AIPS
Airbus Process Specification

Installation of oxygen pipes

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Contents

1 Scope

This Airbus Process Specification defines the Engineering requirements for the installation of oxigen pipes.

The installation of the oxygen system is, in its principle, a standard process of installation with threaded and plugged connections. To this shall be added all the precautions described in this document, which are necessary during the installation, to ensure maximum safety.

This specification does not give detailed instructions; these are given in the Process Instructions (PI) / Airbus Process Instruction (AIPI) and the Work Instructions.

This specification shall not be used as an inspection document.

It shall be applied when mentioned in the relevant standard, material specification or Definition Dossier.

2 Normative references

Only normative references cited in the text are listed hereafter.

The latest issue of the publication referenced shall be used.

A1091	Airbus requirements for the management of hazardous substances.
A-A-58092	Tape, Antiseize, Polytetrafluorethylene – SUPERSEDING MIL-T-27730
ABS0596-003	Insulator, thermal – cable protection – Product Standard.
ABS0916	Tubing, elastomeric, heat-shrinkable, -55°C to +150°C
ABS1169	Aerospace series – Quick-disconnect end – Design standard.
ABS1228	Aerospace series – Cap and plug blanking – Quick-disconnect end.
ABS5334	Tape – Silicone – Self-adhering – Electrical insulation, High temperature.
AIPS03-03-009	Airbus Process Specification – Installation of axial-swaged fittings for oxygen system.
AIPS03-06-008	Airbus Process Specification – Installation of rigid hydraulic pipes and flexible hoses.
AIPS07-01-006	Airbus Process Specification – Electrical bonding.
AIPS09-01-002	Airbus Process Specification – Cleaning with liquid non aqueous agents including vapour phase.
AIPS09-01-003	Airbus Process Specification – Cleaning with aqueous agents.
AIPS09-01-013	Airbus Process Specification – Final cleaning and drying of metallic oxygen pipes, fittings and other components of oxygen systems.
AN817	Nut, tube coupling, long – SUPERSEDED BY SAE AS5206
EN6049-006	Aerospace series – Electrical cables, installation Protection sleeve in meta-aramid fibres – Part 006: Self-wrapping protective sleeve, flexible post installation – Product standard.
EN6049-007	Aerospace series – Electrical cables, installation Protection sleeve in meta-aramid fibres – Part 007: Self-wrapping protective sleeve, flexible post installation, operating temperature from –55ºC to 260ºC – Product standard.
MIL-P-7105	Pipe threads, taper, aeronautical national form, symbol ANPT, General requirements for – SUPERSEDED BY SAE AS71051
MIL-PRF-25567	Leak detection compound, oxygen systems.
MIL-PRF-27210	Oxygen, aviator's breathing, liquid and gas.
MIL-G-27617	Grease, Aircraft and Instrument, fuel and oxidizer resistant – SUPERSEDED BY MIL-PRF-27617
MIL-PRF-27617	Grease, Aircraft and Instrument, fuel and oxidizer resistant.
MIL-T-27730	Tape, antiseize, polytetrafluoroethylene, with dispenser – SUPERSEDED BY A-A-58092
MS33514	Fitting end, standard dimensions for flareless tube connection and gasket seal – SUPERSEDED BY SAE AS33514

MS33656	Fitting end,standard dimensions for flared tube connection and gasket seal – SUPERSEDED BY SAE AS4395
NSA 2017	Torque – Tightening.
NSA835070	Ring for flared tube.
NSA849000	Strip – Spiral.
NSA855010	Union – Straight, For crimped tube.
NSA855034	Bush – Swaged.
NSA935401	Tie – Cable.
NSA935805	Conduit – Electrical, flexible, with normal bend radius.
SAE AS4375	Fitting end, flareless, design standard – SUPERSEDING SAE AS33514
SAE AS4395	Fitting end, flared, tube connection, design standard – SUPERSEDING MS33656
SAE AS5206	Nut, flared, long – SUPERSEDING AN817
SAE AS5863	Fitting end, 24° cone, flareless, fluid connection, design standard – SUPERSEDING SAE AS33514
SAE AS21921	Nut, sleeve coupling, flareless.
SAE AS33514	Fitting end, standard dimensions for flareless tube connection and gasket seal – SUPERSEDING MS33514 – INACTIVE FOR NEW DESIGN – USE SAE AS4375 AND SAE AS5863
SAE AS71051	Pipe threads, taper, aeronautical national form, symbol ANPT – design and inspection standard – SUPERSEDING MIL-P-7105
TNA00710050	Non metallic anti-corrosive coatings (paints – varnishes)

3 Definition, applicability and limitations

3.1 Definition

The requirements of this specification apply to all components of the aircraft oxygen system (ATA35), such as oxygen pipes, flexible hoses, oxygen equipment, pipe couplings etc.

3.2 Nomenclature / Abbreviations

According to Table 1.

Table 1: Nomenclature / Abbreviations

Abbreviation	Meaning
ABS	Airbus Standard
A/C	Aircraft
AIPI	Airbus Process Instruction
AIPS	Airbus Process Specification
ANPT	Aeronautical National Pipe Taper
ATA	Assembly Test Article
e.g.	For example
EIRD	Equipment Installation Requirement Dossier
EN	European Norm

(continued)

Table 1: Nomenclature / Abbreviations (concluded)

Abbreviation	Meaning
GTI	Ground Test Instructions
LR	Long Range
MIL	Military Standard
MS	Military
NA	Not applicable
NSA	Norme Sud Aviation
PI	Process Instructions
PSC	Passenger Supply Channel
PTFE	Poly Tetra Fluoro Ethylene
SA	Single Aisle
TN	Technical Note

3.3 Applicability and limitations

This Airbus specification is applicable when invoked by the drawing directly or through another document for the purpose given in the scope. When processing to AIPS03-06-010 is required, it shall be invoked on the drawing by the words “AIPS03-06-010 – Installation of oxygen pipes”.

For the aircraft oxygen system, this AIPS03-06-010 is defining reference requirements.

For the aircraft oxygen system, exclusively use aerospace type oxygen per MIL-PRF-27210.

Greatest care shall be taken when installing oxygen pipes and hoses. It is not permitted to place objects on or to suspend objects from oxygen pipes and hoses, to draw or pull part over the pipes and hoses or to hang, lie, sit or stand on pipes and hoses.

4 Engineering requirements

Engineering requirements are minimum requirements specified by Responsible Engineering to ensure optimal performance of the manufacturing process.

All Engineering requirements have to be met and controlled in production.

4.1 Cleanliness requirements

4.1.1 System components

The oxygen system shall be free of oil, grease or other readily flammable materials. Furthermore, it shall be free of chips of easily oxidizable metals like aluminium, magnesium and iron, of dust, paint, fibers, wood shavings, paper shreds and other combustible materials.

Oxygen itself represents no hazard, but it is the element which supports the combustion. An increase of its concentration in the air accelerates the combustion. Under certain circumstances (e.g. presence of hydrocarbon vapours, grease, etc.) self-combustion or even explosions can occur.

The combustion process can be caused by self-ignition or by small sparks (e.g. tools or breaking sparks). On account of this behaviour, the cleanliness requirements for the oxygen system are very stringent.

Also particles transported by high speed oxygen flow through the pipe, rubbing at the walls can be heated, so that they reach their autoignition temperature, followed by a perforation of the wall and a possible step by step deflagration of other oxygen equipments.

4.1.2 Workshop requirements

Only the personnel required for the installation of the oxygen system may stay in the working area. Cleaning agents, equipment and tools which are not immediately required for the installation shall be stored outside the working area. Smoking and eating in the working area are forbidden. Operations (such as grinding) which may produce chips are forbidden. Any dust development, e.g. due to sweeping, is unacceptable.

During filling of the oxygen system with oxygen or removal of a system/component already filled, sparking has to be ruled out. This also applies to the leakage test as per subclause 4.4.2 and the removal as per clause 9. For this reason, the electric power supply shall be disconnected and switching operations which may produce electrical sparks are not allowed

4.1.3 Tools and clothes

The tools shall be clean since even smallest particles endanger the tightness of the connections. Furthermore, they shall be free of oil, grease etc. and may only be used for the installation of oxygen pipes. Tools and torque wrenches shall be non-sparking and must be identified with the inscription “For Oxygen”. All tools must be stored in a toolbox with the legend "OXYGEN".

Note 1: Non-sparking tools are not required if the oxygen system or its components are not or were not yet pressurized with oxygen. Due to the high cleanliness requirements on the oxygen system, these tools must be especially marked and stored and **shall in no case be used when the oxygen system or its components are or were already pressurized with oxygen.** In such a case, “spark-free” tools must be used.

Prior to the beginning of work, tools shall be cleaned according to AIPS09-01-002 or AIPS09-01-003. Hands shall be clean, free of oil and grease, including handcream. Bare hands may only touch external surfaces of the oxygen system. Operations on surfaces, which come into contact with oxygen, shall be carried out with nitrile gloves.

Note 2: Lint-free cotton gloves are not admissible.

The operators shall wear clean white overalls or clean room laboratory coats (99% polyester, 1% carbon). Clothes shall be lint-free as far as possible.

Note 3: Angora wool and other fluffy clothing are prohibited.

4.2 Preparations for installation

Check for correct installation and condition of all items used to attach the oxygen components.

4.2.1 Handling of oxygen pipes

On removal from stores utmost care shall be taken when transporting oxygen pipes to the installation. All precautions shall be taken in order to avoid shocks, distortion and scratches.

Once the pipes have been removed from the stores, they shall not be placed anywhere. Provide a mattress or two trestles covered with rubber on which they are to be placed.

4.2.2 Unpacking of the components

Make sure that the components have not been damaged during storage and that their dust-proof plastic bags are correctly sealed.

The oxygen components shall be removed from their plastic bags only just before installation. The caps should only be removed at those points where the fitting will be installed immediately. However, if components cannot be installed immediately, the dust–proof caps on the components must be sealed with Oxygen Clean labels (refer to subclause 4.4.4) to prevent manipulation and contamination.

All components shall be free of oil, grease and solvents containing grease, contamination etc.

If necessary, threads have to be cleaned with cleaning agents as per AIPS09-01-002.

Standard parts have to be cleaned as per AIPS09-01-013, AIPS09-01-002 or AIPS09-01-003.

4.2.3 Lubrication of threads and utilization of thread sealing tape

Lubricants are not allowed as a matter of principle, due to the explosion risk.

Only on systems with gaseous oxygen, the threads flared 37º as per SAE AS4395 and NSA855010 thread flareless 24º as per SAE AS33514 (SAE AS5863 or SAE AS4375) are lubricated with specific product as per MIL-PRF-27617 (previously MIL-G-27617)

However, the lubricant shall be applied very sparingly on the first three turns of external thread parts to avoid introducing the lubricant into the system.

See figures 1 and 2.

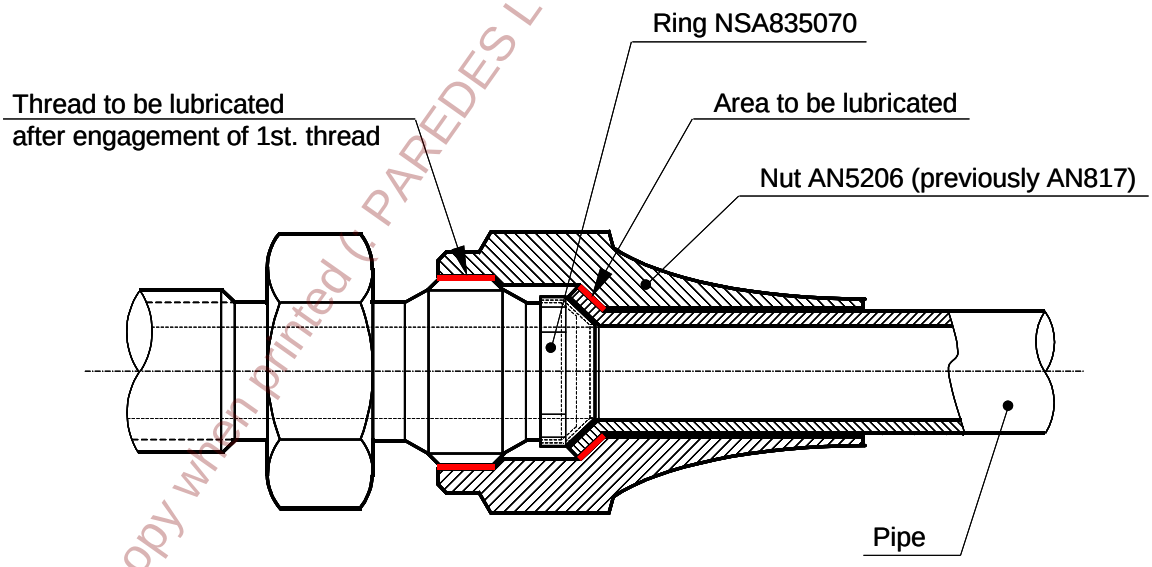


Figure 1: Lubrication of 37° flared fittings

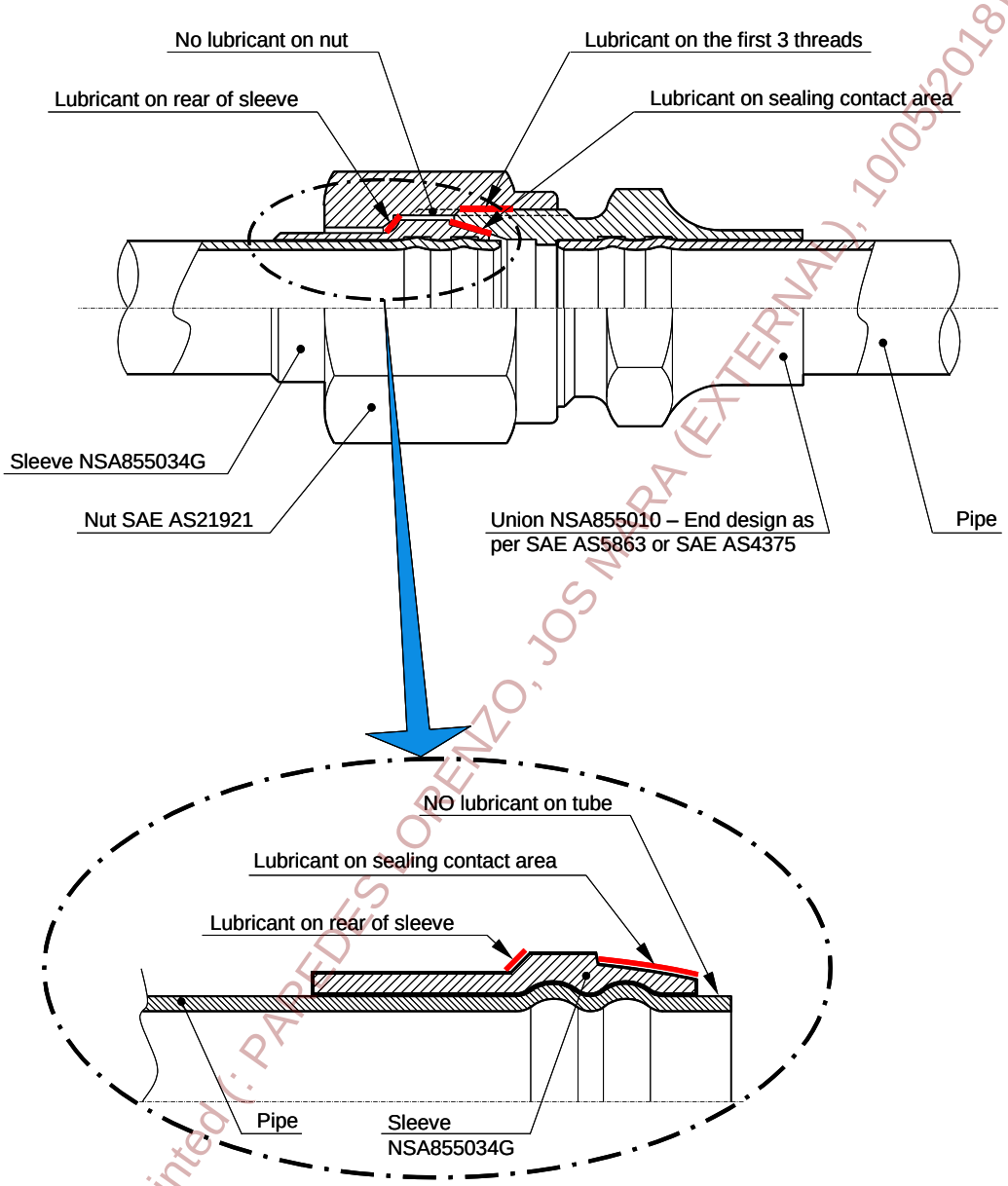


Figure 2: Lubrication of 24° flareless fittings

For taper pipe thread (ANPT – fitting as per MIL-P-7105 or SAE AS71051), a thread sealing tape as per A-A-58092 (previously MIL-T-27730) shall be applied as follows:

- Recommended width = 6,35 mm.
- Apply 1 to 2 turns on the threaded area for diameters up to 38,10 mm, and 2 to 4 turns for larger diameters.
- Wrap over the threads such as to avoid tape displacement during fitting assembly, leaving 1,5 thread free at the end of the fitting.

Note 1: No tape shall be applied to the thread run-out or the fitting face.

When connections using A-A-58092 tape are disassembled, take particular care to avoid contamination of the oxygen system by shreds of the tape. After disassembly, remove the tape, carefully clean and protect the pipe ends and fittings.

Note 2: Due to the explosion risk, never apply lubricant inside the pipes. If lubricant enters the pipe, it must be dismantled and decontaminated in accordance with AIPS09-01-013.

4.2.4 Free ends protection

Special attention shall be kept over oxygen system free ends during assembly. Indeed, during the storage, installation and removal operations, ends left free on equipment, pipes and systems must be blanked with dry, clean, suitable and qualified metal plugs/caps.

It is strictly prohibited to stick adhesive tape directly to the parts to ensure this protection.

Note: For end fittings ABS1169, use plugs/caps ABS1228.

4.3 Installation

4.3.1 Applicable documents

The installation of the oxygen system shall be carried out according to AIPS03-06-008 main requirements and all AIPS03-06-010 requirements.

Electrical bonding connections shall be installed as per AIPS07-01-006.

Swaged fittings (permanent installation) shall be installed in accordance with AIPS03-03-009, specific “oxygen validated” references shall be used.

4.3.2 Minimal clearances

After installation of required protection products on oxygen hoses or pipes, all identifications, labels and markings shall remain visible. In case of conflict between a required protection and a covered label the protection has the higher priority and may cover any label. A protection product shall not be interrupted for any markings and labels.

Note 1: All distances shall be observed by taking into account maximal deflection of parts under any operational conditions.

Note 2: Any deviation to the required clearances to be agreed by oxygen system responsible.

The Table 2 hereunder specifies the minimal clearances allowed during oxygen equipments installation:

Table 2: Minimum distance between oxygen system components and other parts

Dimensions in millimeters

Distance between		Equipment except containers	Tubes / Pipes	Hoses	Oxigen containers
Program	**Component**				
SA	Static parts	10	5	25 15 [2] 6 [3]	10 [5]
LR					
A400M				15 >15 [4]	
A380				25 15 [2] 6 [3]	
A350					
Others					
SA	Moveable part considering maximum deflexion	25	13	50 13 [2]	25
LR					
A400M					
A380			25 13 [1]	25 15 [2]	
A350					
Others					
SA	Electrical wiring and components	150 50 [6] 25 [7] 13 [8]	150 50 [6] 25 [7] 13 [8]	150 50 [6] 25 [7] 13 [8]	150 50 [6] 25 [7] 13 [8]
LR					
A400M					
A380					
A350					
Others					
SA	Combustibles (fuel oils and hydraulic system)	150	150	150	150
LR					
A400M					
A380					
A350					
Others					

[1] If oxygen pipe is protected:
- Preferred: Protection sleeve EN6049-006.
- Other possible protections: Sleeve EN6049-007 or ABS0596, PTFE conduit NSA935805, spiral strip NSA849000 (maintained by cable tie NSA935401), retractable hose ABS0916.

[2] If oxygen hose is protected:
- Preferred: Protection sleeve EN6049-006.
- Other possible protections: Sleeve EN6049-007 or ABS0596, adhesive silicone tape ABS5334.

(continued)

Table 2: Minimum distance between oxygen system components and other parts (concluded)

Distance between		Equipment except containers	Tubes / Pipes	Hoses	Oxigen containers
Program	Component				
[3] Only in PSC and hat racks, hoses must be attached.					
[4] Protect hose with self-adhering silicone tape ABS5334 or retractable hose ABS0916.					
[5] Except minimum distance of oxygen containers to adjacent panels; for minimum allowed distances see relevant EIRD or installation drawings.					
[6] If electrical wires or oxygen lines are electrically protected. (Preferred for wires up to 15 A: sleeve EN6049-007, for wires >15 A sleeve ABS0596 mandatory, also possible on pipes: PTFE conduit NSA935805) **OR** electrical wires supported by additional attachment point.					
[7] If electrical wires or oxygen lines are electrically protected. (Preferred for wires up to 15 A: sleeve EN6049-007, for wires >15 A sleeve ABS0596 mandatory, also possible on pipes: PTFE conduit NSA935805) **OR** electrical wires supported by **secured** attachment point.					
[8] If electrical wires or oxygen lines are electrically protected. (Preferred for wires up to 15 A: sleeve EN6049-007, for wires >15 A sleeve ABS0596 mandatory, also possible on pipes: PTFE conduit NSA935805) **AND** electrical wires supported by secured attachment point. Not allowed for G- and P-routes.					

4.3.3 Tightening torques

Unless otherwise specified on the drawing, the minimum torque values given in NSA2017 apply for tightening of the fittings.

Note: As far as possible, fittings shall be tightened immediately to the minimum torque.

4.3.4 Marking of torqued unions

In order to rule out manipulations or contamination of the system, each fitting shall then be marked (2 mm to 4 mm wide) with a phosphate ester hydraulic resistant red marking lacquer per TNA007.10050 (line ref.182) in accordance with Figure 3.

Before application degrease the surfaces to be painted with cleaning agent as per AIPS09-01-002 or AIPS09-01-003.

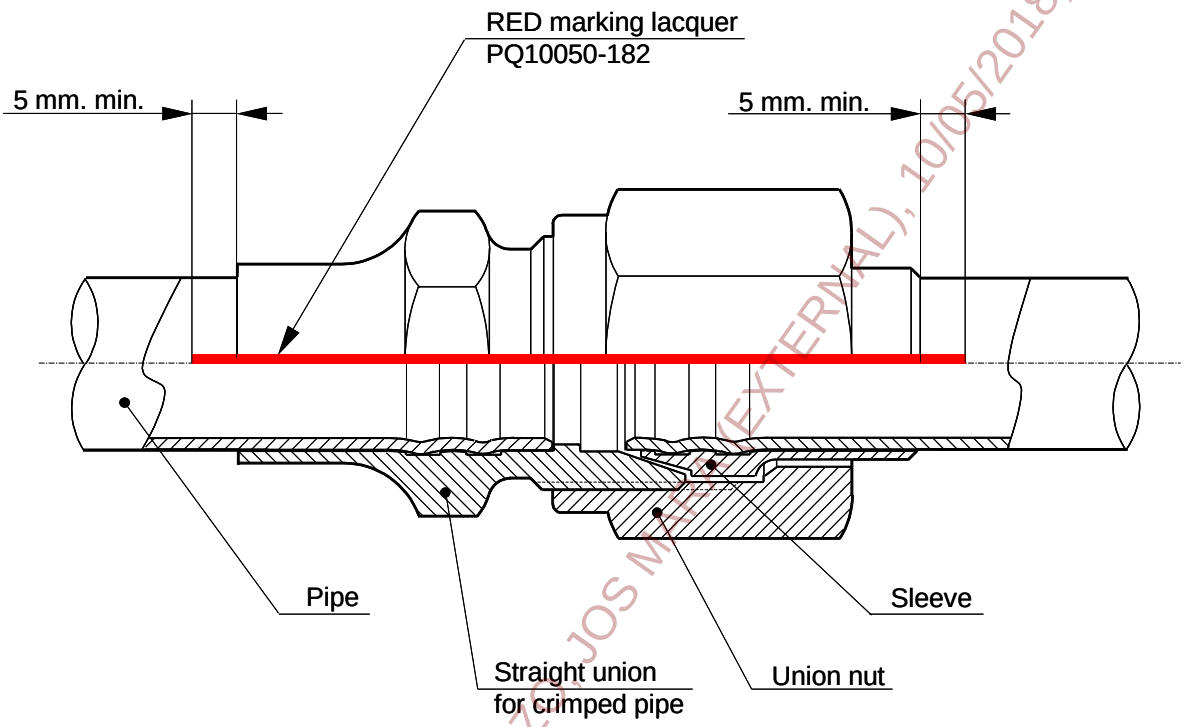


Figure 3: Marking of torqued union

4.3.5 Bonding

All conductive parts, which may be in contact with fuel or fuel/air mixtures, shall be electrically bonded in accordance with relative installation documents and AIPS07-01-006.

Electrical and non-electrical metallic accessories and equipment shall be individually bonded to the structure either directly or through the pipe system.

4.3.6 Removal

Refer to clause 9.

4.4 Tests and quality requirements

4.4.1 Pull test for quick disconnect fittings

Quick disconnect couplings shall be tested by a pull test to ensure the correct installation:

After a successful pull test of the coupling the oxygen clean label shall be sticked.

4.4.2 Leakage test

Leakage testing of the installed oxygen system shall be carried out according to the relevant manufacturing documents and ground test instructions (GTI) in the presence of the responsible inspector.

Leakages shall be detected with the aid of an ultrasonic leak tester or with leak test fluid MIL-PRF-25567 type 1.

Leak test fluid shall be applied around the circumference of all possible leak areas. Care shall be taken to prevent fluid from contacting or dropping on surrounding areas. After completion of the test the fluid shall be wiped off with a clean, lint-free cloth.

In case of leak detection, refer to GTI.

Observe the instructions per 8 with regard to the removal of components of the oxygen system.

4.4.3 Quality control instructions

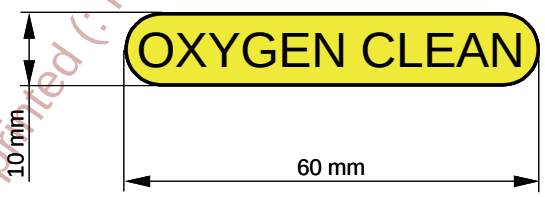
Quality checks shall be performed by the Quality department or by an operator approved by the Quality department to ensure that the requirements of this specification are met.

Refer to clause 8 for requirements to be checked.

4.4.4 Labeling

The labels/seals are marked 'OXYGEN-CLEAN', are yellow with a blue legend and shall only be ordered and applied by the responsible inspector.

See figures 4, 5 and 6.



P/N: L350-77800-202 – Ident No.: 50253682

Figure 4: Application example – Label for screwed and quick connect union

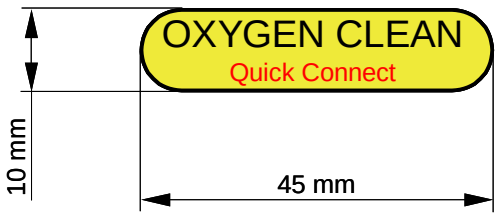


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Figure 5: Application example – Label for quick connect union

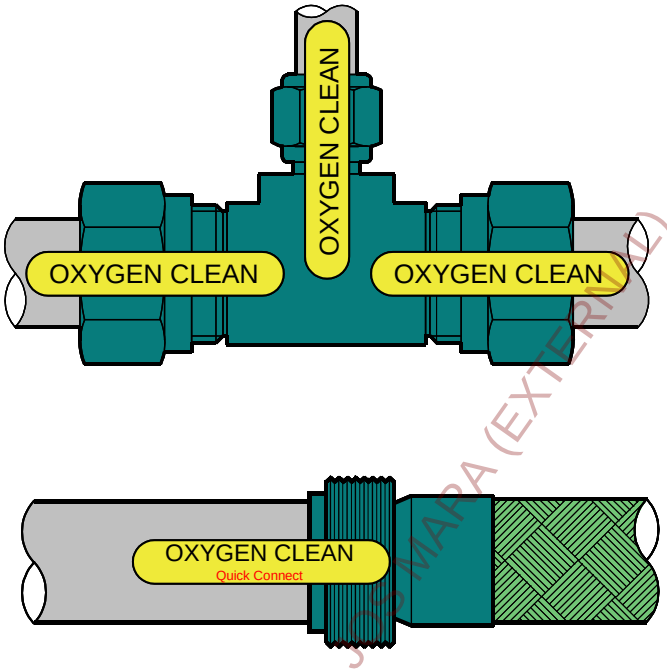

Figure 6: Labelling examples

4.5 Other requirements

4.5.1 Qualification of operators

Only specially trained operators shall be entrusted with the installation of oxygen systems. Operators shall be instructed about the consequences of improper installation and familiar with the contents of this specification. Special instructions about handling of oxygen systems and specific cleanliness requirements for oxygen systems are required.

4.5.2 Manufacturing documents

Reference shall be made to this specification. The manufacturing documents shall ensure that the specified minimum distance between oxygen pipes and that between pipes and adjacent components is achievable within the scope of the specified tolerances.

In cases the torque values for tightening of fittings differ from those given in NSA2017, they shall be specified in the manufacturing documents.

The working plans shall contain the following entry:

CAUTION OXYGEN SYSTEM!

Work must be done without oil and grease!

Extreme explosion hazard!

4.6 Process flow chart

As per Figure 7.

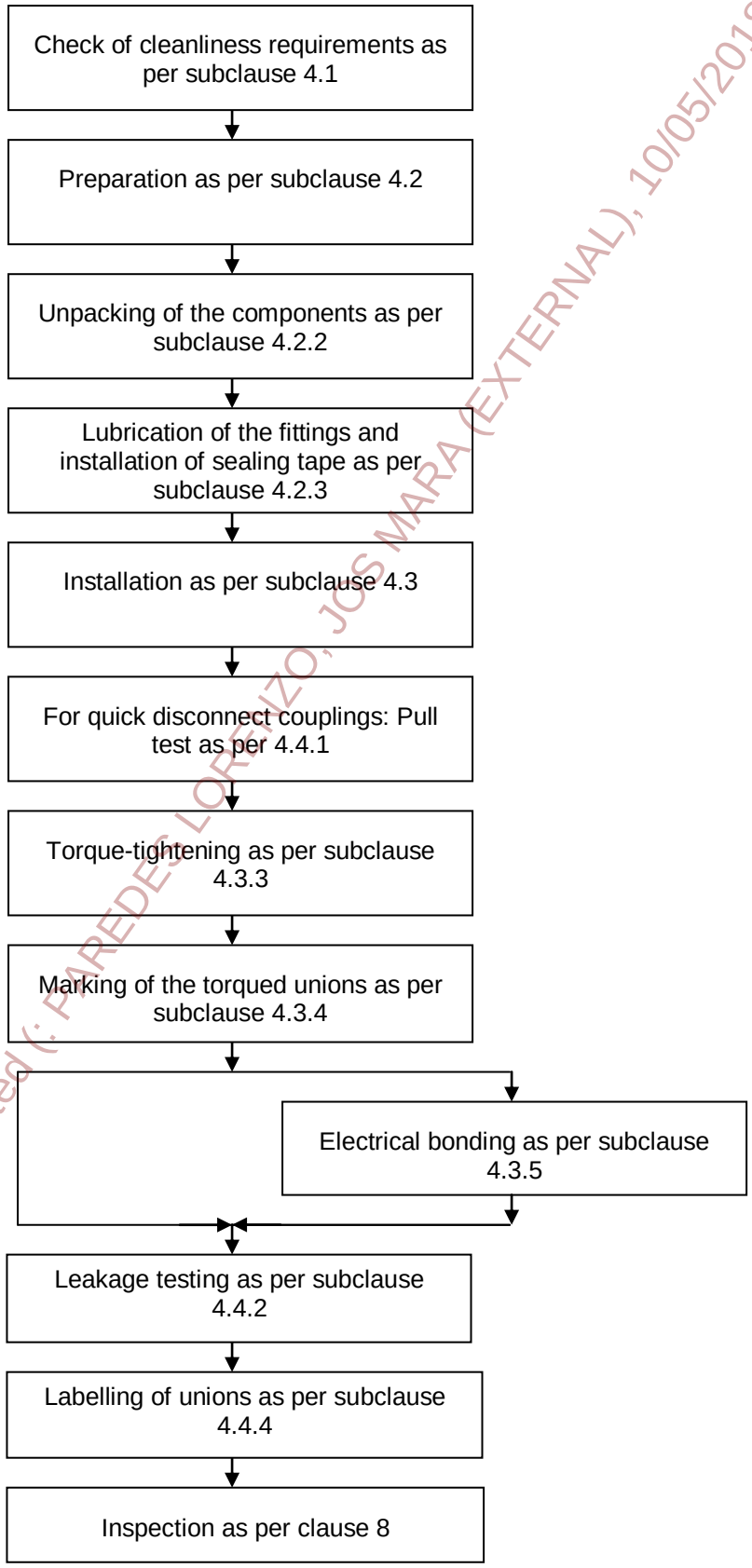

Figure 7: Flow chart

5 Key characteristics

5.1 Key Characteristics

Key Characteristics according to EN9103 are defined by responsible engineering based on a risk analysis for parts installed by this process (see Table 3).
They shall be subject to variation control by production organization according to EN9103.
Key Characteristics do not relieve the production organization from meeting all engineering requirements defined in this document.

Table 3: Key characteristics

Product Key Characteristic			Process Key Characteristic		
No.	**Designation**	**Requirement/ Limit**	**Sub.-No.**	**Designation**	**Requirement/ Limit**
1	Leakage free installation	See subclause 4.4.1	Shall be defined in relevant AIPI		
2	Electrical continuity installation	See subclause 4.3.5			
3	Correct torque tightening	See subclause 4.3.3			

It is assumed that:

a. only qualified tools are used,
b. the installation is damage free,
c. the pipes are installed according to plan ensuring that the segregation distances are achieved

6 Technical qualification

This manufacturing process does not require a technical qualification.

7 First part qualification

Not applicable.

8 Series production inspection

The shop shall perform the following series production inspections under serial conditions:

- All pipes/hoses/equipment shall be subjected to a visual inspection after installation.
- Pipe attachments shall be checked for correct installation. Check that junctions are free from tension and that the pipes are correctly aligned.
- It shall be checked that the specified minimum distances have been observed in accordance with subclause 4.3.2.
- Torque-tightening in accordance with subclause 4.3.3.
- Marking of torqued unions as described in subclause 4.3.4.
- Electrical bonding connections shall be in accordance with subclause 4.3.5.
- Cleaning shall be in accordance with subclause 4.1.
- Leakage testing has to be carried out according to subclause 4.4.2 and relevant GTI.
- After successful leakage testing, all removable connections of the gaseous oxygen system shall be identified with labels/seals by the responsible inspector. This is done in the direction of the pipes so that connections can only be released by destroying the seal. For connected quick disconnect fittings, the labels/ seals shall be sticked after pull test and immediately after installation according to subclause 4.4.1.
- Labeling has to be carried out according to subclause 4.4.4.

9 Rework

9.1 During installation

If the oxygen system has been opened for more than six minutes or if damaged seals/labels detected at the connections show that system has been opened, the following applies:

- In the case of damaged seals/labels, interrupt the oxygen supply and depressurize the affected pipe/system.
- Remove the affected components and all components adjoining the open points such as equipment, hoses, pipes etc. as well as the components at a distance up to 1 m pipe length.
- In order to avoid any contamination of the oxygen system, all open ends of the system and the removed parts shall immediately be sealed with clean, metal plugs and identified with labels/seals per 7. The metal plugs shall be cleaned per AIPS09-01-013, AIPS09-01-002 or AIPS09-01-003 immediately prior to installation. Quick disconnect caps ABS1169 (without style code “S”) shall not be cleaned and reused.

Note 1: Removed components have to be identified.

Note 2: Standard parts, pipes, equipment and hoses shall be packed in dust protection bags.

- Clean the components as per AIPS09-01-013, AIPS09-01-002 or AIPS09-01-003 and put them into intermediate storage at a location selected and identified for this purpose until they are required for installation.

Note 1: Oxygen hoses cannot be cleaned and have to exchanged.

- Re-installation is performed in accordance with subclauses 4.2 and 4.3, followed by a Leakage test as per subclause 4.4.2 and relevant GTI.

9.2 After installation

If the oxygen system has to be opened after installation the following requirements apply:

- Interrupt the oxygen supply and depressurize the affected pipe/system (for permanently pressurized areas only)
- To avoid penetration of contamination into the oxygen system, immediately seal all open ends of the system and removed components with clean, metal plugs and identify with labels/seals according to clause 7. Immediately prior to installation, the metal plugs shall be cleaned according to AIPS09-01-013, AIPS09-01-002 or AIPS09-01-003.
- These steps may then be followed by an inspection or replacement of components or pipes.
- Installation shall be in accordance with subclauses 4.2 and 4.3, followed by a Leakage test as per subclause 4.4.2 and relevant GTI.

10 Environment, health and safety

The manufacturing process shall be in line with Airbus Health and Safety and ecoefficiency policies.

Compliance with A1091 shall be ensured for all materials, substances and/or articles implemented during process. In particular, targeted substances according to A1091 shall not be used, if a safer alternative is available.

Uses made of all substances involved in the process shall be documented in Safety Data Sheet as required by REACh regulation (Registration Evaluation and Authorization of Chemicals)

RECORD OF REVISIONS

Issue	Clause modified	Description of modification
1 09/97		New standard.
2 09/10	All	New template. Including new data from several documents edited after first issue. Updated documents references. Table 1 added. New minimum distances between pipes including A400M, A380 and A350 values. New tools requirements. Installation requirements extended. PTFE conduit ABS0887 not authorized due to flammability weakness.
3 01/13	Chapter 4.4 Figure 4 Chapter 8.1 Table 3	Added Chapter 4.4.1 and reworked flow chart 4.6. Revised figure 4. Revised chapter 8.1. Added Chapter and Table 3. Key Characteristics.