Supplier Document Cover Sheet

GPA ENGINEERING	**Supplier PO/Contract No:**	4100297015
	Supplier Item Description:	Engineering Services
	Equipment/Tag No:	N/A

Project Name:	**Project Marlin: EGP Reversal**			
Supplier Document Title:	HAZOP Report			
Supplier Document No:	20617-REP-020	**Supplier Rev No:**	0	
		Jemena Rev No:	***To be completed by Jemena Document Controller***	
Jemena Document No:	GAS-599-RP-HZ-003	**Total No of Pages (**incl cover page)		125

DOCUMENT REVIEW Jemena

1 ☑	**ISSUED WITH NO COMMENTS** Work may proceed
2 ☐	**ISSUED WITH MINOR COMMENTS** Work may proceed Revise as noted and resubmit
3 ☐	**ISSUED WITH COMMENTS** Work may NOT proceed Revise as noted and resubmit
4 ☐	**INFORMATION ONLY**

Document Revision History:

Rev	Issue Date	Key Reason for Issue (as above table)	Approved By/ Signature	Company Name	Notes (if not applicable N/A)
0	3/12/20	IFU	AS	GPA Engineering	N/A

Key Reason for Issue:

IFR- Issued for Review	**IFI**- Issued for Information	**IFU**- Issued for Use
IFP- Issued for Purchase	**IFC**- Issued for Construction	**AB**- As Built

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HAZOP Report

Project Marlin: EGP Reversal

Jemena Ltd

GPA Document No: 20617-REP-020
Client Document No: GAS-599-RP-HZ-003

GPA Project No: 20617
Client Project No: GAS-599

Rev	Date	By	Checked	QA	Description
0	3/12/2020	LH	SJH	AS	Issued for use

GPA Engineering Pty Ltd. ABN 71 576 133 774
Printed: 03-Dec-2020

Consult
Engineer
Deliver
Ideas
Realised

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1 INTRODUCTION

Jemena is undertaking front end engineering and design, to facilitate a total installed cost (TIC) estimate and schedule to reverse flow the Eastern Gas Pipeline (EGP) south of the Kembla Grange Meter Station (KGMS), to allow the supply of gas into the Victorian and New South Wales gas markets from a new LNG import terminal to be based at Port Kembla.

There is expected to be a total of up to 500 MMSCFD of gas being injected into the EGP from the Floating Storage and Regasification Unit (FSRU) in Port Kembla to be transported to the Victorian and New South Wales gas pipeline networks. Jemena has completed a pipeline modelling report "Project Marlin Pre-FEED Report" which outlines the required flow rates and capacities of the various EGP Facilities to achieve the requirements of Project Marlin.

The EGP, shown in Figure 1, was commissioned in 2000 to supply natural gas from Victoria to the Sydney region. The EGP is a DN450 pipeline with an MAOP of 14,895 kPag.

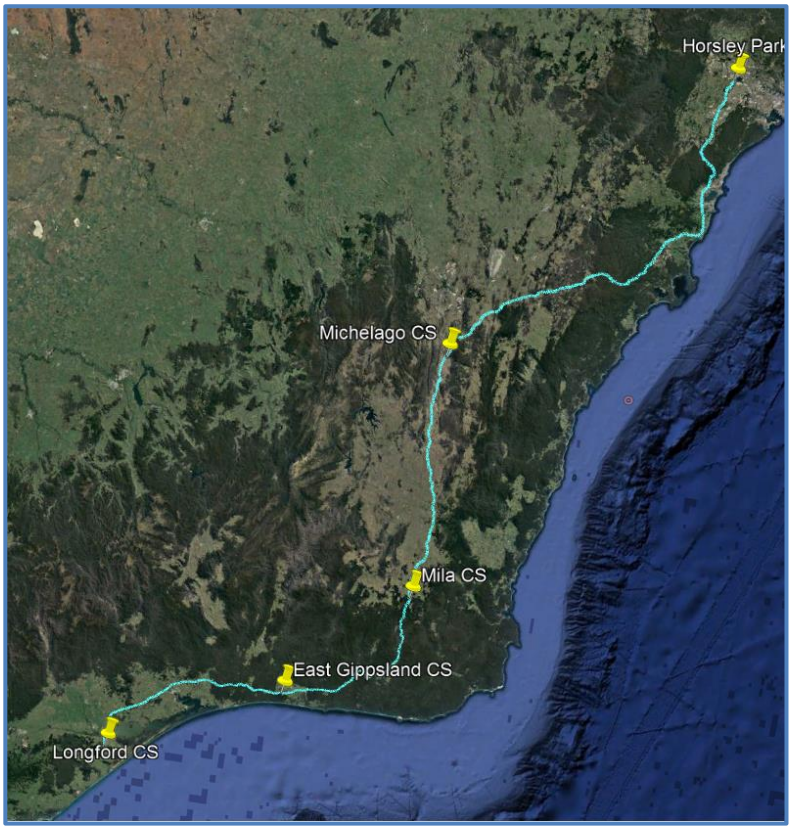


Figure 1: Eastern Gas Pipeline

This project requires new plant, equipment and modifications to existing Jemena facilities along the EGP. The new plant and facility alterations will allow the injection of gas from the Port Kembla LNG import terminal into the EGP upstream of the Kembla Grange Main Line Valve (MLV). The modifications under this project will also allow for the reverse flow of gas south into the Victorian and New South Wales gas pipeline networks and increase northern flow via increased capacity at the Wilton Meter Station (WMS).

The facilities required to be modified include:

- Kembla Grange Main Line Valve (MLV) Station,
- Mila Compressor Station (MCS),
- Michelago Compressor Station (MOCS),
- Vic Hub Interconnect (located within the Longford Compressor Station, LCS); and,
- Wilton Meter Station (WMS).

A new facility, the Kembla Grange Meter Station (KGMS), will be constructed to supply the gas imported from Port Kembla into the EGP.

This HAZOP Report forms part of GPA Engineering's Safety in Design process.

The following report summarises the findings of a Hazard and Operability Study, HAZOP, held on Microsoft Teams on the following dates: 5th, 16th – 18th November 2020. The HAZOP dealt specifically with design facilitating the EGP flow reversal.

2 SCOPE OF STUDY

Specifically, the scope of the HAZOP includes the following:

2.1 KEMBLA GRANGE METER STATION (KGMS)

A new meter station will be installed adjacent to the Kembla Grange MLV to meter gas entering the EGP from the Port Kembla LNG import terminal via the Port Kembla Lateral Looping Pipeline. The meter station project scope includes:

- Pig Receiver on the Port Kembla Lateral Looping Pipeline,
- Metering skid and associated control systems,
- Gas Quality Measurement Equipment,
- Hot tap tie in into the EGP north of Kembla Grange MLV.

2.2 KEMBLA GRANGE MAIN LINE VALVE STATION (MLV)

A piping connection off the south side of the Kembla Grange MLV will be installed including a pressure control valve that is used to bypass the MLV when operating at reduced pressures in the EGP north of the MLV.

The control valve will be used to ensure that pressure in the Port Kembla Lateral Looping Pipeline remains below approximately 9 MPa, which is required to maximise delivery volumes from the LNG terminal. The Longford gas bypassing the MLV will be blended with the imported gas downstream of the new KGMS.

The piping connection for the PCV will be from the existing pipeline cold vent. Valving will be provided to allow this to be used to blowdown the Port Kembla Lateral Looping Pipeline, EGP main line north or EGP mainline south sections.

2.3 MICHELAGO COMPRESSOR STATION (MOCS)

The Michelago Compressor Station will be modified to enable compression of reverse flow in the EGP.

Flow switching pipework and actuated valves of the same size and specification as the existing compressor station will connect into the suction and discharge headers of the compressor to enable reverse flow with compression.

The non-return valve (400-CV-64018) in the above ground pipework will be removed to enable the compressor to be bypassed in reverse flow operation of the EGP. The Station Control System will be modified to include a start/load permissive for the compressor package to prevent starting/loading until the valves are in the correct positions.

2.4 MILA COMPRESSOR STATION (MCS)

Mila Compressor Station will be modified to enable compression of reverse flow in the EGP.

Flow switching pipework and actuated valves of the same size and specification as the existing

compressor station will connect into the suction and discharge headers of the compressor to enable reverse flow with compression.

The non-return valve (400-CV-64018) between the compressor offtakes will be replaced by a new actuated switching valve to enable the compressor to be bypassed in reverse flow operation of the EGP. The Station Control System will be modified to include a start/load permissive for the compressor package to prevent starting/loading until the valves are in the correct positions.

2.5 LONGFORD COMPRESSOR STATION (LCS)

The Longford Compressor Station will be modified to increase the capacity ofof gas able to be directed from the EGP into the VicHub Interconnect pipeline. This new interconnect facility at the Victorian Hub (within the LCS) will be known as Vic Hub 2 (VH2) and include:

- Single Dry Gas Filter with quick opening closure and manual bypass,
- Gas Chromatograph,
- Flow Metering Skid,
- A parallel connection to the existing Vic Hub Water Bath Heater,
- A new Water Bath Heater with bypass Temperature Control Valve (TCV); and,
- Dual Run Flow Control Skid with overpressure slam shut valves.

The offtakes to both Victorian Hubs will be actuated to enable remote operation and management of the interconnect facilities. The facility will be designed to allow gas to be compressed (via LCS) and delivered into the TGP at the same time as flow gas from the EGP to Vic Hub Interconnect.

2.6 WILTON METER STATION (WMS)

The Wilton Meter Station will be expanded to increase the gas supply to the Moomba Sydney Pipeline (MSP) from 150 TJ/d to 325 TJ/d by installation of a new parallel run with a capacity of 175 TJ/d including:

- A new water bath heater with bypass temperature control valve (TCV),
- Relocation of the existing JGN dual run ultrasonic metering skid with series prove pipework; and,
- Relocation of the existing dual run flow control skid with overpressure slam shut valves.

The capacity to the Jemena Gas Network (JGN) will be increased from 150TJ/d to 200 TJ/d by installation of the following equipment:

- A new dual run Ultrasonic metering skid with series prove pipework sized for 200 TJ/d: and,
- A new dual run flow control skid with overpressure slam shut valves sized for 200 TJ/d. The flow control valve runs will include be a single fail closed PCV c/w low noise trim.

Additional modifications required include:

- Installation of an additional parallel inlet dry gas filter,
- Parallel DN250 connection to the MSP; and,
- Parallel DN250 connection to the JGN including hot tap tie-in connection.

The study specifically excluded the following:

- The water bath heater vendor packages
- Any normal flow paths through existing equipment
- A detailed layout review

2.7 PREVIOUS HAZOP STUDIES

This represents the first formal HAZOP study for the EGP Reversal Project.

A design review was conducted on the 1st October 2020 refer to document GAS-599-MM-PM-001.

Operating experience from the EGP and existing stations was drawn upon in reviewing hazards associated with the EGP Reversal Project.

2.8 ASSUMPTIONS

The following was assumed or used as the basis in the HAZOP:

- That the P&IDs of the existing facilities are true and correct
- Operators are trained and competent.

2.9 INFORMATION REVIEWED

The key representation of the design that was reviewed was detailed in the documents listed in the Appendix 2.

2.10 REFERENCE DOCUMENTS

The following supplementary documents were issued for HAZOP and were available for reference during the study:

Table 1: Documents available as reference for HAZOP Study

Document	Revision	Document Description
GAS-599-DG-DN-001	B	PROJECT MARLIN: EGP REVERSAL DESIGN BASIS MANUAL - FACILITIES
GAS-559-RP-HZ-002	1	HAZOP Brief

3 METHODOLOGY

The study was carried out as a workshop and was attended by key operations, maintenance and engineering personnel.

The HAZOP was a detailed design level study dealing with the specific process, control and interface issues related to the EGP Reversal Project. The design was sufficiently mature to enable the HAZOP to take place.

The workshop focused on each aspect of the process individually and used a set of guidewords to prompt and promote discussion. The Guidewords and overall methodology was in accordance with the guidelines of Australian Standard AS IEC 61882 – HAZOP Studies. Guidewords used are attached in Appendix 3.

The key issues uncovered were recorded in the formal HAZOP minutes appearing in Appendix 1 of this report.

The workshop progressed in the following order:

- A general overview of the scope of the EGP Reversal Project was given. Boundaries for the study were established and interface points between existing and new systems clearly defined.
- The study then progressed to the detailed review of each process subsystem (node) as defined in Table 2 below. An overview of the function of each node was considered followed by a line-by-line review that utilised the standard guidewords.

The nodes analysed during the study are summarised below:

Table 2: Node Summary

Part 1

Node	Description
1	Description: Port Kembla metering and discharge to EGP Drawings: GAS-557-DW-PD-001, GAS-557-DW-PD-002, GAS-557-DW-PD-003 Plant and Equipment: Pig Receiver, meter station Line: G-11-C9D-400, G-10-C9D-400, G-01-CE15X-450, G-02-CE15X-400, G-005-C9D-400, G-006-C9D-300, G-09-C9D-400, G-08-C9D-300
2	Description: Piping connection to the Kembla Grange MLV from Longford side Drawings: 550-PI-001, GAS-557-DW-PD-003 Plant and Equipment: pressure control valve Line: NG-02-C9D-200, G-06-C9D-150
3	Description: Blowdown for the Port Kembla Lateral Looping Pipeline via the existing cold vent at the Kembla Grange MLV site. Drawings: 550-PI-001, GAS-557-DW-PD-003 Plant and Equipment: Line: G-06-C9D-150
4	Description: Instrument gas supply Drawings: 550-PI-001

Node	Description
	Plant and Equipment: Line:
5	Description: Overview

Part 2

Node	Description
6	Description: Michelago reverse flow: EGP to compressor suction Drawings: GAS-530-DW-PD-020, GAS-530-DW-PD-018, 530-DW-PD-001 Plant and Equipment: Line: G-020-CE15X-400, G-905-C9D-400, G-64907-C9D-400
7	Description: Michelago reverse flow: compressor discharge to EGP Drawings: 530-DW-PD-001, GAS-530-DW-PD-018, GAS-530-DW-PD-020 Plant and Equipment: Line: G-64906-C9D-400, G-906-C9D-400, G-903-C9D-400, G-901-C9D-400, G-001-CE15X-400, NG-01-XX-450
8	Description: Michelago reverse Flow with no compression Drawings: GAS-530-DW-PD-018 Plant and Equipment: Line: G-029-CE15X-400
9	Description: Michelago forward flow: EGP to compressor suction Drawings: 530-DW-PD-001, GAS-530-DW-PD-018, GAS-530-DW-PD-020 Plant and Equipment: Line: NG-01-XX-450, G-001-CE15X-400, G-64906-C9D-400, G-906-C9D-400, G-64907-C9D-400
10	Description: Michelago forward flow: compressor discharge to EGP Drawings: 530-DW-PD-001, GAS-530-DW-PD-018, GAS-530-DW-PD-020 Plant and Equipment: Line: G-901-C9D-400, G-64904-C9D-400, G-020-CE15X-400, NG-01-XX-450
10A	Description: Michelago MLV actuated pressurisation bypass Drawings: GAS-530-DW-PD-020 Plant and Equipment: Line: G—XXX-C9D-150
11	Description: Mila reverse flow: EGP to compressor suction Drawings: 525-PI-001, GAD-525-DW-PD-039, GTS-525-DW-PD-022 Plant and Equipment: Line: G-909-C9D-400, GAS-525-DW-PD-039, G-905-C9D-400, G-XXX-C9D-400, G-001-XX-400, G-002-PL9Z-400, G-003-C9D-400
12	Description: Mila reverse flow: comrpessor discharge to EGP Drawings: 525-PI-001, GAD-525-DW-PD-039, GTS-525-DW-PD-022 Plant and Equipment: Line: G-021-C9D-400, G-902-C9D-400, G-903-C9D-400, G-906-C9D-400, G-908-C9D-400

Node	Description
13	Description: Mila reverse flow with no compression Drawings: 525-PI-001 Plant and Equipment: Line:NG-01-XX-450,
14	Description: Mila forward flow: EGP to compressor suction Drawings: 525-PI-001, GAD-525-DW-PD-039, GTS-525-DW-PD-022 Plant and Equipment: Line: G-908-C9D-400, G-001-XX-400, G-906-C9D-400, G-907-C9D-400
15	Description: Mila forward flow: compressor discharge to EGP Drawings: 525-PI-001, GAD-525-DW-PD-039, GTS-525-DW-PD-022 Plant and Equipment: Line: G-021-C9D-400, G-902-C9D-400, G-904-C9D-400, G-908-C9D-400,
15A	Description: Mila MLV actuated pressurisation bypass Drawings: GAS-530-DW-PD-039 Plant and Equipment: Line: G—XXX-C9D-150
15B	Description: Michelago and Mila: Overview
16	Description: Longford: EGP to VicHub2 Water Bath Heater Drawings: 510-PI-092, PO-510-PI-110, GAS-511-DW-PD-001, GAS-511-DW-PD-002, GAS-511-DW-PD-003, Plant and Equipment: 510-F-103, 510-HT-102 Line: G-076-C9D-400, G-076-C9D-400, G-701-C9D-400, G-701-C9D-400, G-704-C9D-400, G-702-C9D-400,
17	Description: Longford: VicHub2 to Vic Hub WBH cross over Drawings: GAS-511-DW-PD-003,510-DW-PD-006 Plant and Equipment: 510-HT-101 Line: 510-DW-PD-006, G-716-C9D-200, G-112-C9-200
18	Description: Longford: VicHub2 Water Bath Heater to Flow Regulators Drawings: GAS-511-DW-PD-002, GAS-511-DW-PD-004 Plant and Equipment: 510-HT-102 Line: G-708-C9D-300, G-711-C9D-400, G-712-C9D-400, G-713-C9D-400, G-717-C9D-400,
19	Description: Longford: VicHub2 flow regulators to Gas Net Drawings: GAS-511-DW-PD-004, PO-511-DW-PD-001 Plant and Equipment: Line: G-714-C9D-400, G-718-C9D-400, G-715-C9D-400, G-717-C9D-400,
20	Description: Longford: Fuel Gas to VicHub2 WBH Drawings: GAS-511-DW-PD-004, GAS-511-DW-PD-002 Plant and Equipment: Line: FG-716-C6D-50, FG-709-C3D-50
21	Description: Longford: VicHub2 Filter Separator Liquids to Closed Drain Drawings: GAS-511-DW-PD-001, 510-DW-PD-101 Plant and Equipment: Line: CD-708-C6D-50,
22	Description: Longford: VicHub2 Filter Separator Bund Liquids to open drain

Node	Description
	Drawings: GAS-511-DW-PD-001, 510-PI-140 Plant and Equipment: Line: UPVC
23	Description: Longford: Vic Hub Actuated inlet isolation valves Drawings: GAS-511-DW-PD-002 Plant and Equipment: Line: G-077-C9D-200
23A	Description: Longford: Overview
24	Description: Wilton: EGP to APA Water Bath Heater Drawings: 563-DW-PD-001, 563-DW-PD-002, 563-DW-PD-016 Plant and Equipment: 563-F-01, 563-F-02, Line: 563-G-847-X70-250, 563-G-802-C9D-300, 563-G-802-C9D-300, 563-G-64882-C9D-250. G-64888-C9D-250
25	Description: Wilton: APA Water Bath Heater to APA Metering (563-MR-03, 563-MR-04) Drawings: 563-DW-PD-016, 563-DW-PD-017 Plant and Equipment: 563-HT-001 Line: G-64889-C9D-250, G-64890-C9D-250, G-64880-C9D-250
26	Description: Wilton: APA Flow Metering to Moomba Wilton Mainline Header Drawings: 563-DW-PD-017, 563-DW-PD-018, 563-DW-PD-012 Plant and Equipment: 563-MR-03, 563-MR-04, 563-RR-03, 563-RR-04 (existing equipment, moved location) Line: G-64890-C9D-250, 563-817-PL9Z-250
27	Description: Wilton: Dry Gas Filters to JGN metering via HEX (existing equipment, increased flow and changed composition) Drawings: 563-DW-PD-002, 563-DW-PD-003, Plant and Equipment: 563-HE-01, 563-HE-02 Line: 563-G-808-C9D-250,
28	Description: Wilton: JGN Metering skid Drawings: 563-DW-PD-008 Plant and Equipment: 563-MR-05, 563-MR-06 Line:
29	Description: Wilton: JGN Flow Control Skid Drawings: 563-DW-PD-008, 563-DW-PD-010 Plant and Equipment: 563-RR-05, 563-RR-06 Line: 563-G-815-C9D-250, G-64884-C9D-400, G-64885-C9D-400,
30	Description: Wilton: Instrument Air/Gas Drawings: 563-DW-PD-010, 563-DW-PD-003, 563-DW-PD-011 Plant and Equipment: Line:
31	Description: Wilton Fuel Gas Supply to APA Water Bath Heater Drawings: 563-DW-PD-014, 563-DW-PD-016 Plant and Equipment: Line:
32	Description: Wilton: Overview

Following the Node by Node review general discussions were had on the piping layout and any other operational issues. This included hazard identification using a set of standard risk assessment prompts.

The minutes were reviewed by the HAZOP study team, allocation of the action item responsibilities was completed and priority categories assigned as detailed in

Table 3.

Table 3: HAZOP Priority Categories

Priority	Description
1	To be completed in FEED
2	To be completed in Detailed Design (Prior to construction)
3	To be completed prior to Commissioning
4	To be completed prior to hand-over to Operations

4 STUDY TEAM

The study team comprised the following personnel with their responsibilities in relation to this project outlined below:

Table 4: HAZOP Study Team Members

5th November – Kembla Grange

HAZOP Team Member	Position/Role	Company
Lisa Hein	Chairperson / Facilitator	GPA Engineering
India Carsburg (IC)	Graduate Mechanical Engineer / Scribe	GPA Engineering
Matthew Skaras (MS)	Project Manager	Jemena
Max Imsungnoen	Project Engineer	Jemena
Michael Peoples	Gas Managing Engineer (in part)	Jemena
David Young (DY)	Principal Engineer	Enscope
Nathan Biggins (NB)	Project Manager	Jemena
Stephen Chow (SC)	Project Engineer	Jemena
Akshay Qazi	Systems Controller	Jemena
Steven Bonnici (SB)	Project Manager	Zinfra
Martin Richards (MR)	Pipeline Operator and Technician	Zinfra
Mick Arneil (MA)	Manager, Field Transmission (South)	Zinfra
Sarah Greening (SG)	Project Manager	GPA Engineering
Simon Hanlin	Senior Process Engineer	GPA Engineering
Dylan Falls (DF)	Graduate Process Engineer	GPA Engineering
Peter Blyton (PB)	Senior Mechanical Engineer	GPA Engineering
Adrian Zatta (AZ)	Senior EI&C Engineer	GPA Engineering

16th November - Longford Vic Hub

HAZOP Team Member	Position/Role	Company
Lisa Hein	Chairperson / Facilitator	GPA Engineering
Max Imsungnoen	Project Engineer	Jemena
David Young (DY)	Principal Engineer	Enscope
Stephen Chow (SC)	Project Engineer	Jemena
Luke Gigliotti	Team Leader - Control Room	Jemena
Richard Lamin (RL)	Pipeline Operator Technician	Jemena
Mick Arneil (MA)	Manager, Field Transmission (South)	Zinfra
Sarah Greening (SG)	Project Manager	GPA Engineering
Simon Hanlin	Senior Process Engineer	GPA Engineering
Peter Blyton (PB)	Senior Mechanical Engineer	GPA Engineering
Adrian Zatta (AZ)	Senior EI&C Engineer	GPA Engineering

17th November - Wilton Meter Station (WMS).

HAZOP Team Member	Position/Role	Company
Lisa Hein	Chairperson / Facilitator	GPA Engineering
David Young (DY)	Principal Engineer	Enscope
Stephen Chow (SC)	Project Engineer	Jemena
Luke Gigliotti	Team Leader - Control Room	Jemena
Steven Bonnici (SB)	Team Leader - EGP	Jemena
Adam Christian (AC)	Operations - Wilton Meter Station	Jemena
Mitchell Graham (MG)	Operations - Wilton Meter Station	Jemena
Simon Hanlin	Senior Process Engineer	GPA Engineering
Peter Blyton (PB)	Senior Mechanical Engineer	GPA Engineering
Adrian Zatta (AZ)	Senior EI&C Engineer	GPA Engineering

18th November - Michelago and Mila Compressor Stations

HAZOP Team Member	Position/Role	Company
Lisa Hein	Chairperson / Facilitator	GPA Engineering
David Young (DY)	Principal Engineer	Enscope
Stephen Chow (SC)	Project Engineer	Jemena
Luke Gigliotti	Team Leader - Control Room	Jemena
Mick Arneil (MA)	Manager, Field Transmission (South)	Zinfra
Richard Lamin (RL)	Pipeline Operator Technician	Jemena
Matthew Evans (ME)	Operations	Jemena
Jon Valsamis (JV)	Systems Controller	Jemena
Simon Hanlin	Senior Process Engineer	GPA Engineering
Peter Blyton (PB)	Senior Mechanical Engineer	GPA Engineering
Adrian Zatta (AZ)	Senior EI&C Engineer	GPA Engineering

5 DISCUSSION OF FINDINGS

The overall process was successful in achieving the objectives of the study. The study team possessed the necessary experience and knowledge to be able to address the majority of the issues at the time within the confines of the meeting.

Where information was not adequate, actions have been assigned to GPA Engineering or Jemena personnel to follow up and obtain further clarification.

The study is considered to be at a 30% design completion stage. A HAZOP will be conducted for the water bath heather vendor package as well as a subsequent HAZOP during detailed design and a layout review.

Details of all discussions and findings appear in the formal HAZOP study minutes appearing in Appendix 1.

Key issues potentially impacting in a significant manner on the final system implementation and operation are summarised below.

Kembla Grange

- Details of the FSRU flow control and pressure protection requires a review to determine if it is fit for purpose and to determine any requirements for integration with Jemena equipment.
- In accordance with Jemena's Isolation philosophy GTS-960-DG-PI-001 Section 10.1.2, Jemena have advised GPA to remove the second isolation valve from the pig receiver inlet as a single valve isolation is considered suitable based on a pigging frequency of 5-10 yearly.

Longford Vic Hub

- Pigging of the EGP is currently set up for the forward flow direction. To enable pigging in the reverse direction a review of the configuration of the pipework is required to ensure that a pig can be received at the Longford Compressor Station Pig Barrel.
- When changing modes or directions of flow, a specific sequence of opening and closing valving is required. This is currently planned to be done using procedures. To avoid potential for human error, a review of the requirements to fully automate mode switching is proposed for consideration.

Wilton

- A new filter is being introduced to increase capacity. Operations have requested, where possible for quick opening closures and filter elements to have commonality with existing filters at Longford Compressor Station and the existing filter at WMS.
- Operations reported that the filter isolations valves and plug valves in general frequently pass. When this happens isolations must be sought further upstream resulting in loss of production. Double block and bleed isolation is to be added to existing filter 563-F-01 to be consistent with new installation and Jemena's isolation philosophy. Similarly, the isolation philosophy for the flow control skid and flow control runs requires a review due to the frequent occurrence of passing valves. A review is required to determine if single valve isolation or double block and bleed is required.

- The proposed design of instrument air (IA) with instrument gas (IG) back up is based on a similar Jemena design in service. However, failure of the IA will introduce a flammable mix of air and gas to the system. The IA system has duty standby compressors already and it is suggested that the need for the IG supply as a backup for IA system is reviewed to minimise the risk.
- Site utilities; power, air and water require a capacity check to determine if they can meet the additional demands from the Water Bath Heater (WBH)
- The new project introduces multiple new flow paths. The project is requested to provide an Operating & Maintenance Philosophy documenting the various modes, capacity limits and redundancies associated with each run.

Mila and Michelago Compressor Stations

- When changing the direction of the flow in the EGP large differential pressures (DP) may be present across switching valves. DP interlocks will be required across all flow switching valves and flow valve sequencing for MLV-1 and flow switching valves must be programmed so that the compressor suction pressure is not higher than discharge pressure.
- The existing facility vented ESD may leave some sections at pressure due to the introduction of new valving. A review of the existing Station ESD is required. Determine the requirements for the new switching valve and whether it is required to vent/blowdown on Station ESD. The project is required to document the new Isolation and Blowdown Philosophy.

Global Issues

- Lower pressures in the EGP than design when switching directions may induce high velocities and flow induced or acoustic induced vibration (FIV/AIV). Low pressure/high velocity alarms and trips to be installed and instrumentation (such as thermowells) to be altered to accommodate for potential high velocities. Add DP interlocks across flow switching valves as appropriate.
- Minimum turndown of equipment to be established and advised.

6 CONCLUSIONS

The study was able to adequately review the design of the EGP Reversal Project which is estimated to be at a 30% complete stage.

The review concluded that in most respects the proposed designs were in accordance with requirements of the applicable industry standards and that the design had been documented and completed to the point where the Study Team was confident in the successful implementation of the project.

However a number of key issues requiring final resolution were identified.

A detailed close-out review is essential in guaranteeing that all design and safety objectives are met following final detailed design and construction.

All HAZOP study actions must be closed out prior to system commissioning and the requirement for further formal reviews assessed during the project implementation as the detailed design develops.

APPENDIX 1 FORMAL STUDY MINUTES

GPA	HAZOP MINUTES	20617-REP-015
	Project Marlin - EGP Reversal	SHEET 1 of 10

Client	**Jemena Ltd**
Client Project No	**GAS-599**
GPA Project No	**20617**
Project Title	**Project Marlin - EGP Reversal**
Facilitator	**Lisa Hein**
Scribe	**India Carsburg**
Workshop Date	**04/11/2020**
Workshop Location	**Microsoft Teams**
HAZOP Sponsor	**Nathan Biggins**
HAZOP Stage	**30%, FEED, Stage 1 Kembla Grange MLV and Kembla Grange Meter Station**

HAZOP Participants:

GPA Engineering

Sarah Greening (SG)	Project Manager
India Carsburg (IC)	Graduate Mechanical Engineer / Scribe
Lisa Hein (LH)	Senior Consultant - Risk and Advisory / Facilitator
Simon Hanlin (SH)	Senior Process Engineer
Dylan Falls (DF)	Graduate Process Engineer
Peter Blyton (PB)	Senior Mechanical Engineer
Adrian Zatta (AZ)	Senior EI&C Engineer

Jemena

Nathan Biggins (NB)	Project Manager
Max Imsungnoen (MI)	Project Engineer
Stephen Chow (SC)	Project Engineer
Matthew Skaras (MS)	Project Manager
Luke Gigliotti (LG)	EI&C Engineer (Akshay - Systems Controller attended in place)
Michael Peoples (MP)	Gas Managing Engineer (in part)

Enscope

David Young (DY)	Principal Engineer

Zinfra

Steven Bonnici (SB)	Project Manager
Martin Richards (MR)	Pipeline Operator and Technician
Mick Arneil (MA)	Manager, Field Transmission (South)

Background:

Jemena is undertaking Front End Engineering and Design (FEED) to facilitate a total installed cost (TIC) estimate and schedule to reverse flow the Eastern Gas Pipeline (EGP) south of the Kembla Grange Meter Station (KGMS), to allow the supply of gas into the Victorian and New South Wales gas networks.

The following, key pieces of documentation, formed the basis of the HAZOP (additional information was available – see HAZOP report):

- Pig Receiver P&ID: GAS-557-DW-PD-001(B)
- Metering P&ID: GAS-557-DW-PD-002(B)
- EGP Hot Tap Tie-in P&ID: GAS-557-DW-PD-003(B)
- MLV and Sales Tap P&ID: 550-PI-001

The HAZOP specifically dealt with:

- Pig Receiver on the Port Kembla Pipeline,
- Metering skid and associated control systems,
- Gas Quality Measurement Equipment,
- Hot tap tie in into the EGP north of the existing Kembla Grange MLV, the MLV bypass line/pipeline and station blowdown line

The HAZOP specifically excluded a full formal review of:

- Port Kembla Pipeline,
- Mila Compressor Station (MCS),
- Michelago Compressor Station (MOCS),
- Vic Hub Interconnect (located within the Longford Compressor Station, LCS); and,
- Wilton Meter Station (WMS).

The HAZOP was conducted using a series of guide words which were applied to each of the key phases of operation.

NODE 1: PORT KEMBLA METERING AND DISCHARGE TO EGP

DRAWINGS: GAS-557-DW-PD-001, GAS-557-DW-PD-002, GAS-557-DW-PD-003 **PLANT & EQUIPMENT:** PIG RECEIVER, METER STATION **INSTRUMENTATION: -** **LINE NUMBERS:** G-11-C9D-400, G-10-C9D-400, G-01-CE15X-450, G-02-CE15X-400, G-005-C9D-400, G-006-C9D-300, G-09-C9D-400, G-08-C9D-300

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
1.1	HIGH FLOW	Low pressure in EGP caused by supply interruption.	Potential FIV (flow induced vibration) on thermowells and metering equipment due may result in unmetered gas.	Flow control on FSRU	Confirm the lowest pressure possible in the EGP and ensure it is included in design conditions for all equipment and in the heat mass balance table.	**1**	**DY**		
1.2	HIGH FLOW	Line break on EGP	Loss of containment fed by EGP	Control room monitoring, remote actuated MLV's.	Install pressure rate of change alarms on inlet of Port Kembla pipeline. Confirm remote actuated MLV is included in design and pipeline isolation plan.	**2** **2**	**SH** **SH**		
1.3	HIGH FLOW	High flow in pig receiver – during pigging operations (pigging is for integrity inspections only, will occur at a low frequency).	High flow in the kicker line, potential damage of pipe due to flow induced vibration.	Pigging procedures will specify a flow rate to ensure max velocity (nominally 50 m/s) in kicker line is not exceeded.	Pig kicker line to be included in line sizing calculation with a velocitysizing limit of 50 m/s..	**1**	**SH**		
1.4	HIGH LEVEL	N/A							
1.5	LOW FLOW	Closed manual outlet valves at the Kembla station for maintenance or human error.	Loss of supply	Operations monitoring	None required.				
1.6	LOW FLOW	High pressure in northern end of EGP	High pressure, potential deadhead of FSRU pump (12MPa). Note: Jemena equipment is rated for 14.9MPa.	Flow/pressure control on FSRU pumps	Confirm FSRU flow control and pressure protection is fit for purpose. Confirm if pressure signals from Jemena equipment installed at KGMS are required to be relayed to the FSRU pumps.	**1** **1**	**MS** **MS**		
1.7	LOW FLOW	SLV semi-closure	Lack of supply		Install Position/fail to operate alarm on the SLV.	**1**	**AZ**		
1.8	LOW LEVEL	N/A							
1.9	ZERO FLOW / EMPTY	No issues							
1.10	REVERSE FLOW	Line break upstream of pig trap Port Kembla	EGP backflow through line break	One NRV included Control room monitoring. MLV can be closed remotely to stop backflow.	Add Reverse flow alarm to KGMS meter run, ensure it doesn't trigger falsely at zero flow. Confirm if secondary NRV is required by evaluating risk reduction and confirming if design has reduced risk ALARP (Additional NRV may be included during detailed design).	**2** **2**	**GPA** **MS**		
1.11	HIGH PRESSURE	Blocked discharge, refer low flow 3.5.	Over pressure should not occur as pump deadhead pressure is less than Jemena equipment design pressure.	Pump deadhead pressure low than MAOP of line.	As per 3.4				**A HAZOP for the FSRU connection will be conducted later in the design process. These issues will be further verified in this HAZOP.**

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
1.12	LOW PRESSURE	No issues							
1.13	HIGH TEMPERATURE	No issues							
1.14	LOW TEMPERATURE	Re-pressuring vented section due to joule-thompson effect.	Potential low temperature embrittlement conditions in equipment.	Jemena stated that venting and repressurising procedures will be developed to include flowrate limits to avoid exceeding minimum design temperatures. Actual temperatures will be monitored with temperature gun during the process. - There is a pressurisation bypass line included around the shutdown valve.	None required				
1.15	IMPURITIES	Commissioning debris. Pipeline is lined so corrosion products are not expected.		Cleaning procedures will be used during commissioning	None required				
1.16	CHANGE IN COMPOSITION / CONCENTRATION	High Wobbe index may be received from FSRU due to settle out in ships during transport.	Off spec gas	Metered nitrogen injection based on GC test results is included in the design. The FSRU has a GC which will confirm gas properties prior to loadout.	Configure and include a high Wobbe Index alarm for the 557-AIT-64008 sampling system.	**1**	**SH**		
1.17	CHANGE IN COMPOSITION / CONCENTRATION	Excessive odorant injection	Off spec gas	Operation monitoring.	None required				
1.18	TWO PHASE FLOW	No issues							
1.19	REACTIONS	No issues							
1.20	TESTING EQUIPMENT / PRODUCT	Gas sampling and analysis is included in system for verification of gas being delivered into the EGP. Only one in line GC is proposed for the KGMS. If unavailable delivery into the EGP may be prevented and loadout from the FSRU may be delayed.	Delay in production or offspec gas.	Additional GC on FSRU. Dilution of any offspec gas due to high volume of gas in EGP. Variability may occur between cargos but not within the same cargo. A manual test with portable equipment could be carried out prior to unloading.	Confirm if single GC is enough in regard to quality monitoring according to commercial arrangements. .	**1**	**MS**		
1.21	PLANT ITEM OPERABILITY	Commissioning and start up. Intended filling of Pt Kembla Pipeline is by gas from the EGP, however an NRV is installed in the KGMS pipework preventing backflow from the EGP.	Unable to commissioning/fill Pt Kembla Pipeline.		Install bypass around NRV	**1**	**SH**		
1.22	PLANT ITEM OPERABILITY	Venting – Some manual vents shown as single ball valve, inconsistent with typical vent arrangements	Single vent ball valve will become damaged when used for venting and throttling.		Update manual vents at KGMS to include isolation ball valve and throttling valve.	**1**	**PB**		

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
1.23	PLANT ITEM MAINTAINABILITY	Pig receiver isolation for maintenance. Meter run isolation for maintenance. Pig receiver proposed design had a double block and bleed. Presented design was based on Atlas pig receiver design (GAS-447-DW-PD-001) with double block and bleed installed upstream of the pig trap.	Proving isolation prior to proceeding with maintenance with a single valve. Ensuring single valve isolation remains effective when equipment is open to atmosphere. Inadequate isolation will result in process having to be further isolated upstream and production impacts. Potential safety issue if single valve passes during the maintenance.	Pig receiver proposed design retained double block and bleed. According to Jemena isolation policy GTS-960-DG-PI-001 section 10.1.2 states DBB is only required in system above ANSI 600 where the item being isolated is subjected to maintenance which involves breaking gas containment, on a frequency of once per year or more. Pigging frequency is expected to be 5-10 yearly for integrity inspections. Isolation will be proven using a single vented ball valve. If isolation cannot be proven, the process will be isolated further upstream until it can be proven. For routine maintenance meters will be calibrated in line, removal not required. Blind flanges will be installed downstream of single isolations before proceeding with maintenance activities.	Jemena have advised GPA to remove the second isolation valve from the design based on a pigging frequency of 5-10 yearly and requirements in GTS-960-DG-PI-001 Section 10.1.2 GPA to update P&IDs and remove the DBB isolation configuration and ensure this philosophy is reflected in other elements of the design.	**1**	**SH**		Refer to Jemena's Piping Design Guide and Material Specification for Gas Pipeline Facilities. The relevant section to refer to for isolations is GTS-960-DG-PI-001 section 10.1.2 as follows: Positive isolation (spade/blind/dropout spool) is mandatory where maintenance involving breaking gas containment is done in confined spaces. Valve isolation is acceptable for non-confined-spaces. DBB is required in class #600 and above where the item being isolated is subjected to maintenance which involves breaking gas containment, on a frequency of one year or less.
1.24	ELECTRICAL AREA CLASSIFICATION	No issues - All equipment will be hazardous area rated according to the area							
1.25	EARTHING	No issues - station is earthed (fenced)							Earthing and HA classifications to be completed in detailed design.
1.26	ISOLATION	Ref 3.21 maintainability							
1.27	INSTRUMENTS TOO MANY	UG TIT at Kembla inlet		Jemena stated that there was sufficient temperature indication elsewhere	Remove UG TIT (064001)	**1**	**SH**		
1.28	INSTRUMENTS TOO FEW	Sufficient pressure transmitters							
1.29	CORRECT LOCATION OF INSTRUMENTS	No issues							

NODE 2: PIPING CONNECTION TO THE PORT KEMBLA PIPELINE HOT-TAP FROM SOUTHERN SIDE OF KEMBLA GRANGE MLV

DRAWINGS: 550-PI-001, GAS-557-DW-PD-003 **PLANT & EQUIPMENT:** PRESSURE CONTROL VALVE **INSTRUMENTATION: -** **LINE NUMBERS:** PRESSURE CONTROL VALVE

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
2.1	HIGH FLOW	Control valve PV-064009 fails open Or inadvertent opening ofbypass valve	Induced vibration	Control Valve is Fail Closed Manual bypass managed using procedures and is designed for reverse flow only (Blowdown), refer item 3.1.	Complete AIV or FIV (acoustic or flow induced vibration) assessment during detailed design.	**2**	**PB**		
2.2	HIGH LEVEL	No issues							
2.3	LOW FLOW	Low dP across MLV	Lack of supply to the north		Add a low dP alarm across MLV 1/PV-64009 to alert operators of low dP across MLV so that they can open it.	**1**	**AZ**		
2.4	LOW LEVEL	No issues							
2.5	ZERO FLOW / EMPTY	Valve fails closed	Interruption to supply		Implement out of position alarm on the pressure control valve (PV-064009). Add high dP alarm across MLV 1/PV-64009	**2** **1**	**AZ** **AZ**		
2.6	REVERSE FLOW	Pressure north is higher than pressure south.	Misdirected flow, no safety consequence	Operator will open MLV	As per 2.3				
2.7	HIGH PRESSURE	High pressure from upstream (southern) compression	Potential for pressure to exceed design operating pressure of 12MPag used for equipment and line sizing		Confirm highest possible operating pressure scenario from the south Update equipment and line sizing calculations for PV-064009 and bypass line if required.	**2** **2**	**DY** **SH**		
2.8	LOW PRESSURE	No new issues.							
2.9	HIGH TEMPERATURE	No issues							
2.10	LOW TEMPERATURE	Pressure drop across PV64009	Minimum gas delivery temperature lower than minimum EGP delivery temperature requirement of 2°C	Minimum temp above minimum pipe rating of -10C. Distance from bypass tie to hot tap is ~20m per 200617-50-550 Rev B.	Install additional temperature transmitter before the hot tap tie in, a suitable distance downstream of bypass inlet to allow blending of Pt Kembla and Longford gas.	**1**	**SH**		
2.11	IMPURITIES	No new issues.							
2.12	CHANGE IN COMPOSITION / CONCENTRATION	No new issues.							
2.13	TWO PHASE FLOW	No new issues.							
2.14	REACTIONS	No new issues.							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
2.15	TESTING EQUIPMENT / PRODUCT	No new issues.							
2.16	PLANT ITEM OPERABILITY	No new issues.							
2.17	PLANT ITEM MAINTAINABILITY	No new issues.							
2.18	ELECTRICAL AREA CLASSIFICATION	No new issues.							
2.19	EARTHING	No new issues.							
2.20	ISOLATION	No new issues.							
2.21	INSTRUMENTS TOO MANY	No new issues.							
2.22	INSTRUMENTS TOO FEW	Refer 4.10							
2.23	CORRECT LOCATION OF INSTRUMENTS	Loss of communication between MLV and Meter Station.	Potential unintended control of FCV.		Confirm if signal from PIT2 to PIC64009 needs to be hardwired or if coms is sufficient.	**1**	**MS**		

NODE 3: BLOWDOWN FOR THE PORT KEMBLA PIPELINE VIA THE EXISTING COLD VENT AT THE KEMBLA GRANGE MLV SITE.

DRAWINGS: 550-PI-001, GAS-557-DW-PD-003

PLANT & EQUIPMENT: COLD VENT / PORTABLE BLOWDOWN SILENCER

INSTRUMENTATION: -

LINE NUMBERS: G-06-C9D-150

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
3.1	HIGH FLOW	Fully open plug valve	Noise, FIV, instrument damage		Confirm the sizing of plug valve (150-PV-064010) for blow down, required to limit flow to acceptable levels through the meter station.	**2**	**SH**		
3.2	HIGH LEVEL	No new issues							
3.3	LOW FLOW	No new issues							
3.4	LOW LEVEL	No new issues							
3.5	ZERO FLOW / EMPTY	No new issues							
3.6	REVERSE FLOW	Southern side of EGP will still be live during blow down, passing valves, continuously venting.	Loss of product via vent.	This issue is known to Jemena and addressed procedurally when venting is required.	No actions				
3.7		Control valve is closed (not bi-directional). Reverse flow around control valve using the bypass plug valve.	Potential damage to control valve		Confirm reverse flow using the bypass (150-PV-064010) for blow down scenario will not damage thecontrol valve (PV-064009) with the vendor.	**2**	**PB**		

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
3.8	HIGH PRESSURE	No new issues							
3.9	LOW PRESSURE	No new issues							
3.10	HIGH TEMPERATURE	No new issues							
3.11	LOW TEMPERATURE	During de-pressuring JT effect will cause cooling	Potential for low temperature embrittlement for existing pipe piping material.		Determine minimum gas temperature during blow down. Ensure pipe is rated for minimum temp	**2**	**SH**		
3.12	IMPURITIES	No new issues							
3.13	CHANGE IN COMPOSITION / CONCENTRATION	No new issues							
3.14	TWO PHASE FLOW	No new issues							
3.15	REACTIONS	No new issues							
3.16	TESTING EQUIPMENT / PRODUCT	No new issues							
3.17	PLANT ITEM OPERABILITY	Passing of a single isolation valves V-01, V-02, V-10 a known issue. This existing vent (blowdown bleed, V-05) is presently used for bleeding the EGP or local equipment. Upstream plug valves V-01, V-02, V-10 are known to pass. Vent connection currently has a flange – no valve. Installing a local vent is currently undertaken with upstream isolation valves passing.	Inadequate isolation.	New valve 150-BV-64021 at TIP 550-01 on the vent will be vented cavity ball valve. Jemena accept the risk of installing the vent silencer with existing isolations and passing upstream valves. A construction risk assessment will take place prior to installing the new equipment.	None required				
3.18		Height of equipment and potential vibration in the vent stack.	Damage of equipment due to vibrations		Review structural support for the portable blowdown silencer considering higher connection flange location with 150-BV-64021 installed.	**2**	**PB**		
3.19	PLANT ITEM MAINTAINABILITY	No new issues							
3.20	ELECTRICAL AREA CLASSIFICATION	No new issues							
3.21	EARTHING	No new issues							
3.22	ISOLATION	No new issues							
3.23	INSTRUMENTS TOO MANY	No new issues							
3.24	INSTRUMENTS TOO FEW	No new issues							
3.25	CORRECT LOCATION OF INSTRUMENTS	No new issues							

NODE 4: INSTRUMENT GAS SUPPLY

DRAWINGS: 550-PI-001 **PLANT & EQUIPMENT:** INSTRUMENT GAS **INSTRUMENTATION: -** **LINE NUMBERS: -**

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
4.1	HIGH FLOW	Failure of PV 062005 or PV062007	Over pressure. Noise. Operators attend site once a month for site inspections, failure would go undetected. PSV vents to atmosphere.	PSV 062008	Change PI to PIT with high and low pressure alarm (PI62008)	**1**	**SH**		
4.2	HIGH LEVEL	No new issues							
4.3	LOW FLOW	Failure of supply to control valve	PV064009 will close – supply disruption		As per 2.6				
4.4	LOW LEVEL	No new issues							
4.5	ZERO FLOW / EMPTY	No new issues							
4.6	REVERSE FLOW	No new issues							
4.7	HIGH PRESSURE	No new issues, ref 4.1	Blowing out actuator on valve, loss of containment.	PSV 062008	None required				
4.8	LOW PRESSURE	No new issues							
4.9	HIGH TEMPERATURE	No new issues							
4.10	LOW TEMPERATURE	Cooling associated with pressure drop	Low temperatures in downstream equipment.	Instrument tubing will be stainless steel rated below the expected minimum process temperature downstream of the pressure cut Liquids drop out not expected – dry gas	Include passive heat recovery loop into the instrument gas panel tubing.	**1**	**AZ**		
4.11	IMPURITIES	No new issues							
4.12	CHANGE IN COMPOSITION / CONCENTRATION	No new issues							
4.13	TWO PHASE FLOW	No new issues							
4.14	REACTIONS	CS to SS transition	Galvanic corrosion	FIK shown on P&ID (I.G.)	None required				
4.15	TESTING EQUIPMENT / PRODUCT	Lack of Maintenance	Failure of equipment	Maintenance plans in place	None required				
4.16	PLANT ITEM OPERABILITY	No new issues							
4.17	PLANT ITEM MAINTAINABILITY	Maintenance on instrument gas panel will require PCV to be out of service	Supply interruption	Portable supply could be used.	None required				
4.18	ELECTRICAL AREA CLASSIFICATION	No new issues							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
4.19	EARTHING	No new issues							
4.20	ISOLATION	No new issues							
4.21	INSTRUMENTS TOO MANY	No new issues							
4.22	INSTRUMENTS TOO FEW	No new issues							
4.23	CORRECT LOCATION OF INSTRUMENTS	No new issues							

NODE 5: GENERAL HAZARD IDENTIFICATION AND FACILITY OVERVIEW

DRAWINGS: GAS-557-DW-PD-001, GAS-557-DW-PD-002, GAS-557-DW-PD-003, 550-PI-001

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
5.1	TOXICITY	No new issues							
5.2	SERVICES REQUIRED	No new issues							
5.3	MATERIALS OF CONSTRUCTION	No new issues							
5.4	COMMISSIONING	No new issues							
5.5	BREAKDOWN	No new issues							
5.6	STARTUP / SHUTDOWN	No new issues							
5.7	EFFLUENT	No new issues							
5.8	NOISE / VIBRATION	Noise from control valve PV-64009	Noise may be above allowable threshold		Specify noise attenuating trim for PV-64009 and acoustic insulation to be installed on valve and downstream piping	**1**	**SH**		
5.9	FIRE / EXPLOSION	No new issues							
5.10	SAFETY EQUIPMENT	No new issues							
5.11	QUALITY AND CONSISTENCY	No new issues							
5.12	OUTPUT – RELIABILITY AND BOTTLENECKS	No new issues							
5.13	EFFICIENCY	No new issues							
5.14	SIMPLICITY	No new issues							
5.15	MOBILE EQUIPMENT / PLANT MOVEMENT	No new issues							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
5.16	PROCESS PLANT NORMAL / ABNORMAL MAINTENANCE	No new issues							
5.17	PROCESS PLANT PROCESS FUNCTIONALITY	No new issues							
5.18	ERGONOMICS	No new issues							
5.19	GUARDING	No new issues							
5.20	WARNINGS	No new issues							
5.21	VULNERABILITY	No new issues							
5.22	3RD PARTY INTERFERENCE	No new issues							
5.23	NATURAL EVENTS	No new issues							

	HAZOP MINUTES	20617-REP-018
GPA	Project Marlin: EGP Reversal	SHEET 1 of 18

Client	**Jemena Ltd**
Client Project No	**GAS-599**
GPA Project No	**20617**
Project Title	**Project Marlin: EGP Reversal**
Facilitator	**Lisa Hein**
Scribe	**Peter Blyton** **Sarah Greening**
Workshop Date	**12/11/2020**
Workshop Location	**Microsoft Teams**
HAZOP Sponsor	**Nathan Biggins** **Matthew Skaras**
HAZOP Stage	**30% FEED Stage 2:** • **VicHub2 located at Longford Compressor Station (LCS)**

HAZOP Participants:

GPA Engineering

Sarah Greening (SG)	Project Manager / Minute Taker
Lisa Hein (LH)	Senior Consultant - Risk and Advisory / Facilitator
Simon Hanlin (SH)	Senior Process Engineer
Peter Blyton (PB)	Senior Mechanical Engineer / Minute Taker
Adrian Zatta (AZ)	Senior EI&C Engineer

Jemena

David Young (DY)	Engineering Manager
Max Imsungnoen (MI)	Project Engineer
Stephen Chow (SC)	Project Engineer
Luke Gigliotti (LG)	Team Leader - Control Room
Richard Lamin (RL)	Pipeline Operator Technician
Mick Arneill (MA)	Manager - Gas Transmission South

Background:
Jemena is undertaking Front End Engineering and Design (FEED) to facilitate a total installed cost (TIC) estimate and schedule to reverse flow the Eastern Gas Pipeline (EGP) south of the Kembla Grange Meter Station (KGMS), to allow the supply of gas into the Victorian and New South Wales gas networks.

The following, key pieces of documentation, formed the basis of the HAZOP (refer HAZOP report for additional information):

- Longford Compressor Station
  - Launcher Station P&ID: 510-PI-092
  - Gas Manifold P&ID: PO-510-PI-110
  - Vic Hub 2 – Metering Run P&ID: GAS-511-DW-PD-003
  - Vic Hub 2 – Pressure Regulation P&ID: GAS-511-DW-PD-004
  - Vic Hub 2 – Inlet Filter Separator P&ID: GAS-511-DW-PD-001
  - Vic Hub 2 – Water Bath Heater P&ID: GAS-511-DW-PD-002
  - Vic Hub – Water Bath Heater 510-HT-101 P&ID: 510-DW-PD-006
  - Inlet Filter Separator P&ID: 510-DW-PD-101
  - Open Drain Interceptor P&ID: 510-PI-140
  - Vic Hub – Bi-Directional Pipeline P&ID: PO-511-DW-PD-001

The HAZOP specifically dealt with:

- Vic Hub Interconnect (located within the Longford Compressor Station, LCS)

The HAZOP specifically excluded a full formal review of:

- Water Bath Heater 510-HT-102, Vendor Package HAZOP will be completed as part of Detailed Design

The HAZOP was conducted using a series of guide words which were applied to each of the key phases of operation.

NODE 16: LONGFORD: EGP TO VICHUB2 WATER BATH HEATER

DRAWINGS: 510-PI-092, PO-510-PI-110, GAS-511-DW-PD-001, GAS-511-DW-PD-002, GAS-511-DW-PD-003

PLANT & EQUIPMENT: 510-F-103

INSTRUMENTATION: -

LINE NUMBERS: G-076-C9D-400, NG-01-C9D-400, G-701-C9D-400, G-702-C9D-400, G-703-C9D-400, G-704-C9D-400, G-705-C9D-400, G-706-C9D-400, G-707-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
16.1	HIGH FLOW	High flow nomination Low downstream pressure	High DP across Filter 510-F-103 Loss of effective metering	High DP alarm PDI-64101B for Filter 510-F-103 HH DP shutdown of UV-64101 High flow alarm on FI-64112	No actions				
16.2	HIGH LEVEL	Liquid slug Entrained oil from upstream gas compressors at Orbost and/or ESSO Entrained hydrocarbon liquids Inadequate operation of manual liquid draining of Filter 510-F-103	Liquid carry-over, resulting in off-spec gas	High level alarm LSH-011107/8 on Filter 510-F-103 HH level shutdown on LSHH-011107/8 on Filter 510-F-103 Inlet gas supplied per AS4564 gas specification.	P&ID and datasheet to show that Filter 510-F-103 liquids collection boot is separated into two compartments. P&IDs currently shows this as one compartment which would allow gas to bypass the filter element. Add transmitter to LG-011107/8	**1** **1**	**PB** **AZ**		
16.3	LOW FLOW	Blocked Filter 510-F-103	High DP across filter, leading to filter element damage Flow nomination shortfall	High DP alarm PDI-64101B for Filter 510-F-103 HH DP shutdown of UV-64101	No action				
16.4	LOW LEVEL	No issues identified.							
16.5	ZERO FLOW / EMPTY	Inadvertent closure of downstream valves	Failure to deliver flow nomination	Flow trend monitoring by Operations Personnel	Add position feedback and out of position alarm on downstream flow control valves FV-64118& FV-64124.	**1**	**AZ**		
16.6	REVERSE FLOW	Higher pressure in downstream GasNet than EGP	Reverse flow, leading to filter element damage Loss of effective metering	Check valves in flow control runs					
16.7	HIGH PRESSURE	Inadvertent opening of UV-6470	High pressure from compressor discharge header Very high flow through Filter 510-F-103, leading to filter element damage	Refer High Flow The pressure rating of the piping system and equipment exceeds the upstream pressure source.	Correct the PSV set-point shown on the P&ID for Filter 510-F-103.	**1**	**SH**		

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
16.8	LOW PRESSURE	Lower pressure than expected in the EGP due to continuous withdrawal of gas from the EGP	High gas velocities through the piping and Filter 510-F-103. Longford Compressor discharge harder pressure too low to start compressors.	Refer High Flow Operator intervention	Consider implementation of low pressure alarm on the EGP Consider implementing a back pressure control loop on PV-6440 to maintain adequate pressure in the Longford compressor discharge header to start compressors.	**1** **1**	**DY** **DY**		
16.9	HIGH TEMPERATURE	Hot day (45 deg C) with flow from LCS into the EGP (i.e. north flow), exit temp from LCS would be high, if flow direction swapped to reverse the inlet temp from EGP into VicHub2 would be hotter		Operating temperature up to 46 degC in Vic Hub 2 is being considered Filter design temp is 50 degC	Review how quickly the flow direction can be swapped from north to south flow, i.e. is it plausible 4 hour blocks of direction change. If required would an increase the design temp be required?	**1**	**DY**		
16.10	LOW TEMPERATURE	Repressuriation of Filter 510-F-103 after maintenance	Piping seeing lower temp than designed for	Filter design temp is 15MPa Min piping design temp is -10degC	Check expected repressuring minimum temperatures are above pipe minimum design temperatures.	**2**	**SH**		
16.11	IMPURITIES	H2S is present in gas from Orbost or from Esso, therefore could be in the pipeline. Mercury from Esso (it is in their field and have they have mercury removal) Lube oil Seal oil	Off spec gas Not expecting enough H2S to have corrosion issues OH&S for maintenance – ops not expecting to be exposed. NORM (normally occurring radioactive material)	Spot checks are done on pigging, not yet in the plant. Filter for liquids removal	Operating procedures to include a note regarding materials that could be present in gas	**3**	**DY**		
16.12	CHANGE IN COMPOSITION / CONCENTRATION	Gas is odourised as it is discharged from Longford Compressor Station. If flow is reversed the gas could be odourised again. Mixed gas within plant with different odourised rates	High odorant results in more customers claiming gas leads AEMO will pick this up also		Control functional description to consider odourising controls to ensure it is not doubled up.	**3**	**DY**		
16.13	TWO PHASE FLOW	Nil			No action				
16.14	REACTIONS	Not expecting any issues		Orbost treats for H2S	No action				

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
16.15	TESTING EQUIPMENT / PRODUCT	Metering skid has a single meter only.		All maintenance can be done online (eg meter verification)	Develop procedure for verifying the accuracy of the single meter run and the GC. Probe for the GC will see higher flows during testing. Wake frequency calculation to consider all possible high flow scenarios. Note:External (not Gerni), Welker probe is desired.	**3** **2**	**DY** **AZ**		
16.16	PLANT ITEM OPERABILITY	Closure on filter, type shown on P&ID is the preferred option Pigs – direction of pigging is unknown	Need to be able to receive a pig if flowing from north to south		Pigs – confirm the planned direction of pigging and review the configuration of the pipework to ensure that a pig can be received at the Longford Compressor Station Pig Barrel (location of kicker and equalisation line)	**2**	**DY**		
16.17	PLANT ITEM MAINTAINABILITY	Isolation of filter or strainer for maintenance Meter – single series with no double head for proving	No way to re-pressurise after isolation for maintenance. Large ball valve required to open to re-pressurise isolated strainer/filter, leading to damage to large ball valve. After 10 years difficult to prove the calibration (Esso sometimes query this) No immediate concerns		Strainer - install a pressuriation line around valve 400-BV-064844. Filter - install a pressurisation line around filter isolation valve 400-BV-064844 including an RO to limit the pressurisation rate of the filter and avoid damage to the filter elements.	**1**	**PB**		
16.18		If pigging in reverse (North to South) corrosion by-products in PV-6440 and meter FE-6433	Blockage or damage to PV or FE		If pigging required to be performed north to south the pigging procedure should include closure of PV-6433 during pigging and consider impact of corrosion by-products.	**3**	**DY**		
16.19	ELECTRICAL AREA CLASSIFICATION	HA classification will need to be done		This will be part of the project	No action				
16.20	EARTHING	NIl							
16.21	ISOLATION	Drawing consistency			Implement a consistent approach with regards to valve cavity bleeds	**1**	**PB**		
16.22	INSTRUMENTS TOO MANY	Nil							
16.23	INSTRUMENTS TOO FEW	Nil							
16.24	CORRECT LOCATION OF INSTRUMENTS	Nil							

NODE 17: LONGFORD: VICHUB2 TO VIC HUB WBH CROSS OVER

DRAWINGS: GAS-511-DW-PD-003, 510-DW-PD-006 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS: G-716-C9D-200, G-100-C9-200, G-111-C9-200, G-112-C9-200**

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
17.1	HIGH FLOW	Refer previous node (node 16)	Required heating duty exceeds heater duty could lead to lower than required temp at the regulators (heater can't keep up), hence delivery temperature.	Downstream flow control valve, there will be a max nomination which can be entered per run which should prevent this.	Ensure that a nomination leading to higher than design flows cannot be entered into SCADA Philosophy similar to Hoarlsey to be implemented	**2**	**DY**		
17.2		High volumetric flow through the heater tubes	Exceeding the existing heater tube design velocity		Check the sizing of the VH1 heater for project operating conditions. .	**2**	**DY**		
17.3	HIGH LEVEL	N/A							
17.4	LOW FLOW	Refer previous node (node 16)		Heater controls are assumed to be working	No action				
17.5	LOW LEVEL	N/A							
17.6	ZERO FLOW / EMPTY	Refer node 16							
17.7	REVERSE FLOW	See operability (this node)		All rated for 900#	No action				
17.8	HIGH PRESSURE	Refer node 16							
17.9	LOW PRESSURE	Refer node 16							
17.10	HIGH TEMPERATURE	Loss of 510-HT-101 heater control	Excessive gas temperature downstream of 510-HT-101	Existing heater controls	Review the 510-HT-101 heater control logic and ensure the design is appropriate for reverse flow operation.	**2**	**AZ**		
17.11	LOW TEMPERATURE	Gas temp will be lower than current operating conditions (temp coming in around 19 deg rather than 40deg from the compressor).	Could decrease/change the heater capacity. There are currently scenarios where up to 120 TJ/d resulted in shutdown due to the parameters being considered, this has occurred during winter.	High inlet pressure expected in reverse flow mode compared to current mode A control system was implemented to increase the heater capacity from 135 to 150 however conditions over winter this resulted in numerous trips possibly on high inlet Pressure.	Refer HIGH TEMPERATURE action				
17.12	IMPURITIES	Refer node 16							
17.13	CHANGE IN COMPOSITION / CONCENTRATION	Refer node 16							
17.14	TWO PHASE FLOW	Refer node 16							
17.15	REACTIONS	Refer node 16							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
17.16	TESTING EQUIPMENT / PRODUCT	Existing – nothing added in the node							
17.17	PLANT ITEM OPERABILITY	Switching from EGP North to South then reverse, leading to back flow through the equipment	Line back to filter gets reverse flow for repressurisation Noting this is not significant, may be a meter pulse	NRV at the filter, which is what needs to be protected	Consider relocating 64101 to the other side of filter and meter run Consider new actuated/switching valve at the tie-in point or 64866 to be actuated Consider remote versus manual requirements	**1** **1**	**DY** **DY**		
17.18		If VH1 heater is off-line for maintenance fuel gas is not being heated.	Limited compressor capacity or off spec fuel gas.	Back-up electric heater.	Consider additional FG heating control loop through the new VH2 water bath heater	**1**	**DY**		
17.19	PLANT ITEM MAINTAINABILITY	Refer above							
17.20	ELECTRICAL AREA CLASSIFICATION	HA classification on previous project is not available for this section of the plant		Equipment is expected to be okay	HA classification to be completed for areas where new equipment is being installed.	**2**	**SH**		
17.21	EARTHING	Nil							
17.22	ISOLATION	Nil							
17.23	INSTRUMENTS TOO MANY	Nil							
17.24	INSTRUMENTS TOO FEW	Nil							
17.25	CORRECT LOCATION OF INSTRUMENTS	Nil							

NODE 18: LONGFORD: VICHUB2 WATER BATH HEATER TO FLOW REGULATORS

HEATER BATH TEMP 50 TO 60 DEG C. OLPERATES DIFFERENTLY TO THE OTHER HEATER. TEMP WILL BE ACHIEVEED BY MIXING HOT HEATED GAS WITH BYPASSED GAS.

DRAWINGS: GAS-511-DW-PD-002, GAS-511-DW-PD-004 **PLANT & EQUIPMENT:** 510-HT-102 **INSTRUMENTATION:** - **LINE NUMBERS:** G-708-C9D-300, G-711-C9D-400, G-712-C9D-400, G-713-C9D-400, G-717-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
18.1	HIGH FLOW	TY-064114 fails shut directing more flow through the heater than design	Heater damage / vibration	Position transmitter feedback with out of position alarm	Determine the operational limits of the heater and consider implementing trips or high flow alarms	**2**	**AZ**		
18.2	HIGH LEVEL	N/A							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
18.3	LOW FLOW	Refer NODE 16 Insulation shown on P&ID is for temperature conservation (start up after shut in overnight)							
18.4	LOW LEVEL	N/A							
18.5	ZERO FLOW / EMPTY	No flow through the heater – there will be a bath temp range, it will continue to fire until it reaches the high limit then go into standby mode		There will be a detailed design vendor HAZOP for the heater	No action				
18.6	REVERSE FLOW	Refer node 16							
18.7	HIGH PRESSURE	Heater design pressure and temp shown incorrectly on P&ID			Design pressure on the heater to be changed to 14,895 kPag, temp should be VTC	**1**	**SH**		
18.8	LOW PRESSURE	Refer node 16							
18.9	HIGH TEMPERATURE	TCV control will be via Jemena DCS. If this valve closed inadvertently more gas than is required would be directed to the heater leading to high temperatures.	Wasting fuel gas	Heater package won't overheat gas. Discrepancy alarm on TCV	No action required				
18.10	LOW TEMPERATURE	TCV open too far	Low temp trip downstream AEMO may call with a warning	Discrepancy alarm on TCV Low temp on alarm at regulator outlet (64115)	Add low temperature trip to TIT-64128.	**1**	**AZ**		
18.11		Manual butterfly (64001) at outlet of heater to allow for manual trimming	Not expected to be used or required		Delete this valve	**1**	**PB**		
18.12	IMPURITIES	Water dosing (biocide)		Vendor HAZOP					
18.13	CHANGE IN COMPOSITION / CONCENTRATION	Nil							
18.14	TWO PHASE FLOW	Nil							
18.15	REACTIONS	Nil							
18.16	TESTING EQUIPMENT / PRODUCT								

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
18.17	PLANT ITEM OPERABILITY	Insufficient isolation to maintain TCV-64114 with heater 510-HT-102 online.	Maintenance cannot be completed without depressuring the heater 510-HT-102 and using isolations further upstream/downstream.	Heater can be used with some limitations if TCV-64114 is out of service VicHub 1 heater 510-HT-101 available Valve body/internals not expected to require repair Valve actuator and instrumentation can be maintained with the valve remaining in service. Note – TCV is butterfly type and may be wafer style Can be repaired / replaced during a shutdown	No action required				
18.18	PLANT ITEM OPERABILITY	No bypass arrangement for bundle inspection. Intention is to isolate the run. If VH2 WBH is out and VH1 WBH fails we will lose flow or capacity		Philisophy for maintenance is to isolate whole run to work on the heater. There is 2 tube bundles runs (burners) with redundancy during normal operating conditions.	Removable spool required to get the bundle out (add note to P&ID)	**1**	**SH**		
18.19	PLANT ITEM MAINTAINABILITY	Note only - Heater will be registered type B appliance In Victoria							
18.20		No repressurisation line around isolation ball valve BV-64867 upstream of heater 510-HT-102 No automatic ball valve and plug for repressurisation around the slam shut valves SDV-64116 and SDV-64122.	Repressurisation across BV64867 not possible following double block and bleed isolation on inlet of 510-HT-102. Damage to slam shut valves on re-opening with high DP	Volume between slam shut and regulatoris small Frequency of operation of slam shut valves is rare	Relocate pressurisation line from valve 64886 to 64867 Show inhibit/interlock on not opening the SDV's unless the downstream valves are confirmed closed	**1** **2**	**PB** **SH**		
18.21									
18.22	ELECTRICAL AREA CLASSIFICATION	Heater location is adjacent to a road and a 22kW cable underground In the vicinity	HA zones in this area will be extended		HA classification ot be completed in detailed design.	**2**	**SH**		
18.23	EARTHING	Nil							
18.24	ISOLATION	Bleed is not available between the ball and the plug on the bypass line around BV-64875/64888	Not able to achieve DB&B		Add bleed point between ball and plug valve on pressurisation line around inlet isolation valves BV-64875/64888. Change pressurisation line configuration to 2 ball valves and an orifice (with a bleed)	**1** **1**	**PB** **PB**		
18.25	INSTRUMENTS TOO MANY	Nil							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
18.26	INSTRUMENTS TOO FEW	Nil							
18.27	CORRECT LOCATION OF INSTRUMENTS	Nil							

NODE 19: LONGFORD: VICHUB2 FLOW REGULATORS TO GAS NET

DRAWINGS: PO-511-DW-PD-001, GAS-511-DW-PD-004 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-717-C9D-400, G-714-C9D-400, G-718-C9D-400, G-715-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
19.1	HIGH FLOW	Refer Node 16 Loss of control of flow control valves Both flow control runs open simultaneously	Flow induced vibration in thermowells	Thermowell wake frequency calculations to be completed as part of detailed design High flow alarm on FI-64112	Consider high velocity alarm on FI-64112, based on upstream flowrate and downstream set pressure.	**1**	**DY**		
19.2	HIGH LEVEL	No issues identified							
19.3	LOW FLOW	Refer Node 16							
19.4	LOW LEVEL	No issues identified							
19.5	ZERO FLOW / EMPTY	Refer Node 16							
19.6	REVERSE FLOW	Refer Node 16							
19.7	HIGH PRESSURE	Blocked discharge, pressure bleeds past flow control valves	High pressure downstream of flow control valves	Control valves close on high pressure. Slam shut closes PSVs downstream of flow control valves (leakage PSV only) Piping spec break downstream of flow control skid outlet isolation valves. SIL assessment planned to be completed for this system.	Set slam shut trip to the pressure rating of the downstream system.	**1**	**AZ**		
19.8	LOW PRESSURE	No issues identified							
19.9	HIGH TEMPERATURE	Refer Node X							
19.10	LOW TEMPERATURE	Refer Node 16 JT cooling over control valves Insufficient headting from WBH	Temp below gas spec Temp below material design rating	Downstream temp trip Heat recovery in downstream piping	Add new TIT to DCS downstream of both flow control valves Convert TIT-64128 into SIS low temperature trip	**1** **1**	**SH** **AZ**		
19.11	IMPURITIES	No new issues.							
19.12	CHANGE IN COMPOSITION / CONCENTRATION	No new issues.							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
19.13	TWO PHASE FLOW	No new issues.							
19.14	REACTIONS	No new issues.							
19.15	TESTING EQUIPMENT / PRODUCT			Statutory PM checks on PSVs, CFTs	Confirm requirement for DN20 vents downstream of flow control valves	**1**	**DY**		
19.16	PLANT ITEM OPERABILITY	Isolation of flow control skid from downstream pipeline, single valve isolation provided			Confirm isolation philosophy for flow control skid and flow control runs, determine if single valve isolation or DB&B required. Add isolation valve at TIP-510-04, with bleed upstream to provide DB&B (if required, ref action above).	**1** **1**	**DY** **PB**		
19.17	PLANT ITEM MAINTAINABILITY	Removal of PSV-66121/66127 for maintenance / testing	No bleed between PSV-66121/66127 and isolation valve below		Add bleed ring / test & tap valve below PSV-66121/66127	**1**	**SH**		
19.18	ELECTRICAL AREA CLASSIFICATION								
19.19	EARTHING	Close proximity to 22kV			Review proximity to existing 22kV electrical cable route	**1**	**DY**		
19.20	ISOLATION	Refer Plant Item Operability							
19.21	INSTRUMENTS TOO MANY	No causes							
19.22	INSTRUMENTS TOO FEW	No causes							
19.23	CORRECT LOCATION OF INSTRUMENTS	No causes							

NODE 20: LONGFORD: FUEL GAS TO VICHUB2 WBH

DRAWINGS: GAS-511-DW-PD-004, GAS-511-DW-PD-002 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** FG-716-C6D-50, FG-709-C3D-50

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
20.1	HIGH FLOW			HAZOP for WBH package will be completed during detailed design	No action				
20.2	HIGH LEVEL	No causes							
20.3	LOW FLOW	No causes							
20.4	LOW LEVEL	No causes							
20.5	ZERO FLOW / EMPTY	No causes							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
20.6	REVERSE FLOW	No causes							
20.7	HIGH PRESSURE	No causes							
20.8	LOW PRESSURE	No causes							
20.9	HIGH TEMPERATURE	No causes							
20.10	LOW TEMPERATURE	No causes							
20.11	IMPURITIES	No causes							
20.12	CHANGE IN COMPOSITION / CONCENTRATION	No causes							
20.13	TWO PHASE FLOW	No causes							
20.14	REACTIONS	No causes							
20.15	TESTING EQUIPMENT / PRODUCT	No causes							
20.16					Query with Jemena Commercial regarding the best location for fuel gas offtake for the new WBH for gas accounting	**2**	**DY**		
20.17	PLANT ITEM MAINTAINABILITY	No causes							
20.18	ELECTRICAL AREA CLASSIFICATION	No causes							
20.19	EARTHING	No causes							
20.20	ISOLATION				Include DB&B isolation for fuel gas offtake from flow control skid.	**1**	**PB**		
20.21	INSTRUMENTS TOO MANY	No causes							
20.22	INSTRUMENTS TOO FEW				Include fuel gas flowmeter as part of WBH package.	**2**	**SH**		
20.23	CORRECT LOCATION OF INSTRUMENTS	No causes							

NODE 21: LONGFORD: VICHUB2 FILTER SEPARATOR LIQUIDS TO CLOSED DRAIN

DRAWINGS: GAS-511-DW-001, 510-DW-PD-101 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** CD-708-C6D-50

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
21.1	HIGH FLOW	Gas breakthrough High liquid loading on drain system	Overpressure of closed drain system (CL600) from upstream CL900 system. Frequency pump out of closed drain drum	ROs in drain connections sized for gas breakthrough scenario Open path downstream to closed drain drum	No action				
21.2	HIGH LEVEL	Refer Node 16 regarding Filter 510-F-103							
21.3	LOW FLOW	No issues identified							
21.4	LOW LEVEL	No issues identified							
21.5	ZERO FLOW / EMPTY	No issues identified							
21.6	REVERSE FLOW	No issues identified							
21.7	HIGH PRESSURE	Refer High Flow							
21.8	LOW PRESSURE	No issues identified							
21.9	HIGH TEMPERATURE	No issues identified							
21.10	LOW TEMPERATURE	JT cooling during gas breakthrough	Low temperature	Operator intervention, closes manual valve is gas breakthrough scenario	Ensure minimum design temp of piping suitable for gas breakthrough scenario	**2**	**SH**		
21.11	IMPURITIES	Refer Node 16 Solids from upstream		Notification from upstream Operator regarding prescence of Mercury Filter captures solids	No action				
21.12	CHANGE IN COMPOSITION / CONCENTRATION	No issues identified							
21.13	TWO PHASE FLOW	High velocity liquid slug during gas breakthrough scenario		Piping designed for slugging	No action				
21.14	REACTIONS	No issues identified							
21.15	TESTING EQUIPMENT / PRODUCT	No issues identified							
21.16	PLANT ITEM OPERABILITY	Simultaneous draining of 510-F-103 using manual drain valves, and automatic draining from other filter vessels		Drain drum is open to atmosphere and unlikely to experience backflow from 510-F-103 to other filters if draining simultaneously	No action				
21.17	PLANT ITEM MAINTAINABILITY	RO blockage due to solids			Add rodding point to CD header in DN50 section	**1**	**PB**		
21.18	ELECTRICAL AREA CLASSIFICATION	No issues identified							
21.19	EARTHING	No issues identified							
21.20	ISOLATION	Filter isolation	Inadequate isolation		Confirm isolation philosophy for isolation of CD header from filter.	**1**	**DY**		

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
21.21	INSTRUMENTS TOO MANY	No causes							
21.22	INSTRUMENTS TOO FEW	No causes							
21.23	CORRECT LOCATION OF INSTRUMENTS	No causes							

NODE 22: LONGFORD: VICHUB2 FILTER SEPARATOR BUND LIQUIDS TO OPEN DRAIN

DRAWINGS: GAS-511-DW-PD-001, 501-PD-140 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** UPVC

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
22.1	HIGH FLOW	Draining high level in sump, DN100 drain valve.	Spillage through other vents/connections in the OD system	Operator controls flow using manual valve, drain valve not fully opened for draining.	No action				
22.2	HIGH LEVEL								
22.3	LOW FLOW	No issues identified.							
22.4	LOW LEVEL	No issues identified.							
22.5	ZERO FLOW / EMPTY	No issues identified.							
22.6	REVERSE FLOW	No issues identified.							
22.7	HIGH PRESSURE	No issues identified.							
22.8	LOW PRESSURE	No issues identified.							
22.9	HIGH TEMPERATURE	No issues identified.							
22.10	LOW TEMPERATURE	No issues identified.							
22.11	IMPURITIES			Operators will manage impurities	No action				
22.12	CHANGE IN COMPOSITION / CONCENTRATION	No issues identified.							
22.13	TWO PHASE FLOW	No issues identified.							
22.14	REACTIONS	No issues identified.							
22.15	TESTING EQUIPMENT / PRODUCT	No issues identified.							
22.16	PLANT ITEM OPERABILITY	No issues identified.							
22.17	PLANT ITEM MAINTAINABILITY	No issues identified.							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
22.18	ELECTRICAL AREA CLASSIFICATION			Hazardous area classification will be assessed as part of detailed design.	No action				
22.19	EARTHING	No issues identified.							
22.20	ISOLATION	No issues identified.							
22.21	INSTRUMENTS TOO MANY	No issues identified.							
22.22	INSTRUMENTS TOO FEW	No issues identified.							
22.23	CORRECT LOCATION OF INSTRUMENTS	No issues identified.							

NODE 23: LONGFORD: VIC HUB ACTUATED INLET ISOLATION VALVES

DRAWINGS: 510-DW-PD-006 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-077-C9D-200

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
23.1	MISDIRECTED FLOW	Incorrect valve line-up	Imbalance penalties Not meeting flow nomination.	Proposed control will include a matrix of flow operation modes with permissives for selecting and changing mode.	Review option to fully automate flow mode switching	**2**	**DY**		
23.2	HIGH FLOW	High DP across actuated valves UV-533 High flow velocity in DN20 repressurisation line.	Damage to UV-533 valve seat	Low DP open permissive across flow switching valves	Review mounting and installation of actuators on existing manual valves to be actuated. Ensure actuated valves have low DP permissive for opening. Review sizing of DN20 repressurisation line.	**2** **1** **2**	**DY** **AZ** **SH**		
23.3	HIGH LEVEL	No issues identified.							
23.4	LOW FLOW	No issues identified.							
23.5	LOW LEVEL	No issues identified.							
23.6	ZERO FLOW / EMPTY	No issues identified.							
23.7	REVERSE FLOW	No issues identified.							
23.8	HIGH PRESSURE	No issues identified.							
23.9	LOW PRESSURE	No issues identified.							
23.10	HIGH TEMPERATURE	No issues identified.							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
23.11	LOW TEMPERATURE	JT cooling across repressurisation line	Low temp below equipment design		Confirm lowest possible process temperatures are within piping and equipment limits	**2**	**PB**		
23.12	IMPURITIES	No issues identified.							
23.13	CHANGE IN COMPOSITION / CONCENTRATION	No issues identified.							
23.14	TWO PHASE FLOW	No issues identified.							
23.15	REACTIONS	No issues identified.							
23.16	TESTING EQUIPMENT / PRODUCT	No issues identified.							
23.17	PLANT ITEM OPERABILITY				Review blowdown philosophy and if UV-533/UV-532 are to be FC or FO, and required position during LCS blowdown	**1**	**DY**		
23.18	PLANT ITEM MAINTAINABILITY	No issues identified.							
23.19	ELECTRICAL AREA CLASSIFICATION	No issues identified.							
23.20	EARTHING	No issues identified.							
23.21	ISOLATION	No issues identified.							
23.22	INSTRUMENTS TOO MANY	No issues identified.							
23.23	INSTRUMENTS TOO FEW	No issues identified.							
23.24	CORRECT LOCATION OF INSTRUMENTS	No issues identified.							

NODE 23A: LONGFORD: OVERVIEW

DRAWINGS: 510-PI-092, 501-PD-140, PO-510-PI-110, PO-511-DW-PD-001, GAS-511-DW-PD-001, GAS-511-DW-PD-002, GAS-511-DW-PD-003, GAS-511-DW-PD-004, 510-DW-PD-006, 510-DW-PD-101

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
23.1 A	TOXICITY	No new causes.							
23.2 A	SERVICES REQUIRED	No increase in overall plant utility load due to reduction in compressor operation.							
23.3 A	MATERIALS OF CONSTRUCTION				No action				
23.4 A	COMMISSIONING	No issues identified.							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
23.5 A	BREAKDOWN								
23.6 A	STARTUP / SHUTDOWN	Capacity for TGP ~30TJ/day, well below LCS capacity	LCS running at reduced efficiency	Compressor bypass available for operating at reduced capacity.	Confirm LCS operating philosophy for reduced capacity supply to TGP only.	**2**	**DY**		
23.7 A	EFFLUENT	Refer Node 22							
23.8 A	NOISE / VIBRATION			Proposed design includes acoustic enclosure / wall around flow control skid. Details to be confirmed during detailed design. Regulators will be provided with low noise trim. Additional acoustic insulation on piping & valves may be used if required.	No action				
23.9 A	FIRE / EXPLOSION				Update existing vent radiation zone assessment based on new plant capacity	**2**	**SH**		
23.10 A	SAFETY EQUIPMENT	Additional load on station vent	Increase in station blowdown time		Review station blowdown time with new equipment added.	**2**	**DY**		
23.11 A	QUALITY AND CONSISTENCY								
23.12 A	OUTPUT – RELIABILITY AND BOTTLENECKS								
23.13 A	EFFICIENCY	Refer STARTUP / SHUTDOWN							
23.14 A	SIMPLICITY	Many possible configurations and modes at LCS with VicHub2	STTM/nomination logic complexity increase.		STTM/nomination logic and modes/configurations to be reviewed and defined with Jemena EIC team	**2**	**DY**		
23.15 A	MOBILE EQUIPMENT / PLANT MOVEMENT			Site layout provides space for WBH process bundle and burner tube removal.					
23.16 A	PROCESS PLANT NORMAL / ABNORMAL MAINTENANCE			Constructability and accessibility reviews to be completed as part of designed design.					
23.17 A	PROCESS PLANT PROCESS FUNCTIONALITY	New WBH not always required, and may be unused for long periods (~months)	Corrosion risks if WBH is shut down for long periods and allowed to reach ambient temperature		Review standby philosophy for new WBH	**2**	**DY**		
23.18 A	ERGONOMICS			Filter element access will be reviewed as part of layout/model reviews. Control valve access for maintenance to be reviewed as part of layout/model reviews.	New WBH to have stairs instead of ladders to access the top of the WBH.	**2**	**PB**		
23.19 A	GUARDING								
23.20 A	WARNINGS	Flow control skid introduces hazardous area outside of the LCS site access road		Plant hazardous area drawings will be revised as part of detailed design.	No action				
23.21 A	VULNERABILITY								

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
23.22 A	3RD PARTY INTERFERENCE			VicHub2 equipment installed within existing LCS plant boundary.	No action				
23.23 A	NATURAL EVENTS								

Client	**Jemena Ltd**
Client Project No	**GAS-599**
GPA Project No	**20617**
Project Title	**Project Marlin: EGP Reversal**
Facilitator	**Lisa Hein**
Scribe	**Peter Blyton**
Workshop Date	**12/11/2020**
Workshop Location	**Microsoft Teams**
HAZOP Sponsor	**Nathan Biggins** **Matthew Skaras**
HAZOP Stage	**30% FEED Stage 2:** • **Wilton Meter Station (WMS)**

HAZOP Participants:

GPA Engineering

Lisa Hein (LH)	Senior Consultant - Risk and Advisory / Facilitator
Simon Hanlin (SH)	Senior Process Engineer
Peter Blyton (PB)	Senior Mechanical Engineer / Minute Taker
Adrian Zatta (AZ)	Senior EI&C Engineer

Jemena

David Young (DY)	Engineering Manager
Stephen Chow (SC)	Project Engineer
Luke Gigliotti (LG)	Team Leader - Control Room
Steven Bonnici (SB)	Team Leader - EGP
Adam Christian (AC)	Operations - Wilton Meter Station
Mitchell Graham (MG)	Operations - Wilton Meter Station

Background:
Jemena is undertaking Front End Engineering and Design (FEED) to facilitate a total installed cost (TIC) estimate and schedule to reverse flow the Eastern Gas Pipeline (EGP) south of the Kembla Grange Meter Station (KGMS), to allow the supply of gas into the Victorian and New South Wales gas networks.

The following, key pieces of documentation, formed the basis of the HAZOP (additional information was available – see HAZOP report):

- Wilton Meter Station
  - Receiver Station P&ID: 563-DW-PD-001
  - Dry Gas Filters P&ID: 563-DW-PD-002
  - APA Water Bath Heater P&ID: 563-DW-PD-016
  - APA Flow Metering P&ID: 563-DW-PD-017
  - APA Pressure Reduction Skid P&ID: 563-DW-PD-018
  - Heat Exchangers P&ID: 563-DW-PD-003
  - JGN Flow Metering P&ID: 563-DW-PD-008
  - JGN Pressure Reduction Skid P&ID: 563-DW-PD-010
  - Connection to APA P&ID: 563-DW-PD-012
  - APA Pressure Reduction Skid P&ID: 563-DW-PD-015
  - Instrument Air Package P&ID: 563-DW-PD-011
  - Hot Water Heater Fuel Gas Train P&ID: 563-DW-PD-014

The HAZOP specifically dealt with:

- Wilton Meter Station (WMS).

The HAZOP specifically excluded a full formal review of:

- Water Bath Heater 563-HT-001, Vendor Package HAZOP will be completed as part of Detailed Design

The HAZOP was conducted using a series of guide words which were applied to each of the key phases of operation.

NODE 24: WILTON: EGP TO APA WATER BATH HEATER

DRAWINGS: 563-DW-PD-001, 563-DW-PD-002, 563-DW-PD-016 **PLANT & EQUIPMENT:** 563-F-01, 563-F-02 **INSTRUMENTATION:** - **LINE NUMBERS:** 563-G-847-X70-250, 563-G-849-H150-300,563-G-802-C9D-300, 563-G-800-C9D-250, 563-G-846-C9D-250, 563-G-64881-C9D-250, G-64888-C9D-250

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
24.1	HIGH FLOW	Low pressure in WLP leading to high volumetric flow. One filter offline with full flow through a single filter unit	FIV Erosional velocity limits exceeded High DP across filters 563-F-01/02	Filter bypass line available when filter unit is offline Filter High DP alarms (2 stages of alarm) and HH DP trip provided (PDI-64103/64807), HH trip shuts SLV-64800.	Operating procedures to include requirements for filter element change-out and agreeing reductions in flow nomination or use of filter bypass line while a filter unit is offline. Agree minimum pressures into WMS with Jemena Commercial.	**3** **1**	**DY** **DY**		
24.2	HIGH LEVEL	Liquid slug Solids, dust in gas from pipeline Inadequate operation of manual liquid draining of Filter 563-F-01/02	Liquids carry over, leading to off-spec gas High DP across Filters 563-F-01/02	Dry sales gas, with no nearby upstream gas compressors, no history of oil in inlet gas	No action				
24.3	LOW FLOW	Blocked Filter 563-F-01/02	High DP across filter, leading to filter element damage Flow nomination shortfall	Filter High DP alarms and HH DP trip provided (PDI-64103/64807), HH trip shuts SLV-64800.	No action				
24.4	LOW LEVEL	No issues identified.							
24.5	ZERO FLOW / EMPTY	Inadvertent closure of downstream valves	Failure to deliver flow nomination	Flow trend monitoring by Operations Personnel Position feedback and out of position alarm provided on downstream flow control valves on new skids.	No action				
24.6	REVERSE FLOW	Higher pressure in downstream JGN or APA pipelines than WLP	Reverse flow, leading to filter element damage Loss of effective metering	Check valve in each flow control run Flow control valves will close when downstream pressure is higher than upstream pressure	No action				
24.7	HIGH PRESSURE	Inadvertent closure of downstream valves		The pressure rating of the piping system (C9D, 15.32 MPag) and equipment exceeds the upstream pressure source (14.895 MPag).	No action				

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
24.8	LOW PRESSURE	Lower pressure in WLP than design	High gas velocities through the piping and Filter 563-F-01/02 AIV/FIV Wake frequency limits on thermowells and sampling probes	Refer High Flow Operator intervention Low pressure alarm PAL-64802 on WLP	Agree set point and re-set low pressure alarm PAL-64802 Consider low pressure trip on WLP using PIT-64802, and/or alternatives such as velocity calculation using sum of flow through flow meters and inlet pressure	**1** **1**	**SH** **SH**		
24.9	HIGH TEMPERATURE	No issues identified		Mechanical design temperature meets environmental / solar insolation temperature	No action				
24.10	LOW TEMPERATURE	Repressuriation of Filter 563-F-01/02 after maintenance	Piping seeing lower temp than designed for	Filter design temp is 15MPa Min piping design temp is -10degC	Check expected repressuring minimum temperatures Update P&ID to include minimum design temperature for inlet filters 563-F-01/02	**2** **1**	**SH** **SH**		
24.11	IMPURITIES	Sulphur Solids & dust from pipeline Pyrophorics NORMs (normally occurring radioactive material)	Off spec gas Filter blockage, refer LOW FLOW	Filters 563-F-01/02	No action				
24.12	CHANGE IN COMPOSITION / CONCENTRATION	Step change in gas composition during change in gas supply from Longford or Port Kembla LNG import, some mixing will occur between the two gas supplies	Regulators will adjust based on energy flow	Gas Chromatograph to identify change in gas composition, as input to energy flow nominations	No action				
24.13	TWO PHASE FLOW	No issues identified							
24.14	REACTIONS	No issues identified							
24.15	TESTING EQUIPMENT / PRODUCT	No issues identified		Existing CFT on SLV-64800 GC sample point has been relocated to station inlet such that it is common to all runs	No action				
24.16	PLANT ITEM OPERABILITY	Repressurisation line around DB&B on inlet of 563-F-02 relies on a plug valve for second isolation, which is not recommended.	Insufficient isolation integrity for maintenance of 563-F-02.		Modify repressurisation bypass line around DB&B arrangements on inlet of 563-F-02 such that repressurisation connects in between the two DN250 ball valves, and remove vent on repressurisation line making 250-BV-64102 the second block valve for the repressurisation line.	**1**	**PB**		

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
24.17	PLANT ITEM MAINTAINABILITY	Access into filter required for element changeout Consistency of parts and filter elements with similar filter units at other Jemena sites Maintenance overrides required on SLV-64800 and Filter DP transmitters		Quick opening closure provided	QOC and filter elements to have commonality with other filters at Longford and existing filter at WMS Modify functionality of SLV-64800 to provide MOS required for maintenance Modify functionality to DP transmitters (both filters) to provide MOS required for maintenance	**2** **2** **2**	**PB** **PB** **AZ**		
24.18	ELECTRICAL AREA CLASSIFICATION	No issues identified							
24.19	EARTHING	No issues identified							
24.20	ISOLATION	Existing Filter 563-F-01 has single valve isolation only WBH 563-HT-001 has single valve isolation only.			Add DB&B isolation for existing filter 563-F-01 Relocate repressurisation line around 250-BV-641557 to be located around 250-BV-64154.	**1** **1**	**PB** **PB**		
24.21	INSTRUMENTS TOO MANY	Inconsistent instrument makes and models	Additional sparing for instruments		Ensure new instrumentation is consistent with existing instrumentation used on site	**2**	**DY**		
24.22	INSTRUMENTS TOO FEW	NO CAUSES							
24.23	CORRECT LOCATION OF INSTRUMENTS	NO CAUSES							

NODE 25: WILTON: APA WATER BATH HEATER TO APA METERING

DRAWINGS: 563-DW-PD-016, 563-DW-PD-017 **PLANT & EQUIPMENT:** 563-HT-001 **INSTRUMENTATION:** - **LINE NUMBERS:** G-64889-C9D-250, G-64890-C9D-250

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
25.1	HIGH FLOW	TCV-64148 fails closed, resulting in more flow through the WBH, velocities could exceed design under low pressure scenarios	Heater damage / vibration of process bundle	Position transmitter feedback with out of position alarm on TCV-64148 Physical clamp allows manual setting of minimum closure of TCV-64148	Define maximum flow velocity of WBH. Potentially implement trips or high velocity alarms	**2**	**SH**		
25.2	HIGH LEVEL	No issues identified							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
25.3	LOW FLOW	Refer NODE 24	Unstable operation of heater control.	Insulation and heat tracing shown on P&ID is for heat conservation/temperature (start up after shut in overnight)	All new pipework between 563-HT-001 and flow control skid to be heat traced and insulated, piping on skid does not require heat tracing and insulation Determine minimum turndown for each flow control run at the site	**2** **2**	**AZ** **SH**		
25.4	LOW LEVEL	No issues identified		563-HT-001 has low water level alarm, will be reviewed as part of Vendor Package HAZOP	No action				
25.5	ZERO FLOW / EMPTY	No flow through the heater – there will be a bath temp range, it will continue to fire until it reaches the high limit then go into standby mode		There will be a detailed design vendor HAZOP for the heater	No action				
25.6	REVERSE FLOW	Refer NODE 24							
25.7	HIGH PRESSURE	No sources of additional pressure			Add WBH process bundle design pressure & temperature to the P&ID	**2**	**SH**		
25.8	LOW PRESSURE	Refer HIGH FLOW							
25.9	HIGH TEMPERATURE	Loss of heater control TCV-64148 control will be via SCS. If this closed inadvertently all gas would be directed through heater.	Over-temperature of piping/equipment Wasting fuel gas due to overheating over process gas	High temperature control setpoint on WBH, and a HH temperature trip Position discrepancy alarm on TCV	No action				
25.10	LOW TEMPERATURE	Insufficient heating from 563-HT-001 TCV-64148 open more than required position	Bypassing of cold gas around 563-HT-001, leading to low gas temperature downstream of flow control valves	Low temp trip TALL- downstream on flow control skids (refer NODE 26) Position discrepancy alarm on TCV-64148 Low temp on alarm at regulator outlet (refer NODE 26)	No action				
25.11	IMPURITIES	Refer NODE 24							
25.12	CHANGE IN COMPOSITION / CONCENTRATION	Water dosing (biocide) Refer NODE 24		Vendor HAZOP					
25.13	TWO PHASE FLOW	No issues identified							
25.14	REACTIONS	No issues identified							
25.15	TESTING EQUIPMENT / PRODUCT	No issues identified							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
25.16	PLANT ITEM OPERABILITY	Manual butterfly 150-CV[BUV]-64105 at outlet of heater to allow for manual trimming	Not expected to be used or required		Delete manual butterfly valve 150-CV[BUV]-64105 on outlet of 563-HT-001 Document in Operating Philosophy that 250-BV-641557 may be used to stop flow through WBH and bypass flow using TCV to maintain plant operation., This scenario only possible with low inlet pressures in order to meet outlet temperature requirement.	**1** **3**	**SH** **DY**		
25.17	PLANT ITEM MAINTAINABILITY	TCV-64148 maintenance cannot be done without depressurng the heater	New APA run offline / no flow during TCV maintenance	Removable spools provided at connection to WBH process bundle	Replace 25-BV-641559 with DN50 ball and plug valve vent arrangement	**1**	**PB**		
25.18	ELECTRICAL AREA CLASSIFICATION								
25.19	EARTHING								
25.20	ISOLATION	Removal and maintenance of TCV-64148	Single valve isolation provided only, no DB&B available without using isolations further upstream resulting in full station outage	TCV-64148 actuator and instrumentation can be maintained without process isolation	No action				
25.21	INSTRUMENTS TOO MANY								
25.22	INSTRUMENTS TOO FEW	Temperature upstream of 563-HT-001 is not monitored			WBH 563-HT-001 to include temperature instrumentation on both process gas and water Add TIT upstream of 563-HT-001 & 250-BV-64154 (equivalent to TIT-64808 upstream of existing heaters 563-HE-01/02)	**2** **1**	**AZ** **AZ**		
25.23	CORRECT LOCATION OF INSTRUMENTS								

NODE 26: WILTON: APA FLOW METERING TO MOOMBA WILTON MAINLINE HEADER

DRAWINGS: 563-DW-PD-017, 563-DW-PD-018, 563-DW-PD-012, 563-DW-PD-015

PLANT & EQUIPMENT: 563-MR-03, 563-MR-04, 563-RR-03, 563-RR-04

INSTRUMENTATION: -

LINE NUMBERS: 563-G-B11-C9D-250, 563-G-810-C9D-250, 563-G-B14-C9D-250, G-84890-C9D-250, 563-G-815-C9D-250, 563-G-817-PL92-250, 563-G-XXX-PL62-250, 563-G-816-C9D-250, 563-G-818-PL9Z-250, 563-G-819-PL9Z-250, 563-G-839-C9D-250, 563-G-B19-PL92-250, G-64887-PL62-250, 563-G-869-PL6Z-300, 563-G-068-PL6Z-300, 563-G-870-PL6Z-300, 563-G-069-PL6Z-300,

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
26.1	HIGH FLOW	Refer NODE 24 Flow control valves more open than expected	Refer NODE 24 Additional noise, FIV, high filter DP, equipment vibration and damage	Active, monitor and slam shut on flow control skid High velocity alarm FAH-64858 and HH velocity trip FAHH-64858 which closes SLV-64800 on meter runs 563-MR-03/04 SCADA to have adjustable priority system for controlling flow through each run	Determine velocity limits for all piping and equipemnt within the station and reassess HH velocity trip FAHH-64858 functionality and flow control system configuration as part of detailed design	**2**	**SH**		
26.2	HIGH LEVEL	No issues identified							
26.3	LOW FLOW	Refer NODE 25 regarding turndown		Low flow alarm FAL-64858	Refer action – limits of station				
26.4	LOW LEVEL	No issues identified							
26.5	ZERO FLOW / EMPTY	Refer NODE 24/25							
26.6	REVERSE FLOW	Refer ISOLATION							
26.7	HIGH PRESSURE	Refer NODE 24/25 Fail open of flow control valves Blocked discharge, pressure bleeds past flow control valves	Overpressure of downstream piping system, lower pressure rating (CL600) than upstream system (CL900)	Control valves (active and monitor) close on high pressure Slam shut valve SSV-64864/64865 closes on high pressure Piping spec break downstream of flow control skid outlet isolation valves SIL assessment completed for this system, existing skid relocated from JGN	SIL assessment to be recompleted, as frequency of blocked discharge increased due to issues with flow nominations	**2**	**DY**		
26.8	LOW PRESSURE	Refer NODE 24 HIGH FLOW			Refer common action for min inlet press.				
26.9	HIGH TEMPERATURE	Refer NODE 25		TAH and TAHH	No action				

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
26.10	LOW TEMPERATURE	Refer NODE 25 APA flow control runs 563-RR-03/04 have a common outlet temperature monitoring instrument	Unable to monitor separate temperature on outlet of 563-RR-03/04	TAL and TALL Low temperature is input to low flow selector	Confirm the temperature control loop required when operating the various flow control runs in parallel	**2**	**DY**		
26.11	IMPURITIES	No issues identified							
26.12	CHANGE IN COMPOSITION / CONCENTRATION	No issues identified							
26.13	TWO PHASE FLOW	No issues identified							
26.14	REACTIONS	No issues identified							
26.15	TESTING EQUIPMENT / PRODUCT	563-MR-03/04 flow meter capacity exceeded when in series configuration	Loss of effective metering	563-MR-03/04 can be configured in parallel Series configuration required for meter validation	Include maintenance overrides (MOS) for all equipment and instrumentation	**2**	**AZ**		
26.16	PLANT ITEM OPERABILITY	No new issues							
26.17	PLANT ITEM MAINTAINABILITY								
26.18	ELECTRICAL AREA CLASSIFICATION								
26.19	EARTHING								
26.20	ISOLATION			Z-crossover line between meter runs includes check valve 250-CV-64989 to prevent flow bypassing the meters during series configuration Locked valves used to ensure metering skid remains in desired configuration	Add 2x ball valves shown on outlet of new APA flow control skid (on PFD) to P&ID Isolation valves to be located at each end of the new loop line to APA TIP Add additional valve to the existing connection to APA MLV Add additional ball valve to the crossover connection between RR-01/02 and RR-03/04	**1** **1** **1** **1**	**PB** **SH** **PB** **PB**		
26.21	INSTRUMENTS TOO MANY	No causes							
26.22	INSTRUMENTS TOO FEW	No causes							
26.23	CORRECT LOCATION OF INSTRUMENTS	No causes							

NODE 27: WILTON: DRY GAS FILTERS TO JGN METERING VIA HEX (EXISTING EQUIPMENT, INCREASED FLOW AND CHANGED COMPOSITION)

DRAWINGS: 563-DW-PD-002, 563-DW-PD-003 **PLANT & EQUIPMENT:** 563-HE-01, 563-HE-02 **INSTRUMENTATION:** - **LINE NUMBERS:** 563-G-803-C9D-250, 563-G-804-C9D-250, 563-G-805-C9D-250, 563-G-806-C9D-250, 563-G-807-C9D-250, 563-G-808-C9D-250

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
27.1	HIGH FLOW	Refer NODE 24/25 – lower inlet pressure	Vibration of heat exchanger tubes, leading to equipment damage		No new actions Refer Item 26.1 action regarding velocity limits in station				
27.2	HIGH LEVEL	No issues identified							
27.3	LOW FLOW	Refer NODE – turndown							
27.4	LOW LEVEL	No issues identified							
27.5	ZERO FLOW / EMPTY	No issues identified							
27.6	REVERSE FLOW	Refer NODE – CVs in control runs							
27.7	HIGH PRESSURE	No change to existing							
27.8	LOW PRESSURE	No change to existing							
27.9	HIGH TEMPERATURE	No change to existing							
27.10	LOW TEMPERATURE	Refer NODE 26 – downstream temp control/monitoring No change to existing							
27.11	IMPURITIES	No change to existing							
27.12	CHANGE IN COMPOSITION / CONCENTRATION	No change to existing							
27.13	TWO PHASE FLOW	No change to existing							
27.14	REACTIONS	No change to existing							
27.15	TESTING EQUIPMENT / PRODUCT	GC sample point has been relocated from downstream of HXs to station inlet such that it is common to all runs	Lower sampled gas temperatures may exceed capacity of sampling system heater.		Review and ensure suitable heating of gas sampled for GC	**2**	**SH**		
27.16	PLANT ITEM OPERABILITY	Capacity of both heaters 563-HE-01/02 required to meet highest duty	No redundancy of heating units when running at highest duty / transient cases Flow will be limited if one heating unit is offline	Both heaters 563-HE-01/02 currently run in parallel	Document in the Operating Philosophy for reduction in inlet pressure or capacity curtailment / reduction in flow nomination if one heater unit 563-HE-01/02 is offline	**3**	**DY**		
27.17	PLANT ITEM MAINTAINABILITY	No change to existing							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
27.18	ELECTRICAL AREA CLASSIFICATION	No change to existing							
27.19	EARTHING	No change to existing							
27.20	ISOLATION	No causes							
27.21	INSTRUMENTS TOO MANY	No causes							
27.22	INSTRUMENTS TOO FEW	Refer HIGH PRESSURE	No ability to measure pressure upstream of 563-HE-01/02		Change PI-64980/64981 to a PIT Change PI-64814 to a PIT Add a virtual DP across heaters 563-HE-01/02	**1** **1** **1**	**AZ** **AZ** **AZ**		
27.23	CORRECT LOCATION OF INSTRUMENTS	No causes							

NODE 28: WILTON: JGN METERING SKID

DRAWINGS: 563-DW-PD-008 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-64882-C9D-250, G-64883-C9D-250

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
28.1	HIGH FLOW	Refer Node 24 Loss of control of flow control valves Both flow control runs open simultaneously	Flow induced vibration in piping and thermowells, leading to equipment damage	2x100% metering and flow control skids Thermowell wake frequency calculations as part of detailed design High velocity alarm on FI-64105/64107	Consider duplicating HH velocity trip logic used on existing metering runs at WMS	**1**	**DY**		
28.2	HIGH LEVEL	No issues identified							
28.3	LOW FLOW	Refer Node 24 Larger flow meters than existing JGN meters	Inadequate flow turndown, loss of effective metering		No action Ref Item 25.3 action regarding turndown				
28.4	LOW LEVEL	No issues identified							
28.5	ZERO FLOW / EMPTY	Refer Node 24							
28.6	REVERSE FLOW	Refer Node 24							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
28.7	HIGH PRESSURE	Blocked discharge, pressure bleeds past flow control valves Slam shut valves require control segregation from SCS	High pressure downstream of flow control valves	Control valves close on high pressure. Slam shut closes PSVs downstream of flow control valves Piping spec break downstream of flow control skid outlet isolation valves. SIL assessment planned to be completed for this system.	Set slam shut trip to the pressure rating of the downstream system. Change slam shut valve to be pneumatically operated using slam shut panel to match other slam shut valves at WMS	**1** **1**	**SH** **SH**		
28.8	LOW PRESSURE	No issues identified							
28.9	HIGH TEMPERATURE	Refer Node 24							
28.10	LOW TEMPERATURE	Refer Node 24 JT cooling over control valves Insufficient heating from heaters 563-HE-01/02 Cold locked in gas on startup	Temp below gas spec Temp below material design rating	Downstream temp trip Heat recovery in downstream piping Heat tracing and lagging	Add new TIT to SCS downstream of both flow control valves Convert TIT-64147 into low temperature trip Consider heat tracing and insulation limits to be from outlet of heaters 563-HE-01/02 and upstream of flow control runs on straight run piping and excluding meter and flow control skids, or consider startup override for heaters 563-HE-01/02	**1** **1** **2**	**SH** **SH** **DY**		
28.11	IMPURITIES	No new issues							
28.12	CHANGE IN COMPOSITION / CONCENTRATION	No new issues							
28.13	TWO PHASE FLOW	No new issues							
28.14	REACTIONS	No new issues							
28.15	TESTING EQUIPMENT / PRODUCT			Statutory PM checks on PSVs, CFTs	Confirm requirement for DN20 vents downstream of flow control valves	**1**	**DY**		
28.16	PLANT ITEM OPERABILITY	Isolation of flow control skid from downstream pipeline, single valve isolation provided			Confirm isolation philosophy for flow control skid and flow control runs, determine if single valve isolation or DB&B required. Add isolation valve at TIP-510-04, with bleed upstream to provide DB&B (if required, ref action above).	**1** **1**	**DY** **PB**		
28.17	PLANT ITEM MAINTAINABILITY	Removal of PSV-64135/64148 for maintenance / testing	No bleed between PSV-64135/64148 and isolation valve below		Add bleed ring / test & tap valve below PSV-64135/64148 Add vent adjacent to TW-64147	**1** **1**	**PB** **PB**		

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
28.18	ELECTRICAL AREA CLASSIFICATION	No new causes							
28.19	EARTHING	No new causes							
28.20	ISOLATION	Pressurisation line double block and bleed design inadequate as it relies on a plug valve.	Insufficient isolation of regulator run.		Add re-pressurisation line around 400-BV-64127/64138 to connect in upstream of the slam shut valve. Repressurisation line to be two DN50 ball valves, with RO if required All small bore vents (DN20/DN25) to be provided with a needle valve for throttling and bleed plug	**1** **1**	**PB** **PB**		
28.21	INSTRUMENTS TOO MANY	No new causes							
28.22	INSTRUMENTS TOO FEW	No new causes							
28.23	CORRECT LOCATION OF INSTRUMENTS	No new causes							

NODE 29: WILTON: JGN FLOW CONTROL SKID

DRAWINGS: 563-DW-PD-008, 563-DW-PD-010 **PLANT & EQUIPMENT:** 563-RR-06 **INSTRUMENTATION:** - **LINE NUMBERS:** 563-G-815-C9D-250, G-64884-C9D-400, G-64885-C9D-400, 563-G-820-PL6Z-250, G-64886-PL6Z-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
29.1	HIGH FLOW	Refer NODE 28							
29.2	HIGH LEVEL								
29.3	LOW FLOW								
29.4	LOW LEVEL								
29.5	ZERO FLOW / EMPTY								
29.6	REVERSE FLOW								
29.7	HIGH PRESSURE								
29.8	LOW PRESSURE								
29.9	HIGH TEMPERATURE								
29.10	LOW TEMPERATURE								
29.11	IMPURITIES								

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
29.12	CHANGE IN COMPOSITION / CONCENTRATION								
29.13	TWO PHASE FLOW								
29.14	REACTIONS								
29.15	TESTING EQUIPMENT / PRODUCT								
29.16	PLANT ITEM OPERABILITY								
29.17	PLANT ITEM MAINTAINABILITY								
29.18	ELECTRICAL AREA CLASSIFICATION								
29.19	EARTHING								
29.20	ISOLATION								
29.21	INSTRUMENTS TOO MANY								
29.22	INSTRUMENTS TOO FEW								
29.23	CORRECT LOCATION OF INSTRUMENTS								

NODE 30: WILTON: INSTRUMENT AIR/GAS

DRAWINGS: 563-DW-PD-003, 563-DW-PD-010, 563-DW-PD-011 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** -

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
30.1	HIGH FLOW	Excessive demand / load for IA from instruments	Low pressure in distribution header	Existing IA receiver 563-V-01	No actions				
30.2	HIGH LEVEL	No issued identified							
30.3	LOW FLOW	No issued identified							
30.4	LOW LEVEL	No issued identified							
30.5	ZERO FLOW / EMPTY	Failure of the IA system	Station shutdown	Two redundant air compressor skids Backup IG supply	No actions				

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
30.6	REVERSE FLOW	Reverse flow of IG into IA system	Flammable mix of air and gas, potential fire / explosion	Check valves and 3-way solenoids on Air/Gas Panel to prevent backflow of air/gas into each supply	Per 30.12				
30.7	HIGH PRESSURE	Failure of IG regulator PCV-64889A	Overpressure of downstream equipment	PSV-64888A					
30.8	LOW PRESSURE								
30.9	HIGH TEMPERATURE								
30.10	LOW TEMPERATURE	Large pressure cut across IG regulator PCV-64889A	Low temperature downstream of PCV, below design temperature of actuators	Low flow demand, length of tubing will allow ambient heat recovery IG offtake is downstream of heaters	No actions				
30.11	IMPURITIES			Routine maintenance of IA system	No actions				
30.12	CHANGE IN COMPOSITION / CONCENTRATION	IA with backup IG, failure of IA will introduce a flammable mix of air and gas	Potential fire / explosion	HA rated equipment, no ignition sources present Check valves on Air/Gas Panel to prevent backflow of air/gas into each supply	Review appropriateness of using IG supply as a backup for IA system	**2**	**DY**		
30.13	TWO PHASE FLOW	Refer IMPURITIES							
30.14	REACTIONS	Refer 30.12							
30.15	TESTING EQUIPMENT / PRODUCT	No issues identified							
30.16	PLANT ITEM OPERABILITY	No issues identified							
30.17	PLANT ITEM MAINTAINABILITY	No issues identified		Each SDV/PCV can be individually isolated from the Air/Gas Panel	No actions				
30.18	ELECTRICAL AREA CLASSIFICATION	No issues identified							
30.19	EARTHING	No issues identified							
30.20	ISOLATION	No issues identified							
30.21	INSTRUMENTS TOO MANY	No issues identified							
30.22	INSTRUMENTS TOO FEW	No issues identified							
30.23	CORRECT LOCATION OF INSTRUMENTS	No issues identified							

NODE 31: WILTON FUEL GAS SUPPLY TO APA WATER BATH HEATER

DRAWINGS: 563-DW-PD-014, 563-DW-PD-016 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** FG-XXX-C1D-50

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
31.1	HIGH FLOW			HAZOP for WBH package will be completed during detailed design	No actions				
31.2	HIGH LEVEL								
31.3	LOW FLOW								
31.4	LOW LEVEL								
31.5	ZERO FLOW / EMPTY								
31.6	REVERSE FLOW								
31.7	HIGH PRESSURE								
31.8	LOW PRESSURE								
31.9	HIGH TEMPERATURE								
31.10	LOW TEMPERATURE								
31.11	IMPURITIES								
31.12	CHANGE IN COMPOSITION / CONCENTRATION								
31.13	TWO PHASE FLOW								
31.14	REACTIONS								
31.15	TESTING EQUIPMENT / PRODUCT								
31.16	PLANT ITEM OPERABILITY	Fuel gas supply take-off downstream of custody transfer flowmeters	WBH fuel gas will require custody transfer metering		Fuel gas supply take-off to be relocated upstream of custody transfer meters	**1**	**SH**		
31.17	PLANT ITEM MAINTAINABILITY								
31.18	ELECTRICAL AREA CLASSIFICATION								
31.19	EARTHING								
31.20	ISOLATION				Include DB&B isolation for fuel gas offtake	**1**	**PB**		
31.21	INSTRUMENTS TOO MANY								
31.22	INSTRUMENTS TOO FEW				Include fuel gas flowmeter and fuel gas regulation as part of WBH package	**2**	**SH**		

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
31.23	CORRECT LOCATION OF INSTRUMENTS	No new causes							

NODE 32: WILTON: OVERVIEW

DRAWINGS: 563-DW-PD-002, 563-DW-PD-003, 563-DW-PD-008, 563-DW-PD-010, 563-DW-PD-011, 563-DW-PD-014, 563-DW-PD-015, 563-DW-PD-016, 563-DW-PD-017, 563-DW-PD-018

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
32.1	TOXICITY	No new causes							
32.2	SERVICES REQUIRED	Additional power demand for WBH forced draft fans Additional water required for WBH U/G services in location proposed for the new WBH & skids Existing open drain to the south of the existing site access road Additional plant equipment outside existing lighting zones	Inadequate capacity of existing site power supply Inadequate plant lighting		Review size of 3PH power supply and DC power supplies for additional demand Review capacity of existing IA system for additional demand Review location of existing open drain and U/G services (stormwater, comms & power) relative to proposed location for new WBH & skids Review additional plant lighting requirements Review additional and/or change to existing station security system	**1** **1** **1** **2** **1**	**AZ** **SH** **PB** **AZ** **PB**		
32.3	MATERIALS OF CONSTRUCTION	No issues identified							
32.4	COMMISSIONING	First fill of WBH requires testing of town water supply to ensure suitable			No action				
32.5	BREAKDOWN	No issues identified							
32.6	STARTUP / SHUTDOWN	No issues identified							
32.7	EFFLUENT	Emergency or accidental release of water from WBH	Loss of containment of contaminated water	Truck load-out point provided on WBH for emptying	Review biocide/dosing chemicals used in WBH to ensure WBH does not require bunding	**2**	**DY**		

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
32.8	NOISE / VIBRATION	Increased station capacity	Possible additional noise impacting on nearby sensitive receptors	New flow control valves specified with low noise trims New JGN metering and flow control skids are larger size with lower velocities and likely lower noise level	No actions				
32.9	FIRE / EXPLOSION	Proximity of new plant equipment (WBH & Metering Skid) to private land to the south of the station Proximity to existing APA ethane flare	Encroachment of private/public on exclusion zones or hazardous area zones	Station clearances will be designed per AS2885 requirements Station hazardous area zones will be within fence boundary	No actions				
32.10	SAFETY EQUIPMENT	No issues identified		Fire protection system and LV rescue equipment provided as part of any new LV switchroom Fire extinguishers and other safety equipment will be reviewed as part of layout and 3D model reviews	No actions				
32.11	QUALITY AND CONSISTENCY	No issues identified							
32.12	OUTPUT – RELIABILITY AND BOTTLENECKS	No new issues							
32.13	EFFICIENCY	No new issues							
32.14	SIMPLICITY	Additional multiple runs and hence operating configurations available			Document in the Operating & Maintenance Philosophy the various capacity limits and redundancy associated with each run under the various operating and maintenance conditions	**3**	**DY**		
32.15	MOBILE EQUIPMENT / PLANT MOVEMENT	New WBH & skids change the existing site access routes	New site access routes required	Site access routes will be reviewed as part of layout review workshops	No actions				
32.16	PROCESS PLANT NORMAL / ABNORMAL MAINTENANCE			WBH clearance zones included on layout	No actions				
32.17	PROCESS PLANT PROCESS FUNCTIONALITY								
32.18	ERGONOMICS			Will be reviewed as part of layout review workshops	No actions				
32.19	GUARDING			Requirement for bollards will be reviewed as part of layout review workshops Vehicle access routes will be outside of HA zones	No actions				
32.20	WARNINGS								

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
32.21	VULNERABILITY	Change in noise characteristics due to change in capacity and operation of the station	Impact on other nearby sensitive receptors	Jemena Lands Department responsible for liaison with nearby residents and sensitive receptors / stakeholder engagement	No actions				
32.22	3RD PARTY INTERFERENCE	Refer FIRE / EXPLOSION Plant noise and lighting	Impact on other nearby sensitive receptors						
32.23	NATURAL EVENTS	Grass fire		Flooding not an issue for this area Station hardstand within fence boundary is hardstand, no grassed surfaces	No actions				

GPA	**HAZOP MINUTES**	**20617-REP-018**
	Project Marlin: EGP Reversal	**SHEET 1 of 19**

Client	**Jemena Ltd**
Client Project No	**GAS-599**
GPA Project No	**20617**
Project Title	**Project Marlin: EGP Reversal**
Facilitator	**Lisa Hein**
Scribe	**Peter Blyton**
Workshop Date	**12/11/2020**
Workshop Location	**Microsoft Teams**
HAZOP Sponsor	**Nathan Biggins** **Matthew Skaras**
HAZOP Stage	**30% FEED Stage 2:** • **Michelago Compressor Station (MOCS)** • **Mila Compressor Station (MCS)**

HAZOP Participants:

GPA Engineering

Lisa Hein (LH)	Senior Consultant - Risk and Advisory / Facilitator
Simon Hanlin (SH)	Senior Process Engineer
Peter Blyton (PB)	Senior Mechanical Engineer / Minute Taker
Adrian Zatta (AZ)	Senior EI&C Engineer

Jemena

David Young (DY)	Engineering Manager
Stephen Chow (SC)	Project Engineer
Luke Gigliotti (LG)	Team Leader - Control Room
Richard Lamin (RL)	Pipeline Operator Technician
Mick Arneill (MA)	Manager - Gas Transmission South
Matthew Evans (ME)	Operations
Jon Valsamis (JV)	Systems Controller

Background:
Jemena is undertaking Front End Engineering and Design (FEED) to facilitate a total installed cost (TIC) estimate and schedule to reverse flow the Eastern Gas Pipeline (EGP) south of the Kembla Grange Meter Station (KGMS), to allow the supply of gas into the Victorian and New South Wales gas networks.

The following, key pieces of documentation, formed the basis of the HAZOP (additional information was available – see HAZOP report):

- Michelago Compressor Station
  - Station Isolation Valves P&ID: 530-DW-PD-001
  - Mainline Valve P&ID: 530-DW-PD-018
  - Flow Switching Valves P&ID: GAS-530-DW-PD-020
- Mila Scraper Station & MLV
  - Intermediate Scraper Station P&ID: 525-PI-001
- Mila Compressor Station
  - Flow Switching Valves P&ID: GAS-525-DW-PD-039
  - Station Isolation Valves P&ID: GTS-525-DW-PD-022

The HAZOP specifically dealt with:

- Michelago Compressor Station (MOCS)
- Mila Compressor Station (MCS), Scraper Station and MLV

The HAZOP specifically excluded a full formal review of:

- Compressor units at each compressor station
- EGP mainline pipeline

The HAZOP was conducted using a series of guide words which were applied to each of the key phases of operation.

NODE 6: MICHELAGO REVERSE FLOW: EGP TO COMPRESSOR SUCTION

DRAWINGS: 530-DW-PD-001, 530-DW-PD-018, GAS-530-DW-PD-020

PLANT & EQUIPMENT: -

INSTRUMENTATION: -

LINE NUMBERS: G-64907-C9D-400, G-64904-C9D-400, G-020-CE15X-400, G-904-C9D-400, G-905-C9D-400, G-XXX-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
6.1	HIGH FLOW	Large differential pressure across switching valves, opening of SDV-64104 Higher pressure on suction than discharge	Damage to SDVs High flow leading to FIV (flow induced vibration), equipment damage Forward flow of gas through the compressor when the discharge valve opens, resulting in compressor driving the turbine.	Equalisation line and UV-64109 to be used reduce differential pressure across SDVs / station prior to mode change. Operating procedures.	Add DP interlocks across all flow switching valves, DP permissive to be set at 500 kPa. DP interlock to be between PIT-64107 & PIT-64103, with DP in either direction. Ensure valve sequencing (MLV-1 and flow switching valves) is such that compressor suction pressure does not end up higher than compressor discharge.	**1** **2**	**AZ** **AZ**		
6.2	HIGH LEVEL	No issues identified							
6.3	LOW FLOW	Low demand	Waste of fuel gas	Compressor recycle	No Actions				
6.4	LOW LEVEL	No issues identified							
6.5	ZERO FLOW / EMPTY	Compressor not running, MLV-1 closed. Switching valves out of position	Build-up of high DP across the station, unable to equalise pressure across the station. Inability to start compressor	Equalisation line and UV-64109 to be used to reduce differential pressure across SDVs / station. Operating procedures. Switching valve position interlocks.	Develop the sizing cases for equalisation line with Jemena Commercial.	**1**	**DY**		
6.6	REVERSE FLOW	DP across unit suction valve SDV-64001, higher pressure downstream	Immediate opening of SDV-64001 as PDIT-64004 would not detect a forward DP	Anti-surge & recycle line check valves, compressor can't be spun in reverse direction	Re-range PDIT-64004 such that it can detect both forward and reverse DP across SDV-64001 Review reverse equalisation across loading line and SDV-64002, JT cooling in opposite direction than loading line was designed with downstream stainless steel section	**2** **2**	**AZ** **SH**		
6.7	HIGH PRESSURE	No issues identified		MAOP of system 14.895 MPag, all piping rated for this MAOP	No Actions				
6.8	LOW PRESSURE	Low pressure in EGP during import of LNG at lower pressure (~11 MPag)	Compressor suction pressure below minimum for compressor unit	Compressor suction pressure alarm and trip	Review compressor suction low pressure trips to ensure they are suitable	**2**	**DY**		
6.9	HIGH TEMPERATURE	No issues identified							
6.10	LOW TEMPERATURE	No issues identified							
6.11	IMPURITIES	No issues identified							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
6.12	CHANGE IN COMPOSITION / CONCENTRATION	Change in composition with new gas supplies (LNG import)	Fixed composition parameters used in compressor surge control and FG system incorrect when gas composition changes		Review range of compositions and select worst case composition to calculate fixed parameters in compressor surge controller and FG system	**2**	**SH**		
6.13	TWO PHASE FLOW	No issues identified		Compressor suction scrubber, no history of liquids under current operation	No Actions				
6.14	REACTIONS	No issues identified							
6.15	TESTING EQUIPMENT / PRODUCT	No issues identified							
6.16	PLANT ITEM OPERABILITY	New equipment causing obstruction to vehicle and crane access	Inadequate crane and vehicle access for maintenance		Consider alternative piping & equipment layouts routed further due west with access from the due east direction.	**2**	**PB**		
6.17	PLANT ITEM MAINTAINABILITY	Refer OPERABILITY							
6.18	ELECTRICAL AREA CLASSIFICATION								
6.19	EARTHING				Review requirement for relocation of light pole, earthing and electrical supply.	**2**	**AZ**		
6.20	ISOLATION	Isolation and venting of new switching valve piping Station / compressor unit ESD blows down existing piping to vent	Requirement for venting Switching valve piping is upstream of compressor unit SDVs so remains pressurised on Station ESD		Provide manual vents on switching valve piping. Review isolation, depressurisation and pressurisation of the new switching valve piping to determine requirement for repressurisation lines around switching valves, vents etc. Review existing Station ESD and if new switching valve piping is required to vent/blowdown on Station ESD, and document as part of Isolation and Blowdown Philosphy Configure flow switching valves to close on EGP mainline ESD	**1** **1** **1** **2**	**PB** **SH** **DY** **SH**		
6.21	INSTRUMENTS TOO MANY	No causes							
6.22	INSTRUMENTS TOO FEW				Jemena Ops to provide feedback on where Pressure Gauges to be added	**2**	**Jemena**		
6.23	CORRECT LOCATION OF INSTRUMENTS	No causes							

NODE 7: MICHELAGO REVERSE FLOW: COMPRESSOR DISCHARGE TO EGP

DRAWINGS: 530-DW-PD-001, 530-DW-PD-018, GAS-530-DW-PD-020

PLANT & EQUIPMENT: -

INSTRUMENTATION: -

LINE NUMBERS: G-901-C9D-400, NG-01-XX-450, G-001-CE15X-400, G-64906-C9D-400, G-906-C9D-400, G-903-C9D-400, G-901-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
7.1	HIGH FLOW	Refer NODE 6 Low pressure in system during import of LNG at lower pressure (~11 MPag)	Higher volumetric flow and velocities, leading to flow induced vibration and equipment damage		Review velocity limits within existing system to ensure these are not exceeded	**2**	**DY**		
7.2	HIGH LEVEL	No issues identified							
7.3	LOW FLOW	Refer NODE 6							
7.4	LOW LEVEL	No issues identified							
7.5	ZERO FLOW / EMPTY	Refer NODE 6 Compressor not running, MLV-1 closed	Trapped gas and differential pressure across switching valves		Configure flow switching valves to prevent trapped pressure when compressor not running Consider configuring pipeline north and south free flow modes in lieu of a single bi-directional free-flow mode Configure MLV-1 to operate as a “virtual check-valve” to replace the functionality of the check valve which was removed. MLV-1 to open automatically once DP across the station is low enough for change to free-flow mode to avoid trapping pressure in the Station	**2** **2** **2**	**SH** **SH** **PB**		
7.6	REVERSE FLOW	Refer NODE 6 Reverse flow when transitioning between modes and compressor package starting up. Compressor trip		Check valves within compressor station	No actions				
7.7	HIGH PRESSURE	Gas flow down from 850m elevation to sea level, increases in pressure as it goes forward/southern flow	Exceedance of MAOP at lower sea levels	MAOP of system 14.895 MPag, all piping rated for this MAOP	Add high pressure trip to southern side of MLV set to ensure pressure at sea level does not exceed pipeline MAOP due to gravity head when flowing south. Trip to ESD compressor station.	**1**	**SH**		
7.8	LOW PRESSURE	Refer HIGH FLOW							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
7.9	HIGH TEMPERATURE	Heat of compression	High compressor discharge temperature	Compressor coolers	Review design temperatures of suction and discharge lines, and connection to the EGP for new Southern flow operating scenario. Query Jemena Commercial if TIT-4 requires duplication on the other side of MLV-1A, for purposes of pipeline linepack calculations	**2** **2**	**SH** **DY**		
7.10	LOW TEMPERATURE	Low atmospheric temperature		Piping and equipment designed for -10 deg C	No action				
7.11	IMPURITIES	No issues identified							
7.12	CHANGE IN COMPOSITION / CONCENTRATION	Refer NODE 6							
7.13	TWO PHASE FLOW	No issues identified							
7.14	REACTIONS	No issues identified							
7.15	TESTING EQUIPMENT / PRODUCT	No issues identified							
7.16	PLANT ITEM OPERABILITY	Refer NODE 6							
7.17	PLANT ITEM MAINTAINABILITY	Refer NODE 6			Consider alternative switching valve piping layout with new equipment located due west of the slope up to the A/G MLV-1	**2**	**PB**		
7.18	ELECTRICAL AREA CLASSIFICATION	No issues identified							
7.19	EARTHING	No issues identified							
7.20	ISOLATION	Refer NODE 6							
7.21	INSTRUMENTS TOO MANY	No issues identified							
7.22	INSTRUMENTS TOO FEW	Refer HIGH TEMPERATURE							
7.23	CORRECT LOCATION OF INSTRUMENTS	Refer HIGH TEMPERATURE							

NODE 8: MICHELAGO REVERSE FLOW WITH NO COMPRESSION

DRAWINGS: 530-DW-PD-018 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-029-CE15X-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
8.1	HIGH FLOW	Opening of MLV-1 with high DP	Flow induced vibration, leading to equipment damage		Refer previous action – DP interlocks				
8.2	HIGH LEVEL	No issues identified							
8.3	LOW FLOW	No issues identified							
8.4	LOW LEVEL	No issues identified							
8.5	ZERO FLOW / EMPTY	Compressor not running, MLV-1 closed	No flow in line, build-up of DP		Refer previous action – MLV-1 configuration as a "virtual check valve" Add differential pressure transmitter such that MLV-1 does not open until DP in either direction is very low	**1**	**AZ**		
8.6	REVERSE FLOW	Refer ZERO FLOW MLV-1 left open on compressor start MLV-1 passes and cannot hold discharge pressure across station	Station bypass		MLV-1 to be configured to close as part of compressor start sequence	**2**	**AZ**		
8.7	HIGH PRESSURE			MAOP of system 14.895 MPag, all piping rated for this MAOP	No action				
8.8	LOW PRESSURE	No issues identified							
8.9	HIGH TEMPERATURE	No issues identified							
8.10	LOW TEMPERATURE	No issues identified							
8.11	IMPURITIES	No issues identified							
8.12	CHANGE IN COMPOSITION / CONCENTRATION	No issues identified							
8.13	TWO PHASE FLOW	No issues identified							
8.14	REACTIONS	No issues identified							
8.15	TESTING EQUIPMENT / PRODUCT	No issues identified							
8.16	PLANT ITEM OPERABILITY	Refer NODE 6 & 7							
8.17	PLANT ITEM MAINTAINABILITY	Refer NODE 6 & 7							
8.18	ELECTRICAL AREA CLASSIFICATION	No issues identified							
8.19	EARTHING	No issues identified							
8.20	ISOLATION	Refer NODE 6 & 7							
8.21	INSTRUMENTS TOO MANY	No issues identified							
8.22	INSTRUMENTS TOO FEW				Confirm that MLV-1 is controlled by SCP	**2**	**DY**		

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
8.23	CORRECT LOCATION OF INSTRUMENTS	No issues identified							

NODE 9: MICHELAGO FORWARD FLOW: EGP TO COMPRESSOR SUCTION

DRAWINGS: 530-DW-PD-001, 530-DW-PD-018, GAS-530-DW-PD-020 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-64907-C9D-400, NG-01-XX-450, G-001-CE15X-400, G-64906-C9D-400, G-906-C9D-400, G-907-C9D-400, G-XXX-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
9.1	HIGH FLOW	Refer NODE 6							
9.2	HIGH LEVEL	No issues identified							
9.3	LOW FLOW	No issues identified							
9.4	LOW LEVEL	No issues identified							
9.5	ZERO FLOW / EMPTY	Refer NODE 6 & 7							
9.6	REVERSE FLOW	Refer NODE 8							**Virtual DP logic on MLV-1 to operate in both directions (north or south flow of EGP)**
9.7	HIGH PRESSURE	Refer NODE 6							
9.8	LOW PRESSURE	No issues identified							
9.9	HIGH TEMPERATURE	No issues identified							
9.10	LOW TEMPERATURE	Refer NODE 6							
9.11	IMPURITIES	No issues identified							
9.12	CHANGE IN COMPOSITION / CONCENTRATION	No issues identified							
9.13	TWO PHASE FLOW	No issues identified							
9.14	REACTIONS	No issues identified							
9.15	TESTING EQUIPMENT / PRODUCT	No issues identified							
9.16	PLANT ITEM OPERABILITY	No issues identified							
9.17	PLANT ITEM MAINTAINABILITY	No issues identified							
9.18	ELECTRICAL AREA CLASSIFICATION	No issues identified							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
9.19	EARTHING	No issues identified							
9.20	ISOLATION	Refer NODE 6-8							
9.21	INSTRUMENTS TOO MANY	No issues identified							
9.22	INSTRUMENTS TOO FEW	No issues identified							
9.23	CORRECT LOCATION OF INSTRUMENTS	No issues identified							

NODE 10: MICHELAGO FORWARD FLOW: COMPRESSOR DISCHARGE TO EGP

DRAWINGS: 530-DW-PD-001, 530-DW-PD-018, GAS-530-DW-PD-020

PLANT & EQUIPMENT: -

INSTRUMENTATION: -

LINE NUMBERS: G-901-C9D-400, G-64904-C9D-400, G-020-CE15X-400, G-904-C9D-400, G-901-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
10.1	HIGH FLOW	All issues captured in NODE 7							
10.2	HIGH LEVEL								
10.3	LOW FLOW								
10.4	LOW LEVEL								
10.5	ZERO FLOW / EMPTY								
10.6	REVERSE FLOW								
10.7	HIGH PRESSURE								
10.8	LOW PRESSURE								
10.9	HIGH TEMPERATURE								
10.10	LOW TEMPERATURE								
10.11	IMPURITIES								
10.12	CHANGE IN COMPOSITION / CONCENTRATION								
10.13	TWO PHASE FLOW								
10.14	REACTIONS								
10.15	TESTING EQUIPMENT / PRODUCT								
10.16	PLANT ITEM OPERABILITY								

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
10.17	PLANT ITEM MAINTAINABILITY								
10.18	ELECTRICAL AREA CLASSIFICATION								
10.19	EARTHING								
10.20	ISOLATION								
10.21	INSTRUMENTS TOO MANY								
10.22	INSTRUMENTS TOO FEW								
10.23	CORRECT LOCATION OF INSTRUMENTS								

NODE 10A: MICHELAGO MLV ACTUATED PRESSURISATION BYPASS

DRAWINGS: GAS-530-DW-PD-020 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-XXX-C9D-150

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
10.1	HIGH FLOW	Opening of UV-64109 under high DP	High velocities, flow induced vibration, leading to equipment damage		Refer Item 6.5 and 10.10. Pressurisation valve to be sized to limit velocities to within acceptable limits.	**2**	**SH**		
10.2	HIGH LEVEL	No issues identified							
10.3	LOW FLOW	No issues identified							
10.4	LOW LEVEL	No issues identified							
10.5	ZERO FLOW / EMPTY	No issues identified							
10.6	REVERSE FLOW	Refer LOW TEMPERATURE							
10.7	HIGH PRESSURE	No issues identified							
10.8	LOW PRESSURE	No issues identified							
10.9	HIGH TEMPERATURE	No issues identified							
10.10	LOW TEMPERATURE	Opening of UV-64109 with higher pressure on RO side	UV and RO cannot be operated in both directions as RO will be upstream of UV in one flow direction, leading to UV exposed to excessively low temperatures, valve freezing		Select appropriate valve for repressurisation in both directions and remove RO	**2**	**SH**		
10.11	IMPURITIES	No issues identified							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
10.12	CHANGE IN COMPOSITION / CONCENTRATION	No issues identified							
10.13	TWO PHASE FLOW	No issues identified							
10.14	REACTIONS	No issues identified							
10.15	TESTING EQUIPMENT / PRODUCT	No issues identified							
10.16	PLANT ITEM OPERABILITY	Removal of UV-64109	Single valve isolation provided only		Review isolation requirements for removal of UV-64109 while station remains online	**2**	**DY**		
10.17	PLANT ITEM MAINTAINABILITY	Refer OPERABILITY							
10.18	ELECTRICAL AREA CLASSIFICATION	No issues identified							
10.19	EARTHING	No issues identified							
10.20	ISOLATION				UV-64109 to be configured to close on pipeline mainline ESD	**2**	**SH**		
10.21	INSTRUMENTS TOO MANY	No issues identified							
10.22	INSTRUMENTS TOO FEW	Low temperatures not monitored by instrumentation on repressurisation			Review requirements for low temperature piping to handle minimum temperatures on repressurisation	**2**	**PB**		
10.23	CORRECT LOCATION OF INSTRUMENTS	No issues identified							

NODE 11: MILA REVERSE FLOW: EGP TO COMPRESSOR SUCTION

DRAWINGS: 525-PI-001, GAS-525-DW-PD-039, GTS-525-DW-PD-022 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-909-C9D-400, NG-01-XX-458, G-905-C9D-400, G-XXX-C9D-400, G-002-PL9Z-400, G-003-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
11.1	HIGH FLOW	Refer NODE 6							
11.2	HIGH LEVEL	No issues identified							
11.3	LOW FLOW	Refer NODE 6							
11.4	LOW LEVEL	No issues identified							
11.5	ZERO FLOW / EMPTY	Two MLVs in series (compared with two MLVs in parallel at Michelago)	Potential greater probability of either MLV inadvertently operating / not being able to open	New MLV can be bypassed using DN150 kicker-line on Launcher Trap E-02 using V-15	No new actions. Refer OPERABILITY – action to consider parallel MLV configuration				
11.6	REVERSE FLOW	Refer NODE 6							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
11.7	HIGH PRESSURE	Refer NODE 6 – pressure change due to elevation differences along the pipeline							
11.8	LOW PRESSURE	Refer NODE 6							
11.9	HIGH TEMPERATURE	Refer NODE 6							
11.10	LOW TEMPERATURE	Refer NODE 6							
11.11	IMPURITIES	Refer NODE 6							
11.12	CHANGE IN COMPOSITION / CONCENTRATION	Refer NODE 6 – fixed composition in compressor surge control system and FG system							
11.13	TWO PHASE FLOW	Refer NODE 6							
11.14	REACTIONS	Refer NODE 6							
11.15	TESTING EQUIPMENT / PRODUCT	Refer NODE 6							
11.16	PLANT ITEM OPERABILITY	Refer NODE 6			UV-64110 to be FL, double acting gas-over-oil MLV similar to MLV-7, IG to be taken from pipeline side of MLV. Re-tag UV-64110 to MLV-7 Re-tag MLV-7 to MLV-7A Consider putting this new MLV in parallel to the existing MLV, for a similar configuration to Michelago / EGCS Consider alternative site layout with switching valves located west of MLV-7 Pipeline operability checks to be reviewed in regards to change in delivery pressures at different receipt points along the EGP when flowing south	**1** **1** **1** **1** **2** **2**	**SH** **SH** **SH** **SH** **DY** **Jemena**		
11.17	PLANT ITEM MAINTAINABILITY	Refer OPERABILITY Possible need for pigging of the EGP in reverse flow direction	Pigging facilities not necessarily configured for pigging in reverse flow direction		Confirm if pigging operation required in reverse flow direction.	**2**	**Jemena**		
11.18	ELECTRICAL AREA CLASSIFICATION	Refer NODE 6							
11.19	EARTHING	Refer NODE 6							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
11.20	ISOLATION	Refer NODE 6 Construction tie-in at TIP-525-04 will be behind single valve isolation off the pipeline, using V-16 Construction tie-in at Cann River side of MLV-7 will be behind single valve isolation off the pipeline, using V-07 & V-23 Construction tie-in requires installation of pipeline bypass line between pig trap kicker line connection points	Not able to complete tie-in if valve does not seal	Sealant injection on V-16 & V-07 Testing of V-16, V-07 & V-23 prior to commencing construction tie-in Existing pipeline bypass line on site to be installed (will require dimensional check as pig traps may be displaced/moved)	No actions				
11.21	INSTRUMENTS TOO MANY	Refer NODE 6							
11.22	INSTRUMENTS TOO FEW	Refer NODE 6							
11.23	CORRECT LOCATION OF INSTRUMENTS	GC take-off is located in the dead leg adjacent to UV-64110	Loss of effective GC monitoring of gas composition		Move GC tapping point 25-BV-64006 to main flow path piping adjacent to TIP-525-04	**1**	**SH**		

NODE 12: MILA REVERSE FLOW: COMPRESSOR DISCHARGE TO EGP

DRAWINGS: 525-PI-001, GAS-525-DW-PD-039, GTS-525-DW-PD-022 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-908-C9D-400, G-906-C9D-400, G-903-C9D-400, G-902-C9D-400, G-021-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
12.1	HIGH FLOW	Refer NODE 7							
12.2	HIGH LEVEL	Refer NODE 7							
12.3	LOW FLOW	Refer NODE 7							
12.4	LOW LEVEL	Refer NODE 7							
12.5	ZERO FLOW / EMPTY	Refer NODE 7							
12.6	REVERSE FLOW	Refer NODE 7							
12.7	HIGH PRESSURE	Refer NODE 7							
12.8	LOW PRESSURE	Refer NODE 7							
12.9	HIGH TEMPERATURE	Refer NODE 7							
12.10	LOW TEMPERATURE	Refer NODE 7							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
12.11	IMPURITIES	Refer NODE 7							
12.12	CHANGE IN COMPOSITION / CONCENTRATION	Refer NODE 7							
12.13	TWO PHASE FLOW	Refer NODE 7							
12.14	REACTIONS	Refer NODE 7							
12.15	TESTING EQUIPMENT / PRODUCT	Refer NODE 7							
12.16	PLANT ITEM OPERABILITY	Refer NODE 7							
12.17	PLANT ITEM MAINTAINABILITY	Refer NODE 7							
12.18	ELECTRICAL AREA CLASSIFICATION	Refer NODE 7							
12.19	EARTHING	Refer NODE 7							
12.20	ISOLATION	Refer NODE 7							
12.21	INSTRUMENTS TOO MANY	Refer NODE 7							
12.22	INSTRUMENTS TOO FEW	Refer NODE 7							
12.23	CORRECT LOCATION OF INSTRUMENTS	Refer NODE 7							

NODE 13: MILA REVERSE FLOW WITH NO COMPRESSION

DRAWINGS: 525-PI-001 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** NG-01-C9D-400, NG-01-XX-450

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
13.1	HIGH FLOW	Refer NODE 8							
13.2	HIGH LEVEL	Refer NODE 8							
13.3	LOW FLOW	Refer NODE 8							
13.4	LOW LEVEL	Refer NODE 8							
13.5	ZERO FLOW / EMPTY	Refer NODE 8 Refer NODE 11 – ZERO FLOW							
13.6	REVERSE FLOW	Refer NODE 8							
13.7	HIGH PRESSURE	Refer NODE 8							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
13.8	LOW PRESSURE	Refer NODE 8							
13.9	HIGH TEMPERATURE	Refer NODE 8							
13.10	LOW TEMPERATURE	Refer NODE 8							
13.11	IMPURITIES	Refer NODE 8							
13.12	CHANGE IN COMPOSITION / CONCENTRATION	Refer NODE 8							
13.13	TWO PHASE FLOW	Refer NODE 8							
13.14	REACTIONS	Refer NODE 8							
13.15	TESTING EQUIPMENT / PRODUCT	Refer NODE 8							
13.16	PLANT ITEM OPERABILITY	Refer NODE 8							
13.17	PLANT ITEM MAINTAINABILITY	Refer NODE 8							
13.18	ELECTRICAL AREA CLASSIFICATION	Refer NODE 8							
13.19	EARTHING	Refer NODE 8							
13.20	ISOLATION	Refer NODE 8							
13.21	INSTRUMENTS TOO MANY	Refer NODE 8							
13.22	INSTRUMENTS TOO FEW	Refer NODE 8							
13.23	CORRECT LOCATION OF INSTRUMENTS	Refer NODE 8							

NODE 14: MILA FORWARD FLOW: EGP TO COMPRESSOR SUCTION

DRAWINGS: 525-PI-001, GAS-525-DW-PD-039, GTS-525-DW-PD-022

PLANT & EQUIPMENT: -

INSTRUMENTATION: -

LINE NUMBERS: G-908-C9D-400, G-906-C9D-400, G-907-C9D-400, G-002-PL9Z-400, G-003-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
14.1	HIGH FLOW	Refer NODE 9							
14.2	HIGH LEVEL	Refer NODE 9							
14.3	LOW FLOW	Refer NODE 9							
14.4	LOW LEVEL	Refer NODE 9							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
14.5	ZERO FLOW / EMPTY	Refer NODE 9							
14.6	REVERSE FLOW	Refer NODE 9							
14.7	HIGH PRESSURE	Refer NODE 9							
14.8	LOW PRESSURE	Refer NODE 9							
14.9	HIGH TEMPERATURE	Refer NODE 9							
14.10	LOW TEMPERATURE	Refer NODE 9							
14.11	IMPURITIES	Refer NODE 9							
14.12	CHANGE IN COMPOSITION / CONCENTRATION	Refer NODE 9							
14.13	TWO PHASE FLOW	Refer NODE 9							
14.14	REACTIONS	Refer NODE 9							
14.15	TESTING EQUIPMENT / PRODUCT	Refer NODE 9							
14.16	PLANT ITEM OPERABILITY	Refer NODE 9							
14.17	PLANT ITEM MAINTAINABILITY	Refer NODE 9							
14.18	ELECTRICAL AREA CLASSIFICATION	Refer NODE 9							
14.19	EARTHING	Refer NODE 9							
14.20	ISOLATION	Refer NODE 9							
14.21	INSTRUMENTS TOO MANY	Refer NODE 9							
14.22	INSTRUMENTS TOO FEW	Refer NODE 9							
14.23	CORRECT LOCATION OF INSTRUMENTS	Refer NODE 9							

NODE 15: MILA FORWARD FLOW: COMPRESSOR DISCHARGE TO EGP

DRAWINGS: 525-PI-001, GAS-525-DW-PD-039, GTS-525-DW-PD-022

PLANT & EQUIPMENT: -

INSTRUMENTATION: -

LINE NUMBERS: G-909-C9D-400, NG-01-XX-450, G-904-C9D-400, G-902-C9D-400, G-021-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
15.1	HIGH FLOW	Refer NODE 10							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
15.2	HIGH LEVEL	Refer NODE 10							
15.3	LOW FLOW	Refer NODE 10							
15.4	LOW LEVEL	Refer NODE 10							
15.5	ZERO FLOW / EMPTY	Refer NODE 10							
15.6	REVERSE FLOW	Refer NODE 10							
15.7	HIGH PRESSURE	Refer NODE 10							
15.8	LOW PRESSURE	Refer NODE 10							
15.9	HIGH TEMPERATURE	Refer NODE 10							
15.10	LOW TEMPERATURE	Refer NODE 10							
15.11	IMPURITIES	Refer NODE 10							
15.12	CHANGE IN COMPOSITION / CONCENTRATION	Refer NODE 10							
15.13	TWO PHASE FLOW	Refer NODE 10							
15.14	REACTIONS	Refer NODE 10							
15.15	TESTING EQUIPMENT / PRODUCT	Refer NODE 10							
15.16	PLANT ITEM OPERABILITY	Refer NODE 10							
15.17	PLANT ITEM MAINTAINABILITY	Refer NODE 10							
15.18	ELECTRICAL AREA CLASSIFICATION	Refer NODE 10							
15.19	EARTHING	Refer NODE 10							
15.20	ISOLATION	Refer NODE 10							
15.21	INSTRUMENTS TOO MANY	Refer NODE 10							
15.22	INSTRUMENTS TOO FEW	Refer NODE 10							
15.23	CORRECT LOCATION OF INSTRUMENTS	Refer NODE 10							

NODE 15A: MILA MLV ACTUATED PRESSURISATION BYPASS

DRAWINGS: GAS-525-DW-PD-039 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-XXX-C9D-150

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
15.1	HIGH FLOW	Refer NODE 10A							
15.2	HIGH LEVEL	Refer NODE 10A							
15.3	LOW FLOW	Refer NODE 10A							
15.4	LOW LEVEL	Refer NODE 10A							
15.5	ZERO FLOW / EMPTY	Refer NODE 10A							
15.6	REVERSE FLOW	Refer NODE 10A							
15.7	HIGH PRESSURE	Refer NODE 10A							
15.8	LOW PRESSURE	Refer NODE 10A							
15.9	HIGH TEMPERATURE	Refer NODE 10A							
15.10	LOW TEMPERATURE	Refer NODE 10A							
15.11	IMPURITIES	Refer NODE 10A							
15.12	CHANGE IN COMPOSITION / CONCENTRATION	Refer NODE 10A							
15.13	TWO PHASE FLOW	Refer NODE 10A							
15.14	REACTIONS	Refer NODE 10A							
15.15	TESTING EQUIPMENT / PRODUCT	Refer NODE 10A							
15.16	PLANT ITEM OPERABILITY	Refer NODE 10A							
15.17	PLANT ITEM MAINTAINABILITY	Refer NODE 10A							
15.18	ELECTRICAL AREA CLASSIFICATION	Refer NODE 10A							
15.19	EARTHING	Refer NODE 10A							
15.20	ISOLATION	Refer NODE 10A							
15.21	INSTRUMENTS TOO MANY	Refer NODE 10A							
15.22	INSTRUMENTS TOO FEW	Refer NODE 10A							
15.23	CORRECT LOCATION OF INSTRUMENTS	Refer NODE 10A							

NODE 15B: MICHELAGO AND MILA: OVERVIEW

DRAWINGS: 530-DW-PD-001, 530-DW-PD-018, GAS-530-DW-PD-020, 525-PI-001, GAS-525-DW-PD-039, GTS-525-DW-PD-022

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
15.1 A	TOXICITY	No issues identified							
15.2 A	SERVICES REQUIRED	Additional demand on instrument air system Instrument gas for new MLV (Mila only) New equipment and valves outside of existing plant lighting zones Poor communications service at Mila & Michelago	Insufficient IA supply Insufficient lighting		Review IA system capacity for new IA demands Confirm requirements for additional plant lighting required at Michelago & Mila Review if communications service can be improved at Mila & Michelago	**2** **3** **3**	**DY** **DY** **DY**		
15.3 A	MATERIALS OF CONSTRUCTION	Refer NODE X – low temperature materials may be required for repressurisation line							
15.4 A	COMMISSIONING			Repressurisation valve V-23 (DN50) available around V-07 for repressuristation from pipeline	No actions				
15.5 A	BREAKDOWN	No issues identified							
15.6 A	STARTUP / SHUTDOWN	Refer NODES							
15.7 A	EFFLUENT	No issues identified							
15.8 A	NOISE / VIBRATION	Refer NODES No new issues identified							
15.9 A	FIRE / EXPLOSION	No new issues identified							
15.10 A	SAFETY EQUIPMENT	Piping and equipment in new areas of the plant	New piping and equipment outside of existing plant fire detection camera zones	Safety equipment location will be assessed as part of layout and 3D model reviews	No actions				
15.11 A	QUALITY AND CONSISTENCY	Refer NODE X – series/parallel MLVs			Review Mila electrical contactor isolation and consider if these can be upgraded to be consistent with Michelago	**2**	**DY**		
15.12 A	OUTPUT – RELIABILITY AND BOTTLENECKS	Compressor stations (Mila & Michelago) operating in opposite directions	Station suction/discharge will quickly increase/drop		Confirm philosophy for ensuring that EGP and all compressor stations are all configured in either northern or southern flow, and if this will be automated	**2**	**DY**		
15.13 A	EFFICIENCY	No issues identified							
15.14 A	SIMPLICITY	Refer OUTPUT - RELIABILITY							
15.15 A	MOBILE EQUIPMENT / PLANT MOVEMENT	No new issues identified							
15.16 A	PROCESS PLANT NORMAL / ABNORMAL MAINTENANCE	No new issues identified							
15.17 A	PROCESS PLANT PROCESS FUNCTIONALITY	No new issues identified							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
15.18 A	ERGONOMICS	No new issues identified		Will be assessed as part of layout and 3D model reviews					
15.19 A	GUARDING	No issues identified		Will be assessed as part of layout and 3D model reviews					
15.20 A	WARNINGS	No issues identified		Will be assessed as part of layout and 3D model reviews					
15.21 A	VULNERABILITY	No issues identified		All new piping and equipment within existing station fenceline					
15.22 A	3RD PARTY INTERFERENCE	No issues identified		All new piping and equipment within existing station fenceline					
15.23 A	NATURAL EVENTS	No issues identified		Bushfire assessments completed					

APPENDIX 2 STUDY DOCUMENTATION

This appendix contains all drawings and documents relating to the design specifically reviewed during the study process.

Document/Drawing Number	Revision	Description
550-PI-001	0B	Kembla Grange MLV & Sales Tap Remote Actuated MLV & DN200 Sales Tap
GAS-557-DW-PD-001	B	Kembla Grange Meter Station Pig Receiver
GAS-557-DW-PD-002	B	Kembla Grange Meter Station Metering
GAS-557-DW-PD-003	B	Kembla Grange Meter Station EGP Hot Tap Tie In
530-DW-PD-001	3B	Michelago Compressor Station Isolation Valves
530-DW-PD-018	4B	Michelago Compressor Station Mainline Valve
GAS-530-DW-PD-020	B	Michelago Compressor Station Flow Switching Valves
525-PI-001	3A	Mila Scraper Station & MLV Intermediate Scraper Station
530-525-DW-PD-039	3B	Mila Compressor Station Flow Switching Valves
GTS-525-DW-PD-022	2B	Mila Compressor Station Isolation Valves
GAS-510-DW-PF-001	2A	Longford Compressor Station Vic Hub – Facilities Located within the LCS PFD
GAS-510-DW-PF-101	3A	Longford Compressor Station Main Gas Station
550-PI-092	2B	Longford Compressor Station Launcher Station
PO-510-PI-110	4B	Longford Compressor Station Gas Manifold
GAS-511-DW-PD-003	B	Longford Compressor Station Vic Hub 2 – Metering Run
GAS-511-DW-PD-002	B	Longford Compressor Station Vic Hub 2 – Water Bath Heater
GAS-511-DW-PD-004	B	Longford Compressor Station Vic Hub 2 – Pressure Regulation
PO-511-PD-001	1B	Longford Compressor Station Vic Hub 2 – Bi-directional Pipeline
GAS-511-DW-PD-001	B	Longford Compressor Station Vic Hub 2 – Inlet Filter Separator
510-PI-140	5A	Longford Compressor Station Open Drain Interceptor
510-DW-PD-101	0A	Longford Compressor Station Inlet Filter Separator

Document/Drawing Number	Revision	Description
510-DW-PD-006	5B	Longford Compressor Station Vic Hub
563-DW-PF-001	1B	Wilton Meter Station PFD
563-DW-PD-002	2B	Wilton Meter Station Dry Gas Filters
563-DW-PD-001	2B	Wilton Meter Station Receiver Station
GAS-563-DW-PD-016	B	Wilton Meter Station APA Water Bath Heater
GAS-563-DW-PD-017	B	Wilton Meter Station APA Flow Metering
GAS-563-DW-PD-015	B	Wilton Meter Station APA Pressure Reduction Skid (Run No 4)
563-DW-PD-012	2B	Wilton Meter Station Connection to APA
563-DW-PD-003	2A	Wilton Meter Station Heat Exchangers
563-DW-PD-008	2A	Wilton Meter Station JGN Flow Metering
563-DW-PD-010	7B	Wilton Meter Station JGN Pressure Reduction Skid (Run No. 3)
563-DW-PD-011	2A	Wilton Meter Station Instrument Air Package
563-DW-PD-014	4B	Wilton Meter Station Hot Water Heater Fuel Gas Train
563-DW-PD-009	3A	Wilton Meter Station JGN Pressure Reduction Skid (Run No. 4)

APPENDIX 3 GUIDEWORDS

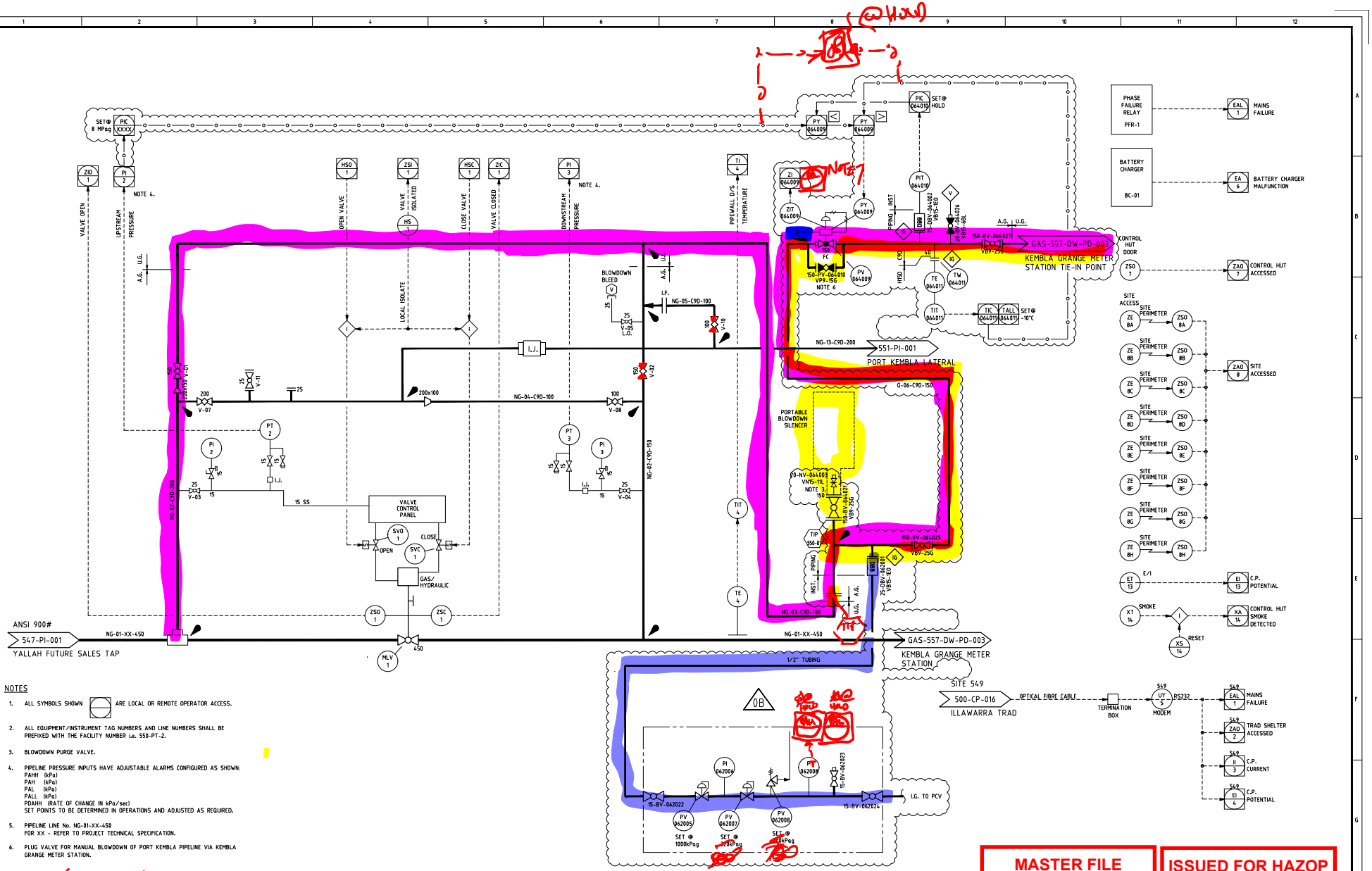
Appendix 3A Nodal Guidewords

- High Flow/High Level
- Low Flow/Low Level
- Zero Flow/ Empty
- Reverse Flow
- High Pressure
- Low Pressure
- High Temperature
- Low Temperature
- Impurities
- Change In Composition/ Change In Concentration
- Two Phase Flow
- Reactions
- Testing Equipment
- Testing Product
- Operability
- Maintainability
- Electrical Area Classification
- Instruments Too Many
- Instruments Too Few
- Instruments Correct Locations
- Earthing
- Isolation

Appendix 3B Overview Guidewords

- Toxicity
- Services
- Materials Of Construction
- Commissioning
- Startup/Shutdown
- Effluent
- Noise/Vibration
- Fire
- Explosion
- Safety Equipment

APPENDIX 4 HAZOP P&ID MARK-UPS



NOTES

1. ALL SYMBOLS SHOWN ◯ ARE LOCAL OR REMOTE OPERATOR ACCESS.
2. ALL EQUIPMENT/INSTRUMENT TAG NUMBERS AND LINE NUMBERS SHALL BE PREFIXED WITH THE FACILITY NUMBER i.e. 550-PT-2.
3. BLOWDOWN PURGE VALVE.
4. PIPELINE PRESSURE INPUTS HAVE ADJUSTABLE ALARMS CONFIGURED AS SHOWN:
   PAHH (kPa)
   PAH (kPa)
   PAL (kPa)
   PALL (kPa)
   PDAHH (RATE OF CHANGE IN kPa/sec)
   SET POINTS TO BE DETERMINED IN OPERATIONS AND ADJUSTED AS REQUIRED.
5. PIPELINE LINE No. NG-01-XX-450
   FOR XX - REFER TO PROJECT TECHNICAL SPECIFICATION.
6. PLUG VALVE FOR MANUAL BLOWDOWN OF PORT KEMBLA PIPELINE VIA KEMBLA GRANGE METER STATION.

MASTER FILE

ISSUED FOR HAZOP

DRAWING No.	REFERENCE DRAWINGS
500-CP-016	C.P. TRAD UNIT SLD & CONNECTION DETAILS - ILLAWARRA RAIL
551-PI-001	BHP (PORT KEMBLA) LAUNCHER AND RECEIVER STATIONS - P & ID
500-PI-001	LEGEND

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
0B	28.10.20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
0A	09.09.20	ISSUED FOR REVIEW (20617)	GPA		SLH	
A		AS BUILT	DH		SLH	PV

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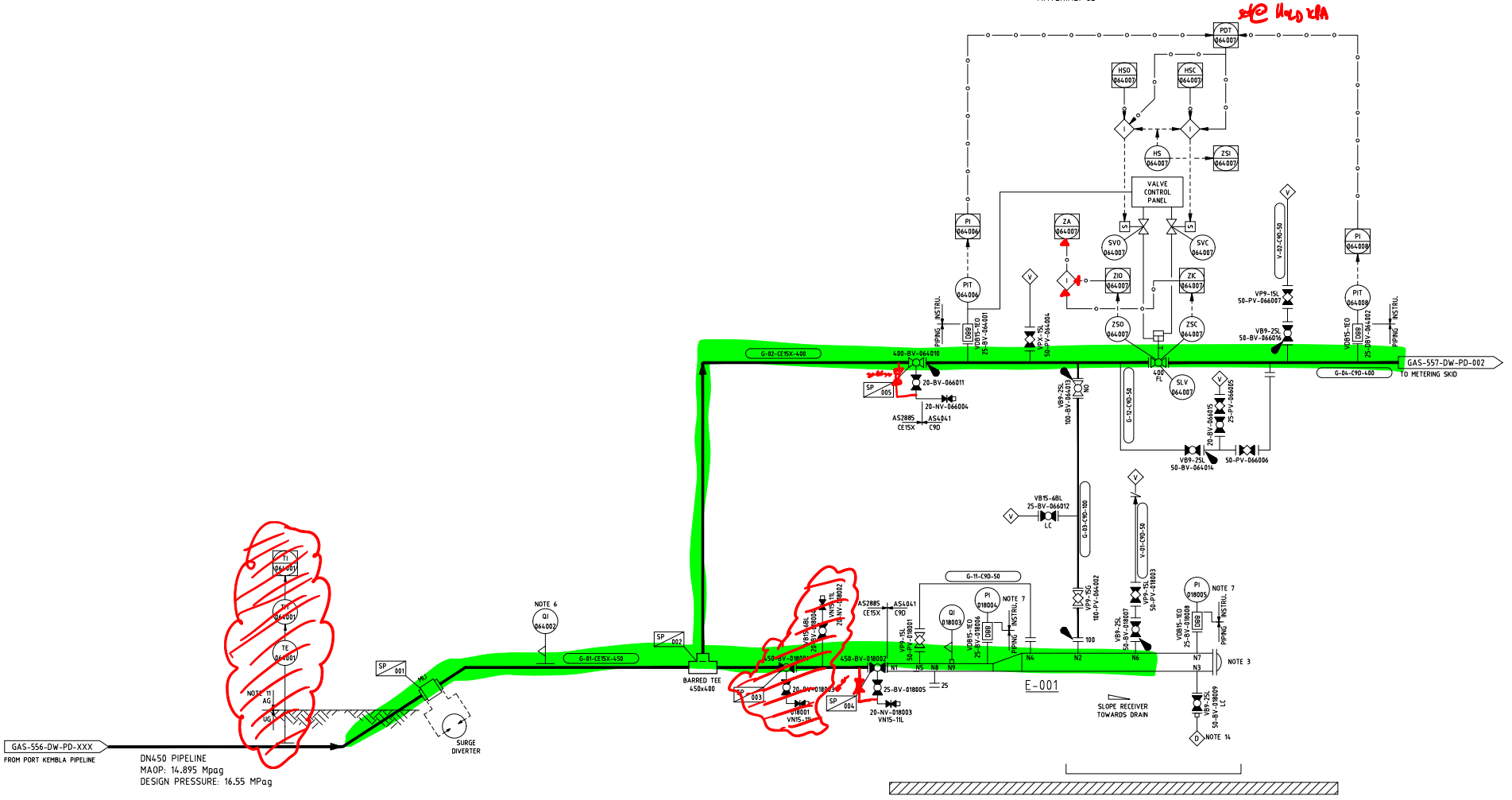
KEMBLA GRANGE MLV & SALES TAP
REMOTE ACTUATED MLV & DN200 SALES TAP
PIPING AND INSTRUMENT - DIAGRAM

	FACILITY	SUBJECT
DRAWN		
DESIGN	SCALE	-
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER	REV 0B
DATE	550-PI-001	

557-E-HOLD
PIG RECEIVER

SIZE MAJOR/MINOR: DN650xDN450
DESIGN PRESSURE: 16.55 MPag
DESIGN TEMPERATURE: -10°C/65°C
MATERIAL: CS



NOTES:

1.
2.
3. RECEIVER SCRAPER TRAP FITTED WITH QUICK-OPENING SCREW TYPE CLOSURE INCLUDING PRESSURE ALERT.
4.
5.
6. NON-INTRUSIVE PIG SIGNALLER PLACED SUCH THAT DISTANCE BETWEEN SCRAPER TRAP ISOLATION VALVE AND DOWNSTREAM PIG PASSAGE INDICATOR IS MORE THAN THE LENGTH OF AN INTELLIGENT PIG.
7. PI TO BE VISIBLE FROM THE PIG LAUNCHER QOC.
8.
9.
10.
11. BURIED TEMPERATURE ELEMENT STRAPPED TO PIPE AND COATED IN PLACE (OVER TOP OF EXISTING JEMENA SPEC COATING).

MASTER FILE

ISSUED FOR HAZOP

DRG No.	DRG DESC												
DRAWING No.	REFERENCE DRAWINGS												

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Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

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Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
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REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
B	27/10/20	ISSUED FOR HAZOP (20617)	GPA	MS	SJH	PJB	NKH
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA				

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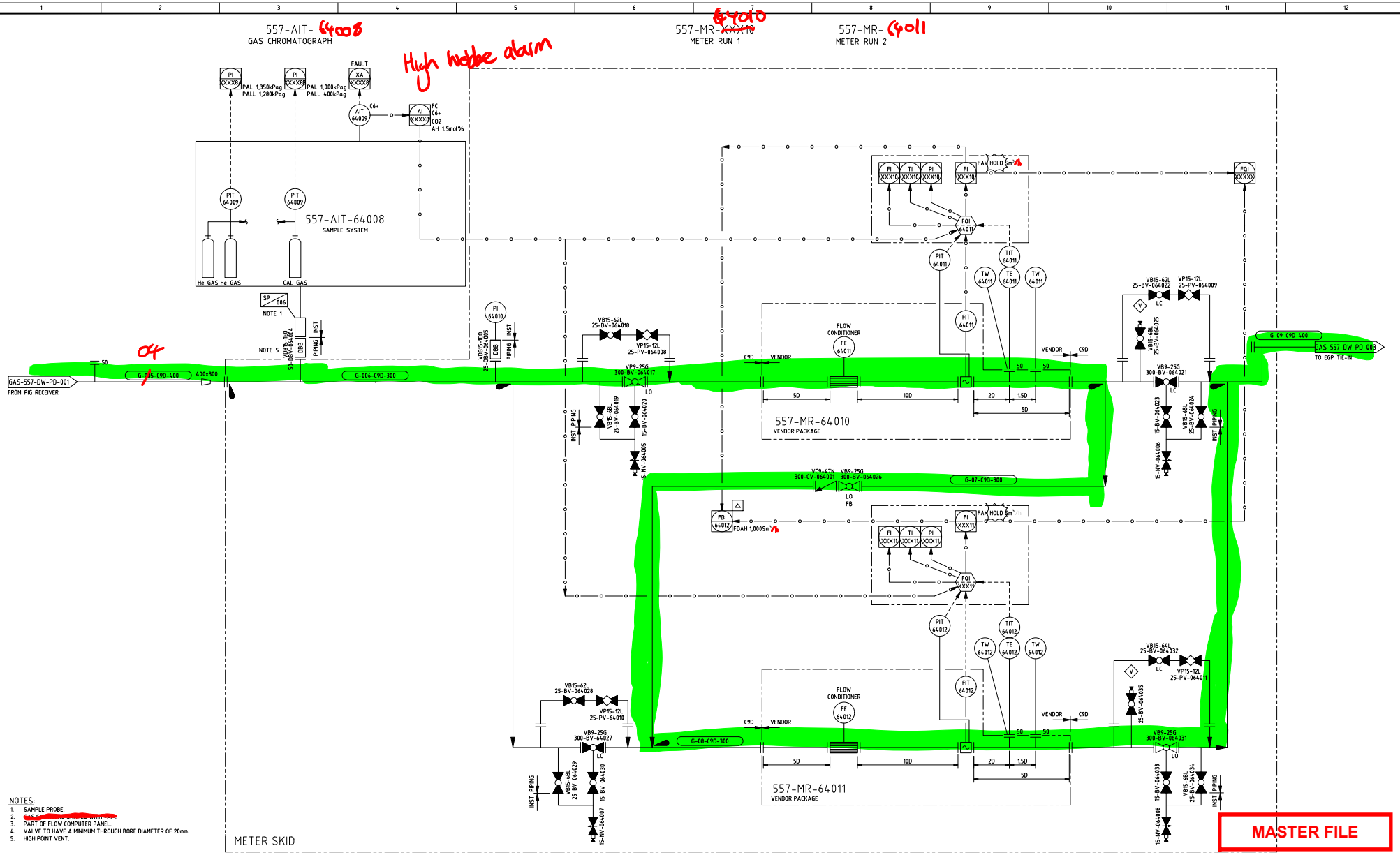
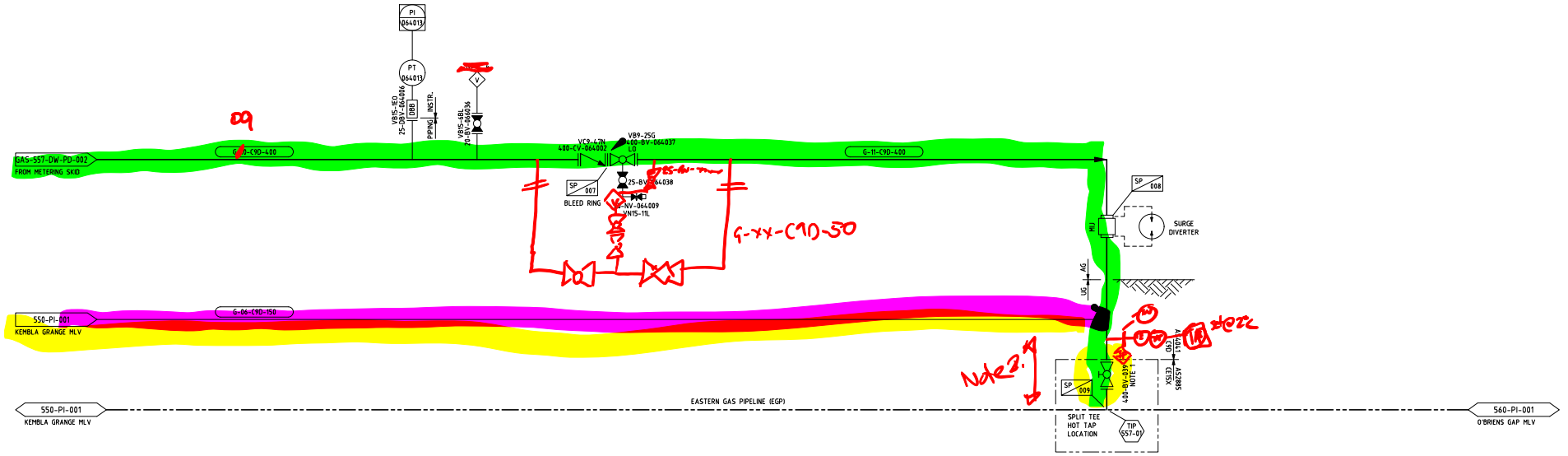
KEMBLA GRANGE METER STATION
PIG RECEIVER
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA		
DESIGN	PJB	SCALE N.T.S.	
CHECKED	SJH	SUPERSEDES	A1
APPROVED	NKH	DRAWING NUMBER	REV
DATE	27/10/20	GAS-557-DW-PD-001	B


557-AIT- 64008
GAS CHROMATOGRAPH
557-MR-XXXX10
METER RUN 1
557-MR- 64011
METER RUN 2
High Wobbe alarm
557-AIT-64008
SAMPLE SYSTEM
He GAS He GAS
CAL GAS
GAS-557-DW-PD-001
FROM PIG RECEIVER
G-05-C9D-400
G-06-C9D-300
G-09-C9D-400
GAS-557-DW-PD-003
TO EGP TIE-IN
557-MR-64010
VENDOR PACKAGE
557-MR-64011
VENDOR PACKAGE
FLOW CONDITIONER
METER SKID
NOTES:
1. SAMPLE PROBE.
2. [redacted]
3. PART OF FLOW COMPUTER PANEL.
4. VALVE TO HAVE A MINIMUM THROUGH BORE DIAMETER OF 20mm.
5. HIGH POINT VENT.
MASTER FILE
ISSUED FOR HAZOP

| | | |



NOTES:

1. VALVE COMPLETE WITH VALVE PIT AND EXTENDED HANDLE FOR OPERATION FROM GRADE.
2. Setback distance for gas bending

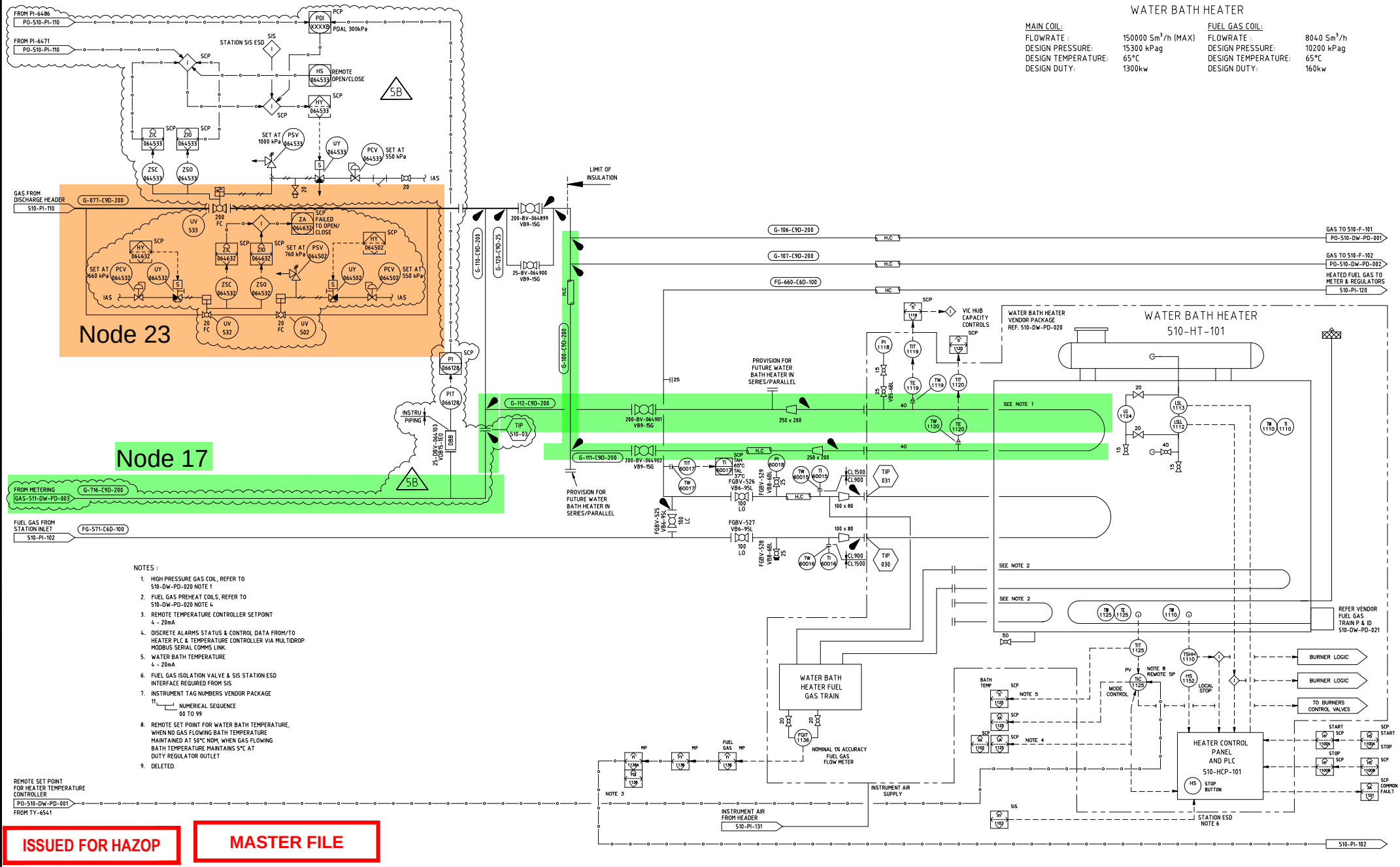
MASTER FILE

ISSUED FOR HAZOP

| | | |

510-HT-101
WATER BATH HEATER

MAIN COIL:		FUEL GAS COIL:	
FLOWRATE :	150000 Sm^3/h (MAX)	FLOWRATE :	8040 Sm^3/h
DESIGN PRESSURE:	15300 kPag	DESIGN PRESSURE:	10200 kPag
DESIGN TEMPERATURE:	65°C	DESIGN TEMPERATURE:	65°C
DESIGN DUTY:	1300kw	DESIGN DUTY:	160kw



NOTES :

1. HIGH PRESSURE GAS COIL, REFER TO 510-DW-PD-020 NOTE 1
2. FUEL GAS PREHEAT COILS, REFER TO 510-DW-PD-020 NOTE 4
3. REMOTE TEMPERATURE CONTROLLER SETPOINT 4 - 20mA
4. DISCRETE ALARMS STATUS & CONTROL DATA FROM/TO HEATER PLC & TEMPERATURE CONTROLLER VIA MULTIDROP MODBUS SERIAL COMMS LINK.
5. WATER BATH TEMPERATURE 4 - 20mA
6. FUEL GAS ISOLATION VALVE & SIS STATION ESD INTERFACE REQUIRED FROM SIS
7. INSTRUMENT TAG NUMBERS VENDOR PACKAGE
   11 — NUMERICAL SEQUENCE 00 TO 99
8. REMOTE SET POINT FOR WATER BATH TEMPERATURE, WHEN NO GAS FLOWING BATH TEMPERATURE MAINTAINED AT 50°C NOM, WHEN GAS FLOWING BATH TEMPERATURE MAINTAINS 5°C AT DUTY REGULATOR OUTLET
9. DELETED.

ISSUED FOR HAZOP

MASTER FILE

DRAWING No.	REFERENCE DRAWINGS
510-DW-PD-021	WATER BATH HEATER 510-HT-101 - FUEL GAS TRAIN - P&ID
510-DW-PD-020	WATER BATH HEATER 510-HT-101 - HEAT TRANSFER COILS & BATH - P&ID

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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REV	DATE	DESCRIPTION	PROJECT	DRAWN	DESIGNED	CHECKED	ENGINEER	APPROVED	CLIENT
5B	2/11/20	ISSUED FOR HAZOP (20617)		GPA		S.JH	P.JB	NKH	
5A	16/09/20	ISSUED FOR REVIEW (20617)		GPA		P.JB			
5	05/02/15	AS BUILT FUEL GAS TRAIN AMENDED DWG No UPDATED TO CURRENT FORMAT		JB		MR		AJ	
4	08/11	LCS4 PROJECT AS BUILT		JEM	JEM	PFR	PFR	PFR	
3	6/4/06	AS BUILT (PROJECT SKY)	09082001	KF	PFR	RG	PFR	PFR	NS
2	17/3/06	ISSUED FOR CONSTRUCTION	4619	KF	PFR	RG	PFR	PFR	NS
1	5/3/03	AS BUILT		J.S.					
0	26/8/02	ISSUED FOR CONSTRUCTION		J.W.		D.J.	P.B.	DLM	

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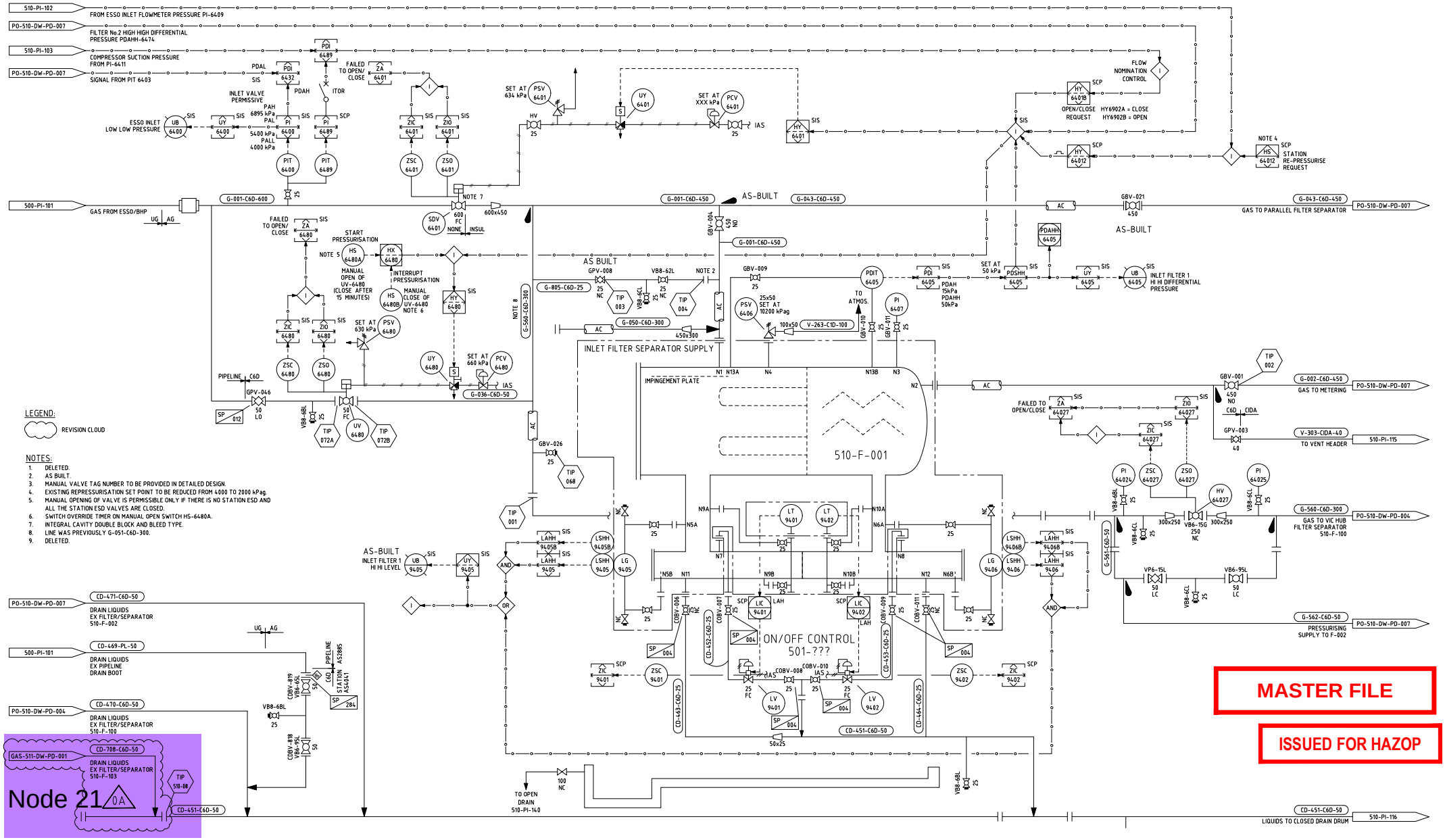
LONGFORD COMPRESSOR STATION
VIC HUB - WATER BATH HEATER 510-HT-101
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	M.L.	FACILITY	SUBJECT
DESIGN	P.BANNISTER	SCALE	N.T.S.
CHECKED	D.JENKIN	SUPERSEDES	PO-510-DW-PD-006_5
APPROVED	D.MITVALSKY	DRAWING NUMBER	510-DW-PD-006
DATE	27/02/02	REV	5B

A1

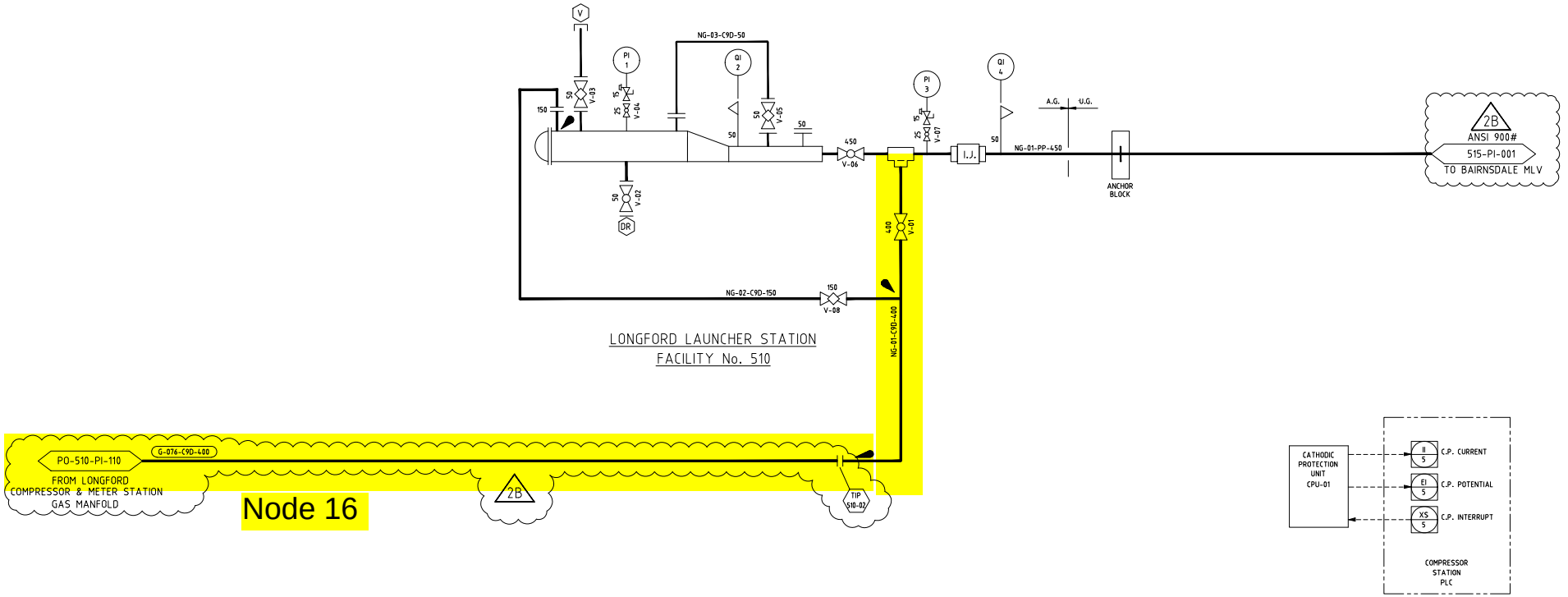
510-F-001
INLET FILTER SEPARATOR

DESIGN PRESSURE : 10200 kPa @ 38°C 10000 kPa @ 50°C
DESIGN TEMPERATURE : 50°C
EQUIPMENT TRIM : G-048-C6D-XXX



V-09

LAUNCHER TRAP



NOTES

1. ALL SYMBOLS SHOWN ARE LOCAL OR REMOTE OPERATOR ACCESS.
2. ALL EQUIPMENT/INSTRUMENT TAG NUMBERS AND LINE NUMBERS SHALL BE PREFIXED WITH THE FACILITY NUMBER i.e. 510-TIT-1
3. PIPELINE LINE No. NG-01-PP-450 FOR PP - REFER TO PROJECT TECHNICAL SPECIFICATION.

MASTER FILE

ISSUED FOR HAZOP

500-PI-109	COMPRESSOR DISCHARGE HEADER
500-PI-001	LEGEND
DRAWING No.	REFERENCE DRAWINGS

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
2B	2/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
2A	09/09/20	ISSUED FOR REVIEW (20617)	GPA		SLH	
2	01/04	AS BUILT	BG		PFR	PAC
1	03/03	AS BUILT TO PROTECT	DMI		GRT	GRM
0		AS BUILT	DH		PWD	PV

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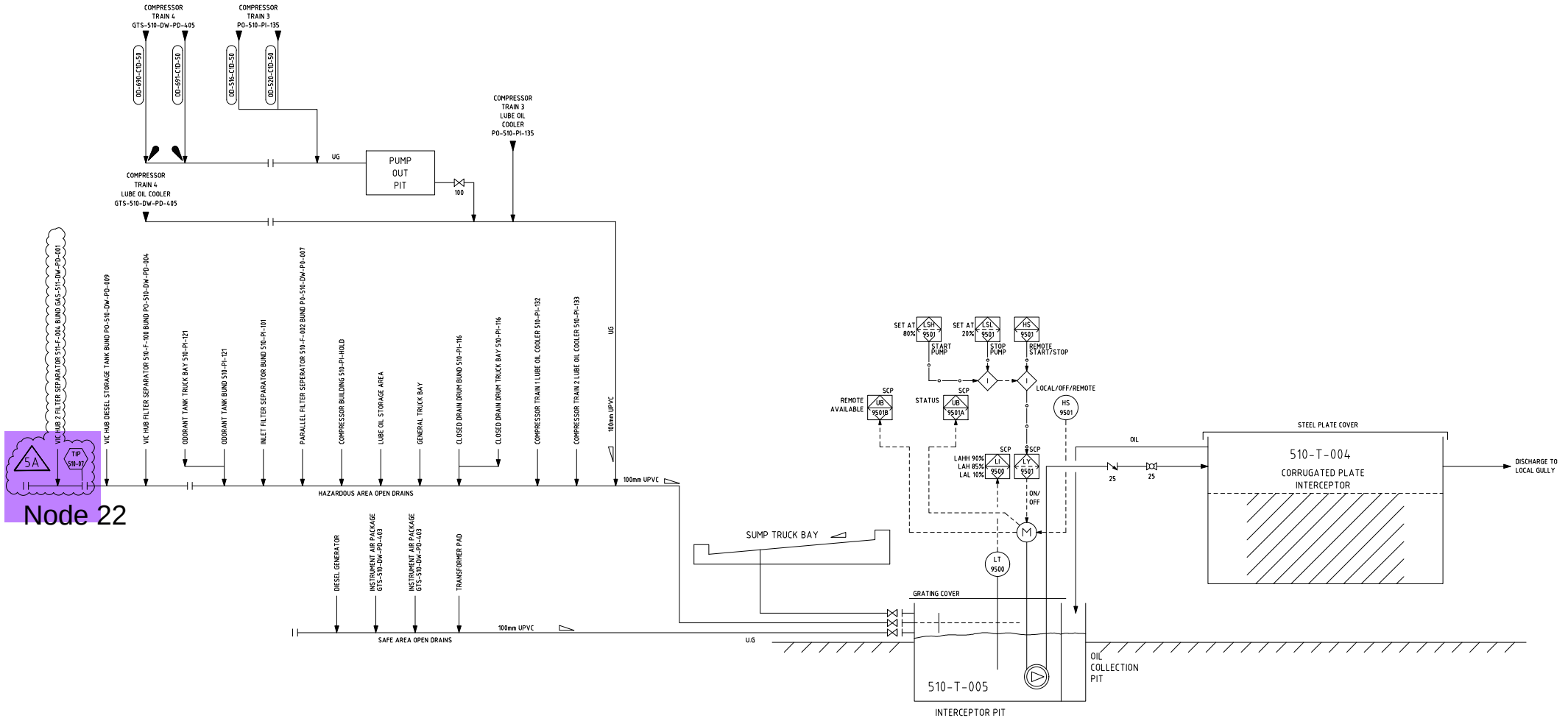
LONGFORD COMPRESSOR STATION
LAUNCHER STATION
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT	
DESIGN	SCALE N.T.S.		
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV.
DATE		510-PI-092	2B

INTERCEPTOR PIT	510-T-005 OIL COLLECTION PIT	510-P-001 CPI FEED PUMP	510-PM-001 CPI FEED PUMP MOTOR	510-T-004 CORRUGATED PLATE INTERCEPTOR
DIMENSIONS : 1600 mmH x 950 mmW x 2575 mmL CAPACITY: 2m^2 NOM	DIMENSIONS : 1600 mmH x 950 mmW x 1200 mmL CAPACITY: 1m^2 NOM	DIMENSIONS : 24m^{2}hr @ 3.9 m	SIZE : 0.55 kW	DIMENSIONS : 2425 mmL x 2159 mmW x 1278 mmH



MASTER FILE

ISSUED FOR HAZOP

ASSET MANAGER

Jemena

Produced by
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ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
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REV	DATE	DESCRIPTION	PROJECT	DRAWN	DESIGNED	CHECKED	ENGINEER	APPROVED	CLIENT
5A	2/11/20	ISSUED FOR HAZOP (20617)		GPA			SJH	PJB	NKH
5	08/11	LCS4 PROJECT AS BUILT		JEM	JEM	PFR		PFR	PFR
4	1/04	AS BUILT		BG				PFR	PAC
3	3/03	AS BUILT TO TNGP & VICHUB PROJECTS	6008&02300	AN				GRT	GRM
2	12/00	ISSUED AS BUILT	08407905	EC				PFR	PV
1	6/99	EQUIPMENT TAG NUMBERS REVISED	08407905	MR				PFR	RR
0	8/10/99	ISSUED FOR CONSTRUCTION	08407905	EC				PFR	RR

DRAWING No. | REFERENCE DRAWINGS

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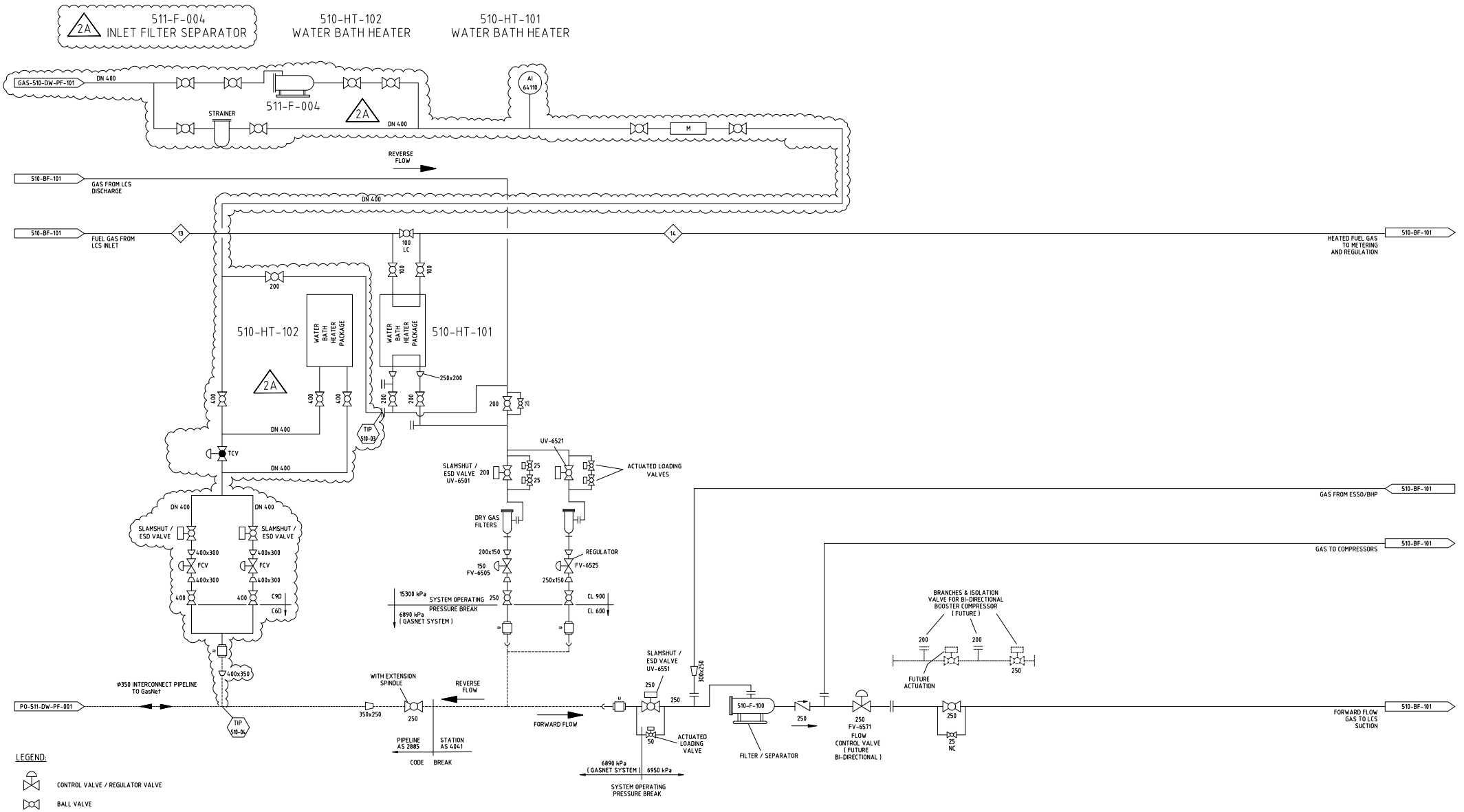
LONGFORD COMPRESSOR STATION
OPEN DRAIN INTERCEPTOR
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	EC	FACILTY	SUBJECT
DESIGN	GRT	SCALE	N.T.S.
CHECKED	PR	SUPERSEDES	A1
APPROVED	PAC	DRAWING NUMBER	REV.
DATE	08/10/00	510-PI-140	5A



MASTER FILE

ISSUED FOR HAZOP

ASSET MANAGER

Jemena

Produced by
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ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
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REV	DATE	DESCRIPTION	PROJECT	DRAWN	DESIGNED	CHECKED	ENGINEER	APPROVED	CLIENT
2A	2/11/20	ISSUED FOR HAZOP (20617)		GPA			SJH	PJB	NKH
2	19/05/09	ISSUED FOR CONSTRUCTION	25697	KW	DXB	KLM	DXB	DAE	
B	27/02/09	ISSUED FOR REVIEW (POST HAZOP)	25697	AP	DXB	KLM	DXB	DXB	
A-A	11/08	ISSUED FOR DETAILED DESIGN HAZOP	25697	KW	JYA	KLM	DXB	DXB	
A	06/08	ISSUED FOR HAZOP	00341	BH		TLV	AH	GPG	
1	21/03/03	AS BUILT	510	JS				DLM	
0	26/08/02	ISSUED FOR CONSTRUCTION	510	ML			DJ	PB	DLM

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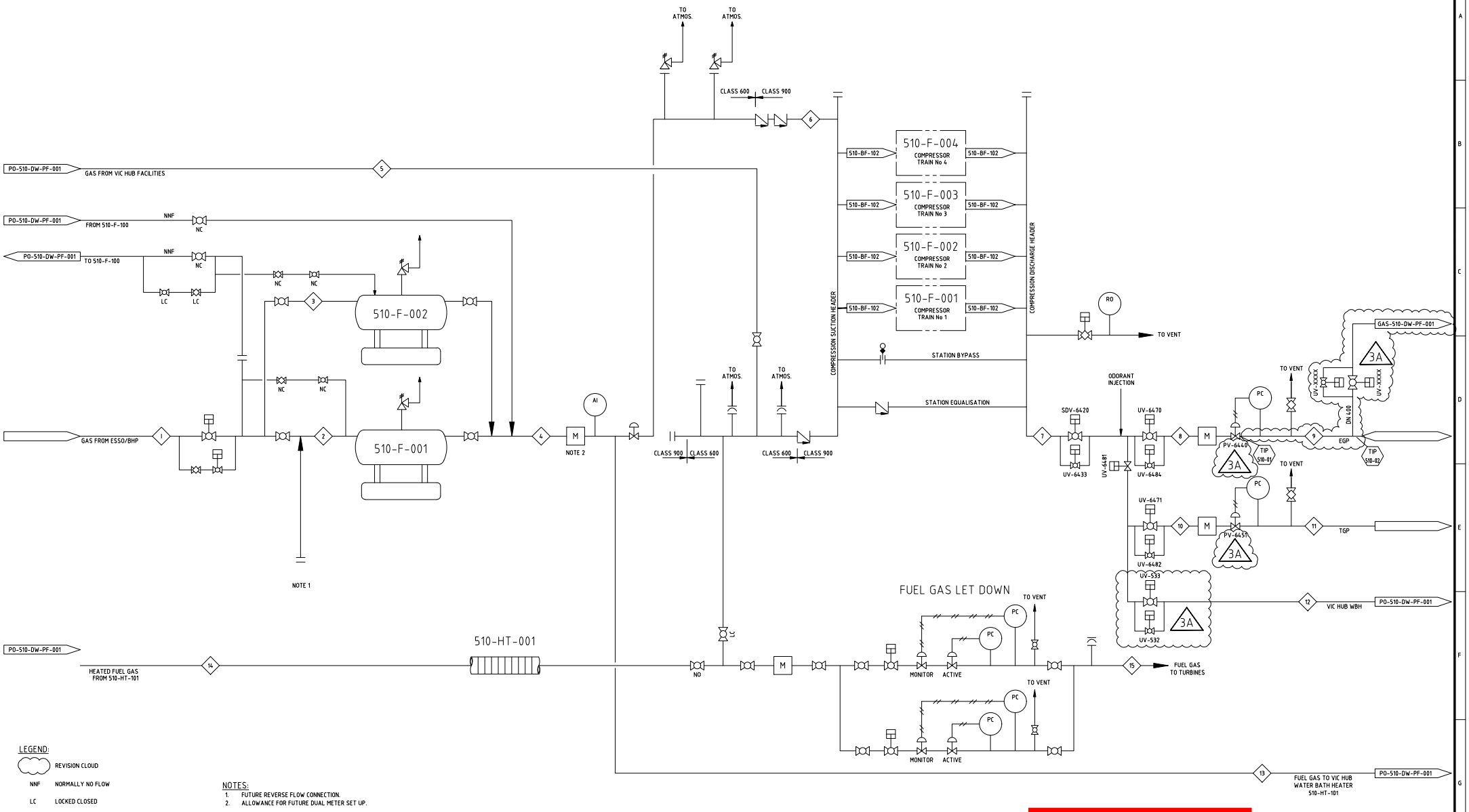
LONGFORD COMPRESSOR STATION
VIC HUB - FACILITIES LOCATED WITHIN THE LCS
PROCESS FLOW DIAGRAM

DRAWN	JW	FACILTY	SUBJECT
DESIGN	PB	SCALE	N.T.S.
CHECKED	DJ	SUPERSEDES	PO-510-DW-PF-001
APPROVED	DM	DRAWING NUMBER	GAS-510-DW-PF-001
DATE	28/02/02		REV 2A

A1

DRAWING No. | REFERENCE DRAWINGS



REV	DATE	DESCRIPTION	PROJECT	DRAWN	DESIGNED	CHECKED	ENGINEER	APPROVED	CLIENT
3A	2/11/20	ISSUED FOR HAZOP (20617)		GPA		SJH	PJB	NKH	
3	15/05/12	AS-BUILT BY LONGFORD EXPANSION PROJECT		GWN		PFR 13.7.10			
2	19/05/09	ISSUED FOR CONSTRUCTION	25697	KW	DXB	KLM	DXB	DAE	
B	27/02/09	ISSUED FOR REVIEW (POST HAZOP)	25697	KW	DXB	KLM	DXB	DAE	
A-A	11/08	ISSUED FOR DETAILED DESIGN HAZOP	25697	AP	JTA	KLM	DXB	DXB	
A	06/08	ISSUED FOR HAZOP	00341	N/C		TLV	AN	GPG	
1	03/03	AS-BUILT TOTNSP & VICHUB PROJECTS	600032310	AN			PR	GTF	
0	08/10/01	ISSUED FOR CONSTRUCTION	08407905	EC			PFR	RR	

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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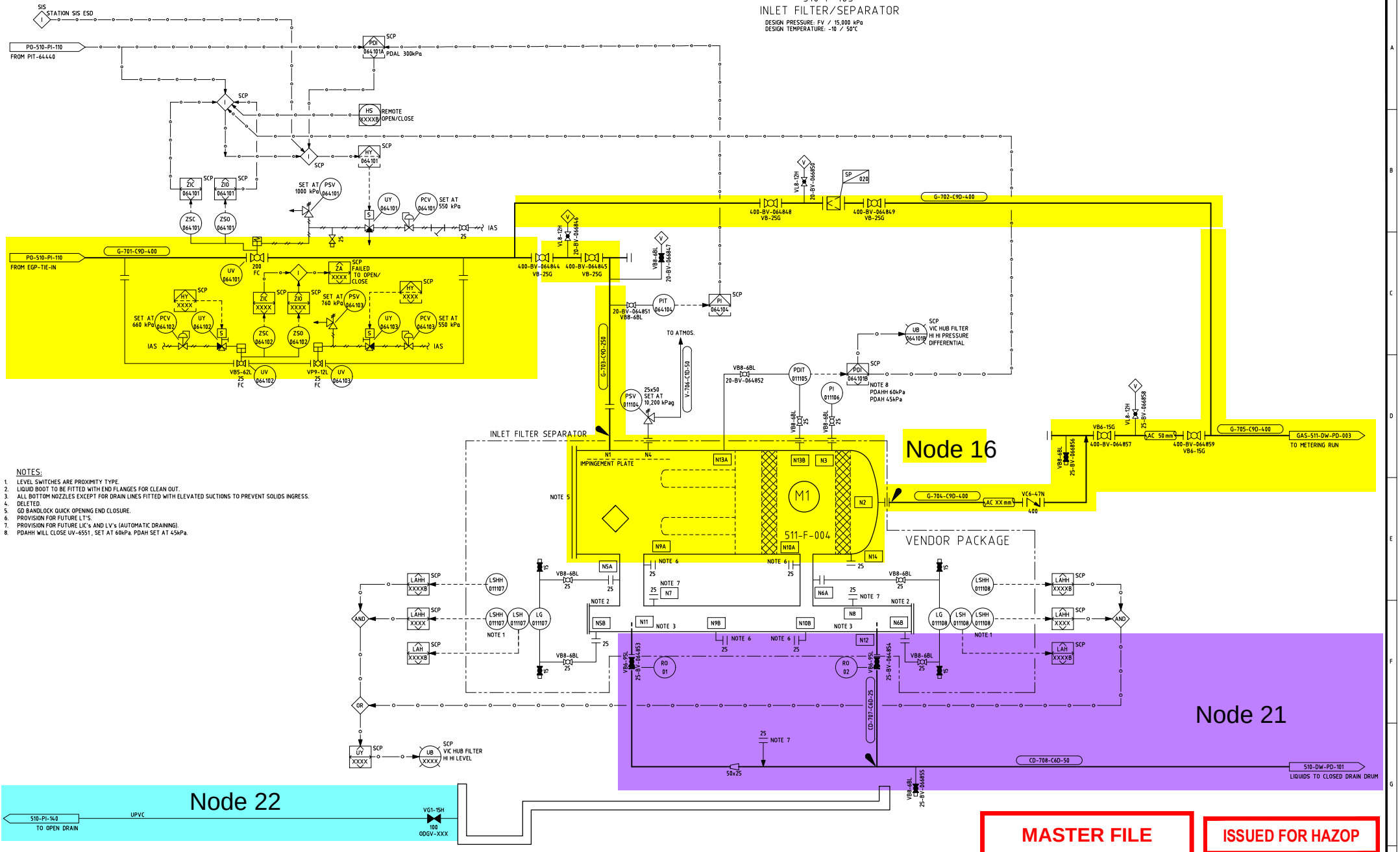
LONGFORD COMPRESSOR STATION
MAIN GAS SYSTEM
PROCESS FLOW DIAGRAM

DRAWN	EC	FACILTY	SUBJECT
DESIGN	GT	SCALE	N.T.S.
CHECKED	PR	SUPERSEDES	510-BF-101_3
APPROVED	PAC	DRAWING NUMBER	GAS-510-DW-PF-101
DATE	08/10/99		REV 3A

DRAWING No. | REFERENCE DRAWINGS

510-F-103
INLET FILTER/SEPARATOR

DESIGN PRESSURE: FV / 15,000 kPa
DESIGN TEMPERATURE: -10 / 50°C



NOTES:

1. LEVEL SWITCHES ARE PROXIMITY TYPE.
2. LIQUID BOOT TO BE FITTED WITH END FLANGES FOR CLEAN OUT.
3. ALL BOTTOM NOZZLES EXCEPT FOR DRAIN LINES FITTED WITH ELEVATED SUCTIONS TO PREVENT SOLIDS INGRESS.
4. DELETED.
5. GD BANDLOCK QUICK OPENING END CLOSURE.
6. PROVISION FOR FUTURE LT'S.
7. PROVISION FOR FUTURE LIC's AND LV's (AUTOMATIC DRAINING).
8. PDAHH WILL CLOSE UV-6551, SET AT 60kPa. PDAH SET AT 45kPa.

MASTER FILE

ISSUED FOR HAZOP

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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REV.	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
B	2/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA			

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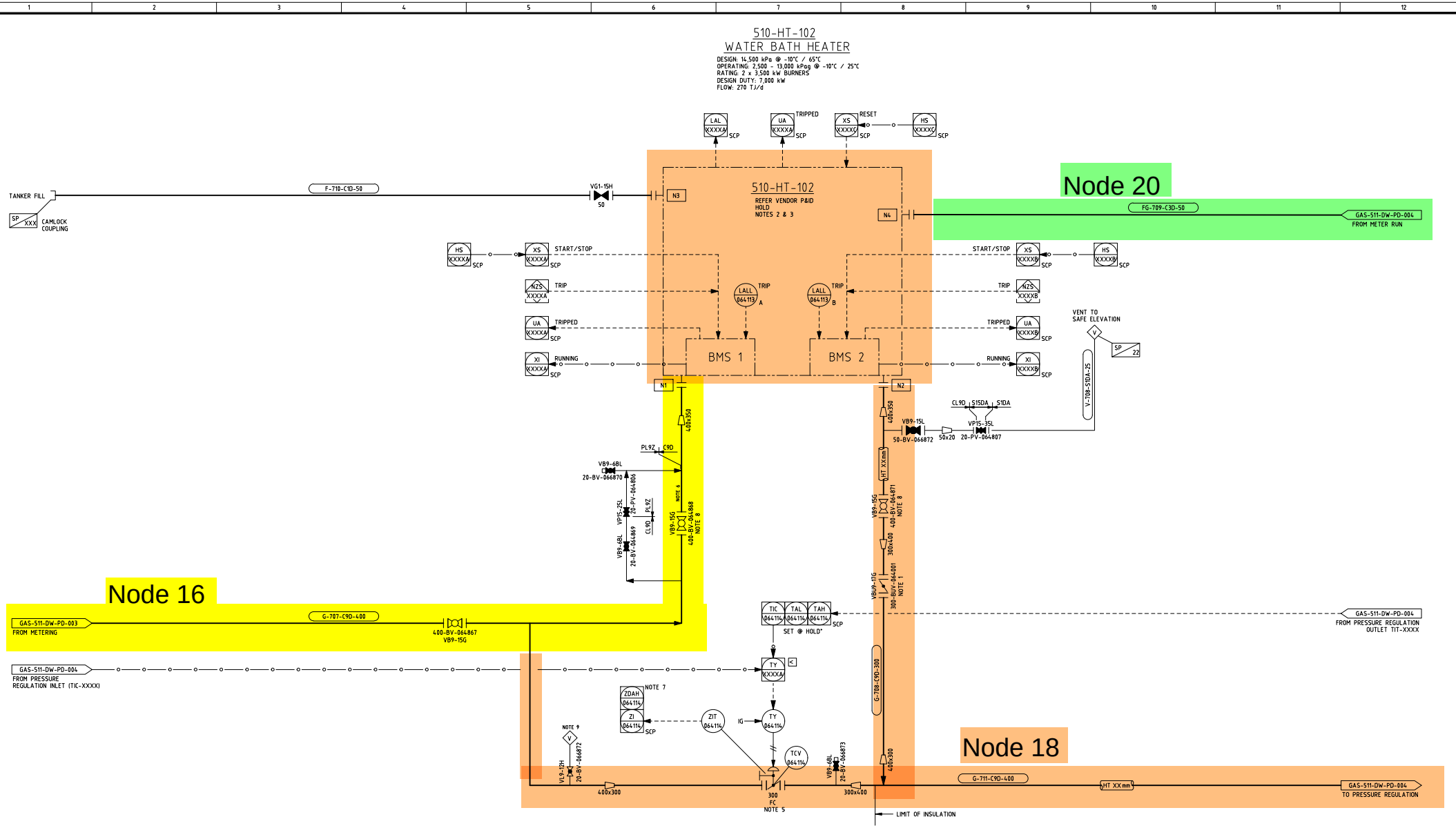
LONGFORD COMPRESSOR STATION
VIC HUB 2 - INLET FILTER SEPARATOR
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILITY	SUBJECT
DESIGN		SCALE	N.T.S.
CHECKED		SUPERSEDES	A1
APPROVED		DRAWING NUMBER	REV B
DATE	26/10/20	GAS-511-DW-PD-001	

DRAWING No. | REFERENCE DRAWINGS



NOTES:
1. VALVE ALLOWS SOME THROTTLING TO FURTHER INCREASE HEATER BYPASS FLOWRATE.
2. WATERBATH HEATER SHALL BE DESIGNED TO MINIMISE WATER LOSS BY EVAPORATION.
3. WATERBATH SHALL BE ADEQUATELY VENTED TO PREVENT PRESSURISATION SHOULD IT BOIL DUE TO INSTRUMENT TRIP FAILURE.
4. REFER PIPING CLASS DATASHEETS FOR IMPACT TESTING/HEAT TREATMENT REQUIREMENTS.
5. MANUAL OVERRIDE FURNISHED ON THE ACTUATOR.
6. LOW TEMPERATURE CARBON STEEL PRESSURISING VALVE/LINE FOR PRESSURISING WATER BATH HEATERS ONLY.
7. DISCREPANCY ALARM.
8. SINGLE BLOCK ISOLATION FOR WATERBATH HEATER REQUIRES OPERATION AT OR BELOW ASME CL300 FLANGE LIMIT WHILE ISOLATING FOR MAINTAINANCE.
9. PVC PIPE, 300mm LONG COMPLETE WITH CAP TO PREVENT RAIN INGRESS. VENT PIPE TO TERMINATE 2m ABOVE GRADE. PVC PIPE TO BE REMOVED PRIOR TO VENTING.

MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
B	2/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA			

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
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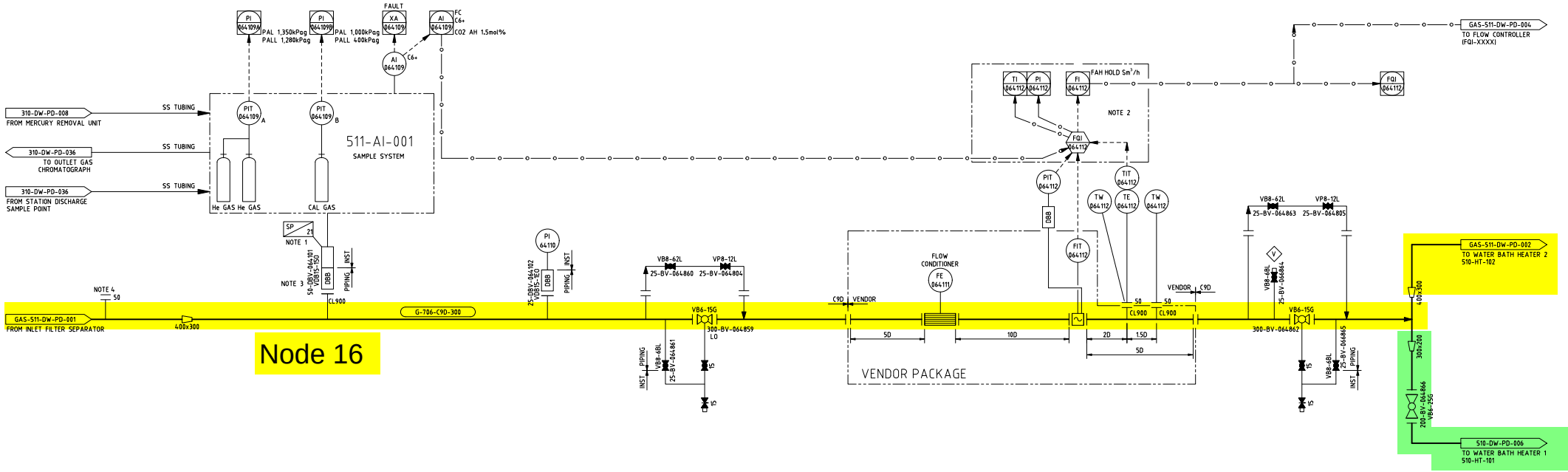
LONGFORD COMPRESSOR STATION
VIC HUB 2 - WATER BATH HEATER
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILTY	SUBJECT
DESIGN		SCALE	N.T.S.
CHECKED		SUPERSEDES	A1
APPROVED		DRAWING NUMBER	REV B
DATE	26/10/20	GAS-511-DW-PD-002	

DRAWING No. | REFERENCE DRAWINGS



NOTES:

1. SAMPLE PROBE.
2. PART OF FLOW COMPUTER PANEL.
3. VALVE TO HAVE A MINIMUM THROUGH BORE DIAMETER OF 20mm.
4. HIGH POINT VENT.

MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
B	2/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA			

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
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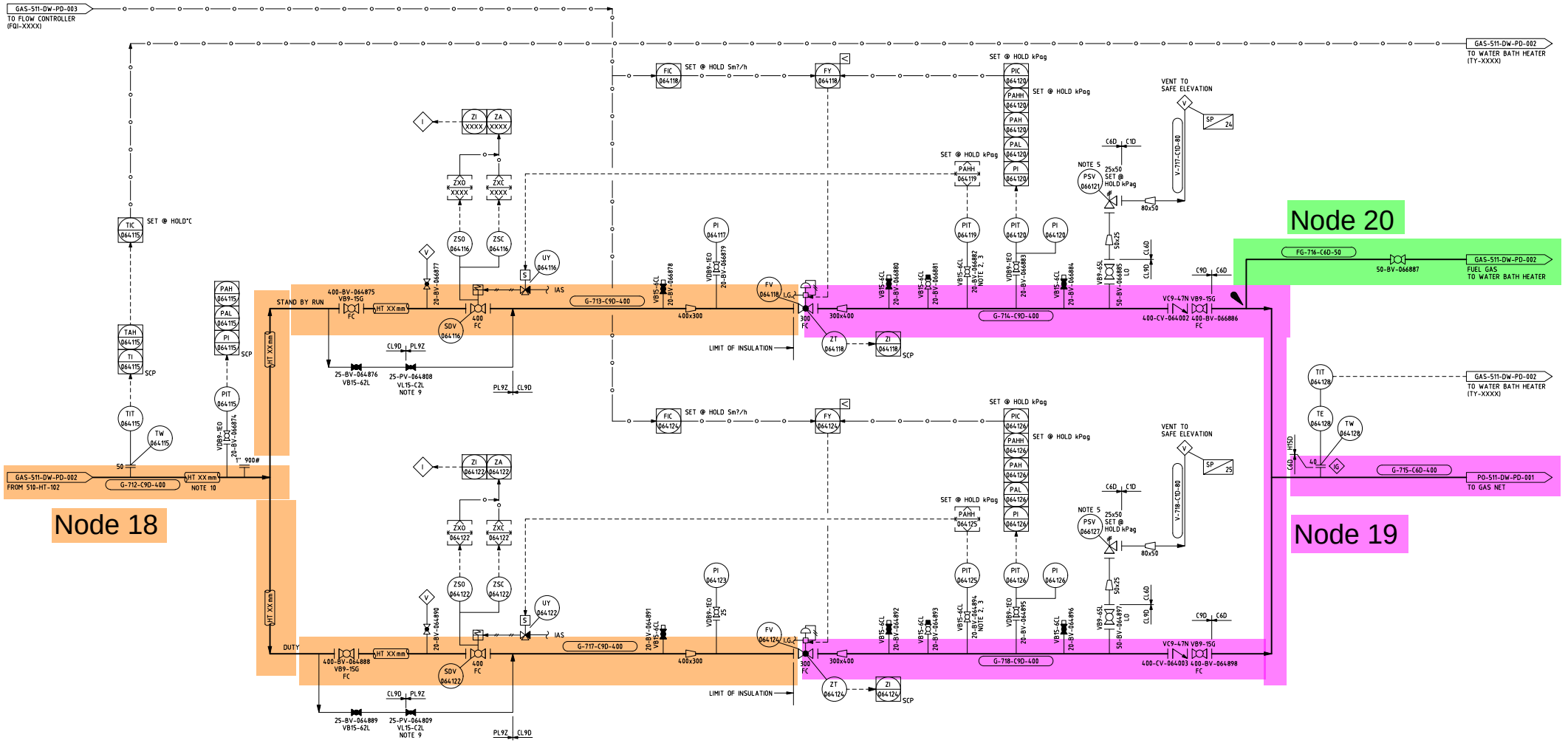
LONGFORD COMPRESSOR STATION
VIC HUB 2 - METERING RUN
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILTY	SUBJECT
DESIGN		SCALE	N.T.S.
CHECKED		SUPERSEDES	A1
APPROVED		DRAWING NUMBER	REV B
DATE	26/10/20	GAS-511-DW-PD-003	



NOTES:

1. DELETED.
2. PILOT SUPPLY LINE.
3. PRESSURE REGULATOR SENSING POINTS SHALL BE LOCATED DOWNSTREAM OF REGULATOR A MINIMUM DISTANCE AS REQUIRED BY VENDOR.
4. SOFT-SEATED CHECK VALVES.
5. TOKEN RELIEF SET AT JUST BELOW Hi PRESSURE PILOT AND PAHH TO ALLOW PSV TO RELIEVE LEAKAGE AND PREVENT "NO FLOW" OVER PRESSURE TRIPS.
6. DELETED.
7. DELETED.
8. DELETED.
9. LOW TEMPERATURE CARBON STEEL VALVE/LINE FOR PRESSURISING INDIVIDUAL PRESSURE REGULATION RUNS ONLY.
10. REFER TO PIPING DATASHEETS FOR IMPACT TESTING OR HEAT TREATMENT REQUIREMENTS.

MASTER FILE

ISSUED FOR HAZOP

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
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REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
B	2/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA			

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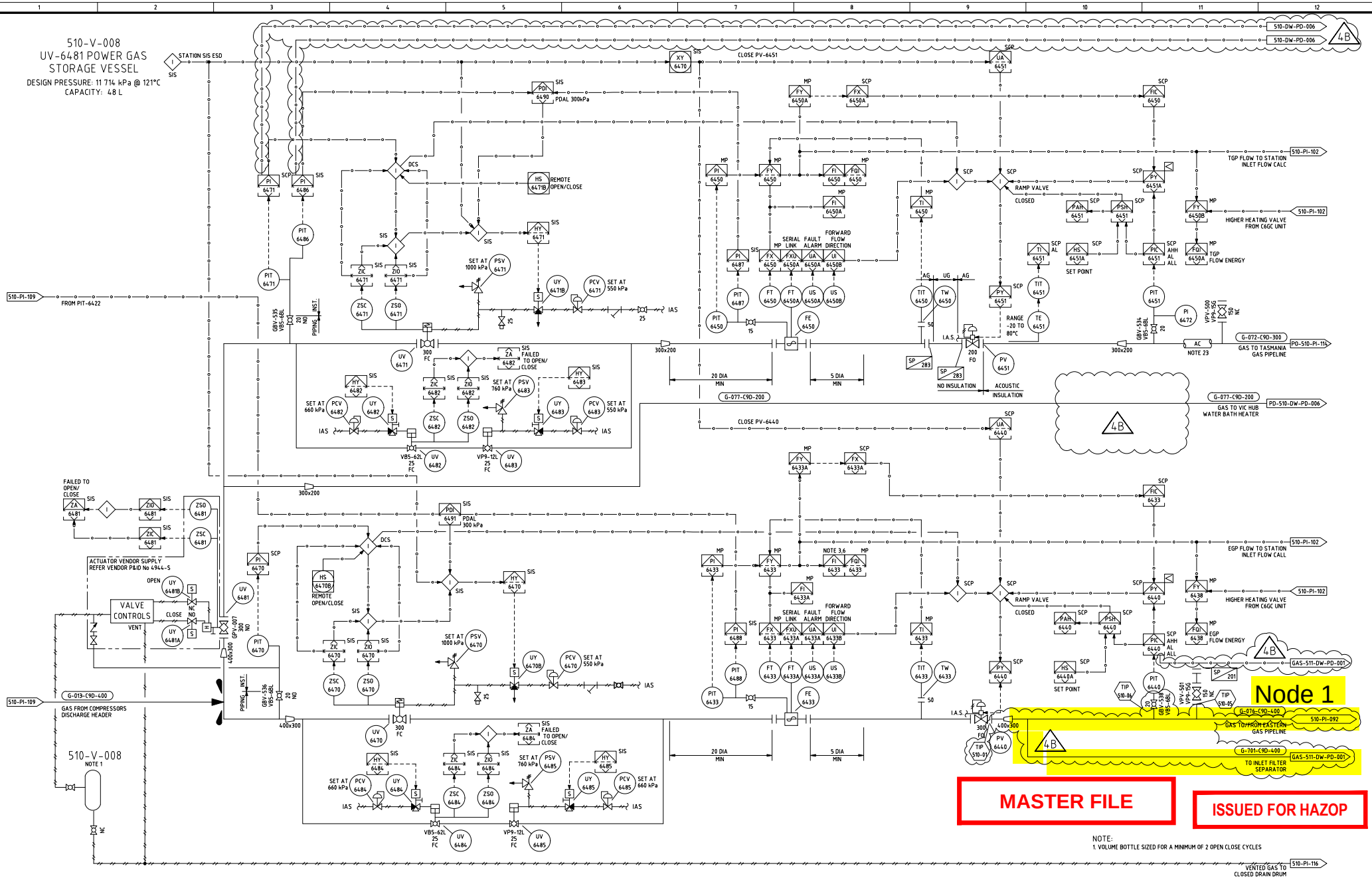
LONGFORD COMPRESSOR STATION
VIC HUB 2 - PRESSURE REGULATION
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILTY	SUBJECT
DESIGN		SCALE	N.T.S.
CHECKED		SUPERSEDES	A1
APPROVED		DRAWING NUMBER	REV
DATE	26/10/20	GAS-511-DW-PD-004	B

DRAWING No. | REFERENCE DRAWINGS


510-V-008
UV-6481 POWER GAS
STORAGE VESSEL
DESIGN PRESSURE: 11 714 kPa @ 121°C
CAPACITY: 48 L
510-V-008
NOTE 1
Node 1
MASTER FILE
ISSUED FOR HAZOP
NOTE:
1. VOLUME BOTTLE SIZED FOR A MINIMUM OF 2 OPEN CLOSE CYCLES

Node 19

NOTES

1. BURIED VALVE WITH SPINDLE EXTENSION.
2. GASNET P&ID DRAWING 3141-PB-006

MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
1B	2/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
1A	09/09/20	ISSUED FOR REVIEW (20617)	GPA		SLH	
1	05/03/03	AS BUILT	JS			
0	27/08/02	ISSUED FOR CONSTRUCTION	ML	DJ	PB	DLM

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
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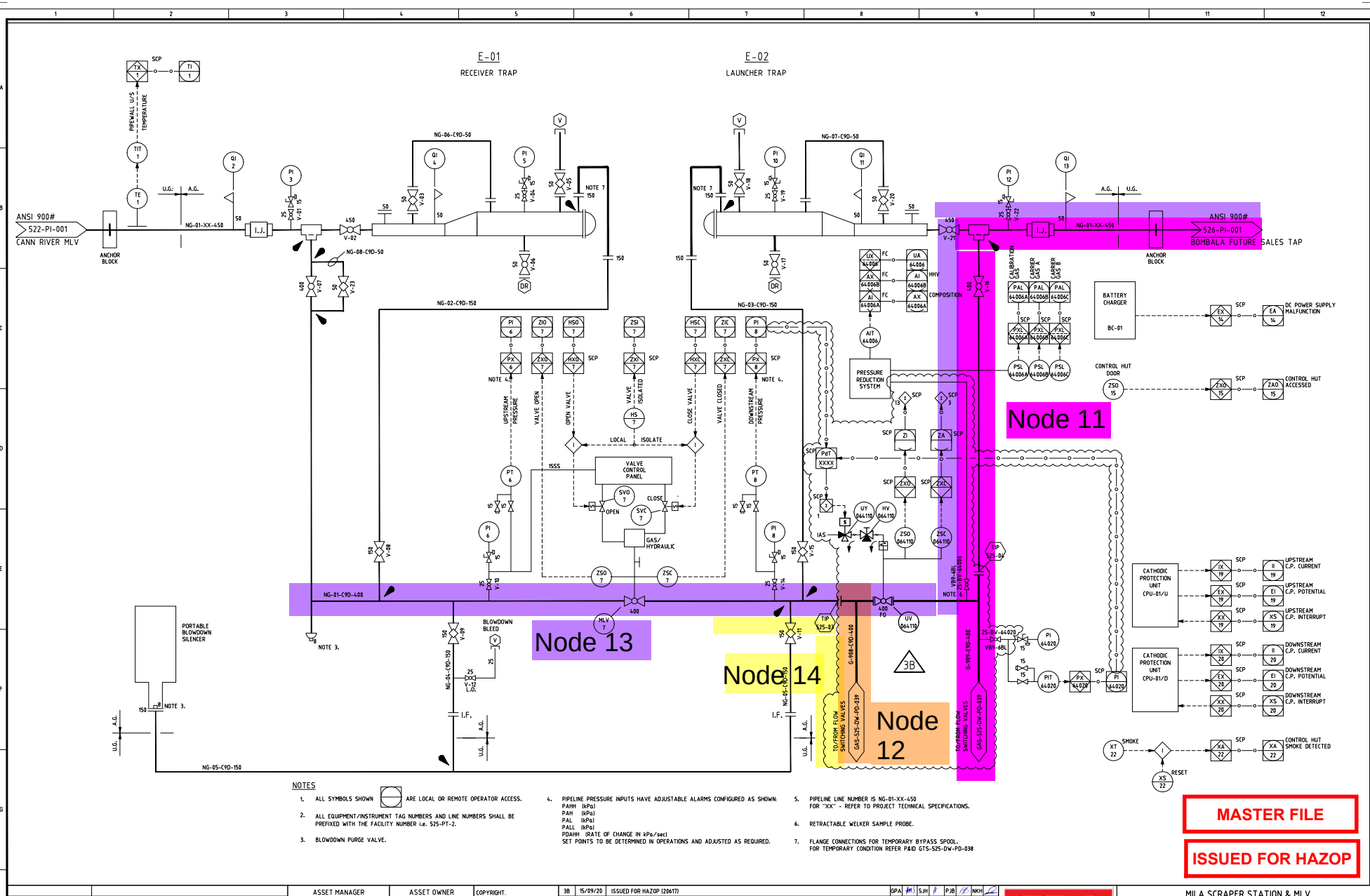
LONGFORD COMPRESSOR STATION
VIC HUB - BI-DIRECTIONAL PIPELINE
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	ML	FACILITY	SUBJECT
DESIGN	P.BANNISTER	SCALE	N.T.S.
CHECKED	D.JENKIN	SUPERSEDES	A1
APPROVED	D.MITVALSKY	DRAWING NUMBER	REV 1B
DATE	27/02/02	PO-511-DW-PD-001	

PO-510-DW-PD-003	CONNECTION TO BI-DIRECTIONAL PIPELINE & FILTER/SEPARATOR
DRAWING No.	REFERENCE DRAWINGS



REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
3B	15/09/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
3A	15/09/20	ISSUED FOR REVIEW (20617)	GPA		SLH	
3	30/06/08	AS BUILT				
2	07/03/08	RE-ISSUED FOR CONSTRUCTION	SMR		CJS	DSY
1	07/02/08	RE-ISSUED FOR CONSTRUCTION	SMR		JM	DSY
0	20/12/07	ISSUED FOR CONSTRUCTION	SMR		PWF	DSY
F	27/08/07	ISSUED FOR DESIGN	JHA		JMU	DSY
E	27/08/07	ISSUED FOR HAZOP	JHA		PWF	DSY
D	16/08/07	ISSUED FOR REVIEW	JHA		PWF	DSY

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
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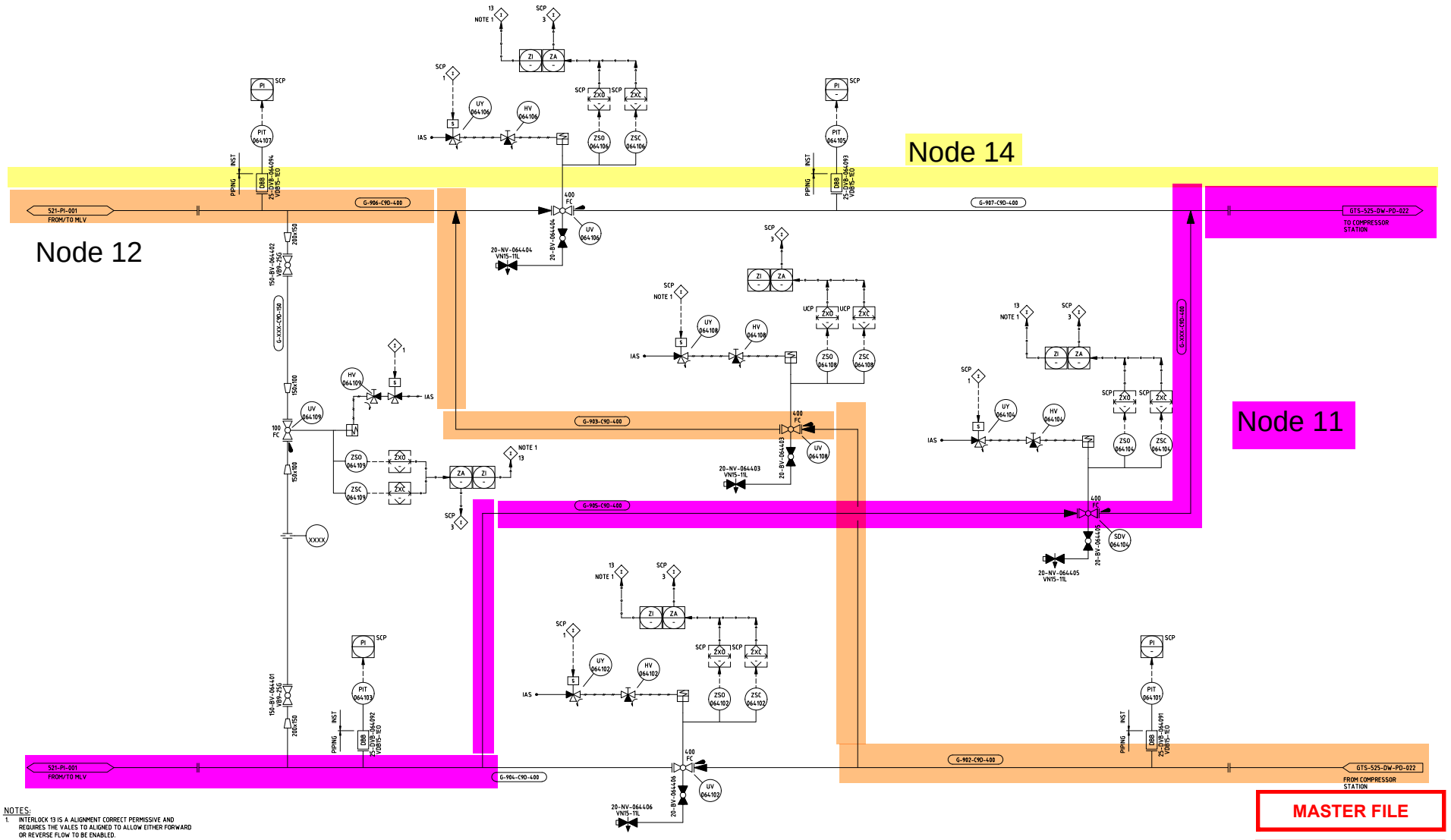
MILA SCRAPER STATION & MLV
INTERMEDIATE SCRAPER STATION
PIPING AND INSTRUMENT DIAGRAM

DRAWN	J.SHAFIQ	FACILITY	SUBJECT
DESIGN	C.SMITH	SCALE	NTS
CHECKED	D.YOUNG	SUPERSEDES	A1
APPROVED	P.FARRER	DRAWING NUMBER	REV 3A
DATE	20/12/07	525-PI-001	



NOTES:
1. INTERLOCK 13 IS A ALIGNMENT CORRECT PERMISSIVE AND REQUIRES THE VALES TO ALIGNED TO ALLOW EITHER FORWARD OR REVERSE FLOW TO BE ENABLED.

MASTER FILE

ISSUED FOR HAZOP

REF. DRG. No	REF. DESCRIPTION
DRAWING No.	REFERENCE DRAWINGS

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
B	27.10.20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
A	16.09.20	ISSUED FOR REVIEW (20617)	GPA	PJB		

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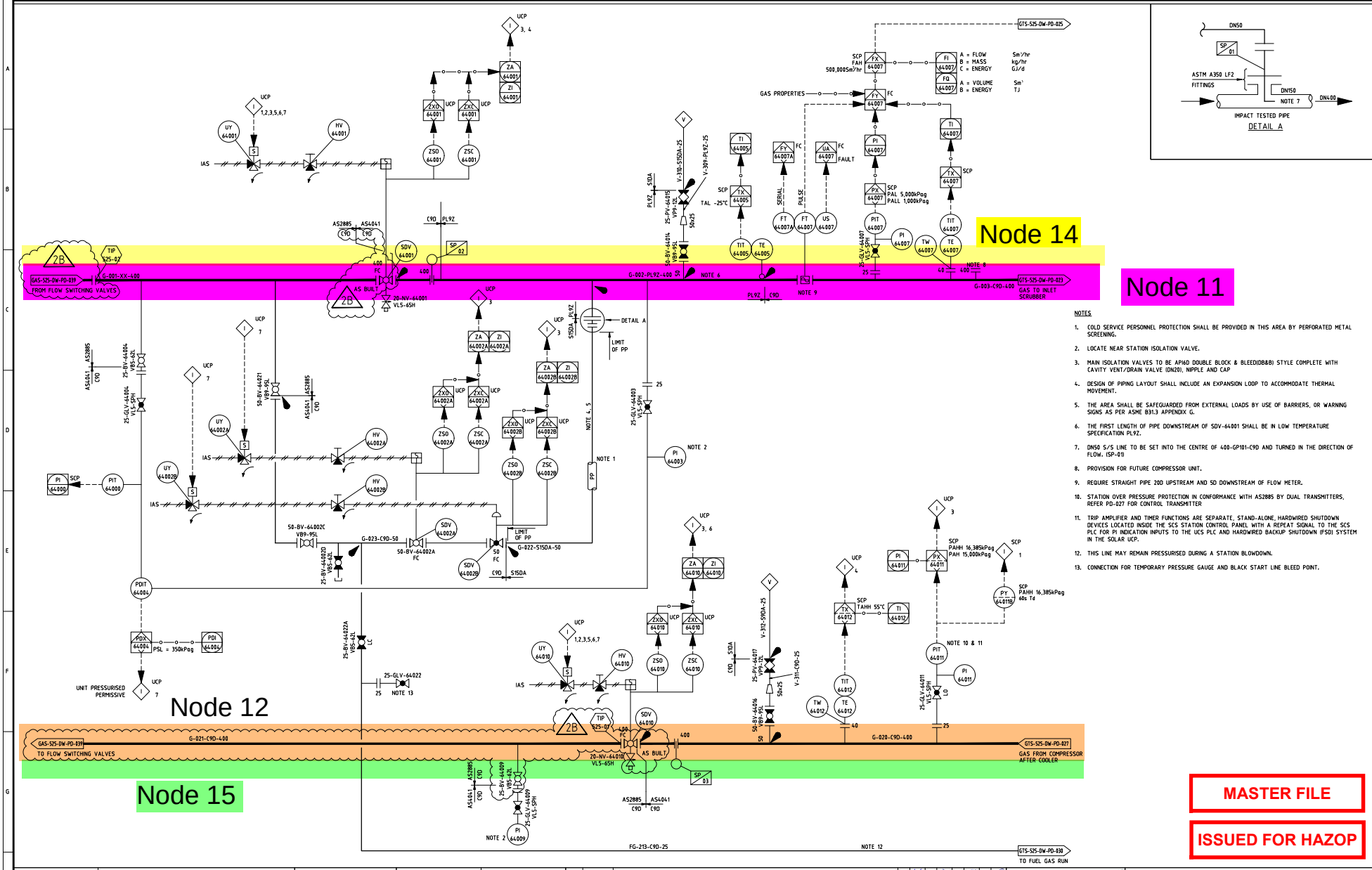
MILA COMPRESSOR STATION
FLOW SWITCHING VALVES
PIPING AND INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILTY	-
DESIGN	PJB	SCALE	-
CHECKED	SJH	SUPERSEDES	-
APPROVED	NKH	DRAWING NUMBER	GAS-525-DW-PD-039
DATE	27.10.20		REV B

A1



MASTER FILE

ISSUED FOR HAZOP

REF. DRG. No	REF. DESCRIPTION
DRAWING No.	REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
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REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
2B	29/10/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
2A	15/09/20	ISSUED FOR REVIEW (20617)	GPA		PJB	
2	30/06/08	AS BUILT				
1	07/02/08	RE-ISSUED FOR CONSTRUCTION	SMR		PWF	DSY
0	20/12/07	ISSUED FOR CONSTRUCTION	SMR		PWF	DSY
D	30/11/07	ISSUED FOR FUEL GAS DESIGN REVIEW	PKA		PWF	DSY
C	09/10/07	ISSUED FOR DESIGN	JHA		JMJ	DSY
B	28/08/07	ISSUED FOR HAZOP	JHA		DSY	PWF
A	16/08/07	ISSUED FOR REVIEW	JHA		DSY	PWF

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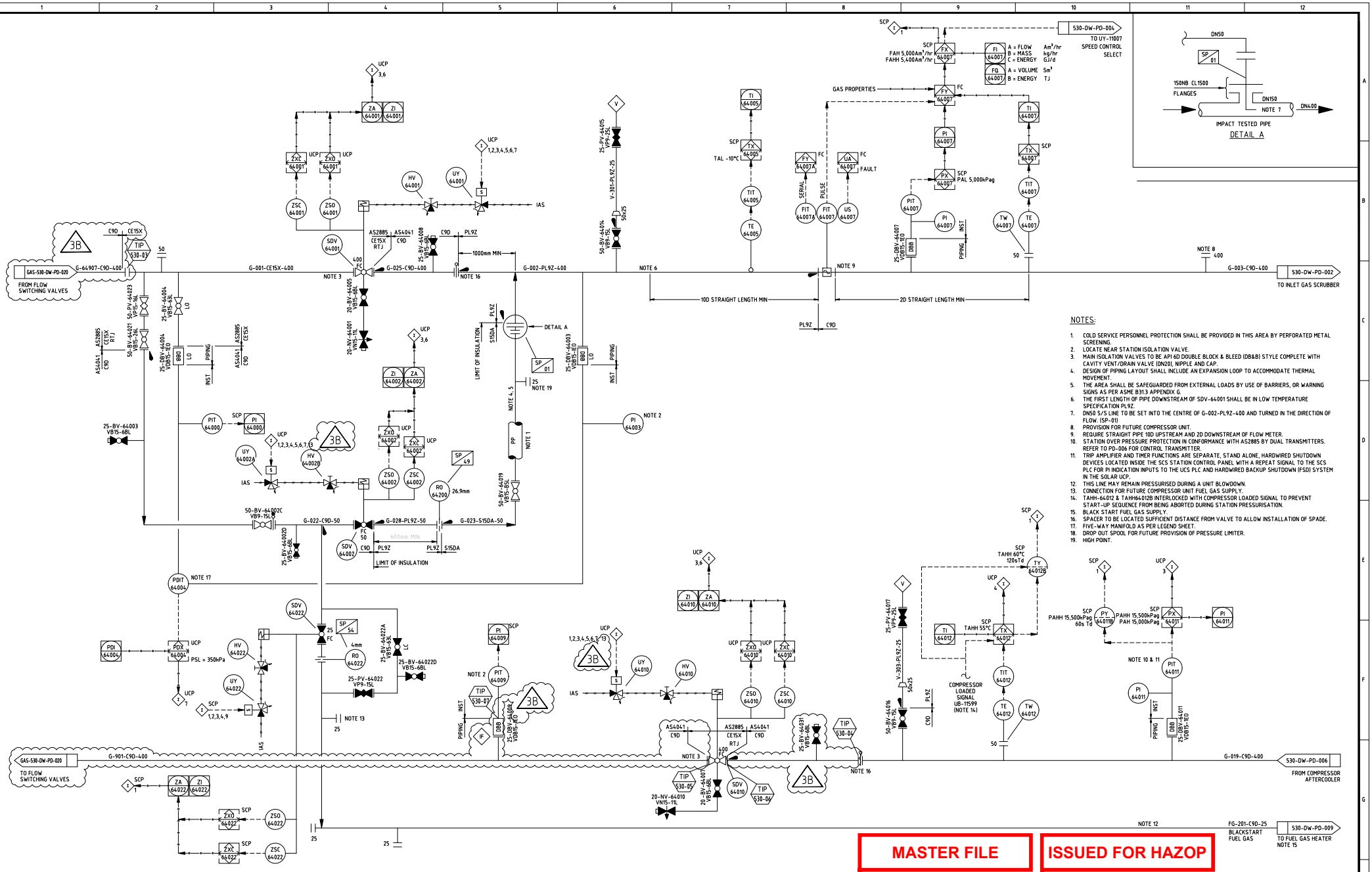
MILA COMPRESSOR STATION
STATION ISOLATION VALVES
PIPING AND INSTRUMENT DIAGRAM

DRAWN	J. SHAFIQ	FACILITY	SUBJECT
DESIGN	C. SMITH	SCALE	NTS
CHECKED	D. YOUNG	SUPERSEDES	A1
APPROVED	P. FARRER	DRAWING NUMBER	GTS-525-DW-PD-022
DATE	07/02/08	REV	2B



NOTES:

1. COLD SERVICE PERSONNEL PROTECTION SHALL BE PROVIDED IN THIS AREA BY PERFORATED METAL SCREENING.
2. LOCATE NEAR STATION ISOLATION VALVE.
3. MAIN ISOLATION VALVES TO BE API 6D DOUBLE BLOCK & BLEED (DB&B) STYLE COMPLETE WITH CAVITY VENT/DRAIN VALVE (DN20), NIPPLE AND CAP.
4. DESIGN OF PIPING LAYOUT SHALL INCLUDE AN EXPANSION LOOP TO ACCOMMODATE THERMAL MOVEMENT.
5. THE AREA SHALL BE SAFEGUARDED FROM EXTERNAL LOADS BY USE OF BARRIERS, OR WARNING SIGNS AS PER ASME B31.3 APPENDIX G.
6. THE FIRST LENGTH OF PIPE DOWNSTREAM OF SDV-64001 SHALL BE IN LOW TEMPERATURE SPECIFICATION PL9Z.
7. DN50 S/S LINE TO BE SET INTO THE CENTRE OF G-002-PL9Z-400 AND TURNED IN THE DIRECTION OF FLOW. (SP-01)
8. PROVISION FOR FUTURE COMPRESSOR UNIT.
9. REQUIRE STRAIGHT PIPE 10D UPSTREAM AND 2D DOWNSTREAM OF FLOW METER.
10. STATION OVER PRESSURE PROTECTION IN CONFORMANCE WITH AS2885 BY DUAL TRANSMITTERS. REFER TO PD-006 FOR CONTROL TRANSMITTER.
11. TRIP AMPLIFIER AND TIMER FUNCTIONS ARE SEPARATE, STAND ALONE, HARDWIRED SHUTDOWN DEVICES LOCATED INSIDE THE SCS STATION CONTROL PANEL WITH A REPEAT SIGNAL TO THE SCS PLC FOR PI INDICATION INPUTS TO THE UCS PLC AND HARDWIRED BACKUP SHUTDOWN (FSD) SYSTEM IN THE SOLAR UCP.
12. THIS LINE MAY REMAIN PRESSURISED DURING A UNIT BLOWDOWN.
13. CONNECTION FOR FUTURE COMPRESSOR UNIT FUEL GAS SUPPLY.
14. TAHH-64012 & TAHH64012B INTERLOCKED WITH COMPRESSOR LOADED SIGNAL TO PREVENT START-UP SEQUENCE FROM BEING ABORTED DURING STATION PRESSURISATION.
15. BLACK START FUEL GAS SUPPLY.
16. SPACER TO BE LOCATED SUFFICIENT DISTANCE FROM VALVE TO ALLOW INSTALLATION OF SPADE.
17. FIVE-WAY MANIFOLD AS PER LEGEND SHEET.
18. DROP OUT SPOOL FOR FUTURE PROVISION OF PRESSURE LIMITER.
19. HIGH POINT.

REF. DRG. No	REF. DESCRIPTION
DRAWING No.	REFERENCE DRAWINGS

ASSET MANAGER: Jemena — Produced by Jemena Asset Management (6) Pty Ltd, ABN 52 104 352 650

ASSET OWNER: Jemena — Jemena EGP(1) P/L, ABN 15 068 570 847; Jemena EGP(2) P/L, ABN 77 006 919 115

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
3B	30.10.20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
3A	09.09.20	ISSUED FOR REVIEW (20617)	GPA	SLH		
3	19.01.16	AS BUILT	MRM	JW		
2	10.06.16	RE-ISSUED FOR CONSTRUCTION	HWI	JW		
1	18.12.14	ISSUED FOR CONSTRUCTION	SLA	NH		
0	25.07.14	ISSUED FOR DESIGN	SLA	NH		
C	25.06.14	REISSUED FOR HAZOP	SLA	NH		
B	19.05.14	ISSUED FOR HAZOP	SLA	WHJW		
A	18.04.08	ISSUED FOR CLIENT REVIEW	SGP	CS		KM

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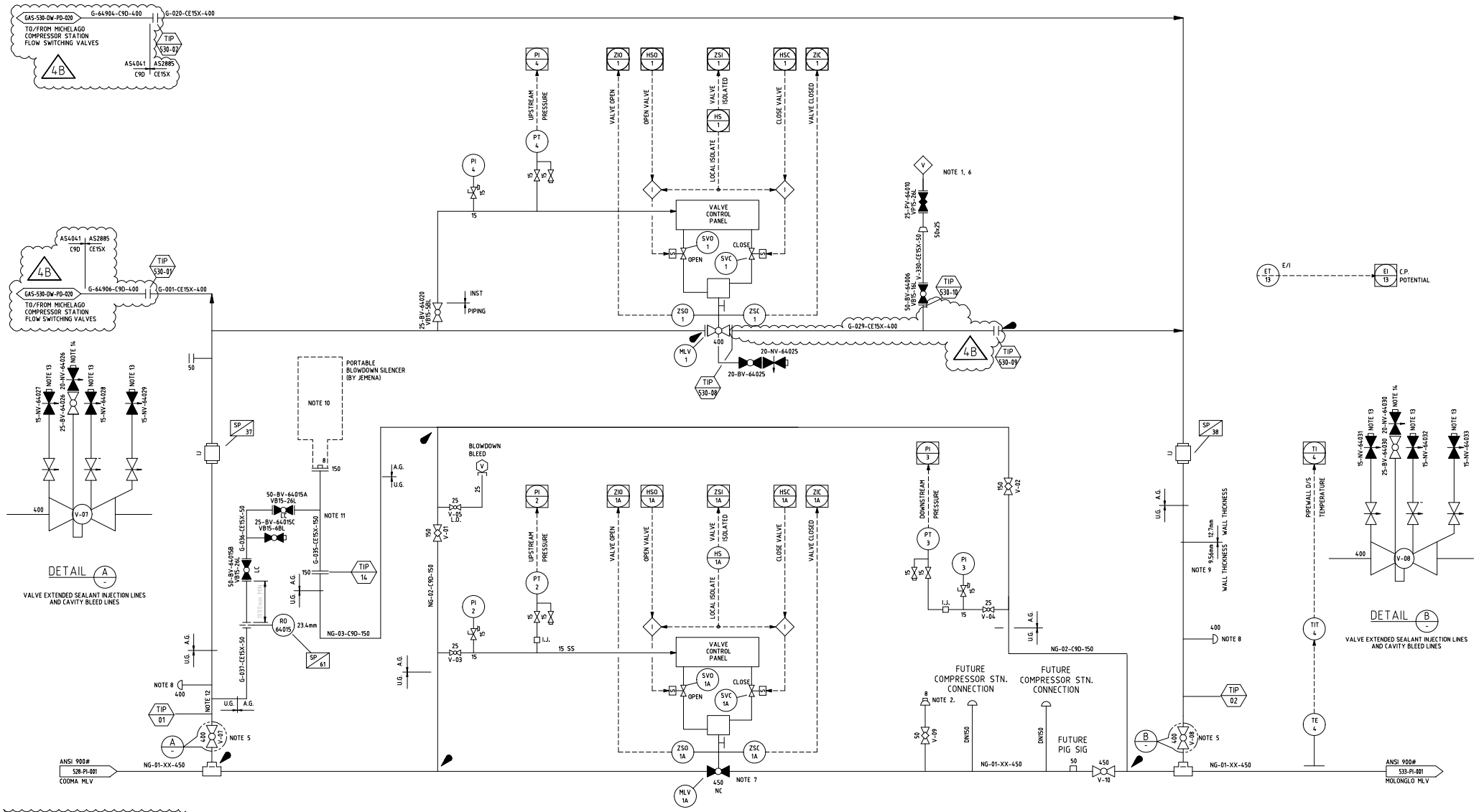
MICHELAGO COMPRESSOR STATION
STATION ISOLATION VALVES
PIPING AND INSTRUMENTATION DIAGRAM

DRAWN	SGP	FACILITY	SUBJECT
DESIGN		SCALE	NTS
CHECKED	CS	SUPERSEDES	A1
APPROVED	KM	DRAWING NUMBER	530-DW-PD-001
DATE	18.04.08	REV	3B



NOTES:

1.
2.
3.
4.
5.

HOLD - NOTES MISSING ON PREVIOUS DRAWING REVISION.

MASTER FILE

ISSUED FOR HAZOP

REF. DRG. No	REF. DESCRIPTION
DRAWING No.	REFERENCE DRAWINGS

ASSET MANAGER

Jemena

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ABN 52 104 352 650

ASSET OWNER

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
4A	15.09.20	ISSUED FOR REVIEW (20617)	GPA	PJB		
4	19.01.16	AS BUILT	MRM	JW		
3	10.06.15	RE-ISSUED FOR CONSTRUCTION	HWJ	JW		
2	13.03.15	RE-ISSUED FOR CONSTRUCTION	SLA	NH		
1	18.12.14	ISSUED FOR CONSTRUCTION	SLA	NH		
0	25.07.14	ISSUED FOR DESIGN	SLA	NH		
C	25.06.14	REISSUED FOR HAZOP	SLA	NH		
B	14.05.14	ISSUED FOR HAZOP	SLA	HH/JW		
4B	23.10.20	ISSUED FOR HAZOP (20617)	GPA	PJB	SJH	NKH

GPA ENGINEERING

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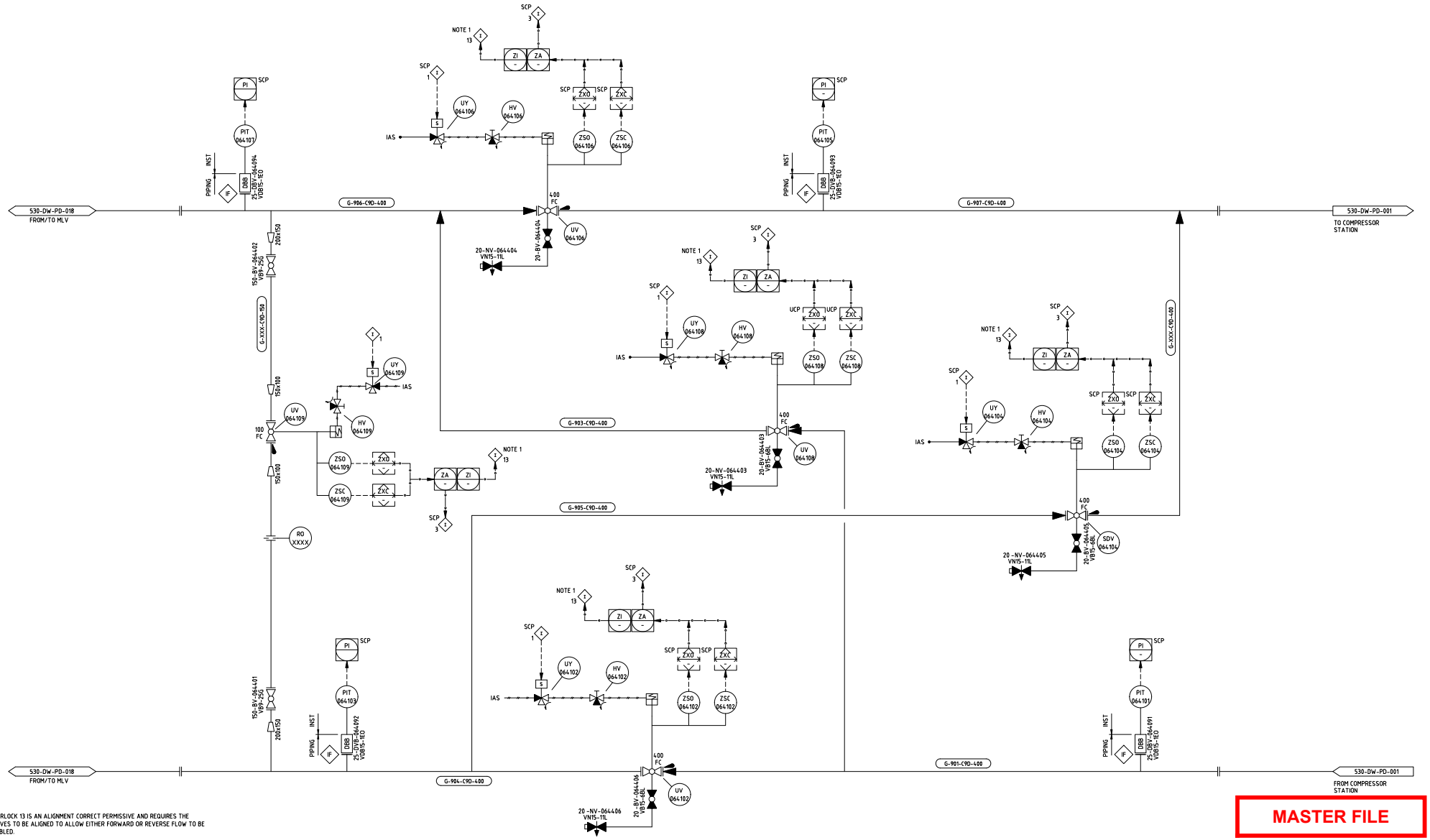
MICHELAGO COMPRESSOR STATION MAINLINE VALVE PIPING AND INSTRUMENTATION DIAGRAM

DRAWN	SGP	FACILITY	SUBJECT
DESIGN		SCALE	Scale
CHECKED	CS	SUPERSEDES	A1
APPROVED	KM	DRAWING NUMBER	
DATE	18.04.20	530-DW-PD-018	REV 4B



NOTES:

1. INTERLOCK 13 IS AN ALIGNMENT CORRECT PERMISSIVE AND REQUIRES THE VALVES TO BE ALIGNED TO ALLOW EITHER FORWARD OR REVERSE FLOW TO BE ENABLED.

MASTER FILE

ISSUED FOR HAZOP

B	22.10.20	ISSUED FOR HAZOP (20617)	GPA	AMS	SJH	PJB	NKH						
A	16.09.20	ISSUED FOR REVIEW (20617)	GPA		PJB								
REV	DATE	DESCRIPTION	DRAWN		CHECKED		ENG CHK		APPRV				

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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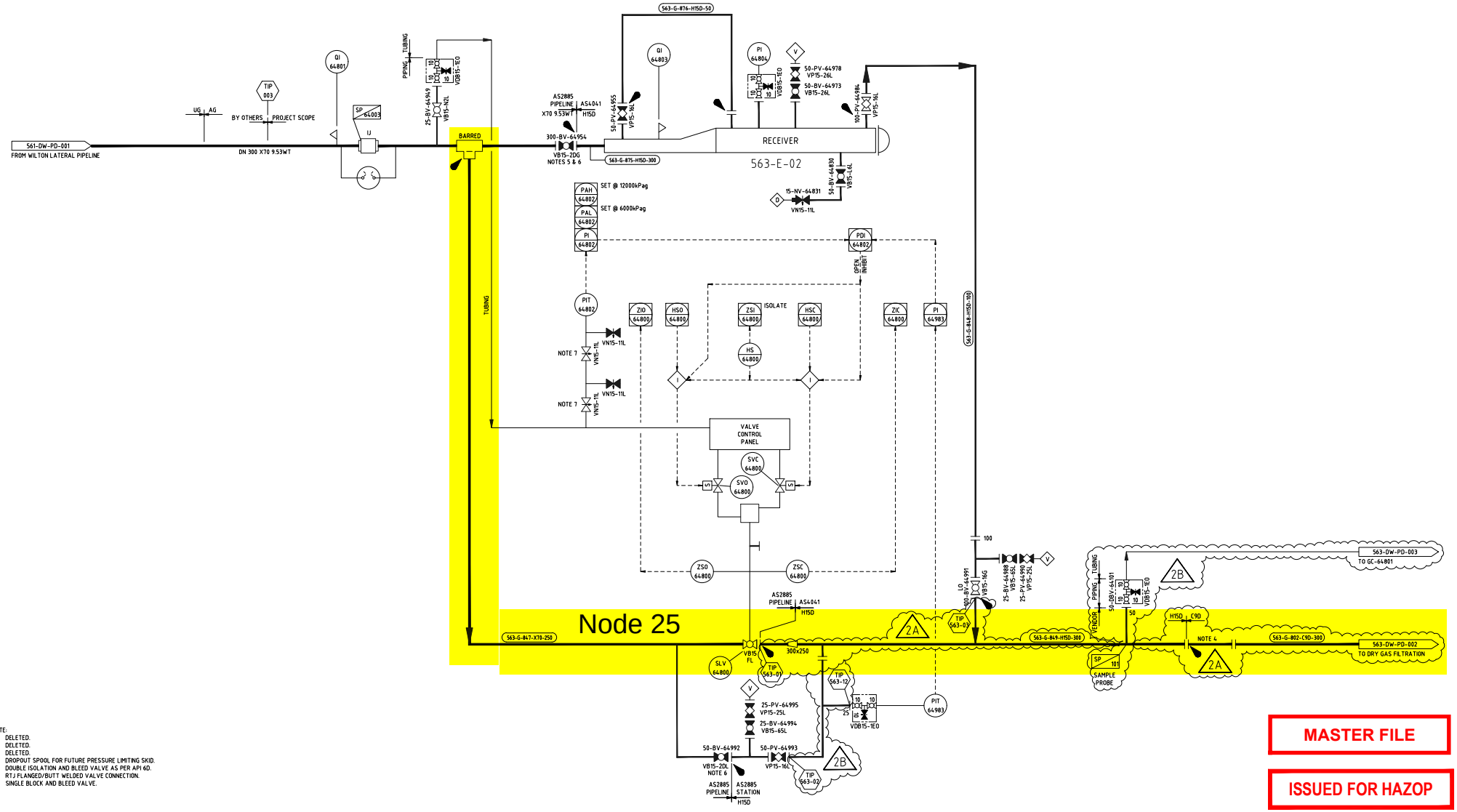
MICHELAGO COMPRESSOR STATION
FLOW SWITCHING VALVES
PIPING AND INSTRUMENTATION DIAGRAM
-

DRAWN	GPA		
DESIGN	-	SCALE	N/A
CHECKED	-	SUPERSEDES	-
APPROVED	-	DRAWING NUMBER	GAS-530-DW-PD-020
DATE	16.09.20	REV	B

A1

563-E-02
RECEIVER TRAP
DESIGN PRESSURE: 16550kPag
DESIGN TEMPERATURE: -6 TO 65°



NOTE:
1. DELETED.
2. DELETED.
3. DELETED.
4. DROPOUT SPOOL FOR FUTURE PRESSURE LIMITING SKID.
5. DOUBLE ISOLATION AND BLEED VALVE AS PER API 60.
6. RTJ FLANGED/BUTT WELDED VALVE CONNECTION.
7. SINGLE BLOCK AND BLEED VALVE.

MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
2B	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
2A	16/09/20	ISSUED FOR REVIEW (20617)	GPA			
2	18/01/16	AS BUILT TO CLIENT MARKUPS	JB	NB		
1	13/02/15	REISSUED FOR CONSTRUCTION	JB	NB	WW	AH
0	12/12/14	ISSUED FOR CONSTRUCTION	JB	NB	WW	AH

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
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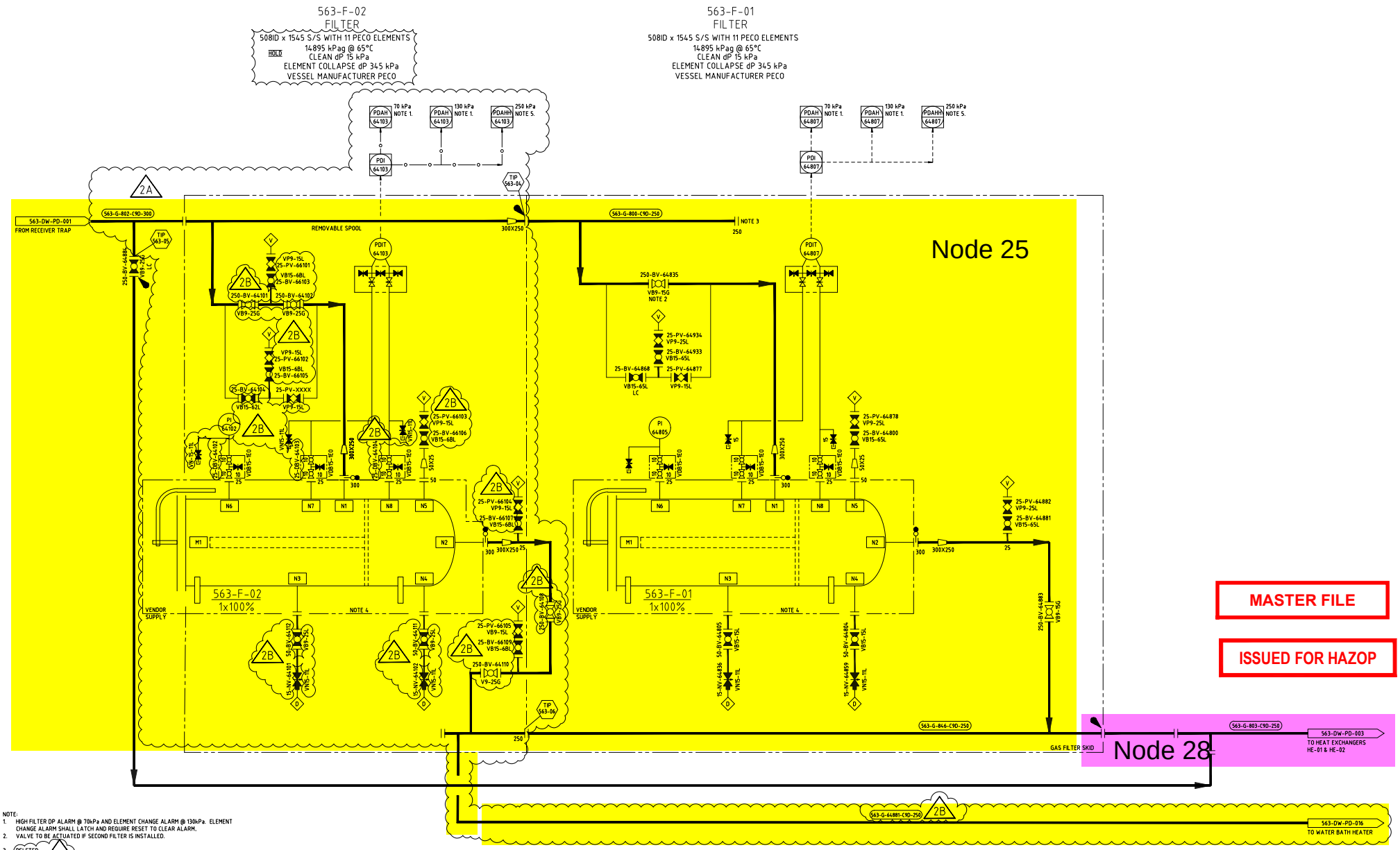
WILTON METER STATION
RECEIVER STATION
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT	
DESIGN	SCALE N.T.S.		
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV 2B
DATE	563-DW-PD-001		



NOTE:
1. HIGH FILTER DP ALARM @ 70kPa AND ELEMENT CHANGE ALARM @ 130kPa. ELEMENT CHANGE ALARM SHALL LATCH AND REQUIRE RESET TO CLEAR ALARM.
2. VALVE TO BE ACTUATED IF SECOND FILTER IS INSTALLED.
3. DELETED. 2A
4. HIGH-HIGH DP WILL TRIP INLET SLV-64800 AFTER 30 CONTINUOUS SECONDS.

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
2B	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
2A	16/09/20	ISSUED FOR REVIEW (20617)	GPA			
2	18/01/16	AS BUILT TO CLIENT MARKUPS	JB	NB		
1	13/02/15	REISSUED FOR CONSTRUCTION	JB	NB	WW	AH
0	12/12/14	ISSUED FOR CONSTRUCTION	JB	NB	WW	AH

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
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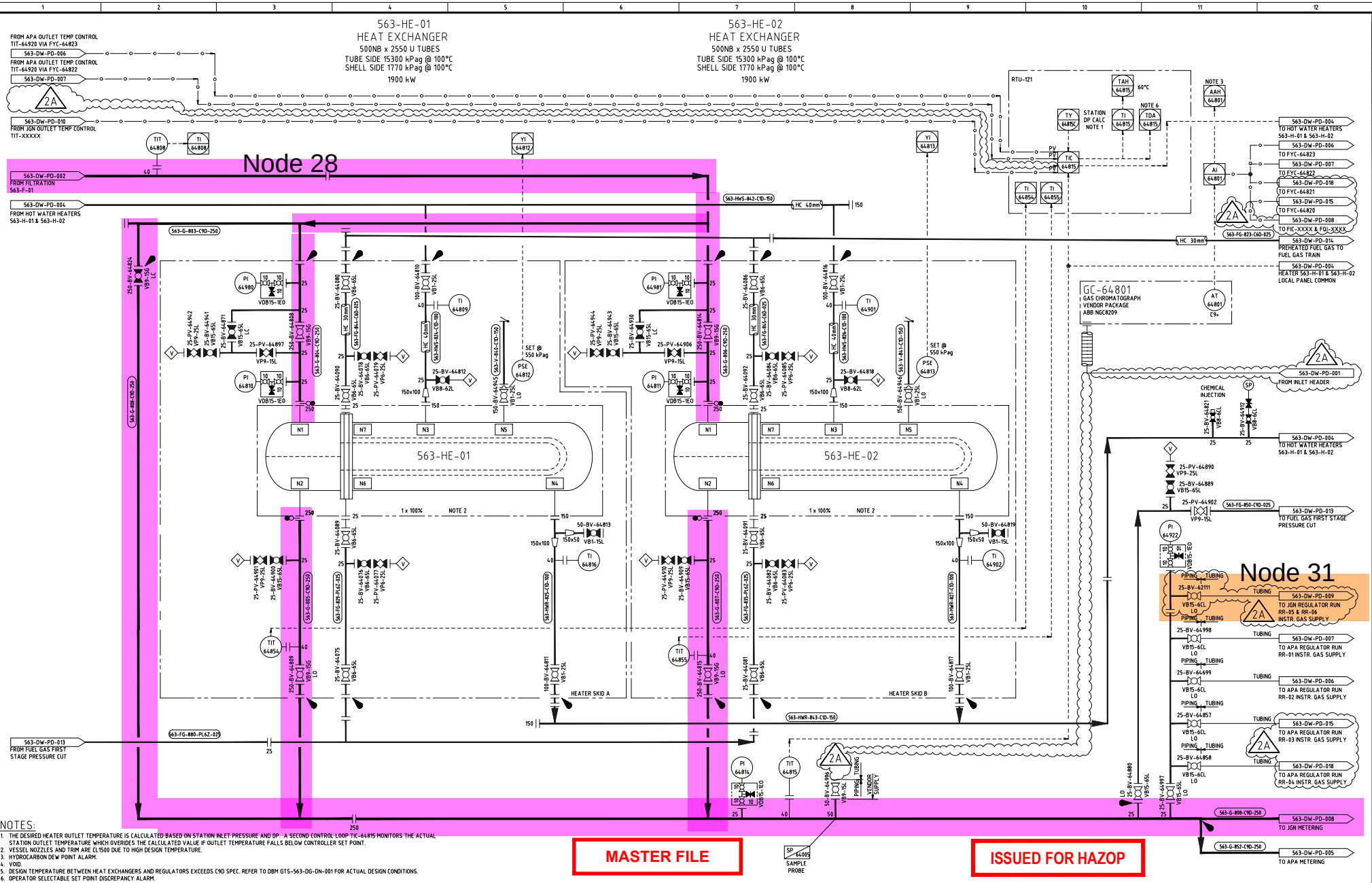
WILTON METER STATION
DRY GAS FILTERS
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILITY	SUBJECT	
DESIGN	SCALE N.T.S.		
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV 2B
DATE	563-DW-PD-002		



NOTES:

1. THE DESIRED HEATER OUTLET TEMPERATURE IS CALCULATED BASED ON STATION INLET PRESSURE AND DP. A SECOND CONTROL LOOP TIC-64815 MONITORS THE ACTUAL STATION OUTLET TEMPERATURE WHICH OVERIDES THE CALCULATED VALUE IF OUTLET TEMPERATURE FALLS BELOW CONTROLLER SET POINT.
2. VESSEL NOZZLES AND TRIM ARE CL1500 DUE TO HIGH DESIGN TEMPERATURE.
3. HYDROCARBON DEW POINT ALARM.
4. VOID.
5. DESIGN TEMPERATURE BETWEEN HEAT EXCHANGERS AND REGULATORS EXCEEDS C9D SPEC. REFER TO DBM GTS-563-DG-DN-001 FOR ACTUAL DESIGN CONDITIONS.
6. OPERATOR SELECTABLE SET POINT DISCREPANCY ALARM.

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
2A	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
2	18/01/16	AS BUILT TO CLIENT MARKUPS	JB	NB		
1	13/02/15	REISSUED FOR CONSTRUCTION	JB	NB	WW	AH
0	12/12/14	ISSUED FOR CONSTRUCTION	JB	NB	WW	AH

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
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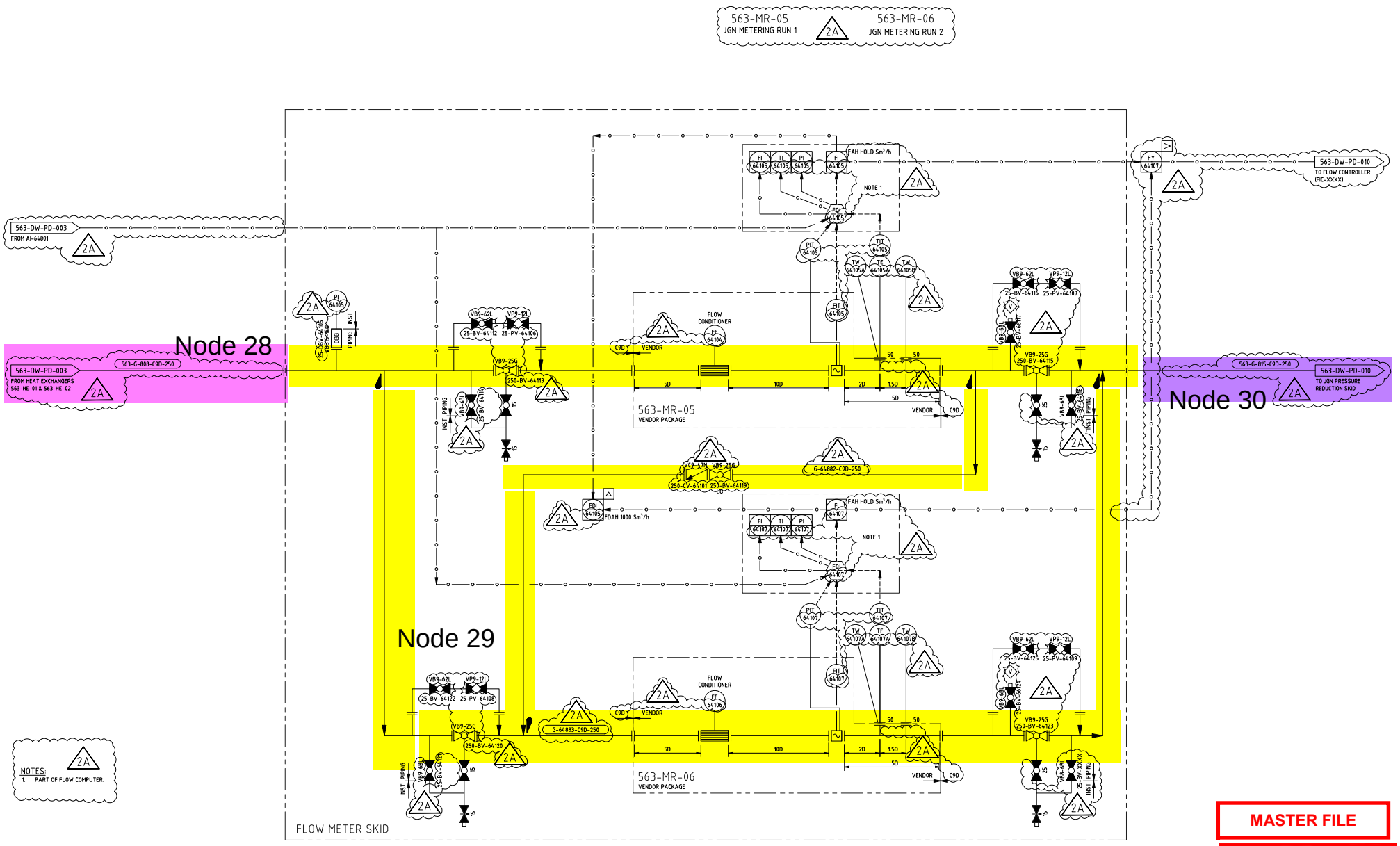
WILTON METER STATION
HEAT EXCHANGERS
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT
DESIGN	SCALE N.T.S.	
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER	REV 2A
DATE	563-DW-PD-003	



MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
2B	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
2	18/01/16	AS BUILT TO CLIENT MARKUPS	JB	NB		
1	13/02/15	REISSUED FOR CONSTRUCTION	JB	NB	WW	AH
0	12/12/14	ISSUED FOR CONSTRUCTION	JB	NB	WW	AH

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
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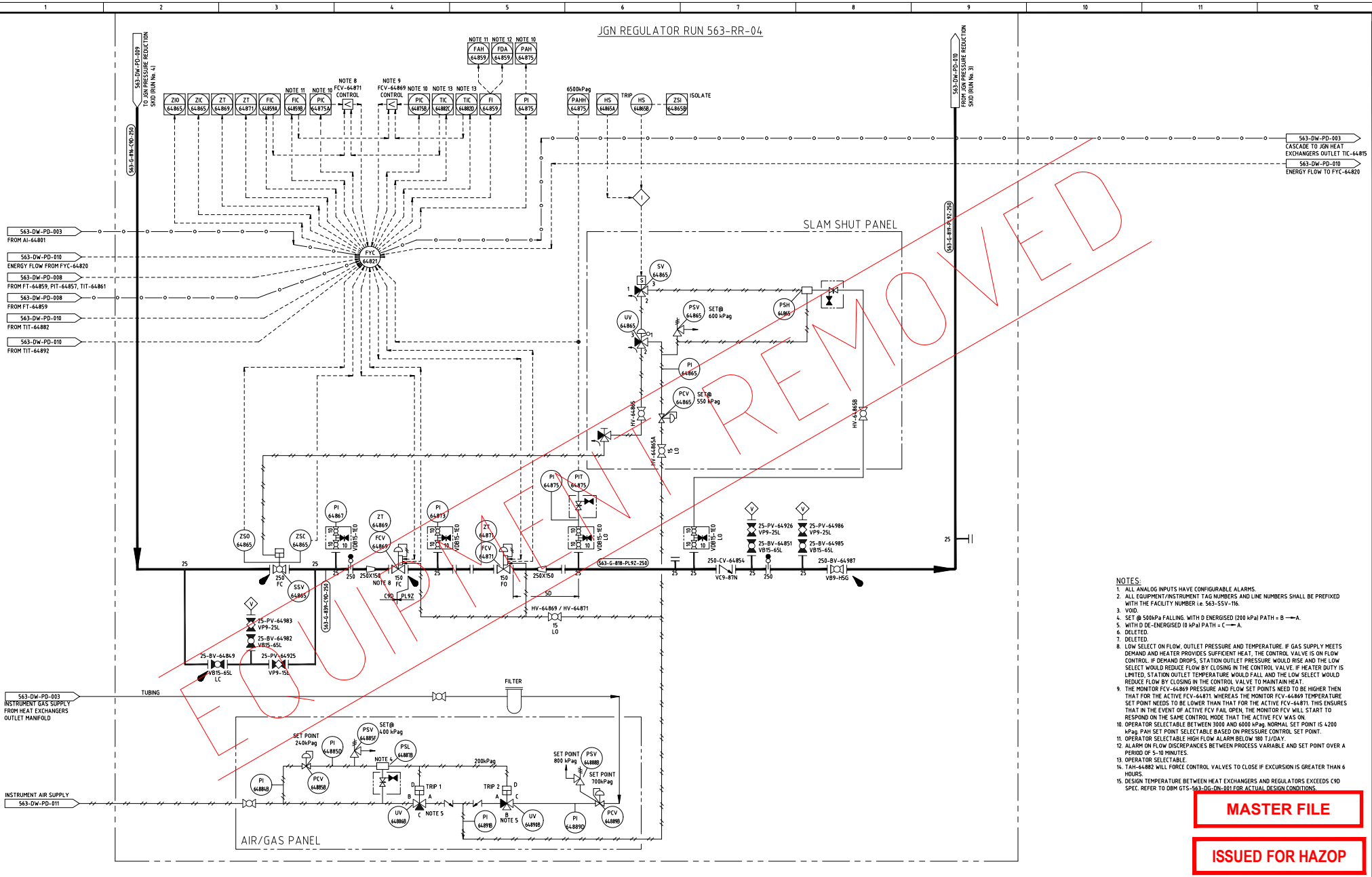
WILTON METER STATION
JGN FLOW METERING
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT	
DESIGN	SCALE N.T.S.		
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV 2A
DATE	563-DW-PD-008		

DRAWING No. | REFERENCE DRAWINGS



EQUIPMENT REMOVED

MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
3A	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
3	10/02/16	AS BUILT TO CLIENT MARKUPS	LC	JB		
2	18/01/16	AS BUILT TO CLIENT MARKUPS	JB	NB		
1	13/02/15	REISSUED FOR CONSTRUCTION	JB	NB	WW	AH
0	12/12/14	ISSUED FOR CONSTRUCTION	JB	NB	WW	AH

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
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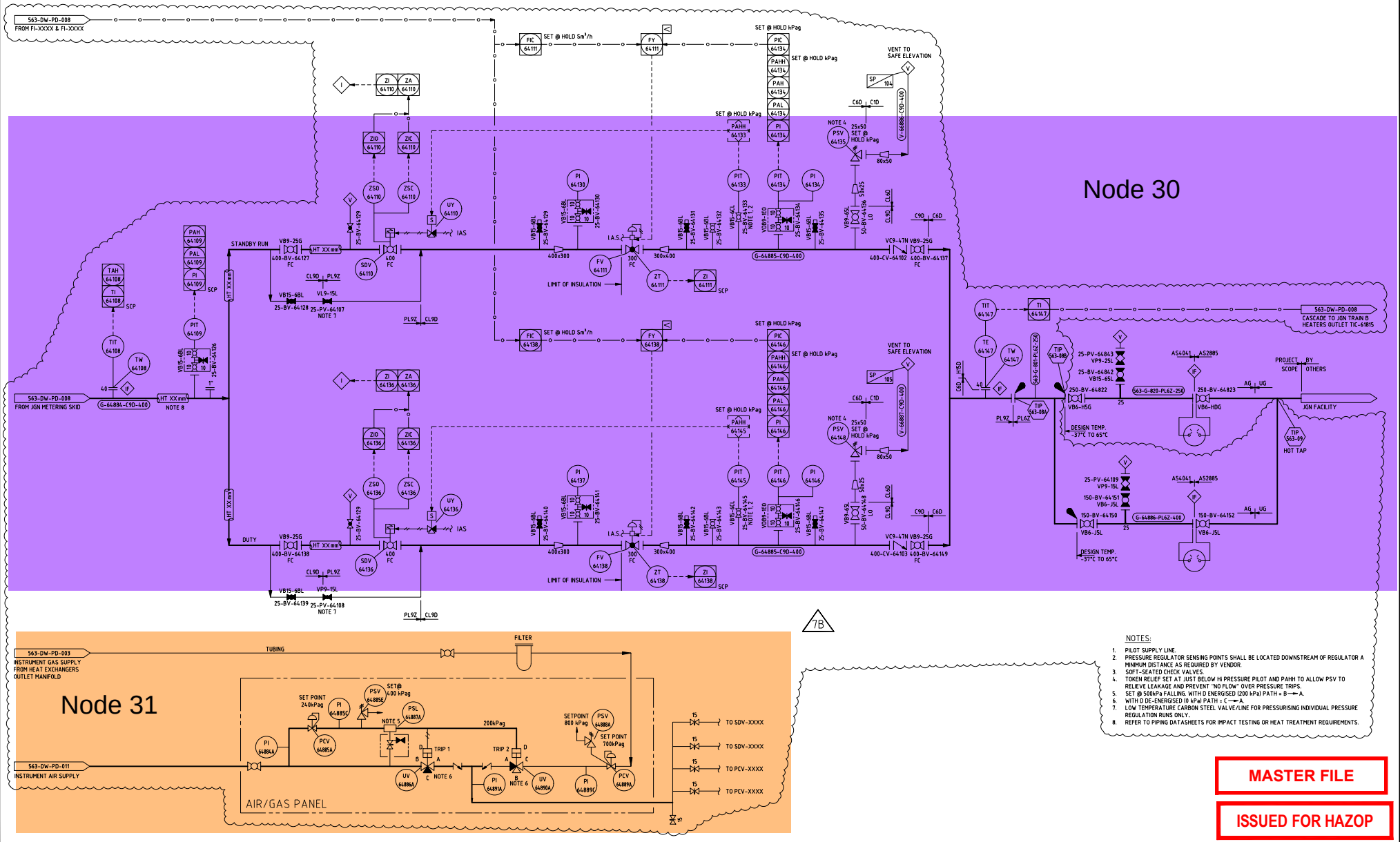
WILTON METER STATION
JGN PRESSURE REDUCTION SKID (RUN No. 4)
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT	
DESIGN	SCALE N.T.S.		
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV 3A
DATE	563-DW-PD-009		

DRAWING No.	REFERENCE DRAWINGS
PO-510-DW-PD-003	CONNECTION TO BI-DIRECTIONAL PIPELINE & FILTER/SEPARATOR

JGN REGULATOR RUN 563-RR-06



NOTES:

1. PILOT SUPPLY LINE.
2. PRESSURE REGULATOR SENSING POINTS SHALL BE LOCATED DOWNSTREAM OF REGULATOR A MINIMUM DISTANCE AS REQUIRED BY VENDOR.
3. SOFT-SEATED CHECK VALVES.
4. TOKEN RELIEF SET AT JUST BELOW Hi PRESSURE PILOT AND PAHH TO ALLOW PSV TO RELIEVE LEAKAGE AND PREVENT "NO FLOW" OVER PRESSURE TRIPS.
5. SET @ 500kPa FALLING. WITH D ENERGISED (200 kPa) PATH = B—►A.
6. WITH D DE-ENERGISED (0 kPa) PATH = C—►A.
7. LOW TEMPERATURE CARBON STEEL VALVE/LINE FOR PRESSURISING INDIVIDUAL PRESSURE REGULATION RUNS ONLY.
8. REFER TO PIPING DATASHEETS FOR IMPACT TESTING OR HEAT TREATMENT REQUIREMENTS.

MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
7A	17/09/20	ISSUED FOR REVIEW (20617)	GPA			
7	10/02/16	AS BUILT TO CLIENT MARKUPS	LC	JB		
6	18/01/16	AS BUILT TO CLIENT MARKUPS	JS	NB		
5	01/09/15	REISSUED FOR CONSTRUCTION	JB	GH	WW	AH
4	18/08/15	REISSUED FOR CONSTRUCTION	JB	NB	WW	AH
3	21/07/15	REISSUED FOR CONSTRUCTION	JB	NB	WW	AH
2	27/03/15	REISSUED FOR CONSTRUCTION	JB	NB	WW	AH
7B	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH

ASSET MANAGER

Jemena

Produced by Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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WILTON METER STATION
JGN PRESSURE REDUCTION SKID (RUN No. 3)
PIPING & INSTRUMENTATION DIAGRAM

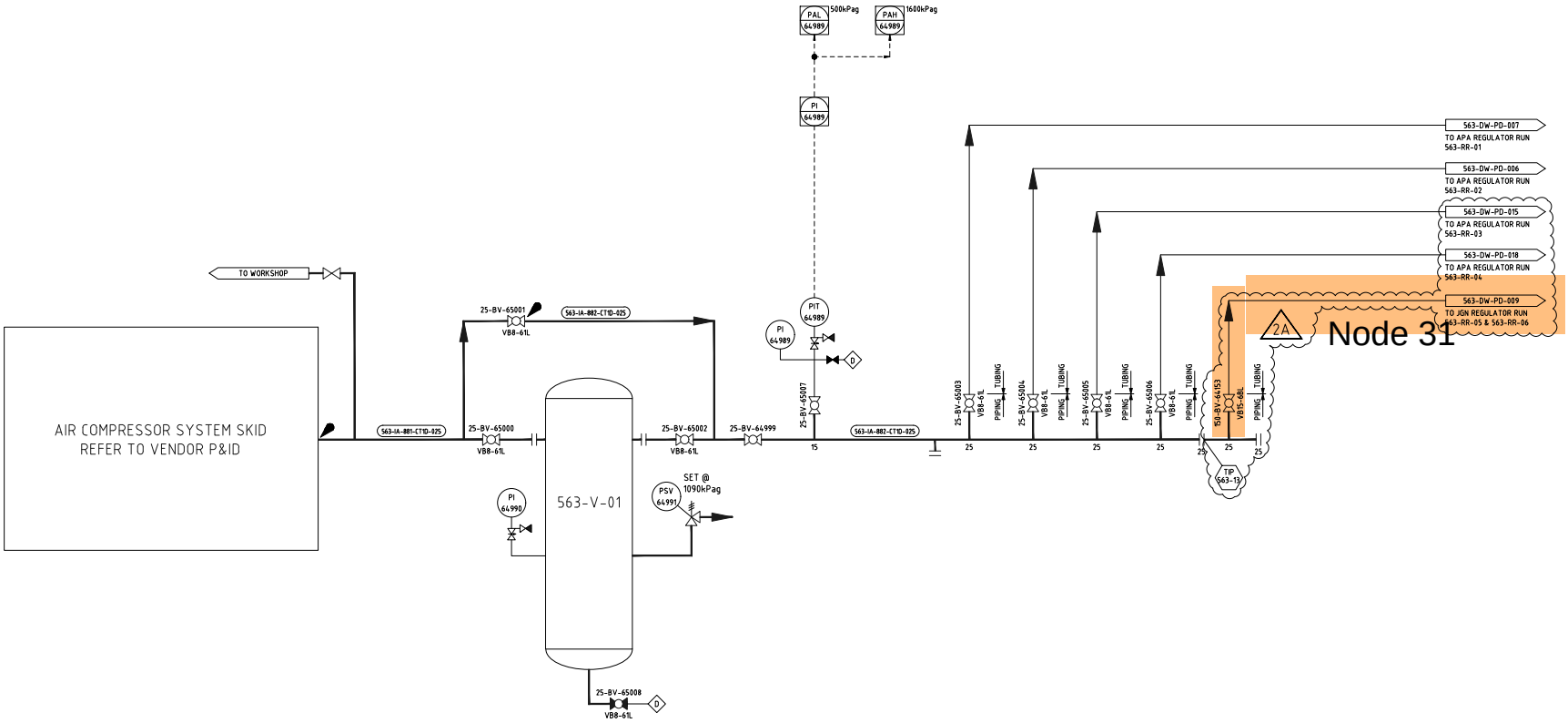
DRAWN	FACILTY	SUBJECT	
DESIGN	SCALE N.T.S.		
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV 7B
DATE	563-DW-PD-010		

DRAWING No.	REFERENCE DRAWINGS
PO-510-DW-PD-003	CONNECTION TO BI-DIRECTIONAL PIPELINE & FILTER/SEPARATOR

563-AC-01
AIR COMPRESSOR PACKAGE

563-V-01
INSTRUMENT AIR RECEIVER

RECEIVER CAPACITY: 1500L
DESIGN PRESSURE: 1750kPag



MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
2A	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
2	18/01/16	AS BUILT TO CLIENT MARKUPS	JB	NB		
1	13/02/15	REISSUED FOR CONSTRUCTION	JB	NB	WW	AH
0	12/12/14	ISSUED FOR CONSTRUCTION	JB	NB	WW	AH

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
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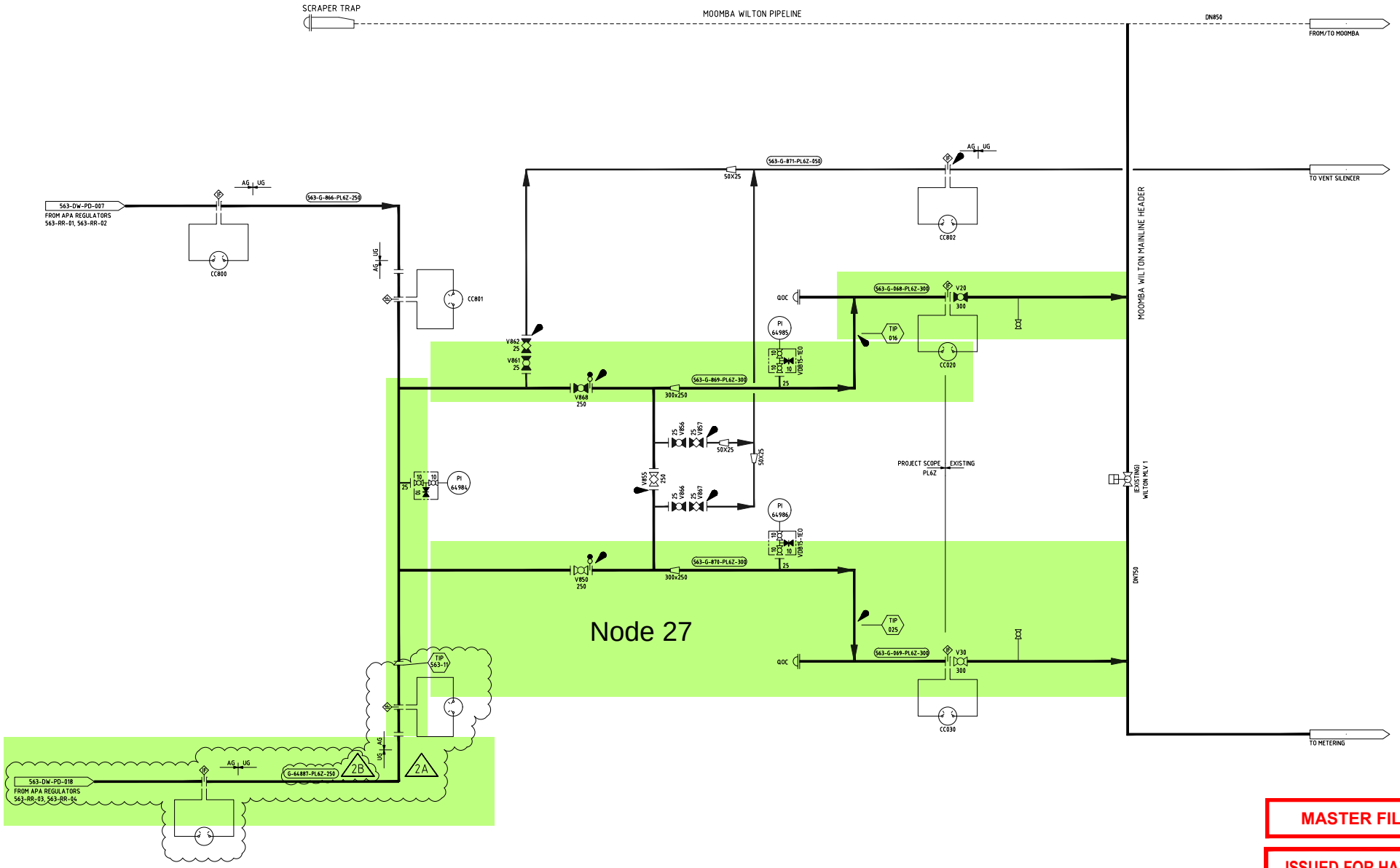
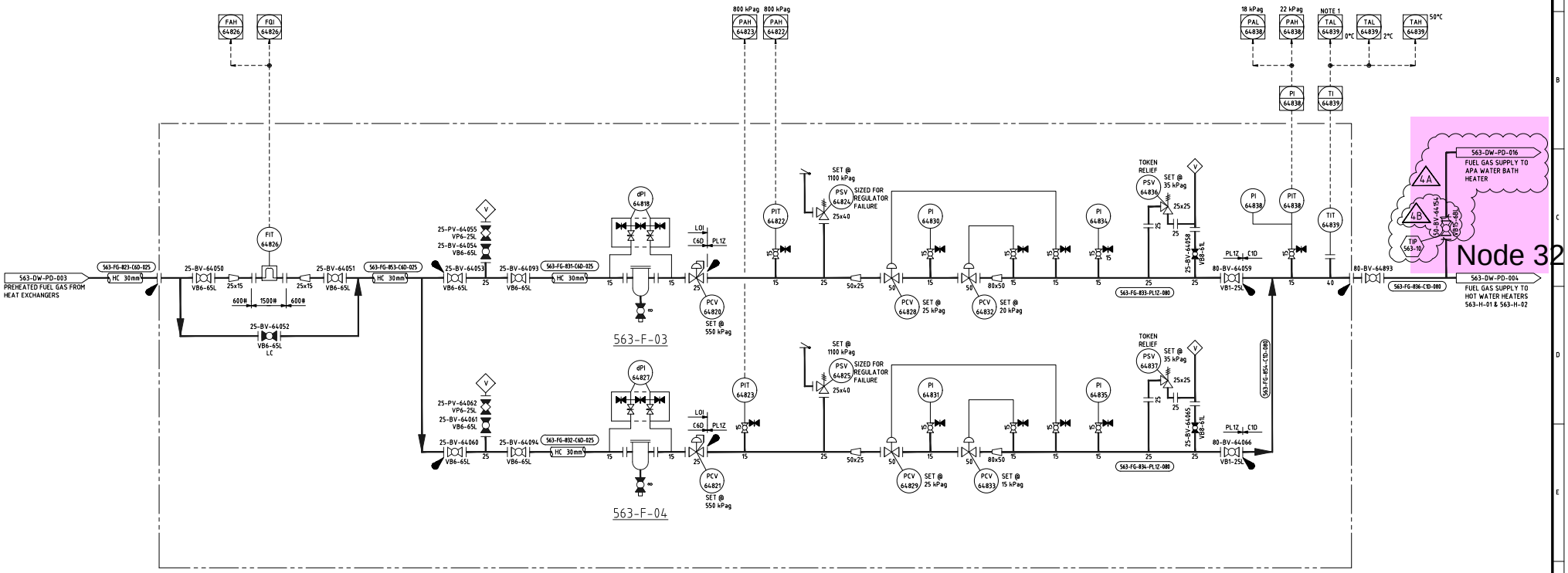
WILTON METER STATION
INSTRUMENT AIR PACKAGE
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT
DESIGN	SCALE N.T.S.	
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER	REV
DATE	563-DW-PD-011	2A



		ASSET MANAGER	ASSET OWNER	COPYRIGHT.										GPA ENGINEERING	WILTON METER STATION CONNECTION TO APA PIPING & INSTRUMENTATION DIAGRAM
		Jemena Produced by Jemena Asset Management (6) Pty Ltd ABN 52 104 352 650	Jemena Jemena EGP(1) P/L ABN 15 068 570 847 Jemena EGP(2) P/L ABN 77 006 919 115	THIS DRAWING AND THE INFORMATION ON THIS DRAWING (MATERIAL) ARE PROTECTED BY THE COPYRIGHT LAWS OF AUSTRALIA. ALL RIGHTS ARE RESERVED. NO PART OF THE MATERIAL MAY IN ANY FORM BE REPRODUCED (IN WHOLE OR IN PART) OR MODIFIED IN ANY WAY WITHOUT THE EXPRESS PRIOR PERMISSION OF JEMENA LIMITED.										www.gpaeng.com.au	DRAWN | FACILITY | SUBJECT DESIGN | SCALE N.T.S. | A1 CHECKED | SUPERSEDES APPROVED | DRAWING NUMBER 563-DW-PD-012 | REV 2B DATE
PO-510-DW-PD-003	CONNECTION TO BI-DIRECTIONAL PIPELINE & FILTER/SEPARATOR				REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV				
DRAWING No.	REFERENCE DRAWINGS				2B	04/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH		PJB		NKH	
					2A	17/09/20	ISSUED FOR REVIEW (20617)	GPA							
					2	18/01/16	AS BUILT TO CLIENT MARKUPS	JB		NB			WW		AH
					1	13/02/15	REISSUED FOR CONSTRUCTION	JB		NB			WW		AH
					0	12/12/14	ISSUED FOR CONSTRUCTION	JB		NB			WW		AH



NOTES
1. TWO LEVELS OF ALARMS, LOW ALARM AT 2°C AND URGENT ALARM AT 0°C

MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
4B	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
4A	17/09/20	ISSUED FOR REVIEW (20617)	GPA			
4	10/02/16	AS BUILT TO CLIENT MARKUPS	LC	JB		
3	18/01/16	AS BUILT TO CLIENT MARKUPS	JS	NB		
2	22/04/15	AS BUILT	SE	JB	WW	AH
1	13/02/15	REISSUED FOR CONSTRUCTION	JB	NB	WW	AH
0	12/12/14	ISSUED FOR CONSTRUCTION	JB	NB	WW	AH

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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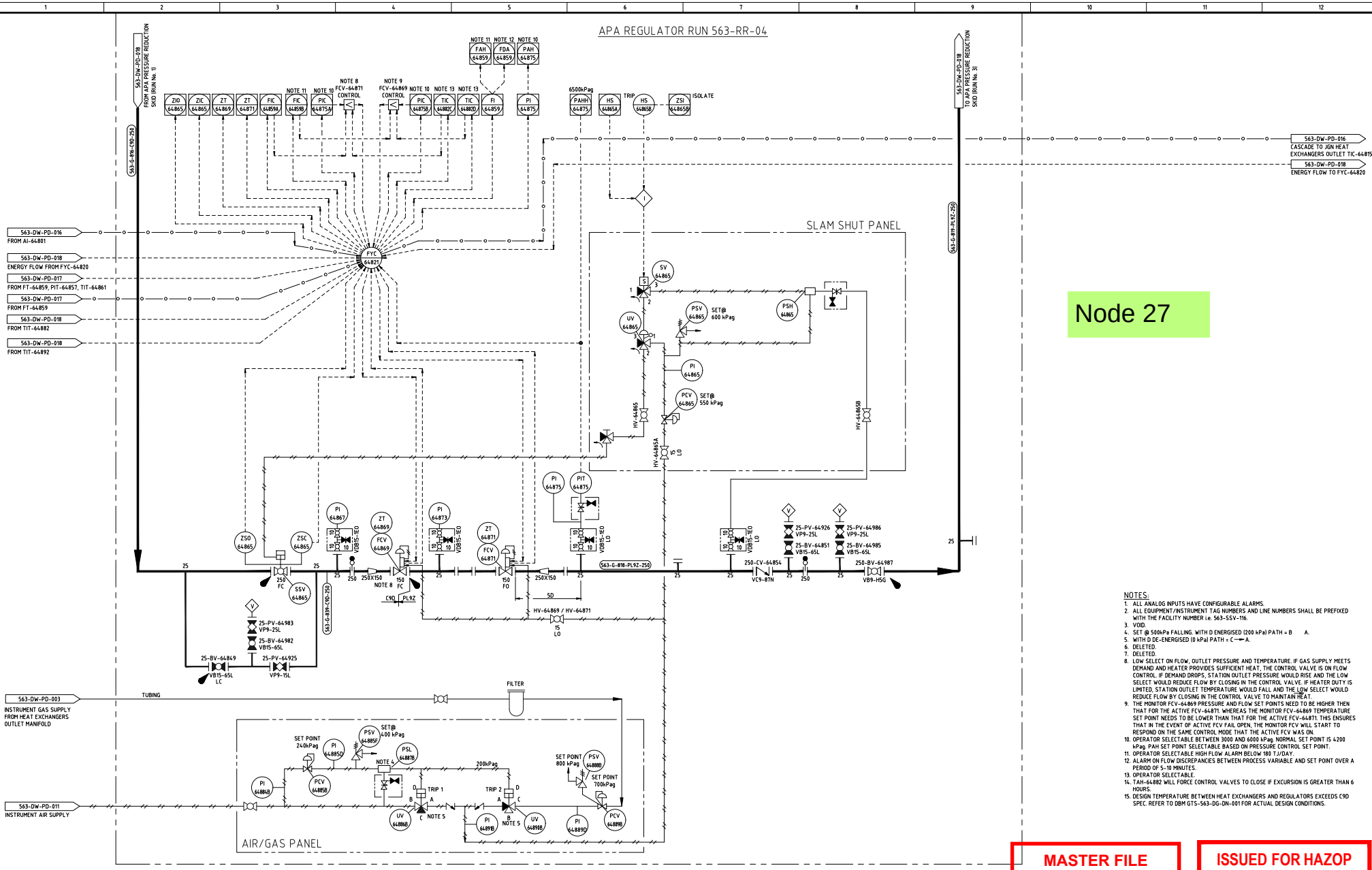
WILTON METER STATION
HOT WATER HEATER FUEL GAS TRAIN
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT	
DESIGN	SCALE N.T.S.		
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV 4B
DATE	563-DW-PD-014		



NOTES:
1. ALL ANALOG INPUTS HAVE CONFIGURABLE ALARMS.
2. ALL EQUIPMENT/INSTRUMENT TAG NUMBERS AND LINE NUMBERS SHALL BE PREFIXED WITH THE FACILITY NUMBER i.e. 563-SSV-116.
3. VOID.
4. SET @ 500kPa FALLING. WITH D ENERGISED (200 kPa) PATH = B A.
5. WITH D DE-ENERGISED (0 kPa) PATH = C A.
6. DELETED.
7. DELETED.
8. LOW SELECT ON FLOW, OUTLET PRESSURE AND TEMPERATURE. IF GAS SUPPLY MEETS DEMAND AND HEATER PROVIDES SUFFICIENT HEAT, THE CONTROL VALVE IS ON FLOW CONTROL. IF DEMAND DROPS, STATION OUTLET PRESSURE WOULD RISE AND THE LOW SELECT WOULD REDUCE FLOW BY CLOSING IN THE CONTROL VALVE. IF HEATER DUTY IS LIMITED, STATION OUTLET TEMPERATURE WOULD FALL AND THE LOW SELECT WOULD REDUCE FLOW BY CLOSING IN THE CONTROL VALVE TO MAINTAIN HEAT.
9. THE MONITOR FCV-64869 PRESSURE AND FLOW SET POINTS NEED TO BE HIGHER THEN THAT FOR THE ACTIVE FCV-64871. WHEREAS THE MONITOR FCV-64869 TEMPERATURE SET POINT NEEDS TO BE LOWER THAN THAT FOR THE ACTIVE FCV-64871. THIS ENSURES THAT IN THE EVENT OF ACTIVE FCV FAIL OPEN, THE MONITOR FCV WILL START TO RESPOND ON THE SAME CONTROL MODE THAT THE ACTIVE FCV WAS ON.
10. OPERATOR SELECTABLE BETWEEN 3000 AND 6000 kPag. NORMAL SET POINT IS 4200 kPag. PAH SET POINT SELECTABLE BASED ON PRESSURE CONTROL SET POINT.
11. OPERATOR SELECTABLE HIGH FLOW ALARM BELOW 188 TJ/DAY.
12. ALARM ON FLOW DISCREPANCIES BETWEEN PROCESS VARIABLE AND SET POINT OVER A PERIOD OF 5-10 MINUTES.
13. OPERATOR SELECTABLE.
14. TAH-64882 WILL FORCE CONTROL VALVES TO CLOSE IF EXCURSION IS GREATER THAN 6 HOURS.
15. DESIGN TEMPERATURE BETWEEN HEAT EXCHANGERS AND REGULATORS EXCEEDS C9D SPEC. REFER TO DBM GTS-563-DG-DN-001 FOR ACTUAL DESIGN CONDITIONS.

MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
B	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
A	22/09/20	ISSUED FOR REVIEW (20617)	GPA			

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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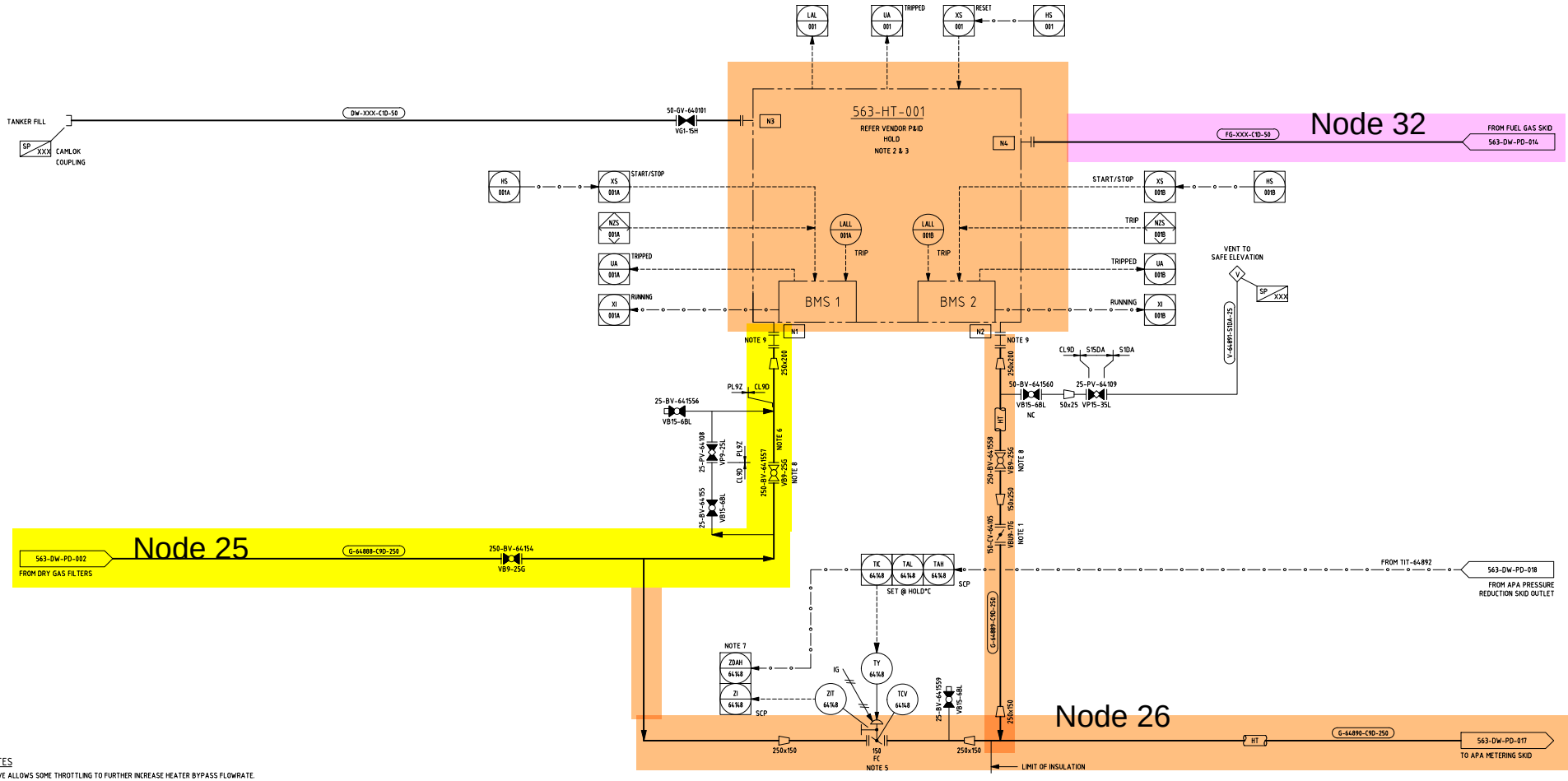
WILTON METER STATION
APA PRESSURE REDUCTION SKID (RUN No. 4)
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILITY	SUBJECT	
DESIGN	SCALE N.T.S.		
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV
DATE	563-DW-PD-015		B

DRAWING No. | REFERENCE DRAWINGS

563-HT-001

WATER BATH HEATER
DESIGN: HOLD kPag @ HOLD °C
OPERATING: HOLD kPag @ HOLD°C
RATING: HOLD kW
DESIGN DUTY: HOLD kW
FLOW: HOLD TJ/hr



NOTES

1. VALVE ALLOWS SOME THROTTLING TO FURTHER INCREASE HEATER BYPASS FLOWRATE.
2. WATER BATH HEATER SHALL BE DESIGNED TO MINIMISE WATER LOSS BY EVAPORATION.
3. WATER BATH SHALL BE ADEQUATELY VENTED TO PREVENT PRESSURISATION SHOULD IT BOIL DUE TO INSTRUMENT TRIP FAILURE.
4. REFER PIPING CLASS DATASHEETS FOR IMPACT TESTING/HEAT TREATMENT REQUIREMENTS.
5. MANUAL OVERRIDE FURNISHED ON THE ACTUATOR.
6. LOW TEMPERATURE CARBON STEEL PRESSURISING VALVE/LINE FOR PRESSURISING WATER BATH HEATERS ONLY.
7. DISCREPANCY ALARM.
8. SINGLE BLOCK ISOLATION FOR WATER BATH HEATER REQUIRES OPERATION AT OR BELOW ASME CL300 FLANGE LIMIT WHILE ISOLATING FOR MAINTENANCE.
9. DROP OUT SPOOL FOR WATER BATH HEATER PROCESS BUNDLE REMOVAL.

MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
B	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
A	22/09/20	ISSUED FOR REVIEW (20617)	GPA			

DRAWING No. | REFERENCE DRAWINGS

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ASSET OWNER: Jemena — Jemena EGP(1) P/L ABN 15 068 570 847, Jemena EGP(2) P/L ABN 77 006 919 115

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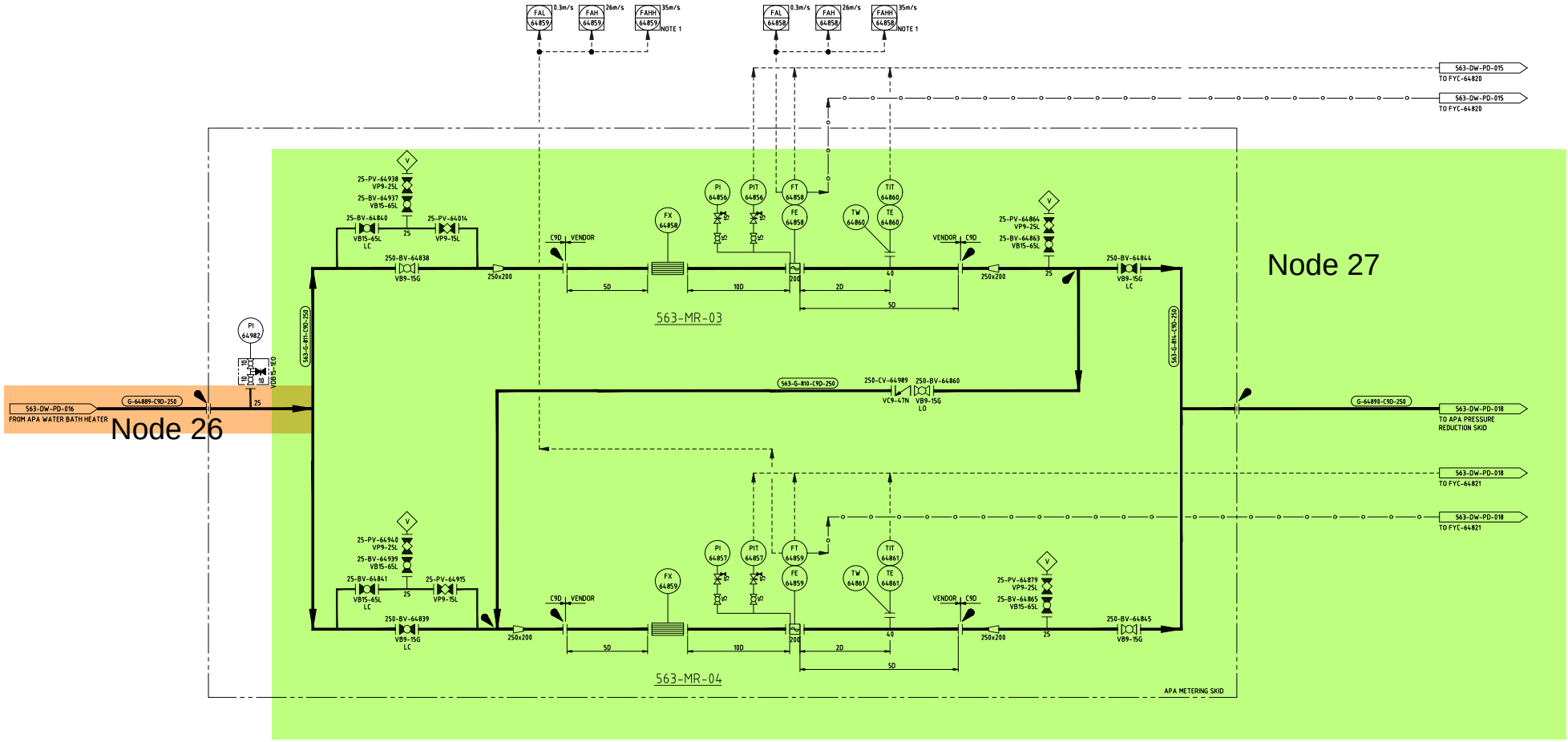
WILTON METER STATION
APA WATER BATH HEATER
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT	
DESIGN	SCALE N.T.S.		
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV
DATE	563-DW-PD-016		B

APA METER RUN 563-MR-03

APA METER RUN 563-MR-04



NOTES:

1. HIGH FLOW WILL TRIP INLET SLV-64800 AFTER 30 CONTINUOUS SECONDS.
2. DESIGN TEMPERATURE BETWEEN HEAT EXCHANGERS AND REGULATORS EXCEEDS C9D SPEC. REFER TO DBM GTS-563-DG-DN-001 FOR ACTUAL DESIGN CONDITIONS.

MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
B	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
A	17/09/20	ISSUED FOR REVIEW (20617)	GPA			

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
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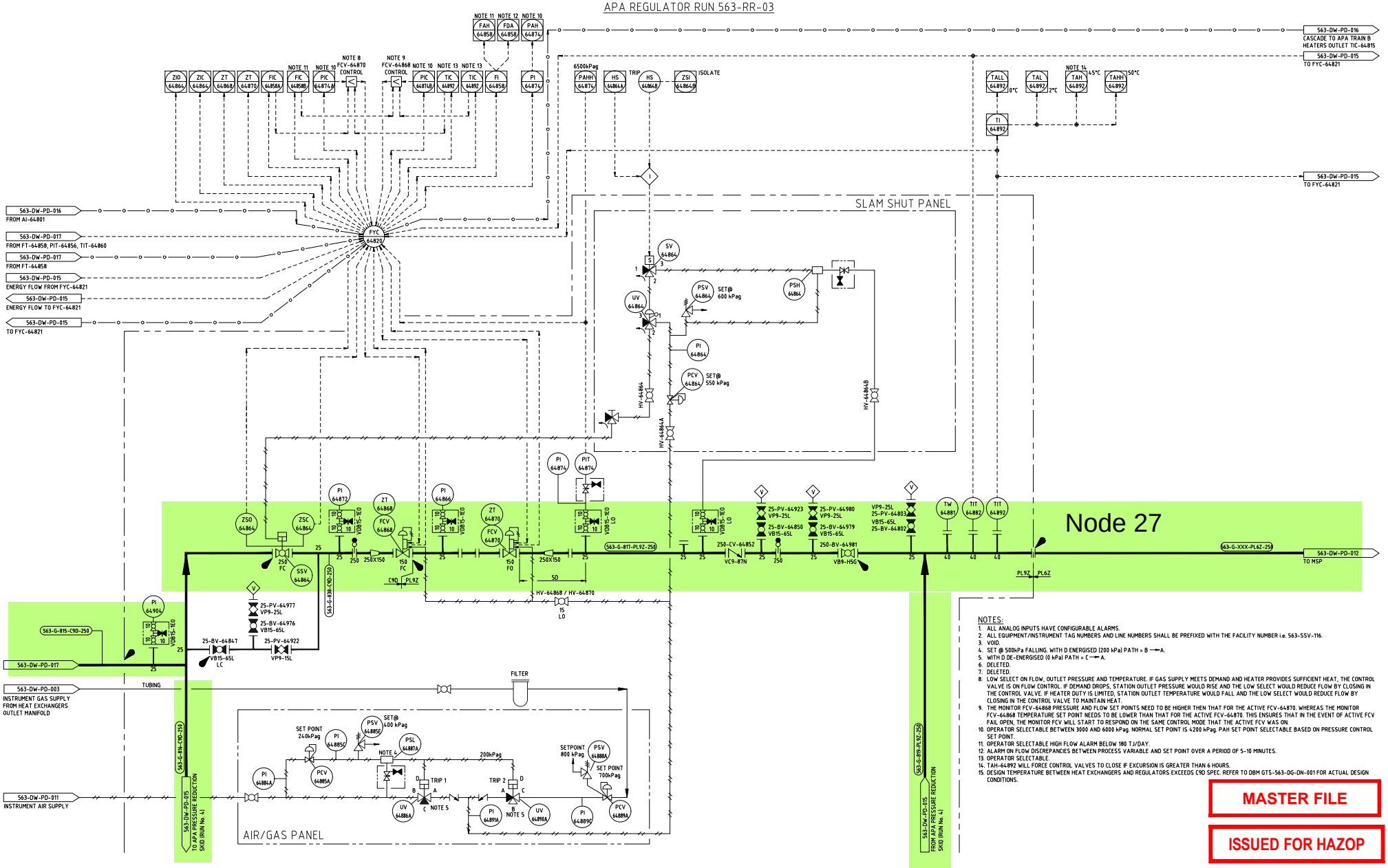
WILTON METER STATION
APA FLOW METERING
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT
DESIGN	SCALE N.T.S.	
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER	REV
DATE	563-DW-PD-017	B



NOTES:

1. ALL ANALOG INPUTS HAVE CONFIGURABLE ALARMS.
2. ALL EQUIPMENT/INSTRUMENT TAG NUMBERS AND LINE NUMBERS SHALL BE PREFIXED WITH THE FACILITY NUMBER i.e. 563-SSV-116.
3. VOID.
4. SET @ 500kPa FALLING. WITH D ENERGISED (200 kPa) PATH = B ⟶A.
5. WITH D DE-ENERGISED (0 kPa) PATH = C ⟶ A.
6. DELETED.
7. DELETED.
8. LOW SELECT ON FLOW, OUTLET PRESSURE AND TEMPERATURE. IF GAS SUPPLY MEETS DEMAND AND HEATER PROVIDES SUFFICIENT HEAT, THE CONTROL VALVE IS ON FLOW CONTROL. IF DEMAND DROPS, STATION OUTLET PRESSURE WOULD RISE AND THE LOW SELECT WOULD REDUCE FLOW BY CLOSING IN THE CONTROL VALVE. IF HEATER DUTY IS LIMITED, STATION OUTLET TEMPERATURE WOULD FALL AND THE LOW SELECT WOULD REDUCE FLOW BY CLOSING IN THE CONTROL VALVE TO MAINTAIN HEAT.
9. THE MONITOR FCV-64868 PRESSURE AND FLOW SET POINTS NEED TO BE HIGHER THEN THAT FOR THE ACTIVE FCV-64870. WHEREAS THE MONITOR FCV-64868 TEMPERATURE SET POINT NEEDS TO BE LOWER THAN THAT FOR THE ACTIVE FCV-64870. THIS ENSURES THAT IN THE EVENT OF ACTIVE FCV FAIL OPEN, THE MONITOR FCV WILL START TO RESPOND ON THE SAME CONTROL MODE THAT THE ACTIVE FCV WAS ON.
10. OPERATOR SELECTABLE BETWEEN 3000 AND 6000 kPag. NORMAL SET POINT IS 4200 kPag. PAH SET POINT SELECTABLE BASED ON PRESSURE CONTROL SET POINT.
11. OPERATOR SELECTABLE HIGH FLOW ALARM BELOW 180 TJ/DAY.
12. ALARM ON FLOW DISCREPANCIES BETWEEN PROCESS VARIABLE AND SET POINT OVER A PERIOD OF 5-10 MINUTES.
13. OPERATOR SELECTABLE.
14. TAH-64892 WILL FORCE CONTROL VALVES TO CLOSE IF EXCURSION IS GREATER THAN 6 HOURS.
15. DESIGN TEMPERATURE BETWEEN HEAT EXCHANGERS AND REGULATORS EXCEEDS C9D SPEC. REFER TO DBM GTS-563-DG-DN-001 FOR ACTUAL DESIGN CONDITIONS.

MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
B	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
A	17/09/20	ISSUED FOR REVIEW (20617)	GPA			

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER: Jemena — Produced by Jemena Asset Management (6) Pty Ltd ABN 52 104 352 650

ASSET OWNER: Jemena — Jemena EGP(1) P/L ABN 15 068 570 847 Jemena EGP(2) P/L ABN 77 006 919 115

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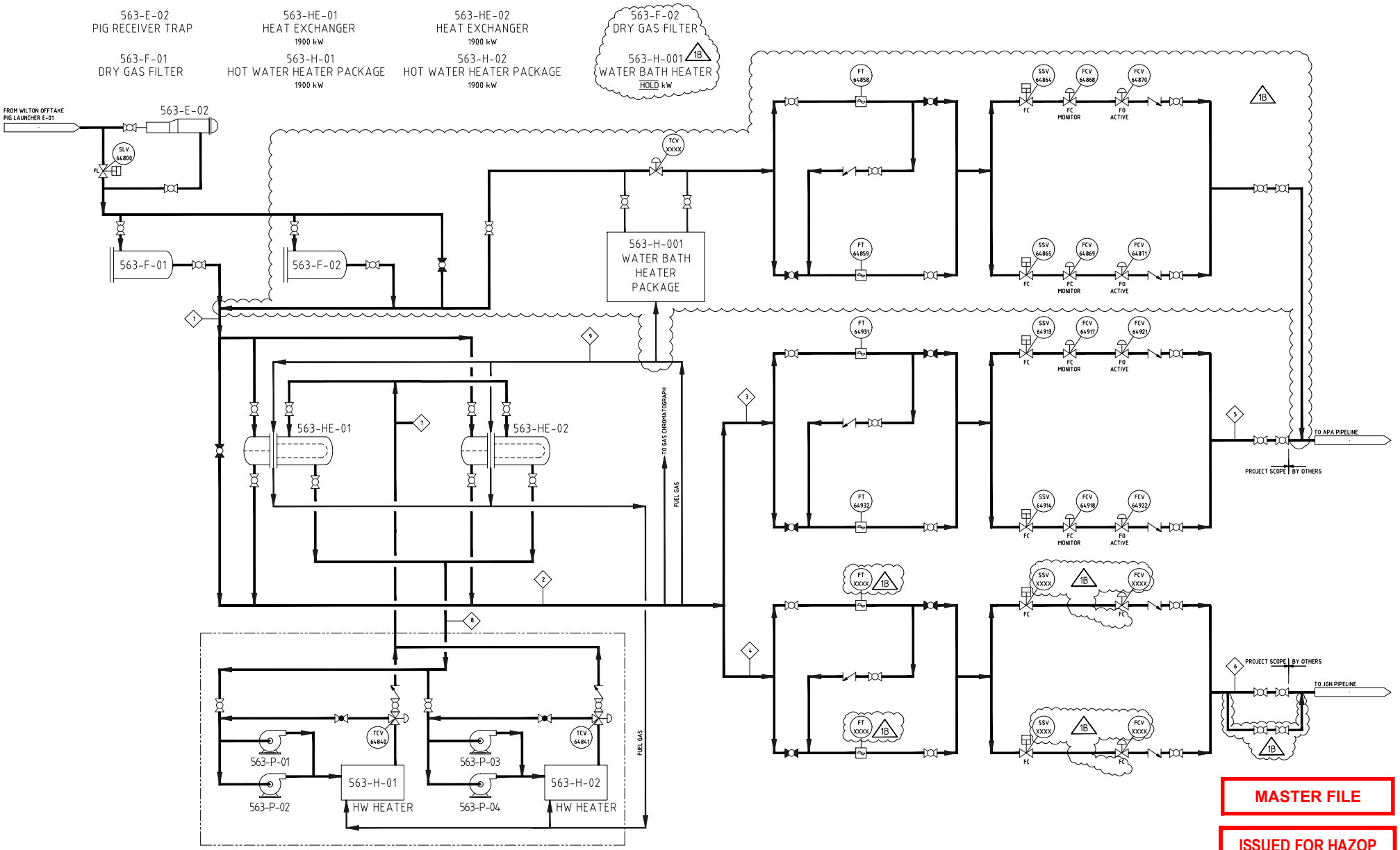
WILTON METER STATION
APA PRESSURE REDUCTION SKID (RUN No. 3)
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT	
DESIGN	SCALE N.T.S.		
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV
DATE	563-DW-PD-018		B



MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
1B	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	PJB	NKH
1A	23/09/20	ISSUED FOR REVIEW (20617)	GPA			
1	08/02/16	AS BUILT TO CLIENT MARKUPS	JB	JS		
0	13/02/15	ISSUED FOR CONSTRUCTION	JB	NB	WW	AH

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
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ABN 77 006 919 115

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WILTON METER STATION
PROCESS SCHEMATIC
PROCESS FLOW DIAGRAM

DRAWN	FACILITY	SUBJECT
DESIGN	SCALE N.T.S.	
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER	REV 1B
DATE	563-DW-PF-001	

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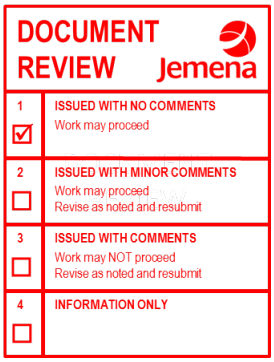


By mpeoples at 1:43:15 PM, 28/05/2021

HAZOP Close Out Report - Facilities scope

Project Marlin: EGP Reversal
Jemena Ltd

GPA Document No: 20617-REP-021
Client Document No: GAS-599-RP-HZ-004

GPA Project No: 20617

Rev	Date	By	Checked	QA	Description
0	05/03/2021	IJC	SJH	NKH	IFI – Issued at completion of FEED

GPA Engineering Pty Ltd. ABN 71 576 133 774
Printed: 05-Mar-2021

Consult
Engineer
Deliver
Ideas
Realised

CONTENTS

1 OVERVIEW 2

2 CLOSEOUT 2

APPENDIX 1 HAZOP MINUTES

APPENDIX 2 CLOSE OUT SHEETS

1 Overview

A FEED HAZOP study specifically dealing with the Project Marlin design was completed on the 5th, 16th, 17th & 18th of November 2020 and is documented in the HAZOP report GAS-599-RP-HZ-003. The HAZOP study identified a number of Category 1 (to be completed in FEED) actions to be incorporated into the FEED design.

2 Closeout

All Category 1 action items have been closed out or progressed in enough detail to be deferred to the detailed design phase of the project as Category 2 action items.

Refer attached HAZOP minutes, revised to show the current status of all actions. Refer to Attachment 1

The respective close out sheets are provided as attachments to this report. Refer to Attachment 2.

APPENDIX 1 HAZOP MINUTES

GPA	HAZOP MINUTES	20617-REP-015
	Project Marlin - EGP Reversal	SHEET 1 of 10

Client	**Jemena Ltd**
Client Project No	**GAS-599**
GPA Project No	**20617**
Project Title	**Project Marlin - EGP Reversal**
Facilitator	**Lisa Hein**
Scribe	**India Carsburg**
Workshop Date	**04/11/2020**
Workshop Location	**Microsoft Teams**
HAZOP Sponsor	**Nathan Biggins**
HAZOP Stage	**30%, FEED, Stage 1 Kembla Grange MLV and Kembla Grange Meter Station**

HAZOP Participants:

GPA Engineering

Sarah Greening (SG)	Project Manager
India Carsburg (IC)	Graduate Mechanical Engineer / Scribe
Lisa Hein (LH)	Senior Consultant - Risk and Advisory / Facilitator
Simon Hanlin (SH)	Senior Process Engineer
Dylan Falls (DF)	Graduate Process Engineer
Peter Blyton (PB)	Senior Mechanical Engineer
Adrian Zatta (AZ)	Senior EI&C Engineer

Jemena

Nathan Biggins (NB)	Project Manager
Max Imsungnoen (MI)	Project Engineer
Stephen Chow (SC)	Project Engineer
Matthew Skaras (MS)	Project Manager
Luke Gigliotti (LG)	EI&C Engineer (Akshay - Systems Controller attended in place)
Michael Peoples (MP)	Gas Managing Engineer (in part)

Enscope

David Young (DY)	Principal Engineer

Zinfra

Steven Bonnici (SB)	Project Manager
Martin Richards (MR)	Pipeline Operator and Technician
Mick Arneil (MA)	Manager, Field Transmission (South)

Background:

Jemena is undertaking Front End Engineering and Design (FEED) to facilitate a total installed cost (TIC) estimate and schedule to reverse flow the Eastern Gas Pipeline (EGP) south of the Kembla Grange Meter Station (KGMS), to allow the supply of gas into the Victorian and New South Wales gas networks.

The following, key pieces of documentation, formed the basis of the HAZOP (additional information was available – see HAZOP report):

- Pig Receiver P&ID: GAS-557-DW-PD-001(B)
- Metering P&ID: GAS-557-DW-PD-002(B)
- EGP Hot Tap Tie-in P&ID: GAS-557-DW-PD-003(B)
- MLV and Sales Tap P&ID: 550-PI-001

The HAZOP specifically dealt with:

- Pig Receiver on the Port Kembla Pipeline,
- Metering skid and associated control systems,
- Gas Quality Measurement Equipment,
- Hot tap tie in into the EGP north of the existing Kembla Grange MLV, the MLV bypass line/pipeline and station blowdown line

The HAZOP specifically excluded a full formal review of:

- Port Kembla Pipeline,
- Mila Compressor Station (MCS),
- Michelago Compressor Station (MOCS),
- Vic Hub Interconnect (located within the Longford Compressor Station, LCS); and,
- Wilton Meter Station (WMS).

The HAZOP was conducted using a series of guide words which were applied to each of the key phases of operation.

NODE 1: PORT KEMBLA METERING AND DISCHARGE TO EGP

DRAWINGS: GAS-557-DW-PD-001, GAS-557-DW-PD-002, GAS-557-DW-PD-003 **PLANT & EQUIPMENT:** PIG RECEIVER, METER STATION **INSTRUMENTATION: -** **LINE NUMBERS:** G-11-C9D-400, G-10-C9D-400, G-01-CE15X-450, G-02-CE15X-400, G-005-C9D-400, G-006-C9D-300, G-09-C9D-400, G-08-C9D-300

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
1.1	HIGH FLOW	Low pressure in EGP caused by supply interruption.	Potential FIV (flow induced vibration) on thermowells and metering equipment due may result in unmetered gas.	Flow control on FSRU	Confirm the lowest pressure possible in the EGP and ensure it is included in design conditions for all equipment and in the heat mass balance table.	**1**	**DY**	**Yes**	**Refer close out sheet for Item No. 1.1. (Appendix 5)**
1.2	HIGH FLOW	Line break on EGP	Loss of containment fed by EGP	Control room monitoring, remote actuated MLV's.	Install pressure rate of change alarms on inlet of Port Kembla pipeline. Confirm remote actuated MLV is included in design and pipeline isolation plan.	**2** **2**	**SH** **SH**		
1.3	HIGH FLOW	High flow in pig receiver – during pigging operations (pigging is for integrity inspections only, will occur at a low frequency).	High flow in the kicker line, potential damage of pipe due to flow induced vibration.	Pigging procedures will specify a flow rate to ensure max velocity (nominally 50 m/s) in kicker line is not exceeded.	Pig kicker line to be included in line sizing calculation with a velocitysizing limit of 50 m/s..	**1**	**SH**	**Yes**	**Refer close out sheet for Item No. 1.3 (Appendix 6)**
1.4	HIGH LEVEL	N/A							
1.5	LOW FLOW	Closed manual outlet valves at the Kembla station for maintenance or human error.	Loss of supply	Operations monitoring	None required.				
1.6	LOW FLOW	High pressure in northern end of EGP	High pressure, potential deadhead of FSRU pump (12MPa). Note: Jemena equipment is rated for 14.9MPa.	Flow/pressure control on FSRU pumps	Confirm FSRU flow control and pressure protection is fit for purpose. Confirm if pressure signals from Jemena equipment installed at KGMS are required to be relayed to the FSRU pumps.	~~**1**~~ **2** ~~**1**~~ **2**	**MS** **MS**	**No**	**Integrated control philosphy from wharf to EGP is to be defined by a separate scope and subject to a separate HAZOP/CHAZOP. DEFERRED TO DETAILED DESIGN.**
1.7	LOW FLOW	SLV semi-closure	Lack of supply		Install Position/fail to operate alarm on the SLV.	**1**	**AZ**	**Yes**	**Refer close out sheet in Appendix 1.**
1.8	LOW LEVEL	N/A							
1.9	ZERO FLOW / EMPTY	No issues							
1.10	REVERSE FLOW	Line break upstream of pig trap Port Kembla	EGP backflow through line break	One NRV included Control room monitoring. MLV can be closed remotely to stop backflow.	Add Reverse flow alarm to KGMS meter run, ensure it doesn't trigger falsely at zero flow. Confirm if secondary NRV is required by evaluating risk reduction and confirming if design has reduced risk ALARP (Additional NRV may be included during detailed design).	**2** **2**	**GPA** **MS**		
1.11	HIGH PRESSURE	Blocked discharge, refer low flow 3.5.	Over pressure should not occur as pump deadhead pressure is less than Jemena equipment design pressure.	Pump deadhead pressure low than MAOP of line.	As per 3.4				**A HAZOP for the FSRU connection will be conducted later in the design process. These issues will be further verified in this HAZOP.**

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
1.12	LOW PRESSURE	No issues							
1.13	HIGH TEMPERATURE	No issues							
1.14	LOW TEMPERATURE	Re-pressuring vented section due to joule-thompson effect.	Potential low temperature embrittlement conditions in equipment.	Jemena stated that venting and repressurising procedures will be developed to include flowrate limits to avoid exceeding minimum design temperatures. Actual temperatures will be monitored with temperature gun during the process. - There is a pressurisation bypass line included around the shutdown valve.	None required				
1.15	IMPURITIES	Commissioning debris. Pipeline is lined so corrosion products are not expected.		Cleaning procedures will be used during commissioning	None required				
1.16	CHANGE IN COMPOSITION / CONCENTRATION	High Wobbe index may be received from FSRU due to settle out in ships during transport.	Off spec gas	Metered nitrogen injection based on GC test results is included in the design. The FSRU has a GC which will confirm gas properties prior to loadout.	Configure and include a high Wobbe Index alarm for the 557-AIT-64008 sampling system.	**1**	**SH**	**Yes**	**Refer close out sheet in Appendix 1**
1.17	CHANGE IN COMPOSITION / CONCENTRATION	Excessive odorant injection	Off spec gas	Operation monitoring.	None required				
1.18	TWO PHASE FLOW	No issues							
1.19	REACTIONS	No issues							
1.20	TESTING EQUIPMENT / PRODUCT	Gas sampling and analysis is included in system for verification of gas being delivered into the EGP. Only one in line GC is proposed for the KGMS. If unavailable delivery into the EGP may be prevented and loadout from the FSRU may be delayed.	Delay in production or offspec gas.	Additional GC on FSRU. Dilution of any offspec gas due to high volume of gas in EGP. Variability may occur between cargos but not within the same cargo. A manual test with portable equipment could be carried out prior to unloading.	Confirm if single GC is enough in regard to quality monitoring according to commercial arrangements. .	**1**	**MS**	**Yes**	**Refer close out sheet for Item No. 1.20 (Appendix 27)**
1.21	PLANT ITEM OPERABILITY	Commissioning and start up. Intended filling of Pt Kembla Pipeline is by gas from the EGP, however an NRV is installed in the KGMS pipework preventing backflow from the EGP.	Unable to commissioning/fill Pt Kembla Pipeline.		Install bypass around NRV	**1**	**SH**	**Yes**	**Refer close out sheet in Appendix 1**
1.22	PLANT ITEM OPERABILITY	Venting – Some manual vents shown as single ball valve, inconsistent with typical vent arrangements	Single vent ball valve will become damaged when used for venting and throttling.		Update manual vents at KGMS to include isolation ball valve and throttling valve.	**1**	**PB**	**Yes**	**Refer close out sheet in Appendix 1**

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
1.23	PLANT ITEM MAINTAINABILITY	Pig receiver isolation for maintenance. Meter run isolation for maintenance. Pig receiver proposed design had a double block and bleed. Presented design was based on Atlas pig receiver design (GAS-447-DW-PD-001) with double block and bleed installed upstream of the pig trap.	Proving isolation prior to proceeding with maintenance with a single valve. Ensuring single valve isolation remains effective when equipment is open to atmosphere. Inadequate isolation will result in process having to be further isolated upstream and production impacts. Potential safety issue if single valve passes during the maintenance.	Pig receiver proposed design retained double block and bleed. According to Jemena isolation policy GTS-960-DG-PI-001 section 10.1.2 states DBB is only required in system above ANSI 600 where the item being isolated is subjected to maintenance which involves breaking gas containment, on a frequency of once per year or more. Pigging frequency is expected to be 5-10 yearly for integrity inspections. Isolation will be proven using a single vented ball valve. If isolation cannot be proven, the process will be isolated further upstream until it can be proven. For routine maintenance meters will be calibrated in line, removal not required. Blind flanges will be installed downstream of single isolations before proceeding with maintenance activities.	Jemena have advised GPA to remove the second isolation valve from the design based on a pigging frequency of 5-10 yearly and requirements in GTS-960-DG-PI-001 Section 10.1.2 GPA to update P&IDs and remove the DBB isolation configuration and ensure this philosophy is reflected in other elements of the design.	**1**	**SH**	**YES**	Refer to Jemena's Piping Design Guide and Material Specification for Gas Pipeline Facilities. The relevant section to refer to for isolations is GTS-960-DG-PI-001 section 10.1.2 as follows: Positive isolation (spade/blind/dropout spool) is mandatory where maintenance involving breaking gas containment is done in confined spaces. Valve isolation is acceptable for non-confined-spaces. DBB is required in class #600 and above where the item being isolated is subjected to maintenance which involves breaking gas containment, on a frequency of one year or less. **Refer close out sheet for Item 1.23 (Appendix 30)**
1.24	ELECTRICAL AREA CLASSIFICATION	No issues - All equipment will be hazardous area rated according to the area							
1.25	EARTHING	No issues - station is earthed (fenced)							Earthing and HA classifications to be completed in detailed design.
1.26	ISOLATION	Ref 3.21 maintainability							
1.27	INSTRUMENTS TOO MANY	UG TIT at Kembla inlet		Jemena stated that there was sufficient temperature indication elsewhere	Remove UG TIT (064001)	**1**	**SH**	**Yes**	**Refer close out sheet in Appendix 1.**
1.28	INSTRUMENTS TOO FEW	Sufficient pressure transmitters							
1.29	CORRECT LOCATION OF INSTRUMENTS	No issues							

NODE 2: PIPING CONNECTION TO THE PORT KEMBLA PIPELINE HOT-TAP FROM SOUTHERN SIDE OF KEMBLA GRANGE MLV

DRAWINGS: 550-PI-001, GAS-557-DW-PD-003 **PLANT & EQUIPMENT:** PRESSURE CONTROL VALVE **INSTRUMENTATION: -** **LINE NUMBERS:** PRESSURE CONTROL VALVE

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
2.1	HIGH FLOW	Control valve PV-064009 fails open Or inadvertent opening ofbypass valve	Induced vibration	Control Valve is Fail Closed Manual bypass managed using procedures and is designed for reverse flow only (Blowdown), refer item 3.1.	Complete AIV or FIV (acoustic or flow induced vibration) assessment during detailed design.	**2**	**PB**		
2.2	HIGH LEVEL	No issues							
2.3	LOW FLOW	Low dP across MLV	Lack of supply to the north		Add a low dP alarm across MLV 1/PV-64009 to alert operators of low dP across MLV so that they can open it.	**1**	**AZ**	**Yes**	**Refer close out sheet in Appendix 1.**
2.4	LOW LEVEL	No issues							
2.5	ZERO FLOW / EMPTY	Valve fails closed	Interruption to supply		Implement out of position alarm on the pressure control valve (PV-064009). Add high dP alarm across MLV 1/PV-64009	**2** **1**	**AZ** **AZ**	**No** **Yes**	**Refer close out sheet in Appendix 1.**
2.6	REVERSE FLOW	Pressure north is higher than pressure south.	Misdirected flow, no safety consequence	Operator will open MLV	As per 2.3				
2.7	HIGH PRESSURE	High pressure from upstream (southern) compression	Potential for pressure to exceed design operating pressure of 12MPag used for equipment and line sizing		Confirm highest possible operating pressure scenario from the south Update equipment and line sizing calculations for PV-064009 and bypass line if required.	**2** **2**	**DY** **SH**		
2.8	LOW PRESSURE	No new issues.							
2.9	HIGH TEMPERATURE	No issues							
2.10	LOW TEMPERATURE	Pressure drop across PV64009	Minimum gas delivery temperature lower than minimum EGP delivery temperature requirement of 2°C	Minimum temp above minimum pipe rating of -10C. Distance from bypass tie to hot tap is ~20m per 200617-50-550 Rev B.	Install additional temperature transmitter before the hot tap tie in, a suitable distance downstream of bypass inlet to allow blending of Pt Kembla and Longford gas.	**1**	**SH**	**Yes**	**Refer close out sheet in Appendix 1.**
2.11	IMPURITIES	No new issues.							
2.12	CHANGE IN COMPOSITION / CONCENTRATION	No new issues.							
2.13	TWO PHASE FLOW	No new issues.							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
2.14	REACTIONS	No new issues.							
2.15	TESTING EQUIPMENT / PRODUCT	No new issues.							
2.16	PLANT ITEM OPERABILITY	No new issues.							
2.17	PLANT ITEM MAINTAINABILITY	No new issues.							
2.18	ELECTRICAL AREA CLASSIFICATION	No new issues.							
2.19	EARTHING	No new issues.							
2.20	ISOLATION	No new issues.							
2.21	INSTRUMENTS TOO MANY	No new issues.							
2.22	INSTRUMENTS TOO FEW	Refer 4.10							
2.23	CORRECT LOCATION OF INSTRUMENTS	Loss of communication between MLV and Meter Station.	Potential unintended control of FCV.		Confirm if signal from PIT2 to PIC64009 needs to be hardwired or if coms is sufficient.	**1**	**MS**	**Yes**	**Refer to close out sheet in Appendix 1.**

NODE 3: BLOWDOWN FOR THE PORT KEMBLA PIPELINE VIA THE EXISTING COLD VENT AT THE KEMBLA GRANGE MLV SITE.

DRAWINGS: 550-PI-001, GAS-557-DW-PD-003

PLANT & EQUIPMENT: COLD VENT / PORTABLE BLOWDOWN SILENCER

INSTRUMENTATION: -

LINE NUMBERS: G-06-C9D-150

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
3.1	HIGH FLOW	Fully open plug valve	Noise, FIV, instrument damage		Confirm the sizing of plug valve (150-PV-064010) for blow down, required to limit flow to acceptable levels through the meter station.	**2**	**SH**		
3.2	HIGH LEVEL	No new issues							
3.3	LOW FLOW	No new issues							
3.4	LOW LEVEL	No new issues							
3.5	ZERO FLOW / EMPTY	No new issues							
3.6	REVERSE FLOW	Southern side of EGP will still be live during blow down, passing valves, continuously venting.	Loss of product via vent.	This issue is known to Jemena and addressed procedurally when venting is required.	No actions				

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
3.7		Control valve is closed (not bi-directional). Reverse flow around control valve using the bypass plug valve.	Potential damage to control valve		Confirm reverse flow using the bypass (150-PV-064010) for blow down scenario will not damage thecontrol valve (PV-064009) with the vendor.	**2**	**PB**		
3.8	HIGH PRESSURE	No new issues							
3.9	LOW PRESSURE	No new issues							
3.10	HIGH TEMPERATURE	No new issues							
3.11	LOW TEMPERATURE	During de-pressuring JT effect will cause cooling	Potential for low temperature embrittlement for existing pipe piping material.		Determine minimum gas temperature during blow down. Ensure pipe is rated for minimum temp	**2**	**SH**		
3.12	IMPURITIES	No new issues							
3.13	CHANGE IN COMPOSITION / CONCENTRATION	No new issues							
3.14	TWO PHASE FLOW	No new issues							
3.15	REACTIONS	No new issues							
3.16	TESTING EQUIPMENT / PRODUCT	No new issues							
3.17	PLANT ITEM OPERABILITY	Passing of a single isolation valves V-01, V-02, V-10 a known issue. This existing vent (blowdown bleed, V-05) is presently used for bleeding the EGP or local equipment. Upstream plug valves V-01, V-02, V-10 are known to pass. Vent connection currently has a flange – no valve. Installing a local vent is currently undertaken with upstream isolation valves passing.	Inadequate isolation.	New valve 150-BV-64021 at TIP 550-01 on the vent will be vented cavity ball valve. Jemena accept the risk of installing the vent silencer with existing isolations and passing upstream valves. A construction risk assessment will take place prior to installing the new equipment.	None required				
3.18		Height of equipment and potential vibration in the vent stack.	Damage of equipment due to vibrations		Review structural support for the portable blowdown silencer considering higher connection flange location with 150-BV-64021 installed.	**2**	**PB**		
3.19	PLANT ITEM MAINTAINABILITY	No new issues							
3.20	ELECTRICAL AREA CLASSIFICATION	No new issues							
3.21	EARTHING	No new issues							
3.22	ISOLATION	No new issues							
3.23	INSTRUMENTS TOO MANY	No new issues							
3.24	INSTRUMENTS TOO FEW	No new issues							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
3.25	CORRECT LOCATION OF INSTRUMENTS	No new issues							

NODE 4: INSTRUMENT GAS SUPPLY

DRAWINGS: 550-PI-001 **PLANT & EQUIPMENT:** INSTRUMENT GAS **INSTRUMENTATION: -** **LINE NUMBERS: -**

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
4.1	HIGH FLOW	Failure of PV 062005 or PV062007	Over pressure. Noise. Operators attend site once a month for site inspections, failure would go undetected. PSV vents to atmosphere.	PSV 062008	Change PI to PIT with high and low pressure alarm (PI62008)	**1**	**SH**	**Yes**	**Refer close out sheet in Appendix 1.**
4.2	HIGH LEVEL	No new issues							
4.3	LOW FLOW	Failure of supply to control valve	PV064009 will close – supply disruption		As per 2.6				
4.4	LOW LEVEL	No new issues							
4.5	ZERO FLOW / EMPTY	No new issues							
4.6	REVERSE FLOW	No new issues							
4.7	HIGH PRESSURE	No new issues, ref 4.1	Blowing out actuator on valve, loss of containment.	PSV 062008	None required				
4.8	LOW PRESSURE	No new issues							
4.9	HIGH TEMPERATURE	No new issues							
4.10	LOW TEMPERATURE	Cooling associated with pressure drop	Low temperatures in downstream equipment.	Instrument tubing will be stainless steel rated below the expected minimum process temperature downstream of the pressure cut Liquids drop out not expected – dry gas	Include passive heat recovery loop into the instrument gas panel tubing.	**1**	**AZ**	**Yes**	**Refer close out sheet in Appendix 1.**
4.11	IMPURITIES	No new issues							
4.12	CHANGE IN COMPOSITION / CONCENTRATION	No new issues							
4.13	TWO PHASE FLOW	No new issues							
4.14	REACTIONS	CS to SS transition	Galvanic corrosion	FIK shown on P&ID (I.G.)	None required				
4.15	TESTING EQUIPMENT / PRODUCT	Lack of Maintenance	Failure of equipment	Maintenance plans in place	None required				

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
4.16	PLANT ITEM OPERABILITY	No new issues							
4.17	PLANT ITEM MAINTAINABILITY	Maintenance on instrument gas panel will require PCV to be out of service	Supply interruption	Portable supply could be used.	None required				
4.18	ELECTRICAL AREA CLASSIFICATION	No new issues							
4.19	EARTHING	No new issues							
4.20	ISOLATION	No new issues							
4.21	INSTRUMENTS TOO MANY	No new issues							
4.22	INSTRUMENTS TOO FEW	No new issues							
4.23	CORRECT LOCATION OF INSTRUMENTS	No new issues							

NODE 5: GENERAL HAZARD IDENTIFICATION AND FACILITY OVERVIEW

DRAWINGS: GAS-557-DW-PD-001, GAS-557-DW-PD-002, GAS-557-DW-PD-003, 550-PI-001

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
5.1	TOXICITY	No new issues							
5.2	SERVICES REQUIRED	No new issues							
5.3	MATERIALS OF CONSTRUCTION	No new issues							
5.4	COMMISSIONING	No new issues							
5.5	BREAKDOWN	No new issues							
5.6	STARTUP / SHUTDOWN	No new issues							
5.7	EFFLUENT	No new issues							
5.8	NOISE / VIBRATION	Noise from control valve PV-64009	Noise may be above allowable threshold		Specify noise attenuating trim for PV-64009 and acoustic insulation to be installed on valve and downstream piping	**1**	**SH**	**Yes**	**Refer close out sheet in Appendix 1.**
5.9	FIRE / EXPLOSION	No new issues							
5.10	SAFETY EQUIPMENT	No new issues							
5.11	QUALITY AND CONSISTENCY	No new issues							
5.12	OUTPUT – RELIABILITY AND BOTTLENECKS	No new issues							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
5.13	EFFICIENCY	No new issues							
5.14	SIMPLICITY	No new issues							
5.15	MOBILE EQUIPMENT / PLANT MOVEMENT	No new issues							
5.16	PROCESS PLANT NORMAL / ABNORMAL MAINTENANCE	No new issues							
5.17	PROCESS PLANT PROCESS FUNCTIONALITY	No new issues							
5.18	ERGONOMICS	No new issues							
5.19	GUARDING	No new issues							
5.20	WARNINGS	No new issues							
5.21	VULNERABILITY	No new issues							
5.22	3RD PARTY INTERFERENCE	No new issues							
5.23	NATURAL EVENTS	No new issues							

GPA	**HAZOP MINUTES**	**20617-REP-018**
	Project Marlin: EGP Reversal	**SHEET 1 of 19**

Client	**Jemena Ltd**
Client Project No	**GAS-599**
GPA Project No	**20617**
Project Title	**Project Marlin: EGP Reversal**
Facilitator	**Lisa Hein**
Scribe	**Peter Blyton**
Workshop Date	**18/11/2020**
Workshop Location	**Microsoft Teams**
HAZOP Sponsor	**Nathan Biggins** **Matthew Skaras**
HAZOP Stage	**30% FEED Stage 2:** • **Michelago Compressor Station (MOCS)** • **Mila Compressor Station (MCS)**

HAZOP Participants:

GPA Engineering

Lisa Hein (LH)	Senior Consultant - Risk and Advisory / Facilitator
Simon Hanlin (SH)	Senior Process Engineer
Peter Blyton (PB)	Senior Mechanical Engineer / Minute Taker
Adrian Zatta (AZ)	Senior EI&C Engineer

Jemena

David Young (DY)	Engineering Manager
Stephen Chow (SC)	Project Engineer
Luke Gigliotti (LG)	Team Leader - Control Room
Richard Lamin (RL)	Pipeline Operator Technician
Mick Arneill (MA)	Manager - Gas Transmission South
Matthew Evans (ME)	Operations
Jon Valsamis (JV)	Systems Controller

Background:
Jemena is undertaking Front End Engineering and Design (FEED) to facilitate a total installed cost (TIC) estimate and schedule to reverse flow the Eastern Gas Pipeline (EGP) south of the Kembla Grange Meter Station (KGMS), to allow the supply of gas into the Victorian and New South Wales gas networks.

The following, key pieces of documentation, formed the basis of the HAZOP (additional information was available – see HAZOP report):

- Michelago Compressor Station
  - Station Isolation Valves P&ID: 530-DW-PD-001
  - Mainline Valve P&ID: 530-DW-PD-018
  - Flow Switching Valves P&ID: GAS-530-DW-PD-020
- Mila Scraper Station & MLV
  - Intermediate Scraper Station P&ID: 525-PI-001
- Mila Compressor Station
  - Flow Switching Valves P&ID: GAS-525-DW-PD-039
  - Station Isolation Valves P&ID: GTS-525-DW-PD-022

The HAZOP specifically dealt with:

- Michelago Compressor Station (MOCS)
- Mila Compressor Station (MCS), Scraper Station and MLV

The HAZOP specifically excluded a full formal review of:

- Compressor units at each compressor station
- EGP mainline pipeline

The HAZOP was conducted using a series of guide words which were applied to each of the key phases of operation.

NODE 6: MICHELAGO REVERSE FLOW: EGP TO COMPRESSOR SUCTION

DRAWINGS: 530-DW-PD-001, 530-DW-PD-018, GAS-530-DW-PD-020

PLANT & EQUIPMENT: -

INSTRUMENTATION: -

LINE NUMBERS: G-64907-C9D-400, G-64904-C9D-400, G-020-CE15X-400, G-904-C9D-400, G-905-C9D-400, G-XXX-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
6.1	HIGH FLOW	Large differential pressure across switching valves, opening of SDV-64104 Higher pressure on suction than discharge	Damage to SDVs High flow leading to FIV (flow induced vibration), equipment damage Forward flow of gas through the compressor when the discharge valve opens, resulting in compressor driving the turbine.	Equalisation line and UV-64109 to be used reduce differential pressure across SDVs / station prior to mode change. Operating procedures.	Add DP interlocks across all flow switching valves, DP permissive to be set at 500 kPa. DP interlock to be between PIT-64107 & PIT-64103, with DP in either direction. Ensure valve sequencing (MLV-1 and flow switching valves) is such that compressor suction pressure does not end up higher than compressor discharge.	**1** **2**	**AZ** **AZ**	**Yes** **No**	**Refer close out sheet in Appendix 4.**
6.2	HIGH LEVEL	No issues identified							
6.3	LOW FLOW	Low demand	Waste of fuel gas	Compressor recycle	No Actions				
6.4	LOW LEVEL	No issues identified							
6.5	ZERO FLOW / EMPTY	Compressor not running, MLV-1 closed. Switching valves out of position	Build-up of high DP across the station, unable to equalise pressure across the station. Inability to start compressor	Equalisation line and UV-64109 to be used to reduce differential pressure across SDVs / station. Operating procedures. Switching valve position interlocks.	Develop the sizing cases for equalisation line with Jemena Commercial.	~~1~~ **2**	**DY**	**No**	Deferred to detailed design as a category 2 action. Add HOLD to P&ID for pipe size. Basis to be confirmed by Jemena in detailed design in conjunction with pipeline modelling team. **Deferred to Detailed Design**
6.6	REVERSE FLOW	DP across unit suction valve SDV-64001, higher pressure downstream	Immediate opening of SDV-64001 as PDIT-64004 would not detect a forward DP	Anti-surge & recycle line check valves, compressor can't be spun in reverse direction	Re-range PDIT-64004 such that it can detect both forward and reverse DP across SDV-64001 Review reverse equalisation across loading line and SDV-64002, JT cooling in opposite direction than loading line was designed with downstream stainless steel section	**2** **2**	**AZ** **SH**		
6.7	HIGH PRESSURE	No issues identified		MAOP of system 14.895 MPag, all piping rated for this MAOP	No Actions				
6.8	LOW PRESSURE	Low pressure in EGP during import of LNG at lower pressure (~11 MPag)	Compressor suction pressure below minimum for compressor unit	Compressor suction pressure alarm and trip	Review compressor suction low pressure trips to ensure they are suitable	**2**	**DY**		
6.9	HIGH TEMPERATURE	No issues identified							
6.10	LOW TEMPERATURE	No issues identified							
6.11	IMPURITIES	No issues identified							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
6.12	CHANGE IN COMPOSITION / CONCENTRATION	Change in composition with new gas supplies (LNG import)	Fixed composition parameters used in compressor surge control and FG system incorrect when gas composition changes		Review range of compositions and select worst case composition to calculate fixed parameters in compressor surge controller and FG system	**2**	**SH**		
6.13	TWO PHASE FLOW	No issues identified		Compressor suction scrubber, no history of liquids under current operation	No Actions				
6.14	REACTIONS	No issues identified							
6.15	TESTING EQUIPMENT / PRODUCT	No issues identified							
6.16	PLANT ITEM OPERABILITY	New equipment causing obstruction to vehicle and crane access	Inadequate crane and vehicle access for maintenance		Consider alternative piping & equipment layouts routed further due west with access from the due east direction.	**2**	**PB**		
6.17	PLANT ITEM MAINTAINABILITY	Refer OPERABILITY							
6.18	ELECTRICAL AREA CLASSIFICATION								
6.19	EARTHING				Review requirement for relocation of light pole, earthing and electrical supply.	**2**	**AZ**		
6.20	ISOLATION	Isolation and venting of new switching valve piping Station / compressor unit ESD blows down existing piping to vent	Requirement for venting Switching valve piping is upstream of compressor unit SDVs so remains pressurised on Station ESD		Provide manual vents on switching valve piping. Review isolation, depressurisation and pressurisation of the new switching valve piping to determine requirement for repressurisation lines around switching valves, vents etc. Review existing Station ESD and if new switching valve piping is required to vent/blowdown on Station ESD, and document as part of Isolation and Blowdown Philosphy Configure flow switching valves to close on EGP mainline ESD	**1** **1** **1** **2**	**PB** **SH** **DY** **SH**	**Yes** **Yes** **Yes** **No**	**Refer close out sheet in Appendix 4.** **Refer close out sheet in Appendix 15.** **Refer close out sheet in Appendix 13**
6.21	INSTRUMENTS TOO MANY	No causes							
6.22	INSTRUMENTS TOO FEW				Jemena Ops to provide feedback on where Pressure Gauges to be added	**2**	**Jemena**		
6.23	CORRECT LOCATION OF INSTRUMENTS	No causes							

NODE 7: MICHELAGO REVERSE FLOW: COMPRESSOR DISCHARGE TO EGP

DRAWINGS: 530-DW-PD-001, 530-DW-PD-018, GAS-530-DW-PD-020

PLANT & EQUIPMENT: -

INSTRUMENTATION: -

LINE NUMBERS: G-901-C9D-400, NG-01-XX-450, G-001-CE15X-400, G-64906-C9D-400, G-906-C9D-400, G-903-C9D-400, G-901-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
7.1	HIGH FLOW	Refer NODE 6 Low pressure in system during import of LNG at lower pressure (~11 MPag)	Higher volumetric flow and velocities, leading to flow induced vibration and equipment damage		Review velocity limits within existing system to ensure these are not exceeded	**2**	**DY**		
7.2	HIGH LEVEL	No issues identified							
7.3	LOW FLOW	Refer NODE 6							
7.4	LOW LEVEL	No issues identified							
7.5	ZERO FLOW / EMPTY	Refer NODE 6 Compressor not running, MLV-1 closed	Trapped gas and differential pressure across switching valves		Configure flow switching valves to prevent trapped pressure when compressor not running Consider configuring pipeline north and south free flow modes in lieu of a single bi-directional free-flow mode Configure MLV-1 to operate as a “virtual check-valve” to replace the functionality of the check valve which was removed. MLV-1 to open automatically once DP across the station is low enough for change to free-flow mode to avoid trapping pressure in the Station	**2** **2** **2**	**SH** **SH** **PB**		
7.6	REVERSE FLOW	Refer NODE 6 Reverse flow when transitioning between modes and compressor package starting up. Compressor trip		Check valves within compressor station	No actions				
7.7	HIGH PRESSURE	Gas flow down from 850m elevation to sea level, increases in pressure as it goes forward/southern flow	Exceedance of MAOP at lower sea levels	MAOP of system 14.895 MPag, all piping rated for this MAOP	Add high pressure trip to southern side of MLV set to ensure pressure at sea level does not exceed pipeline MAOP due to gravity head when flowing south. Trip to ESD compressor station.	**1**	**SH**	**Yes**	**Refer close out sheet for Item 7.7 (Appendix 18).**
7.8	LOW PRESSURE	Refer HIGH FLOW							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
7.9	HIGH TEMPERATURE	Heat of compression	High compressor discharge temperature	Compressor coolers	Review design temperatures of suction and discharge lines, and connection to the EGP for new Southern flow operating scenario. Query Jemena Commercial if TIT-4 requires duplication on the other side of MLV-1A, for purposes of pipeline linepack calculations	**2** **2**	**SH** **DY**		
7.10	LOW TEMPERATURE	Low atmospheric temperature		Piping and equipment designed for -10 deg C	No action				
7.11	IMPURITIES	No issues identified							
7.12	CHANGE IN COMPOSITION / CONCENTRATION	Refer NODE 6							
7.13	TWO PHASE FLOW	No issues identified							
7.14	REACTIONS	No issues identified							
7.15	TESTING EQUIPMENT / PRODUCT	No issues identified							
7.16	PLANT ITEM OPERABILITY	Refer NODE 6							
7.17	PLANT ITEM MAINTAINABILITY	Refer NODE 6			Consider alternative switching valve piping layout with new equipment located due west of the slope up to the A/G MLV-1	**2**	**PB**		
7.18	ELECTRICAL AREA CLASSIFICATION	No issues identified							
7.19	EARTHING	No issues identified							
7.20	ISOLATION	Refer NODE 6							
7.21	INSTRUMENTS TOO MANY	No issues identified							
7.22	INSTRUMENTS TOO FEW	Refer HIGH TEMPERATURE							
7.23	CORRECT LOCATION OF INSTRUMENTS	Refer HIGH TEMPERATURE							

NODE 8: MICHELAGO REVERSE FLOW WITH NO COMPRESSION

DRAWINGS: 530-DW-PD-018 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-029-CE15X-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
8.1	HIGH FLOW	Opening of MLV-1 with high DP	Flow induced vibration, leading to equipment damage		Refer previous action – DP interlocks				
8.2	HIGH LEVEL	No issues identified							
8.3	LOW FLOW	No issues identified							
8.4	LOW LEVEL	No issues identified							
8.5	ZERO FLOW / EMPTY	Compressor not running, MLV-1 closed	No flow in line, build-up of DP		Refer previous action – MLV-1 configuration as a "virtual check valve" Add differential pressure transmitter such that MLV-1 does not open until DP in either direction is very low	**1**	**AZ**	**Yes**	**Refer close out sheet in Appendix 4.**
8.6	REVERSE FLOW	Refer ZERO FLOW MLV-1 left open on compressor start MLV-1 passes and cannot hold discharge pressure across station	Station bypass		MLV-1 to be configured to close as part of compressor start sequence	**2**	**AZ**		
8.7	HIGH PRESSURE			MAOP of system 14.895 MPag, all piping rated for this MAOP	No action				
8.8	LOW PRESSURE	No issues identified							
8.9	HIGH TEMPERATURE	No issues identified							
8.10	LOW TEMPERATURE	No issues identified							
8.11	IMPURITIES	No issues identified							
8.12	CHANGE IN COMPOSITION / CONCENTRATION	No issues identified							
8.13	TWO PHASE FLOW	No issues identified							
8.14	REACTIONS	No issues identified							
8.15	TESTING EQUIPMENT / PRODUCT	No issues identified							
8.16	PLANT ITEM OPERABILITY	Refer NODE 6 & 7							
8.17	PLANT ITEM MAINTAINABILITY	Refer NODE 6 & 7							
8.18	ELECTRICAL AREA CLASSIFICATION	No issues identified							
8.19	EARTHING	No issues identified							
8.20	ISOLATION	Refer NODE 6 & 7							
8.21	INSTRUMENTS TOO MANY	No issues identified							
8.22	INSTRUMENTS TOO FEW				Confirm that MLV-1 is controlled by SCP	**2**	**DY**		

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
8.23	CORRECT LOCATION OF INSTRUMENTS	No issues identified							

NODE 9: MICHELAGO FORWARD FLOW: EGP TO COMPRESSOR SUCTION

DRAWINGS: 530-DW-PD-001, 530-DW-PD-018, GAS-530-DW-PD-020 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-64907-C9D-400, NG-01-XX-450, G-001-CE15X-400, G-64906-C9D-400, G-906-C9D-400, G-907-C9D-400, G-XXX-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
9.1	HIGH FLOW	Refer NODE 6							
9.2	HIGH LEVEL	No issues identified							
9.3	LOW FLOW	No issues identified							
9.4	LOW LEVEL	No issues identified							
9.5	ZERO FLOW / EMPTY	Refer NODE 6 & 7							
9.6	REVERSE FLOW	Refer NODE 8							**Virtual DP logic on MLV-1 to operate in both directions (north or south flow of EGP)**
9.7	HIGH PRESSURE	Refer NODE 6							
9.8	LOW PRESSURE	No issues identified							
9.9	HIGH TEMPERATURE	No issues identified							
9.10	LOW TEMPERATURE	Refer NODE 6							
9.11	IMPURITIES	No issues identified							
9.12	CHANGE IN COMPOSITION / CONCENTRATION	No issues identified							
9.13	TWO PHASE FLOW	No issues identified							
9.14	REACTIONS	No issues identified							
9.15	TESTING EQUIPMENT / PRODUCT	No issues identified							
9.16	PLANT ITEM OPERABILITY	No issues identified							
9.17	PLANT ITEM MAINTAINABILITY	No issues identified							
9.18	ELECTRICAL AREA CLASSIFICATION	No issues identified							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
9.19	EARTHING	No issues identified							
9.20	ISOLATION	Refer NODE 6-8							
9.21	INSTRUMENTS TOO MANY	No issues identified							
9.22	INSTRUMENTS TOO FEW	No issues identified							
9.23	CORRECT LOCATION OF INSTRUMENTS	No issues identified							

NODE 10: MICHELAGO FORWARD FLOW: COMPRESSOR DISCHARGE TO EGP

DRAWINGS: 530-DW-PD-001, 530-DW-PD-018, GAS-530-DW-PD-020

PLANT & EQUIPMENT: -

INSTRUMENTATION: -

LINE NUMBERS: G-901-C9D-400, G-64904-C9D-400, G-020-CE15X-400, G-904-C9D-400, G-901-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
10.1	HIGH FLOW	All issues captured in NODE 7							
10.2	HIGH LEVEL								
10.3	LOW FLOW								
10.4	LOW LEVEL								
10.5	ZERO FLOW / EMPTY								
10.6	REVERSE FLOW								
10.7	HIGH PRESSURE								
10.8	LOW PRESSURE								
10.9	HIGH TEMPERATURE								
10.10	LOW TEMPERATURE								
10.11	IMPURITIES								
10.12	CHANGE IN COMPOSITION / CONCENTRATION								
10.13	TWO PHASE FLOW								
10.14	REACTIONS								
10.15	TESTING EQUIPMENT / PRODUCT								
10.16	PLANT ITEM OPERABILITY								

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
10.17	PLANT ITEM MAINTAINABILITY								
10.18	ELECTRICAL AREA CLASSIFICATION								
10.19	EARTHING								
10.20	ISOLATION								
10.21	INSTRUMENTS TOO MANY								
10.22	INSTRUMENTS TOO FEW								
10.23	CORRECT LOCATION OF INSTRUMENTS								

NODE 10A: MICHELAGO MLV ACTUATED PRESSURISATION BYPASS

DRAWINGS: GAS-530-DW-PD-020 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-XXX-C9D-150

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
10.1A	HIGH FLOW	Opening of UV-64109 under high DP	High velocities, flow induced vibration, leading to equipment damage		Refer Item 6.5 and 10.10. Pressurisation valve to be sized to limit velocities to within acceptable limits.	**2**	**SH**		
10.2A	HIGH LEVEL	No issues identified							
10.3A	LOW FLOW	No issues identified							
10.4A	LOW LEVEL	No issues identified							
10.5A	ZERO FLOW / EMPTY	No issues identified							
10.6A	REVERSE FLOW	Refer LOW TEMPERATURE							
10.7A	HIGH PRESSURE	No issues identified							
10.8A	LOW PRESSURE	No issues identified							
10.9A	HIGH TEMPERATURE	No issues identified							
10.10A	LOW TEMPERATURE	Opening of UV-64109 with higher pressure on RO side	UV and RO cannot be operated in both directions as RO will be upstream of UV in one flow direction, leading to UV exposed to excessively low temperatures, valve freezing		Select appropriate valve for repressurisation in both directions and remove RO	**2**	**SH**		
10.11A	IMPURITIES	No issues identified							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
10.12A	CHANGE IN COMPOSITION / CONCENTRATION	No issues identified							
10.13A	TWO PHASE FLOW	No issues identified							
10.14A	REACTIONS	No issues identified							
10.15A	TESTING EQUIPMENT / PRODUCT	No issues identified							
10.16A	PLANT ITEM OPERABILITY	Removal of UV-64109	Single valve isolation provided only		Review isolation requirements for removal of UV-64109 while station remains online	**2**	**DY**		
10.17A	PLANT ITEM MAINTAINABILITY	Refer OPERABILITY							
10.18A	ELECTRICAL AREA CLASSIFICATION	No issues identified							
10.19A	EARTHING	No issues identified							
10.20A	ISOLATION				UV-64109 to be configured to close on pipeline mainline ESD	**2**	**SH**		
10.21A	INSTRUMENTS TOO MANY	No issues identified							
10.22A	INSTRUMENTS TOO FEW	Low temperatures not monitored by instrumentation on repressurisation			Review requirements for low temperature piping to handle minimum temperatures on repressurisation	**2**	**PB**		
10.23A	CORRECT LOCATION OF INSTRUMENTS	No issues identified							

NODE 11: MILA REVERSE FLOW: EGP TO COMPRESSOR SUCTION

DRAWINGS: 525-PI-001, GAS-525-DW-PD-039, GTS-525-DW-PD-022 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-909-C9D-400, NG-01-XX-458, G-905-C9D-400, G-XXX-C9D-400, G-002-PL9Z-400, G-003-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
11.1	HIGH FLOW	Refer NODE 6							
11.2	HIGH LEVEL	No issues identified							
11.3	LOW FLOW	Refer NODE 6							
11.4	LOW LEVEL	No issues identified							
11.5	ZERO FLOW / EMPTY	Two MLVs in series (compared with two MLVs in parallel at Michelago)	Potential greater probability of either MLV inadvertently operating / not being able to open	New MLV can be bypassed using DN150 kicker-line on Launcher Trap E-02 using V-15	No new actions. Refer OPERABILITY – action to consider parallel MLV configuration				
11.6	REVERSE FLOW	Refer NODE 6							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
11.7	HIGH PRESSURE	Refer NODE 6 – pressure change due to elevation differences along the pipeline							
11.8	LOW PRESSURE	Refer NODE 6							
11.9	HIGH TEMPERATURE	Refer NODE 6							
11.10	LOW TEMPERATURE	Refer NODE 6							
11.11	IMPURITIES	Refer NODE 6							
11.12	CHANGE IN COMPOSITION / CONCENTRATION	Refer NODE 6 – fixed composition in compressor surge control system and FG system							
11.13	TWO PHASE FLOW	Refer NODE 6							
11.14	REACTIONS	Refer NODE 6							
11.15	TESTING EQUIPMENT / PRODUCT	Refer NODE 6							
11.16	PLANT ITEM OPERABILITY	Refer NODE 6			UV-64110 to be FL, double acting gas-over-oil MLV similar to MLV-7, IG to be taken from pipeline side of MLV. Re-tag UV-64110 to MLV-7 Re-tag MLV-7 to MLV-7A Consider putting this new MLV in parallel to the existing MLV, for a similar configuration to Michelago / EGCS Consider alternative site layout with switching valves located west of MLV-7 Pipeline operability checks to be reviewed in regards to change in delivery pressures at different receipt points along the EGP when flowing south	**1** **1** **1** **~~1~~ 2** **2** **2**	**SH** **SH** **SH** **SH** **DY** **Jemena**	**Yes** **Yes** **Yes** **No** **No** **No**	**Refer close out sheet in Appendix 4.** **Refer close out sheet in Appendix 4.** **Refer close out sheet in Appendix 4.** **Design to remain unchanged for FEED. Jemena to raise a Design Change Request during detailed design to change Mila switching valve piping to match Michelago FEED design piping**
11.17	PLANT ITEM MAINTAINABILITY	Refer OPERABILITY Possible need for pigging of the EGP in reverse flow direction	Pigging facilities not necessarily configured for pigging in reverse flow direction		Confirm if pigging operation required in reverse flow direction.	**2**	**Jemena**		
11.18	ELECTRICAL AREA CLASSIFICATION	Refer NODE 6							
11.19	EARTHING	Refer NODE 6							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
11.20	ISOLATION	Refer NODE 6 Construction tie-in at TIP-525-04 will be behind single valve isolation off the pipeline, using V-16 Construction tie-in at Cann River side of MLV-7 will be behind single valve isolation off the pipeline, using V-07 & V-23 Construction tie-in requires installation of pipeline bypass line between pig trap kicker line connection points	Not able to complete tie-in if valve does not seal	Sealant injection on V-16 & V-07 Testing of V-16, V-07 & V-23 prior to commencing construction tie-in Existing pipeline bypass line on site to be installed (will require dimensional check as pig traps may be displaced/moved)	No actions				
11.21	INSTRUMENTS TOO MANY	Refer NODE 6							
11.22	INSTRUMENTS TOO FEW	Refer NODE 6							
11.23	CORRECT LOCATION OF INSTRUMENTS	GC take-off is located in the dead leg adjacent to UV-64110	Loss of effective GC monitoring of gas composition		Move GC tapping point 25-BV-64006 to main flow path piping adjacent to TIP-525-04	**1**	**SH**	**Yes**	**Refer close out sheet in Appendix 4.**

NODE 12: MILA REVERSE FLOW: COMPRESSOR DISCHARGE TO EGP

DRAWINGS: 525-PI-001, GAS-525-DW-PD-039, GTS-525-DW-PD-022 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-908-C9D-400, G-906-C9D-400, G-903-C9D-400, G-902-C9D-400, G-021-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
12.1	HIGH FLOW	Refer NODE 7							
12.2	HIGH LEVEL	Refer NODE 7							
12.3	LOW FLOW	Refer NODE 7							
12.4	LOW LEVEL	Refer NODE 7							
12.5	ZERO FLOW / EMPTY	Refer NODE 7							
12.6	REVERSE FLOW	Refer NODE 7							
12.7	HIGH PRESSURE	Refer NODE 7							
12.8	LOW PRESSURE	Refer NODE 7							
12.9	HIGH TEMPERATURE	Refer NODE 7							
12.10	LOW TEMPERATURE	Refer NODE 7							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
12.11	IMPURITIES	Refer NODE 7							
12.12	CHANGE IN COMPOSITION / CONCENTRATION	Refer NODE 7							
12.13	TWO PHASE FLOW	Refer NODE 7							
12.14	REACTIONS	Refer NODE 7							
12.15	TESTING EQUIPMENT / PRODUCT	Refer NODE 7							
12.16	PLANT ITEM OPERABILITY	Refer NODE 7							
12.17	PLANT ITEM MAINTAINABILITY	Refer NODE 7							
12.18	ELECTRICAL AREA CLASSIFICATION	Refer NODE 7							
12.19	EARTHING	Refer NODE 7							
12.20	ISOLATION	Refer NODE 7							
12.21	INSTRUMENTS TOO MANY	Refer NODE 7							
12.22	INSTRUMENTS TOO FEW	Refer NODE 7							
12.23	CORRECT LOCATION OF INSTRUMENTS	Refer NODE 7							

NODE 13: MILA REVERSE FLOW WITH NO COMPRESSION

DRAWINGS: 525-PI-001 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** NG-01-C9D-400, NG-01-XX-450

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
13.1	HIGH FLOW	Refer NODE 8							
13.2	HIGH LEVEL	Refer NODE 8							
13.3	LOW FLOW	Refer NODE 8							
13.4	LOW LEVEL	Refer NODE 8							
13.5	ZERO FLOW / EMPTY	Refer NODE 8 Refer NODE 11 – ZERO FLOW							
13.6	REVERSE FLOW	Refer NODE 8							
13.7	HIGH PRESSURE	Refer NODE 8							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
13.8	LOW PRESSURE	Refer NODE 8							
13.9	HIGH TEMPERATURE	Refer NODE 8							
13.10	LOW TEMPERATURE	Refer NODE 8							
13.11	IMPURITIES	Refer NODE 8							
13.12	CHANGE IN COMPOSITION / CONCENTRATION	Refer NODE 8							
13.13	TWO PHASE FLOW	Refer NODE 8							
13.14	REACTIONS	Refer NODE 8							
13.15	TESTING EQUIPMENT / PRODUCT	Refer NODE 8							
13.16	PLANT ITEM OPERABILITY	Refer NODE 8							
13.17	PLANT ITEM MAINTAINABILITY	Refer NODE 8							
13.18	ELECTRICAL AREA CLASSIFICATION	Refer NODE 8							
13.19	EARTHING	Refer NODE 8							
13.20	ISOLATION	Refer NODE 8							
13.21	INSTRUMENTS TOO MANY	Refer NODE 8							
13.22	INSTRUMENTS TOO FEW	Refer NODE 8							
13.23	CORRECT LOCATION OF INSTRUMENTS	Refer NODE 8							

NODE 14: MILA FORWARD FLOW: EGP TO COMPRESSOR SUCTION

DRAWINGS: 525-PI-001, GAS-525-DW-PD-039, GTS-525-DW-PD-022

PLANT & EQUIPMENT: -

INSTRUMENTATION: -

LINE NUMBERS: G-908-C9D-400, G-906-C9D-400, G-907-C9D-400, G-002-PL9Z-400, G-003-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
14.1	HIGH FLOW	Refer NODE 9							
14.2	HIGH LEVEL	Refer NODE 9							
14.3	LOW FLOW	Refer NODE 9							
14.4	LOW LEVEL	Refer NODE 9							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
14.5	ZERO FLOW / EMPTY	Refer NODE 9							
14.6	REVERSE FLOW	Refer NODE 9							
14.7	HIGH PRESSURE	Refer NODE 9							
14.8	LOW PRESSURE	Refer NODE 9							
14.9	HIGH TEMPERATURE	Refer NODE 9							
14.10	LOW TEMPERATURE	Refer NODE 9							
14.11	IMPURITIES	Refer NODE 9							
14.12	CHANGE IN COMPOSITION / CONCENTRATION	Refer NODE 9							
14.13	TWO PHASE FLOW	Refer NODE 9							
14.14	REACTIONS	Refer NODE 9							
14.15	TESTING EQUIPMENT / PRODUCT	Refer NODE 9							
14.16	PLANT ITEM OPERABILITY	Refer NODE 9							
14.17	PLANT ITEM MAINTAINABILITY	Refer NODE 9							
14.18	ELECTRICAL AREA CLASSIFICATION	Refer NODE 9							
14.19	EARTHING	Refer NODE 9							
14.20	ISOLATION	Refer NODE 9							
14.21	INSTRUMENTS TOO MANY	Refer NODE 9							
14.22	INSTRUMENTS TOO FEW	Refer NODE 9							
14.23	CORRECT LOCATION OF INSTRUMENTS	Refer NODE 9							

NODE 15: MILA FORWARD FLOW: COMPRESSOR DISCHARGE TO EGP

DRAWINGS: 525-PI-001, GAS-525-DW-PD-039, GTS-525-DW-PD-022

PLANT & EQUIPMENT: -

INSTRUMENTATION: -

LINE NUMBERS: G-909-C9D-400, NG-01-XX-450, G-904-C9D-400, G-902-C9D-400, G-021-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
15.1	HIGH FLOW	Refer NODE 10							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
15.2	HIGH LEVEL	Refer NODE 10							
15.3	LOW FLOW	Refer NODE 10							
15.4	LOW LEVEL	Refer NODE 10							
15.5	ZERO FLOW / EMPTY	Refer NODE 10							
15.6	REVERSE FLOW	Refer NODE 10							
15.7	HIGH PRESSURE	Refer NODE 10							
15.8	LOW PRESSURE	Refer NODE 10							
15.9	HIGH TEMPERATURE	Refer NODE 10							
15.10	LOW TEMPERATURE	Refer NODE 10							
15.11	IMPURITIES	Refer NODE 10							
15.12	CHANGE IN COMPOSITION / CONCENTRATION	Refer NODE 10							
15.13	TWO PHASE FLOW	Refer NODE 10							
15.14	REACTIONS	Refer NODE 10							
15.15	TESTING EQUIPMENT / PRODUCT	Refer NODE 10							
15.16	PLANT ITEM OPERABILITY	Refer NODE 10							
15.17	PLANT ITEM MAINTAINABILITY	Refer NODE 10							
15.18	ELECTRICAL AREA CLASSIFICATION	Refer NODE 10							
15.19	EARTHING	Refer NODE 10							
15.20	ISOLATION	Refer NODE 10							
15.21	INSTRUMENTS TOO MANY	Refer NODE 10							
15.22	INSTRUMENTS TOO FEW	Refer NODE 10							
15.23	CORRECT LOCATION OF INSTRUMENTS	Refer NODE 10							

NODE 15A: MILA MLV ACTUATED PRESSURISATION BYPASS

DRAWINGS: GAS-525-DW-PD-039 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-XXX-C9D-150

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
15.1	HIGH FLOW	Refer NODE 10A							
15.2	HIGH LEVEL	Refer NODE 10A							
15.3	LOW FLOW	Refer NODE 10A							
15.4	LOW LEVEL	Refer NODE 10A							
15.5	ZERO FLOW / EMPTY	Refer NODE 10A							
15.6	REVERSE FLOW	Refer NODE 10A							
15.7	HIGH PRESSURE	Refer NODE 10A							
15.8	LOW PRESSURE	Refer NODE 10A							
15.9	HIGH TEMPERATURE	Refer NODE 10A							
15.10	LOW TEMPERATURE	Refer NODE 10A							
15.11	IMPURITIES	Refer NODE 10A							
15.12	CHANGE IN COMPOSITION / CONCENTRATION	Refer NODE 10A							
15.13	TWO PHASE FLOW	Refer NODE 10A							
15.14	REACTIONS	Refer NODE 10A							
15.15	TESTING EQUIPMENT / PRODUCT	Refer NODE 10A							
15.16	PLANT ITEM OPERABILITY	Refer NODE 10A							
15.17	PLANT ITEM MAINTAINABILITY	Refer NODE 10A							
15.18	ELECTRICAL AREA CLASSIFICATION	Refer NODE 10A							
15.19	EARTHING	Refer NODE 10A							
15.20	ISOLATION	Refer NODE 10A							
15.21	INSTRUMENTS TOO MANY	Refer NODE 10A							
15.22	INSTRUMENTS TOO FEW	Refer NODE 10A							
15.23	CORRECT LOCATION OF INSTRUMENTS	Refer NODE 10A							

NODE 15B: MICHELAGO AND MILA: OVERVIEW

DRAWINGS: 530-DW-PD-001, 530-DW-PD-018, GAS-530-DW-PD-020, 525-PI-001, GAS-525-DW-PD-039, GTS-525-DW-PD-022

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
15.1 A	TOXICITY	No issues identified							
15.2 A	SERVICES REQUIRED	Additional demand on instrument air system Instrument gas for new MLV (Mila only) New equipment and valves outside of existing plant lighting zones Poor communications service at Mila & Michelago	Insufficient IA supply Insufficient lighting		Review IA system capacity for new IA demands Confirm requirements for additional plant lighting required at Michelago & Mila Review if communications service can be improved at Mila & Michelago	**2** **3** **3**	**DY** **DY** **DY**		
15.3 A	MATERIALS OF CONSTRUCTION	Refer NODE X – low temperature materials may be required for repressurisation line							
15.4 A	COMMISSIONING			Repressurisation valve V-23 (DN50) available around V-07 for repressuristation from pipeline	No actions				
15.5 A	BREAKDOWN	No issues identified							
15.6 A	STARTUP / SHUTDOWN	Refer NODES							
15.7 A	EFFLUENT	No issues identified							
15.8 A	NOISE / VIBRATION	Refer NODES No new issues identified							
15.9 A	FIRE / EXPLOSION	No new issues identified							
15.10 A	SAFETY EQUIPMENT	Piping and equipment in new areas of the plant	New piping and equipment outside of existing plant fire detection camera zones	Safety equipment location will be assessed as part of layout and 3D model reviews	No actions				
15.11 A	QUALITY AND CONSISTENCY	Refer NODE X – series/parallel MLVs			Review Mila electrical contactor isolation and consider if these can be upgraded to be consistent with Michelago	**2**	**DY**		
15.12 A	OUTPUT – RELIABILITY AND BOTTLENECKS	Compressor stations (Mila & Michelago) operating in opposite directions	Station suction/discharge will quickly increase/drop		Confirm philosophy for ensuring that EGP and all compressor stations are all configured in either northern or southern flow, and if this will be automated	**2**	**DY**		
15.13 A	EFFICIENCY	No issues identified							
15.14 A	SIMPLICITY	Refer OUTPUT - RELIABILITY							
15.15 A	MOBILE EQUIPMENT / PLANT MOVEMENT	No new issues identified							
15.16 A	PROCESS PLANT NORMAL / ABNORMAL MAINTENANCE	No new issues identified							
15.17 A	PROCESS PLANT PROCESS FUNCTIONALITY	No new issues identified							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
15.18 A	ERGONOMICS	No new issues identified		Will be assessed as part of layout and 3D model reviews					
15.19 A	GUARDING	No issues identified		Will be assessed as part of layout and 3D model reviews					
15.20 A	WARNINGS	No issues identified		Will be assessed as part of layout and 3D model reviews					
15.21 A	VULNERABILITY	No issues identified		All new piping and equipment within existing station fenceline					
15.22 A	3RD PARTY INTERFERENCE	No issues identified		All new piping and equipment within existing station fenceline					
15.23 A	NATURAL EVENTS	No issues identified		Bushfire assessments completed					

GPA	HAZOP MINUTES	20617-REP-018
	Project Marlin: EGP Reversal	SHEET 1 of 18

Client	**Jemena Ltd**
Client Project No	**GAS-599**
GPA Project No	**20617**
Project Title	**Project Marlin: EGP Reversal**
Facilitator	**Lisa Hein**
Scribe	**Peter Blyton** **Sarah Greening**
Workshop Date	**16/11/2020**
Workshop Location	**Microsoft Teams**
HAZOP Sponsor	**Nathan Biggins** **Matthew Skaras**
HAZOP Stage	**30% FEED Stage 2:** • **VicHub2 located at Longford Compressor Station (LCS)**

HAZOP Participants:

GPA Engineering

Sarah Greening (SG)	Project Manager / Minute Taker
Lisa Hein (LH)	Senior Consultant - Risk and Advisory / Facilitator
Simon Hanlin (SH)	Senior Process Engineer
Peter Blyton (PB)	Senior Mechanical Engineer / Minute Taker
Adrian Zatta (AZ)	Senior EI&C Engineer

Jemena

David Young (DY)	Engineering Manager
Max Imsungnoen (MI)	Project Engineer
Stephen Chow (SC)	Project Engineer
Luke Gigliotti (LG)	Team Leader - Control Room
Richard Lamin (RL)	Pipeline Operator Technician
Mick Arneill (MA)	Manager - Gas Transmission South

Background:
Jemena is undertaking Front End Engineering and Design (FEED) to facilitate a total installed cost (TIC) estimate and schedule to reverse flow the Eastern Gas Pipeline (EGP) south of the Kembla Grange Meter Station (KGMS), to allow the supply of gas into the Victorian and New South Wales gas networks.

The following, key pieces of documentation, formed the basis of the HAZOP (refer HAZOP report for additional information):

- Longford Compressor Station
  - Launcher Station P&ID: 510-PI-092
  - Gas Manifold P&ID: PO-510-PI-110
  - Vic Hub 2 – Metering Run P&ID: GAS-511-DW-PD-003
  - Vic Hub 2 – Pressure Regulation P&ID: GAS-511-DW-PD-004
  - Vic Hub 2 – Inlet Filter Separator P&ID: GAS-511-DW-PD-001
  - Vic Hub 2 – Water Bath Heater P&ID: GAS-511-DW-PD-002
  - Vic Hub – Water Bath Heater 510-HT-101 P&ID: 510-DW-PD-006
  - Inlet Filter Separator P&ID: 510-DW-PD-101
  - Open Drain Interceptor P&ID: 510-PI-140
  - Vic Hub – Bi-Directional Pipeline P&ID: PO-511-DW-PD-001

The HAZOP specifically dealt with:

- Vic Hub Interconnect (located within the Longford Compressor Station, LCS)

The HAZOP specifically excluded a full formal review of:

- Water Bath Heater 510-HT-102, Vendor Package HAZOP will be completed as part of Detailed Design

The HAZOP was conducted using a series of guide words which were applied to each of the key phases of operation.

NODE 16: LONGFORD: EGP TO VICHUB2 WATER BATH HEATER

DRAWINGS: 510-PI-092, PO-510-PI-110, GAS-511-DW-PD-001, GAS-511-DW-PD-002, GAS-511-DW-PD-003

PLANT & EQUIPMENT: 510-F-103

INSTRUMENTATION: -

LINE NUMBERS: G-076-C9D-400, NG-01-C9D-400, G-701-C9D-400, G-702-C9D-400, G-703-C9D-400, G-704-C9D-400, G-705-C9D-400, G-706-C9D-400, G-707-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
16.1	HIGH FLOW	High flow nomination Low downstream pressure	High DP across Filter 510-F-103 Loss of effective metering	High DP alarm PDI-64101B for Filter 510-F-103 HH DP shutdown of UV-64101 High flow alarm on FI-64112	No actions				
16.2	HIGH LEVEL	Liquid slug Entrained oil from upstream gas compressors at Orbost and/or ESSO Entrained hydrocarbon liquids Inadequate operation of manual liquid draining of Filter 510-F-103	Liquid carry-over, resulting in off-spec gas	High level alarm LSH-011107/8 on Filter 510-F-103 HH level shutdown on LSHH-011107/8 on Filter 510-F-103 Inlet gas supplied per AS4564 gas specification.	P&ID and datasheet to show that Filter 510-F-103 liquids collection boot is separated into two compartments. P&IDs currently shows this as one compartment which would allow gas to bypass the filter element. Add transmitter to LG-011107/8	**1** **1**	**PB** **AZ**	**Yes** **Yes**	**Refer close out sheet in Appendix 2.** **Refer close out sheet in Appendix 2.**
16.3	LOW FLOW	Blocked Filter 510-F-103	High DP across filter, leading to filter element damage Flow nomination shortfall	High DP alarm PDI-64101B for Filter 510-F-103 HH DP shutdown of UV-64101	No action				
16.4	LOW LEVEL	No issues identified.							
16.5	ZERO FLOW / EMPTY	Inadvertent closure of downstream valves	Failure to deliver flow nomination	Flow trend monitoring by Operations Personnel	Add position feedback and out of position alarm on downstream flow control valves FV-64118& FV-64124.	**1**	**AZ**	**Yes**	**Refer close out sheet in Appendix 2.**
16.6	REVERSE FLOW	Higher pressure in downstream GasNet than EGP	Reverse flow, leading to filter element damage Loss of effective metering	Check valves in flow control runs					
16.7	HIGH PRESSURE	Inadvertent opening of UV-6470	High pressure from compressor discharge header Very high flow through Filter 510-F-103, leading to filter element damage	Refer High Flow The pressure rating of the piping system and equipment exceeds the upstream pressure source.	Correct the PSV set-point shown on the P&ID for Filter 510-F-103.	**1**	**SH**	**Yes**	**Refer close out sheet in Appendix 2.**

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
16.8	LOW PRESSURE	Lower pressure than expected in the EGP due to continuous withdrawal of gas from the EGP	High gas velocities through the piping and Filter 510-F-103. Longford Compressor discharge harder pressure too low to start compressors.	Refer High Flow Operator intervention	Consider implementation of low pressure alarm on the EGP Consider implementing a back pressure control loop on PV-6440 to maintain adequate pressure in the Longford compressor discharge header to start compressors.	**1** **1**	**DY** **DY**	**Yes** **Yes**	**Refer close out sheet in Appendix 2.** **Refer close out sheet in Appendix 2.**
16.9	HIGH TEMPERATURE	Hot day (45 deg C) with flow from LCS into the EGP (i.e. north flow), exit temp from LCS would be high, if flow direction swapped to reverse the inlet temp from EGP into VicHub2 would be hotter		Operating temperature up to 46 degC in Vic Hub 2 is being considered Filter design temp is 50 degC	Review how quickly the flow direction can be swapped from north to south flow, i.e. is it plausible 4 hour blocks of direction change. If required would an increase the design temp be required?	~~**1**~~ **2**	**DY**	**No**	**Refer close out sheet for Item 16.9 (Appendix 29).** **Deferred to detailed design.**
16.10	LOW TEMPERATURE	Repressuriation of Filter 510-F-103 after maintenance	Piping seeing lower temp than designed for	Filter design temp is 15MPa Min piping design temp is -10degC	Check expected repressuring minimum temperatures are above pipe minimum design temperatures.	**2**	**SH**		
16.11	IMPURITIES	H2S is present in gas from Orbost or from Esso, therefore could be in the pipeline. Mercury from Esso (it is in their field and have they have mercury removal) Lube oil Seal oil	Off spec gas Not expecting enough H2S to have corrosion issues OH&S for maintenance – ops not expecting to be exposed. NORM (normally occurring radioactive material)	Spot checks are done on pigging, not yet in the plant. Filter for liquids removal	Operating procedures to include a note regarding materials that could be present in gas	**3**	**DY**		
16.12	CHANGE IN COMPOSITION / CONCENTRATION	Gas is odourised as it is discharged from Longford Compressor Station. If flow is reversed the gas could be odourised again. Mixed gas within plant with different odourised rates	High odorant results in more customers claiming gas leads AEMO will pick this up also		Control functional description to consider odourising controls to ensure it is not doubled up.	**3**	**DY**		
16.13	TWO PHASE FLOW	Nil			No action				
16.14	REACTIONS	Not expecting any issues		Orbost treats for H2S	No action				

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
16.15	TESTING EQUIPMENT / PRODUCT	Metering skid has a single meter only.		All maintenance can be done online (eg meter verification)	Develop procedure for verifying the accuracy of the single meter run and the GC. Probe for the GC will see higher flows during testing. Wake frequency calculation to consider all possible high flow scenarios. Note:External (not Gerni), Welker probe is desired.	**3** **2**	**DY** **AZ**		
16.16	PLANT ITEM OPERABILITY	Closure on filter, type shown on P&ID is the preferred option Pigs – direction of pigging is unknown	Need to be able to receive a pig if flowing from north to south		Pigs – confirm the planned direction of pigging and review the configuration of the pipework to ensure that a pig can be received at the Longford Compressor Station Pig Barrel (location of kicker and equalisation line)	**2**	**DY**		
16.17	PLANT ITEM MAINTAINABILITY	Isolation of filter or strainer for maintenance Meter – single series with no double head for proving	No way to re-pressurise after isolation for maintenance. Large ball valve required to open to re-pressurise isolated strainer/filter, leading to damage to large ball valve. After 10 years difficult to prove the calibration (Esso sometimes query this) No immediate concerns		Strainer - install a pressuriation line around valve 400-BV-064844. Filter - install a pressurisation line around filter isolation valve 400-BV-064844 including an RO to limit the pressurisation rate of the filter and avoid damage to the filter elements.	**1**	**PB**	**Yes**	**Refer close out sheet in Appendix 2.**
16.18		If pigging in reverse (North to South) corrosion by-products in PV-6440 and meter FE-6433	Blockage or damage to PV or FE		If pigging required to be performed north to south the pigging procedure should include closure of PV-6433 during pigging and consider impact of corrosion by-products.	**3**	**DY**		
16.19	ELECTRICAL AREA CLASSIFICATION	HA classification will need to be done		This will be part of the project	No action				
16.20	EARTHING	NIl							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
16.21	ISOLATION	Drawing consistency			Implement a consistent approach with regards to valve cavity bleeds	~~1~~ **2**	**PB**	**No**	Discussed with Jemena (David Young) for this action to be deferred to Jemena for review post-FEED. Details are noted in the FEED Report. Consequence of purchasing current design valves, is too many extra 3/4 Ball valves. Not a long lead item. **Deferred to Detailed Design.**
16.22	INSTRUMENTS TOO MANY	Nil							
16.23	INSTRUMENTS TOO FEW	Nil							
16.24	CORRECT LOCATION OF INSTRUMENTS	Nil							

NODE 17: LONGFORD: VICHUB2 TO VIC HUB WBH CROSS OVER

DRAWINGS: GAS-511-DW-PD-003, 510-DW-PD-006 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS: G-716-C9D-200, G-100-C9-200, G-111-C9-200, G-112-C9-200**

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
17.1	HIGH FLOW	Refer previous node (node 16)	Required heating duty exceeds heater duty could lead to lower than required temp at the regulators (heater can't keep up), hence delivery temperature.	Downstream flow control valve, there will be a max nomination which can be entered per run which should prevent this.	Ensure that a nomination leading to higher than design flows cannot be entered into SCADA Philosophy similar to Hoarlsey to be implemented	**2**	**DY**		
17.2		High volumetric flow through the heater tubes	Exceeding the existing heater tube design velocity		Check the sizing of the VH1 heater for project operating conditions. .	**2**	**DY**		
17.3	HIGH LEVEL	N/A							
17.4	LOW FLOW	Refer previous node (node 16)		Heater controls are assumed to be working	No action				
17.5	LOW LEVEL	N/A							
17.6	ZERO FLOW / EMPTY	Refer node 16							
17.7	REVERSE FLOW	See operability (this node)		All rated for 900#	No action				
17.8	HIGH PRESSURE	Refer node 16							
17.9	LOW PRESSURE	Refer node 16							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
17.10	HIGH TEMPERATURE	Loss of 510-HT-101 heater control	Excessive gas temperature downstream of 510-HT-101	Existing heater controls	Review the 510-HT-101 heater control logic and ensure the design is appropriate for reverse flow operation.	**2**	**AZ**		
17.11	LOW TEMPERATURE	Gas temp will be lower than current operating conditions (temp coming in around 19 deg rather than 40deg from the compressor).	Could decrease/change the heater capacity. There are currently scenarios where up to 120 TJ/d resulted in shutdown due to the parameters being considered, this has occurred during winter.	High inlet pressure expected in reverse flow mode compared to current mode A control system was implemented to increase the heater capacity from 135 to 150 however conditions over winter this resulted in numerous trips possibly on high inlet Pressure.	Refer HIGH TEMPERATURE action				
17.12	IMPURITIES	Refer node 16							
17.13	CHANGE IN COMPOSITION / CONCENTRATION	Refer node 16							
17.14	TWO PHASE FLOW	Refer node 16							
17.15	REACTIONS	Refer node 16							
17.16	TESTING EQUIPMENT / PRODUCT	Existing – nothing added in the node							
17.17	PLANT ITEM OPERABILITY	Switching from EGP North to South then reverse, leading to back flow through the equipment	Line back to filter gets reverse flow for repressurisation Noting this is not significant, may be a meter pulse	NRV at the filter, which is what needs to be protected	Consider relocating 64101 to the other side of filter and meter run Consider new actuated/switching valve at the tie-in point or 64866 to be actuated Consider remote versus manual requirements	**1** **1**	**DY** **DY**	**Yes** **Yes**	**Refer close out sheet for Item 17.17 (Appendix 19)**
17.18		If VH1 heater is off-line for maintenance fuel gas is not being heated.	Limited compressor capacity or off spec fuel gas.	Back-up electric heater.	Consider additional FG heating control loop through the new VH2 water bath heater	**1**	**DY**	**Yes**	**Refer close out sheet for Item 17.18 (Appendix 20)**
17.19	PLANT ITEM MAINTAINABILITY	Refer above							
17.20	ELECTRICAL AREA CLASSIFICATION	HA classification on previous project is not available for this section of the plant		Equipment is expected to be okay	HA classification to be completed for areas where new equipment is being installed.	**2**	**SH**		
17.21	EARTHING	Nil							
17.22	ISOLATION	Nil							
17.23	INSTRUMENTS TOO MANY	Nil							
17.24	INSTRUMENTS TOO FEW	Nil							
17.25	CORRECT LOCATION OF INSTRUMENTS	Nil							

NODE 18: LONGFORD: VICHUB2 WATER BATH HEATER TO FLOW REGULATORS

HEATER BATH TEMP 50 TO 60 DEG C. OLPERATES DIFFERENTLY TO THE OTHER HEATER. TEMP WILL BE ACHIEVEED BY MIXING HOT HEATED GAS WITH BYPASSED GAS.

DRAWINGS: GAS-511-DW-PD-002, GAS-511-DW-PD-004 **PLANT & EQUIPMENT:** 510-HT-102 **INSTRUMENTATION:** - **LINE NUMBERS:** G-708-C9D-300, G-711-C9D-400, G-712-C9D-400, G-713-C9D-400, G-717-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
18.1	HIGH FLOW	TY-064114 fails shut directing more flow through the heater than design	Heater damage / vibration	Position transmitter feedback with out of position alarm	Determine the operational limits of the heater and consider implementing trips or high flow alarms	**2**	**AZ**		
18.2	HIGH LEVEL	N/A							
18.3	LOW FLOW	Refer NODE 16 Insulation shown on P&ID is for temperature conservation (start up after shut in overnight)							
18.4	LOW LEVEL	N/A							
18.5	ZERO FLOW / EMPTY	No flow through the heater – there will be a bath temp range, it will continue to fire until it reaches the high limit then go into standby mode		There will be a detailed design vendor HAZOP for the heater	No action				
18.6	REVERSE FLOW	Refer node 16							
18.7	HIGH PRESSURE	Heater design pressure and temp shown incorrectly on P&ID			Design pressure on the heater to be changed to 14,895 kPag, temp should be VTC	**1**	**SH**	**Yes**	**Refer close out sheet in Appendix 2.**
18.8	LOW PRESSURE	Refer node 16							
18.9	HIGH TEMPERATURE	TCV control will be via Jemena DCS. If this valve closed inadvertently more gas than is required would be directed to the heater leading to high temperatures.	Wasting fuel gas	Heater package won't overheat gas. Discrepancy alarm on TCV	No action required				
18.10	LOW TEMPERATURE	TCV open too far	Low temp trip downstream AEMO may call with a warning	Discrepancy alarm on TCV Low temp on alarm at regulator outlet (64115)	Add low temperature trip to TIT-64128.	**1**	**AZ**	**Yes**	**Refer close out sheet in Appendix 2.**
18.11		Manual butterfly (64001) at outlet of heater to allow for manual trimming	Not expected to be used or required		Delete this valve	**1**	**PB**	**Yes**	**Refer close out sheet in Appendix 2.**
18.12	IMPURITIES	Water dosing (biocide)		Vendor HAZOP					

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
18.13	CHANGE IN COMPOSITION / CONCENTRATION	Nil							
18.14	TWO PHASE FLOW	Nil							
18.15	REACTIONS	Nil							
18.16	TESTING EQUIPMENT / PRODUCT								
18.17	PLANT ITEM OPERABILITY	Insufficient isolation to maintain TCV-64114 with heater 510-HT-102 online.	Maintenance cannot be completed without depressuring the heater 510-HT-102 and using isolations further upstream/downstream.	Heater can be used with some limitations if TCV-64114 is out of service VicHub 1 heater 510-HT-101 available Valve body/internals not expected to require repair Valve actuator and instrumentation can be maintained with the valve remaining in service. Note – TCV is butterfly type and may be wafer style Can be repaired / replaced during a shutdown	No action required				
18.18	PLANT ITEM OPERABILITY	No bypass arrangement for bundle inspection. Intention is to isolate the run. If VH2 WBH is out and VH1 WBH fails we will lose flow or capacity		Philisophy for maintenance is to isolate whole run to work on the heater. There is 2 tube bundles runs (burners) with redundancy during normal operating conditions.	Removable spool required to get the bundle out (add note to P&ID)	**1**	**SH**	**Yes**	**Refer close out sheet in Appendix 2.**
18.19	PLANT ITEM MAINTAINABILITY	Note only - Heater will be registered type B appliance In Victoria							
18.20		No repressurisation line around isolation ball valve BV-64867 upstream of heater 510-HT-102 No automatic ball valve and plug for repressurisation around the slam shut valves SDV-64116 and SDV-64122.	Repressurisation across BV64867 not possible following double block and bleed isolation on inlet of 510-HT-102. Damage to slam shut valves on re-opening with high DP	Volume between slam shut and regulatoris small Frequency of operation of slam shut valves is rare	Relocate pressurisation line from valve 64886 to 64867 Show inhibit/interlock on not opening the SDV's unless the downstream valves are confirmed closed	**1** **2**	**PB** **SH**	**Yes** **No**	**Refer close out sheet in Appendix 2.**
18.21									
18.22	ELECTRICAL AREA CLASSIFICATION	Heater location is adjacent to a road and a 22kW cable underground In the vicinity	HA zones in this area will be extended		HA classification ot be completed in detailed design.	**2**	**SH**		
18.23	EARTHING	Nil							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
18.24	ISOLATION	Bleed is not available between the ball and the plug on the bypass line around BV-64875/64888	Not able to achieve DB&B		Add bleed point between ball and plug valve on pressurisation line around inlet isolation valves BV-64875/64888. Change pressurisation line configuration to 2 ball valves and an orifice (with a bleed)	**1** **1**	**PB** **PB**	**Yes** **Yes**	**Refer close out sheet for Item 18.24. (Appendix 7)** **Refer close out sheet for Item 18.24. (Appendix 7)**
18.25	INSTRUMENTS TOO MANY	Nil							
18.26	INSTRUMENTS TOO FEW	Nil							
18.27	CORRECT LOCATION OF INSTRUMENTS	Nil							

NODE 19: LONGFORD: VICHUB2 FLOW REGULATORS TO GAS NET

DRAWINGS: PO-511-DW-PD-001, GAS-511-DW-PD-004 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-717-C9D-400, G-714-C9D-400, G-718-C9D-400, G-715-C9D-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
19.1	HIGH FLOW	Refer Node 16 Loss of control of flow control valves Both flow control runs open simultaneously	Flow induced vibration in thermowells	Thermowell wake frequency calculations to be completed as part of detailed design High flow alarm on FI-64112	Consider high velocity alarm on FI-64112, based on upstream flowrate and downstream set pressure.	**1**	**DY**	**Yes**	**Refer close out sheet in Appendix 2.**
19.2	HIGH LEVEL	No issues identified							
19.3	LOW FLOW	Refer Node 16							
19.4	LOW LEVEL	No issues identified							
19.5	ZERO FLOW / EMPTY	Refer Node 16							
19.6	REVERSE FLOW	Refer Node 16							
19.7	HIGH PRESSURE	Blocked discharge, pressure bleeds past flow control valves	High pressure downstream of flow control valves	Control valves close on high pressure. Slam shut closes PSVs downstream of flow control valves (leakage PSV only) Piping spec break downstream of flow control skid outlet isolation valves. SIL assessment planned to be completed for this system.	Set slam shut trip to the pressure rating of the downstream system.	**1**	**AZ**	**Yes**	**Refer close out sheet in Appendix 2.**
19.8	LOW PRESSURE	No issues identified							
19.9	HIGH TEMPERATURE	Refer Node X							
19.10	LOW TEMPERATURE	Refer Node 16 JT cooling over control valves Insufficient headting from WBH	Temp below gas spec Temp below material design rating	Downstream temp trip Heat recovery in downstream piping	Add new TIT to DCS downstream of both flow control valves Convert TIT-64128 into SIS low temperature trip	**1** **1**	**SH** **AZ**	**Yes** **Yes**	**Refer close out sheet in Appendix 2.** **Refer close out sheet in Appendix 2.**
19.11	IMPURITIES	No new issues.							
19.12	CHANGE IN COMPOSITION / CONCENTRATION	No new issues.							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
19.13	TWO PHASE FLOW	No new issues.							
19.14	REACTIONS	No new issues.							
19.15	TESTING EQUIPMENT / PRODUCT			Statutory PM checks on PSVs, CFTs	Confirm requirement for DN20 vents downstream of flow control valves	**1**	**DY**	**Yes**	**Refer close out sheet for Item 19.15 (Appendix 21)**
19.16	PLANT ITEM OPERABILITY	Isolation of flow control skid from downstream pipeline, single valve isolation provided			Confirm isolation philosophy for flow control skid and flow control runs, determine if single valve isolation or DB&B required. Add isolation valve at TIP-510-04, with bleed upstream to provide DB&B (if required, ref action above).	**1** **1**	**DY** **PB**	**Yes** **Yes**	**Refer close out sheet for Item 16.9 (Appendix 22)** **Refer close out sheet in Appendix 2.**
19.17	PLANT ITEM MAINTAINABILITY	Removal of PSV-66121/66127 for maintenance / testing	No bleed between PSV-66121/66127 and isolation valve below		Add bleed ring / test & tap valve below PSV-66121/66127	**1**	**SH**	**Yes**	**Refer close out sheet in Appendix 2.**
19.18	ELECTRICAL AREA CLASSIFICATION								
19.19	EARTHING	Close proximity to 22kV			Review proximity to existing 22kV electrical cable route	**1**	**DY**	**Yes**	**Refer close out sheet for Item 19.19 (Appendix 8).**
19.20	ISOLATION	Refer Plant Item Operability							
19.21	INSTRUMENTS TOO MANY	No causes							
19.22	INSTRUMENTS TOO FEW	No causes							
19.23	CORRECT LOCATION OF INSTRUMENTS	No causes							

NODE 20: LONGFORD: FUEL GAS TO VICHUB2 WBH

DRAWINGS: GAS-511-DW-PD-004, GAS-511-DW-PD-002 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** FG-716-C6D-50, FG-709-C3D-50

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
20.1	HIGH FLOW			HAZOP for WBH package will be completed during detailed design	No action				
20.2	HIGH LEVEL	No causes							
20.3	LOW FLOW	No causes							
20.4	LOW LEVEL	No causes							
20.5	ZERO FLOW / EMPTY	No causes							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
20.6	REVERSE FLOW	No causes							
20.7	HIGH PRESSURE	No causes							
20.8	LOW PRESSURE	No causes							
20.9	HIGH TEMPERATURE	No causes							
20.10	LOW TEMPERATURE	No causes							
20.11	IMPURITIES	No causes							
20.12	CHANGE IN COMPOSITION / CONCENTRATION	No causes							
20.13	TWO PHASE FLOW	No causes							
20.14	REACTIONS	No causes							
20.15	TESTING EQUIPMENT / PRODUCT	No causes							
20.16					Query with Jemena Commercial regarding the best location for fuel gas offtake for the new WBH for gas accounting	**2**	**DY**		
20.17	PLANT ITEM MAINTAINABILITY	No causes							
20.18	ELECTRICAL AREA CLASSIFICATION	No causes							
20.19	EARTHING	No causes							
20.20	ISOLATION				Include DB&B isolation for fuel gas offtake from flow control skid.	**1**	**PB**	**Yes**	**Refer close out sheet in Appendix 2.**
20.21	INSTRUMENTS TOO MANY	No causes							
20.22	INSTRUMENTS TOO FEW				Include fuel gas flowmeter as part of WBH package.	**2**	**SH**		
20.23	CORRECT LOCATION OF INSTRUMENTS	No causes							

NODE 21: LONGFORD: VICHUB2 FILTER SEPARATOR LIQUIDS TO CLOSED DRAIN

DRAWINGS: GAS-511-DW-001, 510-DW-PD-101 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** CD-708-C6D-50

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
21.1	HIGH FLOW	Gas breakthrough High liquid loading on drain system	Overpressure of closed drain system (CL600) from upstream CL900 system. Frequency pump out of closed drain drum	ROs in drain connections sized for gas breakthrough scenario Open path downstream to closed drain drum	No action				
21.2	HIGH LEVEL	Refer Node 16 regarding Filter 510-F-103							
21.3	LOW FLOW	No issues identified							
21.4	LOW LEVEL	No issues identified							
21.5	ZERO FLOW / EMPTY	No issues identified							
21.6	REVERSE FLOW	No issues identified							
21.7	HIGH PRESSURE	Refer High Flow							
21.8	LOW PRESSURE	No issues identified							
21.9	HIGH TEMPERATURE	No issues identified							
21.10	LOW TEMPERATURE	JT cooling during gas breakthrough	Low temperature	Operator intervention, closes manual valve is gas breakthrough scenario	Ensure minimum design temp of piping suitable for gas breakthrough scenario	**2**	**SH**		
21.11	IMPURITIES	Refer Node 16 Solids from upstream		Notification from upstream Operator regarding prescence of Mercury Filter captures solids	No action				
21.12	CHANGE IN COMPOSITION / CONCENTRATION	No issues identified							
21.13	TWO PHASE FLOW	High velocity liquid slug during gas breakthrough scenario		Piping designed for slugging	No action				
21.14	REACTIONS	No issues identified							
21.15	TESTING EQUIPMENT / PRODUCT	No issues identified							
21.16	PLANT ITEM OPERABILITY	Simultaneous draining of 510-F-103 using manual drain valves, and automatic draining from other filter vessels		Drain drum is open to atmosphere and unlikely to experience backflow from 510-F-103 to other filters if draining simultaneously	No action				
21.17	PLANT ITEM MAINTAINABILITY	RO blockage due to solids			Add rodding point to CD header in DN50 section	**1**	**PB**	**Yes**	**Refer close out sheet in Appendix 2.**
21.18	ELECTRICAL AREA CLASSIFICATION	No issues identified							
21.19	EARTHING	No issues identified							
21.20	ISOLATION	Filter isolation	Inadequate isolation		Confirm isolation philosophy for isolation of CD header from filter.	**1**	**DY**	**Yes**	**Refer close out sheet for Item 21.20 (Appendix 23).**

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
21.21	INSTRUMENTS TOO MANY	No causes							
21.22	INSTRUMENTS TOO FEW	No causes							
21.23	CORRECT LOCATION OF INSTRUMENTS	No causes							

NODE 22: LONGFORD: VICHUB2 FILTER SEPARATOR BUND LIQUIDS TO OPEN DRAIN

DRAWINGS: GAS-511-DW-PD-001, 501-PD-140 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** UPVC

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
22.1	HIGH FLOW	Draining high level in sump, DN100 drain valve.	Spillage through other vents/connections in the OD system	Operator controls flow using manual valve, drain valve not fully opened for draining.	No action				
22.2	HIGH LEVEL								
22.3	LOW FLOW	No issues identified.							
22.4	LOW LEVEL	No issues identified.							
22.5	ZERO FLOW / EMPTY	No issues identified.							
22.6	REVERSE FLOW	No issues identified.							
22.7	HIGH PRESSURE	No issues identified.							
22.8	LOW PRESSURE	No issues identified.							
22.9	HIGH TEMPERATURE	No issues identified.							
22.10	LOW TEMPERATURE	No issues identified.							
22.11	IMPURITIES			Operators will manage impurities	No action				
22.12	CHANGE IN COMPOSITION / CONCENTRATION	No issues identified.							
22.13	TWO PHASE FLOW	No issues identified.							
22.14	REACTIONS	No issues identified.							
22.15	TESTING EQUIPMENT / PRODUCT	No issues identified.							
22.16	PLANT ITEM OPERABILITY	No issues identified.							
22.17	PLANT ITEM MAINTAINABILITY	No issues identified.							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
22.18	ELECTRICAL AREA CLASSIFICATION			Hazardous area classification will be assessed as part of detailed design.	No action				
22.19	EARTHING	No issues identified.							
22.20	ISOLATION	No issues identified.							
22.21	INSTRUMENTS TOO MANY	No issues identified.							
22.22	INSTRUMENTS TOO FEW	No issues identified.							
22.23	CORRECT LOCATION OF INSTRUMENTS	No issues identified.							

NODE 23: LONGFORD: VIC HUB ACTUATED INLET ISOLATION VALVES

DRAWINGS: 510-DW-PD-006 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-077-C9D-200

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
23.1	MISDIRECTED FLOW	Incorrect valve line-up	Imbalance penalties Not meeting flow nomination.	Proposed control will include a matrix of flow operation modes with permissives for selecting and changing mode.	Review option to fully automate flow mode switching	**2**	**DY**		
23.2	HIGH FLOW	High DP across actuated valves UV-533 High flow velocity in DN20 repressurisation line.	Damage to UV-533 valve seat	Low DP open permissive across flow switching valves	Review mounting and installation of actuators on existing manual valves to be actuated. Ensure actuated valves have low DP permissive for opening. Review sizing of DN20 repressurisation line.	**2** **1** **2**	**DY** **AZ** **SH**	**No** **Yes** **No**	**Refer close out sheet in Appendix 2.**
23.3	HIGH LEVEL	No issues identified.							
23.4	LOW FLOW	No issues identified.							
23.5	LOW LEVEL	No issues identified.							
23.6	ZERO FLOW / EMPTY	No issues identified.							
23.7	REVERSE FLOW	No issues identified.							
23.8	HIGH PRESSURE	No issues identified.							
23.9	LOW PRESSURE	No issues identified.							
23.10	HIGH TEMPERATURE	No issues identified.							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
23.11	LOW TEMPERATURE	JT cooling across repressurisation line	Low temp below equipment design		Confirm lowest possible process temperatures are within piping and equipment limits	**2**	**PB**		
23.12	IMPURITIES	No issues identified.							
23.13	CHANGE IN COMPOSITION / CONCENTRATION	No issues identified.							
23.14	TWO PHASE FLOW	No issues identified.							
23.15	REACTIONS	No issues identified.							
23.16	TESTING EQUIPMENT / PRODUCT	No issues identified.							
23.17	PLANT ITEM OPERABILITY				Review blowdown philosophy and if UV-533/UV-532 are to be FC or FO, and required position during LCS blowdown	**1**	**DY**	**Yes**	**Refer close out sheet for Item 23.17 (Appendix 24).**
23.18	PLANT ITEM MAINTAINABILITY	No issues identified.							
23.19	ELECTRICAL AREA CLASSIFICATION	No issues identified.							
23.20	EARTHING	No issues identified.							
23.21	ISOLATION	No issues identified.							
23.22	INSTRUMENTS TOO MANY	No issues identified.							
23.23	INSTRUMENTS TOO FEW	No issues identified.							
23.24	CORRECT LOCATION OF INSTRUMENTS	No issues identified.							

NODE 23A: LONGFORD: OVERVIEW

DRAWINGS: 510-PI-092, 501-PD-140, PO-510-PI-110, PO-511-DW-PD-001, GAS-511-DW-PD-001, GAS-511-DW-PD-002, GAS-511-DW-PD-003, GAS-511-DW-PD-004, 510-DW-PD-006, 510-DW-PD-101

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
23.1 A	TOXICITY	No new causes.							
23.2 A	SERVICES REQUIRED	No increase in overall plant utility load due to reduction in compressor operation.							
23.3 A	MATERIALS OF CONSTRUCTION				No action				
23.4 A	COMMISSIONING	No issues identified.							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
23.5 A	BREAKDOWN								
23.6 A	STARTUP / SHUTDOWN	Capacity for TGP ~30TJ/day, well below LCS capacity	LCS running at reduced efficiency	Compressor bypass available for operating at reduced capacity.	Confirm LCS operating philosophy for reduced capacity supply to TGP only.	**2**	**DY**		
23.7 A	EFFLUENT	Refer Node 22							
23.8 A	NOISE / VIBRATION			Proposed design includes acoustic enclosure / wall around flow control skid. Details to be confirmed during detailed design. Regulators will be provided with low noise trim. Additional acoustic insulation on piping & valves may be used if required.	No action				
23.9 A	FIRE / EXPLOSION				Update existing vent radiation zone assessment based on new plant capacity	**2**	**SH**		
23.10 A	SAFETY EQUIPMENT	Additional load on station vent	Increase in station blowdown time		Review station blowdown time with new equipment added.	**2**	**DY**		
23.11 A	QUALITY AND CONSISTENCY								
23.12 A	OUTPUT – RELIABILITY AND BOTTLENECKS								
23.13 A	EFFICIENCY	Refer STARTUP / SHUTDOWN							
23.14 A	SIMPLICITY	Many possible configurations and modes at LCS with VicHub2	STTM/nomination logic complexity increase.		STTM/nomination logic and modes/configurations to be reviewed and defined with Jemena EIC team	**2**	**DY**		
23.15 A	MOBILE EQUIPMENT / PLANT MOVEMENT			Site layout provides space for WBH process bundle and burner tube removal.					
23.16 A	PROCESS PLANT NORMAL / ABNORMAL MAINTENANCE			Constructability and accessibility reviews to be completed as part of designed design.					
23.17 A	PROCESS PLANT PROCESS FUNCTIONALITY	New WBH not always required, and may be unused for long periods (~months)	Corrosion risks if WBH is shut down for long periods and allowed to reach ambient temperature		Review standby philosophy for new WBH	**2**	**DY**		
23.18 A	ERGONOMICS			Filter element access will be reviewed as part of layout/model reviews. Control valve access for maintenance to be reviewed as part of layout/model reviews.	New WBH to have stairs instead of ladders to access the top of the WBH.	**2**	**PB**		
23.19 A	GUARDING								
23.20 A	WARNINGS	Flow control skid introduces hazardous area outside of the LCS site access road		Plant hazardous area drawings will be revised as part of detailed design.	No action				
23.21 A	VULNERABILITY								

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
23.22 A	3RD PARTY INTERFERENCE			VicHub2 equipment installed within existing LCS plant boundary.	No action				
23.23 A	NATURAL EVENTS								

Client	**Jemena Ltd**
Client Project No	**GAS-599**
GPA Project No	**20617**
Project Title	**Project Marlin: EGP Reversal**
Facilitator	**Lisa Hein**
Scribe	**Peter Blyton**
Workshop Date	**17/11/2020**
Workshop Location	**Microsoft Teams**
HAZOP Sponsor	**Nathan Biggins** **Matthew Skaras**
HAZOP Stage	**30% FEED Stage 2:** • **Wilton Meter Station (WMS)**

HAZOP Participants:

GPA Engineering

Lisa Hein (LH)	Senior Consultant - Risk and Advisory / Facilitator
Simon Hanlin (SH)	Senior Process Engineer
Peter Blyton (PB)	Senior Mechanical Engineer / Minute Taker
Adrian Zatta (AZ)	Senior EI&C Engineer

Jemena

David Young (DY)	Engineering Manager
Stephen Chow (SC)	Project Engineer
Luke Gigliotti (LG)	Team Leader - Control Room
Steven Bonnici (SB)	Team Leader - EGP
Adam Christian (AC)	Operations - Wilton Meter Station
Mitchell Graham (MG)	Operations - Wilton Meter Station

Background:
Jemena is undertaking Front End Engineering and Design (FEED) to facilitate a total installed cost (TIC) estimate and schedule to reverse flow the Eastern Gas Pipeline (EGP) south of the Kembla Grange Meter Station (KGMS), to allow the supply of gas into the Victorian and New South Wales gas networks.

The following, key pieces of documentation, formed the basis of the HAZOP (additional information was available – see HAZOP report):

- Wilton Meter Station
  - Receiver Station P&ID: 563-DW-PD-001
  - Dry Gas Filters P&ID: 563-DW-PD-002
  - APA Water Bath Heater P&ID: 563-DW-PD-016
  - APA Flow Metering P&ID: 563-DW-PD-017
  - APA Pressure Reduction Skid P&ID: 563-DW-PD-018
  - Heat Exchangers P&ID: 563-DW-PD-003
  - JGN Flow Metering P&ID: 563-DW-PD-008
  - JGN Pressure Reduction Skid P&ID: 563-DW-PD-010
  - Connection to APA P&ID: 563-DW-PD-012
  - APA Pressure Reduction Skid P&ID: 563-DW-PD-015
  - Instrument Air Package P&ID: 563-DW-PD-011
  - Hot Water Heater Fuel Gas Train P&ID: 563-DW-PD-014

The HAZOP specifically dealt with:

- Wilton Meter Station (WMS).

The HAZOP specifically excluded a full formal review of:

- Water Bath Heater 563-HT-001, Vendor Package HAZOP will be completed as part of Detailed Design

The HAZOP was conducted using a series of guide words which were applied to each of the key phases of operation.

NODE 24: WILTON: EGP TO APA WATER BATH HEATER

DRAWINGS: 563-DW-PD-001, 563-DW-PD-002, 563-DW-PD-016 **PLANT & EQUIPMENT:** 563-F-01, 563-F-02 **INSTRUMENTATION:** - **LINE NUMBERS:** 563-G-847-X70-250, 563-G-849-H150-300,563-G-802-C9D-300, 563-G-800-C9D-250, 563-G-846-C9D-250, 563-G-64881-C9D-250, G-64888-C9D-250

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
24.1	HIGH FLOW	Low pressure in WLP leading to high volumetric flow. One filter offline with full flow through a single filter unit	FIV Erosional velocity limits exceeded High DP across filters 563-F-01/02	Filter bypass line available when filter unit is offline Filter High DP alarms (2 stages of alarm) and HH DP trip provided (PDI-64103/64807), HH trip shuts SLV-64800.	Operating procedures to include requirements for filter element change-out and agreeing reductions in flow nomination or use of filter bypass line while a filter unit is offline. Agree minimum pressures into WMS with Jemena Commercial.	**3** **1**	**DY** **DY**	**No** **Yes**	**Refer close out sheet for Item 24.1 (Appendix 9).**
24.2	HIGH LEVEL	Liquid slug Solids, dust in gas from pipeline Inadequate operation of manual liquid draining of Filter 563-F-01/02	Liquids carry over, leading to off-spec gas High DP across Filters 563-F-01/02	Dry sales gas, with no nearby upstream gas compressors, no history of oil in inlet gas	No action				
24.3	LOW FLOW	Blocked Filter 563-F-01/02	High DP across filter, leading to filter element damage Flow nomination shortfall	Filter High DP alarms and HH DP trip provided (PDI-64103/64807), HH trip shuts SLV-64800.	No action				
24.4	LOW LEVEL	No issues identified.							
24.5	ZERO FLOW / EMPTY	Inadvertent closure of downstream valves	Failure to deliver flow nomination	Flow trend monitoring by Operations Personnel Position feedback and out of position alarm provided on downstream flow control valves on new skids.	No action				
24.6	REVERSE FLOW	Higher pressure in downstream JGN or APA pipelines than WLP	Reverse flow, leading to filter element damage Loss of effective metering	Check valve in each flow control run Flow control valves will close when downstream pressure is higher than upstream pressure	No action				
24.7	HIGH PRESSURE	Inadvertent closure of downstream valves		The pressure rating of the piping system (C9D, 15.32 MPag) and equipment exceeds the upstream pressure source (14.895 MPag).	No action				

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
24.8	LOW PRESSURE	Lower pressure in WLP than design	High gas velocities through the piping and Filter 563-F-01/02 AIV/FIV Wake frequency limits on thermowells and sampling probes	Refer High Flow Operator intervention Low pressure alarm PAL-64802 on WLP	Agree set point and re-set low pressure alarm PAL-64802 Consider low pressure trip on WLP using PIT-64802, and/or alternatives such as velocity calculation using sum of flow through flow meters and inlet pressure	**1** **1**	**SH** **SH**	**Yes** **Yes**	**Refer to close out sheet for Item 24.8 (Appendix 25)** **Refer to close out sheet for Item 24.8 (Appendix 26).**
24.9	HIGH TEMPERATURE	No issues identified		Mechanical design temperature meets environmental / solar insolation temperature	No action				
24.10	LOW TEMPERATURE	Repressuriation of Filter 563-F-01/02 after maintenance	Piping seeing lower temp than designed for	Filter design temp is 15MPa Min piping design temp is -10degC	Check expected repressuring minimum temperatures Update P&ID to include minimum design temperature for inlet filters 563-F-01/02	**2** **1**	**SH** **SH**	**No** **Yes**	**Refer to close out sheet in Appendix 3.**
24.11	IMPURITIES	Sulphur Solids & dust from pipeline Pyrophorics NORMs (normally occurring radioactive material)	Off spec gas Filter blockage, refer LOW FLOW	Filters 563-F-01/02	No action				
24.12	CHANGE IN COMPOSITION / CONCENTRATION	Step change in gas composition during change in gas supply from Longford or Port Kembla LNG import, some mixing will occur between the two gas supplies	Regulators will adjust based on energy flow	Gas Chromatograph to identify change in gas composition, as input to energy flow nominations	No action				
24.13	TWO PHASE FLOW	No issues identified							
24.14	REACTIONS	No issues identified							
24.15	TESTING EQUIPMENT / PRODUCT	No issues identified		Existing CFT on SLV-64800 GC sample point has been relocated to station inlet such that it is common to all runs	No action				
24.16	PLANT ITEM OPERABILITY	Repressurisation line around DB&B on inlet of 563-F-02 relies on a plug valve for second isolation, which is not recommended.	Insufficient isolation integrity for maintenance of 563-F-02.		Modify repressurisation bypass line around DB&B arrangements on inlet of 563-F-02 such that repressurisation connects in between the two DN250 ball valves, and remove vent on repressurisation line making 250-BV-64102 the second block valve for the repressurisation line.	**1**	**PB**	**Yes**	**Refer to close out sheet for Item 24.16 (Appendix 16).**

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
24.17	PLANT ITEM MAINTAINABILITY	Access into filter required for element changeout Consistency of parts and filter elements with similar filter units at other Jemena sites Maintenance overrides required on SLV-64800 and Filter DP transmitters		Quick opening closure provided	QOC and filter elements to have commonality with other filters at Longford and existing filter at WMS Modify functionality of SLV-64800 to provide MOS required for maintenance Modify functionality to DP transmitters (both filters) to provide MOS required for maintenance	**2** **2** **2**	**PB** **PB** **AZ**		
24.18	ELECTRICAL AREA CLASSIFICATION	No issues identified							
24.19	EARTHING	No issues identified							
24.20	ISOLATION	Existing Filter 563-F-01 has single valve isolation only WBH 563-HT-001 has single valve isolation only.			Add DB&B isolation for existing filter 563-F-01 Relocate repressurisation line around 250-BV-641557 to be located around 250-BV-64154.	**1** **1**	**PB** **PB**	**Yes** **Yes**	**Refer to close out sheet for item 25.20 (Appendix 16)** **Refer to close out sheet in Appendix 3.**
24.21	INSTRUMENTS TOO MANY	Inconsistent instrument makes and models	Additional sparing for instruments		Ensure new instrumentation is consistent with existing instrumentation used on site	**2**	**DY**		
24.22	INSTRUMENTS TOO FEW	NO CAUSES							
24.23	CORRECT LOCATION OF INSTRUMENTS	NO CAUSES							

NODE 25: WILTON: APA WATER BATH HEATER TO APA METERING

DRAWINGS: 563-DW-PD-016, 563-DW-PD-017 **PLANT & EQUIPMENT:** 563-HT-001 **INSTRUMENTATION:** - **LINE NUMBERS:** G-64889-C9D-250, G-64890-C9D-250

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
25.1	HIGH FLOW	TCV-64148 fails closed, resulting in more flow through the WBH, velocities could exceed design under low pressure scenarios	Heater damage / vibration of process bundle	Position transmitter feedback with out of position alarm on TCV-64148 Physical clamp allows manual setting of minimum closure of TCV-64148	Define maximum flow velocity of WBH. Potentially implement trips or high velocity alarms	**2**	**SH**		
25.2	HIGH LEVEL	No issues identified							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
25.3	LOW FLOW	Refer NODE 24	Unstable operation of heater control.	Insulation and heat tracing shown on P&ID is for heat conservation/temperature (start up after shut in overnight)	All new pipework between 563-HT-001 and flow control skid to be heat traced and insulated, piping on skid does not require heat tracing and insulation Determine minimum turndown for each flow control run at the site	**2** **2**	**AZ** **SH**		
25.4	LOW LEVEL	No issues identified		563-HT-001 has low water level alarm, will be reviewed as part of Vendor Package HAZOP	No action				
25.5	ZERO FLOW / EMPTY	No flow through the heater – there will be a bath temp range, it will continue to fire until it reaches the high limit then go into standby mode		There will be a detailed design vendor HAZOP for the heater	No action				
25.6	REVERSE FLOW	Refer NODE 24							
25.7	HIGH PRESSURE	No sources of additional pressure			Add WBH process bundle design pressure & temperature to the P&ID	**2**	**SH**		
25.8	LOW PRESSURE	Refer HIGH FLOW							
25.9	HIGH TEMPERATURE	Loss of heater control TCV-64148 control will be via SCS. If this closed inadvertently all gas would be directed through heater.	Over-temperature of piping/equipment Wasting fuel gas due to overheating over process gas	High temperature control setpoint on WBH, and a HH temperature trip Position discrepancy alarm on TCV	No action				
25.10	LOW TEMPERATURE	Insufficient heating from 563-HT-001 TCV-64148 open more than required position	Bypassing of cold gas around 563-HT-001, leading to low gas temperature downstream of flow control valves	Low temp trip TALL- downstream on flow control skids (refer NODE 26) Position discrepancy alarm on TCV-64148 Low temp on alarm at regulator outlet (refer NODE 26)	No action				
25.11	IMPURITIES	Refer NODE 24							
25.12	CHANGE IN COMPOSITION / CONCENTRATION	Water dosing (biocide) Refer NODE 24		Vendor HAZOP					
25.13	TWO PHASE FLOW	No issues identified							
25.14	REACTIONS	No issues identified							
25.15	TESTING EQUIPMENT / PRODUCT	No issues identified							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
25.16	PLANT ITEM OPERABILITY	Manual butterfly 150-CV[BUV]-64105 at outlet of heater to allow for manual trimming	Not expected to be used or required		Delete manual butterfly valve 150-CV[BUV]-64105 on outlet of 563-HT-001 Document in Operating Philosophy that 250-BV-641557 may be used to stop flow through WBH and bypass flow using TCV to maintain plant operation. This scenario only possible with low inlet pressures in order to meet outlet temperature requirement.	**1** **3**	**SH** **DY**	**Yes** **No**	**Refer to close out sheet in Appendix 3.**
25.17	PLANT ITEM MAINTAINABILITY	TCV-64148 maintenance cannot be done without depressurng the heater	New APA run offline / no flow during TCV maintenance	Removable spools provided at connection to WBH process bundle	Replace 25-BV-641559 with DN50 ball and plug valve vent arrangement	**1**	**PB**	**Yes**	**Refer to close out sheet in Appendix 3.**
25.18	ELECTRICAL AREA CLASSIFICATION								
25.19	EARTHING								
25.20	ISOLATION	Removal and maintenance of TCV-64148	Single valve isolation provided only, no DB&B available without using isolations further upstream resulting in full station outage	TCV-64148 actuator and instrumentation can be maintained without process isolation	No action				
25.21	INSTRUMENTS TOO MANY								
25.22	INSTRUMENTS TOO FEW	Temperature upstream of 563-HT-001 is not monitored			WBH 563-HT-001 to include temperature instrumentation on both process gas and water Add TIT upstream of 563-HT-001 & 250-BV-64154 (equivalent to TIT-64808 upstream of existing heaters 563-HE-01/02)	**2** **1**	**AZ** **AZ**	**No** **Yes**	**Refer to close out sheet in Appendix 3.**
25.23	CORRECT LOCATION OF INSTRUMENTS								

NODE 26: WILTON: APA FLOW METERING TO MOOMBA WILTON MAINLINE HEADER

DRAWINGS: 563-DW-PD-017, 563-DW-PD-018, 563-DW-PD-012, 563-DW-PD-015

PLANT & EQUIPMENT: 563-MR-03, 563-MR-04, 563-RR-03, 563-RR-04

INSTRUMENTATION: -

LINE NUMBERS: 563-G-B11-C9D-250, 563-G-810-C9D-250, 563-G-B14-C9D-250, G-84890-C9D-250, 563-G-815-C9D-250, 563-G-817-PL92-250, 563-G-XXX-PL62-250, 563-G-816-C9D-250, 563-G-818-PL9Z-250, 563-G-819-PL9Z-250, 563-G-839-C9D-250, 563-G-B19-PL92-250, G-64887-PL62-250, 563-G-869-PL6Z-300, 563-G-068-PL6Z-300, 563-G-870-PL6Z-300, 563-G-069-PL6Z-300,

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
26.1	HIGH FLOW	Refer NODE 24 Flow control valves more open than expected	Refer NODE 24 Additional noise, FIV, high filter DP, equipment vibration and damage	Active, monitor and slam shut on flow control skid High velocity alarm FAH-64858 and HH velocity trip FAHH-64858 which closes SLV-64800 on meter runs 563-MR-03/04 SCADA to have adjustable priority system for controlling flow through each run	Determine velocity limits for all piping and equipemnt within the station and reassess HH velocity trip FAHH-64858 functionality and flow control system configuration as part of detailed design	**2**	**SH**		
26.2	HIGH LEVEL	No issues identified							
26.3	LOW FLOW	Refer NODE 25 regarding turndown		Low flow alarm FAL-64858	Refer action – limits of station				
26.4	LOW LEVEL	No issues identified							
26.5	ZERO FLOW / EMPTY	Refer NODE 24/25							
26.6	REVERSE FLOW	Refer ISOLATION							
26.7	HIGH PRESSURE	Refer NODE 24/25 Fail open of flow control valves Blocked discharge, pressure bleeds past flow control valves	Overpressure of downstream piping system, lower pressure rating (CL600) than upstream system (CL900)	Control valves (active and monitor) close on high pressure Slam shut valve SSV-64864/64865 closes on high pressure Piping spec break downstream of flow control skid outlet isolation valves SIL assessment completed for this system, existing skid relocated from JGN	SIL assessment to be recompleted, as frequency of blocked discharge increased due to issues with flow nominations	**2**	**DY**		
26.8	LOW PRESSURE	Refer NODE 24 HIGH FLOW			Refer common action for min inlet press.				
26.9	HIGH TEMPERATURE	Refer NODE 25		TAH and TAHH	No action				

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
26.10	LOW TEMPERATURE	Refer NODE 25 APA flow control runs 563-RR-03/04 have a common outlet temperature monitoring instrument	Unable to monitor separate temperature on outlet of 563-RR-03/04	TAL and TALL Low temperature is input to low flow selector	Confirm the temperature control loop required when operating the various flow control runs in parallel	**2**	**DY**		
26.11	IMPURITIES	No issues identified							
26.12	CHANGE IN COMPOSITION / CONCENTRATION	No issues identified							
26.13	TWO PHASE FLOW	No issues identified							
26.14	REACTIONS	No issues identified							
26.15	TESTING EQUIPMENT / PRODUCT	563-MR-03/04 flow meter capacity exceeded when in series configuration	Loss of effective metering	563-MR-03/04 can be configured in parallel Series configuration required for meter validation	Include maintenance overrides (MOS) for all equipment and instrumentation	**2**	**AZ**		
26.16	PLANT ITEM OPERABILITY	No new issues							
26.17	PLANT ITEM MAINTAINABILITY								
26.18	ELECTRICAL AREA CLASSIFICATION								
26.19	EARTHING								
26.20	ISOLATION			Z-crossover line between meter runs includes check valve 250-CV-64989 to prevent flow bypassing the meters during series configuration Locked valves used to ensure metering skid remains in desired configuration	Add 2x ball valves shown on outlet of new APA flow control skid (on PFD) to P&ID Isolation valves to be located at each end of the new loop line to APA TIP Add additional valve to the existing connection to APA MLV Add additional ball valve to the crossover connection between RR-01/02 and RR-03/04	**1** **1** **1** **1**	**PB** **SH** **PB** **PB**	**Yes** **Yes** **Yes** **Yes**	**Refer to close out sheet in Appendix 3.** **Refer to close out sheet in Appendix 3.** **Refer to close out sheet in Appendix 3.** **Refer to close out sheet in Appendix 3.**
26.21	INSTRUMENTS TOO MANY	No causes							
26.22	INSTRUMENTS TOO FEW	No causes							
26.23	CORRECT LOCATION OF INSTRUMENTS	No causes							

NODE 27: WILTON: DRY GAS FILTERS TO JGN METERING VIA HEX (EXISTING EQUIPMENT, INCREASED FLOW AND CHANGED COMPOSITION)

DRAWINGS: 563-DW-PD-002, 563-DW-PD-003 **PLANT & EQUIPMENT:** 563-HE-01, 563-HE-02 **INSTRUMENTATION:** - **LINE NUMBERS:** 563-G-803-C9D-250, 563-G-804-C9D-250, 563-G-805-C9D-250, 563-G-806-C9D-250, 563-G-807-C9D-250, 563-G-808-C9D-250

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
27.1	HIGH FLOW	Refer NODE 24/25 – lower inlet pressure	Vibration of heat exchanger tubes, leading to equipment damage		No new actions Refer Item 26.1 action regarding velocity limits in station				
27.2	HIGH LEVEL	No issues identified							
27.3	LOW FLOW	Refer NODE – turndown							
27.4	LOW LEVEL	No issues identified							
27.5	ZERO FLOW / EMPTY	No issues identified							
27.6	REVERSE FLOW	Refer NODE – CVs in control runs							
27.7	HIGH PRESSURE	No change to existing							
27.8	LOW PRESSURE	No change to existing							
27.9	HIGH TEMPERATURE	No change to existing							
27.10	LOW TEMPERATURE	Refer NODE 26 – downstream temp control/monitoring No change to existing							
27.11	IMPURITIES	No change to existing							
27.12	CHANGE IN COMPOSITION / CONCENTRATION	No change to existing							
27.13	TWO PHASE FLOW	No change to existing							
27.14	REACTIONS	No change to existing							
27.15	TESTING EQUIPMENT / PRODUCT	GC sample point has been relocated from downstream of HXs to station inlet such that it is common to all runs	Lower sampled gas temperatures may exceed capacity of sampling system heater.		Review and ensure suitable heating of gas sampled for GC	**2**	**SH**		
27.16	PLANT ITEM OPERABILITY	Capacity of both heaters 563-HE-01/02 required to meet highest duty	No redundancy of heating units when running at highest duty / transient cases Flow will be limited if one heating unit is offline	Both heaters 563-HE-01/02 currently run in parallel	Document in the Operating Philosophy for reduction in inlet pressure or capacity curtailment / reduction in flow nomination if one heater unit 563-HE-01/02 is offline	**3**	**DY**		
27.17	PLANT ITEM MAINTAINABILITY	No change to existing							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
27.18	ELECTRICAL AREA CLASSIFICATION	No change to existing							
27.19	EARTHING	No change to existing							
27.20	ISOLATION	No causes							
27.21	INSTRUMENTS TOO MANY	No causes							
27.22	INSTRUMENTS TOO FEW	Refer HIGH PRESSURE	No ability to measure pressure upstream of 563-HE-01/02		Change PI-64980/64981 to a PIT Change PI-64814 to a PIT Add a virtual DP across heaters 563-HE-01/02	**1** **1** **1**	**AZ** **AZ** **AZ**	**Yes** **Yes** **Yes**	**Refer to close out sheet in Appendix 3.** **Refer to close out sheet in Appendix 3.** **Refer to close out sheet in Appendix 3.**
27.23	CORRECT LOCATION OF INSTRUMENTS	No causes							

NODE 28: WILTON: JGN METERING SKID

DRAWINGS: 563-DW-PD-008 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** G-64882-C9D-250, G-64883-C9D-250

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
28.1	HIGH FLOW	Refer Node 24 Loss of control of flow control valves Both flow control runs open simultaneously	Flow induced vibration in piping and thermowells, leading to equipment damage	2x100% metering and flow control skids Thermowell wake frequency calculations as part of detailed design High velocity alarm on FI-64105/64107	Consider duplicating HH velocity trip logic used on existing metering runs at WMS	**1**	**DY**	**Yes**	**Refer to close out sheet in Appendix 3.**
28.2	HIGH LEVEL	No issues identified							
28.3	LOW FLOW	Refer Node 24 Larger flow meters than existing JGN meters	Inadequate flow turndown, loss of effective metering		No action Ref Item 25.3 action regarding turndown				
28.4	LOW LEVEL	No issues identified							
28.5	ZERO FLOW / EMPTY	Refer Node 24							
28.6	REVERSE FLOW	Refer Node 24							

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
28.7	HIGH PRESSURE	Blocked discharge, pressure bleeds past flow control valves Slam shut valves require control segregation from SCS	High pressure downstream of flow control valves	Control valves close on high pressure. Slam shut closes PSVs downstream of flow control valves Piping spec break downstream of flow control skid outlet isolation valves. SIL assessment planned to be completed for this system.	Set slam shut trip to the pressure rating of the downstream system. Change slam shut valve to be pneumatically operated using slam shut panel to match other slam shut valves at WMS	**1** **1**	**SH** **SH**	**Yes** **Yes**	**Refer to close out sheet in Appendix 3.** **Refer to close out sheet in Appendix 3.**
28.8	LOW PRESSURE	No issues identified							
28.9	HIGH TEMPERATURE	Refer Node 24							
28.10	LOW TEMPERATURE	Refer Node 24 JT cooling over control valves Insufficient heating from heaters 563-HE-01/02 Cold locked in gas on startup	Temp below gas spec Temp below material design rating	Downstream temp trip Heat recovery in downstream piping Heat tracing and lagging	Add new TIT to SCS downstream of both flow control valves Convert TIT-64147 into low temperature trip Consider heat tracing and insulation limits to be from outlet of heaters 563-HE-01/02 and upstream of flow control runs on straight run piping and excluding meter and flow control skids, or consider startup override for heaters 563-HE-01/02	**1** **1** **2**	**SH** **SH** **DY**	**Yes** **Yes** **Yes**	**Refer to close out sheet in Appendix 3.** **Refer to close out sheet in Appendix 3.** **Refer to close out sheet in Appendix 3.**
28.11	IMPURITIES	No new issues							
28.12	CHANGE IN COMPOSITION / CONCENTRATION	No new issues							
28.13	TWO PHASE FLOW	No new issues							
28.14	REACTIONS	No new issues							
28.15	TESTING EQUIPMENT / PRODUCT			Statutory PM checks on PSVs, CFTs	Confirm requirement for DN20 vents downstream of flow control valves	**1**	**DY**	**Yes**	**Refer to close out sheet in Appendix 3.**
28.16	PLANT ITEM OPERABILITY	Isolation of flow control skid from downstream pipeline, single valve isolation provided			Confirm isolation philosophy for flow control skid and flow control runs, determine if single valve isolation or DB&B required. Add isolation valve at TIP-510-04, with bleed upstream to provide DB&B (if required, ref action above).	**1** **1**	**DY** **PB**	**Yes** **Yes**	**Refer close out sheet for Item 28.16 (Appendix 22)** **DB&B not required, therefore action not required. Refer close out sheet for Item28.16 (Appendix 22)**
28.17	PLANT ITEM MAINTAINABILITY	Removal of PSV-64135/64148 for maintenance / testing	No bleed between PSV-64135/64148 and isolation valve below		Add bleed ring / test & tap valve below PSV-64135/64148 Add vent adjacent to TW-64147	**1** **1**	**PB** **PB**	**Yes** **Yes**	**Refer close out sheet for Item 28.17 (Appendix 17)** **Refer close out sheet for Item 28.17 (Appendix 17)**

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
28.18	ELECTRICAL AREA CLASSIFICATION	No new causes							
28.19	EARTHING	No new causes							
28.20	ISOLATION	Pressurisation line double block and bleed design inadequate as it relies on a plug valve.	Insufficient isolation of regulator run.		Add re-pressurisation line around 400-BV-64127/64138 to connect in upstream of the slam shut valve. Repressurisation line to be two DN50 ball valves, with RO if required All small bore vents (DN20/DN25) to be provided with a needle valve for throttling and bleed plug	**1** **1**	**PB** **PB**	**Yes** **Yes**	**Refer close out sheet for Item 28.20 (Appendix 14).** **Refer to close out sheet in Appendix 3.**
28.21	INSTRUMENTS TOO MANY	No new causes							
28.22	INSTRUMENTS TOO FEW	No new causes							
28.23	CORRECT LOCATION OF INSTRUMENTS	No new causes							

NODE 29: WILTON: JGN FLOW CONTROL SKID

DRAWINGS: 563-DW-PD-008, 563-DW-PD-010 **PLANT & EQUIPMENT:** 563-RR-06 **INSTRUMENTATION:** - **LINE NUMBERS:** 563-G-815-C9D-250, G-64884-C9D-400, G-64885-C9D-400, 563-G-820-PL6Z-250, G-64886-PL6Z-400

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
29.1	HIGH FLOW	Refer NODE 28							
29.2	HIGH LEVEL								
29.3	LOW FLOW								
29.4	LOW LEVEL								
29.5	ZERO FLOW / EMPTY								
29.6	REVERSE FLOW								
29.7	HIGH PRESSURE								
29.8	LOW PRESSURE								
29.9	HIGH TEMPERATURE								
29.10	LOW TEMPERATURE								
29.11	IMPURITIES								

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
29.12	CHANGE IN COMPOSITION / CONCENTRATION								
29.13	TWO PHASE FLOW								
29.14	REACTIONS								
29.15	TESTING EQUIPMENT / PRODUCT								
29.16	PLANT ITEM OPERABILITY								
29.17	PLANT ITEM MAINTAINABILITY								
29.18	ELECTRICAL AREA CLASSIFICATION								
29.19	EARTHING								
29.20	ISOLATION								
29.21	INSTRUMENTS TOO MANY								
29.22	INSTRUMENTS TOO FEW								
29.23	CORRECT LOCATION OF INSTRUMENTS								

NODE 30: WILTON: INSTRUMENT AIR/GAS

DRAWINGS: 563-DW-PD-003, 563-DW-PD-010, 563-DW-PD-011 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** -

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
30.1	HIGH FLOW	Excessive demand / load for IA from instruments	Low pressure in distribution header	Existing IA receiver 563-V-01	No actions				
30.2	HIGH LEVEL	No issued identified							
30.3	LOW FLOW	No issued identified							
30.4	LOW LEVEL	No issued identified							
30.5	ZERO FLOW / EMPTY	Failure of the IA system	Station shutdown	Two redundant air compressor skids Backup IG supply	No actions				

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
30.6	REVERSE FLOW	Reverse flow of IG into IA system	Flammable mix of air and gas, potential fire / explosion	Check valves and 3-way solenoids on Air/Gas Panel to prevent backflow of air/gas into each supply	Per 30.12				
30.7	HIGH PRESSURE	Failure of IG regulator PCV-64889A	Overpressure of downstream equipment	PSV-64888A					
30.8	LOW PRESSURE								
30.9	HIGH TEMPERATURE								
30.10	LOW TEMPERATURE	Large pressure cut across IG regulator PCV-64889A	Low temperature downstream of PCV, below design temperature of actuators	Low flow demand, length of tubing will allow ambient heat recovery IG offtake is downstream of heaters	No actions				
30.11	IMPURITIES			Routine maintenance of IA system	No actions				
30.12	CHANGE IN COMPOSITION / CONCENTRATION	IA with backup IG, failure of IA will introduce a flammable mix of air and gas	Potential fire / explosion	HA rated equipment, no ignition sources present Check valves on Air/Gas Panel to prevent backflow of air/gas into each supply	Review appropriateness of using IG supply as a backup for IA system	**2**	**DY**		
30.13	TWO PHASE FLOW	Refer IMPURITIES							
30.14	REACTIONS	Refer 30.12							
30.15	TESTING EQUIPMENT / PRODUCT	No issues identified							
30.16	PLANT ITEM OPERABILITY	No issues identified							
30.17	PLANT ITEM MAINTAINABILITY	No issues identified		Each SDV/PCV can be individually isolated from the Air/Gas Panel	No actions				
30.18	ELECTRICAL AREA CLASSIFICATION	No issues identified							
30.19	EARTHING	No issues identified							
30.20	ISOLATION	No issues identified							
30.21	INSTRUMENTS TOO MANY	No issues identified							
30.22	INSTRUMENTS TOO FEW	No issues identified							
30.23	CORRECT LOCATION OF INSTRUMENTS	No issues identified							

NODE 31: WILTON FUEL GAS SUPPLY TO APA WATER BATH HEATER

DRAWINGS: 563-DW-PD-014, 563-DW-PD-016 **PLANT & EQUIPMENT:** - **INSTRUMENTATION:** - **LINE NUMBERS:** FG-XXX-C1D-50

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
31.1	HIGH FLOW			HAZOP for WBH package will be completed during detailed design	No actions				
31.2	HIGH LEVEL								
31.3	LOW FLOW								
31.4	LOW LEVEL								
31.5	ZERO FLOW / EMPTY								
31.6	REVERSE FLOW								
31.7	HIGH PRESSURE								
31.8	LOW PRESSURE								
31.9	HIGH TEMPERATURE								
31.10	LOW TEMPERATURE								
31.11	IMPURITIES								
31.12	CHANGE IN COMPOSITION / CONCENTRATION								
31.13	TWO PHASE FLOW								
31.14	REACTIONS								
31.15	TESTING EQUIPMENT / PRODUCT								
31.16	PLANT ITEM OPERABILITY	Fuel gas supply take-off downstream of custody transfer flowmeters	WBH fuel gas will require custody transfer metering		Fuel gas supply take-off to be relocated upstream of custody transfer meters	**1**	**SH**	**Yes**	**Refer to close out sheet in Appendix 3.**
31.17	PLANT ITEM MAINTAINABILITY								
31.18	ELECTRICAL AREA CLASSIFICATION								
31.19	EARTHING								
31.20	ISOLATION				Include DB&B isolation for fuel gas offtake	**1**	**PB**	**Yes**	**Refer to close out sheet in Appendix 3.**
31.21	INSTRUMENTS TOO MANY								
31.22	INSTRUMENTS TOO FEW				Include fuel gas flowmeter and fuel gas regulation as part of WBH package	**2**	**SH**		

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
31.23	CORRECT LOCATION OF INSTRUMENTS	No new causes							

NODE 32: WILTON: OVERVIEW

DRAWINGS: 563-DW-PD-002, 563-DW-PD-003, 563-DW-PD-008, 563-DW-PD-010, 563-DW-PD-011, 563-DW-PD-014, 563-DW-PD-015, 563-DW-PD-016, 563-DW-PD-017, 563-DW-PD-018

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
32.1	TOXICITY	No new causes							
32.2	SERVICES REQUIRED	Additional power demand for WBH forced draft fans Additional water required for WBH U/G services in location proposed for the new WBH & skids Existing open drain to the south of the existing site access road Additional plant equipment outside existing lighting zones	Inadequate capacity of existing site power supply Inadequate plant lighting		Review size of 3PH power supply and DC power supplies for additional demand Review capacity of existing IA system for additional demand Review location of existing open drain and U/G services (stormwater, comms & power) relative to proposed location for new WBH & skids Review additional plant lighting requirements Review additional and/or change to existing station security system	**1** **1** **1** **2** ~~**1**~~ **2**	**AZ** **SH** **PB** **AZ** **AZ**	**Yes** **Yes** **Yes** **No** **No**	**Refer to close out sheet in Appendix 10.** **Refer to close out sheet in Appendix 11.** **Reciew close out sheet in Appendix 12.** **Deferred to detailed design as system is not critical.**
32.3	MATERIALS OF CONSTRUCTION	No issues identified							
32.4	COMMISSIONING	First fill of WBH requires testing of town water supply to ensure suitable			No action				
32.5	BREAKDOWN	No issues identified							
32.6	STARTUP / SHUTDOWN	No issues identified							
32.7	EFFLUENT	Emergency or accidental release of water from WBH	Loss of containment of contaminated water	Truck load-out point provided on WBH for emptying	Review biocide/dosing chemicals used in WBH to ensure WBH does not require bunding	**2**	**DY**		

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
32.8	NOISE / VIBRATION	Increased station capacity	Possible additional noise impacting on nearby sensitive receptors	New flow control valves specified with low noise trims New JGN metering and flow control skids are larger size with lower velocities and likely lower noise level	No actions				
32.9	FIRE / EXPLOSION	Proximity of new plant equipment (WBH & Metering Skid) to private land to the south of the station Proximity to existing APA ethane flare	Encroachment of private/public on exclusion zones or hazardous area zones	Station clearances will be designed per AS2885 requirements Station hazardous area zones will be within fence boundary	No actions				
32.10	SAFETY EQUIPMENT	No issues identified		Fire protection system and LV rescue equipment provided as part of any new LV switchroom Fire extinguishers and other safety equipment will be reviewed as part of layout and 3D model reviews	No actions				
32.11	QUALITY AND CONSISTENCY	No issues identified							
32.12	OUTPUT – RELIABILITY AND BOTTLENECKS	No new issues							
32.13	EFFICIENCY	No new issues							
32.14	SIMPLICITY	Additional multiple runs and hence operating configurations available			Document in the Operating & Maintenance Philosophy the various capacity limits and redundancy associated with each run under the various operating and maintenance conditions	**3**	**DY**		
32.15	MOBILE EQUIPMENT / PLANT MOVEMENT	New WBH & skids change the existing site access routes	New site access routes required	Site access routes will be reviewed as part of layout review workshops	No actions				
32.16	PROCESS PLANT NORMAL / ABNORMAL MAINTENANCE			WBH clearance zones included on layout	No actions				
32.17	PROCESS PLANT PROCESS FUNCTIONALITY								
32.18	ERGONOMICS			Will be reviewed as part of layout review workshops	No actions				
32.19	GUARDING			Requirement for bollards will be reviewed as part of layout review workshops Vehicle access routes will be outside of HA zones	No actions				
32.20	WARNINGS								

Item No	Guideword	Problem Description		Existing Safeguard	Action Required	Cat	Action By	Complete Yes/No	Closeout Comments and Reference(s)
		Cause	Consequence						
32.21	VULNERABILITY	Change in noise characteristics due to change in capacity and operation of the station	Impact on other nearby sensitive receptors	Jemena Lands Department responsible for liaison with nearby residents and sensitive receptors / stakeholder engagement	No actions				
32.22	3RD PARTY INTERFERENCE	Refer FIRE / EXPLOSION Plant noise and lighting	Impact on other nearby sensitive receptors						
32.23	NATURAL EVENTS	Grass fire		Flooding not an issue for this area Station hardstand within fence boundary is hardstand, no grassed surfaces	No actions				

APPENDIX 2 CLOSE OUT SHEETS

APPENDIX 1

GPA ENGINEERING	Document Title	*HAZOP Number*
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		Various (see below)

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/21	**Client Project #:**	Project Marlin: EGP Reversal
Node:	1,2,4 & 5	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By	P&ID Updated
		Cause	Consequence				
1.7	LOW FLOW	SLV semi-closure	Lack of supply		Install Position/fail to operate alarm on the SLV.	**1**	**GAS-557-DW-PD-001(C)**
1.16	CHANGE IN COMPOSITION / CONCENTRATION	High Wobbe index may be received from FSRU due to settle out in ships during transport.	Off spec gas	Metered nitrogen injection based on GC test results is included in the design. The FSRU has a GC which will confirm gas properties prior to loadout.	Configure and include a high Wobbe Index alarm for the 557-AIT-64008 sampling system.	**1**	**GAS-557-DW-PD-002(C)**
1.21	PLANT ITEM OPERABILITY	Commissioning and start up. Intended filling of Pt Kembla Pipeline is by gas from the EGP, however an NRV is installed in the KGMS pipework preventing backflow from the EGP.	Unable to commissioning/fill Pt Kembla Pipeline.	None identified	Install bypass around NRV	**1**	**GAS-557-DW-PD-003(C)**
1.22	PLANT ITEM OPERABILITY	Venting – Some manual vents shown as single ball valve, inconsistent with typical vent arrangements	Single vent ball valve will become damaged when used for venting and throttling.	None identified	Update manual vents at KGMS to include isolation ball valve and throttling valve.	**1**	**GAS-557-DW-PD-001(C), GAS-557-DW-PD-002(C), GAS-557-DW-PD-003(C), 550-PI-001(0C)**
1.27	INSTRUMENTS TOO MANY	UG TIT at Kembla inlet	-	Jemena stated that there was sufficient temperature indication elsewhere	Remove UG TIT (064001)	**1**	**GAS-557-DW-PD-001(C)**

2.3	LOW FLOW	Low dP across MLV	Lack of supply to the north	None identified	Add a low dP alarm across MLV 1/PV-64009 to alert operators of low dP across MLV so that they can open it.	**1**	**550-PI-001(0C)**
2.5	ZERO FLOW / EMPTY	Valves fails closed	Interruption to supply	None identified	Add high dP alarm across MLV 1/PV-64009	**1**	**550-PI-001(0C)**
2.10	LOW TEMPERATURE	Pressure drop across PV64009	Minimum gas delivery temperature lower than minimum EGP delivery temperature requirement of 2°C	Minimum temp above minimum pipe rating of -10C.	Install additional temperature transmitter before the hot tap tie in, a suitable distance downstream of bypass inlet to allow blending of Pt Kembla and Longford gas.	**1**	**GAS-557-DW-PD-003(C)**
2.23	CORRECT LOCATION OF INSTRUMENTS	Loss of communication between MLV and Meter Station.	Potential unintended control of FCV.		Confirm if signal from PIT2 to PIC64009 needs to be hardwired or if coms is sufficient .	**1**	**550-PI-001(0C)** **Signal is required to be hard-wired as loss of comms would lead to loss of control or incorrect control. P&ID updated to reflect conenction type.** **Tag updated to PIC-064109.**
4.1	HIGH FLOW	Failure of PV 062005 or PV062007	Over pressure.	PSV 062008	Change PI to PIT with high and low pressure alarm (PI62008)	**1**	**550-PI-001(0C)** **Tags updated to PV-062101, PV-062104 & PIT-062105**
4.10	LOW TEMPERATURE	Cooling associated with pressure drop	Low temperatures in downstream equipment.	Instrument tubing will be stainless steel rated below the expected minimum process temperature downstream of the pressure cut	Include passive heat recovery loop into the instrument gas panel tubing.	**1**	**550-PI-001(0C)**
5.8	NOISE / VIBRATION	Noise from control valve PV-64009	Noise may be above allowable threshold	None identified	Specify noise attenuating trim for PV-64009 and acoustic insulation to be installed on valve and downstream piping	**1**	**550-PI-001(0C)** **Tag updated to PV-064106, refer GAS-550-DS-JJ-001(A)**

DISCUSSION AND RECOMMENDATION

All HAZOP actions documented on this close out sheet have been completed with required P&ID updates included in “Issued for Design” revisions as documented above.

Note: PIC-64009, PV-062005, PV-062007, PSV-062008, PI-62008 & PV-64009 have been updated to PIC-064109, PV-062101, PV-062104, PIT-062105 & PV-064106 respectively.

ACTION TAKEN / CLOSE OUT COMMENTS

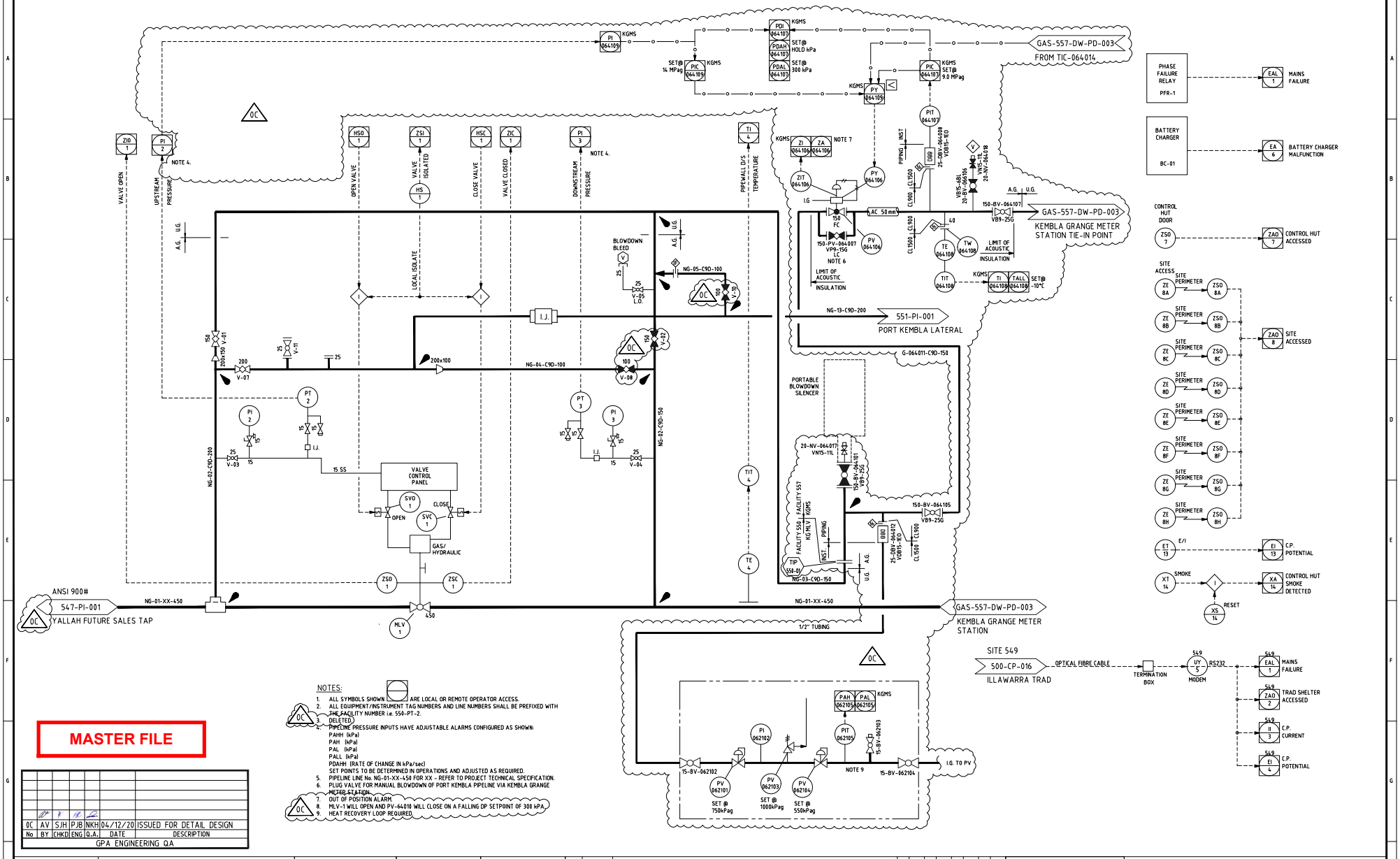
All actions are considered closed by the P&ID changes.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: pp Alf Sanzo **Date:** 12/02/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=Intocat, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 13:54:25 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21



NOTES:

1. ALL SYMBOLS SHOWN ⬭ ARE LOCAL OR REMOTE OPERATOR ACCESS.
2. ALL EQUIPMENT/INSTRUMENT TAG NUMBERS AND LINE NUMBERS SHALL BE PREFIXED WITH THE FACILITY NUMBER i.e. 550-PT-2.
3. DELETED.
4. PIPELINE PRESSURE INPUTS HAVE ADJUSTABLE ALARMS CONFIGURED AS SHOWN:
   PAHH (kPa)
   PAH (kPa)
   PAL (kPa)
   PALL (kPa)
   PDAH (RATE OF CHANGE IN kPa/sec)
   SET POINTS TO BE DETERMINED IN OPERATIONS AND ADJUSTED AS REQUIRED.
5. PIPELINE LINE No. NG-01-XX-450 FOR XX - REFER TO PROJECT TECHNICAL SPECIFICATION.
6. PLUG VALVE FOR MANUAL BLOWDOWN OF PORT KEMBLA PIPELINE VIA KEMBLA GRANGE MC748 STATION.
7. OUT OF POSITION ALARM.
8. MLV-1 WILL OPEN AND PV-64010 WILL CLOSE ON A FALLING DP SETPOINT OF 300 kPA.
9. HEAT RECOVERY LOOP REQUIRED.

MASTER FILE

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
0C	AV	SJH	PJB	NKH	04/12/20	ISSUED FOR DETAIL DESIGN

GPA ENGINEERING Q.A

DRAWING No.	REFERENCE DRAWINGS
500-CP-016	C.P. TRAD UNIT SLD & CONNECTION DETAILS - ILLAWARRA RAIL
551-PI-001	BHP (PORT KEMBLA) LAUNCHER AND RECEIVER STATIONS - P & ID
500-PI-001	LEGEND

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
0C	04.12.20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
0B	28.10.20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
0A	09.09.20	ISSUED FOR REVIEW (20617)	GPA	SLH		
A		AS BUILT	DH	SLH	PV	

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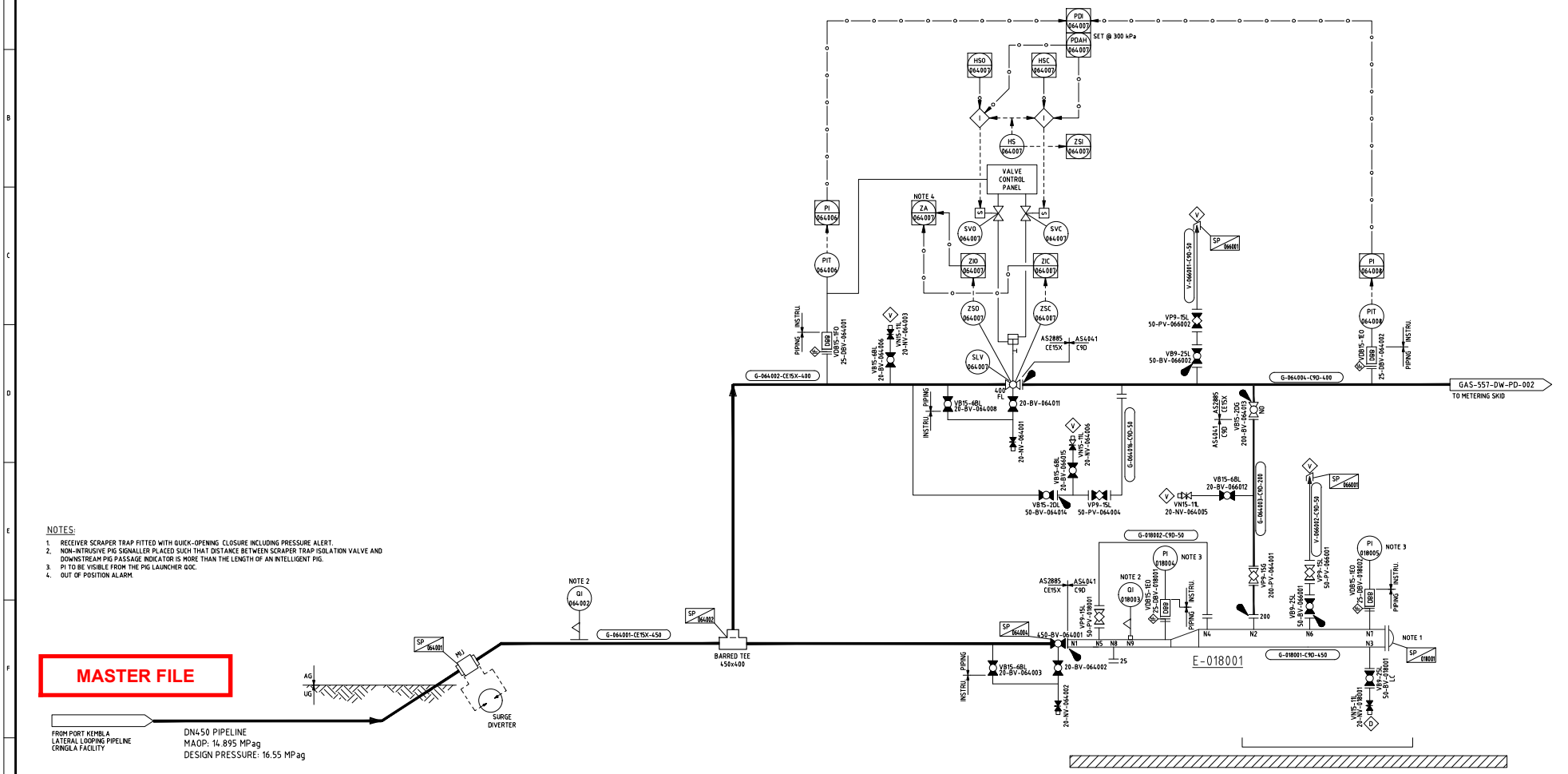
KEMBLA GRANGE MLV & SALES TAP
REMOTE ACTUATED MLV & DN200 SALES TAP
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT
DESIGN	SCALE N.T.S.	
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER 550-PI-001	REV 0C
DATE		

557-E-018001
PIG RECEIVER

SIZE MAJOR/MINOR: DN650xDN450
DESIGN PRESSURE: 14.895 MPag
DESIGN TEMPERATURE: -10°C/65°C
MATERIAL: CS



NOTES:

1. RECEIVER SCRAPER TRAP FITTED WITH QUICK-OPENING CLOSURE INCLUDING PRESSURE ALERT.
2. NON-INTRUSIVE PIG SIGNALLER PLACED SUCH THAT DISTANCE BETWEEN SCRAPER TRAP ISOLATION VALVE AND DOWNSTREAM PIG PASSAGE INDICATOR IS MORE THAN THE LENGTH OF AN INTELLIGENT PIG.
3. PI TO BE VISIBLE FROM THE PIG LAUNCHER QOC.
4. OUT OF POSITION ALARM.

FROM PORT KEMBLA LATERAL LOOPING PIPELINE CRINGILA FACILITY

DN450 PIPELINE
MAOP: 14.895 MPag
DESIGN PRESSURE: 16.55 MPag

MASTER FILE

ISSUED FOR REVIEW

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	AV	SJH	PJB	NKH	04/12/20	ISSUED FOR DETAILED DESIGN

GPA ENGINEERING Q.A

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	04/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
B	27/10/20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA			

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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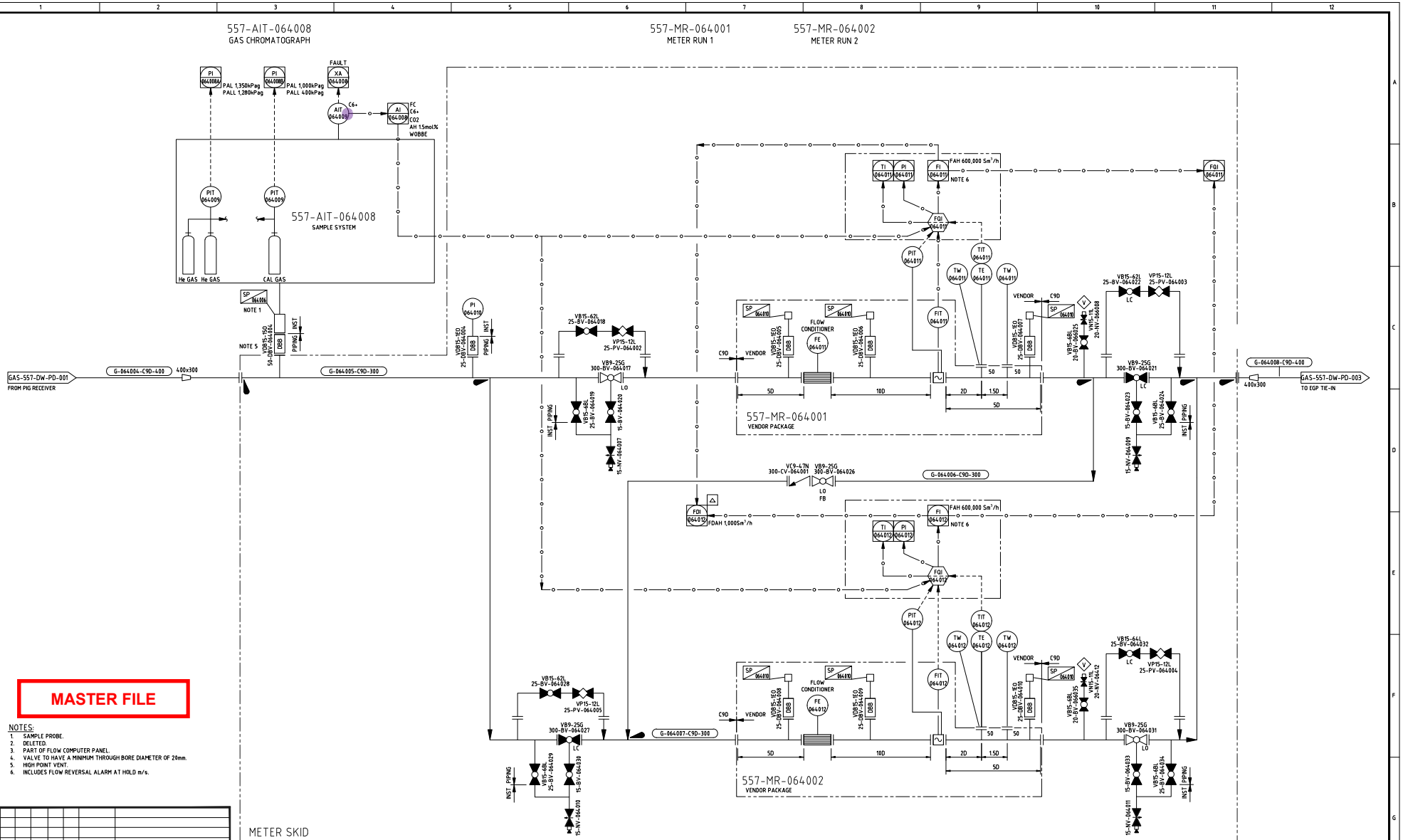
KEMBLA GRANGE METER STATION
PIG RECEIVER
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILITY	SUBJECT
DESIGN	PJB	SCALE	N.T.S.
CHECKED	SJH	SUPERSEDES	A1
APPROVED	NKH	DRAWING NUMBER	REV
DATE	27/10/20	GAS-557-DW-PD-001	C



MASTER FILE

NOTES:
1. SAMPLE PROBE.
2. DELETED.
3. PART OF FLOW COMPUTER PANEL.
4. VALVE TO HAVE A MINIMUM THROUGH BORE DIAMETER OF 20mm.
5. HIGH POINT VENT.
6. INCLUDES FLOW REVERSAL ALARM AT HOLD m/s.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	AV	SJH	PJB	NKH	04/12/20	ISSUED FOR DETAILED DESIGN

GPA ENGINEERING Q.A

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	04/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
B	26/10/20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA			

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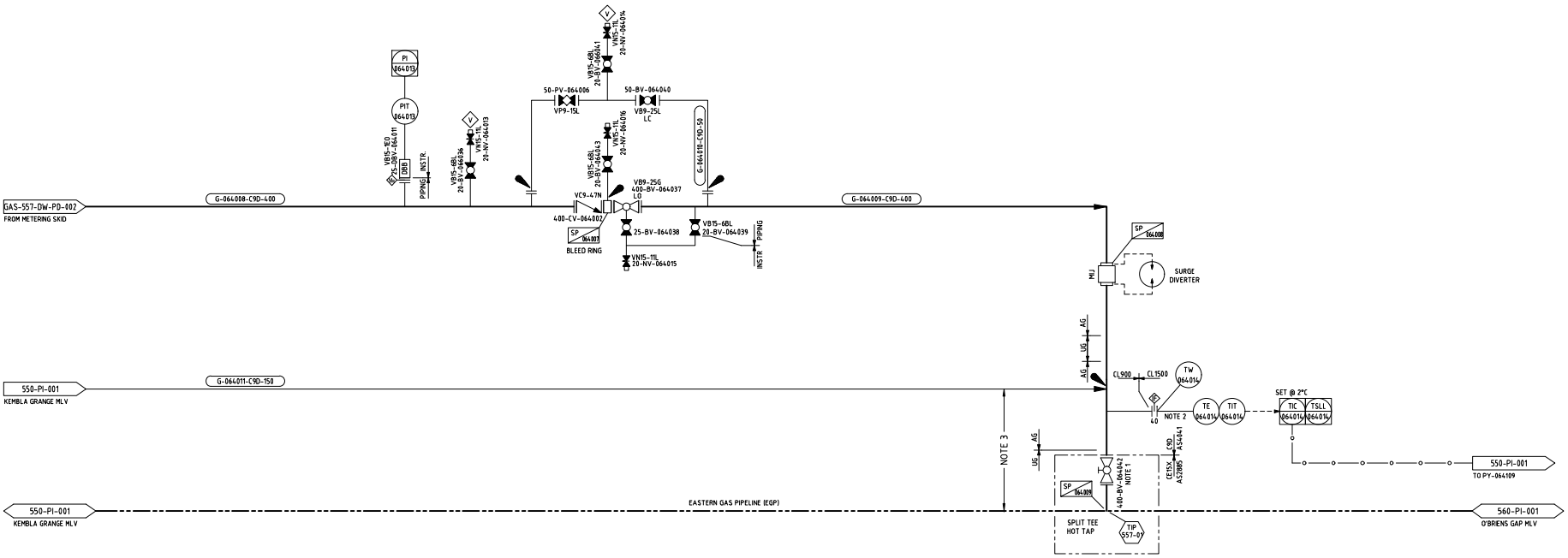
KEMBLA GRANGE METER STATION
METERING
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILITY	SUBJECT
DESIGN	PJB	SCALE	N.T.S.
CHECKED	SJH	SUPERSEDES	A1
APPROVED	NKH	DRAWING NUMBER	REV
DATE	26/10/20	GAS-557-DW-PD-002	C



NOTES:

1. VALVE COMPLETE WITH VALVE PIT AND EXTENDED HANDLE FOR OPERATION FROM GRADE.
2. LOCATE THERMOWELL AS CLOSE TO EGP TIE IN AS POSSIBLE.
3. LOCATE MLV BYPASS LINE A SUITABLE DISTANCE FROM EGP TIE IN FOR GAS BLENDING OF PORT KEMBLA AND LONGFORD GAS PRIOR TO EGP.

MASTER FILE

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	AV	SJH	PJB	NKH	04/12/20	ISSUED FOR DETAILED DESIGN

GPA ENGINEERING Q.A

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	04/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
B	24/10/20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA			

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KEMBLA GRANGE METER STATION
EGP HOT TAP TIE-IN
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILITY	SUBJECT
DESIGN	PJB	SCALE	N.T.S.
CHECKED	SJH	SUPERSEDES	A1
APPROVED	NKH	DRAWING NUMBER	REV
DATE	26/10/20	GAS-557-DW-PD-003	C

APPENDIX 2

GPA ENGINEERING	Document Title	*HAZOP Number*
	HAZOP Closeout Sheet	GAS-500-RP-HZ-003
		Item Number
		Various (see below)

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/21	**Client Project #:**	Project Marlin: EGP Reversal
Node:	16, 18, 19, 20, 21, 23	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By	P&ID Updated
		Cause	Consequence				
16.2	HIGH LEVEL	Liquid slug	Liquid carry-over, resulting in off-spec gas	High level alarm LSH-011107/8 on Filter 510-F-103	P&ID and datasheet to show that Filter 510-F-103 liquids collection boot is separated into two compartments. P&IDs currently shows this as one compartment which would allow gas to bypass the filter element.	**1**	**GAS-510-DW-PD-001(C) Refer to GAS-510-DS-JJ-001(A)**
16.2	HIGH LEVEL	Entrained oil from upstream gas compressors at Orbost and/or ESSO		HH level shutdown on LSHH-011107/8 on Filter 510-F-103	Add transmitter to LG-011107/8	**1**	**GAS-510-DW-PD-001(C)**
16.5	ZERO FLOW / EMPTY	Inadvertent closure of downstream valves	Failure to deliver flow nomination	Flow trend monitoring by Operations Personnel	Add position feedback and out of position alarm on downstream flow control valves FV-64118& FV-64124.	**1**	**GAS-510-DW-PD-004(C)**
16.7	HIGH PRESSURE	Inadvertent opening of UV-6470	High pressure from compressor discharge header	Refer High Flow	Correct the PSV set-point shown on the P&ID for Filter 510-F-103.	**1**	**GAS-510-DW-PD-001(C). Set pressure changed to 14,895 kPag to match vessel design pressure.**
16.8	LOW PRESSURE	Lower pressure than expected in the EGP due to continuous withdrawal of gas from the EGP	High gas velocities through the piping and Filter 510-F-103.	Refer High Flow	Consider implementation of low pressure alarm on the EGP	**1**	**PO-510-PI-110(4C). Low low pressure alarm added, set at 7,000 kPag.**

16.8	LOW PRESSURE	Lower pressure than expected in the EGP due to continuous withdrawal of gas from the EGP	Longford Compressor discharge harder pressure too low to start compressors.	Operator intervention	Consider implementing a back pressure control loop on PV-6440 to maintain adequate pressure in the Longford compressor discharge header to start compressors.	**1**	**PO-510-PI-110(4C). Back pressure control loop added with SP of 11,000 kPag.**
16.17	PLANT ITEM MAINTAIN ABILITY	Isolation of filter or strainer for maintenance	No way to re-pressurise after isolation for maintenance. Large ball valve required to open to re-pressurise isolated strainer/filter, leading to damage to large ball valve.		Strainer - install a pressuriation line around valve 400-BV-064844.	**1**	**GAS-510-DW-PD-001(C) pressurisation line installed around 400-BV-064001. 400-BV-064844 changed to 400-BV-064001.**
18.7	HIGH PRESSURE	Heater design pressure and temp shown incorrectly on P&ID			Design pressure on the heater to be changed to 14,895 kPag, temp should be VTC	**1**	**GAS-510-DW-PD-002(C)**
18.10	LOW TEMPERAT URE	TCV open too far	Low temp trip downstream AEMO may call with a warning	Discrepancy alarm on TCV Low temp on alarm at regulator outlet (64115)	Add low temperature trip to TIT-64128.	**1**	**GAS-510-DW-PD-004(C), TALL-064140 added.**
18.11		Manual butterfly (64001) at outlet of heater to allow for manual trimming	Not expected to be used or required		Delete this valve	**1**	**GAS-510-DW-PD-002(C)**
18.18	PLANT ITEM OPERABILI TY	No bypass arrangement for bundle inspection. Intention is to isolate the run. If VH2 WBH is out and VH1 WBH fails we will lose flow or capacity		Philisophy for maintenance is to isolate whole run to work on the heater.	Removable spool required to get the bundle out (add note to P&ID)	**1**	**GAS-510-DW-PD-002(C)**
18.20		No repressurisation line around isolation ball valve BV-64867 upstream of heater 510-HT-102	Repressurisation across BV64867 not possible following double block and bleed isolation on inlet of 510-HT-102.		Relocate pressurisation line from valve 64886 to 64867	**1**	**GAS-510-DW-PD-002(C), pressurisation spool around 400-BV-064029. BV-64886 & 64867 changed to 400-BV-064028 & 064029 respectively.**
19.1	HIGH FLOW	Refer Node 16	Flow induced vibration in thermowells	Thermowell wake frequency calculations to be completed as part of detailed design	Consider high velocity alarm on FI-64112, based on upstream flowrate and downstream set pressure.	**1**	**GAS-510-DW-PD-003(C). High velocity alarm added to FI-064112**
19.7	HIGH PRESSURE	Blocked discharge, pressure bleeds past flow control valves	High pressure downstream of flow control valves	Control valves close on high pressure. Slam shut closes	Set slam shut trip to the pressure rating of the downstream system.	**1**	**GAS-510-DW-PD-004(C) PSHH set @ 7,100 kPag DUTY RUN and 7,300 kPag**

							for Standby Run, consistent with VH1 regulator run.
19.10	LOW TEMPERATURE	Refer Node 16	Temp below gas spec	Downstream temp trip	Add new TIT to DCS downstream of both flow control valves	**1**	**GAS-510-DW-PD-004(C), TIT-064128 added.**
19.10	LOW TEMPERATURE	JT cooling over control valves	Temp below material design rating	Heat recovery in downstream piping	Convert TIT-64128 into SIS low temperature trip	**1**	**GAS-510-DW-PD-004(C), TIT-064140 added as SIS low temperature trip.**
19.16	PLANT ITEM OPERABILITY	Isolation of flow control skid from downstream pipeline, single valve isolation provided			Add isolation valve at TIP-510-04, with bleed upstream to provide DB&B (if required, ref action above).	**1**	**GAS-510-DW-PD-001(C), Hot Tap valve 400-BV-064053 added for isolation. Vent also added upstream of valve.**
19.17	PLANT ITEM MAINTAINABILITY	Removal of PSV-66121/66127 for maintenance / testing	No bleed between PSV-66121/66127 and isolation valve below		Add bleed ring / test & tap valve below PSV-66121/66127	**1**	**PSVs were removed.**
20.20	ISOLATION				Include DB&B isolation for fuel gas offtake from flow control skid.	**1**	**GAS-510-DW-PD-004(C)**
21.17	PLANT ITEM MAINTAINABILITY	RO blockage due to solids			Add rodding point to CD header in DN50 section	**1**	**510-DW-PD-101(0B)**
23.2	HIGH FLOW	High flow velocity in DN20 repressurisation line.			Ensure actuated valves have low DP permissive for opening.	**1**	**GAS-510-DW-PD-001(C)**

DISCUSSION AND RECOMMENDATION
All HAZOP actions documented on this close out sheet have been completed with required P&ID updates included in “Issued for Design” revisions as documented above. Note: 400-BV-064844, BV-64886 & BV-64867 changed to 400-BV-064001, 400-BV-064028 & 400-BV-064029 respectively.
ACTION TAKEN / CLOSE OUT COMMENTS
All actions are considered closed by the P&ID changes.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: pp Alf Sanzo **Date:** 12/02/2021

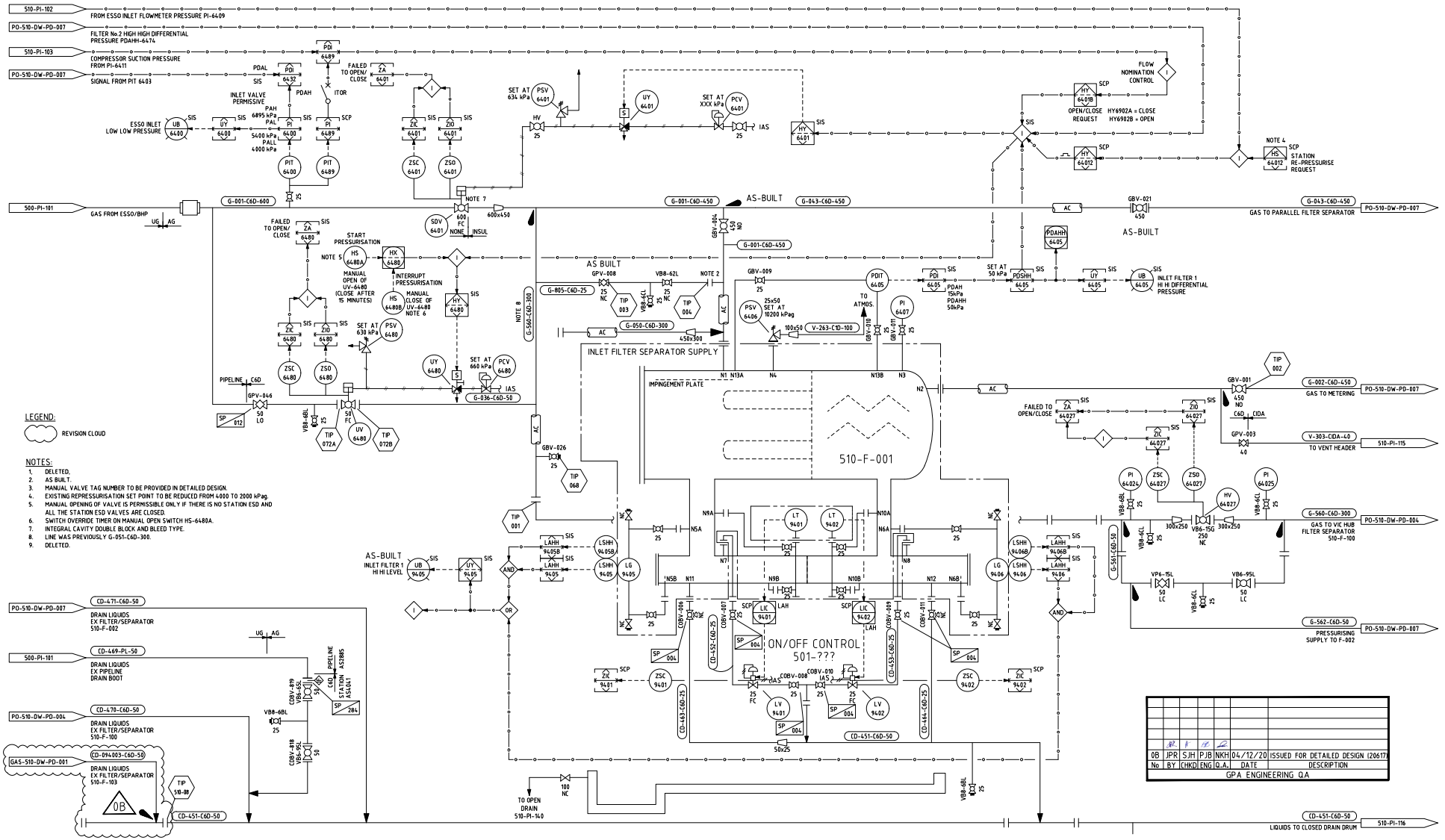
Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:32:47 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

MASTER FILE

510-F-001
INLET FILTER SEPARATOR

DESIGN PRESSURE : 10200 kPa @ 38°C 10000 kPa @ 50°C
DESIGN TEMPERATURE : 50°C
EQUIPMENT TRIM : G-048-C6D-XXX



No	BY	CHKD	ENG Q.A.	DATE	DESCRIPTION
0B	JPR	SJH	PJB	NKH	04/12/20	ISSUED FOR DETAILED DESIGN (20617)
GPA ENGINEERING Q.A.					

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
0B	04/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	JPR	SJH	NKH	
0A	2/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	NKH	
0	24/07/17	REDRAWN. INCLUDES ALL PREVIOUS REVISIONS. AS BUILT 05/05/12	JB				

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L ABN 15 068 570 847
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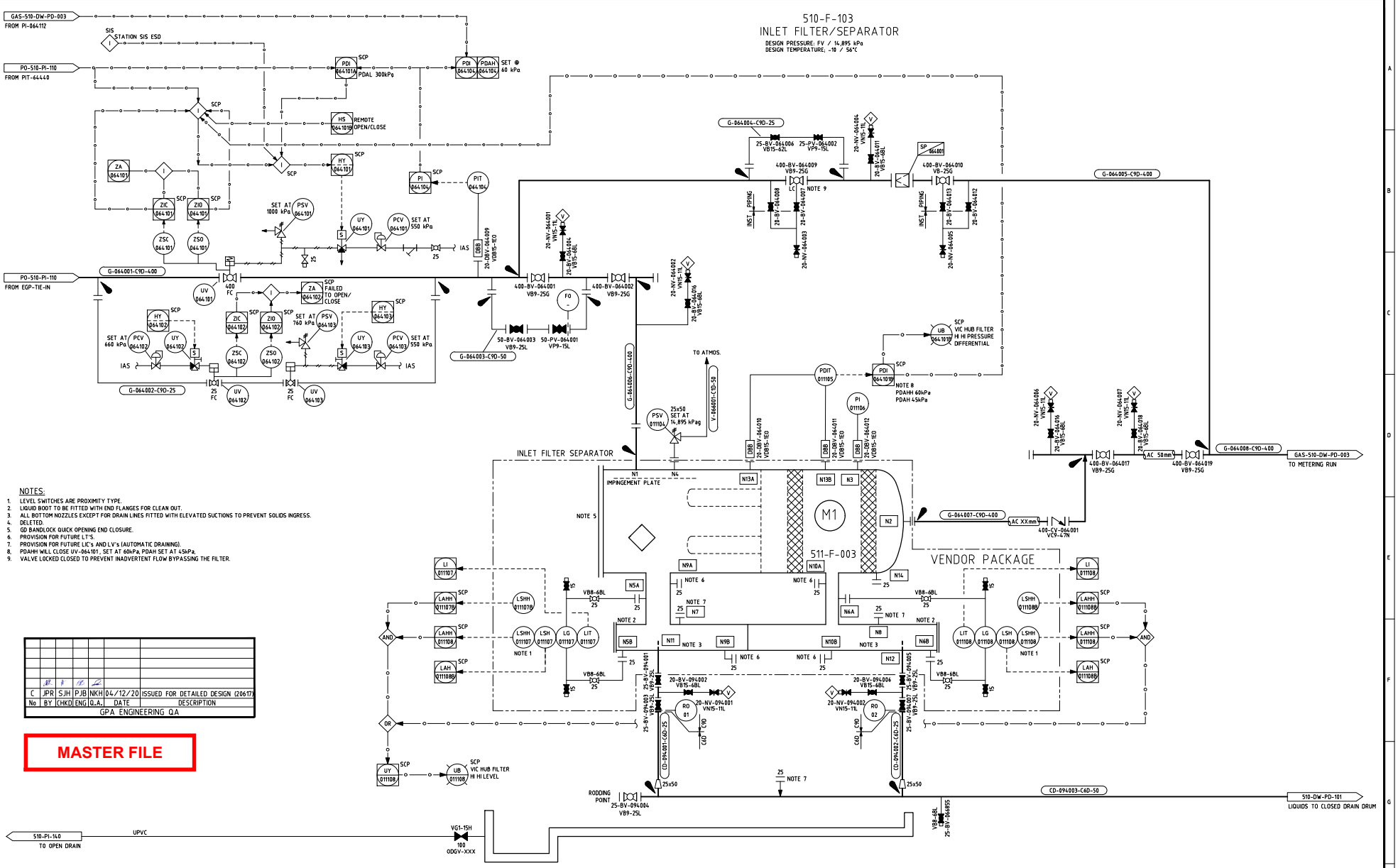
LONGFORD COMPRESSOR STATION
INLET FILTER SEPARATOR
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	EC	FACILITY	SUBJECT
DESIGN	GRT	SCALE	N.T.S.
CHECKED	PR	SUPERSEDES	510-PI-101
APPROVED	PAC	DRAWING NUMBER	510-DW-PD-101
DATE	08/10/99		REV 0B

A1



REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	04/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
B	02/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
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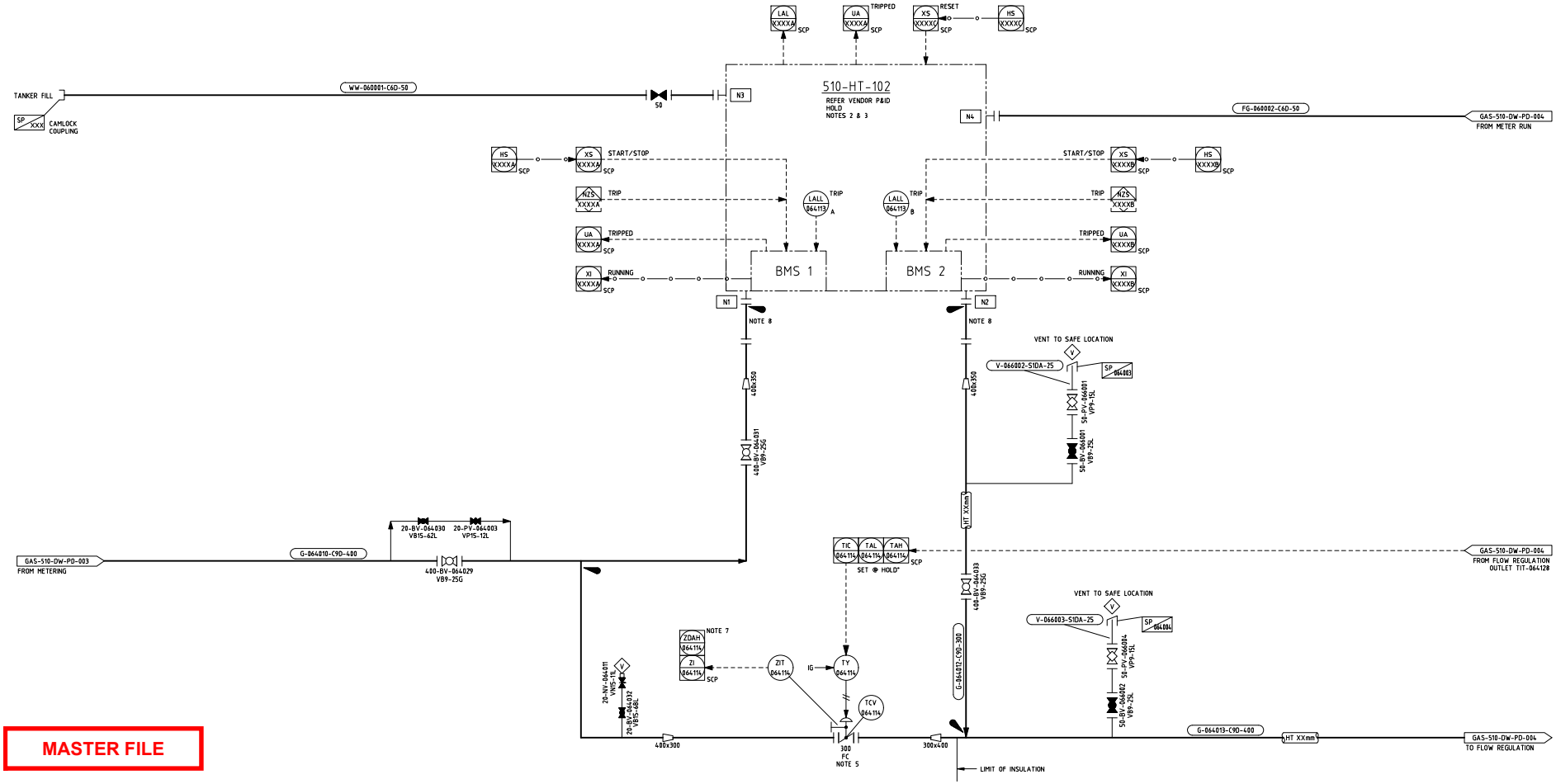
LONGFORD COMPRESSOR STATION
VIC HUB 2 - INLET FILTER SEPARATOR
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILITY	SUBJECT
DESIGN		SCALE	N.T.S.
CHECKED		SUPERSEDES	A1
APPROVED		DRAWING NUMBER	REV
DATE	26/10/20	GAS-510-DW-PD-001	C

510-HT-102
WATER BATH HEATER

DESIGN: 14,895 kPa @ VTA
OPERATING: 4,800 TO 14,800 kPag @ 10°C / 46°C
RATING: 2 x VTA kW BURNERS
DESIGN DUTY: VTA kW
FLOW: 333 TJ/d



MASTER FILE

NOTES:
1. DELETED.
2. WATERBATH HEATER SHALL BE DESIGNED TO MINIMISE WATER LOSS BY EVAPORATION.
3. WATERBATH SHALL BE ADEQUATELY VENTED TO PREVENT PRESSURISATION SHOULD IT BOIL DUE TO INSTRUMENT TRIP FAILURE.
4. REFER PIPING CLASS DATASHEETS FOR IMPACT TESTING/HEAT TREATMENT REQUIREMENTS.
5. MANUAL OVERRIDE FURNISHED ON THE ACTUATOR.
6. DELETED.
7. DISCREPANCY ALARM.
8. DROP OUT SPOOL FOR WATER BATH HEATER PROCESS BUNDLE REMOVAL.
9. DELETED.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	JPR	SJH	PJB	NKH	04/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
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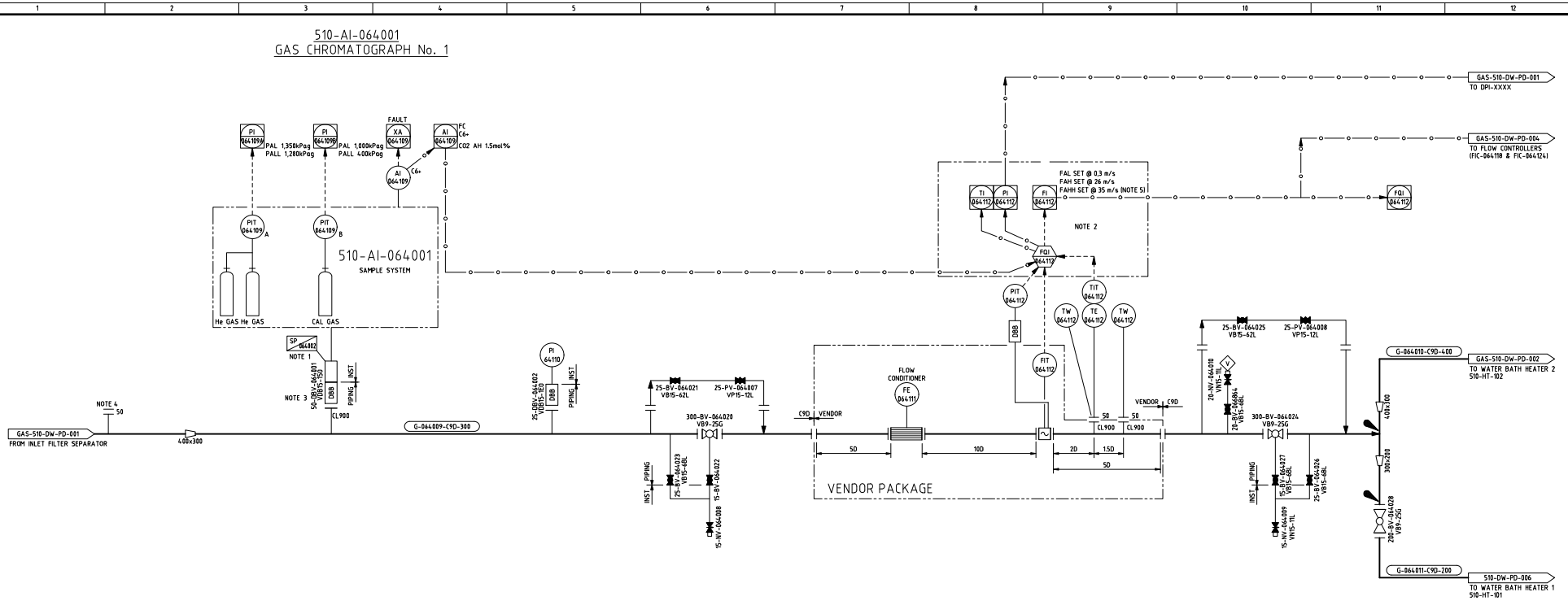
LONGFORD COMPRESSOR STATION
VIC HUB 2 - WATER BATH HEATER
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILITY	SUBJECT
DESIGN		SCALE	N.T.S.
CHECKED		SUPERSEDES	A1
APPROVED		DRAWING NUMBER	REV
DATE	26/10/20	GAS-510-DW-PD-002	C



MASTER FILE

NOTES:

1. SAMPLE PROBE.
2. PART OF FLOW COMPUTER PANEL.
3. VALVE TO HAVE A MINIMUM THROUGH BORE DIAMETER OF 20mm.
4. HIGH POINT VENT.
5. HIGH FLOW WILL TRIP INLET UV-064101 AFTER 30 CONTINUOUS SECONDS.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	JPR	SJH	PJB	NKH	04/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING QA

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
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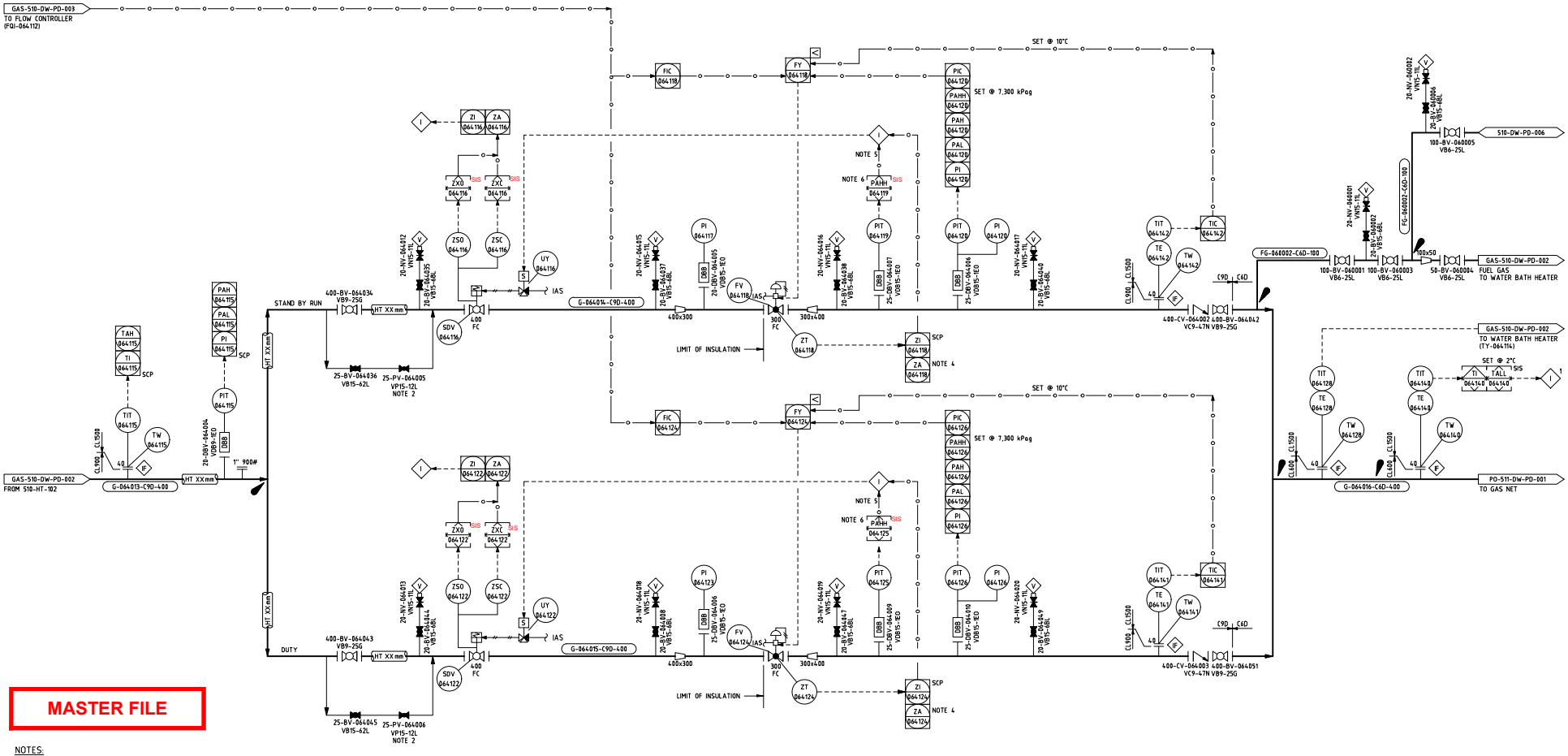
VIC HUB 2 - METERING RUN
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILITY	SUBJECT
DESIGN		SCALE	N.T.S.
CHECKED		SUPERSEDES	A1
APPROVED		DRAWING NUMBER	REV
DATE	26/10/20	GAS-510-DW-PD-003	C



NOTES:

1. DELETED.
2. LOW TEMPERATURE CARBON STEEL VALVE/LINE FOR PRESSURISING INDIVIDUAL PRESSURE REGULATION RUNS ONLY.
3. DELETED.
4. OUT OF POSITION ALARM.
5. ONLY ALLOW OPEN IF FV CLOSED.
6. PSHH SET @ 7,100 kPag FOR DUTY RUN AND 7,300 kPag FOR STANDBY RUN.

No	BY	CHK'D	ENG	Q.A.	DATE	DESCRIPTION
C	JPR	SJH	PJB	NKH	04/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING QA

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	04/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA		SJH	NKH	
B	02/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	NKH	
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA				

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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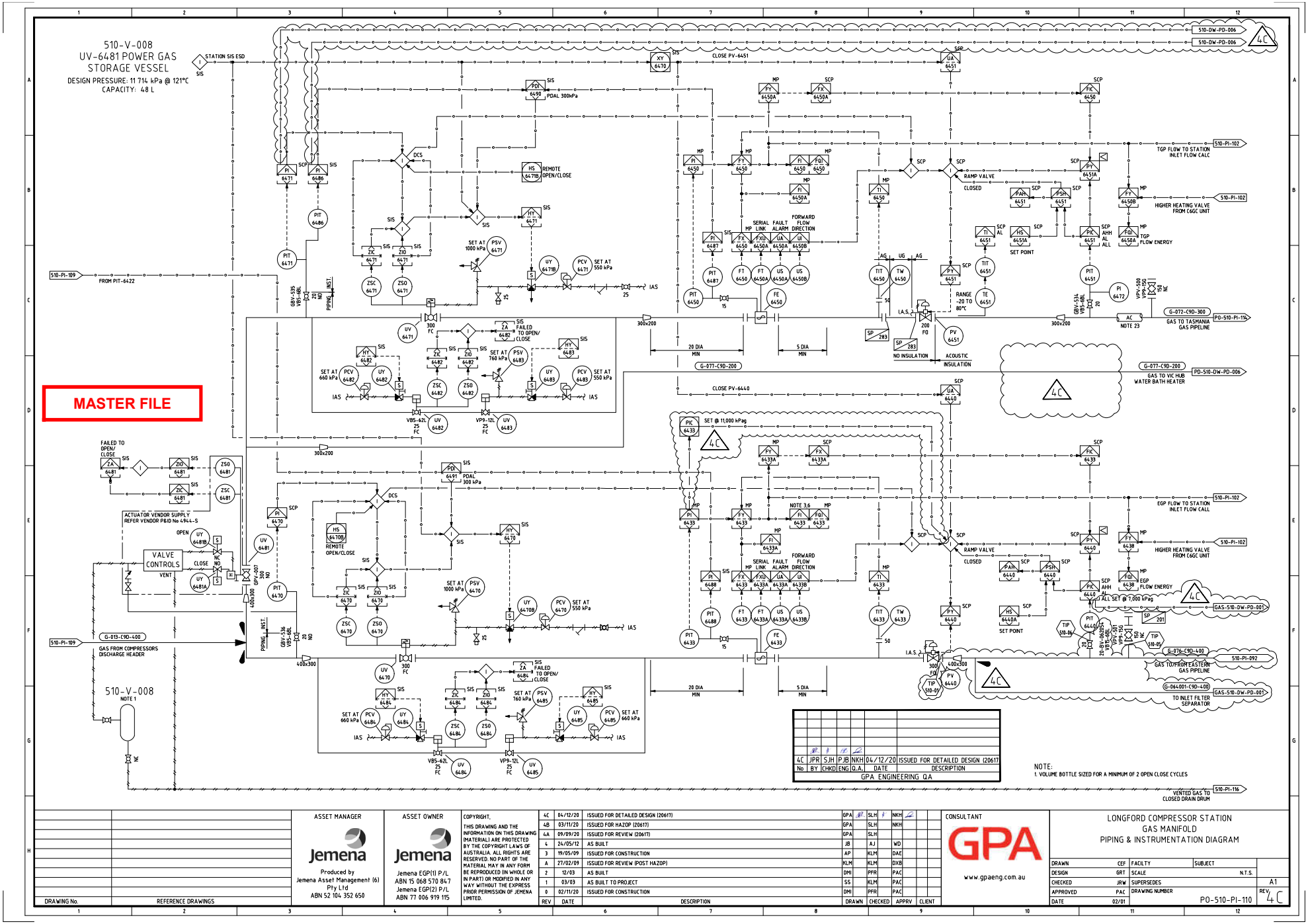
LONGFORD COMPRESSOR STATION
VIC HUB 2 - FLOW REGULATION
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILITY	SUBJECT
DESIGN		SCALE	N.T.S.
CHECKED		SUPERSEDES	A1
APPROVED		DRAWING NUMBER	REV
DATE	26/10/20	GAS-510-DW-PD-004	C



4C	04/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA		SLH		NKH				
4B	03/11/20	ISSUED FOR HAZOP (20617)	GPA		SLH		NKH				
4A	09/09/20	ISSUED FOR REVIEW (20617)	GPA		SLH						
4	24/05/12	AS BUILT	JB		AJ		WD				
3	19/05/09	ISSUED FOR CONSTRUCTION	AP		KLM		DAE				
A	27/02/09	ISSUED FOR REVIEW (POST HAZOP)	KLM		KLM		DXB				
2	12/03	AS BUILT	DMI		PPR		PAC				
1	03/03	AS BUILT TO PROJECT	SS		KLM		PAC				
0	02/11/20	ISSUED FOR CONSTRUCTION	DMI		PPR		PAC				
REV	DATE	DESCRIPTION	DRAWN		CHECKED		APPRV		CLIENT		

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
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LONGFORD COMPRESSOR STATION
GAS MANIFOLD
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	CEF	FACILITY	SUBJECT
DESIGN	GRT	SCALE N.T.S.	
CHECKED	JRW	SUPERSEDES	A1
APPROVED	PAC	DRAWING NUMBER	REV. 4C
DATE	02/01	PO-510-PI-110	

APPENDIX 3

GPA ENGINEERING	Document Title	*HAZOP Number*
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		Various (see below)

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	14/01/21	**Client Project #:**	Project Marlin: EGP Reversal
Node:	24, 25, 26, 27, 28 & 31	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By	P&ID Updated
		Cause	Consequence				
24.10	LOW TEMPERATURE	Repressuriation of Filter 563-F-01/02 after maintenance	Piping seeing lower temp than designed for	Min piping design temp is -10degC	Update P&ID to include minimum design temperature for inlet filters 563-F-01/02	**1**	**563-DW-PD-002(2C)**
24.20	ISOLATION	WBH 563-HT-001 has single valve isolation only.			Relocate repressurisation line around 250-BV-641557 to be located around 250-BV-64154.	**1**	**563-DW-PD-016(C), 250-BV-641557 / 64154 changed to 250-BV-064013 / 064009.**
25.16	PLANT ITEM OPERABILITY	Manual butterfly 150-CV[BUV]-64105 at outlet of heater to allow for manual trimming	Not expected to be used or required		Delete manual butterfly valve 150-CV[BUV]-64105 on outlet of 563-HT-001	**1**	**563-DW-PD-016(C)**
25.17	PLANT ITEM MAINTAINABILITY	TCV-64148 maintenance cannot be done without depressurng the heater	New APA run offline / no flow during TCV maintenance	Removable spools provided at connection to WBH process bundle	Replace 25-BV-641559 with DN50 ball and plug valve vent arrangement	**1**	**563-DW-PD-016(C)**
25.22	INSTRUMENTS TOO FEW	Temperature upstream of 563-HT-001 is not monitored			Add TIT upstream of 563-HT-001 & 250-BV-64154 (equivalent to TIT-64808 upstream of existing heaters 563-HE-01/02)	**1**	**563-DW-PD-016(C) TIT-064160 added. 250-BV-64154 changed to 250-BV-064009**
26.20	ISOLATION			Z-crossover line between meter runs includes check valve 250-CV-64989 to	Add 2x ball valves shown on outlet of new APA flow control skid (on PFD) to P&ID	**1**	**563-DW-PD-012(2C) & 563-DW-PD-018(C),**

				prevent flow bypassing the meters during series configuration			**250-BV-064035 & 250-BV-064032 added.**
26.20	ISOLATION			Locked valves used to ensure metering skid remains in desired configuration	Isolation valves to be located at each end of the new loop line to APA TIP	**1**	**563-DW-PD-018(C), 563-DW-PD-012(2C), 250-BV-064035 & 250-BV-064032 added.**
26.20	ISOLATION				Add additional valve to the existing connection to APA MLV	**1**	**563-DW-PD-012(2C), 250-BV-064039 added.**
26.20	ISOLATION				Add additional ball valve to the crossover connection between RR-01/02 and RR-03/04	**1**	**563-DW-PD-018(C), 250-BV-064033 added.**
27.22	INSTRUMENTS TOO FEW	Refer HIGH PRESSURE	No ability to measure pressure upstream of 563-HE-01/02		Change PI-64980/64981 to a PIT	**1**	**563-DW-PD-003(2B). PIT-64980 added. No need to change PI-64981 as pipe is common with PIT-64980.**
27.22	INSTRUMENTS TOO FEW				Change PI-64814 to a PIT	**1**	**563-DW-PD-003(2B)**
27.22	INSTRUMENTS TOO FEW				Add a virtual DP across heaters 563-HE-01/02	**1**	**563-DW-PD-003(2B), PDI-064980 added.**
28.1	HIGH FLOW	Refer Node 24	Flow induced vibration in piping and thermowells, leading to equipment damage	2x100% metering and flow control skids	Consider duplicating HH velocity trip logic used on existing metering runs at WMS	**1**	**563-DW-PD-008(2B), High velocity alarms and trip added.**
28.7	HIGH PRESSURE	Blocked discharge, pressure bleeds past flow control valves	High pressure downstream of flow control valves	Control valves close on high pressure. Slam shut closes	Set slam shut trip to the pressure rating of the downstream system.	**1**	**563-DW-PD-010(7C). Trip setpoint for pneumatic system (PSH-064136/064110 not specified on P&IDs) PAHH 064134 and 064146 set at 6,500 kPag.**
28.7	HIGH PRESSURE	Slam shut valves require control segregation from SCS		PSVs downstream of flow control valves	Change slam shut valve to be pneumatically operated using slam shut panel to match other slam shut valves at WMS	**1**	**563-DW-PD-010(7C)**
28.10	LOW TEMPERATURE	Refer Node 24	Temp below gas spec	Downstream temp trip	Add new TIT to SCS downstream of both flow control valves	**1**	**563-DW-PD-010(7C), TIT-064147 used for control in SCS.**
28.10	LOW TEMPERATURE	JT cooling over control valves	Temp below material design rating	Heat recovery in downstream piping	Convert TIT-64147 into low temperature trip	**1**	**563-DW-PD-010(7C), TIT-064201 added for TALL**

28.15	TESTING EQUIPMENT / PRODUCT			Statutory PM checks on PSVs, CFTs	Confirm requirement for DN20 vents downstream of flow control valves	**1**	**563-DW-PD-010(7C), DN20 vents consolidated.**
28.20	ISOLATION	Pressurisation line double block and bleed design inadequate as it relies on a plug valve.	Insufficient isolation of regulator run.		All small bore vents (DN20/DN25) to be provided with a needle valve for throttling and bleed plug	**1**	**All vents consolidated to this design.**
31.16	PLANT ITEM OPERABILITY	Fuel gas supply take-off downstream of custody transfer flowmeters	WBH fuel gas will require custody transfer metering		Fuel gas supply take-off to be relocated upstream of custody transfer meters	**1**	**563-DW-PD-016(C), 563-DW-PD-014(4B)**
31.20	ISOLATION				Include DB&B isolation for fuel gas offtake	**1**	**563-DW-PD-016(C)**

DISCUSSION AND RECOMMENDATION

All HAZOP actions documented in this close out sheet have been completed with required P&ID updates included in "Issued for Design" revisions as documented above.

ACTION TAKEN / CLOSE OUT COMMENTS

All actions are considered closed by the P&ID changes.

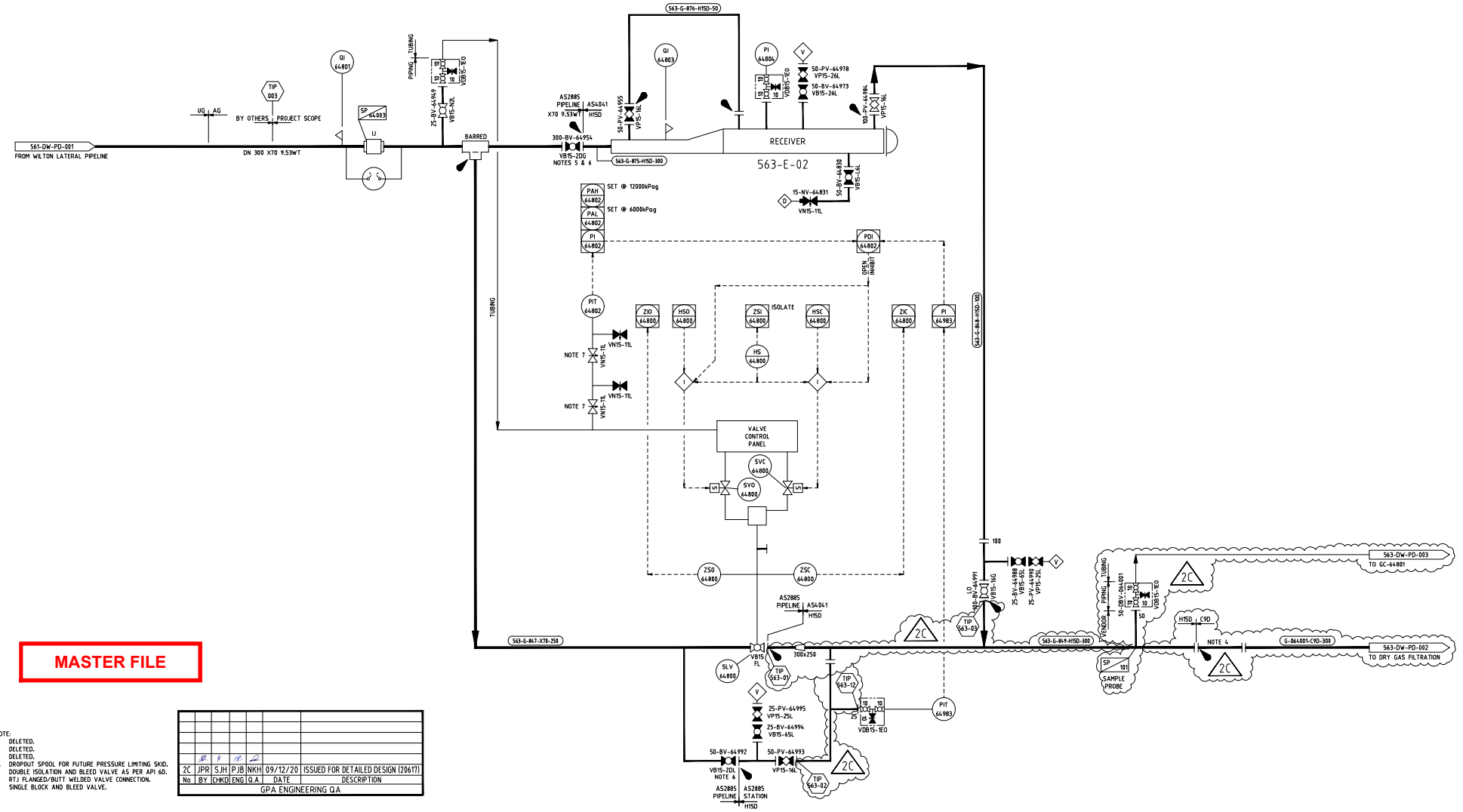
Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: pp Alf Sanzo **Date:** 12/02/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:50:24 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

563-E-02
RECEIVER TRAP
DESIGN PRESSURE: 16550kPag
DESIGN TEMPERATURE: -6 TO 65°



MASTER FILE

NOTE:
1. DELETED.
2. DELETED.
3. DELETED.
4. DROPOUT SPOOL FOR FUTURE PRESSURE LIMITING SKID.
5. DOUBLE ISOLATION AND BLEED VALVE AS PER API 6D.
6. RTJ FLANGED/BUTT WELDED VALVE CONNECTION.
7. SINGLE BLOCK AND BLEED VALVE.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
2C	JPR	SJH	PJB	NKH	09/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
2C	09/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
2B	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
2A	16/09/20	ISSUED FOR REVIEW (20617)	GPA			
2	18/01/16	AS BUILT TO CLIENT MARKUPS	JB	NB		
1	13/02/15	REISSUED FOR CONSTRUCTION	JB	NB	AH	
0	12/12/14	ISSUED FOR CONSTRUCTION	JB	NB	AH	

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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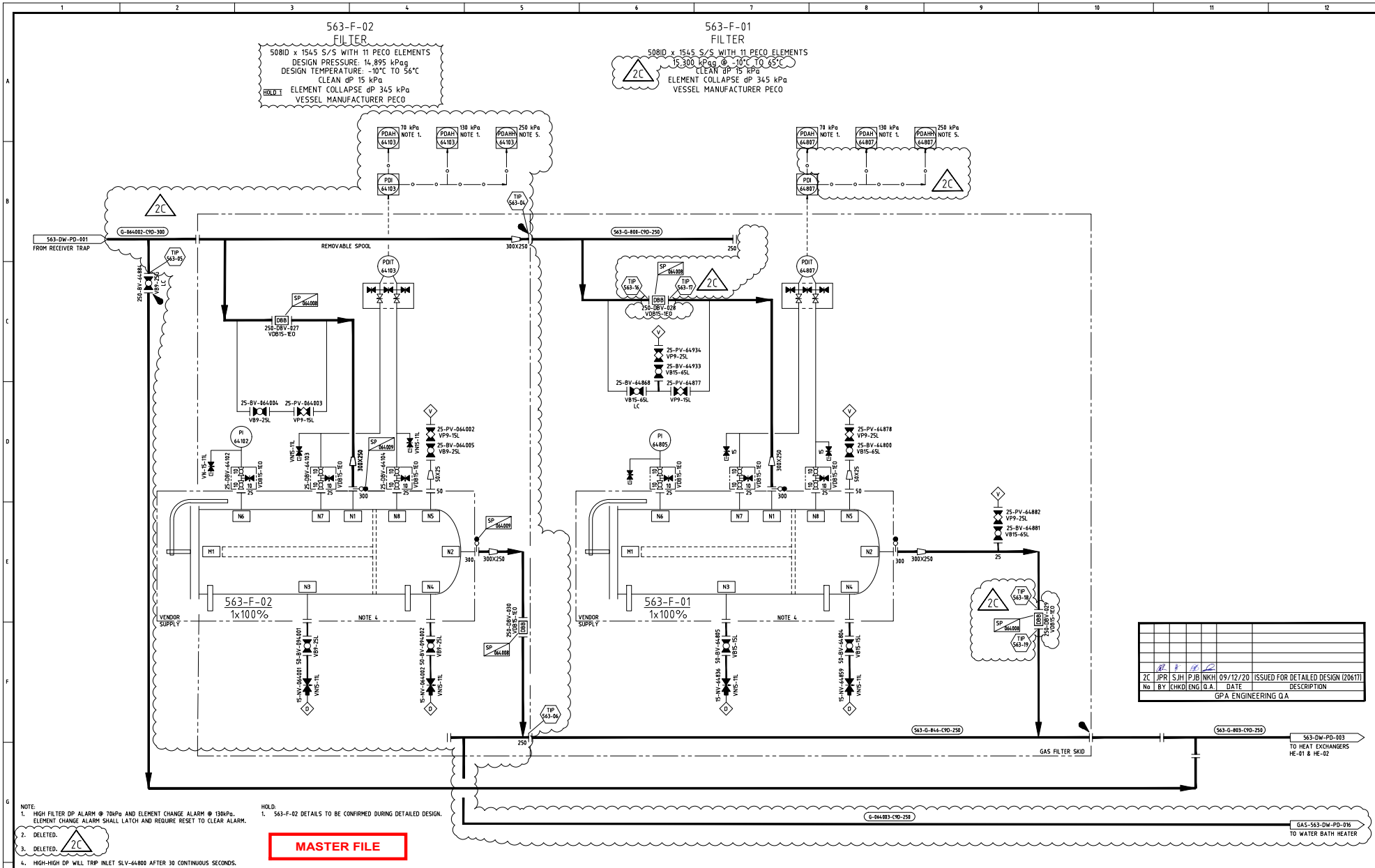
WILTON METER STATION
RECEIVER STATION
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILITY	SUBJECT
DESIGN	SCALE N.T.S.	
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER	REV. 2C
DATE	563-DW-PD-001	



NOTE:
1. HIGH FILTER DP ALARM @ 70kPa AND ELEMENT CHANGE ALARM @ 130kPa. ELEMENT CHANGE ALARM SHALL LATCH AND REQUIRE RESET TO CLEAR ALARM.
2. DELETED.
3. DELETED.
4. HIGH-HIGH DP WILL TRIP INLET SLV-64800 AFTER 30 CONTINUOUS SECONDS.

HOLD:
1. 563-F-02 DETAILS TO BE CONFIRMED DURING DETAILED DESIGN.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
2C	JPR	SJH	PJB	NKH	09/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING QA

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
2C	09/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	JPR	SJH	NKH
2B	04/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	NKH
2A	16/09/20	ISSUED FOR REVIEW (20617)	GPA			
2	18/01/16	AS BUILT TO CLIENT MARKUPS	JB		NB	
1	13/02/15	REISSUED FOR CONSTRUCTION	JB		NB	AH
0	12/12/14	ISSUED FOR CONSTRUCTION	JB		NB	AH

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
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Jemena EGP(1) P/L
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Jemena EGP(2) P/L
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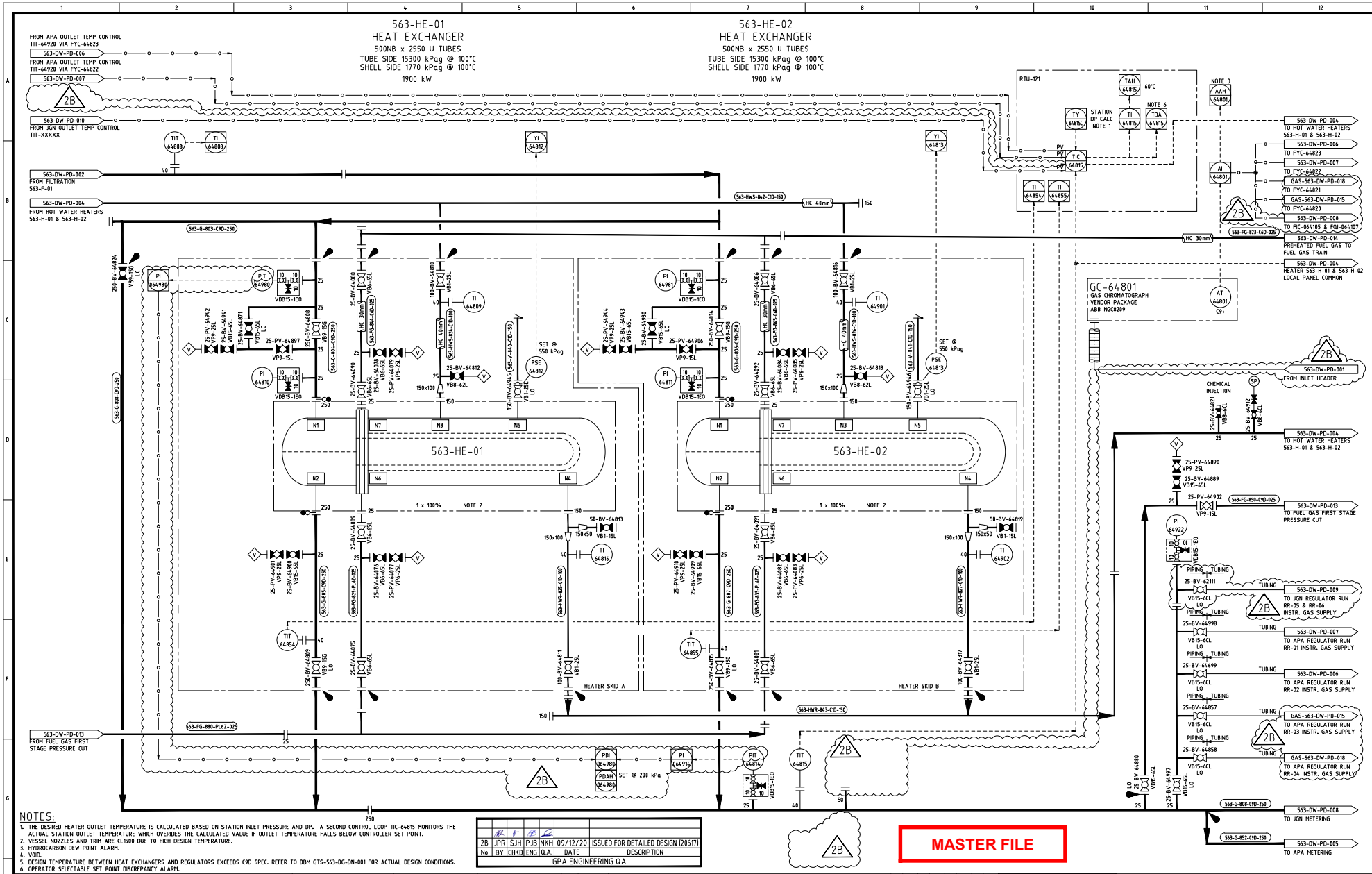
WILTON METER STATION
DRY GAS FILTERS
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT
DESIGN	SCALE N.T.S.	
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER	REV. 2C
DATE	563-DW-PD-002	



NOTES:

1. THE DESIRED HEATER OUTLET TEMPERATURE IS CALCULATED BASED ON STATION INLET PRESSURE AND DP. A SECOND CONTROL LOOP TIC-64815 MONITORS THE ACTUAL STATION OUTLET TEMPERATURE WHICH OVERIDES THE CALCULATED VALUE IF OUTLET TEMPERATURE FALLS BELOW CONTROLLER SET POINT.
2. VESSEL NOZZLES AND TRIM ARE CL1500 DUE TO HIGH DESIGN TEMPERATURE.
3. HYDROCARBON DEW POINT ALARM.
4. VOID.
5. DESIGN TEMPERATURE BETWEEN HEAT EXCHANGERS AND REGULATORS EXCEEDS C9D SPEC. REFER TO DBM GTS-563-DG-DN-001 FOR ACTUAL DESIGN CONDITIONS.
6. OPERATOR SELECTABLE SET POINT DISCREPANCY ALARM.

No	BY	CHKD	ENG	Q.A	DATE	DESCRIPTION
2B	JPR	SJH	PJB	NKH	09/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

MASTER FILE

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
2B	09/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA		SJH	NKH
2A	04/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	NKH
2	18/01/16	AS BUILT TO CLIENT MARKUPS	JB		NB	
1	13/02/15	REISSUED FOR CONSTRUCTION	JB		NB	AH
0	12/12/14	ISSUED FOR CONSTRUCTION	JB		NB	AH

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
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WILTON METER STATION
HEAT EXCHANGERS
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT
DESIGN	SCALE N.T.S.	
CHECKED	SUPERSEDES	A1
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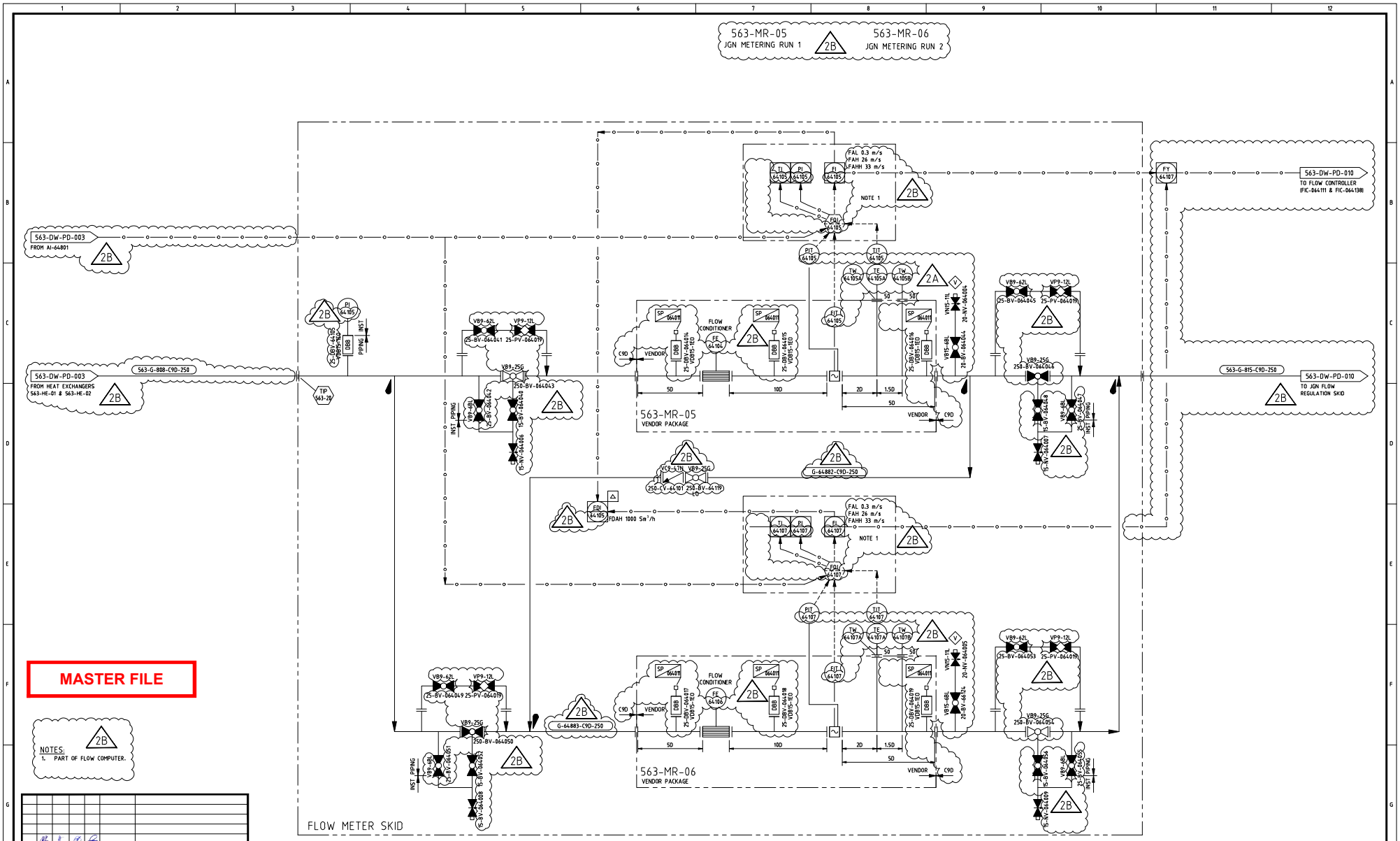

2C	JPR	SJH	PJB	NKH	09/12/20	ISSUED FOR DETAILED DESIGN (20617)
No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION

GPA ENGINEERING Q.A

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
2B	09/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	JPR	SJH	NKH
2A	04/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	NKH
2	18/01/16	AS BUILT TO CLIENT MARKUPS	JB		NB	
1	13/02/15	REISSUED FOR CONSTRUCTION	JB		NB	AH
0	12/12/14	ISSUED FOR CONSTRUCTION	JB		NB	AH

DRAWING No.

REFERENCE DRAWINGS

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

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Jemena EGP(1) P/L
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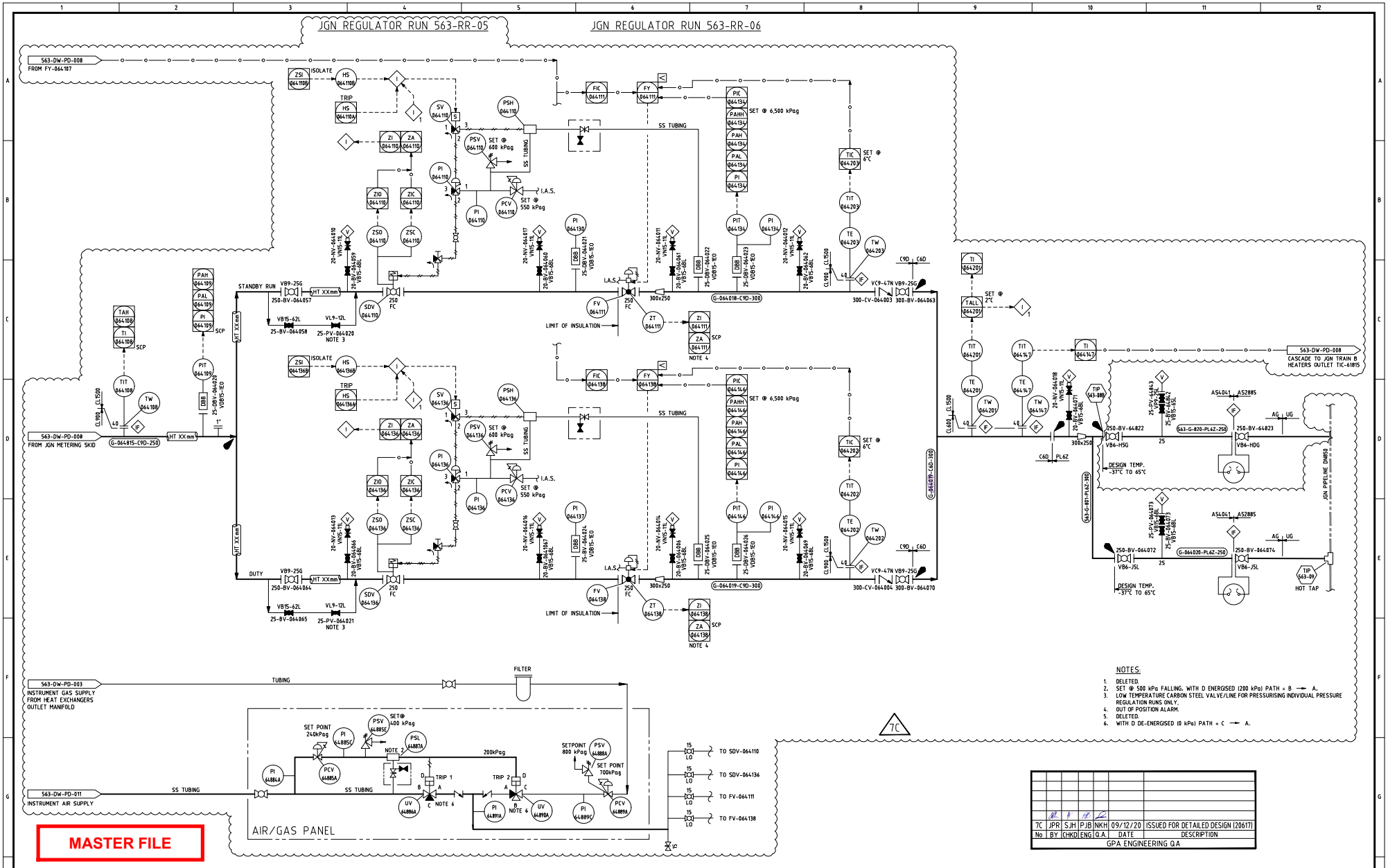
WILTON METER STATION
JGN FLOW METERING
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT
DESIGN	SCALE N.T.S.	
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER	REV 2B
DATE	563-DW-PD-008	



NOTES:

1. DELETED.
2. SET @ 500 kPa FALLING, WITH D ENERGISED (200 kPa) PATH = B → A.
3. LOW TEMPERATURE CARBON STEEL VALVE/LINE FOR PRESSURISING INDIVIDUAL PRESSURE REGULATION RUNS ONLY.
4. OUT OF POSITION ALARM.
5. DELETED.
6. WITH D DE-ENERGISED (0 kPa) PATH = C → A.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
7C	JPR	SJH	PJB	NKH	09/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
7A	17/09/20	ISSUED FOR REVIEW (20617)	GPA			
7	10/02/16	AS BUILT TO CLIENT MARKUPS	LC		JB	
6	18/01/16	AS BUILT TO CLIENT MARKUPS	JS		NB	
5	01/09/15	REISSUED FOR CONSTRUCTION	JB		GH	AH
4	18/08/15	REISSUED FOR CONSTRUCTION	JB		NB	AH
3	21/07/15	REISSUED FOR CONSTRUCTION	JB		NB	AH
7C	09/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	JPR	SJH	NKH
7B	04/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	NKH

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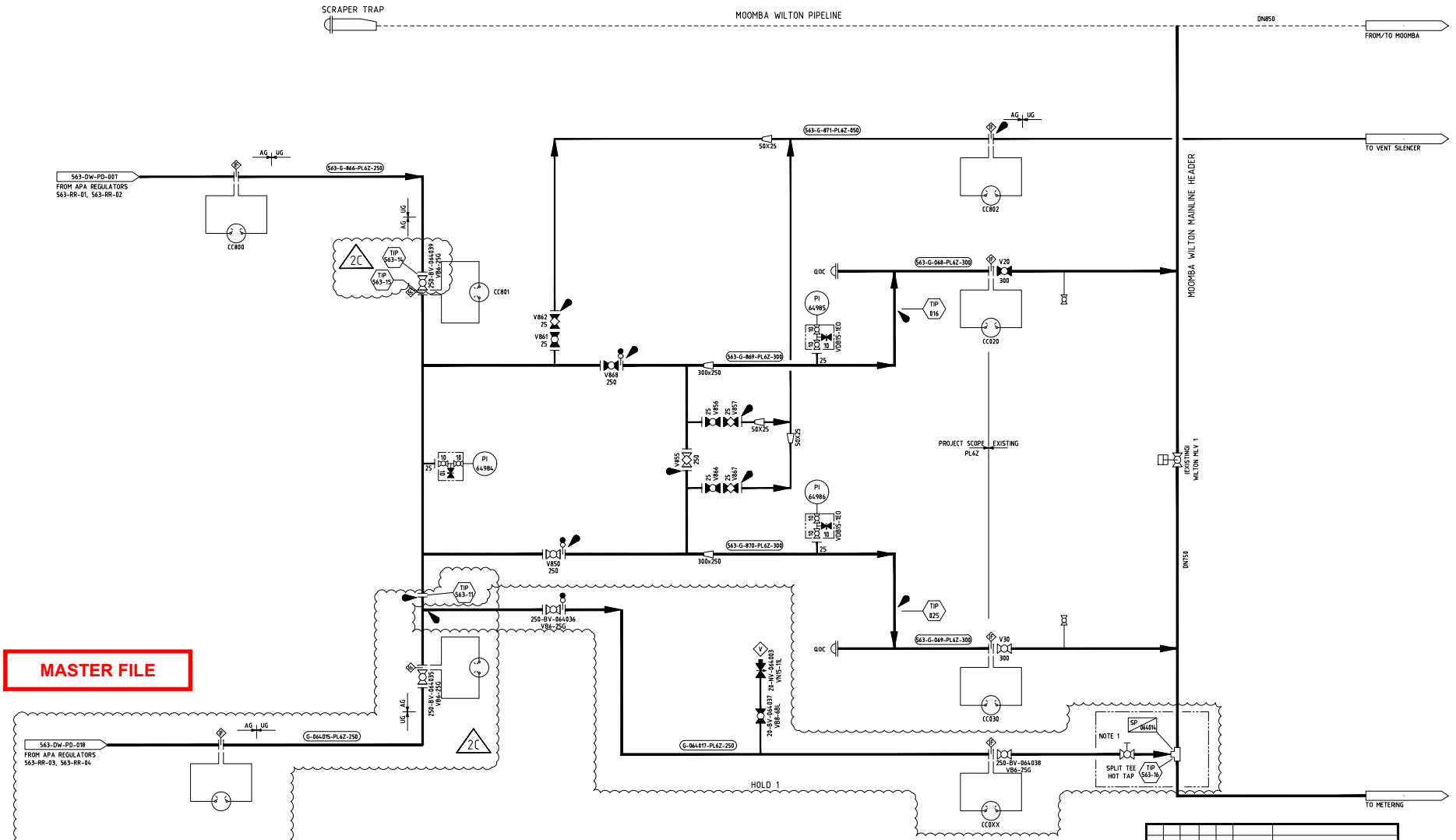
WILTON METER STATION
JGN FLOW REGULATION SKID (RUN No. 5 & 6)
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT	
DESIGN	SCALE	N.T.S.	
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV. 7C
DATE	563-DW-PD-010		

PD-510-DW-PD-003	CONNECTION TO BI-DIRECTIONAL PIPELINE & FILTER/SEPARATOR
DRAWING No.	REFERENCE DRAWINGS



REV	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
2C	JPR	SJH	PJB	NKH	09/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING QA

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
2C	09/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
2B	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
2A	17/09/20	ISSUED FOR REVIEW (20617)	GPA			
2	18/01/16	AS BUILT TO CLIENT MARKUPS	JB	NB		
1	13/02/15	REISSUED FOR CONSTRUCTION	JB	NB	AH	
0	12/12/14	ISSUED FOR CONSTRUCTION	JB	NB	AH	

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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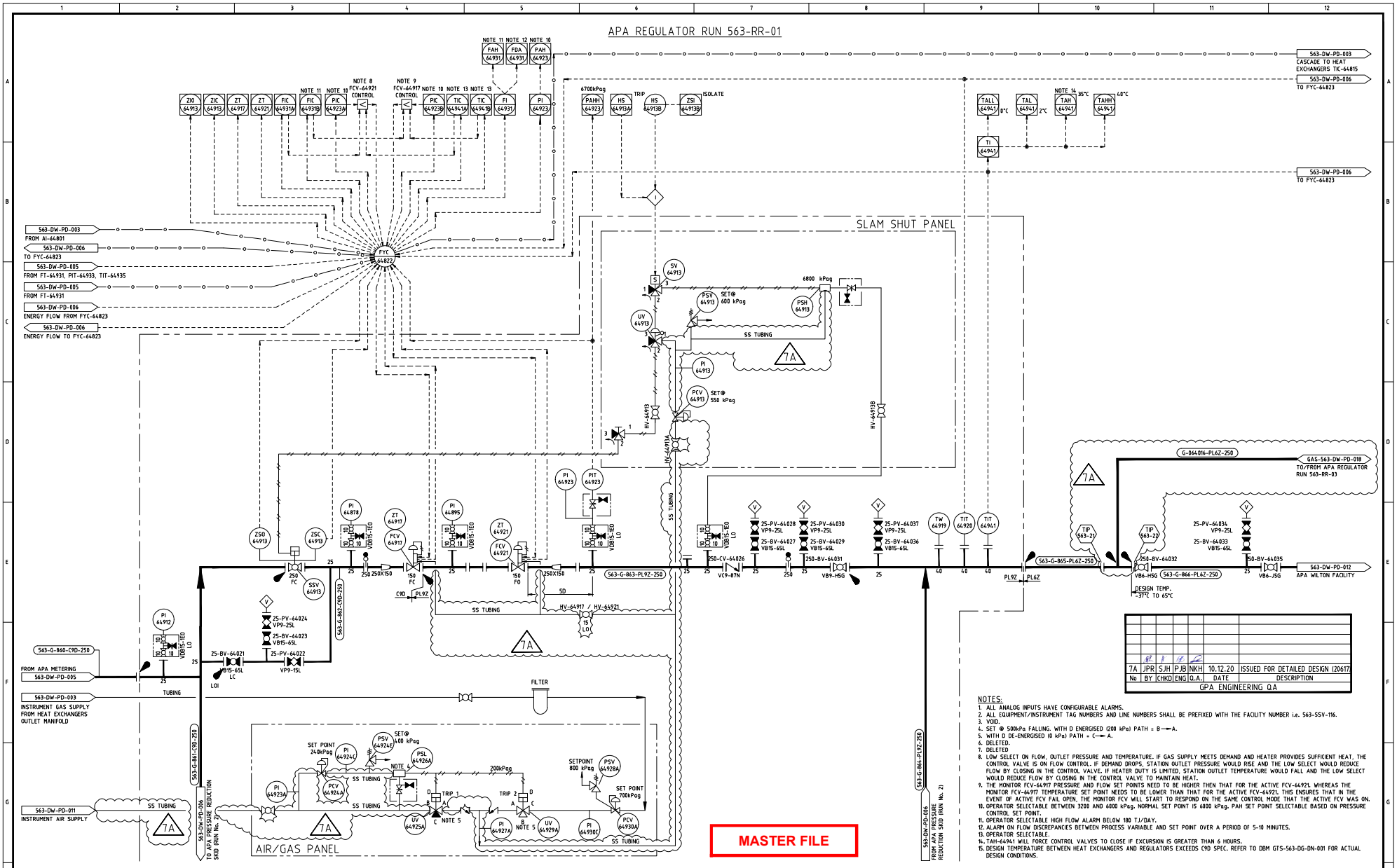
WILTON METER STATION
CONNECTION TO APA
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT
DESIGN	SCALE N.T.S.	
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER	REV. 2C
DATE	563-DW-PD-012	

PD-510-DW-PD-003 | CONNECTION TO BI-DIRECTIONAL PIPELINE & FILTER/SEPARATOR
DRAWING No. | REFERENCE DRAWINGS



7A	10.12.20	JPR	SJH	PJB	NKH	10.12.20
No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION

ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

NOTES:
1. ALL ANALOG INPUTS HAVE CONFIGURABLE ALARMS.
2. ALL EQUIPMENT/INSTRUMENT TAG NUMBERS AND LINE NUMBERS SHALL BE PREFIXED WITH THE FACILITY NUMBER i.e. 563-SSV-116.
3. VOID.
4. SET @ 500kPa FALLING. WITH D ENERGISED (200 kPa) PATH = B⟷A.
5. WITH D DE-ENERGISED (0 kPa) PATH = C⟷A.
6. DELETED.
7. DELETED
8. LOW SELECT ON FLOW, OUTLET PRESSURE AND TEMPERATURE. IF GAS SUPPLY MEETS DEMAND AND HEATER PROVIDES SUFFICIENT HEAT, THE CONTROL VALVE IS ON FLOW CONTROL. IF DEMAND DROPS, STATION OUTLET PRESSURE WOULD RISE AND THE LOW SELECT WOULD REDUCE FLOW BY CLOSING IN THE CONTROL VALVE. IF HEATER DUTY IS LIMITED, STATION OUTLET TEMPERATURE WOULD FALL AND THE LOW SELECT WOULD REDUCE FLOW BY CLOSING IN THE CONTROL VALVE TO MAINTAIN HEAT.
9. THE MONITOR FCV-64917 PRESSURE AND FLOW SET POINTS NEED TO BE HIGHER THEN THAT FOR THE ACTIVE FCV-64921. WHEREAS THE MONITOR FCV-64917 TEMPERATURE SET POINT NEEDS TO BE LOWER THAN THAT FOR THE ACTIVE FCV-64921. THIS ENSURES THAT IN THE EVENT OF ACTIVE FCV FAIL OPEN, THE MONITOR FCV WILL START TO RESPOND ON THE SAME CONTROL MODE THAT THE ACTIVE FCV WAS ON.
10. OPERATOR SELECTABLE BETWEEN 3200 AND 6000 kPag. NORMAL SET POINT IS 6000 kPag. PAH SET POINT SELECTABLE BASED ON PRESSURE CONTROL SET POINT.
11. OPERATOR SELECTABLE HIGH FLOW ALARM BELOW 180 TJ/DAY.
12. ALARM ON FLOW DISCREPANCIES BETWEEN PROCESS VARIABLE AND SET POINT OVER A PERIOD OF 5-10 MINUTES.
13. OPERATOR SELECTABLE.
14. TAH-64941 WILL FORCE CONTROL VALVES TO CLOSE IF EXCURSION IS GREATER THAN 6 HOURS.
15. DESIGN TEMPERATURE BETWEEN HEAT EXCHANGERS AND REGULATORS EXCEEDS C9D SPEC. REFER TO DBM GTS-563-DG-DN-001 FOR ACTUAL DESIGN CONDITIONS.

7A	10.12.20	ISSUED FOR DETAILED DESIGN (20617)	GPA		SJH		NKH		
7	07.12.18	SLAM SHUT SETPOINT CHANGE	EM		NS		IF/NS		
6	10.02.16	AS BUILT TO CLIENT MARK UPS	LC						
5	18.01.16	AS BUILT TO CLIENT MARK UPS	JS						
4	01.09.15	REISSUED FOR CONSTRUCTION	JB		WW		AH		
3	13.08.15	REISSUED FOR CONSTRUCTION	JB		WW		AH		
2	21.07.15	REISSUED FOR CONSTRUCTION	JB		WW		AH		
1	13.02.15	REISSUED FOR CONSTRUCTION	JB		WW		AH		
0	12.12.14	ISSUED FOR CONSTRUCTION	JB		WW		AH		
REV	DATE	DESCRIPTION	DRAWN		CHECKED		APPRV		CLIENT

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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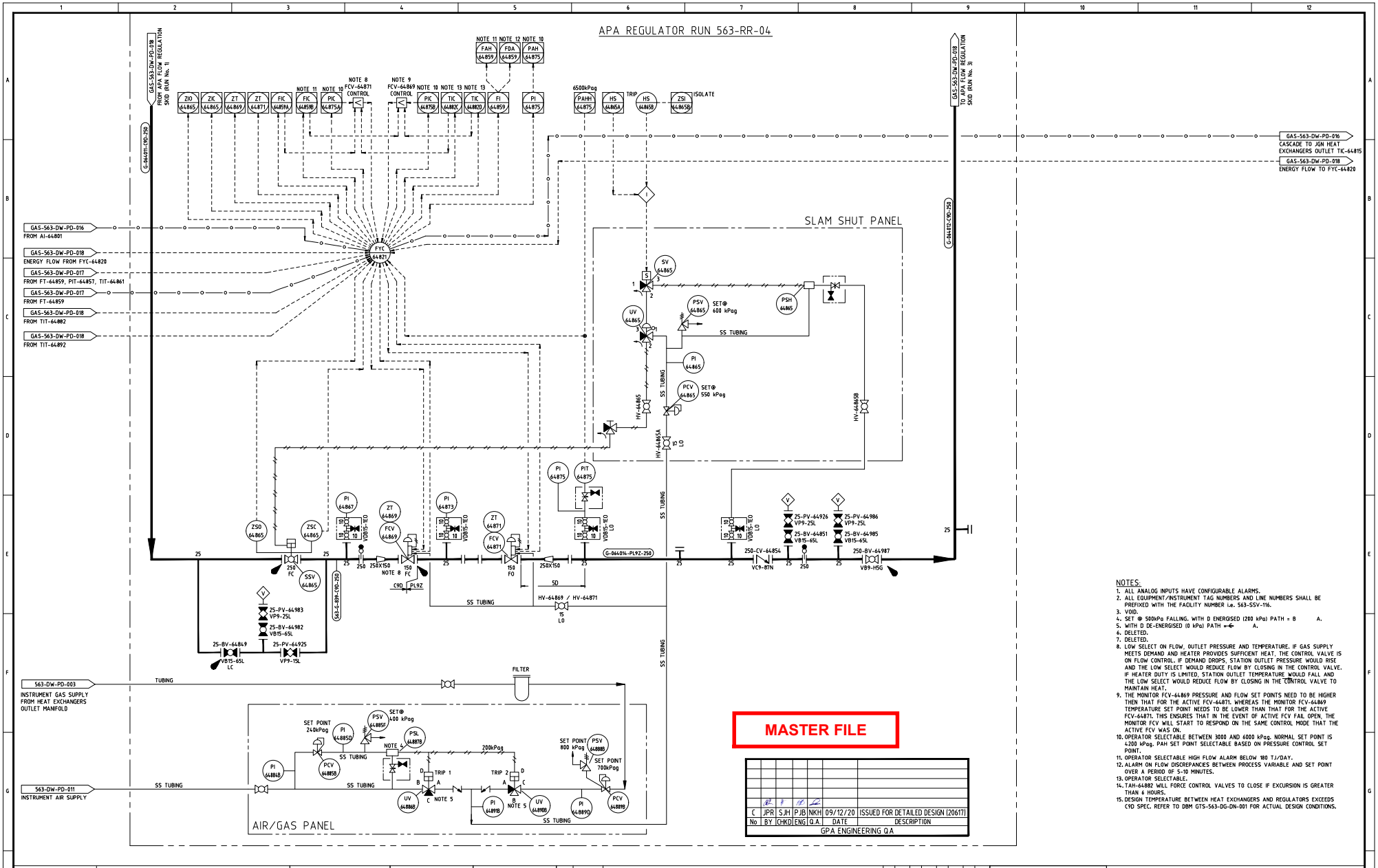
APA PRESSURE REDUCTION SKID (RUN No 1)
PIPING AND INSTRUMENT DIAGRAM

DRAWN	FACILITY	SUBJECT	
DESIGN	SCALE N.T.S.		
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV 7A
DATE	GAS-563-DW-PD-007		



NOTES:

1. ALL ANALOG INPUTS HAVE CONFIGURABLE ALARMS.
2. ALL EQUIPMENT/INSTRUMENT TAG NUMBERS AND LINE NUMBERS SHALL BE PREFIXED WITH THE FACILITY NUMBER i.e. 563-SSV-116.
3. VOID.
4. SET @ 500kPa FALLING. WITH D ENERGISED (280 kPa) PATH = B A.
5. WITH D DE-ENERGISED (0 kPa) PATH = A.
6. DELETED.
7. DELETED.
8. LOW SELECT ON FLOW, OUTLET PRESSURE AND TEMPERATURE. IF GAS SUPPLY MEETS DEMAND AND HEATER PROVIDES SUFFICIENT HEAT, THE CONTROL VALVE IS ON FLOW CONTROL. IF DEMAND DROPS, STATION OUTLET PRESSURE WOULD RISE AND THE LOW SELECT WOULD REDUCE FLOW BY CLOSING IN THE CONTROL VALVE. IF HEATER DUTY IS LIMITED, STATION OUTLET TEMPERATURE WOULD FALL AND THE LOW SELECT WOULD REDUCE FLOW BY CLOSING IN THE CONTROL VALVE TO MAINTAIN HEAT.
9. THE MONITOR FCV-64869 PRESSURE AND FLOW SET POINTS NEED TO BE HIGHER THEN THAT FOR THE ACTIVE FCV-64871. WHEREAS THE MONITOR FCV-64869 TEMPERATURE SET POINT NEEDS TO BE LOWER THAN THAT FOR THE ACTIVE FCV-64871. THIS ENSURES THAT IN THE EVENT OF ACTIVE FCV FAIL OPEN, THE MONITOR FCV WILL START TO RESPOND ON THE SAME CONTROL MODE THAT THE ACTIVE FCV WAS ON.
10. OPERATOR SELECTABLE BETWEEN 3000 AND 6000 kPag. NORMAL SET POINT IS 4200 kPag. PAH SET POINT SELECTABLE BASED ON PRESSURE CONTROL SET POINT.
11. OPERATOR SELECTABLE HIGH FLOW ALARM BELOW 180 TJ/DAY.
12. ALARM ON FLOW DISCREPANCIES BETWEEN PROCESS VARIABLE AND SET POINT OVER A PERIOD OF 5-10 MINUTES.
13. OPERATOR SELECTABLE.
14. TAH-64882 WILL FORCE CONTROL VALVES TO CLOSE IF EXCURSION IS GREATER THAN 6 HOURS.
15. DESIGN TEMPERATURE BETWEEN HEAT EXCHANGERS AND REGULATORS EXCEEDS C9D SPEC. REFER TO DBM GTS-563-DG-DN-001 FOR ACTUAL DESIGN CONDITIONS.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	JPR	SJH	PJB	NKH	09/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A.

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	09/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA		SJH	NKH
B	04/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	NKH
A	22/09/20	ISSUED FOR REVIEW (20617)	GPA			

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L ABN 15 068 570 847
Jemena EGP(2) P/L ABN 77 006 919 115

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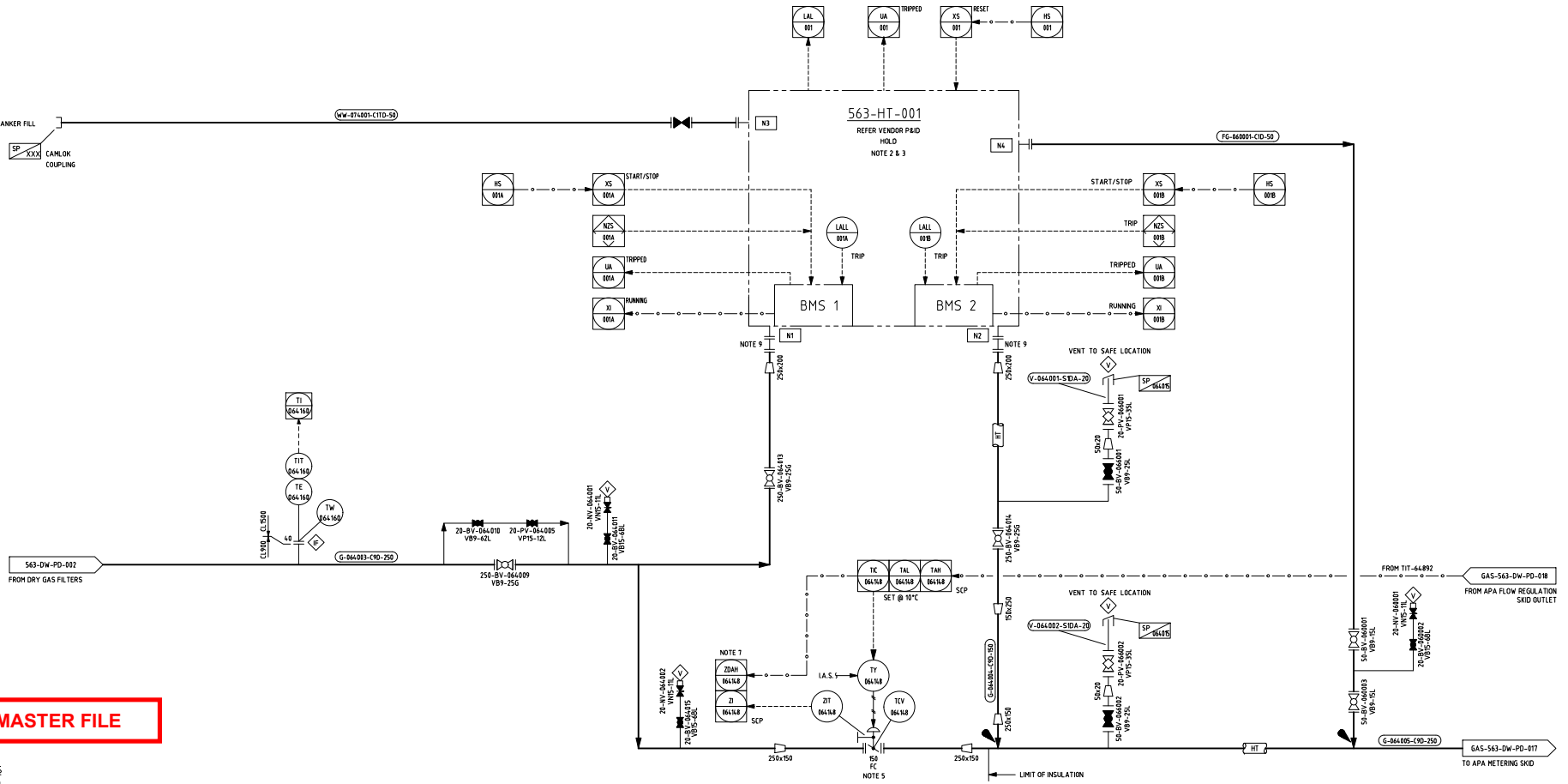
WILTON METER STATION
APA FLOW REGULATION (RUN No. 4)
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT	
DESIGN	SCALE	N.T.S.	
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV
DATE	GAS-563-DW-PD-015		C

563-HT-001

WATER BATH HEATER
DESIGN: 14,895 kPag @ VTA
OPERATING: 4,800 TO 14,000 kPag @ 10°C TO 35°C
RATING: HOLD kW
DESIGN DUTY: HOLD kW
FLOW: 200 TJ/hr



NOTES

1. DELETED.
2. WATER BATH HEATER SHALL BE DESIGNED TO MINIMISE WATER LOSS BY EVAPORATION.
3. WATER BATH SHALL BE ADEQUATELY VENTED TO PREVENT PRESSURISATION SHOULD IT BOIL DUE TO INSTRUMENT TRIP FAILURE.
4. DELETED.
5. MANUAL OVERRIDE FURNISHED ON THE ACTUATOR.
6. DELETED.
7. DISCREPANCY ALARM.
8. DELETED.
9. DROP OUT SPOOL FOR WATER BATH HEATER PROCESS BUNDLE REMOVAL.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	JPR	SJH	PJB	NKH	09/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	09/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
B	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
A	22/09/20	ISSUED FOR REVIEW (20617)	GPA			

DRAWING No. | REFERENCE DRAWINGS

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Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
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Jemena EGP(1) P/L
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Jemena EGP(2) P/L
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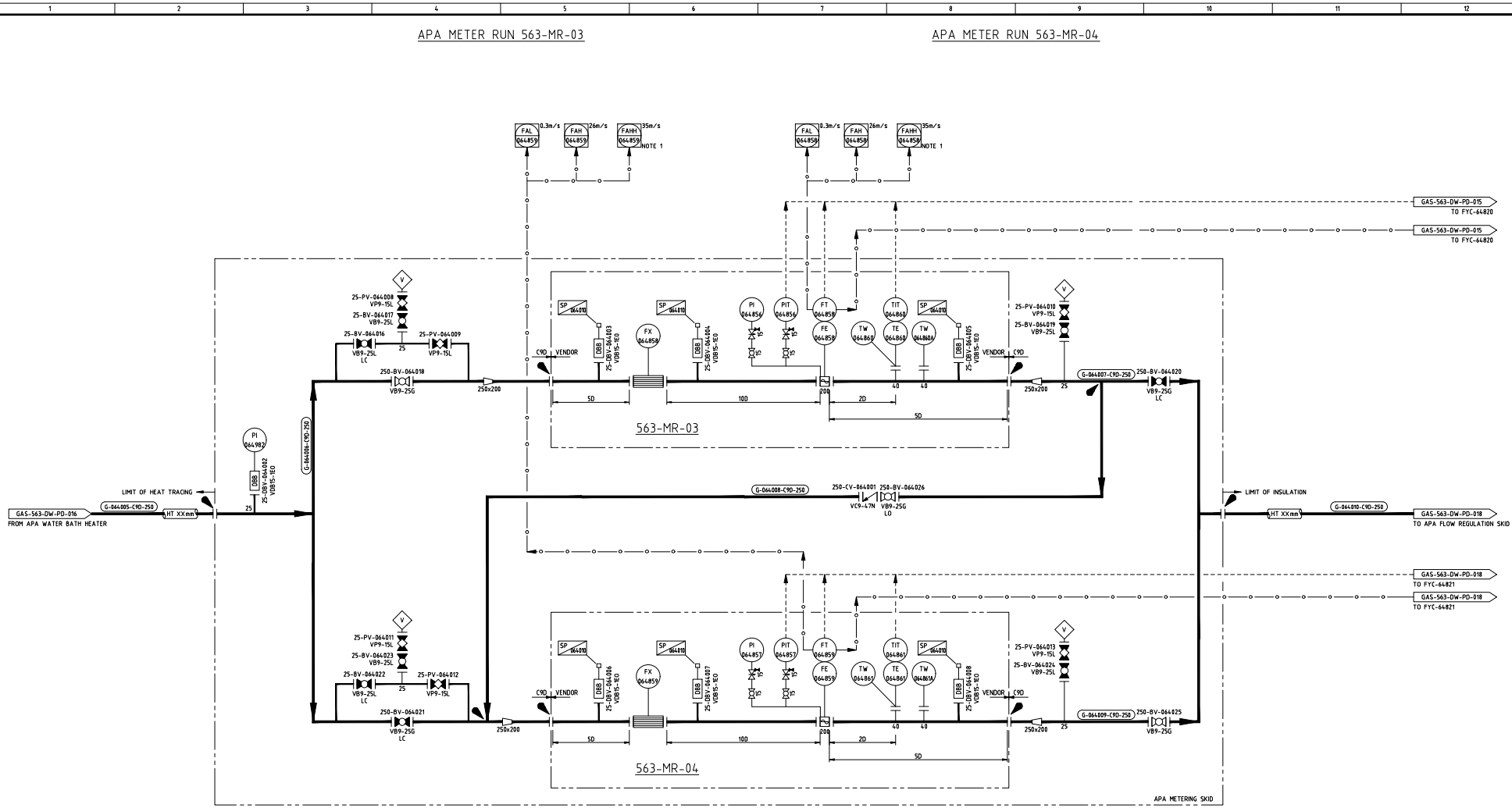
WILTON METER STATION
APA WATER BATH HEATER
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT
DESIGN	SCALE N.T.S.	
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER	REV
DATE	GAS-563-DW-PD-016	C



MASTER FILE

NOTES:
1. HIGH FLOW WILL TRIP INLET SLV-64800 AFTER 30 CONTINUOUS SECONDS.
2. DESIGN TEMPERATURE BETWEEN HEAT EXCHANGERS AND REGULATORS EXCEEDS C9D SPEC. REFER TO DBM GTS-563-DG-DN-001 FOR ACTUAL DESIGN CONDITIONS.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	JPR	SJH	PJB	NKH	09/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	09/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	JPR	SJH	NKH	
B	04/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	NKH	
A	17/09/20	ISSUED FOR REVIEW (20617)	GPA				

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
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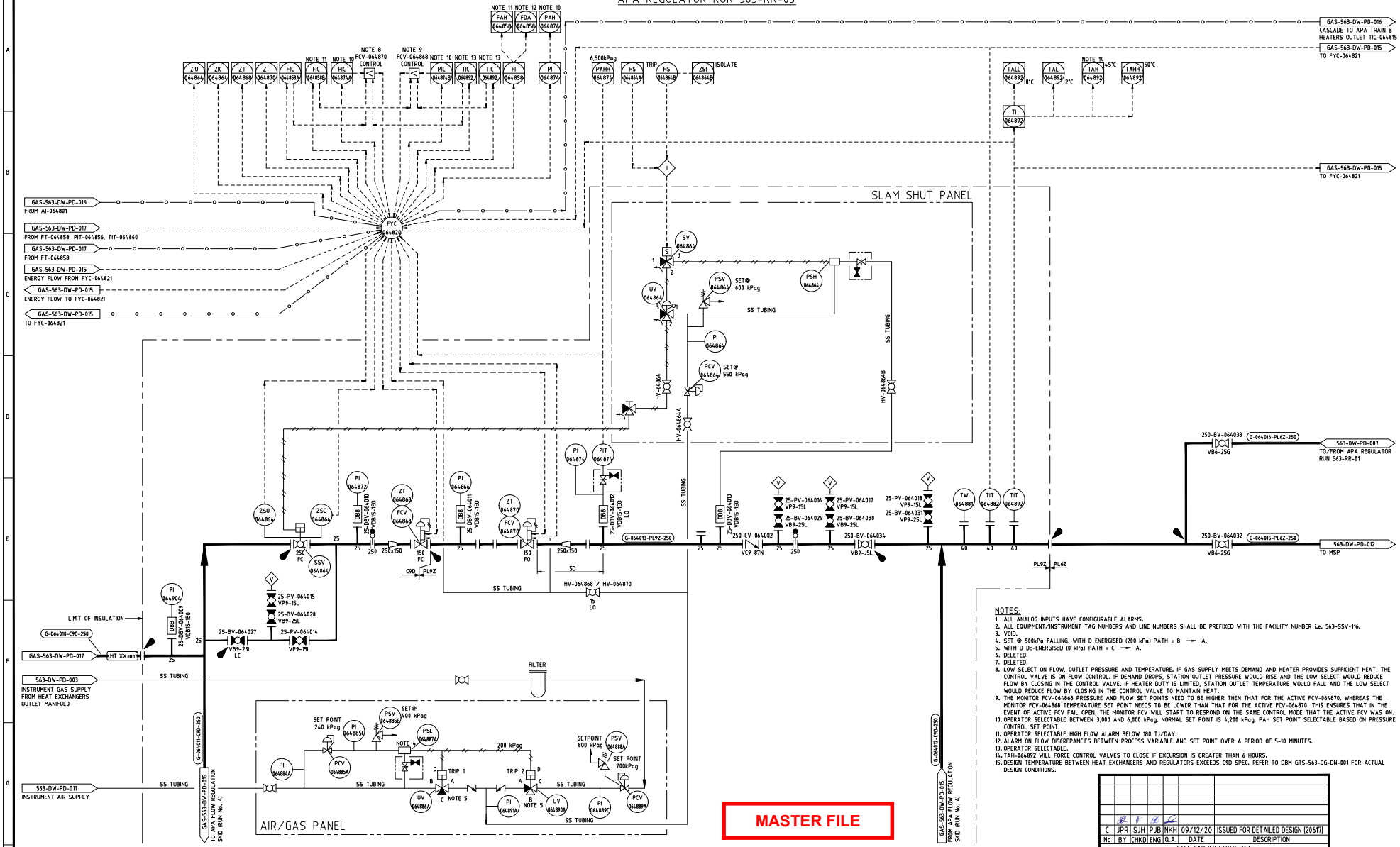
WILTON METER STATION
APA FLOW METERING
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT	
DESIGN	SCALE N.T.S.		
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV
DATE	GAS-563-DW-PD-017		C



NOTES:

1. ALL ANALOG INPUTS HAVE CONFIGURABLE ALARMS.
2. ALL EQUIPMENT/INSTRUMENT TAG NUMBERS AND LINE NUMBERS SHALL BE PREFIXED WITH THE FACILITY NUMBER i.e. 563-SSV-116.
3. VOID.
4. SET @ 500kPa FALLING. WITH D ENERGISED (200 kPa) PATH = B ⟶ A.
5. WITH D DE-ENERGISED (0 kPa) PATH = C ⟶ A.
6. DELETED.
7. DELETED.
8. LOW SELECT ON FLOW, OUTLET PRESSURE AND TEMPERATURE. IF GAS SUPPLY MEETS DEMAND AND HEATER PROVIDES SUFFICIENT HEAT, THE CONTROL VALVE IS ON FLOW CONTROL. IF DEMAND DROPS, STATION OUTLET PRESSURE WOULD RISE AND THE LOW SELECT WOULD REDUCE FLOW BY CLOSING IN THE CONTROL VALVE. IF HEATER DUTY IS LIMITED, STATION OUTLET TEMPERATURE WOULD FALL AND THE LOW SELECT WOULD REDUCE FLOW BY CLOSING IN THE CONTROL VALVE TO MAINTAIN HEAT.
9. THE MONITOR FCV-064868 PRESSURE AND FLOW SET POINTS NEED TO BE HIGHER THEN THAT FOR THE ACTIVE FCV-064870. WHEREAS THE MONITOR FCV-064868 TEMPERATURE SET POINT NEEDS TO BE LOWER THAN THAT FOR THE ACTIVE FCV-064870. THIS ENSURES THAT IN THE EVENT OF ACTIVE FCV FAIL OPEN, THE MONITOR FCV WILL START TO RESPOND ON THE SAME CONTROL MODE THAT THE ACTIVE FCV WAS ON.
10. OPERATOR SELECTABLE BETWEEN 3,000 AND 6,000 kPag. NORMAL SET POINT IS 4,200 kPag. PAH SET POINT SELECTABLE BASED ON PRESSURE CONTROL SET POINT.
11. OPERATOR SELECTABLE HIGH FLOW ALARM BELOW 190 TJ/DAY.
12. ALARM ON FLOW DISCREPANCIES BETWEEN PROCESS VARIABLE AND SET POINT OVER A PERIOD OF 5-10 MINUTES.
13. OPERATOR SELECTABLE.
14. TAH-064892 WILL FORCE CONTROL VALVES TO CLOSE IF EXCURSION IS GREATER THAN 6 HOURS.
15. DESIGN TEMPERATURE BETWEEN HEAT EXCHANGERS AND REGULATORS EXCEEDS C9D SPEC. REFER TO DBM GTS-563-DG-DN-001 FOR ACTUAL DESIGN CONDITIONS.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	JPR	SJH	PJB	NKH	09/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING QA

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	09/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	JPR	SJH	NKH
B	04/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	NKH
A	17/09/20	ISSUED FOR REVIEW (20617)	GPA			

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
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Jemena EGP(2) P/L
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WILTON METER STATION
APA FLOW REGULATION SKID (RUN No. 3)
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT
DESIGN	SCALE N.T.S.	
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER	REV
DATE	GAS-563-DW-PD-018	C

APPENDIX 4

GPA ENGINEERING	Document Title	*HAZOP Number*
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		Various (see below)

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	14/01/21	**Client Project #:**	Project Marlin: EGP Reversal
Node:	6, 7, 8, 11	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By	P&ID Updated
		Cause	Consequence				
6.1	HIGH FLOW	Large differential pressure across switching valves, opening of SDV-64104	Damage to SDVs	Equalisation line and UV-64109 to be used reduce differential pressure across SDVs / station prior to mode change.	Add DP interlocks across all flow switching valves, DP permissive to be set at 500 kPa. DP interlock to be between PIT-64107 & PIT-64103, with DP in either direction.	**1**	**GAS-530-DW-PD-020(C), PDAH-064107 added.**
6.20	ISOLATION	Isolation and venting of new switching valve piping	Requirement for venting		Provide manual vents on switching valve piping.	**1**	**GAS-530-DW-PD-020(C)**
8.5	ZERO FLOW / EMPTY	Compressor not running, MLV-1 closed	No flow in line, build-up of DP		Add differential pressure transmitter such that MLV-1 does not open until DP in either direction is very low	**1**	**GAS-530-DW-PD-018(4C), PDIT-064111 added.**
11.16	PLANT ITEM OPERABILITY	Refer NODE 6			UV-64110 to be FL, double acting gas-over-oil MLV similar to MLV-7, IG to be taken from pipeline side of MLV.	**1**	**525-PI-001(3C), UV-64110 & MLV-7 changed to MLV-7 & MLV-7A respectively.**
11.16	PLANT ITEM OPERABILITY	Refer NODE 6			Re-tag UV-64110 to MLV-7	**1**	**525-PI-001(3C)**
11.16	PLANT ITEM OPERABILITY	Refer NODE 6			Re-tag MLV-7 to MLV-7A	**1**	**525-PI-001(3C)**

11.23	CORRECT LOCATION OF INSTRUMENTS	GC take-off is located in the dead leg adjacent to UV-64110	Loss of effective GC monitoring of gas composition		Move GC tapping point 25-BV-64006 to main flow path piping adjacent to TIP-525-04	**1**	**525-PI-001(3C)**

DISCUSSION AND RECOMMENDATION

All HAZOP actions documented on this close out sheet have been completed with required P&ID updates included in “Issued for Design” revisions as documented above.

ACTION TAKEN / CLOSE OUT COMMENTS

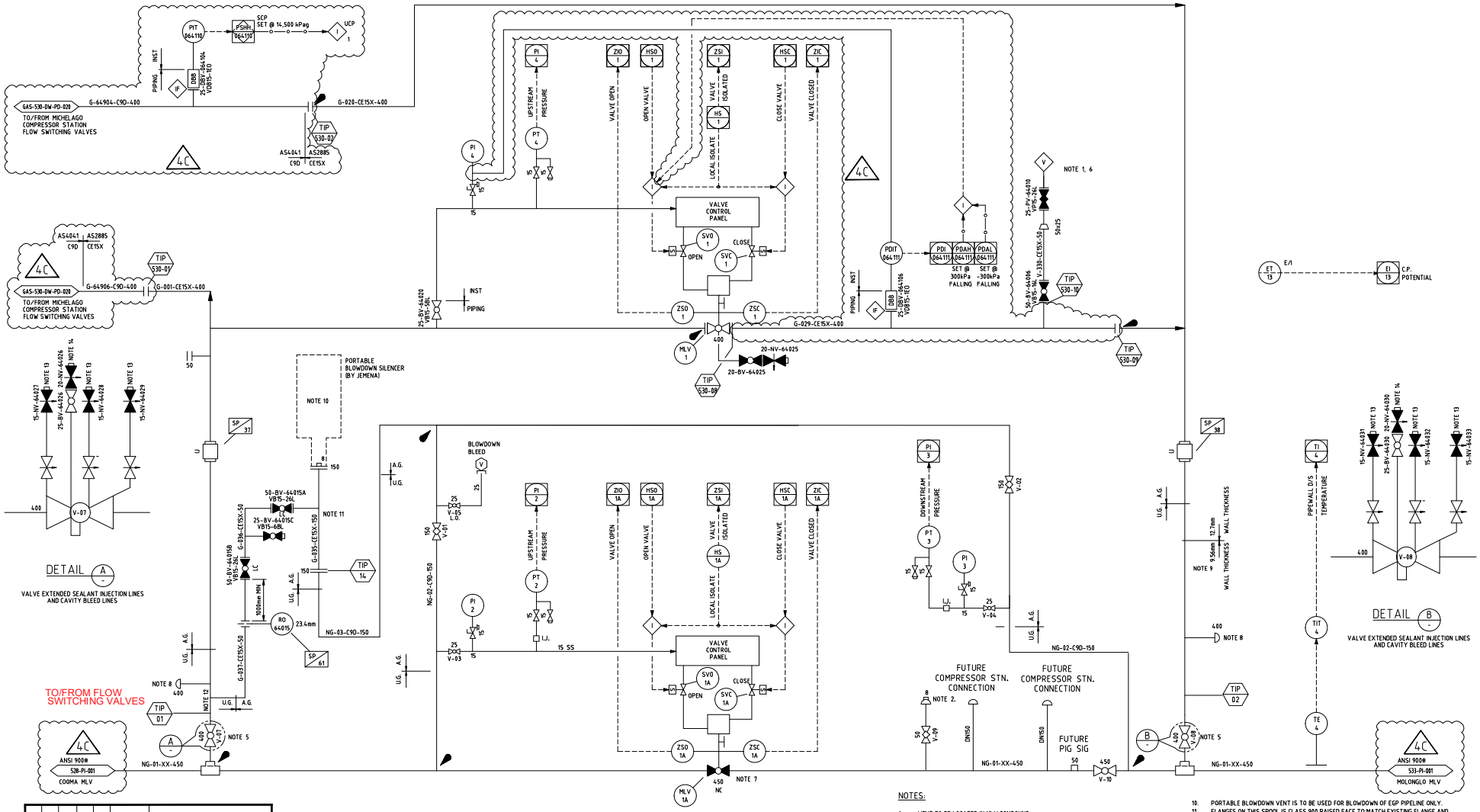
All actions are considered closed by the P&ID changes.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: pp Alf Sanzo **Date:** 12/02/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 13:56:53 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21



4C	JPR	SJH	PJB	NKH	04.12.20	ISSUED FOR DETAILED DESIGN (20617)
No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION

GPA ENGINEERING QA

MASTER FILE

NOTES:

1. VENT TO BE LOCATED IN MLV COMPOUND.
2. BLOWDOWN & FUTURE TAKE-OFFS PURGE VALVES.
3. DELETED.
4. HIGH INTEGRITY NON SLAM CHECK VALVE.
5. EXISTING VALVE TO BE FITTED WITH EXTENDED STEM FOR EXTENSION TO ABOVE GROUND.
6. VENT TO BE IMPACT TESTED TO -80°C.
7. EXISTING MLV AND ALL ASSOCIATED INSTRUMENT TAGS CHANGED FROM MLV-1 TO MLV-1A.
8. FUTURE PIPELINE LOOPING
9. ALL ABOVE GROUND LINE PIPES TO BE 12.7mm THICKNESS (HEAVY WALL). BELOW GROUND LINE PIPES TO BE 9.56mm THICKNESS (STANDARD WALL). TRANSITION FROM HEAVY WALL TO STANDARD WALL BELOW GROUND, 6m FROM AG/UG TRANSITION.
10. PORTABLE BLOWDOWN VENT IS TO BE USED FOR BLOWDOWN OF EGP PIPELINE ONLY.
11. FLANGES ON THIS SPOOL IS CLASS 900 RAISED FACE TO MATCH EXISTING FLANGE AND PORTABLE VENT.
12. USE 3M OF HEAVY WALL PIPE AT THE INJECTION POINT.
13. SEALANT INJECTION LINE COMPLETE WITH SEALANT INJECTION FITTING
14. CAVITY BLEED LINE; EXISTING CAVITY BLEED VALVE TO BE REMOVED AND REPLACED BY ABOVE GROUND VALVES.

960-DW-PD-001 P&ID STANDARD SYMBOLS & ABBREVIATIONS

DRAWING No. REFERENCE DRAWINGS

ASSET MANAGER
Jemena
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ABN 52 104 352 650

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
4C	04.12.20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
4B	23.10.20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
4A	15.09.20	ISSUED FOR REVIEW (20617)	GPA	PJB		
4	19.01.16	AS BUILT	MRM	JW		
3	10.06.15	RE-ISSUED FOR CONSTRUCTION	HWI	JW		
2	13.03.15	RE-ISSUED FOR CONSTRUCTION	SLA	NH		
1	18.12.14	ISSUED FOR CONSTRUCTION	SLA	NH		
0	25.07.14	ISSUED FOR DESIGN	SLA	NH		

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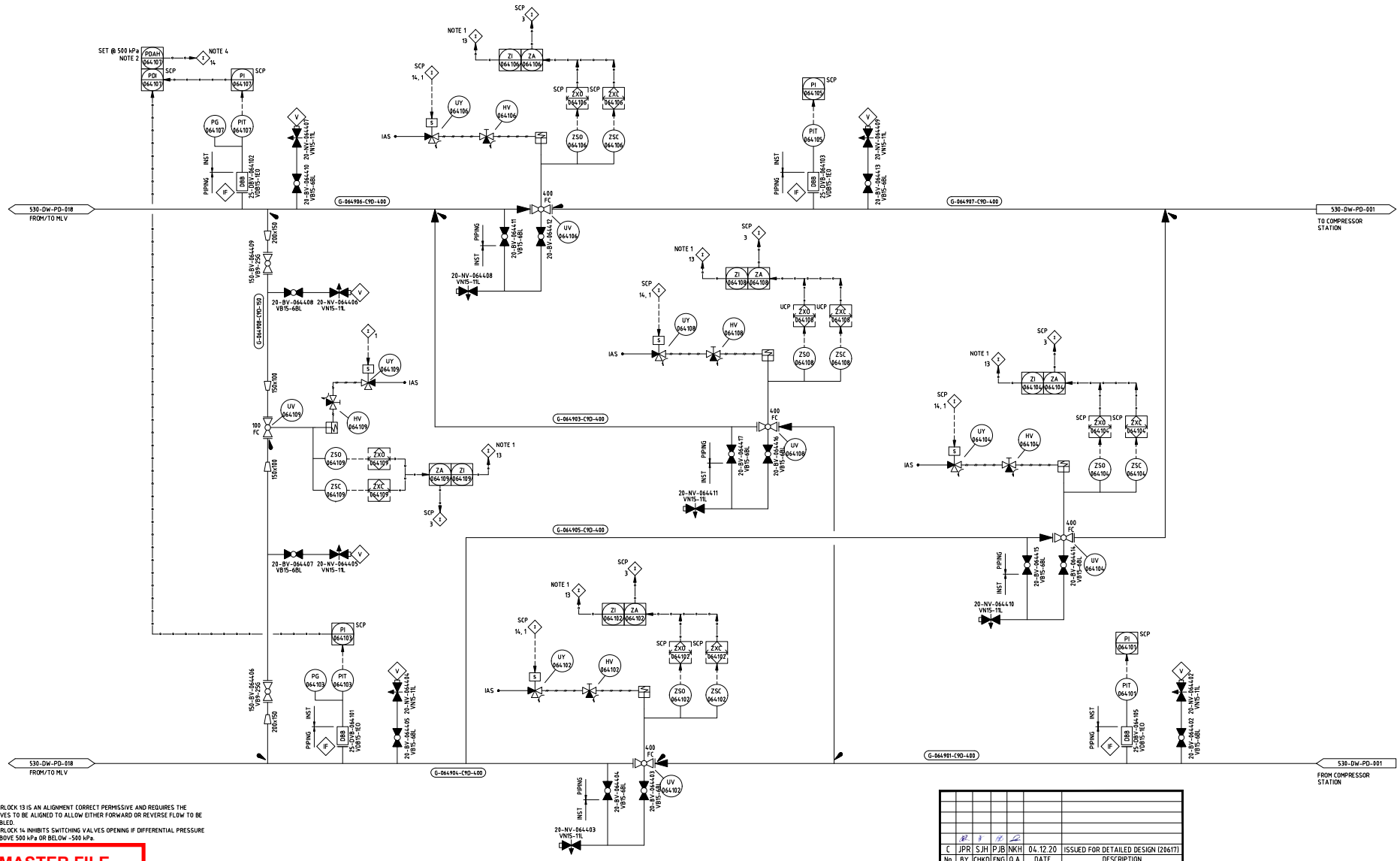
MICHELAGO COMPRESSOR STATION
MAINLINE VALVE
PIPING AND INSTRUMENTATION DIAGRAM

DRAWN	SGP	FACILTY	SUBJECT
DESIGN		SCALE	Scale
CHECKED	CS	SUPERSEDES	A1
APPROVED	KM	DRAWING NUMBER	530-DW-PD-018 REV 4C
DATE	18.04.20		



NOTES:

1. INTERLOCK 13 IS AN ALIGNMENT CORRECT PERMISSIVE AND REQUIRES THE VALVES TO BE ALIGNED TO ALLOW EITHER FORWARD OR REVERSE FLOW TO BE ENABLED.
2. INTERLOCK 14 INHIBITS SWITCHING VALVES OPENING IF DIFFERENTIAL PRESSURE IS ABOVE 500 kPa OR BELOW -500 kPa.

MASTER FILE

No.	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	JPR	SJH	PJB	NKH	04.12.20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	04.12.20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
B	22.10.20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
A	16.09.20	ISSUED FOR REVIEW (20617)	GPA	PJB		

960-DW-PD-001 P&ID STANDARD SYMBOLS & ABBREVIATIONS

DRAWING No. REFERENCE DRAWINGS

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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CONSULTANT

GPA

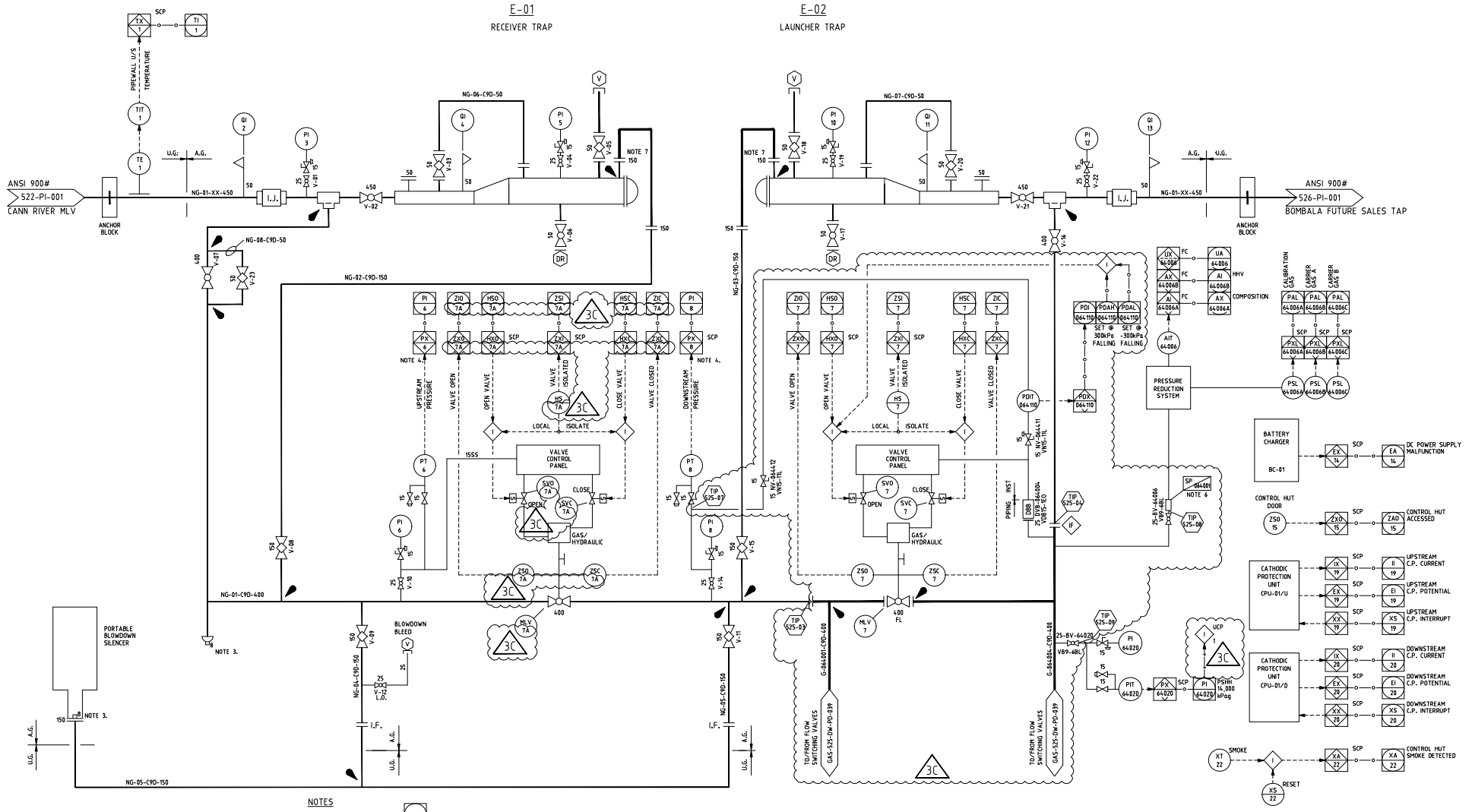
www.gpaeng.com.au

MICHELAGO COMPRESSOR STATION
FLOW SWITCHING VALVES
PIPING AND INSTRUMENTATION DIAGRAM

-

DRAWN	GPA		
DESIGN	-	SCALE	N/A
CHECKED	-	SUPERSEDES	-
APPROVED	-	DRAWING NUMBER	GAS-530-DW-PD-020
DATE	16.09.20		REV C

A1



NOTES

1. ALL SYMBOLS SHOWN ◯ ARE LOCAL OR REMOTE OPERATOR ACCESS.
2. ALL EQUIPMENT/INSTRUMENT TAG NUMBERS AND LINE NUMBERS SHALL BE PREFIXED WITH THE FACILITY NUMBER i.e. 525-PT-2.
3. BLOWDOWN PURGE VALVE.
4. PIPELINE PRESSURE INPUTS HAVE ADJUSTABLE ALARMS CONFIGURED AS SHOWN:
   PAHH (kPa)
   PAH (kPa)
   PAL (kPa)
   PALL (kPa)
   PDAHH (RATE OF CHANGE IN kPa/sec)
   SET POINTS TO BE DETERMINED IN OPERATIONS AND ADJUSTED AS REQUIRED.
5. PIPELINE LINE NUMBER IS NG-01-XX-450 FOR "XX" - REFER TO PROJECT TECHNICAL SPECIFICATIONS.
6. RETRACTABLE WELKER SAMPLE PROBE.
7. FLANGE CONNECTIONS FOR TEMPORARY BYPASS SPOOL. FOR TEMPORARY CONDITION REFER P&ID GTS-525-DW-PD-038

MASTER FILE

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
3C	JPR	SJH	PJB	NKH	04/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
3C	04/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
3B	15/09/20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
3A	15/09/20	ISSUED FOR REVIEW (20617)	GPA		SLH	
3	30/06/08	AS BUILT				
2	07/03/08	RE-ISSUED FOR CONSTRUCTION	SMR		CJS	DSY
1	07/02/08	RE-ISSUED FOR CONSTRUCTION	SMR		JM	DSY
0	20/12/07	ISSUED FOR CONSTRUCTION	SMR		PWF	DSY

ASSET MANAGER
Jemena
Produced by Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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CONSULTANT
GPA
www.gpaeng.com.au

MILA SCRAPER STATION & MLV
INTERMEDIATE SCRAPER STATION
PIPING AND INSTRUMENT DIAGRAM

DRAWN	J.SHAFIQ	FACILITY	SUBJECT
DESIGN	C.SMITH	SCALE	NTS
CHECKED	D.YOUNG	SUPERSEDES	A1
APPROVED	P.FARRER	DRAWING NUMBER	REV
DATE	20/12/07	525-PI-001	3C

960-DW-PD-001 P&ID STANDARD SYMBOLS & ABBREVIATIONS
DRAWING No. REFERENCE DRAWINGS

APPENDIX 5

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		1.1

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	1	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
1.1	HIGH FLOW	Low pressure in EGP caused by supply interruption.	Potential FIV (flow induced vibration) on thermowells and metering equipment due may result in unmetered gas.	Flow control on FSRU	Confirm the lowest pressure possible in the EGP and ensure it is included in design conditions for all equipment and in the heat mass balance table.	**1**

DISCUSSION AND RECOMMENDATION

Stephen Turville, Senior Capacity Planning Engineer for Jemena confirms that a minimum pressure of 8 Mpag is an acceptable low pressure design limit. (Email 20617-R582)

ACTION TAKEN / CLOSE OUT COMMENTS

Operating envelope used for design had a minimum pressure of 8 MPag. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 8/2/21

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 13:29:46 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

Dylan Falls

From: Young, David <dsy@enscope.com.au>
Sent: Friday, 4 December 2020 10:55 AM
To: Peter Blyton; Simon Hanlin
Subject: 20617-R852: FW: Project Marlin - HAZOP Action Close outs

FYI

Regards,

David Young
Principal Engineer

ENSCOPE
A QUANTA SERVICES COMPANY

7/50 Oxford Close, West Leederville WA 6007
T +61 (0)8 6229 6500 **E** dsy@enscope.com.au
M +61 (0)427 277 369 **W** www.enscope.com.au

// **development . engineering . management . completions**

From: Stephen Turville <Stephen.Turville@jemena.com.au>
Sent: Wednesday, 2 December 2020 8:35 AM
To: Young, David <dsy@enscope.com.au>; Michael Peoples <Michael.Peoples@jemena.com.au>
Cc: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Stephen Chow <steven.chow@jemena.com.au>
Subject: RE: Project Marlin - HAZOP Action Close outs

[EXTERNAL]

Dave/Mike

4. Yes agree that we will need some form of backpressure loop or override on high pressure from the southern side to avoid low temp problems unless is there a temp loop for low temp on discharge?

11. It depends on what the design min is used for… There is nothing wrong with Kembla being less than 8MPag, it will just reduce capacity, ideally we want to operate it between 8 – 9MPag, but it shouldn't be considered a hard limit. If it is just to size things, then 8Mpag is fine for that basis.

Regards
Stephen Turville
Senior Capacity Planning Engineer
Jemena
Level 14, 99 Walker Street, North Sydney, NSW 2060
(02) 9867 7322 | 0437 541 877
stephen.turville@jemena.com.au | www.jemena.com.au
www.gonaturalgas.com.au

Natural Gas Jemena bringing energy to life

From: Young, David <dsy@enscope.com.au>
Sent: Wednesday, 2 December 2020 10:50 AM
To: Michael Peoples <Michael.Peoples@jemena.com.au>
Cc: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Stephen Chow <steven.chow@jemena.com.au>; Stephen Turville <Stephen.Turville@jemena.com.au>
Subject: RE: Project Marlin - HAZOP Action Close outs

GPA ENGINEERING	Document Title	*HAZOP Number*
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		1.3

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	1	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
1.3	HIGH FLOW	High flow in pig receiver – during pigging operations (pigging is for integrity inspections only, will occur at a low frequency).	High flow in the kicker line, potential damage of pipe due to flow induced vibration.	Pigging procedures will specify a flow rate to ensure max velocity (nominally 50 m/s) in kicker line is not exceeded.	Pig kicker line to be included in line sizing calculation with a velocity sizing limit of 50 m/s.	**1 / SJH**

DISCUSSION AND RECOMMENDATION

The size of the kicker line was increased from DN100 to DN200. The gas velocity in the DN200 line was calculated to be 31 m/s based on a gas flow rate equivalent to a typical pig velocity of 6 m/s in the pipeline, meeting the velocity sizing limit of 50 m/s.

ACTION TAKEN / CLOSE OUT COMMENTS

Line sizing calculation updated to include kicker line, refer GAS-557-CA-PS-001(0).

Kicker line size increased to DN200, refer to P&ID GAS-557-DW-PD-001(C) line number G-064003-C9D-200.

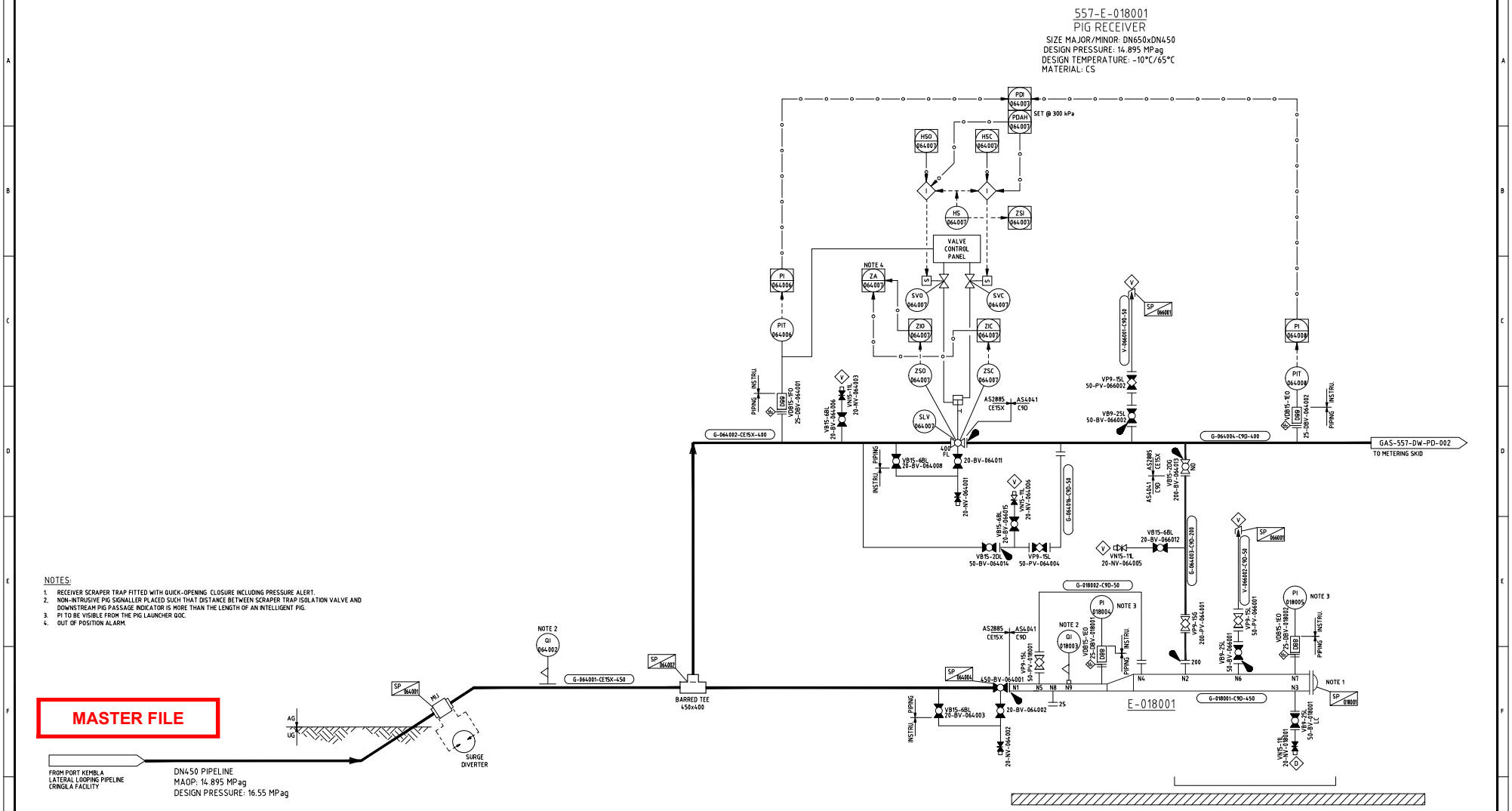
Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 8/02/21

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=reyrilaservices, OU=Quanta International, OU=Australia, OU=Employee, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 10:31:41 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21



NOTES:

1. RECEIVER SCRAPER TRAP FITTED WITH QUICK-OPENING CLOSURE INCLUDING PRESSURE ALERT.
2. NON-INTRUSIVE PIG SIGNALLER PLACED SUCH THAT DISTANCE BETWEEN SCRAPER TRAP ISOLATION VALVE AND DOWNSTREAM PIG PASSAGE INDICATOR IS MORE THAN THE LENGTH OF AN INTELLIGENT PIG.
3. PI TO BE VISIBLE FROM THE PIG LAUNCHER QOC.
4. OUT OF POSITION ALARM.

MASTER FILE

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	AV	SJH	PJB	NKH	04/12/20	ISSUED FOR DETAILED DESIGN

GPA ENGINEERING Q.A

ISSUED FOR REVIEW

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	04/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
B	27/10/20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA			

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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KEMBLA GRANGE METER STATION
PIG RECEIVER
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILITY	SUBJECT
DESIGN	PJB	SCALE	N.T.S.
CHECKED	SJH	SUPERSEDES	A1
APPROVED	NKH	DRAWING NUMBER	REV
DATE	27/10/20	GAS-557-DW-PD-001	C

APPENDIX 7

GPA ENGINEERING	Document Title	*HAZOP Number*
	HAZOP Closeout Sheet	*GAS-599-RP-HZ-003*
		Item Number
		18.24

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	18	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
18.24	ISOLATION	Bleed is not available between the ball and the plug on the bypass line around BV-64875/64888	Not able to achieve DB&B		Add bleed point between ball and plug valve on pressurisation line around inlet isolation valves BV-64875/64888.	**1 / PJB**
					Change pressurisation line configuration to 2 ball valves and an orifice (with a bleed)	**1 / PJB**

DISCUSSION AND RECOMMENDATION

The required equipment isolations were initially defined by Jemena in the Design Review (refer GAS-599-MM-PM-001(A)) and further clarified post HAZOP by the Jemena Engineering Manager (Mike Peoples) to be as per the Jemena Piping Design Guide GTS-960-DG-PI-001 (refer Email 20617-R819). In accordance with the isolation philosophy defined in GTS-960-DG-PI-001 Section 10.1.2, Jemena have advised GPA that a single valve isolation is considered suitable for the water bath heater based on a maintenance frequency of greater than a year (refer JAM-RESTECHQ-000012).

This advice means that:

a) a double block and bleed arrangement and hence a bleed vent on the bypass line around BV-64875/64888 is not required and has not be added to the design.

b) a single ball valve for isolation and a plug valve for throttling are sufficient in the bypass line and this configuration has not been changed.

ACTION TAKEN / CLOSE OUT COMMENTS

No changes were made to the bypass line design as a result of these HAZOP actions per above discussion. Actions are considered closed out.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 10/2/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:41:06 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

Document Title	Document No. (Client / GPA)
Facilities FEED Stage 1 - Design Review Minutes	GAS-599-MM-PM-001
	N/A

Client Name	Jemena			Date	07/10/2020	By	DAF
Client Project No.	N/A	GPA Project No.	20617	Rev/ Status	A	Chkd	PJB / SG
Project Name	Project Marlin: EGP Reversal				IFI	QA	NKH

System	599 - General EGP Reconfig	Reviewed			Comments	Actions	Assigned to
P&ID No(s).		Yes	No	N/A			
1. Basis of Design / Process Overview							
- Is the project scope defined?		X			East Gippsland Compressor Station (EGCS) has to be removed from scope. Reverse flow compression at EGCS is not required due to the close proximity to LCS/Vic Hub.	Provide confirmation that EGCS has been removed from the facilities scope.	Jemena (Matthew Skaras)
- Are the applicable standards defined?							
- Are all the design and operating cases defined?							
- Are the process fluids defined ?(Composition, temperature, pressure,							
- Is the turndown and Turn up requirements defined? (Flowrates, pressures,							
- Site ambient conditions defined?							
- Are the battery limits defined and reasonable							
- Is the operating envelope fully defined?							
- Are pipe specifications appropriate?		X			From the EGP basis of design 500-RP-006, and EGP manual GTS-599-OM-GEN-001, it is understood that the EGP mainline is upgradeable to an MAOP of 16.55 MPag. All items (pipeline assemblies, pig traps, MLVs, valves, flanges etc) which cannot be isolated from the EGP are to be designed to 16.55 MPag, i.e. CL1500. Isolatable equipment remains CL900, with design pressure of 14.895 MPag. For this reason, the KGMS pig receiver, hot tap connection, and compressor station flow switching valves & piping have been designed using CL1500 piping specification CE15X. However it is noted that a number of EGP mainline equipment is not designed to 16.55 MPag, e.g. Mila pig traps, Kembla Grange MLV which are designed to Jemena specification C9D.	Jemena to complete a cost-benefit analysis of designing EGP connected equipment for a future upgrade design pressure of 16.55 MPag. Jemena to advise outcome of the cost-benefit analysis and confirm if piping and equipment should be designed to 16.55 MPag or 14.895 MPag design pressure. GPA to continue working as per the pipe specs shown on the P&ID until a decision is made.	Jemena (Matthew Skaras)
Control Valves							
- Is fail position shown and correct?							
- Is a bypass required and correctly sized?							
Actuated Valves							
- Are start-up pressuring bypasses required?							
- Is fail position shown and correct?							
2. Process Safety considerations							
- Are there overpressure risks, how will they be controlled?							
- Are there over temperature risks, how will they be controlled?							
- Has the venting requirements and location been considered							
- Are the environmental and societal impacts considered in the design							
3. Operations							
- How will equipment operate?							
- Are there different operating modes- has changeover been addressed?							
- Is equipment sparing consistent with sparing policy?							
- What valves and controls require operator access, how often?							
- What services are required - are they provided?							
4. Controls & Instrumentation							
- Are control schemes adequately defined?							
- How does overall flow and pressure control work?							
Has impact of Unit shutdown on other Units been addressed?							
- ESD shutdown Philosophy?							
5. Maintenance / Construction							
- What needs to be maintained, and how often?							
- Is there a venting/purging/draining philosophy?							
- Is isolation for maintenance adequate (consistent with isolation policy)?		X			The Isolation Philosophy to be applied: - Double block and bleed (DB&B) isolation, consisting of two separate block valves and bleed in between, is required for normal maintenance access (major equipment e.g. filter element change) - Single isolation is required for non-routine maintenance, e.g. flow meter removal.	Detail the isolation philosophy in the basis of design document.	GPA (Simon Hanlin)
- Isolations required for tie-in construction							
6. Layout							
- Existing services – underground and above ground				X	N/A - refer to location specific layouts.		
- What land / space is available and clear for use				X	N/A - refer to location specific layouts.		
- Access and maintainability, personnel access				X	N/A - refer to location specific layouts.		
- Egress routes				X	N/A - refer to location specific layouts.		
- Drainage, bulk earthworks requirements				X	N/A - refer to location specific layouts.		
- Geotech condition				X	N/A - refer to location specific layouts.		
- Vehicle access during ops				X	N/A - refer to location specific layouts.		
- Vehicle access during construction (cranes, trucks)				X	N/A - refer to location specific layouts.		

Simon Hanlin

From: Michael Peoples <Michael.Peoples@jemena.com.au>
Sent: Monday, 9 November 2020 5:05 PM
To: Lisa Hein
Cc: Sarah Greening
Subject: 20617-R819: 20617-S2153: Jemena Isolation Policy Guide

Hi Lisa

Yes pig traps have only one isolation valve. Pigging is on a frequency around 5-10 years.

I am the signoff for isolation arrangements, however as Matt says if the HAZOP takes into account the valving arrangements and they are as per the guide, then I do not need to approve them.

It would only be a completely new arrangement, or a scenario somehow outside normal application that I would need to approve.

Cheers

Mike

From: Lisa Hein <Lisa.Hein@gpaeng.com.au>
Sent: Monday, 9 November 2020 5:28 PM
To: Michael Peoples <Michael.Peoples@jemena.com.au>
Cc: Sarah Greening <sarah.greening@gpaeng.com.au>
Subject: 20617-S2153: RE: 20617-S2132: Jemena Isolation Policy Guide

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Thanks Mike,

For my clarity, does a double block and bleed apply to the pig receiver isolation or is a single valve isolation acceptable in this case? I have referred to the design review minutes but it doesn't appear to be mentioned in there. Are you the sign off authority for the valving isolation arrangement in Jemena?

Let me know and I can record in the minutes. Thanks

Lisa Hein
Senior Consultant - Risk and Advisory
BEng (Chem) (Hons) | MIChemE | RPEQ

GPA Engineering
121 Greenhill Road, Unley SA 5061
Dir 08 8299 8331 | **Mob** 0439 843 582 | **Ph** 08 8299 8300
E Lisa.Hein@gpaeng.com.au | **I** http://www.gpaeng.com.au/

From: Michael Peoples <Michael.Peoples@jemena.com.au>
Sent: Monday, 9 November 2020 4:48 PM
To: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Sarah Greening <sarah.greening@gpaeng.com.au>; Nathan Biggins <Nathan.Biggins@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton

<Peter.Blyton@gpaeng.com.au>; Young, David <dsy@enscope.com.au>
Subject: RE: 20617-S2132: Jemena Isolation Policy Guide

Folks

I lose track of which projects we have provided these documents to, and which we haven't.

The relevant section to refer to for isolations is GTS-960-DG-PI-001 section 10.1.2.

Positive isolation (spade/blind/dropout spool) is mandatory where maintenance involving breaking gas containment, is done in confined spaces.

Valve isolation is acceptable for non-confined-spaces.

DBB is required in class #600 and above where the item being isolated is subjected to maintenance which involves breaking gas containment, on a frequency of one year or less.

Cheers

Mike

From: Matthew Skaras <Matthew.Skaras@jemena.com.au>
Sent: Monday, 9 November 2020 4:35 PM
To: Sarah Greening <sarah.greening@gpaeng.com.au>; Nathan Biggins <Nathan.Biggins@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton <Peter.Blyton@gpaeng.com.au>; Young, David <dsy@enscope.com.au>; Michael Peoples <Michael.Peoples@jemena.com.au>
Subject: RE: 20617-S2132: Jemena Isolation Policy Guide

Hi Sarah,

Please refer to the design review minutes, the isolation requirements were discussed at length and I don't believe that anything in the HAZOP changed these requirements. Our ops team wanted to revisit these by raising the isolation issues previously agreed upon, now that we have also had the discussion in HAZOP we should be better informed on the groups views (please be mindful of this in subsequent HAZOP sessions so that we can manage the session and stay on track – this item will no doubt come up again).

In the meantime, I will go back to our team and see if there is a specific reference to a document, however there is unlikely to be anything prescriptive.

As a general note whilst it is acceptable in principle to review items previously agreed (and somewhat welcomed, to convince the group we have covered off on all the risks), any discussion needs to be targeted to the node being considered, justified and worked through on its merits as part of the workshop. If we do start to open up discussions previously held this needs to be managed and challenged by the facilitator (and group) regardless of personal views.

Regards,

Matthew Skaras
Project Manager – Major Projects
Jemena
Level 15, 567 Collins St, Melbourne, VIC 3000
(03) 9173 8416 | 0423 538 955
matthew.skaras@jemena.com.au | www.jemena.com.au

From: Sarah Greening <sarah.greening@gpaeng.com.au>
Sent: Monday, 9 November 2020 1:35 PM
To: Nathan Biggins <Nathan.Biggins@jemena.com.au>; Matthew Skaras <Matthew.Skaras@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton <Peter.Blyton@gpaeng.com.au>
Subject: 20617-S2132: Jemena Isolation Policy Guide

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Hi Nathan, Matthew,

During the first HAZOP session last week you referred to Jemena Isolation Policy Guide, can you please provide a copy of this or the document number for reference in the HAZOP minutes?

Thanks,

Sarah Greening
Project Manager
BEng (Chem) (Hons) | RPEQ

GPA Engineering
121 Greenhill Road, Unley SA 5061
Dir 08 8299 8320 | **Ph** 08 8299 8300
E sarah.greening@gpaeng.com.au | **I** http://www.gpaeng.com.au/

I am in the office on Mondays, Tuesdays, Thursdays, and Fridays.

****
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****

MAIL TYPE
Response to Technical Query
MAIL NUMBER
JAM-RESTECHQ-000012
REFERENCE NUMBER
GPA-TECHQ-000013

Re: Kembla Grange - HAZOP Item 1.23

From	Stephen Chow - Jemena Asset Management
To (2)	Sarah Greening - GPA Engineering
	Matthew Skaras - Jemena Asset Management
Cc (5)	Mr Simon Hanlin - GPA Engineering
	Mr Peter Blyton - GPA Engineering
	GPA Document Control - GPA Engineering
	Nathan Biggins - Jemena Asset Management
	David Young - Jemena Asset Management
Sent	Friday, 4 December 2020

MESSAGE

Hi Sarah,

Please see TQ response from Jemena Gas Engineering Manager:

Engineering has assessed the TQ query and advises that GPA is to proceed with the single valve isolation design.

Whilst Jemena has had some issues with valve isolations in the past, these have been limited and are still judged rare in relation to the total number of valves installed on our assets. The issues encountered have all been related to vendor quality and not related to incorrect specification.

Jemena balances risk against cost when establishing where a leak-tolerant design (two valve DBB) should be installed, and prioritises locations based on frequent scheduled maintenance (opening on a frequency of one year or higher) or where urgent maintenance access might be required, the failure of which might interrupt gas flows. In practice this results in filter assemblies being prioritised and occasionally other equipment in continuous service for which a redundant spare or bypass is installed.

In this particular case, Jemena's history is that one pig trap isolation valve has been replaced on any of Jemena's assets, and this was in relation to a valve stem leak, as opposed to a seat leak. This valve was at Wallumbilla.

In relation to the queries on the application of the risk matrix, Engineering notes that the probability assessment includes a dimension of time – chance of the event per year- thus assessing the relative frequency of the event is relevant to assessing the probability. If a valve is relied upon 4 times per year this is a material difference to if the valve is relied upon once each ten years. Although the probability may not be linear between the two it is relevant to be considered.

In addition Engineering does not believe that the consequence being assessed is Catastrophic. The most credible case is a valve seat leak that results in an excessive cavity vent rate and appreciable cavity pressure, that results in the proposed pigging activity being unable to be carried out. Jemena's experience is that once a DBB "single valve" isolation is proven then there is no credible case for a catastrophic failure.

As part of preparation for pigging, isolation valves are tested and proven well before pigs are mobilised, and the worst case outcome is a repair operation that involves suspension of the pipeline. As this outcome is rare or unexpected the judgement applied is that the additional expense of installing two additional full bore valves (estimate $130k) to mitigate this eventuality is not justified.

Regards,
Stephen Chow

From: S Greening
Sent: 24/11/2020 12:55:45 PM AEDT (GMT +11:00)
To: Stephen Chow, Matthew Skaras
Cc: Peter Blyton, GPA Document Control, Simon Hanlin, Nathan Biggins, David Young
Mail Number: GPA-TECHQ-000013
Subject: Kembla Grange - HAZOP Item 1.23

Are there any attachments?:	No
Authorised Signatory:	n/a
Description:	Kembla Grange - HAZOP Item 1.23
Drawing Reference:	n/a
If yes, state recommended control below:	n/a
Is additional hazard control required?:	No
Is the response critical to work progres:	No
Location:	Kembla Grange
Standard/Specification Reference:	n/a
Urgency:	Routine

Hi Matthew, Stephen,

Can you please respond to this feedback sent from Luke Gigliotti?

I wanted to provide some feedback re Item 1.23 for consideration, which was the removal of the second isolation valve on the inlet to the new pig receiver on the Kembla Grange lateral from the LNG Ship.

My understanding is the remaining single valve is a trunnion mounted ball valve (with 2 faces)- which per the Jemena design guide 'Piping Design Guide and Material Specification for Gas Pipeline Facilities GTS-960-DG-PI-001 Rev 1) is acceptable- but I would like if the following points are considered:

- Performance of Trunnion Mounted Ball Valves on Jemena assets
- Lack of available upstream isolation (operability and commercial considerations)
- Change to risk based on frequency of task?

1. Feedback from those in the field have suggested that there has been multiple failures of different trunnion valves across the EGP. East Gippsland Compressor Station and Longford Compressor station are two sites in which there has been failure of recently acquired and installed trunnion mounted 2 face valves. I'm unsure of their design and specification, but at the least it should be understood what these failure mechanisms were and if we can, build this into the specification for Project Marlin so it is not repeated. Nevertheless, there is a lack of confidence of this valve type in the field along EGP.
2. The feedback from the project that in the absence of a valve holding, the operators in the field would look for an upstream valve to get a safe isolation. For this item, there is no upstream valve available (only at the LNG ship tie-in). In this event there would be a significant commercial implication in terms of venting volume and of time. Is an additional valve worth considering to avoid the consequence?
3. The frequency of the pigging task (every 5 years nominally- unsure of what other PM work is required for the receiver itself and associated isolation valves) is used as a reason (per our guideline) to not install DBB. For me it is unclear how the risk changes based on frequency of task. For the same activity that is executed say 1/year versus 1/ 2 years, the likelihood of failure shouldn't change or not significantly enough to change from say 'possible' to 'unlikely' and therefore change the risk per the Jemena matrix. The exposure to the task does increase but in this example it shouldn't necessarily double i.e. not linear.

   Also note, if we deem any of our maintenance tasks with a catastrophic consequence then the likelihood of the task does not minimise the risk in terms of approval to proceed (see below)- is this the case for receiving a pig? Operationally, when a task is executed on an infrequent basis it tends to attract a higher risk to personnel- and therefore engineering controls are best to be relied upon rather than procedural…would additional isolation provide this in this case and provide greater reduction in risk?

Perhaps these things could be considered by the broader project team before finalisation of the minutes?

Likelihood		Consequence			
		Minor	Serious	Severe	Major
		1	2	3	4
Almost Certain	5	Moderate	High	Extreme	Extreme
Likely	4	Moderate	Significant	High	Extreme
Possible	3	Moderate	Moderate	Significant	High
Unlikely	2	Low	Low	Moderate	Significant
Rare	1	Low	Low	Moderate	Moderate

Figure 7: Risk Matrix

** **Note:** Whilst these risks are rated below extreme, the potentially catastrophic consequen reporting (refer Figure 9 for details).*

Risk Rating*	Suggested Action	Suggested Timing	Monitoring
EXTREME	Requires immediate action. Highest priority to treat risk. Senior level monitoring.	Action plans prepared and normally implemented within 1 month. Status of risk should be monitored monthly.	**SGSPAA:** Board / RHSEC / ERMC / LT **Functional Group / Zinfra:** Managing Director / Executive General Manager
HIGH	Requires immediate attention – must manage with senior level monitoring. Includes RHSEC and ERMC / LT oversight of Unlikely Likelihood, Catastrophic Consequence Events.	Action plans prepared and normally implemented within 3 months. Status of risk should be monitored monthly.	**SGSPAA:** RHSEC** / ERMC / LT **Functional Group (Jemena) / Zinfra:** EGM / General Managers
SIGNIFICANT	Requires Management attention with a degree of priority. Includes RHSEC / ERMC / LT oversight of Rare Likelihood, Catastrophic Consequence Events. High level monitoring.	Action plans prepared and normally implemented within 6 months. Status of risk should be monitored every 6 months.	**SGSPAA:** RHSEC** / ERMC** / LT **Functional Group (Jemena) / Zinfra:** EGM / General Managers
MODERATE	Requires routine to periodic monitoring.	Action plans prepared and normally implemented within 6 – 12 months (where the benefits outweigh the costs). Status of risk should be monitored at least every 6 months.	**SGSPAA / Functional Group (Jemena) / Zinfra:** General Managers Escalate FG / Zinfra risk to the EGM / Zinfra MD if the risk consequence or likelihood is increasing.
LOW	"Business as usual" - should not require much attention but should be reviewed at least annually. Managed by routine policies and procedures.	Ongoing control as part of a management system. Risk Facilitators to maintain register of Low risks and reassess annually.	**SGSPAA / Functional Group (Jemena) / Zinfra:** Managers Escalate FG / Zinfra risk to the GM if the risk consequence or likelihood is increasing.

Note *: Risk oversight requirements are based on the Residual risk rating, i.e. after existing controls have been evaluated and assigned.

**: RHSEC and ERMC reporting only for Rare and Unlikely Likelihood, Catastrophic Consequence Events. However, the RHSEC may escalate any risk matters to the Board if the RHSEC considers it appropriate.

APPENDIX 8

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		19.19

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	19	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
19.19	EARTHING	Close proximity to 22kV			Review proximity to existing 22kV electrical cable route	**1 / DY**

DISCUSSION AND RECOMMENDATION

22 kV high voltage cable located on drawing received under TECHQ-000016 and is included on drawing GAS-510-DW-CV-011(B) "Issued for Design". New equipment has been located so that it does not encroach on the underground service.

ACTION TAKEN / CLOSE OUT COMMENTS

22 kV cable route detailed on GAS-510-DW-CV-011(B) and regulator skid located so that it does not encroach on the cable.

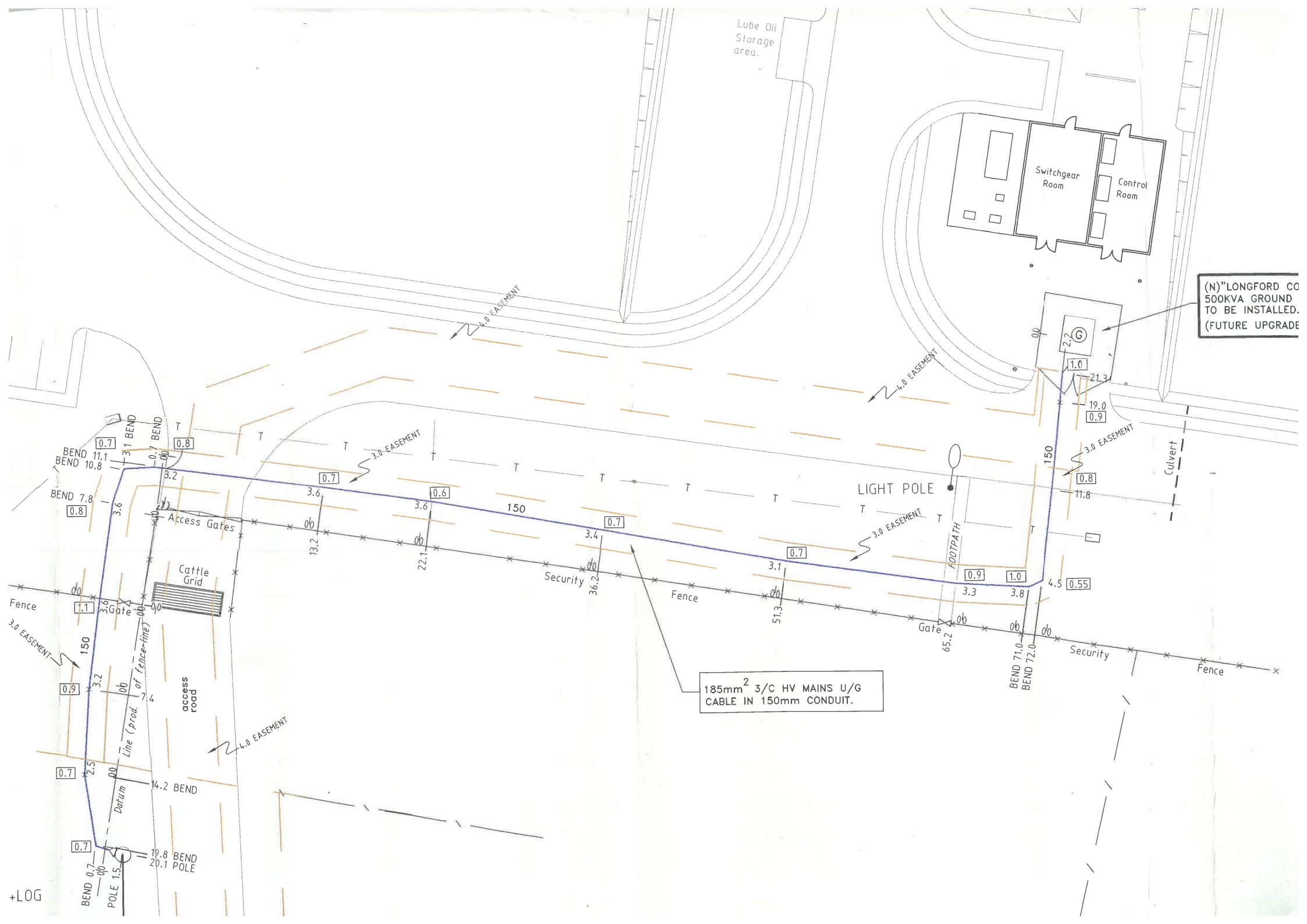
Action considered closed.

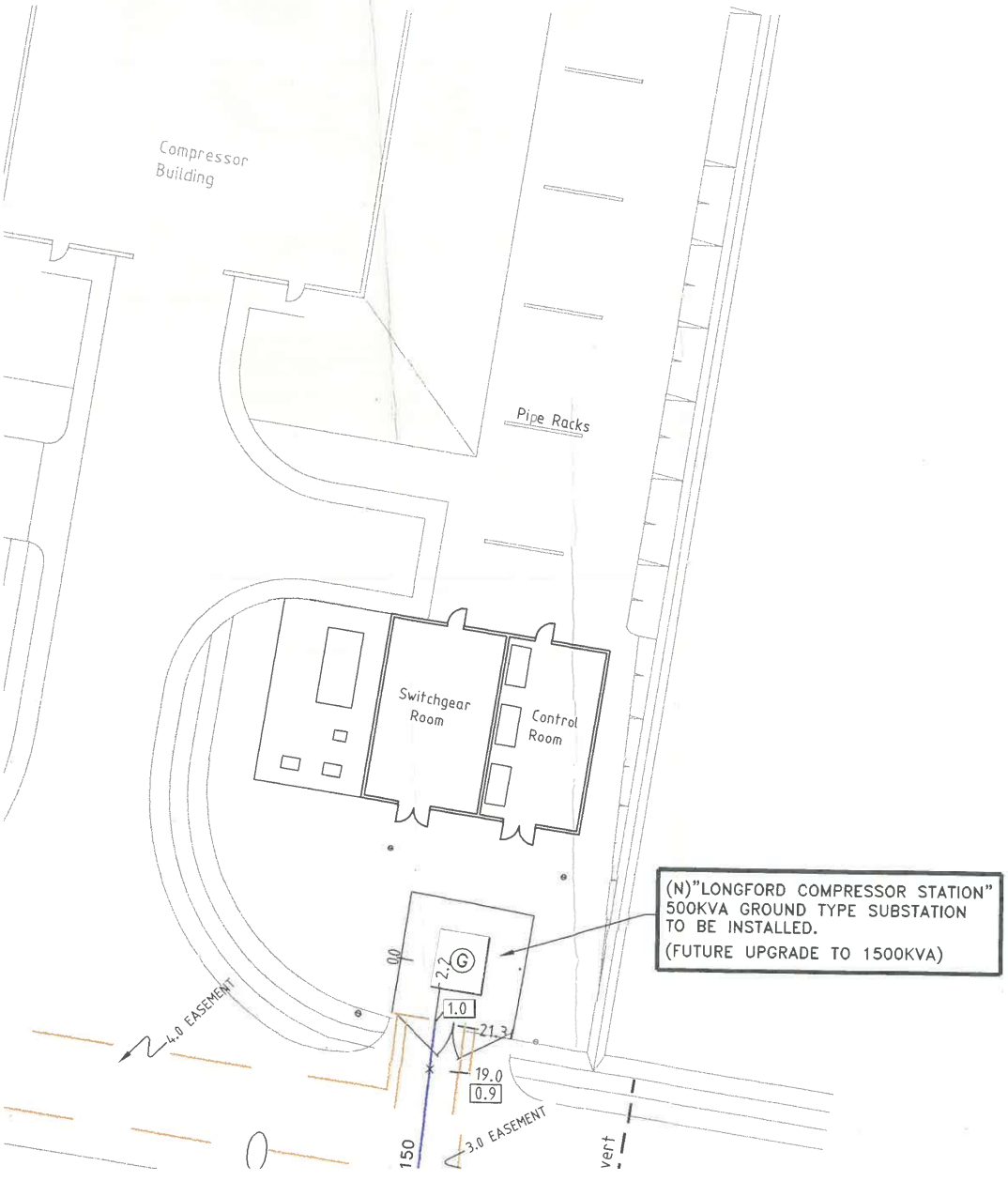
Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 8/02/21

Approved by Jemena:

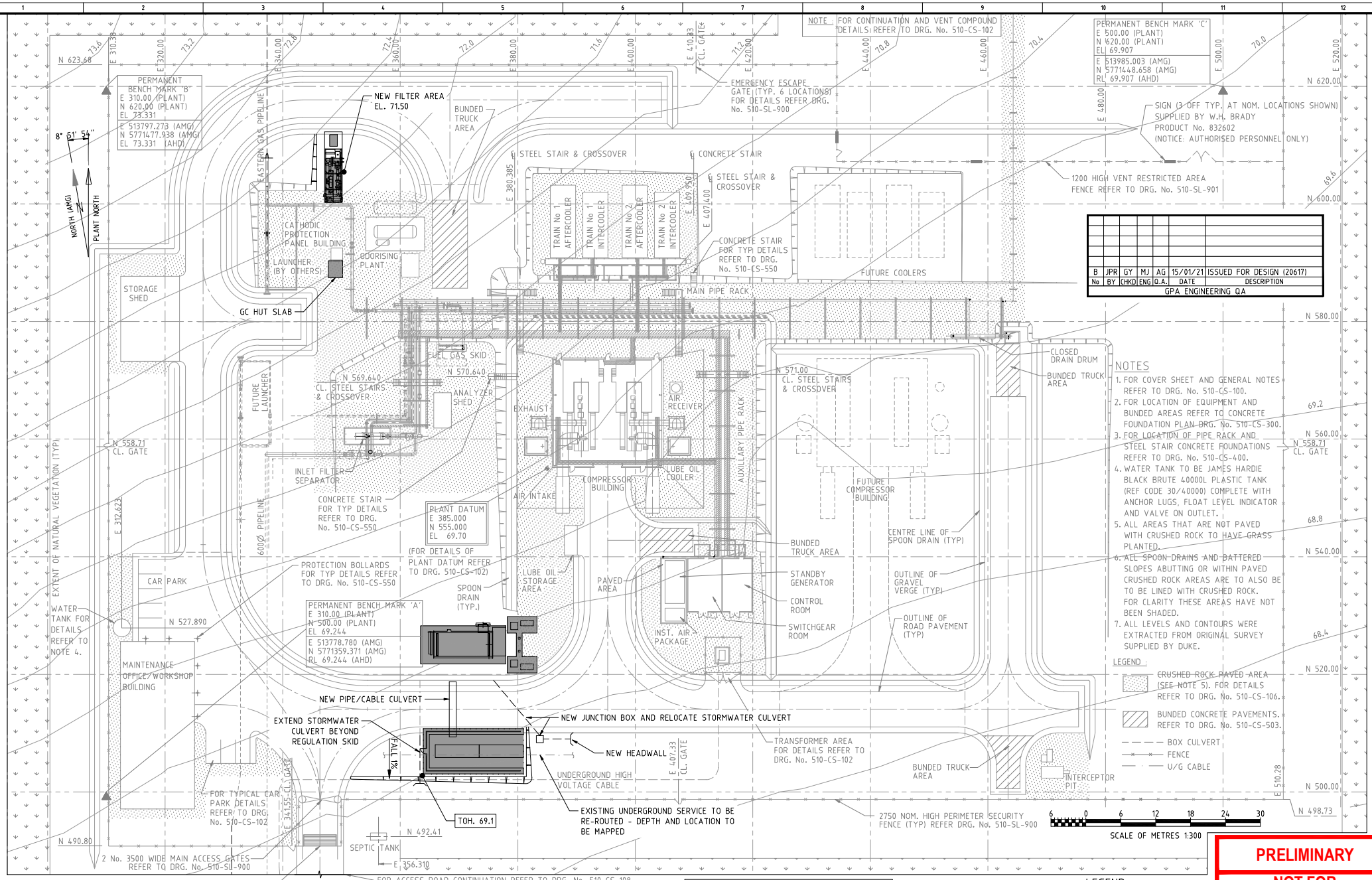
Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:44:19 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21


Lube Oil Storage area.
Switchgear Room
Control Room
(N)"LONGFORD CO
500KVA GROUND
TO BE INSTALLED.
(FUTURE UPGRADE
4.0 EASEMENT
3.0 EASEMENT
LIGHT POLE
Culvert
FOOTPATH
Access Gates
Cattle Grid
Fence
Gate
Security
access road
Line (prod. of fence-line)
Datum
BEND 11.1
BEND 10.8
BEND 7.8
3.1 BEND
0.7 BEND
14.2 BEND
19.8 BEND
20.1 POLE
BEND 0.7
POLE 1.5
BEND 71.0
BEND 72.0
150
185mm² 3/C HV MAINS U/G
CABLE IN 150mm CONDUIT.
+LOG



LEGEND

- 185.3/c.22.a.x.hc.h. HV UNDERGROUND CABLE
- 185.4/c.lv.sa.x.wc. LV UNDERGROUND CABLE
- 16.4/c.lv.c.x. UNDERGROUND SERVICE CABLE
- 4 DINS PUBLIC LIGHTING CABLE
- HV, HV/LV, LV TYPE POLE WITH CABLE HEAD
- LV MAINS STRAIGHT OR TEE-JOINT
- LV SERVICE TEE-JOINT
- 50 CONDUIT & SIZE [mm]
- SERVICE PIT
- OBSTRUCTION PIPE [OTHER AUTHORITY]
- 0.7 DEPTH TO TOP OF CABLE
- (0.6) DEPTH TO TOP OF OBSTRUCTION
- 7m STEEL PUBLIC LIGHTING COLUMN WITH 80W COLOR-CORRECTED MERCURY VAPOUR LAMP



B	JPR	GY	MJ	AG	15/01/21	ISSUED FOR DESIGN (20617)
No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
GPA ENGINEERING QA						

NOTES

1. FOR COVER SHEET AND GENERAL NOTES REFER TO DRG. No. 510-CS-100.
2. FOR LOCATION OF EQUIPMENT AND BUNDED AREAS REFER TO CONCRETE FOUNDATION PLAN DRG. No. 510-CS-300.
3. FOR LOCATION OF PIPE RACK AND STEEL STAIR CONCRETE FOUNDATIONS REFER TO DRG. No. 510-CS-400.
4. WATER TANK TO BE JAMES HARDIE BLACK BRUTE 40000L PLASTIC TANK (REF CODE 30/40000) COMPLETE WITH ANCHOR LUGS, FLOAT LEVEL INDICATOR AND VALVE ON OUTLET.
5. ALL AREAS THAT ARE NOT PAVED WITH CRUSHED ROCK TO HAVE GRASS PLANTED.
6. ALL SPOON DRAINS AND BATTERED SLOPES ABUTTING OR WITHIN PAVED CRUSHED ROCK AREAS ARE TO ALSO BE TO BE LINED WITH CRUSHED ROCK. FOR CLARITY THESE AREAS HAVE NOT BEEN SHADED.
7. ALL LEVELS AND CONTOURS WERE EXTRACTED FROM ORIGINAL SURVEY SUPPLIED BY DUKE.

LEGEND :

- CRUSHED ROCK PAVED AREA (SEE NOTE 5). FOR DETAILS REFER TO DRG. No. 510-CS-106.
- BUNDED CONCRETE PAVEMENTS. REFER TO DRG. No. 510-CS-503.
- BOX CULVERT
- FENCE
- U/G CABLE

FOR EXISTING SITE AS BUILT REFER TO DRAWING 510-CS-102 REV 3

LEGEND
EXISTING SITE
NEW SITE MODIFICATIONS

PRELIMINARY

NOT FOR CONSTRUCTION

GAS-510-DW-CV-012	FOOTING PLAN AND SECTION
GAS-510-PN-ME-001 REV C	LONGFORD COMPRESSOR STATION PLOT PLAN
GAS-599-RG-CV-001	EGP REVERSAL FOOTING REGISTER
GAS-599-DW-CV-001	CIVIL/CONCRETE GENERAL NOTES
GAS-599-DW-SL-001	STEEL STRUCTURE GENERAL NOTES
DRAWING No.	REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
B	15/01/21	ISSUED FOR DESIGN (20617)	GPA	GY	AG	
A	27/11/20	ISSUED FOR REVIEW (20617)	JPR	MJ		

CONSULTANT
GPA
www.gpaeng.com.au

EASTERN GAS PIPELINE (EGP)
CIVIL LAYOUT
LONGFORD COMPRESSOR STATION / VIC HUB-002
PLOT PLAN

DRAWN	JPR	FACILITY	SUBJECT
DESIGN	MJ	SCALE	1:200
CHECKED		SUPERSEDES	A1
APPROVED		DRAWING NUMBER	REV B
DATE	27/11/20	GAS-510-DW-CV-011	

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		24.1

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	13/01/21	**Client Project #:**	Project Marlin: EGP Reversal
Node:	24	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
24.1	HIGH FLOW	Low pressure in WLP leading to high volumetric flow.	Erosional velocity limits exceeded	Filter High DP alarms (2 stages of alarm) and HH DP trip provided (PDI-64103/64807), HH trip shuts SLV-64800.	Agree minimum pressures into WMS with Jemena Commercial.	**1 / DY**

DISCUSSION AND RECOMMENDATION

6.2 MPag minimum inlet pressure at Wilton Meter Station, confirmed by Stephen Turville, Senior Capacity Planning Engineer. No change to WMS inlet low pressure alarms or design basis for line sizing required.

ACTION TAKEN / CLOSE OUT COMMENTS

6.2 MPag agreed as minimum pressure into WMS. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 8/2/21

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:47:18 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

Dylan Falls

From: Young, David <dsy@enscope.com.au>
Sent: Friday, 20 November 2020 11:31 AM
To: Simon Hanlin
Cc: Sarah Greening; Matthew Skaras; Adrian Zatta; Stephen Chow; Peter Blyton
Subject: 20617-R841: FW: 20617-S2297: Wilton Process Calculations

Simon,
I looks like we had some confusion on the minimum pressures into Wilton, the minimum we have to consider is 6.2MPag. Please see the comments below.
We will need to increase the heater capacity to cater for the 11.5MPag max pressure into the site (previously we used 9MPag).

Simon, Adrian,
For the changes in pressure due to elevation can you please include an additional pressure transmitter and over pressure trip amp on the south side of the pipeline facilites at both Mila (14,000kPag) and Michelago(14,500kPag) with the reduced MAOP. They need to be located so that they are always exposed to the south side of the pipeline. This trip amp would be added to the Hardwire ESD string on each of the compressor stations.

Cheers
Dave

Regards,

David Young
Principal Engineer

ENSCOPE
A QUANTA SERVICES COMPANY

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M +61 (0)427 277 369 W www.enscope.com.au

// **development . engineering . management . completions**

From: Stephen Turville <Stephen.Turville@jemena.com.au>
Sent: Friday, 20 November 2020 6:21 AM
To: Young, David <dsy@enscope.com.au>
Cc: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Michael Peoples <Michael.Peoples@jemena.com.au>; Stephen Chow <steven.chow@jemena.com.au>
Subject: RE: 20617-S2297: Wilton Process Calculations

[EXTERNAL]

Hi David,

Sorry for the missed call, was cooking the kids dinner and didn't notice until later

Wilton
I think there is some confusion on the minimum/maximum pressures at Wilton. The modelled **inlet** to Wilton Station is 6.2MPag, I believe the current LL alarm is set at 6MPag and I wouldn't envisage that changing as part of this project. Outside of emergency levels, the pressure at the **inlet** to Wilton station should vary between 11.5 – 6.2MPag.

The **outlet** of Wilton is then where we'll see these low pressures. I would put them at Min/Design/Max for each run as
Wilton MSP: 3.6/4.5/6
Wilton JGN: 3.6/4.5/5.5

The JGN one is interesting because theoretically it could be asked to go to 6.895MPag, however I don't believe it is ever a realistic case given the integrity issues on that pipeline and the significant upgrades to all JGN facilities and 3rd party facilities required to facilitate this increase so I've stuck with the somewhat more realistic number of 5.5MPag.

Other Delivery Stations
All stations are above minimum pressure required under the connection agreement, most are required to be 3-3.8MPag, which is easily achieved. That said the connection agreement for Hoskinstown has never been reflective of the real pressure requirements and for the flow scenarios before any new compression at Kembla it is unlikely that there will be sufficient pressure to support Canberra. Early on in the modelling cases this was flagged with Commercial and I was instructed to leave it out as a limit and that they would work with EVO to come to a solution as I believe the thinking was that it was better to recover costs from the regulated asset where possible however I haven't heard anything about it and my friends in GD are unaware of any requirement.
Bairnsdale has no concerns as by maintaining Vichub greater than 6.9MPag, there is no way for Bairnsdale to be less than this which means its greater than the 4.75MPag under the contract terms.

Overpressure
Yes there is some concern over the significant elevation drop following Mila. At low flow scenarios the pressure gain due to static head is greater than the pressure lost due to friction, in my models I tend to restrict the pressure at Mila discharge to get around this and I would typically limit it to 14MPag so we're in the same ballpark. In terms of capacity it makes no difference as when flows south increase this compressor runs out of power and the discharge will be below this anyway, the only thing it does is reduce potential park opportunities.

Regards
Stephen Turville
Senior Capacity Planning Engineer
Jemena
Level 14, 99 Walker Street, North Sydney, NSW 2060
(02) 9867 7322 | 0437 541 877
stephen.turville@jemena.com.au | www.jemena.com.au
www.gonaturalgas.com.au

Natural Gas Jemena bringing energy to life

From: Young, David <dsy@enscope.com.au>
Sent: Thursday, 19 November 2020 6:26 PM
To: Stephen Turville <Stephen.Turville@jemena.com.au>
Cc: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Michael Peoples <Michael.Peoples@jemena.com.au>; Stephen Chow <steven.chow@jemena.com.au>
Subject: FW: 20617-S2297: Wilton Process Calculations

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and are expecting the content or attachment from the sender.

Stephen,
I gave you a call to chat through the some issues we would like to discuss with the sizing cases at Wilton.
The long and the short of it is low minimum pressure into the facility (from the EGP and the Wilton Lateral) down at 4500kPag is resulting in some very high velocities and making the sizing of the control valves a bit difficult. If we could increase this to around 5500kPag at the full 325TJ/d and then tail the max energy flow as we reduce the pressure (so we effectively limit the volumetric flow) this would make our lives a lot easier. Would this significantly affect the modelling work you have done?
Given we have existing of noise / land owner concerns in the area we are a bit nervous that we are going to struggle to come up with a design that will cater for the high volumetric flow rates and also limit the noise.

On a separate note, we just ran the Hazop for the pipeline reversal and we have couple of queries on this;

1) Have you assessed the minimum pressure requirements for all of the existing EGP offtakes (ie Bairnsdale PS, Hoskinstown, etc)?
2) We will need to modify the existing pipeline over pressure protection at Mila and maybe Michalego to prevent exceeding the 14,895kPag at Cann River as we come down from 860m ASL to pretty much Sea Level. We don't need to finalise the numbers now but it would be good to understand roughly what we are taking about. My Fag Packet say that this is about 900kPag for Mila (ie 110kg/M^3 gas density over say 830m of elevation change).

One to chat through when you have the chance.
Cheers
Dave

Regards,

David Young
Principal Engineer

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M +61 (0)427 277 369 **W** www.enscope.com.au

// **development . engineering . management . completions**

****
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GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		32.2

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	31	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
32.2	SERVICES REQUIRED	Additional power demand for WBH forced draft fans	Inadequate capacity of existing site power supply		Review size of 3PH power supply and DC power supplies for additional demand	**1 / ALZ**

DISCUSSION AND RECOMMENDATION

A LV Maximum demand calculation was completed for the Wilton site using empirical load data from site. Refer to GAS-563-CA-EL-008 for calculation. Data was provided in JAM-RESTECHQ-000013. Maximum demand shows that there is adequate capacity to allow for the additional required loads, however it is noted that there is insufficient spare space in the current distribution board and as such a new distribution board will be required.

A maximum demand for the DC power supply was also completed to show the new loads required for the changes. Refer to GAS-563-CA-EL-009 for calculation. The calculation shows that there is sufficient capacity for additional control system/DC loads.

ACTION TAKEN / CLOSE OUT COMMENTS

LV power load calculated in GAS-563-CA-EL-008(A).

DC load calculated in GAS-563-CA-EL-009(A).

Review of 3PH and DC power supplies documented in FEED report GAS-599-RP-DN-003.

Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 8/2/21

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantiaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN=" Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:58:30 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

Client Name	Jemena		Document Title	Document No. (Client / GPA)	Date: 11/12/2020	By: BG
Client Project No.	-	GPA Project No. 20617	Wilton LV Maximum Demand	-	Rev/ Status: A	Chkd: AZ
Project Name	Project Marlin: EGP Reversal			GAS-563-CA-EL-008	IFR	QA: RHL

REF	TAG	LOAD DESCRIPTION	TYPE	DEVICE NAMEPLATE DATA: # Phases	Voltage, V (V)	Rated Shaft Power, P_{RATED} (kW) or Rated Current, I_{FLC} (A) (Notes 5,8)				Efficiency, eff (Note 8)	Power Factor, pf (Note 4)	CALCULATED ACTUAL LOADS (BASED ON LOAD FACTOR): Load Factor, LF (Note 4,7)	Calculated Actual Consumption, kW_{ACTUAL} (kW)			Calculated Actual Load Current, I_{ACTUAL} (A)			UTILISATION FACTORS (TO DETERMINE MAX. DEMAND): Duty	Utilisation (diversity factor)	Diversity Factor, Div (Note 6)	CALCULATED MAX. DEMAND CONTRIBUTION VALUES: Connected Load, I_{SUM} (A) (Note 1)			Load Current, I_{MD} (A)			Apparent Power, S (kVA)				Real Power, P (kW)				Reactive Power, Q (kVAr)				NOTES
						3ϕ	R	W	B				R	W	B	R	W	B				R	W	B	R	W	B	3ϕ	R	W	B	3ϕ	R	W	B	3ϕ	R	W	B	
	EXISTING LOADS																																								
1	-	Measured Load (Note 9)	3ϕ General	3	400.0	45.0				A	0.71	1.00	7.34	7.34	7.34	45.00	45.00	45.00	1.00	Continuous	1.00	45.00	45.00	45.00	45.00	45.00	45.00	31.18	10.39	10.39	10.39	22.01	7.34	7.34	7.34	22.08	7.36	7.36	7.36	Measured maximum demand on site - 45 A / phase @ 22 kW. Highest actual metered demand over a 30 day period is 24.65 kVA
2																																								
	NEW LOADS					3ϕ	R	W	B				R	W	B	R	W	B				R	W	B	R	W	B	3ϕ	R	W	B	3ϕ	R	W	B	3ϕ	R	W	B	
3	-	Heater Fans	3ϕ General	3	400.0	10.0				kW	default	default	3.51	3.51	3.51	17.87	17.87	17.87	1.00	Continuous	1.00	17.87	17.87	17.87	17.87	17.87	17.87	12.38	4.13	4.13	4.13	10.53	3.51	3.51	3.51	6.52	2.17	2.17	2.17	Size based on Actions List.
4	-	Heat Tracing	1ϕ General	1	230.9			10.0		A		1.00		2.31			10.00		1.00	Continuous	1.00		10.00			10.00				2.31			2.31							Nominal Value assumed. To be updated when heat tracing size is known.
5	-																																							
6																																								
											Section Totals:		10.85	13.16	10.85										62.53	70.35	62.53		14.44	16.25	14.44		10.85	13.16	10.85		9.53	9.53	9.53	

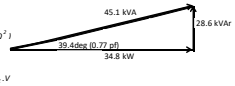
NOTES:

1. The sum of the connected loads takes into account power factor but not load factor.
2. This calculation is intended as a more accurate approach than the guide included in AS/NZS 3000:2007 Appendix C. This calculation is still in accordance with AS/NZS 3000:2018 cl 2.2.2 (a): "...Alternative methods of calculating the maximum demand may be used taking account of all the relevant information available for any particular electrical installation". If the user wishes to follow the calculation guides in AS/NSZ 3000:2007 Appendix C, "Power Factor", "Load Factor" and "Duty" should all be set to 1, and the percentage of connected load values (as shown in AS/NZS 3000:2018 Appendix C) should be entered as the "Diversity Factor".
3. The user is only required to enter data into the white (non-shaded) cells. Refer to the legend adjacent for an explanation of the cell data.
4. For the columns: "Power Factor" and "Load Factor", if these load characteristics are not known, the user may write "default". By writing "default" into this cell, a typical value will be used. This typical value is located in the column header cells. For unusual loads, and where these values are not known, the most conservated approach is to use the value "1" in these columns.
5. Either the Rated Power in kW or load current (FLC) in Amps can be entered into the Rated Power or FLC column. This is assigned by selecting either kW or A in the "Units" column.
6. The Diversity Factors listed in the "Diversity Factor" column header are suggested. These values may be manipulated by the user to suit the specific installation.
7. Load Factor is the factor to which the load is designed to operate at. Eg. An electric motor may have a FLC of 10A, but the load only causes the motor to draw 7.5A, therefore 0.75 Load Factor. Load Factor can be determined from the mechanical design or from actual measured data.
8. Efficiency is only used to calculate electrical input power when motor (shaft power) ratings are given in kW. When the FLC is specified instead, this value is ignored.
9. Due to the lack of accurate information on existing site load data, Jemena have performed a measurement to determine maximum demand in accordance with AS/NZS 3000:2018 cl 2.2.2 c). Refer to TQ response JAM-RESTECHQ-000013.

= user entered known data
= lookup/calculated value

UNBALANCED PHASE TOTALS AND EQUIVALENT THREE PHASE TOTAL

	R	W	B			Equivalent 3ϕ		
Real Power, P	10.8	13.2	10.8	kW	*sum of P*	34.8	kW	*sum of P*
Reactive Power, Q	9.5	9.5	9.5	kVar	*sum of Q*	28.6	kVar	*sum of Q*
Apparent Power, S	14.4	16.2	14.4	kVA	$S=\sqrt{(P^2+Q^2)}$	45.1	kVA	$S=\sqrt{(P^2+Q^2)}$
Connected Load Current, Isum	62.9	72.9	62.9	A	*sum of* I_{sum}	72.9	A (Max)	
Maximum Demand Load Current, I	62.5	70.4	62.5	A	$I=P/V.pf$	70.4	A (Max)	
Power Factor, pf	0.75	0.81	0.75		$pf=P/S$	0.77		$pf=P/S$
						48.7	kVA	$S=\sqrt{3}.I_{MAX}.V$



Spare Capacity

SINGLE PHASE MAXIMUM DEMAND (INCLUDING SPARE CAPACITY)

	R	W	B	
Power	**14.4**	**16.2**	**14.4**	**kVA**
Current	**62.5**	**70.4**	**62.5**	**A**

THREE PHASE MAXIMUM DEMAND (INCLUDING SPARE CAPACITY)

	3ϕ		
Power	**48.7**	**kVA**	*kVA+Spare Capacity*
Current	**70.4**	**A**	$I_{MD}=(kVA+Spare\ Capacity)/\sqrt{3}.V$

Client Name	Jemena Ltd			Document Title		Document No. (Client / GPA)		Date	7/12/20	By	BG
Client Project No.		GPA Project No.	20617	Wilton DC Load Calculation				Rev/ Status	A	Chkd	AZ
Project Name	Project Marlin: EGP Reversal					GAS-563-CA-EL-009				QA	RHL

#	TAG / PART NUMBER	LOAD DESCRIPTION	FULL RATED LOAD (mA)	Power (W)	QTY	FULL CONNECTED LOAD (A)	WORST CASE MAXIMUM DEMAND SCENARIO			USAGE TIME (h/day)	DIVERSITY / DUTY	DAILY ENERGY CONSUMPTION (W·h)	ENERGISATION SURGE FACTOR	EXCESS SURGE CURRENT (A)	WORST CASE START UP SURGE SCENARIO			LOAD COMMENTS
A1	A2	A3	A4	A5	A6	A7	A8	A9	A10	A11	A12	A13	A14	A15	A16	A17	A18	A19
AS/NZS 4509.2:2010			Note 1		Note 2		Note 3			Note 4			Note 5		Note 6			Note 7
FORMULA			load	B31*A4/1000	qty.	A4*A6/1000	on?	fcl %	amps	hours	diversity %	A5*A6*A11*A12	factor	A7*(A14-1)	on?	qty.	amps	
	EXISTING LOADS						**Existing Load Total**		**19.49**									
B1	Control Wave Redundant	RTU-100 Panel	1,919	46.1	1	1.92	☑	100 %	1.92	24	100 %	1,105	1		☑	1	1.92	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B2	Control Wave Micro + Micro150 CPU.	RTU-101, 102, 103 & 104	691	16.6	4	2.76	☑	100 %	2.76	24	100 %	1,592	1		☑	4	2.76	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B3	G2R-S-SNI 24V DC	Output Relays	22	0.5	32	0.70	☑	100 %	0.70	24	100 %	406	1		☑	32	0.70	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B4	EDS-308-MM-SC	Ethernet Switch	350	8.4	2	0.70	☑	100 %	0.70	24	100 %	403	1		☑	2	0.70	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B5	CMF	Emerson Coriolis	460	11.0	1	0.46	☑	100 %	0.46	24	100 %	265	1		☑	1	0.46	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B6	Seniorsonic	Daniel Ultrasonic	335	8.0	4	1.34	☑	100 %	1.34	24	100 %	772	1		☑	4	1.34	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B7		Protocol Convertor	100	2.4	1	0.10	☑	100 %	0.10	24	100 %	58	1		☑	1	0.10	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B8	SK 3239.124	Panel Fans	230	5.5	2	0.46	☑	100 %	0.46	24	100 %	265	1		☑	2	0.46	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B9	SZ4140.840	Panel Lights	160	3.8	4	0.64	☑	100 %	0.64	24	100 %	369	1		☑	4	0.64	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B10	MTL5544A Analogue Input	Transmitter AI IS Loop	70	1.7	17	1.19	☑	100 %	1.19	24	100 %	685	1		☑	17	1.19	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B11	MTL5549 Analogue Output	Analogue Out IS Loop	70	1.7	4	0.28	☑	100 %	0.28	24	100 %	161	1		☑	4	0.28	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B12	MTL5516C Digital Input	Digital Input IS Loop	35	0.8	6	0.21	☑	100 %	0.21	24	100 %	121	1		☑	6	0.21	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B13	MTL5544D	Analogue IS Signal Splitters/Barriers	96	2.3	4	0.38	☑	100 %	0.38	24	100 %	221	1		☑	4	0.38	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B14	Bifold FP10	Solenoid Valves	185	4.4	14	2.59	☑	100 %	2.59	24	100 %	1,492	1		☑	14	2.59	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B15	Optima	Gas Detectors	210	5.0	2	0.42	☑	100 %	0.42	24	100 %	242	1		☑	2	0.42	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B16	NGC-8209	Gas Chromatograph	5,333	128.0	1	5.33	☑	100 %	5.33	24	100 %	3,072	1		☑	1	5.33	Load data based on DC Current Consumption Calculation GTS-563-CA-EL-002
B17									0.00									
B18									0.00									
	NEW LOADS						**New Load Total**		**1.63**									
B19	Flowsic600	Flow Transmitter	150	3.6	2	0.30	☑	100 %	0.30	24	100 %	173	1		☑	2	0.30	Based on Flowsic600 power consumption
B20	RTU2020	Flow Computer - Honeywell	190	4.6	2	0.38	☑	100 %	0.38	24	100 %	219	1		☑	2	0.38	Based on RTU2020 4.6W max power consumption
B21	Finder 58 series	Relay	40	1.0	4	0.16	☑	100 %	0.16	24	50 %	46	1		☑	4	0.16	Based on Finder 58 series relays from datasheet
B22	WSVMET8327B102	Solenoid	150	3.6	2	0.30	☑	100 %	0.30	24	75 %	130	1		☑	2	0.30	Based on Asco WSVMET8327B102 = 3.6W. Allowance for hardwired circuits.
B23	Control Wave Micro	Station Logic Controller	345	8.3	1	0.35	☑	100 %	0.35	24	75 %	149	1		☑	1	0.35	Based on ControlWave Micro with the following modules; 1 x AI, 1 x AO, 1 x DO, 1 x DI.
B24	STA/HLPRG/3PRG/U [DIN]	Trip Amplifier	145	3.5	1	0.15	☑	100 %	0.15	24	100 %	84	1		☑	1	0.15	Based on Moore Industries STA Trip Amplifier 3.5W max power consumption, for SIL loops.
B25				0.0		0.00			0.00			0						
B26				0.0		0.00			0.00			0						
B27				0.0		0.00			0.00			0						
B28				0.0		0.00			0.00			0						
B29				0.0		0.00			0.00			0						
B30				0.0		0.00			0.00			0						
B31				0.0		0.00			0.00			0						
B32				0.0		0.00			0.00			0						

B33

B34 **Notes:**

B35 1) The Full Rated Load of each device type is entered in mA; these values are multipled by Nominal DC Voltage (B31) to calculate Power in Watts per device.

B36

B37 2) The Quantity of each device type is multiplied by it's Full Rated Load per device to determine the Full Connected Load (FCL) of the load group.

B38

B39 3) The Maximum Demand is calculated by running through a "worst case scenario" of which load groups will be energised, and the % of (FCL) energy consumption.

B40

B41 4) An accurate value of Daily Energy Consumption is calculated by stipulating the avergage hours per day that a load group will be "online", along with the average duty/diversity (%) of that load group while "online". Diversity/Duty accounts for loads that (while online) either cycle on & off, or that do not consume 100% of their full rated load on average while energised.

B42

B43

B44 5) The surge factor of each device is used to calculate the excess current (A) consumed by the load group upon energisation. A value of "1" = no surge; > "1" = multipler of Connected Load.

B45

B46 6) A value of "start-up surge" is calculated by selecting a quantity of devices per load group that will be energised on a power up condition, taking into account their surge characteristics.

B47

B48 7) The user should include notes in the "Load Comments" column to describe the basis of the load data entered. (i.e site measurement, calculation, data sheet, etc)

B49

B50 GAS-563-CA-EL-009_rA - Wilton DC Load Calculation.xlsm

Printed: 7/12/2020

Raw DC Load Calulation

System Nominal DC Voltage	24.0	V	
Full Connected Load (A)	21.12	A	(Sum A7)
Maximum Demand FCL %	92.3	%	(B34/B32)*100
Existing Maximum Demand (A)	19.49	A	
New Maximum Demand (A)	21.12	A	
Daily Energy Consumpion (W·h)	12,028	W·h	(Sum A13)

Spare Capacity Considerations

Min Required Spare Capacity (%)	0.0	%	
Nominated Power Supply Size (A)	✓ 40.0	A	
Actual Available Spare Capacity (%)	✓ 89.4	%	((B39/B34)-1)*100

Bottom Line including Min Required Spare Capacity

Maximum Demand (A)	21.1	A	B34+(B34*(B38/100))
Daily Energy Consumpion (W·h)	12,028	W·h	B35+(B35*(B38/100))

Surge Events Calculation

Start Up Surge Current	21.12	A
Maximum Online Surge Current	21.12	A

Maximum Surge Consideration

Power Supply short term overload capability	110.0	%
Max Surge Current	✓ 21.12	A

surge okay

Legend

Input Value
Calculated Value
Bottom Line

Surge current based on all devices selected as energised on start up

Assumes highest surge load group energises with panel at maximum demand

from data sheet enter the % over current capability of the power supply

picks the highest value of surge current; either start up surge or online surge

APPENDIX 11

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		32.2

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	31	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
32.2	SERVICES REQUIRED	Additional power demand for WBH forced draft fans	Inadequate capacity of existing site power supply		Review capacity of existing IA system for additional demand	**1 / SH**

DISCUSSION AND RECOMMENDATION

Wilton instrument air capacity review completed in GAS-563-CA-PS-006(A), as attached.

The instrument air demand of the wider Wilton Meter Station facility was not evaluated. However, based on the relatively low additional demand required due to facility modifications and the inclusion of a back up instrument gas system for each skid no changes to the Wilton Meter Station instrument air system are recommeded.

ACTION TAKEN / CLOSE OUT COMMENTS

IA system capacity reviewed completed and no further actions required. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 8/2/21

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:59:47 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

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Wilton Instrument Air Capacity Review

Project Marlin: EGP Reversal

Jemena Ltd

Client Document No: GAS-563-CA-PS-006

GPA Project No: 20617

Rev	Date	By	Checked	QA	Description
A	3/12/2020	DAF	SJH	NKH	Issued for Review

GPA Engineering Pty Ltd. ABN 71 576 133 774
Printed: 03-Dec-2020

Consult
Engineer
Deliver
Ideas
Realised

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2 BACKGROUND 1
3 INSTRUMENT AIR SYSTEM 1
4 CAPACITY REVIEW 2
APPENDIX 1 563-DW-PD-011
APPENDIX 2 FISHER FIELDVUE DVC6200
APPENDIX 3 ROTORK ACTUATOR DETAILS
APPENDIX 4 INSTRUMENT AIR CALCULATION

1 AIM

The aim of this calculation is to assess the instrument air capacity for the Wilton Meter Station facility, to accommodate additional loads from the Project Marlin: EGP Reversal project.

2 BACKGROUND

Wilton Meter Station will be upgraded with an additional flow metering skid and regulator skid to allow for increased flow through the station as a result of the EGP reversal.

Two additional flow control valves controlled by DVCs, as well as two actuated slam shut valves preceding the flow controls valves will be installed on the JGN regulator skid. There will be an additional temperature control valve for the new water bath heater controlled by a DVC.

3 INSTRUMENT AIR SYSTEM

The compressors feed a 1,500 L instrument air receiver with pressures between the PAL and PAH set points of 500 kPag and 1090 kPag. Each skid has a backup instrument gas supply that will activate if the instrument air pressure at the skid falls below 500 kPag.

4 CAPACITY REVIEW

Two new actuated valves and two DVC controlled valves are being installed at Wilton Meter station to allow for a greater flow through the metering station The valves are listed in Table 1.

Table 1: Valve capacity review.

Tag No.	Nominal Size	Estimated Actuator Air Volume @ 500 kPa (Nm^3)	Comments
SDV-64110	400	0.61	Based on a Rotork GP-161C-585A/C3
SDV-64136	400	0.61	Based on a Rotork GP-161C-585A/C3
FV-64111	300	N/A	The positioner is estimated to have a constant bleed rate of 1.3 Nm3/h, based on a Fisher FIELDVUE DVC6200
FV-64138	300	N/A	The positioner is estimated to have a constant bleed rate of 1.3 Nm3/h, based on a Fisher FIELDVUE DVC6200
TCV-64148	150	N/A	The positioner is estimated to have a constant bleed rate of 1.3 Nm3/h, based on a Fisher FIELDVUE DVC6200

The slam shut valves are air to open/spring to close and will only require instrument air to reopen after a downstream overpressure scenario. If both were to actuate simultaneously, the instrument air demand would be 1.22 Nm^3. The instrument air system capacity is considered sufficient for this service, although cannot be confirmed without evaluating the current facility demands on the system.

The two control valves are controlled by DVCs that will continuously consume instrument air at a combined demand of 3.9 Nm^3/h. Additional demand will be required depending on valve control movements.

As the wider Wilton facility instrument air demands have not been evaluated, the sufficiency to meet the new valves cannot be confirmed, however based on the relatively low new capacity requirement and the presence of a backup gas system for each skid no changes to the Wilton instrument air system are recommended.

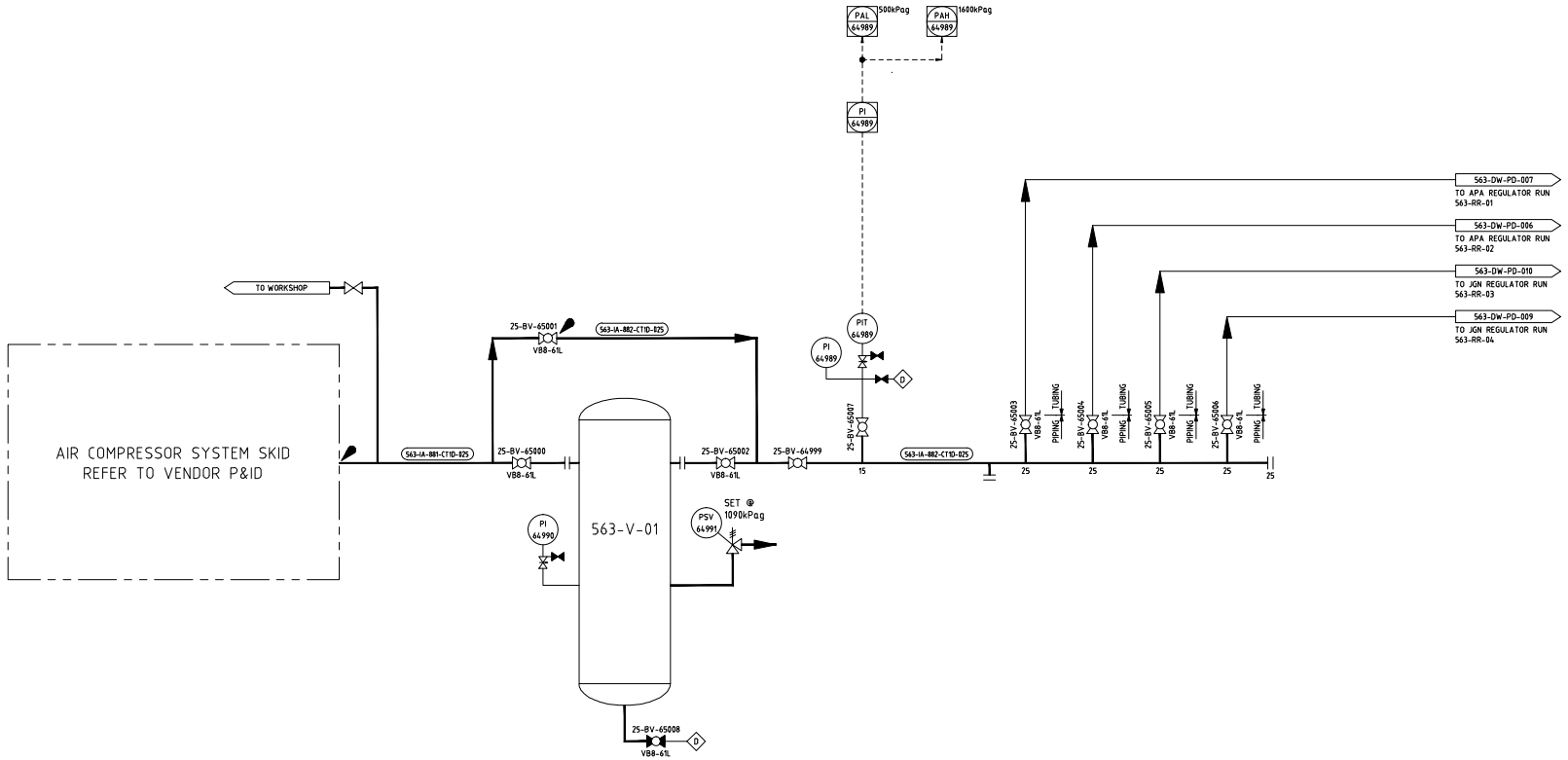
Note, the air stored in the instrument air header and tubing has not been considered as part of the available inventory due to a lack of details on this tubing and the negligible effect it will have.

APPENDIX 1 563-DW-PD-011

563-AC-01
AIR COMPRESSOR PACKAGE

563-V-01
INSTRUMENT AIR RECEIVER

RECEIVER CAPACITY: 1500L
DESIGN PRESSURE: 1750kPag



DRAWING No.	REFERENCE DRAWINGS												

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	DESIGN	ENG CHK	APPRV
2	18.01.16	AS BUILT TO CLIENT MARKUPS	JB	NB			
1	27.02.15	REISSUED FOR CONSTRUCTION	JB	NB	NR	WW	AH
0	13.02.15	ISSUED FOR CONSTRUCTION	JB	NB	NR	WW	AH

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WILTON METER STATION
INSTRUMENT AIR PACKAGE
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	J.GIBBINS		
DESIGN		SCALE	NTS
CHECKED		SUPERSEDES	A1
APPROVED		DRAWING NUMBER	REV 2
DATE		563-DW-PD-011	

APPENDIX 2 FISHER FIELDVUE DVC6200

Specifications

Available Mounting

- Integral mounting to Fisher 657/667 or GX actuators
- Integral mounting to Fisher rotary actuators
- Sliding-stem linear applications
- Quarter-turn rotary applications

DVC6200 digital valve controllers can also be mounted on other actuators that comply with IEC 60534-6-1, IEC 60534-6-2, VDI/VDE 3845 and NAMUR mounting standards.

Communication Protocol

■ HART 5 or ■ HART 7

Input Signal

Point-to-Point

Analog Input Signal: 4-20 mA DC, nominal; split ranging available

Minimum Voltage Available at Instrument Terminals must be 9.5 VDC for analog control, 10 VDC for HART communication
Minimum Control Current: 4.0 mA
Minimum Current w/o Microprocessor Restart: 3.5 mA
Maximum Voltage: 30 VDC
Overcurrent protected
Reverse Polarity protected

Multi-drop

Instrument Power: 11 to 30 VDC at 10 mA
Reverse Polarity protected

Supply Pressure(1)

Minimum Recommended: 0.3 bar (5 psig) higher than maximum actuator requirements

Maximum: 10.0 bar (145 psig) or maximum pressure rating of the actuator, whichever is lower

Supply Medium

Air or Natural Gas

Supply medium must be clean, dry, and noncorrosive and meet the requirements of ISA Standard 7.0.01 or ISO 8573-1

Output Signal

Pneumatic signal, up to full supply pressure
Minimum Span: 0.4 bar (6 psig)
Maximum Span: 9.5 bar (140 psig)
Action: ■ Double, ■ Single Direct or ■ Reverse

Steady-State Air Consumption(2)(3)

At 1.4 bar (20 psig) supply pressure: Less than 0.38 normal m^3/hr (14 scfh)
At 5.5 bar (80 psig) supply pressure: Less than 1.3 normal m^3/hr (49 scfh)

Maximum Output Capacity(2)(3)

At 1.4 bar (20 psig) supply pressure:
10.0 normal m^3/hr (375 scfh)
At 5.5 bar (80 psig) supply pressure:
29.5 normal m^3/hr (1100 scfh)

Operating Ambient Temperature Limits(1)(4)

-40 to 85°C (-40 to 185°F)
-52 to 85°C (-62 to 185°F) for instruments utilizing the Extreme Temperature option (fluorosilicone elastomers)

Independent Linearity(5)

Typical Value: ±0.50% of output span

Electromagnetic Compatibility

Meets EN 61326-1:2013
Immunity—Industrial locations per Table 2 of the EN 61326-1 standard.
Emissions—Class A
ISM equipment rating: Group 1, Class A

Vibration Testing Method

Tested per ANSI/ISA-S75.13.01 Section 5.3.5.

Input Impedance

An equivalent impedance of 550 ohms may be used. This value corresponds to 11V @ 20 mA.

Humidity Testing Method

Tested per IEC 61514-2

Electrical Classification

Hazardous Area Approvals

CSA— Intrinsically Safe, Explosion-proof, Division 2, Dust Ignition-proof

FM— Intrinsically Safe, Explosion-proof, Non-Incendive, Dust Ignition-proof

ATEX— Intrinsically Safe, Flameproof, Type n, Dust by intrinsic safety

IECEx— Intrinsically Safe, Flameproof, Type n, Dust by intrinsic safety or by enclosure

-continued-

APPENDIX 3 ROTORK ACTUATOR DETAILS

ACTUATOR MODEL	ISO 5211 FLANGE TYPE	ACTUATOR OVERALL DIMENSIONS															CENTER BODY		VALVE ADAPTION (OPTIONAL)			LIFTING POINT		CLEARANCE FOR DISASSEMBLY			DISPL. (l)		X (NPT)	WEIGHT [kg]	CENTER OF GRAVITY		
		A	B	C	B2	C2	ØE	F	F1	G	H	K	L	N	P	Q	AL	AR	M1	M (H MIN)	Weight	B3	C3	ES	EC	ET	Symmetric	Canted			Xg	Yg	Zg
GP-160*-735*/C3D	F35	3067	1865	1202	1524	627	840	610	100	160	820	240	580	105	937	90	340	380	127	300	105	1097	1008	530	253	222	173.0	175.5	1"	1886	-201	152	114
GP-160*-735*/C4D	F35	3067	1865	1202	1524	627	840	610	100	160	820	240	580	105	937	90	340	380	127	300	105	1097	1008	530	253	222	173.0	175.5	1"	2058	-276	153	114
GP-160*-785*/C3D	F35	3073	1865	1208	1524	633	890	610	100	160	845	240	605	105	982	90	340	380	127	320	115	1097	1014	530	253	222	197.4	200.3	1"	1996	-145	153	114
GP-160*-785*/C4D	F35	3073	1865	1208	1524	633	890	610	100	160	845	240	605	105	982	90	340	380	127	320	115	1097	1014	530	253	222	197.4	200.3	1"	2168	-221	153	114
GP-161*-485*/C2D	F35	3192	2040	1153	1692	597	570	610	100	160	677	232	445	141	707	114	348	388	158	150	75	1187	985	541	258	289	75.3	76.4	1"	1524	-572	147	136
GP-161*-485*/C2E	F35	3536	2384	1153	2036	597	570	610	100	160	677	232	445	141	707	114	348	388	158	150	75	1346	985	541	258	289	75.3	76.4	1"	1599	-931	147	136
GP-161*-485*/C2G	F35	3536	2384	1153	2036	597	570	610	100	160	677	232	445	141	707	114	348	388	158	150	75	1346	985	541	258	289	75.3	76.4	1"	1599	-931	147	136
GP-161*-485*/C3D	F35	3024	1872	1153	1524	597	570	610	100	160	677	232	445	141	707	114	348	388	158	150	75	1103	985	541	258	289	75.3	76.4	1"	1487	-506	147	136
GP-161*-485*/C3E	F35	3344	2192	1153	1844	597	570	610	100	160	677	232	445	141	707	114	348	388	158	150	75	1250	985	541	258	289	75.3	76.4	1"	1552	-852	147	136
GP-161*-485*/C3G	F35	3344	2192	1153	1844	597	570	610	100	160	677	232	445	141	707	114	348	388	158	150	75	1250	985	541	258	289	75.3	76.4	1"	1552	-852	147	136
GP-161*-535*/C2D	F35	3197	2040	1158	1692	602	620	610	100	160	702	232	470	141	707	79	348	388	158	160	87	1187	990	541	258	289	91.7	93.0	1"	1588	-515	148	136
GP-161*-535*/C2E	F35	3541	2384	1158	2036	602	620	610	100	160	702	232	470	141	707	79	348	388	158	160	87	1346	990	541	258	289	91.7	93.0	1"	1780	-791	148	136
GP-161*-535*/C2G	F35	3541	2384	1158	2036	602	620	610	100	160	702	232	470	141	707	79	348	388	158	160	87	1346	990	541	258	289	91.7	93.0	1"	1780	-791	148	136
GP-161*-535*/C3D	F35	3029	1872	1158	1524	602	620	610	100	160	702	232	470	141	707	79	348	388	158	160	87	1103	990	541	258	289	91.7	93.0	1"	1551	-450	148	136
GP-161*-535*/C3E	F35	3349	2192	1158	1844	602	620	610	100	160	702	232	470	141	707	79	348	388	158	160	87	1250	990	541	258	289	91.7	93.0	1"	1733	-716	148	136
GP-161*-535*/C3G	F35	3349	2192	1158	1844	602	620	610	100	160	702	232	470	141	707	79	348	388	158	160	87	1250	990	541	258	289	91.7	93.0	1"	1733	-716	148	136
GP-161*-535*/C4D	F35	3029	1872	1158	1524	602	620	610	100	160	702	232	470	141	707	79	348	388	158	160	87	1103	990	541	258	289	91.7	93.0	1"	1723	-516	149	136
GP-161*-535*/C4E	F35	3445	2288	1158	1940	602	620	610	100	160	702	232	470	141	707	79	348	388	158	160	87	1293	990	541	258	289	91.7	93.0	1"	1901	-793	149	136
GP-161*-535*/C4G	F35	3445	2288	1158	1940	602	620	610	100	160	702	232	470	141	707	79	348	388	158	160	87	1293	990	541	258	289	91.7	93.0	1"	1901	-793	149	136
GP-161*-585*/C2D	F35	3213	2040	1174	1692	602	680	610	100	160	732	232	500	141	786	98	348	388	158	190	87	1187	990	541	258	289	109.6	111.2	1"	1666	-456	149	136
GP-161*-585*/C2E	F35	3557	2384	1174	2036	602	680	610	100	160	732	232	500	141	786	98	348	388	158	190	87	1346	990	541	258	289	109.6	111.2	1"	1867	-715	149	136
GP-161*-585*/C2G	F35	3557	2384	1174	2036	602	680	610	100	160	732	232	500	141	786	98	348	388	158	190	87	1346	990	541	258	289	109.6	111.2	1"	1867	-715	149	136
GP-161*-585*/C3D	F35	3045	1872	1174	1524	602	680	610	100	160	732	232	500	141	786	98	348	388	158	190	87	1103	990	541	258	289	109.6	111.2	1"	1629	-394	148	136
GP-161*-585*/C3E	F35	3365	2192	1174	1844	602	680	610	100	160	732	232	500	141	786	98	348	388	158	190	87	1250	990	541	258	289	109.6	111.2	1"	1820	-642	148	136
GP-161*-585*/C3G	F35	3365	2192	1174	1844	602	680	610	100	160	732	232	500	141	786	98	348	388	158	190	87	1250	990	541	258	289	109.6	111.2	1"	1820	-642	148	136
GP-161*-585*/C4D	F35	3045	1872	1174	1524	602	680	610	100	160	732	232	500	141	786	98	348	388	158	190	87	1103	990	541	258	289	109.6	111.2	1"	1801	-462	149	136
GP-161*-585*/C4E	F35	3461	2288	1174	1940	602	680	610	100	160	732	232	500	141	786	98	348	388	158	190	87	1293	990	541	258	289	109.6	111.2	1"	1901	-754	149	136
GP-161*-585*/C4G	F35	3461	2288	1174	1940	602	680	610	100	160	732	232	500	141	786	98	348	388	158	190	87	1293	990	541	258	289	109.6	111.2	1"	1901	-754	149	136
GP-161*-585*/C5D	F35	3054	1881	1174	1533	602	680	610	100	160	732	232	500	141	786	98	348	388	158	190	87	1095	990	541	258	289	109.6	111.2	1"	1801	-465	149	136
GP-161*-585*/C5E	F35	3383	2210	1174	1862	602	680	610	100	160	732	232	500	141	786	98	348	388	158	190	87	1254	990	541	258	289	109.6	111.2	1"	2158	-745	149	136
GP-161*-585*/C5G	F35	3383	2210	1174	1862	602	680	610	100	160	732	232	500	141	786	98	348	388	158	190	87	1254	990	541	258	289	109.6	111.2	1"	2158	-745	149	136
GP-161*-635*/C2D	F35	3223	2040	1184	1692	612	730	610	100	160	757	232	525	141	830	97	348	388	158	210	98	1187	1000	541	258	289	129.1	131.0	1"	1767	-385	149	136
GP-161*-635*/C2E	F35	3567	2384	1184	2036	612	730	610	100	160	757	232	525	141	830	97	348	388	158	210	98	1346	1000	541	258	289	129.1	131.0	1"	1964	-632	149	136
GP-161*-635*/C2G	F35	3567	2384	1184	2036	612	730	610	100	160	757	232	525	141	830	97	348	388	158	210	98	1346	1000	541	258	289	129.1	131.0	1"	1964	-632	149	136
GP-161*-635*/C3D	F35	3055	1872	1184	1524	612	730	610	100	160	757	232	525	141	830	97	348	388	158	210	98	1103	1000	541	258	289	129.1	131.0	1"	1730	-324	149	136
GP-161*-635*/C3E	F35	3375	2192	1184	1844	612	730	610	100	160	757	232	525	141	830	97	348	388	158	210	98	1250	1000	541	258	289	129.1	131.0	1"	1917	-560	149	136
GP-161*-635*/C3G	F35	3375	2192	1184	1844	612	730	610	100	160	757	232	525	141	830	97	348	388	158	210	98	1250	1000	541	258	289	129.1	131.0	1"	1917	-560	149	136
GP-161*-635*/C4D	F35	3055	1872	1184	1524	612	730	610	100	160	757	232	525	141	830	97	348	388	158	210	98	1103	1000	541	258	289	129.1	131.0	1"	1902	-395	150	136
GP-161*-635*/C4E	F35	3471	2288	1184	1940	612	730	610	100	160	757	232	525	141	830	97	348	388	158	210	98	1293	1000	541	258	289	129.1	131.0	1"	2085	-643	150	136
GP-161*-635*/C4G	F35	3471	2288	1184	1940	612	730	610	100	160	757	232	525	141	830	97	348	388	158	210	98	1293	1000	541	258	289	129.1	131.0	1"	2085	-643	150	136
GP-161*-635*/C5D	F35	3064	1881	1184	1533	612	730	610	100	160	757	232	525	141	830	97	348	388	158	210	98	1095	1000	541	258	289	129.1	131.0	1"	1902	-398	150	136
GP-161*-635*/C5E	F35	3393	2210	1184	1862	612	730	610	100	160	757	232	525	141	830	97	348	388	158	210	98	1254	1000	541	258	289	129.1	131.0	1"	2255	-671	150	136
GP-161*-635*/C5G	F35	3393	2210	1184	1862	612	730	610	100	160	757	232	525	141	830	97	348	388	158	210	98	1254	1000	541	258	289	129.1	131.0	1"	2255	-671	150	136
GP-161*-685*/C2D	F35	3223	2040	1184	1692	612	780	610	100	160	782	232	550	141	880	92	348	388	158	240	105	1187	1000	541	258	289	150.3	152.5	1"	1849	-335	150	136
GP-161*-685*/C2E	F35	3567	2384	1184	2036	612	780	610	100	160	782	232	550	141	880	92	348	388	158	240	105	1346	1000	541	258	289	150.3	152.5	1"	2015	-608	150	136
GP-161*-685*/C2G	F35	3567	2384	1184	2036	612	780	610	100	160	782	232	550	141	880	92	348	388	158	240	105	1346	1000	541	258	289	150.3	152.5	1"	2015	-608	150	136
GP-161*-685*/C3D	F35	3055	1872	1184	1524	612	780	610	100	160	782	232	550	141	880	92	348	388	158	240	105	1103	1000	541	258	289	150.3	152.5	1"	1812	-276	149	136
GP-161*-685*/C3E	F35	3375	2192	1184	1844	612	780	610	100	160	782	232	550	141	880	92	348	388	158	240	105	1250	1000	541	258	289	150.3	152.5	1"	2004	-518	149	136
GP-161*-685*/C3G	F35	3375	2192	1184	1844	612	780	610	100	160	782	232	550	141	880	92	348	388	158	240	105	1250	1000	541	258	289	150.3	152.5	1"	2004	-518	149	136
GP-161*-685*/C4D	F35	3055	1872	1184	1524	612	780	610	100	160	782	232	550	141	880	92	348	388	158	240	105	1103	1000	541	258	289	150.3	152.5	1"	1984	-348	150	136
GP-161*-685*/C4E	F35	3471	2288	1184	1940	612	780	610	100	160	782	232	550	141	880	92	348	388	158	240	105	1293	1000	541	258	289	150.3	152.5	1"	2172	-600	150	136
GP-161*-685*/C4G	F35	3471	2288	1184	1940	612	780	610	100	160	782	232	550	141	880	92	348	388	158	240	105	1293	1000	541	258	289	150.3	152.5	1"	2172	-600	150	136
GP-161*-685*/C5D	F35	3064	1881	1184	1533	612	780	610	100	160	782	232	550	141	880	92	348	388	158	240	105	1095	1000	541	258	289	150.3	152.5	1"	1984	-351	150	136
GP-161*-685*/C5E	F35	3393	2210	1184	1862	612	780	610	100	160	782	232	550	141	880	92	348	388	158	240	105	1254	1000	541	258	289	150.3	152.5	1"	2342	-631	150	136
GP-161*-685*/C5G	F35	3393	2210	1184	1862	612	780	610	100	160	782	232	550	141	880	92	348	388	158	240	105	1254	1000	541	258	289	150.3	152.5	1"	2342	-631	150	136
GP-161*-735*/C2D	F35	3248	2040	1209	1692	627	840	610	100	160	812	232	580	141	938	90	348	388	158	270	105	1187	1015	541	258	289	173.0	175.5	1"	1998	-249	150	136
GP-161*-735*/C2E	F35	3592	2384	1209	2036	627	840	610	100	160	812	232	580	141	938	90	348	388	158	270	105	1346	1015	541	258	289	173.0	175.5	1"	2194	-514	150	136
GP-161*-735*/C2G	F35	3592	2384	1209	2036	627	840	610	100	160	812	232	580	141	938	90	348	388	158	270	105	1346	1015	541	258	289	173.0	175.5	1"	2194	-514	150	136
GP-161*-735*/C3D	F35	3080	1872	1209	1524	627	840	610	100	160	812	232	580	141	938	90	348	388	158	270	105	1103	1015	541	258	289	173.0	175.5	1"	1961	-193	150	136
GP-161*-735*/C3E	F35	3400	2192	1209	1844	627	840	610	100	160	812	232	580	141	938	90	348	388	158	270	105	1250	1015	541	258	289	173.0	175.5	1"	2147	-447	150	136
GP-161*-735*/C3G	F35	3400	2192	1209	1844	627	840	610	100	160	812	232	580	141	938	90	348	388	158	270	105	1250	1015	541	258	289	173.0	175.5	1"	2147	-447	150	136
GP-161*-735*/C4D	F35	3080	1872	1209	1524	627	840	610	100	160	812	232	580	141	938	90	348	388	158	270	105	1103	1015	541	258	289	173.0	175.5	1"	2133	-267	151	136
GP-161*-735*/C4E	F35	3496	2288	1209	1940	627	840	610	100	160	812	232	580	141	938	90	348	388	158	270	105	1293	1015	541	258	289	173.0	175.5	1"	2315	-530	151	136
GP-161*-735*/C4G	F35	3496	2288	1209	1940	627	840	610	100	160	812	232	580	141	938	90	348	388	158	270	105	1293	1015	541	258	289	173.0	175.5	1"	2315	-530	151	136
GP-161*-735*/C5D	F35	3089	1881	1209	1533	627	840	610	100	160	812	232	580	141	938	90	348	388	158	270	105	1095	1015	541	258	289	173.0	175.5	1"	2133	-270	151	136
GP-161*-735*/C5E	F35	3418	2210	1209	1862	627	840	610	100	160	812	232	580	141	938	90	348	388	158	270	105	1254	1015	541	258	289	173.0	175.5	1"	2485	-563	151	136
GP-161*-735*/C5G	F35	3418	2210	1209	1862	627	840	610	100	160	812	232	580	141	938	90	348	388	158	270	105	1254	1015	541	258	289	173.0	175.5	1"	2485	-563	151	136
GP-161*-785*/C3D	F35	3086	1872	1215	1524	633	890	610	100	160	837	232	605	141	983	90	348	388	158	290	115	1103	1021	541	258	289	197.4	200.3	1"	2072	-140	151	136
GP-161*-785*/C3E	F35	3406	2192	1215	1844	633	890	610	100	160	837	232	605	141	983	90	348	388	158	290	115	1250	1021	541	258	289	197.4	200.3	1"	2270	-334	151	136
GP-161*-785*/C3G	F35	3406	2192	1215	1844	633	890	610	100	160	837	232	605	141	983	90	348	388	158	290	115	1250	1021	541	258	289	197.4	200.3	1"	2270	-334	151	136
GP-161*-785*/C4D	F35	3086	1872	1215	1524	633	890	610	100	160	837	232	605	141	983	90	348	388	158	290	115	1103	1021	541	258	289	197.4	200.3	1"	2244	-214	151	136
GP-161*-785*/C4E	F35	3502	2288	1215	1940	633	890	610	100	160	837	232	605	141	983	90	348	388	158	290	115	1293	1021	541	258	289	197.4	200.3	1"	2439	-420	151	136
GP-161*-785*/C4G	F35	3502	2288	1215	1940	633	890	610	100	160	837	232	605	141	983	90	348	388	158	290	115	1293	1021	541	258	289	197.4	200.3	1"	2439	-420	151	136
GP-161*-785*/C5D	F35	3095	1881	1215	1533	633	890	610	100	160	837	232	605	141	983	90	348	388	158	290	115	1095	1021	541	258	289	197.4	200.3	1"	2244	-216	151	136
GP-161*-785*/C5E	F35	3424	2210	1215	1862	633	890	610	100	160	837	232	605	141	983	90	348	388	158	290	115	1254	1021	541	258	289	197.4	200.3	1"	2608	-460	151	136
GP-161*-785*/C5G	F35	3424	2210	1215	1862	633	890	610	100	160	837	232	605	141	983	90	348	388	158	290	115	1254	1021	541	258	289	197.4	200.3	1"	2608	-460	151	136
GP-161*-835*/C4D	F35	3234	1872	1363	1524	686	940	610	100	160	862	232	630	141	1083	135	348	388	158	320	115	1103	1074	541	258	289	223.3	226.6	1"	2453	-114	152	136
GP-161*-835*/C4E	F35	3650	2288	1363	1940	686	940	610	100	160	862	232	630	141	1083	135	348	388	158	320	115	1293	1074	541	258	289	223.3	226.6	1"	2353	-495	152	136
GP-161*-835*/C4G	F35	3650	2288	1363	1940	686	940	610	100	160	862	232	630	141	1083	135	348	388	158	320	115	1293	1074	541	258	289	223.3	226.6	1"	2353	-495	152	136
GP-161*-835*/C5D	F35	3243	1881	1363	1533	686	940	610	100	160	862	232	630	141	1083	135	348	388	158	320	115	1095	1074	541	258	289	223.3	226.6	1"	2453	-113	152	136
GP-161*-835*/C5E	F35	3572	2210	1363	1862	686	940	610	100	160	862	232	630	141	1083	135	348	388	158	320	115	1254	1074	541	258	289	223.3	226.6	1"	2523	-530	152	136
GP-161*-835*/C5G	F35	3572	2210	1363	1862	686	940	610	100	160	862	232	630	141	1083	135	348	388	158	320	115	1254	1074	541	258	289	223.3	226.6	1"	2523	-530	152	136
GP-161*-885*/C4E	F35	3735	2288	1448	1940	771	990	610	100	160	887	232	655	141	1131	138	348	388	158	340	122	1293	1159	541	258	289	319.6	324.3	1"	2722	-264	155	160
GP-161*-885*/C4G	F35	3735	2288	1448	1940	771	990	610	100	160	887	232	655	141	1131	138	348	388	158	340	122	1293	1159	541	258	289	319.6	324.3	1"	2722	-264	155	160
GP-161*-885*/C5E	F35	3657	2210	1448	1862	771	990	610	100	160	887	232	655	141	1131	138	348	388	158	340	122	1254	1159	541	258	289	319.6	324.3	1"	2892	-309	155	160
GP-161*-885*/C5G	F35	3657	2210	1448	1862	771	990	610	100	160	887	232	655	141	1131	138	348	388	158	340	122	1254	1159	541	258	289	319.6	324.3	1"	2892	-309	155	160
GP-161*-935*/C4D	F35	3324	1872	1453	1524	776	1040	610	100	160	912	232	680	141	1182	134	348	388	158	370	132	1103	1164	541	258	289	356.7	361.9	1"	2696	-5	153	138
GP-161*-935*/C4E	F35	3740	2288	1453	1940	776	1040	610	100	160	912	232	680	141	1182	134	348	388	158	370	132	1293	1164	541	258	289	356.7	361.9	1"	2457	-20	153	136
GP-161*-935*/C4G	F35	3740	2288	1453	1940	776	1040	610	100	160	912	232	680	141	1182	134	348	388	158	370	132	1293	1164	541	258	289	356.7	361.9	1"	2457	-20	153	136
GP-161*-935*/C5D	F35	3333	1881	1453	1533	776	1040	610	100	160	912	232	680	141	1182	134	348	388	158	370	132	1095	1164	541	258	289	356.7	361.9	1"	2696	-4	153	138
GP-161*-935*/C5E	F35	3662	2210	1453	1862	776	1040	610	100	160	912	232	680	141	1182	134	348	388	158	370	132	1254	1164	541	258	289	356.7	361.9	1"	2457	-22	153	136
GP-161*-935*/C5G	F35	3662	2210	1453	1862	776	1040	610	100	160	912	232	680	141	1182	134	348	388	158	370	132	1254	1164	541	258	289	356.7	361.9	1"	2457	-22	153	136
GP-161*-937*/C4D	F35	3140	1872	1269	1524	591	940	610	100	160	862	232	630	141	1084	136	348	388	158	320	115	1103	979	541	258	289	395.9	401.7	1"	2872	53	153	139
GP-161*-937*/C4E	F35	3556	2288	1269	1940	591	940	610	100	160	862	232	630	141	1084	136	348	388	158	320	115	1293	979	541	258	289	395.9	401.7	1"	3069	-139	155	160
GP-161*-937*/C4G	F35	3556	2288	1269	1940	591	940	610	100	160	862	232	630	141	1084	136	348	388	158	320	115	1293	979	541	258	289	395.9	401.7	1"	3069	-139	155	160
GP-161*-937*/C5D	F35	3149	1881	1269	1533	591	940	610	100	160	862	232	630	141	1084	136	348	388	158	320	115	1095	979	541	258	289	395.9	401.7	1"	2872	54	153	139
GP-161*-937*/C5E	F35	3478	2210	1269	1862	591	940	610	100	160	862	232	630	141	1084	136	348	388	158	320	115	1254	979	541	258	289	395.9	401.7	1"	3239	-186	155	160
GP-161*-937*/C5G	F35	3478	2210	1269	1862	591	940	610	100	160	862	232	630	141	1084	136	348	388	158	320	115	1254	979	541	258	289	395.9	401.7	1"	3239	-186	155	160
GP-200*-535*/C1D	F40	3363	1942	1421	1516	746	620	610	100	200	790	280	510	128	702	79	425	475	153	160	125	1165	1222	663	317	271	113.7	116.2	1"	1904	-421	182	138
GP-200*-535*/C1E	F40	3845	2424	1421	1998	746	620	610	100	200	790	280	510	128	702	79	425	475	153	160	125	1392	1222	663	317	271	113.7	116.2	1"	2032	-806	182	138
GP-200*-535*/C1G	F40	3845	2424	1421	1998	746	620	610	100	200	790	280	510	128	702	79	425	475	153	160	125	1392	1222	663	317	271	113.7	116.2	1"	2032	-806	182	138
GP-200*-535*/C2D	F40	3363	1942	1421	1516	746	620	610	100	200	790	280	510	128	702	79	425	475	153	160	125	1165	1222	663	317	271	113.7	116.2	1"	1957	-441	182	138
GP-200*-535*/C2E	F40	3944	2523	1421	2097	746	620	660	100	200	790	280	510	128	722	79	425	475	153	180	140	1452	1222	663	317	271	113.7	116.2	1"	2333	-913	182	138
GP-200*-535*/C2G	F40	3944	2523	1421	2097	746	620	660	100	200	790	280	510	128	722	79	425	475	153	180	140	1452	1222	663	317	271	113.7	116.2	1"	2333	-913	182	138
GP-200*-585*/C1D	F40	3363	1942	1421	1516	746	680	610	100	200	820	280	540	128	781	98	425	475	153	190	145	1165	1222	663	317	271	135.9	138.9	1"	1996	-359	183	138
GP-200*-585*/C1E	F40	3845	2424	1421	1998	746	680	610	100	200	820	280	540	128	781	98	425	475	153	190	145	1392	1222	663	317	271	135.9	138.9	1"	2119	-738	183	138
GP-200*-585*/C1G	F40	3845	2424	1421	1998	746	680	610	100	200	820	280	540	128	781	98	425	475	153	190	145	1392	1222	663	317	271	135.9	138.9	1"	2119	-738	183	138
GP-200*-585*/C2D	F40	3363	1942	1421	1516	746	680	610	100	200	820	280	540	128	781	98	425	475	153	190	145	1165	1222	663	317	271	135.9	138.9	1"	2049	-380	183	138
GP-200*-585*/C2E	F40	3944	2523	1421	2097	746	680	660	100	200	820	280	540	128	781	98	425	475	153	190	145	1452	1222	663	317	271	135.9	138.9	1"	2420	-849	183	138
GP-200*-585*/C2G	F40	3944	2523	1421	2097	746	680	660	100	200	820	280	540	128	781	98	425	475	153	190	145	1452	1222	663	317	271	135.9	138.9	1"	2420	-849	183	138
GP-200*-635*/C1D	F40	3363	1942	1421	1516	746	730	610	100	200	845	280	565	128	835	97	425	475	153	220	145	1165	1222	663	317	271	160.1	163.6	1"	2067	-315	183	138
GP-200*-635*/C1E	F40	3845	2424	1421	1998	746	730	610	100	200	845	280	565	128	835	97	425	475	153	220	145	1392	1222	663	317	271	160.1	163.6	1"	2216	-664	183	138
GP-200*-635*/C1G	F40	3845	2424	1421	1998	746	730	610	100	200	845	280	565	128	835	97	425	475	153	220	145	1392	1222	663	317	271	160.1	163.6	1"	2216	-664	183	138
GP-200*-635*/C2D	F40	3363	1942	1421	1516	746	730	610	100	200	845	280	565	128	835	97	425	475	153	220	145	1165	1222	663	317	271	160.1	163.6	1"	2120	-336	184	138
GP-200*-635*/C2E	F40	3944	2523	1421	2097	746	730	660	100	200	845	280	565	128	835	97	425	475	153	220	145	1452	1222	663	317	271	160.1	163.6	1"	2517	-779	184	138
GP-200*-635*/C2G	F40	3944	2523	1421	2097	746	730	660	100	200	845	280	565	128	835	97	425	475	153	220	145	1452	1222	663	317	271	160.1	163.6	1"	2517	-779	184	138
GP-200*-685*/C1D	F40	3363	1942	1421	1516	746	780	610	100	200	870	280	590	128	875	92	425	475	153	240	162	1165	1222	663	317	271	186.4	190.4	1"	2156	-264	184	138
GP-200*-685*/C1E	F40	3845	2424	1421	1998	746	780	610	100	200	870	280	590	128	875	92	425	475	153	240	162	1392	1222	663	317	271	186.4	190.4	1"	2303	-623	184	138
GP-200*-685*/C1G	F40	3845	2424	1421	1998	746	780	610	100	200	870	280	590	128	875	92	425	475	153	240	162	1392	1222	663	317	271	186.4	190.4	1"	2303	-623	184	138
GP-200*-685*/C2D	F40	3363	1942	1421	1516	746	780	610	100	200	870	280	590	128	875	92	425	475	153	240	162	1165	1222	663	317	271	186.4	190.4	1"	2209	-286	184	138
GP-200*-685*/C2E	F40	3944	2523	1421	2097	746	780	660	100	200	870	280	590	128	875	92	425	475	153	240	162	1452	1222	663	317	271	186.4	190.4	1"	2604	-739	184	138

APPENDIX 4 INSTRUMENT AIR CALCULATION

Document Title	Document No. (Client / GPA)	Rev / Status
Instrument Air Capacity Review		A
	GAS-563-CA-PS-006	

Scenario/Design Case Name:	Wilton Instrument Air Utility Calculation

Scenario/Design Case Input Data

		Units	Metric	Key	Input
Tag #					Calculated
Equipment #					
Location					
P&ID #					

Air Receiver

Description	Reference	Symbol	Units	Value
Instrument air receiver		V	m^3	1.5
Instrument air receiver pressure		P	kPag	1090
Instrument air temperature		T	°C	25
Instrument air receiver density		ρ	kg/m^3	13.9
Instrument air inventory		m	kg	20.80
Instrument receiver min air pressure		P	kPag	500
Instrument receiver min air density	Calculated	ρ	kg/m^3	7.0
Minimum instrument air inventory		m	kg	10.50
Air normal pressure		P	kPag	0
Air normal temperature		T	°C	0
Air normal density		ρ	kg/Nm^3	1.28
Instrument air available inventory		m	kg	10.30
		-	Nm^3	13.22

Shutdown Valve

Description	Reference	Symbol	Units	Value
Slam shut valves Valve	Appendix 2	V	m^3	0.1112
Air required for min pressure	Calculated	m	kg	0.78
			Nm^3	0.61

JGN Regulator

Description	Reference	Symbol	Units	Value
Number of control valves			-	3
Steady state air consumption		q	Nm^3/h	1.30
Max air consumption		q	Nm^3/h	29.50
Total steady state air consumption		q	Nm^3/h	3.90
Total max air consumption		q	Nm^3/h	59.00

Total Air Required

Description	Reference	Symbol	Units	Value
Number of shutdown valves		-	-	2
Maximum air required			Nm^3	1.21

APPENDIX 12

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		32.2

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	31	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
32.2	SERVICES REQUIRED	U/G services in location proposed for the new WBH & skids			Review location of existing open drain and U/G services (stormwater, comms & power) relative to proposed location for new WBH & skids	**1 / PJB**

DISCUSSION AND RECOMMENDATION

The existing U/G stormater services and manholes have been included in the site plan drawing, 563-DW-PI-008(3C) “Issued for Detailed Design” revision, as attached. New skids have been located so that they do not clash with known open drains and U/G services.

ACTION TAKEN / CLOSE OUT COMMENTS

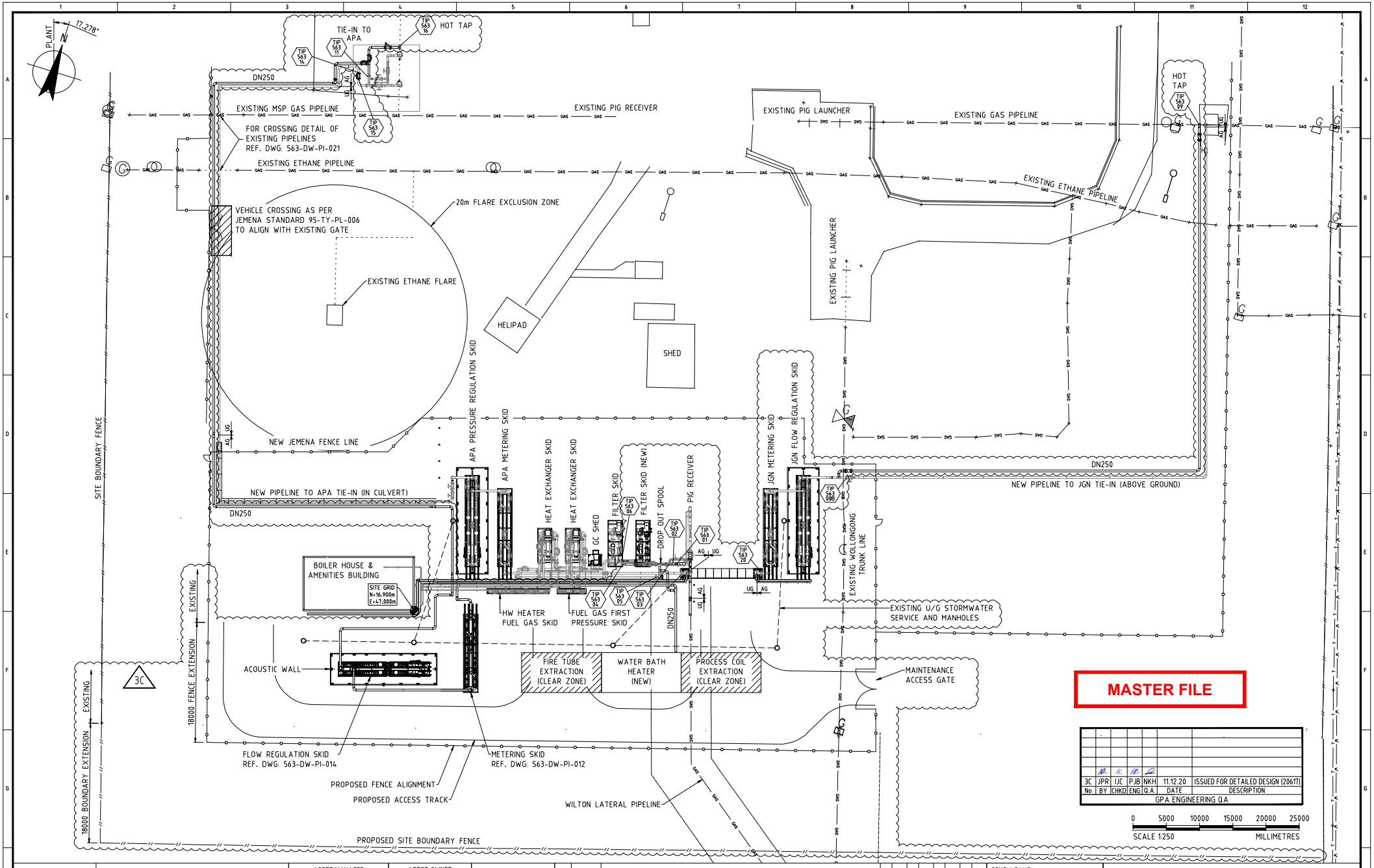
563-DW-PI-008 (plot plan) updated to include known open drain and U/G services. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 8/2/21

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 16:00:27 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21



ASSET MANAGER

Jemena

Produced by Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
3C	11.12.20	ISSUED FOR DETAILED DESIGN (20617)	GPA	IJC	NKH	
3B	13.11.20	ISSUED FOR HAZOP (20617)	GPA	IJC	NKH	
3A	18.09.20	ISSUED FOR REVIEW (20617)	GPA			
3	08.02.16	AS BUILT TO CLIENT MARKUPS	JB			
2	27.05.15	REISSUED FOR CONSTRUCTION	JB	GJ	AH	
1	17.04.15	REISSUED FOR CONSTRUCTION	JB	GJ	AH	
0	16.01.15	ISSUED FOR CONSTRUCTION	JB	GJ	AH	

DRAWING No. | REFERENCE DRAWINGS

CONSULTANT

GPA

www.gpaeng.com.au

WILTON METER STATION
GAS NETWORK DISTRIBUTION
PLOT PLAN
STATION UPGRADE

DRAWN	C. CASSAR	FACILITY	SUBJECT
DESIGN		SCALE	1:250
CHECKED		SUPERSEDES	A1
APPROVED		DRAWING NUMBER	REV. 3C
DATE		563-DW-PI-008	

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		6.20

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	6	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
6.20	ISOLATION	Station / compressor unit ESD blows down existing piping to vent	Switching valve piping is upstream of compressor unit SDVs so remains pressurised on Station ESD		Review isolation, depressurisation and pressurisation of the new switching valve piping to determine requirement for repressurisation lines around switching valves, vents etc.	**1 / SH**

DISCUSSION AND RECOMMENDATION

The switching valves and associated pipework for part of the MLV bypass EGP station pipework. This pipework does not depressure on compressor station blowdown as it is outside of the compressor station isolation valves and will only be depressured during a pipeline blowdown through the station vent. The pipework willl therefore be repressured after blowdown along with the EGP. Pressurisation line G-064908-C9D-150 is designed to equalise the pressure in the bypass pipework up to the compressor isolation valves before the switching valves are actuated to change flow direction. Therefore individual pressurisation lines around switching valves are not required.

ACTION TAKEN / CLOSE OUT COMMENTS
No actions taken. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 10/02/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:13:48 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		28.20

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	28	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
28.20	ISOLATION	Pressurisation line double block and bleed design inadequate as it relies on a plug valve.	Insufficient isolation of regulator run.		Add re-pressurisation line around 400-BV-64127/64138 to connect in upstream of the slam shut valve. Repressurisation line to be two DN50 ball valves, with RO if required	**1 / PB**

DISCUSSION AND RECOMMENDATION

The required equipment isolations were initially defined by Jemena in the Design Review (refer GAS-599-MM-PM-001(A)) and further clarified post HAZOP by the Jemena Engineering Manager (Mike Peoples) to be as per the Jemena Piping Design Guide GTS-960-DG-PI-001 (refer Email 20617-R819). In accordance with the isolation philosophy defined in GTS-960-DG-PI-001 Section 10.1.2, Jemena have advised GPA that a single valve isolation is considered suitable for the regulator runs based on a maintenance frequency of greater than a year (refer JAM-RESTECHQ-000012).

This advice means that a single ball valve for isolation and a plug valve for throttling are sufficient in the repressurisation line and no change to the design of the repressurisation line has been made.

Note: 400-BV-64127/64138 changed to 250-BV-064057/064064 respectively.

ACTION TAKEN / CLOSE OUT COMMENTS

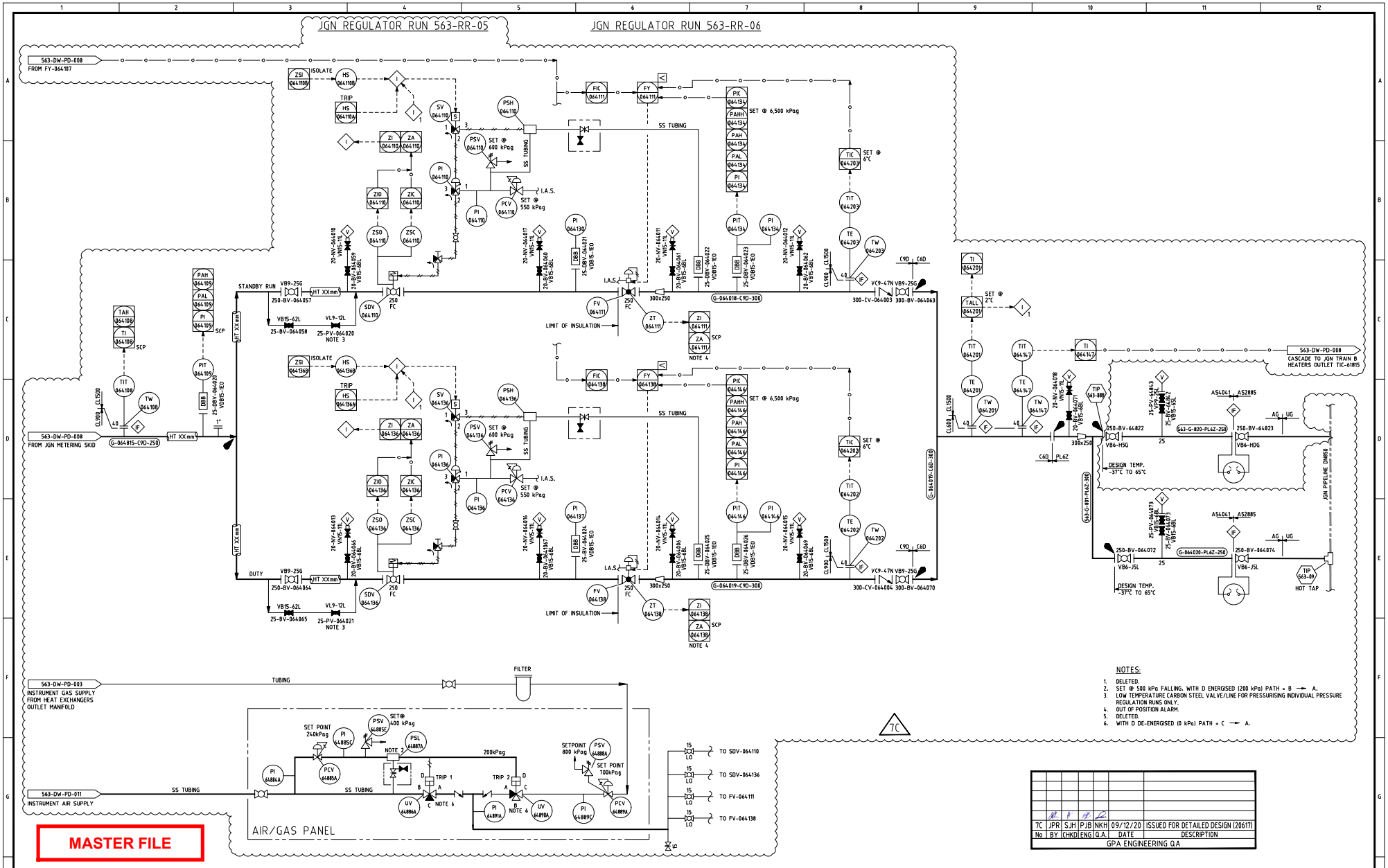
Re-pressurisation line around 400-BV-64127/64138 relocated to connect upstream of slam shut valves on P&ID 563-DW-PD-010(7C). No changes were made to the re-pressurisation line valve configuration per discussion above. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 10/2/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:57:32 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21



NOTES:

1. DELETED.
2. SET @ 500 kPa FALLING, WITH D ENERGISED (200 kPa) PATH = B → A.
3. LOW TEMPERATURE CARBON STEEL VALVE/LINE FOR PRESSURISING INDIVIDUAL PRESSURE REGULATION RUNS ONLY.
4. OUT OF POSITION ALARM.
5. DELETED.
6. WITH D DE-ENERGISED (0 kPa) PATH = C → A.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
7C	JPR	SJH	PJB	NKH	09/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
7A	17/09/20	ISSUED FOR REVIEW (20617)	GPA			
7	10/02/16	AS BUILT TO CLIENT MARKUPS	LC		JB	
6	18/01/16	AS BUILT TO CLIENT MARKUPS	JS		NB	
5	01/09/15	REISSUED FOR CONSTRUCTION	JB		GH	AH
4	18/08/15	REISSUED FOR CONSTRUCTION	JB		NB	AH
3	21/07/15	REISSUED FOR CONSTRUCTION	JB		NB	AH
7C	09/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	JPR	SJH	NKH
7B	04/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	NKH

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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CONSULTANT
GPA
www.gpaeng.com.au

WILTON METER STATION
JGN FLOW REGULATION SKID (RUN No. 5 & 6)
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT	
DESIGN	SCALE	N.T.S.	
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER	563-DW-PD-010	REV 7C
DATE			

PD-510-DW-PD-003	CONNECTION TO BI-DIRECTIONAL PIPELINE & FILTER/SEPARATOR
DRAWING No.	REFERENCE DRAWINGS

Document Title	Document No. (Client / GPA)
Facilities FEED Stage 1 - Design Review Minutes	GAS-599-MM-PM-001
	N/A

Client Name	Jemena			Date	07/10/2020	By	DAF
Client Project No.	N/A	GPA Project No.	20617	Rev/ Status	A	Chkd	PJB / SG
Project Name	Project Marlin: EGP Reversal				IFI	QA	NKH

System	599 - General EGP Reconfig	Reviewed			Comments	Actions	Assigned to
P&ID No(s).		Yes	No	N/A			
1. Basis of Design / Process Overview							
- Is the project scope defined?		X			East Gippsland Compressor Station (EGCS) has to be removed from scope. Reverse flow compression at EGCS is not required due to the close proximity to LCS/Vic Hub.	Provide confirmation that EGCS has been removed from the facilities scope.	Jemena (Matthew Skaras)
- Are the applicable standards defined?							
- Are all the design and operating cases defined?							
- Are the process fluids defined ?(Composition, temperature, pressure,							
- Is the turndown and Turn up requirements defined? (Flowrates, pressures,							
- Site ambient conditions defined?							
- Are the battery limits defined and reasonable							
- Is the operating envelope fully defined?							
- Are pipe specifications appropriate?		X			From the EGP basis of design 500-RP-006, and EGP manual GTS-599-OM-GEN-001, it is understood that the EGP mainline is upgradeable to an MAOP of 16.55 MPag. All items (pipeline assemblies, pig traps, MLVs, valves, flanges etc) which cannot be isolated from the EGP are to be designed to 16.55 MPag, i.e. CL1500. Isolatable equipment remains CL900, with design pressure of 14.895 MPag. For this reason, the KGMS pig receiver, hot tap connection, and compressor station flow switching valves & piping have been designed using CL1500 piping specification CE15X. However it is noted that a number of EGP mainline equipment is not designed to 16.55 MPag, e.g. Mila pig traps, Kembla Grange MLV which are designed to Jemena specification C9D.	Jemena to complete a cost-benefit analysis of designing EGP connected equipment for a future upgrade design pressure of 16.55 MPag. Jemena to advise outcome of the cost-benefit analysis and confirm if piping and equipment should be designed to 16.55 MPag or 14.895 MPag design pressure. GPA to continue working as per the pipe specs shown on the P&ID until a decision is made.	Jemena (Matthew Skaras)
Control Valves							
- Is fail position shown and correct?							
- Is a bypass required and correctly sized?							
Actuated Valves							
- Are start-up pressuring bypasses required?							
- Is fail position shown and correct?							
2. Process Safety considerations							
- Are there overpressure risks, how will they be controlled?							
- Are there over temperature risks, how will they be controlled?							
- Has the venting requirements and location been considered							
- Are the environmental and societal impacts considered in the design							
3. Operations							
- How will equipment operate?							
- Are there different operating modes- has changeover been addressed?							
- Is equipment sparing consistent with sparing policy?							
- What valves and controls require operator access, how often?							
- What services are required - are they provided?							
4. Controls & Instrumentation							
- Are control schemes adequately defined?							
- How does overall flow and pressure control work?							
Has impact of Unit shutdown on other Units been addressed?							
- ESD shutdown Philosophy?							
5. Maintenance / Construction							
- What needs to be maintained, and how often?							
- Is there a venting/purging/draining philosophy?							
- Is isolation for maintenance adequate (consistent with isolation policy)?		X			The Isolation Philosophy to be applied: - Double block and bleed (DB&B) isolation, consisting of two separate block valves and bleed in between, is required for normal maintenance access (major equipment e.g. filter element change) - Single isolation is required for non-routine maintenance, e.g. flow meter removal.	Detail the isolation philosophy in the basis of design document.	GPA (Simon Hanlin)
- Isolations required for tie-in construction							
6. Layout							
- Existing services – underground and above ground				X	N/A - refer to location specific layouts.		
- What land / space is available and clear for use				X	N/A - refer to location specific layouts.		
- Access and maintainability, personnel access				X	N/A - refer to location specific layouts.		
- Egress routes				X	N/A - refer to location specific layouts.		
- Drainage, bulk earthworks requirements				X	N/A - refer to location specific layouts.		
- Geotech condition				X	N/A - refer to location specific layouts.		
- Vehicle access during ops				X	N/A - refer to location specific layouts.		
- Vehicle access during construction (cranes, trucks)				X	N/A - refer to location specific layouts.		

Simon Hanlin

From: Michael Peoples <Michael.Peoples@jemena.com.au>
Sent: Monday, 9 November 2020 5:05 PM
To: Lisa Hein
Cc: Sarah Greening
Subject: 20617-R819: 20617-S2153: Jemena Isolation Policy Guide

Hi Lisa

Yes pig traps have only one isolation valve. Pigging is on a frequency around 5-10 years.

I am the signoff for isolation arrangements, however as Matt says if the HAZOP takes into account the valving arrangements and they are as per the guide, then I do not need to approve them.

It would only be a completely new arrangement, or a scenario somehow outside normal application that I would need to approve.

Cheers

Mike

From: Lisa Hein <Lisa.Hein@gpaeng.com.au>
Sent: Monday, 9 November 2020 5:28 PM
To: Michael Peoples <Michael.Peoples@jemena.com.au>
Cc: Sarah Greening <sarah.greening@gpaeng.com.au>
Subject: 20617-S2153: RE: 20617-S2132: Jemena Isolation Policy Guide

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and are expecting the content or attachment from the sender.

Thanks Mike,

For my clarity, does a double block and bleed apply to the pig receiver isolation or is a single valve isolation acceptable in this case? I have referred to the design review minutes but it doesn't appear to be mentioned in there. Are you the sign off authority for the valving isolation arrangement in Jemena?

Let me know and I can record in the minutes. Thanks

Lisa Hein
Senior Consultant - Risk and Advisory
BEng (Chem) (Hons) | MIChemE | RPEQ

GPA Engineering
121 Greenhill Road, Unley SA 5061
Dir 08 8299 8331 | **Mob** 0439 843 582 | **Ph** 08 8299 8300
E Lisa.Hein@gpaeng.com.au | **I** http://www.gpaeng.com.au/

From: Michael Peoples <Michael.Peoples@jemena.com.au>
Sent: Monday, 9 November 2020 4:48 PM
To: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Sarah Greening <sarah.greening@gpaeng.com.au>; Nathan Biggins <Nathan.Biggins@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton

<Peter.Blyton@gpaeng.com.au>; Young, David <dsy@enscope.com.au>
Subject: RE: 20617-S2132: Jemena Isolation Policy Guide

Folks

I lose track of which projects we have provided these documents to, and which we haven't.

The relevant section to refer to for isolations is GTS-960-DG-PI-001 section 10.1.2.

Positive isolation (spade/blind/dropout spool) is mandatory where maintenance involving breaking gas containment, is done in confined spaces.

Valve isolation is acceptable for non-confined-spaces.

DBB is required in class #600 and above where the item being isolated is subjected to maintenance which involves breaking gas containment, on a frequency of one year or less.

Cheers

Mike

From: Matthew Skaras <Matthew.Skaras@jemena.com.au>
Sent: Monday, 9 November 2020 4:35 PM
To: Sarah Greening <sarah.greening@gpaeng.com.au>; Nathan Biggins <Nathan.Biggins@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton <Peter.Blyton@gpaeng.com.au>; Young, David <dsy@enscope.com.au>; Michael Peoples <Michael.Peoples@jemena.com.au>
Subject: RE: 20617-S2132: Jemena Isolation Policy Guide

Hi Sarah,

Please refer to the design review minutes, the isolation requirements were discussed at length and I don't believe that anything in the HAZOP changed these requirements. Our ops team wanted to revisit these by raising the isolation issues previously agreed upon, now that we have also had the discussion in HAZOP we should be better informed on the groups views (please be mindful of this in subsequent HAZOP sessions so that we can manage the session and stay on track – this item will no doubt come up again).

In the meantime, I will go back to our team and see if there is a specific reference to a document, however there is unlikely to be anything prescriptive.

As a general note whilst it is acceptable in principle to review items previously agreed (and somewhat welcomed, to convince the group we have covered off on all the risks), any discussion needs to be targeted to the node being considered, justified and worked through on its merits as part of the workshop. If we do start to open up discussions previously held this needs to be managed and challenged by the facilitator (and group) regardless of personal views.

Regards,

Matthew Skaras
Project Manager – Major Projects
Jemena
Level 15, 567 Collins St, Melbourne, VIC 3000
(03) 9173 8416 | 0423 538 955
matthew.skaras@jemena.com.au | www.jemena.com.au

From: Sarah Greening <sarah.greening@gpaeng.com.au>
Sent: Monday, 9 November 2020 1:35 PM
To: Nathan Biggins <Nathan.Biggins@jemena.com.au>; Matthew Skaras <Matthew.Skaras@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton <Peter.Blyton@gpaeng.com.au>
Subject: 20617-S2132: Jemena Isolation Policy Guide

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Hi Nathan, Matthew,

During the first HAZOP session last week you referred to Jemena Isolation Policy Guide, can you please provide a copy of this or the document number for reference in the HAZOP minutes?

Thanks,

Sarah Greening
Project Manager
BEng (Chem) (Hons) | RPEQ

GPA Engineering
121 Greenhill Road, Unley SA 5061
Dir 08 8299 8320 | **Ph** 08 8299 8300
E sarah.greening@gpaeng.com.au | **I** http://www.gpaeng.com.au/

I am in the office on Mondays, Tuesdays, Thursdays, and Fridays.

****
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MAIL TYPE
Response to Technical Query
MAIL NUMBER
JAM-RESTECHQ-000012
REFERENCE NUMBER
GPA-TECHQ-000013

Re: Kembla Grange - HAZOP Item 1.23

From	Stephen Chow - Jemena Asset Management
To (2)	Sarah Greening - GPA Engineering
	Matthew Skaras - Jemena Asset Management
Cc (5)	Mr Simon Hanlin - GPA Engineering
	Mr Peter Blyton - GPA Engineering
	GPA Document Control - GPA Engineering
	Nathan Biggins - Jemena Asset Management
	David Young - Jemena Asset Management
Sent	Friday, 4 December 2020

MESSAGE

Hi Sarah,

Please see TQ response from Jemena Gas Engineering Manager:

Engineering has assessed the TQ query and advises that GPA is to proceed with the single valve isolation design.

Whilst Jemena has had some issues with valve isolations in the past, these have been limited and are still judged rare in relation to the total number of valves installed on our assets. The issues encountered have all been related to vendor quality and not related to incorrect specification.

Jemena balances risk against cost when establishing where a leak-tolerant design (two valve DBB) should be installed, and prioritises locations based on frequent scheduled maintenance (opening on a frequency of one year or higher) or where urgent maintenance access might be required, the failure of which might interrupt gas flows. In practice this results in filter assemblies being prioritised and occasionally other equipment in continuous service for which a redundant spare or bypass is installed.

In this particular case, Jemena's history is that one pig trap isolation valve has been replaced on any of Jemena's assets, and this was in relation to a valve stem leak, as opposed to a seat leak. This valve was at Wallumbilla.

In relation to the queries on the application of the risk matrix, Engineering notes that the probability assessment includes a dimension of time – chance of the event per year- thus assessing the relative frequency of the event is relevant to assessing the probability. If a valve is relied upon 4 times per year this is a material difference to if the valve is relied upon once each ten years. Although the probability may not be linear between the two it is relevant to be considered.

In addition Engineering does not believe that the consequence being assessed is Catastrophic. The most credible case is a valve seat leak that results in an excessive cavity vent rate and appreciable cavity pressure, that results in the proposed pigging activity being unable to be carried out. Jemena's experience is that once a DBB "single valve" isolation is proven then there is no credible case for a catastrophic failure.

As part of preparation for pigging, isolation valves are tested and proven well before pigs are mobilised, and the worst case outcome is a repair operation that involves suspension of the pipeline. As this outcome is rare or unexpected the judgement applied is that the additional expense of installing two additional full bore valves (estimate $130k) to mitigate this eventuality is not justified.

Regards,
Stephen Chow

From: S Greening
Sent: 24/11/2020 12:55:45 PM AEDT (GMT +11:00)
To: Stephen Chow, Matthew Skaras
Cc: Peter Blyton, GPA Document Control, Simon Hanlin, Nathan Biggins, David Young
Mail Number: GPA-TECHQ-000013
Subject: Kembla Grange - HAZOP Item 1.23

Are there any attachments?:	No
Authorised Signatory:	n/a
Description:	Kembla Grange - HAZOP Item 1.23
Drawing Reference:	n/a
If yes, state recommended control below:	n/a
Is additional hazard control required?:	No
Is the response critical to work progres:	No
Location:	Kembla Grange
Standard/Specification Reference:	n/a
Urgency:	Routine

Hi Matthew, Stephen,

Can you please respond to this feedback sent from Luke Gigliotti?

I wanted to provide some feedback re Item 1.23 for consideration, which was the removal of the second isolation valve on the inlet to the new pig receiver on the Kembla Grange lateral from the LNG Ship.

My understanding is the remaining single valve is a trunnion mounted ball valve (with 2 faces)- which per the Jemena design guide 'Piping Design Guide and Material Specification for Gas Pipeline Facilities GTS-960-DG-PI-001 Rev 1) is acceptable- but I would like if the following points are considered:

- Performance of Trunnion Mounted Ball Valves on Jemena assets
- Lack of available upstream isolation (operability and commercial considerations)
- Change to risk based on frequency of task?

1. Feedback from those in the field have suggested that there has been multiple failures of different trunnion valves across the EGP. East Gippsland Compressor Station and Longford Compressor station are two sites in which there has been failure of recently acquired and installed trunnion mounted 2 face valves. I'm unsure of their design and specification, but at the least it should be understood what these failure mechanisms were and if we can, build this into the specification for Project Marlin so it is not repeated. Nevertheless, there is a lack of confidence of this valve type in the field along EGP.
2. The feedback from the project that in the absence of a valve holding, the operators in the field would look for an upstream valve to get a safe isolation. For this item, there is no upstream valve available (only at the LNG ship tie-in). In this event there would be a significant commercial implication in terms of venting volume and of time. Is an additional valve worth considering to avoid the consequence?
3. The frequency of the pigging task (every 5 years nominally- unsure of what other PM work is required for the receiver itself and associated isolation valves) is used as a reason (per our guideline) to not install DBB. For me it is unclear how the risk changes based on frequency of task. For the same activity that is executed say 1/year versus 1/ 2 years, the likelihood of failure shouldn't change or not significantly enough to change from say 'possible' to 'unlikely' and therefore change the risk per the Jemena matrix. The exposure to the task does increase but in this example it shouldn't necessarily double i.e. not linear.

   Also note, if we deem any of our maintenance tasks with a catastrophic consequence then the likelihood of the task does not minimise the risk in terms of approval to proceed (see below)- is this the case for receiving a pig? Operationally, when a task is executed on an infrequent basis it tends to attract a higher risk to personnel- and therefore engineering controls are best to be relied upon rather than procedural…would additional isolation provide this in this case and provide greater reduction in risk?

Perhaps these things could be considered by the broader project team before finalisation of the minutes?

Likelihood		Consequence			
		Minor	Serious	Severe	Major
		1	2	3	4
Almost Certain	5	Moderate	High	Extreme	Extreme
Likely	4	Moderate	Significant	High	Extreme
Possible	3	Moderate	Moderate	Significant	High
Unlikely	2	Low	Low	Moderate	Significant
Rare	1	Low	Low	Moderate	Moderate

Figure 7: Risk Matrix

** **Note:** Whilst these risks are rated below extreme, the potentially catastrophic consequen reporting (refer Figure 9 for details).*

Risk Rating*	Suggested Action	Suggested Timing	Monitoring
EXTREME	Requires immediate action. Highest priority to treat risk. Senior level monitoring.	Action plans prepared and normally implemented within 1 month. Status of risk should be monitored monthly.	**SGSPAA:** Board / RHSEC / ERMC / LT **Functional Group / Zinfra:** Managing Director / Executive General Manager
HIGH	Requires immediate attention – must manage with senior level monitoring. Includes RHSEC and ERMC / LT oversight of Unlikely Likelihood, Catastrophic Consequence Events.	Action plans prepared and normally implemented within 3 months. Status of risk should be monitored monthly.	**SGSPAA:** RHSEC** / ERMC / LT **Functional Group (Jemena) / Zinfra:** EGM / General Managers
SIGNIFICANT	Requires Management attention with a degree of priority. Includes RHSEC / ERMC / LT oversight of Rare Likelihood, Catastrophic Consequence Events. High level monitoring.	Action plans prepared and normally implemented within 6 months. Status of risk should be monitored every 6 months.	**SGSPAA:** RHSEC** / ERMC** / LT **Functional Group (Jemena) / Zinfra:** EGM / General Managers
MODERATE	Requires routine to periodic monitoring.	Action plans prepared and normally implemented within 6 – 12 months (where the benefits outweigh the costs). Status of risk should be monitored at least every 6 months.	**SGSPAA / Functional Group (Jemena) / Zinfra:** General Managers Escalate FG / Zinfra risk to the EGM / Zinfra MD if the risk consequence or likelihood is increasing.
LOW	"Business as usual" - should not require much attention but should be reviewed at least annually. Managed by routine policies and procedures.	Ongoing control as part of a management system. Risk Facilitators to maintain register of Low risks and reassess annually.	**SGSPAA / Functional Group (Jemena) / Zinfra:** Managers Escalate FG / Zinfra risk to the GM if the risk consequence or likelihood is increasing.

Note *: Risk oversight requirements are based on the Residual risk rating, i.e. after existing controls have been evaluated and assigned.

**: RHSEC and ERMC reporting only for Rare and Unlikely Likelihood, Catastrophic Consequence Events. However, the RHSEC may escalate any risk matters to the Board if the RHSEC considers it appropriate.

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		6.20

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	6	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
6.20	ISOLATION	Station / compressor unit ESD blows down existing piping to vent	Switching valve piping is upstream of compressor unit SDVs so remains pressurised on Station ESD		Review existing Station ESD and if new switching valve piping is required to vent/blowdown on Station ESD, and document as part of Isolation and Blowdown Philosophy	**1**

DISCUSSION AND RECOMMENDATION

Switching valve pipework is part of the MLV bypass pipework and will not be blown down automatically as part of a compressor station ESD. Therefore, there is no change to the compressor station isolation and blowdown philosophy. Design change (20617-DCR-001) was raised to redesign the switching valve tie in and piping arrangement to segregate the switching valve pipework from the compressor station suction and discharge pipework.

ACTION TAKEN / CLOSE OUT COMMENTS

Review of switching valve piping complete. DCR raised and actioned to complete design change to segregate switching valve pipework form compressor station suction and discharge pipework. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 8/02/21

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason:I am the author of this document Location: your signing location here Date: 2021-02-18 13:58:10 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

Design Change Request
20617-DCR-001

Project Marlin: EGP Reversal

Michelago switching valve TIP change

Client Project Number: 20617

1. REQUEST FOR DESIGN CHANGE

Description of Change (include as attachment if insufficient space)

The proposed change is to relocate the tie-in-points for the flow switching valves at the Michelago Compressor Station to facilitate the relocation of the flow switching valves and pipework away from the compressor suction and discharge pipework. A number of HAZOP action items (6.16, 6.20 and 7.17) were raised to consider revising the layout of the new Michelago Compressor Station pipework to improve site access and to segregate the pipework which blows down on Station ESD (Compressor skid) and the pipework that does not blowdown (MLV bypass and switching valve pipework) as detailed below.

Item No.	Guideword	Cause	Consequence	Action Required
6.16	PLANT ITEM OPERABILITY	New equipment causing obstruction to vehicle and crane access	Inadequate crane and vehicle access for maintenance	Consider alternative piping & equipment layouts routed further due west with access from the due east direction.
6.20	ISOLATION	Station / compressor unit ESD blows down existing piping to vent	Switching valve piping is upstream of compressor unit SDVs so remains pressurised on Station ESD	Review existing Station ESD and if new switching valve piping is required to vent/blowdown on Station ESD, and document as part of Isolation and Blowdown Philosophy
7.17	PLANT ITEM MAINTAINABILITY			Consider alternative switching valve piping layout with new equipment located due west of the slope up to the A/G MLV-1

The switching valve tie in locations will be moved to the pipeline side of the MLV-1A bypass.

Originator: *Dylan Falls (Graduate Process Engineer)*	**Signature:**	**Date: 20/1/21**

Project Leader Acknowledgement of Notification and Review

☐	Cost Impact	☐	Schedule Impact
Scope Change Request Number (if required):			
Relevant WBS number to use for DCR (if required):			

☒	Process Engineer	☒	Mechanical Engineer
☒	Instrument/Electrical Engineer	☐	Civil/Structural Engineer
☐	Software/Controls Engineer	☐	Risk Engineer
☐	Design Drafter	☐	Client
☐	Other (specify):		

☐	Process Flow Diagrams (PFDs)	☒	Piping & Instrumentation Diagrams (P&IDs)
☐	Cause and Effect (C&E) Matrices	☒	Plot Plans
☐	Underground Services Plans/Diagrams	☐	Electrical Single Line Diagrams
☐	Hazardous Area Drawings	☐	Other (specify):

Approval to Distribute and Review

Project Leader: Nigel Hough	**Signature:**	**Date: 20/1/21**
Comments: Mechanical and Structural to confirm any additional work completed as a result of this change		

2. REVIEW OF THE PROPOSED CHANGE

Design Team Review

Personnel	Date	Comments	Signed
Simon Hanlin	21/01/2021	Jemena to confirm that a loss of instrument air (Switching valves fail close) will result in no flow in the EGP without operator intervention to open MLV-1A, is acceptable. The "Virtual Check Valve" functionality of MLV-1 will not work in this scenario.	
Peter Blyton	21/01/2021	TIPs have been moved from existing flanged connections, to golden weld connection to existing buried and above ground piping. Additional work completed: additional revision of P&ID, changes to 3D model and plot plan to incorporated relocated TIPs.	
Adrian Zatta			

Documents and/or Drawings to be Amended

Document/Drawing No.	Rev	Responsibility	Due Date
GAS-530-PN-ME-001	C		
530-DW-PD-001	3C		
530-DW-PD-018	4C		
GAS-530-DW-PD-020	C		

HAZOP Leader Acknowledgement of Notification and Review

Personnel	Date	Comments	Signed
Lisa Hein			

(HAZOP Leader)

☐ HAZOP Required ☐ Risk Assessment Required

Client Acknowledgement of Notification and Review (if required)

Personnel	Date	Comments	Signed

(Client Representative)

3. IMPLEMENTATION

Approval to Implement Proposed Change

Approved [X] **Rejected** [ ]

Scope Change Request Status (if relevant)

[ ]	Approved	[ ]	Rejected
[ ]	Other (specify):		

Project Leader: Nigel Hough	**Signature:**	**Date:** 01/02/2021
Director or Delegate (if required):	**Signature:**	**Date:**

Comments:

Jemen to confirm that a loss of instrument air (switching valves fail close) will result in no flow in the EGP without operator intervention to open MLV-1A is acceptable. The 'Virtual check valve" functionality of MLV-01 will not work in this scenario - ref action 201

4. CLOSE OUT

Close Out Check List

Scope Change Request completed, issued, and closed out (if required)	☐	NR
Scope Change Request number (if required):		
Risk Assessment or HAZOP Complete (if required)	☐	NR
All relevant project design team reviews completed, and comments closed out	☐	COMPLETED
Client review completed, or notification provided (if required)	☐	NR
All affected documents amended, checked, approved and distributed (refer to list of documents in section 2)	☐	COMPLETED
Design Change Request filed	☐	

Close Out Confirmation

Originator: Dylan Falls	**Signature:**	**Date:**
Project Leader: Nigel Hough	**Signature:**	**Date:**

APPENDIX 16

GPA ENGINEERING	Document Title	*HAZOP Number*
	HAZOP Closeout Sheet	*GAS-599-RP-HZ-003*
		Item Number
		Various (see below)

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:		**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
24.16	PLANT ITEM OPERABILITY	Repressurisation line around DB&B on inlet of 563-F-02 relies on a plug valve for second isolation, which is not recommended.	Insufficient isolation integrity for maintenance of 563-F-02.		Modify repressurisation bypass line around DB&B arrangements on inlet of 563-F-02 such that repressurisation connects in between the two DN250 ball valves, and remove vent on repressurisation line making 250-BV-64102 the second block valve for the repressurisation line.	**1 / PB**
24.20	ISOLATION	Existing Filter 563-F-01 has single valve isolation only			Add DB&B isolation for existing filter 563-F-01	**1 / PB**

DISCUSSION AND RECOMMENDATION

Double block and bleed (DB&B) filter skid isolation for both 563-F-02 & 563-F-01 will be achieved through the use of integral DB&B. The required modifications to the repressurisation bypass cannot be completed due to the inclusion of the Integral DB&B, therefore Jemena have advised that the pressurisation bypass of both integral DB&B valves should retain the vent and also include a second ball valve downstream of the plug valve (refer to Email 20617-R1193).

ACTION TAKEN / CLOSE OUT COMMENTS

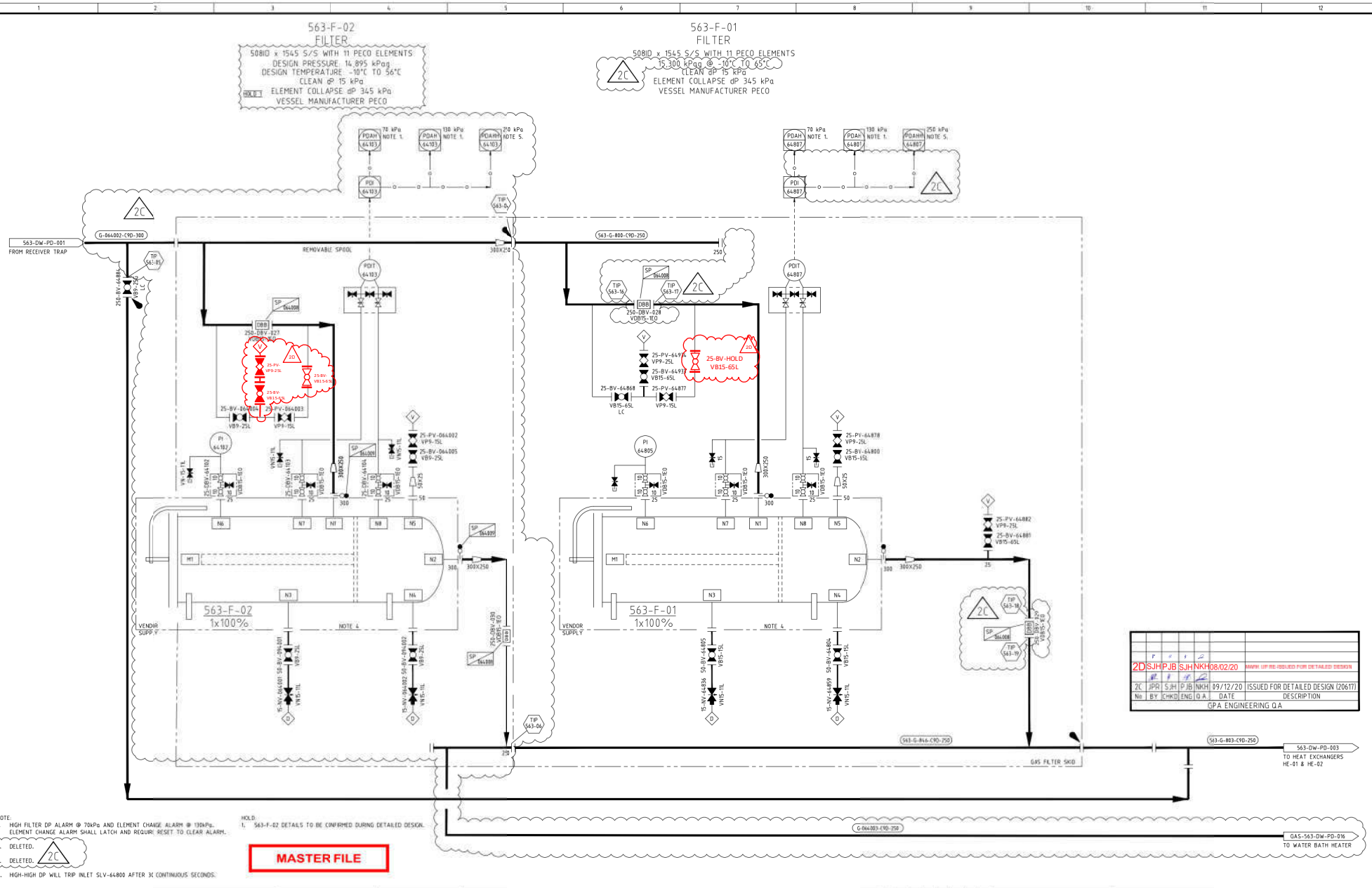
P&ID 563-DW-PD-002 (2D) updated. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 10/2/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:51:20 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21



NOTE:
1. HIGH FILTER DP ALARM @ 70kPa AND ELEMENT CHANGE ALARM @ 130kPa. ELEMENT CHANGE ALARM SHALL LATCH AND REQUIRE RESET TO CLEAR ALARM.
2. DELETED.
3. DELETED.
4. HIGH-HIGH DP WILL TRIP INLET SLV-64800 AFTER 3C CONTINUOUS SECONDS.

HOLD:
1. 563-F-02 DETAILS TO BE CONFIRMED DURING DETAILED DESIGN.

REV	DATE	DESCRIPTION	CHKD	APPRV
2D	SJH/PJB	SJH	NKH	08/02/20	MARK UP RE-ISSUED FOR DETAILED DESIGN
2C	JPR	SJH	PJB	NKH	09/12/20	ISSUED FOR DETAILED DESIGN (20617)
No	BY	CHKD	ENG	Q A	DATE	DESCRIPTION

GPA ENGINEERING QA

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
2C	09/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
2B	04/11/20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
2A	16/09/20	ISSUED FOR REVIEW (20617)	GPA			
2	18/01/16	AS BUILT TO CLIENT MARKUPS	JB	NB		
1	13/02/15	REISSUED FOR CONSTRUCTION	JB	NB	AH	
0	12/12/14	ISSUED FOR CONSTRUCTION	JB	NB	AH	

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER: Jemena — Produced by Jemena Asset Management (6) Pty Ltd ABN 52 104 352 650

ASSET OWNER: Jemena — Jemena EGP(1) P/L ABN 15 068 570 847; Jemena EGP(2) P/L ABN 77 006 919 115

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CONSULTANT: GPA — www.gpaeng.com.au

WILTON METER STATION
DRY GAS FILTERS
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACLTY	SUBJECT
DESIGN	SCALE	N.T.S.
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER	REV 2D
DATE	563-DW-PD-002	

Dylan Falls

From: Young, David <dsy@enscope.com.au>
Sent: Thursday, 4 February 2021 12:49 PM
To: Simon Hanlin
Cc: Peter Blyton; Nigel Hough; Sarah Greening; Matthew Skaras; leon.terenyi@jemena.com.au
Subject: 20617-R1193: RE: 20617-S3807: Project Marlin clarifications

Simon,
As discussed our comments as follows;

1) Lets just add in a second DN25 ball valve upstream of the plug so that we are not compromising the DBB with ball valves. There are other Jemena sites that have this configuration and the cost of the DN25 ball valve is minimal. Lets make this change to both vessels so that everything looks consistent.
2) Lets add an alarm at 50 and a trip 56 TW 64112 to close this out. Noting the trip will go over coms but I don't think I don't think we will actually ever see these sorts of temps and loss of containment is not plausible if the temperature gets to 65.
3) As discussed the high pressure is 11.5Mpag not 14.5MPag, with this included yes it is acceptable to go to 2C noting that the temperature overrides will come into play.

Chat soon

Regards,

David Young
Principal Engineer

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From: Simon Hanlin <Simon.Hanlin@gpaeng.com.au>
Sent: Thursday, 4 February 2021 7:56 AM
To: Young, David <dsy@enscope.com.au>
Cc: Peter Blyton <Peter.Blyton@gpaeng.com.au>; Nigel Hough <Nigel.Hough@gpaeng.com.au>; Sarah Greening <sarah.greening@gpaeng.com.au>; Matthew Skaras <Matthew.Skaras@jemena.com.au>; leon.terenyi@jemena.com.au
Subject: 20617-S3807: Project Marlin clarifications

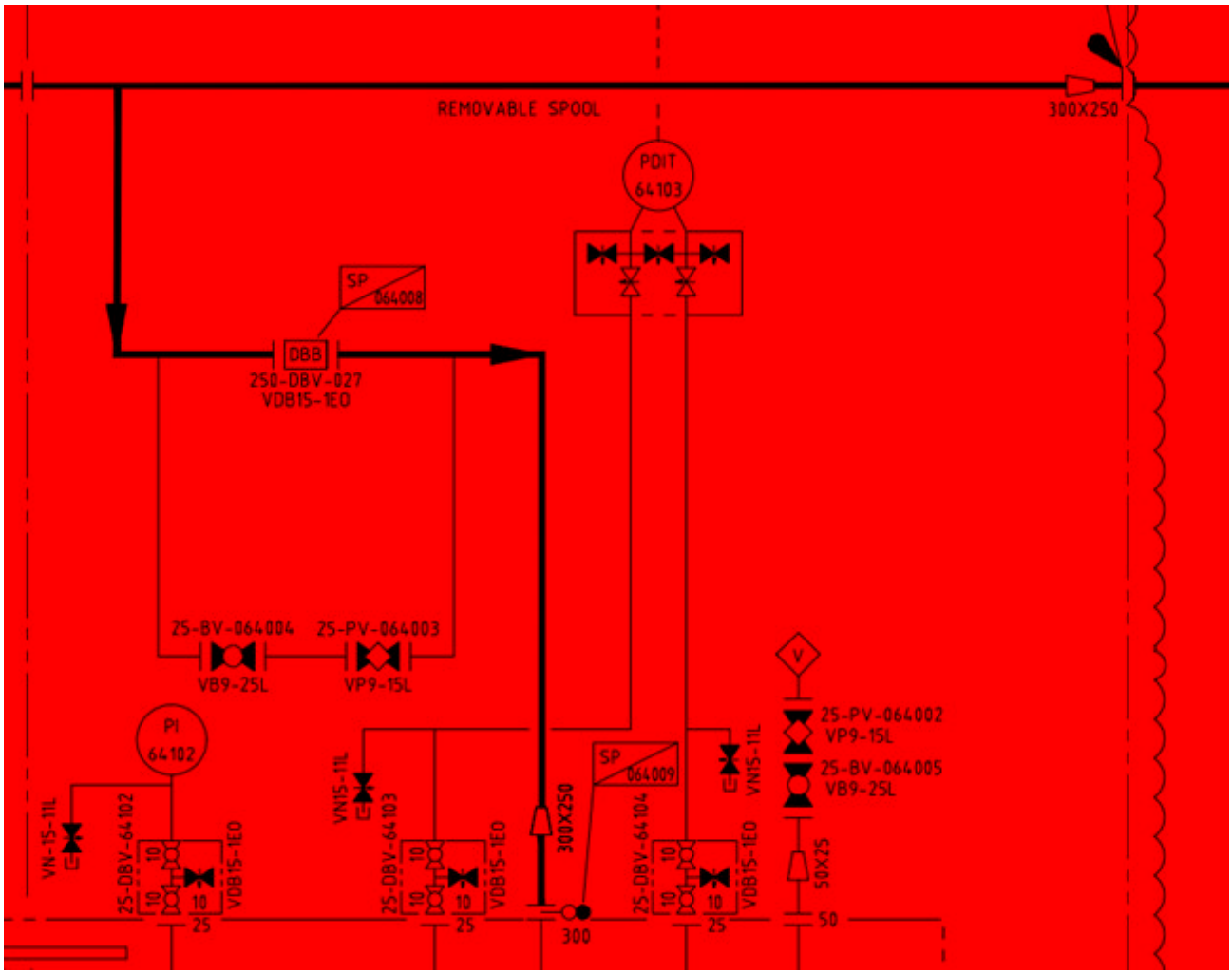
[EXTERNAL]

Dave,

I have three clarifications I want to discuss with you before I finalise HAZOP closeouts and FEED report.

1) DBB bypass for the Wilton filters. (HAZOP action 24.16). We are missing a vent on the new filter on the left (this will be added to P&ID markups attached to the FEED report). HAZOP Action 24.16 required modification to the bypass to make it double block and bleed (without relying on the plug valve as the second block valve). The described action is now not possible because of the integral DBB valve. The cause states that a plug valve for second isolation is not recommended, however I can't see anything in the

Jemena piping design guide isolation philosophy that would preclude the use of a ball and plug valve arrangement as a DBB.
I assume that we aren't modifying the bypass around the existing filter new DBB valve.
Can you confirm that Jemena accepts the design of the bypass with a ball, plug valve and bleed in-between?



2) Vic Hub 2 inlet temperature.
HAZOP item 16.9 was a category 1 item with the following action "Review how quickly the flow direction can be swapped from north to south flow, i.e. is it plausible 4 hour blocks of direction change. If required would an increase the design temp be required?"
We intend to change this action to a CAT 2 (detailed design) with the following closeout comment, which will also be recorded in the FEED operating condition section. **Can you confirm that Jemena are happy with this approach?**

Maximum operating inlet temperature 56°C[(1)]
1. Vic Hub 2 inlet piping will be Jemena Pipe Specification C9D which is rate to 15,320 kPag at 65°C. Vic Hub 2 inlet filter will be rated for class 900 flanges with a design temperature of 56°C at 14,895 kPag.
Gas entering Vic hub 2 comes from the EGP, which in turn comes from Longford compressor station when in a northern flow direction.
The MAOP of the EGP is 14,895 kPag and it has a maximum design operating temperature of 60°C.
Longford Compressor Station has a discharge temperature trip set at 65°C and a discharge pressure trip set at 15,300 kPag.
The maximum inlet temperature and pressure assumptions for Vic Hub 2 above shall be confirmed during detailed design when the dynamics of changing the EGP flow direction are finalised.

3) Increase in WMS inlet pressure from 9MPag to 14.5 MPag.
Our submitted calculations for the heater and heat exchanges assumed a max transient case of 9MPag to

3.6 MPag.
These transient cases confirmed that using all redundancies in the designed heaters would maintain the delivery temperature into the JGN and APA networks above 2°C.
Increasing the transient cases to a pressure reduction from 14.5MPag to 3.6 mPag results in outlet temperatures below zero for both transient cases (200 TJ/d through WBH and 200 TJ/d through existing heat exchangers).
our modelling suggests that maintain temperatures above 2°C the temperature override on the regulator runs will decrease the flow from 200 TJ/d to 150 TJ/d.
Can you confirm if this is acceptable? And we will update the calculation and record the findings in the FEED report.
Alternatively we can increase the required rating of the WBH using the transient case as the sizing case and update the datasheet. I assume you wouldn't want to resize the existing heat exchangers.

Regards,
Simon Hanlin
Senior Process Engineer
BEng (Chem) (Hons) | CEng | MIChemE | RPEQ

GPA Engineering
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Dir 08 8299 8368 | **Ph** 08 8299 8300
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GPA ENGINEERING	Document Title	*HAZOP Number*
	HAZOP Closeout Sheet	*GAS-599-RP-HZ-003*
		Item Number
		28.17

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	28	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
28.17	PLANT ITEM MAINTAINABILITY	Removal of PSV-64135/64148 for maintenance / testing	No bleed between PSV-64135/64148 and isolation valve below		Add bleed ring / test & tap valve below PSV-64135/64148	**1 / PB**
28.17	PLANT ITEM MAINTAINABILITY	Removal of PSV-64135/64148 for maintenance / testing	No bleed between PSV-64135/64148 and isolation valve below		Add vent adjacent to TW-64147	**1 / PB**

DISCUSSION AND RECOMMENDATION

PSVs were removed as they are not required to provide “No flow” trip protection due to the redundant run and did not provide over pressure protection. Over pressure protection is provided by the Fail Close control valve and the slam shut. Design change (20617-DCR-003) was raised to remove the PSVs.

ACTION TAKEN / CLOSE OUT COMMENTS

No actions taken. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 9/2/21

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, QU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:52:16 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

Project Marlin: EGP Reversal

Regulator Run PSV Removal

Client Project Number: **Project Marlin: EGP Reversal**

1. REQUEST FOR DESIGN CHANGE

Description of Change (include as attachment if insufficient space)

Jemena have requested that the PSVs on each of the regulator runs be removed from the design. (refer Email 20617-R849).

PSV-066121 & PSV-066127 at Vic Hub 2 and PSV-64135 & PSV-64148 at Wilton Meter Station on the new JGN pressure reduction skids have been removed. Change shown in attached P&IDs.

The PSVs to be removed were designed to provide a partial relief rate with a set pressure just below the high pressure pilot and PAHH on the regulator runs. This was to allow the PSVs to relieve leakage and prevent "No Flow" over pressure trips.

The PSV's are not used for overpressure protection. The two forms of overpressure protection protecting the pipelines are the Fail Close control valve and the slam shut, which is closed by an independent pressure monitoring device. The integrity and design of the over pressure protection safety instrumented system will be confirmed and verified during detailed design.

In the event of PCV leakage, the high pressure trip will act, closing in the XSV on that run. There is no reliability concern, as the metering arrangement has a redundant run ensuring continued gas flow.

Originator: *Dylan Falls, Graduate Process Engineer*	**Signature:**	**Date: 21/01/21**

Project Leader Acknowledgement of Notification and Review

☐	Cost Impact	☐	Schedule Impact
Scope Change Request Number (if required):			
Relevant WBS number to use for DCR (if required):			

☒	Process Engineer	☒	Mechanical Engineer
☐	Instrument/Electrical Engineer	☐	Civil/Structural Engineer
☐	Software/Controls Engineer	☐	Risk Engineer
☐	Design Drafter	☐	Client
☐	Other (specify):		

☐	Process Flow Diagrams (PFDs)	☒	Piping & Instrumentation Diagrams (P&IDs)
☐	Cause and Effect (C&E) Matrices	☐	Plot Plans
☐	Underground Services Plans/Diagrams	☐	Electrical Single Line Diagrams
☐	Hazardous Area Drawings	☐	Other (specify):

Approval to Distribute and Review

Project Leader: Nigel Hough	**Signature:**	**Date: 21/01/21**
Comments:		

2. REVIEW OF THE PROPOSED CHANGE

Design Team Review

Personnel	Date	Comments	Signed
Simon Hanlin (Process)	25/01/21	Relevent HAZOP actions to be closed stating PSV has been removed. SIL assessment of SIS will form part of detailed design.	
Peter Blyton (Mechanical)	27/01/21	No issues identified. PSVs and associated piping have been removed from FEED MTOs.	

Documents and/or Drawings to be Amended

Document/Drawing No.	Rev	Responsibility	Due Date
563-DW-PD-010	7C	SJH	Completed
GAS-510-DW-PD-004	C	SJH	Completed

HAZOP Leader Acknowledgement of Notification and Review

Personnel	Date	Comments	Signed
Lisa Hein			

(HAZOP Leader)

☐ HAZOP Required ☐ Risk Assessment Required

Client Acknowledgement of Notification and Review (if required)

Personnel	Date	Comments	Signed

(Client Representative)

3. IMPLEMENTATION

Approval to Implement Proposed Change

Approved ☒ **Rejected** ☐

Scope Change Request Status (if relevant)

☐	Approved	☐	Rejected
☐	Other (specify): N/A		

Project Leader: Nigel Hough	**Signature:**	**Date:** 01/02/2021
Director or Delegate (if required):	**Signature:**	**Date:**
Comments: Confirm that relevant HAZOP actions have been losed stating PSV has been removed.		

4. CLOSE OUT

Close Out Check List

Scope Change Request completed, issued, and closed out (if required)	☐	N/A
Scope Change Request number (if required):		
Risk Assessment or HAZOP Complete (if required) SIL assessment required	☒	
All relevant project design team reviews completed, and comments closed out	☐	COMPLETED
Client review completed, or notification provided (if required)	☐	N/A
All affected documents amended, checked, approved and distributed (refer to list of documents in section 2)	☐	COMPLETED
Design Change Request filed	☐	

Close Out Confirmation

Originator: Dylan Falls	**Signature:**	**Date:**
Project Leader: Nigel Hough	**Signature:**	**Date:**

Dylan Falls

From: Young, David <dsy@enscope.com.au>
Sent: Wednesday, 2 December 2020 9:52 AM
To: Simon Hanlin; Peter Blyton
Cc: Sarah Greening; Matthew Skaras; Stephen Chow
Subject: 20617-R849: FW: Project Marlin - HAZOP Action Close outs

Simon, Peter,
Please see the below emails on the HAZOP close out items.
We might need a quick chat through a few of these to make sure we are on the same page.

Regards,

David Young
Principal Engineer

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From: Young, David
Sent: Wednesday, 2 December 2020 7:49 AM
To: 'Michael Peoples' <Michael.Peoples@jemena.com.au>
Cc: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Stephen Chow <steven.chow@jemena.com.au>; Stephen Turville <Stephen.Turville@jemena.com.au>
Subject: RE: Project Marlin - HAZOP Action Close outs

Mike,
Thanks very much for the quick confirmation on this one. Please see my comments below. I
Cheers
Dave

Regards,

David Young
Principal Engineer

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From: Michael Peoples <Michael.Peoples@jemena.com.au>
Sent: Wednesday, 2 December 2020 7:03 AM
To: Young, David <dsy@enscope.com.au>
Cc: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Stephen Chow <steven.chow@jemena.com.au>; Stephen Turville <Stephen.Turville@jemena.com.au>
Subject: RE: Project Marlin - HAZOP Action Close outs

[EXTERNAL]

Dave

1. No need for a second GC provided we can see gas quality off the boat – needs to be a HOLD until we have details on the FSRU. We have signed an MOU with AIE now so I expect more information to be (finally) forthcoming. DSY- Ok one in the base. We will look at the second GC as part of the works we are taking over from AIE.
2. Correct
3. Yes – good practice to have the MLV welded as discussed for "fire safe" effect.
4. I think we would need to have provision for this back pressure loop, in the unfortunate case where GT Control got linepack management wrong and for some reason we started to back out Esso, or otherwise over-pressured that section of the pipeline. Happy to discuss this one with the group though to test that as a realistic case. DSY-Ok we will keep the provision and run a separate hardwired signal (it is not that hard).
5. Happy to go with that idea. We haven't been able to get around the AS 1210 requirements using the AS 2885.1 clauses that seek to eliminate the temperature de-rate issues. If we use ASME VIII vessels presumably we will still have the same issue though? DSY-Yes I haven't ever checked that code but I assume they both rely on the same ASME flange code where the problem really lives? DSY-Yes, my take is the 57C is the way to go.
6. We have a new "standard" for cavity bleed arrangements, that has in some cases a connection upstream or downstream of the valve to allow the cavity to be pressured. You will remember them from PCCS. They are on the master P+ID legend sheet now I think. DSY- OK we will incorporate this into any new installations even if it does not align with the existing site arrangements.
7. Yes I don't see using a PSV as a process contingency is good practice, particularly if there is a redundant run which can take over if the slam-shut does go off. DSY- Done and gone
8. Agreed – two sources of fuel gas is a good contingency and over time the connection to Longford itself might become redundant. Just need to consider black-start capability in the scenario also. I guess we have a DEA and mains so should walk through how to establish fuel gas supply in a total power loss? DSY Yes I think we will have suitable black start capabilities. We will include the tie in to both locations for both fuel gas supplies.
9. Yes – it is preferred to maintain the system the way it is. Agreed it isn't normal practice now however the guys are used to the idea. DSY- Ok we will include this.
10. Would have to talk this one through. Having two MLV's in parallel means both would have to reliably close when commanded to for a real linebreak situation. This might be OK. DSY- OK lets have a chat on this one, there are pros and cons each way, I am flipping and flopping like Kevin Rudd on this one.
11. Steve
12. Contractual obligation to maintain 9 MPa into TGP. DSY- OK thanks

Might need a meeting to discuss a few points?

Mike

From: Young, David <dsy@enscope.com.au>
Sent: Tuesday, 1 December 2020 8:36 PM
To: Michael Peoples <Michael.Peoples@jemena.com.au>
Cc: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Stephen Chow <steven.chow@jemena.com.au>; Stephen Turville <Stephen.Turville@jemena.com.au>
Subject: Project Marlin - HAZOP Action Close outs

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Mike,

There are a bunch of HAZOP actions which need to be closed out to finalise the next revision of the P&ID's for Project Marlin. Happy to chat through these over the phone to come up with the best plan.
List is as follows;

1) Confirm we only need one C6+ GC at KGMS? I don't think we need 2 or a C9+ unit.
2) Do we need welded connections for the first valve off the pipelines- You have confirmed this.. CLOSED
3) At Kembla Grange where the new pipeline arrives into the meter station, can we actuate the first (welded) valve off the pipeline to use as our pipeline isolation valve? This would be as per Wilton so I assume this is OK?
4) For the new pressure control valve around the MVL at Kembla Grange (to reduce the pressure to the north) do we need a back pressure control loop? this would open up if the pressure to the south gets to high or close if it gets too low? I don't see a need for this, can we delete this loops because we would need to install a hardwired link between the new and the existing RTU's/flow computers.
5) What design temperature do you want on the vessels which have a design pressure of 14,895kPag. If we use 57C then this will fit within the class 900 pressure limits and it keeps it simple. Some of the existing vessels have 60C or 65C this can create some issues with design verifiers thinking the vessels need to be class 1500?
6) For the cavity bleed valve tubing arrangements are you happy to keep things consistent with each of the current sites? This would be mean that we just have a ball valve on most of the cavity bleeds.
7) On Colongra the delivery station (MDS) has a PSV which is sized as a "Token Relief" to prevent the slam shut closing, we have copied this across in the work we have done and it has ended up on the drawings. This was a throw back from GHD originally doing the design. Are you happy if we delete this and just that the standard set up with a slam shut and a fail closed PCV?
8) At Longford, do we need to take the fuel gas for the new water bath heater off the current location at the inlet to the compressor station? Or can is stay off the down stream side of new flow control run? Part of me thinks we should put in 2 connections for both the new and the old fuel gas supplies (we could common them up). If we have no flow into the compressor station from Esso we could draw the pressure down in this line over time? Two connects would allow the ops guys to swing between this and the VHI as the source of FG?
9) At Wilton do we want to continue to back up the instrument air system with instrument gas? This is probably not the normal way to do things these days but happy to go either way?
10) At Mila we are thinking we could put the new MLV (which replaces the check valve) in parallel to the existing MLV. This would make the arrangement the same at Michelago and would also have the advantage that if this new valve fails to open after (because we are using it all the time) then you can always open the existing MLV and maintain pipeline flow? Currently the valves are in series and if the valve fails to open the flow in the pipeline will stop. This would mean we have an extra tie in but I think in the long term it is the best solution?

Stephen T.

11) We need to confirm the min design pressure for KGMS is 8000kPag? It think this is correct
12) What is the min pressure into the TGP? I think this was around 11-12MPag?

If need be some of these may need to stay on "Hold" for a while but it would be good to close them out if possible.

Cheers
Dave

Regards,

David Young
Principal Engineer

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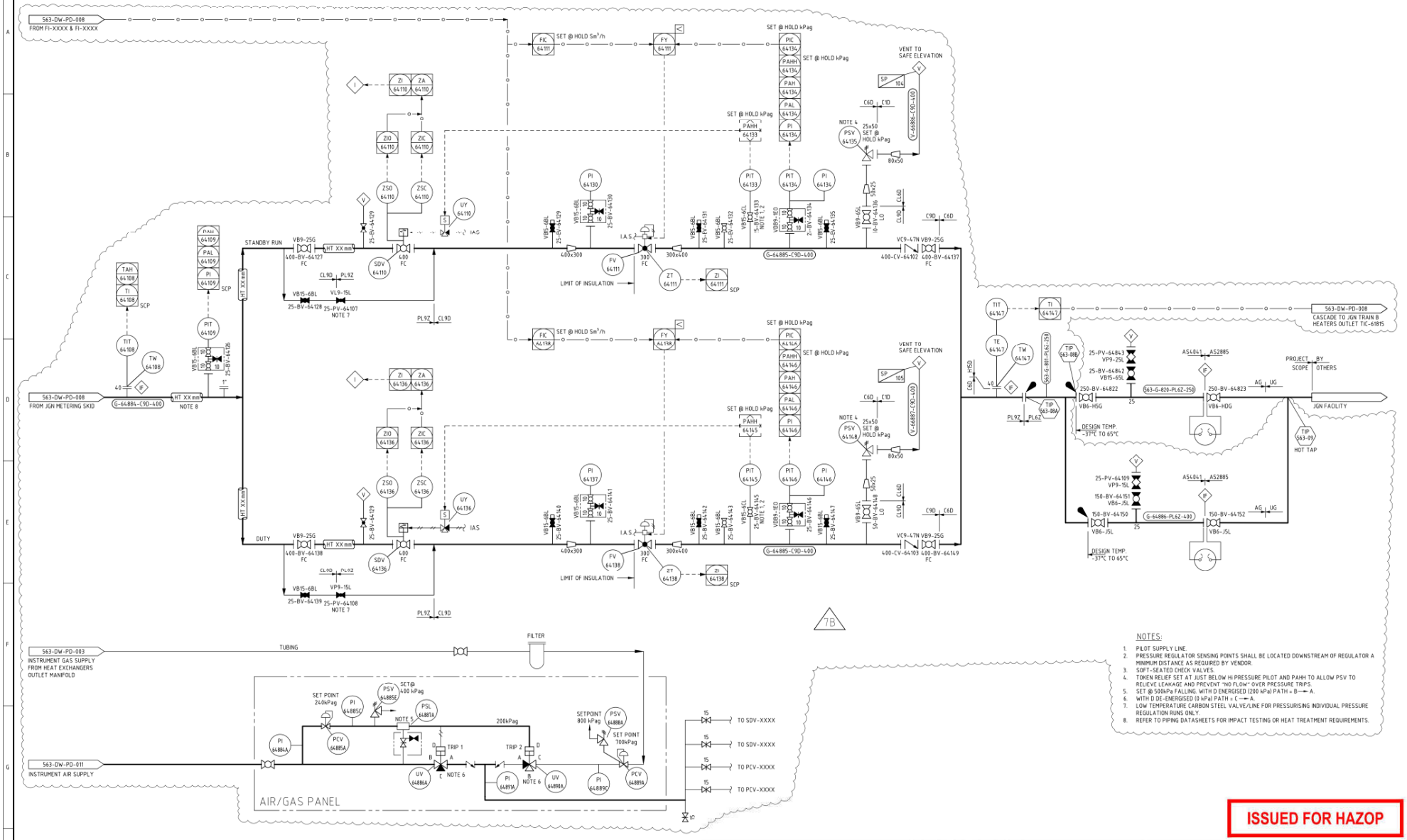
JGN REGULATOR RUN 563-RR-06



NOTES:

1. PILOT SUPPLY LINE.
2. PRESSURE REGULATOR SENSING POINTS SHALL BE LOCATED DOWNSTREAM OF REGULATOR A MINIMUM DISTANCE AS REQUIRED BY VENDOR.
3. SOFT-SEATED CHECK VALVES.
4. TOKEN RELIEF SET AT JUST BELOW Hi PRESSURE PILOT AND PAHH TO ALLOW PSV TO RELIEVE LEAKAGE AND PREVENT "NO FLOW" OVER PRESSURE TRIPS.
5. SET @ 500kPa FALLING, WITH D ENERGISED (200 kPa) PATH = B ⟶ A.
6. WITH D DE-ENERGISED (0 kPa) PATH = C ⟶ A.
7. LOW TEMPERATURE CARBON STEEL VALVE/LINE FOR PRESSURISING INDIVIDUAL PRESSURE REGULATION RUNS ONLY.
8. REFER TO PIPING DATASHEETS FOR IMPACT TESTING OR HEAT TREATMENT REQUIREMENTS.

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
7A	17/09/20	ISSUED FOR REVIEW (20617)	GPA			
7	10/02/16	AS BUILT TO CLIENT MARKUPS	LC		JB	
6	18/01/16	AS BUILT TO CLIENT MARKUPS	JS		NB	
5	01/09/15	REISSUED FOR CONSTRUCTION	JB		GH	WW AH
4	18/08/15	REISSUED FOR CONSTRUCTION	JB		NB	WW AH
3	21/07/15	REISSUED FOR CONSTRUCTION	JB		NB	WW AH
2	27/03/15	REISSUED FOR CONSTRUCTION	JB		NB	WW AH
7B	04/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	PJB NKH

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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PD-510-DW-PD-003	CONNECTION TO BI-DIRECTIONAL PIPELINE & FILTER/SEPARATOR
DRAWING No.	REFERENCE DRAWINGS

GPA ENGINEERING
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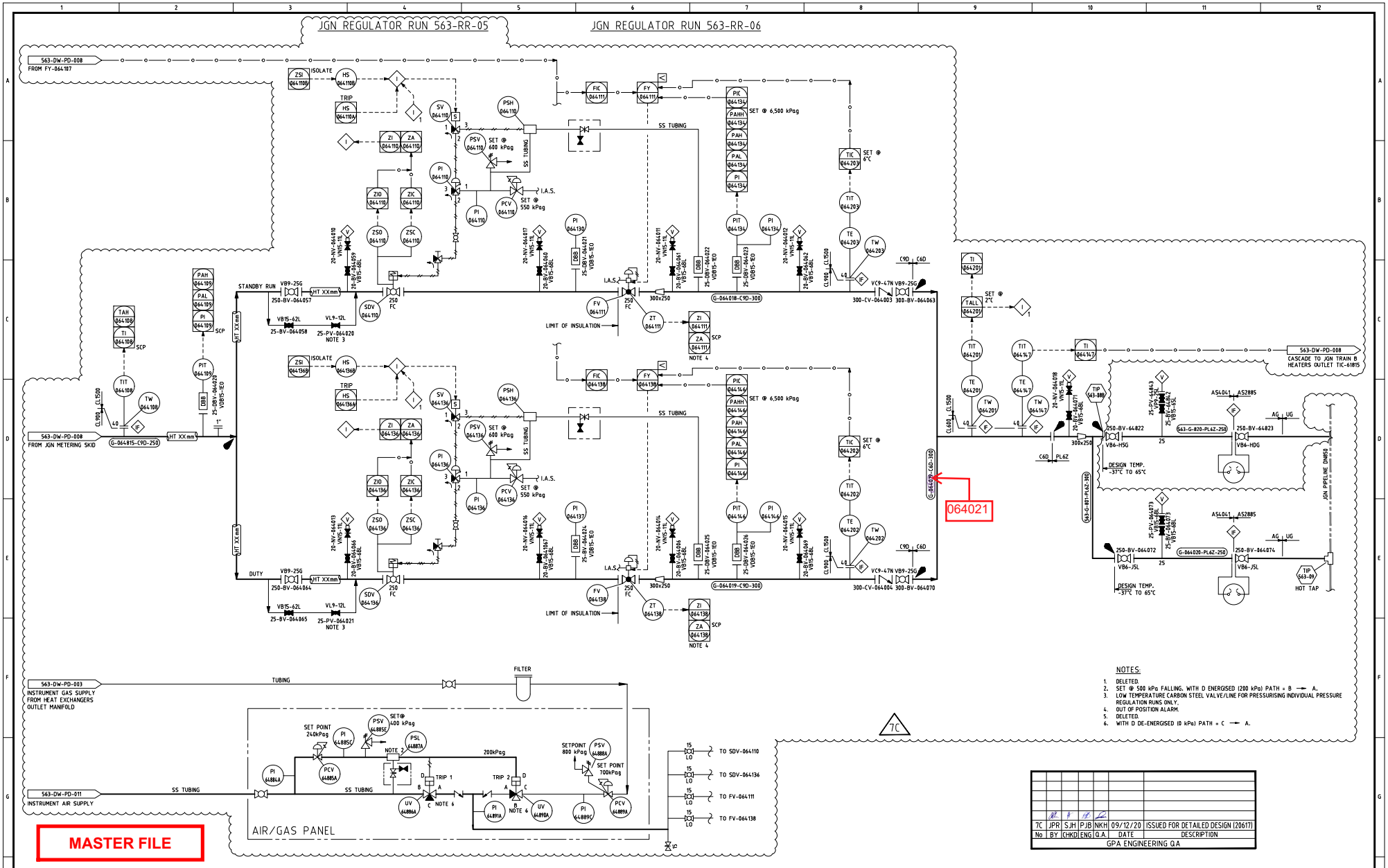
WILTON METER STATION
JGN PRESSURE REDUCTION SKID (RUN No. 3)
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT
DESIGN	SCALE N.T.S.	
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER	REV. 7B
DATE	563-DW-PD-010	



NOTES:

1. DELETED.
2. SET @ 500 kPa FALLING, WITH D ENERGISED (200 kPa) PATH = B → A.
3. LOW TEMPERATURE CARBON STEEL VALVE/LINE FOR PRESSURISING INDIVIDUAL PRESSURE REGULATION RUNS ONLY.
4. OUT OF POSITION ALARM.
5. DELETED.
6. WITH D DE-ENERGISED (0 kPa) PATH = C → A.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
7C	JPR	SJH	PJB	NKH	09/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

MASTER FILE

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
7A	17/09/20	ISSUED FOR REVIEW (20617)	GPA			
7	10/02/16	AS BUILT TO CLIENT MARKUPS	LC		JB	
6	18/01/16	AS BUILT TO CLIENT MARKUPS	JS		NB	
5	01/09/15	REISSUED FOR CONSTRUCTION	JB		GH	AH
4	18/08/15	REISSUED FOR CONSTRUCTION	JB		NB	AH
3	21/07/15	REISSUED FOR CONSTRUCTION	JB		NB	AH
7C	09/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	JPR	SJH	NKH
7B	04/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	NKH

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
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ABN 15 068 570 847
Jemena EGP(2) P/L
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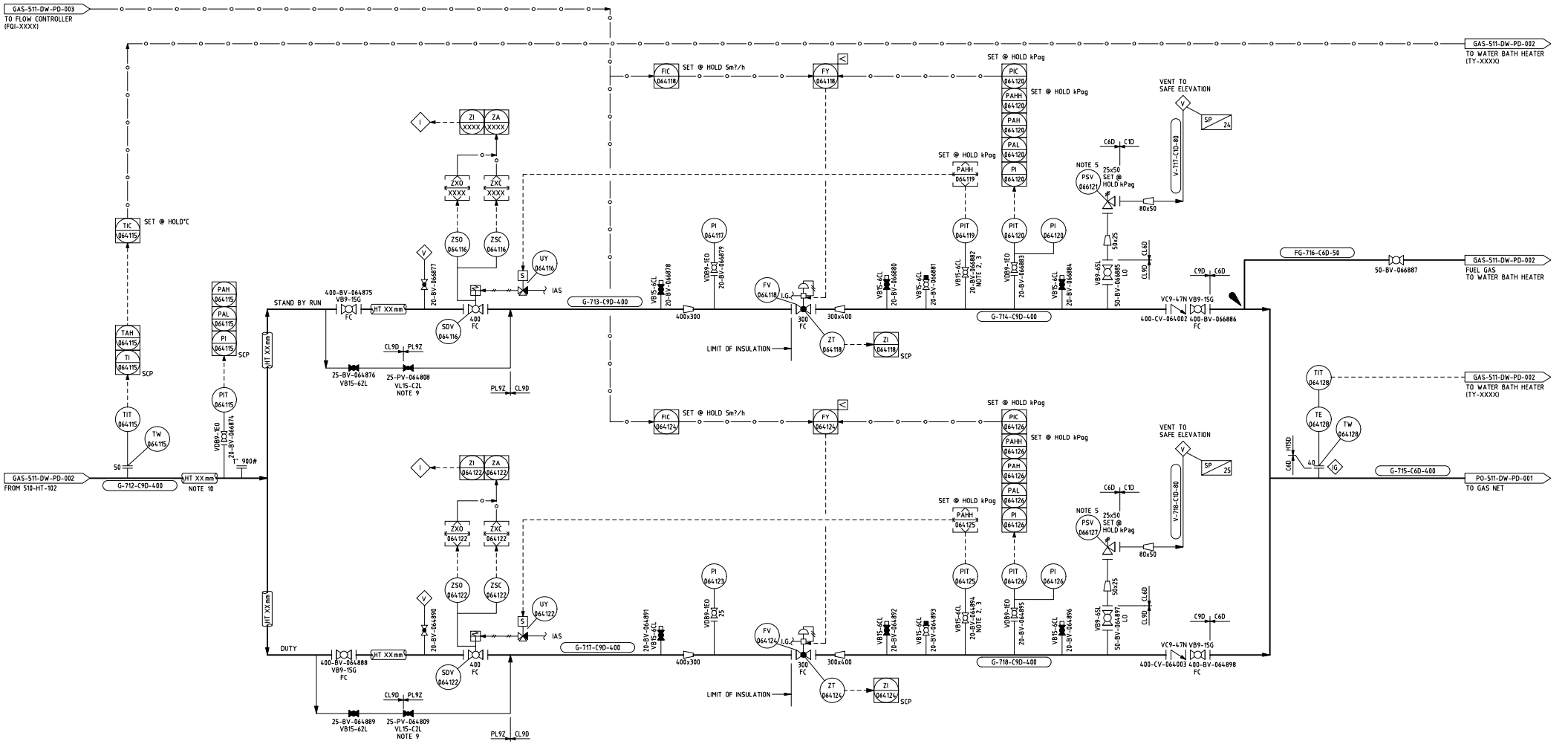
WILTON METER STATION
JGN FLOW REGULATION SKID (RUN No. 5 & 6)
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	FACILTY	SUBJECT
DESIGN	SCALE N.T.S.	
CHECKED	SUPERSEDES	A1
APPROVED	DRAWING NUMBER	REV 7C
DATE	563-DW-PD-010	

PD-510-DW-PD-003	CONNECTION TO BI-DIRECTIONAL PIPELINE & FILTER/SEPARATOR
DRAWING No.	REFERENCE DRAWINGS



NOTES:

1. DELETED.
2. PILOT SUPPLY LINE.
3. PRESSURE REGULATOR SENSING POINTS SHALL BE LOCATED DOWNSTREAM OF REGULATOR A MINIMUM DISTANCE AS REQUIRED BY VENDOR.
4. SOFT-SEATED CHECK VALVES.
5. TOKEN RELIEF SET AT JUST BELOW Hi PRESSURE PILOT AND PAHH TO ALLOW PSV TO RELIEVE LEAKAGE AND PREVENT "NO FLOW" OVER PRESSURE TRIPS.
6. DELETED.
7. DELETED.
8. DELETED.
9. LOW TEMPERATURE CARBON STEEL VALVE/LINE FOR PRESSURISING INDIVIDUAL PRESSURE REGULATION RUNS ONLY.
10. REFER TO PIPING DATASHEETS FOR IMPACT TESTING OR HEAT TREATMENT REQUIREMENTS.

MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	DRAWN	CHECKED	ENG CHK	APPRV
B	2/11/20	ISSUED FOR HAZOP (20617)	GPA	MS	SJH	PJB	NKH
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA			

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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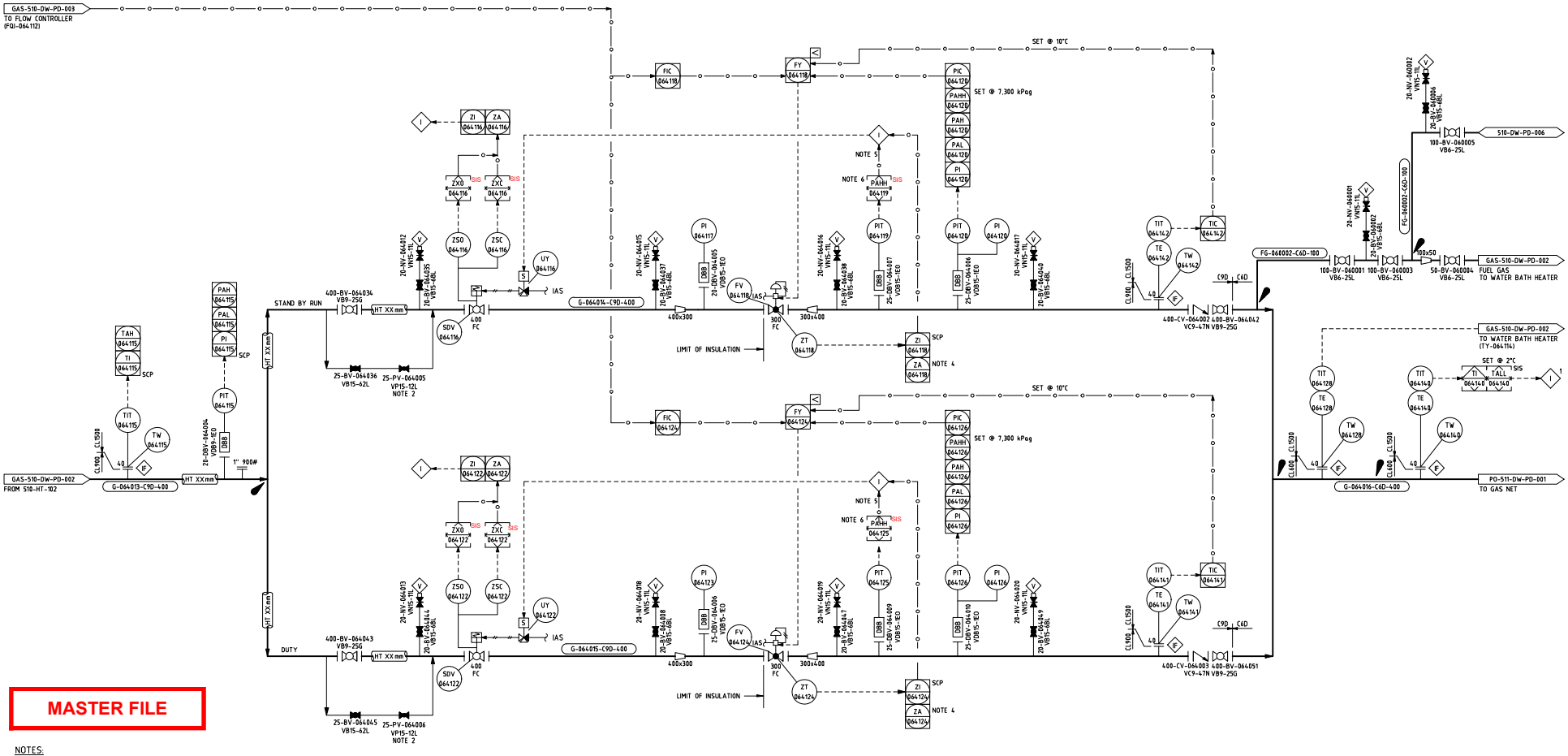
GPA ENGINEERING
www.gpaeng.com.au

LONGFORD COMPRESSOR STATION
VIC HUB 2 - PRESSURE REGULATION
PIPING & INSTRUMENTATION DIAGRAM

DRAWN GPA	FACILTY	SUBJECT	
DESIGN	SCALE N.T.S.		
CHECKED	SUPERSEDES		A1
APPROVED	DRAWING NUMBER		REV B
DATE 26/10/20	GAS-511-DW-PD-004		



NOTES:

1. DELETED.
2. LOW TEMPERATURE CARBON STEEL VALVE/LINE FOR PRESSURISING INDIVIDUAL PRESSURE REGULATION RUNS ONLY.
3. DELETED.
4. OUT OF POSITION ALARM.
5. ONLY ALLOW OPEN IF FV CLOSED.
6. PSHH SET @ 7,100 kPag FOR DUTY RUN AND 7,300 kPag FOR STANDBY RUN.

No	BY	CHK'D	ENG	Q.A.	DATE	DESCRIPTION
C	JPR	SJH	PJB	NKH	04/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING QA

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	04/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA		SJH	NKH	
B	02/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	NKH	
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA				

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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CONSULTANT
GPA
www.gpaeng.com.au

LONGFORD COMPRESSOR STATION
VIC HUB 2 - FLOW REGULATION
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILITY	SUBJECT
DESIGN		SCALE	N.T.S.
CHECKED		SUPERSEDES	A1
APPROVED		DRAWING NUMBER	REV
DATE	26/10/20	GAS-510-DW-PD-004	C

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		7.7

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	7	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
7.7	HIGH PRESSURE	Gas flow down from 850m elevation to sea level, increases in pressure as it goes forward/southern flow	Exceedance of MAOP at lower sea levels	MAOP of system 14.895 MPag, all piping rated for this MAOP	Add high pressure trip to southern side of MLV set to ensure pressure at sea level does not exceed pipeline MAOP due to gravity head when flowing south. Trip to ESD compressor station.	**1 / SH**

DISCUSSION AND RECOMMENDATION

Over pressure trips are included due to the elevation change increasing pressure. Trips are located on the Southern section of pipeline of each compressor station set at 14,000 kPag for Mila and 14,500 kPag for Michelago, refer to email attached. Trips and setpoints are added to P&IDs 525-PI-001(3D) and 530-DW-PD-018(4D).

ACTION TAKEN / CLOSE OUT COMMENTS

Trips and setpoints added to P&IDs 525-PI-001(3D) and 530-DW-PD-018(4D). Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 9/2/21

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:31:50 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

Dylan Falls

From: Young, David <dsy@enscope.com.au>
Sent: Friday, 20 November 2020 11:31 AM
To: Simon Hanlin
Cc: Sarah Greening; Matthew Skaras; Adrian Zatta; Stephen Chow; Peter Blyton
Subject: 20617-R841: FW: 20617-S2297: Wilton Process Calculations

Simon,
I looks like we had some confusion on the minimum pressures into Wilton, the minimum we have to consider is 6.2MPag. Please see the comments below.
We will need to increase the heater capacity to cater for the 11.5MPag max pressure into the site (previously we used 9MPag).

Simon, Adrian,
For the changes in pressure due to elevation can you please include an additional pressure transmitter and over pressure trip amp on the south side of the pipeline facilites at both Mila (14,000kPag) and Michelago(14,500kPag) with the reduced MAOP. They need to be located so that they are always exposed to the south side of the pipeline. This trip amp would be added to the Hardwire ESD string on each of the compressor stations.

Cheers
Dave

Regards,

David Young
Principal Engineer

ENSCOPE
A QUANTA SERVICES COMPANY

7/50 Oxford Close, West Leederville WA 6007
T +61 (0)8 6229 6500 E dsy@enscope.com.au
M +61 (0)427 277 369 W www.enscope.com.au

// **development . engineering . management . completions**

From: Stephen Turville <Stephen.Turville@jemena.com.au>
Sent: Friday, 20 November 2020 6:21 AM
To: Young, David <dsy@enscope.com.au>
Cc: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Michael Peoples <Michael.Peoples@jemena.com.au>; Stephen Chow <steven.chow@jemena.com.au>
Subject: RE: 20617-S2297: Wilton Process Calculations

[EXTERNAL]

Hi David,

Sorry for the missed call, was cooking the kids dinner and didn't notice until later

Wilton
I think there is some confusion on the minimum/maximum pressures at Wilton. The modelled **inlet** to Wilton Station is 6.2MPag, I believe the current LL alarm is set at 6MPag and I wouldn't envisage that changing as part of this project. Outside of emergency levels, the pressure at the **inlet** to Wilton station should vary between 11.5 – 6.2MPag.

The **outlet** of Wilton is then where we'll see these low pressures. I would put them at Min/Design/Max for each run as
Wilton MSP: 3.6/4.5/6
Wilton JGN: 3.6/4.5/5.5

The JGN one is interesting because theoretically it could be asked to go to 6.895MPag, however I don't believe it is ever a realistic case given the integrity issues on that pipeline and the significant upgrades to all JGN facilities and 3rd party facilities required to facilitate this increase so I've stuck with the somewhat more realistic number of 5.5MPag.

Other Delivery Stations
All stations are above minimum pressure required under the connection agreement, most are required to be 3-3.8MPag, which is easily achieved. That said the connection agreement for Hoskinstown has never been reflective of the real pressure requirements and for the flow scenarios before any new compression at Kembla it is unlikely that there will be sufficient pressure to support Canberra. Early on in the modelling cases this was flagged with Commercial and I was instructed to leave it out as a limit and that they would work with EVO to come to a solution as I believe the thinking was that it was better to recover costs from the regulated asset where possible however I haven't heard anything about it and my friends in GD are unaware of any requirement.
Bairnsdale has no concerns as by maintaining Vichub greater than 6.9MPag, there is no way for Bairnsdale to be less than this which means its greater than the 4.75MPag under the contract terms.

Overpressure
Yes there is some concern over the significant elevation drop following Mila. At low flow scenarios the pressure gain due to static head is greater than the pressure lost due to friction, in my models I tend to restrict the pressure at Mila discharge to get around this and I would typically limit it to 14MPag so we're in the same ballpark. In terms of capacity it makes no difference as when flows south increase this compressor runs out of power and the discharge will be below this anyway, the only thing it does is reduce potential park opportunities.

Regards
Stephen Turville
Senior Capacity Planning Engineer
Jemena
Level 14, 99 Walker Street, North Sydney, NSW 2060
(02) 9867 7322 | 0437 541 877
stephen.turville@jemena.com.au | www.jemena.com.au
www.gonaturalgas.com.au

Natural Gas Jemena bringing energy to life

From: Young, David <dsy@enscope.com.au>
Sent: Thursday, 19 November 2020 6:26 PM
To: Stephen Turville <Stephen.Turville@jemena.com.au>
Cc: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Michael Peoples <Michael.Peoples@jemena.com.au>; Stephen Chow <steven.chow@jemena.com.au>
Subject: FW: 20617-S2297: Wilton Process Calculations

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and are expecting the content or attachment from the sender.

Stephen,
I gave you a call to chat through the some issues we would like to discuss with the sizing cases at Wilton.
The long and the short of it is low minimum pressure into the facility (from the EGP and the Wilton Lateral) down at 4500kPag is resulting in some very high velocities and making the sizing of the control valves a bit difficult. If we could increase this to around 5500kPag at the full 325TJ/d and then tail the max energy flow as we reduce the pressure (so we effectively limit the volumetric flow) this would make our lives a lot easier. Would this significantly affect the modelling work you have done?
Given we have existing of noise / land owner concerns in the area we are a bit nervous that we are going to struggle to come up with a design that will cater for the high volumetric flow rates and also limit the noise.

On a separate note, we just ran the Hazop for the pipeline reversal and we have couple of queries on this;

1) Have you assessed the minimum pressure requirements for all of the existing EGP offtakes (ie Bairnsdale PS, Hoskinstown, etc)?
2) We will need to modify the existing pipeline over pressure protection at Mila and maybe Michalego to prevent exceeding the 14,895kPag at Cann River as we come down from 860m ASL to pretty much Sea Level. We don't need to finalise the numbers now but it would be good to understand roughly what we are taking about. My Fag Packet say that this is about 900kPag for Mila (ie 110kg/M^3 gas density over say 830m of elevation change).

One to chat through when you have the chance.
Cheers
Dave

Regards,

David Young
Principal Engineer

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M +61 (0)427 277 369 **W** www.enscope.com.au

// **development . engineering . management . completions**

****
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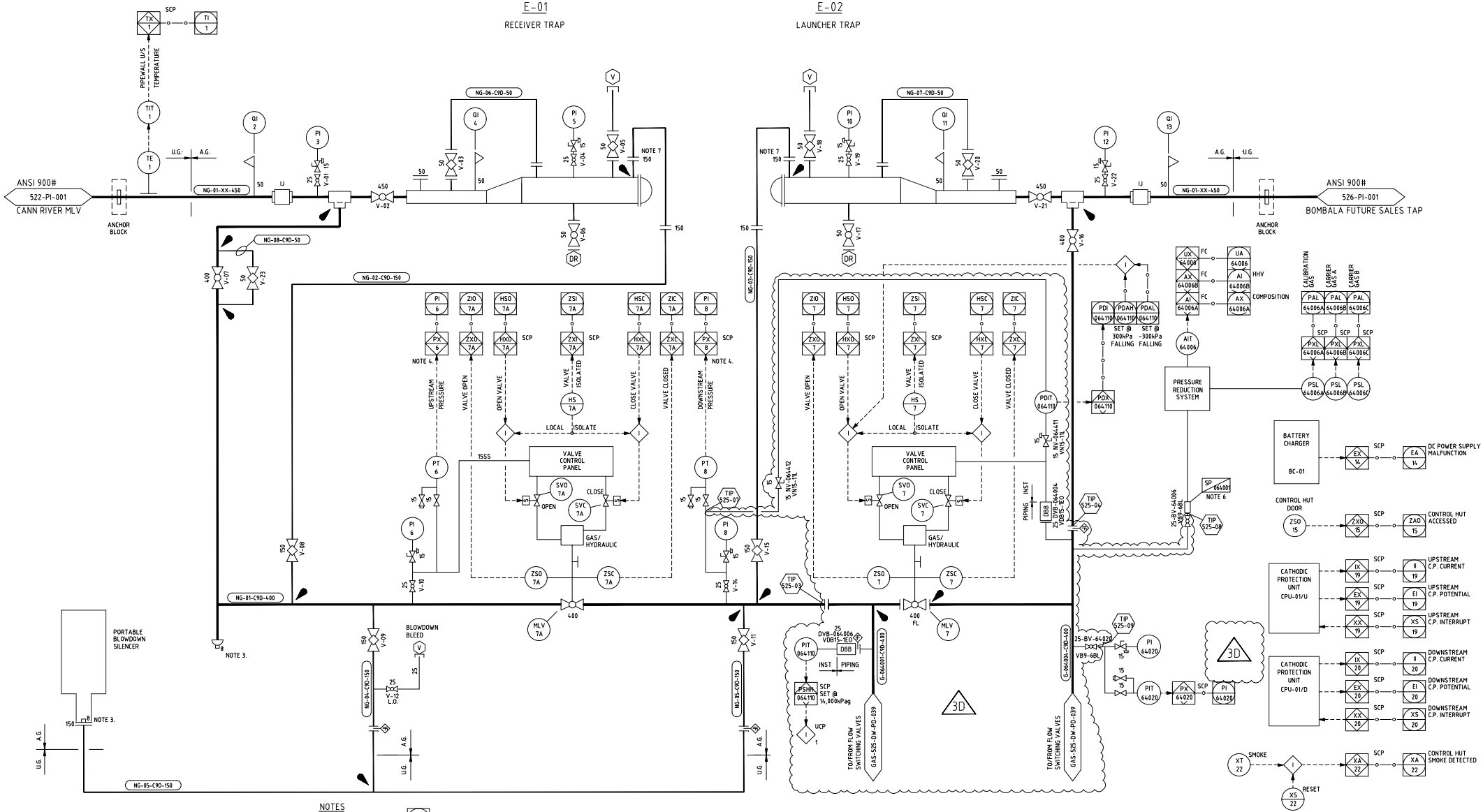

NOTES

1. ALL SYMBOLS SHOWN ◯ ARE LOCAL OR REMOTE OPERATOR ACCESS.
2. ALL EQUIPMENT/INSTRUMENT TAG NUMBERS AND LINE NUMBERS SHALL BE PREFIXED WITH THE FACILITY NUMBER i.e. 525-PT-2.
3. BLOWDOWN PURGE VALVE.
4. PIPELINE PRESSURE INPUTS HAVE ADJUSTABLE ALARMS CONFIGURED AS SHOWN:
   PAHH (kPa)
   PAH (kPa)
   PAL (kPa)
   PALL (kPa)
   PDAHH (RATE OF CHANGE IN kPa/sec)
   SET POINTS TO BE DETERMINED IN OPERATIONS AND ADJUSTED AS REQUIRED.
5. PIPELINE LINE NUMBER IS NG-01-XX-450
   FOR "XX" - REFER TO PROJECT TECHNICAL SPECIFICATIONS.
6. RETRACTABLE WELKER SAMPLE PROBE.
7. FLANGE CONNECTIONS FOR TEMPORARY BYPASS SPOOL.
   FOR TEMPORARY CONDITION REFER P&ID GTS-525-DW-PD-038

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
3D	AV	SJH	PJB	NKH	12/01/21	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
3D	12/01/21	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
3C	04/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
3B	15/09/20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
3A	15/09/20	ISSUED FOR REVIEW (20617)	GPA		SLH	
3	30/06/08	AS BUILT				
2	07/03/08	RE-ISSUED FOR CONSTRUCTION	SMR		CJS	DSY
1	07/02/08	RE-ISSUED FOR CONSTRUCTION	SMR		JM	DSY
0	20/12/07	ISSUED FOR CONSTRUCTION	SMR		PWF	DSY

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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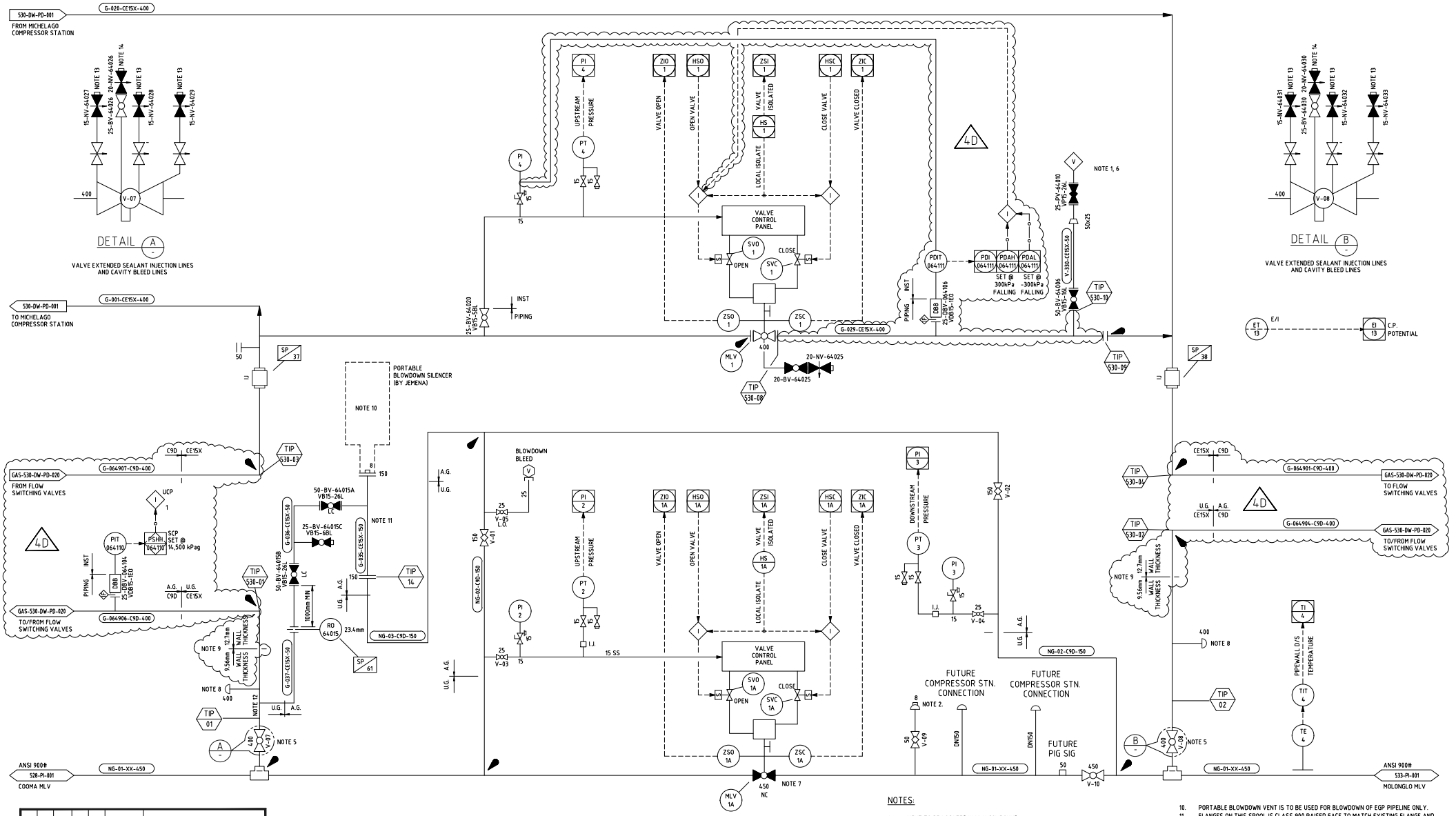
CONSULTANT
GPA
www.gpaeng.com.au

MILA SCRAPER STATION & MLV
INTERMEDIATE SCRAPER STATION
PIPING AND INSTRUMENT DIAGRAM

DRAWN	J.SHAFIQ	FACILTY	SUBJECT
DESIGN	C.SMITH	SCALE	NTS
CHECKED	D.YOUNG	SUPERSEDES	
APPROVED	P.FARRER	DRAWING NUMBER	525-PI-001
DATE	20/12/07	REV	3D

DRAWING No.	REFERENCE DRAWINGS
960-DW-PD-001	P&ID STANDARD SYMBOLS & ABBREVIATIONS



NOTES:

1. VENT TO BE LOCATED IN MLV COMPOUND.
2. BLOWDOWN & FUTURE TAKE-OFFS PURGE VALVES.
3. DELETED.
4. HIGH INTEGRITY NON SLAM CHECK VALVE.
5. EXISTING VALVE TO BE FITTED WITH EXTENDED STEM FOR EXTENSION TO ABOVE GROUND.
6. VENT TO BE IMPACT TESTED TO -80°C.
7. EXISTING MLV AND ALL ASSOCIATED INSTRUMENT TAGS CHANGED FROM MLV-1 TO MLV-1A.
8. FUTURE PIPELINE LOOPING
9. ALL ABOVE GROUND LINE PIPES TO BE 12.7mm THICKNESS (HEAVY WALL). BELOW GROUND LINE PIPES TO BE 9.56mm THICKNESS (STANDARD WALL). TRANSITION FROM HEAVY WALL TO STANDARD WALL BELOW GROUND, 6m FROM AG/UG TRANSITION.
10. PORTABLE BLOWDOWN VENT IS TO BE USED FOR BLOWDOWN OF EGP PIPELINE ONLY.
11. FLANGES ON THIS SPOOL IS CLASS 900 RAISED FACE TO MATCH EXISTING FLANGE AND PORTABLE VENT.
12. USE 3M OF HEAVY WALL PIPE AT THE INJECTION POINT.
13. SEALANT INJECTION LINE COMPLETE WITH SEALANT INJECTION FITTING
14. CAVITY BLEED LINE, EXISTING CAVITY BLEED VALVE TO BE REMOVED AND REPLACED BY ABOVE GROUND VALVES.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
4D	AV	SJH	PJB	NKH	12.01.21	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

DRAWING No.	REFERENCE DRAWINGS
960-DW-PD-001	P&ID STANDARD SYMBOLS & ABBREVIATIONS

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
4D	12.01.21	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
4C	04.12.20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
4B	23.10.20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
4A	15.09.20	ISSUED FOR REVIEW (20617)	GPA	PJB		
4	19.01.16	AS BUILT	MRM	JW		
3	10.06.15	RE-ISSUED FOR CONSTRUCTION	HWI	JW		
2	13.03.15	RE-ISSUED FOR CONSTRUCTION	SLA	NH		
1	18.12.14	ISSUED FOR CONSTRUCTION	SLA	NH		
0	25.07.14	ISSUED FOR DESIGN	SLA	NH		

CONSULTANT

GPA

www.gpaeng.com.au

MICHELAGO COMPRESSOR STATION
MAINLINE VALVE
PIPING AND INSTRUMENTATION DIAGRAM

DRAWN	SGP	FACILTY	SUBJECT
DESIGN		SCALE	Scale
CHECKED	CS	SUPERSEDES	
APPROVED	KM	DRAWING NUMBER	530-DW-PD-018
DATE	18.04.20		REV 4D

A1

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		17.17

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	17	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
17.17	PLANT ITEM OPERABILITY	Switching from EGP North to South then reverse, leading to back flow through the equipment	Line back to filter gets reverse flow for repressurisation	NRV at the filter, which is what needs to be protected	Consider relocating 64101 to the other side of filter and meter run Consider new actuated/switching valve at the tie-in point or 64866 to be actuated	**1 / DY**
			Noting this is not significant, may be a meter pulse		Consider remote versus manual requirements	**1 / DY**

DISCUSSION AND RECOMMENDATION

Relocation of valve 64101 to downstream of the filter and meter run to prevent reverse flow is not required. An NRV protects the filter from reverse flow and there are no significant impacts from reverse flow through the meter.

Reverse flow through the bypass line due to switching of EGP direction as discussed above is not a concern and therefore is not a driver for actuating the cross-over manual isolation valve.

Forward flow through the cross over line is controlled by the Vic Hub 1 regulator skid based on Jemena's flow nominations into the VHI. Therefore this is also not a driver for remote actuation of the cross over manual isolation valve.

Based on the above considerations it is recommended that no further action is required.

ACTION TAKEN / CLOSE OUT COMMENTS
No actions taken. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 10/2/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:37:00 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		17.18

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	17	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
17.18		If VH1 heater is off-line for maintenance fuel gas is not being heated.	Limited compressor capacity or off spec fuel gas.	Back-up electric heater.	Consider additional FG heating control loop through the new VH2 water bath heater	**1 / DY**

DISCUSSION AND RECOMMENDATION

Addition of fuel gas heating through new VH2 water bath heater considered by Dave Young (Jemena EGP Facilities Engineering Manager). The back-up electric heater is considered to be a sufficient safeguard for operational occurrences where the VH2 heater is off-line for maintenance.

ACTION TAKEN / CLOSE OUT COMMENTS

No action taken. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 10/2/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:40:41 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		19.15

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	19	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
19.15	TESTING EQUIPMENT / PRODUCT			Statutory PM checks on PSVs, CFTs	Confirm requirements for DN20 vents downstream of flow control valves	**1 / DY**

DISCUSSION AND RECOMMENDATION

The excess DN20 valves downstream of the flow control valves were previously used for instruments that are not required and were removed from the skid design prior to HAZOP. All DN20 offtake valve on the regulator skid have now been consolidated and the valves not required for connections to instrumentation of for manual venting have been removed from the design, refer GAS-510-DW-PD-004(C).

ACTION TAKEN / CLOSE OUT COMMENTS

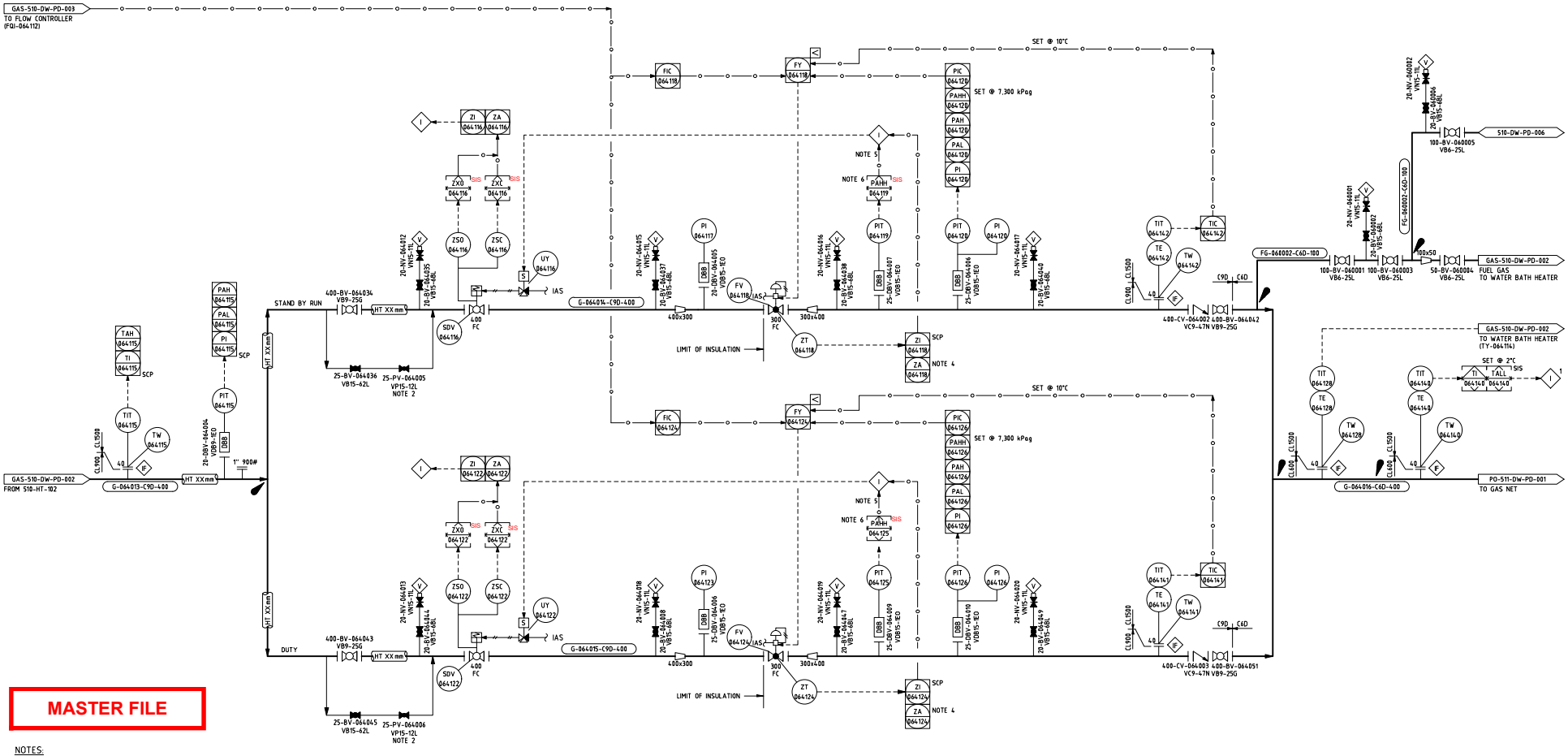
P&ID GAS-510-DW-PD-004(C) updated. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 10/2/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:42:44 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21



NOTES:

1. DELETED.
2. LOW TEMPERATURE CARBON STEEL VALVE/LINE FOR PRESSURISING INDIVIDUAL PRESSURE REGULATION RUNS ONLY.
3. DELETED.
4. OUT OF POSITION ALARM.
5. ONLY ALLOW OPEN IF FV CLOSED.
6. PSHH SET @ 7,100 kPag FOR DUTY RUN AND 7,300 kPag FOR STANDBY RUN.

No	BY	CHK'D	ENG	Q.A.	DATE	DESCRIPTION
C	JPR	SJH	PJB	NKH	04/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING QA

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	04/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA		SJH	NKH	
B	02/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	NKH	
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA				

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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CONSULTANT
GPA
www.gpaeng.com.au

LONGFORD COMPRESSOR STATION
VIC HUB 2 - FLOW REGULATION
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILITY	SUBJECT
DESIGN		SCALE	N.T.S.
CHECKED		SUPERSEDES	A1
APPROVED		DRAWING NUMBER	REV
DATE	26/10/20	GAS-510-DW-PD-004	C

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	19, 28	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
19.16	PLANT ITEM OPERABILITY	Isolation of flow control skid from downstream pipeline, single valve isolation provided			Confirm isolation philosophy for flow control skid and flow control runs, determine if single valve isolation or DB&B required.	**1 / DY**
28.16	PLANT ITEM OPERABILITY	Isolation of flow control skid from downstream pipeline, single valve isolation provided			Confirm isolation philosophy for flow control skid and flow control runs, determine if single valve isolation or DB&B required.	**1 / DY**

DISCUSSION AND RECOMMENDATION

The required equipment isolations were initially defined by Jemena in the Design Review (refer GAS-599-MM-PM-001(A)) and further clarified post HAZOP by the Jemena Engineering Manager (Mike Peoples) to be as per the Jemena Piping Design Guide GTS-960-DG-PI-001 (refer Email 20617-R819). In accordance with the isolation philosophy defined in GTS-960-DG-PI-001 Section 10.1.2, Jemena have advised GPA that a single valve isolation is considered suitable for the flow control skid based on a maintenance frequency of greater than a year (refer JAM-RESTECHQ-000012).

ACTION TAKEN / CLOSE OUT COMMENTS
No change required to HAZOP'd design. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 10/2/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:43:50 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

Document Title	Document No. (Client / GPA)
Facilities FEED Stage 1 - Design Review Minutes	GAS-599-MM-PM-001
	N/A

Client Name	Jemena			Date	07/10/2020	By	DAF
Client Project No.	N/A	GPA Project No.	20617	Rev/ Status	A	Chkd	PJB / SG
Project Name	Project Marlin: EGP Reversal				IFI	QA	NKH

System	599 - General EGP Reconfig	Reviewed			Comments	Actions	Assigned to
P&ID No(s).		Yes	No	N/A			
1. Basis of Design / Process Overview							
- Is the project scope defined?		X			East Gippsland Compressor Station (EGCS) has to be removed from scope. Reverse flow compression at EGCS is not required due to the close proximity to LCS/Vic Hub.	Provide confirmation that EGCS has been removed from the facilities scope.	Jemena (Matthew Skaras)
- Are the applicable standards defined?							
- Are all the design and operating cases defined?							
- Are the process fluids defined ?(Composition, temperature, pressure,							
- Is the turndown and Turn up requirements defined? (Flowrates, pressures,							
- Site ambient conditions defined?							
- Are the battery limits defined and reasonable							
- Is the operating envelope fully defined?							
- Are pipe specifications appropriate?		X			From the EGP basis of design 500-RP-006, and EGP manual GTS-599-OM-GEN-001, it is understood that the EGP mainline is upgradeable to an MAOP of 16.55 MPag. All items (pipeline assemblies, pig traps, MLVs, valves, flanges etc) which cannot be isolated from the EGP are to be designed to 16.55 MPag, i.e. CL1500. Isolatable equipment remains CL900, with design pressure of 14.895 MPag. For this reason, the KGMS pig receiver, hot tap connection, and compressor station flow switching valves & piping have been designed using CL1500 piping specification CE15X. However it is noted that a number of EGP mainline equipment is not designed to 16.55 MPag, e.g. Mila pig traps, Kembla Grange MLV which are designed to Jemena specification C9D.	Jemena to complete a cost-benefit analysis of designing EGP connected equipment for a future upgrade design pressure of 16.55 MPag. Jemena to advise outcome of the cost-benefit analysis and confirm if piping and equipment should be designed to 16.55 MPag or 14.895 MPag design pressure. GPA to continue working as per the pipe specs shown on the P&ID until a decision is made.	Jemena (Matthew Skaras)
Control Valves							
- Is fail position shown and correct?							
- Is a bypass required and correctly sized?							
Actuated Valves							
- Are start-up pressuring bypasses required?							
- Is fail position shown and correct?							
2. Process Safety considerations							
- Are there overpressure risks, how will they be controlled?							
- Are there over temperature risks, how will they be controlled?							
- Has the venting requirements and location been considered							
- Are the environmental and societal impacts considered in the design							
3. Operations							
- How will equipment operate?							
- Are there different operating modes- has changeover been addressed?							
- Is equipment sparing consistent with sparing policy?							
- What valves and controls require operator access, how often?							
- What services are required - are they provided?							
4. Controls & Instrumentation							
- Are control schemes adequately defined?							
- How does overall flow and pressure control work?							
Has impact of Unit shutdown on other Units been addressed?							
- ESD shutdown Philosophy?							
5. Maintenance / Construction							
- What needs to be maintained, and how often?							
- Is there a venting/purging/draining philosophy?							
- Is isolation for maintenance adequate (consistent with isolation policy)?		X			The Isolation Philosophy to be applied: - Double block and bleed (DB&B) isolation, consisting of two separate block valves and bleed in between, is required for normal maintenance access (major equipment e.g. filter element change) - Single isolation is required for non-routine maintenance, e.g. flow meter removal.	Detail the isolation philosophy in the basis of design document.	GPA (Simon Hanlin)
- Isolations required for tie-in construction							
6. Layout							
- Existing services – underground and above ground				X	N/A - refer to location specific layouts.		
- What land / space is available and clear for use				X	N/A - refer to location specific layouts.		
- Access and maintainability, personnel access				X	N/A - refer to location specific layouts.		
- Egress routes				X	N/A - refer to location specific layouts.		
- Drainage, bulk earthworks requirements				X	N/A - refer to location specific layouts.		
- Geotech condition				X	N/A - refer to location specific layouts.		
- Vehicle access during ops				X	N/A - refer to location specific layouts.		
- Vehicle access during construction (cranes, trucks)				X	N/A - refer to location specific layouts.		

10 VALVES

Valves shall be in accordance with the following specifications:

- GTS-960-SP-ME-010, Manual and Actuated Valves
- GTS-960-SP-JJ-002, Control Valves

10.1 ISOLATION PHILOSOPHY

All equipment requiring maintenance shall be provided with suitable redundancy and/or a method of bypass to ensure station availability during routine maintenance.

The normal methods of isolation for mechanical equipment may be classified as:

- Positive Isolation.
- Valve Isolation

10.1.1 POSITIVE ISOLATION

Positive isolation against the high pressure source must be employed where the source potentially supplies gas into a confined space where entry by personnel is to be undertaken. Appropriate depressurisation and isolation procedures shall be followed to enable installation or removal of positive isolations.

Positive isolation must be achieved in one of three ways:

- The removal of a spool piece with blanking of open ends
- The turning of a spectacle blind
- The insertion of a spade (blind) between flanges, or replacement of a spacer with a line blind

Blanks, spades, blinds, bolting and gaskets shall conform to the piping specification for the line.

In addition to the requirement for positive isolation for work involving entry to confined spaces, it is also recommended in the following cases:

- Long duration isolations (more than one week)
- Where equipment is to be mothballed
- For process fluids at or above auto-ignition temperature
- Where risk assessment or approved work procedures stipulate.

10.1.2 VALVE ISOLATION

Valve isolation is most often used to maintain containment while positive isolation is being made, or where valve isolation only is an acceptable option, i.e. in, non-entry situations or where risk assessment or approved maintenance procedures allow this to occur.

To confirm the integrity of the valve isolation, wherever it is used as the primary protection prior to breaking of containment, separate vent / drain point(s) shall be provided.

Table 1 contains the general requirements for isolation type for each pressure class. A double block and bleed is defined as two block valves with a bleed valve in between. The following guidelines apply in conjunction with Table 1.

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For design purposes, where a piece of equipment is subjected to scheduled maintenance or inspection on a frequency of one year or less, and the equipment can be bypassed or is redundant, a double block and bleed isolation (if required by Table 1) should be implemented across the individual equipment. Filters subject to regular element inspection normally fall into this category.

Certain exceptions to Table 1 may be made in design according to the following principles. Where these are implemented they shall be approved.

Where equipment forms part of a process train where individual bypass is not possible, double block and bleed over individual equipment may not be warranted. Isolation over a larger piping volume (up to and including the entire process train) should be considered to balance vented inventory against the frequency of isolation anticipated.

Cavities of ball valves shall be shown and tagged on P&IDs and shall be provided with needle valves for controlled venting of cavities. Refer to GAS-960-GL-ME-001, Cavity Venting of Trunnion Mounted Ball Valves.

Solid plugs are not permitted. Where a plug is required, it shall be of a type where a bleed screw enables the relief of any trapped pressure without loosening the entire plug.

Table 1: Isolation Requirements

Operating Medium	Line Pressure Class	Isolation Standard
Hydrocarbon Gas / Liquid	150#	Single valve (gate or ball) with downstream bleed
Hydrocarbon Gas / Liquid	300#	Single valve (gate or ball) with downstream bleed
Hydrocarbon Gas / Liquid	600#	Double block and bleed
Hydrocarbon Gas / Liquid	900#	Double block and bleed
Hydrocarbon Gas / Liquid	1500#	Double block and bleed
Diesel	150#	Single valve
Instrument Air	150#	Single valve
Service Water	150#	Single valve
Demineralised Water	150#	Single valve
Fire Water	150#	Single valve

Pressurisation lines shall be provided around all large bore isolation valves.

Valves associated with ESD systems shall pneumatically latch and remote opening shall be prevented until a manual local reset is activated. Such valves shall be nominated in preliminary design and their functionality confirmed by HAZOP (and CHAZOP/SIL as appropriate).

Piping pressurisation lines and de-pressurising lines to atmosphere or vent systems shall include a ball valve on the upstream pressure side of the line with a globe valve downstream for throttling.

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All valves which are identified as being critical to remain fully open during operation (such as isolating a PSV or a safety critical pressure transmitter) will be locked open with a 6mm hasp padlock. Operational procedures including work permitting, and approved maintenance and tagging procedures shall be implemented to prevent inappropriate isolation of equipment when in operation.

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Simon Hanlin

From: Michael Peoples <Michael.Peoples@jemena.com.au>
Sent: Monday, 9 November 2020 5:05 PM
To: Lisa Hein
Cc: Sarah Greening
Subject: 20617-R819: 20617-S2153: Jemena Isolation Policy Guide

Hi Lisa

Yes pig traps have only one isolation valve. Pigging is on a frequency around 5-10 years.

I am the signoff for isolation arrangements, however as Matt says if the HAZOP takes into account the valving arrangements and they are as per the guide, then I do not need to approve them.

It would only be a completely new arrangement, or a scenario somehow outside normal application that I would need to approve.

Cheers

Mike

From: Lisa Hein <Lisa.Hein@gpaeng.com.au>
Sent: Monday, 9 November 2020 5:28 PM
To: Michael Peoples <Michael.Peoples@jemena.com.au>
Cc: Sarah Greening <sarah.greening@gpaeng.com.au>
Subject: 20617-S2153: RE: 20617-S2132: Jemena Isolation Policy Guide

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Thanks Mike,

For my clarity, does a double block and bleed apply to the pig receiver isolation or is a single valve isolation acceptable in this case? I have referred to the design review minutes but it doesn't appear to be mentioned in there. Are you the sign off authority for the valving isolation arrangement in Jemena?

Let me know and I can record in the minutes. Thanks

Lisa Hein
Senior Consultant - Risk and Advisory
BEng (Chem) (Hons) | MIChemE | RPEQ

GPA Engineering
121 Greenhill Road, Unley SA 5061
Dir 08 8299 8331 | **Mob** 0439 843 582 | **Ph** 08 8299 8300
E Lisa.Hein@gpaeng.com.au | **I** http://www.gpaeng.com.au/

From: Michael Peoples <Michael.Peoples@jemena.com.au>
Sent: Monday, 9 November 2020 4:48 PM
To: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Sarah Greening <sarah.greening@gpaeng.com.au>; Nathan Biggins <Nathan.Biggins@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton

<Peter.Blyton@gpaeng.com.au>; Young, David <dsy@enscope.com.au>
Subject: RE: 20617-S2132: Jemena Isolation Policy Guide

Folks

I lose track of which projects we have provided these documents to, and which we haven't.

The relevant section to refer to for isolations is GTS-960-DG-PI-001 section 10.1.2.

Positive isolation (spade/blind/dropout spool) is mandatory where maintenance involving breaking gas containment, is done in confined spaces.

Valve isolation is acceptable for non-confined-spaces.

DBB is required in class #600 and above where the item being isolated is subjected to maintenance which involves breaking gas containment, on a frequency of one year or less.

Cheers

Mike

From: Matthew Skaras <Matthew.Skaras@jemena.com.au>
Sent: Monday, 9 November 2020 4:35 PM
To: Sarah Greening <sarah.greening@gpaeng.com.au>; Nathan Biggins <Nathan.Biggins@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton <Peter.Blyton@gpaeng.com.au>; Young, David <dsy@enscope.com.au>; Michael Peoples <Michael.Peoples@jemena.com.au>
Subject: RE: 20617-S2132: Jemena Isolation Policy Guide

Hi Sarah,

Please refer to the design review minutes, the isolation requirements were discussed at length and I don't believe that anything in the HAZOP changed these requirements. Our ops team wanted to revisit these by raising the isolation issues previously agreed upon, now that we have also had the discussion in HAZOP we should be better informed on the groups views (please be mindful of this in subsequent HAZOP sessions so that we can manage the session and stay on track – this item will no doubt come up again).

In the meantime, I will go back to our team and see if there is a specific reference to a document, however there is unlikely to be anything prescriptive.

As a general note whilst it is acceptable in principle to review items previously agreed (and somewhat welcomed, to convince the group we have covered off on all the risks), any discussion needs to be targeted to the node being considered, justified and worked through on its merits as part of the workshop. If we do start to open up discussions previously held this needs to be managed and challenged by the facilitator (and group) regardless of personal views.

Regards,

Matthew Skaras
Project Manager – Major Projects
Jemena
Level 15, 567 Collins St, Melbourne, VIC 3000
(03) 9173 8416 | 0423 538 955
matthew.skaras@jemena.com.au | www.jemena.com.au

From: Sarah Greening <sarah.greening@gpaeng.com.au>
Sent: Monday, 9 November 2020 1:35 PM
To: Nathan Biggins <Nathan.Biggins@jemena.com.au>; Matthew Skaras <Matthew.Skaras@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton <Peter.Blyton@gpaeng.com.au>
Subject: 20617-S2132: Jemena Isolation Policy Guide

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Hi Nathan, Matthew,

During the first HAZOP session last week you referred to Jemena Isolation Policy Guide, can you please provide a copy of this or the document number for reference in the HAZOP minutes?

Thanks,

Sarah Greening
Project Manager
BEng (Chem) (Hons) | RPEQ

GPA Engineering
121 Greenhill Road, Unley SA 5061
Dir 08 8299 8320 | **Ph** 08 8299 8300
E sarah.greening@gpaeng.com.au | **I** http://www.gpaeng.com.au/

I am in the office on Mondays, Tuesdays, Thursdays, and Fridays.

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****

MAIL TYPE
Response to Technical Query
MAIL NUMBER
JAM-RESTECHQ-000012
REFERENCE NUMBER
GPA-TECHQ-000013

Re: Kembla Grange - HAZOP Item 1.23

From	Stephen Chow - Jemena Asset Management
To (2)	Sarah Greening - GPA Engineering
	Matthew Skaras - Jemena Asset Management
Cc (5)	Mr Simon Hanlin - GPA Engineering
	Mr Peter Blyton - GPA Engineering
	GPA Document Control - GPA Engineering
	Nathan Biggins - Jemena Asset Management
	David Young - Jemena Asset Management
Sent	Friday, 4 December 2020

MESSAGE

Hi Sarah,

Please see TQ response from Jemena Gas Engineering Manager:

Engineering has assessed the TQ query and advises that GPA is to proceed with the single valve isolation design.

Whilst Jemena has had some issues with valve isolations in the past, these have been limited and are still judged rare in relation to the total number of valves installed on our assets. The issues encountered have all been related to vendor quality and not related to incorrect specification.

Jemena balances risk against cost when establishing where a leak-tolerant design (two valve DBB) should be installed, and prioritises locations based on frequent scheduled maintenance (opening on a frequency of one year or higher) or where urgent maintenance access might be required, the failure of which might interrupt gas flows. In practice this results in filter assemblies being prioritised and occasionally other equipment in continuous service for which a redundant spare or bypass is installed.

In this particular case, Jemena's history is that one pig trap isolation valve has been replaced on any of Jemena's assets, and this was in relation to a valve stem leak, as opposed to a seat leak. This valve was at Wallumbilla.

In relation to the queries on the application of the risk matrix, Engineering notes that the probability assessment includes a dimension of time – chance of the event per year- thus assessing the relative frequency of the event is relevant to assessing the probability. If a valve is relied upon 4 times per year this is a material difference to if the valve is relied upon once each ten years. Although the probability may not be linear between the two it is relevant to be considered.

In addition Engineering does not believe that the consequence being assessed is Catastrophic. The most credible case is a valve seat leak that results in an excessive cavity vent rate and appreciable cavity pressure, that results in the proposed pigging activity being unable to be carried out. Jemena's experience is that once a DBB "single valve" isolation is proven then there is no credible case for a catastrophic failure.

As part of preparation for pigging, isolation valves are tested and proven well before pigs are mobilised, and the worst case outcome is a repair operation that involves suspension of the pipeline. As this outcome is rare or unexpected the judgement applied is that the additional expense of installing two additional full bore valves (estimate $130k) to mitigate this eventuality is not justified.

Regards,
Stephen Chow

From: S Greening
Sent: 24/11/2020 12:55:45 PM AEDT (GMT +11:00)
To: Stephen Chow, Matthew Skaras
Cc: Peter Blyton, GPA Document Control, Simon Hanlin, Nathan Biggins, David Young
Mail Number: GPA-TECHQ-000013
Subject: Kembla Grange - HAZOP Item 1.23

Are there any attachments?:	No
Authorised Signatory:	n/a
Description:	Kembla Grange - HAZOP Item 1.23
Drawing Reference:	n/a
If yes, state recommended control below:	n/a
Is additional hazard control required?:	No
Is the response critical to work progres:	No
Location:	Kembla Grange
Standard/Specification Reference:	n/a
Urgency:	Routine

Hi Matthew, Stephen,

Can you please respond to this feedback sent from Luke Gigliotti?

I wanted to provide some feedback re Item 1.23 for consideration, which was the removal of the second isolation valve on the inlet to the new pig receiver on the Kembla Grange lateral from the LNG Ship.

My understanding is the remaining single valve is a trunnion mounted ball valve (with 2 faces)- which per the Jemena design guide 'Piping Design Guide and Material Specification for Gas Pipeline Facilities GTS-960-DG-PI-001 Rev 1) is acceptable- but I would like if the following points are considered:

- Performance of Trunnion Mounted Ball Valves on Jemena assets
- Lack of available upstream isolation (operability and commercial considerations)
- Change to risk based on frequency of task?

1. Feedback from those in the field have suggested that there has been multiple failures of different trunnion valves across the EGP. East Gippsland Compressor Station and Longford Compressor station are two sites in which there has been failure of recently acquired and installed trunnion mounted 2 face valves. I'm unsure of their design and specification, but at the least it should be understood what these failure mechanisms were and if we can, build this into the specification for Project Marlin so it is not repeated. Nevertheless, there is a lack of confidence of this valve type in the field along EGP.
2. The feedback from the project that in the absence of a valve holding, the operators in the field would look for an upstream valve to get a safe isolation. For this item, there is no upstream valve available (only at the LNG ship tie-in). In this event there would be a significant commercial implication in terms of venting volume and of time. Is an additional valve worth considering to avoid the consequence?
3. The frequency of the pigging task (every 5 years nominally- unsure of what other PM work is required for the receiver itself and associated isolation valves) is used as a reason (per our guideline) to not install DBB. For me it is unclear how the risk changes based on frequency of task. For the same activity that is executed say 1/year versus 1/ 2 years, the likelihood of failure shouldn't change or not significantly enough to change from say 'possible' to 'unlikely' and therefore change the risk per the Jemena matrix. The exposure to the task does increase but in this example it shouldn't necessarily double i.e. not linear.

   Also note, if we deem any of our maintenance tasks with a catastrophic consequence then the likelihood of the task does not minimise the risk in terms of approval to proceed (see below)- is this the case for receiving a pig? Operationally, when a task is executed on an infrequent basis it tends to attract a higher risk to personnel- and therefore engineering controls are best to be relied upon rather than procedural…would additional isolation provide this in this case and provide greater reduction in risk?

Perhaps these things could be considered by the broader project team before finalisation of the minutes?

Likelihood		Consequence			
		Minor	Serious	Severe	Major
		1	2	3	4
Almost Certain	5	Moderate	High	Extreme	Extreme
Likely	4	Moderate	Significant	High	Extreme
Possible	3	Moderate	Moderate	Significant	High
Unlikely	2	Low	Low	Moderate	Significant
Rare	1	Low	Low	Moderate	Moderate

Figure 7: Risk Matrix

** **Note:** Whilst these risks are rated below extreme, the potentially catastrophic consequen reporting (refer Figure 9 for details).*

Risk Rating*	Suggested Action	Suggested Timing	Monitoring
EXTREME	Requires immediate action. Highest priority to treat risk. Senior level monitoring.	Action plans prepared and normally implemented within 1 month. Status of risk should be monitored monthly.	**SGSPAA:** Board / RHSEC / ERMC / LT **Functional Group / Zinfra:** Managing Director / Executive General Manager
HIGH	Requires immediate attention – must manage with senior level monitoring. Includes RHSEC and ERMC / LT oversight of Unlikely Likelihood, Catastrophic Consequence Events.	Action plans prepared and normally implemented within 3 months. Status of risk should be monitored monthly.	**SGSPAA:** RHSEC** / ERMC / LT **Functional Group (Jemena) / Zinfra:** EGM / General Managers
SIGNIFICANT	Requires Management attention with a degree of priority. Includes RHSEC / ERMC / LT oversight of Rare Likelihood, Catastrophic Consequence Events. High level monitoring.	Action plans prepared and normally implemented within 6 months. Status of risk should be monitored every 6 months.	**SGSPAA:** RHSEC** / ERMC** / LT **Functional Group (Jemena) / Zinfra:** EGM / General Managers
MODERATE	Requires routine to periodic monitoring.	Action plans prepared and normally implemented within 6 – 12 months (where the benefits outweigh the costs). Status of risk should be monitored at least every 6 months.	**SGSPAA / Functional Group (Jemena) / Zinfra:** General Managers Escalate FG / Zinfra risk to the EGM / Zinfra MD if the risk consequence or likelihood is increasing.
LOW	"Business as usual" - should not require much attention but should be reviewed at least annually. Managed by routine policies and procedures.	Ongoing control as part of a management system. Risk Facilitators to maintain register of Low risks and reassess annually.	**SGSPAA / Functional Group (Jemena) / Zinfra:** Managers Escalate FG / Zinfra risk to the GM if the risk consequence or likelihood is increasing.

Note *: Risk oversight requirements are based on the Residual risk rating, i.e. after existing controls have been evaluated and assigned.

**: RHSEC and ERMC reporting only for Rare and Unlikely Likelihood, Catastrophic Consequence Events. However, the RHSEC may escalate any risk matters to the Board if the RHSEC considers it appropriate.

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		21.20

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	21	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
21.20	ISOLATION	Filter isolation	Inadequate isolation		Confirm isolation philosophy for isolation of CD header from filter.	**1 / DY**

DISCUSSION AND RECOMMENDATION

The required equipment isolations were initially defined by Jemena in the Design Review (refer GAS-599-MM-PM-001(A)) and further clarified post HAZOP by the Jemena Engineering Manager (Mike Peoples) to be as per the Jemena Piping Design Guide GTS-960-DG-PI-001 (refer Email 20617-R819). In accordance with the isolation philosophy defined in GTS-960-DG-PI-001 Section 10.1.2, Jemena have advised GPA that a double block and bleed isolation is requiured for the filters based on a maintenance frequency of less than a year (refer JAM-RESTECHQ-000012).

This is consistent with the current design and therefore no changes are required.

ACTION TAKEN / CLOSE OUT COMMENTS

No action required. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: LHein **Date:** 10/2/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscopre, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:45:19 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

Document Title	Document No. (Client / GPA)
Facilities FEED Stage 1 - Design Review Minutes	GAS-599-MM-PM-001
	N/A

Client Name	Jemena			Date	07/10/2020	By	DAF
Client Project No.	N/A	GPA Project No.	20617	Rev/ Status	A	Chkd	PJB / SG
Project Name	Project Marlin: EGP Reversal				IFI	QA	NKH

System	599 - General EGP Reconfig	Reviewed			Comments	Actions	Assigned to
P&ID No(s).		Yes	No	N/A			
1. Basis of Design / Process Overview							
- Is the project scope defined?		X			East Gippsland Compressor Station (EGCS) has to be removed from scope. Reverse flow compression at EGCS is not required due to the close proximity to LCS/Vic Hub.	Provide confirmation that EGCS has been removed from the facilities scope.	Jemena (Matthew Skaras)
- Are the applicable standards defined?							
- Are all the design and operating cases defined?							
- Are the process fluids defined ?(Composition, temperature, pressure,							
- Is the turndown and Turn up requirements defined? (Flowrates, pressures,							
- Site ambient conditions defined?							
- Are the battery limits defined and reasonable							
- Is the operating envelope fully defined?							
- Are pipe specifications appropriate?		X			From the EGP basis of design 500-RP-006, and EGP manual GTS-599-OM-GEN-001, it is understood that the EGP mainline is upgradeable to an MAOP of 16.55 MPag. All items (pipeline assemblies, pig traps, MLVs, valves, flanges etc) which cannot be isolated from the EGP are to be designed to 16.55 MPag, i.e. CL1500. Isolatable equipment remains CL900, with design pressure of 14.895 MPag. For this reason, the KGMS pig receiver, hot tap connection, and compressor station flow switching valves & piping have been designed using CL1500 piping specification CE15X. However it is noted that a number of EGP mainline equipment is not designed to 16.55 MPag, e.g. Mila pig traps, Kembla Grange MLV which are designed to Jemena specification C9D.	Jemena to complete a cost-benefit analysis of designing EGP connected equipment for a future upgrade design pressure of 16.55 MPag. Jemena to advise outcome of the cost-benefit analysis and confirm if piping and equipment should be designed to 16.55 MPag or 14.895 MPag design pressure. GPA to continue working as per the pipe specs shown on the P&ID until a decision is made.	Jemena (Matthew Skaras)
Control Valves							
- Is fail position shown and correct?							
- Is a bypass required and correctly sized?							
Actuated Valves							
- Are start-up pressuring bypasses required?							
- Is fail position shown and correct?							
2. Process Safety considerations							
- Are there overpressure risks, how will they be controlled?							
- Are there over temperature risks, how will they be controlled?							
- Has the venting requirements and location been considered							
- Are the environmental and societal impacts considered in the design							
3. Operations							
- How will equipment operate?							
- Are there different operating modes- has changeover been addressed?							
- Is equipment sparing consistent with sparing policy?							
- What valves and controls require operator access, how often?							
- What services are required - are they provided?							
4. Controls & Instrumentation							
- Are control schemes adequately defined?							
- How does overall flow and pressure control work?							
Has impact of Unit shutdown on other Units been addressed?							
- ESD shutdown Philosophy?							
5. Maintenance / Construction							
- What needs to be maintained, and how often?							
- Is there a venting/purging/draining philosophy?							
- Is isolation for maintenance adequate (consistent with isolation policy)?		X			The Isolation Philosophy to be applied: - Double block and bleed (DB&B) isolation, consisting of two separate block valves and bleed in between, is required for normal maintenance access (major equipment e.g. filter element change) - Single isolation is required for non-routine maintenance, e.g. flow meter removal.	Detail the isolation philosophy in the basis of design document.	GPA (Simon Hanlin)
- Isolations required for tie-in construction							
6. Layout							
- Existing services – underground and above ground				X	N/A - refer to location specific layouts.		
- What land / space is available and clear for use				X	N/A - refer to location specific layouts.		
- Access and maintainability, personnel access				X	N/A - refer to location specific layouts.		
- Egress routes				X	N/A - refer to location specific layouts.		
- Drainage, bulk earthworks requirements				X	N/A - refer to location specific layouts.		
- Geotech condition				X	N/A - refer to location specific layouts.		
- Vehicle access during ops				X	N/A - refer to location specific layouts.		
- Vehicle access during construction (cranes, trucks)				X	N/A - refer to location specific layouts.		

10 VALVES

Valves shall be in accordance with the following specifications:

- GTS-960-SP-ME-010, Manual and Actuated Valves
- GTS-960-SP-JJ-002, Control Valves

10.1 ISOLATION PHILOSOPHY

All equipment requiring maintenance shall be provided with suitable redundancy and/or a method of bypass to ensure station availability during routine maintenance.

The normal methods of isolation for mechanical equipment may be classified as:

- Positive Isolation.
- Valve Isolation

10.1.1 POSITIVE ISOLATION

Positive isolation against the high pressure source must be employed where the source potentially supplies gas into a confined space where entry by personnel is to be undertaken. Appropriate depressurisation and isolation procedures shall be followed to enable installation or removal of positive isolations.

Positive isolation must be achieved in one of three ways:

- The removal of a spool piece with blanking of open ends
- The turning of a spectacle blind
- The insertion of a spade (blind) between flanges, or replacement of a spacer with a line blind

Blanks, spades, blinds, bolting and gaskets shall conform to the piping specification for the line.

In addition to the requirement for positive isolation for work involving entry to confined spaces, it is also recommended in the following cases:

- Long duration isolations (more than one week)
- Where equipment is to be mothballed
- For process fluids at or above auto-ignition temperature
- Where risk assessment or approved work procedures stipulate.

10.1.2 VALVE ISOLATION

Valve isolation is most often used to maintain containment while positive isolation is being made, or where valve isolation only is an acceptable option, i.e. in, non-entry situations or where risk assessment or approved maintenance procedures allow this to occur.

To confirm the integrity of the valve isolation, wherever it is used as the primary protection prior to breaking of containment, separate vent / drain point(s) shall be provided.

Table 1 contains the general requirements for isolation type for each pressure class. A double block and bleed is defined as two block valves with a bleed valve in between. The following guidelines apply in conjunction with Table 1.

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For design purposes, where a piece of equipment is subjected to scheduled maintenance or inspection on a frequency of one year or less, and the equipment can be bypassed or is redundant, a double block and bleed isolation (if required by Table 1) should be implemented across the individual equipment. Filters subject to regular element inspection normally fall into this category.

Certain exceptions to Table 1 may be made in design according to the following principles. Where these are implemented they shall be approved.

Where equipment forms part of a process train where individual bypass is not possible, double block and bleed over individual equipment may not be warranted. Isolation over a larger piping volume (up to and including the entire process train) should be considered to balance vented inventory against the frequency of isolation anticipated.

Cavities of ball valves shall be shown and tagged on P&IDs and shall be provided with needle valves for controlled venting of cavities. Refer to GAS-960-GL-ME-001, Cavity Venting of Trunnion Mounted Ball Valves.

Solid plugs are not permitted. Where a plug is required, it shall be of a type where a bleed screw enables the relief of any trapped pressure without loosening the entire plug.

Table 1: Isolation Requirements

Operating Medium	Line Pressure Class	Isolation Standard
Hydrocarbon Gas / Liquid	150#	Single valve (gate or ball) with downstream bleed
Hydrocarbon Gas / Liquid	300#	Single valve (gate or ball) with downstream bleed
Hydrocarbon Gas / Liquid	600#	Double block and bleed
Hydrocarbon Gas / Liquid	900#	Double block and bleed
Hydrocarbon Gas / Liquid	1500#	Double block and bleed
Diesel	150#	Single valve
Instrument Air	150#	Single valve
Service Water	150#	Single valve
Demineralised Water	150#	Single valve
Fire Water	150#	Single valve

Pressurisation lines shall be provided around all large bore isolation valves.

Valves associated with ESD systems shall pneumatically latch and remote opening shall be prevented until a manual local reset is activated. Such valves shall be nominated in preliminary design and their functionality confirmed by HAZOP (and CHAZOP/SIL as appropriate).

Piping pressurisation lines and de-pressurising lines to atmosphere or vent systems shall include a ball valve on the upstream pressure side of the line with a globe valve downstream for throttling.

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All valves which are identified as being critical to remain fully open during operation (such as isolating a PSV or a safety critical pressure transmitter) will be locked open with a 6mm hasp padlock. Operational procedures including work permitting, and approved maintenance and tagging procedures shall be implemented to prevent inappropriate isolation of equipment when in operation.

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Simon Hanlin

From: Michael Peoples <Michael.Peoples@jemena.com.au>
Sent: Monday, 9 November 2020 5:05 PM
To: Lisa Hein
Cc: Sarah Greening
Subject: 20617-R819: 20617-S2153: Jemena Isolation Policy Guide

Hi Lisa

Yes pig traps have only one isolation valve. Pigging is on a frequency around 5-10 years.

I am the signoff for isolation arrangements, however as Matt says if the HAZOP takes into account the valving arrangements and they are as per the guide, then I do not need to approve them.

It would only be a completely new arrangement, or a scenario somehow outside normal application that I would need to approve.

Cheers

Mike

From: Lisa Hein <Lisa.Hein@gpaeng.com.au>
Sent: Monday, 9 November 2020 5:28 PM
To: Michael Peoples <Michael.Peoples@jemena.com.au>
Cc: Sarah Greening <sarah.greening@gpaeng.com.au>
Subject: 20617-S2153: RE: 20617-S2132: Jemena Isolation Policy Guide

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Thanks Mike,

For my clarity, does a double block and bleed apply to the pig receiver isolation or is a single valve isolation acceptable in this case? I have referred to the design review minutes but it doesn't appear to be mentioned in there. Are you the sign off authority for the valving isolation arrangement in Jemena?

Let me know and I can record in the minutes. Thanks

Lisa Hein
Senior Consultant - Risk and Advisory
BEng (Chem) (Hons) | MIChemE | RPEQ

GPA Engineering
121 Greenhill Road, Unley SA 5061
Dir 08 8299 8331 | **Mob** 0439 843 582 | **Ph** 08 8299 8300
E Lisa.Hein@gpaeng.com.au | **I** http://www.gpaeng.com.au/

From: Michael Peoples <Michael.Peoples@jemena.com.au>
Sent: Monday, 9 November 2020 4:48 PM
To: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Sarah Greening <sarah.greening@gpaeng.com.au>; Nathan Biggins <Nathan.Biggins@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton

<Peter.Blyton@gpaeng.com.au>; Young, David <dsy@enscope.com.au>
Subject: RE: 20617-S2132: Jemena Isolation Policy Guide

Folks

I lose track of which projects we have provided these documents to, and which we haven't.

The relevant section to refer to for isolations is GTS-960-DG-PI-001 section 10.1.2.

Positive isolation (spade/blind/dropout spool) is mandatory where maintenance involving breaking gas containment, is done in confined spaces.

Valve isolation is acceptable for non-confined-spaces.

DBB is required in class #600 and above where the item being isolated is subjected to maintenance which involves breaking gas containment, on a frequency of one year or less.

Cheers

Mike

From: Matthew Skaras <Matthew.Skaras@jemena.com.au>
Sent: Monday, 9 November 2020 4:35 PM
To: Sarah Greening <sarah.greening@gpaeng.com.au>; Nathan Biggins <Nathan.Biggins@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton <Peter.Blyton@gpaeng.com.au>; Young, David <dsy@enscope.com.au>; Michael Peoples <Michael.Peoples@jemena.com.au>
Subject: RE: 20617-S2132: Jemena Isolation Policy Guide

Hi Sarah,

Please refer to the design review minutes, the isolation requirements were discussed at length and I don't believe that anything in the HAZOP changed these requirements. Our ops team wanted to revisit these by raising the isolation issues previously agreed upon, now that we have also had the discussion in HAZOP we should be better informed on the groups views (please be mindful of this in subsequent HAZOP sessions so that we can manage the session and stay on track – this item will no doubt come up again).

In the meantime, I will go back to our team and see if there is a specific reference to a document, however there is unlikely to be anything prescriptive.

As a general note whilst it is acceptable in principle to review items previously agreed (and somewhat welcomed, to convince the group we have covered off on all the risks), any discussion needs to be targeted to the node being considered, justified and worked through on its merits as part of the workshop. If we do start to open up discussions previously held this needs to be managed and challenged by the facilitator (and group) regardless of personal views.

Regards,

Matthew Skaras
Project Manager – Major Projects
Jemena
Level 15, 567 Collins St, Melbourne, VIC 3000
(03) 9173 8416 | 0423 538 955
matthew.skaras@jemena.com.au | www.jemena.com.au

From: Sarah Greening <sarah.greening@gpaeng.com.au>
Sent: Monday, 9 November 2020 1:35 PM
To: Nathan Biggins <Nathan.Biggins@jemena.com.au>; Matthew Skaras <Matthew.Skaras@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton <Peter.Blyton@gpaeng.com.au>
Subject: 20617-S2132: Jemena Isolation Policy Guide

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Hi Nathan, Matthew,

During the first HAZOP session last week you referred to Jemena Isolation Policy Guide, can you please provide a copy of this or the document number for reference in the HAZOP minutes?

Thanks,

Sarah Greening
Project Manager
BEng (Chem) (Hons) | RPEQ

GPA Engineering
121 Greenhill Road, Unley SA 5061
Dir 08 8299 8320 | **Ph** 08 8299 8300
E sarah.greening@gpaeng.com.au | **I** http://www.gpaeng.com.au/

I am in the office on Mondays, Tuesdays, Thursdays, and Fridays.

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****

MAIL TYPE
Response to Technical Query
MAIL NUMBER
JAM-RESTECHQ-000012
REFERENCE NUMBER
GPA-TECHQ-000013

Re: Kembla Grange - HAZOP Item 1.23

From	Stephen Chow - Jemena Asset Management
To (2)	Sarah Greening - GPA Engineering
	Matthew Skaras - Jemena Asset Management
Cc (5)	Mr Simon Hanlin - GPA Engineering
	Mr Peter Blyton - GPA Engineering
	GPA Document Control - GPA Engineering
	Nathan Biggins - Jemena Asset Management
	David Young - Jemena Asset Management
Sent	Friday, 4 December 2020

MESSAGE

Hi Sarah,

Please see TQ response from Jemena Gas Engineering Manager:

Engineering has assessed the TQ query and advises that GPA is to proceed with the single valve isolation design.

Whilst Jemena has had some issues with valve isolations in the past, these have been limited and are still judged rare in relation to the total number of valves installed on our assets. The issues encountered have all been related to vendor quality and not related to incorrect specification.

Jemena balances risk against cost when establishing where a leak-tolerant design (two valve DBB) should be installed, and prioritises locations based on frequent scheduled maintenance (opening on a frequency of one year or higher) or where urgent maintenance access might be required, the failure of which might interrupt gas flows. In practice this results in filter assemblies being prioritised and occasionally other equipment in continuous service for which a redundant spare or bypass is installed.

In this particular case, Jemena's history is that one pig trap isolation valve has been replaced on any of Jemena's assets, and this was in relation to a valve stem leak, as opposed to a seat leak. This valve was at Wallumbilla.

In relation to the queries on the application of the risk matrix, Engineering notes that the probability assessment includes a dimension of time – chance of the event per year- thus assessing the relative frequency of the event is relevant to assessing the probability. If a valve is relied upon 4 times per year this is a material difference to if the valve is relied upon once each ten years. Although the probability may not be linear between the two it is relevant to be considered.

In addition Engineering does not believe that the consequence being assessed is Catastrophic. The most credible case is a valve seat leak that results in an excessive cavity vent rate and appreciable cavity pressure, that results in the proposed pigging activity being unable to be carried out. Jemena's experience is that once a DBB "single valve" isolation is proven then there is no credible case for a catastrophic failure.

As part of preparation for pigging, isolation valves are tested and proven well before pigs are mobilised, and the worst case outcome is a repair operation that involves suspension of the pipeline. As this outcome is rare or unexpected the judgement applied is that the additional expense of installing two additional full bore valves (estimate $130k) to mitigate this eventuality is not justified.

Regards,
Stephen Chow

From: S Greening
Sent: 24/11/2020 12:55:45 PM AEDT (GMT +11:00)
To: Stephen Chow, Matthew Skaras
Cc: Peter Blyton, GPA Document Control, Simon Hanlin, Nathan Biggins, David Young
Mail Number: GPA-TECHQ-000013
Subject: Kembla Grange - HAZOP Item 1.23

Are there any attachments?:	No
Authorised Signatory:	n/a
Description:	Kembla Grange - HAZOP Item 1.23
Drawing Reference:	n/a
If yes, state recommended control below:	n/a
Is additional hazard control required?:	No
Is the response critical to work progres:	No
Location:	Kembla Grange
Standard/Specification Reference:	n/a
Urgency:	Routine

Hi Matthew, Stephen,

Can you please respond to this feedback sent from Luke Gigliotti?

I wanted to provide some feedback re Item 1.23 for consideration, which was the removal of the second isolation valve on the inlet to the new pig receiver on the Kembla Grange lateral from the LNG Ship.

My understanding is the remaining single valve is a trunnion mounted ball valve (with 2 faces)- which per the Jemena design guide 'Piping Design Guide and Material Specification for Gas Pipeline Facilities GTS-960-DG-PI-001 Rev 1) is acceptable- but I would like if the following points are considered:

- Performance of Trunnion Mounted Ball Valves on Jemena assets
- Lack of available upstream isolation (operability and commercial considerations)
- Change to risk based on frequency of task?

1. Feedback from those in the field have suggested that there has been multiple failures of different trunnion valves across the EGP. East Gippsland Compressor Station and Longford Compressor station are two sites in which there has been failure of recently acquired and installed trunnion mounted 2 face valves. I'm unsure of their design and specification, but at the least it should be understood what these failure mechanisms were and if we can, build this into the specification for Project Marlin so it is not repeated. Nevertheless, there is a lack of confidence of this valve type in the field along EGP.
2. The feedback from the project that in the absence of a valve holding, the operators in the field would look for an upstream valve to get a safe isolation. For this item, there is no upstream valve available (only at the LNG ship tie-in). In this event there would be a significant commercial implication in terms of venting volume and of time. Is an additional valve worth considering to avoid the consequence?
3. The frequency of the pigging task (every 5 years nominally- unsure of what other PM work is required for the receiver itself and associated isolation valves) is used as a reason (per our guideline) to not install DBB. For me it is unclear how the risk changes based on frequency of task. For the same activity that is executed say 1/year versus 1/ 2 years, the likelihood of failure shouldn't change or not significantly enough to change from say 'possible' to 'unlikely' and therefore change the risk per the Jemena matrix. The exposure to the task does increase but in this example it shouldn't necessarily double i.e. not linear.

   Also note, if we deem any of our maintenance tasks with a catastrophic consequence then the likelihood of the task does not minimise the risk in terms of approval to proceed (see below)- is this the case for receiving a pig? Operationally, when a task is executed on an infrequent basis it tends to attract a higher risk to personnel- and therefore engineering controls are best to be relied upon rather than procedural…would additional isolation provide this in this case and provide greater reduction in risk?

Perhaps these things could be considered by the broader project team before finalisation of the minutes?

Likelihood		Consequence			
		Minor	Serious	Severe	Major
		1	2	3	4
Almost Certain	5	Moderate	High	Extreme	Extreme
Likely	4	Moderate	Significant	High	Extreme
Possible	3	Moderate	Moderate	Significant	High
Unlikely	2	Low	Low	Moderate	Significant
Rare	1	Low	Low	Moderate	Moderate

Figure 7: Risk Matrix

** **Note:** Whilst these risks are rated below extreme, the potentially catastrophic consequen reporting (refer Figure 9 for details).*

GPA ENGINEERING	Document Title	*HAZOP Number*
	HAZOP Closeout Sheet	*GAS-599-RP-HZ-003*
		Item Number
		23.17

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	23	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
23.17	PLANT ITEM OPERABILITY				Review blowdown philosophy and if UV-533/UV-532 are to be FC or FO, and required position during LCS blowdown	**1**

DISCUSSION AND RECOMMENDATION

Vic Hub 1 currently blows down through the Longford Compressor Station vent. UV-064101 and UV-064102 will be fail closed and remain shut during blowdown. Vic Hub 2 will blow down through Vic Hub 1 via the cross over line. UV-533/UV-532 will be actuated and mirror the functionality of SDV-6420 and UV-6433. They are fail closed valves, however the bypass valve UV-532 will remain open during blowdown.

ACTION TAKEN / CLOSE OUT COMMENTS

Blowdown philosophy documented in FEED document GAS-599-RP-DN-003(A). Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 10/2/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:46:08 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

LONGFORD COMPRESSOR STATION
CAUSE AND EFFECT MATRIX

510-JJ-001

Revisions to Cause & Effects Document:

1 Revised document layout.
2 Compressor 4 scope included
3 CCR-014: Additional VESDA Systems
4 CCR-017: Actuator modifications to SDV-6401, SDV-6420, UV-6470 & UV-6471.
5 CCR-034: Removal of outputs to UV-6481
6 CCR-035: Open/Close commands for valves UV-6501, UV-6521, UV-6521, UV-6420, UV-6470 & UV-6471 now serial communications from DCS
7 CCR-037: VicHub Filter/Inlet Valve revised logic.
8 CCR-039: Fuel Gas Pressure Regulation high high pressure trips
9 CCR-041: Alarm Annunciator Modifications/Shutdown resets for valves UV-6501, UV-6521 & UV-6551 deleted.

Revision Legend

[ ] - Deleted as a result of Longford 4 project

[Blue Text] - Updates a result of Longford 4 project

Uhde Shedden
A company of ThyssenKrupp Technologies

Jemena

NO.	DATE	REVISION	ORIGINATOR	DESIGN CHECKED	ENGINEER CHECKED	PROJECT APPROVED	CLIENT APPROVED
6	13/07/2010	As Built	PR	WD	WD		CDC
5	16/07/2009	Issued for Construction	AKC	PEV	PEV	DAE	PFR
B	21/05/2009	Revised Format - Issued for Client Review	AKC	PEV	PEV	DAE	
4A-A	17/12/2008	Issued for Detailed Design	JXC				
4A	12/06/2008	IFD - 4th Compressor FEED	LF		GPG	LF	
3	28/02/2003	As Built - TNGP & VicHub Projects	PFR		TK	PAC	

PROJECT NUMBER: 25697

JOB No. JNN ESD VA: 25697
REFERENCE No.: 510-JJ-001

DOC CLASS

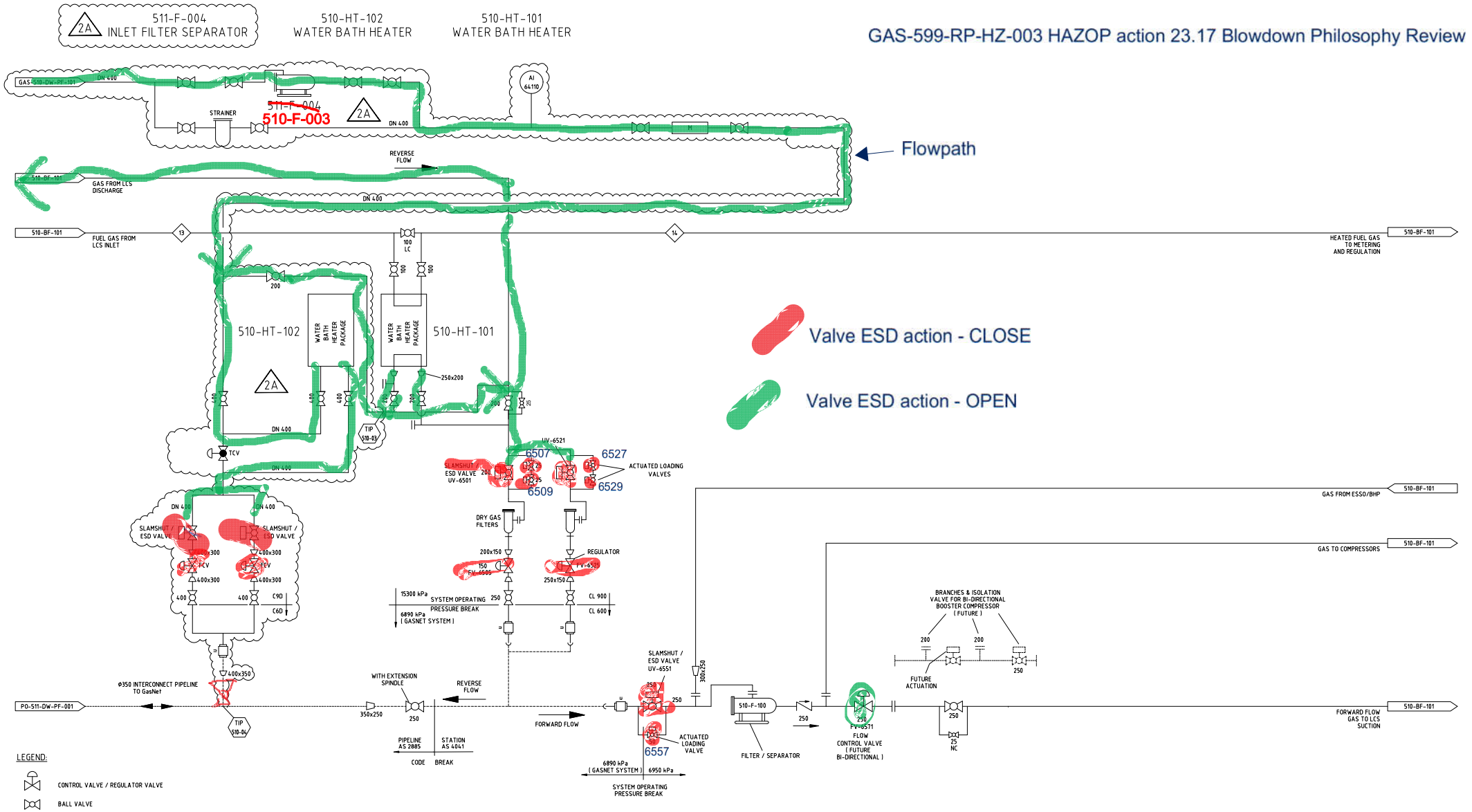
EGP EXPANSION LCS 4th COMPRESSOR PROJECT
LONGFORD COMPRESSOR STATION
CAUSE AND EFFECT MATRIX

SCALE	PROJECT No	Doc. No	REV
NTS	25697	510-JJ-001	6

28/01/20163:52 PM

C:\Users\phootsen\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.Outlook\8YKBMNLQ\510-JJ-001_Rev 6

GAS-599-RP-HZ-003 HAZOP action 23.17 Blowdown Philosophy Review



MASTER FILE

ISSUED FOR HAZOP

REV	DATE	DESCRIPTION	PROJECT	DRAWN	DESIGNED	CHECKED	ENGINEER	APPROVED	CLIENT
2A	2/11/20	ISSUED FOR HAZOP (20617)		GPA			SJH		PJB		NKH	
2	19/05/09	ISSUED FOR CONSTRUCTION	25697	KW		DXB		KLM		DXB		DAE	
B	27/02/09	ISSUED FOR REVIEW (POST HAZOP)	25697	AP		DXB		KLM		DXB		DXB	
A-A	11/08	ISSUED FOR DETAILED DESIGN HAZOP	25697	KW		JYA		KLM		DXB		DXB	
A	06/08	ISSUED FOR HAZOP	00341	BH				TLV		AH		GPG	
1	21/03/03	AS BUILT	510	JS								DLM	
0	26/08/02	ISSUED FOR CONSTRUCTION	510	ML						DJ	PB	DLM	

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ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

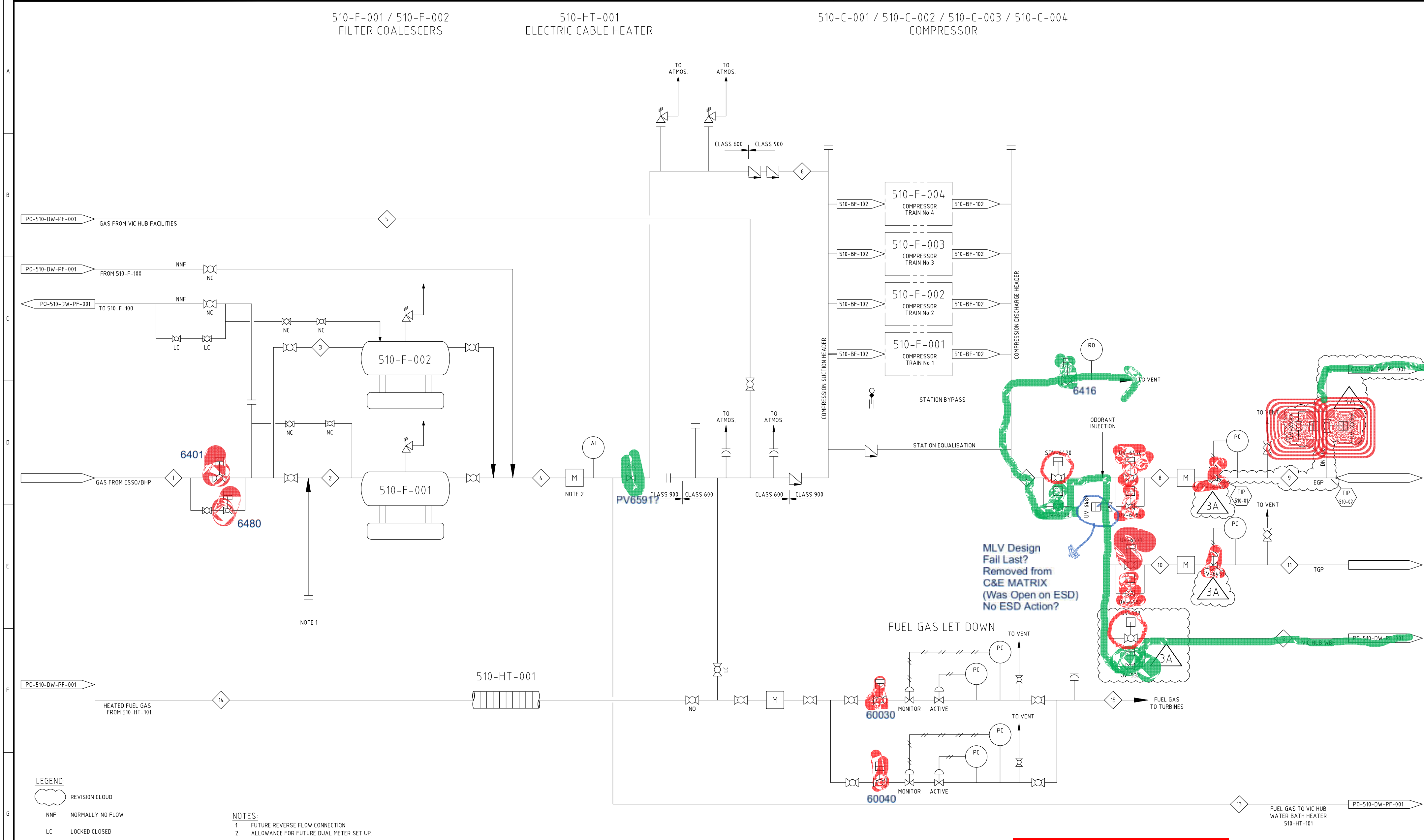
ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

GPA ENGINEERING
www.gpaeng.com.au

LONGFORD COMPRESSOR STATION
VIC HUB – FACILITIES LOCATED WITHIN THE LCS
PROCESS FLOW DIAGRAM

DRAWN	JW	FACILTY	SUBJECT
DESIGN	PB	SCALE	N.T.S.
CHECKED	DJ	SUPERSEDES	PO-510-DW-PF-001
APPROVED	DM	DRAWING NUMBER	GAS-510-DW-PF-001
DATE	28/02/02		REV 2A

DRAWING No. | REFERENCE DRAWINGS



LEGEND:

REVISION CLOUD

NNF NORMALLY NO FLOW

LC LOCKED CLOSED

NOTES:
1. FUTURE REVERSE FLOW CONNECTION.
2. ALLOWANCE FOR FUTURE DUAL METER SET UP.

MASTER FILE

ISSUED FOR HAZOP

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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REV	DATE	DESCRIPTION	PROJECT	DRAWN	DESIGNED	CHECKED	ENGINEER	APPROVED	CLIENT
3A	2/11/20	ISSUED FOR HAZOP (20617)		GPA		SJH	PJB	NKH	
3	15/05/12	AS-BUILT BY LONGFORD EXPANSION PROJECT		GWN		PFR 13.7.10			
2	19/05/09	ISSUED FOR CONSTRUCTION	25697	KW	DXB	KLM	DXB	DAE	
B	27/02/09	ISSUED FOR REVIEW (POST HAZOP)	25697	KW	DXB	KLM	DXB	DAE	
A-A	11/08	ISSUED FOR DETAILED DESIGN HAZOP	25697	AP	JTA	KLM	DXB	DXB	
A	06/08	ISSUED FOR HAZOP	00341	N/C		TLV	AN	GPG	
1	03/03	AS-BUILT TOTNSP & VICHUB PROJECTS	600032310	AN			PR	GTF	
0	08/10/01	ISSUED FOR CONSTRUCTION	08407905	EC			PFR	RR	

GPA ENGINEERING
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LONGFORD COMPRESSOR STATION
MAIN GAS SYSTEM
PROCESS FLOW DIAGRAM

DRAWN	EC	FACILTY	SUBJECT
DESIGN	GT	SCALE	N.T.S.
CHECKED	PR	SUPERSEDES	510-BF-101_3
APPROVED	PAC	DRAWING NUMBER	GAS-510-DW-PF-101
DATE	08/10/99	A1	REV 3A

CAUSE AND EFFECT MATRIX

NOTES:

1. REFER TO UCP CAUSE & EFFECT FOR COMPRESSOR INPUT AND OUTPUT DEVICES
2. ANY SIS PRESSURE INPUT THAT HAS CHANNEL STATUS "FAULTY" OR SENSE INPUT "FAULTY" CAUSES ACTIONS AS IDENTIFIED BY THEIR RESPECTIVE TRIP FUNCTIONS.
3. ANY SIS ESD PB/VESDA/FM200/FIRE PANEL/VIBRATION/LEVEL SWITCH INPUT THAT HAS CHANNEL STATUS "FAULTY" CAUSES ACTIONS AS IDENTIFIED BY EFFECTS

NOTE - ANY FAULTY FIRE OR GAS DETECTOR WILL NOT INITIATE A HIIGH HIGH ALARM.

LEGEND:

X INITIATES ACTION
P PERMISSIVE (OTHER ACTIONS IN COLUMN MAY BE REQUIRED
O REQUIRES PERSON ONSITE STATUS TO BE ONSITE
R SIS OUTPUTS ARE ENABLED/RESET ONLY IF TRIP INPUTS ARE NORMAL/HEALTHY
T TIMER FUNCTION. ACTION IS INITIATED FOR A LIMITED TIME PERIOD.
N INDICATES FINAL ACTION WILL BE INHIBITED

THIS MATRIX DOES NOT IDENTIFY UNIT SHUTDOWNS INITIATED BY UNIT CONTROLS.
SEE VENDOR DOCUMENTATION.

FINAL ACTION

| P&ID | SERVICE | DEVICE I.D. | MAINTENANCE OVER RIDE PROVIDED | OPEN ESSO INLET VALVE | HY-6401 | CLOSE ESSO INLET VALVE | OPEN ESSO INLET LOADING VALVE | HY-6480 | CLOSE ESSO INLET LOADING VALVE | OPEN EGP SD VALVE | HY-6470 | CLOSE EGP SD VALVE | OPEN TGP SD VALVE | HY-6471 | CLOSE TGP SD VALVE | OPEN STATION OUTLET VALVE | XY-6420 | CLOSE STATION OUTLET VALVE | OPEN STATION OUTLET LOADING VALVE | UY-6443A | CLOSE STATION OUTLET LOADING VALVE | OPEN STATION BLOWDOWN VALVE | UY-6416A | CLOSE STATION BLOWDOWN VALVE | TRIP INSTRUMENT AIR COMPRESSORS | UY-24038 | S/DOWN ODOURANT DRIVE AIR SUPPLY | UY-1021A | SHUTDOWN VICHUB HEATER HT-101 | XY-1103 | COMPRESSOR 1 ESD (TO UCP1) | UY-0141 | COMPRESSOR 1 FIRE S/D (TO UCP1) | UY-0315 | COMPRESSOR 1 FIRE S/D (TO UCP4) | UY-0146 | COMPRESSOR 2 ESD (TO UCP2) | UY-0241 | COMPRESSOR 2 FIRE S/D (TO UCP2) | UY-0415 | COMP2 FAST STOP, NO B/DOWN, NON LOCKOUT | UY-0246 | COMPRESSOR 3 ESD (TO UCP3) | UY-3041 | COMPRESSOR 3 FIRE S/D (TO UCP3) | UY-3115 | COMP3 FAST STOP, NO B/DOWN, NON LOCKOUT | UY-3046 | COMPRESSOR 4 ESD (TO UCP4) | UY-04041 | COMPRESSOR 4 FIRE S/D (TO UCP4) | UY-04115 | COMP4 FAST STOP, NO B/DOWN, NON LOCKOUT | UY-04046 | TRIP FM200-CTRL RM FIRE | UY-2028 | WARNING TO FM200 UNIT -CNTRLLRM | UY-2006 | TRIP FM200-SWITCHGEAR RM FIRE | UY-2021 | WARNING TO FM-200 SWITCHGEAR RM | UY-2009 | TRIP FM-200 BATTERY RM FIRE | UY-20054 | WARNING TO FM-200 BATTERY RM | UY-20052 | START COMP BLDG 1 VENTILATION FANS | UY-2207 | STOP COMP BLDG 1 VENTILATION FAN 1 | UY-9601A | STOP COMP BLDG 1 VENTILATION FAN 2 | UY-9602A | STOP COMP BLDG 1 VENTILATION FAN 3 | UY-9603A | STOP COMP BLDG 1 VENTILATION FAN 4 | UY-9604A | START COMP BLDG 2 VENTILATION FANS | UY2217 | STOP COMP BLDG 2 VENTILATION FAN 1 | UY-9611A | STOP COMP BLDG 2 VENTILATION FAN 2 | UY-9612A | STOP COMP BLDG 2 VENTILATION FAN 3 | UY-9613A | STOP COMP BLDG 2 VENTILATION FAN 4 | UY-9614A | OPEN TGP HEADER ISOLATION VALVE | HY-6481A | CLOSE TGP HEADER ISOLATION VALVE | HY-6481B | CLOSE TGP BALL LOADING VALVE | HY-6482 | OPEN TGP BALL LOADING VALVE | XY-24050 | CLOSE TGP PLUG LOADING VALVE | OPEN TGP PLUG LOADING VALVE | CLOSE TGP CONTROL VALVE PV-6451 (DCS) | XY-24050 | CLOSE EGP BALL LOADING VALVE | HY-6484 | OPEN EGP BALL LOADING VALVE | XY-24050 | CLOSE EGP PLUG LOADING VALVE | OPEN EGP PLUG LOADING VALVE | CLOSE EGP CONTROL VALVE PV-6440 (DCS) | XY-24050 | CLOSE FORWARD FLOW ESD VALVE | XY-6551A | OPEN FORWARD FLOW ESD VALVE | HY-6557 | CLOSE FORWARD FLOW LOADING VALVE (UV-6558) | OPEN FORWARD FLOW LOADING VAL VE (UV-6558) | CLOSE VICHUB REG RUN VALVES (DCS) | XY-6573 | OPEN FORWARD CONTROL VALVE PV6571 | HY-6571 | OPEN ESSO INLET CONTROL VALVE PV6691 | HY-6591 | OPEN REG NO.1 ESD/SLAM SHUT VALVE | XY-6501A | CLOSE REG NO.1 ESD/SLAM SHUT VALVE | OPEN REG NO.1 LOADING BALL VALVE (UV-6508) | XY-6507 | CLOSE REG NO.1 LOADING BALL VALVE (UV-6508) | OPEN REG NO.1 LOADING PLUG VALVE | XY-6509 | CLOSE REG NO.1 LOADING PLUG VALVE | SET REG SLAM SHUT SETPOINT TO 7300 KPA | PAHH6501 | SET REG SLAM SHUT SETPOINT TO 7100 KPA | PAHH6501 | OPEN REG NO.2 ESD/SLAM SHUT VALVE | XY-6521A | CLOSE REG NO.2 ESD/SLAM SHUT VALVE | OPEN REG NO.2 LOADING BALL VALVE (UV-6528) | CLOSE REG NO.2 LOADING BALL VALVE (UV-6528) | XY-6527 | OPEN REG NO.2 LOADING PLUG VALVE | XY-6529 | CLOSE REG NO.2 LOADING PLUG VALVE | OPEN FUEL GAS REG RUN 1 SLAMSHUT VALVE | XY-60030 | CLOSE FUEL GAS REG RUN 1 SLAMSHUT VALVE | OPEN FUEL GAS REG RUN 2 SLAMSHUT VALVE | XY-60040 | CLOSE FUEL GAS REG RUN 2 SLAMSHUT VALVE | PAHH6521 | SET REG SLAM SHUT SETPOINT TO 7100 KPA | PAHH6521 | SET REG SLAM SHUT SETPOINT TO 7300 KPA | UY-2415 | ALARM HORNS & STROBES | ALARM WINDOWS ON SIS | SCADA ALARM INDICATION |
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CAUSE AND EFFECT MATRIX

NOTES:

1. REFER TO UCP CAUSE & EFFECT FOR COMPRESSOR INPUT AND OUTPUT DEVICES
2. ANY SIS PRESSURE INPUT THAT HAS CHANNEL STATUS "FAULTY" OR SENSE INPUT "FAULTY" CAUSES ACTIONS AS IDENTIFIED BY THEIR RESPECTIVE TRIP FUNCTIONS.
3. ANY SIS ESD PB/VESDA/FM200/FIRE PANEL/VIBRATION/LEVEL SWITCH INPUT THAT HAS CHANNEL STATUS "FAULTY" CAUSES ACTIONS AS IDENTIFIED BY EFFECTS

NOTE - ANY FAULTY FIRE OR GAS DETECTOR WILL NOT INITIATE A HIIGH HIGH ALARM.

LEGEND:

X INITIATES ACTION
P PERMISSIVE (OTHER ACTIONS IN COLUMN MAY BE REQUIRED
O REQUIRES PERSON ONSITE STATUS TO BE ONSITE
R SIS OUTPUTS ARE ENABLED/RESET ONLY IF TRIP INPUTS ARE NORMAL/HEALTHY
T TIMER FUNCTION. ACTION IS INITIATED FOR A LIMITED TIME PERIOD.
& Indicates "AND" Logic

THIS MATRIX DOES NOT IDENTIFY UNIT SHUTDOWNS INITIATED BY UNIT CONTROLS.
SEE VENDOR DOCUMENTATION.

FINAL ACTION

| INITIATING DEVICES | | | MAINTENANCE OVER RIDE PROVIDED | OPEN ESSO INLET VALVE | CLOSE ESSO INLET VALVE | | | | | OPEN ESSO INLET LOADING VALVE | CLOSE ESSO INLET LOADING VALVE | | | | | OPEN EGP SD VALVE | CLOSE EGP SD VALVE | OPEN TGP SD VALVE | CLOSE TGP SD VALVE | OPEN STATION OUTLET VALVE | CLOSE STATION OUTLET VALVE | OPEN STATION OUTLET LOADING VALVE | CLOSE STATION OUTLET LOADING VALVE | OPEN STATION BLOWDOWN VALVE | CLOSE STATION BLOWDOWN VALVE | S/DOWN ODOURANT DRIVE AIR SUPPLY | SHUTDOWN VICHUB HEATER HT-101 | COMPRESSOR 1 ESD (TO UCP1) | COMPRESSOR 1 FIRE S/D (TO UCP1) | COMP1 FAST STOP, NO B/DOWN, NON LOCKOUT | COMPRESSOR 2 ESD (TO UCP2) | COMPRESSOR 2 FIRE S/D (TO UCP2) | COMP2 FAST STOP, NO B/DOWN, NON LOCKOUT | COMPRESSOR 3 ESD (TO UCP3) | COMPRESSOR 3 FIRE S/D (TO UCP3) | COMP3 FAST STOP, NO B/DOWN, NON LOCKOUT | COMPRESSOR 4 ESD (TO UCP4) | COMPRESSOR 4 FIRE S/D (TO UCP4) | COMP4 FAST STOP, NO B/DOWN, NON LOCKOUT | TRIP FM200-CTRL RM FIRE | WARNING TO FM200 UNIT -CNTRLLRM | TRIP FM200-SWITCHGEAR RM FIRE | WARNING TO FM-200 SWITCHGEAR RM | TRIP FM-200 BATTERY RM FIRE | WARNING TO FM-200 BATTERY RM | START COMP BLDG 1 VENTILATION FANS | STOP COMP BLDG 1 VENTILATION FAN 1 | STOP COMP BLDG 1 VENTILATION FAN 2 | STOP COMP BLDG 1 VENTILATION FAN 3 | STOP COMP BLDG 1 VENTILATION FAN 4 | START COMP BLDG 2 VENTILATION FANS | STOP COMP BLDG 2 VENTILATION FAN 1 | STOP COMP BLDG 2 VENTILATION FAN 2 | STOP COMP BLDG 2 VENTILATION FAN 3 | STOP COMP BLDG 2 VENTILATION FAN 4 | ~~OPEN TGP HEADER ISOLATION VALVE~~ | ~~CLOSE TGP HEADER ISOLATION VALVE~~ | CLOSE TGP BALL LOADING VALVE | OPEN TGP BALL LOADING VALVE | CLOSE TGP PLUG LOADING VALVE | OPEN TGP PLUG LOADING VALVE | CLOSE TGP CONTROL VALVE PV-6451 (DCS) | CLOSE EGP BALL LOADING VALVE | OPEN EGP BALL LOADING VALVE | CLOSE EGP PLUG LOADING VALVE | OPEN EGP PLUG LOADING VALVE | CLOSE EGP CONTROL VALVE PV-6440 (DCS) | CLOSE FORWARD FLOW ESD VALVE | OPEN FORWARD FLOW ESD VALVE | CLOSE FORWARD FLOW LOADING VALVE (UY-6556) | OPEN FORWARD FLOW LOADING VALVE (UY-6556) | CLOSE VICHUB REG RUN VALVES (DCS) | OPEN FORWARD CONTROL VALVE FV6571 | OPEN ESSO INLET CONTROL VALVE PV6691 | OPEN REG NO.1 ESD/SLAM SHUT VALVE | CLOSE REG NO.1 ESD/SLAM SHUT VALVE (UY-6506) | OPEN REG NO.1 LOADING BALL VALVE (UY-6506) | CLOSE REG NO.1 LOADING BALL VALVE (UY-6506) | OPEN REG NO.1 LOADING PLUG VALVE | CLOSE REG NO.1 LOADING PLUG VALVE | SET REG SLAM SHUT SETPOINT TO 7300 KPA | SET REG SLAM SHUT SETPOINT TO 7100 KPA | OPEN REG NO.2 ESD/SLAM SHUT VALVE | CLOSE REG NO.2 ESD/SLAM SHUT VALVE | OPEN REG NO.2 LOADING BALL VALVE (UY-6528) | CLOSE REG NO.2 LOADING BALL VALVE (UY-6528) | OPEN REG NO.2 LOADING PLUG VALVE | CLOSE REG NO.2 LOADING PLUG VALVE | OPEN FUEL GAS REG RUN 1 SLAMSHUT VALVE | CLOSE FUEL GAS REG RUN 1 SLAMSHUT VALVE | OPEN FUEL GAS REG RUN 2 SLAMSHUT VALVE | CLOSE FUEL GAS REG RUN 2 SLAMSHUT VALVE | SET REG SLAM SHUT SETPOINT TO 7100 KPA | SET REG SLAM SHUT SETPOINT TO 7300 KPA | ALARM HORNS & STROBES | ALARM WINDOWS ON SIS | SCADA ALARM INDICATION |
|---|---|---

CAUSE AND EFFECT MATRIX

NOTES:

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3. ANY SIS ESD PB/VESDA/FM200/FIRE PANEL/VIBRATION/LEVEL SWITCH INPUT THAT HAS CHANNEL STATUS "FAULTY" CAUSES ACTIONS AS IDENTIFIED BY EFFECTS

NOTE - ANY FAULTY FIRE OR GAS DETECTOR WILL NOT INITIATE A HIIGH HIGH ALARM.

LEGEND:

X INITIATES ACTION
P PERMISSIVE (OTHER ACTIONS IN COLUMN MAY BE REQUIRED
O REQUIRES PERSON ONSITE STATUS TO BE ONSITE
R SIS OUTPUTS ARE ENABLED/RESET ONLY IF TRIP INPUTS ARE NORMAL/HEALTHY
T TIMER FUNCTION. ACTION IS INITIATED FOR A LIMITED TIME PERIOD.

THIS MATRIX DOES NOT IDENTIFY UNIT SHUTDOWNS INITIATED BY UNIT CONTROLS.
SEE VENDOR DOCUMENTATION.

FINAL ACTION

| P&ID | SERVICE | DEVICE I.D. | MAINTENANCE OVER RIDE PROVIDED | OPEN ESSO INLET VALVE | CLOSE ESSO INLET VALVE | OPEN ESSO INLET LOADING VALVE | CLOSE ESSO INLET LOADING VALVE | OPEN EGP SD VALVE | CLOSE EGP SD VALVE | OPEN TGP SD VALVE | CLOSE TGP SD VALVE | OPEN STATION OUTLET VALVE | CLOSE STATION OUTLET VALVE | OPEN STATION OUTLET LOADING VALVE | CLOSE STATION OUTLET LOADING VALVE | OPEN STATION BLOWDOWN VALVE | CLOSE STATION BLOWDOWN VALVE | S/DOWN ODOURANT DRIVE AIR SUPPLY | SHUTDOWN VICHUB HEATER HT-101 | COMPRESSOR 1 ESD (TO UCP1) | COMPRESSOR 1 FIRE S/D (TO UCP1) | COMP1 FAST STOP, NO B/DOWN, NON LOCKOUT | COMPRESSOR 2 ESD (TO UCP2) | COMPRESSOR 2 FIRE S/D (TO UCP2) | COMP2 FAST STOP, NO B/DOWN, NON LOCKOUT | COMPRESSOR 3 ESD (TO UCP3) | COMPRESSOR 3 FIRE S/D (TO UCP3) | COMP3 FAST STOP, NO B/DOWN, NON LOCKOUT | COMPRESSOR 4 ESD (TO UCP4) | COMPRESSOR 4 FIRE S/D (TO UCP4) | COMP4 FAST STOP, NO B/DOWN, NON LOCKOUT | TRIP FM200-CTRL RM FIRE | WARNING TO FM200 UNIT -CNTRLLRM | TRIP FM200-SWITCHGEAR RM FIRE | WARNING TO FM-200 SWITCHGEAR RM | TRIP FM-200 BATTERY RM FIRE | WARNING TO FM-200 BATTERY RM | START COMP BLDG 1 VENTILATION FANS | STOP COMP BLDG 1 VENTILATION FAN 1 | STOP COMP BLDG 1 VENTILATION FAN 2 | STOP COMP BLDG 1 VENTILATION FAN 3 | STOP COMP BLDG 1 VENTILATION FAN 4 | START COMP BLDG 2 VENTILATION FANS | STOP COMP BLDG 2 VENTILATION FAN 1 | STOP COMP BLDG 2 VENTILATION FAN 2 | STOP COMP BLDG 2 VENTILATION FAN 3 | STOP COMP BLDG 2 VENTILATION FAN 4 | OPEN TGP HEADER ISOLATION VALVE | CLOSE TGP HEADER ISOLATION VALVE | CLOSE TGP BALL LOADING VALVE | OPEN TGP BALL LOADING VALVE | CLOSE TGP PLUG LOADING VALVE | OPEN TGP PLUG LOADING VALVE | CLOSE TGP CONTROL VALVE PV-6451 (DCS) | CLOSE EGP BALL LOADING VALVE | OPEN EGP BALL LOADING VALVE | CLOSE EGP PLUG LOADING VALVE | OPEN EGP PLUG LOADING VALVE | CLOSE EGP CONTROL VALVE PV-6440 (DCS) | CLOSE FORWARD FLOW ESD VALVE | OPEN FORWARD FLOW ESD VALVE | CLOSE FORWARD FLOW LOADING VALVE (UV-6558) | OPEN FORWARD FLOW LOADING VALVE (UV-6558) | CLOSE VICHUB REG RUN VALVES (DCS) | OPEN FORWARD CONTROL VALVE PV6571 | OPEN ESSO INLET CONTROL VALVE PV6591 | OPEN REG NO.1 ESD/SLAM SHUT VALVE | CLOSE REG NO.1 ESD/SLAM SHUT VALVE | OPEN REG NO.1 LOADING BALL VALVE (UV-6508) | CLOSE REG NO.1 LOADING BALL VALVE (UV-6508) | OPEN REG NO.1 LOADING PLUG VALVE | CLOSE REG NO.1 LOADING PLUG VALVE | SET REG SLAM SHUT SETPOINT TO 7300 KPA | SET REG SLAM SHUT SETPOINT TO 7100 KPA | OPEN REG NO.2 ESD/SLAM SHUT VALVE | CLOSE REG NO.2 ESD/SLAM SHUT VALVE | OPEN REG NO.2 LOADING BALL VALVE (UV-6528) | CLOSE REG NO.2 LOADING BALL VALVE (UV-6528) | OPEN REG NO.2 LOADING PLUG VALVE | CLOSE REG NO.2 LOADING PLUG VALVE | SET REG SLAM SHUT SETPOINT TO 7100 KPA | SET REG SLAM SHUT SETPOINT TO 7300 KPA | ALARM HORNS & STROBES | ALARM WINDOWS ON SIS | SCADA ALARM INDICATION |
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CAUSE AND EFFECT MATRIX

NOTES:

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3. ANY SIS ESD PB/VESDA/FM200/FIRE PANEL/VIBRATION/LEVEL SWITCH INPUT THAT HAS CHANNEL STATUS "FAULTY" CAUSES ACTIONS AS IDENTIFIED BY EFFECTS

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X INITIATES ACTION
P PERMISSIVE (OTHER ACTIONS IN COLUMN MAY BE REQUIRED
O REQUIRES PERSON ONSITE STATUS TO BE ONSITE
R SIS OUTPUTS ARE ENABLED/RESET ONLY IF TRIP INPUTS ARE NORMAL/HEALTHY
T TIMER FUNCTION. ACTION IS INITIATED FOR A LIMITED TIME PERIOD.

THIS MATRIX DOES NOT IDENTIFY UNIT SHUTDOWNS INITIATED BY UNIT CONTROLS.
SEE VENDOR DOCUMENTATION.

FINAL ACTION

P&ID	SERVICE	DEVICE I.D.	MAINTENANCE OVER RIDE PROVIDED	STOP COMP 1 INTERCOOLER FAN 1	STOP COMP 1 INTERCOOLER FAN 2	STOP COMP 1 AFTERCOOLER FAN 1	STOP COMP 1 AFTERCOOLER FAN 2	STOP COMP 2 INTERCOOLER FAN 1	STOP COMP 2 INTERCOOLER FAN 2	STOP COMP 2 AFTERCOOLER FAN 1	STOP COMP 2 AFTERCOOLER FAN 2	STOP COMP 3 INTERCOOLER FAN 1	STOP COMP 3 INTERCOOLER FAN 2	STOP COMP 3 AFTERCOOLER FAN 1	STOP COMP 3 AFTERCOOLER FAN 2	STOP COMP 4 INTERCOOLER FAN 1	STOP COMP 4 INTERCOOLER FAN 2	STOP COMP 4 AFTERCOOLER FAN 1	STOP COMP 4 AFTERCOOLER FAN 2	OPEN FG REG RUN 1 SLAMSHUT VALVE	CLOSE FGREG RUN 1 SLAMSHUT VALVE	OPEN FG REG RUN 2 SLAMSHUT VALVE	CLOSE FG REG RUN 2 SLAMSHUT VALVE	ALARM HORNS & STROBES	ALARM WINDOWS ON SIS	SCADA ALARM INDICATION
				UY- 0111C	UY- 0112C	UY- 0123C	UY- 0124C	UY- 0211C	UY- 0212C	UY- 0223C	UY- 0224C	UY- 3011C	UY- 3012C	UY- 3023C	UY- 3024C	UY- 04011C	UY- 04012C	UY- 04023C	UY- 04024C	XY-60030		XY-60040		UY-2415		
-	ESD TRIPS (REFER SHEET 1)	-		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X			
-	ESD RESET (REFER SHEET 1)	-																								
	FIRE & GAS TRIPS (REFER SHEET 1)																									
510-PI-130	IA LO LO PRESS PIT54002A/B/C (2oo3)(550 kPa)	PALL-54002																								
	FIRE - COMPRESSOR BUILDING 1			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X			
-	FIRE - COMPRESSOR BUILDING 2	-		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X		X			
510-PI-104	COMP 1 INTERCOOLER FAN 1 HIGH VIBRATION	VAH- 0111	x	X																				X	X	
510-PI-104	COMP 1 INTERCOOLER FAN 2 HIGH VIBRATION	VAH- 0112	x		X																			X	X	
510-PI-104	COMP 1 AFTERCOOLER FAN 1 HIGH VIBRATION	VAH- 0123	x			X																		X	X	
510-PI-104	COMP 1 AFTERCOOLER FAN 2 HIGH VIBRATION	VAH- 0124	x				X																	X	X	
510-PI-105	COMP 2 INTERCOOLER FAN 1 HIGH VIBRATION	VAH-0211	X					X																X	X	
510-PI-105	COMP 2 INTERCOOLER FAN 2 HIGH VIBRATION	VAH-0212	X						X															X	X	
510-PI-105	COMP 2 AFTERCOOLER FAN 1 HIGH VIBRATION	VAH-0223	X							X														X	X	
510-PI-105	COMP 2 AFTERCOOLER FAN 2 HIGH VIBRATION	VAH-0224	X								X													X	X	
PO-510-PI-106	COMP 3 INTERCOOLER FAN 1 HIGH VIBRATION	VAH-3011	x									X												X	X	
PO-510-PI-106	COMP 3 INTERCOOLER FAN 2 HIGH VIBRATION	VAH-3012	x										X											X	X	
PO-510-PI-106	COMP 3 AFTERCOOLER FAN 1 HIGH VIBRATION	VAH-3023	X											X										X	X	
PO-510-PI-106	COMP 3 AFTERCOOLER FAN 2 HIGH VIBRATION	VAH-3024	X												X									X	X	
GTS-510-DW-PD-401	COMP 4 INTERCOOLER FAN 1 HH VIBRATION (10mm/s)	VAHH-04011	X													X								X	X	
GTS-510-DW-PD-401	COMP 4 INTERCOOLER FAN 2 HH VIBRATION (10mm/s)	VAHH-04012	X														X							X	X	
GTS-510-DW-PD-402	COMP 4 AFTERCOOLER FAN 1 HH VIBRATION (10mm/s)	VAHH-04023	X															X						X	X	
GTS-510-DW-PD-402	COMP 4 AFTERCOOLER FAN 2 HH VIBRATION(10mm/s)	VAHH-04024	X																X					X	X	
510-PI-120	FUEL GAS PRESSURE REGULATION RUN 1	PAHH-60035																		X					X	
510-PI-120	FUEL GAS PRESSURE REGULATION RUN 2	PAHH-60045																				X			X	
	COMP 1 UNIT VENTING	UX-01060																					X			
	COMP 2 UNIT VENTING	UX-02060																					X			
	COMP 3 UNIT VENTING	UX-03060																					X			
	COMP 4 UNIT VENTING	UX-04060																					X			
	COMP 1 ALARM ENABLED	HX-01060																					N			
	COMP 2 ALARM ENABLED	HX-02060																					N			
	COMP 3 ALARM ENABLED	HX-03060																					N			
	COMP 4 ALARM ENABLED	HX-04060																					N			

INITIATING DEVICES

REV.	DATE	REVISION	PREPARED	CHECKED	APPROVED	CLIENT
4A-A	17/12/08	ISSUED FOR DETAILED DESIGN	JXC			
4A	12/6/08	IFD - 4th COMPRESSOR FEED	LF	GPG	LF	PR
5	16-Jul-09	Issued for Construction	AKC	PEV	DAE	PFR
6	13-Jul-10	As Built	PR	WD	CDC	CDC

Uhde Shedden
A company of ThyssenKrupp Technologies

Jemena

LONGFORD COMPRESSOR STATION

Project No: 25697 **Scope:**

Plant No.: 510 **Rev:**

Cause and Effect No: **510-JJ-001** Sht 4 of 5

G:\MELASPFS01 (Shared)\Pipelines\ETS 2 - Gas Transmission South\Asset Strategy\Technical Investigations\EGP & QGP SPFA\Source R

CAUSE AND EFFECT MATRIX

SUPPLEMENTARY TABLES

VALVE OPEN/CLOSED LIMIT SIGNALS

TAG No.	P&ID No.	DESCRIPTION
ZIC-6401 *	510-PI-101	Esso Station Inlet ESD Valve
ZIO-6401	510-PI-101	Esso Station Inlet ESD Valve
ZIC-6480 *	510-PI-101	LCS Esso Inlet Loading Valve
ZIO-6480	510-PI-101	LCS Esso Inlet Loading Valve
ZIC-6416 *	510-PI-109	Station Blowdown Valve
ZIO-6416	510-PI-109	Station Blowdown Valve
ZIC-6420 *	510-PI-109	Station Outlet Valve
ZIO-6420	510-PI-109	Station Outlet Valve
ZIC-6470 *	510-PI-110	ESD Valve - Gas to EGP
ZIO-6470	510-PI-110	ESD Valve - Gas to EGP
ZIC-6471 *	510-PI-110	ESD Valve - Gas to TGP
ZIO-6471	510-PI-110	ESD Valve - Gas to TGP
ZIC-6551 *	PO-510-DW-PD-003	Gasnet - Forward Flow Slam Shut Valve
ZIO-6551	PO-510-DW-PD-003	Gasnet - Forward Flow Slam Shut Valve
ZIC-6558 *	PO-510-DW-PD-003	Gasnet - Forward Flow Loading Valve
ZIO-6558	PO-510-DW-PD-003	Gasnet - Forward Flow Loading Valve
ZIC-6482 *	PO-510-PI-110	TGP ESD Loading Valve
ZIO-6482	PO-510-PI-110	TGP ESD Loading Valve
ZIC-6484 *	PO-510-PI-110	EGP ESD Loading Valve
ZIO-6484	PO-510-PI-110	EGP ESD Loading Valve
ZIC-6501 *	PO-510-DW-PD-001	VicHub Regulator Run No.1 Slam Shut Valve
ZIO-6501	PO-510-DW-PD-001	VicHub Regulator Run No.1 Slam Shut Valve
ZIC-6508 *	PO-510-DW-PD-001	VicHub Regulator Run No.1 Loading Valve
ZIO-6508	PO-510-DW-PD-001	VicHub Regulator Run No.1 Loading Valve
ZIC-6521*	PO-510-DW-PD-002	VicHub Regulator Run No.2 Slam Shut Valve
ZIO-6521	PO-510-DW-PD-002	VicHub Regulator Run No.2 Slam Shut Valve
ZIC-6528*	PO-510-DW-PD-002	VicHub Regulator Run No.2 Loading Valve
ZIO-6528	PO-510-DW-PD-002	VicHub Regulator Run No.2 Loading Valve
ZIC-6443	510-PI-109	Station Outlet Loadingt Valve
ZIO-6443	510-PI-109	Station Outlet Loadingt Valve
ZIC-60030	510-PI-120	Fuel Gas Regulation Run #1 Shut-Off
ZIO-60030	510-PI-120	Fuel Gas Regulation Run #1 Shut-Off
ZIC-60040	510-PI-120	Fuel Gas Regulation Run #2 Shut-Off
ZIO-60040	510-PI-120	Fuel Gas Regulation Run #2 Shut-Off
ZIC-64027	510-PI-101	Gas to VicHub Filter Separator 510-F-100
ZIO-64027	510-PI-101	Gas to VicHub Filter Separator 510-F-100
ZIC-64028	PO-510-DW-PD-004	Gas to Metering
ZIO-64028	PO-510-DW-PD-004	Gas to Metering
ZIC-6481	PO-510-PI-110	TGP Isolation Valve
ZIO-6481	PO-510-PI-110	TGP Isolation Valve

* - Denotes limit switch used in logic as permissive.

HARD-WIRED ANNUNCIATOR SIGNALS

FIRE & GAS ANNUNCIATOR

TAG No.	P&ID No.	DESCRIPTION
UY-2001	510-PI-134	Fire Detected Compressor Building 1 (SW)
UY-2002	510-PI-134	Fire Detected Compressor Building 1 (NW)
UY-2014	510-PI-134	Fire Detected Compressor Building 1 (W)
UY-2003	510-PI-134	Fire Detected Compressor Building 1 (SE)
UY-2004	510-PI-134	Fire Detected Compressor Building 1 (NE)
UY-2015	510-PI-134	Fire Detected Compressor Building 1 (E)
UY-2419	510-PI-134	Fire ESD Compressor Building 1
AAHH-2201	510-PI-134	Gas 20% LEL Compressor 1 Air Intake
AAHH-2202	510-PI-134	Gas 10% LEL Compressor Building 1
AAHH-2203	510-PI-134	Gas 10% LEL Compressor Building 1
AAHH-2204	510-PI-134	Gas 20% LEL Compressor 2 Air Intake
AAHH-2205	510-PI-134	Gas 10% LEL Compressor Building 1
AAHH-2206	510-PI-134	Gas 10% LEL Compressor Building 1
UY-2040	PO-510-PI-136	Fire Detected Compressor Building 2 (SW)
UY-2041	PO-510-PI-136	Fire Detected Compressor Building 2 (NW)
UY-2044	PO-510-PI-136	Fire Detected Compressor Building 2 (W)
UY-2043	PO-510-PI-136	Fire Detected Compressor Building 2 (NE)
UY-2042	PO-510-PI-136	Fire Detected Compressor Building 2 (SE)
UY-2045	PO-510-PI-136	Fire Detected Compressor Building 2 (E)
UY-2435	PO-510-PI-136	Fire ESD Compressor Building 2
AAHH-2211	PO-510-PI-136	Gas 20% LEL Compressor 3 Air Intake
AAHH-2212	PO-510-PI-136	Gas 10% LEL Compressor Building 2
AAHH-2213	PO-510-PI-136	Gas 10% LEL Compressor Building 2
AAHH-22014	PO-510-PI-136	Gas 20% LEL Compressor 4 Air Intake
AAHH-2215	PO-510-PI-136	Gas 10% LEL Compressor Building 2
AAHH-2216	PO-510-PI-136	Gas 10% LEL Compressor Building 2
UY-2005	GTS-510-DW-PD-420	Control Room VESDA Detected Fire
UY-2008	GTS-510-DW-PD-420	Switchgear Room VESDA Detected Fire
UY-20051	GTS-510-DW-PD-420	Battery Room VESDA Detected Fire
UY-2012	GTS-510-DW-PD-420	Maintenance Building Fire
UY-2029	GTS-510-DW-PD-420	Control Room FM200 Activated
UY-2022	GTS-510-DW-PD-420	Switchgear Room FM200 Activated
UY-20055	GTS-510-DW-PD-420	Battery Room FM200 Activated
UY-20500	GTS-510-DW-PD-420	Outside Smoke Detected
UY-20033	GTS-510-DW-PD-420	Control Room Thermal Detected Fire
UY-20026	GTS-510-DW-PD-420	Switchgear Room Thermal Detected Fire
UY-20061	GTS-510-DW-PD-420	Battery Room Thermal Detected Fire

PROCESS & ESD ANNUNCIATOR

TAG No.	P&ID No.	DESCRIPTION
UY-0111	510-PI-104	Compressor 1 Intercooler/Aftercooler Hi Hi Vibration
UY-0146A	510-PI-132	Compressor 1 Fast Stop
UY-0211	510-PI-105	Compressor 2 Intercooler/Aftercooler Hi Hi Vibration
UY-0246A	510-PI-133	Compressor 2 Fast Stop
UY-3011	PO-510-PI-106	Compressor 3 Intercooler/Aftercooler Hi Hi Vibration
UY-3046A	PO-510-PI-135	Compressor 3 Fast Stop
UY-04011	GTS-510-DW-PD-401	Compressor 4 Intercooler/Aftercooler Hi Hi Vibration
UY-04046A	GTS-510-DW-PD-405	Compressor 4 Fast Stop
UY-6400	510-PI-101	Esso Inlet Low Low Pressure
UY-6403	PO-510-DW-PD-007	Station Inlet High High Pressure
UY-9405	510-PI-101	Inlet Filter 1 High High Level
UY-9440	PO-510-DW-PD-007	Inlet Filter 2 High High Level
UY-9430	PO-510-DW-PD-004	VicHub Filter High High Level
UY-6422A	510-PI-109	Outlet Header High High Pressure
UY-6422B	510-PI-109	Outlet Header Low Low Pressure
UY-6550	PO-510-DW-PD-003	GasNet Interconnect High High Pressure/Low Low Pres
UY-6511	PO-510-DW-PD-001	Regulator Run 1 Outlet High High/Low Low Pressure
UY-6531	PO-510-DW-PD-002	Regulator Run 2 Outlet High High/Low Low Pressure
UY-6543C	PO-510-DW-PD-001	GasNet Shut-In ESD
UY-6416B	510-PI-109	Station Vent Valve Failed To Open
UY-54002	510-PI-130	Instrument Air Low Low Pressure
UY-2417	GTS-510-DW-PD-421	Remote RTU ESD
UY-2425	GTS-510-DW-PD-421	SIS System Fault
UY-2423	GTS-510-DW-PD-421	MOR Active
UY-2423B	GTS-510-DW-PD-421	MOR Keyswitch Enabled
UY-2418	GTS-510-DW-PD-421	Station ESD
UY-24040	GTS-510-DW-PD-421	Manual ESD
UY-60035	510-PI-120	FG Regulation Run #1 Hi Hi Pressure
UY-60045	510-PI-120	FG Regulation Run #2 Hi Hi Pressure
UY-6560	PO-510-DW-PD-004	VicHub Filter High High Differential Pressure
UY-6405	510-PI-101	Inlet Filter 1 High High Differential Pressure
UY-6474	PO-510-DW-PD-007	Inlet Filter 2 High High Differential Pressure

MISCELLANEOUS SIS SIGNALS NOT SHOWN IN LOGIC OR OTHER TABLES

TAG No.	P&ID No.	DESCRIPTION
HI-2423	GTS-510-DW-PD-421	Safety Systems Master Override
HA-2418	GTS-510-DW-PD-421	Safety Systems Alarm Reset
HA-2426	GTS-510-DW-PD-421	Safety Systems Alarm Acknowledge
HA-2427	GTS-510-DW-PD-421	Safety Systems Alarm Test
UY-2409	510-PI-134	Compressor Building No. 1 Alarm Strobes
UY-2410	GTS-510-DW-PD-421	ESD Hooter Output
UY-2411	GTS-510-DW-PD-421	Process Hooter Output
UY-2416	GTS-510-DW-PD-420	Workshop/Maintenance Building Alarm Strobe
UY-24036	GTS-510-DW-PD-420	Battery Room Alarm Strobe
UY-2432	PO-510-PI-136	Compressor Building No. 2 Alarm Strobes
UA-5508	GTS-510-DW-PD-421	P&F Barrier Fault Alarm
HS-2410A	GTS-510-DW-PD-421	ESD Hooter Test Switch
HS-2410B	GTS-510-DW-PD-421	Process Hooter Test Switch
UX-24037	GTS-510-DW-PD-421	Real Time Clock Synchronization
HX-7000	GTS-510-DW-PD-421	Main Gate Intrusion Detected

REV.	DATE	REVISION	PREPARED	CHECKED	APPROVED	CLIENT	
4A-A	17/12/08	ISSUED FOR DETAILED DESIGN	JXC				
4A	28/4/09	IFD - 4th COMPRESSOR FEED	LF	GPG	LF	PR	
5	16-Jul-09	Issued for Construction	AKC	PEV	DAE	PFR	
6	13-Jul-10	As Built	PR	WD	CDC	CDC	

Uhde Shedden
A company of ThyssenKrupp Technologies

Jemena

LONGFORD COMPRESSOR STATION

Project No: 25697 Scope:

Plant No.: 510 Rev:

Cause and Effect No: **510-JJ-001** Sht 5 of 5

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GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		24.8

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	24	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
24.8	LOW PRESSURE	Lower pressure in WLP than design	High gas velocities through the piping and Filter 563-F-01/02	Refer High Flow	Agree set point and re-set low pressure alarm PAL-64802	**1 / SH**

DISCUSSION AND RECOMMENDATION

Minimum pressure at the inlet to Wilton Meter Station has been agreed with Jemena's Senior Capacity Planning Engineer (Stephen Turville) to be 6.2 MPag refer email 20617-R841. PAL-64802 is currently set at 6,000kPag. No change to this set point is recommended.

ACTION TAKEN / CLOSE OUT COMMENTS

No action required. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 9/2/21

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:48:01 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

Dylan Falls

From: Young, David <dsy@enscope.com.au>
Sent: Friday, 20 November 2020 11:31 AM
To: Simon Hanlin
Cc: Sarah Greening; Matthew Skaras; Adrian Zatta; Stephen Chow; Peter Blyton
Subject: 20617-R841: FW: 20617-S2297: Wilton Process Calculations

Simon,
I looks like we had some confusion on the minimum pressures into Wilton, the minimum we have to consider is 6.2MPag. Please see the comments below.
We will need to increase the heater capacity to cater for the 11.5MPag max pressure into the site (previously we used 9MPag).

Simon, Adrian,
For the changes in pressure due to elevation can you please include an additional pressure transmitter and over pressure trip amp on the south side of the pipeline facilites at both Mila (14,000kPag) and Michelago(14,500kPag) with the reduced MAOP. They need to be located so that they are always exposed to the south side of the pipeline. This trip amp would be added to the Hardwire ESD string on each of the compressor stations.

Cheers
Dave

Regards,

David Young
Principal Engineer

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// **development . engineering . management . completions**

From: Stephen Turville <Stephen.Turville@jemena.com.au>
Sent: Friday, 20 November 2020 6:21 AM
To: Young, David <dsy@enscope.com.au>
Cc: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Michael Peoples <Michael.Peoples@jemena.com.au>; Stephen Chow <steven.chow@jemena.com.au>
Subject: RE: 20617-S2297: Wilton Process Calculations

[EXTERNAL]

Hi David,

Sorry for the missed call, was cooking the kids dinner and didn't notice until later

Wilton
I think there is some confusion on the minimum/maximum pressures at Wilton. The modelled **inlet** to Wilton Station is 6.2MPag, I believe the current LL alarm is set at 6MPag and I wouldn't envisage that changing as part of this project. Outside of emergency levels, the pressure at the **inlet** to Wilton station should vary between 11.5 – 6.2MPag.

The **outlet** of Wilton is then where we'll see these low pressures. I would put them at Min/Design/Max for each run as
Wilton MSP: 3.6/4.5/6
Wilton JGN: 3.6/4.5/5.5

The JGN one is interesting because theoretically it could be asked to go to 6.895MPag, however I don't believe it is ever a realistic case given the integrity issues on that pipeline and the significant upgrades to all JGN facilities and 3rd party facilities required to facilitate this increase so I've stuck with the somewhat more realistic number of 5.5MPag.

Other Delivery Stations
All stations are above minimum pressure required under the connection agreement, most are required to be 3-3.8MPag, which is easily achieved. That said the connection agreement for Hoskinstown has never been reflective of the real pressure requirements and for the flow scenarios before any new compression at Kembla it is unlikely that there will be sufficient pressure to support Canberra. Early on in the modelling cases this was flagged with Commercial and I was instructed to leave it out as a limit and that they would work with EVO to come to a solution as I believe the thinking was that it was better to recover costs from the regulated asset where possible however I haven't heard anything about it and my friends in GD are unaware of any requirement.
Bairnsdale has no concerns as by maintaining Vichub greater than 6.9MPag, there is no way for Bairnsdale to be less than this which means its greater than the 4.75MPag under the contract terms.

Overpressure
Yes there is some concern over the significant elevation drop following Mila. At low flow scenarios the pressure gain due to static head is greater than the pressure lost due to friction, in my models I tend to restrict the pressure at Mila discharge to get around this and I would typically limit it to 14MPag so we're in the same ballpark. In terms of capacity it makes no difference as when flows south increase this compressor runs out of power and the discharge will be below this anyway, the only thing it does is reduce potential park opportunities.

Regards
Stephen Turville
Senior Capacity Planning Engineer
Jemena
Level 14, 99 Walker Street, North Sydney, NSW 2060
(02) 9867 7322 | 0437 541 877
stephen.turville@jemena.com.au | www.jemena.com.au
www.gonaturalgas.com.au

Natural Gas Jemena bringing energy to life

From: Young, David <dsy@enscope.com.au>
Sent: Thursday, 19 November 2020 6:26 PM
To: Stephen Turville <Stephen.Turville@jemena.com.au>
Cc: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Michael Peoples <Michael.Peoples@jemena.com.au>; Stephen Chow <steven.chow@jemena.com.au>
Subject: FW: 20617-S2297: Wilton Process Calculations

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and are expecting the content or attachment from the sender.

Stephen,
I gave you a call to chat through the some issues we would like to discuss with the sizing cases at Wilton.
The long and the short of it is low minimum pressure into the facility (from the EGP and the Wilton Lateral) down at 4500kPag is resulting in some very high velocities and making the sizing of the control valves a bit difficult. If we could increase this to around 5500kPag at the full 325TJ/d and then tail the max energy flow as we reduce the pressure (so we effectively limit the volumetric flow) this would make our lives a lot easier. Would this significantly affect the modelling work you have done?
Given we have existing of noise / land owner concerns in the area we are a bit nervous that we are going to struggle to come up with a design that will cater for the high volumetric flow rates and also limit the noise.

On a separate note, we just ran the Hazop for the pipeline reversal and we have couple of queries on this;

1) Have you assessed the minimum pressure requirements for all of the existing EGP offtakes (ie Bairnsdale PS, Hoskinstown, etc)?
2) We will need to modify the existing pipeline over pressure protection at Mila and maybe Michalego to prevent exceeding the 14,895kPag at Cann River as we come down from 860m ASL to pretty much Sea Level. We don't need to finalise the numbers now but it would be good to understand roughly what we are taking about. My Fag Packet say that this is about 900kPag for Mila (ie 110kg/M^3 gas density over say 830m of elevation change).

One to chat through when you have the chance.
Cheers
Dave

Regards,

David Young
Principal Engineer

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GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		24.8

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	24	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
24.8	LOW PRESSURE	Lower pressure in WLP than design	AIV/FIV	Operator intervention	Consider low pressure trip on WLP using PIT-64802, and/or alternatives such as velocity calculation using sum of flow through flow meters and inlet pressure	**1 / SH**

DISCUSSION AND RECOMMENDATION

As per Item No. 24.8, the minimum pressure into Wilton Meter Station has been agreed to be 6.2 MPag as per the project design basis. Design will be completed on this basis. No change to low pressure trip setpoints are required. Alternatives such as velocity calculation will be considered as part of Action 26.1 in detailed design.

ACTION TAKEN / CLOSE OUT COMMENTS

No actions required. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 9/2/21

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:48:53 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

Dylan Falls

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Cheers
Dave

Regards,

David Young
Principal Engineer

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// **development . engineering . management . completions**

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Regards
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Senior Capacity Planning Engineer
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I gave you a call to chat through the some issues we would like to discuss with the sizing cases at Wilton.
The long and the short of it is low minimum pressure into the facility (from the EGP and the Wilton Lateral) down at 4500kPag is resulting in some very high velocities and making the sizing of the control valves a bit difficult. If we could increase this to around 5500kPag at the full 325TJ/d and then tail the max energy flow as we reduce the pressure (so we effectively limit the volumetric flow) this would make our lives a lot easier. Would this significantly affect the modelling work you have done?
Given we have existing of noise / land owner concerns in the area we are a bit nervous that we are going to struggle to come up with a design that will cater for the high volumetric flow rates and also limit the noise.

On a separate note, we just ran the Hazop for the pipeline reversal and we have couple of queries on this;

1) Have you assessed the minimum pressure requirements for all of the existing EGP offtakes (ie Bairnsdale PS, Hoskinstown, etc)?
2) We will need to modify the existing pipeline over pressure protection at Mila and maybe Michalego to prevent exceeding the 14,895kPag at Cann River as we come down from 860m ASL to pretty much Sea Level. We don't need to finalise the numbers now but it would be good to understand roughly what we are taking about. My Fag Packet say that this is about 900kPag for Mila (ie 110kg/M^3 gas density over say 830m of elevation change).

One to chat through when you have the chance.
Cheers
Dave

Regards,

David Young
Principal Engineer

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// **development . engineering . management . completions**

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GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		1.20

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	1	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
1.20	TESTING EQUIPMENT / PRODUCT	Gas sampling and analysis is included in system for verification of gas being delivered into the EGP. Only one in line GC is proposed for the KGMS. If unavailable delivery into the EGP may be prevented and loadout from the FSRU may be delayed.	Delay in production or offspec gas.	Additional GC on FSRU.	Confirm if single GC is enough in regard to quality monitoring according to commercial arrangements.	1 / MS

DISCUSSION AND RECOMMENDATION

Only a single GC is required, confirmed by Matthew Skaras, Project Manager Jemena. Refer to email 20617-R1158 attached.

ACTION TAKEN / CLOSE OUT COMMENTS

No action required. Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 9/2/21

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta Infrastructure, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 10:33:10 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21

Dylan Falls

From: Matthew Skaras <Matthew.Skaras@jemena.com.au>
Sent: Wednesday, 27 January 2021 11:44 AM
To: Nigel Hough
Cc: Simon Hanlin; Peter Blyton; Adrian Zatta; Dylan Falls; Leon Terenyi; Cameron Moore; Young, David
Subject: 20617-R1158: RE: 20617-S3605: EGP Facilities - HAZOP close outs

Hi Nigel, regarding the HAZOP actions assigned to me, please see the closeout comments below:

1.20 Confirmed, only a single GC is required
2.23 Proceed with finalising FEED on the basis of a hardwired signal, to be reviewed is detailed design if necessary.

Regarding action item 1.6 not sure why this was assigned to me, in any case I have not looked at it to date. There might be some miscommunication somewhere along the line with what is the latest status of closed actions.

To move forward can you please work with Leon Terenyi to come up with a clear picture of the status of each action and to determine what actions can be changed to Cat 2 status. Just to be clear I don't want to have any Cat 1 deferred actions, if a Cat 1 actions *can* be deferred then it isn't a Cat 1 action so it should be changed to reflect its actual category i.e. Cat 2.

Regards,

Matthew Skaras
Project Manager – Major Projects
Jemena
Level 15, 567 Collins St, Melbourne, VIC 3000
(03) 9173 8416 | 0423 538 955
matthew.skaras@jemena.com.au | www.jemena.com.au

Jemena
bringing energy to life

From: Nigel Hough <Nigel.Hough@gpaeng.com.au>
Sent: Wednesday, 20 January 2021 11:44 AM
To: Matthew Skaras <Matthew.Skaras@jemena.com.au>
Cc: Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton <Peter.Blyton@gpaeng.com.au>; Adrian Zatta <Adrian.Zatta@gpaeng.com.au>; Dylan Falls <Dylan.Falls@gpaeng.com.au>
Subject: 20617-S3605: EGP Facilities - HAZOP close outs

CAUTION: This email originated from outside of the organisation. Do not click links or open attachments unless you recognise the sender and are expecting the content or attachment from the sender.

Matthew,

As mentioned in the meeting yesterday, we are progressing to finalise the HAZOP close out report to reflect status at the completion of FEED. The team has discussed a number of the items internally as well as with Dave Young.

Of the 99 actions raised, only 8 "Cat 1" remain as outstanding. Please see table below. For the 5 Jemena actions (MS/DY), any preliminary feedback we have received has been included in the "Closeout comments and references" column.

I did not attend the HAZOP, however on my preliminary review of the below, the only action that perhaps should be resolved prior to completion of FEED is action 1.20 as this would have a material impact on long lead item purchase. Please confirm if this needs to be resolved now?

Can you please review the table below and confirm that you are happy for us to issue the Close out report to reflect status at end of FEED. This will have all Cat 1 actions closed except for the below, which we propose to defer until Detailed Design.

Regards,

Item No.	Guideword	Cause	Consequence	Existing Safeguard	Action Required	C
1.6	LOW FLOW	High pressure in northern end of EGP	High pressure, potential deadhead of FSRU pump (12MPa). Note: Jemena equipment is rated for 14.9MPa.	Flow/pressure control on FSRU pumps	Confirm FSRU flow control and pressure protection is fit for purpose.	
1.6					Confirm if pressure signals from Jemena equipment installed at KGMS are required to be relayed to the FSRU pumps.	
1.20	TESTING EQUIPMENT / PRODUCT	Gas sampling and analysis is included in system for verification of gas being delivered into the EGP. Only one in line GC is proposed for the KGMS. If unavailable delivery into the EGP may be prevented and loadout from the FSRU may be delayed.	Delay in production or offspec gas.	Additional GC on FSRU.	Confirm if single GC is enough in regard to quality monitoring according to commercial arrangements. .	
16.9	HIGH TEMPERATURE	Hot day (45 deg C) with flow from LCS into the EGP (i.e. north flow), exit temp from LCS would be high, if flow direction swapped to reverse the inlet temp from EGP into VicHub2 would be hotter		Operating temperature up to 46 degC in Vic Hub 2 is being considered	Review how quickly the flow direction can be swapped from north to south flow, i.e. is it plausible 4 hour blocks of direction change. If required would an increase the design temp be required?	
16.2	ISOLATION	Drawing consistency			Implement a consistent approach with regards to valve cavity bleeds	
31.2	SERVICES REQUIRED	Additional plant equipment outside existing lighting zones			Review additional and/or change to existing station security system	

6.5	ZERO FLOW / EMPTY	Compressor not running, MLV-1 closed.	Build-up of high DP across the station, unable to equalise pressure across the station.	Equalisation line and UV-64109 to be used to reduce differential pressure across SDVs / station.	Develop the sizing cases for equalisation line with Jemena Commercial.	
11.2					Consider putting this new MLV in parallel to the existing MLV, for a similar configuration to Michelago / EGCS	

Regards,

Nigel Hough
Queensland Regional Manager | Senior Project Manager
BEng (Chem) (Hons) | MBA | CPEng | NER | RPEQ

GPA Engineering
L5/193 North Quay, Brisbane QLD 4000
Dir 07 3551 1302 | **Ph** 07 3551 1300
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APPENDIX 29

GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:		**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
16.9	HIGH TEMPERATURE	Hot day (45 deg C) with flow from LCS into the EGP (i.e. north flow), exit temp from LCS would be high, if flow direction swapped to reverse the inlet temp from EGP into VicHub2 would be hotter		Operating temperature up to 46 degC in Vic Hub 2 is being considered	Review how quickly the flow direction can be swapped from north to south flow, i.e. is it plausible 4 hour blocks of direction change. If required would an increase the design temp be required?	**1 / DY**

DISCUSSION AND RECOMMENDATION

The following design inputs have been considered during FEED:

- Vic Hub 2 inlet piping is Jemena Pipe Specification C9D which is rate to 15,320 kPag at 65°C.
- Vic Hub 2 inlet filter will be rated for class 900 flanges with a design temperature of 56°C at 14,895 kPag.
- Gas entering Vic hub 2 comes from the EGP, which in turn comes from Longford compressor station when in a northern flow direction. The MAOP of the EGP is 14,895 kPag and it has a maximum design operating temperature of 60°C.
- Longford Compressor Station has a discharge temperature trip set at 65°C and a discharge pressure trip set at 15,300 kPag.

The maximum operating temperature being considered in the design basis has been increased from 46°C to 56°C and a temperature alarm and trip point added at 50°C and 56°C respectively to the VH2 meter run (downstream of the inlet filter and upstream of the regulator skids) on P&ID GAS-510-DW-PD-003 (D) (refer Email 20617-R1226).

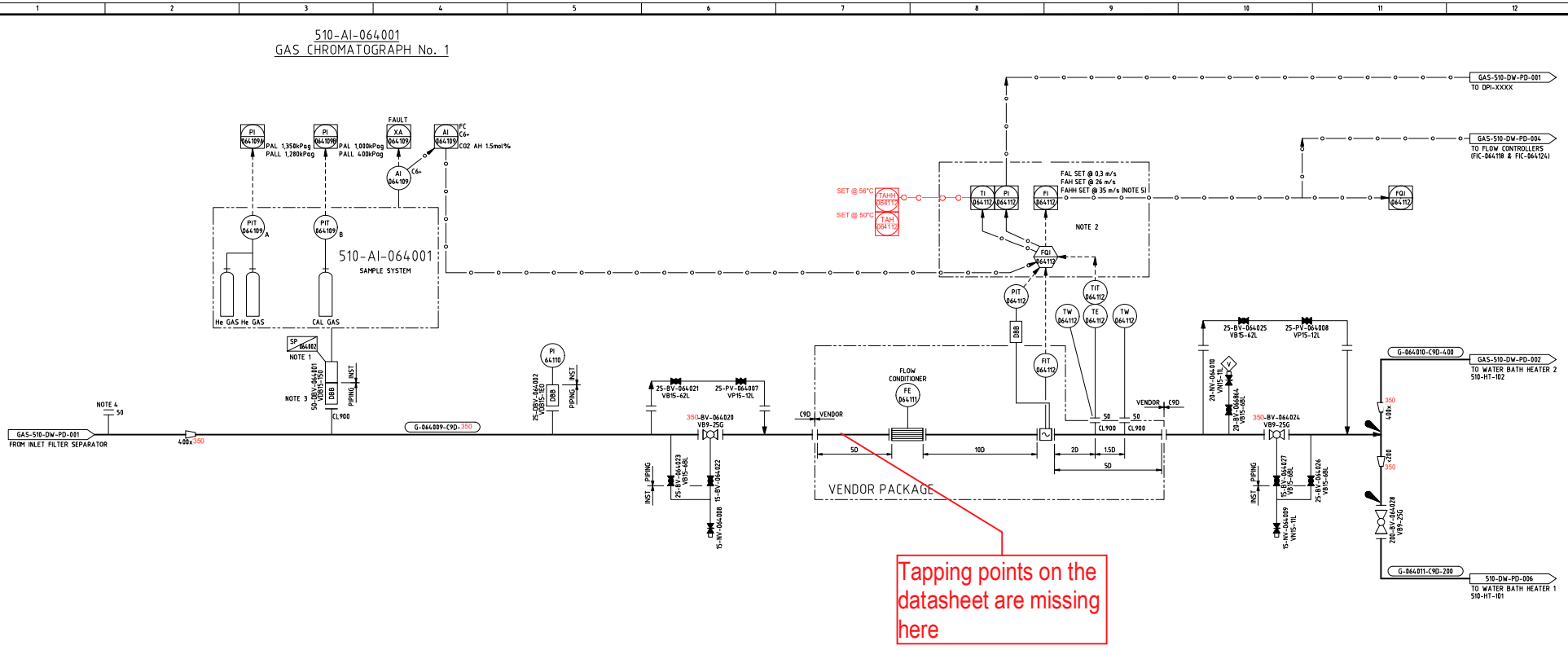
The maximum inlet temperature and pressure assumptions for Vic Hub 2 above shall be confirmed during detailed design when the dynamics of changing the EGP flow direction are finalised. It is recommended that based on the FEED inputs that have been considered above that this action be changed to Category 2.
ACTION TAKEN / CLOSE OUT COMMENTS Priority updated to Category 2. ACTION NOT CLOSED.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 10/02/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 15:34:33 Foxit PhantomPDF Version: 10.0.1 **Date:** 18/02/21



MASTER FILE

NOTES:

1. SAMPLE PROBE.
2. PART OF FLOW COMPUTER PANEL.
3. VALVE TO HAVE A MINIMUM THROUGH BORE DIAMETER OF 20mm.
4. HIGH POINT VENT.
5. HIGH FLOW WILL TRIP INLET UV-064101 AFTER 30 CONTINUOUS SECONDS.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	JPR	SJH	PJB	NKH	04/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING QA

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	04/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA		SJH	NKH
B	02/11/20	ISSUED FOR HAZOP (20617)	GPA		SJH	NKH
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA			

DRAWING No. | REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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CONSULTANT
GPA
www.gpaeng.com.au

LONGFORD COMPRESSOR STATION
VIC HUB 2 - METERING RUN
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILITY	SUBJECT
DESIGN		SCALE	N.T.S.
CHECKED		SUPERSEDES	A1
APPROVED		DRAWING NUMBER	REV
DATE	26/10/20	GAS-510-DW-PD-003	C

Simon Hanlin

From: Young, David <dsy@enscope.com.au>
Sent: Thursday, 4 February 2021 1:19 PM
To: Simon Hanlin
Cc: Peter Blyton; Nigel Hough; Sarah Greening; Matthew Skaras; leon.terenyi@jemena.com.au
Subject: 20617-R1226: RE: 20617-S3807: Project Marlin clarifications

Simon,
As discussed our comments as follows;

1) Lets just add in a second DN25 ball valve upstream of the plug so that we are not compromising the DBB with ball valves. There are other Jemena sites that have this configuration and the cost of the DN25 ball valve is minimal. Lets make this change to both vessels so that everything looks consistent.
2) Lets add an alarm at 50 and a trip 56 TW 64112 to close this out. Noting the trip will go over coms but I don't think I don't think we will actually ever see these sorts of temps and loss of containment is not plausible if the temperature gets to 65.
3) As discussed the high pressure is 11.5Mpag not 14.5MPag, with this included yes it is acceptable to go to 2C noting that the temperature overrides will come into play.

Chat soon

Regards,

David Young
Principal Engineer

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From: Simon Hanlin <Simon.Hanlin@gpaeng.com.au>
Sent: Thursday, 4 February 2021 7:56 AM
To: Young, David <dsy@enscope.com.au>
Cc: Peter Blyton <Peter.Blyton@gpaeng.com.au>; Nigel Hough <Nigel.Hough@gpaeng.com.au>; Sarah Greening <sarah.greening@gpaeng.com.au>; Matthew Skaras <Matthew.Skaras@jemena.com.au>; leon.terenyi@jemena.com.au
Subject: 20617-S3807: Project Marlin clarifications

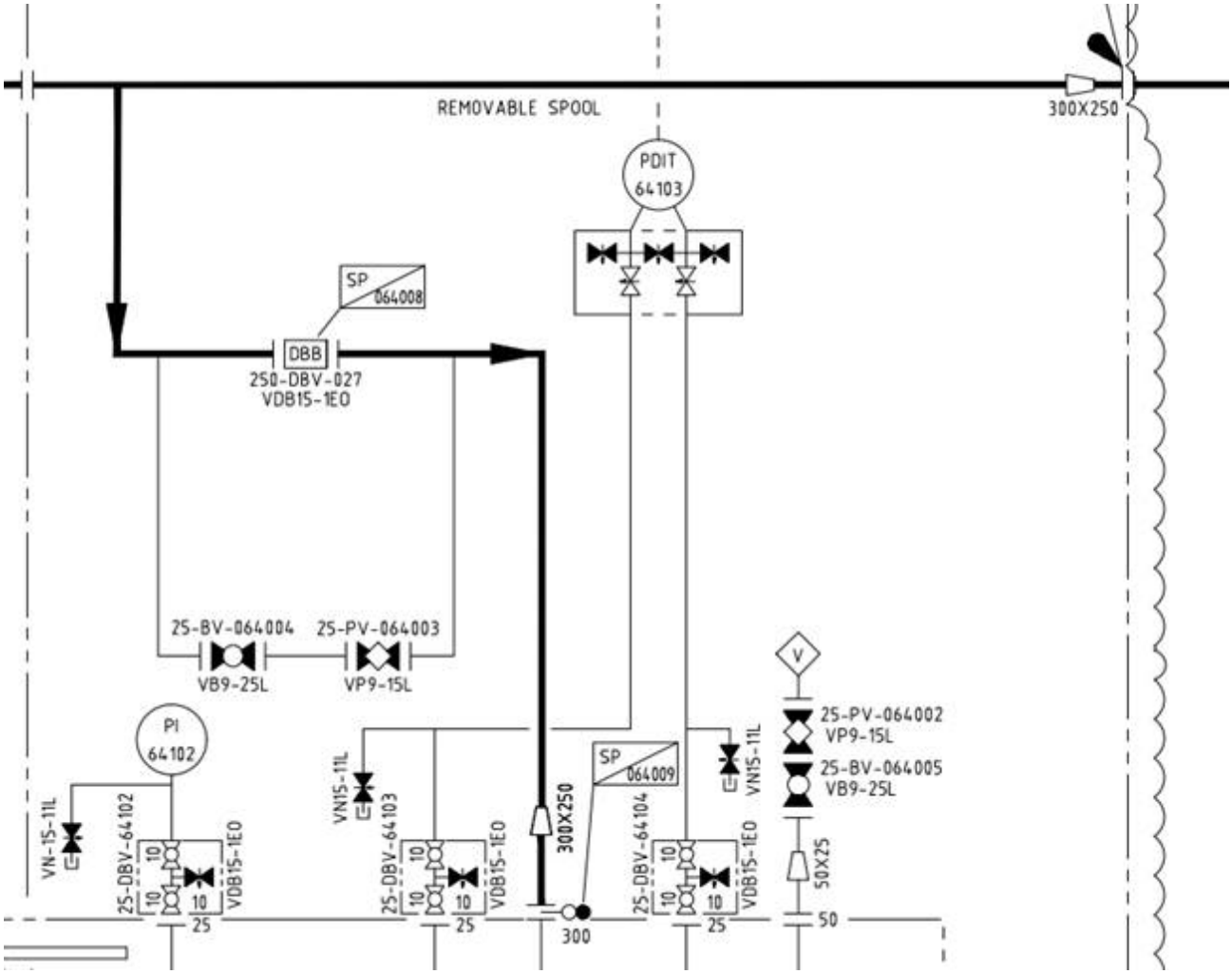
[EXTERNAL]

Dave,

I have three clarifications I want to discuss with you before I finalise HAZOP closeouts and FEED report.

1) DBB bypass for the Wilton filters. (HAZOP action 24.16). We are missing a vent on the new filter on the left (this will be added to P&ID markups attached to the FEED report). HAZOP Action 24.16 required modification to the bypass to make it double block and bleed (without relying on the plug valve as the second block valve). The described action is now not possible because of the integral DBB valve. The cause states that a plug valve for second isolation is not recommended, however I can't see anything in the

Jemena piping design guide isolation philosophy that would preclude the use of a ball and plug valve arrangement as a DBB.
I assume that we aren't modifying the bypass around the existing filter new DBB valve.
Can you confirm that Jemena accepts the design of the bypass with a ball, plug valve and bleed in-between?



2) Vic Hub 2 inlet temperature.
HAZOP item 16.9 was a category 1 item with the following action "Review how quickly the flow direction can be swapped from north to south flow, i.e. is it plausible 4 hour blocks of direction change. If required would an increase the design temp be required?"
We intend to change this action to a CAT 2 (detailed design) with the following closeout comment, which will also be recorded in the FEED operating condition section. **Can you confirm that Jemena are happy with this approach?**

Maximum operating inlet temperature 56°C(1)
1. Vic Hub 2 inlet piping will be Jemena Pipe Specification C9D which is rate to 15,320 kPag at 65°C. Vic Hub 2 inlet filter will be rated for class 900 flanges with a design temperature of 56°C at 14,895 kPag.
Gas entering Vic hub 2 comes from the EGP, which in turn comes from Longford compressor station when in a northern flow direction.
The MAOP of the EGP is 14,895 kPag and it has a maximum design operating temperature of 60°C.
Longford Compressor Station has a discharge temperature trip set at 65°C and a discharge pressure trip set at 15,300 kPag.
The maximum inlet temperature and pressure assumptions for Vic Hub 2 above shall be confirmed during detailed design when the dynamics of changing the EGP flow direction are finalised.

3) Increase in WMS inlet pressure from 9MPag to 14.5 MPag.
Our submitted calculations for the heater and heat exchanges assumed a max transient case of 9MPag to

3.6 MPag.
These transient cases confirmed that using all redundancies in the designed heaters would maintain the delivery temperature into the JGN and APA networks above 2°C.
Increasing the transient cases to a pressure reduction from 14.5MPag to 3.6 mPag results in outlet temperatures below zero for both transient cases (200 TJ/d through WBH and 200 TJ/d through existing heat exchangers).
our modelling suggests that maintain temperatures above 2°C the temperature override on the regulator runs will decrease the flow from 200 TJ/d to 150 TJ/d.
Can you confirm if this is acceptable? And we will update the calculation and record the findings in the FEED report.
Alternatively we can increase the required rating of the WBH using the transient case as the sizing case and update the datasheet. I assume you wouldn't want to resize the existing heat exchangers.

Regards,
Simon Hanlin
Senior Process Engineer
BEng (Chem) (Hons) | CEng | MIChemE | RPEQ

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GPA ENGINEERING	Document Title	HAZOP Number
	HAZOP Closeout Sheet	GAS-599-RP-HZ-003
		Item Number
		1.23

Project Title:	Project Marlin: EGP Reversal	**Client:**	Jemena Ltd
Date:	12/01/2021	**Client Project #:**	Project Marlin: EGP Reversal
Node:	1	**GPA Project #:**	20617

HAZOP FINDINGS

Item No	Guide Word	Problem Description		Existing Safeguards	Action Required and Comments	Priority /Action By
		Cause	Consequence			
1.23	PLANT ITEM MAINTAINABILITY	Pig receiver isolation for maintenance.	Proving isolation prior to proceeding with maintenance with a single valve.	Pig receiver proposed design retained double block and bleed.	Jemena have advised GPA to remove the second isolation valve from the design based on a pigging frequency of 5-10 yearly and requirements in GTS-960-DG-PI-001 Section 10.1.2	**1 / SH**

DISCUSSION AND RECOMMENDATION

The required equipment isolations were initially defined by Jemena in the Design Review (refer GAS-599-MM-PM-001(A)) and further clarified post HAZOP by the Jemena Engineering Manager (Mike Peoples) to be as per the Jemena Piping Design Guide GTS-960-DG-PI-001 (refer Email 20617-R819). In accordance with the isolation philosophy defined in GTS-960-DG-PI-001 Section 10.1.2, Jemena have advised GPA that a single valve isolation is considered suitable for the pig receiver based on a pigging frequency of 5-10 yearly (refer JAM-RESTECHQ-000012).

ACTION TAKEN / CLOSE OUT COMMENTS

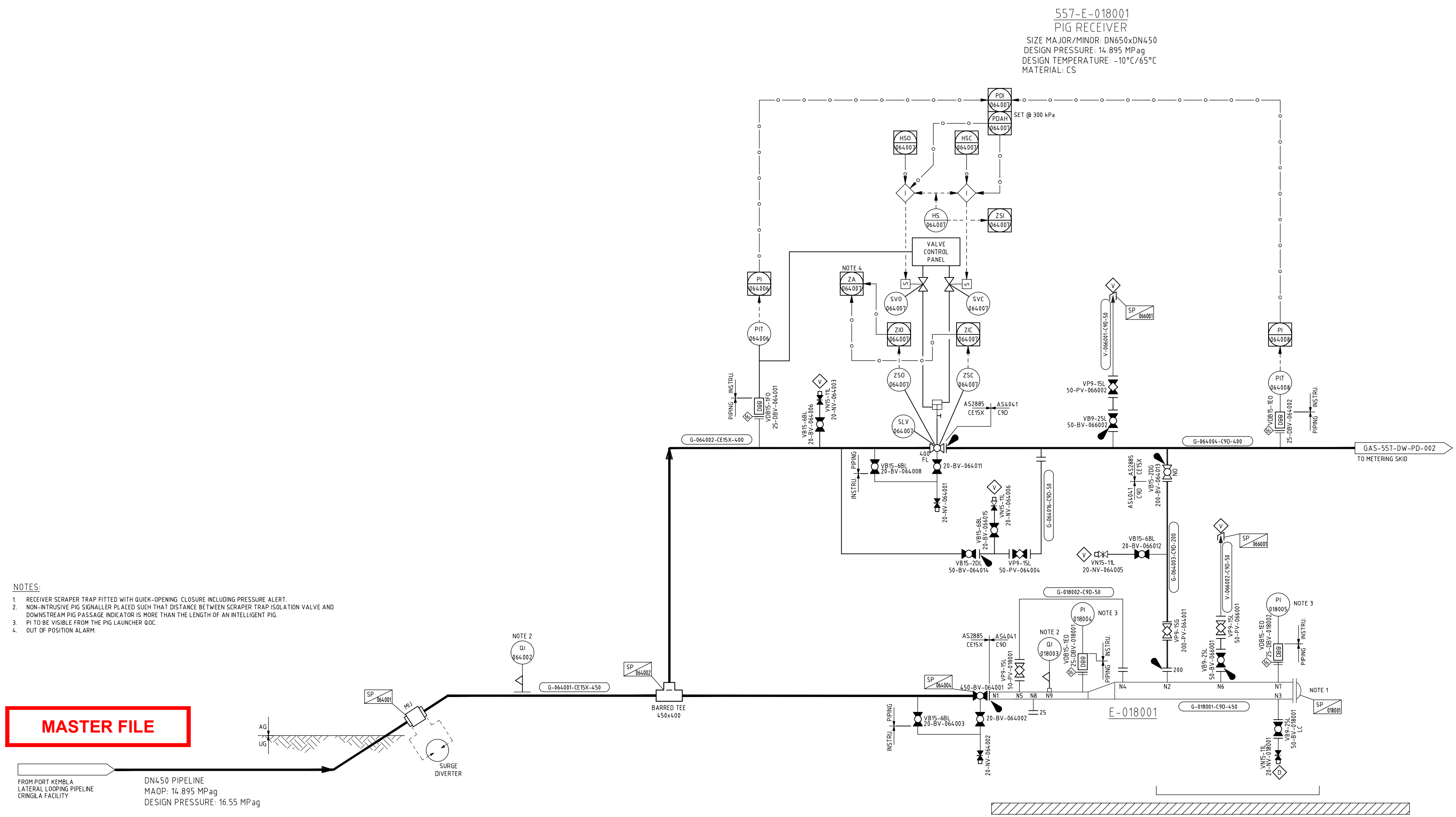
Second isolation valve removed from P&ID GAS-557-DW-PD-001(C). Action considered closed.

Approved by HAZOP Facilitator:

Name: Lisa Hein **Signature**: L Hein **Date:** 10/2/2021

Approved by Jemena:

Name: David Young **Signature**: Young, David Digitally signed by Young, David DN: DC=local, DC=quantaservices, OU=Quanta International, OU=Australia, OU=Enscope, OU=Users, CN="Young, David" Reason: I am the author of this document Location: your signing location here Date: 2021-02-18 13:55:27 Foxit PhantomPDF Version: 10.0.1 **Date:** 21/02/21



NOTES:

1. RECEIVER SCRAPER TRAP FITTED WITH QUICK-OPENING CLOSURE INCLUDING PRESSURE ALERT.
2. NON-INTRUSIVE PIG SIGNALLER PLACED SUCH THAT DISTANCE BETWEEN SCRAPER TRAP ISOLATION VALVE AND DOWNSTREAM PIG PASSAGE INDICATOR IS MORE THAN THE LENGTH OF AN INTELLIGENT PIG.
3. PI TO BE VISIBLE FROM THE PIG LAUNCHER QOC.
4. OUT OF POSITION ALARM.

MASTER FILE

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	AV	SJH	PJB	NKH	04/12/20	ISSUED FOR DETAILED DESIGN

GPA ENGINEERING QA

ISSUED FOR REVIEW

DRAWING No.	REFERENCE DRAWINGS

ASSET MANAGER
Jemena
Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
Jemena
Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
ABN 77 006 919 115

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REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	04/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
B	27/10/20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
A	17/09/20	ISSUED FOR INFORMATION ONLY	GPA			

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KEMBLA GRANGE METER STATION
PIG RECEIVER
PIPING & INSTRUMENTATION DIAGRAM

DRAWN	GPA	FACILTY	SUBJECT
DESIGN	PJB	SCALE	N.T.S.
CHECKED	SJH	SUPERSEDES	A1
APPROVED	NKH	DRAWING NUMBER	REV
DATE	27/10/20	GAS-557-DW-PD-001	C

Document Title	Document No. (Client / GPA)
Facilities FEED Stage 1 - Design Review Minutes	GAS-599-MM-PM-001
	N/A

Client Name	Jemena			Date	07/10/2020	By	DAF
Client Project No.	N/A	GPA Project No.	20617	Rev/ Status	A	Chkd	PJB / SG
Project Name	Project Marlin: EGP Reversal				IFI	QA	NKH

System	599 - General EGP Reconfig	Reviewed			Comments	Actions	Assigned to
P&ID No(s).		Yes	No	N/A			
1. Basis of Design / Process Overview							
- Is the project scope defined?		X			East Gippsland Compressor Station (EGCS) has to be removed from scope. Reverse flow compression at EGCS is not required due to the close proximity to LCS/Vic Hub.	Provide confirmation that EGCS has been removed from the facilities scope.	Jemena (Matthew Skaras)
- Are the applicable standards defined?							
- Are all the design and operating cases defined?							
- Are the process fluids defined ?(Composition, temperature, pressure,							
- Is the turndown and Turn up requirements defined? (Flowrates, pressures,							
- Site ambient conditions defined?							
- Are the battery limits defined and reasonable							
- Is the operating envelope fully defined?							
- Are pipe specifications appropriate?		X			From the EGP basis of design 500-RP-006, and EGP manual GTS-599-OM-GEN-001, it is understood that the EGP mainline is upgradeable to an MAOP of 16.55 MPag. All items (pipeline assemblies, pig traps, MLVs, valves, flanges etc) which cannot be isolated from the EGP are to be designed to 16.55 MPag, i.e. CL1500. Isolatable equipment remains CL900, with design pressure of 14.895 MPag. For this reason, the KGMS pig receiver, hot tap connection, and compressor station flow switching valves & piping have been designed using CL1500 piping specification CE15X. However it is noted that a number of EGP mainline equipment is not designed to 16.55 MPag, e.g. Mila pig traps, Kembla Grange MLV which are designed to Jemena specification C9D.	Jemena to complete a cost-benefit analysis of designing EGP connected equipment for a future upgrade design pressure of 16.55 MPag. Jemena to advise outcome of the cost-benefit analysis and confirm if piping and equipment should be designed to 16.55 MPag or 14.895 MPag design pressure. GPA to continue working as per the pipe specs shown on the P&ID until a decision is made.	Jemena (Matthew Skaras)
Control Valves							
- Is fail position shown and correct?							
- Is a bypass required and correctly sized?							
Actuated Valves							
- Are start-up pressuring bypasses required?							
- Is fail position shown and correct?							
2. Process Safety considerations							
- Are there overpressure risks, how will they be controlled?							
- Are there over temperature risks, how will they be controlled?							
- Has the venting requirements and location been considered							
- Are the environmental and societal impacts considered in the design							
3. Operations							
- How will equipment operate?							
- Are there different operating modes- has changeover been addressed?							
- Is equipment sparing consistent with sparing policy?							
- What valves and controls require operator access, how often?							
- What services are required - are they provided?							
4. Controls & Instrumentation							
- Are control schemes adequately defined?							
- How does overall flow and pressure control work?							
Has impact of Unit shutdown on other Units been addressed?							
- ESD shutdown Philosophy?							
5. Maintenance / Construction							
- What needs to be maintained, and how often?							
- Is there a venting/purging/draining philosophy?							
- Is isolation for maintenance adequate (consistent with isolation policy)?		X			The Isolation Philosophy to be applied: - Double block and bleed (DB&B) isolation, consisting of two separate block valves and bleed in between, is required for normal maintenance access (major equipment e.g. filter element change) - Single isolation is required for non-routine maintenance, e.g. flow meter removal.	Detail the isolation philosophy in the basis of design document.	GPA (Simon Hanlin)
- Isolations required for tie-in construction							
6. Layout							
- Existing services – underground and above ground				X	N/A - refer to location specific layouts.		
- What land / space is available and clear for use				X	N/A - refer to location specific layouts.		
- Access and maintainability, personnel access				X	N/A - refer to location specific layouts.		
- Egress routes				X	N/A - refer to location specific layouts.		
- Drainage, bulk earthworks requirements				X	N/A - refer to location specific layouts.		
- Geotech condition				X	N/A - refer to location specific layouts.		
- Vehicle access during ops				X	N/A - refer to location specific layouts.		
- Vehicle access during construction (cranes, trucks)				X	N/A - refer to location specific layouts.		

10 VALVES

Valves shall be in accordance with the following specifications:

- GTS-960-SP-ME-010, Manual and Actuated Valves
- GTS-960-SP-JJ-002, Control Valves

10.1 ISOLATION PHILOSOPHY

All equipment requiring maintenance shall be provided with suitable redundancy and/or a method of bypass to ensure station availability during routine maintenance.

The normal methods of isolation for mechanical equipment may be classified as:

- Positive Isolation.
- Valve Isolation

10.1.1 POSITIVE ISOLATION

Positive isolation against the high pressure source must be employed where the source potentially supplies gas into a confined space where entry by personnel is to be undertaken. Appropriate depressurisation and isolation procedures shall be followed to enable installation or removal of positive isolations.

Positive isolation must be achieved in one of three ways:

- The removal of a spool piece with blanking of open ends
- The turning of a spectacle blind
- The insertion of a spade (blind) between flanges, or replacement of a spacer with a line blind

Blanks, spades, blinds, bolting and gaskets shall conform to the piping specification for the line.

In addition to the requirement for positive isolation for work involving entry to confined spaces, it is also recommended in the following cases:

- Long duration isolations (more than one week)
- Where equipment is to be mothballed
- For process fluids at or above auto-ignition temperature
- Where risk assessment or approved work procedures stipulate.

10.1.2 VALVE ISOLATION

Valve isolation is most often used to maintain containment while positive isolation is being made, or where valve isolation only is an acceptable option, i.e. in, non-entry situations or where risk assessment or approved maintenance procedures allow this to occur.

To confirm the integrity of the valve isolation, wherever it is used as the primary protection prior to breaking of containment, separate vent / drain point(s) shall be provided.

Table 1 contains the general requirements for isolation type for each pressure class. A double block and bleed is defined as two block valves with a bleed valve in between. The following guidelines apply in conjunction with Table 1.

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For design purposes, where a piece of equipment is subjected to scheduled maintenance or inspection on a frequency of one year or less, and the equipment can be bypassed or is redundant, a double block and bleed isolation (if required by Table 1) should be implemented across the individual equipment. Filters subject to regular element inspection normally fall into this category.

Certain exceptions to Table 1 may be made in design according to the following principles. Where these are implemented they shall be approved.

Where equipment forms part of a process train where individual bypass is not possible, double block and bleed over individual equipment may not be warranted. Isolation over a larger piping volume (up to and including the entire process train) should be considered to balance vented inventory against the frequency of isolation anticipated.

Cavities of ball valves shall be shown and tagged on P&IDs and shall be provided with needle valves for controlled venting of cavities. Refer to GAS-960-GL-ME-001, Cavity Venting of Trunnion Mounted Ball Valves.

Solid plugs are not permitted. Where a plug is required, it shall be of a type where a bleed screw enables the relief of any trapped pressure without loosening the entire plug.

Table 1: Isolation Requirements

Operating Medium	Line Pressure Class	Isolation Standard
Hydrocarbon Gas / Liquid	150#	Single valve (gate or ball) with downstream bleed
Hydrocarbon Gas / Liquid	300#	Single valve (gate or ball) with downstream bleed
Hydrocarbon Gas / Liquid	600#	Double block and bleed
Hydrocarbon Gas / Liquid	900#	Double block and bleed
Hydrocarbon Gas / Liquid	1500#	Double block and bleed
Diesel	150#	Single valve
Instrument Air	150#	Single valve
Service Water	150#	Single valve
Demineralised Water	150#	Single valve
Fire Water	150#	Single valve

Pressurisation lines shall be provided around all large bore isolation valves.

Valves associated with ESD systems shall pneumatically latch and remote opening shall be prevented until a manual local reset is activated. Such valves shall be nominated in preliminary design and their functionality confirmed by HAZOP (and CHAZOP/SIL as appropriate).

Piping pressurisation lines and de-pressurising lines to atmosphere or vent systems shall include a ball valve on the upstream pressure side of the line with a globe valve downstream for throttling.

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All valves which are identified as being critical to remain fully open during operation (such as isolating a PSV or a safety critical pressure transmitter) will be locked open with a 6mm hasp padlock. Operational procedures including work permitting, and approved maintenance and tagging procedures shall be implemented to prevent inappropriate isolation of equipment when in operation.

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Simon Hanlin

From: Michael Peoples <Michael.Peoples@jemena.com.au>
Sent: Monday, 9 November 2020 5:05 PM
To: Lisa Hein
Cc: Sarah Greening
Subject: 20617-R819: 20617-S2153: Jemena Isolation Policy Guide

Hi Lisa

Yes pig traps have only one isolation valve. Pigging is on a frequency around 5-10 years.

I am the signoff for isolation arrangements, however as Matt says if the HAZOP takes into account the valving arrangements and they are as per the guide, then I do not need to approve them.

It would only be a completely new arrangement, or a scenario somehow outside normal application that I would need to approve.

Cheers

Mike

From: Lisa Hein <Lisa.Hein@gpaeng.com.au>
Sent: Monday, 9 November 2020 5:28 PM
To: Michael Peoples <Michael.Peoples@jemena.com.au>
Cc: Sarah Greening <sarah.greening@gpaeng.com.au>
Subject: 20617-S2153: RE: 20617-S2132: Jemena Isolation Policy Guide

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Thanks Mike,

For my clarity, does a double block and bleed apply to the pig receiver isolation or is a single valve isolation acceptable in this case? I have referred to the design review minutes but it doesn't appear to be mentioned in there. Are you the sign off authority for the valving isolation arrangement in Jemena?

Let me know and I can record in the minutes. Thanks

Lisa Hein
Senior Consultant - Risk and Advisory
BEng (Chem) (Hons) | MIChemE | RPEQ

GPA Engineering
121 Greenhill Road, Unley SA 5061
Dir 08 8299 8331 | **Mob** 0439 843 582 | **Ph** 08 8299 8300
E Lisa.Hein@gpaeng.com.au | **I** http://www.gpaeng.com.au/

From: Michael Peoples <Michael.Peoples@jemena.com.au>
Sent: Monday, 9 November 2020 4:48 PM
To: Matthew Skaras <Matthew.Skaras@jemena.com.au>; Sarah Greening <sarah.greening@gpaeng.com.au>; Nathan Biggins <Nathan.Biggins@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton

<Peter.Blyton@gpaeng.com.au>; Young, David <dsy@enscope.com.au>
Subject: RE: 20617-S2132: Jemena Isolation Policy Guide

Folks

I lose track of which projects we have provided these documents to, and which we haven't.

The relevant section to refer to for isolations is GTS-960-DG-PI-001 section 10.1.2.

Positive isolation (spade/blind/dropout spool) is mandatory where maintenance involving breaking gas containment, is done in confined spaces.

Valve isolation is acceptable for non-confined-spaces.

DBB is required in class #600 and above where the item being isolated is subjected to maintenance which involves breaking gas containment, on a frequency of one year or less.

Cheers

Mike

From: Matthew Skaras <Matthew.Skaras@jemena.com.au>
Sent: Monday, 9 November 2020 4:35 PM
To: Sarah Greening <sarah.greening@gpaeng.com.au>; Nathan Biggins <Nathan.Biggins@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton <Peter.Blyton@gpaeng.com.au>; Young, David <dsy@enscope.com.au>; Michael Peoples <Michael.Peoples@jemena.com.au>
Subject: RE: 20617-S2132: Jemena Isolation Policy Guide

Hi Sarah,

Please refer to the design review minutes, the isolation requirements were discussed at length and I don't believe that anything in the HAZOP changed these requirements. Our ops team wanted to revisit these by raising the isolation issues previously agreed upon, now that we have also had the discussion in HAZOP we should be better informed on the groups views (please be mindful of this in subsequent HAZOP sessions so that we can manage the session and stay on track – this item will no doubt come up again).

In the meantime, I will go back to our team and see if there is a specific reference to a document, however there is unlikely to be anything prescriptive.

As a general note whilst it is acceptable in principle to review items previously agreed (and somewhat welcomed, to convince the group we have covered off on all the risks), any discussion needs to be targeted to the node being considered, justified and worked through on its merits as part of the workshop. If we do start to open up discussions previously held this needs to be managed and challenged by the facilitator (and group) regardless of personal views.

Regards,

Matthew Skaras
Project Manager – Major Projects
Jemena
Level 15, 567 Collins St, Melbourne, VIC 3000
(03) 9173 8416 | 0423 538 955
matthew.skaras@jemena.com.au | www.jemena.com.au

From: Sarah Greening <sarah.greening@gpaeng.com.au>
Sent: Monday, 9 November 2020 1:35 PM
To: Nathan Biggins <Nathan.Biggins@jemena.com.au>; Matthew Skaras <Matthew.Skaras@jemena.com.au>
Cc: Lisa Hein <Lisa.Hein@gpaeng.com.au>; Simon Hanlin <Simon.Hanlin@gpaeng.com.au>; Peter Blyton <Peter.Blyton@gpaeng.com.au>
Subject: 20617-S2132: Jemena Isolation Policy Guide

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Hi Nathan, Matthew,

During the first HAZOP session last week you referred to Jemena Isolation Policy Guide, can you please provide a copy of this or the document number for reference in the HAZOP minutes?

Thanks,

Sarah Greening
Project Manager
BEng (Chem) (Hons) | RPEQ

GPA Engineering
121 Greenhill Road, Unley SA 5061
Dir 08 8299 8320 | **Ph** 08 8299 8300
E sarah.greening@gpaeng.com.au | **I** http://www.gpaeng.com.au/

I am in the office on Mondays, Tuesdays, Thursdays, and Fridays.

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MAIL TYPE
Response to Technical Query
MAIL NUMBER
JAM-RESTECHQ-000012
REFERENCE NUMBER
GPA-TECHQ-000013

Re: Kembla Grange - HAZOP Item 1.23

From	Stephen Chow - Jemena Asset Management
To (2)	Sarah Greening - GPA Engineering
	Matthew Skaras - Jemena Asset Management
Cc (5)	Mr Simon Hanlin - GPA Engineering
	Mr Peter Blyton - GPA Engineering
	GPA Document Control - GPA Engineering
	Nathan Biggins - Jemena Asset Management
	David Young - Jemena Asset Management
Sent	Friday, 4 December 2020

MESSAGE

Hi Sarah,

Please see TQ response from Jemena Gas Engineering Manager:

Engineering has assessed the TQ query and advises that GPA is to proceed with the single valve isolation design.

Whilst Jemena has had some issues with valve isolations in the past, these have been limited and are still judged rare in relation to the total number of valves installed on our assets. The issues encountered have all been related to vendor quality and not related to incorrect specification.

Jemena balances risk against cost when establishing where a leak-tolerant design (two valve DBB) should be installed, and prioritises locations based on frequent scheduled maintenance (opening on a frequency of one year or higher) or where urgent maintenance access might be required, the failure of which might interrupt gas flows. In practice this results in filter assemblies being prioritised and occasionally other equipment in continuous service for which a redundant spare or bypass is installed.

In this particular case, Jemena's history is that one pig trap isolation valve has been replaced on any of Jemena's assets, and this was in relation to a valve stem leak, as opposed to a seat leak. This valve was at Wallumbilla.

In relation to the queries on the application of the risk matrix, Engineering notes that the probability assessment includes a dimension of time – chance of the event per year- thus assessing the relative frequency of the event is relevant to assessing the probability. If a valve is relied upon 4 times per year this is a material difference to if the valve is relied upon once each ten years. Although the probability may not be linear between the two it is relevant to be considered.

In addition Engineering does not believe that the consequence being assessed is Catastrophic. The most credible case is a valve seat leak that results in an excessive cavity vent rate and appreciable cavity pressure, that results in the proposed pigging activity being unable to be carried out. Jemena's experience is that once a DBB "single valve" isolation is proven then there is no credible case for a catastrophic failure.

As part of preparation for pigging, isolation valves are tested and proven well before pigs are mobilised, and the worst case outcome is a repair operation that involves suspension of the pipeline. As this outcome is rare or unexpected the judgement applied is that the additional expense of installing two additional full bore valves (estimate $130k) to mitigate this eventuality is not justified.

Regards,
Stephen Chow

From: S Greening
Sent: 24/11/2020 12:55:45 PM AEDT (GMT +11:00)
To: Stephen Chow, Matthew Skaras
Cc: Peter Blyton, GPA Document Control, Simon Hanlin, Nathan Biggins, David Young
Mail Number: GPA-TECHQ-000013
Subject: Kembla Grange - HAZOP Item 1.23

Are there any attachments?:	No
Authorised Signatory:	n/a
Description:	Kembla Grange - HAZOP Item 1.23
Drawing Reference:	n/a
If yes, state recommended control below:	n/a
Is additional hazard control required?:	No
Is the response critical to work progres:	No
Location:	Kembla Grange
Standard/Specification Reference:	n/a
Urgency:	Routine

Hi Matthew, Stephen,

Can you please respond to this feedback sent from Luke Gigliotti?

I wanted to provide some feedback re Item 1.23 for consideration, which was the removal of the second isolation valve on the inlet to the new pig receiver on the Kembla Grange lateral from the LNG Ship.

My understanding is the remaining single valve is a trunnion mounted ball valve (with 2 faces)- which per the Jemena design guide 'Piping Design Guide and Material Specification for Gas Pipeline Facilities GTS-960-DG-PI-001 Rev 1) is acceptable- but I would like if the following points are considered:

- Performance of Trunnion Mounted Ball Valves on Jemena assets
- Lack of available upstream isolation (operability and commercial considerations)
- Change to risk based on frequency of task?

1. Feedback from those in the field have suggested that there has been multiple failures of different trunnion valves across the EGP. East Gippsland Compressor Station and Longford Compressor station are two sites in which there has been failure of recently acquired and installed trunnion mounted 2 face valves. I'm unsure of their design and specification, but at the least it should be understood what these failure mechanisms were and if we can, build this into the specification for Project Marlin so it is not repeated. Nevertheless, there is a lack of confidence of this valve type in the field along EGP.
2. The feedback from the project that in the absence of a valve holding, the operators in the field would look for an upstream valve to get a safe isolation. For this item, there is no upstream valve available (only at the LNG ship tie-in). In this event there would be a significant commercial implication in terms of venting volume and of time. Is an additional valve worth considering to avoid the consequence?
3. The frequency of the pigging task (every 5 years nominally- unsure of what other PM work is required for the receiver itself and associated isolation valves) is used as a reason (per our guideline) to not install DBB. For me it is unclear how the risk changes based on frequency of task. For the same activity that is executed say 1/year versus 1/ 2 years, the likelihood of failure shouldn't change or not significantly enough to change from say 'possible' to 'unlikely' and therefore change the risk per the Jemena matrix. The exposure to the task does increase but in this example it shouldn't necessarily double i.e. not linear.

   Also note, if we deem any of our maintenance tasks with a catastrophic consequence then the likelihood of the task does not minimise the risk in terms of approval to proceed (see below)- is this the case for receiving a pig? Operationally, when a task is executed on an infrequent basis it tends to attract a higher risk to personnel- and therefore engineering controls are best to be relied upon rather than procedural…would additional isolation provide this in this case and provide greater reduction in risk?

Perhaps these things could be considered by the broader project team before finalisation of the minutes?

Likelihood		Consequence			
		Minor	Serious	Severe	Major
		1	2	3	4
Almost Certain	5	Moderate	High	Extreme	Extreme
Likely	4	Moderate	Significant	High	Extreme
Possible	3	Moderate	Moderate	Significant	High
Unlikely	2	Low	Low	Moderate	Significant
Rare	1	Low	Low	Moderate	Moderate

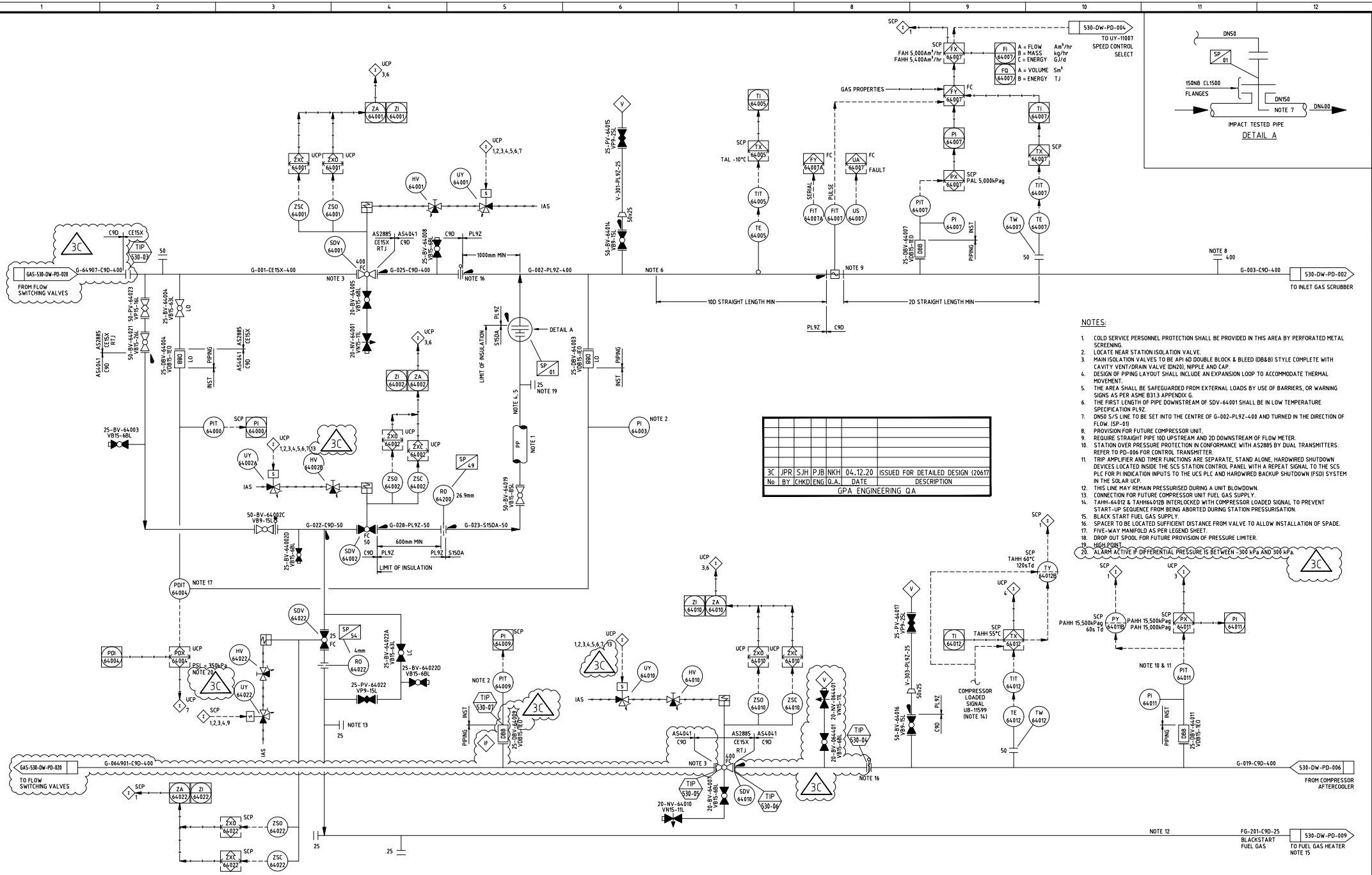
Figure 7: Risk Matrix

** **Note:** Whilst these risks are rated below extreme, the potentially catastrophic consequen reporting (refer Figure 9 for details).*

Risk Rating*	Suggested Action	Suggested Timing	Monitoring
EXTREME	Requires immediate action. Highest priority to treat risk. Senior level monitoring.	Action plans prepared and normally implemented within 1 month. Status of risk should be monitored monthly.	**SGSPAA:** Board / RHSEC / ERMC / LT **Functional Group / Zinfra:** Managing Director / Executive General Manager
HIGH	Requires immediate attention – must manage with senior level monitoring. Includes RHSEC and ERMC / LT oversight of Unlikely Likelihood, Catastrophic Consequence Events.	Action plans prepared and normally implemented within 3 months. Status of risk should be monitored monthly.	**SGSPAA:** RHSEC** / ERMC / LT **Functional Group (Jemena) / Zinfra:** EGM / General Managers
SIGNIFICANT	Requires Management attention with a degree of priority. Includes RHSEC / ERMC / LT oversight of Rare Likelihood, Catastrophic Consequence Events. High level monitoring.	Action plans prepared and normally implemented within 6 months. Status of risk should be monitored every 6 months.	**SGSPAA:** RHSEC** / ERMC** / LT **Functional Group (Jemena) / Zinfra:** EGM / General Managers
MODERATE	Requires routine to periodic monitoring.	Action plans prepared and normally implemented within 6 – 12 months (where the benefits outweigh the costs). Status of risk should be monitored at least every 6 months.	**SGSPAA / Functional Group (Jemena) / Zinfra:** General Managers Escalate FG / Zinfra risk to the EGM / Zinfra MD if the risk consequence or likelihood is increasing.
LOW	"Business as usual" - should not require much attention but should be reviewed at least annually. Managed by routine policies and procedures.	Ongoing control as part of a management system. Risk Facilitators to maintain register of Low risks and reassess annually.	**SGSPAA / Functional Group (Jemena) / Zinfra:** Managers Escalate FG / Zinfra risk to the GM if the risk consequence or likelihood is increasing.

Note *: Risk oversight requirements are based on the Residual risk rating, i.e. after existing controls have been evaluated and assigned.

**: RHSEC and ERMC reporting only for Rare and Unlikely Likelihood, Catastrophic Consequence Events. However, the RHSEC may escalate any risk matters to the Board if the RHSEC considers it appropriate.



NOTES:

1. COLD SERVICE PERSONNEL PROTECTION SHALL BE PROVIDED IN THIS AREA BY PERFORATED METAL SCREENING.
2. LOCATE NEAR STATION ISOLATION VALVE.
3. MAIN ISOLATION VALVES TO BE API 6D DOUBLE BLOCK & BLEED (DB&B) STYLE COMPLETE WITH CAVITY VENT/DRAIN VALVE (DN20), NIPPLE AND CAP.
4. DESIGN OF PIPING LAYOUT SHALL INCLUDE AN EXPANSION LOOP TO ACCOMMODATE THERMAL MOVEMENT.
5. THE AREA SHALL BE SAFEGUARDED FROM EXTERNAL LOADS BY USE OF BARRIERS, OR WARNING SIGNS AS PER ASME B31.3 APPENDIX G.
6. THE FIRST LENGTH OF PIPE DOWNSTREAM OF SDV-64001 SHALL BE IN LOW TEMPERATURE SPECIFICATION PL9Z.
7. DN50 S/S LINE TO BE SET INTO THE CENTRE OF G-002-PL9Z-400 AND TURNED IN THE DIRECTION OF FLOW. (SP-01)
8. PROVISION FOR FUTURE COMPRESSOR UNIT.
9. REQUIRE STRAIGHT PIPE 10D UPSTREAM AND 2D DOWNSTREAM OF FLOW METER.
10. STATION OVER PRESSURE PROTECTION IN CONFORMANCE WITH AS2885 BY DUAL TRANSMITTERS. REFER TO PD-006 FOR CONTROL TRANSMITTER.
11. TRIP AMPLIFIER AND TIMER FUNCTIONS ARE SEPARATE, STAND ALONE, HARDWIRED SHUTDOWN DEVICES LOCATED INSIDE THE SCS STATION CONTROL PANEL WITH A REPEAT SIGNAL TO THE SCS PLC FOR PI INDICATION INPUTS TO THE UCS PLC AND HARDWIRED BACKUP SHUTDOWN (FSD) SYSTEM IN THE SOLAR UCP.
12. THIS LINE MAY REMAIN PRESSURISED DURING A UNIT BLOWDOWN.
13. CONNECTION FOR FUTURE COMPRESSOR UNIT FUEL GAS SUPPLY.
14. TAHH-64012 & TAHH64012B INTERLOCKED WITH COMPRESSOR LOADED SIGNAL TO PREVENT START-UP SEQUENCE FROM BEING ABORTED DURING STATION PRESSURISATION.
15. BLACK START FUEL GAS SUPPLY.
16. SPACER TO BE LOCATED SUFFICIENT DISTANCE FROM VALVE TO ALLOW INSTALLATION OF SPADE.
17. FIVE-WAY MANIFOLD AS PER LEGEND SHEET.
18. DROP OUT SPOOL FOR FUTURE PROVISION OF PRESSURE LIMITER.
19. HIGH POINT.
20. ALARM ACTIVE IF DIFFERENTIAL PRESSURE IS BETWEEN -300 kPa AND 300 kPa.

3C	JPR	SJH	PJB	NKH	04.12.20	ISSUED FOR DETAILED DESIGN (20617)
No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
GPA ENGINEERING Q.A						

3C	04.12.20	ISSUED FOR DETAILED DESIGN (20617)	GPA		SJH		NKH			
3B	30.10.20	ISSUED FOR HAZOP (20617)	GPA		SJH		NKH			
3A	09.09.20	ISSUED FOR REVIEW (20617)	GPA		SLH					
3	19.01.16	AS BUILT	MRM		JW					
2	10.06.16	RE-ISSUED FOR CONSTRUCTION	HWI		JW					
1	18.12.14	ISSUED FOR CONSTRUCTION	SLA		NH					
0	25.07.14	ISSUED FOR DESIGN	SLA		NH					
REV	DATE	DESCRIPTION	DRAWN		CHECKED		APPRV		CLIENT	

960-DW-PD-001	P&ID STANDARD SYMBOLS & ABBREVIATIONS
DRAWING No.	REFERENCE DRAWINGS

ASSET MANAGER

Jemena

Produced by
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ABN 52 104 352 650

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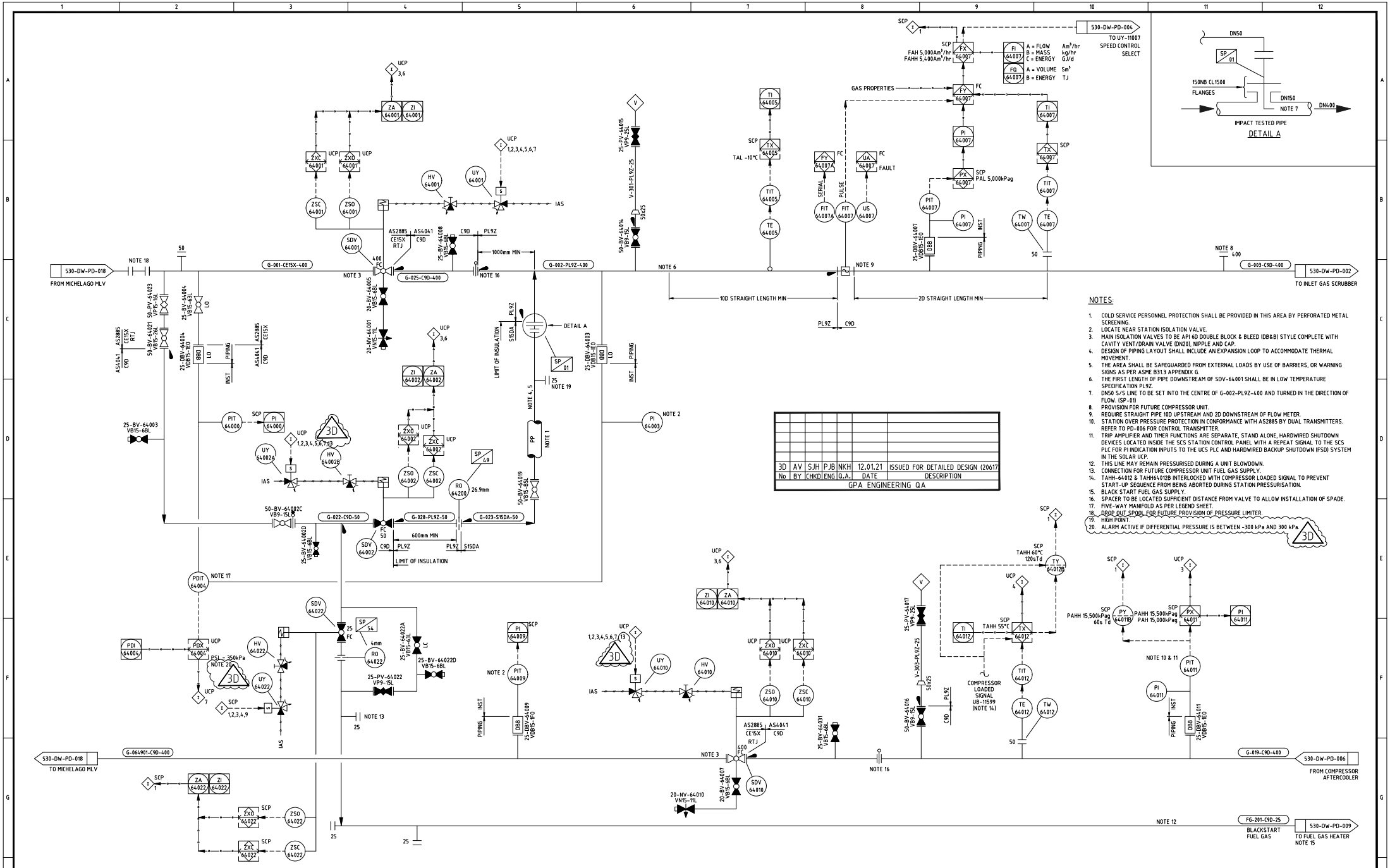
CONSULTANT

GPA

www.gpaeng.com.au

MICHELAGO COMPRESSOR STATION
STATION ISOLATION VALVES
PIPING AND INSTRUMENTATION DIAGRAM

DRAWN	SGP	FACILITY	SUBJECT
DESIGN		SCALE	NTS
CHECKED	CS	SUPERSEDES	A1
APPROVED	KM	DRAWING NUMBER	REV-
DATE	18.04.08	530-DW-PD-001	3C



NOTES:

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2. LOCATE NEAR STATION ISOLATION VALVE.
3. MAIN ISOLATION VALVES TO BE API 6D DOUBLE BLOCK & BLEED (DB&B) STYLE COMPLETE WITH CAVITY VENT/DRAIN VALVE (DN20), NIPPLE AND CAP.
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18. DROP OUT SPOOL FOR FUTURE PROVISION OF PRESSURE LIMITER.
19. HIGH POINT.
20. ALARM ACTIVE IF DIFFERENTIAL PRESSURE IS BETWEEN -300 kPa AND 300 kPa.

3D	AV	SJH	PJB	NKH	12.01.21	ISSUED FOR DETAILED DESIGN (20617)
No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
GPA ENGINEERING Q.A						

3D	12.01.21	ISSUED FOR DETAILED DESIGN (20617)	GPA		SJH		NKH				
3C	04.12.20	ISSUED FOR DETAILED DESIGN (20617)	GPA		SJH		NKH				
3B	30.10.20	ISSUED FOR HAZOP (20617)	GPA		SJH		NKH				
3A	09.09.20	ISSUED FOR REVIEW (20617)	GPA		SLH						
3	19.01.16	AS BUILT	MRM		JW						
2	10.06.16	RE-ISSUED FOR CONSTRUCTION	HWI		JW						
1	18.12.14	ISSUED FOR CONSTRUCTION	SLA		NH						
0	25.07.14	ISSUED FOR DESIGN	SLA		NH						
REV	DATE	DESCRIPTION	DRAWN		CHECKED		APPRV		CLIENT		

ASSET MANAGER

Jemena

Produced by Jemena Asset Management (6) Pty Ltd ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L ABN 15 068 570 847
Jemena EGP(2) P/L ABN 77 006 919 115

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960-DW-PD-001	P&ID STANDARD SYMBOLS & ABBREVIATIONS
DRAWING No.	REFERENCE DRAWINGS

CONSULTANT

GPA

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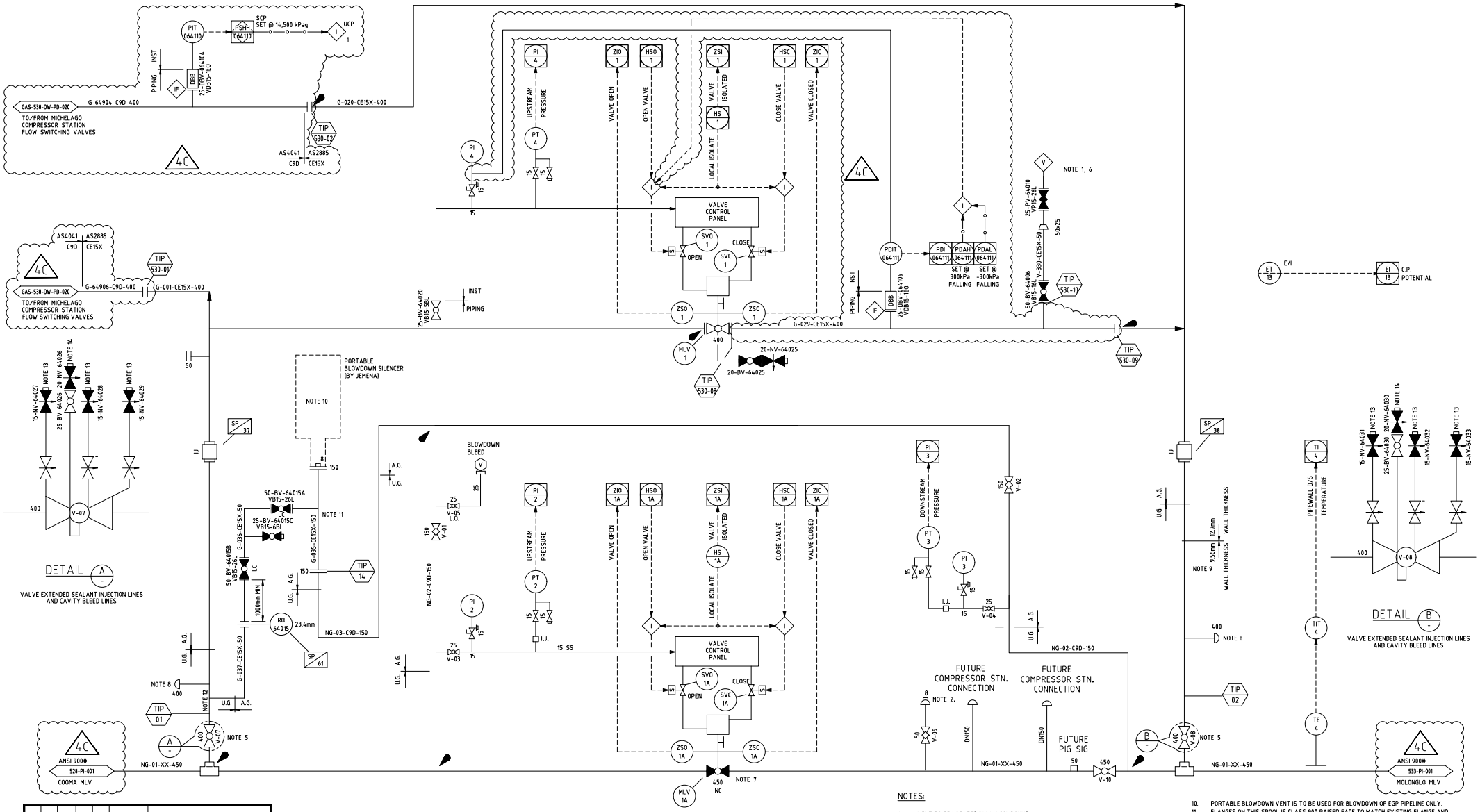
MICHELAGO COMPRESSOR STATION
STATION ISOLATION VALVES
PIPING AND INSTRUMENTATION DIAGRAM

DRAWN	SGP	FACILITY	SUBJECT
DESIGN		SCALE	NTS
CHECKED	CS	SUPERSEDES	A1
APPROVED	KM	DRAWING NUMBER	REV 3D
DATE	18.04.08	530-DW-PD-001	



NOTES:

1. VENT TO BE LOCATED IN MLV COMPOUND.
2. BLOWDOWN & FUTURE TAKE-OFFS PURGE VALVES.
3. DELETED.
4. HIGH INTEGRITY NON SLAM CHECK VALVE.
5. EXISTING VALVE TO BE FITTED WITH EXTENDED STEM FOR EXTENSION TO ABOVE GROUND.
6. VENT TO BE IMPACT TESTED TO -80°C.
7. EXISTING MLV AND ALL ASSOCIATED INSTRUMENT TAGS CHANGED FROM MLV-1 TO MLV-1A.
8. FUTURE PIPELINE LOOPING
9. ALL ABOVE GROUND LINE PIPES TO BE 12.7mm THICKNESS (HEAVY WALL). BELOW GROUND LINE PIPES TO BE 9.56mm THICKNESS (STANDARD WALL). TRANSITION FROM HEAVY WALL TO STANDARD WALL BELOW GROUND, 6m FROM AG/UG TRANSITION.
10. PORTABLE BLOWDOWN VENT IS TO BE USED FOR BLOWDOWN OF EGP PIPELINE ONLY.
11. FLANGES ON THIS SPOOL IS CLASS 900 RAISED FACE TO MATCH EXISTING FLANGE AND PORTABLE VENT.
12. USE 3M OF HEAVY WALL PIPE AT THE INJECTION POINT.
13. SEALANT INJECTION LINE COMPLETE WITH SEALANT INJECTION FITTING
14. CAVITY BLEED LINE, EXISTING CAVITY BLEED VALVE TO BE REMOVED AND REPLACED BY ABOVE GROUND VALVES.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
4C	JPR	SJH	PJB	NKH	04.12.20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

DRAWING No.	REFERENCE DRAWINGS
960-DW-PD-001	P&ID STANDARD SYMBOLS & ABBREVIATIONS

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
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REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
4C	04.12.20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
4B	23.10.20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
4A	15.09.20	ISSUED FOR REVIEW (20617)	GPA	PJB		
4	19.01.16	AS BUILT	MRM	JW		
3	10.06.15	RE-ISSUED FOR CONSTRUCTION	HWI	JW		
2	13.03.15	RE-ISSUED FOR CONSTRUCTION	SLA	NH		
1	18.12.14	ISSUED FOR CONSTRUCTION	SLA	NH		
0	25.07.14	ISSUED FOR DESIGN	SLA	NH		

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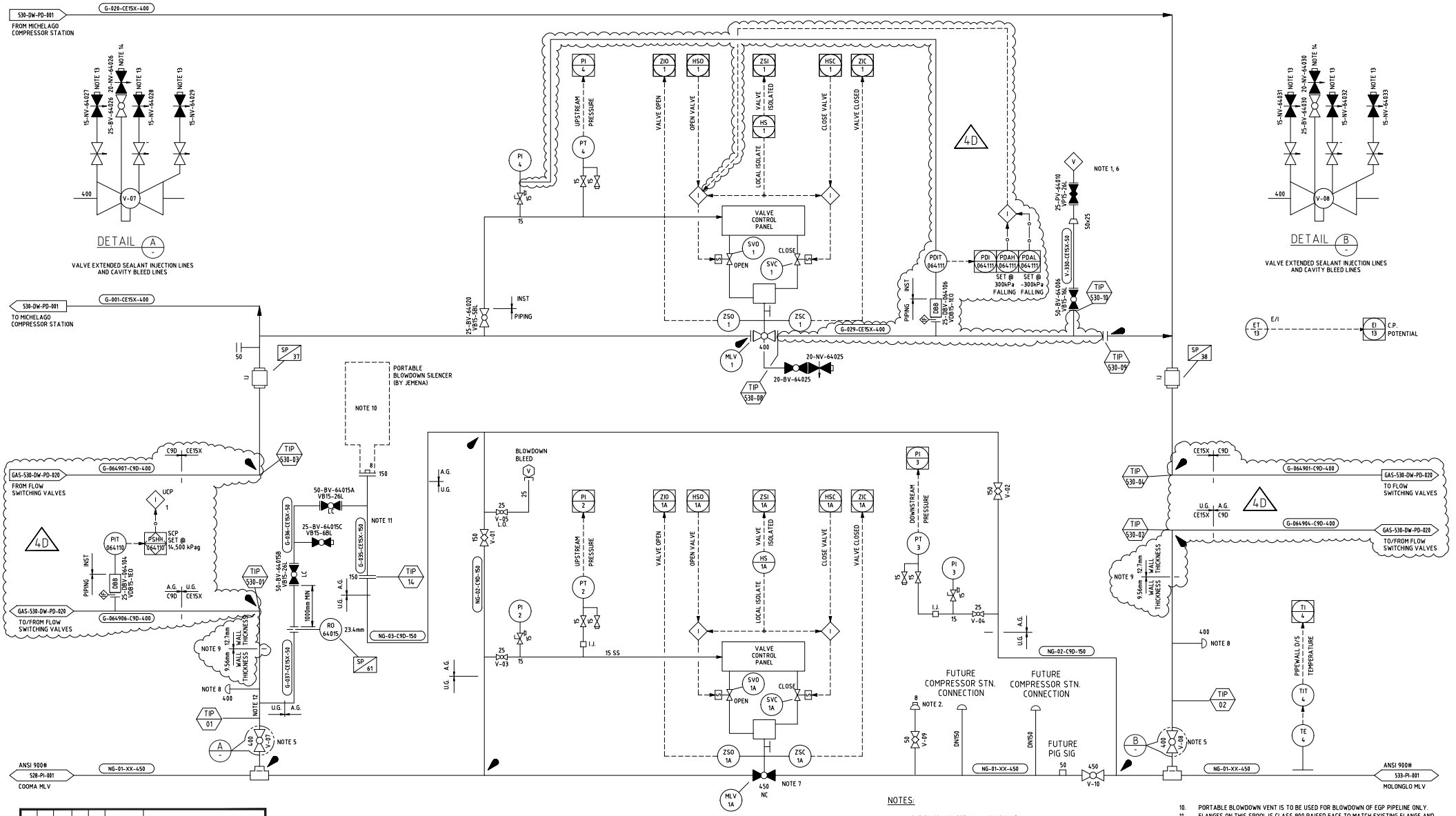
MICHELAGO COMPRESSOR STATION MAINLINE VALVE PIPING AND INSTRUMENTATION DIAGRAM

DRAWN	SGP	FACILTY	SUBJECT
DESIGN		SCALE Scale	
CHECKED	CS	SUPERSEDES	A1
APPROVED	KM	DRAWING NUMBER	REV. 4C
DATE	18.04.20	530-DW-PD-018	



4D	AV	SJH	PJB	NKH	12.01.21	ISSUED FOR DETAILED DESIGN (20617)
No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
GPA ENGINEERING Q.A						

4D	12.01.21	ISSUED FOR DETAILED DESIGN (20617)	GPA		SJH		NKH						
4C	04.12.20	ISSUED FOR DETAILED DESIGN (20617)	GPA		SJH		NKH						
4B	23.10.20	ISSUED FOR HAZOP (20617)	GPA		SJH		NKH						
4A	15.09.20	ISSUED FOR REVIEW (20617)	GPA		PJB								
4	19.01.16	AS BUILT	MRM		JW								
3	10.06.15	RE-ISSUED FOR CONSTRUCTION	HWI		JW								
2	13.03.15	RE-ISSUED FOR CONSTRUCTION	SLA		NH								
1	18.12.14	ISSUED FOR CONSTRUCTION	SLA		NH								
0	25.07.14	ISSUED FOR DESIGN	SLA		NH								
REV	DATE	DESCRIPTION	DRAWN		CHECKED		APPRV		CLIENT				

960-DW-PD-001	P&ID STANDARD SYMBOLS & ABBREVIATIONS
DRAWING No.	REFERENCE DRAWINGS

ASSET MANAGER

Jemena

Produced by
Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER

Jemena

Jemena EGP(1) P/L
ABN 15 068 570 847
Jemena EGP(2) P/L
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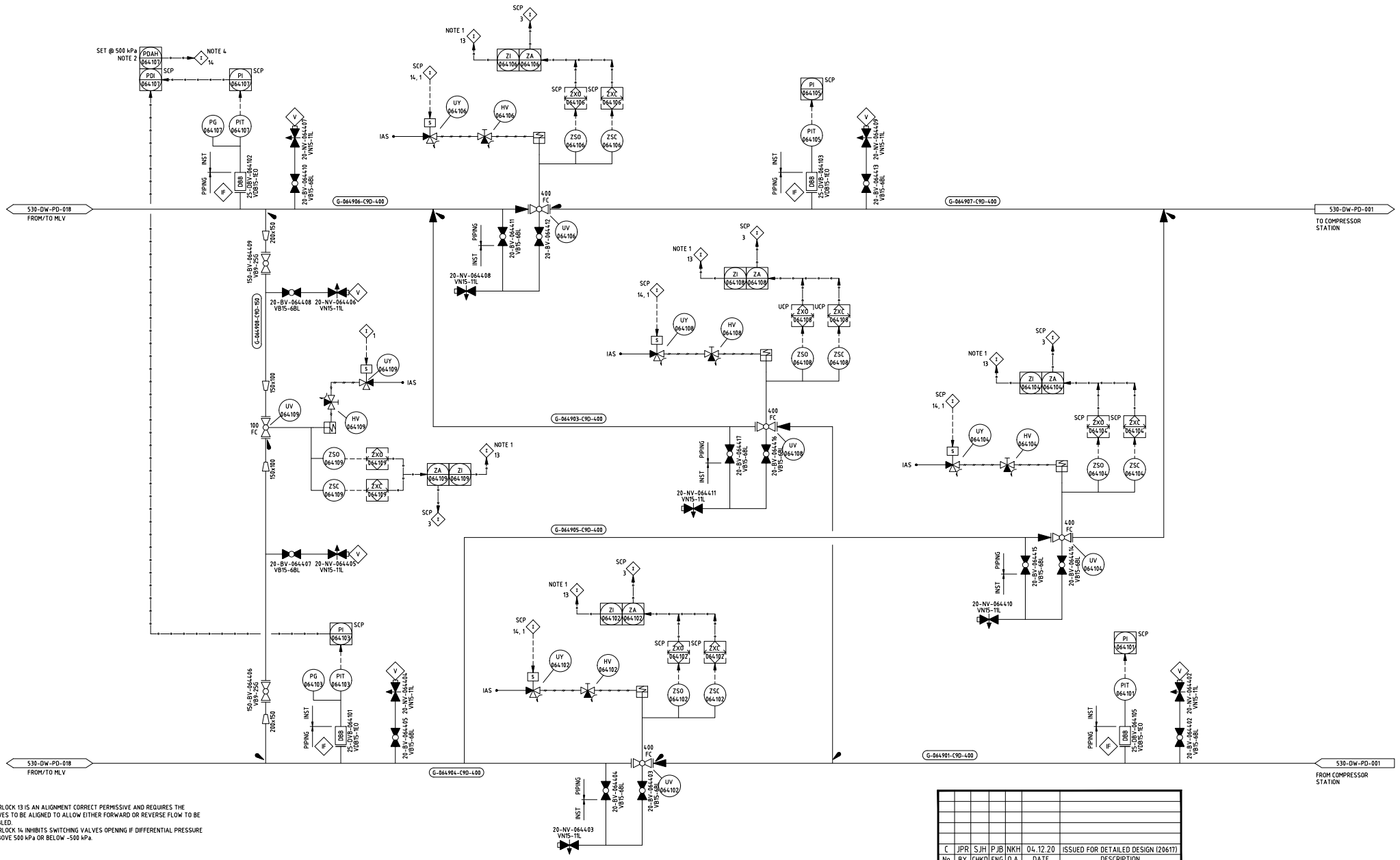
MICHELAGO COMPRESSOR STATION MAINLINE VALVE PIPING AND INSTRUMENTATION DIAGRAM

DRAWN	SGP	FACILITY	SUBJECT
DESIGN		SCALE	Scale
CHECKED	CS	SUPERSEDES	A1
APPROVED	KM	DRAWING NUMBER	REV 4D
DATE	18.04.20	530-DW-PD-018	



NOTES:

1. INTERLOCK 13 IS AN ALIGNMENT CORRECT PERMISSIVE AND REQUIRES THE VALVES TO BE ALIGNED TO ALLOW EITHER FORWARD OR REVERSE FLOW TO BE ENABLED.
2. INTERLOCK 14 INHIBITS SWITCHING VALVES OPENING IF DIFFERENTIAL PRESSURE IS ABOVE 500 kPa OR BELOW -500 kPa.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	JPR	SJH	PJB	NKH	04.12.20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	04.12.20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
B	22.10.20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
A	16.09.20	ISSUED FOR REVIEW (20617)	GPA	PJB		

960-DW-PD-001 P&ID STANDARD SYMBOLS & ABBREVIATIONS

DRAWING No. REFERENCE DRAWINGS

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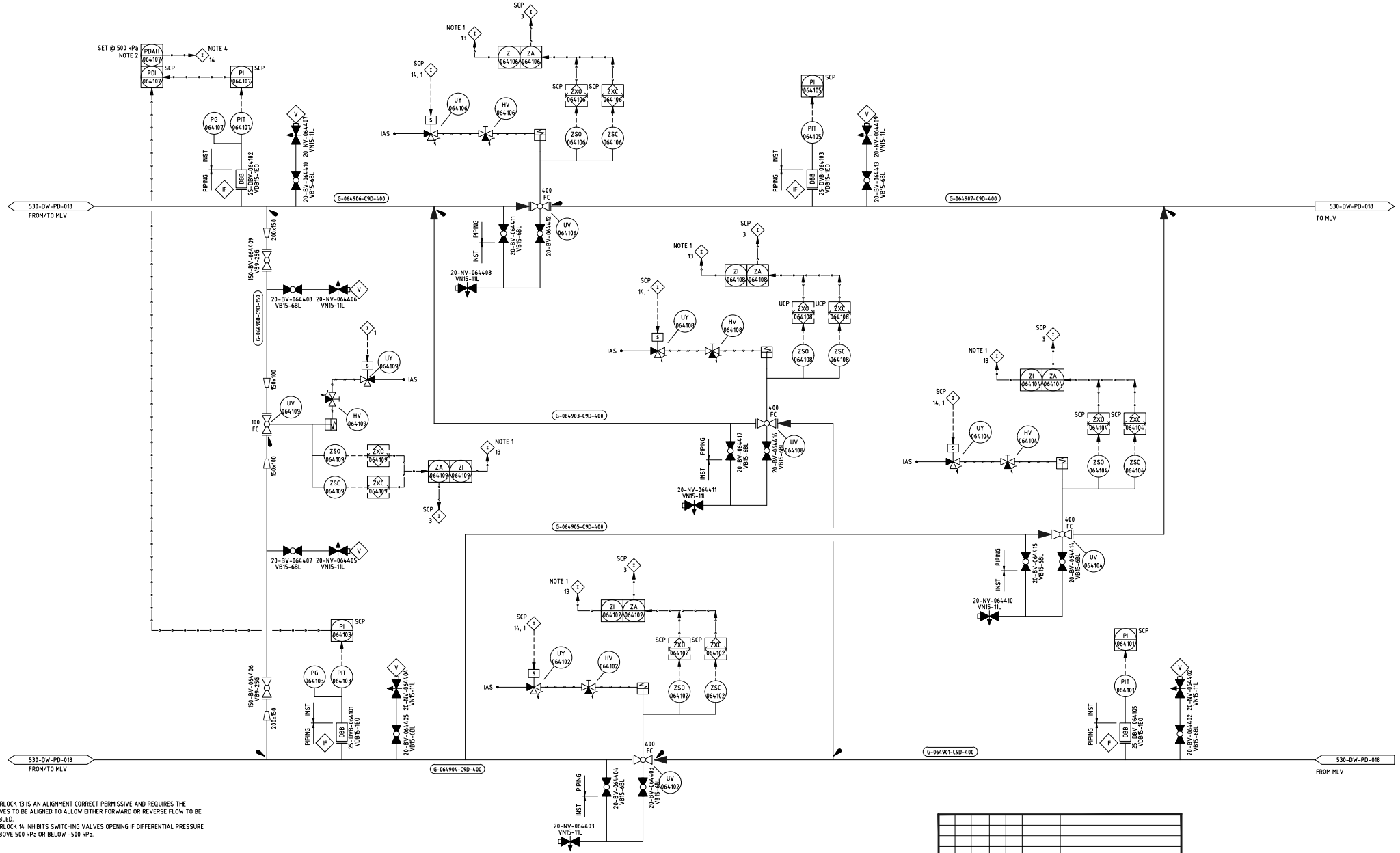
MICHELAGO COMPRESSOR STATION
FLOW SWITCHING VALVES
PIPING AND INSTRUMENTATION DIAGRAM
-

DRAWN	GPA		
DESIGN	-	SCALE	N/A
CHECKED	-	SUPERSEDES	-
APPROVED	-	DRAWING NUMBER	REV
DATE	16.09.20	GAS-530-DW-PD-020	C



NOTES:

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2. INTERLOCK 14 INHIBITS SWITCHING VALVES OPENING IF DIFFERENTIAL PRESSURE IS ABOVE 500 kPa OR BELOW -500 kPa.

No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
D	AV	SJH	PJB	NKH	12.01.21	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
D	12.01.21	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
C	04.12.20	ISSUED FOR DETAILED DESIGN (20617)	GPA	SJH	NKH	
B	22.10.20	ISSUED FOR HAZOP (20617)	GPA	SJH	NKH	
A	16.09.20	ISSUED FOR REVIEW (20617)	GPA	PJB		

DRAWING No.	REFERENCE DRAWINGS
960-DW-PD-001	P&ID STANDARD SYMBOLS & ABBREVIATIONS

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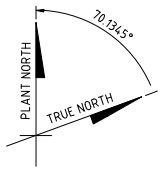
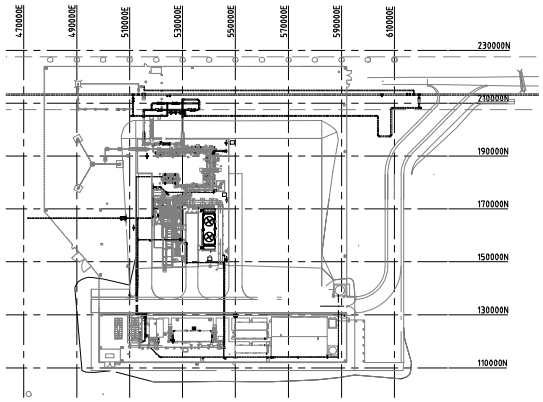
MICHELAGO COMPRESSOR STATION
FLOW SWITCHING VALVES
PIPING AND INSTRUMENTATION DIAGRAM

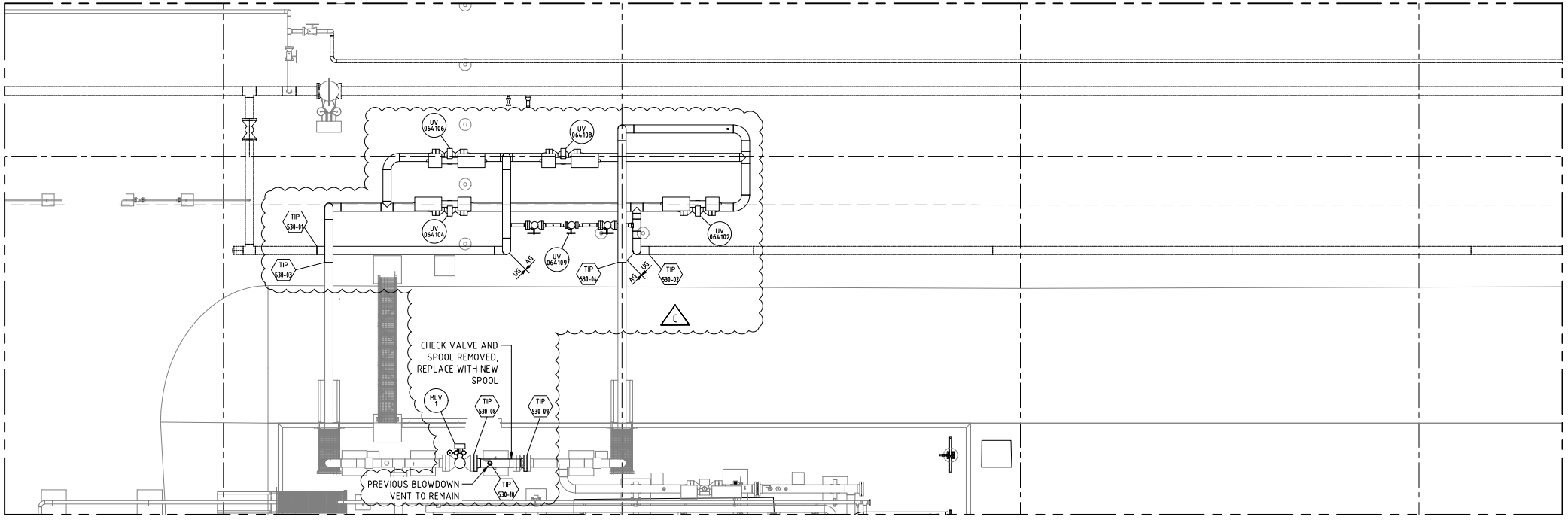
-

DRAWN	GPA		
DESIGN	-	SCALE	N/A
CHECKED	-	SUPERSEDES	-
APPROVED	-	DRAWING NUMBER	GAS-530-DW-PD-020
DATE	16.09.20	REV	D





KEY PLAN
1:1000



PLAN
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No	BY	CHKD	ENG	Q.A.	DATE	DESCRIPTION
C	JPR	IJC	PJB	NKH	16/12/20	ISSUED FOR DETAILED DESIGN (20617)

GPA ENGINEERING Q.A

MASTER FILE

NOTES
1. MGA 55 - GDA 94.
2. GRID REFLECTS THE CAD FILE SUPPLIED 10277-P-2400.

0 2.5 5.0 7.5 10
SCALE 1:100 METRES

REV	DATE	DESCRIPTION	DRAWN	CHECKED	APPRV	CLIENT
C	16/12/20	ISSUED FOR DETAILED DESIGN (20617)	GPA	IJC	NKH	
B	13/11/20	ISSUED FOR HAZOP (20617)	GPA	IJC	NKH	
A	18/09/20	ISSUED FOR INFORMATION (20617)	GPA			

DRAWING No. | REFERENCE DRAWINGS

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Jemena
Produced by Jemena Asset Management (6) Pty Ltd
ABN 52 104 352 650

ASSET OWNER
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Jemena EGP(1) P/L
ABN 15 068 570 847
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EASTERN GAS PIPELINE (EGP)
SITE LAYOUT
MICHELAGO COMPRESSOR STATION
PLOT PLAN

DRAWN	GPA	FACILITY	SUBJECT
DESIGN	PJB	SCALE	AS SHOWN
CHECKED	IJC	SUPERSEDES	A1
APPROVED	NKH	DRAWING NUMBER	REV
DATE	16/12/20	GAS-530-PN-ME-001	C