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**NORTH ATLANTIC TREATY ORGANIZATION
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See Distribution List : STANAG AC/112 (PHEWG)

**STANAG 3756 (EDITION 4) – FACILITIES AND EQUIPMENT FOR RECEIPT AND
DELIVERY OF AVIATION KEROSENE AND DIESEL FUELS**

References: (a) MAS(AIR)24-PHE/3756, dated 27 February 1990
(b) LOG/SUPP.P(00)77, dated 26 July 2000 (Edition 4) (Ratification Draft 3)

1. The enclosed NATO Standardisation Agreement which has been ratified by nations as reflected in page iii is promulgated herewith.
2. The above references are to be destroyed in accordance with local document destruction procedures.
3. AAP-4 should be amended to reflect the latest status of the STANAG.

ACTION BY NATIONAL STAFFS

4. National staffs are requested to examine page iii of the STANAG and, if they have not already done so, advise the Chairman, NATO Pipeline Committee (AC/112) of their intention regarding its ratification and implementation.

Jan H. ERIKSEN
Rear Admiral, NONA
Director, NSA

M.H. Vermeulen
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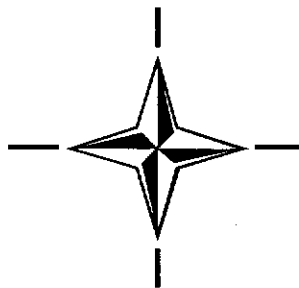
Enclosure:
STANAG 3756 (Edition 4)

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**STANAG 3756
(Edition 4)**

**NORTH ATLANTIC TREATY ORGANIZATION
(NATO)**



**NATO STANDARDIZATION AGENCY
(NSA)**

**STANDARDIZATION AGREEMENT
(STANAG)**

**SUBJECT: FACILITIES AND EQUIPMENT FOR RECEIPT AND DELIVERY OF
AVIATION KEROSENE AND DIESEL FUELS**

Promulgated on 9 September 2002

Jan H ERIKSEN
Rear Admiral, NONA
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STANAG 3756
(Edition 4)

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, NSA under the authority vested in him by the NATO Military Committee.
2. No departure may be made from the agreement without consultation with the tasking authority. 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.

DEFINITIONS

4. Ratification is "In NATO Standardization, the fulfilment by which a member nation formally accepts, with or without reservation, the content of a Standardization Agreement" (AAP-6).
5. Implementation is "In NATO Standardization, the fulfilment by a member nation of its obligations as specified in a Standardization Agreement" (AAP-6).
6. Reservation is "In NATO Standardization, the stated qualification by a member nation that describes the part of a Standardization Agreement that it will not implement or will implement only with limitations" (AAP-6).

RATIFICATION, IMPLEMENTATION AND RESERVATIONS

7. Page iii gives the details of ratification and implementation of this agreement. If no details are shown it signifies that the nation has not yet notified the tasking authority of its intentions. Page iv (and subsequent) gives details of reservations and proprietary rights that have been stated.

FEEDBACK

8. Any comments concerning this publication should be directed to NATO/NSA - Bvd Leopold III, 1110 Brussels - BE.

NATO STANDARDIZATION AGREEMENT
(STANAG)

FACILITIES AND EQUIPMENT FOR RECEIPT AND DELIVERY OF AVIATION KEROSENE AND
DIESEL FUELS

Annexes:

- A. Connections for Receipt and Delivery of Aviation Kerosene and Diesel Fuels.
- B. Connections for Receipt and Delivery of Aviation Kerosene Fuels (Road Tanker).
- C. Connections for Receipt and Delivery of Aviation Kerosene Fuels (Aircraft Refuelling Tanker).
- D. Table of Critical Dimensions for Grooved API Spec 5L Pipe.
- E. Specification for the NATO Standard Connector.

Related Documents:

AC/4-M(96)001 dated 10 July 1996 ISO 228/1	- NATO APPROVED TECHNICAL CRITERIA AND STANDARDS FOR POL FACILITIES - PIPE THREADS WHERE PRESSURE-TYPE JOINTS ARE NOT MADE ON THE THREADS (1/16 INCH TO 6 INCHES)
ANSI B16.5, BS1560 API SPEC 5L API 1004	- STEEL PIPE FLANGES AND FLANGED FITTINGS - SPECIFICATION FOR LINE PIPE - BOTTOM LOADING AND VAPOUR RECOVERY for MC-306 VEHICLES
ISO 45 STANAG 2946 STANAG 3149	- AIRCRAFT PRESSURE REFUELLING CONNECTIONS - FORWARD AIR REFUELLING EQUIPMENT - MINIMUM QUALITY SURVEILLANCE OF PETROLEUM PRODUCTS
STANAG 3681	- CRITERIA FOR PRESSURE FUELLING/DEFUELLING OF AIRCRAFT
STANAG 3682	- ELECTROSTATIC SAFETY CONNECTION PROCEDURES FOR AVIATION FUEL HANDLING AND LIQUID FUEL LOADING/ UNLOADING OPERATIONS DURING GROUND TRANSFER AND AIRCRAFT FUELLING/DEFUELLING

AIM

1. The agreement is to standardise connections in on-base and off-base facilities and equipment, including fixed fuel installations, field fuel installations, vehicles and vessels used for the receipt and delivery of Aviation Kerosene and Diesel fuels.
2. The system is to prevent fuel spillage on connection/disconnection.

AGREEMENT

3. Participating nations agree:

- a. That NATO Forces must be able to supply and/or receive aviation kerosene and diesel fuels from each other without encountering technical difficulties.
 - b. To adopt a common terminology.
 - c. That member nations may employ their own national standard connectors. If the national standard is not the NATO standard, then that nation shall provide adaptors to interface with the agreed NATO standard couplings for supply and receipt of fuel during operations or peacetime exercises.
4. This agreement specifically excludes:
- a. Ship-board operations (covered in ATP-I6, 'Replenishment at Sea').
 - b. Aircraft fuelling operations (covered by STANAG 3681).
 - c. Liquid petroleum gas.
 - d. Long delivery, pressurised pipeline.

IMPLEMENTATION OF THE AGREEMENT

5. This STANAG is implemented when a nation has issued the necessary orders and instructions to its forces to provide the facilities, fittings and/or adaptors in accordance with specifications detailed in this agreement.

CONNECTIONS FOR RECEIPT AND DELIVERY OF AVIATION KEROSENE AND DIESEL FUELS

1. General. The receipt and delivery of aviation kerosene and diesel fuels shall be achieved by the use of standard dry-break connectors attached to delivery hoses or loading arms. The convention shall be a female connector at the delivery system and a male connector on the receipt system. The fitting of the female ISO 45 aircraft standard connector shall be restricted to equipment and vehicle delivery systems designed to deliver fuel to the requirements of STANAG 3149, and incorporating fuel filter separator vessels and coalescer and separator elements to STANAG 3967. The use of the NATO standard 3" connector (detailed at Annex E) shall be restricted to transfers in to and out of non-pressurised tanks and containers. The receipt and delivery points should be marked in such a way as to indicate clearly the identity of the product. The NATO Marking for the product shall be incorporated as a minimum in any national marking or identification scheme and shall be displayed on all operating points.
2. Road Tankers. Road tanker trucks shall be equipped with the following connections:
 - a. Bottom-Loading. Male 3" NATO dry-break connector.
 - b. Top Loading (for field operations only). Military road tank trucks should be provided with a manhole, not less than 250 mm (10 in) dia, in each compartment to permit top-loading for use on operations where no bottom-loading facilities exist.
 - c. Dispense. Female 3" NATO dry-break coupling on the end of the delivery hose.
3. Aircraft Refuellers.
 - a. Bottom-Loading. Aircraft refuellers shall be provided with a male 3" NATO dry-break connector. (The transfer of fuel from an aircraft refueller to a road tanker may be achieved by connecting the hose reel end of the refueller to the male 3" NATO dry-break connector of the road tanker, by means of an adaptor).
 - b. Top Loading (for field operations only). Military refuellers should be provided with a manhole, not less than 250 mm (10 in) dia, in each compartment to permit top-loading for use on operations where no bottom-loading facilities exist.
 - c. Dispense. Female, pressure regulated ISO 45 coupling to STANAG 3681.

4. Fixed and Tactical Bulk Fuel Installations.
 - a. Fill Stands - Road Tankers. Fill stands will be provided with a hose fitted with female 3" NATO dry-break connector.
 - b. Fill Stands - Aircraft Refuellers. Fill stands will be provided with a hose fitted with a female 3" NATO dry-break connector.
 - c. Receipt Points - For Deliveries From Road Tankers. Receipt points will be equipped with a male 3" NATO dry-break connector.
5. Rail Tank Wagons. Rail tank wagons shall be provided with male connections conforming to one of the following commercial standards:
 - a. ISO 228/1 - 4" BSP threads.
 - b. API 1004 - 4" cam-and-groove coupler (for use in non-pressurised gravity discharge operations)
6. Fuel Tanks of POL-Consuming Equipment and Vehicles. Construction shapes and capacity of tanks on vehicles and POL-consuming equipment are built to national requirements.
 - a. The fuel tank filler openings of own-use fuel tanks, fitted to vehicles solely for the operation of such vehicles, shall be able to accommodate a filler nozzle of external diameter 25 mm for wheeled vehicles and external diameter 32 mm for tracked vehicles.
 - b. The fuel tank filler openings, or pipes, on vehicles and POL-consuming equipment must be constructed in such a way as to enable direct refuelling from jerry cans, or by the use of supplementary devices (e.g., funnels or discharge nozzles for the jerry cans). Any supplementary refuelling devices required must be carried on the vehicle or attached to the POL-consuming equipment as part of the POL-consuming equipment.
7. Low-Pressure Pipelines (<16 bar Design Pressure). Interoperability of low-pressure petroleum pipelines among NATO forces shall be achieved by:
 - a. The use of grooved-end connections for pipes and hoses conforming to API Spec 5L and the dimensions given in Annex D.

b. Adaptors conforming to API Spec 5L and the dimensions given in Annex D to enable an interface to be made between pipeline systems with a 6" connection.

8. High-Pressure Pipelines, Sea Tankers and River Barges. Standardisation under this heading is limited to hoses and couplers above 100 mm (4") dia for connecting to high-pressure pipelines, sea tankers and river barges. The use of cast-iron flanges is prohibited.

a. High-pressure pipeline off-take points shall have a 6" flange conforming to the dimensions and drilling of ANSI B16.5, BS 1560 Series 600.

b. Portable equipment for connection to Emergency Connecting Points (ECP) of NATO pipelines shall have a 6" flange conforming to ANSI B16.5, BS 1560 Series 600, and must include the necessary equipment to reduce pressure from the high pressure in the pipeline to that of the low-pressure system.

c. Shore manifolds for offloading sea tankers and river barges shall have flanges conforming to the dimensions and drilling of ANSI B16.5, BS 1560 Series 150.

d. For sea tanker unloading operations, connection systems should be suitable for working pressures of not less than 10 bar.

CONNECTIONS FOR RECEIPT AND DELIVERY OF AVIATION KEROSENE AND DIESEL FUELS (ROAD TANKER)

1. Road tanker connectors used for the receipt and delivery of aviation kerosene and diesel fuels shall be by the following means.

Receipt

Male 3" NATO dry-break connector.

Delivery

Female 3" NATO dry-break coupling on the end of hose.

ANNEX C TO

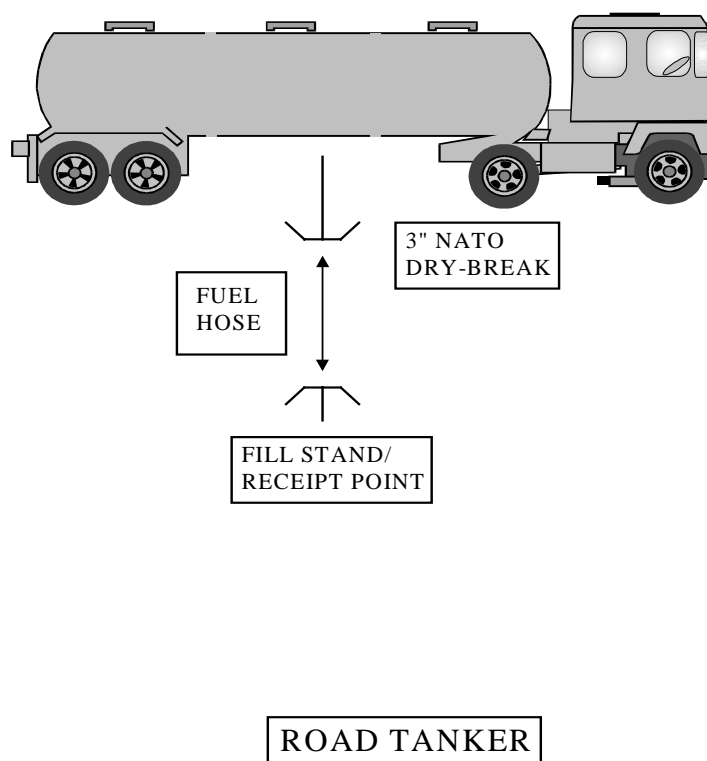


FIGURE 1

CONNECTIONS FOR RECEIPT AND DELIVERY OF AVIATION KEROSENE FUELS
(AIRCRAFT REFUELLER).

1. Aircraft refueller connectors used for the receipt and delivery of aviation kerosene shall be achieved by the following means:

Receipt

Male 3" NATO dry-break connector.

Delivery

ISO 45 (female) connector on the end of the delivery hose.

Top Loading

250mm Opening manhole/lid.

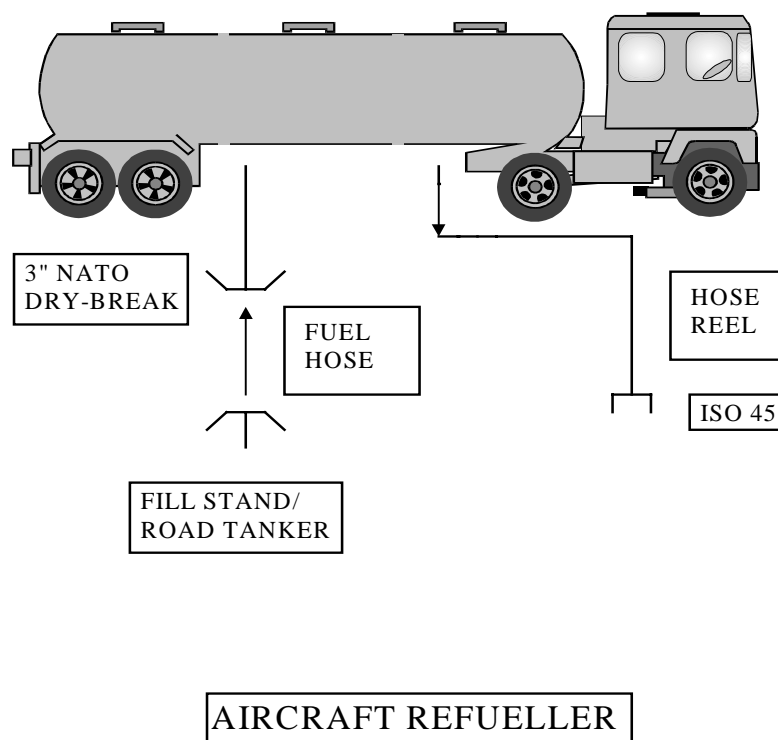
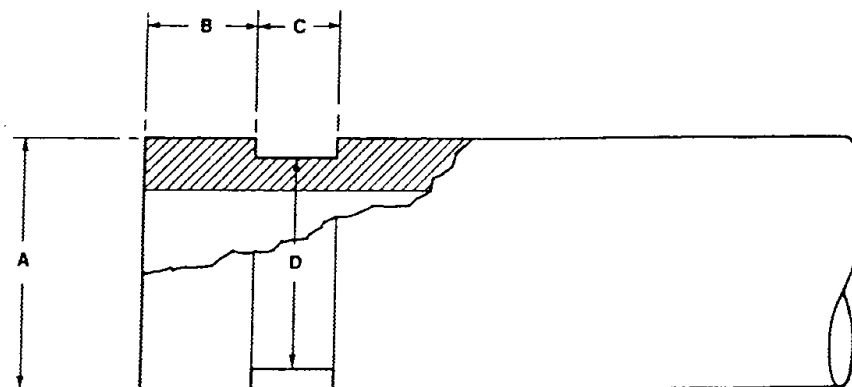


FIGURE 2

TABLE OF CRITICAL DIMENSIONS FOR GROOVED API SPEC 5L LINE PIPE



Nom pipe size (in)	Dimensions (mm) for Cut Groove							
	A		B		C		D	
1	33.4	+ 0.33 - 0.33	15.88	+ 0.76 - 0.76	7.95	+ 0.76 - 0.76	30.23	+ 0.00 + 0.38
1¼	42.2	+ .041 - 0.41	15.88	+ 0.76 - 0.76	7.95	+ 0.76 - 0.76	38.99	+0.00 - 0.38
1½	48.3	+ 0.48 - 0.48	15.88	+ 0.76 - 0.76	7.95	+ 0.76 - 0.76	45.09	+ 0.00 - 0.38
2	60.3	+ 0.61 - 0.61	15.88	+ 0.76 - 0.76	7.95	+ 0.76 - 0.76	57.15	+ 0.00 - 0.38
2½	73.0	+ 0.74 - 0.74	15.88	+ 0.76 - 0.76	7.95	+ 0.76 - 0.76	69.09	+ 0.00 - 0.46
3	88.9	+ 0.89 - 0.79	15.88	+ 0.76 - 0.76	7.95	+ 0.76 - 0.76	84.94	+ 0.00 - 0.46
4	114.3	+ 1.14 - 0.79	15.88	+ 0.76 - 0.76	9.53	+ 0.76 - 0.76	110.08	+ 0.00 - 0.51
6	168.3	+ 1.60 - 0.79	15.88	+ 0.76 - 0.76	9.53	+ 0.76 - 0.76	163.96	+ 0.00 - 0.56
8	219.1	+ 1.60 - 0.79	19.05	+ 0.76 - 0.76	11.13	+ 0.76 - 0.76	214.40	+ 0.00 - 0.64
12	323.9	+ 1.60 - 0.79	19.05	+ 0.76 - 0.76	12.70	+ 0.76 - 0.76	318.29	+ 0.00 - 0.76
14	355.6	+ 1.60 - 0.79	23.83	+ 0.76 - 0.76	12.70	+ 0.76 - 0.76	350.04	+ 0.00 - 0.76

SPECIFICATION

FOR THE

NATO STANDARD

CONNECTOR

TABLE OF CONTENTS

	Page No
1 SCOPE	3
2 DESIGN	3
2.1 ADAPTOR DEFINITION	
2.2 TANK UNIT	
2.3 HOSE UNIT	
2.4 COUPLING	
3 SIZE	3
4 PRESSURE RATING	3
5 VACUUM RATING	4
5.1 TANK UNIT	
5.2 HOSE UNIT	
5.3 COUPLING	
6 SPILLAGE OF DISCONNECTION	4
7 SELECTIVITY	4
8 PRESSURE DROP	4
9 MARKING	5
10 WORKMANSHIP	5
11 MATERIALS OF CONSTRUCTION	5
11.1 SEALS	
12 ELECTRICAL CONTINUITY	5
13 CLEARANCE ACCESS	6
14 QUALIFICATION TESTING	6

APPENDICES

- APPENDIX 1 Clearance Access
- APPENDIX 2 Adaptor Dimensions
- APPENDIX 3 Pressure Drop Measurement

1 SCOPE

This standard specifies the requirements for fluid handling couplings designed to permit connection via a bayonet style adaptor, whilst pressurized, without significant spillage. Only the dimensions of the adaptor face are instructed; the method of connecting the tank unit to the tank, and the hose unit to the hose is not covered by this standard. (See Paragraph 2 below)

2 DESIGN

The coupling consists of two parts, the male half coupling or tank unit and the female half coupling or hose unit.

a. ADAPTOR DEFINITION

The mating face of the tank unit to the hose unit is known as the adaptor. The dimensions are considered fundamental and should conform in all aspects to Appendix 2.

b. TANK UNIT

This is the male half of the coupling. It contains a valve which closes before the hose unit is disconnected. Attachment of this tank unit may be a flange or thread which is outside the scope of this standard.

c. HOSE UNIT

The hose unit will be designed to couple with the adaptor of the tank unit in any of the three lug positions and shall be interlocked in such a way that product cannot flow until a seal is achieved between the adaptor and, the interlock must ensure that flow will cease before the seal between the adaptor and hose is broken. Attachment of the hose unit will be by a thread or flange arrangement which is outside the scope of this standard.

d. COUPLING

A term coupling shall refer to an tank unit and hose unit when connected by the adaptor. The design of the interface between the hose unit and tank unit shall ensure that the residue on disconnection is minimized and all cases will be less than that specified in Paragraph 6 below.

3 SIZE

The size of the coupling shall be defined by the nominal bore size of the adaptor to the nearest half inch or metric equivalent of this size.

This specification shall cover a coupling of the following size:

Imperial (Inch)	3
Metric (mm)	80

4 PRESSURE RATING

- a. The minimum working pressure rating of the coupling shall be 6 bar.

- b. The test pressure for the rank unit and hose unit should be 1.5 x working pressure.
- c. The hose unit and tank unit should not leak nor permanently distort at 1.75 x working pressure.
- d. The hose unit and tank unit should not leak at 2.5 x working pressure.
- e. The design of the hose and tank unit should permit coupling/uncoupling when pressurized to 4 bar without excessive spillage or force.
- f. The coupling should withstand 5 x working pressure without leakage or failure.

5 VACUUM RATING

Where a vacuum rating is claimed for a coupling it shall be permanently stamped on both the hose and tank unit (ref Section 9).

a. TANK UNIT

The vacuum rating of the tank unit shall be measured by blanking the end of the flange, removing any dust or sealing cap, and measuring the maximum vacuum that may be applied before the poppet seal fails.

b. HOSE UNIT

The vacuum rating of the hose unit shall be measured by blanking the end of the flange, removing any dust or sealing cap, and measuring the maximum vacuum that before the poppet seals fails.

c. COUPLING

The vacuum rating of the coupling shall be the lower of the vacuum rating of the hose unit or the tank unit.

6 SPILLAGE ON DISCONNECTION

The average loss over 10 couplings and uncouplings at 1 bar to the maximum working pressure should not exceed 4 ml, where:

$$\text{The permitted loss} = \frac{\text{Coupling size (mm)}}{20} \quad (\text{ml})$$

7 SELECTIVITY

Although the couplings can be manufactured for selectivity where there is a risk of accidentally transferring the wrong product, this specification does not address this aspect.

8 PRESSURE DROP

The coupling shall be tested as specified in Appendix 3 over its full flow range and the pressure drop presented in either graphical form or at the maximum flow rate.

Unless otherwise stated the normal direction of flow will be from the hose unit to the tank unit. Flow from the tank unit to the hose unit will be deemed REVERSE FLOW.

The test fluid may be either water or kerosene depending on the final application and this should be clearly stated along with the density and viscosity of the fluid.

The maximum flowrate shall be calculated to give a maximum velocity of 5.25 m/s through the minimum bore of the coupling (ref BS5958 Part 2). This is the maximum recommended flow velocity when bottom loading a tank with product which has a conductivity greater than 50pS/m. (Higher flow rate may be achieved at an increased pressure loss, but caution needs to be exercised with static generation in hydrocarbons.)

In all cases the pressure drop at the maximum flowrate for the coupling tested on kerosene shall be less than 0.5 bar (7.5 psi)

9 MARKING

All tank units and hose units should be permanently marked with:

- Manufacturer's name/ID
- Maximum working pressure
- Vacuum rating (if applicable)

10 WORKMANSHIP

Workmanship shall be of good quality with all burrs and sharp edges removed.

11 MATERIALS OF CONSTRUCTION

Materials used shall be compatible with the liquid for which the coupling is to be used and the supplier must state, upon request, the full specification of the materials of construction.

Attention shall be given to the selection of materials to avoid corrosion due to the use of dissimilar metals in contact giving rise to electrolytic action.

The possibility of seizure between sliding surfaces of similar metals shall be taken into consideration.

Where materials containing aluminium, titanium or magnesium are used, due consideration shall be given to the prevention of incendive sparking from impact with rusty iron.

a. SEALS

All the seals and washers shall be compatible with the liquid for which the coupling is to be employed and the supplier must state, upon request, the full specification of the materials supplied.

Seals shall be made of elastomeric materials or suitable alternatives conforming to the minimum requirements of British Standards or equivalent.

The use of trade names for seals should be avoided unless that specific brand is used exclusively in the coupling.

12 ELECTRICAL CONTINUITY

The electrical resistance across a coupling, measured from thread to thread (or flange) with the coupling dry, shall be less than 10 ohms (Ref BS5958 Part 1).

In addition, means shall be provided to ensure that continuity is achieved when a coupling is fitted to a flexible hose or tank and to ensure that the complete assembly, from hose inlet to tank, does not exceed 10 ohms resistance.

13 CLEARANCE ACCESS

When fitting tank units due consideration should be given to access space for the hose. Appendix 1 gives the recommended access required for safe coupling.

14 QUALIFICATION TESTING

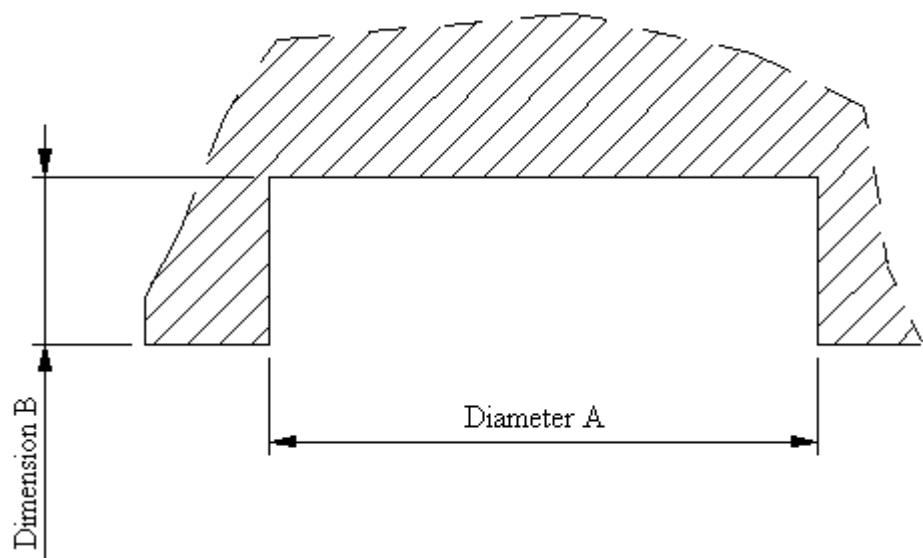
All tests carried should be on couplings using tank units and hose units from a single source manufacturer.

Specifications quoted will, therefore, only be applicable to couplings. Individual figures for tank units and hose units from differing manufacturers may not be meaningfully combined.

In order to conform with this standard the supplier must issue, upon request, an independently assessed report on the coupling, hose unit or tank unit. Such a report will contain the following data:

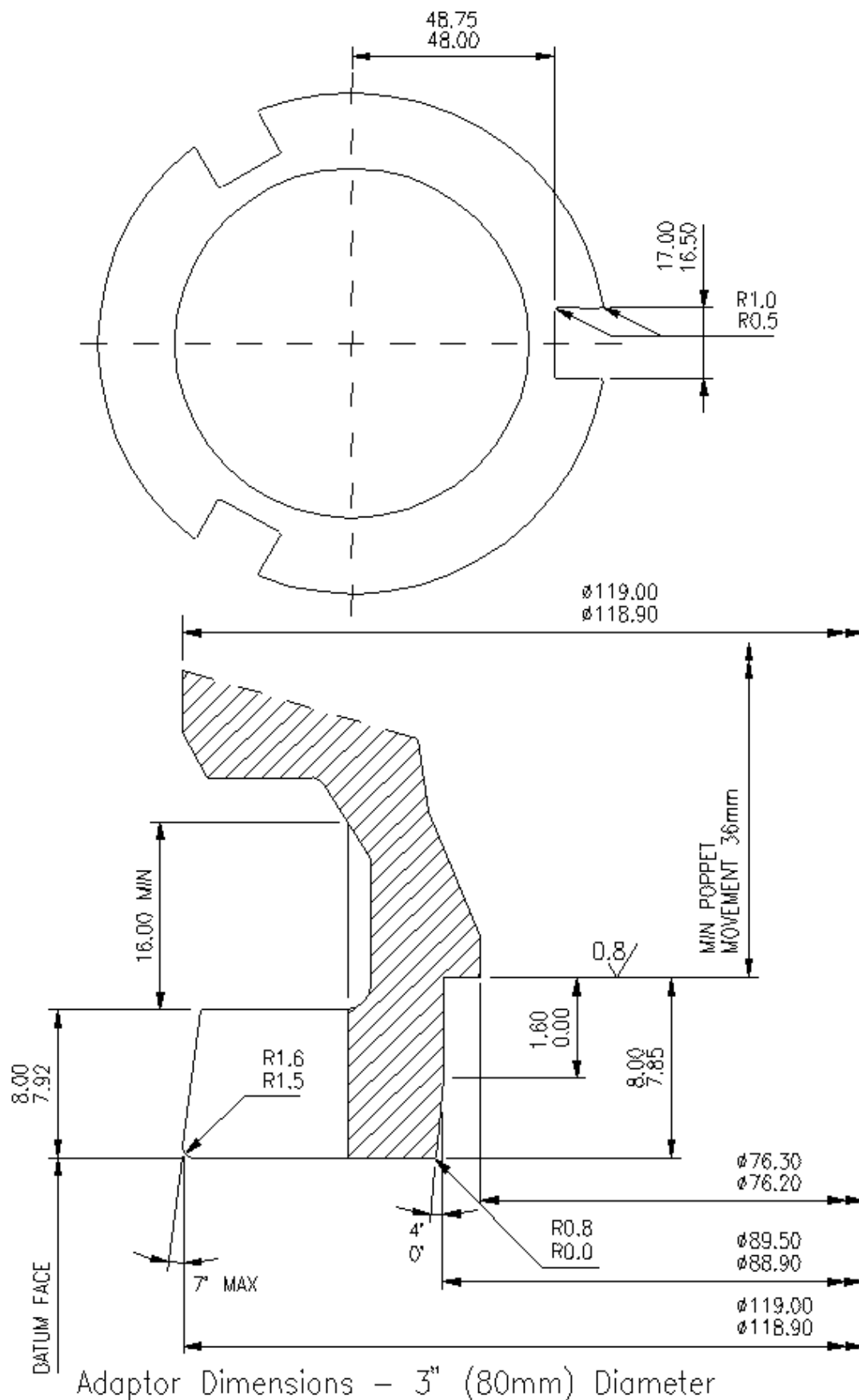
- Manufacturer's name and address.
- Part number and issue of unit under test.
- Issue number of standard against which conformance is claimed.
- Confirmation that the geometry agrees with Appendix 2.
- Pressure test results in accordance with Appendix 3.
- Results of vacuum tests (if required).
- Spillage measured on disconnection in accordance with Section 6.
- Pressure drop results in accordance with Section 8.
- Details of materials of construction and seals in accordance with Section 11.
- Results of an electrical continuity test in accordance with Section 12.
- Confirmation of clearance access in accordance with Section 13.

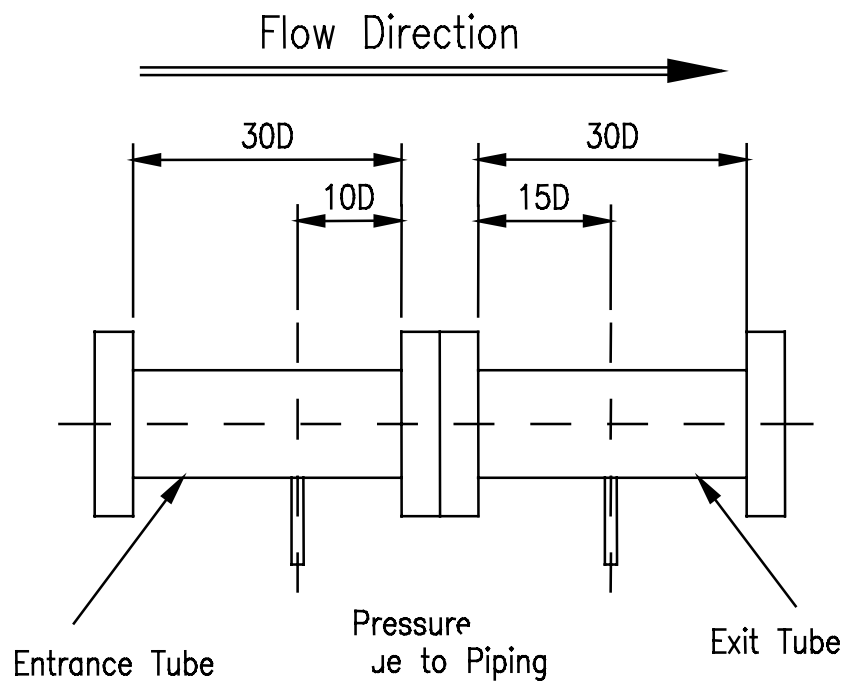
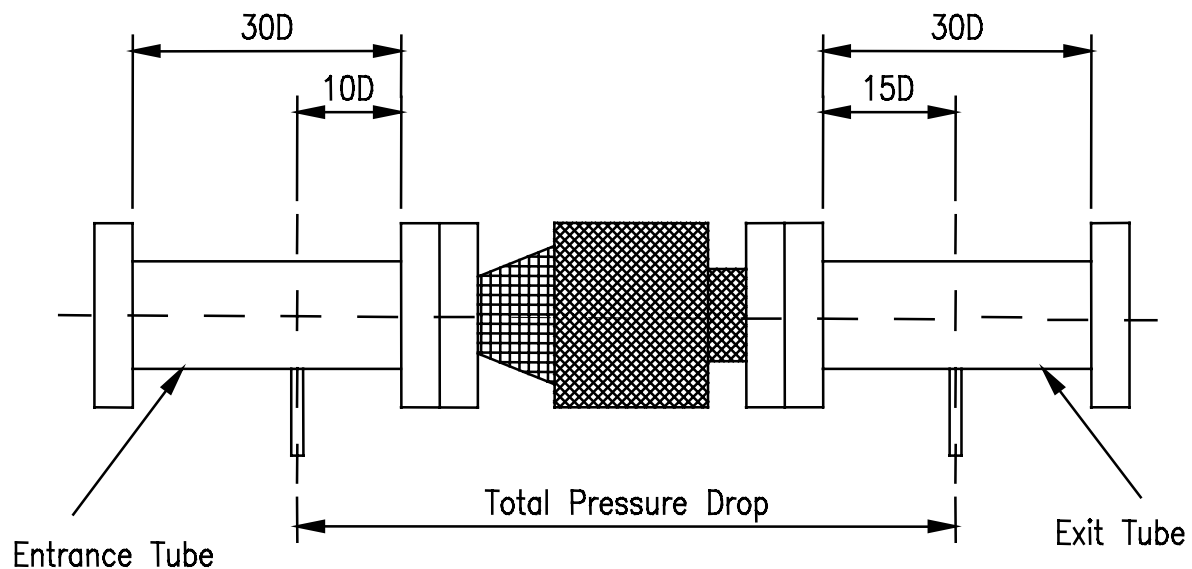
Reference Plane
Top of Tank Unit



Adaptor Size	Dia. A (minimum)	Dim.B (maximum)
3" (80 mm)	390 mm	170 mm

CLEARANCE ACCESS





$P = \text{Total Pressure Drop} - \text{Pressure Drop Due to Piping}$

PRESSURE DROP MEASUREMENT