPLA22001-LAR3-017	SKI-MPLA22001-LAR3-017	FCC CRACKING PROJECT RW-0023 SIS INSTRUMENT PLAN	FCC – I&E
203	SKI-MPLA22001-LAR3-018	SKI-MPLA22001-LAR3-018	FCC CRACKING PROJECT RW-0023 SIS CABLE/CONDUIT SCHEDULE	FCC – I&E
204	SKI-MPLA22001-LAR3-085	SKI-MPLA22001-LAR3-085	FCC COMPRESSOR PROJECT PIGNONE 1ST STAGE COMPRESSOR CONDUIT & CABLE SCHEDULE	FCC – I&E
205	SKI-MPLA22001-LAR3-086	SKI-MPLA22001-LAR3-086	FCC COMPRESSOR PROJECT PIGNONE 1ST STAGE COMPRESSOR BLOCK DIAGRAM	FCC – I&E
206	E-0106-56360D	67557	OFFPLOT AREA 6 HAZARDOUS AREA CLASSIFICATION PLAN	FFHDS – I&E
207	E-0106-56359D	67558	OFFPLOT AREA 6 HAZARDOUS AREA CLASSIFICATION PLAN	FFHDS – I&E
208	E-0106-56344D	67562	OFFPLOT AREA 6 HAZARDOUS AREA CLASSIFICATION PLAN	FFHDS – I&E
209	E-2400-24923F-26-S1	98548	C5-C6 ISOM HDS ELEC AREA PLOT PLAN #4 POWER AND LIGHTING	FFHDS – I&E
210	2300-10033934-1	10033934	HDS PRISM COMPRESSOR PANEL 23-LP-01 EQUIPMENT DETAIL	FFHDS – I&E
211	E-0106-99643D	11059401	OFFPLOT AREA FFHDS PRISM COMPRESSOR A/G POWER & CONTROL CONDUIT PLAN	FFHDS – I&E
212	E-2300-99635D-4-S1	11101341	FLUID FEED HDS PRISM COMPRESSOR CONTROL CIRCUIT ELECT SCHEMATIC & CONNECTION DIAG	FFHDS – I&E
213	SKI-MPLA22001-LAR3-027	SKI-MPLA22001-LAR3-027	FLUID FEED HDS PROJECT RW-0048 HEATER SIS BLOCK SYSTEM DIAGRAM	FFHDS – I&E
214	SKI-MPLA22001-LAR3-028	SKI-MPLA22001-LAR3-028	FLUID FEED HDS PROJECT RW-0048 SIS INSTRUMENT PLAN	FFHDS – I&E
215	SKI-MPLA22001-LAR3-029	SKI-MPLA22001-LAR3-029	FLUID FEED HDS PROJECT RW-0048 SIS CABLE / CONDUIT SCHEDULE	FFHDS – I&E
216	SKI-MPLA22001-LAR3-087	SKI-MPLA22001-LAR3-087	FFHDS PROJECT RW0057 CONDUIT & CABLE SCHEDULE	FFHDS – I&E
217	SKI-MPLA22001-LAR3-088	SKI-MPLA22001-LAR3-088	FFHDS PROJECT RW0057 (MOTOR DRIVEN RECIP) INSTRUMENT BLOCK DIAGRAM	FFHDS – I&E
218	SKI-MPLA22001-LAR3-089	SKI-MPLA22001-LAR3-089	FFHDS PROJECT RW0057 (MOTOR DRIVEN RECIP) POWER CONDUIT ROUTING	FFHDS – I&E
219	E-0104-56314D	67539	OFFPLOT AREA 4 ELECTRICAL AREA CLASSIFICATION PLAN	LHU – I&E
220	SKI-MPLA22001-LAR3-024	SKI-MPLA22001-LAR3-024	1 REFORMER LIGHT HYDRO PROJECT RW-0028 HEATER SIS BLOCK SYSTEM DIAGRAM	LHU – I&E

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	129 of 146	

Item	#	File Name	Description	WBS
221	SKI-MPLA22001-LAR3-025	SKI-MPLA22001-LAR3-025	1 REFORMER LIGHT HYDRO PROJECT RW-0028 SIS INSTRUMENT PLAN	LHU – I&E
222	SKI-MPLA22001-LAR3-026	SKI-MPLA22001-LAR3-026	1 REFORMER LIGHT HYDRO PROJECT RW-0028 SIS CABLE/CONDUIT SCHEDULE	LHU – I&E
223	8100-10003961	10003961	NAPHTHA HDS UNIT ELECTRICAL PLAN AREA CLASSIFICATION	NHDS – I&E
224	SKI-MPLA22001-LAR3-030	SKI-MPLA22001-LAR3-030	NAPHTHA HDS PROJECT RW-0053 HEATER SIS BLOCK SYSTEM DIAGRAM	NHDS – I&E
225	SKI-MPLA22001-LAR3-031	SKI-MPLA22001-LAR3-031	NAPHTHA HDS PROJECT RW-0053 SIS INSTRUMENT PLAN	NHDS – I&E
226	SKI-MPLA22001-LAR3-032	SKI-MPLA22001-LAR3-032	NAPHTHA HDS PROJECT RW-0053 SIS CABLE/CONDUIT SCHEDULE	NHDS – I&E
227	926-D-620-D-5	D05P4306-5	HPD RACK ROOM ELECTRICAL UNDERFLOOR CONDUIT PLAN HCU BACKFLOW PROTECTION SYSTEM	HCU – I&E
228	D05P4360	D05P4360	HCU AREA CLASSIFICATION (23)	HCU – I&E HGU – I&E
229	SKI-MPLA22001-LAR3-067	SKI-MPLA22001-LAR3-067	HCU UNIT PROJECT H-300 & H-301 HEATER BLOCK SYSTEM DIAGRAM	HCU – I&E
230	SKI-MPLA22001-LAR3-068	SKI-MPLA22001-LAR3-068	HCU PROJECT H-300 & H-301 CONDUIT & CABLE SCHEDULE	HCU – I&E
231	SKI-MPLA22001-LAR3-069	SKI-MPLA22001-LAR3-069	HCU PROJECT H-300, H-301, H-302, H-303, & H-304 CONDUIT & CABLE SCHEDULE	HCU – I&E
232	SKI-MPLA22001-LAR3-070	SKI-MPLA22001-LAR3-070	HCU UNIT PROJECT H-301 HEATERS BLOCK SYSTEM DIAGRAM	HCU – I&E
233	SKI-MPLA22001-LAR3-071	SKI-MPLA22001-LAR3-071	HCU UNIT PROJECT H-302 & H-303 HEATER BLOCK SYSTEM DUAGRANM	HCU – I&E
234	SKI-MPLA22001-LAR3-072	SKI-MPLA22001-LAR3-072	HCU PROJECT H-302 & H-303 CONDUIT & CABLE SCHEDULE	HCU – I&E
235	SKI-MPLA22001-LAR3-074	SKI-MPLA22001-LAR3-074	HCU PROJECT H-302 & H-303 PROJECT INSTRUMENT PLAN SKETCH 1	HCU – I&E
236	SKI-MPLA22001-LAR3-075	SKI-MPLA22001-LAR3-075	HCU UNIT PROJECT H-304 HEATER BLOCK SYSTEM DIAGRAM	HCU – I&E
237	SKI-MPLA22001-LAR3-076	SKI-MPLA22001-LAR3-076	HCU PROJECT H-304 CONDUIT & CABLE SCHEDULE	HCU – I&E

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	130 of 146	

Item	#	File Name	Description	WBS
238	SKI-MPLA22001-LAR3-077	SKI-MPLA22001-LAR3-077	HCU PROJECT H-304 PROJECT INSTRUMENT PLAN SKETCH 1	HCU – I&E
239	SKI-MPLA22001-LAR3-078	SKI-MPLA22001-LAR3-078	HCU PROJECT OVERALL HOMERUN ROUTING INSTRUMENT PLAN SKETCH 1	HCU – I&E
240	SKI-MPLA22001-LAR3-079	SKI-MPLA22001-LAR3-079	HCU/HGU 05-SMP-XX1/06-SMP-XX1 MARSHALLING CABINET LAYOUT	HCU – I&E
241	SKI-MPLA22001-LAR3-080	SKI-MPLA22001-LAR3-080	HPD OPERATIONS/SIH BLDG. SIH PLAN, CONDUIT (CABLE TRAY) RTG. EQUIPMENT LOCATION PLAN	HCU – I&E
242	SKI-MPLA22001-LAR3-081	SKI-MPLA22001-LAR3-081	HCU PROJECT H-304 PROJECT INSTRUMENT PLAN SKETCH 1	HCU – I&E
243	SKI-MPLA22001-LAR3-096	SKI-MPLA22001-LAR3-096	HCU PROJECT C-93 SURGE TRIP BLOCK DIAGRAM	HCU – I&E
244	SKI-MPLA22001-LAR3-102	SKI-MPLA22001-LAR3-102	HPD OPERATIONS/SIH BLDG PROJECT POWER PANEL SCHEDULE UPS PANELBOARD "R" & "S"	HCU – I&E
245	SKI-MPLA22001-LAR3-110	SKI-MPLA22001-LAR3-110	HCU PROJECT 05-RP-XX1 RELAY PANEL INSTALLATION DETAILS	HCU – I&E
246	SKI-MPLA22001-LAR3-105	SKI-MPLA22001-LAR3-105	HGU-2 P208/120VAC DIST. PANELS SCHEDULES 05-PPE-1291, 1292, 1293	HCU – I&E HGU – I&E
247	SKI-MPLA22001-LAR3-108	SKI-MPLA22001-LAR3-108	LARW PROJECT TYPICAL JUNCTION BOX INSTALLATION DETAIL	HCU – I&E HGU – I&E
248	SKI-MPLA22001-LAR3-109	SKI-MPLA22001-LAR3-109	LARW PROJECT TYPICAL LIGHT OFF PANEL INSTALLATION DETAIL	HCU – I&E HGU – I&E
249	926-D-621-AC-3	B05P0548-3	HPD OPERATIONS/SIH BUILDING SIH CONDUIT PLAN & DETAILS	HGU – I&E
250	926-D-616-A-1	B05P0568-1	HPD OPERATIONS/ SIH BUILDING PROJECT LIGHTING PANEL SCHEDULE UPS PANELBOARDS "G" THRU "M"	HGU – I&E
251	D06P0291-1	D06P0291-1	HGU-1/HGU-2 PROJECT VENDOR FABRICATION DRAWING/DETAILS/LAYOUT 06-IPS-01/ SWING FRAME/HPD SIH	HGU – I&E
252	D06P0293-1	D06P0293-1	HGU-1/HGU-2 PROJECT VENDOR FABRICATION DRAWING/DETAILS/LAYOUT 06-IPS-01/ INTERNAL REAR/HPD SIH	HGU – I&E
253	D06P0299-1	D06P0299-1	HGU-1/HGU-2 PROJECT VENDOR FABRICATION DRAWING/DETAILS/LAYOUT 06-IPS-01/ 24 VDC AI CONNECTIONS/HPD SIH	HGU – I&E
254	D06P0302-1	D06P0302-1	HGU-1/HGU-2 PROJECT VENDOR FABRICATION DRAWING/DETAILS/LAYOUT 06-IPS-01/COMMUNICATIONS/HPD SIH	HGU – I&E

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	131 of 146	

Item	#	File Name	Description	WBS
255	D06P0306-1	D06P0306-1	HGU-1/HGU-2 PROJECT VENDOR FABRICATION DRAWING/DETAILS/LAYOUT 06-IPS-01/CHASSIS LAYOUT/HPD SIH	HGU – I&E
256	D06P0349	D06P0349	HGU-1/C4 ISOM-DIB PROJECT AREA CLASSIFICATION DESCRIPTION	HGU – I&E
257	260-D-619-N-1	D06P0386-1	HGU-1/C4ISOM (DIB) PROJECT INSTRUMENT PLAN (AREA -)	HGU – I&E
258	260-D-619-V-1	D06P0393-1	HGU-1/C4ISOM (DIB) PROJECT INSTRUMENT PLAN	HGU – I&E
259	260-D-619-W-1	D06P0394-1	HGU-1 INSTRUMENT PLAN	HGU – I&E
260	260-D-619-X-1	D06P0395-1	HGU-1/C4ISOM (DIB) INSTRUMENT PLAN	HGU – I&E
261	260-D-619-Y-1	D06P0396-1	HGU-1 PROJECT INSTRUMENT PLAN	HGU – I&E
262	260-D-619-Z-1	D06P0397-1	HGU-1 INSTRUMENT PLAN	HGU – I&E
263	D06P0961-1	D06P0961-1	HGU-1 208/120VAC DIST. PANELS PANEL SCHEDULES 05-PPE-1291, 1292, 1293	HGU – I&E
264	D14P4300	D14P4300	HGU-2 PROJECT AREA CLASSIFICATION	HGU – I&E
265	261-D-730-C-1	D61J0120-1	HGU-2 INSTRUMENT CONTROL SYSTEM LOGIC DIAGRAM COMPRESSORS C-146 & C-147 SHUTDOWN	HGU – I&E
266	261-D-619-C-3	D61P0077-3	HGU-2 PROJECT INSTRUMENTATION PLAN	HGU – I&E
267	261-D-619-C-1	D61P0207-1	HGU-2 PROJECT INSTRUMENTATION PLAN	HGU – I&E
268	D61P4488	D61P4488-1	HGU-2 POWER PANEL SCHEDULE PANELBOARDS PPM-1283, PPM1297	HGU – I&E
269	D61P4505	D61P4505-1	HGU-2 MISCELLANEOUS CONNECTION DIAGRAM SUB9 24VDC POWER DISTRIBUTION 61-DCP-100	HGU – I&E
270	SKI-MPLA22001-LAR3-036	SKI-MPLA22001-LAR3-036	HGU2 PROJECT C-84, C-156, C-147, C-148 BLOCK DIAGRAM	HGU – I&E
271	SKI-MPLA22001-LAR3-037	SKI-MPLA22001-LAR3-037	HGU-1 PROJECT C-84 / 147 / 147 / 148 CONDUIT AND CABLE SCHEDULE	HGU – I&E
272	SKI-MPLA22001-LAR3-038	SKI-MPLA22001-LAR3-038	HGU-2 PROJECT INSTRUMENT PLAN CONTINUED	HGU – I&E
273	SKI-MPLA22001-LAR3-039	SKI-MPLA22001-LAR3-039	HGU-2 PROJECT INSTRUMENT PLAN CONTINUED	HGU – I&E
274	SKI-MPLA22001-LAR3-111	SKI-MPLA22001-LAR3-111	HGU-2 PROJECT CABLE BLOCK DIAGRAM H-42 SIS SYSTEM	HGU – I&E
275	SKI-MPLA22001-LAR3-112	SKI-MPLA22001-LAR3-112	HGU-2 PROJECT CABLE BLOCK DIAGRAM H-43 SIS SYSTEM	HGU – I&E
276	SKI-MPLA22001-LAR3-113	SKI-MPLA22001-LAR3-113	HGU-2 PROJECT INSTRUMENT PLAN CONDUIT/CABLE TRAY ROUTING H-42 & H-32 SIS CABLES	HGU – I&E
277	SKI-MPLA22001-LAR3-114	SKI-MPLA22001-LAR3-114	HGU-2 PROJECT INSTRUMENT PLAN CONDUIT/CABLE TRAY ROUTING H-42 & H-32 SIS CABLES	HGU – I&E

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	132 of 146	

Item	#	File Name	Description	WBS
278	SKI-MPLA22001-LAR3-115	SKI-MPLA22001-LAR3-115	HGU-2 PROJECT CONDUIT/CABLE SCHEDULE H-42 SIS SYSTEM CABLES	HGU – I&E
279	SKI-MPLA22001-LAR3-116	SKI-MPLA22001-LAR3-116	HGU-2 PROJECT CONDUIT/CABLE SCHEDULE H-42 SIS SYSTEM CABLES	HGU – I&E
280	SKI-MPLA22001-LAR3-117	SKI-MPLA22001-LAR3-117	HGU-2 PROJECT CONDUIT/CABLE SCHEDULE H-43 SIS SYSTEM CABLES	HGU – I&E
281	SKI-MPLA22001-LAR3-118	SKI-MPLA22001-LAR3-118	HGU-2 PROJECT CONDUIT/CABLE SCHEDULE H-43 SIS SYSTEM CABLES	HGU – I&E
282	SKI-MPLA22001-LAR3-120	SKI-MPLA22001-LAR3-120	HGU-2 PROJECT CONDUIT/CABLE SCHEDULE 61-SMP-XX1 & HPD RACK ROOM	HGU – I&E
283	SKI-MPLA22001-LAR3-121	SKI-MPLA22001-LAR3-121	HGU-2 PROJECT CONDUIT/CABLE SCHEDULE 61-SMP-XX1 & HPD RACK ROOM	HGU – I&E
284	SKI-MPLA22001-LAR3-122	SKI-MPLA22001-LAR3-122	HGU-2 PROJECT INSTRUMENT CONDUIT ROUTING PLAN H-42 SIS SYSTEM	HGU – I&E
285	SKI-MPLA22001-LAR3-123	SKI-MPLA22001-LAR3-123	HGU-2 PROJECT INSTRUMENT CONDUIT ROUTING PLAN H-43 SIS SYSTEM	HGU – I&E
286	SKI-MPLA22001-LAR3-147	SKI-MPLA22001-LAR3-147	HGU-2 H-42 & H-43 24VDC CONNECTION DIAGRAM	HGU – I&E
287	SKI-MPLA22001-LAR3-149	SKI-MPLA22001-LAR3-149	HGU-2 PROJECT AUX BOILER FRESH AIR FLOW INSTRUMENT INSTALLATION DETAIL	HGU – I&E
288	SKF-MPLA22001-LAR3-001	SKF-MPLA22001-LAR3-001	LAR3 PROJECT BLOWN FIBER - FIBER OPTIC CABLE BLOCK DIAGRAM	FIBER
289	SKF-MPLA22001-LAR3-002	SKF-MPLA22001-LAR3-002	REFINERY MAPS / OFF PROPERTY PROJECT AIR BLOWN FIBER ROUTING INSTRUMENT CONDUIT PLANS	FIBER
290	SKF-MPLA22001-LAR3-003	SKF-MPLA22001-LAR3-003	OFFPLOT AREA 10 PROJECT AIR BLOWN FIBER ROUTING PLAN EQUIPMENT LAYOUT	FIBER
291	SKF-MPLA22001-LAR3-004	SKF-MPLA22001-LAR3-004	OFFPLOT AREA 19 PROJECT AIR BLOWN FIBER ROUTING PLAN EQUIPMENT LAYOUT	FIBER
292	SKF-MPLA22001-LAR3-005	SKF-MPLA22001-LAR3-005	OFFPLOT AREA 14 PROJECT AIR BLOWN FIBER ROUTING PLAN EQUIPMENT LAYOUT	FIBER
293	SKF-MPLA22001-LAR3-006	SKF-MPLA22001-LAR3-006	OFFPLOT AREA 19 PROJECT AIR BLOWN FIBER ROUTING PLAN EQUIPMENT LAYOUT	FIBER
294	SKF-MPLA22001-LAR3-007	SKF-MPLA22001-LAR3-007	OFFPLOT AREA 13 PROJECT AIR BLOWN FIBER ROUTING PLAN EQUIPMENT LAYOUT	FIBER

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	133 of 146	

Item	#	File Name	Description	WBS
295	SKF-MPLA22001-LAR3-008	SKF-MPLA22001-LAR3-008	OFFPLOT AREA 19 PROJECT AIR BLOWN FIBER ROUTING PLAN EQUIPMENT LAYOUT	FIBER
296	SKF-MPLA22001-LAR3-009	SKF-MPLA22001-LAR3-009	LAR3 PROJECT FIBER OPTIC CABLE SCHEDULE	FIBER
297	SKF-MPLA22001-LAR3-010	SKF-MPLA22001-LAR3-010	OFFPLOT AREA 2 PROJECT AIR BLOWN FIBER ROUTING INSTRUMENT CONDUIT PLANS	FIBER
298	SKF-MPLA22001-LAR3-011	SKF-MPLA22001-LAR3-011	PLANT COMMUNICATION SYSTEM PROJECT FIBER OPTIC DISTRIBUTION BOX INSTRUMENT INSTALLATION DETAILS	FIBER
299	747002-LAR3C-VTZ-DWG-0001	747002-LAR3C-VTZ-DWG-0001	LAR3 CARSON NETWORK ARCHITECTURE	FIBER
300	E-0116-56660D-3	12723	OFFPLOT AREA 16 HAZARDOUS AREA CLASSIFICATION PLAN	CONSOLE
301	E-0116-56639D-4	12757	OFFPLOT AREA 16 HAZARDOUS AREA CLASSIFICATION PLAN	CONSOLE
302	E-0116-56619D	12796	OFFPLOT AREA 16 HAZARDOUS AREA CLASSIFICATION PLAN	CONSOLE
303	E-0117-56486D-11	162731	OFFPLOT AREA 17 HAZARDOUS AREA CLASSIFICATION PLAN (4-6)	CONSOLE
304	E-0117-56504D-12	162732	OFFPLOT AREA 17 HAZARDOUS AREA CLASSIFICATION PLAN (4-6)	CONSOLE
305	E-6202-56487D-12	232297	DECOKING HAZARDOUS AREA CLASSIFICATION PLAN (4-6)	CONSOLE
306	E-0115-56599D-10	11081364	OFFPLOT AREA 16 HAZARDOUS AREA CLASSIFICATION PLAN (4-6)	CONSOLE
307	76-HS-9200-SP	76-HS-9200	76HS9200 INSTRUMENT SPECIFICATION	CONSOLE
308	80-HS-080-SP	80-HS-080	80HS080 INSTRUMENT SPECIFICATION	CONSOLE
309	80-HS-106-SP	80-HS-106	90HS106 INSTRUMENT SPECIFICATION	CONSOLE
310	80-HS-924-SP	80-HS-924	80HS924 INSTRUMENT SPECIFICATION	CONSOLE
311	80-HS-965-SP	80-HS-965	80HS965 INSTRUMENT SPECIFICATION	CONSOLE
312	80-HS-970-SP	80-HS-970	80HS970 INSTRUMENT SPECIFICATION	CONSOLE
313	80-HS-986-SP	80-HS-986	80HS986 INSTRUMENT SPECIFICATION	CONSOLE
314	81-HS-099-SP	81-HS-099	81HS099 INSTRUMENT SPECIFICATION	CONSOLE
315	81-HS-957-SP	81-HS-957	81HS957 INSTRUMENT SPECIFICATION	CONSOLE
316	81-HS-958-SP	81-HS-958	81HS958 INSTRUMENT SPECIFICATION	CONSOLE
317	81-HS-979-SP	81-HS-979	81HS979 INSTRUMENT SPECIFICATION	CONSOLE
318	81-HS-981-SP	81-HS-981	81HS981 INSTRUMENT SPECIFICATION	CONSOLE
319	81-HS-985-SP	81-HS-985	81HS985 INSTRUMENT SPECIFICATION	CONSOLE
320	81-HS-986-SP	81-HS-986	81HS986 INSTRUMENT SPECIFICATION	CONSOLE
321	81-HS-994-SP	81-HS-994	81HS994 INSTRUMENT SPECIFICATION	CONSOLE
322	82-HS-099-SP	82-HS-099	82HS099 INSTRUMENT SPECIFICATION	CONSOLE
323	82-HS-981-SP	82-HS-981	82HS981 INSTRUMENT SPECIFICATION	CONSOLE

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	134 of 146	

Item	#	File Name	Description	WBS
324	82-HS-986-SP	82-HS-986	82HS986 INSTRUMENT SPECIFICATION	CONSOLE
325	MPLA22001-40-301	MPLA22001-40-301	Carson SACCR Console Swim Lane	CONSOLE
326	MPLA22001-44-101	MPLA22001-44-101	SACCR CONSOLE REPLACEMENT - ISOM/ALKY CONSOLE BUTTON PANEL CUTOVER STRATEGY	CONSOLE
327	SKI-MPLA22001-LAR3-014	SKI-MPLA22001-LAR3-014	NACR CONTROL PANEL PROJECT CPD CONTROL PANEL SECT. 108 CONNECTION DIAGRAM CONSOLE SHUTDOWN PANEL	CONSOLE
328	SKI-MPLA22001-LAR3-040	SKI-MPLA22001-LAR3-040	LCR-7 V-SERVER POWER BLOCK DIAGRAM	CONSOLE
329	SKI-MPLA22001-LAR3-041	SKI-MPLA22001-LAR3-041	LCR-7 V-SERVER & NETWORK A/B EQUIPMENT PLAN	CONSOLE
330	SKI-MPLA22001-LAR3-041-DEMO	SKI-MPLA22001-LAR3-041-DEMO	LCR-7 V-SERVER & NETWORK A/B EQUIPMENT PLAN	CONSOLE
331	SKI-MPLA20001-LAR3-042	SKI-MPLA22001-LAR3-042	LCR-7 67MCC-4803 SINGLE LINE DIAGRAM V-SERVER	CONSOLE
332	SKI-MPLA22001-LAR3-043	SKI-MPLA22001-LAR3-043	SULF PLT CLAUS D CONTROL ROOM B-106 POWER & COMMUNICATION PLAN (4-57)	CONSOLE
333	SKI-MPLA22001-LAR3-043-DEMO	SKI-MPLA22001-LAR3-043-DEMO	SULF PLT CLAUS D CONTROL ROOM B-106 POWER & COMMUNICATION PLAN (4-57)	CONSOLE
334	SKI-MPLA22001-LAR3-044	SKI-MPLA22001-LAR3-044	OFFPLOT AREA 14 B-1094 CRUDE ROW OPERATOR SHLTR SAFETY EVACUATION PLAN	CONSOLE
335	SKI-MPLA22001-LAR3-044-DEMO	SKI-MPLA22001-LAR3-044-DEMO	OFFPLOT AREA 14 B-1094 CRUDE ROW OPERATOR SHLTR SAFETY EVACUATION PLAN	CONSOLE
336	SKI-MPLA22001-LAR3-045	SKI-MPLA22001-LAR3-045	1 CRUDE LCR-3 BLDG (B-1066) EXTENSION EQUIP. LOC. & GND PLAN (4-25)	CONSOLE
337	SKI-MPLA22001-LAR3-045-DEMO	SKI-MPLA22001-LAR3-045-DEMO	1 CRUDE LCR-3 BLDG (B-1066) EXTENSION EQUIP. LOC. & GND PLAN (4-25)	CONSOLE
338	SKI-MPLA22001-LAR3-046	SKI-MPLA22001-LAR3-046	OFFPLOT AREA 18 UPS PANEL 67UP01 & 67UP02 SCHEDULES	CONSOLE
339	SKI-MPLA22001-LAR3-046-DEMO	SKI-MPLA22001-LAR3-046-DEMO	OFFPLOT AREA 18 UPS PANEL 67UP01 & 67UP02 SCHEDULES	CONSOLE
340	SKI-MPLA22001-LAR3-047	SKI-MPLA22001-LAR3-047	ALKY PROJECT CABLE TRAY DCS LCR6 (B-529) CABLE/CONDUIT SCHEDULES	CONSOLE
341	SKI-MPLA22001-LAR3-047-DEMO	SKI-MPLA22001-LAR3-047-DEMO	ALKY PROJECT CABLE TRAY DCS LCR6 (B-529) CABLE/CONDUIT SCHEDULES	CONSOLE

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	135 of 146	

Item	#	File Name	Description	WBS
342	SKI-MPLA22001-LAR3-048	SKI-MPLA22001-LAR3-048	OFFPLOT AREA 14 B-1049 OP'S SHLTR FOR CRUDE ROW PANEL SCHEDULE & DETAILS	CONSOLE
343	SKI-MPLA22001-LAR3-049	SKI-MPLA22001-LAR3-049	ALKY UNINTERRUPTABLE PWR SYSTEM, B-529 UPS PANEL SCHEDULE	CONSOLE
344	SKI-MPLA22001-LAR3-049-DEMO	SKI-MPLA22001-LAR3-049-DEMO	ALKY UNINTERRUPTIBLE PWR SYSTEM, B-529 UPS PANEL SCHEDULE	CONSOLE
345	SKI-MPLA22001-LAR3-050	SKI-MPLA22001-LAR3-050	OFF-PLOT AREA 18 SULFUR PLANT PWR, LTG & INSTR PANEL SCHEDULES	CONSOLE
346	SKI-MPLA22001-LAR3-092	SKI-MPLA22001-LAR3-092	OFF-PLOT AREA 16 PROJECT SUBSTATION 67 PANEL SCHEDULE	CONSOLE
347	SKI-MPLA22001-LAR3-092-DEMO	SKI-MPLA22001-LAR3-092-DEMO	OFF-PLOT AREA 16 PROJECT SUBSTATION 67 PANEL SCHEDULE	CONSOLE
348	SKI-MPLA22001-LAR3-093	SKI-MPLA22001-LAR3-093	OFF-PLOT AREA 16 & 17 PROJECT SACCR UPS PANEL SCHEDULE	CONSOLE
349	SKI-MPLA22001-LAR3-093-DEMO	SKI-MPLA22001-LAR3-093-DEMO	OFF-PLOT AREA 16 & 17 PROJECT SACCR UPS PANEL SCHEDULE	CONSOLE
350	SKI-MPLA22001-LAR3-098	SKI-MPLA22001-LAR3-098	OFF PLOT 16 SO. CENTRAL CONTROL BLDG. B-1065 A/G CONDUIT PLAN (4-57)	CONSOLE
351	SKI-MPLA22001-LAR3-099	SKI-MPLA22001-LAR3-099	SULFUR B-106 & B-118 PROJECT CONDUIT/LOCATION PLAN CABLE/CONDUIT ROUTING	CONSOLE
352	SKI-MPLA22001-LAR3-100	SKI-MPLA22001-LAR3-100	B-1086, B-1065 & B-1085 PROJECT CONDUIT/LOCATION PLAN CABLE/CONDUIT ROUTING	CONSOLE
353	SKI-MPLA22001-LAR3-124	SKI-MPLA22001-LAR3-124	SACCR PROJECT CONDUIT/CABLE SCHEDULE CONSOLES	CONSOLE
354	SKI-MPLA22001-LAR3-133	SKI-MPLA22001-LAR3-133	OFF-PLOT AREA 16 PROJECT SACCR PHASE #A DCS EQUIPMENT LAYOUT	CONSOLE
355	SKI-MPLA22001-LAR3-134	SKI-MPLA22001-LAR3-134	OFF-PLOT AREA 16 PROJECT SACCR PHASE #B DCS EQUIPMENT LAYOUT	CONSOLE
356	SKI-MPLA22001-LAR3-135	SKI-MPLA22001-LAR3-135	OFF-PLOT AREA 16 PROJECT SACCR PHASE #C DCS EQUIPMENT LAYOUT	CONSOLE
357	SKI-MPLA22001-LAR3-136	SKI-MPLA22001-LAR3-136	OFF-PLOT AREA 16 PROJECT SACCR PHASE #D DCS EQUIPMENT LAYOUT	CONSOLE
358	SKI-MPLA22001-LAR3-137	SKI-MPLA22001-LAR3-137	OFF-PLOT AREA 16 PROJECT SACCR PHASE #1 DCS EQUIPMENT LAYOUT	CONSOLE

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	136 of 146	

Item	#	File Name	Description	WBS
359	SKI-MPLA22001-LAR3-137-DEMO	SKI-MPLA22001-LAR3-137-DEMO	OFF-PLOT AREA 16 PROJECT SACCR PHASE #1 DCS EQUIPMENT LAYOUT	CONSOLE
360	SKI-MPLA22001-LAR3-138	SKI-MPLA22001-LAR3-138	OFF-PLOT AREA 16 PROJECT SACCR PHASE #2 DCS EQUIPMENT LAYOUT	CONSOLE
361	SKI-MPLA22001-LAR3-138-DEMO	SKI-MPLA22001-LAR3-138-DEMO	OFF-PLOT AREA 16 PROJECT SACCR PHASE #2 DCS EQUIPMENT LAYOUT	CONSOLE
362	SKI-MPLA22001-LAR3-139	SKI-MPLA22001-LAR3-139	OFF-PLOT AREA 16 PROJECT SACCR PHASE #3 DCS EQUIPMENT LAYOUT	CONSOLE
363	SKI-MPLA22001-LAR3-139-DEMO	SKI-MPLA22001-LAR3-139-DEMO	OFF-PLOT AREA 16 PROJECT SACCR PHASE #3 DCS EQUIPMENT LAYOUT	CONSOLE
364	SKI-MPLA22001-LAR3-140	SKI-MPLA22001-LAR3-140	OFF-PLOT AREA 16 PROJECT SACCR PHASE #4 DCS EQUIPMENT LAYOUT	CONSOLE
365	SKI-MPLA22001-LAR3-140-DEMO	SKI-MPLA22001-LAR3-140-DEMO	OFF-PLOT AREA 16 PROJECT SACCR PHASE #4 DCS EQUIPMENT LAYOUT	CONSOLE
366	SKI-MPLA22001-LAR3-141	SKI-MPLA22001-LAR3-141	OFF-PLOT AREA 16 PROJECT SACCR PHASE #5 DCS EQUIPMENT LAYOUT	CONSOLE
367	SKI-MPLA22001-LAR3-141-DEMO	SKI-MPLA22001-LAR3-141-DEMO	OFF-PLOT AREA 16 PROJECT SACCR PHASE #5 DCS EQUIPMENT LAYOUT	CONSOLE
368	SKI-MPLA22001-LAR3-143	SKI-MPLA22001-LAR3-143	OFF-PLOT AREA 16 PROJECT SACCR PHASE #6 DCS EQUIPMENT LAYOUT	CONSOLE
369	SKI-MPLA22001-LAR3-143-DEMO	SKI-MPLA22001-LAR3-143-DEMO	OFF-PLOT AREA 16 PROJECT SACCR PHASE #6 DCS EQUIPMENT LAYOUT	CONSOLE
370	SKI-MPLA22001-LAR3-144	SKI-MPLA22001-LAR3-144	OFF-PLOT AREA 16 PROJECT SACCR PHASE #7 DIM DCS EQUIPMENT LAYOUT	CONSOLE
371	SKI-MPLA22001-LAR3-146	SKI-MPLA22001-LAR3-146	OFF PLOT 14 B-1094 CRUDE ROW OP. SHELTER UPS ONE LINE DIAGRAM (4-108)	CONSOLE
372	SKI-MPLA22001-LAR3-146-DEMO	SKI-MPLA22001-LAR3-146-DEMO	OFF PLOT 14 B-1094 CRUDE ROW OP. SHELTER UPS ONE LINE DIAGRAM (4-108)	CONSOLE
373	SKI-MPLA22001-LAR3-148	SKI-MPLA22001-LAR3-148	ISOM LCR7 8100-UP-07 & 8100-IP-1 PANEL SCHEDULE	CONSOLE
397	056-D-619-B	B02J0425	STANDARD DRAWING INSTRUMENT DETAILS INSTALLATION ASSEMBLIES	STANDARD
398	056-D-619-D	B02J0432	STANDARD DRAWING FIELD INSTRUMENT LAYOUT WIRING AND INSTALLATION NOTES	STANDARD
399	056-D-619-A	B02J0433	STANDARD DRAWING INSTRUMENT DETAILS INSTALLATION ASSEMBLIES	STANDARD

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	137 of 146	

Item	#	File Name	Description	WBS
400	056-D-613-C	B02J0498	STANDARD DRAWING GROUNDING DRAWING INSTALLATION ASSEMBLIES	STANDARD
401	056-D-613-E	B02J0502	STANDARD DRAWING GROUNDING DRAWING INSTALLATION ASSEMBLIES	STANDARD
402	056-D-613-B	B02J0631	STANDARD DRAWING GROUNDING DRAWING INSTALLATION ASSEMBLIES	STANDARD
403	056-D-614-A	B02P0499	STANDARD DRAWING ABOVEGROUND CONDUIT ROUTING CONDUIT SUPPORTS	STANDARD
404	056-D-614-B	B02P0572	STANDARD DRAWING ABOVEGROUND POWER DETAILS CONDUIT SUPPORTS	STANDARD
405	056-D-614-E	B02P0851	STANDARD DRAWING ABOVEGROUND CONDUIT ROUTING CONDUIT SUPPORTS	STANDARD
406	RSD-60-38-005	RSD-60-38-005	ELECTRICAL GROUNDING FIREPROOFED/INSULATED STEEL COLUMN GROUND ASSEMBLY	STANDARD
407	RSD-60-38-006	RSD-60-38-006	ELECTRICAL GROUNDING STEEL COLUMN OR EQUIPMENT GROUND ASSEMBLY	STANDARD
408	RSD-60-38-007	RSD-60-38-007	ELECTRICAL GRONDING CONCTETE COLUMN RISER GROUND ASSEMBLY	STANDARD
409	RSD-60-38-009	RSD-60-38-009	ELECTRICAL GROUNDING GROUND BUS CONCRETE MOUNT	STANDARD
410	RSD-60-38-010	RSD-60-38-010	ELECTRICAL GROUNDING GROUND BUS STEEL COLUMN MOUNTING ASSEMBLY	STANDARD
411	RSD-60-38-024	RSD-60-38-024	ELECTRICAL GROUNDING MISCELLANEOUS EQUIPMENT, PANEL OR ENCLOSURE	STANDARD
412	RSD-60-38-025	RSD-60-38-025	ELECTRICAL GROUNDING POWER TRANSFORMER SWITCH GEAR AND MCC	STANDARD
413	RSD-60-38-030	RSD-60-38-030	ELECTRICAL GROUNDING CONDUIT STUP-UP/TERMINATION BONDING JUMPER	STANDARD
414	RSD-60-38-111	RSD-60-38-111	ELECTRICAL - PANELBOARDS COLUMN MOUNT TRANSFORMER/PANELBOARD CASS 1, DIVISION 2, RGS CONDUIT	STANDARD
415	RSD-60-38-113	RSD-60-38-113	ELECTRICAL - MISCELLANEOUS SUPPORTS COLUMN MOUNT TRANSFORMER	STANDARD
416	RSD-70-07-05	RSD-70-07-05	INSTRUMENT - LEVEL GUIDED WAVE RADAR - CHAMBER	STANDARD
417	SKI-MPLA22001-LAR3-063	SKI-MPLA22001-LAR3-063	1 REFORMER, NAPHTH HDS, FCC PROJECT TYPICAL JUNCTION BOX INSTALLATION DETAIL	STANDARD
418	SKI-MPLA22001-LAR3-065	SKI-MPLA22001-LAR3-065	1 REFORMER, NAPHTH HDS, FCC PROJECT TYPICAL LIGHT OFF PANEL INSTALLATION DETAIL	STANDARD
419	SKI-MPLA22001-LAR3-066	SKI-MPLA22001-LAR3-066	1 REFORMER, NAPHTH HDS, FCC PROJECT TYPICAL RELAY PANEL INSTALLATION DETAIL	STANDARD
420	SKI-MPLA22001-LAR3-082	SKI-MPLA22001-LAR3-082	1 REFORMER, NAPHTH HDS, FCC PROJECT TYPICAL ASCO PANEL INSTALLATION DETAIL	STANDARD
421	SKI-MPLA22001-LAR3-090	SKI-MPLA22001-LAR3-090	1 REFORMER, NAPHTH HDS, FCC PROJECT TYPICAL LOCAL CONTROL PANEL EQUIPMENT LAYOUT	STANDARD
422	ALKY-N-E-009 Narrative	ALKY-N-E-009 Narrative	Carson Electrical Exploratory	ALKY-N-E-009

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	138 of 146	

Item	#	File Name	Description	WBS
423	SKI-MPLA22001-LAR3-001	SKI-MPLA22001-LAR3-001	CABLE TRAY AUDIT	ALKY-N-E-009
424	261-D-633-A	D61P0033	HGU#2 ELECTRICAL UNDERGROUND CONDUIT PLAN	SUB9-N-EX-003A
425	261-D-633-B	D61P0034	HGU#2 ELECTRICAL UNDERGROUND CONDUIT PLAN	SUB9-N-EX-003A
426	261-D-633-C	D61P0035	HGU-2 UNDERGROUND CONDUIT DETAILS	SUB9-N-EX-003A
427	261-D-633-D	D61P0036	HGU#2 ELECTRICAL UNDERGROUND CONDUIT SECTIONS	SUB9-N-EX-003A
428	261-D-608-B	D61P0219	HGU-2 CONDUIT SCHEDULE	SUB9-N-EX-003A
429	839-D-633-B	D83P4506	SUBSTATION #9 UNDERGROUND CONDUIT SECTIONS GROUNDING, POWER & INSTRUMENT SYSTEMS	SUB9-N-EX-003A
430	SKI-MPLA22001-LAR3-125	SKI-MPLA22001-LAR3-125	HGU-2 UNDERGROUND CONDUIT STUB-UP LOCATIONS	SUB9-N-EX-003A
431	SUB9-N-EX-003A Narrative	SUB9-N-EX-003A Narrative	AMP LAR3 Wilmington HGU2 Non-TAR Exploratory	SUB9-N-EX-003A
432	FFHDS-N-E-019 Narrative	FFHDS-N-E-019 Narrative	AMP LAR3 Carson Fiber Exploratory	FFHDS-N-E-019
433	SKF-MPLA22001-LAR3-012	SKF-MPLA22001-LAR3-012	C5-C6 ISOM HDS ELEC AREA PLOT PLAN #4 POWER AND LIGHTING	FFHDS-N-E-019
434	MPLA22001-61-509	MPLA22001-61-509	PIPING LINE SCHEDULE UNIT: #1 REFORMER/DESULF.	1 REF - PIP
435	MPLA22001-61-510	MPLA22001-61-510	TIE-IN LIST (#1 REFORMER/DESULF.)	1 REF - PIP
436	MPLA22001-64-509	MPLA22001-64-509	TIE-IN LOCATION FORM	1 REF - PIP
437	MPLA22001-64-510	MPLA22001-64-510	TIE-IN LOCATION FORM	1 REF - PIP
438	MPLA22001-64-511	MPLA22001-64-511	TIE-IN LOCATION FORM	1 REF - PIP
439	MPLA22001-64-512	MPLA22001-64-512	TIE-IN LOCATION FORM	1 REF - PIP
440	MPLA22001-64-513	MPLA22001-64-513	TIE-IN LOCATION FORM	1 REF - PIP
441	MPLA22001-64-514	MPLA22001-64-514	TIE-IN LOCATION FORM	1 REF - PIP
442	MPLA22001-64-515	MPLA22001-64-515	TIE-IN LOCATION FORM	1 REF - PIP
443	MPLA22001-64-516	MPLA22001-64-516	TIE-IN LOCATION FORM	1 REF - PIP
444	MPLA22001-64-517	MPLA22001-64-517	TIE-IN LOCATION FORM	1 REF - PIP
445	MPLA22001-64-518	MPLA22001-64-518	TIE-IN LOCATION FORM	1 REF - PIP
446	MPLA22001-64-519	MPLA22001-64-519	TIE-IN LOCATION FORM	1 REF - PIP
447	MPLA22001-64-520	MPLA22001-64-520	TIE-IN LOCATION FORM	1 REF - PIP
448	MPLA22001-64-521	MPLA22001-64-521	TIE-IN LOCATION FORM	1 REF - PIP
449	MPLA22001-64-522	MPLA22001-64-522	TIE-IN LOCATION FORM	1 REF - PIP
450	MPLA22001-64-523	MPLA22001-64-523	TIE-IN LOCATION FORM	1 REF - PIP

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	139 of 146	

Item	#	File Name	Description	WBS
451	MPLA22001-64-524	MPLA22001-64-524	TIE-IN LOCATION FORM	1 REF - PIP
452	MPLA22001-64-525	MPLA22001-64-525	TIE-IN LOCATION FORM	1 REF - PIP
453	MPLA22001-64-526	MPLA22001-64-526	TIE-IN LOCATION FORM	1 REF - PIP
454	SKP-MPLA22001-LAR3-018	SKP-MPLA22001-LAR3-018	1 REFORM. & DESULF. MPLA22001 LAR#3 HEATER UPGRADE RW-0025/26 TIE-IN LOCATION PLAN	1 REF - PIP
455	SKP-MPLA22001-LAR3-019	SKP-MPLA22001-LAR3-019	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 REFORMER PV-437 FUEL GAS	1 REF - PIP
456	SKP-MPLA22001-LAR3-020	SKP-MPLA22001-LAR3-020	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 REFORMER PV-439 FUEL GAS	1 REF - PIP
457	SKP-MPLA22001-LAR3-021	SKP-MPLA22001-LAR3-021	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 REFORMER PV-438 FUEL GAS	1 REF - PIP
458	SKP-MPLA22001-LAR3-022	SKP-MPLA22001-LAR3-022	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 REFORMER PV-440 FUEL GAS	1 REF - PIP
459	SKP-MPLA22001-LAR3-023	SKP-MPLA22001-LAR3-023	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 REFORMER #1 REFORMER FUEL GAS STATOIN PIPING	1 REF - PIP
460	SKP-MPLA22001-LAR3-024	SKP-MPLA22001-LAR3-024	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 REFORMER #1 REFORMER PILOT GAS STATION PIPING	1 REF - PIP
461	SKP-MPLA22001-LAR3-025	SKP-MPLA22001-LAR3-025	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 REFORMER FT-184 BOILER FEED WATER	1 REF - PIP
462	SKP-MPLA22001-LAR3-026	SKP-MPLA22001-LAR3-026	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 REFORMER FT-183 BOILER FEED WATER	1 REF - PIP
463	SKP-MPLA22001-LAR3-027	SKP-MPLA22001-LAR3-027	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 REFORMER FT-130 150# STEAM	1 REF - PIP
464	SKP-MPLA22001-LAR3-028	SKP-MPLA22001-LAR3-028	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 REFORMER HV-010A/B RECYCLE GAS	1 REF - PIP
465	SKP-MPLA22001-LAR3-029	SKP-MPLA22001-LAR3-029	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 DESULFURIZER RW-0026 PILOT GAS STATION PIPING INSTALL	1 REF - PIP
466	SKP-MPLA22001-LAR3-030	SKP-MPLA22001-LAR3-030	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 DESULFURIZER RW-0026 FUEL GAS STATION PIPING INSTALL	1 REF - PIP
467	SKP-MPLA22001-LAR3-031	SKP-MPLA22001-LAR3-031	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 DESULFURIZER FT-110 TAP ADDITIONS	1 REF - PIP
468	SKP-MPLA22001-LAR3-032	SKP-MPLA22001-LAR3-032	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 DESULFURIZER FT-105 PIPING INSTALLATION	1 REF - PIP

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	140 of 146	

Item	#	File Name	Description	WBS
469	SKP-MPLA22001-LAR3-033	SKP-MPLA22001-LAR3-033	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 DESULFURIZER FT-150 TAP ADDITIONS	1 REF - PIP
470	SKP-MPLA22001-LAR3-034	SKP-MPLA22001-LAR3-034	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 DESULFURIZER PV-441 FUEL GAS	1 REF - PIP
471	SKP-MPLA22001-LAR3-035	SKP-MPLA22001-LAR3-035	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 DESULFURIZER HV-011A/B PIPING INSTALL	1 REF - PIP
472	SKP-MPLA22001-LAR3-036	SKP-MPLA22001-LAR3-036	MPLA22001-2025/26 TAR HEATER UPGRADE LAR CARSON #1 DESULFURIZER FT-#108 SPILLBACK LINE INSTALL	1 REF - PIP
473	SKP-MPLA22001-LAR3-054	SKP-MPLA22001-LAR3-054	FT-176 SPILLBACK LINE INSTALL SKETCH	1 REF - PIP
474	MPLA22001-61-501	MPLA22001-61-501	PIPING LINE SCHEDULE UNIT: FCC (RW-0023)	FCC - PIP
475	MPLA22001-61-502	MPLA22001-61-502	TIE-IN LIST (FCC RW-0023)	FCC - PIP
476	MPLA22001-64-501	MPLA22001-64-501	TIE-IN LOCATION FORM	FCC - PIP
477	MPLA22001-64-502	MPLA22001-64-502	TIE-IN LOCATION FORM	FCC - PIP
478	MPLA22001-64-503	MPLA22001-64-503	TIE-IN LOCATION FORM	FCC - PIP
479	SKP-MPLA22001-LAR3-006	SKP-MPLA22001-LAR3-006	FCC FRAC MPLA22001 LAR#3 HEATER UPGRADE RW-0023 TIE-IN LOCATION PLAN	FCC - PIP
480	SKP-MPLA22001-LAR3-007	SKP-MPLA22001-LAR3-007	MPLA22001-2023/24 TAR HEATER UPGRADE LAR CARSON FCC FRAC RW-0023 FUEL GAS CHOP. INSTALL.	FCC - PIP
481	SKP-MPLA22001-LAR3-008	SKP-MPLA22001-LAR3-008	MPLA22001-2023/24 TAR HEATER UPGRADE LAR CARSON FCC FRAC RW-0023 PILOT GAS CHOP. INSTALL.	FCC - PIP
482	MPLA22001-61-507	MPLA22001-61-507	PIPING LINE SCHEDULE UNIT: FFHDS (RW-0048)	FFHDS - PIP
483	MPLA22001-61-508	MPLA22001-61-508	TIE-IN LIST (FFHDS RW-0048)	FFHDS - PIP
484	MPLA22001-64-507	MPLA22001-64-507	TIE-IN LOCATION FORM	FFHDS - PIP
485	MPLA22001-64-508	MPLA22001-64-508	TIE-IN LOCATION FORM	FFHDS - PIP
486	SKP-MPLA22001-LAR3-014	SKP-MPLA22001-LAR3-014	FLUID FEED HDS MPLA22001 LAR#3 HEATER UPGRADE RW-0048 TIE-IN LOCATION PLAN	FFHDS - PIP
487	SKP-MPLA22001-LAR3-015	SKP-MPLA22001-LAR3-015	MPLA22001-2023/24 TAR HEATER UPGRADE LAR CARSON #1 FFHDS RW-0048 FUEL GAS CHOP. INSTALL	FFHDS - PIP
488	SKP-MPLA22001-LAR3-016	SKP-MPLA22001-LAR3-016	MPLA22001-2023/24 TAR HEATER UPGRADE LAR CARSON #1 FFHDS RW-0048 PILOT GAS CHOP. INSTALL	FFHDS - PIP
489	SKP-MPLA22001-LAR3-017	SKP-MPLA22001-LAR3-017	MPLA22001-2023/24 TAR HEATER UPGRADE LAR CARSON #1 FFHDS RW-0048 TAP INSTALL	FFHDS - PIP
490	MPLA22001-61-505	MPLA22001-61-505	PIPING LINE SCHEDULE UNIT: LHU (RW-0028)	LHU - PIP

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	141 of 146	

Item	#	File Name	Description	WBS
491	MPLA22001-61-506	MPLA22001-61-506	TIE-IN LIST (LHU RW-0028)	LHU - PIP
492	MPLA22001-64-506	MPLA22001-64-506	TIE-IN LOCATION FORM	LHU - PIP
493	MPLA22001-64-505	MPLA22001-64-505	TIE-IN LOCATION FORM	LHU - PIP
494	SKP-MPLA22001-LAR3-011	SKP-MPLA22001-LAR3-011	LHU MPLA22001 LAR#3 HEATER UPGRADE RW-0028 TIE-IN LOCATION PLAN	LHU - PIP
495	SKP-MPLA22001-LAR3-012	SKP-MPLA22001-LAR3-012	MPLA22001-2023/24 TAR HEATER UPGRADE LAR CARSON #1 REFORMER LIGHT HYDRO RW-0028 FUEL GAS CHOP. INSTALL.	LHU - PIP
496	SKP-MPLA22001-LAR3-013	SKP-MPLA22001-LAR3-013	MPLA22001-2023/24 TAR HEATER UPGRADE LAR CARSON #1 REFORMER LIGHT HYDRO RW-0028 PILOT GAS CHOP. INSTALL.	LHU - PIP
497	MPLA22001-61-503	MPLA22001-61-503	PIPING LINE SCHEDULE UNIT: NHDS (RW-0053)	NHDS - PIP
498	MPLA22001-61-504	MPLA22001-61-504	TIE-IN LIST (NAPTHA HDS RW-0053)	NHDS - PIP
499	MPLA22001-64-504	MPLA22001-64-504	TIE-IN LOCATION FORM	NHDS - PIP
500	SKP-MPLA22001-LAR3-009	SKP-MPLA22001-LAR3-009	NAPTHA HDS MPLA22001 LAR#3 HEATER UPGRADE RW-0053 TIE-IN LOCATION PLAN	NHDS - PIP
501	SKP-MPLA22001-LAR3-010	SKP-MPLA22001-LAR3-010	MPLA22001-2023/24 TAR HEATER UPGRADE LAR CARSON NAPTHA HDS UNIT RW-0053 FUEL GAS CHOP. INSTALL	NHDS - PIP
502	MPLA22001-61-511	MPLA22001-61-511	PIPING LINE SCHEDULE UNIT: HCU	HCU - PIP
503	MPLA22001-61-512	MPLA22001-61-512	TIE-IN LIST (HCU)	HCU - PIP
504	MPLA22001-64-527	MPLA22001-64-527	TIE-IN LOCATION FORM	HCU - PIP
505	MPLA22001-64-528	MPLA22001-64-528	TIE-IN LOCATION FORM	HCU - PIP
506	MPLA22001-64-529	MPLA22001-64-529	TIE-IN LOCATION FORM	HCU - PIP
507	MPLA22001-64-530	MPLA22001-64-530	TIE-IN LOCATION FORM	HCU - PIP
508	MPLA22001-64-531	MPLA22001-64-531	TIE-IN LOCATION FORM	HCU - PIP
509	MPLA22001-64-532	MPLA22001-64-532	TIE-IN LOCATION FORM	HCU - PIP
510	MPLA22001-64-533	MPLA22001-64-533	TIE-IN LOCATION FORM	HCU - PIP
511	MPLA22001-64-534	MPLA22001-64-534	TIE-IN LOCATION FORM	HCU - PIP
512	MPLA22001-64-535	MPLA22001-64-535	TIE-IN LOCATION FORM	HCU - PIP
513	MPLA22001-64-536	MPLA22001-64-536	TIE-IN LOCATION FORM	HCU - PIP
514	MPLA22001-64-537	MPLA22001-64-537	TIE-IN LOCATION FORM	HCU - PIP
515	MPLA22001-64-538	MPLA22001-64-538	TIE-IN LOCATION FORM	HCU - PIP
516	SKP-MPLA22001-LAR3-037	SKP-MPLA22001-LAR3-037	HCU MPLA22001 LAR#3 HEATER UPGRADE H-300/301/302/303 TIE-IN LOCATION PLAN	HCU - PIP
517	SKP-MPLA22001-LAR3-038	SKP-MPLA22001-LAR3-038	HCU MPLA22001 LAR#3 HEATER UPGRADE H-304 TIE-IN LOCATION PLAN	HCU - PIP

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	142 of 146	

Item	#	File Name	Description	WBS
518	SKP-MPLA22001-LAR3-039	SKP-MPLA22001-LAR3-039	MPLA22001-2025/26 TAR HEATER UPGRADE LAR WILMINGTON HCU H-300 FUEL GAS STATION CHOP. INSTALL	HCU - PIP
519	SKP-MPLA22001-LAR3-040	SKP-MPLA22001-LAR3-040	MPLA22001-2025/26 TAR HEATER UPGRADE LAR WILMINGTON HCU H-301 FUEL GAS STATION CHOP. INSTALL	HCU - PIP
520	SKP-MPLA22001-LAR3-041	SKP-MPLA22001-LAR3-041	MPLA22001-2025/26 TAR HEATER UPGRADE LAR WILMINGTON HCU H-302 FUEL GAS STATION CHOP. INSTALL	HCU - PIP
521	SKP-MPLA22001-LAR3-042	SKP-MPLA22001-LAR3-042	MPLA22001-2025/26 TAR HEATER UPGRADE LAR WILMINGTON HCU H-303 FUEL GAS STATION CHOP. INSTALL	HCU - PIP
522	SKP-MPLA22001-LAR3-043	SKP-MPLA22001-LAR3-043	MPLA22001-2025/26 TAR HEATER UPGRADE LAR WILMINGTON HCU H-304 FUEL GAS STATION CHOP. INSTALL	HCU - PIP
523	SKP-MPLA22001-LAR3-044	SKP-MPLA22001-LAR3-044	MPLA22001-2025/26 TAR HEATER UPGRADE LAR WILMINGTON HCU H-304 FUEL GAS SPOOL INSTALL	HCU - PIP
524	SKP-MPLA22001-LAR3-045	SKP-MPLA22001-LAR3-045	MPLA22001-2025/26 TAR HEATER UPGRADE LAR WILMINGTON HCU H-300/301 PILOT GAS STATION INSTALL	HCU - PIP
525	SKP-MPLA22001-LAR3-046	SKP-MPLA22001-LAR3-046	MPLA22001-2025/26 TAR HEATER UPGRADE LAR WILMINGTON HCU H-303/302 PILOT GAS STATION INSTALL	HCU - PIP
526	SKP-MPLA22001-LAR3-047	SKP-MPLA22001-LAR3-047	MPLA22001-2025/26 TAR HEATER UPGRADE LAR WILMINGTON HCU H-304 PILOT GAS STATION INSTALL	HCU - PIP
527	MPLA22001-61-513	MPLA22001-61-513	PIPING LINE SCHEDULE UNIT: HGU-2	HGU - PIP
528	MPLA22001-61-514	MPLA22001-61-514	TIE-IN LIST (HGU-2)	HGU - PIP
529	MPLA22001-64-539	MPLA22001-64-539	TIE-IN LOCATION FORM	HGU - PIP
530	MPLA22001-64-540	MPLA22001-64-540	TIE-IN LOCATION FORM	HGU - PIP
531	MPLA22001-64-541	MPLA22001-64-541	TIE-IN LOCATION FORM	HGU - PIP
532	MPLA22001-64-542	MPLA22001-64-542	TIE-IN LOCATION FORM	HGU - PIP
533	MPLA22001-64-543	MPLA22001-64-543	TIE-IN LOCATION FORM	HGU - PIP
534	MPLA22001-64-544	MPLA22001-64-544	TIE-IN LOCATION FORM	HGU - PIP
535	MPLA22001-64-545	MPLA22001-64-545	TIE-IN LOCATION FORM	HGU - PIP
536	MPLA22001-64-546	MPLA22001-64-546	TIE-IN LOCATION FORM	HGU - PIP
537	MPLA22001-64-547	MPLA22001-64-547	TIE-IN LOCATION FORM	HGU - PIP
538	MPLA22001-64-548	MPLA22001-64-548	TIE-IN LOCATION FORM	HGU - PIP
539	MPLA22001-64-549	MPLA22001-64-549	TIE-IN LOCATION FORM	HGU - PIP
540	SKP-MPLA22001-LAR3-048	SKP-MPLA22001-LAR3-048	H-42 AND H-43 TIE-IN LOCATION PLAN	HGU - PIP

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	143 of 146	

Item	#	File Name	Description	WBS
541	SKP-MPLA22001-LAR3-049	SKP-MPLA22001-LAR3-049	H-42 PURGE GAS LINE BYPASS INSTALL	HGU - PIP
542	SKP-MPLA22001-LAR3-050	SKP-MPLA22001-LAR3-050	H-42 FUEL GAS CHOPPER INSTALL	HGU - PIP
543	SKP-MPLA22001-LAR3-051	SKP-MPLA22001-LAR3-051	H-42 PILOT GAS CHOPPER STATION INSTALL	HGU - PIP
544	SKP-MPLA22001-LAR3-052	SKP-MPLA22001-LAR3-052	FT-#198A INSTALL	HGU - PIP
545	SKP-MPLA22001-LAR3-053	SKP-MPLA22001-LAR3-053	H-43 FUEL GAS CHOPPER STATION INSTALL	HGU - PIP
546	SKP-MPLA22001-LAR3-054	SKP-MPLA22001-LAR3-054	V-2191 TRANSMITTER INSTALL PIPING SKETCH	HGU - PIP
547	SKP-MPLA22001-LAR3-055	SKP-MPLA22001-LAR3-055	V-1780 TRANSMITTER INSTALL PIPING SKETCH	HGU - PIP
548	AMP-LAR3-RTE-RPT-0004	AMP-LAR3-RTE-RPT-0004	AMP LAR #3 2025/2026 TAR RTE Gap Report	REPORT
549	AMP-LAR3-SIS-RPT-0001	AMP-LAR3-SIS-RPT-0001	AMP LAR#3 Heater Gap Assessment	REPORT
550	MPLA22001-40-201	MPLA22001-40-201	LCR-7 UPS SIZING CALCULATION	REPORT
551	MPLA22001-40-202	MPLA22001-40-202	DCP UPS for Light off Panel	REPORT
552	MPLA22001-61-100	MPLA22001-61-100	BPCS ALKY Hiway Migration IO Summary Report	REPORT

6.2 LAR Site Standards

374	0132-10052953	10052953	GENERAL LAR ENGINEERING STAND ELECTRICAL INSTRUMENT STANDARD ASSEMBLIES	STANDARD
-----	---------------	----------	---	----------

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	144 of 146	

375	0132-10052954	10052954	GENERAL LAR ENGINEERING STAND ELECTRICAL INSTRUMENT STANDARD ASSEMBLIES	STANDARD
376	0132-10052955	10052955	GENERAL LAR ENGINEERING STAND ELECTRICAL INSTRUMENT STANDARD ASSEMBLIES	STANDARD
377	0132-10052962	10052962	GENERAL LAR ENGINEERING STANDARD INSTRUMENT TERMINAL BOX STANDARD ASSEMBLIES (2-3)	STANDARD
378	A02W0028	A02W0028	INSTRUMENT INSTALLATION DETAIL FLOW TRANSMITTER LIQUID SERVICE	STANDARD
379	A02W0031	A02W0031	INSTRUMENT INSTALLATION DETAIL FLOW TRANSMITTER STEAM SERVICE	STANDARD
380	A02W0038	A02W0038	INSTRUMENT INSTALLATION DETAIL PRESSURE TRANSMITTER STEAM SERVICE	STANDARD
381	A02W0039	A02W0039	INSTRUMENT INSTALLATION DETAIL PRESSURE TRANSMITTER VAPOR SERVICE	STANDARD
382	A02W0054	A02W0054	INSTRUMENT INSTALLATION DETAIL PRESSURE GAUGE CLOSE COUPLED	STANDARD
383	A02W0062	A02W0062	INSTRUMENT INSTALLATION DETAIL HEATAER DRAFT TRANSMITTER	STANDARD
384	A02W0105	A02W0105	INSTRUMENT INSTALLATION DETAIL INSTRUMENT AIR SUPPLY SOLENOID VALVE	STANDARD
385	A02W0115	A02W0115	INSTRUMENT INSTALLATION DETAIL ON/OFF CONTROL VALVE W/3-WAY OPEN/CLOSE SOLENOID VALVE	STANDARD
386	A02W0123	A02W0123	INSTRUMENT INSTALLATION DETAIL INSTRUMENT AIR SUPPLY AIR SUB-HEADER PIPING	STANDARD
387	A02W0128	A02W0128	INSTRUMENT INSTALLATION DETAIL SINGLE INSTRUMENT SUPPORT MOUNTED AT GRADE	STANDARD
388	A02W0129	A02W0129	INSTRUMENT INSTALLATION DETAIL DUAL INSTRUMENT SUPPORT MOUNTED AT GRADE	STANDARD
389	A02W0130	A02W0130	INSTRUMENT INSTALLATION DETAIL TRIPLE INSTRUMENT SUPPORT MOUNTED AT GRADE	STANDARD
390	A02W0131	A02W0131	INSTRUMENT INSTALATION DETAIL SINGLE PLATFORM MOUNTED PEDESTAL ON PLATE OR GRATING	STANDARD
391	A02W0132	A02W0132	INSTRUMENT INSTALLATION DETAIL DUAL PLATFORM MOUNTED PEDESTAL ON PLATE OR GRATING	STANDARD
392	A02W0133	A02W0133	INSTRUMENT INSTALLATION DETAIL TRIPLE PLATFORM MOUNTED PEDESTAL ON PLATE OR GRATING	STANDARD
393	A02W0135	A02W0135	INSTRUMENT INSTALLATION DETAIL DUAL MOUNTED PEDESTAL OUTSIDE PLATFORM	STANDARD
394	A02W0157	A02W0157	INSTRUMENT INSTALLATION DETAIL AIR TUBING SUPPORT DETAILS	STANDARD
395	A02W0219	A02W0219	INSTRUMENT INSTALLATION DETAIL PRESSURE TRANSMITTER VAPOR SERVICE - BELOW TAP	STANDARD

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	145 of 146	

396	056-D-619-C	B02J0424	STANDARD DRAWING INSTRUMENT DETAILS INSTALLATION ASSEMBLIES	STANDARD
-----	-------------	----------	---	----------

	Title	LAR3 AMP Basis of Design - Definition			Rev.	E	
	No.	LAR3-PM-BOD-0001			Date	20 APR 2023	
	Type	Basis of Design	Owner	Paton	Page	146 of 146	

7. Revision History

Rev. No.	Description of Change	Author	Approved By	Rev. Date
A	Outline – Issue for Review	C. Leach		02/01/2021
B	Draft Issue For Review	C. Leach		05/03/2022
C	Issue For Review	C. Leach		6/13/2022
D	Issue for Approval	Paton		03/14/2023
E	Issued for Design	Paton		4/20/2022