



**ASSOCIATION OF
AMERICAN RAILROADS**

Pamphlet 34 -

Recommended Methods for the Safe Loading
and Unloading of Non-Pressure (General
Service) and Pressure Tank Cars

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Preface

This document presents general guidelines for the securement of tank cars and recommended procedures for loading and unloading of the cars. It is not a complete and comprehensive set of methods, instructions, or procedures applicable for all situations and car types. Each user company is encouraged to develop specific procedures using this document as a general guide where it applies. A particular location may require the use of additional or different precautions for the loading or unloading operations to be performed safely. **Appropriate individual company procedures and applicable government requirements, including U.S. Department of Transportation (DOT) Hazardous Materials or Transport Canada (TC) Transportation of Dangerous Goods Regulations must be followed.**

Most repairs to the tank car tank or tank car valves and fittings must be performed by a properly Certified Tank Car Facility or certified mobile unit (see M1002, Appendix B for exceptions). Experienced, trained personnel who are knowledgeable of the safety requirements and loading/unloading operations must be used. For loading and unloading of Hazardous Materials/Dangerous Goods, these knowledgeable persons must be designated and trained as “HazMat”/or qualified employees per government regulations. Loading/ unloading personnel must be responsible for compliance with all company procedures and regulatory requirements during the entire operation. See regulatory references at the end of this document.

CAUTION: Since the loading and unloading of tank cars involves the opening of valves, fittings, flanges, caps, plugs, and other closures there is always a possibility of product spillage or leakage. While this should be minimized, the loader/unloader must be prepared to capture, collect, and dispose of any spilled or leaked product in an environmentally acceptable manner. In the event that the volume of released product meets regulatory requirements (e.g., reportable quantity threshold), agency notifications and specific remediation actions may be triggered or required.

Appropriate Personal Protective Equipment (PPE) should be worn throughout the loading or unloading procedure.

Section 1: General Instructions for Loading and Unloading

1.1 The car(s) must have hand brakes set, and the wheel(s) blocked to prevent movement in both directions before any loading/unloading activities are started.

1.2 When the car is positioned for loading or unloading, securely block access to the track to prevent entry by other rail equipment, including motorized service vehicles by use of derails, aligned and locked switches, bumper blocks or other such apparatus that provides an equivalent level of security.

1.3 While a car is connected for loading/unloading, blue caution signs that display “STOP” in 4-inch letters (Sometimes known as “blue flags”) must be placed on the track as required by regulations and company procedures.

1.4 Before loading/unloading, each tank car must have an external visual inspection performed, including:

- tank shell and heads for abrasion, corrosion, cracks, dents, distortions, defects in welds, or any other condition that makes the tank car unsafe
- the piping, valves, fittings, and gaskets for corrosion, damage, or any other condition that makes the tank car unsafe
- jacket, *if so equipped*, is “weather tight.” (*No tears, corrosion holes, broken welds, etc. that would allow water to enter and degrade the insulation or thermal protection.*)
- missing or loose bolts, nuts
- the external thermal protection system, tank-head puncture resistance system, coupler vertical restraint system, and bottom discontinuity protection for conditions that make the tank car unsafe for transportation
- the required markings on the tank car for legibility
- the periodic inspection date markings to ensure that the inspection and test intervals are within the prescribed intervals

If found, contact the car owner or lessor for further instructions prior to loading.

1.5 Safety equipment such as safety showers and eye wash stations should be verified to be present and operational before conducting loading/unloading activities.

1.6 Tools designed for the task at hand should be used for loading/unloading operations. They must always be clean and in proper working order/condition.

1.7 Tank car tanks containing flammable/combustible gases and/or liquids should be electrically grounded and bonded during loading and unloading operations. Grounding and bonding of cars carrying other commodities are also recommended.

1.8 All loading/unloading inspections must be properly documented through a checklist or similar methods.

1.9 The loading/unloading area should have adequate lighting and be free of obstacles or unnecessary equipment.

1.10 During the loading/unloading process, cars must be attended by trained personnel or monitored by an approved monitoring system. Do not allow the loading/unloading operation to stand unattended or unmonitored while connections are attached to the car. If necessary to discontinue operations for a period of time, all valves must be closed, all connections removed, and the car must be prepared as if ready for transportation. However, operations can be discontinued on an attended or monitored car by closing valves on the car and closing valves at the facility without disconnecting hoses.

1.11 When operating gauging devices, top operated bottom outlet valves, or any other top fittings or closures, loaders/unloaders should not stand directly above or place any part of their body directly above the gauging device, valve, fitting, closure, or pressure relief device.

1.12 During loading and unloading, the pressure in the tank must not exceed the lesser of:

- 75% of the pressure relief valve start-to-discharge pressure; **or**
- 75% of the tank test pressure; **or**
- 60% of the rupture disc burst pressure in a combination device.

NOTE: Limiting the pressure below the above values helps ensure that the pressure relief device will not function during product transfer operations. For example, for a DOT111A60W1 tank car with a 75-psig pressure relief device, the pressure within the tank must not exceed 45-psig. (75% of 60 psi). Maintaining the pressure below 75% of the pressure relief valve start-to-discharge pressure helps ensure that the pressure in the tank is below the vapor-tight pressure of the device and limiting the pressure below 60% of the rupture disc pressure in a combination device ensures the pressure is below the point which disc deformation may occur.

Section 2: Loading a Tank Car

2.1 Before Loading a Tank Car

2.1.1 Ensure that general procedures in Section 1 are followed.

2.1.2 Shippers must ensure that the tank car selected is authorized for the product being loaded. The tank car must comply with DOT or TC regulations and/or AAR's current Manual of Standards and Recommended Practices, Section C-Part III (Specifications for Tank Cars, Specification M-1002).

2.1.3 The tank car must be of sufficient capacity, both by weight and volume to contain the quantity of the product being loaded. Applicable requirements such as outage, filling density or weight restrictions must be met. Consult the appropriate regulations/company policies & guidelines for specific filling requirements.

2.1.4 Inspect the car for overall integrity and any visible damage. All safety appliances must be in proper condition. The car must show no sign of leakage, have no visible defects, and no product adhering to the exterior of the car. If jacketed, the jacket must be weather tight.

NOTE: *During the inspection of the car, look for any items that are not typical of standard tank car designs as they may indicate a security breach – follow company-specific procedures or guidelines if such items are found.*

2.1.5 Qualification stencils must be reviewed to confirm that the car is not overdue for any tests, qualifications, or inspections. Do not load a car with overdue tests, qualifications, or inspections. If deficiencies are found, contact the car owner or lessor for further instructions.

2.1.6 All fittings, valves, gaskets, and fasteners must be in proper condition (e.g., not corroded, torn, worn, stripped, loose, missing, or otherwise damaged). Materials contacting the lading must be compatible with the product being loaded into the car.

2.1.7 Unless the car is cleaned/purged, ensure that any residue in the car is compatible with the product being loaded. Do not load a car that has unidentified residue. Visually verify there is no trash/debris (e.g., old manway gaskets) inside the car which could cause damage or prevent closure of the BOV or prevent proper unloading.

2.1.8 If equipped with a non-reclosing pressure relief device (safety vent), the rupture disc must be thoroughly inspected from both sides. Verify that the rupture disk is rated for the correct burst pressure and the gasket is in good condition and in place. *Be sure the car is de-pressurized before attempting to remove the rupture disk.* If equipped with a pressure relief valve, the valve must be inspected to ensure no debris is in its discharge area. If a combination pressure relief device is present, each detection device (including, for example, telltale indicator or needle valve) should be checked to determine the integrity of the rupture disk. These devices must be closed prior to transportation.

NOTE: *An excess flow valve is a device that closes automatically against the flow of the contents of the tank in case the external closure valve is broken off or removed in transit. Excess flow valves are neither*

designed, nor intended, to stop the flow of a tank car's contents in the event of a failure of a loading/unloading system's piping or hoses.

2.1.9 If equipped with a Top Operated Bottom Outlet Valve, if practicable, loosen the top packing nut and operate the valve to verify proper operation. If the Top Operated Bottom Outlet Valve and packing gland is not operating as designed, close the valve, and tighten the top packing nut or stop the operation and contact the car owner to arrange for a certified facility to repair the valve before loading the car.

CAUTION: This process may allow gasses and/or liquids to collect in the outlet nozzle of the car between the BOV and auxiliary valve or cap.

2.1.10 If equipped with a Bottom Operated, Bottom Outlet Valve, if practicable, operate the BOV to verify proper operation. If product is discovered releasing, close the valve and lock the handle in the closed position and stop the operation. Contact the car owner to arrange the repair the valve prior to the continuation of offloading the car.

CAUTION: This process may allow the product to drain into the outlet nozzle of the car between its BOV and auxiliary valve or cap.

2.1.11 If equipped with BOV(s), the outlet cap(s) and/or plug(s) should be removed to check the BOV for leakage. If equipped with an auxiliary valve, open the auxiliary valve with its cap/plug removed to check the BOV for leakage. Upon removal of the plug and/or cap or opening of the auxiliary valve, be prepared for the possible release of product from the outlet nozzle and defective or leaking valve. It is recommended that the bottom outlet plug and/or cap remain off its fitting during entire loading process to ensure that the BOV is not leaking. If equipped with an auxiliary bottom outlet valve, the auxiliary valve should be left open with the plug removed during the entire loading process, ensuring that the primary BOV is not leaking.

2.1.12 If equipped with a heating system, thoroughly inspect the exposed parts of the system. If the car is equipped with interior heater coils, remove the caps, be prepared for release of the product, and check for leaks prior to loading the car.

2.1.13 If equipped, remove thermometer well cap and the magnetic gauge rod cover cap slowly to determine if there is a leak. Listen for gas pressure releasing. If leak is detected, do not remove the cap. If leak is not detected, inspect the O-ring on the thermometer well-fitting and the magnetic gauge rod body and replace as required. Verify that adequate ethylene glycol/anti-freeze mixture is present in the thermometer well to allow for taking an accurate product temperature reading.

2.1.14 Where applicable, connect the vapor valve to a recovery system. Open the vapor valve for pressure displacement before opening any product/liquid valve or manway.

2.1.15 If equipped with a hinged and bolted manway, thoroughly inspect the manway nozzle and cover assembly, assuring that:

2.1.15.1 The manway cover is functional, properly aligned and centered on the manway nozzle, the hinge pin operates freely, is in place and not bent or damaged, and the eyebolt slots and ears are not bent, worn, damaged, or deformed. The cover must be free of product or other build-up that would prevent proper operation of the eyebolts. The area adjacent to the gasket sealing surface must be free of product or other build-up that would interfere with adjacent surfaces and must be free of corrosion or damage that would allow the unintentional release of product with the cover in the closed and bolted position.

2.1.15.2 The manway nozzle sealing surface is free of gouges, nicks, corrosion, displaced metal, residual product, and remnants of old gaskets that may prevent proper sealing.

2.1.15.3 The manway gasket is properly secured in place, in good condition, not cut or misaligned, does not have permanent compression interfering with proper sealing, is the style and design compatible with the manway nozzle assembly, and is of a material compatible with the product.

2.1.15.4 The eyebolts, nuts, and washers are not bent, damaged, or corroded, and the assemblies are free of excess paint or product. Nuts and washers must be of size to fully bridge the eyebolt slots, and washers must not be deformed. The manway nozzle is equipped with safety eyebolts at the proper locations opposite the hinge side of the nozzle. Safety eye bolts must be examined and tested to ensure proper operation.

2.1.15.5 Check that the eyebolt pins and hinges are not bent, damaged, deformed, or worn to the extent to prevent free movement of the eyebolts and ensure (?) proper engagement in the manway cover eyebolt slots.

2.2 During Loading a Tank Car

2.2.1 During loading, continually monitor the car for leakage.

2.2.2 Ensure adequate outage space remains in the car when loading is completed to prevent overloading by volume or by weight, and to allow for normal product expansion while in transit. Refer to applicable regulations for correct outage, filling density, and other weight restrictions for the product.

2.3 After Loading a Tank Car

2.3.1 When loading is complete re-inspect the car for any signs of a product release. If there is any indication of release and it cannot be stopped, the car must not be offered for transportation.

2.3.2 Document, per company procedures, the outage level, seal numbers, and product identification information on a proper or suitable form (?).

2.3.3 After the correct volume of product is loaded into the car, close all valves. Verify there is no detectable product release from valves, flanges, threaded connections, and packing glands. Secure all plugs and outlet caps with a suitable tool. Use non-sparking tools if required by company procedures or regulations (?). (PTFE, Teflon®, paste or not more than three wraps of PTFE tape have been found to be acceptable [bring next line up to meet])

materials for use in sealing plugs and caps.) {Note: In most cases, exterior heater coils should not have caps}. Do not offer the car for transportation if any vapor or liquid release(s) are identified/observed.

NOTE: Tank cars that are leaking can't be offered for or moved in transportation. However, if a primary closure/valve is leaking but not past(?)the secondary closure (plug/cap) the car shall be stenciled, as shown below, and can be moved upon receipt of a One Time Movement Approval (OTMA) by the FRA.

Stenciling- Association of American Railroads Interchange Rules require that any leaky tank, regardless of the product carried, be stenciled, "LEAKY TANK, DO NOT LOAD UNTIL REPAIRED", in 3-inch letters, on each side adjacent to the car number, and the location of the leak must be identified by an "X". In addition, the car must be stenciled or decaled "HOME SHOP FOR REPAIRS DO NOT LOAD."

2.3.4 Verify that the manway cover ears are not deformed or bent out of plane due to the torque applied to the eyebolts. Ensure the eyebolt, bolt, and washer are in the proper location, with the washer on the top of the manway cover ears. Lubricate, with an appropriate lubricant, manway eyebolts as required to maintain serviceability of the bolts and to ensure that proper torque values are achieved. When securing a manway cover, tighten the bolts using the appropriate star pattern and internal company procedures. The use of electric or air-operated impact tools is not recommended.

2.3.5 After loading, apply and hand-tighten magnetic gauge cover and thermometer well cap.

2.3.6 After the tank car has passed the appropriate leak test, top unloading valve handles that are not enclosed in a protective housing must be removed before the car is offered for transportation.

NOTE: All valves, fittings, closures, plugs, caps, and fasteners must be checked for tool tightness even if the item was not utilized during the loading process (thermometer and magnetic gauging device covers with O-rings are to be hand-tight, not tool-tight.)

2.3.7 Product spillage on the tank exterior must be removed as DOT regulations prohibit any hazardous materials or hazardous material residue to be on the outside of the package/tank car. While removing spillage, caution should be taken to not damage any paint, decals, and reflective material.

2.3.8 The car must be properly inspected, placarded, and marked before it is offered for transportation ensuring:

- All stenciling and markings are legible
- Proper placards are on all sides
 - Placards are not torn, faded, or missing
 - Placards are correct for the product being loaded
- BOV cap and plug chains are attached
- Valve plugs and caps are attached to car
- Securement pins are attached to the car, are in place, and properly secured
- Safety equipment such as handrails, running boards, platforms, and ladder rungs or steps are not bent or loose

Section 3: Unloading a Tank Car

3.1 Before Unloading a Tank Car:

3.1.1 General procedures in Section 1 should be followed.

3.1.2 Inspect all seals before removing them for evidence of tampering. Verify seal numbers match those on the shipping documents. If there is evidence of tampering or the numbers do not match, contact the shipper of the product for guidance.

3.1.3 Verify that valves and fittings are closed before removing plugs, caps, or flanges.

3.1.4 Remove any dirt or debris from fittings before opening.

3.1.5 Verify the contents of the tank car and the receiving vessel are compatible and have acceptable capacity before beginning unloading.

3.1.6 If the tank car is a non-pressure car, relieve tank pressure by one or more of the following methods:

3.1.6.1 If equipped with a vapor valve, slowly open the vent valve (preferred method). Or,

3.1.6.2 If not equipped with a vent valve, carefully open the fill hole cover or hinged manway cover. If using the manway cover for pressure relief, use caution when loosening bolts. The bolt(s) by the handle is/are the safety bolt(s). Loosen the bolt(s) closest to the hinge by one or two turns at a time, then loosen the remaining bolts.

3.1.6.3 If required, send vapors to a vapor handling system.

NOTE: CAUTION should be exercised because any tank car may be under pressure.

NOTE: The vacuum relief valve must not be used to vent pressure.

NOTE: Atmospheric venting may create a safety and/or environmental hazard.

3.1.7 Venting is not necessary if a pressure differential is used to unload the tank car however, a means to prevent over-pressurizing the tank car must be provided.

3.2 If Heater Coils Are Required for Unloading

NOTE: If equipped with interior heater coils, remove heater coil caps, and check for leakage before connecting steam hoses.

3.2.1 Connect steam hoses to inlet connections of the heating system. Use a shut-off valve to control the steam flow. The tank should be vented before and during steaming to prevent pressure build-up.

3.2.2 Caution must be taken when applying steam to the system. Apply steam slowly until it is observed at the heater coil outlet. Rapid expansion of the coils could cause cracking/breakage of the steam system. If steam is bubbling in the product, the interior steam coil is broken, or there is a crack in the weld of an exterior steam coil, allowing it to enter the car. Shut off the steam. If there is a dual system on

the car, use the other bank. Report defects per company procedures to the shipper of the product and/or to the car owner.

3.2.3 Steaming operations should be carefully monitored to ensure the product or container does not become overheated.

3.2.4 If the bottom outlet valve is steam jacketed, steam should be applied to the outlet steam jacket. ***DO NOT apply steam directly into the outlet chamber!***

3.2.5 When unloading non-pressure tank cars with protective interior coatings, it is important to remember that steaming of a partially filled tank car may damage the interior coating from localized overheating. Once unloading is in process, steam pressure should be reduced or shut off to the car to avoid damaging the protective lining.

3.3 Unloading

3.3.1 When unloading, ensure the car is properly vented.

NOTE: if the manway is open, take care to prevent contamination of the product

3.3.2 When unloading through the bottom outlet valve, first verify that the bottom valve is closed before loosening the bottom outlet plug or cap.

3.3.3 Be prepared to collect any product trapped in the bottom outlet nozzle upon loosening of the cap/plug assembly. Slowly loosen the outlet cap. If more than 2 - 3 quarts are collected in the containment system, there is a probability of bottom outlet valve leakage and/or damage. Do not remove the cap completely. If the valve continues to leak, tighten the cap/plug assembly. Inform the tank car owner of the leaking condition and request guidance on actions to take.

3.3.4 Before opening the unloading valves, securely attach the transfer system and perform a leak test, if possible.

3.3.5 If a non-pressure tank car is being unloaded by pumping through the bottom outlet valve or top-mounted liquid valve, a means of preventing vacuum (Which may cause a collapse of the tank) must be provided. Relieve all pressure used to unload the car, except for those products that may have a nitrogen pad applied. A warning should be applied in the manway area to indicate when nitrogen or other non-life-supporting gas is present as a pad.

3.4 After Unloading a Tank Car

3.4.1 If the steam supply is still active, shut it off and remove connections. Check the heating coils for water retention and check for leaks per company procedures. If leaks are found, notify the car owner and/or the shipper.

3.4.2 Verify that all valves are closed.

3.4.3 Verify that all unloading connections are removed.

3.4.4 Secure all fittings, valves, and openings in the appropriate manner. (All plugs and outlet caps must be secured with a suitable tool (use non-sparking tools per company procedures when required.)

Exceptions: Thermometer and magnetic gauging device covers with O-rings are to be hand-tight, not tool-tight.

NOTE: *All valves, fittings, closures, plugs, caps, and fasteners must be checked for tool tightness even if the item was not utilized during the loading process (thermometer and magnetic gauging device covers with O-rings are to be hand-tight, not tool-tight.)*

3.4.5 Prior to release, you must inspect the manway gasket for damage, deterioration, permanent compression, and proper alignment. Tighten the manway bolts using the appropriate pattern and torque values per company procedures.

3.4.6 If equipped with a safety vent, the rupture disc must be examined for integrity, proper burst-pressure rating, and condition. If the tank car is to be reloaded at the same facility, one inspection of the rupture disk may be adequate. The key requirement is that the rupture disk is thoroughly inspected per federal requirements prior to offering for transport with the following exceptions:

3.4.6.1 Residue of some class 8 and 9 materials by Special Permit in the USA and

3.4.6.2 Most residue cars in Canada except class 2.

3.4.7 Relieve all pressure used to unload the car, except for those commodities that may have a nitrogen pad applied. A warning should be applied in the manway area to indicate when nitrogen or other non-life supporting gas is present as a pad.

3.4.8 All cars (except class 9 material under certain circumstances) must be properly placarded and marked before being offered for transportation.

3.4.9 Product spillage on the tank exterior must be removed as DOT regulations prohibit any hazardous materials or hazardous material residue from being on the outside of the package/tank car. While removing spillage, caution should be taken to not damage any paint, decals, and reflective material.

3.4.10 Ensure proper documentation for transportation is available.

3.4.11 Visually inspect the car to verify that no obvious defects are present.

NOTE: *A car containing the residue of a dangerous good or hazardous material must be offered for transportation in the same condition as a car loaded with that product. It must be leak free, placarded, marked, closed with seal present, if required, and properly documented.*

3.4.12 The car must be properly inspected, placarded, and marked before it is offered for transportation, including:

- All stenciling and markings are legible
- Properly placarded on all sides
 - Placards are not torn, faded, or missing
 - Placards are correct for the product being loaded
- BOV cap wrench tight and cap and plug chains attached
- Valve plugs or caps wrench tight and plugs and caps attached to car

- Securement pins are attached to the car, in place, and properly secured
- Safety equipment such as handrails, running boards, platforms, ladder rungs or steps are not bent or loose

Section 4: List of activities that can be performed without a Tank Car Facility Certification.

NOTE: Refer to the latest version of the AAR Manual of Standards and Recommended Practice, Section C Part III, Specifications for Tank Cars, **Appendix B (M-1002)** for the scope and description of the tank car certification elements listed in the tank car M-1002 certification registry.

The following exceptions are listed in the M-1002:

- Examinations prior to shipping per 49 CFR 173.31(d).
- Conductivity or resistivity examinations of *tank car interior linings* and *interior* coatings prior to shipping.
- Replacement/repair of any markings or stencils on tank cars other than those specified in paragraph 3.1.5.5.
- Double shelf coupler replacement (i.e., coupler vertical restraint system) in accordance with the Field Manual of the AAR Interchange Rules.
- Replacement of gaskets with the correct size as specified by the equipment owner and compatible with the lading on the following service equipment: hinged and bolted manway cover, fill port cover, bottom outlet cap, secondary closure, secondary fitting, secondary valve, and quick disconnect dust cap.
- Replacement of O-rings with the correct size as specified by the *equipment owner* on gauging device caps and thermometer well housing tubes.
- Replacement of the rupture disc, including the rupture disc gasket, with the correct dimensional size and pressure rating as specified by the equipment owner and compatible with the lading.
- *Manufacture* of O-rings, gaskets, eyebolts, washers, and threaded fasteners.
- The repair of attachments to jacket pads (see Field Manual of the AAR Interchange Rules, Rule 81).
- The repair of draft lugs, striker, draft key slot, and coupler carrier (see Field Manual of the AAR Interchange Rules, Rule 81).
- Service equipment category C or F for activity codes C4a, C4m, and C5.
- Replacement of manway eyebolts, bottom outlet valve caps, magnetic gauging device rods, chains, secondary closures, secondary fittings, and secondary valves as specified by the original or alternative approved design.
- The *qualification* of product purity *interior linings* or *internal coatings*.

Section 5: Additional Information

5.1 Websites References

AAR/MxV Rail NAR Website - <http://nar.aar.com>

BOE/MvX Rail Website – <http://boe.aar.com>

Federal Railroad Administration (FRA) - <http://www.fra.dot.gov/>

DOT Hazmat Safety Homepage - <http://hazmat.dot.gov/>

Transport Canada (Dangerous Goods, TDG) -<https://tc.canada.ca/en/dangerous-goods/transportation-dangerous-goods-canada>

Transport Canada (Rail) - <https://tc.canada.ca/en/rail-transportation>

5.2 Regulation and Standard References

AAR Manual of Standards and Recommended Practices - <https://aarpublishations.com/section-c-part-iii-specifications-for-tank-cars-m-1002-2014g.html>

Hazardous Materials Employee Training – 49 CFR 172.704

Dangerous Goods Employee Training – TDG Clear Language Regulations, Part 6

Empty Packaging – 49 CFR 173.29

Examination Before Shipping - 49 CFR 173.31(d) or TP 14877

Tank Car Unloading (transloading only) – 49 CFR 174.67

Tank Car Loading and Unloading in Canada – TP 14877

HOME SHOP FOR REPAIRS DO NOT LOAD – Field Manual AAR Interchange Rule 1, 3.e. and Rule 80 B. 6.

Hinged Manway Covers – AAR MSRP, M-1002, Appendix D.