DEPARTMENT OF THE AIR FORCE
48TH FIGHTER WING (USAFE)

TECHNICAL GUIDE
PERFORMANCE SPECIFICATION
ABOVE GROUND STORAGE TANKS (AST's)
(Diesel Fuel for Heating & Generators)

Table of Contents

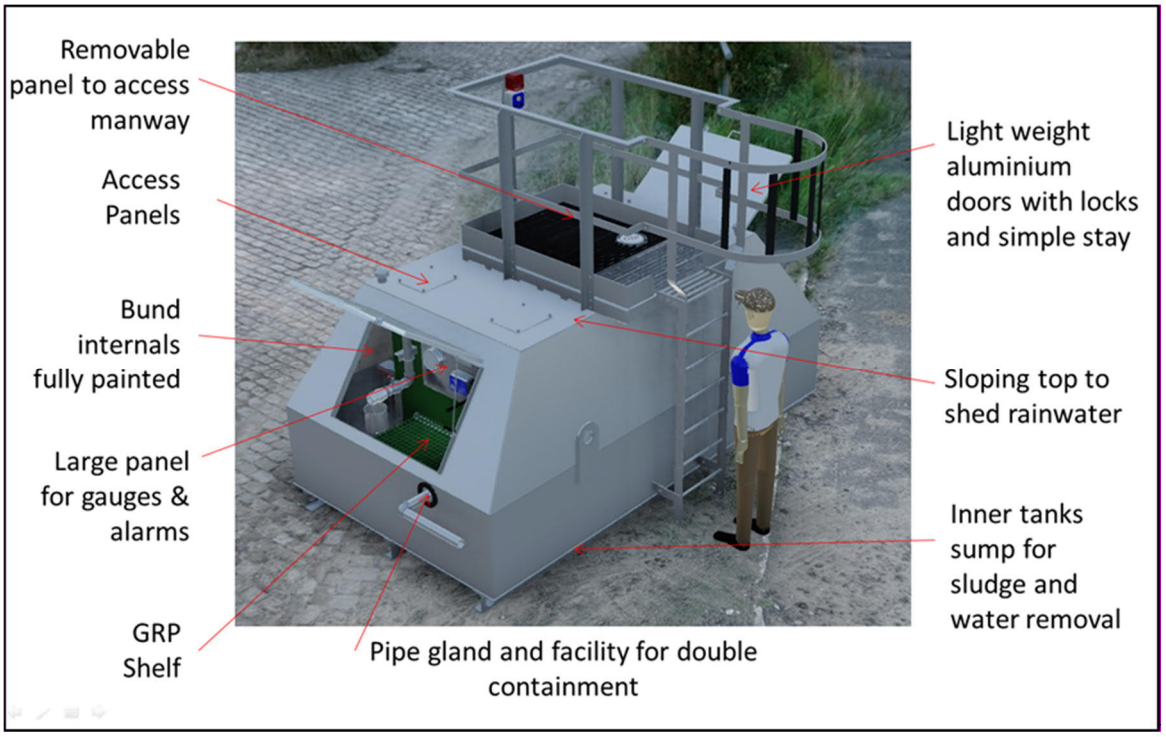
1. Introduction

This specification has been prepared to establish & clarify the design requirements for diesel above ground fuel storage tanks installed at RAF Lakenheath & Feltwell. These will in general be of a proprietary totally enclosed steel tanks comprising the primary holding tank of desired capacity within a secondary containment tank and cover providing a minimum design life expectancy of 20 years and sited in-accordance with the requirements of National Fire Protection Association (NFPA) (2018).

Refer to: *22.4.1.1 Tanks storing Class I, Class II, or Class IIIA stable liquids whose internal pressure is not permitted to exceed gauge pressure of 2.5 psi (17 kPa) shall be located in accordance with Table 22.4.1.1(a) and Table 22.4.1.1(b)'.*

General Arrangement

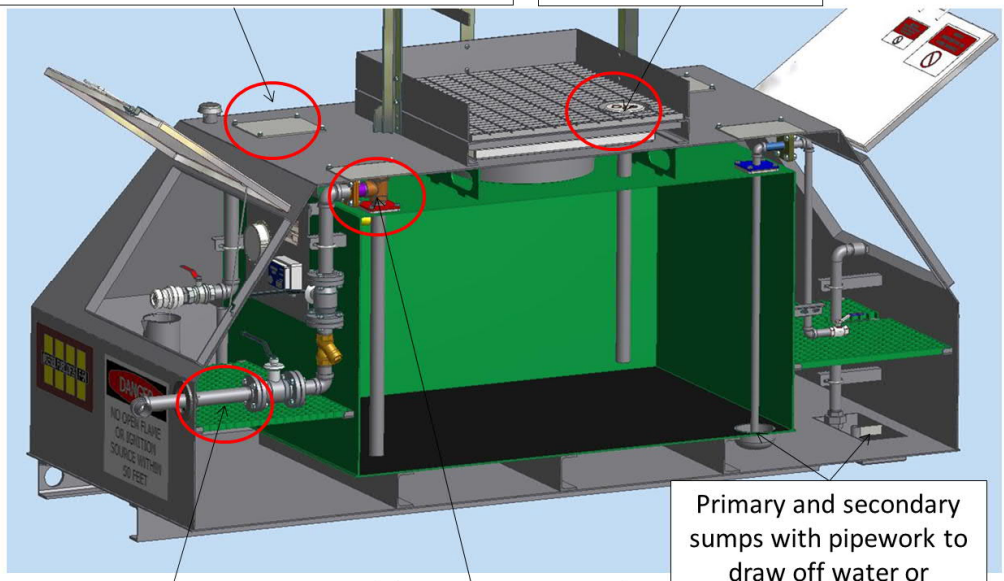
A typical general arrangement for the AST's is shown below:



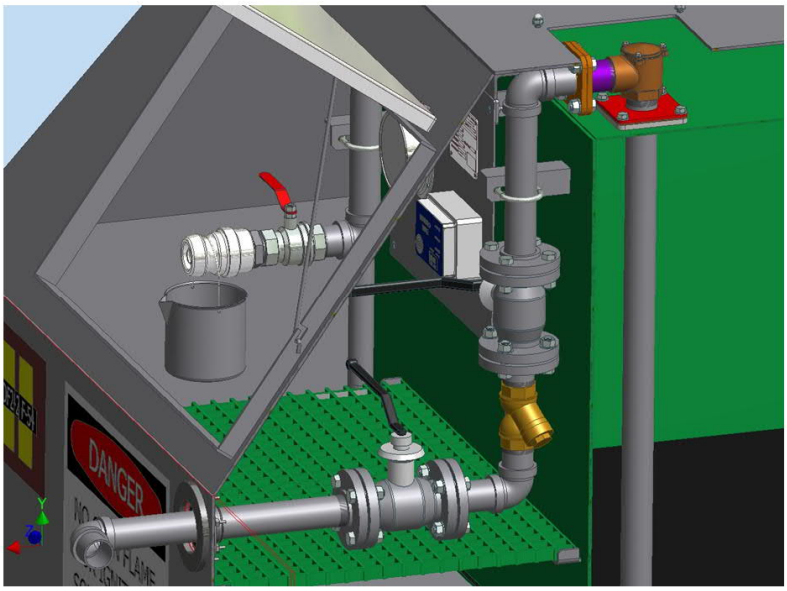
~~1~~ AST General Arrangement - External details

Note A: External control panel for gauges & alarms and level controls; to be sited so that the displays are visible at the fill point & shall not be within the tank enclosure.

NOTE- for ease of viewing not all openings and connections have been shown on the following diagrams



2. AST General Arrangement – Internal details



3. AST General Arrangement – Internal pipework connection details

2. Capacity

The design capacity for any “heating” system tank be calculated using the existing boiler and a desk top study completed to assume the system is operating at 100% capacity for 28 days (24 hrs/ day).

Other tanks (i.e. serving generators) shall be specified in the design document / AFI/ ETL etc. Where multiple tanks are specified they shall comply with the above requirements.

Where multiple tanks are specified they shall comply with the above requirements.

3. Fabrication

Generally, to BS799: Pt 5: 2010 in mild steel plate to BS1447 and BS EN 10 023.

Minimum steel thickness: Primary tank – to BS799
Secondary tank/bund – to BS799
Cover (above freeboard/containment level) – 3mm.

Sufficient lifting points are to be provided for safe lifting, without deforming or distorting the tank. The unit is to sit on rolled steel joist skids, which should be constructed in a manner to limit corrosion.

Each tank is to be factory tested and certified for quality of workmanship and compliance with the specification. The test pressure for the primary tank shall not be less than that specified by BS or BSEN requirements. A certificate of test will be required by 48CES prior to acceptance.

All mechanical joints must be within the secondary containment and above the free board level.

4. Drawings & Specification

Fabrication drawings in AutoCad (.dwg) format identifying thickness, size, all fittings, pipework etc. and data sheets on proposed fittings, shall be provided and in sufficient detail to enable a full evaluation of the proposals.

Final “As installed” record drawings are required for maintenance H&S/ FM files. These will conform to current 48CES contractor guidelines document.

5. Design

Comply with UK GOV Oil Storage regulations for businesses (i.e., non-domestic).

Provide bund storage equating not less than 110% of the total volume of the tank, or tanks, in the event of more than one tank per bund, the bund must be capable of storing 110% of the largest tank or 25% of the total storage capacity whichever is the greater.

Any openings in the tank structure (e.g. hatch) for access to bund shall be above the freeboard level. Barriers or guards are required if there is a risk that personnel may trip or fall into any open hatches, between tanks etc.

6. Appearance

The base has standardized the design style and functionality of all new & replacement AST's. As a guide only, examples of previously approved tank "constructional appearances" are shown below.

The bund tank floor and primary tank is to be constructed to falls, i.e. 1:50. A collection sump shall be located at the low point, minimum dimensions 100mm deep x 200mm wide x 450mm long which should not be penetrated by any valves or drains. Space between tank base and bund should allow free drainage.

7. Primary Tank Material Draw off

The design is to incorporate a sump within the primary tank together with a pipework system to allow the removal of material in the primary tank (all within secondary containment).

8. Secondary Tank Material Draw off

The design is to incorporate a sump within the primary tank together with a pipework system to allow the removal of material in the primary tank (all within secondary containment).

Minimum distance between the primary tank and bund end walls to be 750mm where maintenance is necessary for access to gauges, valves and fittings etc.

Tank secondary containment roof, where possible, is to be constructed with a slight convex shape to facilitate run-off of rain water.

9. Finishes to Tank & Bund

External Finishes to Tank & Bund

Surface preparation:	Abrasive blast clean to BS 7079 Sa 2.5, surface profile 50-75 microns
Primer coat	Epoxy zinc phosphate primer, minimum dry film thickness 50 microns.
Intermediate coat	Epoxy micaceous iron oxide, minimum dry film thickness 100 microns.
Finishing coat	Oil resistant gloss paint: Colour - Van Dyke Brown, BS reference 08 B 29.

Internal finishes to Tank & Bund

Interline® 850

Surface preparation:	Abrasive blast clean to BS 7079 Sa 2.5, surface profile 50-75 microns.
Primer coat	40 microns dry film thickness to hold blast for up to 28 days.
Finishing coat	Two coat system at 125 microns per coat to give total coatings dry film thickness of 250 microns.

Interline® 984

Surface preparation:	Abrasive blast clean to BS 7079 Sa 2.5, surface profile 50-75 microns.
Primer coat	Consult International Protective Coatings for end-use specific advice regarding each tank lining/ re-lining application.
Finishing coat	As above.

10. Fittings

The tank shall be fitted with:

(i) A mild steel vent pipe, sited on the top of the primary tank, diameter not smaller than the delivery pipe, discharging downwards into the bund.

(ii) 2 No. 50mm dia. mild steel vent pipes situated at each end of the bund to prevent a build-up of gases within the containment void. Located at the top of the cover.

(iii) A drain point with isolating valve, minimum diameter 25mm, located and accessible at the lower end of the primary tank and extending to outside of the secondary containment. The isolation valve should be of the quarter-turn pad-lockable pattern with a permanent extension handle so the valve can be operated without having to gain access into the confined space. The extension handle should be labelled adjacent, indicating purpose and open/ closed position. The valve should have the ability of being physically locked in the closed position by padlock supplied by others. The pipe penetration through the secondary containment should be fully welded and fitted with a cap which can be removed by a tool.

11. Tank Filling

The tank filling pipework and valves etc. must be within the secondary containment.

(i) A separate mild steel fill point and fill pipe to each tank situated within the hatch, discharging from the connection point within the access hatch into the top of the tank. The fill point shall be 50mm (min) diameter; located within the bund and terminated with a dry break coupler.

The Base standard dry break coupler is manufactured by CIVACON – OPW, reference "Civacon-Kamvalok", supplied from The Stables Coach House, Hythe Road, Smeeth, Kent TN25 6SP; Tel. 01303 813030, Fax 01303 814040. Tank to be fitted with MALE coupling.

(ii) A lockable calibrated dip stick with "calibration/ strapping chart" for each tank. The units employed shall be litres or thousands of litres if appropriate. The dip stick is to be located in the primary tank man-way, with a bump plate on the tank floor.

(iii) A calibrated contents gauge of continuous indication type with remote reading. The gauge shall be of a weatherproof pattern or located in a weatherproof housing. The gauge shall be marked 'FULL' and 'EMPTY' to indicate the limits of usable oil in the tank i.e. to correspond with high level alarm and fuel outlet levels respectively. (Note: Battery-powered devices are not permitted). The gauge is to be sited adjacent to the fill point.

The Base Standard contents gauge type B reference 28RBP is supplied by T J Williams Ltd. Tel 01446 729200.

(iv) A fail safe overfill alarm incorporating an externally located weatherproof audible warning sounder and flashing beacon, arranged and located to give clear warning at or close to the filling point when the tank has been filled to 90% capacity (Note: Battery-operated devices are not permitted). Once the level drops 5% below the alarm set point, the alarm shall automatically reset. A plate, similar to that for fuel identification, shall be fitted near the warning device to indicate its purpose.

(v) Install a high-level mechanical limiter valve set to 90% of max capacity to prevent over filling of the tank. The valve shall be installed in accordance with the manufacturer's instructions and be suitable for a pumped delivery. The limiter valve shall meet the requirements of' *BS EN 13616-1:2016 Overfill prevention devices for static tanks for liquid fuels - Part 1: Overfill prevention devices with closure device'.*

(vi) Install a bund alarm system to provide an externally mounted audio visual warning that a spill has occurred into the secondary containment. It shall include a means of muting alarm condition by trained / authorised personnel. A sign is to be provided to indicate actions to be taken by persons (any) hearing/seeing alarm warnings. The bund alarm probe is to be set at the same height as to the depth of the sump i.e. 100mm off the bottom of the sump.

(Note: Battery-operated devices are not permitted).

Leak detection systems to be in accordance with the requirement of BS EN 13160-1-2016-Parts 1 – 7 for the system components/ sub-systems as appropriate:

EN 13160-1-2016-Part 1 - General Principals.
EN 13160-1-2016-Part 2 - Requirements and test/ assessment methods for pressure and vacuum.
EN 13160-1-2016-Part 3 - Requirements and test/ assessment methods for liquid systems for tanks.
EN 13160-1-2016-Part 4 - Requirements and test/ assessment methods for sensor based leak detection systems.

EN 13160-1-2016-Part 5 - Requirements and test/ assessment methods for in-tank gauge systems and pressurised pipework systems.

EN 13160-1-2016-Part 6 - Sensors in monitoring wells.

EN 13160-1-2016-Part 7 - Requirements and test/ assessment methods for interstitial spaces, leak detection linings and leak detection jackets.

(vii) A removable, stainless steel, drip bucket sited beneath the fill point; suitable for collection and manual disposal of localised spills. The bucket is to be fitted with a corrosion resistant chain that is secured to the bund wall. Bucket shall be designed with a spout.

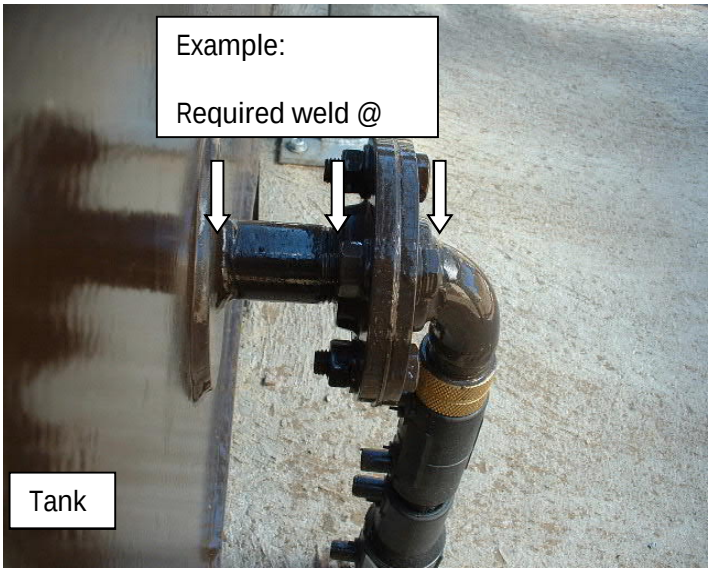
(viii) Install a 2 inch BSP threaded boss and plug for BMS connection. The BMS system is described within the RAF Lakenheath Base Standard. Where an existing tank already has a BMS system fitted and is to be replaced, the new tank shall be so equipped and commissioned to provide no less than that of the existing BMS requirements and should be proven acceptable to 48CES. All BMS installation and commissioning works shall be completed under the tank replacement project or work order.

(ix) All Isolating Valves will be of the quarter-turn pad-lockable pattern (not wheel type) this being for quick isolation and inherent visibility as to open or shut positions. Operating valves that are for practicable reasons sited within a bund or other inaccessible location shall be fitted with a permanent extension operating handle. The extension handles to be labelled adjacent, indicating purpose and open or closed position. It should also allow physical valve locking by padlock supplied by others.

12. Feed Lines/ Draw-off Pipes

(i) Oil feed line(s) provided with first stage filters of the “dual type” with isolating valves and drain cock. These should, for environmental reasons be located within the bund but must still be easily accessible for operation & routine maintenance tasks. First stage filters at tank position can be omitted only if during design it is agreed in writing with 48 CES maintenance engineers on a case by case review. All externally located equipment shall be lockable. All fittings shall be marked to show whether open, closed or selected where appropriate

(ii) Above ground pipe work to be mild steel to BS5410 to match existing in diameter and comply with DWFS M&E 036 **with all joints welded**. This applies to low level feed pipework and pipe that might extend from the top of the tank. Screw or flange connections only permitted where dismantling required. Rubber or Neoprene flexible hoses will not be used. The steel pipe work shall be painted to match the tank specification. Note: Galvanised pipe is not permitted with these fuel systems. All above ground pipework shall be provided with mechanical protection to prevent accidental damage.



(iii) Underground pipe work shall also comply with *'UK Government 'Oil storage regulations for businesses-How to store oil, design standards for tanks and containers, where to locate and how to protect them, and capacity of bunds and drip trays. published 6 May 2015; last updated 3 January 2018'*.

The pipework installation external to the tank is to include a proprietary leak detection system using a Flexwell twin-wall safety pipe and suitable monitoring system or equal and approved. Secondary containment shall terminate above the floor sump in the plant room to enable any leakage to be contained.

(iv) If two or more tanks are connected by common fill/ discharge, to prevent overfilling, a non-return valve shall be installed between a pair of isolation valves (for maintenance) in each tank discharge line.

(v) All underground "metallic" fuel pipe work must be cathodically protected & documented in accordance with AFI 32-1054 and BS 7361-1, 1991.

(vi) The use of a concrete or shingle surround should be utilized where the oil feed line rises from the ground and connects to the supply tank flange.

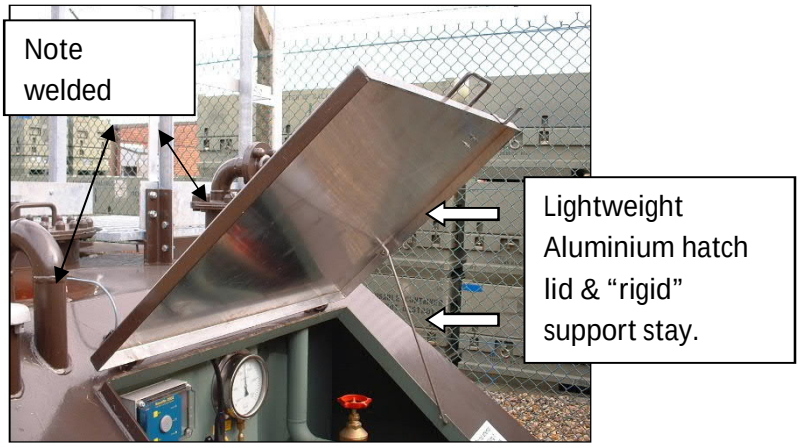
13. Access

(i) Access for non-entry to primary tanks of capacity up to 22,000 litres shall be through a manhole of clear opening size 600mm.

(ii) Access for entry by personnel to primary tanks of capacity greater than 22,000 litres shall be through a manhole of clear opening size 800mm.

(iii) Access to the bund shall be through a lockable hatch (hatch of lightweight aluminum/ GRP construction). It will be fitted with “rigid steel” (not hydraulic or gas) stays to safely maintain the open position. Locking to be via “galvanized” hasp & staple. Access is to be located at both front and rear of the unit.

Roller shutter access doors are not permitted.



(iv) To prevent any un-authorised access to the fuel the following tank points will be secured using Base Standard Fuel Tank padlocks supplied through the tank project/ work order.

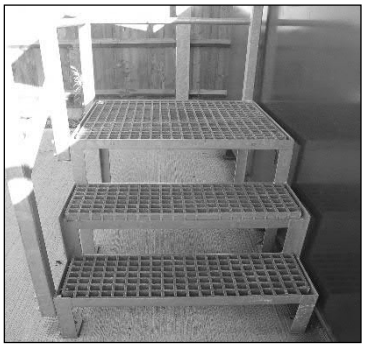
- Tank gauging/ Dipping Point
- Anti-climb Device (if the tank is not installed within a fenced enclosure).
- One for each of the bund access hatches.
- One to the access gate on the fuel tank compound.

Padlock to be to BS EN 12320 Security Grade 3 and to have an
extruded brass body be black chrome plated and have a rustproof hardened steel shackle with a tensile strength of over 1.5 tons. All as per ASSA ABLOY C25841 padlock to suit the base master suiting number 9EA1341with fuel tank differ 826-31.

(v) Galvanised steel framed steps and platform shall be provided at each hatch/ doorway and be of sufficient size and height to safely gain access to the bund and internal fittings for maintenance and filling operations. All uprights will be painted to match the tank and all bolts will be galvanized.

(vi) Galvanised steel ladder and platform frames shall be provided to gain safe access to the tank access manhole, dip stick and hatches. Rungs, steps, treads and surfaces i.e.

gratings shall were possible have surface finishes, which reduce the risk of slipping/ personal falls. This requirement favors the use of non-conductive oil resistant fiberglass gratings with non-slip coating. Any fiberglass gratings to be “grey” in colour and be securely fixed in position.



(vii) Vertical rung ladders are to incorporate a galvanized, hinged & lockable anti-climb device with a “no unauthorised access” sign fixed to same.

(viii) All access steps, ladders and platforms are to be designed and constructed to BS 4592 and BS 5395.

(ix) Lighting. Suitable utility and task lighting should be installed around the area to ensure safe access and egress. Any lighting provided should be installed in consideration of any Explosive Atmosphere zoning.

14. Earthing

(i) To be provided to BS 7340, BS 799, NFPA 780 and Defense Works Functional Standard 05 “Specification for Specialist Works on Petroleum Installations – Mechanical), and recommendations of the Institute of Petroleum.

(ii) Provide earth clips/ points for static earth discharge. This is for temporary delivery tanker connections.

(iii) Electrical earthing, bonding, static earthing (2# diagonal to tank stake/ pits minimum) and any lightning protection installations or connections are to be shown on as installed drawings. These will be appropriately documented, tested and certified in facility/ project or work order FM manuals.

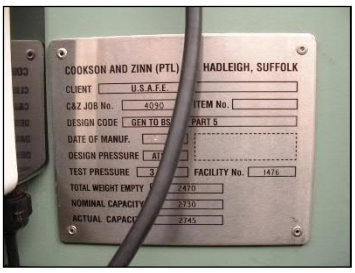
15. Signage & Labels

(i) Provide statutory and base signs, nameplates and equipment identification labels to each tank (internal or external as appropriate). Signs and labels are mentioned, displayed & clarified throughout this specification document and by US/ UK standards. All external signage and labels are to be UV stable.

(ii) Labels to include those for safety i.e. Danger 230v or other similar warnings

16. Nameplate

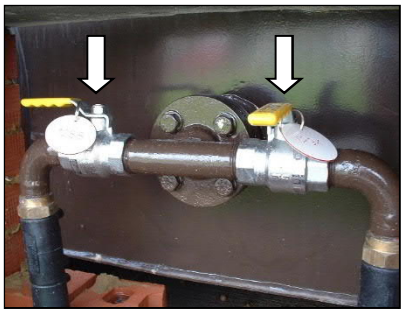
(i) Nameplate identifying as minimum: Manufacturer, tank dry weight, fuel contents BS EN ###, capacity nominal, capacity actual, B.S. tank constructed to, date constructed, test pressure, the tank number, (tank numbers, if more than one), building number or facility I.D to which the tank contents are supplied. These shall be via, durable, securely fixed & visible/ accessible label(s). See BS 799 Part 5, Clause 5.5.



(ii) A non-corrodible plate approximately 250 x 100mm at each filling point clearly and indelibly inscribed ‘Diesel Fuel’. This separate text label can be omitted if “Diesel Fuel” text is included in the yellow/ black DF2 F54/ DL 2 F54 sign shown below.

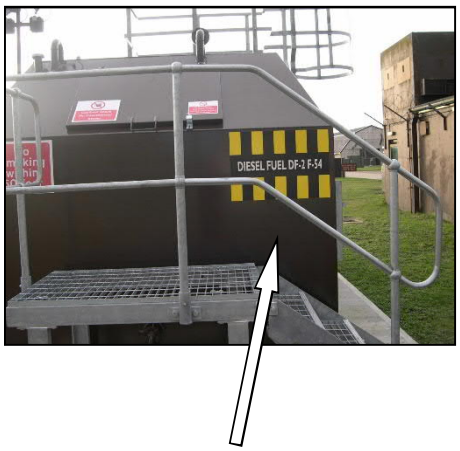
(iii) The fuel feed lines or isolating valve(s) originating from the tank to be labelled as to the locations/ buildings they feed.

Building Number Label(s)



(iv) Danger signs I.A.W. AFI 91-203 and “other required signs” are to be placed on all visible approachable sides of the tank. If a fence surrounds and obscures the tank, the necessary supplementary signs will be fitted to the surrounding fence. See MIL STD 161 G dated 25th August 2005 and AFI 91-203 dated 15th June 2012 for specific dimensional requirements.

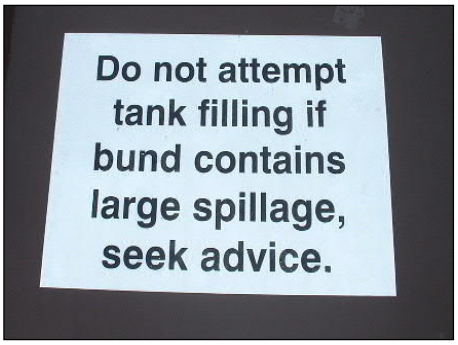
As a minimum requirement the ‘DANGER’ element should have a legible distance of 90 feet, with all other wording a legible distance of 60 feet.



Incorrect markings for product identification (too many yellow bands)

This is the correct product identification I.A.W MIL-STD-161G (LRS provided picture)

(v) Confined space notices shall be placed at the point of access to the secondary containment bund.



(vi) Provide a warning sign next to the fill point that warns against filling of the tank if the bund contains an oil spillage.

17. Protection

(i) All ASTs shall be protected from accidental damage by collision or other means. Each location shall be considered for risk of damage. Protection will normally take the form of fencing, protection posts or steel profiled traffic barriers appropriate to the location, and pre-approved with 48CES project manager. Barriers will be BS 08B29 colour unless specified otherwise.

(ii) Unnecessary vegetative growth (i.e. trees, bushes) near to tanks should be avoided. These encourage birds and possible fouling of the tank structure thus reducing coating life. Consult DE grounds maintenance officer and 48 CES Corrosion Engineer for advice if required.

18. Installation

(i) Comply with UK Government '*Oil storage regulations for businesses-How to store oil, design standards for tanks and containers, where to locate and how to protect them, and capacity of bunds and drip trays. published 6 May 2015; last updated 3 January 2018'.*

(ii) Ensure that all electrical connections/ installations comply with current UK electrical regulations. In addition, comply with relevant Air force instructions/ ETLs & MIL/ DoD Standards, (the most stringent to apply).

(iii) Where required each tank should be installed within a compound and visually screened utilizing wooden close boarded fence panels to the current edition of BS 1722. Panels should be 1.8 meters in height and not span no more than 2 meters and be complete with top capping. Panels should be fixed to no less than 3 rails which in turn should be fixed to pre-cast concrete fence posts including all necessary strainer posts and concrete gravel boards. A suitably sized external ledged and braced access gate with all necessary heavy-duty galvanized ironmongery should be provided. All timber to be treated with two coats of base standard Johnstone's Dark Oak water-based wood stain.

19. Tank Suppliers

Previous suppliers to base include: -

- P & D Tank Services, Tel: 01508 570629
- JA Envirotanks, Tel: 0121 622 4661
- Adler and Allen Ltd, Tel: 020 8555 7111
- Cookson & Zinn, Hadleigh, Suffolk. Tel 01473 825200.

20. Notes:

(i) Tanks previously supplied to base/ shown in example photographs may not have contained all the items specified above.

~~(ii) EA does not endorse products.~~

(iii) Suggestions for change to this specification should in the first instance be submitted to 48CES/ CEPT or 48CES/ CEV.

(iv) In certain design/ temporary situations manufacturer pre-bunded "plastic tanks" may be suitable instead of steel ASTs. The use of a plastic tank should not be viewed as a means to omit required standards & provisions. Written pre-approval from base architect, maintenance engineering, environmental flight and LRS will be required where it is proposed to use these. Justification and design/ manufacturer details will be required to support initial request to CES.

Do not place orders/ procure/ install without written pre-approval of design.

(v) O&M Training & familiarization will be required to be offered/ provided for maintainers and custodians on completion of installation. This will also be required for any significant modifications to existing tank/ pipe installations.