

FORBES



PLASTICS TANKS AND ENVIRONMENTAL TECHNOLOGIES

Operating & Maintenance Manual (OMM)

Date	Rev.	Issue	Reason for Issue	Created by	Checked By	Approved
31-Oct-17	1	1	Update of document contents	A Lusher	B Whicker	<i>M.A. Jupp</i>

OMM003 –STANDARD OPERATING & MAINTENANCE MANUAL

Forklifting:

The forks or extensions must exceed the tank diameter, or use timbers/pallet to span the diameter.

Strutted Bases:

Strutted bases (sloping bases with an integral skirt) must be lifted with the forks at right angles to the struts. You can tell which way they run by the position of the outlet fitting – See diagram opposite.

Base Nozzles:

Take particular care with nozzles that project below the base of the tank. These must not be subjected to any loading – Not even the weight of the tank. If you are putting the tank down temporarily then support it so that any such base fittings are kept clear of the ground. When installing permanently, take care to make an adequate cut-out in the plinth or stand and carefully lower the tank into position to avoid any damage to the nozzle.

- ✗ Do not sling the tank from any nozzles or fittings except lifting trunnions or lugs, which are designed for the load.**
- ✗ Do not roll or deform the tank during installation.**
- ✗ During offloading and installation, avoid point loads on the base of the tank. Only chock at the edge. Do not lever underneath the base.**
- ✓ Install the tank on a firm, flat surface (flat to within 3mm/metre) giving full base support. Sweep the area clean prior to installation of the tank.**



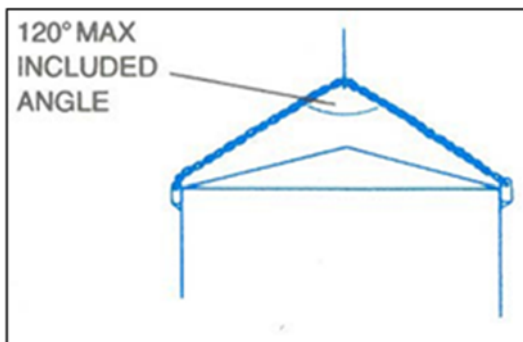
IF YOUR TANK IS FITTED WITH LIFTING LUGS OR TRUNNIONS FOLLOW THE INSTRUCTIONS FOR LARGER TANKS & VESSELS ON THE FOLLOWING PAGES.

UNLESS YOU ARE TRAINED AND EXPERIENCED IN LIFTING OPERATIONS, DO NOT UNDERTAKE THESE PROCEDURES YOURSELF. EMPLOY A REPUTABLE CRANE HIRE COMPANY WITH AN APPOINTED PERSON AND LIFT SUPERVISOR.

ALTERNATIVELY, FOR A FULL INSTALLATION SERVICE, PLEASE CONTACT FORBES.

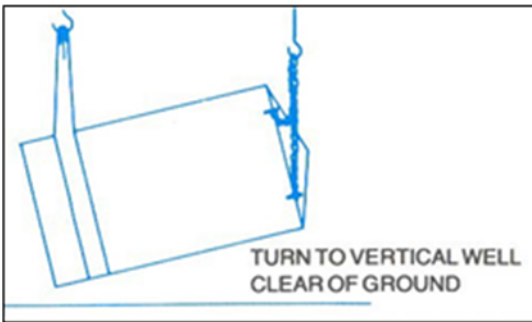
When delivering tank and bund sets (e.g. the Forbes Minibulk[®] range), the tank is sometimes transported standing inside the bund. **DO NOT ATTEMPT TO LIFT THE TWO UNITS TOGETHER** (unless otherwise specified by Forbes). First lift the tank out of the bund and stand it aside – Then put the bund in place – Finally lift the tank back into the bund. Separate detailed instructions are issued for these units. Please refer to our specific Minibulk[®] Operating & Maintenance Manual.

LIFTING USING ONE CRANE (Tank Vertical on Transport):



Attach lifting chains, or fabric slings to the lifting points (usually 4, sometimes 2) at the top of the tank. On GRP and some very large thermoplastic tanks, these will be stainless steel lugs with holes to accommodate 25mm diameter shackle pins. Smaller thermoplastic tanks are fitted with trunnions – Slings must be looped round these and carefully checked for security as the strain is taken up. The chains or slings must be long enough to give a maximum 120° included angle between the legs and must be adequately rated to take the loadings imposed by this.

TANDEM LIFT USING TWO CRANES (Tank Horizontal on Transport)



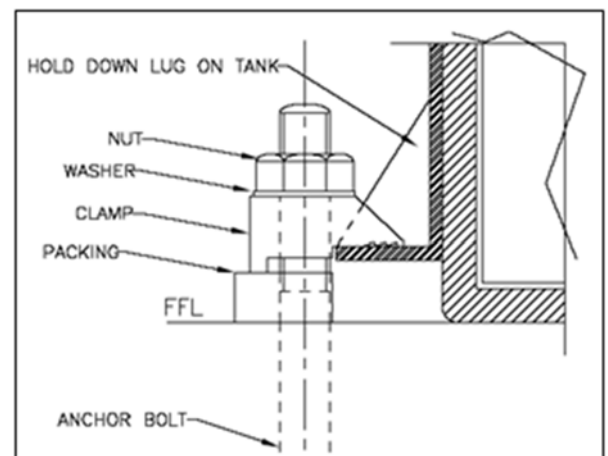
From the “main” crane, attach lifting chains to the lifting points at the top of the tank in the same manner as above, ensuring that the lower lugs take the initial weight of the lift. Use a “tailing” crane to lift the lower end of the tank, using a minimum 150mm wide fabric sling. Pass the sling round the lower girth of the tank and make a “noose” by passing one looped end through the other. To prevent the sling slipping up the wall of the tank as it is turned to the vertical, you can tie a

rope to the sling, passing it under the base of the tank at least twice, making a “basket”. Lift the tank evenly off the delivery vehicle and raise it high enough to be well clear of the vehicle, the ground and any other obstructions. Then carefully turn it to the vertical. Once the crane is entirely supported by the “main” crane, you should detach the sling and move the jib of the “tailing” crane out of the way.

POSITIONING & BOLTING DOWN

Thoroughly check that the intended position for the tank is clean and flat as previously outlined. Lower the tank into the required position, checking very carefully for correct position and orientation.

Anchor bolts are not usually supplied. Sizes vary - diameters are specified on tank drawings – you must select a length to suit the civils, taking into account the wind loadings on an empty tank. In the case of GRP tanks, clamps and shims are supplied to locate on the bolt-down lugs. Mechanical or chemical anchor bolts can be used. Once the tank has been filled, re-tighten the anchor bolts.



PIPEWORK CONNECTIONS

Connect pipework to the nozzles on the tank, ensuring that you do not impose loads on the nozzles. Do not pull pipework into position by tightening the bolting. Ensure that all pipework and valves are properly supported to ensure no loads are transmitted to the tank nozzles or tank.



CHECK ALL TRANSIT BLANKS AND PACKING MATERIALS ARE REMOVED PRIOR TO FILLING AND TESTING AND THAT THE TANK OR TOWER IS SUITABLY VENTED.

If you have any problems or need further information, please contact Forbes.

3.4 EXTERNAL PIPEWORK CONNECTIONS

Make the entire necessary pipe connections, ensuring that all pipe work is adequately and independently supported.



PLEASE NOTE: CARE SHOULD BE TAKEN, BOTH AT THE TIME OF INSTALLATION AND IN SERVICE, TO ENSURE THAT PIPEWORK IS CORRECTLY ALIGNED AND ADEQUATELY SUPPORTED SO THAT IT DOES NOT IMPOSE ANY LOADS ON THE TANK NOZZLES AND THAT NO VIBRATIONS ARE TRANSMITTED BACK FROM PUMPS ETC. REFER TO PARAGRAPH 3.6 FOR INFORMATION ON BOLT TORQUES.

3.5 INSTRUMENTATION AND EQUIPMENT

Install any additional instrumentation to be fitted to the tank, following manufacturer's instructions. Connect all instrumentation to control system and configure, following manufacturer's instructions.



ALL REQUIRED ELECTRICAL CONNECTIONS MUST BE MADE BY A FULLY QUALIFIED ELECTRICIAN.

3.6 BOLT TORQUES - WORK INSTRUCTION: INSTALLATION OF TANKS & VESSELS – MAKING CONNECTIONS – FLANGED TYPE

When bolting up a flanged connection to a tank or vessel the following procedures are to be followed.

Flange faces must be parallel to each other and on no account must misaligned flanges be pulled up with bolts.



GREAT CARE MUST BE TAKEN TO PREVENT ANY EXCESSIVE LOADS BEING PLACED ON A NOZZLE. BOLTING MUST BE TIGHTENED EVENLY AND NOT OVER TIGHTENED. THE LEVER EFFECT OF SPANNERS MUST BE KEPT TO A MINIMUM.

No loads to be placed on nozzles. All valves and pipework must be fully supported independently of the tank. If the support is rigid and fixed and there is possible movement of the vessel due to thermal changes, agitation, movement during filling/emptying cycles etc. a bellows should be fitted to allow movement between valve/pipework/tank.

Gasket materials must be soft, C.A.F. and other hard type materials must not be used. Maximum hardness of material must not exceed a shore hardness of 70.

If PTFE envelopes are used these must have soft rubber inserts. This normally requires the PTFE envelopes to be of milled section to prevent creasing of the PTFE. 'V' profiled type envelopes are not recommended as they tend to crease and prevent a good seal.

Solid PTFE or materials with a slow recovery or poor memory must not be used. They either relax and extrude which loses the seal pressure on the faces or if too hard will not seal. Either milled PTFE envelopes or materials such as Viton or Hypalon are considered.

A washer to be placed under all bolt heads and nuts.

Types of Flanges:

Full-face this type of flange must only be mated with full face flanges. NEVER BOLT FULL-FACE FLANGE TO A RAISED FACE FLANGE OR STUB FLANGE. In the event where this cannot be avoided spacers must be fitted to the bolts between the flanges to prevent over tightening and pulling the full-face flange around the raised face. This however is not recommended.

Stub flanges – this type of flange can mate up to any steel flange, however should not be bolted to a full-face plastic flange.

Table 1 or table 2 below show the recommended minimum Torque settings for bolted flanges with soft flat gaskets. Please ensure you follow the correct table for either a GRP tank/vessel or a Thermoplastic tank/vessel – if in doubt ask Forbes.

TABLE 1 - BOLT TORQUE DETAILS FOR GRP TANKS AND VESSELS

Nozzle NB		Bolt Size	No. of Bolts	Bolt Torque	Duty
ins	mm	mm		Nm	
1 ½	40	16	4	25	Standard Flanged Connections
2	50	16	4	25	
3	80	16	4	25	
4	100	16	8	25	
6	150	20	8	35	
8	200	20	8	50	
10	250	20	12	50	
12	300	20	12	75	
14	350	20	16	95	
16	400	24	16	95	
18	450	24	20	115	
20	500	24	20	115	
24	600	27	20	163	
18	450	16	24	100	
20	500	16	24	150	
24	600	16	30	160	
30	750	16	36	160	
36	900	16	40	160	

(These values are the minimum required to ensure gasket sealing!) (For pipe and valve connections; Gasket seating stress = 2.32 N/mm² for soft rubber only i.e. 70 shore). For harder materials, high figures will be required. On a normal configuration of flange design i.e. full face or stub higher torques will not damage the flange if in GRP and/or incorporates thick backing rings (see BS4994). Tighten down evenly by moving across the full set of bolting gradually tightening the joint evenly.

NOTE – Access opening may require secondary tightening within a few days into service. This is due to the gasket materials relaxing. Check torque settings after initial commissioning.

TABLE 2 - BOLT TORQUES DETAILS FOR THERMOPLASTIC TANKS AND VESSELS

Nozzle NB		Bolt Size	No. of Bolts	Bolt Torque	Duty
ins	mm	mm		Nm	
1½	40	16	4	25	Standard Flanged Connections
2	50	16	4	25	
3	80	16	8	25	
4	100	16	8	25	
6	150	20	8	34	
8	200	20	8	47	
10	250	20	12	50	
12	300	20	12	75	
14	350	20	16	90	
16	400	24	16	90	
18	450	24	20	100	
20	500	24	20	100	
24	600	27	20	120	
18	450	16	24	100	
20	500	16	24	100	
24	600	16	30	100	
30	750	16	36	100	
36	900	16	40	120	

(These values are the minimum required to ensure gasket sealing!) (For pipe and valve connections; Gasket seating stress = 2.32 N/mm² for soft rubber only i.e. 70 shore). For harder materials, high figures will be required. On a normal configuration of flange design i.e. full face or stub higher torques will not damage the flange if in GRP and/or incorporates thick backing rings (see BS4994). Tighten down evenly by moving across the full set of bolting gradually tightening the joint evenly.

NOTE – Access opening may require secondary tightening within a few days into service. This is due to the gasket materials relaxing. Check torque settings after initial commissioning.

Threaded socket joints – this type of connection is not recommended in plastics tanks. In unavoidable circumstances, the threaded socket is only used on atmospheric tanks and above liquid level. On small capacity thermoplastic tanks this type of fitting maybe used anywhere in the shell. Female threaded sockets should be supplied with a suitable threaded barrel nipple in plastic. This to be inserted and sealed using PTFE thread seal type.



BOLT TORQUES MUST BE CHECKED AS PART OF THE INSTALLATION PROCESS, AND RE-CHECKED ONE WEEK AFTER INSTALLATION.

4.0 COMMISSIONING & OPERATING

GENERAL SAFETY NOTICE

Only trained personnel should operate the unit. Protective equipment to be used as deemed appropriate by the site safety officer. As this equipment forms part of the end user's system, Forbes will issue only limited commissioning instructions, full-commissioning instructions should be sought from the system designers.



NOTE: CARE SHOULD BE TAKEN, BOTH AT THE TIME OF INSTALLATION AND IN SERVICE, TO ENSURE THAT PIPEWORK IS CORRECTLY ALIGNED AND ADEQUATELY SUPPORTED SO THAT IT DOES NOT IMPOSE ANY LOADS ON THE TANK NOZZLES AND THAT NO VIBRATIONS ARE TRANSMITTED BACK FROM PUMPS ETC.

Below is a very brief checklist Forbes advise the approved personnel to follow when commissioning the tank/vessel.

Dry Commissioning –

- Check all valves operate correctly
- Check for any external damage to the tank
- Check tank is bolted into position
- Check the tank is free of any foreign bodies or damage
- Check vent and overflow are free from obstruction

Wet Commissioning –

- Check flanged connections and welded joints for leaks
- Check valves operate correctly
- Check the tank body, base, manway and stub flanges for leakage
- Check instrumentation is working
- Ensure the seal pot (if fitted) is filled with the correct media

4.1 TESTING

It is recommended that tanks should be water tested for a minimum of 12 hours once positioned on site.

Refer to job-specific drawing(s) for testing recommendations.

Before filling the tank

Prior to filling the vessel ensure that:

- The installation has been fully completed as per the Offloading and Installation instructions.
- Any valves on liquid inlet(s) or outlet(s) are fully closed and isolated (excluding overflow).
- Any spare nozzles are securely blanked.
- The tank is effectively vented to prevent overpressure during filling and creating a vacuum during emptying. Rapid drain down through large diameter base nozzles can create a vacuum if the vent is not correctly sized.

The tank water test can be combined with a simulation of the delivery procedure using water, this will be dependent upon whether there is a suitable available water supply which can be coupled with the fill connection. Testing of any instrumentation such as level switches should also be completed during water testing.

If the bund is subjected to a water test, the tank must be filled initially to prevent floatation of the tank. The bund must be fully drained down prior to the tank being emptied.

In the event of any leaks please contact Forbes.

Check and re-tighten bolts if needed.

4.2 CLEANING

Although cleaned and sealed at our works it must **NOT** be assumed the tank is clean.

Always flush the tank through.

Prior to use, the tank must be filled to its maximum design liquid level with water and left to stagnate for a minimum of 24 hours.

Drain down; flush through again with water. Test in accordance to your acceptance protocol. The tank is now ready for use.

NB: For all Forbes LION*, CHEETAH* & JAGUAR* products for use on drinking water plants – please refer to specific cleaning instructions supplied with each product.

(*These products are supplied to comply with The Water Industry Act 1991 (c.56) (Water Supply). Regulation 31 of the Water Supply (Water Quality) Regulations 2016 (Statutory Instruments 2016 No. 614)).

4.3 OPERATIONAL CHECKS

The units should require very little attention during normal operation, however the following checks should be made on a regular basis (dependant on operation):

- Check for leakage anywhere on the vessel or nearby flanged connections (look for wet patches on concrete, corrosion to metal parts, etc.)
- Check level transmitters (where applicable) are readings as expected.

5.0 MAINTENANCE AND INSPECTION

It is recommended that all aspects of a tanks service history should be recorded and maintained. Information to be included:

- Manufacturer's design information, such as any relevant Databooks, certification, design calculations and information on construction materials and methods.
- Drawings
- Installation information
- Regular inspection reports
- Any modifications carried out
- Records of any maintenance and repairs completed
- Operational history, such as change of duty (contents, temperature, etc.), re-siting of the tank, incidents that have occurred (overflowing, mechanical damage), decommissioning.

The materials of construction of the tank have been selected for the specified application and are essentially maintenance free. No painting is required and, provided that the units remain free of physical damage, the structure of the tank will require no attention.

Care should be taken, both at the time of installation and in service, to ensure that pipework and valves connected to the unit are adequately supported so that it does not impose any loads on the tank nozzles.

5.1 TANK INSPECTIONS

The purpose of regular inspection is to ensure the tank is still fit for purpose and any defects can be rectified in a timely manner. Periodic external inspections should be made to ensure that the tank is free of physical damage and that pipework connections are secure and leak free. In the event of damage occurring to the system, Forbes should be consulted to provide advice or repair services.

It is the responsibility of the end user to establish an appropriate inspection schedule and maintain adequate records of maintenance and inspection. Forbes would recommend that all thermoplastic and GRP tanks are regularly inspected, and details recorded in a database of records over the lifetime of the tank. This is recommended by the Health and Safety Executive in their Guidelines - PM86 (Thermoplastic tanks) and PM75 (GRP tanks).

When carrying out a visual inspection, the main areas to review are; all welds on the tank, look out for signs of tank swelling, chemical attack, blistering, indication of weathering and cracking.

The frequency of inspection should primarily be determined by the tank age and the nature of its contents. The main areas to inspect are as follows; tank bases and supports, tank shell/body, tank bottom and roof and connections and nozzles. This list is not exhaustive. If you require further advice or information on inspection, please contact Forbes.



REGULAR INSPECTION SCHEDULES MUST BE MAINTAINED AND FOLLOWED. FORBES CAN PROVIDE INTERNAL INSPECTION SERVICES IF REQUIRED.

In addition to external inspections, Forbes recommend that periodically the tank should be completely drained for an internal inspection. It is recommended this is done every 2 years, although this may not be possible due to operational requirements. Once a tank has been in use for over 10 years it is recommended that internal inspections are scheduled more frequently. If it is not possible to carry out internal inspections, there is an increased importance on completing more regular external inspections.

In the event any concerns during these inspections, Forbes should be consulted to provide advice or repair services. Refer to the HSE Good Practice Guidance Notes – <http://www.forbesgroup.co.uk/hse-guidance-pm75/>

UltraAnalytix™ Tank Inspection technology allows detailed analysis of GRP tanks and vessels whilst they remain in service. A report assesses the GRP laminate properties through the wall of the tank, including the condition of the corrosion barrier. It will also identify any leakage into the laminate through a thermoplastic inner shell. The need to drain down the tank has many associated costs which are avoided with this technology. For more information visit www.tankinspections.co.uk.



5.2 SAFE ACCESS

Users must consider all potential hazards prior to inspection and ensure they have the relevant permit-to-work systems in place. If you are entering the tank, you must follow procedures for confined space entry and gas freeing. This must be undertaken by an approved person.



IMPORTANT: ALWAYS CONSULT SITE HEALTH AND SAFETY MANAGER BEFORE ACCESSING THE TANK OR ASSOCIATED EQUIPMENT. IT IS THE RESPONSIBILITY OF SITE MANAGEMENT TO ENSURE ANY PERSONS ACCESSING VESSELS HAVE SUITABLE PPE, ARE APPROPRIATELY EXPERIENCED AND HAVE ALL RELEVANT QUALIFICATIONS I.E. CONFINED SPACE CERTIFICATION.



WORKING AT HEIGHT: HIGH LEVEL NOZZLES OR FITTINGS SHOULD BE ACCESSED SAFELY, SITE PROCEDURES MUST BE FOLLOWED, AND PERSONNEL MUST BE APPROPRIATELY TRAINED.

5.3 ACCESSING THE TANK

- Ensure the tank is fully drained and any remaining liquid removed, if hazardous, by specialist personnel. These liquids are to be either transferred to alternative storage or removed from site and treated to make safe, if necessary.
- The atmosphere internally to be purged if necessary. Prior to entry, internal atmosphere must be certified as safe.
- Isolate and lockout all tank inlets by ensuring valves in inlet pipework are fully closed and locked.
- Any pump feeding the tank should be electrically isolated and locked out following site-specific procedures.
- Enter and exit through the tank manway.
- Once maintenance is complete, replace the manway cover, ensuring the gasket is correctly fitted and cover is secured. (Refer to Bolt Torque settings in section 3.6).
- The tank can then be refilled.

5.4 SPARE PARTS

Refer to job-specific drawing(s) for details of spare parts.

6.0 DRAWING(S) & ADDITIONAL INFORMATION

See our job specific drawing(s) and handling, installing specialist equipment and commissioning information.



THIS IS A STANDARD OPERATING & MAINTENANCE MANUAL DESIGNED TO GIVE AN OVERVIEW WHEN INSTALLING A FORBES TANK OR VESSEL. PLEASE READ THIS MANUAL IN CONJUNCTION WITH THE SPECIFIC PRODUCT MANUAL –THE FOLLOWING STANDARD PRODUCT MANUALS ARE AVAILABLE. PLEASE SPEAK TO FORBES IF YOU REQUIRE A COPY.

PRODUCT SPECIFIC MANUALS

- FD Degasser Operating & Maintenance Manual
- Minibulk® Operating & Maintenance Manual
- Overflow Sealpot Operating & Maintenance Manual
- Salt Saturator Operating & Maintenance Manual
- SB2 / SB2R Scrubber Operating & Maintenance Manual
- SB30R Scrubber Operating & Maintenance Manual
- SB4R Scrubber Operating & Maintenance Manual