OMNI TANKER BY MACLTT

REFERENCE GUIDE

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1 INTRODUCTION – THE OMNI TANKER US ROAD TANKER

Australian advanced composite manufacturer, Omni Tanker, and US trailer manufacturer MAC Liquid Tank Trailer have launched the next major innovation for chemical transportation, the Omni Tanker by MAC LTT.

Specifically designed for use in the transport of highly corrosive liquids, such as acids and bleach, Omni Tanker's innovative carbon composite tanks are underpinned by high-quality stainless steel trailer chassis', engineered, and made in the USA by highly respected, Ohio-based, MAC LTT.

MAC LTT also fits the trailer with liquid handling fit out and provides sales and service through their extensive North American dealer network.

The collaboration underscores 10 years of research and development by Omni Tanker in the field of dangerous goods transport equipment. The patented composite materials technology addresses the limitations of traditional rubber-lined steel and fibreglass tanker solutions. It does this by combining a completely seamless interior of chemically resistant thermoplastic with a high-strength carbon fibre structural exterior, to deliver a product with unrivalled safety and performance for these high consequence chemicals.

The exceptional chemical resistance of the tank interior and easy washout means the tanker can be used for a wide range of chemicals, and minimal maintenance and no relining means lowest operating cost.

At Omni Tanker our core focus is innovating better ways for our customers to move and store dangerous and difficult liquids and gasses reducing the environmental impact on society.

2 WHY OMNI TANKER? WHAT DOES IT DO FOR YOUR BUSINESS?

Omni Tanker's products have been in use for the transport of Class 8 corrosive chemicals throughout Australia since 2007 and feature a unique and internationally patented construction that sees a carbon fibre reinforced polymer (CRFP) exterior tank which is structurally bonded to a seamless thermoplastic interior tank.

The Omni Cargo Tank has US DOT Special Permit and provides the highest safety and efficiency for high consequence cargos because the CRFP tank structure is six times stronger by weight than steel, and the seamless thermoplastic interior is a thick layer which has no welds or joins to eliminate potential lining failure. The weight savings typically lead to an 8-10 per cent increase in payload compared with rubber lined steel or fibreglass tankers.

The key to the Omni Tanker's innovation is the high strength connection between the internal seamless thermoplastic tank, and the exterior carbon composite tank. This technology overcomes the inherent difficulty in bonding to thermoplastics and structurally reinforces the thermoplastic while preventing any delamination. The outcome is a tank with the excellent chemical resistance properties of the thermoplastic materials and the high-strength lightweight properties of the carbon reinforced structure to create tanks with exceptional safety, light weight, durability, and chemical resistance.

The smooth interior of the Omni cargo tank has minimal absorption which means it is easy to clean and allows switching between different incompatible products. There is minimal maintenance required beyond statutory inspections and regular maintenance of seals, and no relining of the barrel is needed.

The Omni by MAC LTT provides transporters of corrosive chemicals safety and peace of mind with minimal maintenance and a highly versatile asset which can be deployed to different chemicals to take advantage of seasonal and contract changes.

3 TANK SPECIFICATIONS

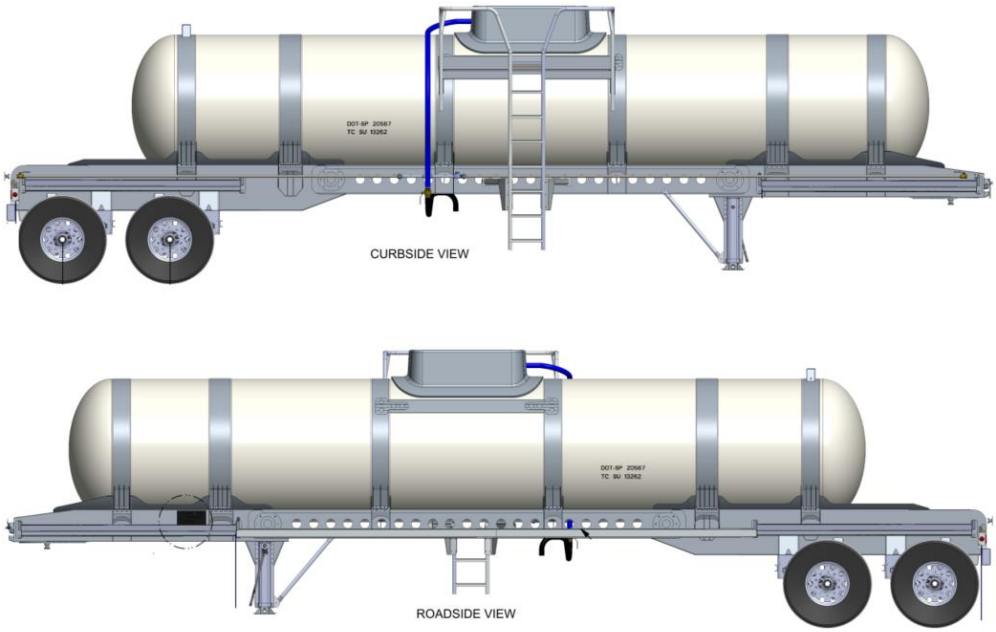

Figure 1: Omni Cargo Tank mounted on the trailer.

Nominal Working Capacity:	5,500 U. S. Gal / 20,820 l
Nominal Outage:	2.5%
Nominal Diameter:	67 in / 1702 mm
Shell Material:	CFRP / Polyethylene
Head Material:	CFRP
Lining Material:	Polyethylene
Min Shell Thickness:	0.27 in / 6 mm
Min Head Thickness:	0.15 in / 3.8 mm
Maximum Allowable Working Pressure (MAWP):	40 psi / 275 kPa
Hydrostatic Test Pressure:	60 psi / 414 kPa
Design Temp. Range:	-30 to 140°F / -34 to 60°C
Exposed Surface Area:	581 ft^2 / 54 m^2
Maximum Loading Rate:	660 GPM @ 40 psi / 275 kPa
Maximum Unloading Rate:	660 GPM @ 40 psi / 275 kPa
Design Code:	49 CFR under consideration of DOT-SP 20567
	CSA B620 under consideration of SU13262

4 SPECIAL PERMIT / EQUIVALENCY CERTIFICATE

4.1 U.S. DEPARTMENT OF TRANSPORTATION SPECIAL PERMIT DOT-SP 20567

Omni Tanker holds a Special Permit DOT-SP 20567 issued by U. S. Department of Transportation.

DOT-SP 20567 authorises the manufacture, mark, sale and use on non-DOT specification carbon fibre reinforced plastic (CFRP) cargo tanks, to be used in the assembly of cargo tank motor vehicles (CTMV) conforming to all applicable requirements for DOT specification 407/412 CTMV's, except as specified in the Special Permit.

A copy of the US DOT Special Permit DOT-SP 20567 is added to the Appendix 10.1.

4.2 TRANSPORT CANADA EQUIVALENCY CERTIFICATE SU 13262

Omni Tanker holds an Equivalency Certificate SU 13262 issued by Transportation of Dangerous Goods Directorate in Canada.

SU 13262 authorises to design and manufacture a means of containment used or intended to be used in importing, offering for transport, handling, or transporting dangerous goods in a manner that does not comply with section 5.1 of the TDG Act.

A copy of the Transport Canada Equivalency Certificate SU 13262 is added to the Appendix 10.2.

5 CHEMICAL COMPATIBILITY LIST

Class 8 materials are authorized to be transported in polyethylene lined DOT 407/412 Omni Tanker Cargo Tanks. The compatibility list is added to the Appendix 10.3.

6 MAINTENANCE / INSPECTION / SERVICE

All Cargo tanks shall be periodically tested in accordance with requirements of 49 CFR §180.407 and DOT-SP 20567; TC B620 §7.1 and §7.2.

Periodic testing and inspection types along with testing intervals are given in Table 1 and must be performed by an inspector, meeting the following criteria:

- is registered with the Federal Motor Carrier Safety Administration,
- possess a valid training certificate covering the inspections performed,
- possess the knowledge and ability to determine if a tank conforms to the 407/412 specification,
- have the education and experience in the inspection-of tanks of 407/412 specification in accordance with CSA B620 and CFR 49, Part 180,
- have performed, under the direct supervision of a qualified tank inspector, at least three inspections in accordance with CSA B620 Clause 7 and CFR 49, Part 180.

Table 1: Compliance Dates – Inspections and Tests

Test or inspection	**Interval period after first test**
External Visual Inspection	1 year
Internal Visual Inspection	1 year
Lining Inspection	1 year
Leakage Test	1 year
Pressure Test	1 year

7 TANK WASH OUT PROCEDURE

Change in the chemical cargo is permitted, within the bounds of the chemical compatibility list. Where a change in cargo involves two chemicals which are not compatible, the tank must be thoroughly washed out between cargoes strictly according to the protocol given below.

This Cleaning Procedure is mandatory when changing chemical cargo.

7.1 GENERAL WASHOUT REQUIREMENTS

Ensure that:

- The substance that was carried prior to washout does not react adversely with water.
- Water is clean and at ambient temperature to maximum of 50°C.
- Do not use steam.
- No detergents or chemicals are present in wash water.

General Note:

- A spray fitting may be used through the manway opening. Do not insert any spray lances or similar equipment through any port other than the manway opening.
- The washout site must have provisions to dispose of all washout water and liquid mixtures safely according to relevant regulatory requirements.

7.2 WASHOUT PROCEDURE SEQUENCE

Step 1: Prepare tank for washing.

- Close all ports in the tank that are not used during washout.
- Open the manway lid.
- Take care to protect coated parts from damage.

Step 2: Insert wash out fittings.

- Place the washout fitting and hoses into the manway.
- Protect the coating of the manway upstand by wash out fittings.

Step 3: Wash tank

- Use clean water with temperature less than 50°C.
- Do not use detergents or any other chemicals.
- Do not use steam.

Step 4: During wash

- For bottom discharge tanks, the outermost closure on the discharge assembly shall remain closed for at least 5 minutes from commencement of wash.
- Ensure that discharge assembly is completely flooded.

Step 5: Empty tank

- For bottom discharge tanks, drain tank through outlet.
- For tanks fitted with top discharge connection, the wash out must also clean the siphon tube by introducing washout water from the top connection.
- For tanks fitted with top discharge only, use air pressure discharge or suction pump to remove water from the tank via the siphon tube.

Step 6: pH test

- For bottom discharge tanks, perform pH test on final drips or wet pH test in the tank outlet.
- For top discharge tanks, perform pH test on water drips present on siphon tube connection.
- Ensure that the pH level from step is =7 ± 0.5.
- If pH is not in the acceptable range, then repeat Steps 3 - 6.

8 TANK OUTSIDE CLEANING

For cleaning of the outside of the tank, only water and mild cleaners which are compatible with parts being cleaned (metallic materials, plastic materials, plastic coatings, or paint) may be used.

If surfactants and detergents of any form are used during outside cleaning, do not cross contaminate the inside and outside of the tank as the polyethylene liner is affected by these chemicals. Corrosive chemicals transported in the tank are water solutions, and water solutions of chemicals do not require hot wash or detergents.

Strong mechanical forces by scrapers, cleaning brushes or close high-pressure water jet cleaners (distance within 30 cm) are not allowed.

Cleaning is to occur at room temperature only. No elevated temperatures are permitted, especially when cleaning with chemical agents. No cleaning is permitted at temperatures beyond 50°C, which is the maximum service temperature of the tank. Steam cleaning is not permitted.

In the event that residue from a sticker that has been removed from below the “please put labels here” and it requires cleaning, the exterior surface can be cleaned with the following agents (all agents at room temperature) applied to a cloth:

- Soap mixed with water.
- Isopropyl alcohol
- Acetone

9 FREQUENTLY ASKED QUESTIONS (FAQS)

9.1 TECHNICAL

Question **What is the Omni Cargo Tank made from?**	The Omni Cargo Tank is an advanced composite construction with a seamless internal tank of Polyethylene (PE) thermoplastic within a Carbon Fibre Reinforced Polymer (CFRP) tank shell. Patented technology is used to create a high-strength interface between these materials to provide a tank with exceptional chemical resistance, safety, and durability. The thermoplastic tank is fully supported by the CFRP shell, reducing strains, and preventing delamination from the tank structure. The seamless thermoplastic material is one piece and has no welds or joins. The CFRP tank wall is 6mm thick, with areas of additional thickness for reinforcement, and the PE internal tank is nominally 7 mm thick. Tank flanges are stainless steel with Halar or PFA coatings. Blind closures and caps can be coated stainless steel or thermoplastic. Valves can be customer specified, lined stainless steel, or PVC. This combination of advanced materials in the Omni Cargo Tank has been recognised with innovation awards from JEC, the world's leading composites organisation, as well as awards from Petrotrans and Gefahrgut, Germany's leading Dangerous Goods transportation journal. The technology has also been recognised in scientific publications including the Journal of Reinforced Plastics and Composites and Comprehensive Composite Materials Encyclopaedia.

9.1 TECHNICAL (FAQ'S CONTINUED)

Question **What is the thickness of the tank wall materials?**	The tank wall layers comprising PE and CFRP is in the order of 1/2" thick (13 mm). An additional layer is also present on the outside of the tank to improve weathering characteristics. The seamless internal PE tank is nominally 9/32" (7 mm) thick and the CFRP tank wall is 15/64" (6 mm) thick, with areas of additional thickness for reinforcement around the manway and outlet openings.
Question **What is the weight of the tank?**	The cargo container has a mass of 3,500 lb / 1,600 kg which can vary depending on specification options.
Question **Are there any temperature limitations?**	Cargo temperature range of: -30F to +140F / -34°C to +60°C This temperature range can be varied depending on the specific fit out chosen, and the chemical to be transported.
Question **What is the insulation factor / heat loss of the tank?**	The tank provides better insulation than a steel tank without insulation but is less than an insulated steel tank. For uninsulated steel tanks, R value = 0.0001 m^2K/W, whereas for the steel tanks with 50 mm of rockwool insulation, R value = 1.0001 m^2K/W. Omni Tanks have an R value = 0.037 m^2K/W, without additional insulation. Therefore, the R value of Omni Cargo Tank walls is 370 times that of uninsulated steel equipment.
Question **Can the valve types and sizes be changed to meet our requirements?**	Yes, valves compliant with the requirements of 49 CFR 178 specification 407 / 412 cargo tank motor vehicles may be fit to this unit.

9.1 TECHNICAL (FAQ'S CONTINUED)

Question **Does the tank have a temperature gauge?**	This is a potential add-on if required but is not fitted as standard.
Question **How are the valves and other openings protected from the corrosive products?**	The tank flanges in the Omni cargo tank are stainless steel with Halar or PFA coatings. Blind closures and caps can be coated stainless steel or thermoplastic. Valves can be customer specified, lined stainless steel, or PVC. Fluoropolymers (such as Halar or PFA) have very high chemical resistance and are used regularly in the corrosive chemicals industry. Specific gaskets are used in combination with the valves which also have very high chemical resistance. These include gaskets of expanded PTFE, or Aflas® which is a highly resistant fluoro-elastomer based on a copolymer of Tetrafluoroethylene and Propylene.
Question **Can the tank be equipped with a different design manlid?**	Yes, it can be fitted with any type of manlid that complies with the requirements of regulations.
Question **Can the tank be fitted with a pressure gauge?**	Yes. A regulatory approval process may be required based on valve type and size, and the region of use.

9.2 APPROVALS (FAQ'S CONTINUED)

Question **What approvals does Omni Cargo Tank have?**	**Approval** US DOT 49 CFR Specification 407 / 412 and Special Permit DOT-SP 20567 **Issued by:** US DOT PHMSA **Approval:** TC B620 Specification TC-407 / TC-412 and Equivalency Certificate SU 13262 **Issued by:** Transport Canada The Omni Cargo Tank is approved for the transport of Hazardous Materials by road under US DOT 49 Code of Federal Regulations (CFR) 178 and a Special Permit from the Pipeline and Hazardous Materials Safety Administration (PHMSA). It is also approved under Transport Canada (TC) Regulations B620 and an Equivalency Certificate. The approvals for the Omni Cargo Tank mean that it can be used for road transportation for Class 8 Hazardous Materials in North America. The cargo tank is issued with all necessary documentation and approval stamps.
Question **Where can the Omni Cargo Tank be used?**	Road transport for Hazardous Materials in countries which accept US DOT 49 CFR Special Permit and Canadian B620 Equivalency Certificate. The following Countries accept 49 CFR and B620 certification: • United States of America • Canada

9.3 CHEMICAL SUITABILITY (FAQ'S CONTINUED)

Question

What cargos can the Omni Cargo Tank be used for?

The Omni Cargo Tank is suitable and approved for use with a wide range of liquids including:

- Class 8 Corrosive
- Diesel Emission Fluid (DEF)
- Various sticky and difficult to clean liquids such as TDI and MDI.
- Food grade / Potable water

Question

What CORROSIVE cargos can the Omni Cargo Tank be used for?

Corrosives
The Omni Cargo Tank is suitable for a wide range of aggressive Class 8 corrosive chemicals and provides an attractive alternative to lined steel and FRP tanks for such chemicals.

A full list of approved chemicals is provided in the appendix.

Typical chemicals in this group include:

Chemical name	UN Reference	Conc.
Ferric Chloride	UN 2582	30-60%
Ferrous Chloride	UN 1760	20-30%
Hydrochloric acid	UN 1789	28-36%
Hydrofluoric acid	UN 1790	10-60%
Hydrofluosilicic acid	UN 1778	40%
Nitric acid	UN 2031	55%
Phosphoric acid	UN 1805	50%
Sodium Hydroxide	UN 1824	50%
Sodium Hypochlorite	UN 1791	15%
Sulfuric acid	UN 2796	17-51%
Sulfuric acid	UN 1830	51-80%

9.3 CHEMICAL SUITABILITY (FAQ'S CONTINUED)

Question **What STICKY / DIFFICULT TO CLEAN cargos can the Omni Cargo Tank be used for?**	Sticky / Difficult to clean The PE internal tank features a smooth surface and the PE material itself is very difficult to bond to. As a result, sticky materials can be easily cleaned from the surface using pressure wash. Such liquids include Isocyanates (MDI and TDI), Latex and Polymers.
Question **Are there any chemicals not compatible?**	Currently Omni Cargo Tanks are approved for the transport of Class 8 corrosives. **Not Compatible for Solvents and Plasticisers** Solvents are not suitable due to effects on the polyethylene and permeation issues. **Not Compatible for Plasticising** chemicals such as Vinyl Acetate Monomer are also not suitable. Class 5.1 oxidising chemicals are not approved for transport transported.
Question **Is the tank approved for food contact applications?**	Yes, the PE is approved for food contact and potable water applications. The PE material has approval under European food contact regulations and is approved for use with potable water and food cargos.

9.4 MAINTENANCE AND REPAIR (FAQ'S CONTINUED)

Question **What is the service life of the tank?**	Service life of 20+ years is projected with corrosive chemicals. The service life of Omni Cargo Tank is based on the performance of the polyethylene interior in contact with the chemicals and the structural performance of the carbon fibre tank. The PE interior of the Omni Cargo Tank is a seamless moulded tank, which has no welds or joins. This eliminates the normal failure points of a thermoplastic lining. In addition to this, the patented high strength connection of the seamless PE tank to the high strength structural carbon fibre over-wrap of the tank, means that all the structural loads are taken in the structure, dramatically reducing the strains in the PE.
Question **CLEANING - Any special tank cleaning requirements? Can the tanks be washed out with spinners like a stainless-steel tank?**	The tanks can be washed with standard spinner washers. Recommended wash out is with room temperature water. No detergents or steam wash is permitted. Detailed information on tank washing can be found in the Operational User's Manual. High pressure wash is OK using standard tank container spinner.
Question **MAINTENANCE - What regular maintenance is required?**	Standard regulated 1- year inspections. **Note: No spark testing is required for tank interior.** Visual inspection only. The Operational User's Manual sets out regular maintenance checks for the Cargo Tank. The regular inspection periods are a good time to undertake low level maintenance such as seal changes. There is no requirement for thickness assessment (as is required in stainless steel tanks), nor relining of rubber as per lined steel tanks.

9.4 MAINTENANCE AND REPAIR (FAQ'S CONTINUED)

Question **REPAIRS - In the case of damage to the barrel or barrel support, who can perform the required maintenance & repair?**	Authorised depots can repair the tank and tank mounting structures. Omni Tanker is identifying and providing support to authorised depots in the USA. In general, repairs to the tank structure will be in consultation with the manufacturer. Repairs that may affect structural integrity of the barrel are subject to the following rules in the United States: If the total area of the barrel which requires repair is less than 2 square feet, then the tanks may be repaired in a depot under instruction from the manufacturer. If the total area which requires repair exceeds 2 square feet, it must be repaired by the manufacturer.
Question **What if the tank is damaged inside (internal PE)?**	The PE can be repaired via welded. The PE interior of the tank is a thick layer with a good elongation and impact resistant properties, so the interior of the tank is highly resistant to damage. The thickness is nominally 7mm thick ~¼" thick). The PE material can be welded, so in the event of mechanical damage to the PE interior can be repaired using standard PE welding equipment that is widely available from the PE pipe industry. Omni Tanker have an established welding protocol for the tank interior, and approved depots can carry out this repair.
Question **TESTING - Will it be necessary to change the seal/gasket set between the tank connections / flanges? Is this a regular/preventive schedule, what is the lifetime for these 1 or 5 years?**	The required frequency of gasket change is dependent on the chemical being transported, combined with the seal/gasket material, and is generally advised by the seal/gasket manufacturer. Normally, Intermediate test at 1 years will not require gasket change, Periodic test at 5 years will require gasket change. Overall, the Intermediate Test, at 1 years, is a pressure test, and if the test is passed, then there is no need to change the seals/gaskets. It is advised that seals/gaskets be changed just prior to the 5-year periodic test as a precautionary measure to reduce the possibility of a seal/gasket related pressure leak in the subsequent inspection interval.

10 APPENDIX

10.1 COPY OF SPECIAL PERMIT DOT-SP 20567

10.2 COPY OF TRANSPORT CANADA EQUIVALENCY CERTIFICATE SU 13262

10.3 CHEMICAL COMPATIBILITY LIST