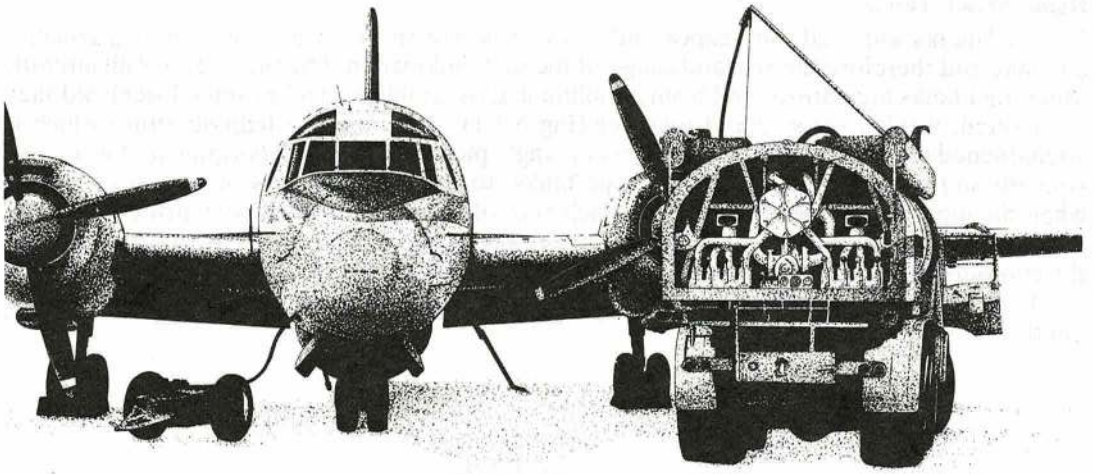


CHAPTER 3

AIRCRAFT FUEL TANKS

(Construction – Installation – Precautions)

Introduction

1. In the first two Chapters of this section we dealt with information related to aircraft fuel systems and some of the components which are a necessary part of such systems. In this Chapter we shall deal with the types of fuel tank in general use, including information about their construction, installation and essential safety precautions. However, at this point, it must be stressed that these notes are not a repair or servicing authority and that specific information must be obtained from the appropriate Air Publication in the 106B-0200 series and the aircraft AP.

General Information

2. Fuel tanks normally fall into three main categories of:

- Rigid construction
- Flexible construction
- Integral construction.

Rigid tanks are normally made from metal or plastic material; they are fitted internally where space permits or as external drop tanks. Flexible fuel tanks have an advantage over rigid tanks because they can be shaped and fitted into odd shaped spaces where rigid tanks cannot be fitted. In general, flexible tanks are lighter and easier to handle and store than rigid tanks. Integral fuel tanks are of rigid construction because they are part of the airframe structure. They are not independent items like the other tanks.

Whatever the construction method, fuel tanks should be shaped so that almost all the fuel is available to the engine. Awkward pockets which prevent fuel from leaving the tank are undesirable and are avoided if possible.

Rigid Metal Tanks

3. Fuel tanks are made in shapes and sizes to fit the spaces available in each particular airframe and therefore the size and shape of the fuel tanks will not be the same for all aircraft. Metal fuel tanks are constructed from aluminium alloy, stainless steel or tinned steel and they are riveted, welded, or soldered together (Fig 6.3.1). The tank is a light structure which is strengthened by the use of internal stiffeners, angle pieces and by incorporating baffles to give strength and which are necessary, in large tanks, to reduce the effects of fuel surge caused when the aircraft manoeuvres. Secure attachment of a rigid tank within the airframe may be achieved by built-in padded cradles and padded metal straps. The cradle is shaped to match the contours of the tank and the straps secure the tank to its cradle. Each tank will have the brackets, strap guides and fittings to match the aircraft structure into which the tank is to be fitted.

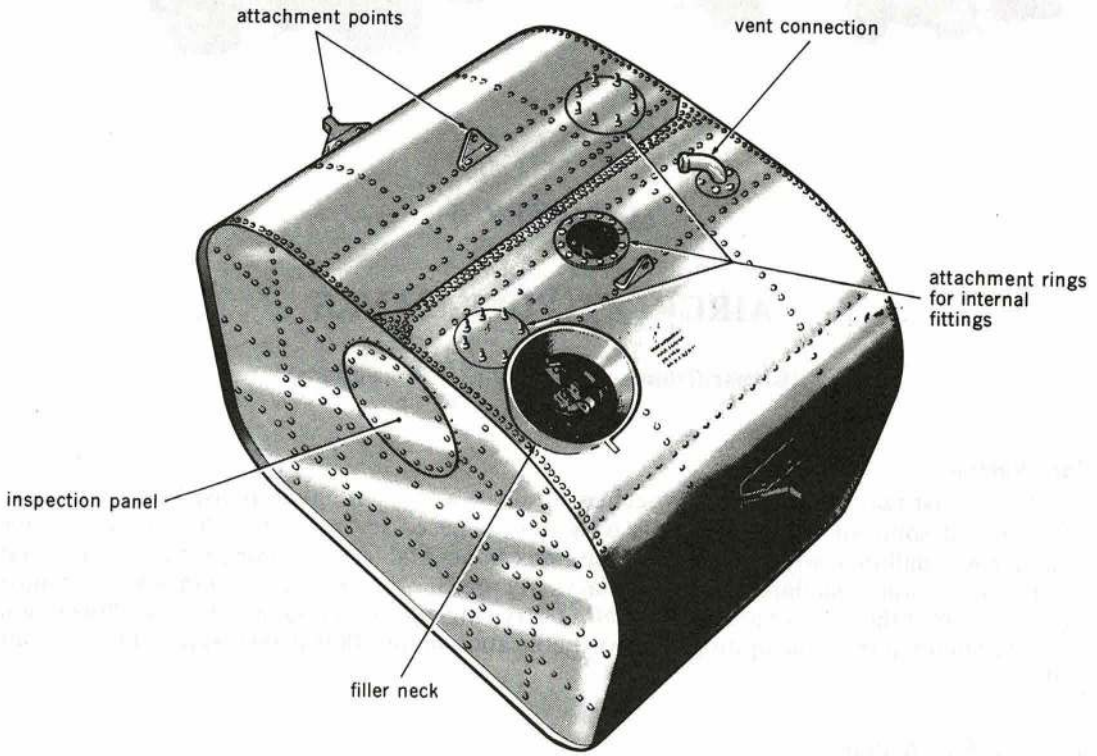


Fig 6.3.1 A typical rigid internal fuel tank

4. **Fuel tank fittings.** Each fuel tank is constructed with apertures and internal mounting points for the fuel system components required at that place in the fuel systems. Fitted internally are such items as, float valves, fuel contents transmitters, air/no fuel valves, low pressure fuel pump and fuel/no air valve as required at that tank position. Externally, the tank will have a filler orifice, fuel and air connections, vents, drain valves and fuel transfer connections as appropriate. Some metal tanks are covered by a self-sealing material which swells when in contact with fuel and tends to seal any leak. The self-sealing properties of the covering greatly reduces the amount of fuel which can leak away if the seam or joint in a metal tank is ruptured.

Integral Fuel Tanks

5. An integral fuel tank is a fuel-proofed space in the aircraft structure which is filled with fuel and provided with the appropriate fittings and connections for fuel feed, fuel transfer, air lines, vents and fuel pumps required at that particular position in the fuel system. Connections and fittings cause few problems, but sealing and fuel-proofing the aircraft structure is the vital element which decides the success of the integral tank. An integral wing tank is usually an area of a mainplane between the front and rear spars and bounded by the external skin which covers the wing structure. The tank area is sealed and fuel proofed during assembly. Special sealants are used under controlled conditions and the skin attachments, structures, rivets and bolts are assembled whilst the sealant is wet. Dry assemblies cannot be adequately sealed afterwards.

6. Before assembly, all the structural parts which become integral fuel tanks are cleaned to a particular process specification; the clean parts are immediately coated with a special sealant and assembled wet. It is important that the joints are finished (rivets closed or bolts tightened) before the sealant sets. This first coating of sealant is called the 'interfay' and it should bond with all parts of the joint. After the joint is tightened it is necessary to remove the surplus sealant that has been squeezed out as the joint closed. After cleaning the work a neat coating of sealant is applied at the edges of the joint; this coating is called the fillet (Fig 6.3.2), and it

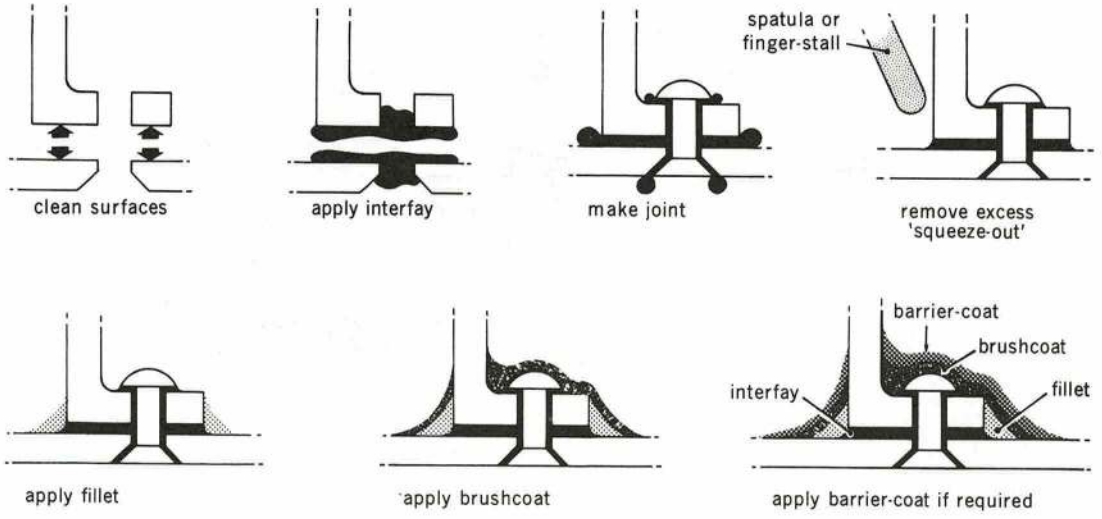


Fig 6.3.2. Integral tank sealing

should be strong enough to cope with any flexing between the parts. A final brush-on coat of sealant is applied to overlap the joint and fillet. Interfay, fillet and the brush-on coat are part of the standard treatment for sealing integral fuel tank structures and all use a similar sealant. As an aid to quick production, the joint can be covered by a barrier-coating of a quicker drying substance. The barrier-coating material is not the same as the sealant used for jointing and it will not prevent or cure leaks. The barrier-coat becomes tack-free in a relatively short time and it is applied over partially cured sealants to reduce the possibility of contamination from swarf, when work must continue in the area of an uncured joint. To extend the leak-free life of the integral fuel tank, take great care when handling of working on the skin area which covers the integral fuel tank.

External Fuel Tanks

7. External fuel tanks are fitted to increase the total fuel capacity of an aircraft and to improve the range of the aircraft. The method of attachment is peculiar to aircraft type and, usually, external fuel tanks can be released in flight so that the tanks fall away from the aircraft. Such tanks are sometimes called 'drop-tanks' and the fuel system is designed so that the external tanks are emptied first and they can be dropped before an aircraft engages in combat, or in an emergency, with the minimum loss of fuel.

External fuel tanks are always of rigid construction. They may, however, be made from either metal or plastic material and they are shaped to blend with the contours of the aircraft so that they cause a minimum amount of drag and turbulence (Fig 6.3.3). External fuel tanks are fitted in any or all the following positions:

- To the wing tips, and called 'tip tanks'.
- On pylons under the wing, and called 'pylon tanks'.
- Under the fuselage, and called 'ventral tanks'.

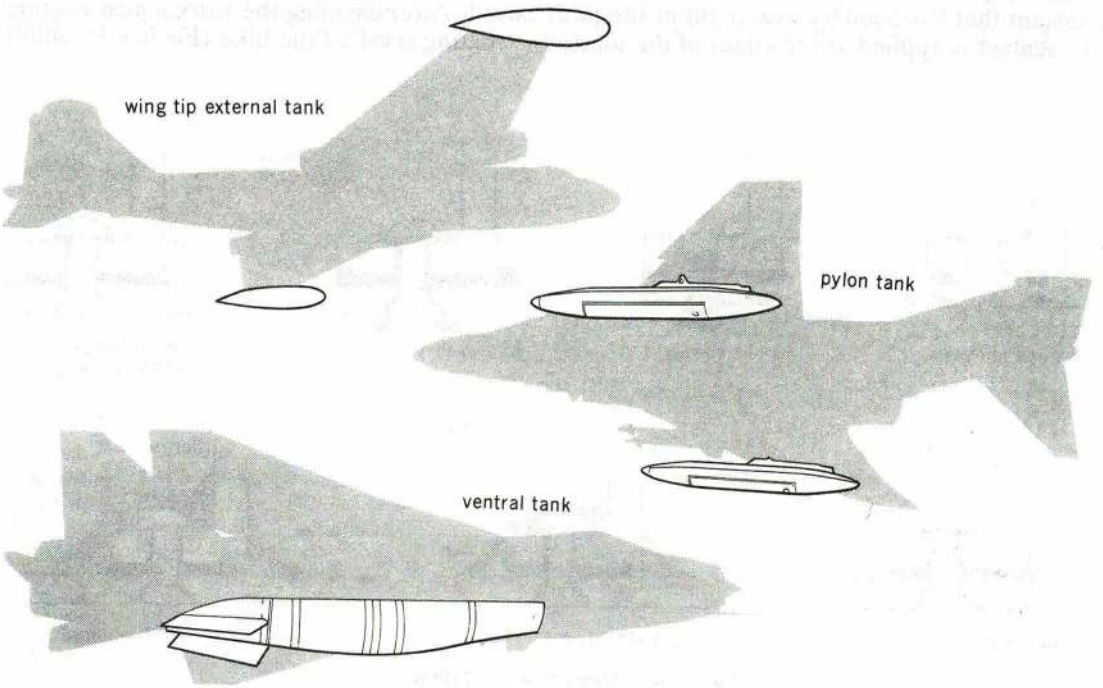


Fig 6.3.3. External fuel tanks

8. **Drop tank fuel lines.** When an external fuel tank is dropped from an aircraft in flight, the fuel lines between the tank and the aircraft must be broken. The break must be simple and it must not require an effort which will prevent the tank from dropping quickly and cleanly away from the aircraft. Spring-loaded valves or glass break tubes are examples of this quick disconnect point (Fig 6.3.4). After a tank has been dropped, or when a tank is not fitted, the air/fuel transfer line just remain intact and functional. For this purpose a fuel and air valve is usually fitted. This valve directs transfer pressure air to the external tank and provides a fuel transfer passage between the external drop tank and the main fuel system. When the external tank is dropped, the fuel and air valve automatically connects the transfer air flow into the main fuel system.

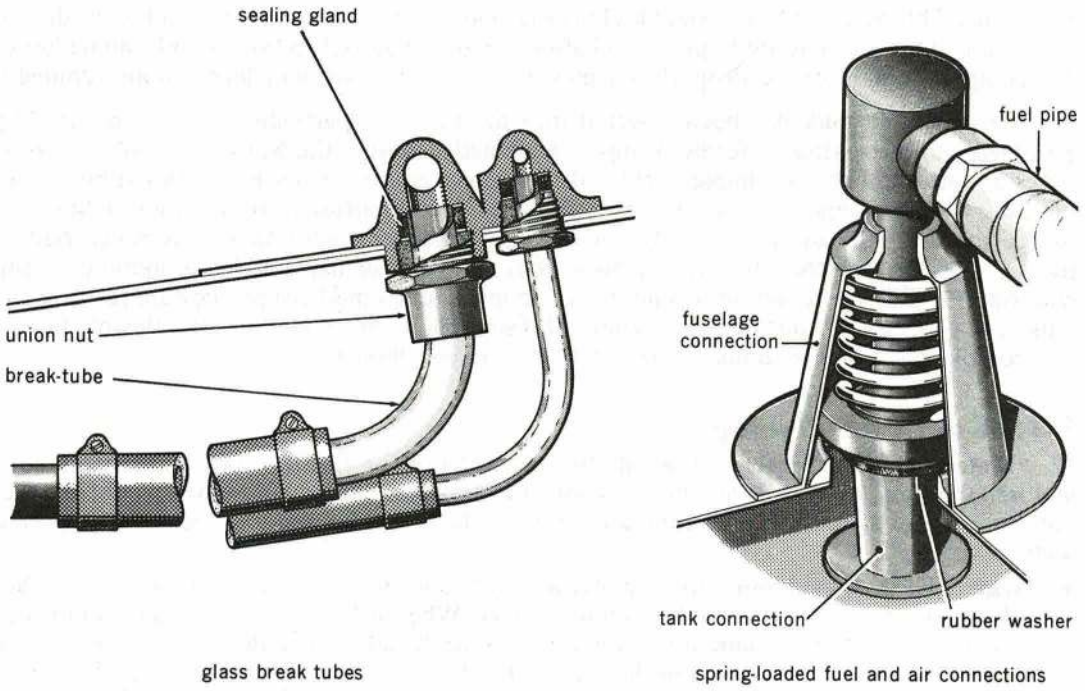


Fig 6.3.4. Drop tank fuel line breaks

9. External fuel tanks may be filled from a trigger nozzle hose or they may fill with the pressure refuelled system (*see* Aircraft AP). Some external tanks have facilities for recording their contents and they are fitted with float switches and any internal equipment necessary to assist with the proper management of the fuel system. Such external tanks are usually considered as part of the main fuel system and they are rarely removed.

Note: Great care is needed when handling external fuel tanks that are made from a plastic material called Durestos. This material is not flexible and, therefore, there is no warning before fracture. *Do not overstress this material when lifting and fitting the tanks to the aircraft.*

Flexible Fuel Tanks

10. Flexible fuel tanks may be constructed with thin and very flexible walls (called bag tanks) or they may be made of thicker less flexible material. These tanks are made in shapes to fit particular spaces in the aircraft structure and their flexibility enables the tanks to be folded and inserted through a small aperture which would not allow a rigid tank of similar capacity to be fitted. Because flexible tanks can be made in shapes to suit most of the space available, a greater fuel capacity is made available to a particular aircraft when flexible tanks are used. Some aircraft fuel systems are designed to include rigid, flexible and external fuel tanks so that the greatest possible fuel load is carried.

11. The compartment for a flexible fuel tank is made as smooth as possible on the inside and projecting joints are covered to prevent chafing the tank material. Before a tank can be fitted, the compartment must be properly cleaned out and all swarf and loose items removed.

After a flexible tank has been inserted into the tank compartment the tank is carefully unfolded and the various external fittings are aligned. Usually, the walls of the more flexible tanks are attached to the compartment walls by a type of press stud fitting. When filled with fuel, the tank expands to contact the walls of the tank compartment so that the weight of the fuel is carried by the aircraft structure and not by the tank. Because the load is not carried by the tank, flexing of the aircraft structure does not impose harmful loads upon the tank material. Flexible fuel tanks are resilient, like an inner tube, and because they are resilient the tanks can withstand a considerable amount of distortion or shock loading. If a flexible tank is not completely full it is unlikely to burst on a crash impact.

Tank Materials and Coverings

12. **Materials.** The material used in the construction of flexible fuel tanks must be a material that is not adversely affected by contact with fuel, oil or ozone. However, flexible fuel tanks are not of a common structure and they may be made from any of the following listed materials:

- **Hycar.** This is a synthetic rubber material which is made into sheets of two or more plies and finished by passing through calender rollers. When finished this material is known as flexsyn sheet but when made into a tank it becomes flexelite. The flexsyn sheet is made in different thicknesses for tanks of different capacity. A tank of 100 gallons capacity uses a particular thickness of material and for each increase in tank size (up to 300 gallons) a thicker material is used.
- **Marlite.** This material is made in one thickness only and the size of the fuel tank is not restricted by the thickness of the material. Marlite is a two-ply construction consisting of nylon and terylene fabric plies with a fuel-proof resin barrier bonded between the layers of fabric.
- **Hycatrol.** This is a nitrile-based compound material that is not affected by contact with fuel or oil. The compound is produced in sheets, as mouldings or extrusions as required and in a thickness to suit the tank size and application.

Tank Coverings

13. **Protective covering.** A protective covering may be fixed to the outside of a flexible fuel tank. The covering is not special to type and similar covering materials are used to protect different types of tank. The protective covering usually consists of several layers of fabric, or fabric and rubber, which are cemented to the material of the tank with adhesives. When a tank is fitted with a protective cover it, in general, becomes stiff enough to support its own weight and retain its shape. However, when the various metal fittings are added, the tank will sag and it needs support when fitted.

Some tanks, which do not have protective covers, are reinforced by nylon fabric or net. This type of reinforcement does not stiffen the tank, which remains very flexible and limp. This type of tank cannot support its own weight and is the type which is sometimes called a 'bag tank'.

14. **Self-sealing coverings.** These coverings have been developed to reduce the magnitude of a fuel leak if, for any reason, the fuel tank is pierced or ruptured. The self sealing covering is usually made up from layers of cellular rubber with an overall protective cover of glass fabric or nylon fabric on the outside. This type of rubber is a material that is immediately affected by

contact with fuel. If a tank leaks, the cellular rubber swells on contact with the fuel and forces its way into the puncture to block the hole and reduce or stop the leak. Unfortunately, minor leaks may remain undiscovered for some time until the self-sealing cover begins to swell and bulge on the outside.

15. A self-sealing covering consists of either a 2½ mm thick layer and a 5 mm thick layer of cellular rubber or two layers of 3½ mm thick material. When used, the 2½ mm material forms the inner layer which is butt jointed and cemented to the outer surface of the fuel tank. The 5 mm material is cemented onto the inner layer so that the butt joints are staggered and do not coincide one with the other. The self-sealing material is covered on the outside by glass fabric sheets which are cemented to the self-sealing rubber. The glass fabric sheet is fitted with overlapping joints which are arranged so that they do not coincide with the joints of the self-sealing material. All the joints in the glass fabric sheet are covered by a 50 mm wide sealing strip. The self-sealing material may be omitted or reduced in thickness over the top of the fuel tank and above the full tank fuel level in formal flight.

16. **Crash proof coverings.** To give some measure of protection against crash impact damage, fuel tanks may be covered by layers of woven glass fabric. When fuel tanks are covered in this way they are called crash proof tanks. A normal crash proof covering consists of three layers of rubber impregnated glass fabric which is cemented onto the outer surface of the fuel tanks and finished externally by painting all over with a special flame-retardent red dope. Crash proof coverings are much thinner and lighter than self-sealing coverings. The two types of covering are not used together.

Attachments and Fittings

17. To complete a flexible fuel tank, provision must be made for attaching fuel system components and for joining each tank into the fuel system. The fuel tank is constructed with moulded connectors and apertures of an appropriate size and position but, because of the flexible nature of the material, each aperture needs to be reinforced before a system component can be fitted. Each aperture is strengthened and stiffened by fitting a metal attachment ring. The attachment rings are sometimes call 'stud rings' or 'bolt rings' (Fig 6.3.5).

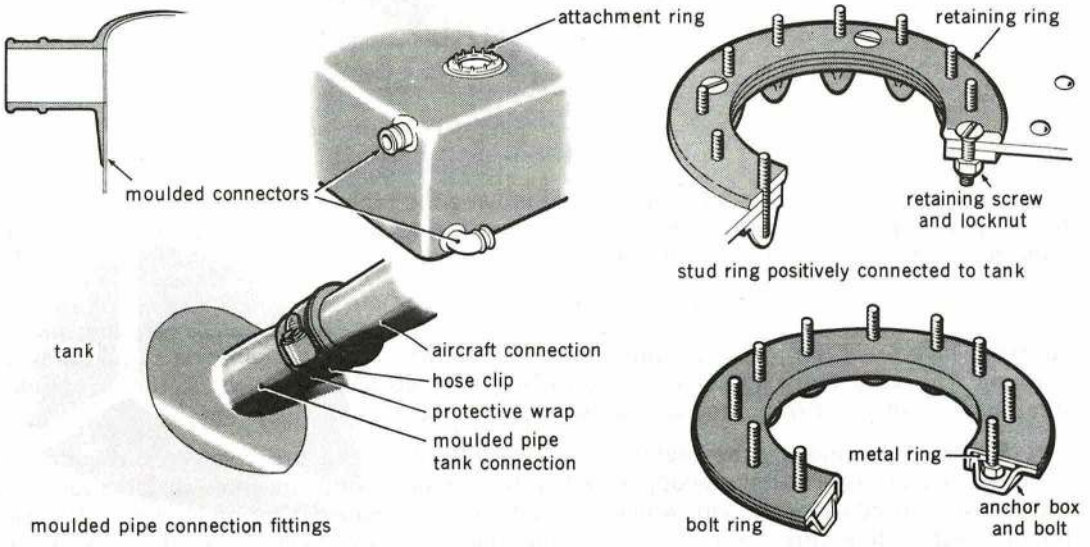
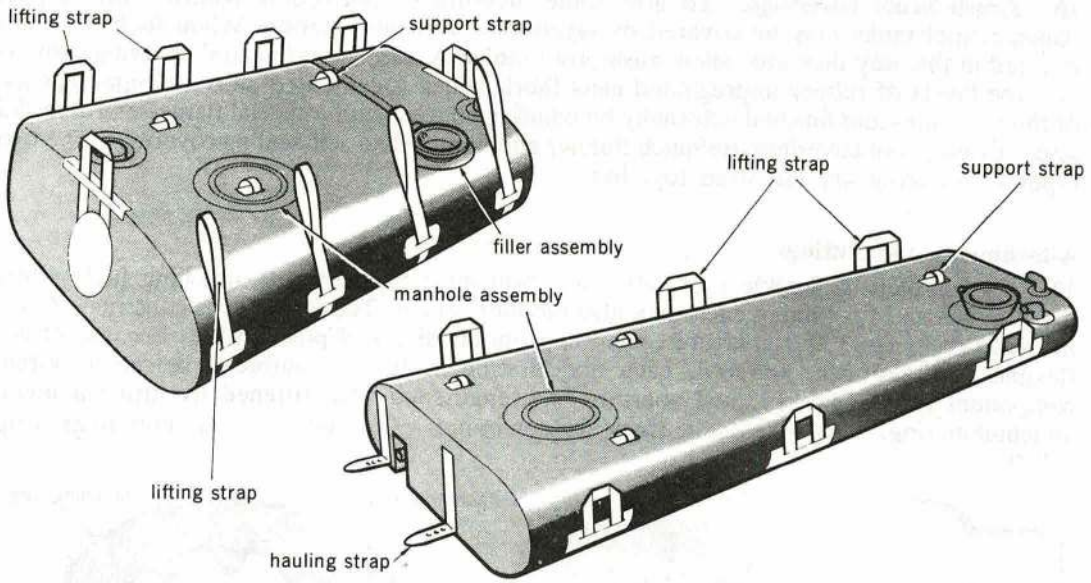


Fig 6.3.5. Attachment rings and moulded connections

18. **The attachment ring.** The attachment ring is normally a detachable item consisting of an inner metal ring with holes tapped for studs (stud ring) or with slots for bolt heads (bolt ring) and an outer metal flange ring which has clearance holes for the studs or bolts. The two parts of the attachment ring are assembled with reinforced tank material between them. The tank material is punched to match the stud/bolt pattern and the inner ring is fitted inside the tank with the studs or bolts projecting outwards through the tank material. The outer ring is positioned on the studs and when the nuts are fitted and tightened the two parts of the attachment ring clamp the tank material. No adhesive is needed to make a leak free joint between the material of the tank and the attachment ring.

19. **Handling straps.** Flexible fuel tanks should not be handled or lifted by grasping external pipes, whether moulded on or attached by a stud ring. Straps are usually included in the structure and are intended to provide strong points for lifting or carrying the tanks (Fig 6.3.6). When handling straps are not provided, extra care is needed to avoid damage to the



external and internal fittings when lifting and moving the tanks. Uncovered (bag) tanks must be handled with exceptional care especially if heavy fittings are attached. Such tanks are easily damaged and, because of the limp nature of the material, internal fittings are vulnerable.

20. Many tanks with self-sealing coverings appear to be much stronger than they are and, although they are well padded, they are easily damaged. The flexible lining is very thin and the covering layers are only rubber and fabric. Therefore, common sense is required when working with such fuel tanks if they are to be protected from damage. Rough or careless treatment is almost certain to damage or destroy the flexible fuel tank.

21. **Electrical bonding.** The metal fittings of a flexible tank are connected together by bonding wire of braided-tinned-copper. When the bonding wires are fitted inside a fuel tank they are supported by small loops which are built onto the inside of the tank material. External bonding wires are secured by a fabric strip material which is cemented over the bonding and onto the outside of the fuel tank.

WORKING WITH AIRCRAFT FUEL TANKS

22. The fuels carried in aircraft tanks are toxic and potentially dangerous. Unless the appropriate safety precautions are taken these fuels can be harmful to personnel and there is an ever present risk of explosion and fire. In the following paragraphs we shall consider the means of ensuring the safety of personnel and reducing the risk of fire or explosion during essential work with fuel tanks and fuel systems. Although information that applies to a particular aircraft type is found in the appropriate aircraft Air Publication series, many safety precautions are of a more general nature and are included in these notes.

Safety Precautions

23. **Explosion risks.** The most highly flammable liquid carried in an aircraft fuel tank is gasoline (Avgas), a liquid fuel which mixes readily with the atmosphere to give off toxic and highly explosive fumes. Full fuel tanks are safer than partially full tanks because any air space is always filled with explosive vapour. Therefore, the smaller the amount of gasoline in a tank, the greater is the explosive risk. Consequently, small pockets of gasoline remaining in a tank are capable of causing a dangerous and explosive vapour to remain inside an otherwise empty fuel tank. Initially draining a fuel tank does not eliminate the dangerous vapour and apparently empty gasoline tanks (or containers) have been known to explode. Because of this known danger, action is taken to remove all trace of fuel vapour before any work is carried out on a gasoline tank.

24. Kerosine (Avtur) is less flammable than Avgas, but Avgas vapour is more easily removed from an empty fuel tank than Avtur vapour. This is because avgas has a relatively low boiling point and evaporates more rapidly than avtur. Small amounts of gasoline left in a fuel tank after draining can be vaporized and the fumes removed by adequate ventilation at a warm temperature.

25. **Removing vapour from fuel tanks.** The first step towards making a fuel tank non-toxic and explosively safe is to drain the fuel from the tank. Although the fuel is drained, so far as is possible, before the tank is removed from the aircraft, some small pockets of fuel may remain inside the tank when it is removed. Some of the residual fuel may be removed by tilting the tank in all directions to swish the fuel to the outlet. Fuel which will not drain away can sometimes be mopped up with suitable absorbent material which must be fluff-free. Materials used for mopping up fuel constitute a fire hazard and they must be destroyed by a locally approved method.

26. When the fuel has been removed, the tank can be made safe by adequate ventilation and, whilst clearing out the explosive vapour, flexible fuel tanks should be supported so that they retain their natural shape. Gasoline tanks can be cleared of vapour by leaving the tank in a fresh airflow with all the detachable panels removed. However, this is a long process and the tank remains extremely dangerous for quite a long time with the danger period lasting longer at low temperatures.

27. **Blown air venting of gasoline tanks.** Clearing the explosive fumes from a gasoline fuel tank by induced airflow is the method generally used, because it is simple and possibly the quickest way of making a fuel tank non-toxic and explosively safe. In this method of venting, an air hose is arranged so that it blows air into the tank through an aperture at the top of the tank. With all the detachable panels removed, the airflow will fill the tank and air/fuel vapour will leave through all the other openings and initially a dangerous area will surround the tank. To speed the clearance of explosive fumes, the tank should be positioned in a well ventilated place and a warm airflow used with a temperature not greater than 60°C. The length of time

that air blowing must continue will depend upon the rate of airflow, the air temperature and the size of the tank. In general, air must be circulated through a tank for at least one hour and, if the odour of the fuel remains, a further period of blowing is necessary to make the tank safe.

28. **Use of inspection lamps.** Although every effort has been made to remove explosive fumes from a fuel tank, no naked light or open heater element is permitted in or near the tank. When inspection lighting is essential and *explosion-proof lamp* must be used.

29. **Aviation kerosine tanks.** When a flexible fuel tank has contained kerosine, some of the fuel is absorbed into the lining of the tank. This fuel can be removed by filling the tank with *gasoline* for a period of about forty eight hours. The tank is then drained and vented by one of the methods approved for gasoline tanks.

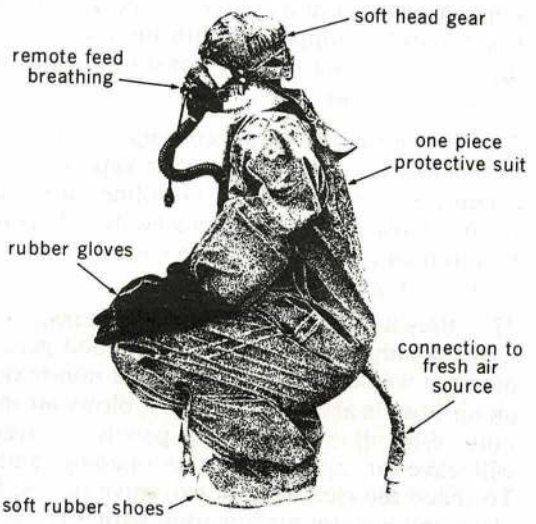
Personal Protection

30. **Toxic effects.** Aircraft fuels and the cleaning solvents used in tank repair processes are poisonous and special precautions are necessary to safeguard the health of persons working with these fluids. Poisoning will occur if the fumes from such liquids are inhaled; poison can also enter the body through broken skin, or even if unprotected unbroken skin if it regularly remains in contact with liquids or contaminated materials. The effects of these poisons are insidious and can do irreversible damage to health if the proper precautions are not enforced. For health and safety reasons it is important to:

- Avoid breathing fumes given off by fuels and solvents.
- Protect the skin by wearing approved protective clothing and by using barrier cream on any exposed skin.

31. **Entering a fuel tank.** There are occasions when it is necessary for a person to enter a large fuel tank to inspect the inner skin, fit or remove system components, and carry out routine servicing operations. Entering a fuel tank is permitted only under carefully controlled conditions. Regardless of the efforts taken to make a fuel tank safe there is always a danger for a person who must enter, whether the tank is fitted to the aircraft or not.

32. Before entering a fuel tank, the operator must dress in rubber overalls, rubber boots, rubber gloves, special head gear and wear a respirator (Fig 6.3.7). Only explosion proof lamps and spark proof tools can be taken into the fuel tank and before dressing in the special protective clothing, the operator should remove from his person such items as matches, lighter, coins, knife, watch, rings, and any sharp-edged or dangerous items. Large fuel tanks not fitted to an aircraft should be adequately supported to prevent collapse when an operator is inside the tank.



33. **Special precautions.** Because of the dangers involved, the following conditions and precautions are enforced whenever a person must enter a fuel tank for any reason. When a person is permitted to enter a fuel tank it is essential that:

- He is medically examined.
- He wears a remote intake breathing apparatus.
- The intake (free) end of the respirator tube is positioned clear and upwind of the fuel tank.
- The person entering the tank must wear protective clothing and a life line.
- The tank must be in the open air or in a well ventilated building.
- Fire extinguishers of the correct type must be ready for use.
- A second person must act as an observer who, whilst remaining clear of possible fumes, is responsible for the safety of the operator inside the tank.
- The work must be properly supervised and a person must not stay inside the tank for more than 30 minutes for each shift. Each period inside the tank must be followed by an equal or longer period spent in fresh air.
- Personnel employed upon internal work in fuel tanks must wash thoroughly before eating, drinking and smoking.

Note: Most of the precautions for personal protection apply also to smaller integral tanks where, although a person cannot completely enter the tank, the head and arms may be partially inside or the head and face will be very close to the tank apertures.

Removal and Fitting of Fuel Tanks

34. **Fuel tank removal.** When fuel tanks are detachable (not integral) the procedure for preparation and removal is peculiar to aircraft type. The correct information and work sequence is to be found in the aircraft Air Publication and the following notes cover the subject in a general manner only. When the tanks to be changed are of a flexible construction it is good practice to use the oldest tanks in stock before newer and more recently folded tanks. If flexible tanks have been stored in an unheated building during very cold weather, the lining material may be stiff and liable to crack if the tank is unfolded and handled in preparation for fitting to the aircraft. Because cold tank lining tends to be brittle, it is always best to put the tank in a warm place and allow time for the material to recover its flexibility before unfolding it ready for inspection and fitting.

35. Never draw a tank from stores and fit it to an aircraft without subjecting the tank to a thorough inspection and leak test. Althouth this is a lengthy process, to fit an unserviceable tank wastes much more time.

36. **Preparing a tank for removal.** In preparation for removing a fuel tank, the fuel must be drained. In some aircraft this may mean draining the complete fuel system; in another aircraft only the affected tank group may need to be drained. This information and the method of draining the fuel is detailed in the aircraft Air Publication. After the fuel has been drained, the tank must be disconnected from the fuel system and vented to remove the toxic and explosive fumes. To prepare a tank for removal it is necessary to:

- Remove the tank access panels to uncover the pipe connections and fittings.
- Disconnect all pipes from the tank, and blank and secure the loose pipes clear of the tank. Where disconnecting a pipe may cause minor fuel spillage, use a suitable absorbent material to limit the amount of fuel that can escape into the aircraft structure. Fuel-soaked material becomes a fire hazard and local disposal instructions should be obeyed.
- Disconnect electrical connections.
- Remove internal or external fittings as detailed in the aircraft Air Publication.

- If the tank has stiffening supports these must be removed to enable the tank to be withdrawn from the tank compartment.

37. Many flexible fuel tanks and all uncovered tanks need to be supported to retain their shape when fitted in the tank compartment. The support is usually a series of buttons or studs which are moulded onto the outside of the tank and pressed through holes in the tank compartment skin to hold the tank in position (Fig 6.3.8).

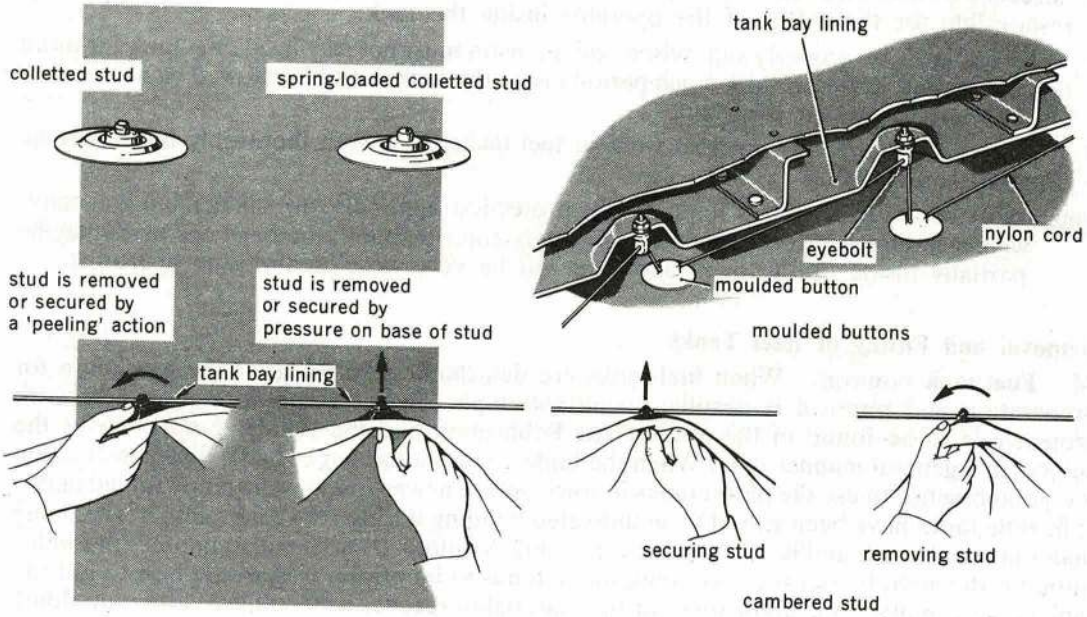


Fig 6.3.8. Support attachments for flexible tanks

Another method of supporting flexible fuel tanks in their compartment is to thread cord through mouldings on the tank outer skin and attach the cord to the compartment skin (*see* Fig 6.3.8). When fitting or removing the tanks, care is needed to avoid tearing the tank material when pressing the support studs into place or, particularly, when removing them. This is the kind of work which often is carried out by feel alone, because it is not normally possible to see the studs and reach them at the same time.

38. **Removing the tank.** When all disconnections have been made and the tank is loose in the tank compartment, it must be carefully withdrawn through the largest aperture in the structure. Rigid fuel tanks rarely cause any problems because the structure of the tank includes (by necessity), a detachable panel which provides an aperture larger than the tank. If removing such a panel weakens the structure, jury rigging may be needed (*see* aircraft AP). For flexible tanks, the situation is not the same and a flexible tank may need to be folded inside the tank compartments before it can be withdrawn. Flexible fuel tanks may have contents gauging equipment inserted into pockets inside the tank. This equipment is vulnerable when folding and removing a tank.

When the fuel tank has been removed it must be inspected so that its condition (*ie* repairable, scrap) can be decided. The tank may require folding and packing (*see later*) or stiffening supports which were removed may need refitting to retain the shape of the tank.

Fitting Fuel Tanks

39. Like tank removal, fitting a fuel tank requires work that is special to aircraft type and details of such work are to be found in the aircraft Air Publication. However, although details of the work vary from one aircraft to another, in general, the following items require attention as a tank is being prepared and fitted:

- The replacement tank be the correct type, reference and part number.
- The tank must be serviceable and leak proof with the necessary internal and external components attached so far as possible before the tank is fitted to the aircraft.
- The tank compartment is to be cleaned out until it is free from foreign objects of any kind, and projecting surfaces must be padded to reduce the possibility of puncturing or chafing the material of the tank.
- If necessary, carefully fold the fuel tank so that it may be inserted into the tank compartment.
- Unfold and ease the tank into position carefully removing creases and aligning the tank in its compartment.
- Fasten the positioning buttons or studs.
- Connect the fuel, vent, overflow, and pressure lines, removing the blanks immediately before each connection is made.
- A tradesman of the appropriate trade will make the electrical and instrument connections.
- Duplicate and independent checks are required to prove the integrity of the fuel system.
- Refit access panels.

40. In general, connecting and disconnecting pipelines for rigid tanks is similar to the work involved with flexible tanks. However, the rigid tank compartment is more accessible and the method of securing the tank is not the same.

System Testing

41. After a fuel system has been disturbed by removal and fitting of fuel tanks, or for any other reason, the whole system must be tested and proved to be serviceable. The tests are peculiar to aircraft type and the details of the work necessary are to be obtained from the aircraft Air Publication series. However, the work done must cover all the following points:

- Fuel leak tests.
- Fuel flow tests.
- Fuel contents gauging.

42. **Fuel leak tests.** The installed fuel system is tested for leaks by applying air pressure to empty tanks or by applying fuel pressure and visually examining all possible areas where leaks can occur. Normally pressure gauges are fitted into the system at pre-selected points so that specified test pressures can be maintained without any danger of causing damage by using excessive pressure.

43. **Fuel flow tests.** To ensure that the fuel system is properly installed and that non-return valves (NRV) are fitted with a correct direction of flow, it is necessary to test the fuel flow at the last connection before the engine. Normal low pressure fuel pump pressure is used and the fuel flow is measured. Where cross-feed facilities exist, these must be tested to ensure that the cross-feed will be adequate in an emergency.

44. **Fuel contents gauging.** When fuel tanks or contents gauges have been changed, the electrical tradesman will be required to test, and correct if necessary, the fuel contents gauging equipment to ensure accurate presentation of the fuel carried.

CONCLUSION

45. A study of this Chapter will reveal information about the different types of fuel tank which are used in aircraft fuel systems, why they are necessary, how they are made, and how they should be handled. Very important safety precautions are listed; these are essential and must never be ignored.

46. Instructions for fitting and removing fuel tanks are special to aircraft type and, therefore, the notes in this Chapter are of a general nature and not an authority. However, your attention is directed to the fuel system tests mentioned in paras 41 to 44; although the tests are special to type they are vital tests and are not to be neglected.

This Chapter ends the fuel system story except for fuel tank repairs. This is specialist work and is dealt with in the next Chapter.

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