NATO STANDARDIZATION AGENCY
AGENCE OTAN DE NORMALISATION

MILITARY COMMITTEE AIR STANDARDIZATION BOARD (MCASB)

4 March 2005 NSA(AIR)0197-GGS/7106

MCASB

STANAG 7106 GGS (EDITION 2) – CHARACTERISTICS OF GASEOUS BREATHING OXYGEN, LIQUID BREATHING OXYGEN AND SUPPLY PRESSURES, HOSES AND REPLENISHMENT COUPLINGS

References:
A. NSA(AIR)0981-GGS/7106 dated 10 November 2003 (Edition 2) (Ratification Draft 1).
B. NSA(AIR)1240-GGS/7106 dated 19 December 2002 (Edition 1).

1. The enclosed NATO Standardization Agreement, which has been ratified by nations as reflected in the **NATO Standardization Document Database (NSDD)**, is promulgated herewith.

2. The references listed above are to be destroyed in accordance with local document destruction procedures.

ACTION BY NATIONAL STAFFS

3. National staffs are requested to examine their ratification status of the STANAG and, if they have not already done so, advise the MCASB, NSA, through their national delegation as appropriate of their intention regarding its ratification and implementation.

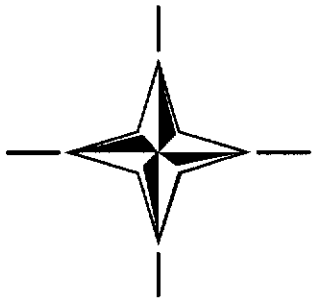
J. MAJ
Brigadier General, POL(A)
Director, NSA

Enclosure:
STANAG 7106 (Edition 2.)

NATO Standardization Agency – Agence OTAN de Normalisation
B-1110 Brussels, Belgium Internet site: http://nsa.nato.int
E-mail: nsa.air@hq.nato.int – Tel 32.2.707.5588 – Fax 32.2.707.5718

STANAG 7106
(Edition 2)

NORTH ATLANTIC TREATY ORGANIZATION
(NATO)



NATO STANDARDIZATION AGENCY
(NSA)

STANDARDIZATION AGREEMENT
(STANAG)

SUBJECT: CHARACTERISTICS OF GASEOUS BREATHING OXYGEN, LIQUID BREATHING OXYGEN AND SUPPLY PRESSURES, HOSES AND REPLENISHMENT COUPLINGS

Promulgated on 4 March 2005

J. MAJ
Brigadier General, POL(A)
Director, NSA

RECORD OF AMENDMENTS

No.	Reference/date of Amendment	Date Entered	Signature

EXPLANATORY NOTES

AGREEMENT

1. This NATO Standardization Agreement (STANAG) is promulgated by the Director NATO Standardization Agency under the authority vested in him by the NATO Standardization Organisation Charter.

2. No departure may be made from the agreement without informing the tasking authority in the form of a reservation. Nations may propose changes at any time to the tasking authority where they will be processed in the same manner as the original agreement.

3. Ratifying nations have agreed that national orders, manuals and instructions implementing this STANAG will include a reference to the STANAG number for purposes of identification.

RATIFICATION, IMPLEMENTATION AND RESERVATIONS

4. Ratification, implementation and reservation details are available on request or through the NSA websites (internet http://nsa.nato.int; NATO Secure WAN http://nsa.hq.nato.int).

FEEDBACK

5. Any comments concerning this publication should be directed to NATO/NSA – Bvd Leopold III - 1110 Brussels - BEL.

STANAG 7106
(Edition 2)

NAVY/ARMY/AIR

NATO STANDARDIZATION AGREEMENT (STANAG)

CHARACTERISTICS OF GASEOUS BREATHING OXYGEN, LIQUID BREATHING OXYGEN AND SUPPLY PRESSURES, HOSES AND REPLENISHMENT COUPLINGS

Annexes:

A. Mating dimensions and Access clearance dimensions for gaseous oxygen replenishment coupling – aircraft half.

B. Mating dimensions and Access clearance dimensions for liquid oxygen replenishment coupling – ground half.

Related Documents:

ISO 725 - ISO INCH SCREW THREADS – BASIC DIMENSIONS

ISO 1101 - TECHNICAL DRAWINGS – GEOMETRIC TOLERANCING – TOLERANCING OF FORM, ORIENTATION, LOCATION AND RUN-OUT – GENERALITIES, DEFINITIONS, SYMBOLS, INDICATIONS ON DRAWINGS

ISO 1302 - GEOMETRICAL PRODUCT SPECIFICATIONS (GPS) – INDICATION OF SURFACE TEXTURE IN TECHNICAL DRAWINGS.

ISO 3161 - AEROSPACE - UNJ THREADS – GENERAL REQUIREMENTS AND LIMIT DIMENSIONS

AIM

1. The aim of this agreement is:

   a. to establish the minimum acceptable characteristics of gaseous breathing oxygen and liquid breathing oxygen purchased or produced for cross-servicing NATO aircraft;

   b. to simplify the cross-servicing of aircraft gaseous oxygen systems through the adoption of standardised supply pressures, hoses, couplings and access clearance for the replenishment of those gaseous oxygen systems,

   c. to increase the effectiveness of cross-servicing NATO aircraft by ensuring the minimum acceptable characteristics of charging connectors used in the replenishment of aircraft liquid oxygen systems.

AGREEMENT

2. Participating nations agree that when liquid or breathing oxygen is purchased or produced, it shall have the following characteristics:

a. Minimum purity: 99.5 %

b. Maximum water content: 5 mg/m^3 at 288 K (15 °C) and 101,3 KPa (760 mm Hg) (7 ppm by volume) (- 63 °C dewpoint, over ice).

c. Odour: Free from odour.

d. That the oxygen shall be free from toxic or irritating concentrations of contaminating substances. Table 1 provides the maximum limits of minor contaminants permitted for both gaseous and liquid oxygen.

3. When Breathing oxygen is supplied for cross-servicing NATO aircraft, participating nations agree:

a. That Breathing oxygen shall be supplied at sufficient pressure to replenish the aircraft oxygen system. Pressure reducing valves (regulators) shall be used to reduce the supply pressure to that of the aircraft being filled.

b. That the oxygen charging hoses shall be able to withstand the maximum working pressure indicated in Table 2, with the provision for a momentary increase in pressure to allow for temperature and pressure correction. For safety reasons, the charging hoses shall be approved for use in replenishing oxygen systems and be constructed of a material known to be compatible with oxygen at the pressures quoted.

c. For replenishment of gaseous oxygen, that the charging hose shall be a minimum of 9 metre (30 ft) in length.

d. That where practicable a 30 μm filter, of the sintered brass type, shall be fitted as close as possible to the delivery equipment or hose outlet.

4. Participating nations agree:

a. That aircraft gaseous oxygen systems with charge pressures up to a maximum of 20 MPa (200 bar / 2,900 psi), shall have replenishment couplings which comply with the mating features detailed in Annex A, Figure A-1.

b. That the connecting thread shall be either:

(1) 3/8-24 UNF in accordance with the general requirements of ISO 725, and with dimensions as given in Table 3; or

(2) 0.375-24 UNJF in accordance with ISO 3161 and with dimensions as given in Table 3.

c. To provide coupling access clearance in future aircraft designs which accord with the minima given in Annex A, Figure A-2.

d. That ground servicing equipment for the replenishment of aircraft gaseous oxygen systems, shall be equipped with a half coupling which is compatible with Annex A, Figure A-1, and capable of being fitted to and removed from the aircraft half coupling within the clearance envelope defined in Annex A, Figure A-2.

5. Participating nations agree:

a. That the liquid oxygen replenishment half-coupling fitted to Ground Servicing Equipment used for the servicing of aircraft systems shall incorporate the following requirements:

(1) That the valve seal shall be held in its longitudinal position by means of a spring having the following characteristics:

(a) Spring deflection rate: 1.3 ± 0.29 mm per decaNewton (0.023 ± 0.005 inches per lbf).

(b) In the fully coupled position the sealing zone of the nose shall remain leak-proof through all positions of dimensions "X" (see Annex B, Figure B-1), that is from 10.11 mm to 25.02 mm (0.398 inch to 0.985 inch), and shall produce a load on the seal of the aircraft half connector of 22.24 ± 2.24 decaNewton (50 lbf ± 5) when the dimension "X" is 11.94 mm (0.470 inch). The load shall not exceed 35.58 decaNewton (80 lbf) for any value of "X" in its permitted range.

NOTE: Seal contact at 0.500 inch (12.70 mm) gauge diameter is assumed for the purpose of this Standard.

(2) In the uncoupled position the valve poppet shall be held by a spring having the following characteristics:

(a) Spring rate: 5 ± 0.57 mm per decaNewton (0.088 ± 0.010 inch deflection per lbf).

(b) That the spring shall provide a force of 2.67 ± 0.22 decaNewton (6 ± 0.5 lbf) when the leading face of the poppet is located flush with the forward face of the seal.

(c) That the range of movement of the poppet valve shall be permitted to a depth of 2.03 mm (0.080 inch) within the seal.

b. That the aircraft shall be fitted with a liquid oxygen replenishment half coupling compatible with Annex B, Figures B-1, B-2 and B-3, and a minimum clearance envelope as defined in Annex B, Figure B-4 such that the ground half coupling specified in Annex B, Figures B-1, B-2 and B-3 is capable of being fitted to and removed from the aircraft replenishment half coupling."

c. That the storage and transfer tanks and hoses for liquid oxygen shall be suitable for a working pressure of up to 3.5 Bar (or 50 psi). For safety reasons, the charging hoses shall be approved for use in replenishing liquid oxygen systems and be constructed of a material known to be compatible with liquid oxygen.

d. That the aircraft servicing hose shall be flexible for easy handling and shall have a minimum length of 3 metres (10 feet). That the minimum bend radius of the hose shall not exceed 152.40 mm (6.000 inches).

e. That the aircraft servicing equipment, including delivery hose and ground service connector, when engaged with the aircraft external charging connector shall be capable of transferring liquid oxygen at a minimum rate of 3.63 kg per minute (8 pounds per minute) using a tank driving pressure of 2.1 ± 0.3 bar (30 ± 5 psi) while discharging the flow to atmosphere.

6. For the information of nations in the event of cross-servicing requirements for LOX, there are essential differences between the connectors of the GBR and the USA bulk tank and servicing carts which are illustrated in Annex B, Figures B-5 and B-6.

TABLE 1 – LIMITS FOR MINOR CONTAMINANTS.

CONTAMINANT	MAXIMUM LIMIT (ppm by volume)	
	Gaseous Oxygen	Liquid Oxygen
Carbon Dioxide (CO_2)	10.0	5.0
Methane (CH_4)	50.0	25.0
Acetylene (C_2H_2)	0.1	0.05
Ethylene (C_2H_4)	0.4	0.20
Ethane and higher hydrocarbons (as ethane) (C_2H_6)	6.0	3.0
Nitrous Oxide (N_2O)	4.0	2.0
Refrigerants	2.0	1.0
Solvents	0.2	0.1
Other Contaminants	0.2 See notes 2 & 3.	0.1 See notes 2 & 3.

NOTES:

(1) Contaminants shall be determined using analytical techniques approved by an accredited laboratory.
(2) Nitrogen and argon shall not be considered as contaminants.
(3) Other contaminants, other than those listed in Table 1, shall be identified and reported to the relevant Quality Assurance Authority. If this level is exceeded, the oxygen shall not be used.

TABLE 2 - SUPPLY PRESSURE FOR REPLENISHING AIRCRAFT OXYGEN SYSTEMS

ITEM No.	SUPPLY PRESSURES		
	MPa	(kgf / cm^2)	(lbf / in^2)
1	3.1	31.6	450
2	12.4	127.0	1800
3	14.5	148.0	2100
4	17.5	180.0	2550
5	22.0	225.0	3200
6	30.0	306.0	4350

NOTES:

(1) The 30.0 MPa supply pressure is included as the breathing gas supply industry is in the process of supplying 30.0 MPa (300 bar) cylinders, however not all countries are expected to implement this supply pressure.

(2) Supply pressures are quoted in accordance with the International System of Units (SI) in units of Pascal (Pa), in this case in the multiple units: megaPascal. To aid conversion to other units of pressure in common use: 1 MPa = 1 MN / m^2 (megaNewtons per square metre) = 10 bar = 145.038 psi (pounds per square in). The two non-SI units of kgf / cm^2 and lbf / in^2 are kilogramme force per square centimetre and pounds force per square inch respectively.

TABLE 3 - THREAD DIMENSIONS – GASEOUS REPLENISHMENT COUPLINGS

THREAD DESIGNATION	DIMENSIONS						
	Limits	Major Diameter		Pitch Diameter		Minor Diameter	
		mm	(Inches)	mm	(Inches)	mm	(Inches)
3/8-24 UNF based on ISO 725	Max Min	9.525 9.343	0.3750 0.3678	8.836 8.763	0.3479 0.3450	8.227 8.077	0.3239 0.3180
0.375-24 UNJF based on ISO 3161	Max Min	9.525 9.343	0.3750 0.3678	8.836 8.763	0.3479 0.3450	8.300 8.164	0.3268 0.3214

IMPLEMENTATION OF THE AGREEMENT

7. This STANAG is considered implemented in separate parts:

a. When participating nations have issued the necessary national instructions/specifications for the liquid or breathing oxygen to conform to the provisions contained herein.

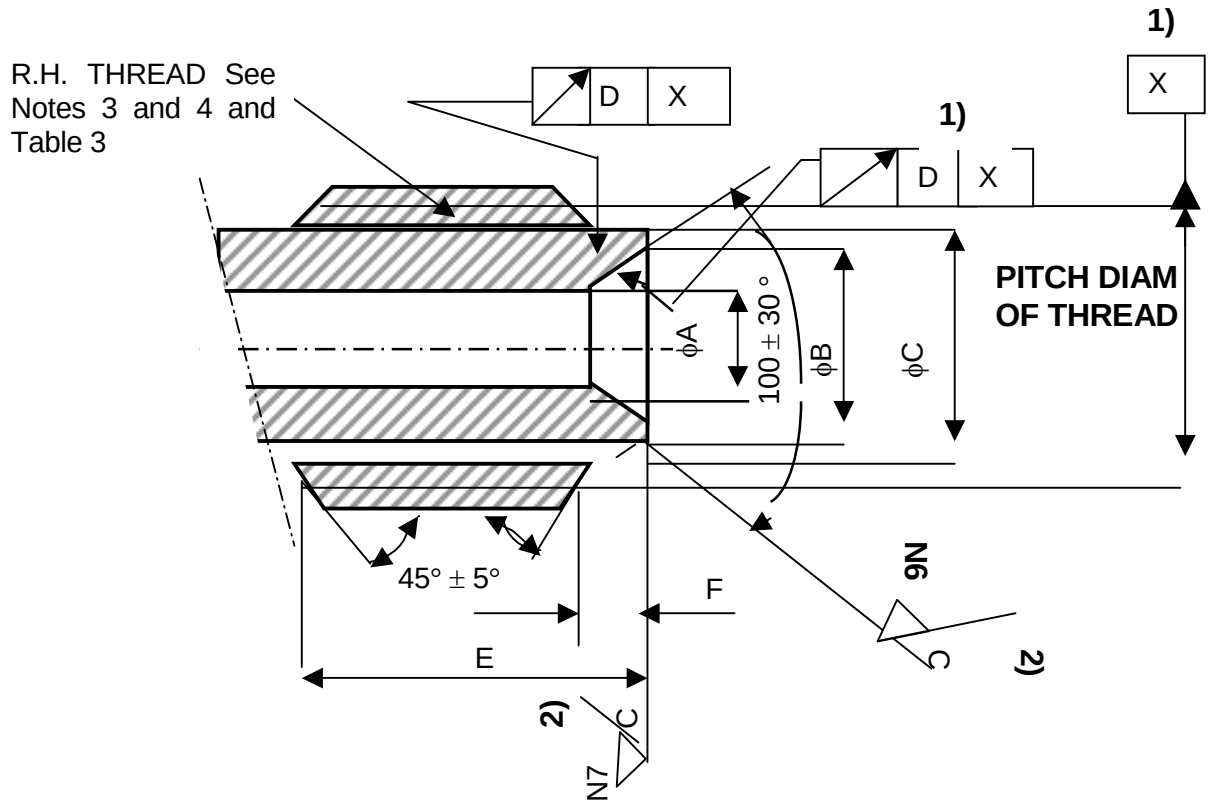
b. When participating nations have issued instructions that future aircraft gaseous oxygen charging systems will be inaccordance with this agreement.

c. When participating nations have issued instructions that its ground servicing equipment shall comply with this agreement.

ANNEX A TO
STANAG 7106
(EDITION 2)

MATING DIMENSIONS AND ACCESS CLEARANCE DIMENSIONS FOR GASEOUS OXYGEN REPLENISHMENT COUPLING – AIRCRAFT HALF.

FIGURE A-1 - MATING DIMENSIONS FOR GASEOUS OXYGEN REPLENISHMENT COUPLING – AIRCRAFT HALF



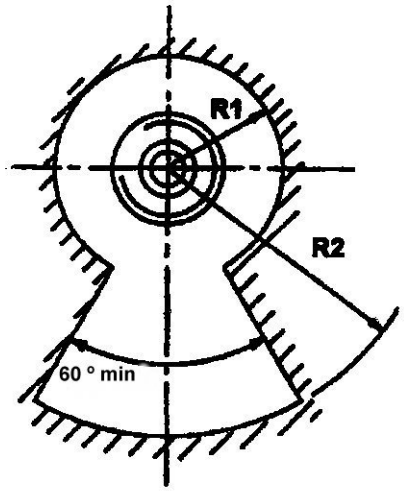
DIMENSIONS		
LETTER	INCHES	MILLIMETRES
ϕA	0.166 0.118	4.22 3.00
ϕB	0.286 0.276	7.26 7.01
ϕC	0.310 0.305	7.87 7.75
D	0.004	0.10
E	0.297 0.327	7.54 8.31
F	0.052 0.042	1.32 1.07
N6	32μ in (Ra)	0.8μ m (Ra)
N7	63μ in (Ra)	1.6μ m (Ra)

NOTES
1) GEOMETRIC TOLERANCES: ISO 1101.
2) SURFACE TEXTURE: ISO 1302.
3) INCH SCREW THREADS – BASIC DIMENSIONS – ISO 725.

OR

4) UNJ THREADS WITH CONTROLLED ROOT RADIUS FOR AEROSPACE INCH SERIES ISO 3161.

FIGURE A-2 - ACCESS CLEARANCE DIMENSIONS FOR GASEOUS OXYGEN REPLENISHMENT COUPLING – AIRCRAFT HALF.

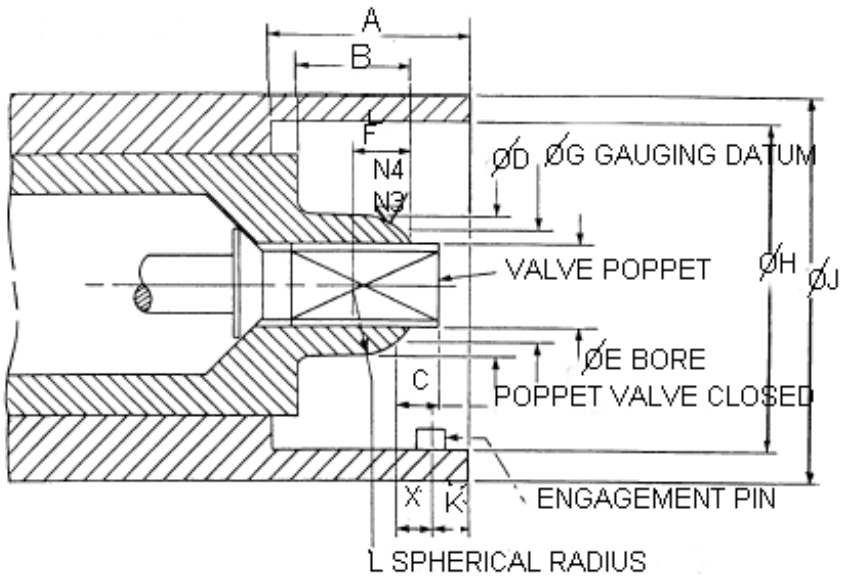


DIMENSIONS	MM	(INCHES)
R1 min	55	2.2
R2 min	190	7.5

ANNEX B TO
STANAG 7106
(EDITION 2)

MATING DIMENSIONS AND ACCESS CLEARANCE DIMENSIONS FOR LIQUID OXYGEN REPLENISHMENT COUPLING – GROUND HALF.

FIGURE B-1 - MATING DIMENSIONS OF LIQUID OXYGEN GROUND HALF COUPLING.



Dimension	Maximum		Minimum	
	Millimetres	(Inches)	Millimetres	(Inches)
A	-	-	21.33	0.840
B	12.04	0.474	11.79	0.464
C	4.95	0.195	4.45	0.175
D	16.00	0.630	15.75	0.620
E	8.79	0.346	8.69	0.342
F	6.48	0.255	6.22	0.245
G	12.70	0.500	12.70	0.500
H	35.76	1.408	35.71	1.406
J	51.21	2.016	-	-
K	4.09	0.161	-	-
L	8.00	0.315	7.87	0.310
M	-	-	76.20	3.000
N4/N3	0.0002	8×10^{-6}	0.0001	4×10^{-6}

FIGURE B-2: POPPET, FEMALE FILL VALVE.

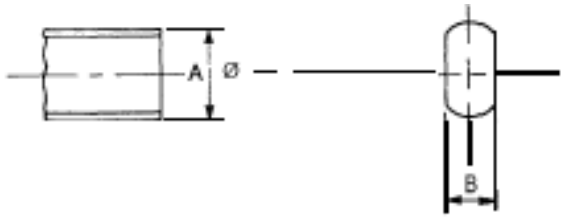
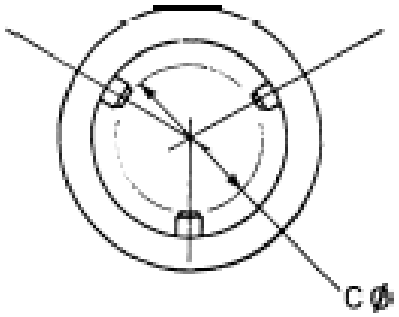


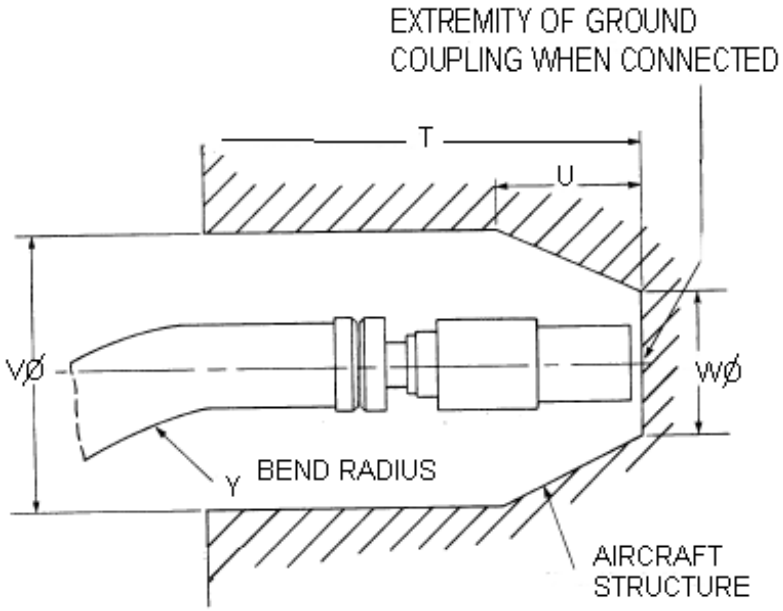
FIGURE B-3: ENGAGEMENT PINS – LIQUID OXYGEN GROUND HALF COUPLING



THREE ENGAGEMENT PINS 3.96 ± 0.13 MM (0.156 ± 0.005 INCHES) DIAMETER SHALL BE EQUALLY SPACED AT 120 ° ± 0.5 ° AND SHALL BE PERPENDICULAR TO THE VALVE CENTRE LINE WITHIN ± 0.5 °.

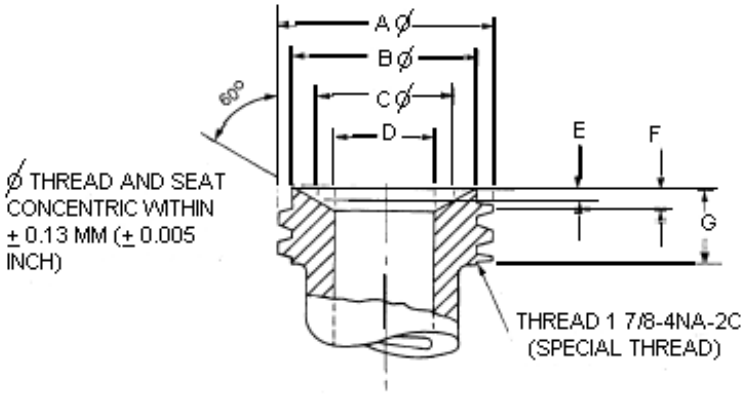
DIMENSION (FIGURES B-2 AND B-3)	MAXIMUM		MINIMUM	
	MILLIMETRES	(INCHES)	MILLIMETRES	(INCHES)
A	8.59	0.338	8.48	0.334
B	4.90	0.193	4.65	0.183
C	28.98	1.141	28.17	1.109

FIGURE B-4: CLEARANCE ENVELOPE FOR LIQUID OXYGEN GROUND HALF COUPLING



DIMENSION	MAXIMUM		MINIMUM	
	MILLIMETRES	(INCHES)	MILLIMETRES	(INCHES)
T	279.40	11.000	-	-
U	101.60	4.000	-	-
V	-	-	177.80	7.000
W	-	-	95.25	3.750
Y	-	-	152.40	6.000

FIGURE B-5: MATING DIMENSIONS – GBR LIQUID OXYGEN BULK TANK OR SERVICING CART



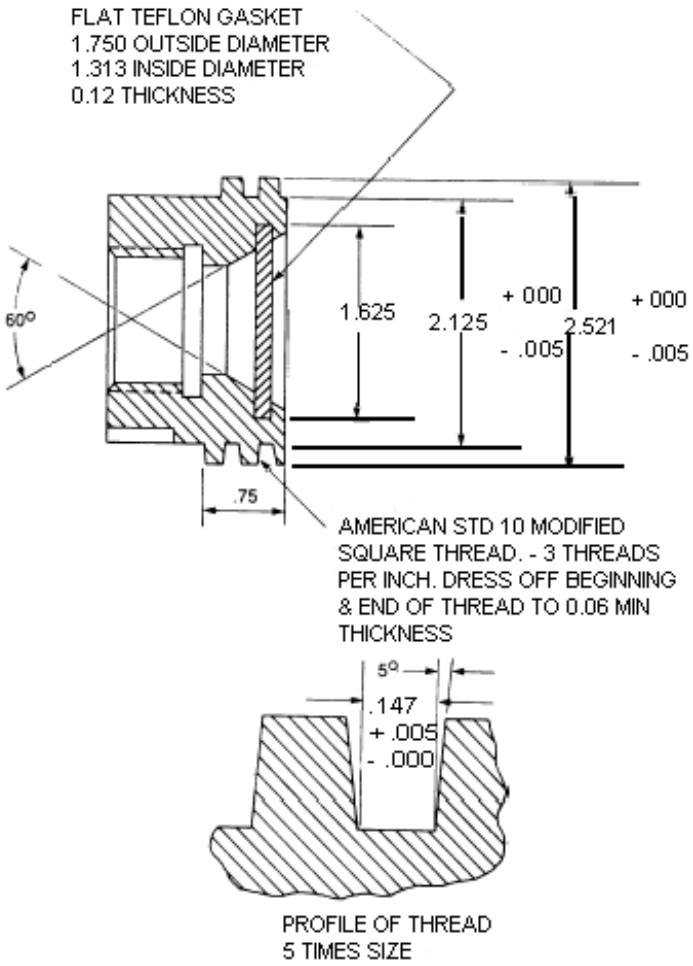
Note. For the information of nations in the event of cross-servicing requirements for LOX, there are essential differences between the connectors of the GBR and the USA bulk tank and servicing carts see Figures B-5 and B-6.

DIMENSION	MAXIMUM		MINIMUM	
	MM	(INCHES)	MM	(INCHES)
A	47.63	1.875	47.50	1.870
B	40.77	1.605	39.88	1.570
C	37.29	1.468	SEE NOTE	
D	28.58	1.125	82.23	0.875
E	0.97	0.038	SEE NOTE	
F	5.13	0.202	4.37	0.172
G	14.66	0.577	13.89	0.547

DIMENSION	MM	(INCH)
MAJOR DIA.	47.63 47.50	1.875 1.870
PITCH DIA.	44.20 43.59	1.740 1.716
PITCH	6.35	0.250
THICKNESS OF THREAD AT PITCH LINE		
	3.18	0.125
ANGLE OF THREAD	29 °	

NOTE: DIMENSIONS C & E REFER TO DATUM CONTACT POINT OF HOSE CONNECTION

FIGURE B-6: USA 1 INCH LIQUID OXYGEN COUPLING FILL POINT FOR AIRCRAFT SERVICING CARTS



Note. For the information of nations in the event of cross-servicing requirements for LOX, there are essential differences between the connectors of the GBR and the USA bulk tank and servicing carts see Figures B-5 and B-6.