kellas
MIDSTREAM

cats

Central Area Transmission System

Technical Brochure

March 2025

Contents

CATS System Technical Overview

The CATS system carries natural gas from various points in the North Sea to the CATS terminal at Seal Sands, Teesside. Natural gas delivered into the CATS system at the CATS system offshore riser platform (CRP) or other points of entry along the pipeline (the CATS pipeline) is redelivered to CATS system users at specified redelivery points located at the CATS terminal.

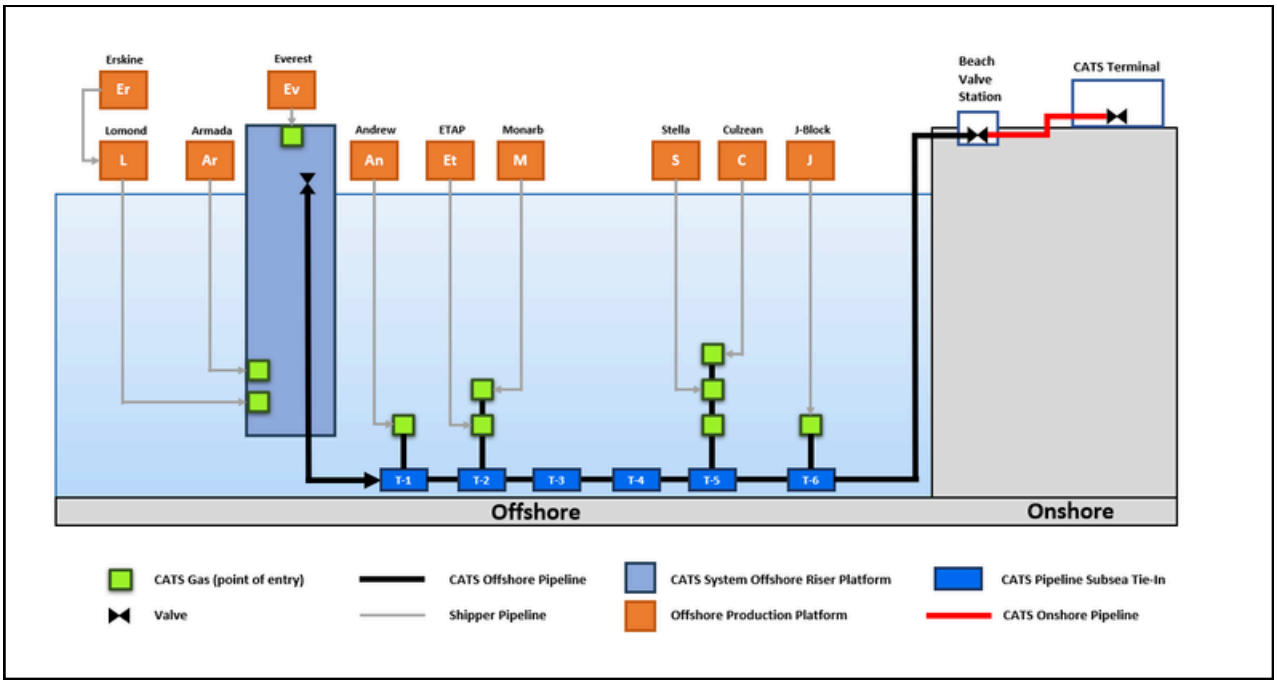


Diagram 1

The CATS System

The CATS system is shown in **Diagram 1**.

The Armada, Erskine, Lomond and Everest production platforms tie-in to the CATS system at the CRP.

The CATS pipeline was commissioned in 1992 with six subsea tee structures T-1 to T-6 pre-installed with subsea valves and tie-in points for future shippers to tie-in to the CATS system. When a new shipper connects into one of these subsea tee structures, a short new spur line from the CATS pipeline is created which connects to the new shipper's tee structure. The new shipper's tee structure itself provides a further connection point for future shippers. This process can be repeated for multiple new shippers, and the subsea tee structures 'daisy chained' together; this arrangement exists at T-1, T2, and T-5. The shipper owns the pipeline connecting their offshore facilities/platform to the points of entry into the CATS pipeline.

- The Andrew production platform connects into the CATS system at T-1.
- The ETAP and Montrose-Arbroath production platforms connect into the CATS system at T-2.
- T-3 and T-4 are currently not used.
- The Stella facilities and the Culzean production platform connect into the CATS system at T-5.
- The J-Block production platforms connect into the CATS system at T-6.

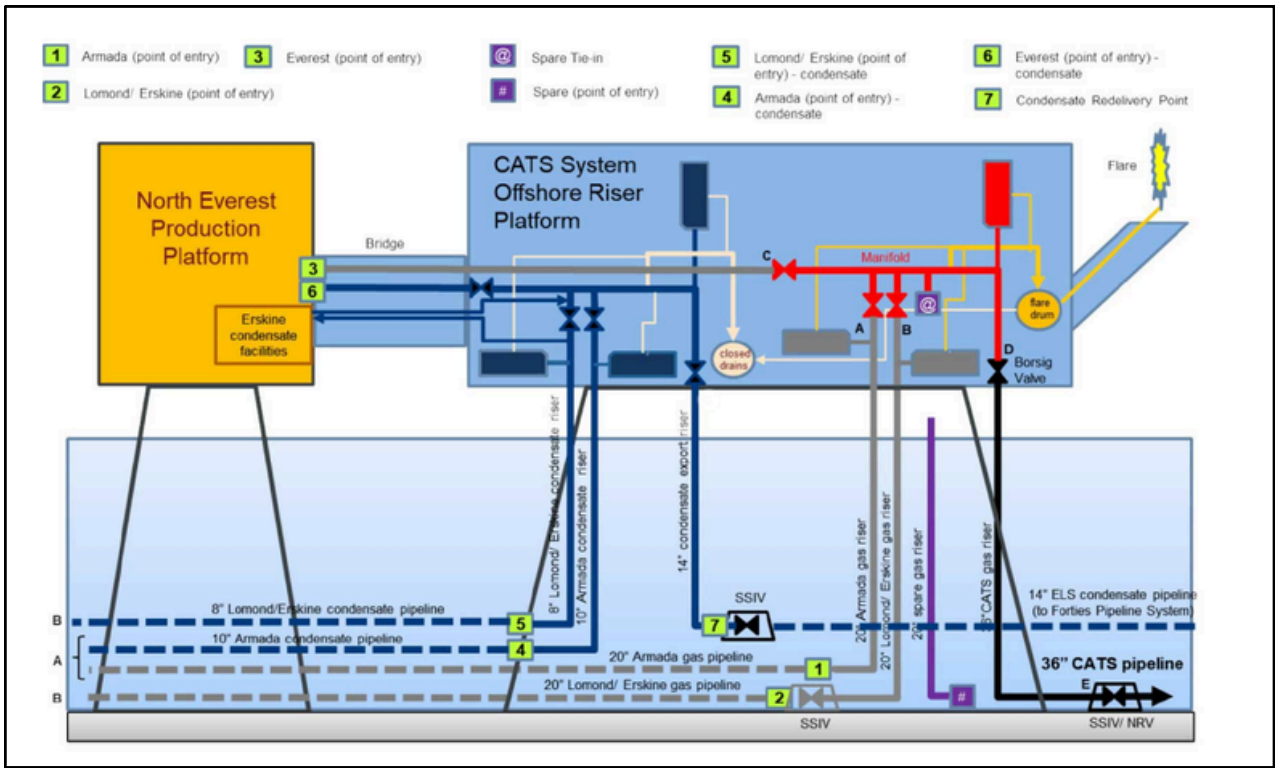


Diagram 2

The CATS System Offshore Riser Platform

The CATS offshore riser platform or CRP is shown in **Diagram 2**. It is located in the Central North Sea and is linked by a physical bridge structure to the North Everest production platform. The platforms are operated as a Combined Offshore Facility under a combined Safety Case.

The CRP is a gathering station for hydrocarbon gas and liquid condensate, which are produced from wells connected to the CATS system via the Armada, Lomond, and North Everest offshore production platforms.

The CRP is owned by the CATS joint venture parties (CATS Parties) and operated by the owners of the North Everest production platform (Harbour Energy) who the CATS Parties have appointed as their duty holder.

All accommodation is located on the North Everest production platform.

The CATS system begins at the gas points of entry [1], [2], [3] to the CRP.

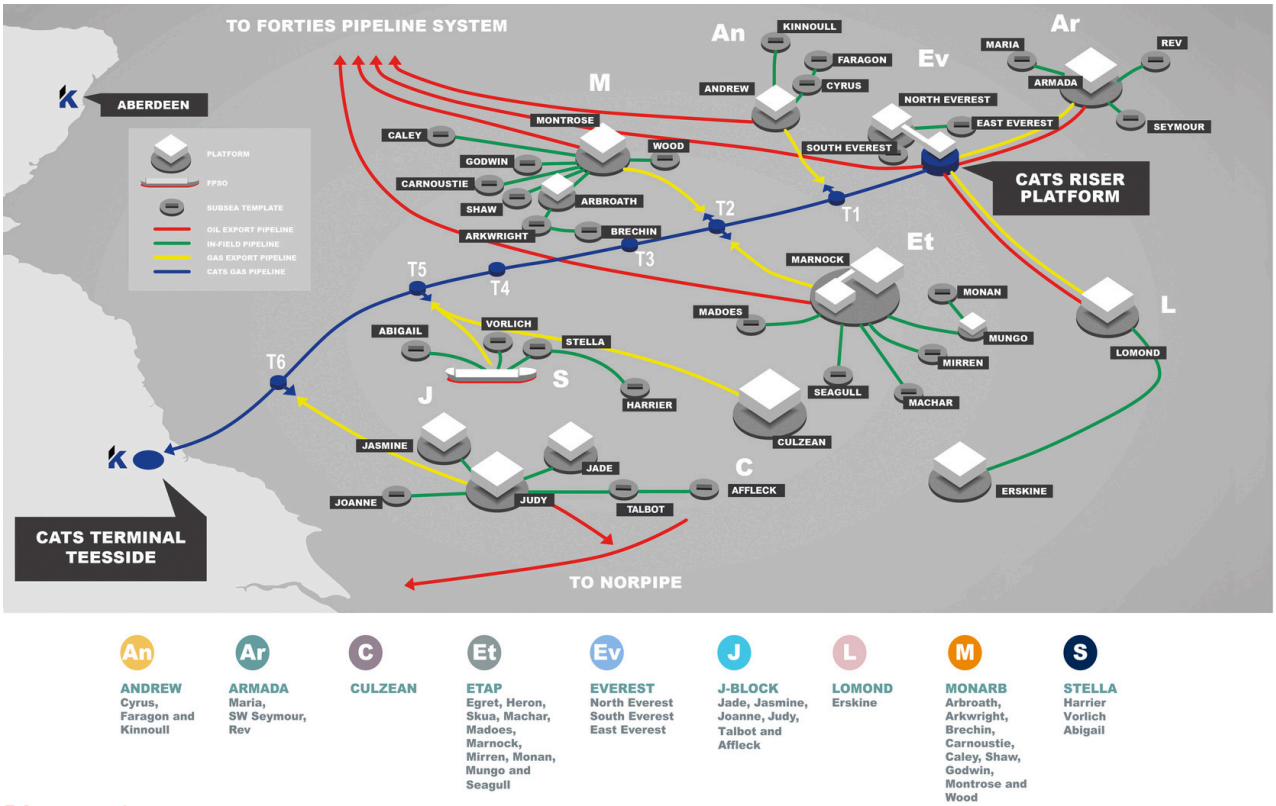
There is a spare 20” gas riser installed on the CRP (**shown in purple, Diagram 2**).

The common gas manifold (shown in red, Diagram 2), includes the CATS gas pig launcher and associated pipework, structures, valves, and instrumentation. The common gas manifold connects to the CATS 36” gas export riser [D].

The CATS 36” gas export riser (**shown in black, Diagram 1**) connects the common gas manifold via the 36” emergency shutdown valve to the CATS subsea isolation valve/ non-return valve spool piece [E].

The CATS subsea isolation valve/non-return valve spool piece connects to the CATS 36” diameter subsea pipeline (the CATS pipeline).

In addition to gas facilities, there are also liquid condensate facilities on the CRP. The 14” diameter condensate export riser connects to the Everest Liquid System (ELS) subsea pipeline, which connects into the Forties Pipeline System (FPS). The liquid condensate points of entry are at [4], [5], [6] and the condensate redelivery point on the CRP at [7].



An **ANDREW** Cyrus, Faragon and Kinnoull

Ar **ARMADA** Maria, SW Seymour, Rev

C **CULZEAN**

Et **ETAP** Egret, Heron, Skua, Machar, Madoes, Marnock, Mirren, Monan, Mungo and Seagull

Ev **EVEREST** North Everest South Everest East Everest

J **J-BLOCK** Jade, Jasmine, Joanne, Judy, Talbot and Affleck

L **LOMOND** Erskine

M **MONARB** Arbroath, Arkwright, Brechin, Carnoustie, Caley, Shaw, Godwin, Montrose and Wood

S **STELLA** Harrier Vorlich Abigail

Diagram 3

The CATS Pipeline

The CATS pipeline (**shown in blue, Diagram 3**) transports methane, ethane, propane, butane, natural gas liquids, and various contaminants (such as water, hydrogen sulphide, and mercury) from offshore production facilities on the CRP to the onshore terminal for gas treatment, metering, and processing.

The CATS pipeline extends for 396km offshore from the tie-in point at the subsea isolation valve/non-return valve spool piece to the pipeline landfall at Teesside, where the offshore section of the CATS pipeline terminates at the beach valve station ('BVS').

The BVS is located at Redcar approximately 250m from the shore. The pipeline is fitted with an emergency shutdown valve at the BVS, which enables the offshore section of the pipeline to be isolated from the onshore section of the pipeline in the event of an emergency. The BVS is unmanned and is operated remotely from the CATS terminal control room.

The 7.8km onshore section of the CATS pipeline is buried for its full length and passes through heavily industrial land, and under the River Tees. It connects the BVS to the CATS terminal at Seal Sands. The CATS pipeline is fitted with an emergency shutdown valve at the inlet to the CATS terminal so that the CATS pipeline may be isolated from the terminal in the event of an emergency.

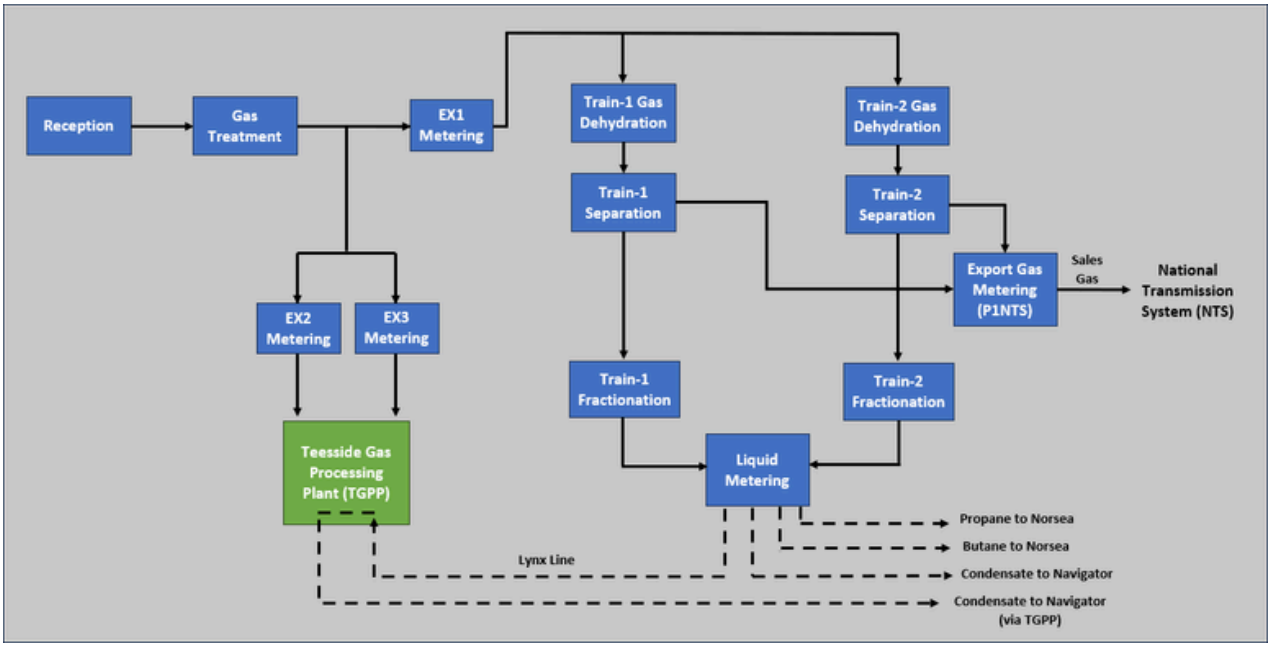


Diagram 4

The CATS Terminal

The CATS terminal is shown in **Diagram 4**. It has been designed to treat gas transported to shore, to meet the specification required for entry to the UK National Grid and domestic gas network. The gas that flows in the CATS pipeline must be treated and processed to achieve the requisite gas specification for the entry into the UK National Transmission System. This treatment involves removing contaminants from the gas (principally hydrogen sulphide and mercury), and removing the LPG (propane, and butane), and NGL (natural gas liquid) components.

Inlet facilities
CATS gas enters the CATS terminal at the tie-in point of the CATS pipeline to the Reception facilities. The Reception facilities consist of vessels, piping, valves, filters, structures, instrumentation, and safety systems for the safe and efficient transportation of gas to the Gas Redelivery Points and NGL Redelivery Points.

Liquids can be routed from the Reception facilities to CATS processing facilities via NGL Redelivery Point Ex1, or to TGPP via NGL Redelivery Points Ex2, and Ex3.

Gas treatment
The gas treatment facilities consist of vessels, piping, valves, filters, structures, instrumentation, safety systems, and special absorbent materials to remove hydrogen sulphide (H2S), mercury, and particulate contaminants from the gas transported via the CATS pipeline.

Metering and redelivery
Upon leaving the treatment facilities, the gas is routed via fiscal quality gas metering facilities to the Gas Redelivery Points Ex1, Ex2, and Ex3. The fiscal gas metering facilities measures the volume of gas flowing through the terminal for HMRC (tax) purposes, and for billing the CATS system shippers for the CATS transportation service.

CATS processing plant
The CATS processing plant was built in 1997. It separates propane, butane, and natural gas liquid components from the gas that is routed via Gas Redelivery Point Ex1 to the two processing trains. Propane, butane, and NGLs are extracted from the gas and metered. The metered products are pumped via individual pipelines to third party storage and processing facilities on Teesside. The sales quality gas stream is metered and redelivered to the UK National Transmission System.

The Teesside Gas Processing Plant
Underground pipelines carry gas from the Gas Redelivery Points Ex2 and Ex3 to the Teesside Gas Processing Plant (TGPP). TGPP (**facilities shown in green, Diagram 4**) is owned independently of the CATS system. Propane, butane, and NGLs are extracted from the gas and metered. The metered products are pumped via individual pipelines to third party storage and processing facilities on Teesside. The sales quality gas stream is metered and redelivered to the UK National Transmission System.

Typical Gas Entry & Product Specifications

This section provides details of the typical gas entry specification and the product specifications which appear in the CATS Transportation Agreement. These specifications may vary at the discretion of the CATS Operator.

Standard Entry Specification

In order to comply with the Entry Specification, all Shipper Gas shall comply at the Delivery Point with the following requirements:

1. Delivered at the Delivery Point in gaseous single phase only and commercially free from objectionable odours and from materials and dusts or other solid or fluid matter which might cause injury to or interference with the proper operation of the CATS System and/or which could affect the merchantability of CATS Gas or CATS Product. For the avoidance of doubt, such materials shall include but not be limited to, lead, radioactive materials, waxes, gums, and gum forming constituents, foaming agents and excessive solids;
2. Have a hydrocarbon dew point which at all pressures in excess of 9300 kPa Gauge does not exceed -2 degC;
3. Have a maximum water content to be the lesser of:
    a. 15 Kg per million standard cubic metres; or
    b. that content equivalent to a water dew point at 7,500 kPa Gauge of -26 degC;
4. Have a maximum hydrogen sulphide content of 3.0 ppmv;
5. Have a maximum methyl + ethyl mercaptan sulphur content of 0.5 ppmv; and have a maximum total mercaptan sulphur content of 3.1 ppmv;
6. Have a maximum carbonyl sulphide content of 1.0 ppmv;
7. Have a maximum total sulphur content of 14.4 ppmv measured as hydrogen sulphide;
8. Have a maximum carbon dioxide content of 2.8 mol %;
9. Have a maximum oxygen content of 9.0 ppmv;
10. Have a maximum nitrogen content of 4.5 mol %;
11. Have a total non-hydrocarbon content of 5.5 mol %;
12. Have a maximum mercury content of 0.01 microgrammes per Cubic Metre;
13. Have such delivery pressure at the Delivery Point as may be requested by the CATS Parties from time to time provided that such pressure shall not exceed seventeen thousand two hundred and thirty (17,230) kPa Gauge;
14. Have a maximum entry temperature of 51 degC;
15. Have a maximum Propane content of 5.5 mol %;
16. The CATS Operator forecasts that if all Natural Gas in the CATS System had the same composition as the Shipper Gas, the Condensate arising from the processing of that Natural Gas would not exceed a Reid Vapour Pressure at 37.8 degrees centigrade of 14.5 psia.

Gas Redelivery Specification

In order to comply with the Gas Redelivery Specification contained within the National Grid Network Entry Agreement, all Shipper Gas shall comply at the Gas Redelivery Point with the following requirements:

1. Commercially free from objectionable odours and from materials or other solid, liquid or gaseous matter, which might interfere with the integrity or operation of the National Grid transportation and distribution network or any pipeline connected to such system or any appliance which a consumer might reasonably be expected to have connected to such system;
2. Hydrocarbon dew point, which at all pressures up to and including 7,000 KPa Gauge does not exceed -2 deg C;
3. Water dew point not greater than -10 deg C at a pressure of 7,000 KPa Gauge;
4. Maximum hydrogen sulphide content to be 3.3 ppmv;
5. Maximum total sulphur content to be 15 ppmv measured as hydrogen sulphide equivalent;
6. Maximum carbon dioxide content to be 4.0 mol %;
7. Maximum hydrogen content to be 0.1 mol%;
8. Maximum oxygen content to be 10.0 ppmv;
9. Wobbe Index which is not more than 51.41 Megajoules per Standard Cubic Metre and not less than 48.14 Megajoules per Standard Cubic Metre;
10. Gross Calorific Value, which is not more than 42.3 Megajoules per Standard Cubic Metre and not less than 36.9 Megajoules per Standard Cubic Metre (real gross dry)
11. Maximum delivery pressure to be 7,000 KPa Gauge;
12. Temperature not less than 1 deg C and not more than 38 deg C;
13. Maximum relative density to be 0.7.

Product Redelivery Specification

Propane and Butane Specifications

The Propane and Butane export specifications are set out hereunder.

The CATS Parties retain the right at its discretion to vary the specifications from time to time provided that at all times the delivered Product will be of merchantable quality. In all cases the test methods shall be based on the most recently published standards:

SPECIFICATION	PROPANE	BUTANE
Moisture Content	Pass	
Free Water Content		None
DEWPOINT	Less than -40 degC at 1.013 bara	Less than -30 degC at 1.013 bara
VAPOUR PRESSURE @ 37.8 degC	1434 kPa Gauge (maximum)	483 kPa Gauge (maximum)
COMPOSITION	**(LIQUID VOLUME)**	**(LIQUID VOLUME)**
Nitrogen	0.1% (maximum)	0.1% (maximum)
Carbon Dioxide	0.01% (maximum)	0.01% (maximum)
Ethane (C2 hydrocarbons)	2.0% (maximum)	0.1% (maximum)
Propane	95.0% (maximum)	0.5% (maximum)
Mixed Butanes	2.5% (maximum)	95.0% (minimum)
Pentanes	0.1% (maximum)	1.5% (maximum)
Total unsaturated hydrocarbons (olefins)	1.0% (maximum)	1.0% (maximum)
RESIDUAL MATTER		
Maximum R Number	10	10
Maximum O Number	Pass	Pass
CORROSION, COPPER STRIP		
Maximum	No.1	No.1
H_2S	8 ppm (wt) (maximum)	8 ppm (wt) (maximum)
TOTAL SULPHAR (Maximum)	50 ppm (wt)	50 ppm (wt)
MERCURY	5 ppb (wt) (maximum)	5 ppb (wt) (maximum)
DELIVERY PRESSURE	a maximum of 19 barg	a maximum of 10.5 barg
DELIVERY TEMPERATURE	33 degC (maximum)	33 degC (maximum)

Condensate Characteristics

Condensate shall be of average quality and merchantable and comply with the specification set out hereunder.

The CATS Parties retain the right at their discretion to vary the specifications from time to time provided that at all times the delivered Product will be of merchantable quality. In all cases the test methods shall be based on the most recently published standards.

SPECIFICATION	TEST METHOD	VALUE
WATER		
Free Water Content		none
REID VAPOUR PRESSURE @ 37.8 deg.C	ASTM D-323	14.5 psia (maximum)
DELIVERY PRESSURE		A maximum of 4.0 bar g
DELIVERY TEMPERATIRE		33 degC (maximum)
MERCURY		5ppb (weight)

CATS New Entrant Co-ordination Procedure

Any new Shipper must comply with the CATS New Entrant Co-ordination Procedure detailed in Document reference CAT-MMS-PRC-003 (as amended from time to time) which is available on request to potential new Shippers. This summarises the requirements and actions to be undertaken when a new Shipper ties in to CATS. This process includes a checklist as the final stage.

The CATS New Entrant Co-ordination Procedure and subsequent requirements will be dependent on the scope of the project.

See next page for Example New Entrant Co-ordination Checklist.

Example New Entrant Co-ordination Checklist

ACTION	SHIPPER ACTION	CATS ACTION
General		
CATS Change Management System to be followed		X
Establish document control interface between CATS and Shipper	X	X
Issue communications plan for stakeholders and existing Shippers		X
Process Engineering Requirements		
Process Overview Issued (inc. pressure envelope)	X	
HAZOP and MoC actions and Safety Critical Equipment checks complete	X	
Update internal CATS documentation		X
Pipeline OPEP review		X
Identify commissioning and operation / start-up fluids	X	
Issue Commissioning Procedures	X	
Issue Shipper with start-up guidance procedure		X
Issue list of chemicals to be injected for approval	X	
Shipper to issue post-startup sample results to CATS, as defined in the CMM	X	
Pipeline Engineering		
Design to satisfy CATS pipeline technical requiremnts	X	X
Subsea procedures reviewed, work programme agreed.	X	X
Offshore construction and ATW in place.	X	X
Pipeline startup readiness review	X	X
Provide key Technical Documentation	X	
Update CATS Pipeline Documentation		X
Complete Operations and ER Training	X	X
OGA approvals in place	X	
CATS PWA updated.	X	X
Communications protocol agreed.	X	
Telemetry System		
Issue Telemetry Overview	X	
Issue CATS Telemetry Design & Assurance Procedure		X
Issue Shipper tag list for approval (Modbus map)	X	
Define telemetry and PI modifications		X
Issue commissioning / test procedure and schedule	X	
Complete DCS FAT, iFAT and SAT inc. end-to-end	X	X
Complete voice communication checks	X	X
Testing of allocation system mods for new shipper		X
Measurement Systems		
Metering Systems Technical Manual and CMM issued to shipper		X
Submit metering system BOD, FDS inc. P&IDs and GA's for approval	X	
Submit Metering Uncertainty Calculations (expected uncertainty using assumed process data)	X	
Submit PON6 to OGA	X	
Submit Testing and Acceptance Requirements for approval	X	
Plan, conduct and report on FAT	X	X
Plan, conduct and report on SAT	X	X
Issue metering calibration, commissioning, operating and maintenance information	X	
Arrange first Measurement System Audit with CATS independent Auditor	X	
Issue uncertainty calculations & post-1st gas sample data for review	X	
Gas Admin/ Hydrocarbon Accounting		
Define and implement allocation mods for new Shipper		X
Training and procedure updates for Allocation Agreements, nominations and allocations.		X
Confirm invoicing process	X	X
Hydrocarbon allocation “end to end” desktop review	X	X
Commercial & Legal		
Commercial Agreements executed	X	X
Issue forecasts	X	
Shipper Statement of Readiness	X	X
Shipper Letter of Authorisation		X
Notices to Shippers iro Admission of New Parties		X
Book product export capacity with downstream customers	X	
Confirm Commisioning Gas process (within TPA)	X	X
Confirm mercury charging arrangements	X	

Kellas Midstream Limited

6th Floor, The Capitol, 431 Union Street, Aberdeen AB11 6DA

Tel: +44 (0) 1224 084520 | General Enquiries: info@kellasmidstream.com

www.kellasmidstream.com