

## TECHNICAL SPECIFICATION

**Proposal No.** 30009214 0570

**Rev 0**

**Title:** Installation of Cryogenic LAR Storage Tank and Vaporisation

**Presented to:** MEGGITT AIRCRAFT  
BRAKING SYSTEMS  
AVIATION DIVISION  
HOLBROOK LANE  
COVENTRY  
CV6 4AA



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**Date** 23/01/2019

**Rev Date**

**On behalf of** Air Products PLC

Reviewed / Approved By			
Company	Name	Signature	Date
Air Products	Kelly Paul	<i>Kelly Paul</i>	23/01/2019
Customer			

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## 1 Summary

- 1.1 The site requirements are currently for Gaseous Argon supply to the customers heat treatment process.
- 1.2 Current usage data, provided by the customer, is:
  - Forecasted Consumption      9.6 Nm<sup>3</sup>/hr
  - Usage Pattern                      24 hr/day, 7 day/week (continuous)
- 1.3 The Air Products scope of work is to supply labour and materials to install, pressure test and commission:
  - 1.3.1 *1 off 11,000 litre Liquid Argon Storage Tank (or nearest equivalent)*
  - 1.3.2 *2 off AV3M Ambient Vaporisers*
  - 1.3.3 *1 off vaporiser Auto Changeover Manifold*
  - 1.3.4 *1 off DN25 Pressure and Temperature Control Equipment*
  - 1.3.5 *1 off Low Temperature Alarm System*
- 1.4 The equipment has been sized to meet the customer's requirements details in section 1.2 above.
- 1.5 All interconnecting pipe work in the tank compound shall be Copper Tube (Degreased), installed using silver brazed fittings with oxy – Acetylene brazing equipment.

## 1.6 Scope of Works – Responsibilities

Details of work – Civil	Responsibility
All civil engineering works including ground work, plinth, impact protection and security fencing (where required). (ref to Tank Plinth Specification)	Customer
Ensuring compliance with the separation distances from typical hazards and the installation as recommended by the BCGA Code of Practice CP36 for the operational life of the installation	Customer
Details of Work – Mechanical	Responsibility
Interconnecting pipeline installation within the Air Products compound area.	Air Products
Pressure systems safety regulations (2000) Compliance	Air Products
Pressure Equipment Directive Compliance	Air Products
Delivery of equipment to installation site	Air Products
Supply suitable cranes for the offloading and positioning of equipment	Air Products
Filtration unless otherwise agreed	Customer
Details of Work – Electrical	Responsibility
Tanker offloading power requirement (415V TP-E 63A) including 5 pin socket with RCD. Refer to AL17.005.	Customer
Suitable electrical supplies to facilitate the use of technicians' power tools. (Normally 110 volt, 50Hz, Centre tapped earth).	Customer
All Earthing requirements	Customer
Suitable lighting of the area around the site to facilitate a safe working environment (ref to Tank Plinth Specification).	Customer
Single Phase 110/230V for telemetry system	Customer
Single Phase 230V for Vaporiser changeover system	Customer
Single Phase 230V for Low Temperature Alarm Panel	Customer

## 2 Performance Criteria

### 2.1 System Requirements:

2.1.1 *The system has been designed to meet the following conditions*

Design Flowrate (Norm)	9.6 Nm <sup>3</sup> /hr
Normal Flow Duration	24 hr/day
Application	Industrial (heat treatment)
Design Pressure	25 barg
Supply Pressure	14 barg
Design Temperature	-196/+65°C
Minimum Supply Temperature (Ref 2.1.5)	-15°C
Maximum Downstream Pressure Ref 2.1.3	18.51 barg

2.1.2 *Flow rates quoted are at 0°C and 1atm. Product outlet temperature at the design flow rate shall be a nominal 10°C below the prevailing ambient temperature.*

2.1.3 *Fault pressure is provided above for guidance and shall be confirmed at project stage for the actual equipment installed. The customer is responsible for ensuring that downstream piping and equipment can withstand the fault pressure and should notify Air Products if this is not the case.*

2.1.4 *The vaporiser system is designed to provide design flow at ambient environmental conditions at a 1% winter low of -5°C (3.65 Days per year). For periods where the ambient temperature falls below these conditions, de-icing may be required by the customer (reference 5.5).*

2.1.5 *The vaporiser system is designed to provide safe operation at the design flow rate.*

## 3 Specification

### 3.1 Statutory Requirements

All work carried out in relation to this specification shall be in accordance with all relevant statutory requirements for an installation of this type as are in force at the time of system commissioning in the country within which the system will be operated, namely:

- 3.1.1 *Pressure equipment and assemblies in accordance with the Pressure Equipment Directive 2014/68/EC.*
- 3.1.2 *All information to support the Users instigation of their obligations under the PSSR 2000 legislation.*

### 3.2 Air Products Standards

Air Products standards make provision for the production of Air Products standard documentation to meet the requirements of these standards (e.g. O&M Manuals, and Operational Readiness Inspections.), any editing, revision, rework or reformatting in line with any specific requirements not detailed within relevant Air Products standards and specifications will be treated as a variation from said standard and will require submission in accordance with a variation procedure to be agreed between the two parties.

### 3.3 Equipment Specification

#### 3.3.1 *Liquid Storage Tank*

3.3.1.1 Storage tank delivered to site tested, purged and ready for intended service.

3.3.1.2 Tank to be supplied complete with:

- Control valves, relief valves, and interconnecting pipe work.
- Liquid level gauge, pressure gauge and instrumentation.
- Pressure building vaporiser and control regulator.

3.3.1.3 The storage tank colour shall be white.

#### 3.3.2 *Product Vaporisers (Ambient Air)*

3.3.2.1 Product vaporiser delivered to site tested, purged and ready for intended service. Vaporiser converts Liquid product to gaseous at a nominal 10°C below prevailing ambient conditions.

3.3.2.2 Vaporiser sized to meet process flow requirements based on a minimum ambient temperature of -5°C.

3.3.2.3 It is the customer's responsibility to notify Air Products if the stated design conditions will be exceeded.

3.3.2.4 For construction details please refer to the equipment data sheet.

### **3.3.3 Pressure and Temperature Control Manifold**

3.3.3.1 Air Products standard Pressure Control Manifold delivered to site tested, purged and ready for intended service. The manifold, which controls process pressure comprises of:

- Process Relief Valve
- Temperature probe
- Pressure Control Valve
- Process line Vent Valve, Isolation Valve and Pressure Gauge

3.3.3.2 For construction details please refer to the equipment data sheet.

### **3.3.4 Auto Changeover Manifold**

3.3.4.1 Air Products standard Changeover Manifold delivered to site tested, purged and ready for intended service. The manifold, which switches between product vaporisers:

- Actuated valves
- Regulated gas supply to actuated valves
- Relief valves
- Control unit.

For construction details please refer to the equipment data sheet.

### **3.3.5 Storage Tank Contents Monitoring**

3.3.5.1 Air Products proprietary Telemetry system comprising:

- 110/230V IP65 control panel complete with operator keypad, backlit LCD display and internal GSM modem.
- Tank differential pressure transducer / transmitter providing a 4-20mA output to Remote Telemetry Unit.
- Interconnecting signal cabling and 110/230V power lead between customer-supplied power socket and remote telemetry unit (RTU).

### **3.3.6 Interconnecting Pipe Work**

3.3.6.1 All interconnecting pipe work in the tank compound shall be silver brazed copper as follows:

- Material: EN1057 R250/R290 Copper Tube
- Fittings: Silver brazed fittings
- Supports: Steel angle brackets & nylon clamps
- Cleaning: To Air Products standards

- Testing: Pneumatic strength test at 1.1 x design pressure using pure dry nitrogen via calibrated test rig.  
  
Leak test at working pressure using dry nitrogen and test all brazed and mechanical joints using a leak detection fluid.

### **3.3.7 Low Temperature Alarm System**

3.3.7.1 The alarm panel shall consist of;

- IP66 wall mount sheet steel enclosure
- -50 degC to +50 degC temperature control unit
- Power on LED
- Mute audible alarm push button
- Accept alarm push button
- Sounder / beacon unit
- Terminals for optional remote sounder / beacon
- PT100 temperature probe (non-intrusive, pipework mounted)



## 4 Scope of Work – Air Products

- 4.1 All equipment listed below shall be leased to the customer throughout the duration of the Bulk Gas Supply Agreement.
- 4.2 Air Product scope of work is to supply transport, cranes, labour and materials to deliver, offload, install, pressure test and commission the equipment listed in section 1.3 and detailed below:
- 4.2.1 *Air Products Storage Tank as specified in 3.3.1.*
  - 4.2.2 *Ambient air product vaporiser as specified in 3.3.2.*
  - 4.2.3 *Pressure and Temperature Control Manifold as specified in 3.3.3*
  - 4.2.4 *Auto Changeover Manifold as specified in 3.3.4*
  - 4.2.5 *Low temperature alarm system as specified in 3.3.7.*
  - 4.2.6 *Air Products proprietary telemetry system for monitoring tank liquid level as specified in 3.3.5.*
  - 4.2.7 *Interconnecting pipe work between the tank, vaporiser and pressure control manifold as specified in 3.3.6.*
  - 4.2.8 *Pressure System Safety Regulation*
  - 4.2.9 *Compliance with Pressure Equipment Directive*
  - 4.2.10 *Equipment Identification - Air Products will label all equipment, pipework, valves and instrumentation in accordance with Air Products standard nomenclature.*
  - 4.2.11 *Design & Installation Documentation*

Air Products shall supply their standard documentation, during the design and installation phase of the project, including:

    - Process & Instrumentation Drawing, including valve and instrumentation schedules.
    - General Layout Drawing
    - Electrical Control Drawing limited to connection details only.
    - Installation Method Statements / Risk Assessments.
    - Equipment details, limited to drawings, electrical requirements, dimensions and weights.
    - All documentation supplied shall be to Air Products or their sub supplier's standard.

#### 4.2.12 *Hand Over Documentation*

Air Products shall supply their standard documentation package, on completion of the specified scope of works which shall include:

- Process & Instrumentation Drawing
- General Layout Drawing
- Installation, Operation and Maintenance Manuals for the system,
- Completed/signed customer acceptance certificate for the bulk installation

#### 4.2.13 *Acceptance Tests*

To be completed in accordance with Air Products operational readiness standards and procedures for systems of this type.

#### 4.2.14 *Training*

Air Products have allowed for the provision of sufficient information, instruction and training on the day of the system commissioning to be undertaken in one session. The customer is responsible for providing suitable personnel to be trained. Air Products reserve the right to charge for any additional training required.

## **5 Scope of Work – Customer**

### **5.1 Civil Works**

All civil engineering works in providing tank, vaporiser plinth including tanker access apron to Air Products' specifications and security fencing (if required).

Plinth construction to be completed to ensure sufficient strength in time for the agreed installation date.

### **5.2 Ground Conditions**

It shall be the responsibility of the customer to ensure that ground conditions are adequate for any associated crane operations on site. Particular attention should be taken with regard to ground bearing conditions under crane outriggers and any underground pipe work, ducts or tanks that could affect ground stability. Any additional costs resulting from unsuitability of ground bearing conditions shall be the responsibility of the customer. Responsibility for Ground Conditions can be undertaken by Air Products, at a rate to be advised, with written notice from the Customer.

### **5.3 Site Access**

Sufficient site access for installing vehicles and cranes. Depending on the size of the installation this shall consist of, (as a minimum), 1 off 16.5m long articulated vehicles and 2 off mobile cranes sized to suit associated installation equipment.

On installation completion provision of a permanent roadway providing adequate access to the installation by an articulated delivery vehicle.

### **5.4 Electrical Supplies**

All electrical supplies need to be installed & tested prior to the installation in accordance to the layout drawing provided during the project stage.

#### **5.4.1 Installation Supply**

Suitable electrical supplies to facilitate the use of technicians power tools. (Normally 110 volt, 50Hz, Centre tapped earth). Any unusual or heavy current consuming equipment to be used will be specified in advance.

#### **5.4.2 Tanker Power Supply**

Installation of a tanker off-loading socket together with a 415V, 3 phase electrical supply in accordance with current Air Products specification A.L.17.005. This must be completed prior to the installation of the tank.

#### **5.4.3 Vaporiser Changeover Power supply**

Service requirements as indicated on Air Products document F2618. This will consist of a 110/230-volt single-phase supply, terminated in an IP67, BS4343, and surface mounted socket and fused for 16A.

#### **5.4.4 Telemetry Power supply**

Service requirements for telemetry supply as indicated on Air Products document F2618. This will consist of a 110/230-volt single-phase supply, terminated in an IP67, BS4343, and surface mounted socket and fused for 16A.

#### **5.4.5 Low Temperature Alarm System Power Supply**

Service requirements as indicated on Air Products document F2618. This will consist of a 110/230-volt single-phase supply, terminated in an IP67, BS4343, and surface mounted socket and fused for 16A.

#### **5.4.6 Lighting**

Provision of adequate lighting for the duration of Air Products' construction work on site and subsequent maintenance activities / product deliveries. Refer to Tank Plinth Specification

#### **5.4.7 Site Earthing**

All information regarding the site earthing details (including the value of the earth resistance) and to carry out and provide Air Products with the value of the Earth Fault Loop Impedance for the site - as required by IEE Current Edition Wiring Regulations.

#### **5.5 De-icing**

All equipment and labour to de-ice tank pipe work, pressure building and product vaporiser during normal use to prevent excessive ice formation which can reduce system efficiency.

#### **5.6 Filtration**

Prior to commissioning, the system will be thoroughly purged by Air Products to ensure it is free from any contaminants. Should there be any specific filtration requirements, filters should be installed by the customer downstream of the Air Products installation unless otherwise agreed.

#### **5.7 Downstream Piping**

The customer is responsible for the provision of the downstream piping and connection on to the Air Products termination point normally the discharge of the pressure control manifold unless detailed in this Technical Specification.

#### **5.8 Downstream Pressure Protection**

The customer is responsible for ensuring that the downstream piping and equipment is capable of withstanding the fault pressure detailed in section 2. Should additional pressure relief be required this should be provided by the customer following consultation with Air Products.

#### **5.9 Statutory Maintenance**

The customer shall provide access to our equipment and shutdown when requested during normal working hours to allow Air Products to discharge our legal responsibilities for statutory maintenance in accordance with the Pressure

System Safety Regulations (2000). Should the customer not be able to shut down then this should be notified to Air Products to provide suitable measures.

## **6 Supporting Documentation**

- 6.1 Tank Data Sheet
- 6.2 Vaporiser Data Sheet
- 6.3 Pressure and Temperature Control Manifold Data Sheet
- 6.4 Telemetry Service Requirements
- 6.5 Tanker Power Socket
- 6.6 Foundation Details
- 6.7 Generic Plinth layout
- 6.8 Tank Plinth Specification
- 6.9 Material Safety Data Sheet
- 6.10 Safety Distances Data Sheet
- 6.11 Air Products Terms for Engineering Works
- 6.12 Variation Template.

## 7 Notes

- 7.1 Should the customer wish to provide The Pressure Systems Safety Regulations (2000) Written Scheme of Examination and complete the initial examination they may do so. Air Products shall provide system drawings 4 weeks from receipt of order. The customer shall provide a copy of the scheme 2 weeks prior to commissioning and also complete the examination prior to commissioning.
- 7.2 After contract award, and throughout the period of the Bulk Gas Supply Agreement between the customer and Air Products, the customer is responsible for conforming to the responsibilities of a user of the Equipment in accordance with the Pressure Systems Safety Regulations (2000), or any modification, substitution or re-enactment of those regulations. Unless notified in writing, this will be carried out by Air Products at a rate to be advised at the time of conformance.
- 7.3 The installation shall comply with the relevant BCGA Code of Practice and The Application of the Pressure Equipment Regulations to Customer Sites. The code of practice allows for the utilisation of new and used pressure equipment and either a 'Statement of Compliance' or 'Declaration of Conformity' shall be issued for the installation dependent on the equipment installed. The customer shall be responsible for establishing any requirement to CE certify the complete installation prior to project commencement to enable Air Products to establish changes to scope, delivery and project costs
- 7.4 It shall be the responsibility of the customer to ensure compliance with the separation distances from typical hazards and the installation as recommended by the BCGA Code of Practice CP36 for the operational life of the installation. Any changes to the area surrounding the installation which may affect its performance or breach the recommended separation distances should be notified to Air Products for review.
- 7.5 Air Products shall be responsible for ensuring that any electrical equipment under their ownership is maintained in a safe and serviceable condition, in accordance with the Electricity at Work Regulations 1989. The tanker offloading socket shall become the property of the customer and all subsequent maintenance shall be the responsibility of the customer.
- 7.6 It shall be the responsibility of the customer to ensure that any electrical supply to Air Products equipment is installed and maintained in accordance with the IEE Current Edition Wiring Regulations and also complies with any relevant sections of the Electricity at Work Regulations, 1989.
- 7.7 The Equipment as detailed in Section 0 shall be installed to comply with current Air Products standards and specifications in relation to system and component design including material suitability and finish. The equipment will satisfy agreed performance and will meet or exceed any statutory requirements.

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- 7.8 Following satisfactory installation, Air Products shall provide sufficient information, instruction and training on product hazards, the operation of mechanical and electrical equipment, including fault finding and emergency contacts to ensure, so far as is reasonably practicable, the safety of operators. The customer shall be responsible for assisting in any initial fault finding activities to resolve a problem prior to a site visit.
- 7.9 Unless otherwise agreed design validation shall be demonstrated by successful commissioning and recorded by customer acceptance.
- 7.10 All work will be carried out in accordance with the applicable BCGA Codes of Practice and to Air Products' procedures and specifications.
- 7.11 The costs supplied allow for normal weekday working from 8.45am to 5.15pm including travel time. For customer requests to operate outside these hours or at weekends, Air Products reserve the right to levy a charge for this time. This charge shall be at the prevailing engineering charge out hourly rate.
- 7.12 Air Products 'Terms for Engineering Works' apply.
- 7.13 The supplied costs are valid for 30 days
- 7.14 Air Products typical lead time for installation is 8 – 16 weeks from receipt of purchase order dependent on the use of refurbished or new equipment. Actual installation dates to be agreed with your site technical representative at project stage.
- 7.15 Should the installation need to be cancelled or postponed by the customer, 5 working days' notice is required or additional charges may apply.
- 7.16 Should the scope agreed within this document need to be changed the customer is requested to complete the attached variation scope document for review by Air Products to advise cost and time implications.

## **8 Exclusions**

- 8.1 All civil engineering work.
- 8.2 All electrical work (unless specifically stated).
- 8.3 All earthing requirements.
- 8.4 Liquid required for first fill.
- 8.5 Welfare facilities.
- 8.6 Temporary supplies.
- 8.7 Site security

## 9 Service Plus

**Air Products offers the following as part of the Service Plus programme:**

- **Process Evaluation**
- **Process Optimisation**
- **Project Management**
- **Gas Handling, Control and Distribution Equipment**
- **Standard Installation Package**
- **Distribution Systems**
- **Telemetry**
- **Inspection**
- **Maintenance**
- **Pressure Testing**
- **APEX™ (Industrial Gas Services)**
- **Analytical Services**
- **Training**
- **Safety, Health and Environmental**
- **Emergency Cover**
- **Flow & Purity Trials**
- **Pressure System Generation or Written Schemes and Inspections for Users Equipment**
- **Dangerous Substances and Explosive Atmospheres Regulations (2002) Compliance Surveys**

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