

BLAISE AD HAZOP

RMD-02-004



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CONTENTS

| | |
|--------------------------------------|----------|
| 1.0 INTRODUCTION | 1 |
| 2.0 METHODOLOGY | 2 |
| 2.1 Introduction | 2 |
| 2.2 Parameters and Guide Words | 2 |
| 2.3 HAZOP Study Team | 3 |
| 2.4 Nodes Considered | 4 |
| 3.0 CLOSURE | 5 |

APPENDICES

Appendix A: HAZOP Sheets

Appendix B: HAZOP Action Sheets

DRAWINGS

All drawings based upon BioConstruct drawing B201903 / A02, dated 15.05.19.

Node Drawings: All Nodes
Node 1
Node 2
Node 3
Node 4
Node 5
Node 6
Node 7
Node 8
Node 9
Node 10
Node 11
Node 12
Node 13
Node 14
Node 15
Node 16
Node 17
Node 18
Node 19
Node 20
Node 21
Node 22
Node 23

1.0 Introduction

An interface HAZOP study was undertaken at BioConstruct's offices at Stockton-on-Tees, Teesside on 3rd June 2019, commencing on 4th June and being completed on 9th July, on the design of the proposed Anaerobic Digestion Facility for Crofthead.

The HAZOP Study Team comprised:

- | | | |
|--------------------|------------------------------|-----------------------------------|
| • Simon Hemingway | – Project Engineer | – BioConstruct New Energy |
| • Paul Foxton | – CDM Advisor | – SRC |
| • Charlie Jones | – Apprentice | – SRC |
| • Martin Swift | – Engineer | – D&G |
| • Gary Marshall | – Client's Representative | – SRC |
| • Albert Ogundipe | – Asset Manager | – SGN |
| • Steven Whitlock | – Asset Distribution Manager | – SGN |
| • Shaun Stephenson | – Gas Quality Engineer | – SGN |
| • Russ Harley | – Project Manager | – Elster |
| • Janice Grant | – HAZOP Scribe | – Scotia Scribe |
| • Rónan M. Doyle | – HAZOP Study Leader | – RMD Consulting Engineer Limited |

This report details the findings of the HAZOP Study. The drawings used in the HAZOP study are found in the Drawings Section of this report and are based upon the following P&IDs:

- BioConstruct P&IDs, "B201903 / A02 a", dated 07.06.19;
- Elster P&ID, "MMB-336441.02.BNEF.101.PI", dated 15.04.19;
- Elster P&ID, "MMB-336441.02.BNEF.102.PI", dated 15.04.19;
- Elster P&ID, "MMB-336441.02.LPG.101.PI", dated 15.04.19;
- Pentair P&ID, "195012.01.1.01, Revision 1", dated 25.04.2019; and,
- Flogas P&ID, "2078-1, Revision 1", dated 20.05.19;

2.0 Methodology

2.1 Introduction

Hazard and Operability (HAZOP) studies are structured and systematic examinations of processes or operations, used to identify and evaluate problems that may represent risks to personnel or equipment, or the operability of the process or operation. The intention of the HAZOP study is to identify risks, their potential causes and consequences, and the preventative or mitigation measures in place. Once these have been identified the HAZOP Team considers whether the preventative and mitigation measures are sufficient, or whether additional measures are required. If additional measures are believed to be required, the HAZOP Team identifies options available and allocates the consideration of those measures to team members.

2.2 Parameters and Guide Words

The HAZOP is undertaken by a multidisciplinary team led by a HAZOP Study Leader with the aid of a Scribe to note the discussions undertaken. The HAZOP Team considers the operation or process through the systematic study of the Process and Instrumentation Diagrams (P&IDs) of the process. The process is divided in to small sections, known as nodes, each node having a design intention.

The node is then studied using Guide Words and Parameters.

The Guide Words used during the HAZOP study were:

Table 2-1
Guide Words

| Guide Word | Meaning |
|-------------------|--|
| No | Complete negation of the design intent |
| High / More | Quantitative increase |
| Low / Less | Quantitative decrease |
| As Well As | Qualitative modification / increase |
| Part Of | Qualitative modification / decrease |
| Reverse | Logical opposite of the design intent |
| Other Than | Complete substitution |

The parameters used during the HAZOP study were:

Table 2-1
Parameters

| Parameter |
|------------------|
| Flow |
| Pressure |
| Temperature |
| Level |
| Reaction |
| Stirring |
| Viscosity |
| Mixing |

| Parameter |
|-------------|
| Start-up |
| Shut-down |
| Maintenance |
| Composition |
| Sequence |

The Guide Words and Parameters are combined to form a deviation which the team will consider. Examples combinations are identified in Table 2-3.

**Table 2-3
Deviations**

| Guide Word | Parameter | Deviation |
|------------|-------------|------------------|
| No | Flow | No Flow |
| More | Flow | More Flow |
| Less | Flow | Less Flow |
| High | Temperature | High Temperature |
| Low | Temperature | Low Temperature |
| Reverse | Flow | Reverse Flow |
| More | Stirring | More Stirring |

2.3 HAZOP Study Team

The HAZOP Study Team comprised

**Table 2-4
HAZOP Study Team**

| Team Member | Role | Company |
|------------------|----------------------------|-----------------------------|
| Simon Hemingway | Project Engineer | BioConstruct New Energy |
| Martin Swift | Engineer | D&G |
| Paul Foxtton | CDM Advisor | SRC |
| Charlie Jones | Apprentice | SRC |
| Gary Marshall | Client's Representative | SRC |
| Albert Ogundipe | Asset Manager | SGN |
| Steven Whitlock | Asset Distribution Manager | SGN |
| Shaun Stephenson | Gas Quality Engineer | SGN |
| Russ Harley | Project Manager | Elster |
| Janice Grant | HAZOP Scribe | Scotia Scribe |
| Rónan M Doyle | HAZOP Study Leader | RMD Consulting Engineer Ltd |

2.4 Nodes Considered

The nodes considered during the HAZOP of the week of 3rd June 2019 were:

- Node 1 – The GUU;
- Node 2 – The GEU;
- Node 3 – The Reject System; and
- Node 4 – The Propane System.

The HAZOP Study Sheets can be found in Appendix A, and the HAZOP Action Sheets can be found in Appendix B.

3.0 Closure

The HAZOP findings are presented in the HAZOP recording sheets presented in Appendix A, and the actions recorded are identified in Appendix B. There were no findings that would present any significant safety or operability hazards within the design, as reviewed through the HAZOP.

This document considered the design as presented over the week of 3rd June. If there are any significant changes to the design, those changes should undergo hazard assessment, and be considered under a change management process.

APPENDIX A –

HAZOP Sheets

| | | | |
|--------------|---|-----------------|---|
| Project: | RMD-02-006 Blaise Interface HAZOP | Date of meeting | 09/07/2019 |
| Item: | | Members present | Simon Hemmingway, Paul Foxton, Charlie Jones, Martin Swift, Gary Marshall, Albert Ogundipe, Steven Whitlock, Shaun Stephenson, Russ Harley, Janice Grant, Rónan Doyle |
| Notes: | | | |
| Drawing Ref: | B201903 / A02 a, MMB-336441.02.BNEF.101.PI, 195012.01.1.01 | | |
| Node: | 1 | | |
| Title | The GUU | | |
| Desc: | The provision of Biogas to the Gas upgrade Unit and biomethane to the Grid Entry Unit | | |

| ID/No. | Deviation | | No. | Possible Causes | Consequence | Safeguards | No. | Actions Required | Action Allocated to |
|--------|----------------|-----------|-------|--|--|--|---------|---|----------------------------|
| | Guide word | Parameter | | | | | | | |
| 1.1 | No | Flow | 1.1.1 | No flow into the BUU Poor biogas quality | <ul style="list-style-type: none"> Poor gas quality to Pentair unit potential for out of spec biomethane failure of GSMR specifications reject from GEU | <ul style="list-style-type: none"> Biogas analysis within AD facility will identify out of spec biogas feed to Pentair and will prevent feed to BUU - Pentair take BioConstruct signals and determine biogas quality Methane measurement within Pentair unit to ensure correct quality feed to GEU | | | |
| | | | 1.1.2 | Manual valve GT5G Y300 closed when should be open normally open operator / commissioning / maintenance error | <ul style="list-style-type: none"> Valve shut prior to start-up of Pentair unit results in low flow signal and inability to start the Pentair unit Valve closed during operation potential catastrophic failure of compressors increased fire and explosion risk | <ul style="list-style-type: none"> Operator training Pre-commissioning and post maintenance checks Secure site Low pressure alarm shuts down Pentair unit compressors Overpressure relief within Pentair unit through PSV-2802-01 (14barg) | | | |
| 1.2 | No | Flow | 1.2.1 | No flow to GEU | <ul style="list-style-type: none"> No flow of biomethane to the GEU - no injection to grid inefficient operation Potential overpressure of BUU, increased fire and explosion risk | <ul style="list-style-type: none"> Operator training Pre-commissioning and post maintenance checks Overpressure relief within the BUU Alarm signals from the BUU ROV will stay open Ability to interrogate the Pentair through the BioConstruct dial in system | | | |
| | | | 1.2.2 | Manual valve GT6G Y300 closed when should be open normally open operator / maintenance / commissioning error | | | | | |
| 1.3 | General Action | | | | | | 1.3.2.1 | Ensure design of pipework between BUU and GUU is corrects | DNG, Elster & BioConstruct |
| 1.4 | More | Pressure | 1.4.1 | High inlet pressure from BUU | <ul style="list-style-type: none"> Potential overpressure of GUU - increased fire and explosion risk | <ul style="list-style-type: none"> GEU pipework and system designed to 16 bar pressure Interconnecting pipework between BEU and GEU designed to 16 bar pressure Overpressure relief in BUU 14bar Pressure regulator PCV-2904-01 regulates inlet pressure to GEU to approximately 7.5 - 8.5barg | | | |
| 1.5 | No | Signal | 1.5.1 | Loss of signal from BUU to GEU | <ul style="list-style-type: none"> Loss of signal will result in shutdown of GEU if operational if not operational GEU sits in readiness | <ul style="list-style-type: none"> Reciprocal watch dog on signals which will alarm on loss of signal Shutdown of GEU will result in controlled shutdown of BEU | | | |
| | | | 1.5.2 | Loss of signal from GEU to BUU | <ul style="list-style-type: none"> Loss of signal will result in controlled shutdown of BEU resulting in controlled shutdown of GEU | <ul style="list-style-type: none"> Reciprocal watch dog on signals which will alarm on loss of signal Shutdown of BEU will result in controlled shutdown of GEU | | | |

| | | | |
|--------------|---|-----------------|---|
| Project: | RMD-02-006 Blaise Interface HAZOP | Date of meeting | 09/07/2019 |
| Item: | | Members present | Simon Hemmingway, Paul Foxton, Charlie Jones, Martin Swift, Gary Marshall, Albert Ogundipe, Steven Whitlock, Shaun Stephenson, Russ Harley, Janice Grant, Rónan Doyle |
| Notes: | | | |
| Drawing Ref: | B201903 / A02 a, MMB-336441.02.BNEF.101.PI, MMB-336441.02.BNEF.102.PI | | |
| Node: | 2 | | |
| Title | The GEU | | |
| Desc: | The provision of biomethane from the Grid Entry Unit to the Grid | | |

| ID/No. | Deviation | | No. | Possible Causes | Consequence | Safeguards | No. | Actions Required | Action Allocated to |
|--------|------------|-----------|-------|---|--|--|-----|------------------|---------------------|
| | Guide word | Parameter | | | | | | | |
| 2.1 | No | Flow | 2.1.1 | Poor biomethane quality | <ul style="list-style-type: none"> The Elster unit goes to reject to flare - 20 minute reject to allow gas quality to improve, inefficient operation | <ul style="list-style-type: none"> Gas analysis in the AD facility to monitor gas quality fed to BUU BUU CH4 measurement to ensure correct purity fed to Elster unit Realtime monitoring of biomethane quality within Elster unit allows adjustment of propane to maintain CV OFGEM analyser on outlet measures full biomethane quality | | | |
| | | | 2.1.2 | The ROV is shut | <ul style="list-style-type: none"> The Elster unit will reject to flare After 20 minutes a "not available" signal sent to Elster to Pentair - Pentair unit shuts down and bleeds back to the AD biogas line to relieve pressure - approximately 2 hours gas storage buffer within the AD facility at normal operation Potential flaring of biogas | <ul style="list-style-type: none"> Poor gas quality (see 2.1.1) Loss of communications (see 2.1.3) | | | |
| | | | 2.1.3 | Loss of communications | <ul style="list-style-type: none"> Closure of ROV and reject to flare (see 2.1.1 & 2.1.2) | <ul style="list-style-type: none"> 2 methods of communication, satellite link and backup telephone line - 4 minute lag to allow either satellite link to be restored or telephone line communication to synchronise | | | |
| | | | 2.1.4 | Interference damage on grid | <ul style="list-style-type: none"> Inability to inject to grid requiring divert to flare If catastrophic damage to gas main ROV will operate and reject to flare from Elster unit | <ul style="list-style-type: none"> A valve chamber available to SGN engineers to allow fitting of a valve rider governor which can be fitted to facilitate pressure reduction | | | |
| | | | 2.1.5 | Loss of propane | <ul style="list-style-type: none"> Biomethane quality unable to meet CV target - unable to inject to grid (see 2.1.1) See Node 4 | <ul style="list-style-type: none"> See Node 4 See 2.1.1 | | | |
| | | | 2.1.6 | High inject differential pressure compared with grid pressure | <ul style="list-style-type: none"> Unlikely scenario | | | | |
| | | | 2.1.7 | No flow from BUU | <ul style="list-style-type: none"> Inability to inject to grid (see Node 1) | <ul style="list-style-type: none"> See Node 1 | | | |
| | | | 2.1.8 | Power failure (including lightning strike) | <ul style="list-style-type: none"> Unable to inject gas to grid thus reject to flare approximately 2 hours gas storage space in normal operation before requirement to reduce pressure through flaring | <ul style="list-style-type: none"> Battery pack capable of maintaining 8 hours instrument life for SGN RTU (remote telemetry unit) 2 hour battery pack for controlled shutdown of grid entry unit Battery pack for Coms and instrumentation within AD facility Automatic start-up of backup generator on AD facility to maintain critical plant and equipment including the flare Lightning risk assessment (see DSEAR assessment) | | | |

| ID/No. | Deviation | | No. | Possible Causes | Consequence | Safeguards | No. | Actions Required | Action Allocated to |
|--------|------------|-----------|--------|---|---|--|-----|------------------|---------------------|
| | Guide word | Parameter | | | | | | | |
| 2.1 | No | Flow | 2.1.9 | Failure of LGT (odour unit) | <ul style="list-style-type: none"> Potential to inject un-odorised gas into network - not GSMR compliant | <ul style="list-style-type: none"> Low level alarm on the odorant, alerts operator to refill - operator decants to onboard reserve tank and new bottle ordered for delivery(approximately 7-10 days minimum capacity within reserve tank) Flow meter measures odorant injection Measure odorant injection pump strokes and calculate flow - if pump strokes or flow measurement inconsistent then alarm and send to divert | | | |
| | | | 2.1.10 | Biomethane temperature outside specified range in NEA (0-20 degrees maximum) On start-up high or low ambient temperature Failure of Pentair chiller | <ul style="list-style-type: none"> Inability to inject to grid - divert to flare Potential damage to gas main | <ul style="list-style-type: none"> Temperature measurement within Elster unit TT1023 ensures high temperature or low temperature biomethane is diverted Temperature measurement from TT1140 ensures temperature to grid within specification and diverts when outwith specification 10 minute period granted by SGN on start-up to allow temperature to fall within range | | | |
| | | | 2.1.11 | Compressed air failure | <ul style="list-style-type: none"> Inability to operate valves - potential unsafe scenarios, increased fire and explosion risk | <ul style="list-style-type: none"> Compressor reservoir allows sufficient capacity to shutdown plant in a controlled manor Valve to reject fails open ROV and gas to grid valve fail closed Propane valve fails closed Low pressure switch in Pentair compressor alarms Potential to connect to BioConstruct compressed air system if required | | | |

| | | | |
|--------------|---|-----------------|---|
| Project: | RMD-02-006 Blaise Interface HAZOP | Date of meeting | 09/07/2019 |
| Item: | | Members present | Simon Hemmingway, Paul Foxton, Charlie Jones, Martin Swift, Gary Marshall, Albert Ogundipe, Steven Whitlock, Shaun Stephenson, Russ Harley, Janice Grant, Rónan Doyle |
| Notes: | RMD to include flare from AD facility | | |
| Drawing Ref: | B201903 / A02 a, MMB-336441.02.BNEF.101.PI | | |
| Node: | 3 | | |
| Title | Reject System | | |
| Desc: | The reject of biomethane from the GEU to the flare and flaring from the AD facility | | |

| ID/No. | Deviation | | No. | Possible Causes | Consequence | Safeguards | No. | Actions Required | Action Allocated to |
|--------|----------------|-------------|-------|---|---|--|---------|---|---------------------|
| | Guide word | Parameter | | | | | | | |
| 3.1 | As Well As | Flow | 3.1.1 | Requirement to flare from both GEU reject as well as biogas plant | • Inability to burn biomethane and biogas at same time - potential to over-pressurise the biogas system, increased fire and explosion risk, overpressure potential within GEU and BUU increased fire and explosion risk | | | | |
| 3.2 | General Action | | | | | | 3.2.1.1 | Remove pressure regulating valve GV6G Y301 due to Elster unit having PRV 1074 | BioConstruct |
| 3.3 | General Action | | | | | | 3.3.1.1 | To install a motorised valve in the reject line to fermenter 2 | BioConstruct |
| 3.4 | General Action | | | | | | 3.4.1.1 | Prioritise reject to flare over reject to fermenter 2 from GEU and prioritise reject from GEU over flaring from the AD plant | BioConstruct |
| 3.5 | More | Pressure | 3.5.1 | Motorised valve PBV2 / PBV0 not opening quick enough | • Potential to over-pressurise GEU increased fire and explosion risk | • Slamshut valve SSV3003 and integral safety shutoff within regular valve PRV1074 protects pipeline | | | |
| 3.6 | No | Flow | 3.6.1 | No flow of biomethane to flare - failure of internal motorised valves within flare or manual valve GV1G Y301 (operator / maintenance / commissioning error) | • Inability to flare biomethane potential increased fire and explosion risk | • Operator training • Regular maintenance and inspection • Pre-commissioning and post maintenance checks | 3.6.1.1 | On inability to flare biomethane for any reason ensure motorised valve to be installed on reject to fermenter 2 will open rapidly | BioConstruct |
| 3.7 | General Action | | | | | | 3.7.1.1 | If the flare does not ignite and "goes to dump" ensure that reject to fermenter 2 can occur rapidly | BioConstruct |
| 3.8 | More | Composition | 3.8.1 | Reject of enriched biomethane to fermenter 2 | • Enriched biogas within biogas system - potential for CHP failure • Potential for over enriched feed to the Pentair unit - constant reject • Potential over enriched biogas to flare - potential damage to flare or inability to flare | • Maximum time for reject before shut down signal occurs is 20 minutes • Biogas quality (methane concentration) agreed for feed to Pentair unit | | | |

| | | | |
|--------------|---|-----------------|--|
| Project: | RMD-02-006 Blaise Interface HAZOP | Date of meeting | 09/07/2019 |
| Item: | | Members present | Simon Hemmingway, Paul Foxtton, Charlie Jones, Martin Swift, Gary Marshall, Albert Ogundipe, Steven Whitlock, Shaun Stephenson, Russ Harley, Janice Grant, Rónan Doyle |
| Notes: | | | |
| Drawing Ref: | B201903 / A02 a, 2078-1, MMB-336441.02.LPG.101.PI | | |
| Node: | 4 | | |
| Title | The propane system | | |
| Desc: | The provision of propane to the GEU | | |

| ID/No. | Deviation | | No. | Possible Causes | Consequence | Safeguards | No. | Actions Required | Action Allocated to |
|--------|----------------|-------------|-------|--|---|--|---------|---|---------------------|
| | Guide word | Parameter | | | | | | | |
| 4.1 | General Action | | | | | | 4.1.0.1 | Install manual isolation valve on propane inlet to GEU | Flogas |
| 4.2 | More | Flow | 4.2.1 | Failure of spillback valve LV3008 | • Increase in pressure in propane line - increased fire and explosion risk | • Overpressure relief within Flogas system and GEU | | | |
| 4.3 | No | Flow | 4.3.1 | Failure of duty propane pump electrical mechanical failure | • Unable to propanate the biomethane resulting in reject | • Automatic start-up of standby pump on reduced pressure - on pump failure due to electrical failure there is a pump error signal. On low pressure if low pressure continues once standby pump operational both pumps will be shut-down an alarm signal is raised • Regular maintenance and inspection • Operator training | | | |
| | | | 4.3.2 | Manual valve LV 3014 /3017 closed when should be open normally open operator / commissioning / maintenance error | • Unable to propanate the biomethane resulting in reject | • Operator training • Pre-commissioning and post maintenance checks • Propane storage within separate secured compound | | | |
| 4.4 | Less | Temperature | 4.4.1 | Vaporiser malfunction electrical failure | • Inability to blend propane - failure to meet GSMR quality standards, biomethane to reject | • Regular maintenance and inspection • Alarms on the electrical breaker • Low temperature alarm on water and propane exit • Automatic valves 1 & 3 are closed until correct temperature achieved | | | |
| 4.5 | No | Flow | 4.5.1 | Tank runs dry | • Inability to blend propane - failure to meet GSMR quality standards, biomethane to reject | • Low flow alarm will shut-down GEU • Propane supply contract ensuring weekly top up of tanks • Level indication and telemetry on propane tanks will automatically trigger a delivery at 1/3 volume | | | |
| | | | 4.5.2 | Fractured propane line external to the GEU | • Loss of containment of propane and increased fire and explosion risk | • Low pressure alarm within GEU stops propane pumps | | | |
| | | | 4.5.3 | Propane line fracture within GEU | • Loss of containment of propane and increased fire and explosion risk | • Propane detection within GEU raises alarm • GEU rated ATEX zone 1 | | | |
| 4.6 | General Action | | | | | | 4.6.3.1 | Flogas to provide SRCPM with fire precaution requirements | Flogas |

APPENDIX B –

HAZOP Action Sheets

| | | | |
|--------------|---|-----------------|---|
| Project: | RMD-02-006 Blaise Interface HAZOP | Date of meeting | 09/07/2019 |
| Item: | | Members present | Simon Hemmingway, Paul Foxton, Charlie Jones, Martin Swift, Gary Marshall, Albert Ogundipe, Steven Whitlock, Shaun Stephenson, Russ Harley, Janice Grant, Rónan Doyle |
| Notes: | | | |
| Drawing Ref: | B201903 / A02 a, MMB-336441.02.BNEF.101.PI, 195012.01.1.01 | | |
| Node: | 1 | | |
| Title | The GUU | | |
| Desc: | The provision of Biogas to the Gas upgrade Unit and biomethane to the Grid Entry Unit | | |

| ID/No. | Deviation | No. | Possible Causes | Consequence | Safeguards | No. | Actions Required | Action Allocated to | Action Complete | Validation |
|--------|----------------|-----|-----------------|-------------|------------|---------|---|----------------------------|-----------------|------------|
| 1.3 | General Action | | | | | 1.3.2.1 | Ensure design of pipework between BUU and GUU is corrects | DNG, Elster & BioConstruct | | |

| | | | |
|--------------|---|-----------------|---|
| Project: | RMD-02-006 Blaise Interface HAZOP | Date of meeting | 09/07/2019 |
| Item: | | Members present | Simon Hemmingway, Paul Foxton, Charlie Jones, Martin Swift, Gary Marshall, Albert Ogundipe, Steven Whitlock, Shaun Stephenson, Russ Harley, Janice Grant, Rónan Doyle |
| Notes: | No actions identified in this node | | |
| Drawing Ref: | B201903 / A02 a, MMB-336441.02.BNEF.101.PI, MMB-336441.02.BNEF.102.PI | | |
| Node: | 2 | | |
| Title | The GEU | | |
| Desc: | The provision of biomethane from the Grid Entry Unit to the Grid | | |

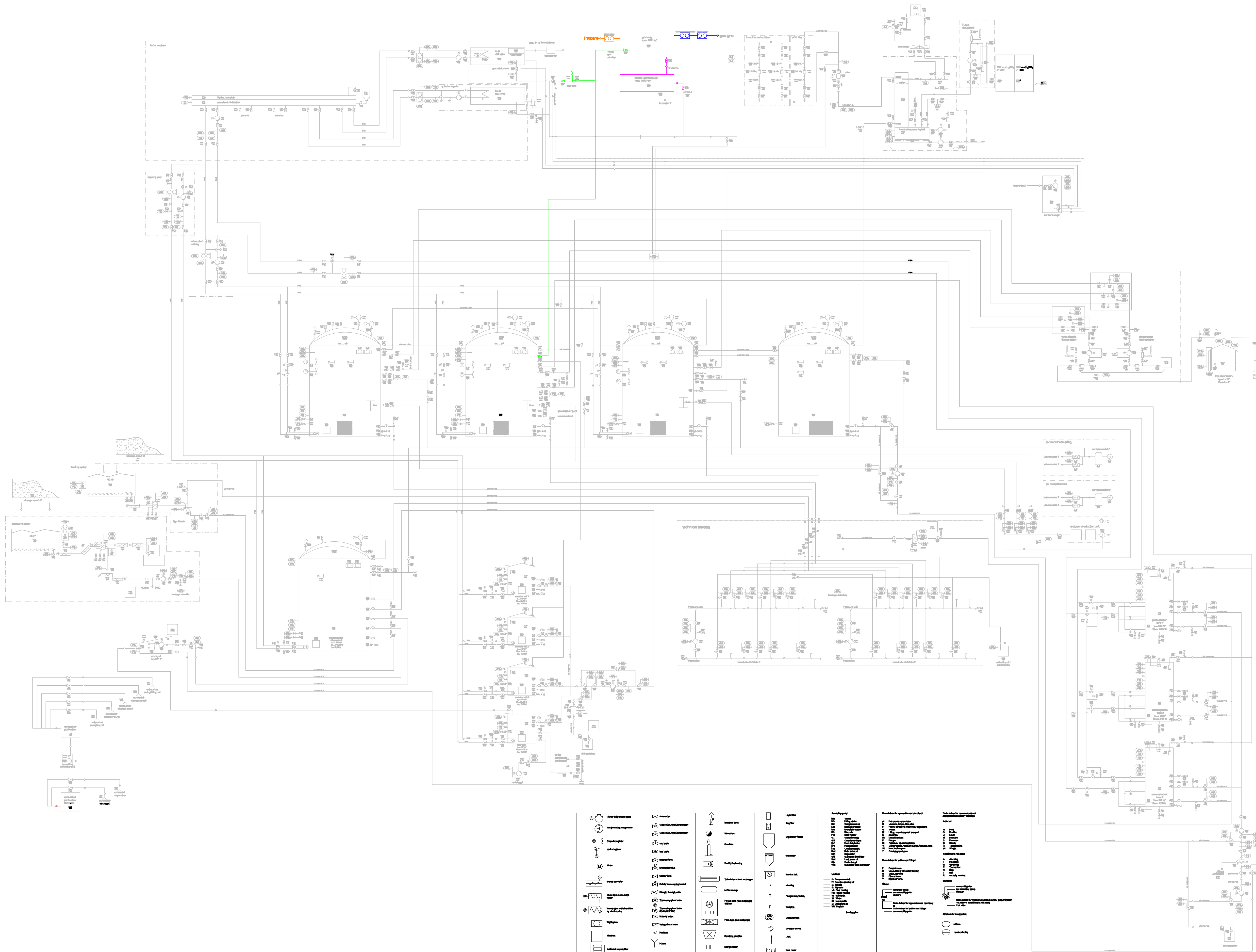
| | | | |
|--------------|---|-----------------|--|
| Project: | RMD-02-006 Blaise Interface HAZOP | Date of meeting | 09/07/2019 |
| Item: | | Members present | Simon Hemmingway, Paul Foxtton, Charlie Jones, Martin Swift, Gary Marshall, Albert Ogundipe, Steven Whitlock, Shaun Stephenson, Russ Harley, Janice Grant, Rónan Doyle |
| Notes: | RMD to include flare from AD facility | | |
| Drawing Ref: | B201903 / A02 a, MMB-336441.02.BNEF.101.PI | | |
| Node: | 3 | | |
| Title | Reject System | | |
| Desc: | The reject of biomethane from the GEU to the flare and flaring from the AD facility | | |

| ID/No. | Deviation | | No. | Possible Causes | Consequence | Safeguards | No. | Actions Required | Action Allocated to | Action Complete | Validation |
|--------|----------------|------|-------|---|---|--|---------|---|---------------------|-----------------|------------|
| 3.2 | General Action | | | | | | 3.2.1.1 | Remove pressure regulating valve GV6G Y301 due to Elster unit having PRV 1074 | BioConstruct | | |
| 3.3 | General Action | | | | | | 3.3.1.1 | To install a motorised valve in the reject line to fermenter 2 | BioConstruct | | |
| 3.4 | General Action | | | | | | 3.4.1.1 | Prioritise reject to flare over reject to fermenter 2 from GEU and prioritise reject from GEU over flaring from the AD plant | BioConstruct | | |
| 3.6 | No | Flow | 3.6.1 | No flow of biomethane to flare - failure of internal motorised valves within flare or manual valve GV1G Y301 (operator / maintenance / commissioning error) | • Inability to flare biomethane potential increased fire and explosion risk | • Operator training • Regular maintenance and inspection • Pre-commissioning and post maintenance checks | 3.6.1.1 | On inability to flare biomethane for any reason ensure motorised valve to be installed on reject to fermenter 2 will open rapidly | BioConstruct | | |
| 3.7 | General Action | | | | | | 3.7.1.1 | If the flare does not ignite and "goes to dump" ensure that reject to fermenter 2 can occur rapidly | BioConstruct | | |

| | | | |
|--------------|---|-----------------|--|
| Project: | RMD-02-006 Blaise Interface HAZOP | Date of meeting | 09/07/2019 |
| Item: | | Members present | Simon Hemmingway, Paul Foxtton, Charlie Jones, Martin Swift, Gary Marshall, Albert Ogundipe, Steven Whitlock, Shaun Stephenson, Russ Harley, Janice Grant, Rónan Doyle |
| Notes: | | | |
| Drawing Ref: | B201903 / A02 a, 2078-1, MMB-336441.02.LPG.101.PI | | |
| Node: | 4 | | |
| Title | The propane system | | |
| Desc: | The provision of propane to the GEU | | |

| ID/No. | Deviation | | No. | Possible Causes | Consequence | Safeguards | No. | Actions Required | Action Allocated to | Action Complete | Validation |
|--------|----------------|--|-----|-----------------|-------------|------------|---------|---|---------------------|-----------------|------------|
| 4.1 | General Action | | | | | | 4.1.0.1 | Install manual isolation valve on propane inlet to GEU | Flogas | | |
| 4.6 | General Action | | | | | | 4.6.3.1 | Flogas to provide SRCPM with fire precaution requirements | Flogas | | |

All valves capped!



Node 1 —
Node 2 —
Node 3 —
Node 4 —



| | |
|---|--|
| building owner: Blaise Farm Quarry Ashton Way West Mallin ME19 4PN | plan drafter: BioConstruct GmbH Wellingstraße 66 D-49328 Melle Tel.: +49 (0)5226 / 5932-0 Fax: +49 (0)5226 / 5932-11 |
|---|--|

place: ...

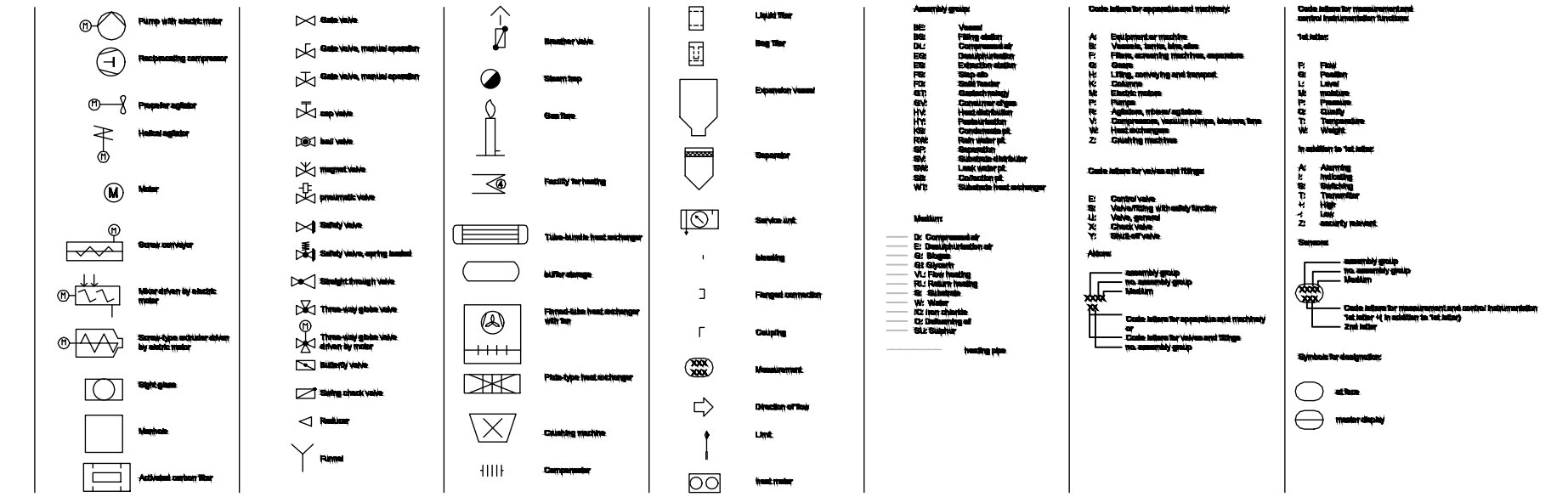
Construction of a biogas plant Blaise Farm

P&I diagram

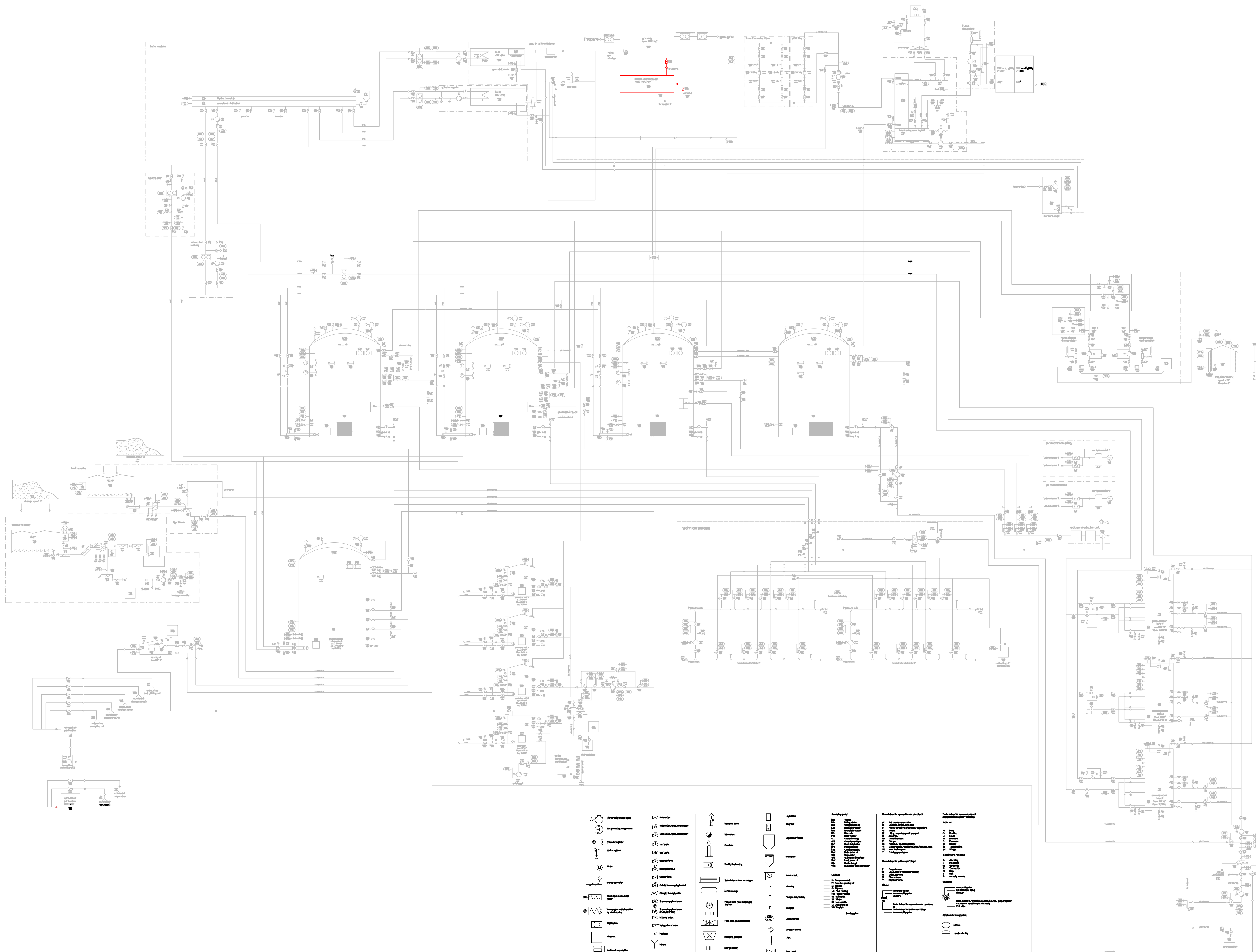
filename:
P&I-diagram_Blaise Farm_WS_190626.dwg

| | | |
|---|--------------------|-----------------------------|
| project-nr. / plan-nr.: B201903 / A02 a | scale: % | plan size: DIN A0 |
|---|--------------------|-----------------------------|

| designed: | date: | name: |
|-----------|-------------------|------------|
| | 15.05.19 | W.Seilmann |
| changed: | date: | name: |
| | | |
| nr. | kind of change: | date: |
| a | heat pipe changed | 07.06.19 |
| | | |
| | | |
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| | | |
| | | |
| | | |



All valves capped!



Node 1 —



| | |
|--|---|
| building owner: Blaise Farm Quarry Ashton Way West Malling ME19 4PN | plan drafter: BioConstruct GmbH Wellingsstraße 66 D-49328 Melle Tel.: +49 (0)5226 / 5932-0 Fax: +49 (0)5226 / 5932-11 |
|--|---|

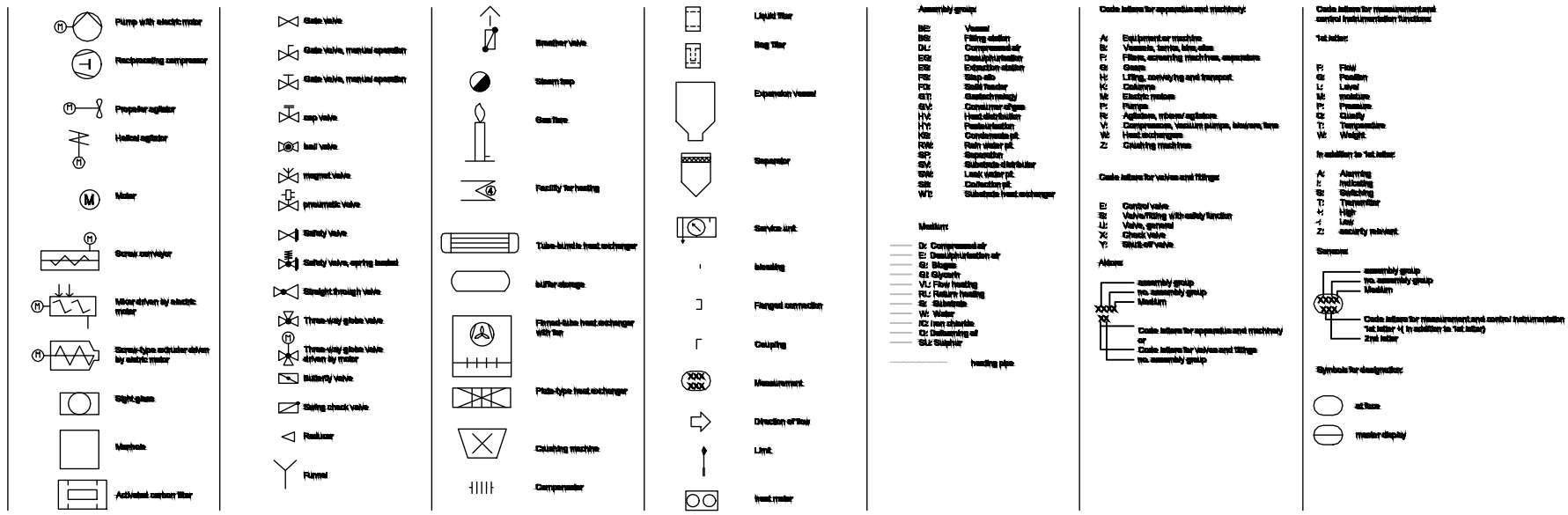
place: ...

Construction of a biogas plant Blaise Farm

P&I diagram

| | | |
|---|--------------------|-----------------------------|
| filename: P&I-diagram_Blaise Farm_WS_190626.dwg | scale: % | plan size: DIN A0 |
|---|--------------------|-----------------------------|

| designated: | date: | name: |
|----------------------------|----------|------------|
| | 15.05.19 | W.Seilmann |
| changed: | date: | name: |
| a heat pipe changed | 07.06.19 | W.Seilmann |
| | | |
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NOTE:
UNLESS SPECIFIED OTHERWISE ALL VENTS TO TERMINATE
IN 1/2" OD AND FITTED WITH SUITABLE VENT CAP.

THIRD ANGLE PROJECTION

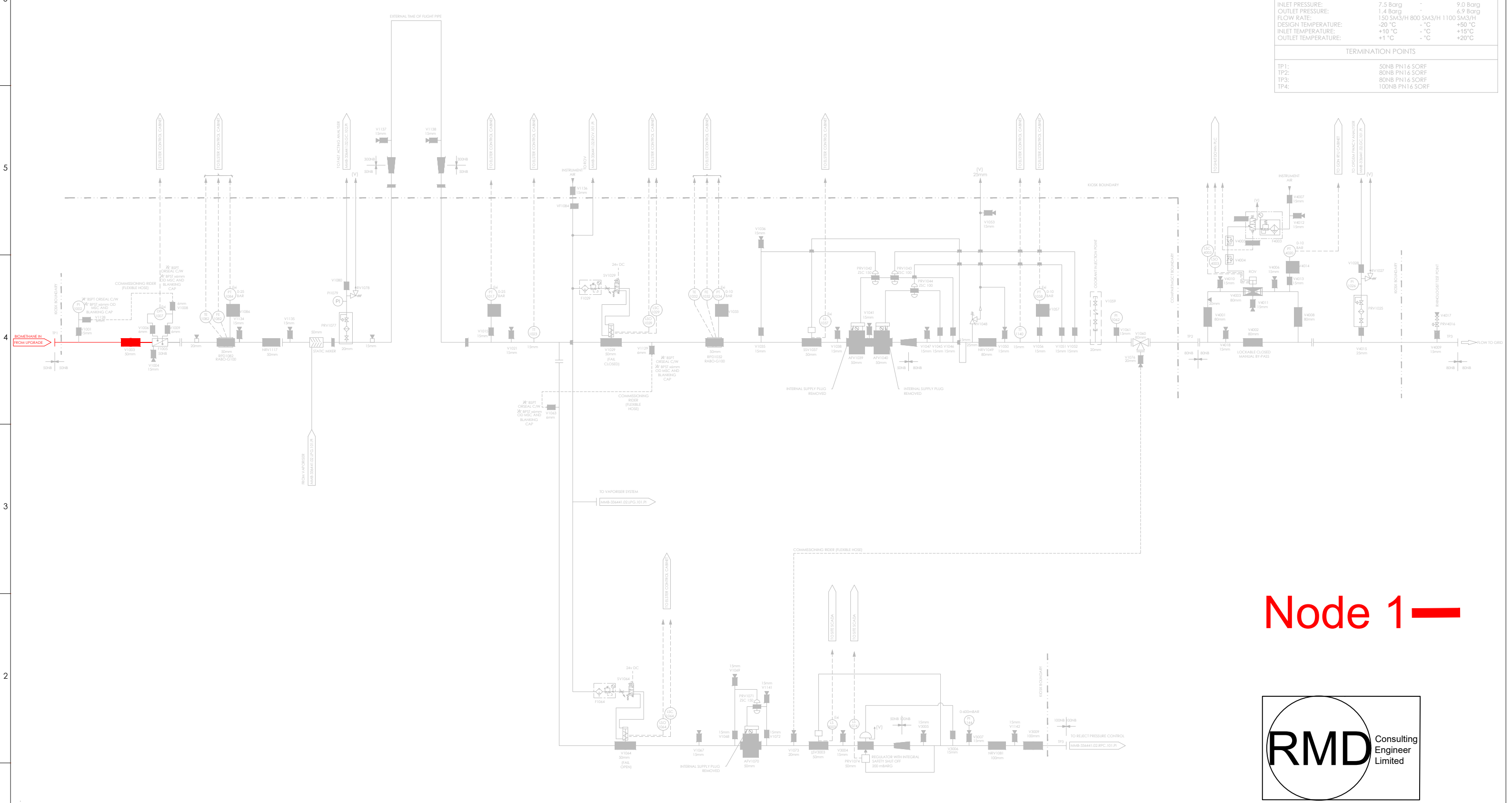


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| DESIGN & CONSTRUCTION | |
|-----------------------|---|
| OPERATING CONDITIONS | |
| DESIGN PRESSURE: | 1.6 Barg |
| INLET PRESSURE: | MINIMUM 7.5 Barg NORMAL MAXIMUM 9.0 Barg |
| OUTLET PRESSURE: | 1.4 Barg 6.9 Barg |
| FLOW RATE: | 150 SM3/H 800 SM3/H 1100 SM3/H |
| DESIGN TEMPERATURE: | -20 °C - °C +50 °C |
| INLET TEMPERATURE: | +10 °C - °C +15 °C |
| OUTLET TEMPERATURE: | +1 °C - °C +20 °C |
| TERMINATION POINTS | |
| TP1: | 50NB PN16 SORF |
| TP2: | 80NB PN16 SORF |
| TP3: | 80NB PN16 SORF |
| TP4: | 100NB PN16 SORF |



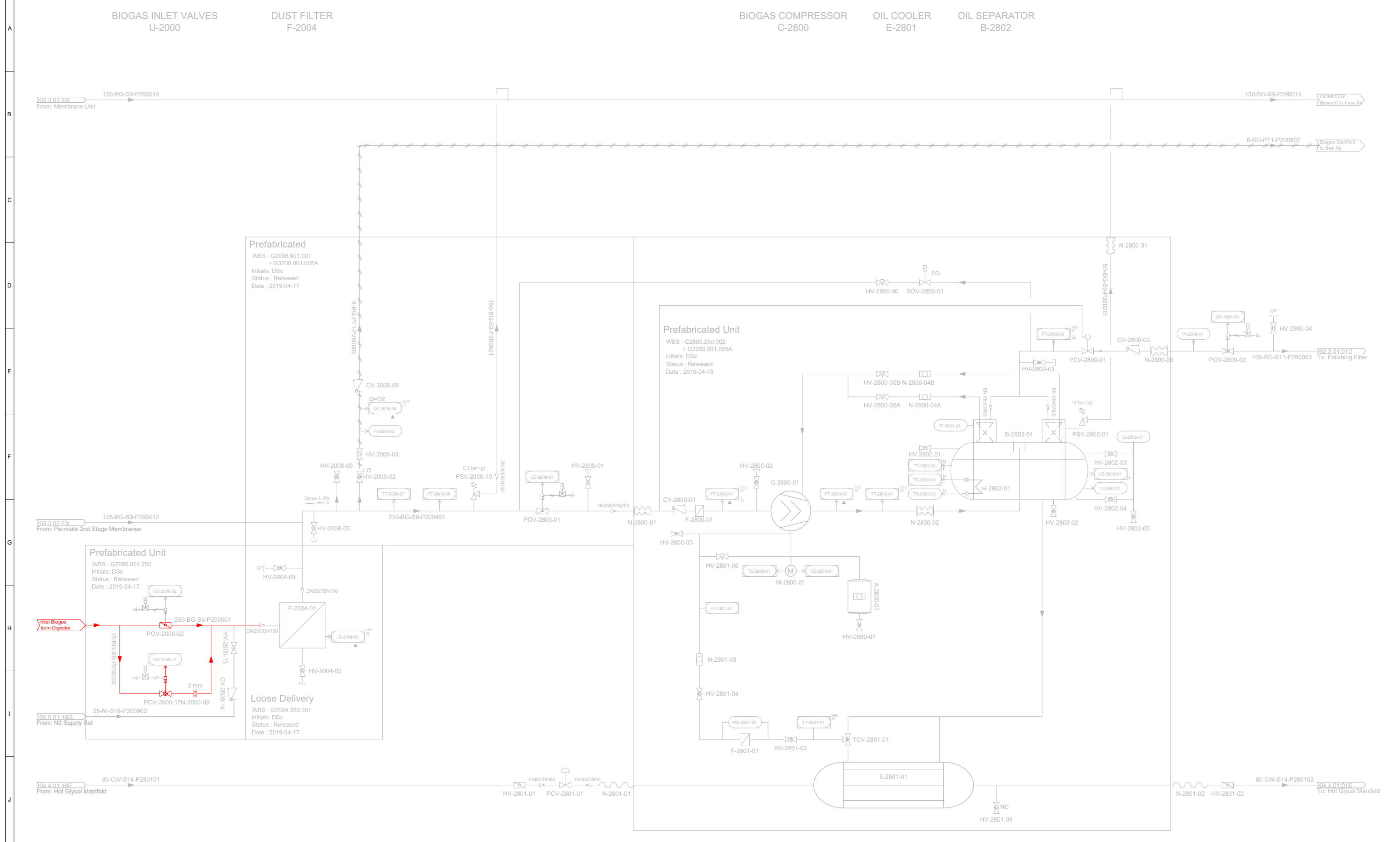
Node 1



| | | | | | | |
|-----|-------|----------|------|------|----------|--------------|
| 7 | | | | | | |
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| 1 | | | | | | |
| 0 | JMC | 15.04.19 | AS | | 15.04.19 | RH |
| REV | DRAWN | DATE | CHKD | DATE | APPD | DATE |
| | | | | | | MODIFICATION |

| | |
|-----------------------------|--|
| TITLE | BLAISE BNEF PRESSURE REDUCTION & METERING SKID P&ID DRAWING |
| ELSTER STANDARD DESIGN REF: | N/A |
| CLIENT ORDER REF: | BLAISE FARM QUARRY |
| CLIENT: | BLAISE BIOGAS LTD |
| TOLERANCE: | N/A |

| | | | |
|------------------|--|----------|--------|
| | Elster Instramet - Elster Metering Ltd Mutual House Leicester Road Melton Mowbray Leicestershire, LE13 0DB United Kingdom Tel: +44 (0) 1664 567797 Fax: +44 (0) 1664 504199 Elsterksales.hps@honeywell.com www.elster-instromet.com | | |
| | SCALE | NTS @ A3 | |
| Project Doc Ref: | MMB-336441.02.BNEF.101.P1 | SHEET | 1 OF 1 |
| REV | | 0 | |



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Node 1



NOTE: Automatic Valves are normally closed (NC), unless noted otherwise.

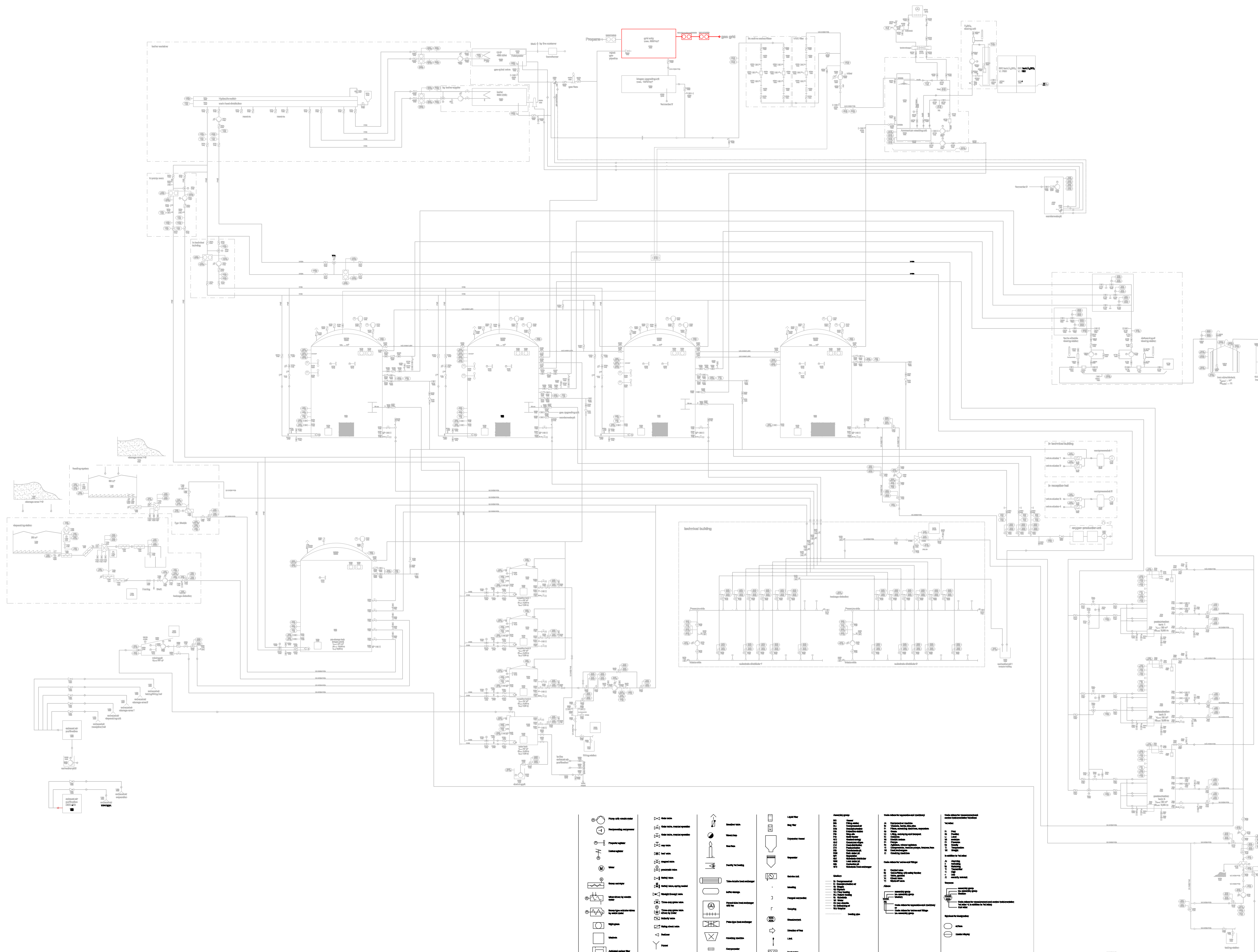
DRAFT

Union Engineering Supply
Customer Supply

| Insulation data | |
|---------------------------------|--|
| Cold pipe/walls (150°C W/C) | Insulation code C-30 |
| PU Foam: 10.023 W/m²K@20°C | Thickness [mm] 30 |
| Cold pipe/walls (40°C C/20°C) | Insulation code CA-19 |
| PU Foam: 10.035 W/m²K@20°C | Thickness [mm] 19 |
| Warm pipe/walls (30°C/200°C) | Insulation code W-30 |
| Mineral Wool: 10.030 W/m²K@20°C | Thickness [mm] 30 |
| TRG pipe/walls (200°C/200°C) | Insulation code H-30 |
| Mineral Wool: 10.035 W/m²K@20°C | Thickness [mm] 30 |
| Alu Jacket (Cladding) | Diameter <300 mm x 0.7 mm, Diameter >300 mm x 1 mm (Aluflake is not used with aluminium) |

| | | | | |
|----------------------------|-----------------|--------------|-----------------|--------------------------------|
| PENTAIR HAFFMANS | | Date | 04-04-2019 | Customer: Edit in project data |
| Eng. | Dave Schroemges | Project no.: | 195012 | Customer project no.: |
| Chk. | Dave Schroemges | Project: | West Malling | P&I Diagram |
| 1 RFD | | | | PID 01 |
| 0 P | | | | Drawing number: 195012.01.1.01 |
| 1 RFD | | | | Draw no. customer: - |
| 0 P | | | | |
| Rev. | Description | Date | Name | Rpl. for: - |
| 1 | | 04-04-2019 | Dave Schroemges | Rpl. by: - |

All valves capped!



Node 2



| | |
|---|--|
| building owner: Blaise Farm Quarry Ashton Way West Mallin ME19 4PN | plan drafter: BioConstruct GmbH Wellingstraße 66 D-49328 Melle Tel.: +49 (0)5226 / 5932-0 Fax: +49 (0)5226 / 5932-11 |
|---|--|

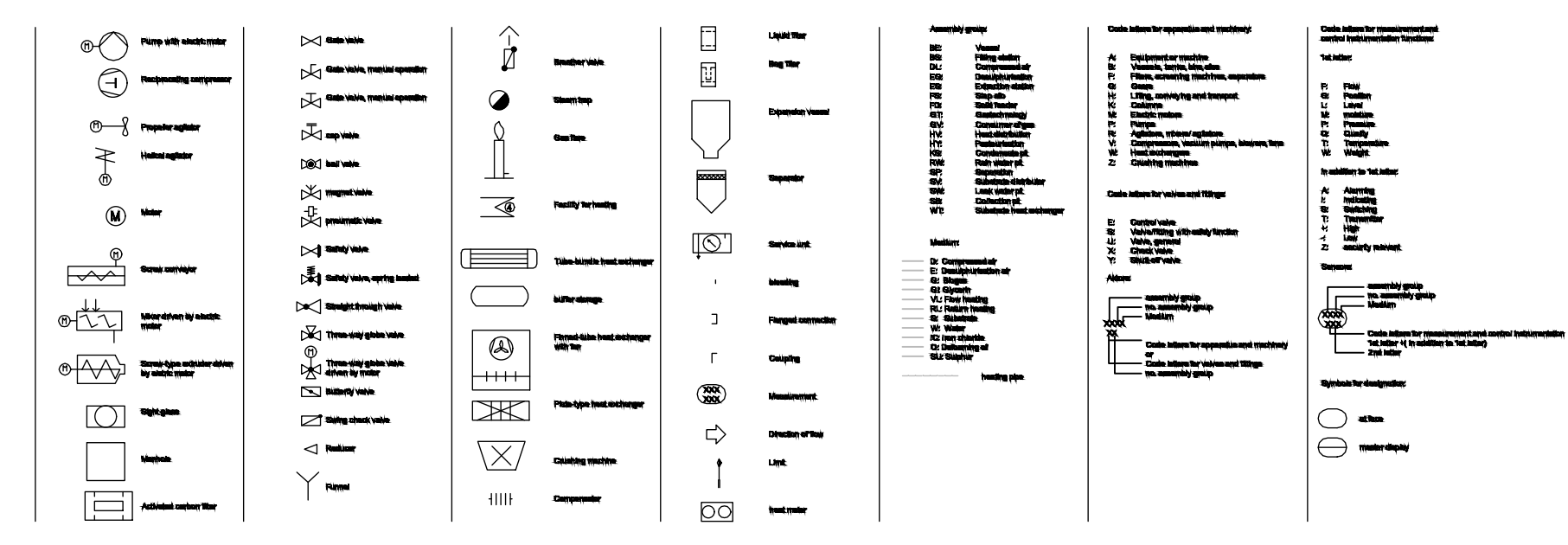
place: ...

Construction of a biogas plant Blaise Farm

P&I diagram

| | | | |
|---|---|--------------------|-----------------------------|
| filename: P&I-diagram_Blaise Farm_WS_190626.dwg | project-nr. / plan-nr.: B201903 / A02 a | scale: % | plan size: DIN A0 |
|---|---|--------------------|-----------------------------|

| designed: | date: | name: | |
|-----------|-------------------|------------|------------|
| | 15.05.19 | W.Seilmann | |
| changed: | date: | name: | |
| | | | |
| nr. | kind of change: | date: | name: |
| a | heat pipe changed | 07.06.19 | W.Seilmann |
| | | | |
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NOTE:
UNLESS SPECIFIED OTHERWISE ALL VENTS TO TERMINATE
IN 1/2" OD AND FITTED WITH SUITABLE VENT CAP.

THIRD ANGLE PROJECTION

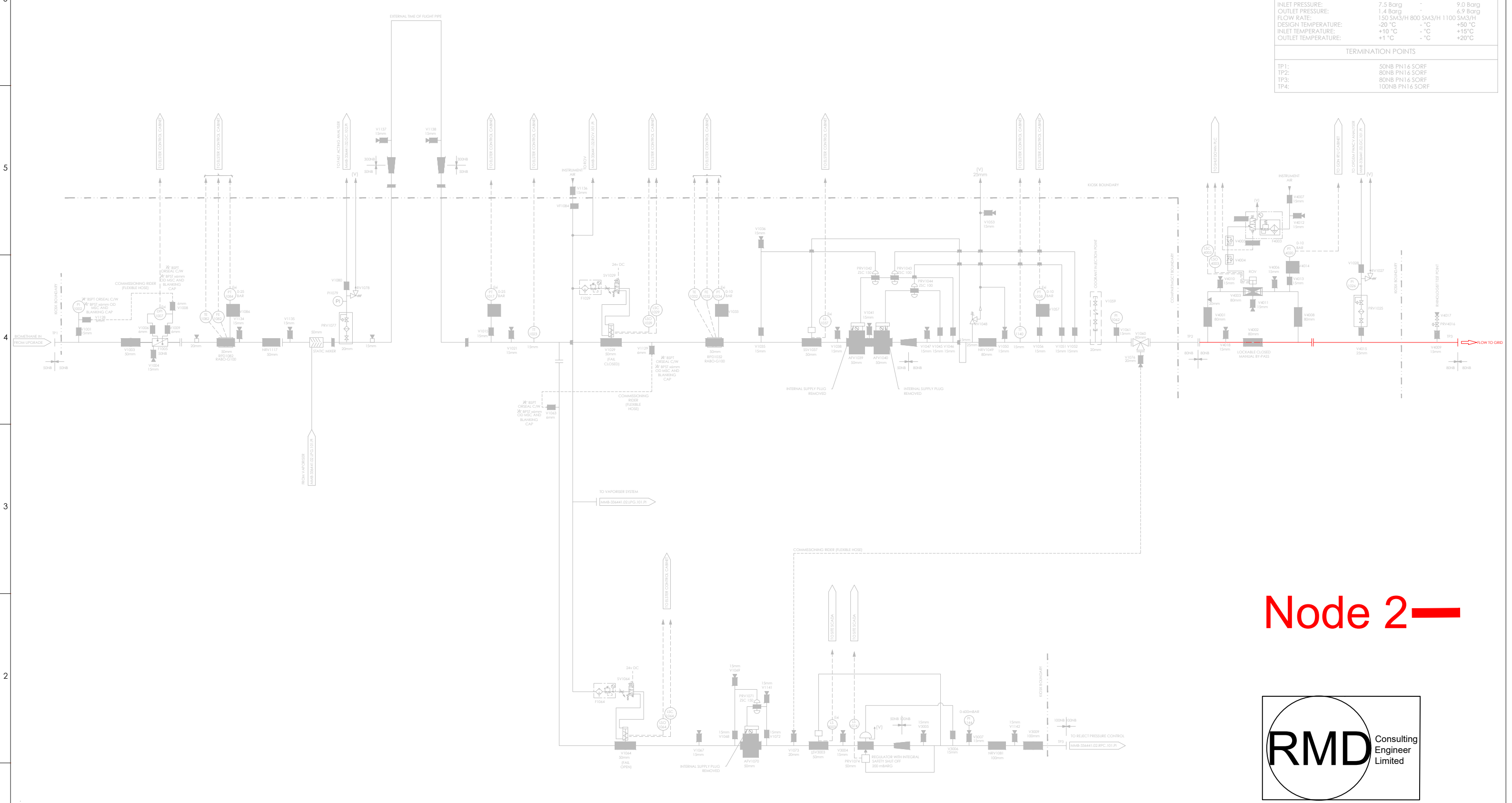


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| DESIGN & CONSTRUCTION | |
|-----------------------|--------------------------------|
| OPERATING CONDITIONS | |
| DESIGN PRESSURE: | 1.6 Barg |
| INLET PRESSURE: | 7.5 Barg |
| OUTLET PRESSURE: | 1.4 Barg |
| FLOW RATE: | 150 SM3/H 800 SM3/H 1100 SM3/H |
| DESIGN TEMPERATURE: | -20 °C |
| INLET TEMPERATURE: | +10 °C |
| OUTLET TEMPERATURE: | +1 °C |
| TERMINATION POINTS | |
| TP1: | 50NB PN16 SORF |
| TP2: | 80NB PN16 SORF |
| TP3: | 80NB PN16 SORF |
| TP4: | 100NB PN16 SORF |



Node 2



| | | | | | | | |
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| 1 | | | | | | | |
| 0 | JMC | 15.04.19 | AS | | 15.04.19 | RH | INITIAL ISSUE |
| REV | DRAWN | DATE | CHKD | DATE | APPD | DATE | MODIFICATION |

| | |
|-----------------------------|---|
| TITLE | BLAISE BNEF PRESSURE REDUCTION & METERING SKID P&ID DRAWING |
| ELSTER STANDARD DESIGN REF: | N/A |
| CLIENT ORDER REF: | BLAISE FARM QUARRY |
| CLIENT: | BLAISE BIOGAS LTD |
| TOLERANCE: | N/A |

| | | |
|------------------|--|--------------|
| | Elster Instramet - Elster Metering Ltd Mutual House Leicester Road Melton Mowbray Leicestershire, LE13 0DB United Kingdom Tel: +44 (0) 1664 567797 Fax: +44 (0) 1664 504199 Elsterksales.hps@honeywell.com www.elster-instromet.com | |
| | SCALE | NTS @ A3 |
| Project Doc Ref: | MMB-336441.02.BNEF.101.P1 | SHEET 1 OF 1 |

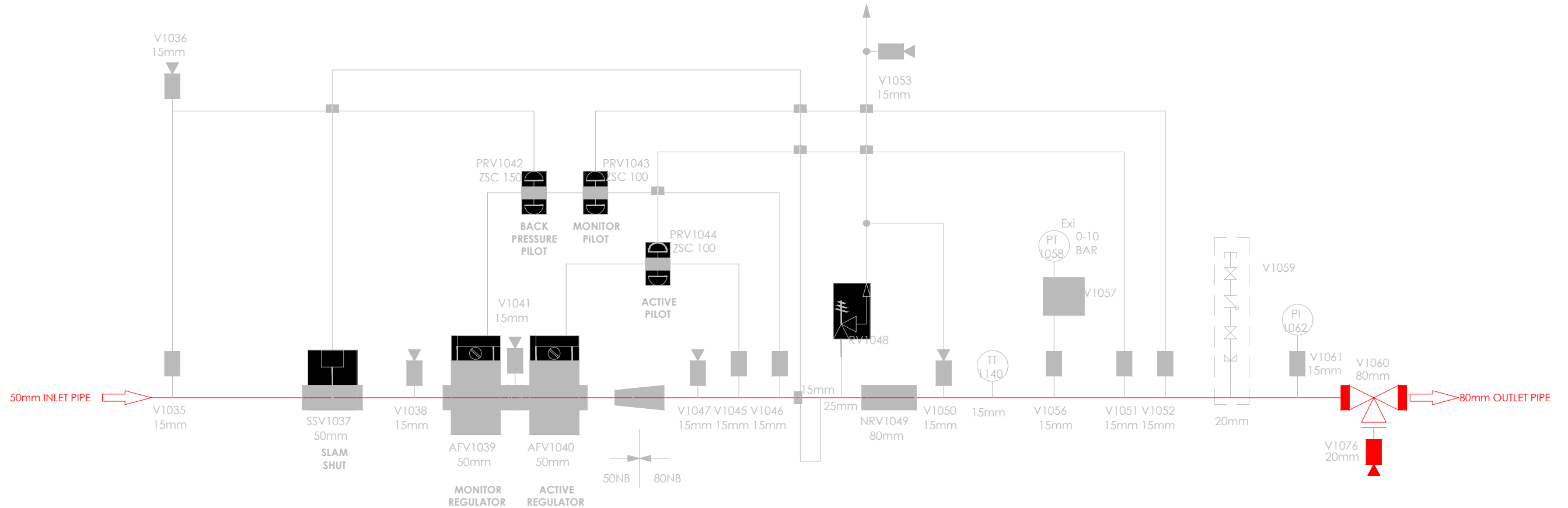
REV 0



| BNEF OPERATING PARAMETERS | | |
|---------------------------|-------------------------|--------------------------|
| | MINIMUM | MAXIMUM |
| INLET PRESSURE | 7.5 Barg | 9.0 Barg |
| OUTLET PRESSURE | 1.4 Barg | 6.9 Barg |
| FLOW RATE | 150 SM ³ /Hr | 1100 SM ³ /Hr |
| INLET TEMPERATURE | 10°C | 15°C |
| OUTLET TEMPERATURE | 1°C | 20°C |

| PRESSURE LIMITS | |
|-----------------|----------|
| ITEM | PRESSURE |
| MIP(u) | 16 BARG |
| MOP(u) | 9.0 BARG |
| MIP(d) | 8.4 BARG |
| MOP(d) | 7.0 BARG |

| SET PRESSURES | | | |
|---------------|------------|-----------|----------------|
| ITEM | TAG NUMBER | SET POINT | ACCURACY CLASS |
| SSV | SSV1037 | 8.2 BARG | 2.5% |
| RELIEF | RV1048 | 7.8 BARG | 5% |
| MONITOR | AFV1039 | 7.5 BARG | 5% |
| ACTIVE | AFV1040 | 7.0 BARG | 5% |



Node 2



| REV | DRAWN | DATE | CHKD | DATE | APPD | DATE | MODIFICATION |
|-----|-------|----------|------|----------|------|----------|---------------|
| 7 | | | | | | | |
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| 1 | | | | | | | |
| 0 | JMC | 15.04.19 | AS | 15.04.19 | RH | 15.04.19 | INITIAL ISSUE |

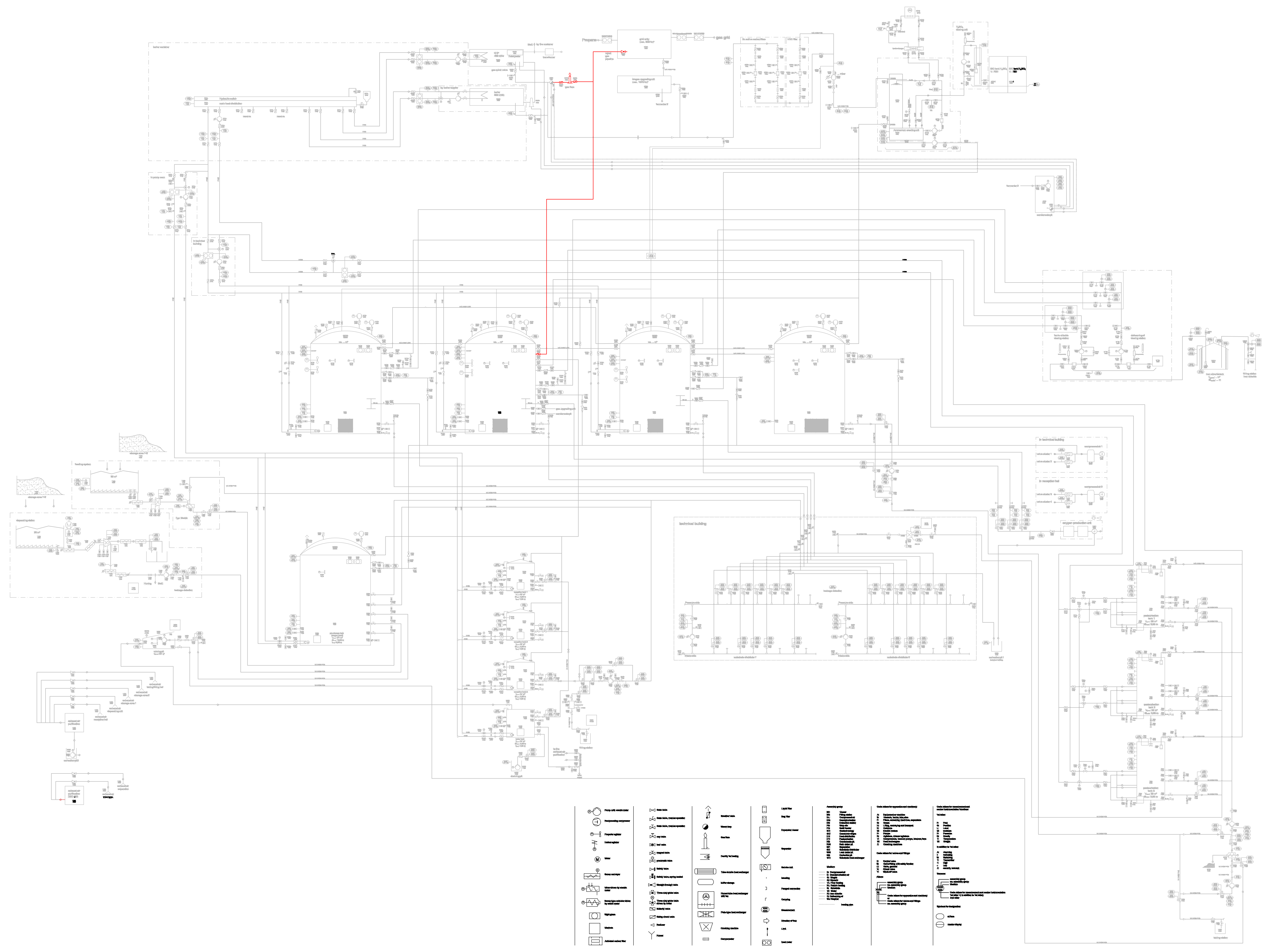
| | |
|-----------------------------|---|
| TITLE | BLAISE BNEF PRESSURE REDUCTION & METERING SKID P&ID DRAWING |
| ELSTER STANDARD DESIGN REF: | N/A |
| CLIENT ORDER REF: | BLAISE FARM QUARRY |
| CLIENT: | BLAISE BIOGAS LTD |
| TOLERANCE: | N/A |

Elster Instramet - Elster Metering Ltd
Mutual House
Leicester Road
Melton Mowbray
Leicestershire, LE13 0DB United Kingdom
Tel: +44 (0) 1664 567797
Fax: +44 (0) 1664 504199
Elsteruksales.hps@honeywell.com
www.elster-instromet.com

SCALE NTS @ A3 SHEET 1 OF 1

Project Doc Ref: MMB-336441.02.BNEF.102.PI

All valves capped!



Node 3



| | |
|---|--|
| building owner: Blaise Farm Quarry Ashton Way West Mallon ME19 4PN | plan drafter: BioConstruct GmbH Wellingstraße 66 D-49328 Melle Tel.: +49 (0)5226 / 5932-0 Fax: +49 (0)5226 / 5932-11 |
|---|--|

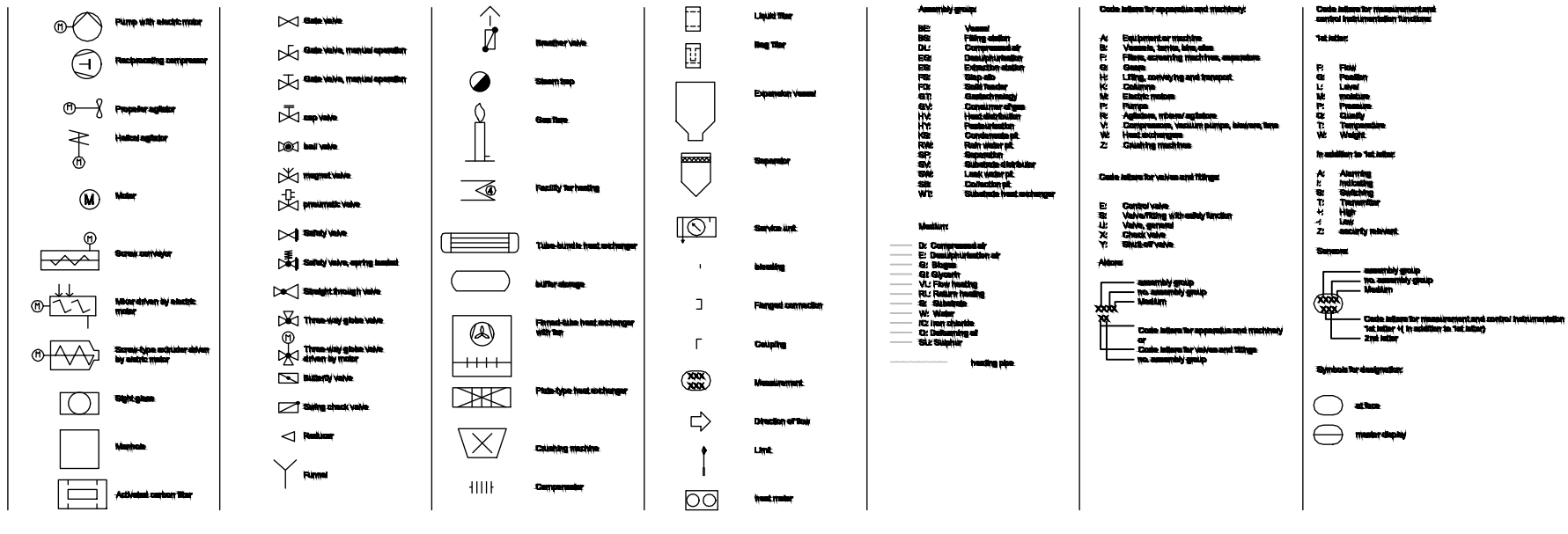
place: ...

**Construction of a biogas plant
Blaise Farm**

P&I diagram

| | | | |
|---|--------------------|-----------------------------|----------------------------|
| filename: P&I-diagram_Blaise Farm_WS_190626.dwg | | date: 15.05.19 | name: W.Seilmann |
| project-nr. / plan-nr.: B201903 / A02 a | scale: % | plan size: DIN A0 | |

| designated: | date: | name: |
|-------------|-------------------|---------------------|
| nr. | kind of change: | date: name: |
| a | heat pipe changed | 07.06.19 W.Seilmann |
| | | |
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NOTE:
UNLESS SPECIFIED OTHERWISE ALL VENTS TO TERMINATE
IN 1/2" OD AND FITTED WITH SUITABLE VENT CAP.

THIRD ANGLE PROJECTION

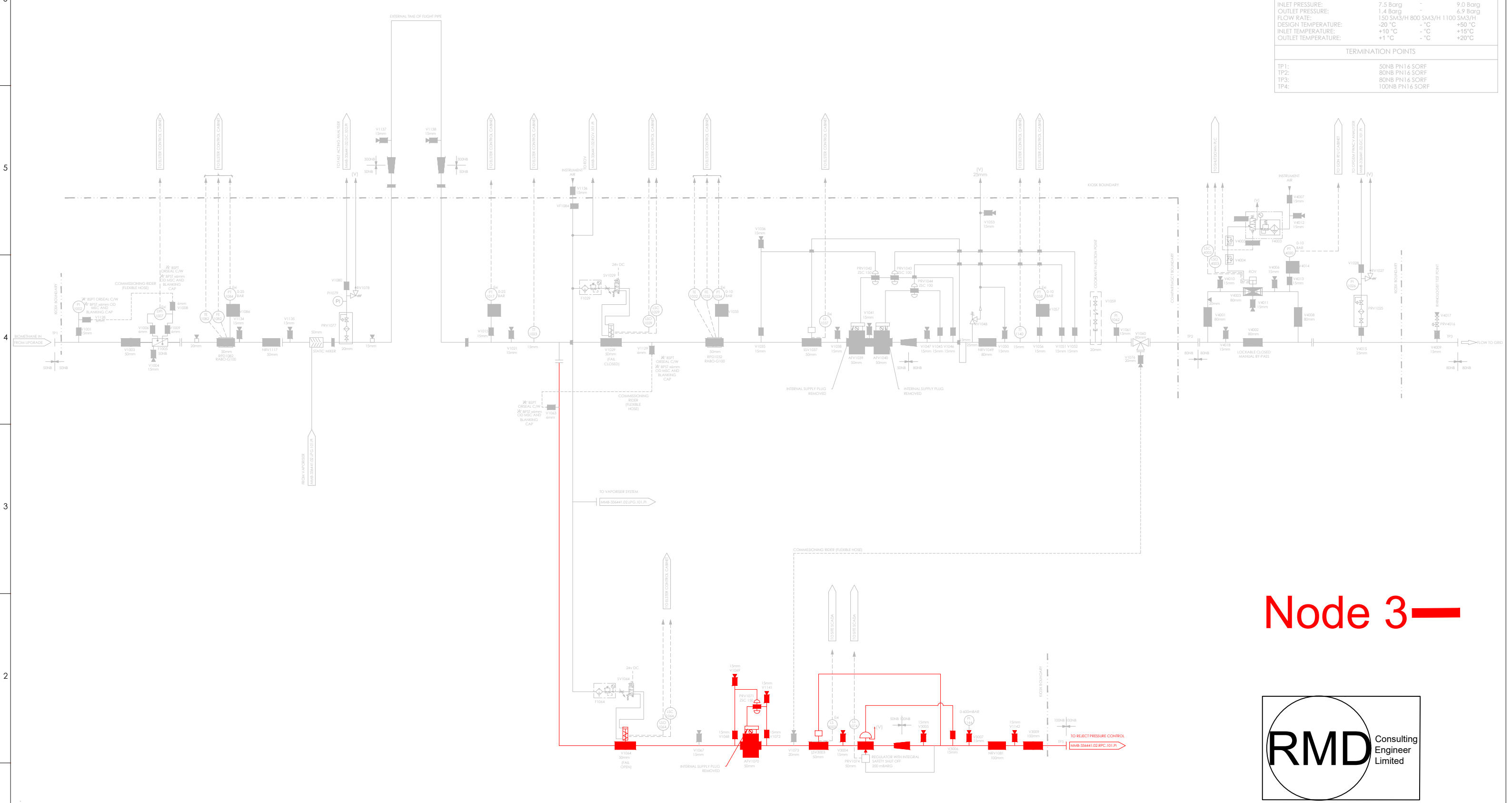


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| DESIGN & CONSTRUCTION | |
|-----------------------|--------------------------------|
| OPERATING CONDITIONS | |
| DESIGN PRESSURE: | 1.6 Barg |
| INLET PRESSURE: | 7.5 Barg |
| OUTLET PRESSURE: | 1.4 Barg |
| FLOW RATE: | 150 SM3/H 800 SM3/H 1100 SM3/H |
| DESIGN TEMPERATURE: | -20 °C |
| INLET TEMPERATURE: | +10 °C |
| OUTLET TEMPERATURE: | +1 °C |
| TERMINATION POINTS | |
| TP1: | 50NB PN16 SORF |
| TP2: | 80NB PN16 SORF |
| TP3: | 80NB PN16 SORF |
| TP4: | 100NB PN16 SORF |



Node 3

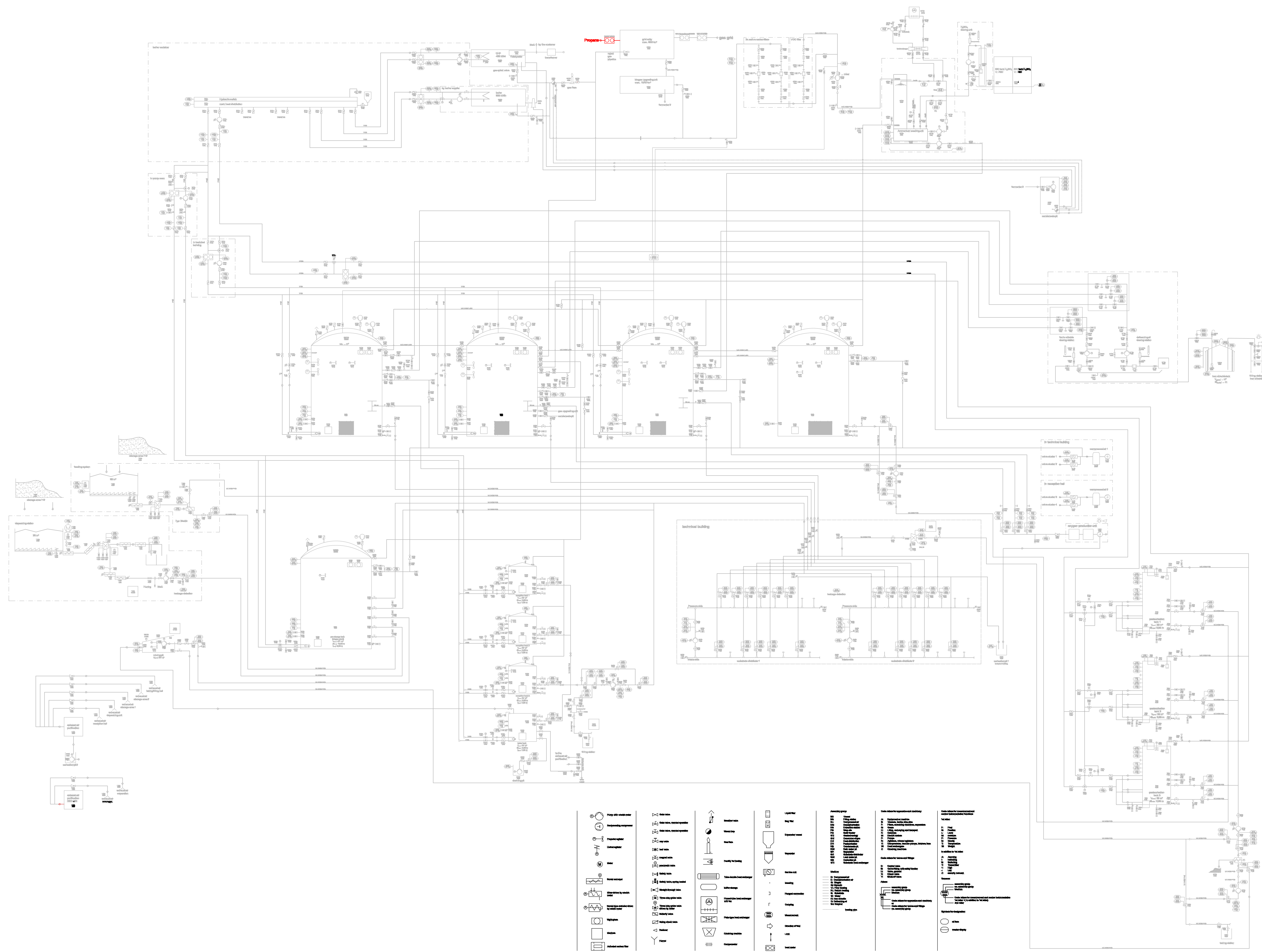


| REV | DRAWN | DATE | CHKD | DATE | APPD | DATE | MODIFICATION |
|-----|-------|----------|------|------|----------|------|---------------|
| 7 | | | | | | | |
| 6 | | | | | | | |
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| 4 | | | | | | | |
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| 1 | JMC | 15.04.19 | AS | | 15.04.19 | RH | INITIAL ISSUE |

| | |
|-----------------------------|---|
| TITLE | BLAISE BNEF PRESSURE REDUCTION & METERING SKID P&ID DRAWING |
| ELSTER STANDARD DESIGN REF: | N/A |
| CLIENT ORDER REF: | BLAISE FARM QUARRY |
| CLIENT: | BLAISE BIOGAS LTD |
| TOLERANCE: | N/A |

| | | | |
|------------------|---------------------------|-------|--------|
| SCALE | NTS @ A3 | SHEET | 1 OF 1 |
| Project Doc Ref: | MMB-336441.02.BNEF.101.PI | | |
| REV | 0 | | |

All valves capped!



Node 4



building owner:
Blaise Farm Quarry
Ashton Way
West Mallon
ME19 4PN

plan drafter:
BioConstruct GmbH
Wellingsstraße 66
D-49328 Melle
Tel.: +49 (0)5226 / 5832-0
Fax: +49 (0)5226 / 5832-11

place: ...

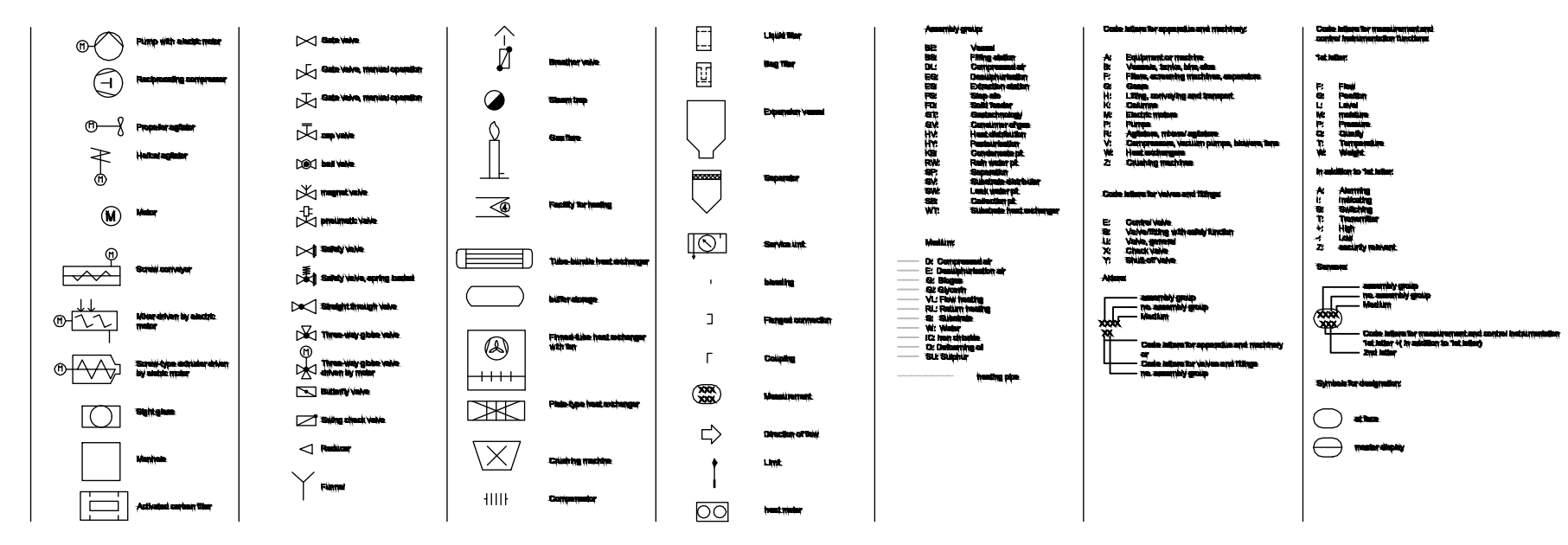
**Construction of a biogas plant
Blaise Farm**
P&I diagram

filename:
P&I-diagram_Blaise Farm_WS_190626.dwg

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|-------------------------|--------|------------|
| project-nr. / plan-nr.: | scale: | plan size: |
| B201903 / A02 a | % | DIN A0 |

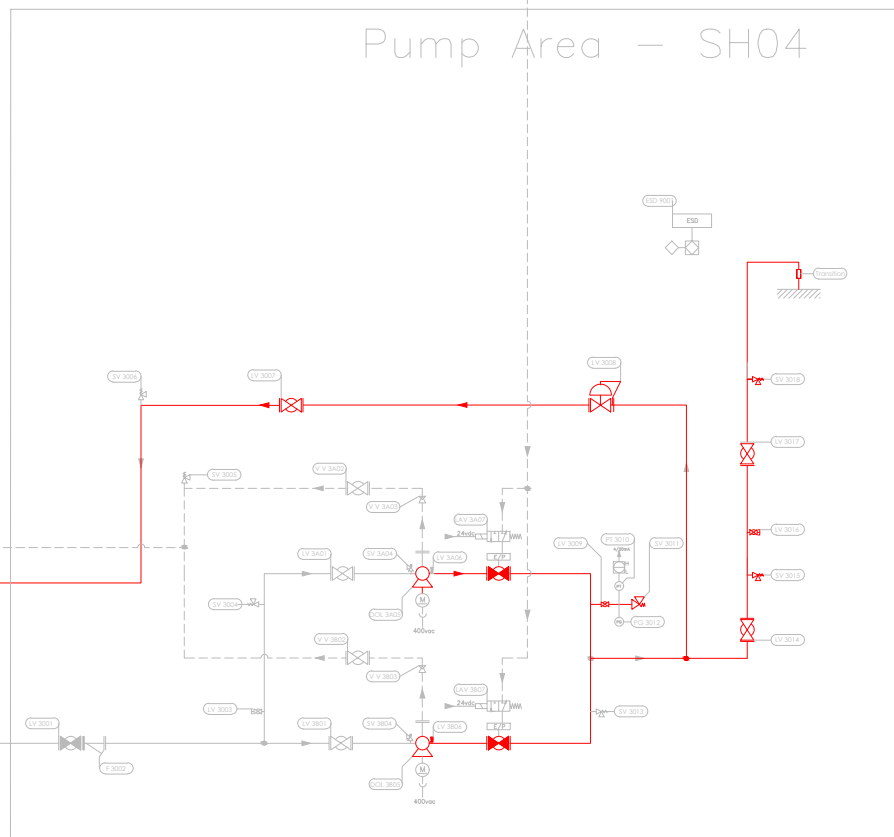
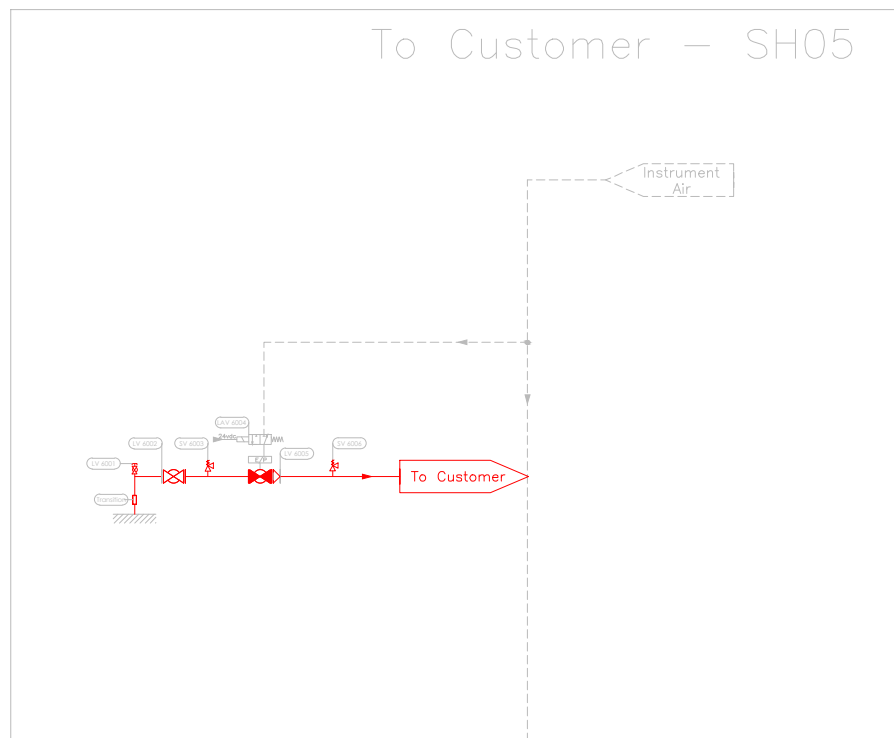
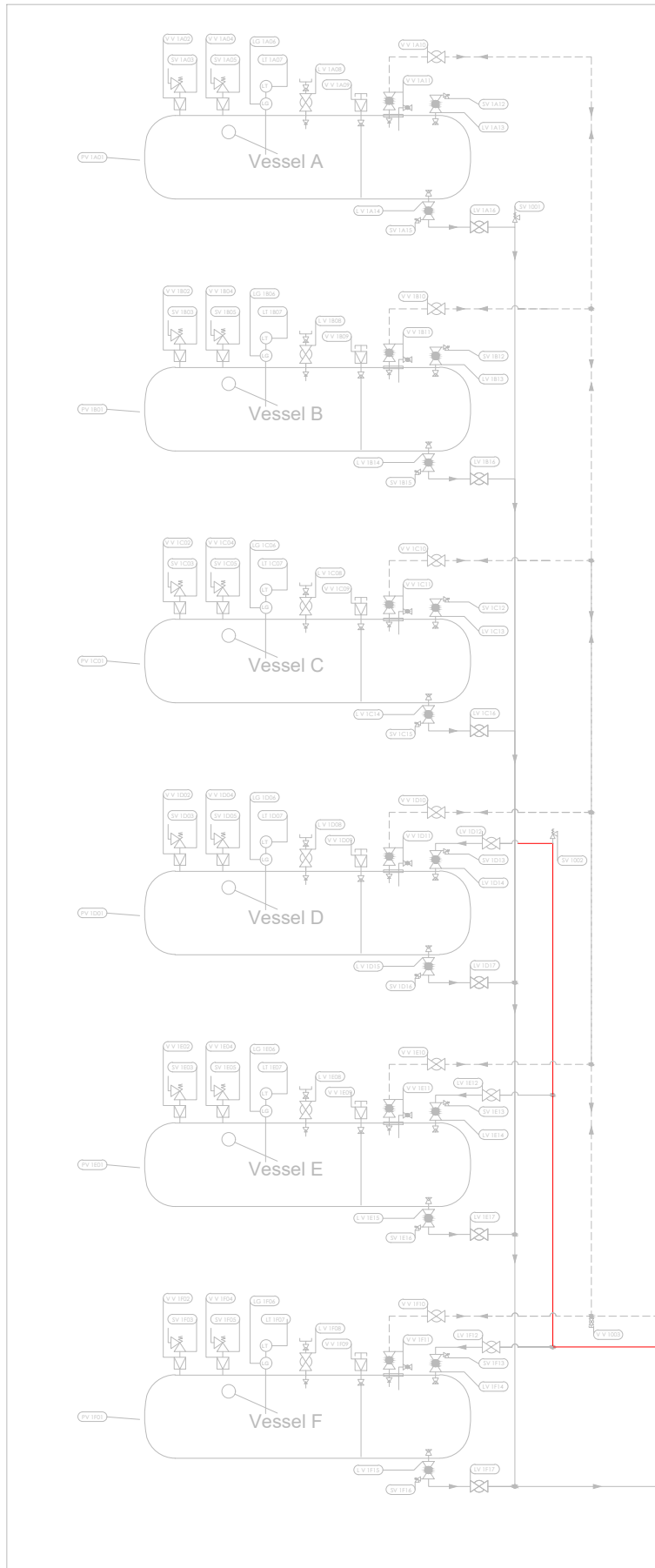
| | | |
|-----------|----------|-----------|
| designed: | date: | name: |
| | 15.05.19 | W.Selmann |

| | | | |
|----------|-------------------|----------|-----------|
| changed: | kind of change: | date: | name: |
| a | heat pipe changed | 07.06.19 | W.Selmann |





24/05/2019 08:51:09, O.O



Node 4



| Flanged | Other | Abreviation | Description |
|---------|-------|-------------|--|
| | | LV | Ball Valve - Liquid phase |
| | | V V | Ball Valve - Vapour phase |
| | | LV | Globe Valve - Liquid phase |
| | | V V | Globe Valve - Vapour phase |
| | | V | Non Return Valve |
| | n/a | n/a | Flanged Joint |
| n/a | | SV | Pressure Relief Valve |
| n/a | | SV | Hydrostatic Relief Valve |
| | n/a | V V | Y-Type Strainer |
| n/a | | V V | Check Lock Valve |
| n/a | | V V | Excess Flow Valve |
| | | V V | Pressure Regulator |
| | | DOL/VSD | Liquid Propane Pump |
| | n/a | VAV/LAV | Electro-Pneumatic Valve |
| n/a | | V V | Tank Vapour off-take Valve c/w ullage (Fixed Liquid Level Gauge) |
| n/a | | LV | Tank Filling Valve c/w 2 x back check valves |
| n/a | | LV | Tank Liquid off-take Valve c/w excess flow valve |
| n/a | | V V | Acme Fill Connection c/w check & NRV |
| n/a | | LG | Contents Level Gauge (float) |
| n/a | | LT | Level Transmitter (A-Level) |
| n/a | | PG | Pressure Gauge |
| n/a | | PT | Pressure Transmitter |
| n/a | | TT | Temperature Transmitter |
| n/a | | TS | Temperature Switch |
| | | VAV/LAV | Direct Acting Solenoid Valve |
| n/a | | ESD | Emergency Stop Device |
| n/a | | n/a | Electrical Plug & Socket |
| n/a | | EI | Electrical Isolator |
| | | | Valves Normally Open |
| | | | Valves Normally Closed |
| | | | Knock-out Pot |
| | | | Pressure Test Point |

| | | | | | | | |
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| 1 | OO 20/05/19 | DH | 21/05/19 | DH | 21/05/19 | See Sheets 3 and 4 | |
| 0 | OO 18/03/19 | | | | | INITIAL ISSUE | |
| REV | DRAWN | DATE | CHKD | DATE | APPD | DATE | MODIFICATION |

| | |
|-------------------|---|
| TITLE | P&ID Extents Blaise Farm Above Ground - 6 x 2T Pumped Liquid Biomethane |
| FLOGAS REF: | C2426 |
| CLIENT ORDER REF: | |
| CLIENT: | Blaise Farm |
| TOLERANCE: | NOT TO SCALE |

| | | |
|-----------------|---|----------|
| | FLOGAS BRITAIN LIMITED WATERMEAD BUSINESS PARK, RAYNS WAY, SYSTON, LEICESTER LE7 1PF, United Kingdom Tel: +44 (0) 1162 649 000 Fax: +44 (0) 1162 649 012 Email: flogasenergyservices@flogas.co.uk Website: www.flogas.co.uk | |
| | SCALE | NTS @ A3 |
| DRG. No. 2078-1 | SHEET | 1 OF 5 |

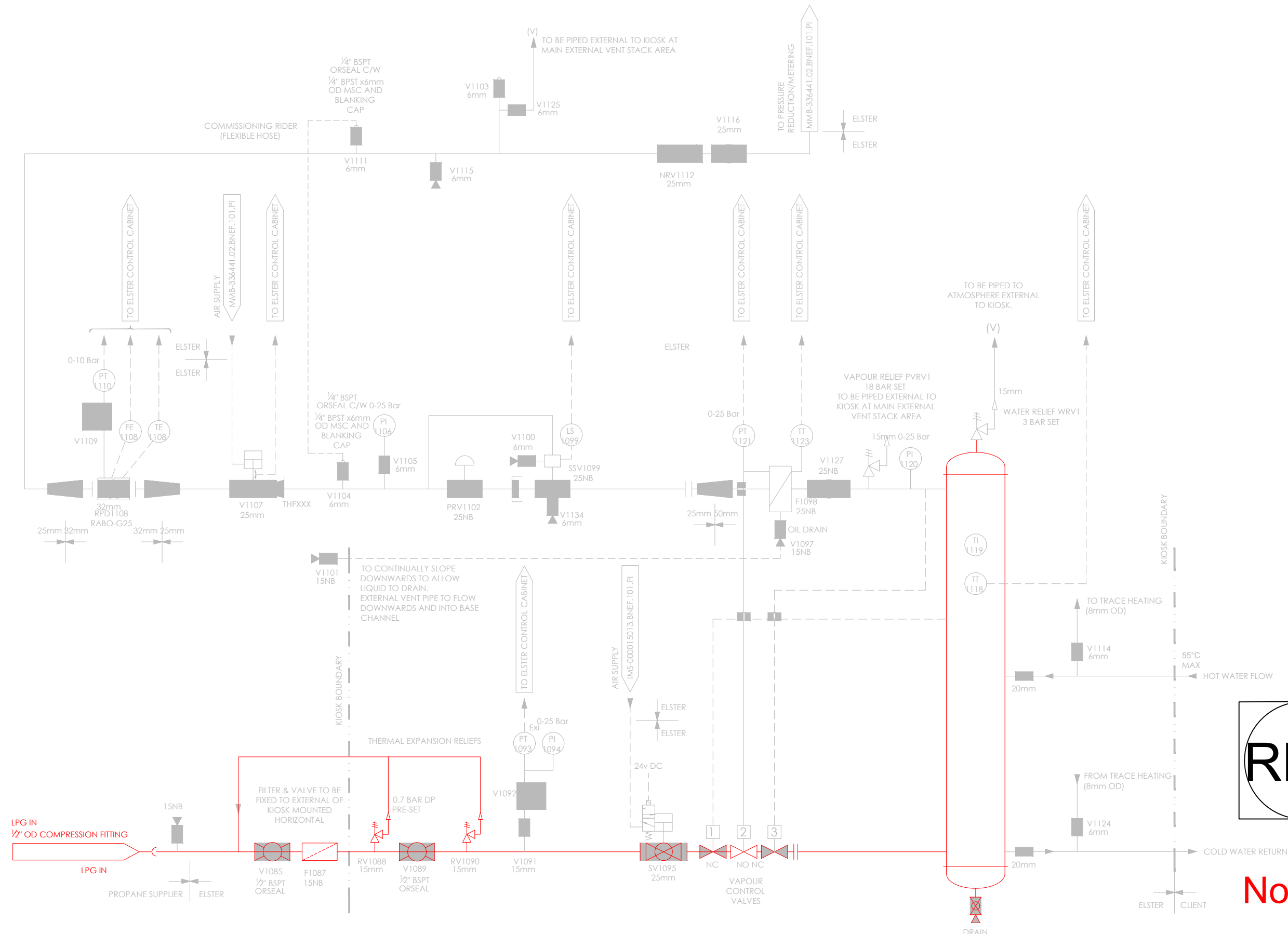
THIRD ANGLE PROJECTION



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Node 4

| | | | | | | | | | | |
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| 2 | | | | | | | | | | |
| 1 | JMC | 15.04.19 | AS | 15.04.19 | RH | 15.04.19 | | | INITIAL ISSUE | |
| REV | DRAWN | DATE | CHKD | DATE | APPD | DATE | | | MODIFICATION | |

| | |
|-----------------------------|---|
| TITLE | BLAISE BNEF VAPORISER SYSTEM P&ID DRAWING |
| ELSTER STANDARD DESIGN REF: | N/A |
| CLIENT ORDER REF: | BLAISE FARM QUARRY |
| CLIENT: | BLAISE BIOGAS LTD |
| TOLERANCE: | N/A |

| | | |
|---|--|----------|
| | Elster Instramet - Elster Metering Ltd Mutual House Leicester Road Melton Mowbray Leicestershire, LE13 0DB United Kingdom Tel: +44 (0) 1664 567797 Fax: +44 (0) 1664 504199 Elsteruksales.hps@honeywell.com www.elster-instramet.com | |
| | SCALE | NTS @ A3 |
| | SHEET | 1 OF 1 |
| Project Doc Ref: MMB-336441.02.LPG.101.PI | | REV 0 |

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