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REPORT

January 2023

TOWN OF
Nantucket
MASSACHUSETTS

Fleet Maintenance Operational Assessment

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EXECUTIVE SUMMARY

Weston & Sampson was selected by the Town of Nantucket to assess its current fleet operations. The objective of this study was to assess the adequacy of the management and operations so corrective action can be taken to strengthen or improve areas as needed.

The results of our review are based on information gathered and compiled through interviews with the Town's department heads, fleet users, and mechanics that are tasked with maintaining the fleet. Weston & Sampson also walked the Department of Public Works (DPW) maintenance garage with the mechanics to observe the layout, equipment, and general operating procedures at the facility. Due to the lack of any detailed Work Order (WO) system, we were not able to review its fiscal stability. In the absence of detailed cost data, this study focuses on issues pertaining to the general fleet operation processes based on observation, interviews held in October 2022, and general fleet data provided by the Town.

Since the intent of our review was to identify opportunities for improvement, we have devoted our report primarily to discussing fleet related problems and potential solutions, rather than discussing aspects of the operation which are fundamentally sound. If a particular functional area of fleet management or operation is not mentioned in our report, it may be concluded that we did not find any cause for concern in that area.

As a note to the reader, during the conducting of this study, we used the national standard or commented on "best in class" or "best in practice" as performance milestones for the organization to strive to attain.

For the reader's clarification, we have used a number of acronyms or terms throughout the report. They are:

- ✓ WO – Work Order
- ✓ DPW – Department of Public Works
- ✓ VEU – Vehicle Equivalency Unit
- ✓ PM – Preventive Maintenance
- ✓ Circle Check – daily vehicle inspection report
- ✓ VMIS – Vehicle Management Information System
- ✓ FMIS – Fuel Management Information System
- ✓ ASE – Automotive Service Excellence
- ✓ APWA – American Public Works Association
- ✓ EV – Electric Vehicle

General Overview

Vehicle repairs and preventative maintenance for the Town's fleet are currently either sent to the Town's DPW Fleet Maintenance Garage (referred to herein as the "DPW Garage"), the local Ford dealership, or other dealerships and maintenance providers off-island. A significant portion of the fleet maintenance is subcontracted out to the dealerships. Select vehicles are also repaired and maintained by manufacturers where service contracts have been established (e.g., Milton CAT).

The DPW currently has two mechanics and a Fleet Manager. The mechanics report to the Fleet Manager, who reports directly to the DPW Director. The DPW Garage hours are 7:00 AM to 3:30 PM on weekdays.

The DPW Garage provides service to DPW vehicles as well as various other Town departments. It is unclear the exact number of vehicles the DPW Garage is currently servicing out of the roughly 230 units of rolling stock in the Town's fleet, not including Airport vehicles (i.e., cars, trucks, construction equipment, trailers, etc.). The current departments being served by the DPW Garage are understood to include Finance/Assessors, Fire Department (excluding work that requires EVT certificate), Harbormaster, Health, Natural Resources, Our Island Home, Plus, DPW, Sewer, Tourism, and Town Administration. However, it is also understood that due to the backlog of work, many of these vehicles are brought elsewhere for maintenance. Departments that do not use DPW Garage services include Land Bank, Marine, Police, School, Water, and Airport. A complete list of units in the Town fleet is included in Appendix A. The estimated value of the fleet is in excess of $18 million dollars, as tabulated in Appendix J.

In general, the Town's fleet maintenance operation appears to be operating in a reactionary mode, where vehicles are brought in for service only when issues arise. With no centralized preventative maintenance program or oversight for determining maintenance schedules and reminding the departments when services are due, the various departments and individuals who drive each vehicle are tasked with tracking this information. Existing Town resources/technology could be used more effectively to streamline maintenance tracking, though there are other resources available on the market that may be better suited for the Town's needs. Although there is a general lack of training, staff, and funding as compared to well-run fleet shops we see nationally, the lack of technology utilization is one of the biggest "bottle necks" as we see it. The following items could be implemented to enhance performance in the DPW Garage, as well as track vehicle maintenance and plan for/justify vehicle replacements:

- A fully structured Work Order (WO) system;
- Standard maintenance repair codes;
- Shop performance monitoring tools;
- Structured Preventive Maintenance (PM) program;
- Fuel Management Information System (FMIS) that has yet to be integrated with a Vehicle Management Information System
- An active vehicle replacement program;
- Training programs, and
- Written policies and procedures.

Nearly all of what we would consider "best in fleet practices" that would provide "real time" informational benchmarks is unable to be accomplished because the Town has not yet fully implemented a Vehicle

Management Information System (VMIS) software package. It is our understanding that the full capabilities of the Town's VMIS and FMIS systems are not being used at this time, though the Verizon VMIS may not ultimately be the best option for the Town's maintenance tracking needs. The Verizon VMIS does have vehicle maintenance tracking abilities, but it appears to be heavily geared towards vehicle location tracking. The lack of overall VMIS data collection/input is severely hindering the DPW Garage productivity and monitoring due to the lack of fleet related cost and performance data. Ideally the Town would integrate their VMIS and FMIS systems so that maintenance reminders can be initiated through the VMIS as it receives odometer/chronometer data from vehicles before they fuel. It does not appear that the Verizon VMIS has the capability to accept data from the Fuelmaster FMIS. However, if the Town began to require odometer readings be entered into the FMIS prior to fueling, the FMIS does have the capability on its own to provide preventative maintenance alerts based on odometer/chronometer readings.

Our review of the DPW Garage found a limited ability to provide quality service due to outdated or missing maintenance equipment, as well as inefficient use and misuse of space for parts storage and maintenance operations. These items and other areas of enhancement will be discussed further in the body of this report.

It should be noted that the two working mechanics currently do not carry Automotive Service Excellence (ASE) Certified Master Mechanics credentials in either automobile & light truck repair or medium-heavy truck repair. ASE training is the industry standard for mechanics training and helps ensure their skills and knowledge are adequate for working on a diverse Town fleet. While the Fleet Manager has significant vehicle maintenance experience and knowledge, he is not able to perform hands on maintenance work due to union contracts. The working mechanics would benefit greatly from formal training, and in turn, the fleet maintenance operations would benefit as well. Operations could also be improved if the union issues affecting the Fleet Manager working in the garage are resolved.

The following report outlines areas of the existing fleet operations and DPW Garage operations that are cause for concern. Corrective action can and should be implemented to promote DPW Garage safety, increase productivity, reduce operating costs, and meet Town initiatives. While some corrective actions are policy and operations driven, others will require monetary investment. We feel confident that these monetary investments will provide returns that far exceed the initial investment when fully implemented.

In general, in order to help simplify the process we recommend that the Town initially focus on the following three items:

1. Hire additional mechanics. As summarized in Section 7, Table 1 of this report, the Town should hire three more mechanics if they desire to maintain the majority of the vehicles in the Town's fleet, with the exception of specialty vehicles that require additional training/certifications for the mechanics. Also see Recommendation No. 12 in the report for additional details.
2. Get training for the Fleet Manager and the two existing mechanics, see Recommendation No. 2 in the report for additional information.
3. Implement the use of a vehicle management information system (VMIS) to track preventative maintenance, repairs, and other key information/fleet data for each vehicle. See Recommendation No. 1 in the report for additional information.

The other recommendations in the report should also be implemented as soon as practical.

1.0 DATA REVIEW AND PROJECT KICKOFF

Weston & Sampson initiated a project kickoff meeting with the Town Manager and Assistant Town Manager on October 5, 2022. During this meeting, project initiatives were discussed, which included those outlined within the body of this report such as safety, training, assessment of current facilities, staffing, vehicle maintenance outsourcing, fleet replacement planning, VMIS, Green Communities Program, and other topics.

A fleet inventory spreadsheet was provided by the Town, though information on engine hours, odometer readings, maintenance costs, and vehicle conditions were not immediately available. This spreadsheet would be used in the vehicle equivalency analysis described later in this report, and was referenced during meetings with Town departments during the interview process.

2.0 DPW FLEET OPERATIONS REVIEW

Weston & Sampson conducted interviews with the DPW mechanics and DPW Director in order to understand the day to day operations and challenges of maintaining the fleet, as well as gather feedback outlining possible improvements to the fleet management procedures. The Fleet Manager was on sick leave and unable to meet with us during this time.

Many of the topics discussed during our meeting overlap with those found in subsequent sections of this report, but general conclusions include the following:

- General PM schedules for Town vehicles have been discussed but not established to this point.
- The DPW Garage is not able to keep up with PM and repairs. There is a backlog of vehicles that need service and not enough mechanics. The Fleet Manager is a mechanic, but is not allowed to work on vehicles due to not being part of the union.
- The DPW Garage keeps paper service slips each job indicating what was completed, who worked on it, how long did it take, etc. They plan to eventually add these records to a VMIS but have not done so yet.
- There is a desire for a software program that can produce an automatic summary for each vehicle, to show when it needs to be replaced, based on maintenance records.
- There is no system in place currently to alert the DPW Garage or vehicle users of PM coming due on a given vehicle.
- They would like resources that the DPW Garage can use to reference standard times for service tasks. Then, they could check their performance based on industry standards.
- The Town has difficulty keeping mechanics on staff due to higher salaries in the private sector. The turnover rate makes it difficult to establish a steady workflow over the long term.
- The DPW Garage is unclear on what Town vehicles are their responsibility to service. Other Town departments bring vehicles to them on an as-needed basis, but the backlog of work blurs the line of responsibility when they simply cannot accept more vehicles at any given time.
- There is a desire for a clear, written fleet replacement program.
- Environmental conditions on the island make maintaining the fleet more challenging (i.e., rust damage to vehicle due to high salt environment, example photos in Appendix G).
- The mechanics and Director agree that mechanic training is crucial to developing an effective operation, and that this should be prioritized. The mechanics currently have no formal training.
- Work requests are generated on “circle check” forms that Town staff are supposed to fill out each day before using vehicles to ensure that the vehicle is safe. If they have an issue with the vehicle, it is noted on the form and brought to the DPW Garage. There is no official work order tracking system in place currently.
- Their parts inventory operation is unorganized and inefficient.
- There is a lack of guidance on what repairs should be done in the DPW Garage versus what should be sent elsewhere. In general, the Director would like to establish a set of guidelines and systems that the shop can use for all their operations.

Additional notes from the interview can be found in the meeting minutes in Appendix I.

Recommendation 1: Implement VMIS

Fully implement a VMIS, whether it is the Verizon software or another software, to track vehicle maintenance records, alert the Fleet Manager and vehicle users of PMs coming due, track open work orders, track parts inventory, and document costs associated with keeping each vehicle in service. Many inefficiencies in the fleet operations stem from a lack of central data tracking program. Once implemented, fleet users will have a better understanding of maintenance needs for their vehicles, and the mechanics will have records for each vehicle to reference when performing new services. This data will also help with vehicle replacement planning and justification.

Furthermore, Massachusetts may be adopting a new regulation in the near future, 310 CMR 7.41, that would require the Town to report key information about the fleet, such as maintenance logs, vehicle logs, odometer readings, annual mileage for vehicles, etc. This would be a one time reporting requirement, however, the Town would not be well equipped for this task without beginning the VMIS implementation process. The information would need to be reported six months after the regulation is instituted.

Recommendation 2: Training for Mechanics

Invest in training for the mechanics to receive ASE certification, and any other training necessary to work on Town vehicles/equipment safely and efficiently. See Appendix C – Training Summary for more information regarding ASE certification and testing. The Fleet Manager can also take part in an APWA Public Fleet Management Certificate Program, or a more intensive Public Fleet Professional Certification Program. More information about these programs can be found at the websites below.

- https://www.apwa.net/MYAPWA/Education___Credentialing/Certificate_Programs/MyApwa/Apwa_Public/Education_and_Events/Certificate_Programs.aspx?hkey=b1616f4a-d9ba-4e59-a0d1-82c1bb2bbbc2
- https://www.apwa.net/MYAPWA/Events/Professional_Development/Certification/Public_Fleet_Professional__CPFP_/Apwa_Public/Education_and_Events/Certifications/CPFP.aspx?hkey=a9958132-408b-4bb0-aa79-6220507742bf

3.0 INTERVIEWS OF DEPARTMENTS UTILIZING FLEET MAINTENANCE SERVICES

In addition to meeting with the DPW staff to understand operations from a vehicle maintenance provider standpoint, Weston & Sampson also conducted interviews with other Town departments to understand their prospective as current, prospective, previous users, or "customers," of these services. Those departments that were interviewed include Facilities, Fire, Energy, Our Island Home, Culture & Tourism, Natural Resources, Health & Human Services, Sewer, and Police. The level of use of DPW Garage services varied between these departments, but many common themes were found throughout the interviews, as listed below.

- There is general understanding that the DPW Garage is understaffed and not able to maintain the fleet for the whole Town.
- Much of the PM and repair work is directed towards the local Don Allen Ford Dealership due to concerns about long turnaround time if vehicles are brought to the DPW Garage.
- Departments and individual drivers are the only ones who initiate PM for the vehicles. There are no reminders and no central tracking for PM services.
- Even when vehicles are brought to the dealership or work is subcontracted to outside mechanics, wait times can be very long.
- Obtaining parts for repairing vehicles can cause long lead times. There are national parts shortages, but being on the island exacerbates the problem.
- There is a general lack of understanding between the DPW and other departments regarding what their vehicle maintenance relationship is, and what they would like it to be under ideal conditions. In some cases, there is no relationship.
- The departments do not know what services are available on a timely basis.
- Circle checks (daily vehicle inspections) are not done regularly, and the policy is not enforced.
- Vehicles are purchased based on what can be most easily serviced on the island through Don Allen, and not necessarily based on what is best for the work.
- Procurement of new vehicles can be a slow process, and many people are not aware of the Town's Green Communities Program requirements for new vehicles. Old vehicles also stay in service for too long, and there is no clear guidance on when vehicle should be replaced.
- There is a pattern of reactive maintenance instead of preventative maintenance.
- Sometimes staff for various departments do PM on their own department's vehicles.
- Sending vehicle off island for maintenance is very difficult. Ferries do not prioritize Town vehicles.
- Departments often do not know the status or repair timeline of vehicles that have been left at the DPW Garage.

Items of specific concern from these interviews are as follows:

- Several vehicles in the fleet have not passed state inspection, including emergency vehicles.
- There has been an incident in recent years where the brakes went out on one of the Town trucks and it went through an intersection. There were no collisions or injuries, but the fact that this occurred points to issues within the preventative maintenance program structure, or lack thereof.
- The Fire Department has had breakdowns of several fire trucks and had to rely on a mechanic who is not employed by the Town anymore to get the trucks running and back to the station.

- The Fire Department mechanic (outside contractor) comes to the island but is not always able to finish the work before he leaves. It can be months before he is able to come back. Some fire trucks are unusable for long periods of time.
- There has been no guidance on what preventative maintenance should be done on the Town's electric vehicle, and it has been on the road for several years.

Additional notes from the interviews can be found in the meeting minutes in Appendix I.

Recommendation 3: Establish List of Available Services

Create a list of maintenance and repair services that are available to the various Town departments at the DPW Garage. By creating a list that is accessible to all Town personnel, fleet users will know what services can be provided by the DPW Garage, and the mechanics will have clear guidelines for what jobs they can accept. Currently there is work being performed in the DPW Garage that should be contracted out. A list of available services will relieve the mechanics of making decisions on an individual basis, or feeling pressure to perform tasks that they cannot complete efficiently.

Recommendation 4: Circle Checks

Create and implement a clear policy regarding the daily inspection "circle check" of vehicles before they are used. The current "Town Owned Vehicle Use Policy" makes reference to employees reporting damage, malfunctions, and needed routine maintenance to their supervisors, but documented vehicle inspections should be required in this policy. These inspections will help Vehicle users understand their responsibility for the condition and maintenance of the vehicle, and problems can be addressed before they lead to more costly damages. Every Town department should make its staff aware of this policy, and forms should also be available in each vehicle. Alternatively, the Town could implement an online checklist through Google Forms or a similar platform where staff can fill out the checklist on their phones. This paperless approach would allow for each form to be automatically recorded into a spreadsheet and would allow for continuous tracking of the circle check process across all departments. There are also VMIS providers who can integrate daily inspection reports into their software, so that all records can be accessed in one place.

Recommendation 5: Fleet Maintenance Repair Survey

Develop a fleet maintenance repair survey. The survey should be of very simple design which would take only a few moments to complete. Typically, these are printed on "hangers" and attached to the vehicle's rear-view mirror or other prominent place. Users are asked a few identifying questions and asked to rate the service they received, friendliness of staff, and timing of repair. Similar to the recommendation for circle checks, this can also be done as a paperless activity.

To supplement the routine survey, a more comprehensive survey should be developed and shared with users on an annual basis. It is beneficial to have an unbiased third party, familiar with fleet operations, perform the annual customer survey. The survey should be designed to identify potential problem areas, provide qualified and unbiased interpretation of the information collected, and retain the complete anonymity of the survey respondents. Records of the level of satisfaction can be tracked over time, and areas where improvement is needed can easily be identified.

4.0 PERFORMANCE DATA/INFORMATION REVIEW

With information gathered from the interview process, observation of the DPW Garage, and the Town-provided fleet spreadsheet, it is clear that vehicle maintenance and overall fleet management operations can be improved.

The median age of the vehicles in the fleet is 8 years old (not including Airport vehicles). Data on the condition of the fleet is not currently available, though it is understood that environmental conditions on the island are harsh on the vehicles, and there is no regular washing program in place for the majority of departments to remove corrosive salt buildup.

As previously discussed, there is no established Town-wide preventative maintenance program in place. Vehicles are generally serviced as issues arise. Unscheduled repairs are understood to be the vast majority of services performed by the DPW Garage.

Data on fleet utilization is not currently available, and based on interviews with the departments, it appears that utilization varies between the departments. In implementing a system of entering odometer readings into the FMIS, future data can be collected for fleet utilization based on the number of miles driven per year, or engine hours per year, for each vehicle. Weston & Sampson was informed that some vehicles have been off the road for extended periods due to repairs and delays in receiving parts. While nationwide parts shortages are difficult to address, increasing general vehicle maintenance efficiency would help to reduce the number of vehicles needed in the fleet by keeping more units available on a day to day basis.

Weston & Sampson was also told that even when vehicles are available for use, they are not always the correct vehicle for the job, and their current condition can be uncertain due to not having current inspection stickers. For example, the Ford Rangers that are commonly found across the departments are often too small for the Facilities staff to efficiently complete their work, and at least three of their vehicles did not pass inspection. They often borrow larger vehicles from other departments to haul trailers or worksite debris.

As mentioned previously in this report, we recommend a robust training program for the DPW Garage mechanics. While their on the job learning has helped them grow their skill levels, a dedicated program will provide deeper knowledge and help them increase their effectiveness in servicing a diverse fleet.

Recommendation 6: FMIS Odometer Readings

Require that the odometer reading or engine hours be entered into the Fuelmaster FMIS at each fill up. Annual vehicle usage can be tracked using reports from the FMIS, and ideally the FMIS can ultimately be set up to interface with the VMIS so that usage and maintenance data can all be tracked in the same program. The Town will be able to determine which vehicles are underutilized and overutilized, and plan next steps accordingly.

Recommendation 7: Vehicle Usage Staff Surveys

Conduct periodic surveys of staff for all departments where feedback can be given on what fleet related needs can be addressed to assist in maintaining departmental performance.

5.0 DOCUMENTATION OF MANAGEMENT PROCESS

Subcontracting Maintenance

Weston & Sampson discussed the various management practices and procedures in use at the DPW Garage during the interview process. Subcontracting work to outside vendors was a major topic of discussion, and one that warrants continued assessment. It has been well established that the mechanics are struggling to keep up with the current workload in the DPW Garage, making the subcontracting of repairs and PM to outside vendors a critical aspect of the fleet's management. However, even if the DPW Garage begins to operate at optimal capacity with adequate staff to serve the fleet, it is expected that subcontracting major repairs, warranty work, and other more specialized work will always be necessary to maintain an efficient operation. Expanding upon existing relationships and contracts with vehicle/equipment maintenance providers will be essential to help establish a more reliable operation in the near term and the future. It was discussed that when possible, buying equipment that has a service agreement available is ideal. Manufacturers like Milton CAT offer these services, and the Town has felt the service agreement is very valuable. Equipment providers such as CN Wood also offer these services.

Most, if not all, of the Town departments are using vehicle maintenance services outside of the DPW Garage on a regular basis to maintain and repair their vehicles. The local Ford Dealership, for example, is used frequently in this regard. In an efficiently run central fleet maintenance program, it can be expected that up to thirty percent of the Town's vehicle maintenance work would be subcontracted out. Though records have not been provided regarding how much maintenance is currently being performed by outside vendors, it is likely that the current rate exceeds thirty percent out of necessity. Among the various departments, there is list of vehicle maintenance providers that are working to service the Town's fleet on an as-needed basis. Typical vehicle maintenance providers include Don Allen Ford, MHQ, Tri-State, CN Wood, Billy Built, and private mechanics.

Vehicle Acquisition

The manner in which specifications are developed and used, not only impacts the ultimate cost effectiveness and suitability of the vehicles that are purchased, but also impacts the level of effort and amount of time required to acquire vehicles as well. An effective specification process incorporates information about user needs. They blend in experiences reported by the shop on how maintainable and reliable certain types of vehicles might be. They also review information about the major components offered and balance custom design requirements with standard features. The more custom the design, the longer it takes to develop the specification and deliver the vehicle, and the vehicle will be more expensive to procure.

Vehicle procurement is understood to be a slow process currently, and there also appears to be a lack of Department-wide knowledge surrounding the Green Communities Program requirements for new vehicles. We have been told that the Fleet Manager is in charge of vehicle procurement, and that training in the Town's procurement process is needed to help streamline this process. Delays due to existing market conditions already exist in the auto industry, and these delays can be compounded by not submitting orders in a timely manner. On a departmental basis, collaboration with the users of the fleet should be a priority so that vehicles are not purchased that do not fit the needs of personnel.

Recommendation 8: Establish Formal Maintenance Agreements

Contact entities that are currently providing maintenance services and create structured agreements, when possible, for servicing vehicles. Structured agreements would allow for more reliable maintenance of vehicles and equipment. For example, the Town has used the services of CN Wood to maintain certain vehicles/equipment in the past. The Town could create a formal agreement for CN Wood to come to the island on a periodic basis for preventative maintenance and repairs.

Recommendation 9: Solidify the Procurement Procedures

Consolidate all procurement activities to the Fleet Manager position if this has not already happened. The Fleet Manager should understand all Green Communities Program requirements for new vehicles, as well as all department heads. The Fleet Manager should work with the various departments to develop the specifications for new vehicles, as necessary. All vehicle acquisitions and retirements should be documented and maintained in a master spreadsheet or VMIS by the Fleet Manager. Users of the potential new vehicles should be consulted about its features to ensure the vehicle specifications are ideal for day-to-day operations.

6.0 RESOURCE ASSESSMENT

As previously discussed, the DPW Garage currently has two mechanics and a Fleet Manager. According to the Town's website, there are no advertised open mechanic positions at the DPW. It is our understanding that there is no specific assignment pattern associated with the DPW Garage maintenance and repair work. The mechanics prioritize work based on what vehicles are needed most urgently, and then they work on any lingering long-term repairs. However, the number of vehicles that the DPW Garage is theoretically tasked to maintain indicates that they are understaffed with just the two mechanics. There is only one shift in the DPW Garage, and anything more than that would be unjustified given the lack of staffing. It is our understanding that the mechanics are performing work as outlined in their job descriptions. One area that we believe requires greater attention is parts inventory and general shop organization. The parts storage area needs a complete reorganization and decluttering. Once it has been decluttered, a systematic approach to parts organization and ordering needs to be implemented to help shop efficiency.

Improper staffing is detrimental to the cost-effective delivery of service. With staffing levels being too low, breakdowns can increase at a dramatic rate, which can result in more expensive breakdowns and higher operating costs for the Town. It also promotes more downtime of the fleet and poor customer relations. As downtime increases, more parts are required, user departments demand more equipment, and the fleet starts to grow out of control in numbers. We refer to this as "fleet creep". In our interviews with other departments, we were told that the departments could be waiting for months for vehicles to be repaired, and bringing them to the Ford Dealership or sending them off island was difficult as well. The fleet size and number of mechanics will be further discussed in Section 7 of this report.

In discussions with the DPW, we were told that mechanic positions with the Town are in the low $30/hr range. While the Town offers a very competitive benefits package, including a pension program, it is clear that private sector can be much more appealing to mechanics on the island. While the benefits packages may not be as robust, it is our understanding that mechanics in the private sector can make roughly $50/h.

Recommendation 10: Advertise for Openings

Advertise for open mechanic position(s). While mechanics are scarce on the island, it will be difficult to hire without public knowledge of an open position. It is our understanding that the Town offers a very competitive benefits package, good job security, and a pension program. These benefits should all be highlighted in the advertisement.

Recommendation 11: Parts Operation

The parts storage area and overall shop should be decluttered and overseen by the Fleet Manager. All equipment and storage not associated with current fleet operations should be moved out of the shop to make room for parts that can be used to service the current fleet. Any legacy parts storage that has no current usefulness needs to be removed immediately.

7.0 VEHICLE EQUIVALENCY ANALYSIS – FLEET METRICS

Typically, we will assign the fleet operation a fixed number of vehicle equivalency units (VEUs) for which they will be responsible. This serves to identify staffing levels estimated to be appropriate for the size of the fleet in question. While 100 VEUs per mechanic is the foundation for the best in class maintenance, we make staffing recommendations assuming the APWA standard of 70 VEUs for a better indicator of what a typical Town garage can reasonably achieve. Dozens of issues that are often Town-specific are used in the process of identifying the recommended staffing ratio for the fleet in question.

Each of the following elements were used in the process of developing the recommended VEU ratio(s) for the DPW Garage. While there is no set formula for raising and lowering the ratio, decisions for developing the recommended VEU ratio are made based on experience and the elements listed below.

Element of Consideration	Ratio Raised for Positive	Ratio Lowered for Negatives
The amount of outsourcing done	High level of outsourced work	Many labor-intensive tasks performed in house
The facilities in which the mechanics work	Very adequate facilities, supportive of the work performed	Inadequate facilities
The weather conditions	Moderate, temperate, little or no snow and ice	Cold, rain, snow and/or ice present
The type of vehicle considered “front line”	Most of the fleet vehicles are relatively uncomplicated	Complex systems, multiple axles, highly specialized
The availability of spare parts within the municipality	Many parts sources, parts often delivered same day	Travel to other communities to obtain parts is often required
The type of procurement policies that are in place [vehicles and equipment]	Procurement of best-in-class models; procurement of vehicles that match the workload; attention to standardization; training is included; focus on warranties is strong	Procurement of lowest bidder; procurement of vehicles that inadequately match the workload; no attention to standardization; training is not included; warranty programs are not included/followed
The type of procurement policies that are in place for parts	Parts procurement decisions are made based on quality of parts and/or dealer recommendations	Aftermarket parts used; fabricated parts used; rebuilt parts used

Element of Consideration	Ratio Raised for Positive	Ratio Lowered for Negatives
The location of the fleet vis-à-vis the maintenance facility	Co-located, staged at or adjacent to the fleet maintenance facility	Distance from the fleet maintenance facility
The type of mileage put on the vehicles	Road access available, used predominantly, miles are easy on the vehicles	Stop and go traffic, spurts of acceleration followed by brake application, idling time
Driving conditions	Paved streets, freeways, few traffic signals and stop signs	Potholes, jammed traffic, unusually long idling periods, off road, mud, ice, snow
Maintenance procedures—level of maintenance performed	Major component swap outs	Major component overhauls
The age of the fleet—replacement plans	Younger fleet based on strong and well-supported replacement plan	Aging fleet; older vehicles; procurement slippages prevail
Operator procedures—maintenance contributions made by the operators	Strong focus on first level maintenance, daily checks, maintenance reporting	Operators get in and go without routine daily checks
Focus on Preventive Maintenance	Strong focus on PM	Abundance of corrective maintenance
Type of information system in use	Robust fleet management information system	Manual, partial, or non-dedicated fleet management information system
Quality assurance procedures	Strong commitment to QA	Little or no QA available
Staging Options	Warm [indoor] storage	Cold [outdoor] storage
Customer surveys	Strong feedback system in place	Little or no feedback available
Self-evaluation	Strong self-evaluation system in place	Little or no self-evaluation
Training programs	Strong focus on training mechanics	Inadequate training program

Many other elements can exist that will have an impact on the VEU estimate. The elements shown above are just a few representative examples. These examples, however, help describe the process.

For the elements shown above, the VEU ratio can be raised if there are certain positive operational characteristics and can be lowered if certain negative operational characteristics exist. As such, establishing a VEU total for the fleet is an exercise in statistical analysis—a mathematical process. For example, a standard sedan is 1.0 vehicle equivalent and the typical fire truck rates 6.5 vehicle equivalents. This means that it takes about six and one-half times the labor effort to maintain a fire truck as it does to maintain a sedan.

The current Vehicle Equivalent calculation has determined that there are approximately 126 pieces of rolling stock (air compressors to front-end loaders) equipment that would currently be expected to be maintained by the DPW Garage. Table 1 shows a summary of the VEU analysis, with additional departments broken out in the lower section to show how many mechanics and maintenance bays are calculated to be necessary in a full central fleet maintenance scenario. Utilizing the "Elements for Criteria" listed above, we have established there are 243 VEUs in the fleet in the current operation, which equates to about 122 VEUs for each mechanic. This is far above the 70 VEU to 1 target ratio we typically see. This high ratio is deceiving, as it is not indicating the mechanics are working at an incredible pace. Instead, this 122 to 1 ratio suggests that the mechanics are likely not maintaining all the vehicles listed for these departments, and they are understaffed to serve these departments effectively. It is unclear the exact number of VEUs the DPW Garage is currently serving vs how many are subcontracted out to other mechanics.

This VEU analysis shown in Table 1 is based on the VEUs assigned to each vehicle in the fleet and then categorized by department. With each VEU requiring 22 man hours per year, and the number of yearly "billable" hours estimated at 1,516 per mechanic (in accordance with APWA standards) we show that the number of mechanics required for the DPW is 3.5, or 7 if all the additional departments listed in the table are served by the DPW Garage in the future. The highlighted rows and their associated total also indicate the number of mechanics needed to serve these select departments is 5. These highlighted rows show the assumed expanded central fleet maintenance operation, used for future staffing planning and preliminary sizing of the new DPW Facility.

As indicated in the table below, we calculated that the DPW mechanics would need a total of 7 maintenance bays in a combined DPW building, where only the departments and vehicle categories that are highlighted will be serviced by the DPW mechanics. If all Departments/Divisions were to bring their outsourced maintenance in-house, it is estimated that a total of 7 mechanics and 10 maintenance bays would be needed, assuming one shift. Alternatively, the Town could look to reduce the number of maintenance bays needed by bringing on a second shift (day and night). Workshop spaces currently programmed in the DPW Study could also be designed to serve as vehicle maintenance bays, to help provide additional vehicle maintenance space, however this work would need to be coordinated with the DPW Divisions that require this space to support their workshop/maintenance needs.

Please note that the VEU analysis method presented provides a reference point for fleet staffing and that the best way to adequately staff the fleet is to track the actual labor hours needed to maintain the fleet using a VMIS as described above. Fleet staffing needs to be assessed on a continuous basis, and adjusted as needed, moving forward.

Table 1: VEU Analysis Summary

Department	VEU [1]	APWA MRU [2]	Man Hours Required Per Year	Yearly Billable Hours Per Mechanic [3]	Mechanics Needed	Maintenance Bays Needed [4]
Finance/Assessors	2	22	44	1516	0.03	-
Fire Dept (Non-Emergency Vehicles) [5]	17.2	22	378.4	1516	0.25	-
Harbormaster	4.8	22	105.6	1516	0.07	-
Health Dept	7	22	154	1516	0.10	-
Misc. [6]	24	22	528	1516	0.35	-
Natural Resource	7.2	22	158.4	1516	0.10	-
Our Island Home	7.5	22	165	1516	0.11	-
Plus	6.5	22	143	1516	0.09	-
Public Works	114.1	22	2510.2	1516	1.66	-
Sewer Department	50.8	22	1117.6	1516	0.74	-
Tourism	1	22	22	1516	0.01	-
Town Administration	1	22	22	1516	0.01	-
Subtotal	**243.1**		**5348.2**		**3.5**	**4.8**
Additional Departments						
Airport (Not Assessed)	N/A	N/A	N/A	N/A	N/A	N/A
Fire Dept (Emergency/Specialty Vehicles) - Standard Maintenance [8]	48.5	22	1067	1516	0.70	-
Fire Dept (Emergency/Specialty Vehicles) - Special Maintenance [9]	37	22	814	1516	0.54	-
Marine	6	22	132	1516	0.09	-
Land Bank [7]	30.1	22	662.2	1516	0.44	-
Police	88.1	22	1938.2	1516	1.28	-
School [7]	9.8	22	215.6	1516	0.14	-
Sewer Department - Special Maintenance [9]	6	22	132	1516	0.09	-
Water Company [7]	14.9	22	327.8	1516	0.22	-
Subtotal	**240.4**		**5288.8**		**3.5**	**4.7**
Grand Total	**483.5**		**10637**		**7.0**	**10**
Total of Highlighted Rows (Planning for Expanded Central Fleet Maint. at New DPW Facility)	**352.4**		**7752.8**		**5.1**	**7.2**

(1) VEU stands for Vehicle Equivalency Unit. VEUs symbolize the level of effort required to maintain a vehicle and were assigned based on APWA and industry standards.

(2) MRU stands for Maintenance and Repair Unit. There are 22 MRUs per VEU, which show that each VEU requires 22 hours of labor per year by a mechanic, per APWA standards.

(3) The 1516 billable hours per year represents time spent doing actual repair work, and excludes time for vacation, sick time, training, custodial, and other indirect time.

(4) The number of maintenance bays is calculated by assuming 1 dedicated PM bay with 1 dedicated PM mechanic, then the remaining number of mechanics is multiplied by 1.5 bays per mechanic and added to the 1 PM bay.

(5) Fire Dept (Non-Emergency Vehicles) VEU calculation does not include fire trucks and other specialty vehicles. It includes SUVs, pickup trucks, trailers, etc.

(6) "Misc." VEUs are associated with an assumed 80 pieces of equipment with small engines across all departments that will be maintained by the DPW mechanics.

(7) Vehicles from these departments were not originally included in the scope of the study, but are shown as possible additional vehicles for DPW mechanics to maintain.

(8) Fire Dept (Emergency/Specialty Vehicles) VEU calculation includes only VEUs associated with standard maintenance for emergency vehicles that can be performed by the DPW Garage, such oil changes, tire changes, etc.

(9) Special maintenance associated with the specialty vehicles in these departments is accounted for with these categories (e.g., If full maintenance of a fire truck is 6.5 VEUs and the DPW Garage can do 3 VEUs of non-specialty maintenance, the remaining 3.5 VEUs go in "Special Maintenance" category).

General Notes:

a) See attached table for VEU breakdown by vehicle. Vehicle information and unit #s are as provided by the Town.

b) As detailed information on the fleet is not available, VEU analysis was performed assuming average conditions and industry standard estimates for VEU assignments. This analysis establishes a benchmark for evaluating fleet maintenance needs, and will need to be further assessed as fleet data becomes available.

Recommendation 12: Hiring Additional Mechanics

As discussed with the Town it is best to consolidate the fleet management program on the island as much as possible. Following a review of the fleet management needs and how they relate to the plans for a new Fleet Maintenance Facility, as part of the new Public Works Facility Project, it was decided to plan for the DPW to maintain the vehicles highlighted in blue in the above Table 1. In general, this approach will have the DPW maintain the majority of the Town's fleet, with the exception of specialty vehicles such as fire trucks, police vehicles and sewer vacuum trucks, which require additional certifications/training for the mechanics. In order to maintain this fleet, the Town should have a total of five (5) mechanics and a Fleet Manager. This will require the addition of three more mechanics to the current fleet maintenance staff, which consists of two mechanics and Fleet Manager.

Recommendation 13: Consider Subcontracting Fleet Maintenance Operations

There are companies, such as First Vehicle Services, who will create contracts with towns and cities to completely take over their fleet maintenance operations. They have a network of trained/certified mechanics that can be hired under contract to perform all of the Town's fleet maintenance, or simply come to the island periodically to perform maintenance/repairs and supplement the DPW Garage's mechanics. The unique geographical challenges of Nantucket would play a role in the final contract, but if Recommendation 12 fails, or mechanics continually leave the DPW for the private sector, this could be an option for the Town to consider.

8.0 CAPITAL EQUIPMENT AND DIAGNOSTIC TOOLS REVIEW

Weston & Sampson toured the DPW Garage during our visit to the island to observe how it was being used. The facility and safety in which a mechanic works is the most important tool they have available to them for providing a cost effective delivery of service and to eliminate personal injury. The capital equipment they use daily in the garage is equally important. The DPW Garage has several shortcomings that would hinder efficient and safe maintenance operations, including the following:

1. No vehicle exhaust source capture system
2. Lack of proper emergency shower and eye wash stations
3. Inadequate vehicle lifts. DPW only has one 4-post 19k mobile column lift for large trucks, and their 2-post light duty lift is permanently out of service
4. Inadequate parts supply storage
5. No vehicle maintenance lubrication distribution system or waste fluid collection system
6. Lack of a proper vehicle wash bay with undercarriage wash
7. No tire inflation cage
8. Lack of welding fume ventilation
9. No safety data sheets (SDS) for vehicle maintenance fluids.

Appendix B includes equipment cutsheets and general costs associated with improving the conditions listed above, and Appendix G includes photos of existing operational equipment/spaces. While some of these items may be better, or more easily, addressed with the construction of a new DPW facility, many items can be upgraded while operations are still run out of the DPW Garage.

It should also be noted that if shop safety meetings are not already being held, they should be conducted at least on a monthly basis and include review of proper/safe use of existing equipment.

Recommendation 14: Purchase Light Duty Lift

As a significant portion of the DPW Garage maintenance work focuses on light duty pickup trucks and SUVs, a new light duty lift should be purchased to replace the current 2-post lift that is out of service. While the 4-post mobile column lift is able to lift light duty vehicles, it is not ideal for the type of work that is typical for the garage. Any work related to tires or brakes would require the vehicles to be lifted by the mobile column lift and put on jack stands, or it could be systematically lifted for each wheel by using a floor jack. A new light duty lift would greatly streamline these operations and keep the 4-post lift available for heavy duty vehicles.

Recommendation 15: Parts Storage Area Overhaul

Not only should the existing parts storage area be decluttered, as previously mentioned, but it should also be outfitted with the shelving and general layout that the mechanics feel is best for their day to day operations. The parts area needs significant improvement, and the goal would be to provide shelving, bins, and drawers as necessary to keep the parts operation efficient and allow for inventory to be easily tracked.

Recommendation 16: Safety Meetings

Scheduling a monthly shop safety meeting with the mechanics should be a priority of the Fleet Manager. These meetings should focus on resolving any safety related issues in the shop and provide safety training. Document the meeting and procedures in a log book which will ultimately develop a safety history. These safety logs will also document that the DPW Garage has safety procedures in place in an effort to reduce personal injury.

Recommendation 17: Equipment Inspection

Implement a systematic inspection procedure for all major DPW Garage capital equipment in accordance with the manufacturer's recommendation. Document these inspections in a log book that will create a safety inspection history log. These inspections will document that the DPW Garage has safety procedures in place in an effort to reduce personal injuries in the work place.

Recommendation 18: Shop Technology

When the VMIS is implemented, mechanics should also be given the ability to enter data and track maintenance records on portable equipment in the garage. Whether this equipment is a laptop cart or a tablet, the mechanics will benefit from having information readily available to them in the shop, and from having the ability to close out work orders. Paperless tracking of work orders will increase efficiency and long-term data tracking for the vehicle users and the mechanics.

9.0 REVIEW OF LEASING VERSUS PURCHASING VEHICLES

While leasing vehicles is a common practice for personal vehicles, we have found that municipalities can get more value from their vehicles by purchasing them outright through established State Contracts. Language from the Statewide VEH110 Contract states the following regarding benefits and cost savings:

> "Statewide contracts are an easy way to obtain benefits for your organization by leveraging the Commonwealth's buying power, solicitation process, contracting expertise, vendor management and oversight, and the availability of environmentally preferable products.
>
> All Vendors are committed to a maximum percentage above their cost (i.e., a gross profit percentage) for the life of the Contract, as reflected in the Vendor Information section. Additionally, each Vendor offers Prompt Payment Discounts and competitive pricing on vehicles featured in the VEH110 Master Vehicle List that can be further negotiated."

When leasing a vehicle, it is common for fifty percent of a vehicle's retail value to be paid during a three year lease agreement. For example, a new 2023 Ford F-150 may sell for $49,000 according to Edmunds.com, but a three year lease would end up costing an estimated $25,000 over that period based on an estimate by the same website. This "fifty percent over three years" assumption was also confirmed during our conversations with the local Ford dealership when discussing leasing vehicles. The average lifespan of vehicles on the road in the US has recently been hovering around 12 years according to CNBC. This would mean that if the Town acquired vehicles in three year leases over those 12 years instead of purchasing one vehicle outright, they would spend $100,000, whereas an outright purchase would have cost $49,000. The cost of leasing would be roughly double the cost of purchasing. When purchasing outright, the Town would also be able to sell the vehicle, as they currently do, when they are finished using it. While this analysis is a simplification of the comparison process and there are other factors to consider (e.g., annual mileage, cost of maintenance, cost to upfit specialized vehicles, level of wear and tear, etc.), the magnitude of potential cost savings for purchasing vehicles outright is readily apparent. Furthermore, by purchasing vehicles from the Statewide Contract, Towns are able to obtain competitive prices from many vendors.

Aside from the bare cost comparison, there are many contractual implications associated with leasing vehicles. Contracts generally include the following terms:

- Mileage restrictions, with penalties for exceeding
- Maintenance of vehicle condition, with penalties for excess wear and tear
- Early termination fees
- Possible end of lease fees

While the island setting may limit mileage on vehicles, the heavy use of vehicles in many of the Town departments, as well as the harsh island environmental conditions, would make it difficult to maintain the condition of the vehicles over the leasing period. There are also the obvious disadvantages to leasing, such as lack of control over the asset, lack of equity in the asset, ongoing payments, increased time managing lease agreements, and any customization needs to be removed at the end of the lease.

Our conversations with vendors indicate that it is very uncommon for municipalities to lease vehicles. Our contact at CN Wood, a main vendor for the Town's heavy duty equipment, indicated that there have

only ever been a handful of leases that they have provided. They are on the State Bid List, and equipment is almost always purchased outright. They also indicated that purchasing the vehicle is a simpler process than leasing it, because the expense is incurred one time after a bid is solicited. In the leasing scenario, Towns would typically need to go to committee each year over the leasing term to secure funding. This process adds more complexity and uncertainty to the funding process.

Other towns have researched leasing versus owning, such as Burlington, MA. The Town performed a cost comparison for their pickups, sedans, and SUVs, and determined that leasing was not a cost effective option for them. They tend to keep vehicles for much longer than a typical leasing term, with relatively low mileage put on the vehicles, so the value of leasing vehicles is severely diminished. Their analysis was completed roughly ten to fifteen years ago, and was definitive enough to discourage any further analysis since. They were also not aware of any opportunities to lease heavy duty equipment and off road vehicles.

Our discussion in this Section has revolved around operating leases, meaning a lease to use a vehicle that is returned to the owner at the end of the leasing period. However, there is another type of lease that companies like Ford offer, where it is a lease to own agreement. Ford calls this their Municipal Finance Lease-Purchase Program. This lease essentially functions as a traditional car loan financing agreement, where a municipality would lease the vehicle for a certain period of time (2-5 years) and then purchase the vehicle for $1 at term end. The advantage to a program like this is that it frees up money if many vehicles need to be procured at the same time, there are no excess wear and tear charges or mileage restrictions, upfitting costs can be included in the amount financed, and it provides an alternative to bonds as a source of tax exempt financing. Based on discussions, it is our understanding that the lease/purchase agreement does not show as debt on the municipality's balance sheet due to its structure. Through this program, police, fire, DPW, and other transportation vehicles can be leased and upfitted, and extended warranties are offered.

10.0 REPLACEMENT CYCLE

Many fleet professionals and government decision makers confuse fleet replacement planning with procedures used to select which vehicles should actually be replaced. The former is a planning activity designed to predict replacement funding needs and the latter is a tactical activity, with the goal to spend allocated funds in the most beneficial manner by selecting the vehicles that "deserve" replacement. Fleet assets can be replaced in a planned and rational manner before undesirable operating impacts occur, such as high repair costs and disruptions in service delivery activities caused by vehicle breakdowns.

It was noted that there are many aging units in the fleet, that appear to be at or near the time for replacement. For example, there are 74 rolling stock units that are 15 years or older, not including Airport vehicles. These vehicles should be evaluated closely for replacement using the methods discussed below.

It is important that vehicles be replaced in a timely manner. As the fleet ages operating costs begin to escalate at an alarming rate while service levels fall sharply. What results is a phenomenon called Fleet Creep, with the resulting process below:

- Assets are deferred
- Warranties expire
- Fleet age grows older
- Fleet is less reliable due to age
- Parts costs escalate
- When a few new units are purchased, users are reluctant to give up the old unit due to unreliable prime equipment
- Parts become harder to get due to fleet age
- More maintenance space is required
- Fleet down time increases (units waiting on parts)
- Users again keep more old units
- Fleet growth in numbers increases (Fleet Creep)
- Mechanics can't keep up with demand
- Fleet downtime continues to escalate
- Overall morale declines, as service levels drop.

Because there is not an active VMIS system it is not possible to confirm if fleet creep is occurring, however, based on a review of the vehicle ages, it does appear it is occurring in certain areas. Once the VMIS is up and running with current vehicle mileage and engine hours, the Town will be able to accurately assess metrics such as vehicle utilization, fleet size, and the potential for fleet reduction and/or implementation of a vehicle pool.

Recommendation 19: Implement Structured Vehicle Replacement Plan

Develop a more structured vehicle replacement planning procedure. In most fleet operations, 10% of the replacement value of a proactive fleet is set aside annually to fund the program. As cost data on the fleet becomes easier to collect and more valid, expand on the replacement planning process by

adjusting the two major components: (1) replacement planning parameters that determine when each vehicle and piece of equipment should be replaced using the process described below; and (2) a financing and funding process to ensure money is available to purchase a replacement when the replacement date is reached. A clear distinction needs to be drawn between the (strategic) replacement planning and funding process and the (tactical) process for selecting specific units to be replaced.

Replacement cycles are planning parameters, and as such, are predictive criteria used to establish funding requirements. While they are also often used to identify potential candidates for replacement, additional factors need to be considered when developing the list of units – in priority order – that need replacement. These additional factors include maintenance and repair costs, reliability, type of use, and vehicle condition.

Weston & Sampson has created a Vehicle Replacement Policy and accompanying Vehicle Replacement Spreadsheet Tool for the Town, which is included in Appendix E. This policy follows the guidelines established by APWA in their Planned Fleet Replacement handbook. The APWA uses a point system to determine when a vehicle should be replaced by assigning points to the vehicle criteria listed below:

- Age
- Miles/Engine Hours
- Type of Service (e.g., heavy use construction vehicle or police cruiser vs light use administration vehicle)
- Reliability (i.e., frequency that a vehicle is in the shop for repair)
- Maintenance and Repair Costs
- Condition (i.e., body condition, rust, interior condition, accident history, anticipated repairs, etc.)

When a vehicle hits pre-determined point thresholds the vehicle is placed into one of the following categories:

- Excellent (Green)*
- Good (Yellow)*
- Qualifies for Replacement (Gold)*
- Needs Immediate Replacement Consideration (Red)*

*Color code assigned to the respective category in the vehicle replacement spreadsheet

We have programmed the spreadsheet so that the Town just needs to complete the data entry portions. In addition, the spreadsheet is programmed so that the color code system identifying the applicable vehicle replacement category automatically appears.

The use of this systematic vehicle replacement program will help provide the Fleet Operations with more stable and predictable operating costs, a safer fleet, increased user satisfaction, improved vehicle reliability, a potential reduction in fleet size, and increased accountability for total fleet related costs. It also helps to keep the political process out of fleet replacement.

The primary objective of a formal replacement plan is to estimate aggregate, long-term fleet replacement costs to ensure that sufficient funds are recovered to defray these costs. Having a solid work order tracking system will provide the data necessary to demonstrate the true cost of maintaining an aging

vehicle, which will help the Fleet Operations to secure adequate funds for the timely replacement of vehicles, which we understand is often great challenge. Therefore, this recommendation greatly relies on the Town's implementation of a VMIS and keeping accurate digital records of all maintenance activities and costs incurred for each vehicle.

Recommendation 20: Excessive Damage Policy

Define an excessive damage policy for directly charging intentional, excessive or clearly preventable damage. While this practice may seem unacceptable to current users, having a clear policy in place and tracking the revenue from these charges separately would serve as a tool for improved budgeting, and an incentive for users to reduce damages.

Recommendation 21: Do Not Defer Fleet Replacement

Do not defer fleet replacement purchases. This is an important recommendation, so to reiterate the "findings" in this section of the report, deferring fleet replacement applies tremendous pressure on the fleet maintenance infrastructure. Additional maintenance space, additional technical staff and additional maintenance dollars increase while vehicle downtime and reduced worker productivity are seen. What results are the current chronic maintenance issues discussed above and the significantly inflated fleet size. The Town is charged with providing services to taxpayers; realize that having a vehicle down for maintenance does not eliminate the need to deliver promised services in a timely manner. As vehicles become less dependable, incur more unscheduled maintenance, and spend longer periods in the maintenance shop, the Department heads look for solutions to keep their employees productive. One such solution is to retain vehicles as they are replaced rather than permitting them to be retired. As mentioned, this provides the needed backup or spare vehicle.

Even the best replacement planning efforts will fail if the appropriate funding to renew the fleet is not available. **It is important to recognize that a dollar of fleet replacement funding deferred is not a dollar saved.** Fleet assets wear out. Over time they not only become more unreliable, but more costly and unsafe to operate. Decisions to defer replacement for a particular unit or type beyond its planned service life will impact the average maintenance and repair costs for those units. It will also affect the manner in which the unit is utilized due to its actual or perceived drop in reliability. Significant deferment, in our experience, also leads to an overall increase in the size of the fleet due to the need, real or not, to have spare vehicles available. The ultimate need to replace the unit in question is not eliminated; it is only delayed to another year then another year and so on.

11.0 PARTS OPERATION

The cost effective and timely provision of high-quality repair parts to the maintenance staff is another key element in the overall success of the DPW Garage. The organization of the parts supply function, the timely procurement of parts, parts inventory management, warehousing, and inventory control, all impact overall management success.

The DPW Garage currently has a limited parts program. Several factors affecting the parts operation include:

- Limited available space due to shop clutter and unused legacy parts
- Lack of an electronic parts tracking and management system
- Lack of general parts organization and inventory control

Weston & Sampson has a series of recommendations in order to better organize and manage the current parts operation. In reviewing the adequacy of stock mix and amount it was seen that there is generally inefficient and cluttered parts storage in the current facility that prevent a true analysis from being completed. There are many parts that appear to be obsolete or have not been touched in years, and these are stored in the same location as newer parts. Due to the unkempt nature of the parts storage area on the mezzanine of the DPW Garage, it would be difficult to find or access parts efficiently on a consistent basis (see photos in Appendix G). It is also our understanding that there are personal items being stored on the mezzanine and in the workshop area that further make it difficult to have an organized parts operation. These personal items add clutter and confusion for staff who are looking for parts and equipment needed to maintain the Town's vehicles.

Key aspects of a parts management operation involve the following:

- Documentation of all existing inventory
- Tracking how often each part is used or "turned" on an annual basis
- Organizing inventory into categories so that parts can be located easily

When considering outsourcing of the parts operation, we have determined that this would not be a beneficial use of resources, given the size of the fleet operations. Outsourcing the parts operation would put the Town into a binding agreement, and if there happens to be poor contractual performance that affects the shop's efficiency in any adverse way, it will cost the Town money. Furthermore, all parts would be sold to the Town as dispensed and marked up at 10% of the gross profit of their purchase price, not the market price.

Recommendation 22: Construct a New Parts Room

When the new DPW is constructed, the Town should utilize a full-sized parts storage room. This room will be sized to keep enough of the frequently used parts on hand when necessary. This minimizes the need for an employee to buy parts from a local store when the supply company cannot provide it in a timely manner, minimizing down time. This will give the Town more flexibility on where to purchase parts, and potentially obtain more competitive pricing, as they will be less reliant on vendors on the island that have the ability to deliver parts more quickly.

Recommendation 23: Implement Electronic Inventory Control

The Town did not appear to currently have controls and reporting of stock maintained at the DPW Garage. We recommend the Town integrate electronic tracking of the parts inventory with a VMIS. This system will allow the mechanics to quickly and efficiently obtain the basic parts needed, and track parts used. There are many services that can do this, but the general management system functions should include at the minimum:

- Part type, quantity, and cost
- Inventory type and manufacturer
- Generate and store frequently used parts lists
- Receive ticket tracking by vendor
- Low stock point and re-ordering reminders
- Bar code tracking capabilities
- Turnover rate

This system will give the Town an annual turnover rate of parts that can further be assessed to better stock inventory. Typically, the total turnover rate for parts should be 4-6 times per year. If a part is not being issued 4-6 times per year, it should not be kept in stock constantly and can likely be purchased on an as-needed basis, unless there is a supply chain issue with the part.

Recommendation 24: Establish Accounts Under Fleet Manager

All accounts relating to the ordering of parts for the DPW Garage should be established under the Fleet Manager. We understand that some parts are ordered through the Sewer Department because they have accounts already set up with certain parts providers. All parts ordering for the DPW Garage should be independent to facilitate simple tracking of costs and streamline any inefficiencies that come from coordinating parts orders through other departments.

Recommendation 25: Utilize Sourcewell for Parts

If the DPW Garage is not already, they should subscribe to a membership called Sourcewell (previously the National Joint Powers Alliance). This is a government subsidized organization that offers the purchase of parts and major components for trucks and equipment that have already been bid. It is our understanding that the Sewer Department is already using this resource. The following is a link to the fleet parts section of their website, with step by step instructions:

https://www.sourcewell-mn.gov/

Recommendation 26: Check Parts Pricing Annually

The best way to search for good pricing and delivery options is to send a request annually to vendors asking for their pricing structures. Many parts houses, truck dealers and equipment distributors offer a host of pricing structures as follows:

- Municipal
- Jobber
- Retail

- State
- Wholesale Distributor (WD)

Many will work hard to get you as a customer and the rapid delivery of parts can greatly expedite the repair times. All purchases should be made through the DPW Garage utilizing proper Town bidding procedures. Furthermore, warranty tracking procedures must be put in place that can save the Town thousands of dollars annually.

Recommendation 27: Perform Annual Inventory Audit

The Town should be performing an annual inventory audit in accordance with State requirements.

12.0 SHOP OPERATIONS

The cost-effective utilization of in-house maintenance resources should minimize maintenance, decrease repair turn-around time and decrease equipment downtime. Processes should be in place to improve the scheduling of work into the shop in advance, and for performing minor repairs while the driver/operator waits. Service hours and scheduling processes should be flexible enough to accommodate vehicle user's work schedules. In addition, they should serve to maintain a steady flow of work to mechanics. The goal is to avoid the peaks and valleys (management by crisis) associated with unplanned service demands.

Work orders (WO) should be created as soon as the vehicle is presented to the shop and be used to document all maintenance and report services accomplished, by vehicle. Preferably the Fleet Manager should be the individual to open a work order and should estimate the time required to complete the work by referencing an appropriate flat rate manual, past experience or, once developed, an in-house time standard. This is not to insinuate that you should use flat rates to accomplish work but use it as a tool to estimate the repair flow in the shop.

Although many of the topics discussed in this section have been introduced in previous sections of the report, it is important to summarize our findings from the interview process and tour of the DPW Garage with the mechanics.

Work orders are generated when a vehicle user notices an issue with their vehicle during their circle checks or while operating the vehicle. All work orders are currently kept in paper format. Photos of an example work order and circle check form are included in Appendix H. It is our understanding that the work orders are kept on file, but this information has not been transferred into a VMIS to this point. Work orders include information about the parts required, description of the problem or work to be completed, as well as general information about the vehicle (i.e., odometer reading, vehicle number, plate number), driver who requested service, and date the service was requested. Both scheduled and unscheduled repair/maintenance requests are common for the DPW Garage.

There is only one shift for the shop, and it is open from 7 AM to 3:30 PM on weekdays. The Fleet Manager is the head of the DPW Garage and gives verbal instructions to the mechanics regarding their assignments. While the Fleet Manager is not authorized to perform maintenance tasks because of the union contract, he provides training to the mechanics on how to perform the tasks when needed. There was no mention of a structured priority system for the DPW Garage during our conversations. We understand that the mechanics have been catching up on many repairs to get vehicles back on the road, so the priority has been to address this backlog and then start working on PM for the fleet.

With the DPW Garage being a small operation in its current form, the assignment and control of work within the shop is relatively straightforward. The mechanics and Fleet Manager are all working in the same building, and the task that each person is working on should be relatively apparent and easily communicated. However, as the operation expands to more mechanics, more devoted attention will need to be paid to how work is assigned, how long tasks are taking, and the quality of each mechanic's work. Quality assurance procedures should already be in place in the DPW Garage, though it is our understanding that there are no formal policies governing the quality of work produced.

Recommendation 28: Electronic WO Tracking

Develop an electronic work order tracking system or purchase a separate Vehicle Management Information System (VMIS) software package to accomplish this. The Work Order System should be able to track multiple items, including but not limited to, the following functions:

- Vehicle ID
- Driver
- Date initiated/completed
- Repair/work order type/category
- Estimated and actual labor hours spent
- Fully burdened cost of labor
- Parts numbers and costs
- Material types, quantities, and costs

In general, the Work Order system should be able to easily capture all costs associated with maintaining and repairing each vehicle. This information shall then be used to help assess the need to replace the vehicle, in accordance with the Town's Vehicle Replacement Plan, as described in this report. As mentioned in *Recommendation 18*, if the shop becomes paperless and work orders can be entered directly into the system right away via tablets or laptops, it will increase shop efficiency. If the Fleet Manager would like to keep paper backups of the work orders, it would be better to print reports from the VMIS rather than initiating the work orders on paper copies to be entered into the system later. If handwritten work orders are generated first, there is a higher likelihood that they will be put aside and never entered into the system. A person wishing to use the DPW Garage for their vehicle maintenance/repair should also have the option to submit an electronic request through the VMIS, to be processed by the Fleet Manager into a work order upon confirmation with the user and delivery of the vehicle.

13.0 FLEET SIZE

Weston & Sampson was provided with a list of vehicles within the Town fleet. In order to understand more clearly how these vehicles are being utilized, more information about the annual mileage and engine hours would be required. We understand that mileage data for all vehicles is being collected from the departments. Once these baseline readings are established and documented, future readings can be used to analyze usage of each vehicle over time to determine what level of utilization is occurring. The Town can streamline the process of future data collection by requiring the mileage for all vehicles be entered into the FMIS prior to fueling. This will make all data available electronically wherever the FMIS data is accessible.

It should be noted that data should be analyzed in cooperation with those who use the vehicles on a daily basis, and the Fleet Manager, if the analysis is being performed outside of their purview. Simple data analysis without user or Fleet Manager input could yield false conclusions. For example, a simple data analysis may show that only 2,000 miles have been driven on a certain vehicle over the course of a year. This would indicate that the vehicle is underutilized. However, when department staff are asked about this vehicle, they say that the vehicle was out of service for 8 months due to a national parts shortage associated with its repair. Staff input for any conclusions is critical, and any discussions on the expansion or reduction of the fleet size should involve user input.

Recommendation 29: Calculate Annual Usage

Implement odometer/engine hours data entry into typical fueling operations, and use this data collected in the Fuelmaster FMIS to calculate the annual mileage or engine hours of vehicles in the fleet. Compare the usage against the median usage across all vehicles in the fleet to determine high use versus low use vehicles. This data can be used to establish whether fleet expansion or reduction in the future is necessary. Because Nantucket is an island with unique vehicle usage patterns, comparing usage to the median found in the fleet itself will yield the most useful results, as opposed to using national averages. Using the median instead of the average will also help to lower the effect of outlier data on either end of the usage spectrum.

14.0 CONTRACTING

In any Town fleet maintenance operation, contracting special services to outside entities is essential for maintaining efficient operations. A rule of thumb is that roughly thirty percent of repairs and maintenance should be subcontracted out in a central fleet operation. However, with the shortage of mechanics in the DPW Garage, it our estimation that more than thirty percent of the work is being performed by outside contractors out of necessity. Traditionally, there are certain types of repairs that are best performed outside of the DPW Garage. These outsourced repairs typically include:

- Warranty work
- Glass replacement
- Transmission work
- Upholstery repair
- Painting
- Collision damage repair
- Rebuilding engines and other major, long-term repairs

Given the current workload in the DPW Garage, they do not have time for any repairs or maintenance above and beyond the standard fluid changes, tire changes, wheel balancing, brake work, and other relatively small repairs.

The DPW has been buying construction equipment from companies like CN Wood, where they have the option of purchasing a service agreement at the same time. They have been purchasing these service agreements, and we recommend that they continue this practice. Until there are more trained/certified mechanics on staff who can efficiently service heavy duty equipment/vehicles, the Town needs to take advantage of the service agreements offered.

While there is no official agreement, Town vehicles are also regularly taken to the Don Allen Ford dealership for maintenance and repairs. The Town has long bought Ford vehicles so that warranty and specialty work, as well as routine maintenance could be easily done on the island. In conversations with Don Allen Ford, Weston & Sampson has been told that the dealership cannot expand their services beyond what they are currently doing for the Town. It is our understanding that there is currently no opportunity for Don Allen mechanics to supplement the DPW Garage in any official/contractual capacity.

The Town also uses several other on island and off island maintenance garages for the fleet. The Police, for example, send their vehicles off the island to MHQ when necessary, and the Fire Department uses Billy Built Automotive for maintenance of their ambulances. The Fire Department also brings a mechanic to the island periodically for fire truck maintenance and repairs.

As previously mentioned in Section 11, the DPW Garage operation is not large enough to warrant outsourcing the parts management. The DPW should instead focus on building a network of mechanics both on island and off island who can service vehicles and keep the fleet in good condition.

It is understood that there are very few mechanics on the island, but it would be possible to supplement the DPW Garage operation using a company such as First Vehicle Services. First Vehicle can develop a contract with the Town to send their mechanics to the island for whatever level of service is agreed

upon. They could even take over the entire operation if the Town thought this was the best course of action. In this scenario, First Vehicle would look to hire the existing DPW Garage staff and train them, given they meet their employment criteria. Having an outside company take over the DPW Garage operation completely would certainly include its challenges, such as housing for additional mechanics and union contracts, but it is an option that may be worth exploring.

Recommendation 30: Formal Maintenance Agreement

Consider hiring a fleet service specialist, such as First Vehicle Services, to either supplement current DPW Garage operations, or to take over fleet maintenance for the Town entirely. As discussed, there are challenges that would need to be overcome in the process of creating an agreement, but it should be considered as an option. There are other operations in the region who have outsourced their maintenance to First Vehicle such as Chelsea, MA, the Maine DOT, and Newport, RI. During our initial conversations with First Vehicle, they mentioned that they have taken over operations for several high end resort towns in Colorado that would have similar challenges to Nantucket in terms of accessibility and high cost of living. One additional advantage to using these services would be the proprietary VMIS software that they would implement. They would inspect the entire fleet, enter data into their software, and maintain paperless shop records thereafter. The Town would not need to invest in a separate VMIS, or implement it on its own.

15.0 MANAGEMENT INDICATORS

Similar to any other operation, vehicle maintenance requires attention to key performance indicators to ensure that users are receiving quality and timely service. These indicators include, but are not necessarily limited to:

- Turnaround time
- Repeat services
- Downtime
- Parts management
- Preventative maintenance compliance
- Mechanic productivity

Currently these management indicators are difficult to track and analyze due to the lack of electronic record tracking. With the implementation of a VMIS, data can be analyzed and summarized to track the performance of the DPW Garage and to identify areas that can be improved. Appendix D includes key performance indicators for the shop for reference, based on industry standards.

Turnaround time can easily be tracked by the time a vehicle was received compared to the time it was returned. These service times can be compared to industry standards for specific repairs or maintenance. Tracking the exact services provided for each job electronically will provide context behind the turnaround times and help to explain any deviations from industry standard expectations. If any unexpected challenges arise during the service, these should be noted, and the vehicle user should be informed of any resulting delays.

Repeat services can be an indication of several issues, including, but not limited to:

- Quality of workmanship
- Unresolved endemic issues (e.g., salty air causing rust)
- Certain vehicles could simply be “lemons”
- User-related problems
- Faulty parts

While the causes of repeat services can vary greatly, the foremost priority is developing the VMIS database so that the Town has the tools to identify repeat services and then start asking why it is happening.

For the purposes of this report, downtime is used as a measure of long term repair time. While the DPW Garage should not be undertaking complicated, long term repairs as previously discussed, downtime should still be tracked by the Fleet Manager for each vehicle when repairs are outsourced. Downtime tracking provides another indicator of overall fleet health.

Parts management has been discussed previously in Section 11, but maintaining a clear record of parts inventory and tracking usage can allow for further analysis of fleet health and shop efficiency. If certain parts are being used more than they should be, there may be an overarching problem with how the fleet is being used or how service is being carried out.

Preventative maintenance compliance tracking is a straightforward indicator of fleet operations. If PMs are not being performed when they are due, there is an obvious problem to be addressed. VMIS software can track when PMs are due and when they are carried out. Ideally, each vehicle in the VMIS would have a PM schedule outlined so that all the information is readily available to the Fleet Manager.

Mechanic productivity is also an obvious indicator of DPW Garage operations. If mechanics are consistently taking more hours to complete a task than what would be expected, it could indicate that more training is needed, there is a lack of incentive for efficient work, the condition of the vehicles is hindering efficiency, etc.

Recommendation 31: Annual Management Indicator Evaluation

Perform an annual evaluation of the criteria listed in Section 15. Though it is not technically necessary to perform the analysis, implementing a VMIS prior to the evaluation will greatly expedite the review process. The VMIS, depending on the final package, may be able to complete most of this analysis as a basic function of the software. If this is not the case, as long as data can be exported to a spreadsheet format, simple spreadsheet manipulation and formulas will help to identify problem areas for the fleet and mechanics.

16.0 GREEN FLEET TRANSITION

Green Communities Program

In April 2020 the Town of Nantucket received a grant of $139,340 from the Commonwealth of Massachusetts Department of Energy resources by becoming a Green Community. This requires the Town to purchase only fuel-efficient vehicles as part of the program. These requirements are outlined in Appendix F. A fuel efficient vehicle policy has been adopted in order to qualify for the program.

The Town has been developing an inventory list of all vehicles, including the information on drive system (2WD, 4WD, or AWD), weight, exemption status, and MPG rating per vehicle. The Town has adopted a fuel efficient vehicle replacement policy in conformance with the Green Communities Program requirements, which dictate that non-exempt vehicles, "shall be replaced when they are no longer operable and will not be recycled from one municipal department to another unless the recycled replacement is more efficient than the vehicle it is replacing. In addition, when replacing exempt vehicles, the function of the vehicle will be reviewed for potential replacement with a more fuel efficient vehicle, including a fuel efficient non-exempt vehicle." The replacement vehicles are required to be fuel efficient vehicles per the criteria outlined below. While the Town has adopted a fuel efficient vehicle policy, there is currently no process in place for ensuring new vehicles requested by the various departments meet the Green Communities requirements. There is a lack of Town-wide knowledge of this program that needs to be addressed.

Per Appendix F, a fuel-efficient vehicle is defined by vehicles that have a combined city and highway MPG no less than the following:

- 2 wheel drive car: 30 MPG
- 4 wheel drive car: 29 MPG
- 2 wheel drive van: 22 MPG
- 4 wheel drive van: 20 MPG
- 2 wheel drive pick-up truck: 21 MPG
- 4 wheel drive pick-up truck: 18 MPG
- 2 wheel drive sport utility vehicle: 24 MPG
- 4 wheel drive sport utility vehicle: 21 MPG

Please note: all Hybrid or electric vehicles in these vehicle classes will meet the above criteria. Many vehicles that meet the above criteria can be found on statewide contract, VEH110.

The requirements listed above apply to all new vehicles purchased, with a few exemptions. The exemptions include off-road vehicles, motorcycles, and heavy-duty vehicles. Heavy-duty vehicles are defined as having a manufacturer's gross vehicle weight rating (GVWR) of more than 8,500 pounds. We found this to typically be any vehicle larger than a standard Ford F150. In addition, police cruisers are exempt from the criteria until July 1, 2023 based on market availability.

Electric Fleet Transition

With the transition to fuel efficient vehicles as a part of the Town's Green Communities Program requirements, the adoption of electric vehicles into the fleet will fit easily into this mission. The Town has already purchased one electric vehicle and one hybrid vehicle, and they are exploring how fleet electrification can be implemented through a separate study being performed by National Grid. While transitioning the Town's fleet to electric vehicles will require infrastructure improvements related to electrical service and charging stations, it will also have effects on future fleet maintenance operations.

Much of the current equipment in the DPW Garage will aid in maintaining electric vehicles in the future. Standard lifts and equipment would likely be able to be used for the new EVs, though existing lifts may need attachments and additions to manage pulling out the batteries of EVs. It is expected that tire, wheel, and brake maintenance would be much the same for EVs as compared to traditional internal combustion engine vehicles.

In order to transition the maintenance garage to be optimized for maintaining a fleet of electric vehicles, there would ideally be a battery storage room. The battery storage room would be used for storing large banks of batteries. It would consist of wash stations, storage racks, and handling equipment. This room would ideally be forklift accessible. There is equipment available to assist with all types of battery extraction: rear, side, overhead, and underneath. This equipment includes powered mobile lift tables (underneath extraction), battery transfer carriages (rear and side extraction), and automotive battery racks for the small lead acid batteries. The batteries would then be placed on the powered mobile lift tables and be brought to the battery storage room for storage. The room would ideally be equipped with pallet racks and battery roller stands for storing batteries. Battery wash stations could also be located in the battery storage room. These stations would allow both lithium-ion batteries and any lead acid batteries to be washed and maintained in accordance with manufacturer recommendations. It is also understood that battery testing may be required as a part of typical maintenance operations.

To best serve a future electric fleet, Weston & Sampson suggests the mechanics complete the "Light Duty Hybrid/Electric Vehicle Specialist Certification Test (L3)". This test is administered through The National Institute for Automotive Service Excellence (ASE). This training would aid the mechanics in the following:

- Perform high voltage disconnect procedure; reconnect/enable high voltage system.
- Select, test, and use proper safety gloves.
- Select, qualify, and use proper electrical testing equipment and leads.
- Retrieve and diagnose diagnostic trouble codes (DTCs); determine needed repairs.
- Diagnose problems caused by damaged or failed harnesses, connectors, terminals and fuses.
- Diagnose high voltage (HV) battery pack malfunctions.
- Remove and install high voltage battery pack.
- Test, diagnose and repair high voltage leaks/loss of isolation.
- Test, diagnose and repair high voltage battery pack heating and cooling systems.
- Test, diagnose, repair or replace high voltage battery pack internal components.
- Test and diagnose charging problems when using electric vehicle supply equipment (EVSE)

Weston & Sampson suggests all other work to be subcontracted out to the dealership, and work on these vehicles at the DPW Garage is performed only after confirming with the manufacturer that no warranties will be voided and there are no safety concerns.

For electric vehicles, traditional engine oil is not needed, and fewer bulk fluids would need to be stored if the Town transitions to a significant amount of EVs in the fleet. However, fluid storage could not be eliminated in its entirety, as EVs still require windshield washer fluid, transmission fluid, brake fluid, coolant, grease, power steering fluid, etc. Oils for heavy duty equipment internal combustion engines would likely still need to be stored at the facility as well, as these pieces of equipment are more difficult to replace with electric vehicles than the standard light duty, on road vehicles.

The Town currently owns one EV, a Nissan Leaf for the Tourism Department. Nissan provides a maintenance schedule in its Service and Maintenance Guide. This guide provides a good representation of the general maintenance requirements for light duty EVs. General maintenance activities include:

- Tire rotation
- Inspections of the following:
    - Axle and suspension parts
    - Brakes
    - Drive shaft boots
    - Suspension
    - Steering gear and linkage
    - Steering linkage ball joints
    - Charging port
    - Gear oil
    - Battery
- Brake fluid change
- Cabin microfilter change

While Nissan recommends that vehicles be serviced at the dealership, it is not necessarily a requirement for standard preventative maintenance. However, if there is a leak or damage to the lithium-ion battery, the Nissan dealer shall be contacted immediately. The Lithium-ion battery coverage is 96 months/100,000 miles. The Nissan dealers are trained specifically for these Nissan Leaf battery issues and should be contacted when there are major battery problems. Otherwise, standard maintenance procedures should be able to be performed by the Town, in accordance with the vehicle warranty terms.

APPENDIX A

Fleet VEU Analysis

DRAFT

Town of Nantucket
Fleet Vehicle Equivalency Analysis Summary

Department	VEU [1]	APWA MRU [2]	Man Hours Required Per Year	Yearly Billable Hours Per Mechanic [3]	Mechanics Needed	Maintenance Bays Needed [4]
Finance/Assessors	2	22	44	1516	0.03	-
Fire Dept (Non-Emergency Vehicles) [5]	17.2	22	378.4	1516	0.25	-
Harbormaster	4.8	22	105.6	1516	0.07	-
Health Dept	7	22	154	1516	0.10	-
Misc. [6]	24	22	528	1516	0.35	-
Natural Resource	7.2	22	158.4	1516	0.10	-
Our Island Home	7.5	22	165	1516	0.11	-
Plus	6.5	22	143	1516	0.09	-
Public Works	114.1	22	2510.2	1516	1.66	-
Sewer Department	50.8	22	1117.6	1516	0.74	-
Tourism	1	22	22	1516	0.01	-
Town Administration	1	22	22	1516	0.01	-
Subtotal	**243.1**		**5348.2**		**3.5**	**4.8**
Additional Departments						
Airport (Not Assessed)	N/A	N/A	N/A	N/A	N/A	N/A
Fire Dept (Emergency/Specialty Vehicles) - Standard Maintenance [8]	48.5	22	1067	1516	0.70	-
Fire Dept (Emergency/Specialty Vehicles) - Special Maintenance [9]	37	22	814	1516	0.54	-
Marine	6	22	132	1516	0.09	-
Land Bank [7]	30.1	22	662.2	1516	0.44	-
Police	88.1	22	1938.2	1516	1.28	-
School [7]	9.8	22	215.6	1516	0.14	-
Sewer Department - Special Maintenance [9]	6	22	132	1516	0.09	-
Water Company [7]	14.9	22	327.8	1516	0.22	-
Subtotal	**240.4**		**5288.8**		**3.5**	**4.7**
Grand Total	**483.5**		**10637**		**7.0**	**10**
Total of Highlighted Rows (Planning for Expanded Central Fleet Maint. at New DPW Facility)	**352.4**		**7752.8**		**5.1**	**7.2**

[1] VEU stands for Vehicle Equivalency Unit. VEUs symbolize the level of effort required to maintain a vehicle and were assigned based on APWA and industry standards.

[2] MRU stands for Maintenance and Repair Unit. There are 22 MRUs per VEU, which show that each VEU requires 22 hours of labor per year by a mechanic, per APWA standards.

[3] The 1516 billable hours per year represents time spent doing actual repair work, and excludes time for vacation, sick time, training, custodial, and other indirect time.

[4] The number of maintenance bays is calculated by assuming 1 dedicated PM bay with 1 dedicated PM mechanic, then the remaining number of mechanics is multiplied by 1.5 bays per mechanic and added to the 1 PM bay.

[5] Fire Dept (Non-Emergency Vehicles) VEU calculation does not include fire trucks and other specialty vehicles. It includes SUVs, pickup trucks, trailers, etc.

[6] "Misc." VEUs are associated with an assumed 80 pieces of equipment with small engines across all departments that will be maintained by the DPW mechanics.

[7] Vehicles from these departments were not originally included in the scope of the study, but are shown as possible additional vehicles for DPW mechanics to maintain.

[8] Fire Dept (Emergency/Specialty Vehicles) VEU calculation includes only VEUs associated with standard maintenance for emergency vehicles that can be performed by the DPW Garage, such oil changes, tire changes, etc.

[9] Special maintenance associated with the specialty vehicles in these departments is accounted for with these categories (e.g., If full maintenance of a fire truck is 6.5 VEUs and the DPW Garage can do 3 VEUs of non-specialty maintenance, the remaining 3.5 VEUs go in "Special Maintenance" category).

General Notes:

a) See attached table for VEU breakdown by vehicle. Vehicle information and unit #s are as provided by the Town.

b) As detailed information on the fleet is not available, VEU analysis was performed assuming average conditions and industry standard estimates for VEU assignments. This analysis establishes a benchmark for evaluating fleet maintenance needs, and will need to be further assessed as fleet data becomes available.

P:\MA\Nantucket MA\Fleet Study\Fleet Information\[CAUT excel spreadsheet showing vehicles thru 011222.xlsx]By#

#	MAKE	MODEL	YEAR	VIN	VEHICLE SPECIAL PURPOSE	GROSS VEHICLE WEIGHT RATING (LBS.)	DEPARTMENT	VEU
8	JOHN DEERE		1988	DW644EB518874	LOADER		AIRPORT	NOT ASSESSED
6	OSKOSH	FIRE	1989	10T9L5BHK1037629	TRUCK	>8,500	AIRPORT	NOT ASSESSED
11	FORD		1994	1FDYK82E0RVA27067	DUMP	>8,500	AIRPORT	NOT ASSESSED
22	FORD	F250	1999	1FTNF21F4XEB69678	PICKUP	>8,500	AIRPORT	NOT ASSESSED
25	EAG. BEAVER	FLATBED	2001	112HTN3041L055959	TRAILER		AIRPORT	NOT ASSESSED
34	OSHKOSH		2002	10TBK8Z1025072137	FIRE TRUCK	>8,500	AIRPORT	NOT ASSESSED
43	LOAD RITE		2002	5A4KRAL1X22050148	TRAILER		AIRPORT	NOT ASSESSED
35	AM GENERAL	HUMMER	2003	137FA553X3E202023	TRUCK	>8,500	AIRPORT	NOT ASSESSED
33	JOHN DEERE		2003	DW724JX586227	LOADER		AIRPORT	NOT ASSESSED
38	FORD	EXPEDITION	2004	1FMPU16L04LA05967	UTILITY	7450	AIRPORT	NOT ASSESSED
46	FORD	F550	2004	1FDAF57P74ED45033	TRUCK	>8,500	AIRPORT	NOT ASSESSED
40	STERLING		2004	2FZAAWAK24AM87574	DUMP	>8,500	AIRPORT	NOT ASSESSED
47	FORD	F350	2005	1FDWF31P65EB93489	PICKUP	>8,500	AIRPORT	NOT ASSESSED
64	FREIGHTLINER	FC80	2006	1FVAB6BV56DDW22321	SWEEPER	>8,500	AIRPORT	NOT ASSESSED
66	CARGO EXPRESS	ENCLOSED	2006	4U01C14226A029793	TRAILER		AIRPORT	NOT ASSESSED
67	FORD	EXPLORER	2007	1FMEU73E17UA47417	UTILITY	6160	AIRPORT	NOT ASSESSED
100	JOHN DEERE	772c	2010	DW772GP627874	GRADER		AIRPORT	NOT ASSESSED
104	ELDORADO	1871	2011	1FDEE3FL4BDB09630	BUS	>8,500	AIRPORT	NOT ASSESSED
105	ELDORADO	1871	2011	1FDEE3FL6BDB09631	BUS	>8,500	AIRPORT	NOT ASSESSED
149	FORD	F350	2012	1FDRF3HT4CFC05586	PICKUP	>8,500	AIRPORT	NOT ASSESSED
132	JOHN DEERE	724K	2014	1DW724KZTED661804	LOADER		AIRPORT	NOT ASSESSED
196	JOHN DEERE	COMPACT LOADER	2014	1T0319EJTEJ263876	LOADER		AIRPORT	NOT ASSESSED
142	FORD	F250	2015	1FT7X2BT8FEB98500	PICKUP	>8,500	AIRPORT	NOT ASSESSED
158	OSHKOS	FIRE	2015	10TADLJF8FA774072	TRUCK	>8,500	AIRPORT	NOT ASSESSED
166	Ford	EXPLORER	2016	1FM5K8D8XGGB43646	SUV	6160	AIRPORT	NOT ASSESSED
177	FORD	F250	2016	1FT7W2B63GEB89010	PICKUP	>8,500	AIRPORT	NOT ASSESSED
184	FORD	F350	2016	1FDWE3FSXGDC55730	VAN	>8,500	AIRPORT	NOT ASSESSED
	FORD	F150	2018	1FTMF1EBXJKE40622	PICKUP	7050	AIRPORT	NOT ASSESSED
	FORD	EXPLORER	2019	1FM5K8D86KGA62426	UTILITY	6160	AIRPORT	NOT ASSESSED
	FORD	F550	2019		OTHER		AIRPORT	NOT ASSESSED
	FORD	E350	2021		OTHER		AIRPORT	NOT ASSESSED
	FORD	F350	2021		OTHER		AIRPORT	NOT ASSESSED
55	FORD	RANGER	2206	1FTYR15E56PA10929	PICKUP	6050	AIRPORT	NOT ASSESSED
133	FORD	EXPLORER	2006	1FMEU74E06UB30012	UTILITY	6160	FINANCE/ASSESSORS	1.0
128	FORD	EXPLORER	2014	1FM5K8AR1EGA70886	UTILITY	6160	FINANCE/ASSESSORS	1.0
178	AM GENERAL	HMMWV	1986	15711	CARGO	>8,500	FIRE DEPT	2.0
169	AM GENERAL	HMMWV	1992	3101609	CARGO	>8,500	FIRE DEPT	2.0
167	STEWAR	M1088	1998	T010771BDJG	TRACTOR		FIRE DEPT (EMERGENCY/SPECIALTY VEH)	5.0
168	STEWAR	M1088	1998	T010762BDJC	TRACTOR		FIRE DEPT (EMERGENCY/SPECIALTY VEH)	5.0
52	CHEVROLET	K2500 SILVERADO	2005	1GCH29U45E319247	PICKUP	>8,500	FIRE DEPT	2.0
57	WELLS CARGO	UTILITY	2006	1WC200J2368009291	TRAILER		FIRE DEPT	0.3
62	WELLS CARGO	UTILITY	2006	1WC200J2568009650	TRAILER		FIRE DEPT	0.3
63	WELLS CARGO	UTILITY	2006	1WC200J2668009866	TRAILER		FIRE DEPT	0.3
218	FORD	EXPEDITION	2010	1FMJU1G55AEA29042	UTILITY	7450	FIRE DEPT	2.0
102	FOAM	TANK	2010	1S9FT192X00407231	TRAILER		FIRE DEPT	0.3
171	FORD	EXPEDITION	2016	1FMJU1G12FEG23463	SUV	7450	FIRE DEPT	2.0

#	MAKE	MODEL	YEAR	VIN	VEHICLE SPECIAL PURPOSE	GROSS VEHICLE WEIGHT RATING (LBS.)	DEPARTMENT	VEU
183	FORD	F150	2016	1FTX1EG3GFA34670	PICKUP	7050	FIRE DEPT	2.0
185	FORD	EXPEDITION	2016	1FMJU1GTXGEF15529	UTILITY	7450	FIRE DEPT	2.0
	FORD	EXPEDITION	2019		FIRE TRUCK		FIRE DEPT	2.0
	FORD	F550	2020		FIRE TRUCK		FIRE DEPT (EMERGENCY/SPECIALTY VEH)	2.5
1	FORD	F800	1988	1FDYK84A1JVA47293		>8,500	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	3.0
2	FREIGHTLINER		2002	1FVDBWBV72HH85572	TRUCK	>8,500	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	3.0
42	FREIGHTLINER	RESCUE	2004	1FVABXCS54HM57595	TRUCK	>8,500	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	3.0
58	HME	1871-P2	2005	44KFT428X5WZ20647	FIRE TRUCK	>8,500	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	3.0
68	FORD	FREIGHTLINER	2007	1FVDCYDJ77HX06683	FIRE TRUCK	>8,500	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	3.0
80	FORD	CABCHASSIS	2007	3FRML55Z67V554788	TRUCK	>8,500	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	3.0
88	FORD	F450	2008	1FDXF46R68EB78256	AMBULANCE	>8,500	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	**1.5**
97	HME	SPO	2009	44KFT428X8WZ21477	FIRE TRUCK	>8,500	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	3.0
106	HME		2011	44KFT4287BWZ22058	FIRE TRUCK	>8,500	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	3.0
130	CHEVROLET	HORTON TYPE III	2013	1GB6G5CL8D1115362	AMBULANCE	>8,500	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	**1.5**
188	FORD	F550	2016	1FDUF5HT8GEC26307	AMBULANCE	>8,500	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	**1.5**
220	FORD	F550	2017	1FDWF54T24DA06877	AMBULANCE	>8,500	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	**1.5**
	ROSENBAUER	CABOVER	2020		FIRE EMERGENCY RESPONSE		FIRE DEPT (EMERGENCY/SPECIALTY VEH)	3.0
	FREIGHTLINER	FIRE	2022		FIRE EMERGENCY RESPONSE		FIRE DEPT (EMERGENCY/SPECIALTY VEH)	3.0
204	LOAD	BOAT	2006	4YPAB23216T041526	TRAILER		HARBORMASTER	0.3
107	FORD	F250	2011	1FTBF2B60BED08537	PICKUP	>8,500	HARBORMASTER	1.5
137	FORD	F250	2015	1FTBF2B69FEB32660	PICKUP	>8,500	HARBORMASTER	1.5
152	FORD	F250	2015	1FTBF2B60FEC98873	PICKUP	>8,500	HARBORMASTER	1.5
83	FORD	RANGER	2008	1FTYR11U68PA20658	PICKUP	6050	HEALTH DEPT	1.5
84	FORD	RANGER	2008	1FTYR11U88PA19253	PICKUP	6050	HEALTH DEPT	1.5
173	FORD	FUSION	2016	2FA6PU6GR189283	SEDAN	3280	HEALTH DEPT	1.0
	FORD	RANGER	2019	1FTER1FH3KLA46003	PICKUP	6050	HEALTH DEPT	1.5
	FORD	RANGER	2019		OTHER		HEALTH DEPT	1.5
19	JOHN DEERE	2755	1983	CD4239T920441	TRACTOR		LAND BANK	3.0
127	CHEVROLET	CUCV	1986	1GCGD34J4GF443492	PICKUP	>8,500	LAND BANK	1.5
170	AM GENERAL	HMMWV	1992	006978	CARGO	>8,500	LAND BANK	2.0
23	CASE	MAXXUM	1994	JJF1034294	TRACTOR		LAND BANK	3.0
21	FORD	F350	1997	1FDKF3867VEC42266	TRUCK	>8,500	LAND BANK	1.5
18	LOAD RITE		1997	4L2KY4L16V2000178	TRAILER		LAND BANK	0.3
60	TOWMASTER	T-14DD	2006	4KNUT20276L160588	TRAILER		LAND BANK	0.3
61	ROADRUNNER		2006	IR9PD24236L427038	TRAILER		LAND BANK	0.3
75	VERMER	BRUSH CHIPPER	2007	1VRY1119X71009019	TRAILER		LAND BANK	0.3
90	FORD	F550	2008	1FDAF57Y68EE22991	CHASSIS CAB	>8,500	LAND BANK	2.5
89	LOAD RITE	UTILITY	2008	4ZEUT122381051314	TRAILER		LAND BANK	0.3
123	FORD	F150	2013	1FTPF1FF4DKF94714	PICKUP	7050	LAND BANK	1.5
121	LOAD	UTILITY	2013	4ZECH122XD1943041	TRAILER		LAND BANK	0.3
140	FORD	F250	2015	1FTBF2B62FEC37959	PICKUP	>8,500	LAND BANK	1.5
155	FORD	F150	2015	1FTMF1E82FFA60968	PICKUP	7050	LAND BANK	1.5
156	FORD	F150	2015	1FTMF1E80FFA60967	PICKUP	7050	LAND BANK	1.5
174	FORD	F150	2016	1F7MF1E89GFB30256	PICKUP	7050	LAND BANK	1.5
213	LOADRITE	EP22	2017	5A4DCFV27H2011246	TRAILER		LAND BANK	0.3

#	MAKE	MODEL	YEAR	VIN	VEHICLE SPECIAL PURPOSE	GROSS VEHICLE WEIGHT RATING (LBS.)	DEPARTMENT	VEU
	FORD	F550	2019		OTHER		LAND BANK	2.5
	FORD	RANGER	2020		OTHER		LAND BANK	1.5
	FORD	TRANSIT	2021		OTHER		LAND BANK	1.5
	FORD	RANGER	2022		OTHER		LAND BANK	1.5
	FORD	F250	2013		BOAT TOWING	>8,500	MARINE	1.5
	FORD	F350	2015		BOAT TOWING	>8,500	MARINE	1.5
	FORD	F250	2016		BOAT TOWING	>8,500	MARINE	1.5
	FORD	F250	2017		BOAT TOWING	>8,500	MARINE	1.5
					80 MISC. SMALL ENGINES (0.3 VE EACH)		MISC.	24.0
16	KARAVAN	BOAT	1997	186RLE2UBVF010992	TRAILER		NATURAL RESOURCE	0.3
20	KARAVAN	BOAT	1997	186B0C152VF014867	TRAILER		NATURAL RESOURCE	0.3
91	FORD	F250	2009	1FTSX21579EA10504	PICKUP	>8,500	NATURAL RESOURCE	1.5
172	CHEVROLET	SILVERADO	2017	1GC1KUEG1GF147740	PICKUP	7100	NATURAL RESOURCE	1.5
214	LOADRITE	UTILITY	2017	5A4DCFV2X2011161	TRAILER		NATURAL RESOURCE	0.3
215	LOADRITE	UTILITY	2017	5A4XJRJ18E2019918	TRAILER		NATURAL RESOURCE	0.3
	FORD	F150	2018	1FTFW1E50JKF08963	PICKUP	7050	NATURAL RESOURCE	1.5
	FORD	F150	2019	1FTEW1EB7KFB91002	PICKUP	7050	NATURAL RESOURCE	1.5
49	FORD	F250	2005	1FTNF21525EC51980	PICKUP	>8,500	OUR ISLAND HOME	1.5
49	FORD	F250	2005	1FTNF21525EC51980	PICKUP	>8,500	OUR ISLAND HOME	1.5
72	FORD	ECONOLINE	2006	1FDXE45S16DB03572	BUS	>8,500	OUR ISLAND HOME	3.0
162	FORD	TRANSIT	2015	1FTNR2CM4FKB26221	VAN	4866	OUR ISLAND HOME	1.5
81	FORD	EXPLORER	2008	1FMFU73F58UA18729	WAGON	6160	PLUS	1.0
86	FORD	RANGER	2008	1FTYR11U18PA19255	PICKUP	6050	PLUS	1.5
157	JEEP	PATRIOT	2015	1C4NJRBB3FD437420	WAGON	4575	PLUS	1.0
191	JEEP	PATRIOT	2017	1C4NJRBB2HD208584	UTILITY	4575	PLUS	1.0
192	JEEP	PATRIOT	2017	1C4NJRBB0HD208583	UTILITY	4575	PLUS	1.0
224	JEEP	RENEGADE	2017	ZACCJBAB7HPG30044	UTILITY	4586	PLUS	1.0
28	CARGO	UTILITY	2002	1UK00E2321040839	TRAILER		POLICE	2.4
71	INTERNATIONAL	4300	2007	1HTMMAAL17H502020	TRUCK	>8,500	POLICE	3.0
103	FORD	E250	2011	1FTNE2EL8BDA48136	VAN	>8,500	POLICE	2.0
111	FORD	ESCAPE	2012	1FMCU9DGXCKB80976	UTILITY	4680	POLICE	1.0
113	FORD	E350	2012	1FBNE3BL2CDB25535	VAN	>8,500	POLICE	2.0
117	FORD	F150	2012	1FTFX1EF1CFB96475	PICKUP	7050	POLICE	1.5
114	HD	FLHTP	2012	1HD1FMM12CB668256	M/C		POLICE	1.3
115	HD	FLHTP	2012	1HD1FMM15CB663424	M/C		POLICE	1.3
112	FORD	EXPLORER	2013	1FM5K8D87DGA51230	UTILITY	6160	POLICE	2.4
118	FORD	EXPLORER	2013	1FM5K8D82DGB21023	UTILITY	6160	POLICE	2.4
120	FORD	EXPLORER	2013	1FM5K8AR7DGA89022	UTILITY	6160	POLICE	2.4
122	FORD	EXPLORER	2013	1FM5K8AR4DGA89057	UTILITY	6160	POLICE	2.4
125	FORD	F250	2013	1FT7X2B61DEB00768	PICKUP	>8,500	POLICE	2.4
129	FORD	EXPEDITION	2014	1FMJU1J55EEF15042	UTILITY	7450	POLICE	2.4
143	FORD	K8D	2015	1FM5K8D83FGB62327	SUV	6160	POLICE	2.4
151	FORD	EXPLORER	2015	1FM5K8AR0FGA88605		6160	POLICE	2.4
154	FORD	TRANSIT	2015	1FTSW3XM9FKA59577	VAN	4866	POLICE	2.0
161	FORD	F350	2015	1FT8X3B68FEC82434	VAN	>8,500	POLICE	2.0

#	MAKE	MODEL	YEAR	VIN	VEHICLE SPECIAL PURPOSE	GROSS VEHICLE WEIGHT RATING (LBS.)	DEPARTMENT	VEU
189	FORD	F250	2016	1FT7X2B65GED29653	PICKUP	>8,500	POLICE	2.4
193	FORD	EXPLORER	2016	1FM5K8AR2GGB89212	UTILITY	6160	POLICE	2.4
198	FORD	EXPLORER	2016	1FM5K8AR4GGB89213	UTILITY	6160	POLICE	2.4
202	FORD	EXPLORER	2016	1FM5K8ARAHGB34462	UTILITY	6160	POLICE	2.4
207	FORD	EXPLORER	2017	1FM5K8D83HGC79098	UTILITY	6160	POLICE	2.4
208	FORD	EXPLORER	2017	1FM5K8D81HGC79097	UTILITY	6160	POLICE	2.4
209	FORD	250	2017	1FT7X2B62HED70677	PICKUP		POLICE	2.4
226	FORD	EXPLORER	2018	1FM5K8AR0JGA89956	UTILITY	6160	POLICE	2.4
227	FORD	EXPLORER	2018	FM5K8AR2JGA89957	UTILITY	6160	POLICE	2.4
228	FORD	EXPEDITION	2018	1FMJU1JTXJEA25771	UTILITY	7450	POLICE	2.4
	FORD	EXPLORER	2018	1FM5K8AR0JGA83705	UTILITY	6160	POLICE	
	FORD	EXPLORER	2018	1FM5K8AR3JGC17820	UTILITY	6160	POLICE	2.4
	FORD	EXPLORER	2018	1FM5K8AR3JGC17821	UTILITY	6160	POLICE	2.4
	FORD	EXPLORER	2018	1FM5K8AR3JGC17822	UTILITY	6160	POLICE	2.4
	TOYOTA	CAMRY	2019		POLICE PATROL		POLICE	2.4
	FORD	EXPLORER	2019		POLICE PATROL		POLICE	2.4
	FORD	EXPLORER	2019		POLICE PATROL		POLICE	2.4
	FORD	EXPLORER	2019		POLICE PATROL		POLICE	2.4
	FORD	EXPLORER	2019		POLICE PATROL		POLICE	2.4
	FORD	F150	2019		POLICE PATROL		POLICE	2.4
	FORD	ESCAPE	2020		POLICE PATROL		POLICE	2.4
	FORD	F150	2021		POLICE PATROL		POLICE	2.4
9	MGS	G5	1988	16MG10912JD014914	TRAILER		PUBLIC WORKS	0.3
3	GMC		1989	1GDP7D1G5KV516286	TANKER	>8,500	PUBLIC WORKS	3.0
10	HEAVY	HAULER	1993	1B9UF0815PC301165	TRAILER		PUBLIC WORKS	0.3
14	INTERNTNL		1995	1ZFUF1620SB004046	TRAILER		PUBLIC WORKS	0.3
13	FORD	RANGER	1996	1FTCR11U6TTA11114	PICKUP	6050	PUBLIC WORKS	
24	FORD	F350	2000	1FDWF36S1YED76395	RACK	>8,500	PUBLIC WORKS	1.5
27	HI STRIKET	DUNK	2001	72301	TRAILER		PUBLIC WORKS	0.3
31	VOLVO		2001	G86201022	GRADER		PUBLIC WORKS	5.0
51	FORD	RANGER	2002	1FTZR45E82TA67679	PICKUP	6050	PUBLIC WORKS	
30	FORD	RANGER	2003	1FTZR11U33TA05717	PICKUP	6050	PUBLIC WORKS	
36	FORD	RANGER	2004	1FTZR11U94TA00894	PICKUP	6050	PUBLIC WORKS	1.5
37	FORD	RANGER	2004	1FTZR11U04TA00895	PICKUP	6050	PUBLIC WORKS	1.5
41	FORD	RANGER	2004	1FTZR45E74TA17231	PICKUP	6050	PUBLIC WORKS	
50	ELGIN	PELICAN	2005	S9297D	SWEEPER	>8,500	PUBLIC WORKS	
119	BOBCAT	SKID	2005	525019209	LOADER		PUBLIC WORKS	2.0
54	FORD	RANGER	2006	1FTYR11UX6PA13838	PICKUP	6050	PUBLIC WORKS	
65	VOLVO	L70E	2006	L70EV61136	WHEEL LOADER		PUBLIC WORKS	6.0
216	ANDERSON	TAG ALONG	2006	4YNBN25266C039417	TRAILER		PUBLIC WORKS	0.3
56	FORD	F550	2007	1FDAF57YX7EA99351	DUMP	>8,500	PUBLIC WORKS	
69	FORD	F350	2007	1FTWF31557EA99352	PICKUP	>8,500	PUBLIC WORKS	1.5
73	FORD	RANGER	2007	1FTYR15E37PA56051	PICKUP	6050	PUBLIC WORKS	1.5
139	FORD	F350	2007	1FTWF31597RA99354	PICKUP	>8,500	PUBLIC WORKS	1.5

#	MAKE	MODEL	YEAR	VIN	VEHICLE SPECIAL PURPOSE	GROSS VEHICLE WEIGHT RATING (LBS.)	DEPARTMENT	VEU
	FORD	F150	2007	1FTPX14577FB44805	PICKUP	7050	PUBLIC WORKS	
85	FORD	RANGER	2008	1FTYR11UX8PA19254	PICKUP	6050	PUBLIC WORKS	
79	FORD	F150	2008	1FTVF14508KB29744	PICKUP	7050	PUBLIC WORKS	
85	FORD	RANGER	2008	1FTYR11UX8PA19254	PICKUP	6050	PUBLIC WORKS	
74	CROSS COUNTRY	FLATBED	2008	431FS202X81000106	TRAILER		PUBLIC WORKS	0.3
159	CAT	420E	2008	CAT0420EHHLS07972	BACKHOE		PUBLIC WORKS	5.0
95	FORD	ESCAPE	2009	1FMCU59329KB80753	UTILITY	4680	PUBLIC WORKS	1.0
92	STERLING	DUMP	2009	2FZAAWBS29AAJ9157	TRUCK	>8,500	PUBLIC WORKS	3.0
108	KUBOTA	M4070	2011	M7040DTC187798	TRACTOR		PUBLIC WORKS	3.0
109	FORD	F550	2012	1FDUF5GT1CEA71403	PACKER	>8,500	PUBLIC WORKS	2.5
124	INTL	DUMP	2013	1HTMMAAR7DH482615	TRUCK		PUBLIC WORKS	3.0
131	CARRY	UTILITY	2014	4YMUL1216EV053331	TRAILER		PUBLIC WORKS	0.3
138	JOHN DEERE	5085M	2014	1LV5085MHEJ644262	TRACTOR		PUBLIC WORKS	3.0
150	BOBCAT	LOADER	2014	ALJU1236005022014	LOADER		PUBLIC WORKS	2.0
160	DOWNE	TL718	2015	5RSLU1823FT00596	UTILITY		PUBLIC WORKS	
135	INTL	7400SBA	2015	3HAWHAZT3FL653595	DUMP		PUBLIC WORKS	3.0
153	TRACKLESS ROPS	ROPS	2015	MT61916	CAB		PUBLIC WORKS	3.0
164	VERME	CONST	2015	1VRY1119XF1022478	TRAIL		PUBLIC WORKS	0.3
176	ELGIN	PELICAN	2016	NP30775	SWEEPER	>8,500	PUBLIC WORKS	6.0
175	FORD	F350	2016	1FTRF3B65GEB89007	PICKUP	>8,500	PUBLIC WORKS	1.5
179	FORD	F550	2016	1FDUF5HY6GEB89009	TRUCK	>8,500	PUBLIC WORKS	2.5
200	KM		2016	1K9BU2022GN246272	TRAILER		PUBLIC WORKS	0.3
201	KM		2016	1K9BU242XGN246353	TRAILER		PUBLIC WORKS	0.3
229	LOADRITE	UT8314	2016	4ZEUT1426G1115096	TRAILER		PUBLIC WORKS	0.3
230	LOADRITE	CH8316	2016	4ZECH1625G1115097	TRAILER		PUBLIC WORKS	0.3
190	CHEVROLET	SILVERADO	2017	1GCK2UEG1HZ158662	PICKUP	7100	PUBLIC WORKS	1.5
211	FHT	DUMP	2017	1FVAGCY5HHJE5496	TRUCK		PUBLIC WORKS	5.0
195	FORD	TRANSIT	2017	1FTYR2XM5HKA35095	VAN	4866	PUBLIC WORKS	1.5
206	FREIGHTLINER	114SD	2017	1FVHG3DV2HHJE5494	FIRE	>8,500	PUBLIC WORKS	6.0
187	CAM	SUPERLINE	2017	5JPBU2521JP047291	TRAILER		PUBLIC WORKS	0.3
210	SATELITTE	RESTROOM	2017	4S98E19SXH2345573	TRAILER		PUBLIC WORKS	0.3
219	NORAM	65E	2017	65ET10230	GRADER		PUBLIC WORKS	5.0
222	FORD	F550	2018	1FDUF5HY8JEB13783	DUMP	>8,500	PUBLIC WORKS	2.5
223	FORD	F350	2018	1FTRF3B67JEB13781	TRUCK	>8,500	PUBLIC WORKS	1.5
	FREIGHLINER	M2106	2018	1ALACXFC5JDJN4111	TRUCK	>8,500	PUBLIC WORKS	3.0
	CAT	299D2	2018	CAT0299DKDX203309	LOADER		PUBLIC WORKS	5.0
	CAT	CS448	2018	CATCS44BPCS300638	COMPACTOR		PUBLIC WORKS	5.0
	FORD	F550	2019	1FDUF5HY4KED88620	DUMP	>8,500	PUBLIC WORKS	2.5
	FORD	F550	2019	1FDUF5HY8KED8861	TRUCK	>8,500	PUBLIC WORKS	2.5
	FREIGHTLINER	SD114	2019	1FVAG3FEXJHJs1193	TRUCK	>8,500	PUBLIC WORKS	3.0
	CAM	UTILITY	2019	5JWCK3126KP071488	TRAILER		PUBLIC WORKS	0.3
	CAM	UTILITY	2019	5JWCG2421KP071843	TRAILER		PUBLIC WORKS	0.3
	SULLAIR	185DPQ-KU	2019	2018121	TRAILER		PUBLIC WORKS	0.3
	FORD	TRANSIT	2020		OTHER		PUBLIC WORKS	1.5

#	MAKE	MODEL	YEAR	VIN	VEHICLE SPECIAL PURPOSE	GROSS VEHICLE WEIGHT RATING (LBS.)	DEPARTMENT	VEU
48	BOBCAT	5600	2005	424811112			SCHOOL	2.0
110	FORD	F350	2012	1FDRF3H65CEA59404	DUMP	>8,500	SCHOOL	1.5
180	LOADRITE		2016	5A4GALJ10G2010548	TRAILER		SCHOOL	0.3
186	Ford	ESCAPE	2017	1FMCU9GD6HUA73291	SEDAN	4680	SCHOOL	1.0
194	FORD	F350	2017	1FDRF3H68HEB23801	TRUCK	>8,500	SCHOOL	1.5
	KUBOTA	RTVX1100CW	2017	A5KC2GDBEHG039014	UTILITY	4326	SCHOOL	1.0
	KUBOTA	RTVX1100CW	2017	A5KC2GDBPHG039132	UTILITY	4326	SCHOOL	1.0
	FORD	ECOSPORT	2020		OTHER		SCHOOL	1.5
59	JOHN DEERE	5225	2006	LV5525H258095	TRACTOR		SEWER DEPARTMENT	3.0
94	STERLING	LT8500	2009	2FZHAWBS39AAF7295	DUMP	>8,500	SEWER DEPARTMENT	3.0
99	FORD	F450	2010	1FDAF4HY3AEA24006	DUMP	>8,500	SEWER DEPARTMENT	1.5
101	FORD	F450	2011	1FD0X4HYXBEA65212	UTILITY	>8,500	SEWER DEPARTMENT	1.5
116	INTL	7400	2013	1HTWDAZR2DH303202	VACUUM		SEWER DEPARTMENT	3.0
148	FORD	EXPLORER	2014	1FM5K8B88EGB80047	UTILITY	6160	SEWER DEPARTMENT	1.0
144	UTILITY		2014	1Z9BU1010DM026216	TRAILER		SEWER DEPARTMENT	0.3
145	UTILITY		2014	1Z9BU1012DM026217	TRAILER		SEWER DEPARTMENT	0.3
146	UTILITY		2014	1z9BU1014DM026218	TRAILER		SEWER DEPARTMENT	0.3
147	UTILITY		2014	1Z9PU1422EM026017	TRAILER		SEWER DEPARTMENT	0.3
134	FORD	F450	2015	1FDUF4HY9FEA66118	TRUCK	>8,500	SEWER DEPARTMENT	1.5
141	FRT	108SD	2015	1FVAG5CY3FHGD9453	TRUCK		SEWER DEPARTMENT	3.0
212	FORD	F350	2016	1FT7X2B8XGED47968	PICKUP	>8,500	SEWER DEPARTMENT	1.5
197	CHEVROLET	SILVERADO	2017	1GCVKNEC6HZ200727	PICKUP	7100	SEWER DEPARTMENT	1.5
205	CHEVROLET	CITY EXP	2017	3N63M0YN3HK704793	UTILITY		SEWER DEPARTMENT	1.5
203	FTL	114SD	2017	1FVHG3DV7HHJE6513	REFUSE	>8,500	SEWER DEPARTMENT	3.0
	FORD	F350	2018	1FDRF3B64JEC70163	PICKUP	>8,500	SEWER DEPARTMENT	1.5
221	FREIGHTLINER	M2106	2018	1FVACXFCXFC4JHJL8654	SEWER TRUCK	>8,500	SEWER DEPARTMENT	3.0
	RAM	CAMERA PROMASTER	2018	3C6URVJG5JE134583	VAN	>8,500	SEWER DEPARTMENT	1.5
	FORD	F350	2019	1FT7W2B64KEC48381	PICKUP	>8,500	SEWER DEPARTMENT	1.5
	INTERNATIONAL	HV607	2019	3HTESTZT8KN322364	TRUCK	>8,500	SEWER DEPARTMENT	3.0
	FORD	EXPLORER	2019		OTHER		SEWER DEPARTMENT	1.0
	FORD	F250	2019		OTHER		SEWER DEPARTMENT	1.5
	FORD	F350	2019		OTHER		SEWER DEPARTMENT	2.0
	CAM	UTILITY	2019	5JWCK2728KP500695	TRAILER		SEWER DEPARTMENT	0.3
	VER-MAC	PCMS-320	2019	2S9US3111KS132133	TRAILER		SEWER DEPARTMENT	0.3
	HINO	195-20	2020		OTHER		SEWER DEPARTMENT	1.5
	FORD	F650	2021		OTHER		SEWER DEPARTMENT	2.5
	WESTERN STAR	4700	2021		OTHER		SEWER DEPARTMENT	**5.0**
	Nissan	Leaf	2019		OTHER		TOURISM	1.0
98	FORD	ESCAPE	2009	1FMCU59359KC41349	UTILITY	4680	TOWN ADMINISTRATION	1.0
4	FORD	F450	1996	1FDLF47F3TEB09844	TRUCK	>8,500	WATER COMPANY	1.5
	HOMEMADE	LE4000	1996	NONE	TRAILER		WATER COMPANY	0.3
5	HURCO	POWER WASH	2006	1C(BV13186B987040	TRAILER		WATER COMPANY	0.3
77	FORD	F150	2007	1FTPX14577FB44805	PICKUP	7050	WATER COMPANY	1.5
76	FORD	SPORT TRAC	2008	1FMEU53E78UA41272	PICKUP	6160	WATER COMPANY	1.5
78	FORD	RANGER	2008	1FTZR45E88PA38085	PICKUP	6050	WATER COMPANY	1.5
87	LOADRITE		2008	5A4PNFH1182001349	TRAILER		WATER COMPANY	0.3

#	MAKE	MODEL	YEAR	VIN	VEHICLE SPECIAL PURPOSE	GROSS VEHICLE WEIGHT RATING (LBS.)	DEPARTMENT	VEU
181	FORD	F250	2016	1FT7X2B68GEB79067	PICKUP	>8,500	WATER COMPANY	1.5
182	FORD	TRANSIT	2016	NMOLS7E9F1176079	VAN	4866	WATER COMPANY	1.5
217	FORD	F150	2017	1FTEX1E8XHFB28311	PICKUP	7050	WATER COMPANY	1.5
	FORD	F150	2018	1FTEX1EP8JKF00202	PICKUP	7050	WATER COMPANY	1.5
	FORD	F250	2020		OTHER		WATER COMPANY	2.0

NOTES:

VEUs ADJUSTED FOR SPECIALTY VEHICLES TO REFLECT ROUTINE MAINTENANCE WORK BEING DONE BY THE DPW AND ANY ADDITIONAL WORK BEING SUBCONTRACTED OUT. FIRE TRUCK AND VAC TRUCK VEUs ADJUSTED FROM 6.5 TO 3. AMBULANCES WERE ADJUSTED FROM 2 TO 1.5. THE DIFFERENCE IN VEUs IS ACCOUNTED FOR IN THE SUMMARY TABLE WITH THE "SPECIAL MAINTENANCE" CATEGORIES FOR THESE DEPARTMENTS.

1. VEHICLE THAT HAS BEEN REPLACED OR RETIRED FROM THE FLEET ACCORDING TO "INVENTORY FY21-22" SPREADSHEET PROVIDED BY ENERGY OFFICE. NO VEU ASSIGNED.

APPENDIX B

Select Equipment Cutsheets

LUBRICATION DISTRIBUTION SYSTEM

Industrial Equipment					
- Wash Equipment	$	96,900	x	$	96,900
- Wash Equipment - Undercarriage Wash	$	61,500	x	$	61,500
- Heavy Duty Vehicle Lift (Fixed)	$	147,700	x	$	147,700
- Light Duty Vehicle Lift (16,000 lb capacity minimum)	$	46,100	x	$	46,100
- Bridge Crane	$	84,900	x	$	84,900
- Overhead Lubrication System	$	150,000	x	$	150,000
- Miscellaneous Shop and Support Equipment	$	64,100	x	$	64,100
- Storage Shelving / Benches / Racks	$	51,800	x	$	51,800
- Exhaust Removal System (2 units)	$	50,700	x	$	50,700
Industrial Equipment Subtotal:				**$**	**753,700**

NOTE: COST ESTIMATE FROM SEPTEMBER 2022 DUXBURY, MA DPW SCHEMATIC DESIGN ESTIMATE

HEAVY DUTY REELS

Alemite Heavy Duty Reels set the industry standard for reliable, rugged performance in tough work environments. Engineered for optimum performance and safety, these reels are suitable for a wide range of demanding applications.

FEATURES:

- Superior Performance – Swivel and reel ball bearings reduce torque load on power spring for smooth retraction every time
- Anti-Lockout Design – Ratchet prevents lockup when hose is fully extended, eliminating the need to manually release the pawl at the reel
- Corrosion Resistant – Sealed bearings prevent contamination and minimize maintenance, a critical performance factor in dirty environments
- Easy Installation and Maintenance – Factory lubricated one piece power spring cassette makes installation and maintenance safe and easy
- Durable – Heavy metal arbor design withstands extreme stress and eliminates breakage associated with non-metal and light weight metal arbors
- Adjustable and Versatile – 5 position guide arm allows hose to release at an optimum position. Narrow design allows for efficient use of available space
- Compatibility – Oil, grease, air, water

8078 Series

INCLUDED ITEMS:

- Hose Reel
- Hose
- Hose Stop
- Union
- 24" *(61 cm)* Connecting Hose

Colors not available in every size or length.

Oil

Product #	Color	Max Pressure	Delivery Hose			Connecting Hose[1]		Weight
			Specification	Part #	Outlet	Inlet	Part #	
8078-C	Maroon	1,500 psi *(103 bar)*	1/2" ID x 30 ft	317813-30	1/2" NPTF(m)	1/2" NPTF(m)	317813-2	58 lb *(26 kg)*
8078-D	Maroon	1,500 psi *(103 bar)*	1/2" ID x 50 ft	317813-50	1/2" NPTF(m)	1/2" NPTF(m)	317813-2	58 lb *(26 kg)*
8078-DBL	Blue	1,500 psi *(103 bar)*	1/2" ID x 50 ft	317813-50	1/2" NPTF(m)	1/2" NPTF(m)	317813-2	58 lb *(26 kg)*
8078-DBK	Black	1,500 psi *(103 bar)*	1/2" ID x 50 ft	317813-50	1/2" NPTF(m)	1/2" NPTF(m)	317813-2	58 lb *(26 kg)*
8078-DW	White	1,500 psi *(103 bar)*	1/2" ID x 50 ft	317813-50	1/2" NPTF(m)	1/2" NPTF(m)	317813-2	58 lb *(26 kg)*

[1]Connecting Hose length is 24" *(61 cm)*

Grease

Product #	Color	Max Pressure	Delivery Hose			Connecting Hose[1]		Weight
			Specification	Part #	Outlet	Inlet	Part #	
8078-A	Maroon	6,400 psi *(440 bar)*	1/4" ID x 30 ft	317874-30	1/4" NPTF(f)	3/8" NPTF(m)	317876-2	56 lb *(25 kg)*
8078-B	Maroon	6,000 psi *(413 bar)*	1/4" ID x 50 ft	317874-50	1/4" NPTF(f)	3/8" NPTF(m)	317876-2	59 lb *(27 kg)*
8078-T	Maroon	6,400 psi *(440 bar)*	3/8" ID x 50 ft	317870-50	1/4" NPTF(f)	3/8" NPTF(m)	317882-2	63 lb *(29 kg)*
8078-BBL	Blue	6,000 psi *(413 bar)*	1/4" ID x 50 ft	317874-50	1/4" NPTF(f)	3/8" NPTF(m)	317876-2	59 lb *(27 kg)*
8078-BBK	Black	6,000 psi *(413 bar)*	1/4" ID x 50 ft	317874-50	1/4" NPTF(f)	3/8" NPTF(m)	317876-2	59 lb *(27 kg)*
8078-BW	White	6,000 psi *(413 bar)*	1/4" ID x 50 ft	317874-50	1/4" NPTF(f)	3/8" NPTF(m)	317876-2	59 lb *(27 kg)*

[1]Connecting Hose length is 24" *(61 cm)*

HEAVY DUTY REELS

Air/Water

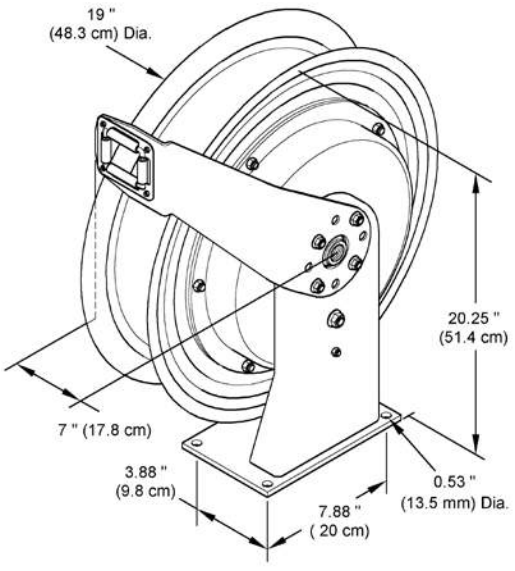
Product #	Color	Max Pressure	Delivery Hose			Connecting Hose[1]		Weight
			Specification	Part #	Outlet	Inlet	Part #	
8078-E*	Maroon	300 psi *(20 bar)*	3/8" ID x 30 ft	317803-30	1/4" NPTF(m)	1/2" NPTF(m)	317811-2	51 lb *(23 kg)*
8078-F*	Maroon	300 psi *(20 bar)*	3/8" ID x 50 ft	317803-50	1/4" NPTF(m)	1/2" NPTF(m)	317811-2	53 lb *(24 kg)*
8078-M*	Maroon	300 psi *(20 bar)*	1/2" ID x 50 ft	317811-50	1/2" NPTF(m)	1/2" NPTF(m)	317811-2	61 lb *(28 kg)*
8078-FBL*	Blue	300 psi *(20 bar)*	3/8" ID x 50 ft	317803-50	1/4" NPTF(m)	1/2" NPTF(m)	317811-2	53 lb *(24 kg)*
8078-FBK*	Black	300 psi *(20 bar)*	3/8" ID x 50 ft	317803-50	1/4" NPTF(m)	1/2" NPTF(m)	317811-2	53 lb *(24 kg)*
8078-FW*	White	300 psi *(20 bar)*	3/8" ID x 50 ft	317803-50	1/4" NPTF(m)	1/2" NPTF(m)	317811-2	53 lb *(24 kg)*

[1]Connecting Hose length is 24" *(61 cm)*

* ⚠ **WARNING** California Proposition 65: Cancer and reproductive harm. www.P65Warnings.ca.gov

Bare Reels

Product #	Color	Usage	Max Pressure	Reel Inlet	Reel Outlet	Weight
7135-A	Blue	Oil	1,500 psi *(103 bar)*	1/2" NPTF(f)	1/2" NPTF(f) Swivel	50 lb *(23 kg)*
7135-B	Black	Oil	1,500 psi *(103 bar)*	1/2" NPTF(f)	1/2" NPTF(f) Swivel	50 lb *(23 kg)*
7135-C	White	Oil	1,500 psi *(103 bar)*	1/2" NPTF(f)	1/2" NPTF(f) Swivel	50 lb *(23 kg)*
7335-B	Maroon	Oil	1,500 psi *(103 bar)*	1/2" NPTF(f)	1/2" NPTF(f) Swivel	50 lb *(23 kg)*
7134-A	Blue	Grease	6,000 psi *(413 bar)*	1/2" NPTF(f)	3/8" NPTF(f) Swivel	50 lb *(23 kg)*
7134-B	Black	Grease	6,000 psi *(413 bar)*	1/2" NPTF(f)	3/8" NPTF(f) Swivel	50 lb *(23 kg)*
7134-C	White	Grease	6,000 psi *(413 bar)*	1/2" NPTF(f)	3/8" NPTF(f) Swivel	50 lb *(23 kg)*
7334-B	Maroon	Grease	6,400 psi *(440 bar)*	1/2" NPTF(f)	3/8" NPTF(f) Swivel	50 lb *(23 kg)*
7136-A	Blue	Air/Water	300 psi *(20 bar)*	1/2" NPTF(f)	3/8" NPTF(f)	50 lb *(23 kg)*
7136-B	Black	Air/Water	300 psi *(20 bar)*	1/2" NPTF(f)	3/8" NPTF(f)	50 lb *(23 kg)*
7136-C	White	Air/Water	300 psi *(20 bar)*	1/2" NPTF(f)	3/8" NPTF(f)	50 lb *(23 kg)*
7336-B	Maroon	Air/Water	300 psi *(20 bar)*	1/2" NPTF(f)	3/8" NPTF(f)	50 lb *(23 kg)*



METERS

Alemite Electronic and Mechanical Meters provide consistent, reliable performance for dispensing applications.

Electronic

3670-B

The versatile Alemite Electronic Meter is designed for accurate, high volume dispensing of a wide range of fluids.

FEATURES:

- Electronic digital readout (±1% accuracy)
- Ergonomic trigger design for easy dispensing
- Rubber guard to protect meter from damage
- Programmable to measure in pints, quarts, gallons or liters
- Displays current fluid delivery, and registers total amount of fluid used
- Easy to calibrate – no disassembly required
- Uses 2 standard AAA batteries, replaceable with a coin screw on back of meter
- Low battery indicator
- ½" NPT(f) Inlet
- Fluid compatibility: oil, gear oil, transmission fluid, antifreeze - antifreeze concentrate only, not compatible with water/antifreeze mixture

Product #	Description	Measures	Totalizes	Extension	Non-drip tip	Weight
3670	Electronic meter	Quart	Gallon	Rigid	Automatic	3 lb *(1.4 kg)*
3670-B	Electronic meter	Quart	Gallon	Rigid	Manual	3 lb *(1.4 kg)*
3671	Electronic meter	Quart	Gallon	Flexible	Automatic	3 lb *(1.4 kg)*
3671-B	Electronic meter	Quart	Gallon	Flexible	Manual	3 lb *(1.4 kg)*
3673	Electronic meter	Pint	Gallon	Rigid	Automatic	3 lb *(1.4 kg)*
3674-C	Electronic meter	Gallon	Gallon	Rigid	High-volume manual	3 lb *(1.4 kg)*
3679	In-line electronic meter	Quart	Gallon	–	–	0.83 lb *(0.4 kg)*

MISCELLANEOUS

Non-Drip Nozzles

Alemite Non-Drip Nozzles help prevent drips and spills, for a cleaner, safer work space. The nozzles are available with an automatic shut off, or manual twist lock mechanism.

Product #	Description	Used with	Thread Sizes
B339800	Automatic assembly (blister pack)	3620 Series, 3621, 3621-A, 3622, 3622-A, 3640 Series, 3641-1, 3686-1, 3686-B, 3670, 3671, 3671-A, 3672, 3673, 7948	1/4" NPTF(f)
339084	Manual	3620-B, 3621-B, 3641-B1, 3670-B, 3671-B, 3685-J, 3685-F, 3685-G	1/4" NPTF(f)
340084	Manual high-volume	3624-C, 3644-C1, 3674-C, 3691-C, 3690 Series, 7498-C	1/2" NPTF(f)

Water Bib (BSWA321)

Alemite's Water Bib manual dispensing valve is suitable for dispensing water, antifreeze, or windshield washer fluid. Inlet size is ¼" *(6 mm)*.

BSWA321

LOW PROFILE TRUCK CADDY

NEW

ITEM NAME/NUMBER

Lincoln 3665, 3667 & 3669 17 Gallon Portable Truck Drain Carts

Polypropylene Cart

PRICE

SEE IMAGE BELOW

WEBSITE

westechequipment.com/

AS OF 5-12-2020

IMAGES

Select Model & Quantity:		
Model#	**Description**	**Price**
3665	Polypropylene Cart	$272.14
3667	Polypropylene Cart with Manual Pump	$369.64
3669	Polypropylene Cart with Electric Pump	$461.27

DESCRIPTION

Lincoln Models 3665, 3667 & 3669 Truck drains
Lincoln now offers a professional alternative to lifting heavy vehicles during fluid changes. Models 3665, 3667 and 3669 truck drains offer a low-profile design that can be easily positioned under high-clearance vehicles for capturing used fluids including motor oil, coolant and transmission fluid.

All three models feature a 17-gallon (65 liter) capacity reservoir molded from robust, lightweight high-impact polypropylene and mounted on four 4 inch (100 mm) diameter swivel casters. The drains offer a choice of three discharge methods.

Models 3665, 3667 and 3669 low-profile truck drains

Eliminates need to lift heavy vehicles during fluid changes

Lincoln models 3665, 3667 and 3669 truck drains offer a low-profile design that can be easily positioned under high-clearance vehicles for capturing used fluids including motor oil, coolant and transmission fluid. All three models feature a 17 gallon *(65 liter)* capacity reservoir molded from robust, lightweight high-impact polypropylene and mounted on four 4 in. *(100 mm)* diameter swivel casters. Overall height is only 7 3/4 in. *(195 mm)*. The top of the reservoir features a large 20 x 29 in. *(510 x 735 mm)* recessed area for capturing fluid and a removable metal screen covers the reservoir opening to keep out debris. Recessed pockets at each corner provide storage for drain plugs and filters.

To best suit a shop layout or preference, the Lincoln truck drains offer a choice of three discharge methods:

- **Model 3665**
  Features a 6 ft. *(1,8 m)* long discharge hose with a 3/4 in. camlock style connector and cap. The hose extends from the bottom of the reservoir and can be connected to diaphragm pump or other fluid transfer system to evacuate fluid from the reservoir.

- **Model 3667**
  Features a rotary hand pump mounted horizontally to the front of the reservoir and a 6 ft. *(1,8 m)* long discharge hose with a steel J-hook installed at the outlet. Fluid is discharged from the reservoir by manually operating the pump.

- **Model 3669**
  Features a durable 120 V electric pump installed below the front of the reservoir. The pump operates when plugged into a standard power outlet and discharges fluid through a 6 ft. *(1,8 m)* hose with steel J-hook.

Pump specifications

Manual pump output
1 gal. *(3,8 liter)*/15 revolutions

Electric pump output
1 gal. *(3,8 liter)*/minute (10W-30 at room temperature)

2.6 gal. *(9,8 liter)*/minute (antifreeze)

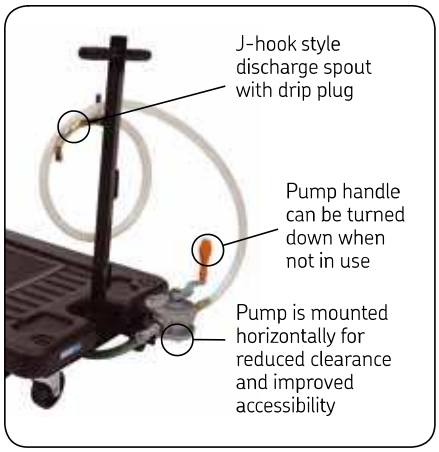
Models 3665, 3667 and 3669 low-profile truck drains

Model 3665

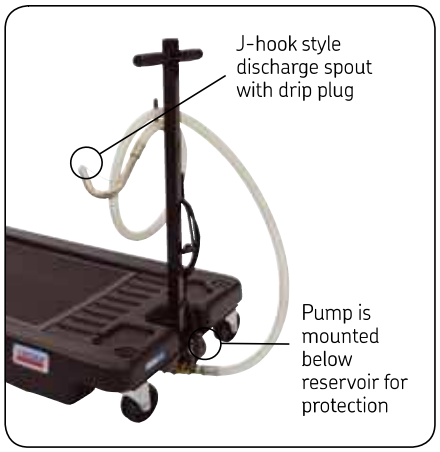
* Model 3665 connects to any of the three Lincoln diaphragm pump kits (models 4100, 4102 or 4104).

Model 4100
For use with model 3665

Lincoln offers three models of diaphragm pump evacuation kits for evacuating used fluid drains using a 3/4 in. camlock style connector, such as model 3665. The kits include a diaphragm pump and all recommended air supply, fluid extraction, and fluid discharge fittings, components, and accessories.



Model 3667



Model 3669

Diaphragm pump evacuation kits

Model 4100

Features 1 in. *(25,4 mm)* UL-approved aluminum double diaphragm pump (model 85634), recommended for transferring flammable liquids.

Model 4102

Features 1 in. *(25,4 mm)* non-UL aluminum double diaphragm pump (model 85627), recommended for transferring non-flammable liquids.

Model 4104

Features 1/2 in. *(12,7 mm)* non-UL aluminum double diaphragm pump (model 85631), for transferring non-flammable liquids.

Please contact:
SKF USA, Inc.
One Lincoln Way
St. Louis, MO 63120 USA
Tel. +1 (314) 679-4200

SKF **PUB LS/P2 XXXXX EN** · June 2013 · **FORM 444583**

WASTE FLUID PUMPOUT

NEW

ITEM NAME/NUMBER	PRICE
Lincoln *4100* Fluid Evacuation Pumping System	SEE IMAGE BELOW
	WEBSITE westechequipment.com/
	AS OF 5-12-2020

IMAGES

Select Model & Quantity:		
Model#	**Description**	**Price**
4100	Fluid Evacuation Pumping System	$1,123.62

Add Optional Accessories:		
Model#	**Description**	**Price**
84817	Wall Mount Bracket - For 1/2 to 2 In. Air-Operated Diaphragm Pumps	$147.75
84816	4-way 1 In. Reversing Valve - Enables one pump to pump into and out of drum or tank	$406.37

DESCRIPTION

Lincoln Model 4100 Fluid Evacuation Pumping System
Lincoln's Basic Fluid Evacuation and Disposal System features a corrosion-resistant aluminum double-diaphragm pump that creates a powerful suction to drain used fluids quickly, and transfers them though a completely enclosed system to any type of remote storage tank. Provides clean, safe disposal of waste fluids with no drips, no spills.

Pump is air-operated and can be easily mounted on any convenient wall surface. One basic system can service multiple bays with the addition of hardware.

Includes rugged, heavy-duty, 1" U.L. Listed air-operated double diaphragm self-priming pump 84811, 1" x 5' fluid hose 237105, 3' air hose 72036, airline filter 600104, lubricator 600204, regulator 600004, 3/4" x 5' fluid inlet hose 68620 and other air couplings for easy outlet installation. Note: Include (1) 241408 couple and (1) 241409 nipple per receiver.

Model 4100 diaphragm pump evacuation system

Powerful, clean and safe method of used fluid evacuation

The Lincoln model 4100 diaphragm pump evacuation system provides a clean, safe method for evacuating used fluids from collection equipment such as portable drains and evacuators, and pumping it through an enclosed system to a remote storage tank. It features a U.L.-listed air-operated double-diaphragm pump that can be conveniently installed near one or more service bays. Any type of used fluid equipment fitted with a 3/4 in. cam lock coupler can be easily connected to the pump and evacuated. In addition to the pump, the 4100 includes all recommended air supply, fluid extraction and fluid discharge fittings, components and accessories. Wall-mount bracket is available for separate purchase

For the convenient evacuation and transfer of non-flammable fluids such as coolant and washer fluid, model 4102 is available with a non-U.L.-listed pump.

Features

- Powerful 1 in. U.L.-listed (4100) or non-U.L.-listed (4102) corrosion-resistant aluminum double-diaphragm pump quickly extracts and transfers fluids from portable drains and other collection equipment
- System can be conveniently installed near service bay(s) and fluid pumped to remote storage tanks
- Kit includes fittings, valves, hoses and other components required for compressed air connection as well as fluid collection and discharge
- Cam lock style connection system can be adapted to virtually any type of drain
- Many new Lincoln drains and evacuators are designed specifically for evacuation using the 4100/4102

Model 4100 diaphragm pump evacuation system

Lincoln manufactures several models of used fluid collection equipment including portable drains, pit drains and evacuators, specifically designed or easily adapted for use with the 4100/4102 system. The 4100/4102 saves shops time, money and space by locating the evacuation system near the service bay(s) and pumping the fluid remotely.

Specifications

Recommended air pressure
60–120 psi *(4,1–8,2 bar)*

Weight
33.8 lbs. *(15,3 kg)*

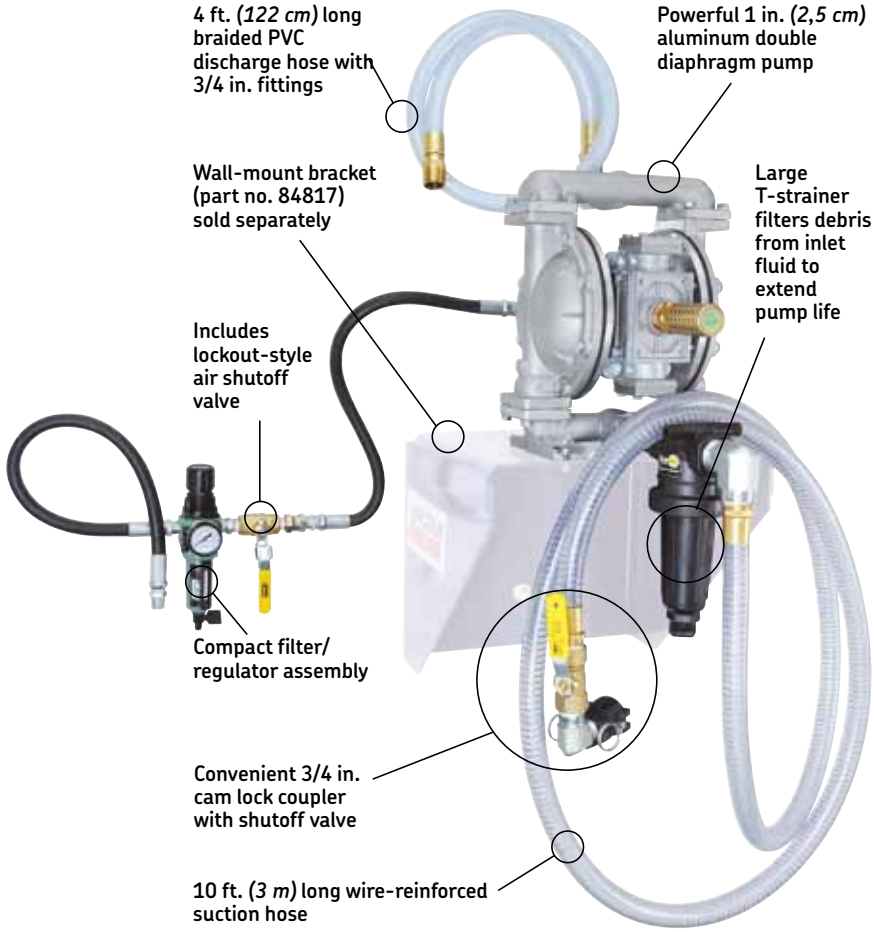
The following components may be required to adapt the 4100/4102 to your application and are available from Lincoln for separate purchase.

Lincoln 3/4 in. cam lock connectors 276291 with 3/4 in. NPT female thread and 277645 with 3/4 in. male thread, provide the appropriate male connection for the 4100/4102.

Use Lincoln model 4105 drain adapter kit to convert a gravity drain or drum for use with the 4100/4102. Threads into 3/4 in. drain outlet, and includes fittings, shutoff valve and male 3/4 in. cam lock connector.

Install Lincoln 274879 3/4 in. check valve or 273607 3/4 in. ball valve at the discharge of the pump to prevent fluid backflow when the pump is shut off.

Kit includes pump and all air supply, fluid extraction and fluid discharge fittings, components and accessories required for a typical installation.



SKF **PUB LS/P2 12275 EN.R1** · October 2011 · **FORM 444567**

WASTE FLUID PUMPOUT SYSTEM HIGH LEVEL ALARM
NEW

ITEM NAME/NUMBER

WARRICK CONDUCTIVITY CONTROLS

WARRICK TA-730 ALARM PANEL

Part Number: TA731A0

PRICE

$784.00

AS OF 5-20-2020

IMAGES

DESCRIPTION

Features

- Intrinsically Safe Approved
- Auxiliary Contact for Remote Annunciation or Cutoff
- One or Two Channels
- Two Conduit Connection Hubs

SPECIFICATIONS

Model	TA73
Protection	Intrinsically Safe
Enclosure	NEMA 4
Sku	TA731A0
Supply Voltage	120 VAC
Secondary Voltage	12 VAC
Audible Alarm	Adjustable from 77 to 97 dB at 2 feet
Interface Contacts	Normally Open Dry
AuxillaryContacts	1
Contact Design	N/A
Contact Rating	N/A
Indicators	Red, Green, Yellow Solid State LED's
Maximum Temperature	150°F
Approvals	UL 913 Intrinsically Safe

WASTE FLUID CADDY

NEW

ITEM NAME/NUMBER

Lincoln *3626* 26 Gallon Plastic Upright Fluid Drain

PRICE

$522.48

WEBSITE

westechequipment.com/

AS OF 5-12-2020

IMAGES

DESCRIPTION

26-gallon (98 liter) reservoir molded from high-strength, chemical-resistant polyethylene for lighter weight, reduced corrosion and lower risk of damage to surrounding vehicles. Each unit has large recesses for tool and used filter storage molded into the top that drain directly into the reservoir. The convenient 18-inch (457 mm) offset funnel includes a removable filter screen and secondary debris screen and can be adjusted from 53 to 79 inches (135 to 200 cm) in height.

The reservoirs are supported by two four-inch (102 mm), ball-bearing swivel casters and two 10-inch 254 mm), fixed-axle wheels, which provide durability and resistance to shop chemicals. Model 3626 has a black reservoir for identification of common used fluids, while model 3627 features a green reservoir to distinguish it for used coolant. Both models feature a 3/4-inch (19 mm), male camlock connector extending directly from the top of the reservoir for simple connection to a fluid transfer system.

26-gallon (98 liter) polyethylene reservoir

SALES Bulletin

SKF

October, 2013

Bulletin DC2316

Lincoln model 3626 used fluid drain and model 3627 used coolant drain

3626 **3627**

Models 3626 used fluid drain and 3627 used coolant drain have a portable upright configuration commonly used for collecting fluids under lift-mounted vehicles. Both models are designed for use with pump-assist used fluid collection and transfer systems, which are ideal for large multi-bay shops and applications or environments where movement is restricted.

Model 3626 features a black reservoir for identification of common used fluids and model 3627 features a green reservoir for easy identification of used coolant. Both offer many outstanding features, including:

- 26 gallon *(98 liter)* reservoir molded from high-strength, chemical resistant polyethylene for lighter weight, reduced corrosion and lower risk of damage to surrounding vehicles
- 18 in. *(457 mm)* offset funnel with removable metal filter screen and secondary debris screen
- Funnel height is adjustable from 53 to 79 in. *(135 to 200 cm)*
- Top-mounted, adjustable-height 3/4 in. male camlock connector
- Large recesses for tool and filter storage are molded into the top and drain directly into the reservoir
- Easy-to-read fluid level sight gauge
- Front and back handles improve maneuverability
- Simple height-locking handle
- Two 4 in. *(102 mm)* ball-bearing swivel casters and two 10 in. *(254 mm)* fixed-axle wheels

For more details on features and accessories, refer to Lincoln sales flyer 444588, or go to lincolnindustrial.com for additional information and to download images

Sincerely,

Mark Allen
Senior Product Manager
314-679-4383
mark.allen@skf.com

Model No.	Description	Product Code	U.S. Suggested User Price
3626	26 gallon *(98 liter)* used fluid drain		
3627	26 gallon *(98 liter)* used coolant drain		

Lubrication Business Unit
SKF Industrial Market, Strategic Industries
One Lincoln Way, St. Louis, MO 63120 USA
Tel +1 314-679-4000 · Fax +1 314-679-4359 · www.LincolnIndustrial.com

LINCOLN

Model 3626 used fluid drain and model 3627 used coolant drain

Models 3626 used fluid drain and 3627 used coolant drain have a portable upright configuration commonly used for collecting fluids under lift-mounted vehicles. Both feature a 26 gal. *(98 liter)* reservoir molded from high-strength, chemical resistant polyethylene for lighter weight, reduced corrosion and lower risk of damage to surrounding vehicles. Large recesses for tool and filter storage are molded into the top and drain directly into the reservoir. The large 18 in. *(457 mm)* offset funnel includes a removable metal filter screen and secondary debris screen. Funnel height is adjustable from 53 to 79 in. *(135 to 200 cm)*.

The reservoir is supported by two 4 in. *(102 mm)* ball-bearing swivel casters and two 10 in. *(254 mm)* fixed-axle wheels selected for their size, durability and resistance to shop chemicals. Model 3626 features a black reservoir for identification of common used fluids, while model 3627 features a green reservoir for easy identification of used coolant.

Both models are designed for use with pump-assist used fluid collection and transfer systems which are ideal for large multi-bay shops and applications or environments where movement is restricted. In these situations, a strategically located diaphragm pump can be used to transfer fluids from the collection equipment to a remote storage location.

Both models feature a 3/4 in. *(19 mm)* male camlock connection extending directly from the top of the reservoir, for easy connection to a fluid transfer system. The height of the pickup tube that extends from the camlock to the bottom of the reservoir is adjustable up or down to compensate for the collection of debris between cleanings.

Model 3626

Model 3627

Specifications

Reservoir capacity	26 gal. *(98 liter)*
Reservoir material	Polyethylene
Funnel diameter	18 in. *(457 mm)*
Wheel diameters	4 in. *(102 mm)* swivel casters 10 in. *(254 mm)* fixed-axle wheels

Model 3626

Model 4100

Lincoln offers three models of diaphragm pump evacuation kits for evacuating used fluid drains using a 3/4 in. camlock style connector, such as models 3626 and 3627. The kits include a diaphragm pump and all recommended air supply, fluid extraction, and fluid discharge fittings, components and accessories.

Diaphragm pump evacuation kits

Model 4100 features 1 in. *(25,4 mm)* UL-approved aluminum double-diaphragm pump (model 85634), recommended for transferring flammable liquids.

Model 4102 features 1 in. *(25,4 mm)* non-UL aluminum double-diaphragm pump (model 85627), recommended for transferring non-flammable liquids.

Model 4104 features 1/2 in. *(12,7 mm)* non-UL aluminum double-diaphragm pump (model 85631), for transferring non-flammable liquids.

Optional accessories

Model 277208 gravity drain spigot
Can be installed at reservoir base to allow gravity draining of fluids.

Model 278802 rotary pump adapter
Can be used to replace the camlock evacuation connector with a rotary pump for transfering fluid in or out of the reservoir.

Model 3610 funnel extension
Extends 18 in. *(457 mm)* funnel to 24 in. *(610 mm)* overall diameter.

Model 277208

Model 278802

Model 3610

Please contact:
SKF USA, Inc.
One Lincoln Way
St. Louis, MO 63120 USA
Tel. +1 (314) 679-4200

SKF **PUB LS/P2 14165 EN** · October 2013 · **FORM 444588**

OIL FILTER DRAIN BOX
NEW

ITEM NAME/NUMBER

Safe-T-Tank CORP

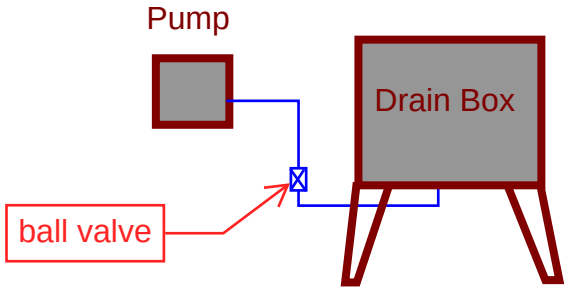
Model STW-20-1A-FM

PRICE

WEBSITE
https://www.safe-t-tank.com/tanks/waste-gasoil-tanks/

AS OF

IMAGES



EMPTIED WITH WASTE OIL PUMP OUT STATION

DESCRIPTION

Model STW-20-1A-FM
single wall 20-gallon floor mounted waste collection sink with removable debris screen, 2" inlet. Call for pricing and specifications.

CONTAINMENT SOLUTIONS®

LUBE CUBE®
MULTI-PURPOSE TANKS

Lube Cube® lube oil tanks are the best solution for storage of new and used lubrication oils. Lube Cubes provide lower installed costs than underground tanks, better space utilization than cylindrical aboveground tanks and lower operation costs than 55-gallon drums.

Lube Cube Tanks are designed for easy and convenient installation either indoors, in service bays or basements, or outdoors, next to the building. Lube Cube's rectangular shape allows for the storage of up to 20% more volume in a given space than comparable cylindrical tank capacities.

Lube Cubes are available as either single or double-wall tanks. Double-wall tanks are UL listed as integral secondary containment and therefore do not require dikes for leak containment.

Desert sand primer finish is standard. Special colors, coatings and interior linings, custom dimensions and equipment packages are available upon request.

STANDARD FEATURES:

- UL-142 listed
- Meets NFPA 30 Standard
- Skid mounted for easy installation
- Shop primed exterior
- Moveable by forklift
- NPT fittings with PVC plugs
  Single-Wall: 5 (plus emergency vent opening)
  Double-Wall: above fittings (plus emergency vent and inspection opening)
- Lifting lugs

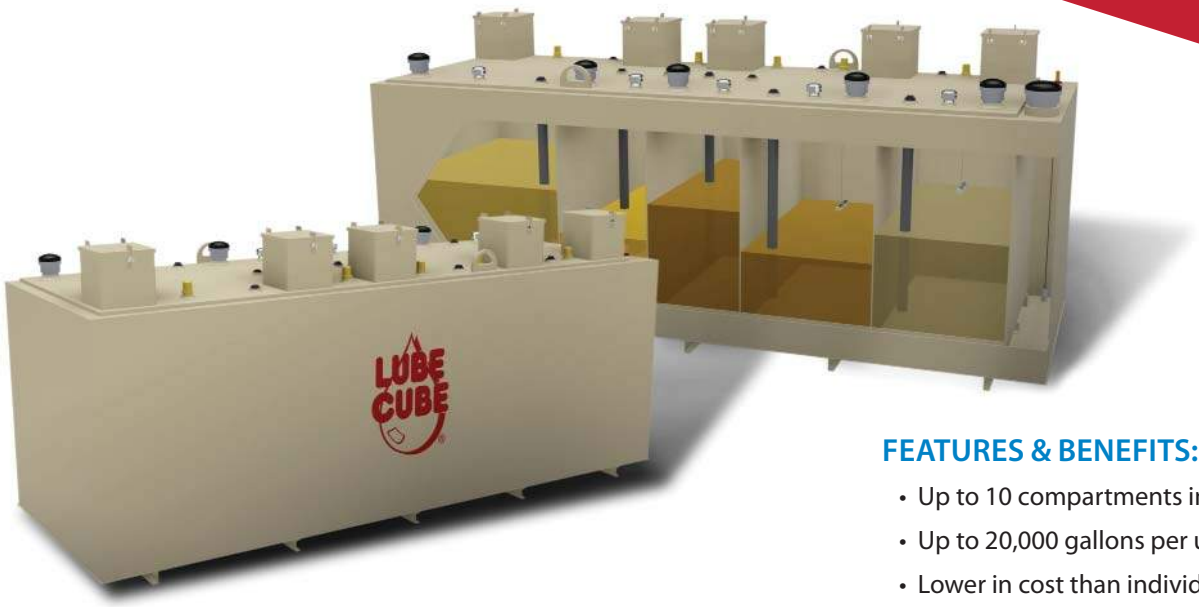
OPTIONS:

- Corrosion resistant exterior coating
- 7 gallon spill box
- Custom sizes
- Compartments available
- Stainless-steel construction
- Interior coatings
- Equipment packages

Lube Cube tanks are available in standard sizes from 60 to 20,000 gallons.

CONTAINMENT SOLUTIONS®

LUBE CUBE®
MULTI-COMPARTMENT TANKS



MULTI-COMPARTMENT TANKS

Containment Solutions offers multi-compartment tanks for the storage of new and used lubrication products. Multi-compartment Lube Cube® tanks from CSI provide lower installation costs and better space utilization than multiple aboveground tanks.

CSI compartment tanks provide a minimum floor space savings of 15% and cost savings of 20%-30% when compared to multiple tanks.

Multi-compartment tanks can be manufactured with up to 10 compartments and may store up to 20,000 gallons. Leak detection for these tanks will also require fewer electronic sensors compared to individual tanks. CSI compartment tanks are UL-142 listed and meet NFPA 30 standards and can be custom designed to suit limited space requirements.

A complete selection of Containment Solutions tank configurations are available nationwide. Our experienced sales staff is ready to assist you in selecting the tank best suited to fit your needs.

FEATURES & BENEFITS:

- Up to 10 compartments in a single tank
- Up to 20,000 gallons per unit
- Lower in cost than individual units
- Lower insurance costs*
- UL-142 listed
- Meets NFPA 30 Standard
- Skid mounted for easy installation
- Moveable by forklift
- Lifting lugs
- Shop primed exterior standard
  - (Epoxy exterior coating available)

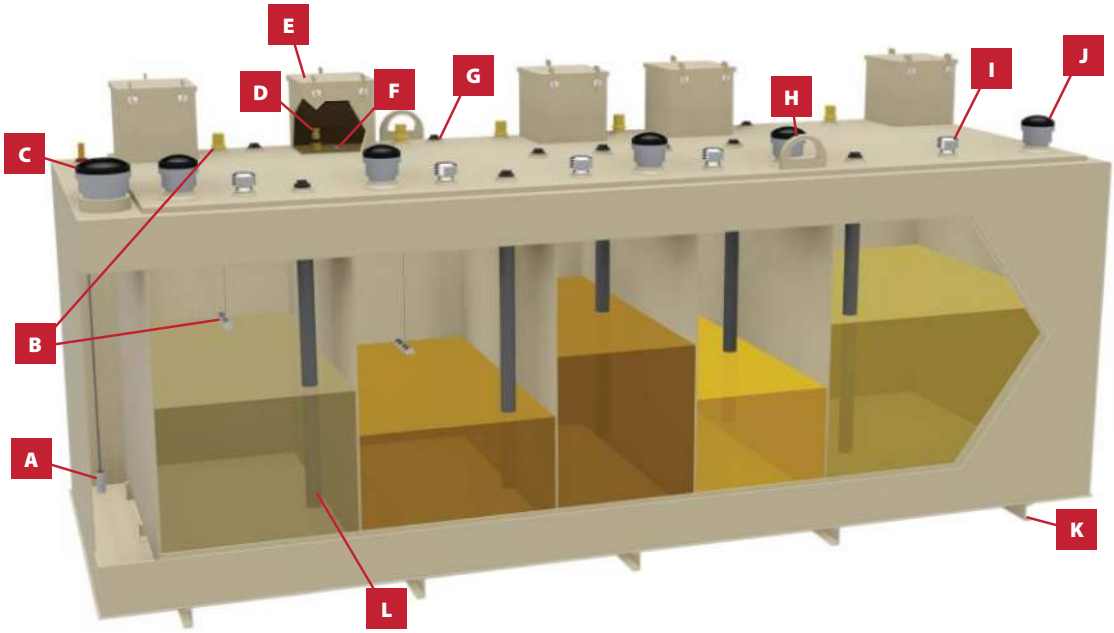
OPTIONS:

- Stainless-steel construction
- Interior coatings
- 7 gallon spill box
- Equipment packages

* *Savings will vary by area, and are dependant on insurance carrier.*

1,250 gallon, 4 compartment tank.

LUBE CUBE® MULTI-COMPARTMENT TANK



A. Secondary Containment Leak Gauge
B. Product Level Gauge
C. Secondary Containment Emergency Vent - 4", 6", 8" or 10"
D. Primary Tank Fill opening - 2", 4", or 6"
E. Optional Spill Box
F. 1/2" NPT Drain
G. 2" Spare
H. Lifting Lugs
I. 2" Primary Working Vent
J. Primary Tank Emergency Vent - 4", 6", 8", or 10"
K. Support Feet
L. Product Suction Tube

▼ TYPICAL CLUTTERED LAYOUT

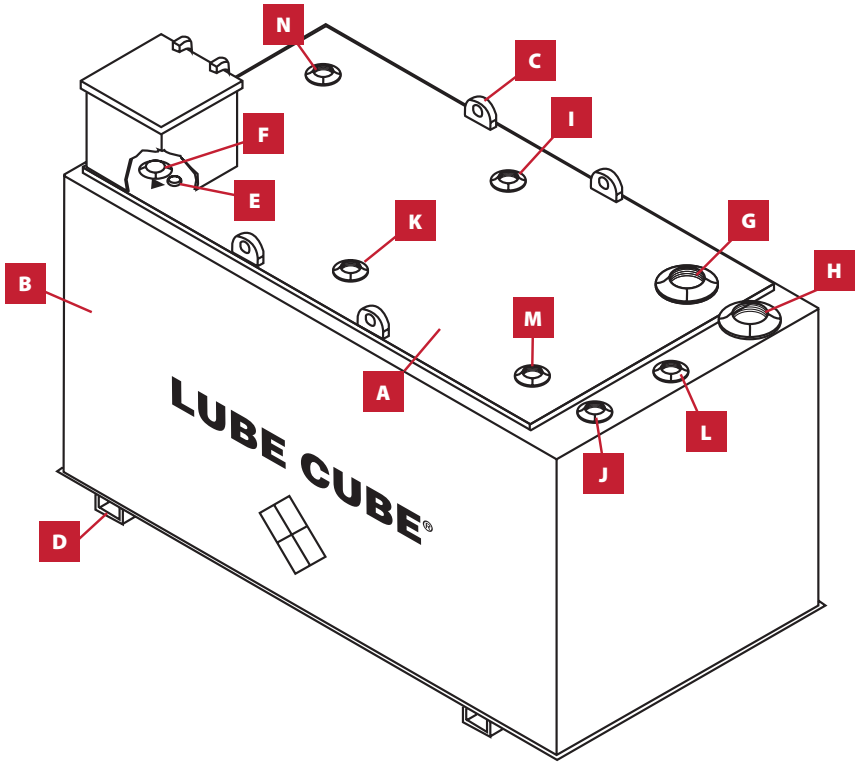
▼ FLOOR SPACE SAVINGS OF CSI TANKS

CONTAINMENT SOLUTIONS®

333 North Rivershire Drive, Suite 190 Chemical Road • Conroe, TX 77304 • Phone: (936) 756-7731 • containmentsolutions.com

STANDARD TANK SIZES:

CAPACITY (GALLONS)	DIMENSIONS (L x W x H)	WEIGHT (LBS)	CAPACITY (GALLONS)	DIMENSIONS (L x W x H)	WEIGHT (LBS)
60	1' 11" x 2' 10" x 3' 1"	385	480	5' 8" x 3' 10" x 4' 1"	1,350
90	2' 6" X 2' 10" X 3' 1"	460	500	4' 10" x 3' 10" x 5' 1"	1,425
120	3' 2" x 2' 10" x 3' 1"	485	550	5' 2" X 3' 10" X 5'1"	1,450
150	3' 9" X 2' 10" X 3' 1"	675	600	5' 7" X 3' 10" X 5' 1"	1,475
150	2' 10" X 2' 10" X 4' 1"	650	650	6' 3" x 3' 10" x 5' 1"	1,525
180	3' 4" X 2' 10" X 4' 1"	700	750	6' 9" x 4' 0" x 5' 1"	1,625
200	3' 7" X 2' 10" X 4' 1"	740	1,000	9' 4" x 4' 0" x 5' 1"	2,400
210	3' 9" X 2' 10" X 4' 1"	765	1,500	13' 4" x 4' 0" x 5' 1"	3,250
225	3' 11" X 2' 10" X 4' 1"	790	2,000	13' 9" x 5' 0" x 5' 1"	3,800
240	4' 2" X 2' 10" X 4' 1"	830	2,500	17' 0" x 5' 0" x 5' 1"	4,500
250	4' 4" X 2' 10" X 4' 1"	860	3,000	20' 5" x 5' 0" x 5' 1"	6,650
275	4' 8" X 2' 10" X 4' 1"	900	4,000	22' 3" x 5' 0" x 6' 1"	8,150
280	4' 10" x 2' 10" x 4' 1"	850	5,000	17' 1" x 8' 0" x 6' 1"	10,150
300	3' 10" X 3' 10" X 4' 1"	925	6,000	20' 3" x 8' 0" x 6' 1"	11,400
325	4' 1" X 3' 10" X 4' 1"	975	8,000	19' 11" x 8' 0" x 8' 1"	14,000
350	4' 4" X 3' 10" X 4' 1"	1,000	10,000	24' 7" x 8' 0" x 8' 1"	16,125
375	4' 7" X 3' 10" X 4' 1"	1,050	12,000	29' 3" x 8' 0" x 8' 1"	18,550
400	4' 10" X 3' 10" X 4' 1"	1,100	15,000	36' 3" x 8' 0" x 8' 1"	22,100
450	5' 5" X 3' 10" X 4' 1"	1,200	20,000	48'2" x 8'0" x 8'1"	28,900



Standard Equipment

A. Primary Tank

B. Secondary Tank
with Corrosion Resistant Desert Sand Primer Exterior Coating

C. Lifting Lugs
(2) 60 - 650 Gallon
(4) 1,000 - 20,000 Gallon

D. Support Feet

E. 1/2" NPT Drain with Optional Spill Box

F. Fill - 2", 4" or 6"

G. Primary Tank Emergency Vent
4", 6", 8", or 10"

H. Secondary Containment
Emergency Vent 4", 6", 8" or 10"

I. 2" Primary Working Vent

J. 2" Secondary Containment
Working Vent

K. 2" Gauge

L. 2" Monitoring Point

M. 2" Spare

N. 2" or 4" Spare

CONTAINMENT SOLUTIONS®

333 North Rivershire Drive, Suite 190 • Conroe, TX 77304 • Phone: (936) 756-7731 • www.containmentsolutions.com

FLUID STORAGE SUMP ALARM
NEW

ITEM NAME/NUMBER

WARRICK CONDUCTIVITY CONTROLS

WARRICK TA-730 ALARM PANEL

Part Number: TA731A0

PRICE

$784.00

AS OF 5-20-2020

IMAGES

DESCRIPTION

Features

- Intrinsically Safe Approved
- Auxiliary Contact for Remote Annunciation or Cutoff
- One or Two Channels
- Two Conduit Connection Hubs

SPECIFICATIONS

Model	TA73
Protection	Intrinsically Safe
Enclosure	NEMA 4
Sku	TA731A0
Supply Voltage	120 VAC
Secondary Voltage	12 VAC
Audible Alarm	Adjustable from 77 to 97 dB at 2 feet
Interface Contacts	Normally Open Dry
AuxillaryContacts	1
Contact Design	N/A
Contact Rating	N/A
Indicators	Red, Green, Yellow Solid State LED's
Maximum Temperature	150°F
Approvals	UL 913 Intrinsically Safe

FLUID DISTRIBUTION PUMPS
NEW

Lincoln Industrial

POWER MASTER III

IMAGES

DESCRIPTION

Ball pumps

- Material outlet: 3/4 in. NPTF
- Output per cycle: 11.9 cu. in. (195 cc)
- Approximate cycles per gal./L: 20 gallons/ 5 liters
- Gallons/Liters per minute:
- Air motors and pump tubes shipped separately. Assembly required.
- State of the art, fully pneumatic Air Motors, 3–4–6–8 inches (76–101–152–203 mm) diameter
- Full 6" stroke for greater output per cycle
- Modular design for easy repair
- Only 5 moving parts, no metal to metal contact
- Newly designed pump tubes offer ratios and outputs to fit any application
- Available to fit any drum or pail size
- Offered in carbon steel, stainless steel or hard chrome plated
- Complete selection of packing materials available
- Full line of priming equipment and mounting devices
- Ball style for fluid materials, shovel foot style for high viscosity non-fluid materials

SPECIFICATIONS

Model std. Air Motor only	Ratio	Pump tube style	Pump tube model	Air motor model	Diameter in.	Diameter mm	Min. ID air supply hose in.	Min. ID air supply hose mm	Air consumption per cycle SCFM @ 70 psig	Air consumption per cycle M3/Min. @ 4.8 bar	Air consumption per cycle SCFM @ 100 psig	Air consumption per cycle M3/Min. @ 6.8 bar
2021(1)	24:1	55 gal	**84985**	Std. 84806 w/ AirBrake 94906*	6	152	1/2	12	1.1	0.031	1.6	0.045
2001	12:1	55 gal	**84985**	Std. 84804 w/ AirBrake 94904*	4-1/4	108	1/2	12	.08	0.023	1.1	0.031
2014	12:1	stub	**84986**	Std. 84804 w/ AirBrake 94904*	4-1/4	108	1/2	12	.08	0.023	1.1	0.031
2052	6:1	55 gal	**84985**	Std. 84803	3	76	3/8	10	0.5	0.014	0.7	0.02
2051	6:1	stub	**84986**	Std. 84803	3	76	3/8	10	0.5	0.014	0.7	0.02

*Order pump tube and air motor separately for these models or when ordering AirBrake™ equipped models.

LIGHT DUTY 2 POST LIFT

Industrial Equipment					
- Wash Equipment	$	96,900	x	$	96,900
- Wash Equipment - Undercarriage Wash	$	61,500	x	$	61,500
- Heavy Duty Vehicle Lift (Fixed)	$	147,700	x	$	147,700
- Light Duty Vehicle Lift (16,000 lb capacity minimum)	$	46,100	x	$	46,100
- Bridge Crane	$	84,900	x	$	84,900
- Overhead Lubrication System	$	150,000	x	$	150,000
- Miscellaneous Shop and Support Equipment	$	64,100	x	$	64,100
- Storage Shelving / Benches / Racks	$	51,800	x	$	51,800
- Exhaust Removal System (2 units)	$	50,700	x	$	50,700
Industrial Equipment Subtotal:				**$**	**753,700**

NOTE: COST ESTIMATE FROM SEPTEMBER 2022 DUXBURY, MA DPW SCHEMATIC DESIGN ESTIMATE

ROTARY TWO POST LIFT
NEW

Extended Height Kits
Raise the overhead clearance on 10,000 and 12,000 lbs. capacity two-post lifts to service more vehicles at a comfortable working height. Kit includes column extensions and hardware.
CONSULT FACTORY FOR OPTIONS

Jack Stands / 4,000 lbs. CAPACITY
The lift certified RS4 jack stand provides added assurance of vehicle lift safety.
Maximum height: 84" (2133mm)
Minimum height: 55 1/2" (1410mm)
Fine thread-up height:
1 5/8" to 7 1/8" (41mm to 181mm)

MW-200 Tire Lift
200 lbs. capacity air operated tire and wheel lift. Provides maneuverability and adjustable lifting and lowering speeds.
- Quick transfers to tire balancers
- Easy positioning of the tire / wheel
- Includes air hose and auxiliary air tool connection

#MW-500
500 lbs. capacity model available

Air / Utility Box
Mounts easily on any column and provides quick access to utilities
- Two 110v electric outlets and air connection
- The filter/regulator/lubricator helps extend the life of your air tools

#FA5911BK

Tool Holder
To keep tools handy for the technician, this patented tool holder keeps air guns, torque sticks, and other tools within easy reach. This accessory mounts easily in holes already drilled and tapped in the two-post column.
#FA5191EBK

Power and Air Requirements from Installation Manual

IMPORTANT: Use separate circuit for each power unit. Protect each circuit with time delay fuse or circuit breaker. For single phase 208-230V, use 30 amp fuse. For wiring see Figs. 19 and 20. All wiring must comply with NEC and all local electrical codes.

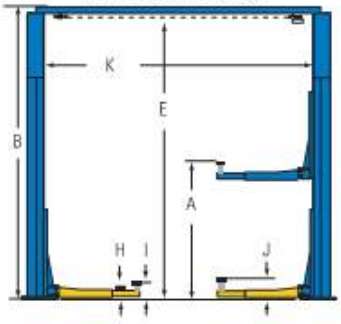
Note: Absence of air filter/regulator/lubricator will void the warranty on all pneumatic components.

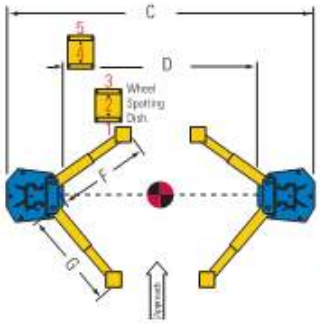
To Main Air Supply
Note: Use an Operational
Air Pressure of 90-100 psi

Available with SHOCKWAVE™

	Model:	SP016 **TRIO 3-STAGE Arms** Truck Adapters	SP020 **TRIO 3-STAGE Arms** Truck Adapters
	SHOCKWAVE Models	**SP016 -SW**	**SP020 -SW**
	Lifting Capacity	16,000 lbs. (7257kg)	20,000 lbs. (9072kg)
	Max. Load (per arm)	4,000 lbs. (1814kg)	5,000 lbs. (2268kg)
A.	Rise* Min.Truck Adapter Height Max.Truck Adapter Height	 77 31/32" (1979mm) 80 1/32" (2035mm)	 77 31/32" (1979mm) 80 1/32" (2035mm)
B.	Height Overall: Standard Adjustments Low Ceiling (LC)	 15' to 16' 6" (4572-5029mm) 13' 6"to 14' 6" (4115-4420mm)	 15' to 16' 6" (4572-5029mm) 13' 6"to 14' 6" (4115-4420mm)
C.	Width Overall (outside to outside of base plates) Narrow Standard Wide	 12' 11" (3937mm) 13' 5" (4089mm) 13' 11" (4242mm)	 12' 11" (3937mm) 13' 5" (4089mm) 13' 11" (4242mm)
	Wide width setting provides greatest tire clearance for shorter wheelbases		
D.	Narrow Drive-Thru Clearance Standard Drive-Thru Clearance Wide Drive-Thru Clearance	105 11/32" (2677mm) 111 11/32" (2829mm) 117 11/32" (2981mm)	105 11/32" (2677mm) 111 11/32" (2829mm) 117 11/32" (2981mm)
E.	Floor To Overhead Switch	15' 10 13/16" (4851mm)	15' 10 13/16" (4851mm)
F.	Reach / Front Arm Min./Max.	34 11/16" (881mm) / 64" (1626mm)	34 11/16" (881mm) / 64" (1626mm)
G.	Reach / Rear Arm Min./Max.	34 11/16" (881mm) / 64" (1626mm)	34 11/16" (881mm) / 64" (1626mm)
H.	Min./Max. Truck Adapter Height	5 31/32" to 8 1/32" (152-203mm)	5 31/32" to 8 1/32" (152-203mm)
I.	Min./Max. Low Step Height	10 31/32"to 13 1/32" (278-344mm)	10 31/32"to 13 1/32" (278-344mm)
J.	Min./Max. High Step Height	15 31/32"to 18 1/32 (406-470mm)	15 31/32"to 18 1/32 (406-470mm)
K.	Inside Columns Narrow Standard Wide	 120 15/32" (3061mm) 126 15/32" (3213mm) 132 15/32" (3366mm)	 120 15/32" (3061mm) 126 15/32" (3213mm) 132 15/32" (3366mm)
	Motor / Voltage** **With SHOCKWAVE**	4 HP / 208v-230v **5 HP / 110v**	4 HP / 208v-230v **5 HP / 110v**
	Time of Full Rise **With SHOCKWAVE***	81 seconds at full capacity **60 seconds at full capacity** **36 seconds at half capacity**	81 seconds at full capacity **60 seconds at full capacity** **36 seconds at half capacity**
	Time of Descent	**20 seconds for all vehicle weights**	
	Ceiling Height Required: Standard Low Ceiling (LC)	 15' 2" to 16' 8" (4576-5080mm) 13' 8" to 14' 8" (4166-4470mm)	 15' 2" to 16' 8" (4576-5080mm) 13' 8" to 14' 8" (4166-4470mm)
	Min. Bay Size	15' x 30' (4572 x 9144mm)	15' x 30' (4572 x 9144mm)
	Total Product Weight	3,500 lbs.	3,500 lbs.

Models: SP016 / SP020





* Rise is measured from floor to adapter in lowest and highest position

** Optional DC SHOCKWAVE battery power available

*** Actual rise times may vary depending on weight of the vehicle

Standard color of lifts are blue and red unless otherwise noted. Gray and black are available at no additional charge. Additional colors are available, consult your Rotary® representative for details.

RAL5005 RAL3002 RAL7040 RAL9005

VEHICLE WASH EQUIPMENT

Industrial Equipment					
- Wash Equipment	$	96,900	x	$	96,900
- Wash Equipment - Undercarriage Wash	$	61,500	x	$	61,500
- Heavy Duty Vehicle Lift (Fixed)	$	147,700	x	$	147,700
- Light Duty Vehicle Lift (16,000 lb capacity minimum)	$	46,100	x	$	46,100
- Bridge Crane	$	84,900	x	$	84,900
- Overhead Lubrication System	$	150,000	x	$	150,000
- Miscellaneous Shop and Support Equipment	$	64,100	x	$	64,100
- Storage Shelving / Benches / Racks	$	51,800	x	$	51,800
- Exhaust Removal System (2 units)	$	50,700	x	$	50,700
Industrial Equipment Subtotal:				**$**	**753,700**

NOTE: COST ESTIMATE FROM SEPTEMBER 2022 DUXBURY, MA DPW SCHEMATIC DESIGN ESTIMATE

MANUAL WASH SYSTEM

IMAGES

Dimensions:
37" L x 27" D x 73"H

Control Panel Dimensions:
25" L x 12" D x 31" H

CONDENSING COMMERCIAL GAS WATER HEATERS

MTI
MAINTENANCE TECHNOLOGY

SHIELD™
COMMERCIAL WATER HEATERS

SNA 286-125

- 8 MODELS FROM 125,000 TO 500,000 BTU/HR
- NO EFFICIENCY LOSS FROM LIME SCALE
- VIRTUALLY SILENT OPERATION
- ADVANCED SMART CONTROL™
- VENTING UP TO 100 FEET

LOW NOx Certified
PROTECTING OUR ENVIRONMENT

Efficiency Maine
QUALIFIED PARTNERS

96% THERMAL EFFICIENCY

Lochinvar®
High Efficiency Water Heaters, Boilers and Pool Heaters

Lochinvar.com

SHIELD™

COMMERCIAL WATER HEATERS

SHIELD – EVEN BETTER

Lochinvar has done it again! The Shield™ commercial water heating product line has been upgraded, refined and expanded to give you more reasons to choose Shield. The Shield is now available in eight models. Offering you more sizes in ASME construction and a new 125,000 Btu/hr-65 gallon model. We have added a large LCD display and a new control with more features. All utility connections are now out the top of the unit to reduce equipment room footprint and improve installation flexibility. Additionally, a large removable pump access panel has been added and the control has been moved to the front of the cabinet, improving the serviceability of the Shield. These design improvements and more make the new Shield better than ever.

96% EFFICIENCY — LIME SCALE FREE FOR LIFE

The Shield water heater operates at 96% thermal efficiency and provides 100% effective defense against a water heater's worst enemy – lime scale buildup on the tank and heating surfaces.

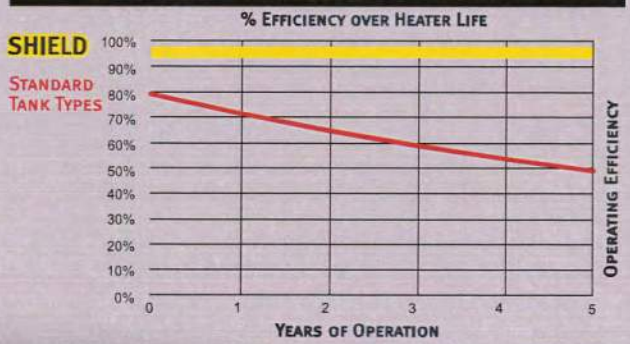
Tank type water heaters suffer from one thing the Shield does not, lime scale buildup. Lime scale insulates the water from the heat source, decreasing thermal efficiency and increasing operating costs. Just a ¼" of lime scale will increase fuel consumption and raise operating costs as much as 25%.

Shield has no flue tubes inside the tank. The water is heated in a separate stainless steel heat exchanger mounted above the tank. By controlling and creating high water velocity through the heat exchanger, the heat surface areas are kept clean so thermal efficiency remains high, for life.

The chart below illustrates Shield's sustained long life efficiency compared to standard, tank type water heaters.

"In-tank" flue tubes and heat exchangers suffer from lime scale buildup beginning from the first hours of operation.

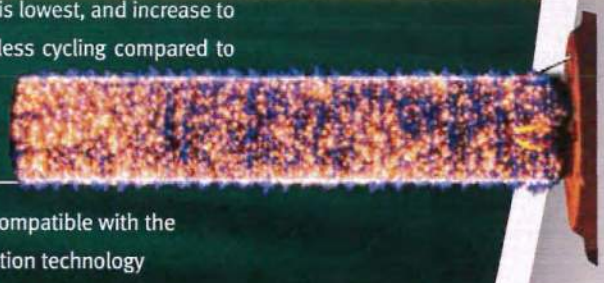
EFFICIENCY LOSS DUE TO LIME SCALE BUILDUP



***NOTE:** The chart is based on limescale build-up of 1/16 inch per year which reduces operating efficiency approximately 8-10% per year.*

FULLY MODULATING BURNER WITH 5:1 TURNDOWN

SHIELD can fire as low as 20% of maximum input when water heating demand is lowest, and increase to 100% for peak-demand periods. This results in better overall efficiency and less cycling compared to "on-off" tank-type units that can only fire at 100%.



'NEG/REG' SEALED COMBUSTION TECHNOLOGY

SHIELD utilizes an advanced combustion system which provides NOx ratings compatible with the most stringent air quality standards. Additionally, the NEG/REG sealed combustion technology allows the unit to operate with inlet gas pressure as low as 4 inches water column.

Advanced Electronic Control

SHIELD features the ultimate water heater control which makes system setup, service and operation a breeze. A backlit LCD display gives readouts of setup, system status and diagnostic information. SMART CONTROL™ also includes:

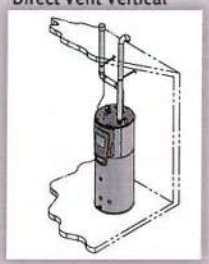
- › Night Setback
- › Time Clock
- › Alarm Contacts
- › Runtime Contacts
- › Enable/Disable Contacts
- › Last 10 Lock-Outs
- › Security Protection
- › Adjustable Pump Delay
- › Contacts for Louvers

7 Venting Options!

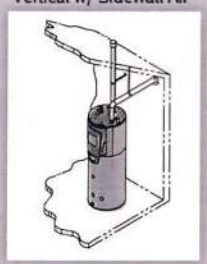
Room Air Vertical

Room Air Sidewall

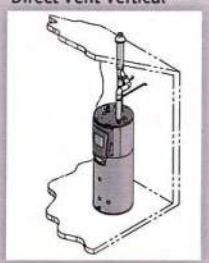
Direct Vent Vertical



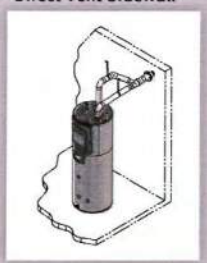
Vertical w/ Sidewall Air



Direct Vent Vertical*

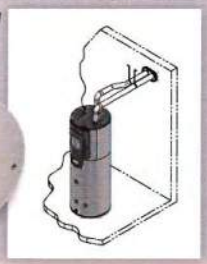


Direct Vent Sidewall*



Direct Vent Sidewall

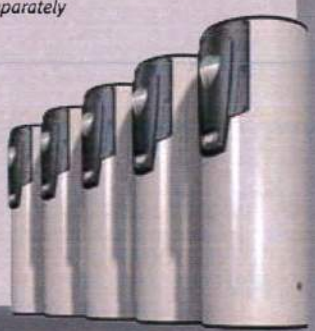
Sidewall Vent Termination Factory Supplied and Shipped Standard with Every Model!



**Optional Concentric Vent Kit Sold Separately*

Installation Flexibility

As always, multiple SHIELD water heaters can be manifolded together to meet large demands. Now, with new optional Side Tappings, a SHIELD can be connected to an additional heat source, such as a Lochinvar/TiSun Solar Array or a ARMOR water heater.



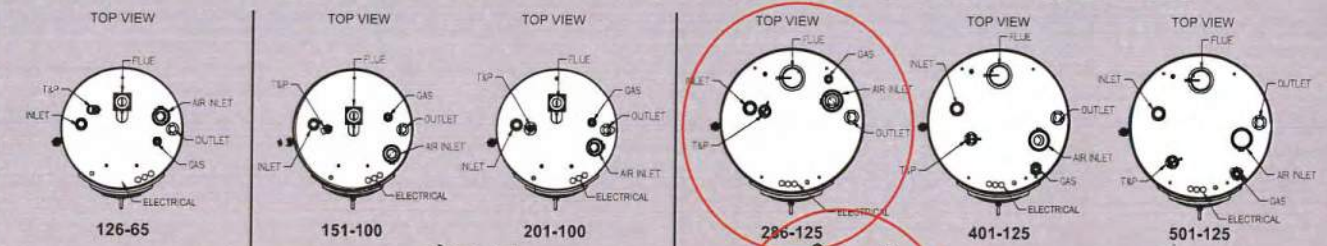
SHIELD™ PAYBACK CALCULATOR

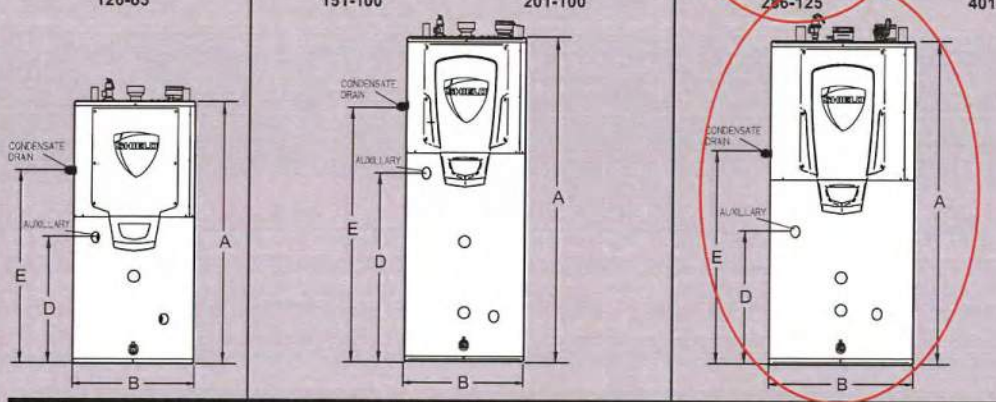
SHIELD™ innovation makes the difference! The following estimated comparisons show the effects of lime scale buildup on thermal efficiency and yearly operating cost for the 96% efficient SHIELD and a standard 80% efficient tank-type commercial water heater. Comparison is based on 200,000 Btu/hr units delivering 2,000 gallons of hot water per day, 365 days per year, at an 80°F temperature rise, with a natural gas rate of $1.22 per therm. (Based on DOE Energy Guide price per therm).

Bottom line, these numbers show that because of its 96% efficiency and lime scale free performance, SHIELD will pay back the initial cost difference in energy savings alone in just 1.43 years!

	SHIELD WATER HEATER		STANDARD 80% EFFICIENT UNIT		OPERATING COST DIFFERENCE	
	Efficiency	Operating Cost	Efficiency	Operating Cost	Yearly	Cumulative
Year 1	96%	$6,123	72%	$8,164	$2,041	$2,041
Year 2	96%	$6,123	65%	$9,043	$2,920	$4,961
Year 3	96%	$6,123	58%	$10,134	$4,011	$8,972
Year 4	96%	$6,123	52%	$11,304	$5,181	$14,153
Year 5	96%	$6,123	47%	$12,506	$6,383	$20,536

SHIELD™ WATER HEATER DIMENSIONS AND SPECIFICATIONS





Model Number Guide

S	N	A	401	125
SHIELD	Natural Gas	ASME Construction	Btu/hr Input	Tank Capacity

SHIELD Water Heater
Natural Gas
ASME
400,000 Btu/hr Input
125 Gallon Tank

Model Number	Btu/hr Input	Capacity (Gal)	GPH @ 100° Rise	First Hour	A	B	D	E	Gas Conn.	Water Conn.	Air Inlet	Vent Size	Shipping Wt. (lbs.)
SNR126-065	125,000	65	145	197	60-1/4"	28"	29-1/2"	45-1/4"	1/2"	1-1/2"	3"	3"	377
SNR151-100	150,000	90	175	247	75-1/2"	28"	44"	59-1/2"	1/2"	1-1/2"	3"	3"	700
SNR201-100	199,999	90	233	305	75-1/2"	28"	44"	59-1/2"	1/2"	1-1/2"	3"	3"	725
SNA151-100*	150,000	90	175	247	75-1/2"	28"	44"	59-1/2"	1/2"	1-1/2"	3"	3"	700
SNA201-100*	199,999	90	233	305	75-1/2"	28"	44"	59-1/2"	1/2"	1-1/2"	3"	3"	725
SNA286-125*	285,000	120	332	428	75-1/2"	34"	31"	49"	3/4"	2"	4"	4"	800
SNA401-125*	399,999	120	465	561	75-1/2"	34"	31"	49"	1"	2"	4"	4"	850
SNA501-125*	500,000	120	582	678	75-1/2"	34"	31"	49"	1"	2"	4"	4"	875

Change N to L for LP gas. *Electrical Requirements: 120 VAC/60Hz/Phase* **A = ASME Construction* *Field convertible to LP Gas* *All Information is subject to change.*

STANDARD FEATURES

- 96% Thermal Efficiency
- Modulating Burner with 5:1 Turndown
- Operates at Temperatures up to 180°F for Sanitizing Applications
- Stainless Steel Heat Exchanger
- Glass-Lined Steel Tank
- 150 PSI Working Pressure
- ASME Construction (SNA151–501)
- ASME Temperature and Pressure Relief Valve
- Zero Clearances to Combustible Material
- Certified for Installation on Combustible Floors
- PVC, CPVC, Polypropylene and Stainless Steel Venting up to 100 Equivalent Feet
- Direct-Vent Sealed Combustion
- Rooftop and Sidewall Venting
- Sidewall Vent Termination
- Advanced SMART CONTROL, with:
  - LCD Display
  - Time Clock
  - Night Setback
  - Alarm Contacts
  - Runtime Contacts
  - Manual Reset High Limit
  - 3 Water Temperature Sensors
  - Flue Temperature Sensor
  - Contacts for Louvers
  - Adjustable Pump Delay
  - Security Protection
  - Enable/Disable Contacts
- Low-NOx Operation, meets SCAQMD Rule 1146.2
- Low Gas Pressure Operation
- Direct-Spark Ignition
- Full Port Brass Drain Valve
- 8-Foot Power Cord
- 3-Year Limited Warranty
- 1-Year Parts Warranty

OPTIONAL EQUIPMENT

- Alarm Bell
- Concentric Vent Kit
- Condensate Neutralization Kit
- Low Water Cutoff
- Tank Side Tappings for Alternate Heat Source

Lochinvar
High Efficiency Water Heaters, Boilers and Pool Heaters

MTI MAINTENANCE TECHNOLOGY
Efficiency Maine QUALIFIED PARTNERS
AHRI CERTIFIED
LOW LEAD CONTENT
HLW

MAINTENANCE TECH., INC. ~ 207-775-1516
235 Riverside Industrial Pkwy. ~ Portland, Maine 04103

FG-10M-4/13-Printed in U.S.A

FESTOON SYSTEM

IMAGES

AUTOMATIC UNDERCARRIAGE WASH SYSTEM

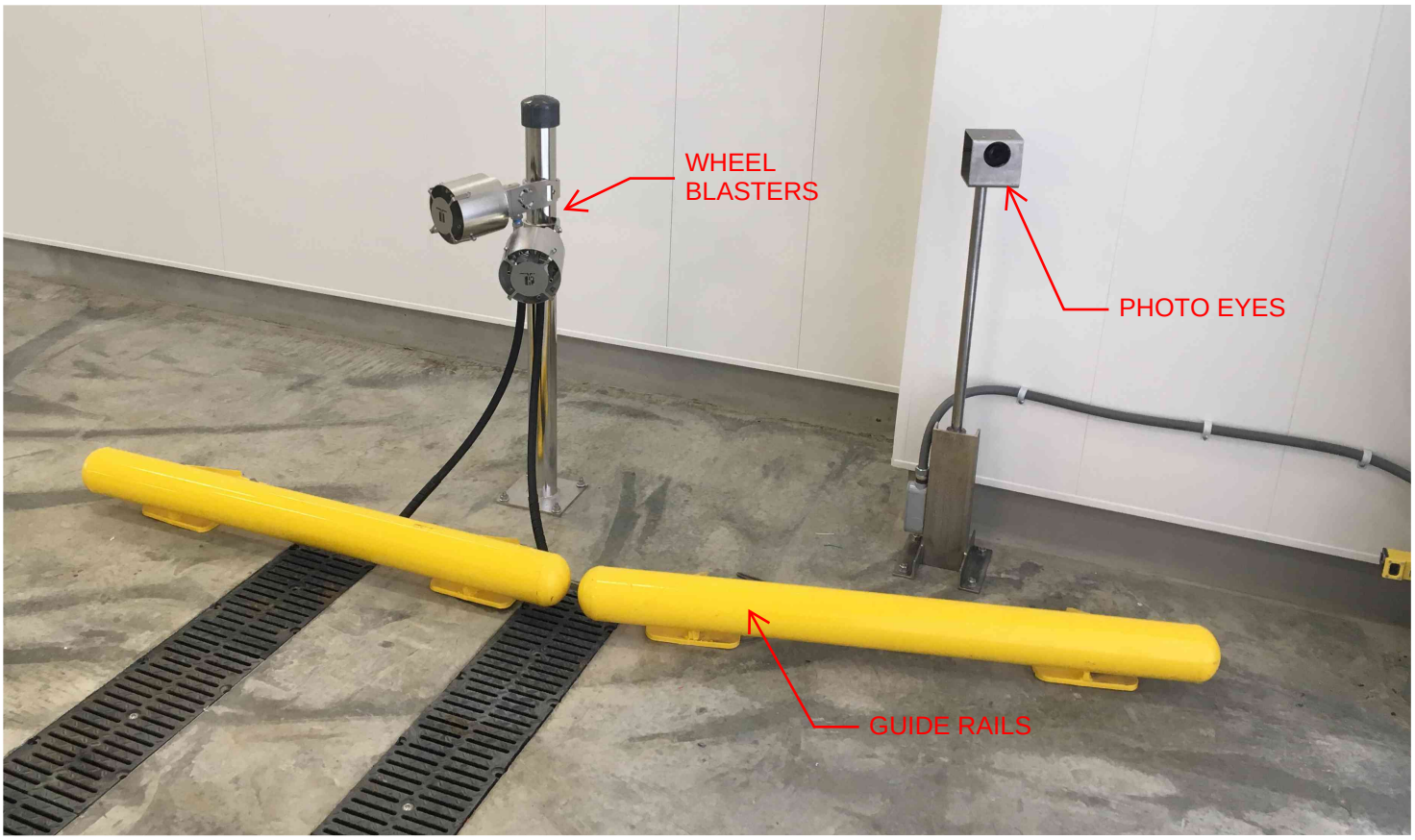
IMAGES

Dimensions:
90" L x 32" D x 73" H

Control Panel Dimensions:
25" L x 12" D x 31" H

UNDERCARRIAGE WASH ASSEMBLY (WHEEL BLASTERS, GUIDE RAILS, PHOTO EYES, & TRENCHES)

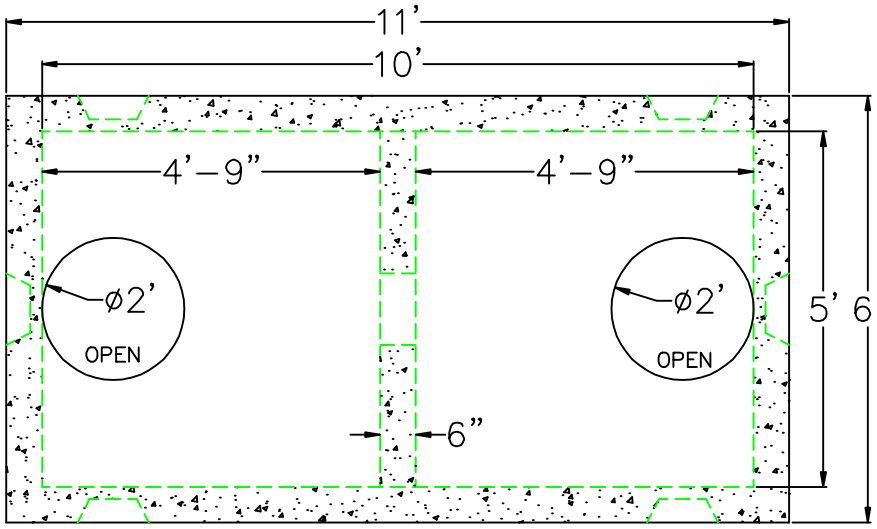
IMAGES

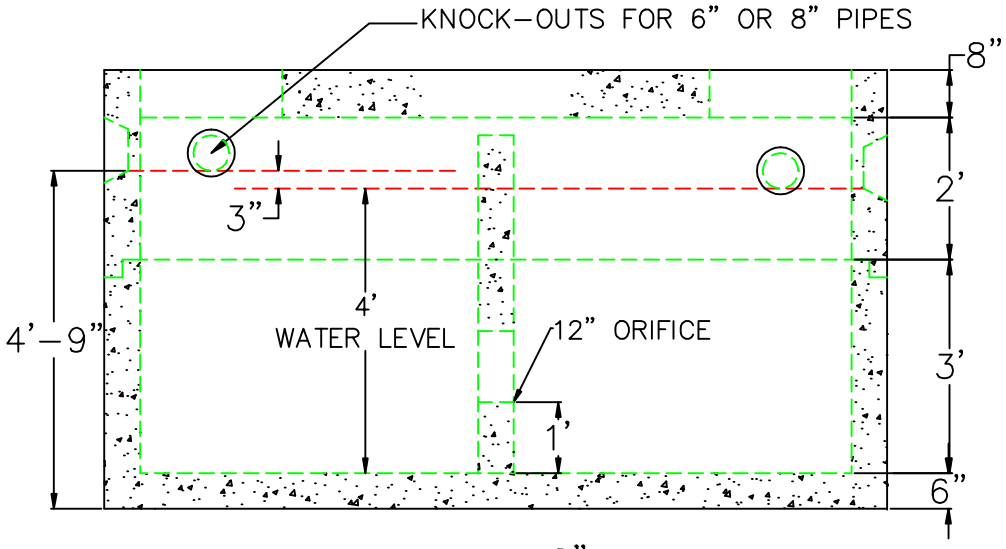


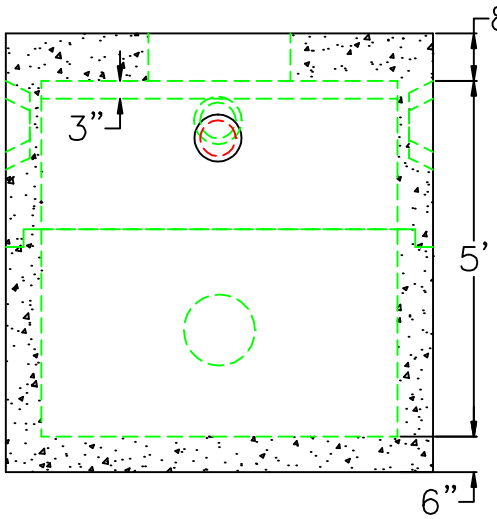
UNDERCARRIAGE WASH TRAFFIC LIGHT

IMAGES

1,500 GALLON TANK WITH BAFFLE







DESIGN NOTES:
1. CONRETE 5,000 PSI. @ 28 DAYS
2. HS-20-44 LOADING WITH 12" TO 60" OF COVER
3. REINFORCING ASTM A-615 GRADE 60
4. CONST. JOINT TO HAVE MIN. 1" BUTYL SEALANT

	FLOOR	VERT. FT	FLAT TOP
WEIGHT	4,850 lbs.	2,470 lbs.	6,400 lbs.
VOLUME		375gal.	

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SCITUATE RAY PRECAST
120 CLAY PIT ROAD
MARSHFIELD, MA 02050
PHONE # 1-800-440-0009
FAX # 781-837-4320

CONTRACTOR: WESTON & SAMPSON

JOB NAME: HOPKINTON DPW

DATE: 6/30/2016 | APPROVED BY: | DRAWING BY: JOHN KASPER

Cotterman®

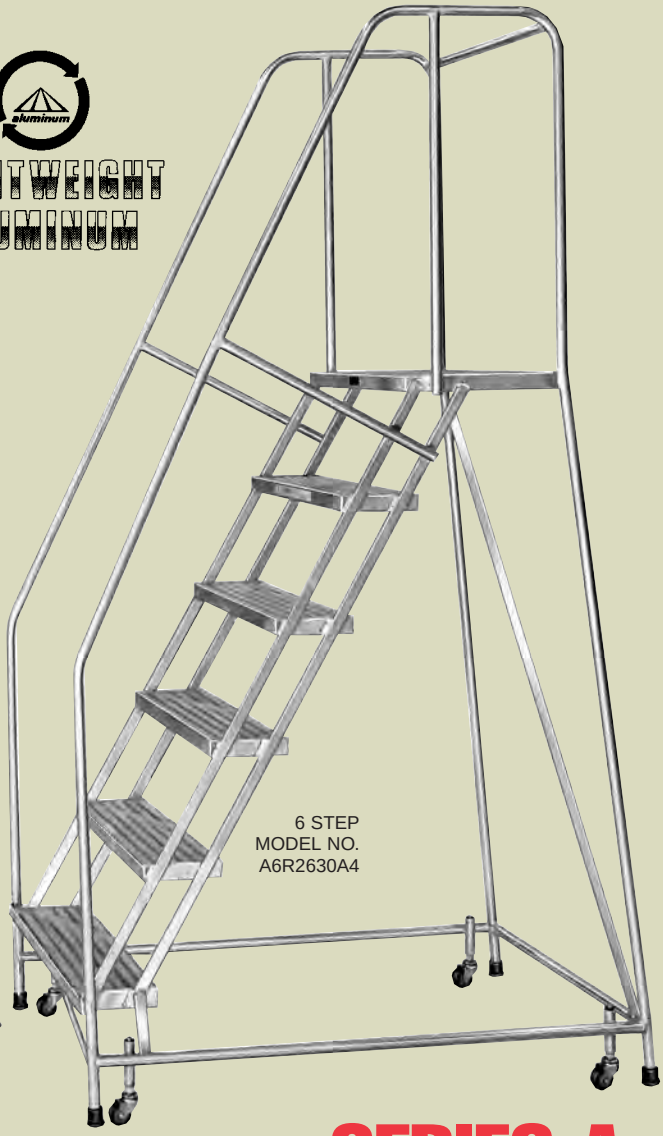
COTTERMAN ALUMINUM SERIES "A" SAFETY LADDERS are one-piece set-up assemblies of high strength aluminum alloy. The solid ribbed aluminum steps and platform provide sure footing in areas where dress shoes or high heels are worn. In addition to being lightweight, aluminum ladders are corrosion resistant and easy to clean. They are also non-magnetic.

LIGHTWEIGHT ALUMINUM

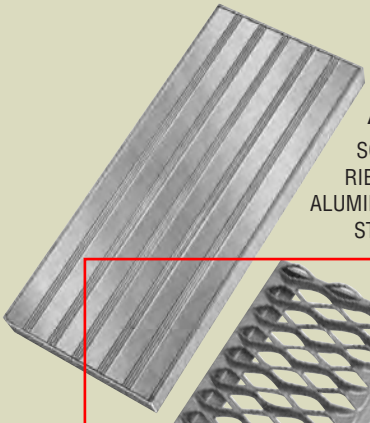
FEATURES:

- **The structural framework is of 1" O.D. 6061-T6 high strength aluminum alloy tube.**
- **Both the steps and the top step are 16" or 24" wide and available in solid ribbed extruded aluminum alloy or aluminum grip strut. The steps are 7" deep. The top step is 14" deep.**
- **All ladders are provided with spring loaded 2" ball bearing swivel brake casters and reinforced rubber tipped legs.**
- **Ladders are normally furnished with unpainted aluminum mill finish.**
- **Series A aluminum ladders comply with OSHA 1910.29 and ANSI A14.7 standards with a 350 lb. load rating. Cal-OSHA models also available.**

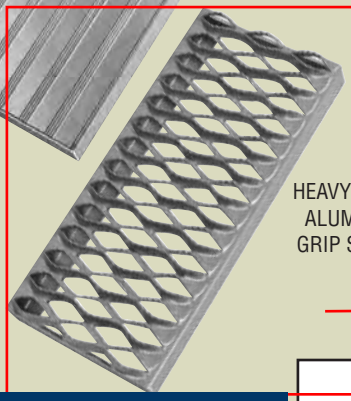
3 STEP
MODEL NO.
A3R2630A3



6 STEP
MODEL NO.
A6R2630A4



A4
SOLID RIBBED ALUMINUM STEPS



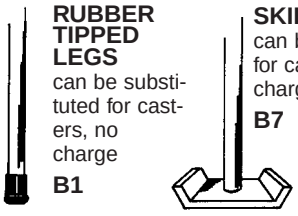
A3
HEAVY DUTY ALUMINUM GRIP STRUT

WELDED ALUMINUM SAFETY LADDERS SERIES A

NO. STEPS INCL. TOP STEP	TYPE OF RAILS	TOP STEP HT.	OVER-ALL HT.	18" WIDE AT TOP					26" WIDE AT TOP				
				MODEL NO.	BASE W"xL"	SHPG. WT.	A4 TREAD	A3 TREAD	MODEL NO.	BASE W"xL"	SHPG. WT.	A4 TREAD	A3 TREAD
1	NONE	12"	12"	*A1N1818	18x20	13			*A1N2626	26x20	14		
2	NONE	20"	20"	*A2N1818	20x23	16			*A2N2626	26x23	20		
2	HAND	20"	50"	A2R1818	20x23	19			A2R2626	26x23	21		
3	NONE	30"	30"	A3N1822	22x29	21			A3N2630	30x29	25		
3	HAND	30"	60"	A3R1822	22x29	24			A3R2630	30x29	27		
4	NONE	40"	40"	A4N1822	22x36	26			A4N2630	30x36	30		
4	HAND	40"	70"	A4R1822	22x36	28			A4R2630	30x36	32		
5	HAND	50"	80"	A5R1822	22x43	35			A5R2630	30x43	39		
6	HAND	60"	90"	A6R1824	24x50	39			A6R2630	30x50	44		
7	HAND	70"	100"	-	-	-			A7R2630	30x57	54		
8	HAND	80"	110"	-	-	-			A8R2630	30x63	61		

***Shippable via UPS at additional boxing cost**

OPTIONS



RUBBER TIPPED LEGS can be substituted for casters, no charge
B1

SKID PLATES can be substituted for casters, no charge
B7

COTTERMAN COMPANY IS PROUD TO BE A MEMBER OF THE FOLLOWING ASSOCIATIONS:

MEMBER ANSI

MHIA® The Material Handling Industry of America MEMBER COMPANY

MEMBER SCAFFOLD INDUSTRY ASSOCIATION SIA

National Safety Council

MTI MAINTENANCE TECHNOLOGY

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UNDERCARRIAGE WASH STATUS LIGHT

IMAGES

REMOTE ON/OFF CONTROLS

IMAGES

UNDERCARRIAGE WASH CONTROL STATION

IMAGES

EXHAUST REMOVAL SYSTEM

Industrial Equipment					
- Wash Equipment	$	96,900	x	$	96,900
- Wash Equipment - Undercarriage Wash	$	61,500	x	$	61,500
- Heavy Duty Vehicle Lift (Fixed)	$	147,700	x	$	147,700
- Light Duty Vehicle Lift (16,000 lb capacity minimum)	$	46,100	x	$	46,100
- Bridge Crane	$	84,900	x	$	84,900
- Overhead Lubrication System	$	150,000	x	$	150,000
- Miscellaneous Shop and Support Equipment	$	64,100	x	$	64,100
- Storage Shelving / Benches / Racks	$	51,800	x	$	51,800
- Exhaust Removal System (2 units)	$	50,700	x	$	50,700
Industrial Equipment Subtotal:				**$**	**753,700**

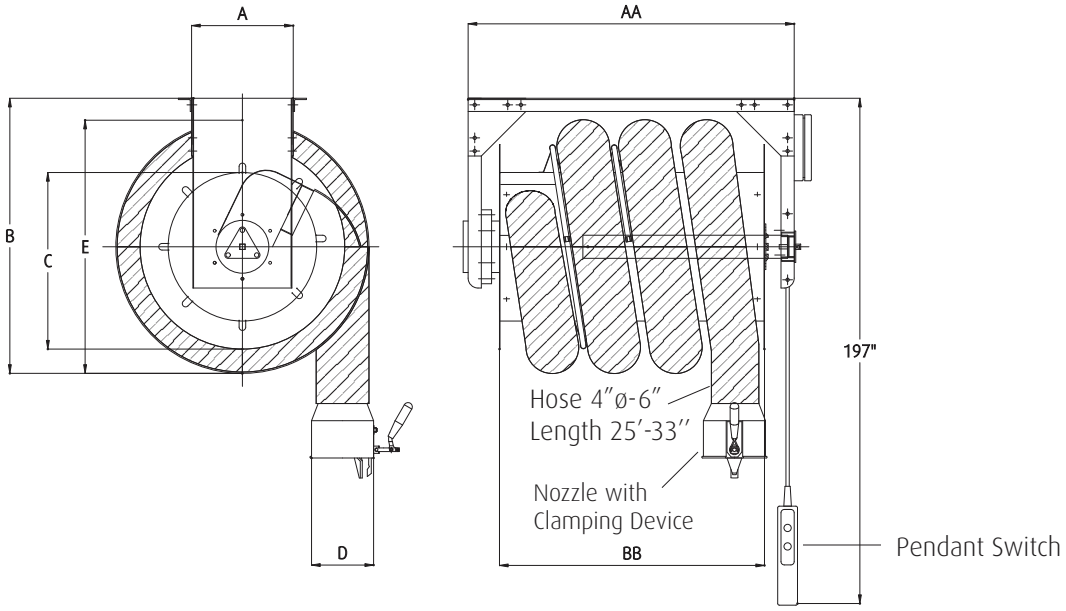
NOTE: COST ESTIMATE FROM SEPTEMBER 2022 DUXBURY, MA DPW SCHEMATIC DESIGN ESTIMATE

Section 2: Hose Reels

For Cars, Trucks & Buses

Stationary Motorized

Hose Reel



MODEL	WEIGHT	HOSE	A	B	C	D	E	AA	BB	TEMP
ARI-100	123 lbs.	4"	15.25"	33"	18"	4"	30.25"	38.75"	31.5"	360°F
ARI-125	128 lbs.	5"	15.25"	33"	18"	5"	30.25"	38.75"	31.5"	360°F
ARI-150	150 lbs.	6"	15.25"	33"	18"	6"	30.25"	38.75"	31.5"	360°F

* Drawings above feature 25' of hose. Dimensions will change with additional hose.

Hose Reel

The standard hose reel is capable of holding 25' of exhaust gas hose. The reel rotates via two maintenance-free bushings. Bushings come in two sizes - 6.25" and 2.75" - and are made of friction-free material.

Hose Reel Frame

The hose reel frame is composed of zinc-plated steel. Each member of the frame features a thickness of no less than .2". All hardware is zinc-plated. The hose reel drum is constructed from 22 gauge zinc-plated steel. Drum ends are made of .125" aluminum with a non-abrasive rubber edge strip.

Hose Reel Motor

ARI-HETRA motorized hose reels feature a compact cylindrical control motor with thermal overload protection.

Torque: 44 ft./lbs. Speed: 12 rpm Power: 330W
Voltage: 115V/ 60Hv or 220V Current: 2.8A 1-Phase

Hose Reels in Chart Above Include:

- 25' of hose that is temperature rated to 360°F
- Nozzle end with clamping device *(See Components Section)*

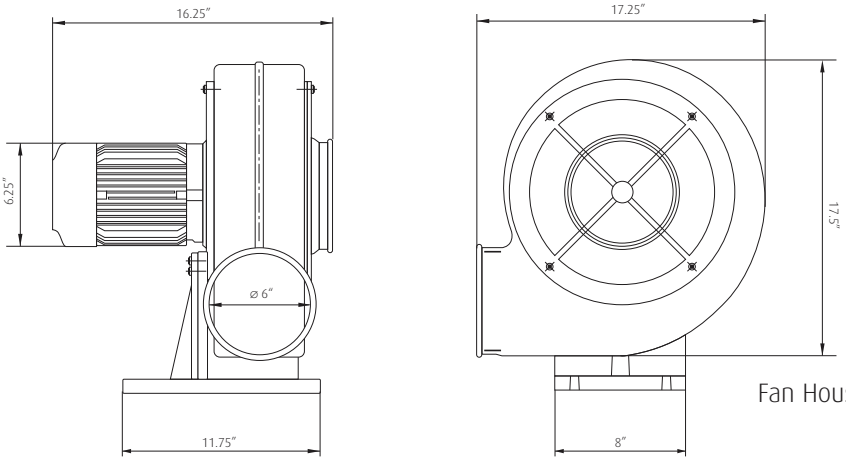
Available Accessories

- Pendant Remote
- Radio Remote

} Only Motorized

- Hose in lengths of 33', 42', 56'
- Flange-Mount Fan *(See Fan Section)*
- Shut-Off Damper

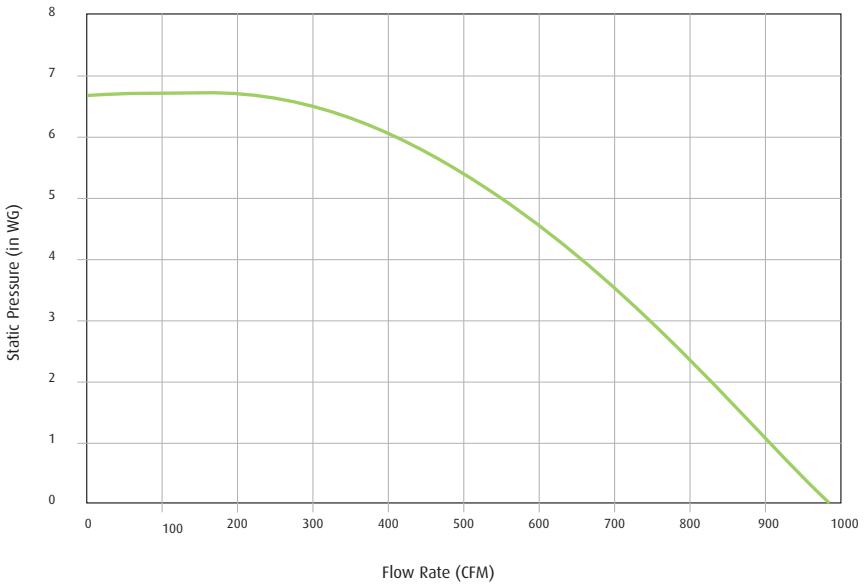
ARI 17



Fan Housing painted "safety green".

Motor Data

Free Outlet Flow Rate	1018 CFM
Pressure Increase, Fully Throttled	6.95" WG
Motor Nominal Rating	1.5HP
Weight Approximately	52 lbs.
Voltage Delta Connection	110V, Single Phase, 60Hz
Current Draw Approximately	12.8A



MISC. EQUIPMENT

WELD FUME EXTRACTOR

NEW

ITEM NAME/NUMBER

MILLER

FILTAIR MWX-D FUME EXTRACTOR W/7-FT EXTRACTION ARM (951507)

PRICE

$5,695.00

WEBSITE

www.weldingsuppliesfromioc.com

AS OF 5-19-2020

IMAGES

SPECIFICATIONS

SEE ATTACHED PAGES

DESCRIPTION

The powerful high-volume system with a MERV 15 high-efficiency filter is ideal for fabrication shops, manufacturing, repair work and training centers where mobility is needed. The MWX-D models include a disposable filter, whereas the MWX-S models include a self-cleaning filter.

Quick Specs:
- Filter Media: 490ft
- Air Flow: 875 CFM
- Sound Level: Aprox. 70 dBA at 5 feet
- Motor Specs: 1HP, 3450 RPM
- Input Power: 115V, 1-Phase, 60 Hz at approximately 11.9A
- Extractor Dims: 35"H, 32" W, 48"D
- Extractor Arm Dims: 8-inch diameter, Available in 7, 10, & 12 foot lengths
- Weight: MWX-D: 238 lbs, MWX-S: 300 lbs

Comes With:
- 115V mobile fume extractor
- 7-foot extraction arm (8-inch diameter)
- FilTek XL Filter

FILTAIR® MWX Series

Issued June 2012 • Index No. AY/3.0

Fume Extractor

Quick Specs

Industrial Applications
- Manufacturing and Fabrication
- Maintenance and Repair Operations
- School and Training Facilities

Processes
- Stick (SMAW)
- Flux-Cored (FCAW)
- MIG (GMAW)
- TIG (GTAW)

Filter Media 490 ft.² (45.52 m²)
Accu-Rated™ Airflow 875 CFM (413 L/sec.)
Sound Level Approximately 70 dBA at 5 ft. (1.5 m)
Motor Specifications 1 HP, 3450 RPM
Input Power 115 V/1-Phase/60 Hz at approximately 11.9 A

Dimensions H: 34.75 in. (883 mm)
W: 31.75 in. (806 mm)
D: 48 in. (1219 mm)
Extraction Arm 8-in. (203 mm) diameter 7-, 10-, and 12-ft. lengths (2.1, 3 and 3.7 m)
Weight MWX-S 300 lb. (136 kg)
MWX-D 238 lb. (108 kg)

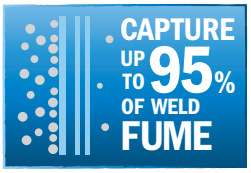
The Power of Blue®

Mobile fume extraction systems designed specifically for welding.

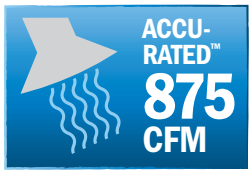
The powerful high-volume system with a MERV 15 high-efficiency filter is ideal for fabrication shops, manufacturing, repair work and training centers where mobility is needed.

Have a certified industrial hygienist test the air in your facility to determine equipment requirements and ensure adequate protection from contaminants.

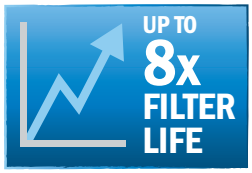
Disposable filter (MWX-D) and self-cleaning filter (MWX-S) models available.



Standard high-efficiency filter designed to capture weld fume



Better suction for a cleaner work space



FilTek™ XL cleanable filters last longer

TRUE BLUE® WARRANTY

Fume extractor is warranted for 1 year, parts and labor.

Intertek *Meets both UL and CSA standards.*

Miller®

Miller Electric Mfg. Co.
An Illinois Tool Works Company
1635 West Spencer Street
Appleton, WI 54914 USA

Equipment Sales US and Canada
Phone: 866-931-9730
FAX: 800-637-2315
International Phone: 920-735-4554
International FAX: 920-735-4125

Website
MillerWelds.com

ISO 9001 REGISTERED QUALITY SYSTEM

FilTek™ XL Filters

Cleaner Air with FilTek XL Filters

The FilTek XL filter's higher MERV rating means unrivaled filtering performance.

Filters are rated on a MERV scale, which measures filter efficiency based on particle count. MERV ratings range from 1–16, with 16 being the best at filtering small particles—such as those found in weld fumes. The vast majority of weld fumes are less than one micron in diameter, or roughly 1/100th the width of a human hair.

Filters in common air filtration systems often have MERV ratings between 7–11. FilTek XL filters are rated at class-leading MERV 15–16 to capture up to 95 percent of weld fume particulates.

MERV Comparison

Applicable Weld Fume MERV Rating Categories[1]	Particle Size Range Efficiency %[2]		
	0.3 to 1 µm	1 to 3 µm	3 to 10 µm
10	Not Rated	50–65%	85%
11	Not Rated	65–80%	85%
12	Not Rated	80–90%	85%
13	<75%	90%	90%
14	75–85%	90%	90%
15 Miller® FilTek XL	85–95%	90%	90%
16 Miller® FilTek XL	95%	90%	90%
Percentage of Weld Fume Particle Size[3]	75–95%	15%	10%

[1] *American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) 52.2*
[2] *National Air Filtration Association (NAFA) Guide*
[3] *Jenkins, Pierce, Edgar, Particle Size Distribution of GMAW and FCAW*

Filter Media Performance Summary

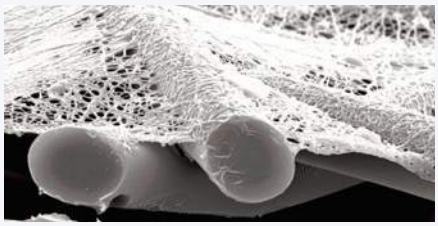
FilTek XL filters have the highest efficiencies and lowest pressure drops to capture better, last longer, and lower operating costs.

Filter Media Type	Weld Fume Capture Efficiency	Pressure Drop	Relative Cost
Cellulose	Very Low	Low	$
Cellulose Blend	Low	Moderate	$
Spunbond Polyester	Moderate/high	High	$$$
Meltblown Composite	High	High	$$
Miller FilTek XL	**High**	**Low**	**$$**

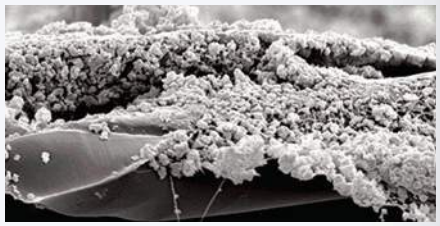
FilTek XL filters provide high efficiencies and low operating pressure to out-filter, outperform, and outlast all the rest.

Not Just Filters — FilTek XL Filters

The FilTek XL filter media design results in extended filter life, higher efficiency and stronger suction, resulting in a cleaner work space and improved weld fume capture. Filter media from FilTek XL high-volume filters are made up of a durable substrate with an engineered fiber designed to capture even the smallest of weld fume particles, while maintaining the highest level of efficiency.



Clean FilTek XL media



Surface loaded FilTek XL media (substrate still clean)

The FILTAIR® Advantage

Accu-Rated™ Performance Summary

- The MWX design and ratings are specific to weld fume capture.
- While most extractors have CFM rated at the blower, the Miller® MWX is rated at 875 CFM at the capture hood which is where suction is needed to capture weld fume.
- The MWX is designed to exceed the ACGIH recommended weld fume transport velocity of 2000 feet per minute.

This results in the MWX having stronger suction power for a cleaner work space.

Easy-to-operate extraction arm with external adjustments so air can pass through with less airflow resistance, giving you stronger CFM (airflow). It offers reliable and accurate positioning across the full range of motion of the arm, as well as easy adjustment and maintenance to ensure long-lasting operation. Pre-assembled extraction arms are available in 7-, 10- and 12-foot lengths.

***NEW!* Preassembled arms** for fast, easy setup.

Durable bellmouth-shaped hood features a convenient 360 degree rotation for unlimited positioning. One of the largest in the industry, FILTAIR's extraction hood captures weld fumes at a greater distance from the source than other hood designs. This also means less hood adjustments for longer welds.

Built-in tool tray provides workers with a convenient area to place their tools without them rolling off of the unit.

Exclusive hinged filter hatch features a convenient locking mechanism for easy access to the filter and tool-free replacement.

Power switch is conveniently located for easy on/off access.

Metal cabinet design ensures long-lasting durability in a manufacturing environment.

Filter pressure gauge with easy-to-read color code indicates when pressure drop increases and cartridge filter needs to be replaced (MWX-D) or cleaned (MWX-S).

Large rear wheels allow for easy movement over weld cables and from one work cell to another.

Lockable swivel casters allow users to keep fume extraction system stationary during movement of the arm.

Particulate disposal bin (MWX-S only) provides easy and convenient access to empty out collected particulate. Handle releases drawer allowing it to slide out.

Self-cleaning mechanism (MWX-S only) is easy to use. Just push button on control panel to activate the pulse cleaning cycle that cleans the filter from the inside out. Weld fume particulate is removed from the filter and safely deposited in the particulate disposal drawer.

Convenient air connection (MWX-S only) for dry compressed air supply.

Note: Compressed air required to operate cleaning mechanism.

115 VAC, 20-foot (6 m) power cord enables welders to freely move fume extractor.

Specifications (Subject to change without notice.)

Filter Media	Accu-Rated™ Airflow	Extraction Arm Diameter	Sound Level	Motor	Power	Dimensions	Net Weight	Shipping Weight
490 ft.^{2} (45.52 m^2)	875 CFM (413 L/sec.)	8 in. (203 mm)	Approximately 70 dBA at 5 ft. (1.5 m)	1 HP, 3450 RPM	115 V/1-Phase/60 Hz at approximately 11.9 A	H: 34.75 in (883 mm) W: 31.75 in (806 mm) D: 48 in (1219 mm)	**MWX-D** 238 lb. (108 kg) **MWX-S** 300 lb. (136 kg)	**MWX-D** 285 lb. (129 kg) **MWX-S** 340 lb. (154 kg)

Genuine Miller® Accessories

Replacement Filter

#300 539
Disposable

#300 540
Self-cleaning (shown)

MWX Hood Light with Arc Sensor
#300 689 Field
The hood light with arc sensor illuminates the welding zone and enables the fume extractor to start automatically when welding begins.

Ordering Information

Equipment and Options	Stock No.	Description	Qty.	Price
MWX-D Packages (Includes mobile extractor, high-efficiency filter and arm.)	**#951 507** **#951 508** **#951 509**	With 7-ft. extraction arm and disposable filter With 10-ft. extraction arm and disposable filter With 12-ft. extraction arm and disposable filter		
MWX-S Packages (Includes mobile extractor, high-efficiency filter and arm.)	**#951 510** **#951 511** **#951 512**	With 7-ft. extraction arm and self-cleaning filter With 10-ft. extraction arm and self-cleaning filter With 12-ft. extraction arm and self-cleaning filter		
Base Components				
SA-807	**#300 977**	7-ft. pre-assembled extraction arm		
SA-810	**#300 978**	10-ft. pre-assembled extraction arm		
SA-812	**#300 979**	12-ft. pre-assembled extraction arm		
Replacement Filters				
Disposable Filter	**#300 539**			
Self-Cleaning Filter	**#300 540**			
Accessories				
MWX Hood Light with Arc Sensor	**#300 689**	Field		

Date: **Total Quoted Price:**

Please call toll-free 855-FILTAIR (855-345-8247) for information on fume extraction solutions.

Distributed by:

Miller®

Litho in USA

Bradley® Portable Drench Hose & Eye Wash

PLS1617 – Write a Review

Portable, Holds 10 gal., Flow Rate 0.4 gal./Minute Minimum

Take this portable eye wash unit anywhere to provide ANSI-compliant emergency flushing.
Read More >

Risk-Free Guarantee

PRICING (Based on quantity)

1+
$2,044.00

QTY 1 $2,044.00

ADD TO CART

VIEW PRODUCT ACCESSORIES

+ **Proposition 65** - Attention CA Residents

− Overview

Take this portable eye wash unit anywhere to provide ANSI-compliant emergency flushing.

clean and clear (water-treatment additive sold separately)

- 8' hose extends reach and full-size spray head fully

- Stay-open valve prevents accidental shut off prior to full irrigation
- 10-gallon pressurized tank ensures ANSI standard 15 minutes of 0.4 gpm flow through eye wash or 3 minutes of 3 gpm flow through drench hose
- Tire-filler valve allows convenient pressurizing with standard air compressor or pump
- Attached gauge and relief valve help you monitor and maintain a safe pressure level
- Dust caps protect eye wash and drench hose heads from contamination and automatically release with activation

Bradley

+ Specifications

+ Resources & Downloads

Accessories for PLS1617

PLS726

★★★★☆ (1)

Hydrosep® Water Treatment Additive

- For 6 to 20 gal. Eyewashes
- 4 - 8 oz. Bottles
- 4 each

$49.00

SGN2018

PIG® Eye Wash Station Sig

- Personal Protection & First Aid
- 14" x 10"
- 1 each

$15.00 - $19.00

Reviews

Be the first to write a review for Bradley® Portable Drench Hose & Eye Wash.

WRITE A REVIEW

Customers Also Bought:

TIRE INFLATION CAGE

NEW

ITEM NAME/NUMBER

MARTINS INDUSTRIES

YOUR TIRE EQUIPMENT MANUFACTURER

5-BAR TIRE INFLATION CAGE

PRODUCT NUMBER: MIC-5

PRICE

$539.00

WEBSITE

www.martinsindustries.com/

AS OF 5-19-2020

IMAGES

DESCRIPTION

The 3-bar, 4-bar and 5-bar tire inflation cages are used for changing and inflating tires for trucks, buses, military vehicles, etc. These truly heavy-duty inflation cages are manufactured in our Canadian plant using steel that meets the toughest standards in North America. MARTINS safety cages, a mandatory precaution for tire inflation, provide good protection and exceed the requirements of OSHA Standard 29 CFR 1910.177 in the U.S. and is CE certified.

SPECIFICATION

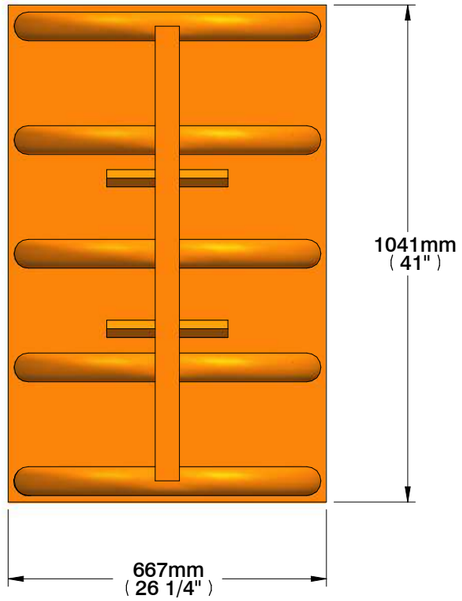
Dimensions (L x W x H)	41'' X 26-1/4'' X 57-5/16'' 1041 X 667 X 1455 mm
Max. tire size	47'' OD X 19'' W 1194 mm X 483 mm W
Weight	182 lb / 82,5 kg
Colour	Orange - Powder coated paint UV Resistant - Never loses is lustre
Warranty	2 years

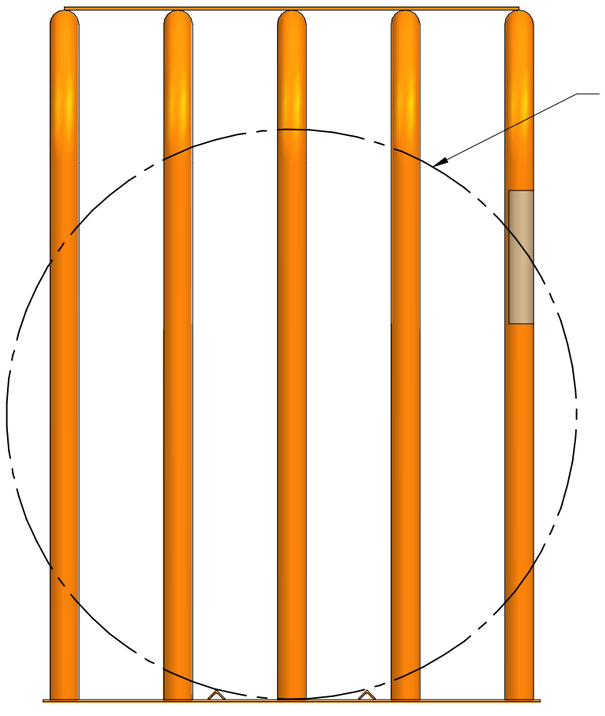
MARTINS INDUSTRIES

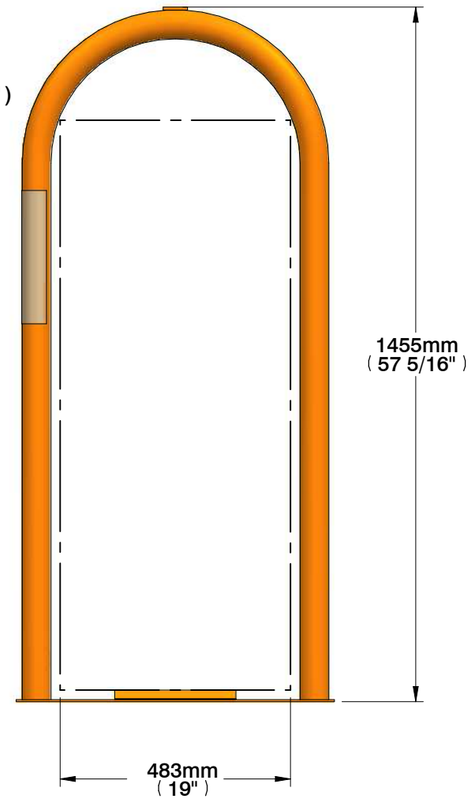
MARTINSINDUSTRIES.COM

MIC-5

WEIGHT **82,5 kg / 182 lb**







APPENDIX C

Training Summary

ASE Certification Summary

Prerequisites to taking ASE Certification Tests:

- 2 years of on the job training; or
- 1 year of on the job training and a two-year degree in automotive repair.

Certification Renewal:

- To remain ASE Certified, professionals must retest every 5 years to keep up with ever-advancing automotive technology.

Cost of tests:

- Certification Tests (except L1, L2, L3, and L4): $50 each
- Advanced Level Tests (L1, L2, L3, and L4): $100 each
- Recertification Tests: Same cost as corresponding certification test
- Registration Fee: $34 for any combination of tests

Test Preparation:

- Practice tests are available on the www.ase.com starting at $14.95 each with discounts for multiple purchases ($12.95 for 3-24 vouchers and $11.95 for 25 or more vouchers). These practice tests are highly recommended as a method of preparation.
- Free study guides are available on the www.ase.com website with step-by-step guides to understand what is involved in each test.

See attached for additional details

TEST SERIES AVAILABLE

- Automobile & Light Truck Certification Tests (A Series) +
- Collision Repair & Refinish Certification Tests (B Series) +
- Damage Analysis & Estimating Certification Test (B6) +
- Automobile Service Consultant Certification Test (C1) +
- Truck Equipment Certification Tests (E Series) +
- Alternate Fuels Certification Test (F1) +
- Auto Maintenance and Light Repair Certification Test (G1) +
- Transit Bus Certification Tests (H Series) +
- Advanced Engine Performance Specialist Certification Test (L1) +
- Electronic Diesel Engine Diagnosis Specialist Certification Test (L2) +
- Light Duty Hybrid/Electric Vehicle Specialist Test (L3) +
- Advanced Driver Assistance Systems (ADAS) Specialist Certification Test (L4) +
- Parts Specialist Certification Tests (P Series) +
- School Bus Certification Tests (S Series) +
- Medium-Heavy Truck Certification Tests (T Series) +
- Undercar Specialist Exhaust Systems Test (X1) +
- ASE Military Tactical Wheeled Vehicle Certification Tests (MIL Series) +
- Non-Certification Assessments +

MEDIUM - HEAVY TRUCK CERT. TESTS

Medium-Heavy Truck Certification Tests (T1 – T8)

Objective:

To identify and recognize those Medium and Heavy Truck Technicians who can demonstrate knowledge of the skills necessary to diagnose, service, and repair different systems of Class 4 through Class 8 trucks and tractors.

Tests Offered:

- T1 – Gasoline Engines (50 scored questions)
- T2 – Diesel Engines (55)
- T3 – Drive Train (40)
- T4 – Brakes (50)
- T5 – Suspension & Steering (50)
- T6 – Electrical/ Electronic Systems (50)
- T7 – Heating, Ventilation & Air Conditioning (HVAC) (40)
- T8 – Preventive Maintenance Inspection (50)

Master Certification Requirements:

Those who are certified in tests T2 – T8 are recognized as ASE Certified Master Medium-Heavy Truck Technicians. Master Truck Technicians who were current as of January 1, 2017, are exempt from the T8 test requirement until the first of their other truck certifications expires. When the time comes to recertify in any of the required truck tests, they will also need to take and pass the T8 test. *NOTE: T1 is not required for Master Medium-Heavy Truck Technician Status.*

Recertification:

Technicians must retest every five years to retain their certification. The Medium-Heavy Truck recertification tests (T1R – T8R) are about half as long as the initial certification tests.

Download the Study Guide:

Medium-Heavy Truck Study Guide - this guide contains test specifications, tasks lists, sample test questions, and training resources.

WORK EXPERIENCE REQUIREMENTS

ASE recognizes the following types of automotive service industry work experience:

Category	Description	Minimum amount of experience	Required for these Tests
Repair Technician	Hands-on experience maintaining, servicing, and/or repairing light-duty or heavy-duty motor vehicles.	1 year full-time (or part-time equivalent)	G1
		2 years full-time (or part-time equivalent)	A1-A9, B2-B5, E1-E3, F1, H1-H8, MIL2-MIL8, S1-S7, T1-T8, and X1
		3 years full-time (or part-time equivalent)	L1, L2, L3, and L4
Service Consultant	Hands-on experience as an automotive service writer/consultant or service manager.	2 years full-time (or part-time equivalent)	C1
Parts Specialist	Hands-on experience as a parts counterperson or managing a wholesale or retail parts store or in-house parts department.	2 years full-time (or part-time equivalent)	P1, P2, and P4
Collision Damage Estimator	Hands-on experience as an automotive collision damage estimator/adjuster.	2 years full-time (or part-time equivalent)	B6

Repair Technicians who have 2 years of experience will also automatically receive credit for the 1-year requirement. Repair Technicians who have 3 or more years of experience will also automatically receive credit for the 1-year and 2-year requirements.

FORMAL EDUCATION CREDITS

Formal Education: You can substitute high school, trade school, or community college education for part of the Repair Technician work experience requirement, as shown below. This credit can be combined with additional hands-on work experience if needed to meet the 1, 2, and 3-year Repair Technician requirements.

Formal Education / Training	Credit toward 1-year Repair Technician requirement	Credit toward 2-year Repair Technician requirement	Credit toward 3-year Repair Technician requirement
1) Complete any ASE-Accredited Program – Auto, M/H Truck or Collision-Refinish, including MLR, AST, MAST and all other current or grandfathered ASE standards	6 months	1 year	1 year
-or- 2) Complete an ASE-Accredited OEM-Sponsored Co-op Program	1 year	2 years	2 years
-or- 3) Pass 3 or more different ASE Entry-Level Certification Program Tests	6 months	1 year	1 year
-or- 4) All other training: 2 months of full-time training (or 200 program hours) equals 1 month credit	Up to 6 months	Up to 1 year	Up to 1 year

- These substitutes cannot be combined, and do not apply to the Service Consultant, Parts Specialist, or Collision Damage Estimator work experience categories.
- The ASE Education Foundation evaluates and accredits Automobile, Medium/Heavy Duty Truck, and Collision Repair and Refinish training programs based on industry-established standards. To learn more and view the list of ASE-accredited programs, visit http://www.aseeducationfoundation.org.
- To receive credit in categories 1) and 2) above, you must complete the training program in its entirety, and it must be ASE-accredited at the time you complete it.
- Examples of OEM-sponsored co-op programs include GM ASEP, Ford ASSET, Toyota T-TEN, Honda PACT, Chrysler CAP, and Mercedes-Benz DRIVE. You must participate in the co-op hands-on work experience portion of the program.
- ASE Entry-Level Certification Program tests are not the same as the ASE professional certification tests. ASE Entry-Level certification tests are administered in schools. For more information, visit www.ase.com/entry-level.
- For categories 1) and 2), attach a copy of your program completion certificate. For category 3), attach copies of your ASE Entry-Level certification test certificates. For category 4), attach an official transcript that clearly shows the hours or weeks of completed training and the graduation/completion date.

THE OFFICIAL ASE STUDY GUIDE

ASE Medium/Heavy Truck Tests

INCLUDES CNG VEHICLE TEST!

National Institute for
AUTOMOTIVE
SERVICE
EXCELLENCE

ASE Medium/Heavy Truck Tests

Table of Contents

Overview

Introduction

The Official ASE Study Guide for Medium/Heavy Truck Tests is designed to help technicians prepare for the ASE certification tests. This guide, which includes detailed information for each test, should help you review your technical knowledge. Your focus should be on less familiar topics. This should make it easier to select additional reference materials that will help you prepare for your test(s).

ASE voluntary certification helps technicians prove their abilities to themselves, to their employers, and to their customers. By passing the tests and submitting appropriate work experience, you will earn the most valuable credential available to medium/heavy truck technicians. Because the tests are challenging, you'll have the satisfaction of knowing you are among the elite in your profession. What's more, these credentials are recognized throughout the U.S.

Certified technicians promote customer trust and improve the image of the industry. And trust and professionalism are the first steps to a better, more prosperous business.

ASE encourages you to take the tests and to join the proven pros who wear the ASE Blue Seal of Excellence®.

How Do I Become Certified?

There are eight tests in the Medium/Heavy Truck Technician certification series. Class 4 through Class 8 trucks are covered. Medium duty Class 4–6 is 14,001 to 26,000 lbs. gross vehicle weight (GVW). Heavy duty Class 7–8 is 26,001 and above gross vehicle weight (GVW).

If you pass one or more test(s) and have at least two years of hands-on work experience in truck repair (appropriate training may substitute for up to one year of experience), you will be certified as an ASE Medium/Heavy Truck Technician. If you pass tests T2 through T8, you will earn certification as a Master Medium/Heavy Truck Technician.

Some of these tests are prerequisities for the Advanced Level tests. If you hold current certification in Diesel Engines (A9, H2, S2, or T2) and Electrical/

Electronic Systems (A6, H6, S6, or T6), you are eligible to take the Advanced Level (L2) Electronic Diesel Engine Diagnosis Specialist test.

Your test results will be emailed to you immediately following your testing appointment. Results will not be given over the phone nor will they be released to anyone without your written permission. If you fail a test, you must wait 30 days from the test date before you can purchase it again.

Certification credentials are valid for five years. Recertification ensures certified technicians are seen as up-to-date in their profession. If you have been certified in an area for almost five years, it is time to register for the corresponding recertification test. Most recertification tests are about half the length of the initial certification tests.

Medium/Heavy Truck Tests

This Study Guide contains Test Specifications, Task Lists, and sample questions for the following ASE tests:

- Gasoline Engines (Test T1)
- Diesel Engines (Test T2)
- Drive Train (Test T3)
- Brakes (Test T4)
- Suspension and Steering (Test T5)
- Electrical/Electronic Systems (Test T6)
- Heating, Ventilation, and Air Conditioning (HVAC) Systems (Test T7)
- Preventive Maintenance Inspection (PMI) (Test T8)
- Compressed Natural Gas (CNG) Vehicles (Test F1)

ASE also offers certification in areas including Automobile, Truck Equipment, Maintenance & Light Repair, Transit Bus, School Bus, Collision Repair/Refinish, Parts Specialist, and Advanced Level specialties. Separate guides are available for each test series.

For full information on ASE testing as well as downloadable Study Guides and other test preparation resources, visit **www.ase.com**.

Who Writes the Questions?

Working professionals from the service industry with expertise in the test topic write the questions, which are entirely job-related. The questions are designed to test knowledge of the skills that you need to know in servicing medium/heavy trucks; theoretical knowledge is not covered.

How Long are the Tests?

M/H Truck Tests 2022		Certification Tests		Recertification Tests	
	Name	Number of questions	Testing time	Number of questions	Testing time
T1	Gasoline Engines	60*	1.25 hrs	25	30 mins
T2	Diesel Engines	65*	1.5 hrs	28	45 mins
T3	Drive Train	50*	1 hr	20	30 mins
T4	Brakes	60*	1.25 hrs	25	30 mins
T5	Suspension and Steering	60*	1.25 hrs	25	30 mins
T6	Electrical / Electronic Systems	60*	1.5 hrs	25	45 mins
T7	Heating, Ventilation, and A/C	50*	1 hr	20	30 mins
T8	Preventive Maintenance Inspection	60*	1.25 hrs	25	30 mins
Alternate Fuels Test					
F1	Compressed Natural Gas Vehicles	65*	1.5 hrs	28	45 mins

*** Certification tests include 10 research questions that are not counted for score. Since you don't know which questions those are, you need to answer every question. You must have passed the corresponding certification test once to be eligible for the shorter recertification test.**

Each question has its roots in an ASE "item-writing" workshop where working technicians, service representatives from truck manufacturers, aftermarket parts and equipment manufacturers and technical educators meet to share ideas and translate them into test questions. Each test question must survive review by all members of the group. The questions are written to mirror problems relevant to the diagnosis and repair performed by technicians in their day-to-day work.

After being written, all questions are pre-tested and quality-checked on a national sample of technicians. Those questions meeting ASE standards of quality and accuracy are included in the scored sections of the tests; those that do not are redrafted or discarded altogether.

How Do I Prepare for the ASE Tests?

The most important thing you can do is become familiar with test content and question formats.

The Test Specifications in this booklet describe the content covered by each test. The Task Lists detail the actual work performed by technicians in each specialty area. Together, these are the blueprint for writing and assembling the ASE tests.

Each question on the test relates to a particular task or set of tasks in the task list. Therefore, review the task list, thinking about whether you know how to perform each task listed.

All questions are multiple-choice. The sample questions in this Study Guide are examples of the five types of questions on the test. Note there are different instructions for some question types.

Read each question carefully so that you understand exactly what is being asked. Each question tests a specific diagnostic or repair problem and has only one correct answer.

To summarize, we suggest the following steps be taken:

- **Step 1.** Carefully read the Test Specifications for each test you will attempt.
- **Step 2**. Study the Task List for each area.
- **Step 3.** Go over the sample questions to become familiar with each question type. This is very important!
- **Step 4.** Review steps 1 through 3 and identify the skill areas where you need additional study.

Getting Started

Registration information is available at **www.ase.com**. This site shows testing locations and provides other important information, including an electronic version of all ASE Study Guides.

While on the ASE website, take a moment to create your own myASE account (if you do not already have one), which will allow you to register for tests, make test appointments, and have direct access to all your personal ASE certification information. Should you have questions that the website does not answer, you can reach our helpful customer service staff at contactus@ase.com or 800-390-6789.

At the Test Center—Some Tips

Try to be well rested on exam day. Allow extra time to find parking and the Test Center office. Late arrivals may be turned away by TestCenter staff. If you cannot take a test because you are late, you will forfeit your test fees.

Bring your Admission Ticket and unexpired, government-issued photo ID with you. Books, notes, calculators, and electronic devices (including cell phones) will not be permitted in the test room. You will be assigned a locker to store personal items. Most test centers have airport-level security procedures for all candidates, so be prepared for "wanding" or other security checks.

Bring--
- ✔ **Admission Ticket**
- ✔ **Current Government Issued Photo ID**

Leave in locker--
- ✔ **Books**
- ✔ **Calculator**
- ✔ **Coat**
- ✔ **Cell Phone**
- ✔ **Smart Devices**
- ✔ **Wallet**
- ✔ **Keys**

You will receive scratch paper and pencils, and for certain advanced level tests, a printed reference booklet. Each test appointment begins with a short tutorial on the operation of the testing platform. You may also preview the platform online at **www.ase.com/asedemo** before you arrive at the Test Center.

Each test has a time limit, as listed in the chart on page 5. After you start your test, the computer screen will continuously display the amount of time left. If you finish early, you can either review your answers or end the test and continue to the next test (if you are taking more than one). Once you submit a test for scoring, you cannot go back and review it. If you are taking several tests and need a short break, take it between tests. Take your break when you reach the screen that asks if you are taking additional tests. Do not take a break during a test as the test clock will continue to run.

If a question is difficult, mark the answer that you think is correct and flag the question using the on-screen button. Then go on to the next question. When you have finished the test, you may have time to go back to the flagged questions. Your score is based on the number of correct answers, so you should try to answer every question.

When you finish your last test, you will be given a short customer satisfaction survey. After you complete the survey, inform the staff and leave. When you check your email, your test results will be waiting for you! If you need a paper copy right away, ask the staff to print your results before you leave the test center.

Test Content and Sample Questions

To help you prepare, each section begins with the Test Specifications, which will list the main categories covered and the number of test questions, as well as percentage of the test devoted to each topic.

The Task List describes the work activities a technician should be able to perform. This list was developed by working technicians and technical experts and will provide a valuable checklist telling you what you should know for the test.

The number of tasks listed does not equal the number of questions. Although every question relates to at least one listed task, some tasks may not appear on the test. Some complex tasks may be covered by several questions. Some questions may cover multiple simple tasks. The main goal of the list is to describe what is done on the job; any task on the list **may be** covered on the test.

Sample questions follow the task list. Although these specific questions will not appear on tests, they are in the same format as actual test questions. Note that some questions have special instructions; the same instructions will appear with similar questions on the ASE tests. ■

Test Specifications and Task List
Gasoline Engines (Test T1)

Content Area	Questions in Test	Percentage of Test
A. General Engine Diagnosis	14	28%
B. Cylinder Head and Valve Train Diagnosis and Repair	4	8%
C. Engine Block Diagnosis and Repair	4	8%
D. Lubrication and Cooling Systems Diagnosis and Repair	3	6%
E. Ignition System Diagnosis and Repair	6	12%
F. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair	6	12%
G. Emissions Control Systems Diagnosis and Repair	5	10%
H. Computerized Engine Controls Diagnosis and Repair	8	16%
Total	**50**	**100%**

A. General Diagnosis (14 questions)

1. Verify the complaint and/or road test vehicle; review driver/customer interview and past maintenance documents (if available); determine further diagnosis.
2. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, technical service bulletins, and service campaigns/recalls.
3. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed action.
4. Diagnose noises and/or vibration problems related to engine performance; determine needed action.
5. Diagnose the cause of unusual exhaust color, odor, and sound; determine needed action.
6. Perform engine manifold vacuum or pressure tests; determine needed action.
7. Perform cylinder power balance test; determine needed action.
8. Perform cylinder compression test; determine needed action.
9. Perform cylinder leakage/leak-down test; determine needed action.
10. Diagnose engine mechanical, electrical, electronic, fuel, and ignition problems with an oscilloscope, engine analyzer, digital multimeter (DMM), and/or scan tool; determine needed action.

T1 List (continued)

11. Inspect engine compartment wiring harness, connectors, seals, locks, vacuum hoses; check for proper routing and condition; determine needed repairs.
12. Observe and interpret instrument panel gauge readings.
13. Read and interpret electrical schematic diagrams and symbols.
14. Test and diagnose emissions or driveability problems caused by battery condition, connections, or excessive key-off battery drain; determine needed repairs.
15. Perform starter current draw test; determine needed action.
16. Perform starter and charging circuit voltage drop tests; determine needed action.
17. Inspect, test, and repair or replace components, connectors, and wires in the starter and charging control circuits.
18. Differentiate between electrical and mechanical problems that cause a slow crank, no-crank, extended cranking, or a cranking noise condition.
19. Test and diagnose engine performance problems resulting from an undercharge, overcharge, or a no-charge condition; determine needed action.
20. Inspect, adjust, and replace alternator (generator) drive belts, pulleys, tensioners, and fans.

B. Cylinder Head and Valve Train Diagnosis and Repair (4 questions)

1. Remove, inspect, disassemble, and clean cylinder head assembly(s).
2. Inspect threaded holes, studs, and bolts for serviceability; service/replace as needed.
3. Measure cylinder head thickness; check mating surfaces for warpage and surface finish; inspect for cracks/damage; check condition of passages; inspect core and gallery plugs; determine serviceability and needed repairs.
4. Inspect valves, guides, seats, springs, retainers, locks, and seals; determine serviceability and needed repairs.
5. Reassemble, check, and install cylinder head assembly(s) and gasket(s) as specified by the manufacturer.
6. Inspect pushrods, rocker arms, rocker arm shafts, electronic wiring harness, and brackets; repair/replace as needed.
7. Inspect, install, and adjust valve lifters and retainers; adjust valve clearance.
8. Inspect, measure, and replace/reinstall overhead camshaft and bearings; measure and adjust endplay.

C. Engine Block Diagnosis and Repair (4 questions)

1. Remove, inspect, service, and install pans, covers, ventilation systems, gaskets, seals, and wear sleeves.
2. Disassemble, clean and inspect engine block for cracks; check mating surfaces and related components for damage or warpage and surface finish; check deck height; check condition of passages, core, and gallery plugs; inspect threaded holes, studs, dowel pins and bolts for serviceability; service/replace as needed.
3. Inspect and measure cylinder walls for wear and damage; determine serviceability and needed repairs.
4. Inspect in-block camshaft bearings for wear and damage; replace as needed.
5. Inspect, measure, and replace/reinstall in-block camshaft; measure/and correct end play; inspect, replace/reinstall, and adjust valve lifters.
6. Clean and inspect crankshaft and journals for surface cracks and damage; check condition of oil passages; check passage plugs; measure journal diameters; check mounting surfaces; determine needed repairs.

7. Diagnose piston, connecting rod bearing, and main bearing wear patterns that indicate connecting rod and crankshaft alignment or bearing bore problems; check bearing bore and bushing condition; determine needed repairs.
8. Determine the proper select-fit components such as pistons, connecting rods, and main bearings.
9. Inspect and replace main bearings; check cap fit and bearing clearances; check and correct crankshaft end play.
10. Remove and/or replace the timing chain and gears; ensure correct timing.
11. Inspect, measure, or replace pistons, pins, and retainers.
12. Measure piston-to-cylinder wall clearance.
13. Check ring-to-groove fit and end gaps; install rings on pistons. Assemble pistons and connecting rods and install in block; install rod bearings and check clearances.
14. Inspect and/or replace crankshaft vibration damper.
15. Inspect flywheel/flexplate (including ring gear) and mounting surfaces for cracks, wear, and runout; determine needed repairs.

D. Lubrication and Cooling Systems Diagnosis and Repair (3 questions)

1. Diagnose engine lubrication system problems; perform oil pressure tests; determine needed repairs.
2. Disassemble and inspect oil pump (includes gears, rotors, housing, and pick-up assembly); measure oil pump clearance; inspect pressure relief devices and pump drive; determine needed repairs.
3. Inspect, clean, test, reinstall/replace oil cooler, by-pass valve, lines and hoses.
4. Change engine oil and filter(s); add proper type, viscosity, and rating of oil.
5. Inspect and reinstall/replace pulleys, tensioners, and drive belts; adjust drive belts and check alignment.
6. Diagnose engine cooling system temperature and pressure problems; determine needed repairs.
7. Inspect, test, and replace thermostat, coolant by-pass, and thermostat housing, seals, hoses, and fittings.
8. Inspect and test coolant; drain, flush, and refill cooling system with recommended coolant; bleed air from cooling system as required.
9. Inspect and replace water pump, housing, and hoses.
10. Inspect and replace radiator, pressure cap, expansion tank, and coolant recovery system.
11. Inspect, test, and repair/replace fan (both electrical and mechanical), fan clutch, fan shroud, air dams, and cooling fan electrical circuits.
12. Verify proper operation of engine related gauges and warning indicators; determine needed repairs.

E. Ignition System Diagnosis and Repair (6 questions)

1. Diagnose ignition system related problems such as no-starting, hard starting, engine misfire, poor driveability, spark knock, power loss, reduced fuel economy, and emissions problems; determine root cause; determine needed repairs.
2. Interpret ignition system related diagnostic trouble codes (DTCs); determine needed repairs.
3. Inspect, test, repair, or replace ignition primary circuit wiring and components.

4. Inspect, test, repair, or replace ignition system secondary circuit wiring and components.
5. Inspect, test, and replace ignition coil(s).
6. Inspect, test, and replace ignition system sensors; adjust as necessary.
7. Inspect, test, and/or replace ignition control module (ICM)/powertrain/engine control module (PCM/ECM); reprogram as needed.

F. Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair (6 questions)

1. Diagnose fuel system related problems such as no-starting, hard starting, poor driveability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, reduced fuel economy, and emissions problems; determine root cause; determine needed repairs.
2. Interpret fuel or induction system related diagnostic trouble codes (DTCs); analyze fuel trim and other scan tool data; determine needed repairs.
3. Inspect fuel tank, filler neck, and fuel cap; inspect and replace fuel lines, fittings, and hoses; check fuel for contaminants and quality.
4. Inspect, test, and replace fuel pump(s) and/or fuel pump assembly; inspect, service, and replace fuel filters.
5. Inspect and test electric fuel pump control circuits and components; determine needed repairs.
6. Inspect, test, and repair or replace fuel pressure regulation system and components of fuel injection systems; perform fuel pressure/volume test.
7. Inspect, remove, service or replace throttle body assembly and controls, including electronic throttle actuator control (TAC) systems; make related adjustments.
8. Inspect, test, clean, and replace fuel injectors and fuel rails.
9. Inspect, service, and repair or replace air filtration system components.
10. Inspect air induction system, intake manifold, and gaskets for air/vacuum leaks.
11. Remove, clean, inspect, test, and repair or replace fuel system vacuum and electrical components and connections.
12. Inspect, service, and replace exhaust manifold, gaskets, exhaust pipes, oxygen sensors, mufflers, catalytic converters, resonators, tailpipes, and heat shields.
13. Test for exhaust system restriction or leaks; determine needed repair.

G. Emissions Control Systems Diagnosis And Repair (5 questions)

1. Test and diagnose emissions or driveability problems caused by positive crankcase ventilation (PCV) system.
2. Inspect, service, and replace positive crankcase ventilation (PCV) filter, valve, tubes, orifice/metering device, and hoses.
3. Test and diagnose driveability problems caused by the exhaust gas recirculation (EGR) system.
4. Interpret exhaust gas recirculation (EGR) related scan tool data and diagnostic trouble codes (DTCs); determine needed repairs.
5. Inspect, test, service, and replace components of the exhaust gas recirculation (EGR) system, including EGR valve, tubing, passages, vacuum/pressure controls, filters, hoses, electrical/electronic sensors, controls, solenoids, and wiring of EGR systems.
6. Test and diagnose emissions or driveability problems caused by the secondary air injection or catalytic converter systems.

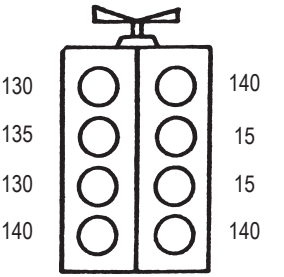
7. Interpret secondary air injection system related scan tool data and diagnostic trouble codes (DTCs); determine needed repairs.
8. Inspect, test, service, and replace mechanical components and electrical/electronically operated components and circuits of secondary air injection system.
9. Inspect catalytic converter. Interpret catalytic converter related diagnostic trouble codes (DTCs); analyze related scan tool data to determine root cause of DTCs; determine needed repairs.
10. Test and diagnose emissions or driveability problems caused by the evaporative emissions control system.
11. Interpret evaporative emissions-related scan tool data and diagnostic trouble codes (DTCs); determine needed repairs.
12. Inspect, test, and replace canister, lines, hoses, mechanical, and electrical components of the evaporative emissions control system.

H. Computerized Engine Controls Diagnosis And Repair (8 questions)

1. Research OBD II system operation to determine the enable criteria for setting and clearing diagnostic trouble codes (DTCs) and malfunction indicator lamp (MIL) operation. Perform appropriate drive cycle to determine system condition and verify repair effectiveness.
2. Interpret OBD II scan tool data stream, diagnostic trouble codes (DTCs), freeze frame data, system monitors, monitor readiness indicators, and trip and drive cycle information.
3. Read and interpret technical literature (service publications and information including wiring schematics).
4. Diagnose the causes of emissions or driveability problems with stored or active diagnostic trouble codes (DTCs).
5. Diagnose the causes of emissions or driveability problems without diagnostic trouble codes (DTCs).
6. Use a scan tool, digital multimeter (DMM), or digital storage oscilloscope (DSO) to inspect or test computerized engine control system sensors, actuators, circuits, and powertrain/engine control module (PCM/ECM); determine needed repairs.
7. Measure and interpret voltage, voltage drop, amperage, and resistance using digital multimeter (DMM) readings.
8. Test, remove, inspect, clean, service, and repair or replace power and ground distribution circuits and connections.
9. Remove and replace the powertrain/engine control module (PCM/ECM); reprogram as needed.
10. Diagnose driveability and emissions problems resulting from failures of interrelated systems (for example: cruise control, security alarms/theft deterrent, torque controls, traction controls, torque management, A/C, and/or non-OEM installed accessories).
11. Clear diagnostic trouble codes (DTCs), run all OBD II monitors, and verify the repair. ■

Sample Questions
Gasoline Engines (Test T1)

COMPRESSION
SPECIFICATION
140 PSI

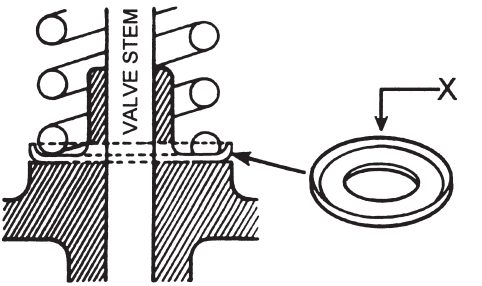


1. Technician A says that the compression test readings shown could be caused by a blown cylinder head gasket.

   Technician B says that the compression test readings shown could be caused by incorrect valve timing.

   Who is right?

   * (A) A only
   (B) B only
   (C) Both A and B
   (D) Neither A nor B



2. Technician A says that part X shown is used to improve valve spring rotation.

   Technician B says that part X shown is used to correct installed spring height.

   Who is right?

   (A) A only
   * (B) B only
   (C) Both A and B
   (D) Neither A nor B

T1 Sample Questions (continued)

3. An engine is using too much oil.

   Technician A says that worn valve guides could be the cause.

   Technician B says that tapered cylinder walls could be the cause.

   Who is right?

   (A) A only
   (B) B only
   * (C) Both A and B
   (D) Neither A nor B

4. While performing a cylinder leakage test on an engine, the technician sees air bubbles in the upper radiator tank. Which of these could be the cause?

   (A) Worn piston rings
   * (B) A cracked engine block
   (C) A cracked overflow bottle
   (D) A leaking intake valve

5. Technician A says that main bearing oil clearance can be checked with plastigage.

   Technician B says that main bearing oil clearance can be checked with a feeler gauge.

   Who is right?

   * (A) A only
   (B) B only
   (C) Both A and B
   (D) Neither A nor B

6. The technician finds no spark and no injector pulses on a vehicle that will not start. The cause could be a failed:

   (A) mass air flow sensor (MAF).
   * (B) crankshaft position sensor (CKP).
   (C) throttle position sensor (TPS).
   (D) fuel pump module (FP).

7. An engine with a return-type fuel injection system has high fuel pressure at idle. Which of these could be the cause?

   * (A) Low manifold vacuum
   (B) A leaking fuel pump check valve
   (C) A plugged fuel injector
   (D) High manifold vacuum

8. A truck has stored “Fuel System Too Lean–Bank 1” and “Fuel System Too Lean–Bank 2” DTCs. Which of these could be the cause?

   (A) A leaking Bank 2 exhaust manifold gasket
   (B) A failed Bank 1 HO2S
   (C) A restricted fuel return line
   * (D) A leaking intake manifold gasket

This question contains the word EXCEPT. Read the question carefully before choosing your answer.

9. Any of these could cause a catalytic converter to overheat EXCEPT:

   (A) a fouled spark plug.
   * (B) a stuck-closed exhaust gas recirculation (EGR) valve.
   (C) worn piston rings.
   (D) a leaking fuel injector.

Test Specifications and Task List
Diesel Engines (Test T2)

Content Area	Questions in Test	Percentage of Test
A. General Engine Diagnosis	11	20%
B. Cylinder Head and Valve Train Diagnosis and Repair	4	7%
C. Engine Block Diagnosis and Repair	5	9%
D. Lubrication and Cooling Systems Diagnosis and Repair	6	11%
E. Air Induction and Exhaust Systems Diagnosis and Repair	6	11%
F. Fuel System Diagnosis and Repair	16	29%
G. Starting and Charging System Diagnosis and Repair	4	7%
H. Engine Brakes	3	5%
Total	**55**	**100%**

A. General Engine Diagnosis (11 questions)

1. Verify the complaint, and road/dyno test vehicle; review driver/customer interview and past maintenance documents (if available); determine further diagnosis.
2. Identify engine model and serial number to research applicable vehicle and service information, service precautions, service procedures, and technical service bulletins; determine needed actions.
3. Inspect engine assembly and compartment for fuel, oil, coolant, exhaust, or other leaks; determine needed action.
4. Inspect engine compartment wiring harness, connectors, seals, and locks; check for proper routing and condition; determine needed repairs.
5. Isolate and diagnose engine noises; determine needed action.
6. Check engine exhaust for odor, smoke color, and density; determine needed action.
7. Perform fuel supply and return system tests; check fuel for contamination, quality, and consumption; determine needed action.
8. Perform air intake system restriction and leakage tests; determine needed action.
9. Perform intake manifold and system pressure tests; determine needed action.
10. Perform exhaust back pressure and temperature tests; determine needed action.
11. Perform crankcase pressure test; determine needed action.
12. Diagnose no cranking, cranks but fails to start, hard starting, and starts but does not continue to run problems; determine needed action.

13. Diagnose surging, rough operation, misfiring, low power, slow deceleration, slow acceleration, and shutdown problems; determine needed action.
14. Isolate and diagnose engine related vibration problems; determine needed action.
15. Check cooling system for freeze point, level, contamination, coolant type, temperature, pressure, circulation, conditioner concentration, filtration, and fan operation; determine needed action.
16. Check lubrication system for contamination, oil level, temperature, pressure, filtration, and oil consumption; interpret oil analysis information; determine needed action.
17. Check and record electronic diagnostic codes and trip/operational data; monitor electronic data; verify customer programmable parameters; clear diagnostic trouble codes; verify the repair; determine if further diagnosis is needed.
18. Perform visual inspection for physical damage and missing, modified, or tampered with components; determine needed action.

B. Cylinder Head and Valve Train Diagnosis and Repair (4 questions)

1. Remove, inspect, disassemble, and clean cylinder head assembly(s).
2. Inspect threaded holes, studs, and bolts for serviceability; service/ replace as needed.
3. Measure cylinder head thickness, and check mating surfaces for warpage and surface finish; inspect for cracks/damage; check condition of passages; inspect core and gallery plugs; determine serviceability and needed action.
4. Inspect valves, guides, seats, springs, retainers, rotators, locks and seals; determine serviceability and needed actions.
5. Inspect and/or replace injector sleeves and seals; pressure test to verify repair (if applicable); measure injector tip or nozzle protrusion where specified by manufacturer.
6. Inspect, and/or replace valve bridges (crossheads) and guides; adjust bridges (crossheads) if applicable.
7. Clean components; reassemble, check, and install cylinder head assembly.
8. Inspect pushrods, rocker arms, rocker arm shafts, electronic wiring harness, and brackets for wear, bending, cracks, looseness, and blocked oil passages; repair/ replace as needed.
9. Inspect, install, and adjust cam followers and retainers.
10. Adjust valve clearance and injector settings.
11. Inspect, measure, and replace/reinstall overhead camshaft and bearings; measure and adjust endplay and backlash.

C. Engine Block Diagnosis and Repair (5 questions)

1. Remove, inspect, service, and install pans, covers, ventilation systems, gaskets, seals, and wear rings.
2. Disassemble, clean and inspect engine block for cracks; check mating surfaces and related components for damage or warpage and surface finish; check deck height; check condition of passages, core, and gallery plugs; inspect threaded holes, studs, dowel pins and bolts for serviceability; service/replace as needed.
3. Inspect cylinder sleeve counterbore and lower bore; check bore distortion; determine needed action.

4. Inspect and measure cylinder walls or liners for wear and damage; determine needed action.
5. Replace/reinstall cylinder liners and seals; check and adjust liner height/protrusion.
6. Inspect in-block camshaft bearings for wear and damage; replace as needed.
7. Inspect, measure, and replace/reinstall in-block camshaft; measure/adjust end play; inspect, replace/reinstall cam followers or lifters (tappets).
8. Clean and inspect crankshaft and journals for surface cracks and damage; check condition of oil passages; check passage plugs; measure journal diameters; check mounting surfaces; determine needed action.
9. Inspect and replace main bearings; verify bearing and cap fit. Verify bearing clearances; check and correct crankshaft end play; determine needed action.
10. Inspect, reinstall, and time the drive gear train (includes checking engine position and speed indicator components, gear wear, and backlash of crankshaft, camshaft, auxiliary, drive, and idler gears; service shafts, bushings, and bearings); determine needed action.
11. Clean, inspect, measure, or replace pistons, pins, and retainers; determne needed action.
12. Measure piston-to-cylinder wall clearance; determine needed action.
13. Check ring-to-groove fit and end gaps; install rings on pistons; determine needed action.
14. Identify piston, connecting rod bearing, and main bearing wear patterns that indicate connecting rod and crankshaft alignment or bearing bore problems; check bearing bore and bushing condition; determine needed action.
15. Assemble pistons and connecting rods and install in block; check piston height/protrusion; replace rod bearings and check clearances; check condition, position, and clearance of piston cooling nozzles.
16. Clean, inspect and measure crankshaft vibration damper; replace as needed.
17. Inspect, install, and align flywheel housing.
18. Inspect flywheel/flexplate (including ring gear) and mounting surfaces for cracks, wear, and runout; determine needed action.

D. Lubrication and Cooling Systems Diagnosis and Repair (6 questions)

1. Verify engine oil pressure and check operation of pressure sensor/switch and pressure gauge; verify engine oil temperature and check operation of temperature sensor.
2. Inspect, measure, and repair/replace oil pump, housing, drives, pipes, and screens; adjust drive gear clearance (if applicable).
3. Inspect and repair/replace oil pressure regulator valve(s), and by-pass valve(s).
4. Inspect, clean, test, and reinstall/replace oil cooler, by-pass valve, oil thermostat; lines and hoses.
5. Inspect turbocharger lubrication and cooling systems; determine needed action.
6. Perform engine oil and filter service; add proper type and quantity of oil.
7. Inspect and reinstall/replace pulleys, tensioners and drive belts; adjust drive belts and check alignment.
8. Verify coolant temperature and check operation of temperature and level sensors/switch, and temperature gauge.
9. Inspect and replace thermostat(s), by-passes, housing(s), seals, and coolant restrictors.
10. Flush and refill cooling system; bleed air from system; recover/recycle coolant.
11. Inspect and repair/replace coolant conditioner/filter, valves, lines, fittings, and housing (if applicable).

12. Inspect and repair/replace water pump, housing, hoses, and idler pulley or drive gear.
13. Inspect radiator, pressure cap(s), and tank(s); determine needed action.
14. Inspect and repair/replace fan, fan hub, fan clutch, fan controls, fan thermostat, fan shroud, and airflow management systems.
15. Pressure test cooling system and pressure cap(s); determine needed repairs.

E. Air Induction and Exhaust Systems Diagnosis and Repair (6 questions)

1. Inspect and service/replace air induction piping, air cleaner, and element; check for inlet air restriction.
2. Inspect, test, and replace fixed and variable turbocharger(s), pneumatic, hydraulic, and electronic controls and actuators; inspect, test, and replace wastegate and wastegate controls.
3. Inspect and repair/replace intake manifold, gaskets, temperature and pressure sensors, and connections.
4. Inspect, test, clean, or replace charge air cooler and piping system.
5. Inspect and repair/replace exhaust manifold, gaskets, piping, mufflers, and mounting hardware.
6. Inspect, test, and repair/replace preheater/inlet air heater, or glow plug system and controls.
7. Inspect, test, and replace exhaust aftertreatment system components and controls, including diesel oxidation catalyst (DOC), selective catalytic reduction (SCR), diesel exhaust fluid (DEF), diesel particulate filter (DPF); check regeneration system operation.
8. Inspect, test, service, and replace exhaust gas recirculation (EGR) system components, including EGR valve, cooler, piping, sensors, controls, and wiring.

F. Fuel System Diagnosis and Repair (16 questions)

1. Inspect, test, and repair/replace fuel system tanks, vents, caps mounts, valves, single/dual supply and return lines, and fittings.
2. Inspect, clean, test, and repair/replace fuel transfer (supply) pump, pump drives, strainers and fuel/water separators, sensors, filters, heaters, coolers, ECM cooling plates, and mounting hardware.
3. Check fuel supply system for air; determine needed repairs; prime and bleed fuel system; check, repair/replace primer pump.
4. Inspect, test, and repair/replace low-pressure regulator systems (check valves, pressure regulator valves and restrictive fittings).
5. Inspect high-pressure injection lines, fittings, transfer tubes, seals, and mounting hardware; determine needed action.
6. Perform on-engine inspections, tests, and replace high-pressure common rail (HPCR) fuel system components and electronic controls; determine needed action.
7. Perform on-engine inspections and tests on hydraulic electronic unit injectors (HEUI) and electronic controls (rail pressure control).
8. Perform on-engine inspections, tests and adjustments on electronic unit injectors (EUI) and electronic controls.
9. Inspect, adjust, and repair/replace electronic throttle/engine speed control devices, circuits, and sensors.
10. Inspect, test, and repair/replace engine protection and automatic shutdown system components.

T2 Task List (continued)

11. Inspect, test and repair/replace electrical connector terminals, pins, harnesses, seals, and locks.
12. Connect diagnostic scan tool to vehicle/engine; access, verify, and update software calibration settings, injector calibration codes, programmable parameters; perform module re-learn procedures; determine needed action.
13. Connect diagnostic scan tool to vehicle; inspect and test electronic engine control system, sensors, actuators, electronic control modules, and circuits; determine needed actions.
14. Measure and interpret voltage, voltage drop, amperage, and resistance readings using a digital multimeter (DMM) or appropriate test equipment.

G. Starting and Charging System Diagnosis and Repair (4 questions)

1. Perform battery state-of-charge and load or capacitance tests; determine needed action.
2. Charge battery using correct method for application.
3. Start a vehicle using jumper cables or a booster battery.
4. Inspect, clean, and repair/replace batteries, battery cables, and terminal connections.
5. Inspect, test, and reinstall/replace starter relays, safety switch(s), and solenoids.
6. Perform alternator voltage and amperage output tests; determine needed action.
7. Perform starter and charging circuit voltage drop tests; determine needed action.

H. Engine Brakes (3 questions)

1. Inspect, test, and adjust engine compression and exhaust brakes.
2. Inspect, test, adjust, and repair/replace engine compression and exhaust brake control circuits, switches, actuators, and solenoids; adjust control parameter settings.
3. Inspect and repair/replace engine compression and exhaust brake housing(s), valves, seals, springs, lines, and fittings. ■

Sample Questions
Diesel Engines (Test T2)

1. When a diesel engine is operated under a load, coolant continually comes out of the radiator overflow and there are bubbles in the radiator. Which of these could be the cause?

   (A) Too much coolant in the cooling system
   (B) A clogged radiator
   (C) A stuck-open thermostat
   * (D) Compression leakage into the cooling system

2. A diesel engine has excessive black smoke when started in the morning. Which of these could be the cause?

   * (A) A sticking fuel injection nozzle
   (B) A restricted fuel filter
   (C) A blocked fuel tank vent
   (D) A leaking fuel return line

3. Which of these can cause a no-start condition on a HEUI engine?

   (A) High fuel pressure
   * (B) Low injection control pressure
   (C) High boost pressure
   (D) Low boost pressure

4. A diesel engine is hard to start, but runs good after it has been primed and run for a few minutes. This could be caused by a:

   (A) leaking injector line.
   (B) leaking fuel return line.
   (C) plugged fuel tank vent.
   * (D) stuck-open transfer pump check valve.

5. A diesel engine with wet cylinder liners has been running too hot, and there is coolant in the crankcase. This could be caused by:

   (A) a cracked block.
   (B) cracked liners.
   * (C) leaking liner seals.
   (D) a leaking injector seal.

6. Diesel engine cylinder liner protrusion (height) can be adjusted by selecting the correct size:

   (A) connecting rod bearing.
   (B) head gasket.
   * (C) liner shim.
   (D) fire ring.

This question contains the word EXCEPT. Read the question carefully before choosing your answer.

7. An electronically controlled diesel engine will not start. All of these could be the cause EXCEPT a failed:

   (A) camshaft position sensor.
   (B) engine control module (ECM).
   (C) ECM ground circuit.
   * (D) throttle position sensor (TPS).

8. The cause of a logged fault code in an electronic diesel engine has just been repaired.

   Technician A says that the codes should be cleared before releasing the vehicle.

   Technician B says that the customer's password should be reset before releasing the vehicle.

   Who is right?

   * (A) A only
   (B) B only
   (C) Both A and B
   (D) Neither A nor B

9. A diesel engine has low power and low turbocharger boost pressure is found.

   Technician A says that a leaking exhaust manifold could be the cause.

   Technician B says that a plugged turbocharger oil return line could be the cause.

   Who is right?

   * (A) A only
   (B) B only
   (C) Both A and B
   (D) Neither A nor B

Test Specifications and Task List
Drive Train (Test T3)

Content Area	Questions in Test	Percentage of Test
A. Clutch Diagnosis and Repair	11	28%
B. Transmission Diagnosis and Repair	13	33%
C. Driveshaft and Universal Joint Diagnosis and Repair	7	18%
D. Drive Axle Diagnosis and Repair	9	23%
Total	**40**	**100%**

A. Clutch Diagnosis and Repair (11 questions)

1. Diagnose clutch noise, binding, slippage, pulsation, vibration, grabbing, and chatter problems; determine cause of failure and needed repairs.
2. Inspect, adjust, repair, or replace clutch linkage, cables, levers, brackets, bushings, pivots, springs, and clutch safety switch (includes push and pull type assemblies); check pedal height and travel.
3. Inspect, adjust, repair or replace hydraulic clutch slave and master cylinders (including air assist), lines, fittings, and hoses; bleed system.
4. Inspect, adjust, repair or replace electronic/automated clutch actuator.
5. Inspect, or remove and install release (throw out) bearing, sleeve, bushings, springs, housing, levers, release fork, fork pads, fork rollers, shafts, and seals; measure and adjust release (throw out) bearing position.
6. Inspect, or remove and install single-disc clutch pressure plate and clutch disc; adjust free play and release bearing position.
7. Inspect, or remove and install two-plate clutch pressure plate, clutch disc, intermediate plate; determine proper clutch torque rating; adjust free play and release bearing position.
8. Inspect and replace clutch brake assembly; inspect and replace input shaft and bearing retainer.
9. Inspect, or remove and install self-adjusting/continuous-adjusting clutch assembly; perform initial and/or reset adjustment procedure.
10. Inspect and replace pilot bearing.
11. Inspect flywheel mounting area on crankshaft, rear main oil seal, and measure crankshaft end play; determine needed repairs.
12. Inspect flywheel (including center plate drive pins/lugs and anti-rattle springs), starter ring gear, and measure flywheel face and pilot bore runout and depth; determine needed repairs.

T3 List (continued)

13. Inspect flywheel housing(s) to transmission housing/engine mating surface(s) and measure flywheel housing face and bore runout; determine needed repairs.

B. Transmission Diagnosis and Repair (13 questions)

1. Determine the cause of transmission component wear and failure, both before and during disassembly procedures.
2. Diagnose transmission vibration/noise, shifting, lockup, slipping/ jumping out-of-gear, and overheating problems; determine needed repairs.
3. Inspect, adjust, repair or replace transmission remote shift linkages, cables, brackets, bushings, pivots, and levers.
4. Inspect, test operation, adjust, repair or replace air shift controls, lines, fittings, hoses, valves, regulators, filters, and cylinder assemblies.
5. Inspect, test operation, adjust, repair or replace electronic shift controls, range, shift and splitter actuators, shift motors, indicators, speed and range sensors, electronic/ transmission control units (ECU/TCU), neutral/in gear and reverse switches, and wiring harnesses.
6. Inspect, test operation, repair or replace electronic shift selectors (in-cab controls), air and electrical switches, displays and indicators, wiring harnesses, air lines and fittings.
7. Diagnose electronic transmission control systems using appropriate test equipment, service information, technical service bulletins and schematics; diagnose shorts, grounds, opens and resistance problems in electrical/electronic circuits; check and record diagnostic codes; determine needed repairs.
8. Diagnose electronic (automated mechanical and automatic) transmission problems caused by data link/bus interfaces with related electronic control systems.
9. Remove and replace transmission; inspect and replace transmission mounts, insulators, and mounting bolts.
10. Inspect for leakage; repair or replace transmission cover plates, gaskets, sealants, seals, vents, and cap bolts; inspect seal surfaces.
11. Check transmission fluid level and condition; determine needed service; add proper type and amount of lubricant.
12. Inspect, adjust, and replace transmission shift lever, cover, rails, forks, levers, bushings, sleeves, detents, interlocks, springs, and lock bolts.
13. Inspect and replace input shaft, gears, spacers, bearings, retainers, and slingers.
14. Inspect main shaft, gears, sliding clutches, washers, spacers, bushings, bearings, auxiliary drive gear/assembly, retainers/snap rings, and keys; determine needed repairs.
15. Inspect countershafts, gears, bearings, retainers/snap rings, and keys; check bearing preload/end play; verify multiple countershaft gear timing; determine needed repairs.
16. Inspect output shaft, gears, washers, spacers, bearings, retainers/snap rings, and keys; determine needed repairs.
17. Inspect reverse idler shaft(s), gear(s), bushings, bearings, thrust washers, and retainers/snap rings; check reverse idler gear end play; determine needed repairs.
18. Inspect synchronizer hub, sleeve, keys/inserts, springs, blocking rings, synchronizer plates, blocker pins, and sliding clutches; determine needed repairs.

T3 List (continued)

19. Inspect transmission cases and bell housings, including mating surfaces, bores, bushings, pins, studs, nuts, bolts, vents, and magnetic plugs; determine needed repairs.
20. Inspect, service, or replace transmission lubrication system components, pumps, troughs, collectors, slingers, coolers, filters, lines, fittings and hoses.
21. Inspect, test, replace, and adjust electronic speedometer drive components.
22. Inspect, adjust, service, repair or replace power take-off assemblies and controls.
23. Inspect and test operation of backup light, neutral start/crank inhibit, and warning device circuits and switches; determine needed repairs.
24. Inspect and test transmission temperature sending unit/sensor and gauge; determine needed repairs.
25. Inspect, adjust, repair or replace transfer case assemblies and controls.

C. Driveshaft and Universal Joint Diagnosis and Repair (7 questions)

1. Diagnose driveshaft and universal joint noise, vibration, and runout problems; determine cause of failure, and determine needed repairs.
2. Inspect, service, or replace driveshaft, slip joints/yokes, yokes, drive flanges, universal joints, driveshaft boots and seals, and retaining hardware; properly phase yokes.
3. Inspect and replace driveshaft center support bearings, fasteners and mounts.
4. Measure and adjust vehicle ride height; measure and adjust driveline slopes and angles (vehicle loaded and unloaded), including PTO driveshafts.
5. Use appropriate driveline analysis tools and software to diagnose driveline problems.

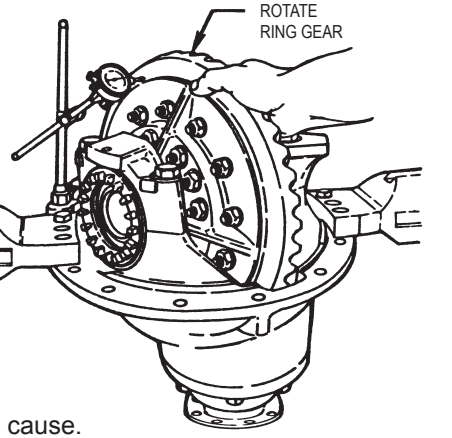
D. Drive Axle Diagnosis and Repair (9 questions)

1. Diagnose drive axle unit noise and overheating problems; determine needed repairs.
2. Check and repair fluid leaks; inspect and replace drive axle housing cover plates, gaskets, sealants, vents, magnetic plugs, and seals.
3. Check drive axle fluid level and condition; determine needed service (service filter, fluid); add proper type and amount of lubricant using correct fill procedure.
4. Remove and replace differential carrier assembly.
5. Inspect and replace differential case assembly including spider/pinion gears, cross shaft, side gears, thrust washers, case halves, bearings and races.
6. Inspect and replace components of locking differential case assembly.
7. Measure ring gear backlash and runout; determine needed actions.
8. Inspect ring and drive pinion gears, spacers, shims, sleeves, bearings and races. Inspect and adjust bearing preload; determine needed repairs.
9. Check ring and pinion gear tooth contact pattern; interpret pattern and determine needed repairs.
10. Inspect and replace power divider (inter-axle differential) assembly.
11. Inspect, adjust, repair, or replace air operated power divider (inter-axle differential) lockout assembly including diaphragms, seals, springs, yokes, pins, lines, hoses, fittings, and controls.
12. Inspect and measure drive axle housing mating surfaces and alignment; determine needed repairs.

T3 List (continued)

13. Inspect, service or replace drive axle lubrication system components, pump, troughs, collectors, coolers, lines, fittings, slingers, tubes and filters.
14. Inspect and replace drive axle shafts.
15. Check drive axle wheel/hub seal and axle flange gasket for leaks; determine needed repairs.
16. Diagnose drive axle wheel bearing noises and damage; determine needed repairs.
17. Clean, inspect, lubricate, and replace wheel bearings and races/cups; replace seals and wear rings; adjust drive axle wheel bearings (including single and double nut types) to manufacturers' specifications.
18. Test and inspect drive axle temperature sending unit/sensor and gauge; determine needed repairs.
19. Check, test, clean, adjust and/or replace wheel speed sensor(s) and tone-exciter rings.
20. Inspect or replace extended service (preset and unitized) bearing assemblies; perform initial installation procedures to manufacturers' specifications. ■

Sample Questions
Drive Train (Test T3)



1. What operation is being performed in the setup shown?

   (A) Adjusting tooth contact
   * (B) Checking ring gear runout
   (C) Checking ring gear backlash
   (D) Setting differential bearing preload

2. A truck does not move in any gear. Technician A says that a broken transmission shifter fork could be the cause.

   Technician B says that a broken transmission output shaft could be the cause.

   Who is right?

   (A) A only
   * (B) B only
   (C) Both A and B
   (D) Neither A nor B

3. The shift lever on a 13-speed transmission is hard to move. Which of these could be the cause?

   (A) Bent shift rails
   * (B) Galled sliding clutch gears
   (C) Worn detent springs
   (D) Too much mainshaft gear end play

4. The air pressure regulator for a transmission is being checked.

   Technician A says that the tractor air pressure should be at maximum system pressure.

   Technician B says that the regulator air filter should be cleaned and the system rechecked if the air pressure reading is below normal.

   Who is right?

   (A) A only
   (B) B only
   * (C) Both A and B
   (D) Neither A nor B

5. The driver of a truck says that a grinding noise can be heard when the clutch pedal is pressed. Which of these could be the cause?

   (A) Too little clutch pedal freeplay
   * (B) A worn clutch release (throwout) bearing
   (C) A low transmission lubricant level
   (D) A worn clutch pressure plate

6. A two-plate pull-type clutch engages OK, but the transmission grinds when going into first gear from neutral.

   Tehnician A says that a worn clutch brake could be the cause.

   Technician B says that too little free play could be the cause.

   Who is right?

   * (A) A only
   (B) B only
   (C) Both A and B
   (D) Neither A nor B

This question contains the word EXCEPT. Read the question carefully before choosing your answer.

7. An electronic speedometer works intermittently. Any of these could be the cause EXCEPT:

   (A) a loose electrical connection.
   * (B) improper speedometer calibration.
   (C) metal debris on the vehicle speed sensor (VSS).
   (D) improper adjustment of the vehicle speed sensor (VSS).

8. A truck with a single rear axle has too much rear axle noise only when the truck is pulling. Which of these could be the cause?

   (A) Worn axle shaft bearings
   (B) Worn wheel bearings
   (C) Worn differential pinion (spider) gears
   * (D) Worn ring and pinion gears

Test Specifications and Task List
Brakes (Test T4)

Content Area	Questions in Test	Percentage of Test
A. Air Brakes Diagnosis and Repair 1. Air Supply and Service Systems (16) 2. Mechanical/Foundation and Wheel Hub (13) 3. Parking Brakes (4)	33	66%
B. Hydraulic Brakes Diagnosis and Repair	12	24%
C. Air and Hydraulic Antilock Brake Systems (ABS), Automatic Traction Control (ATC), and Electronic Stability Control Systems	5	10%
Total	**50**	**100%**

A. Air Brakes Diagnosis and Repair (33 questions)

1. Air Supply and Service Systems (16 questions)

1. Review driver/vehicle inspection report (DVIR); verify the complaint and road test vehicle; review driver/customer interview and past maintenance documents (if available); determine further diagnosis.
2. Check air system build up time; check air system air loss rate (leakage); determine needed repairs.
3. Inspect, test, repair or replace air pressure gauges, in-cab lines, hoses, fittings, and pressure sensors (transducers).
4. Inspect, test, and replace low pressure warning devices.
5. Drain air reservoir tanks; check for oil, water, and foreign material; determine needed repairs.
6. Inspect, adjust, align, and replace compressor drive belts and pulleys.
7. Inspect and replace compressor drive gear and coupling.
8. Inspect, repair, or replace air compressor, air inlet supply, oil supply, water lines, hoses, fittings and mounting brackets.
9. Inspect, test, adjust, and replace system pressure controls (governor/relief valve), unloader assembly, lines, hoses, and fittings.
10. Inspect, repair, or replace air system lines, hoses, fittings, and couplings; check for proper routing and mounting.
11. Inspect, test, clean, and replace air tank relief (pop off) valves, one-way (single) check valves, drain valves, automatic drain (spitter) valves, heaters, wiring, and connectors.

T4 List (continued)

12. Inspect, test, clean, repair, or replace air drier systems, filters, valves, heaters, wiring, and connectors.
13. Inspect, test, and replace brake application (foot) valve, fittings, and mounts; check pedal operation.
14. Inspect, test, repair, or replace stop and parking brake light circuit switches, wiring, and connectors.
15. Inspect, test, repair, or replace hand brake (trailer) control valve, lines, hoses, fittings, and mountings.
16. Inspect, test, and replace brake relay valves, quick relay valves, and anti-compounding circuits.
17. Inspect, test, and replace tractor protection valve.
18. Inspect, test, and replace inversion/emergency (spring) brake control valve(s).
19. Determine if air brake system problem is caused by tractor or trailer supply or service system components.

2. Mechanical/Foundation and Wheel Bearings (13 questions)

1. Diagnose poor stopping, premature wear, brake noise, pulling, grabbing, or dragging problems caused by foundation brake components; determine needed repairs.
2. Inspect, test, and replace service brake chambers, diaphragms, clamps, return springs, pushrods, clevises, and mounting brackets.
3. Inspect, service, and replace automatic slack adjusters.
4. Inspect and replace S-cam brake rollers, bushings, camshafts, seals, spacers, retainers, brake spiders, shields, anchor pins, and springs.
5. Inspect, clean, adjust, and replace air disc brake caliper assemblies.
6. Inspect brake shoes or pads; determine needed repairs.
7. Replace brake shoes or pads; determine correct replacement lining/pad coefficient of friction rating for application.
8. Inspect and replace brake drums or rotors as needed.
9. Clean, inspect, lubricate, and replace wheel hubs, wheel bearings and races/cups; replace seals and wear rings; adjust wheel bearings (including one and two nut types) to manufacturers' specifications.
10. Inspect and replace unitized hub bearing assemblies; perform initial installation and maintenance procedures to manufacturers' specifications.

3. Parking Brakes (4 questions)

1. Inspect and test parking (spring) brake chambers operation to include spring condition, leakage, and installation/mounting.
2. Replace parking (spring) brake chambers; dispose of chambers in accordance with local regulations.
3. Inspect, test, and replace parking (spring) brake valves, lines, hoses, and fittings.
4. Inspect, test, and replace parking (spring) brake dash control valve.
5. Manually release (cage) and set (uncage) parking (spring) brakes.

B. Hydraulic Brakes Diagnosis and Repair (12 questions)

1. Diagnose poor stopping, brake noise, premature wear, pulling, grabbing, dragging, or pedal feel problems caused by hydraulic system components; determine needed repairs.
2. Pressure test hydraulic system and inspect for fluid leaks; check system pressure actuator operation, and diagnose fault codes using a PC computer if applicable.

3. Check brake pedal operation and adjust free play.
4. Inspect, test, and replace master cylinder; check pushrod length.
5. Inspect and replace brake lines, flexible hoses, and fittings; check for proper routing and mounting.
6. Inspect, test, and replace metering (hold off), load sensing/proportioning, proportioning, and combination valves.
7. Inspect, test, repair, or replace brake pressure differential valve and warning light circuits, switches, bulbs, wiring, and connectors.
8. Inspect and replace wheel cylinders.
9. Inspect, service, and replace disc brake caliper assemblies.
10. Inspect/test brake fluid; bleed and/or flush system; determine proper fluid type for application.
11. Diagnose poor stopping, brake noise, premature wear, pulling, grabbing, dragging, or pedal feel problems caused by disc and drum brake mechanical components; determine needed repairs.
12. Inspect and replace brake drums or rotors; resurface rotors if applicable.
13. Inspect, adjust, and replace brake shoes, mounting hardware, adjuster mechanisms, and backing plates.
14. Inspect, service, and replace brake pads, hardware, and mounts.
15. Inspect, adjust, and replace drive line parking brake system components.
16. Diagnose poor stopping complaints caused by brake assist (booster) system problems; determine needed repairs (includes hydraulic and hydraulic/electric assist systems).
17. Inspect, test, repair, or replace power brake assist (booster), hoses, control valves and filters; determine proper fluid type for application.
18. Test, adjust, repair or replace brake stop light switch, bulbs, wiring, and connectors.

C. Air and Hydraulic Antilock Brake Systems (ABS), Automatic Traction Control (ATC), and Electronic Stability Control Systems (5 questions)

1. Observe antilock brake system (ABS) operation, self-test operation and warning light operation; determine if further diagnosis is needed (includes dash mounted trailer ABS warning light).
2. Diagnose antilock brake system (ABS) electronic controls and components using self-diagnosis (blink codes) and/or specified test equipment (scan tool, PC based software); determine needed repairs.
3. Diagnose poor stopping and wheel lock-up caused by failure of the antilock brake system (ABS); determine needed repairs.
4. Inspect, test, and replace antilock brake system (ABS) air, hydraulic, electrical, and mechanical components.
5. Diagnose automatic traction control (ATC) electronic control(s) and components using self-diagnosis (blink codes) and/or specified test equipment (scan tool, PC based software); determine needed repairs.
6. Diagnose electronic stability control systems and components using self-diagnosis (blink codes) and/or specified test equipment (scan tool, PC based software); determine needed repairs. ■

Sample Questions
Brakes (Test T4)

1. The parking brakes fail to apply on a truck with air brakes.

   Technician A says that low air pressure in the spring brake chamber could be the cause.

   Technician B says that a ruptured spring brake diaphragm could be the cause.

   Who is right?

   (A) A only
   (B) B only
   (C) Both A and B
   * (D) Neither A nor B

2. A truck equipped with air brakes has an uneven braking problem. Which of these could be the cause?

   (A) A binding treadle (foot) valve
   (B) Low brake line air pressure
   * (C) A damaged brake drum
   (D) A failed governor

3. A service brake on a truck with an air brake system releases too slowly.

   Technician A says that low air pressure could be the cause.

   Technician B says that a kinked air line could be the cause.

   Who is right?

   (A) A only
   * (B) B only
   (C) Both A and B
   (D) Neither A nor B

4. A service brake chamber leaks when the brakes are applied. Which of these could be the cause?

   (A) Excessive push rod travel
   * (B) A failed chamber diaphragm
   (C) A broken chamber return spring
   (D) A misaligned push rod

T4 Sample Questions (continued)

5. All the wheels on a truck with air brakes lock up when a small amount of pressure is applied to the treadle (foot) valve. Which of these could be the cause?

   * (A) The application valve is bad.
   (B) The limiting valve is leaking.
   (C) The compressor regulator is set too high.
   (D) The brakes are adjusted too high.

6. When an air reservoir tank is drained, there is an excessive amount of moisture. This could be caused by a:

   (A) cracked air compressor bracket.
   (B) clogged air compressor intake.
   (C) failed one way check valve.
   * (D) failed air drier purge valve.

7. All the brakes drag on a truck with hydraulic brakes. Which of these could be the cause?

   (A) Air in the hydraulic system
   (B) Too high vacuum supply to the power brake booster
   (C) A leaking secondary cup in the master cylinder
   * (D) No brake pedal free travel

These questions contains the word EXCEPT. Read the questions carefully before choosing your answer.

8. A truck with hydraulic brakes pulls to one side when the brakes are applied. Any of these could be the cause EXCEPT a:

   (A) sticking wheel cylinder piston.
   (B) grease contaminated brake lining.
   (C) crimped hydraulic line.
   * (D) plugged compensating port.

9. The driver of a truck with air brakes says it has poor stopping power. Any of these could be the cause EXCEPT:

   * (A) the quick release valve exhaust port is plugged.
   (B) the air pressure is too low.
   (C) the application line is restricted.
   (D) the brakes are out of adjustment.

Test Specifications and Task List
Suspension and Steering (Test T5)

Content Area	Questions in Test	Percentage of Test
A. Steering System Diagnosis and Repair	12	24%
B. Suspension, Frame, and 5th Wheel Diagnosis and Repair	16	32%
C. Wheel Alignment Diagnosis, Adjustment, and Repair	13	26%
D. Wheels, Tires, and Hub Diagnosis and Repair	9	18%
Total	**50**	**100%**

A. Steering System Diagnosis and Repair (12 Questions)

1. Diagnose steering column (tilt, telescoping, or fixed) for noise, looseness, and binding problems; determine needed repairs.
2. Inspect and replace steering shaft U-joint(s), slip joints, bearings, bushings, and seals; phase shaft U-joints.
3. Check cab mounting and adjust ride height.
4. Remove the steering wheel (includes steering wheels equipped with electrical/electronic controls and components); install and center the steering wheel. Inspect, test, replace, and calibrate steering angle sensors.
5. Diagnose power steering system noise, steering binding, darting/oversteer, reduced wheel cut, steering wheel kick, pulling, non-recovery, turning effort, looseness, hard steering, overheating, fluid leakage, and fluid aeration problems; determine needed repairs.
6. Determine recommended type of power steering fluid; check level and condition; determine needed service.
7. Flush and refill power steering system; purge air from system.
8. Perform power steering system pressure, temperature, and flow tests; determine needed repairs.
9. Inspect, service, or replace power steering reservoir including filter, seals, and gaskets.
10. Inspect and reinstall/replace power steering pump drive belts, pulleys and tensioners; adjust drive belts and check alignment.
11. Inspect, adjust, or replace power steering pump, drive gears/shafts, mountings, and brackets.

12. Inspect and replace power steering system cooler, lines, hoses, clamps/mountings, fittings; check hose routing.
13. Inspect, adjust, or replace linkage-assist type power steering cylinder or gear (dual system).
14. Inspect, adjust, repair, or replace integral type power steering gear.
15. Adjust manual and automatic steering gear poppet/relief valves.
16. Inspect, align, and replace pitman arm.
17. Inspect, adjust, and replace drag link (relay rod) and tie rod ends (ball and adjustable socket type).
18. Inspect and replace steering arms.
19. Inspect and replace tie rod cross tube (relay rod/center link), clamps, and retainers; position as needed.
20. Check and adjust wheel stops.

B. Suspension System Diagnosis and Repair (16 Questions)

1. Inspect and replace front axle beam and mounting hardware.
2. Inspect, service, adjust, and replace kingpins, bushings, locks, bearings, seals, and covers.
3. Inspect and replace shock absorbers, bushings, brackets, and mounts.
4. Inspect, repair, and replace (leaf and parabolic) springs, center bolts, clips, spring eye bolts and bushings, shackles, slippers, insulators, brackets, and mounts.
5. Inspect, adjust, and replace axle aligning devices including radius rods/arms, torque rods, transverse torque rods/track bars, stabilizer bars, bushings, mounts, shims, and cams.
6. Inspect and replace walking beams, center (cross) tube, bushings, mounts, load pads, brackets, caps, and mounting hardware.
7. Inspect, test, and replace air suspension springs (bags), mounting plates, and main support beams/springs, pressure regulator and height control valves, linkages, lines, hoses, and fittings.
8. Diagnose, inspect, and replace, auxiliary lift axle components and controls.
9. Measure front and rear vehicle ride heights; determine needed adjustments or repairs.
10. Verify and diagnose vehicle suspension complaints; determine needed repairs.
11. Torque U-bolts to manufacturers' specifications.
12. Check axle load distribution problems on rear suspensions; check axle seat planing angles and pinion angles.
13. Inspect frame and frame members for cracks, breaks, distortion, elongated holes, looseness, and damage; determine needed repairs.
14. Inspect, install, or repair frame hangers, brackets, crossmembers and fasteners in accordance with manufacturers' recommended procedures.
15. Inspect, adjust, service, repair, or replace fifth wheel, pivot pins, bushings, locking jaw mechanisms, and mounting bolts.
16. Inspect, adjust, service, repair, or replace sliding fifth wheel, tracks, stops, locking systems, air cylinders, springs, lines, hoses, and controls.
17. Inspect, install, repair or replace pintle hooks and draw bars.

T5 List (continued)

C. Wheel Alignment Diagnosis, Adjustment, and Repair (13 Questions)

1. Diagnose vehicle wandering, darting, pulling, drifting, shimmy, and steering effort problems; determine needed adjustments and repairs.
2. Check camber and KPI (kingpin inclination); determine needed repairs.
3. Check and adjust caster.
4. Check and adjust toe.
5. Check rear axle(s) alignment (thrustline/centerline) and tracking (lateral offset, parallelism); adjust or determine needed repairs.
6. Check turning/Ackerman angle (toe out on turns) and maximum turning radius (wheel cut); determine needed repairs.

D. Wheels, Tires and Hub Diagnosis and Repair (9 Questions)

1. Diagnose tire wear patterns; determine needed repairs.
2. Diagnose wheel end vibration, shimmy, pounding, hop (tramp) problems; determine needed repairs.
3. Inspect and replace wheels, mounting hardware, studs, and fasteners.
4. Measure wheel and tire radial and lateral runout; determine needed repairs or adjustments
5. Inspect tires; check and adjust air pressure to manufacturers' specifications.
6. Perform static balance of wheel and tire assembly.
7. Perform dynamic balance of wheel and tire assembly.
8. Measure tire diameter and match tires on axles.
9. Remove and reinstall tire/wheel assemblies to manufacturers' specifications.
10. Clean, inspect, lubricate, and replace wheel hubs, wheel bearings and races/cups; replace seals and wear rings; adjust wheel bearings (including one- and two-nut types) to manufacturers' specifications.
11. Inspect and replace unitized hub bearing assemblies; perform initial installation and maintenance procedures to manufacturers' specifications. ■

Sample Questions
Suspension and Steering (Test T5)

1. Which of these could cause the front tires of a truck to show a feathered edge wear pattern?

   * (A) An incorrect toe setting
   (B) An incorrect camber setting
   (C) An incorrect caster setting
   (D) Incorrect tire pressures

2. The drive axles on a truck with a walking beam suspension are out of alignment.
   Technician A says that incorrect length torque rods could be the cause.
   Technician B says that worn walking beam bushings could be the cause.
   Who is right?

   (A) A only
   * (B) B only
   (C) Both A and B
   (D) Neither A nor B

3. The driver of a truck that has just had its front springs and hangers replaced says that it is hard to keep in a straight ahead position.
   Technician A says that this could be caused by installing the caster shims backwards.
   Technician B says that this could be caused by installing forward spring hangers which are too short.
   Who is right?

   * (A) A only
   (B) B only
   (C) Both A and B
   (D) Neither A nor B

4. The driver of a truck says that it is hard to steer and the steering wheel return is poor.
   Technician A says that binding kingpins could be the cause.
   Technician B says that too much toe-in could be the cause.
   Who is right?

   * (A) A only
   (B) B only
   (C) Both A and B
   (D) Neither A nor B

T5 Sample Questions (continued)

5. Rust streaks coming from around the stud holes of a disc wheel could be caused by:

   (A) an overloaded condition.
   (B) overtorqued lug/cap nuts.
   (C) an out-of-balance condition.
   * (D) loose lug/cap nuts.

6. A truck has a history of springs breaking at the center bolt holes. Technician A says that loose U-bolts could be the cause. Technician B says that loose spring shackles could be the cause. Who is right?

   * (A) A only
   (B) B only
   (C) Both A and B
   (D) Neither A nor B

7. A constant buzzing noise is coming from the power steering pump. Technician A says air in the system could be the cause. Technician B says that a stuck-open relief valve could be the cause. Who is right?

   * (A) A only
   (B) B only
   (C) Both A and B
   (D) Neither A nor B

8. The tandem rear axle air suspension ride height rises above normal as the vehicle is unloaded. Which of these could be the cause?

   (A) A kinked air spring (bag) supply line
   (B) A leaking height control valve
   * (C) A plugged height control valve exhaust port
   (D) A leaking pressure protection valve

This question contains the word EXCEPT. Read the question carefully before choosing your answer.

9. All of these should be checked before aligning the front wheels on a truck **EXCEPT**:

   (A) tire pressure.
   (B) ride height.
   (C) wheel bearing adjustment.
   * (D) tire balance.

Test Specifications and Task List
Electrical/Electronic Systems (Test T6)

Content Area	Questions in Test	Percentage of Test
A. General Electrical/ Electronic System Diagnosis	14	28%
B. Battery and Starting System Diagnosis and Repair	11	22%
C. Charging System Diagnosis and Repair	7	14%
D. Lighting Systems Diagnosis and Repair	6	12%
E. Related Vehicle Systems Diagnosis and Repair	12	24%
Total	**50**	**100%**

A. General Electrical/Electronic System Diagnosis (14 questions)

1. Check applied voltages, circuit voltages, and voltage drops in electrical/electronic circuits using digital multimeter (DMM), or appropriate test equipment.
2. Check current flow in electrical/electronic circuits and components using a digital multimeter (DMM), clamp-on ammeter, or appropriate test equipment.
3. Check continuity and resistance in electrical/electronic circuits and components using digital multimeter (DMM), or appropriate test equipment.
4. Find shorts, grounds, and opens in electrical/electronic circuits.
5. Diagnose key-off battery drain (parasitic draw) problems; determine needed repairs.
6. Inspect and test fusible links, circuit breakers, fuses, and other circuit protection devices; include reset when required.
7. Inspect and test spike suppression diodes/resistors and capacitors.
8. Inspect and test relays and solenoids (including solid state devices).
9. Read and interpret electrical schematic diagrams and symbols.
10. Diagnose failures in the multiplexed data communications bus network; determine needed repairs.
11. Diagnose vehicle electronic control systems using appropriate diagnostic tools, software, and service information; check and record diagnostic codes; access and verify parameters and calibration settings; determine needed repairs.
12. Check electronic circuit waveforms; interpret readings and determine needed repairs.

B. Battery and Starting System Diagnosis and Repair (11 questions)

1. Determine battery state of charge by measuring terminal post voltage using a digital multimeter (DMM).
2. Perform battery tests (load and capacitance); determine needed service.
3. Inspect, clean, service, or replace battery, cables, and terminal connections.
4. Inspect, clean, repair or replace battery boxes, mounts, and hold-downs.

5. Charge battery using appropriate method for battery type (absorbed glass mat, lead acid and super capacitors).
6. Jump-start a vehicle using jumper cables and a booster battery or appropriate auxiliary power supply.
7. Diagnose low voltage disconnect (LVD) systems; determine needed repairs.
8. Test/monitor battery and starting system voltage during cranking; determine needed repairs.
9. Perform starting circuit voltage drop tests; determine needed repairs.
10. Inspect, test, and replace starter control circuit switches, relays, connectors, terminals and wires (including over crank protection).
11. Diagnose starter cranking inhibit systems; determine needed repairs.
12. Inspect, test, and replace starter, relays and solenoids/switches including integrated MAG switch (IMS).
13. Inspect, clean, repair, or replace cranking control circuit wires, connectors, and terminals.
14. Verify starter operation; remove and replace starter as needed; inspect flywheel ring gear or flex plate.
15. Differentiate between electrical and/or mechanical problems that cause a slow crank, intermittent crank, no-crank, extended cranking, or a cranking noise condition.

C. Charging System Diagnosis and Repair (7 questions)

1. Verify operation of charging system circuit indicators; determine needed repairs.
2. Diagnose the cause of no charge, low charge, or overcharge conditions; determine needed repairs.
3. Inspect, adjust, and replace alternator, drive belts/gears, pulleys, fans, mounting brackets, and tensioners.
4. Test charging system voltage (AC and DC) and amperage output; determine needed repairs.
5. Perform charging circuit voltage drop tests; determine needed repairs.
6. Inspect, repair, or replace charging circuit connectors, terminals, and wires.
7. Inspect and test generator (alternator) and control components including control modules/regulators; determine needed actions.

D. Lighting Systems Diagnosis and Repair (6 questions)

1. Diagnose the cause of brighter than normal, intermittent, or no operation of exterior lighting including daytime running light (DRL) operation; determine needed repairs.
2. Inspect, replace, and aim/adjust headlights and auxiliary lights.
3. Inspect, test, repair, or replace headlight switches, dimmer switches, control components, relays, sockets, connectors, terminals, and wires.
4. Inspect, test, repair, or replace truck and trailer lighting circuit switches/electronic control components, bulbs, light-emitting diodes (LEDs), sockets, relays, connectors, terminals, and wires.
5. Inspect, test, repair, or replace instrumentation light circuit switches, bulbs, LEDs, sockets, circuit boards, connectors, terminals, and wires.
6. Inspect, test, repair, or replace interior cab light circuit switches, electronic control components, bulbs, LEDs, sockets, connectors, terminals, and wires.
7. Inspect, test, adjust, repair, or replace stoplight circuit switches, relectronic control components, relays, bulbs, LEDs, sockets, connectors, terminals, and wires.
8. Diagnose the cause of turn signal and hazard light system malfunctions; determine needed repairs.
9. Inspect, test, repair, or replace turn signal and hazard circuit flashers or electronic control components, switches, relays, bulbs, LEDs, sockets, connectors, terminals, and wires.

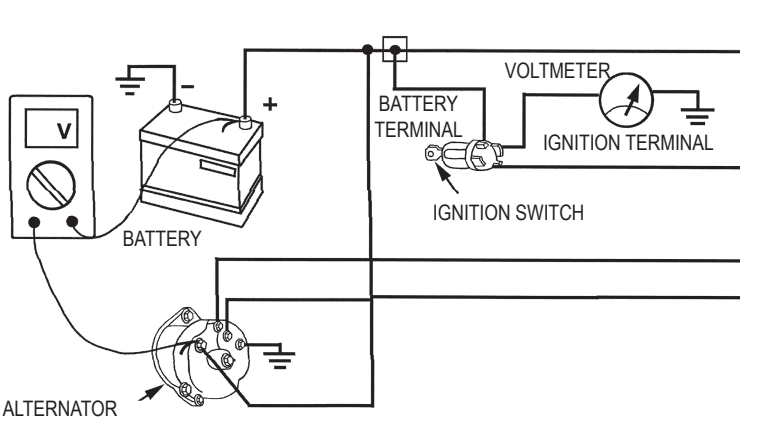
T6 List (continued)

10. Inspect, test, adjust, repair, or replace backup light and warning devices, circuit switches, bulbs, LEDs, sockets, connectors, terminals, and wires.
11. Inspect and test trailer light cord connector and cable; determine needed repairs.

E. Related Vehicle Systems Diagnosis and Repair (12 questions)

1. Diagnose the cause of intermittent, inaccurate, or no gauge readings; determine needed repairs.
2. Diagnose the cause of high, low, intermittent, or no readings on electronic instrument cluster gauges; determine needed repairs.
3. Inspect, test, adjust, repair, or replace gauge circuit sending units, sensors, gauges, connectors, terminals, and wires.
4. Inspect, test, repair, or replace warning devices (lights and audible) circuit sending units, sensors, circuit boards/control modules, bulbs, audible component, sockets, connectors, terminals, and wires.
5. Inspect, test, and replace electronic instrumentation systems; verify proper calibration for vehicle application.
6. Diagnose the cause of constant, intermittent, or no horn operation; determine needed repairs.
7. Inspect, test, repair, or replace airbag circuit, clock spring, connectors, terminals, and wires.
8. Diagnose the cause of constant, intermittent, or no wiper operation; wiper speed control and/or park problems; determine needed repairs.
9. Inspect, test, and replace wiper motor and transmission mechanical linkage, arms, and blades, in addition to relays, switches, connectors, terminals, and wires.
10. Inspect, test, repair, or replace windshield washer motor or pump/relay assembly, switches, connectors, terminals, and wires.
11. Inspect, test, repair, or replace sideview mirror motors, heater circuit grids, relays, switches, connectors, terminals, and wires.
12. Inspect, test, repair, or replace heater and A/C electrical components including: A/C clutches, motors, resistors, sensors, relays, switches, control modules, connectors, terminals, and wires.
13. Inspect, test, repair, or replace cigarette lighter and/or auxiliary power outlet, integral fuse, connectors, terminals, and wires.
14. Diagnose the cause of slow, intermittent, or no power window operation; determine needed repairs.
15. Inspect, test, repair, or replace power window motors, switches, relays, connectors, terminals, and wires.
16. Diagnose inverter/shore/auxiliary/HVAC auxiliary power units (APU) and controls; determine needed repairs.
17. Diagnose the cause of poor, intermittent, or no operation of electric door locks; determine needed repairs.
18. Inspect, test, repair, or replace electric door lock circuit switches, relays, controllers, actuators/solenoids, connectors, terminals, and wires.
19. Inspect, test, and replace cruise control electrical controls and components.
20. Inspect, test, and replace engine cooling fan electrical control components.
21. Inspect, test, and replace electric fuel supply/transfer pump control components.
22. Inspect, test, repair, or replace telematics/electronic logging devices (ELD), controls, and components.
23. Diagnose operation of safety systems and related circuits (speed control, collision avoidance, backup cameras, etc.; determine needed repairs. ■

Sample Questions
Electrical/Electronic Systems (Test T6)

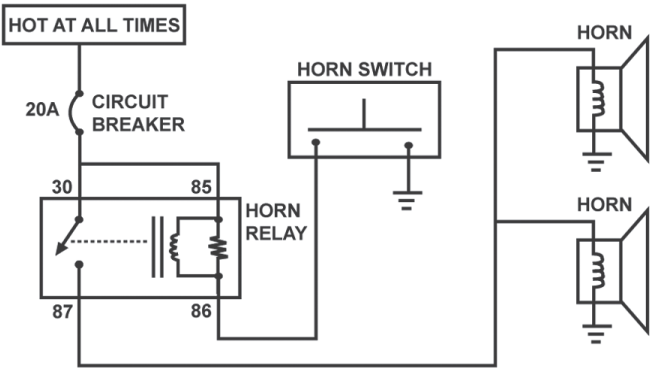


1. In the charging system shown, the meter reading will show:

   (A) charging output voltage.
   (B) regulator operating voltage.
   * (C) charging circuit voltage drop.
   (D) ignition switch voltage drop.

2. A truck's cab heater blower motor operates at low speed only. Which of these could be the cause?

   (A) An open blower switch ground
   * (B) A bad blower switch
   (C) A binding blower cage
   (D) A short to power at the blower motor



3. The horns in the circuit shown blow only when a jumper wire is connected between terminals 30 and 87 of the horn relay.

   Technician A says that a failed horn relay could be the cause.

   Technician B says that a short to ground in the circuit between the horn relay and the horn button could be the cause.

   Who is right?

   * (A) A only
   (B) B only
   (C) Both A and B
   (D) Neither A nor B

This question contains the word EXCEPT. Read the question carefully before choosing your answer.

4. Any of these may cause low alternator output EXCEPT:

   (A) a loose alternator output terminal.
   (B) a slipping alternator belt.
   * (C) shorted-to-ground stators.
   (D) high resistance at the alternator ground.

5. A driver complains that the trailer marker lights are dim at night while braking. Which of these could be the cause?

   (A) Low battery voltage
   (B) One burned-out brake light bulb
   * (C) A poor ground in the trailer light cord
   (D) Too much grease on the 5th wheel

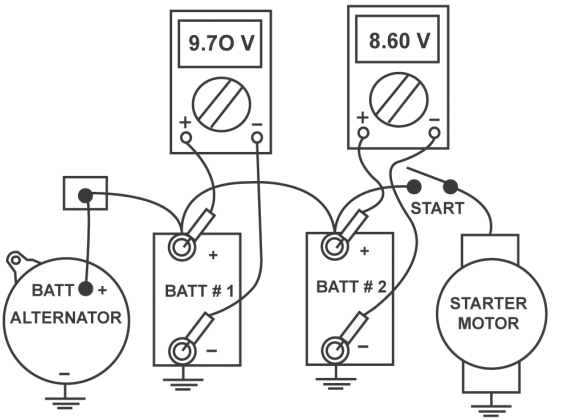
6. Both headlights on a vehicle are dim in high beam and normal in low beam.

   Technician A says that a poor headlight ground could be the cause.

   Technician B says that a shorted headlight switch could be the cause.

   Who is right?

   (A) A only
   (B) B only
   (C) Both A and B
   * (D) Neither A nor B



7. The voltage readings shown were taken while cranking the engine. Which of these is indicated by the readings?

   (A) Battery #2 has resistance in the ground cable.
   * (B) Battery # 2 is weaker than battery #1.
   (C) Battery #1 is low on electrolyte.
   (D) Battery #2 should be replaced.

Test Specifications and Task List Heating, Ventilation, and Air Conditioning (HVAC) Systems (Test T7)

Note: ASE HVAC certifications (A7, T7, H7 or S7) do not provide the necessary credentials to satisfy EPA requirements for Section 609 refrigerant management. The ASE Refrigerant Recovery and Recycling Review and Quiz program meets Section 609 requirements and can be taken online and in print. Details are at www.ase.com/cfc.

Content Area	Questions in Test	Percentage of Test
A. HVAC Systems Diagnosis, Service, and Repair	6	15%
B. A/C System and Component Diagnosis, Service, and Repair	20	50%
C. Heating and Engine Cooling Systems Diagnosis, Service, and Repair	6	15%
D. Operating Systems and Related Controls Diagnosis and Repair	8	20%
Total	**40**	**100%**

A. HVAC Systems Diagnosis, Service, and Repair (6 questions)

1. Verify the complaint, road test the vehicle, review driver/customer interview and past maintenance documents (if available); determine further diagnosis.
2. Verify the need for service or repair of HVAC systems based on unusual operating noises; determine appropriate action.
3. Diagnose HVAC system problems indicated by sight, sound, smell, and component temperature conditions; determine appropriate action.
4. Identify system type and components (cycling clutch orifice tube–CCOT, thermal expansion valve–TXV), and conduct performance test(s) on HVAC systems (vent outlet temperature, air flow, and verify system pressures); determine appropriate action.
5. Identify HVAC control system type; check and record electronic diagnostic codes/indicator lights; determine further diagnosis.

B. A/C System and Component Diagnosis, Service, and Repair (20 questions)

► A/C System—General

1. Diagnose the cause of temperature control problems in the A/C system; determine needed repairs.
2. Identify refrigerant and lubricant type and check for contamination; determine appropriate action.
3. Diagnose A/C system problems indicated by pressure gauge readings and sight glass/moisture indicator conditions (where applicable); compare gauge readings to ambient temperature/pressure chart; determine needed service or repairs.

4. Perform A/C system leak test (UV dye, electronic tester, pressure); determine needed repairs.
5. Recover A/C system refrigerant; determine amount of refrigerant and oil removed; determine appropriate action.
6. Evacuate A/C system using appropriate equipment.
7. Determine if contaminated A/C system components can be cleaned and reused or require replacement.
8. Charge A/C system with correct type and quantity of refrigerant and lubricant.
9. Recycle refrigerant.
10. Handle, label and store refrigerant.
11. Test refrigerant cylinders for non-condensable gases; identify refrigerant.
12. Maintain and verify correct operation of certified equipment.

► Compressor and Clutch

13. Diagnose A/C system problems that cause protection devices (pressure, thermal, and electronic) to interrupt compressor operation; determine needed repairs.
14. Inspect, test, and replace A/C system pressure, thermal and electronic protection devices.
15. Inspect and replace A/C compressor drive belts, pulleys, idlers, and tensioners, mountings, and hardware; adjust drive belts if applicable. Check belt alignment.
16. Inspect, test, service, and replace A/C compressor clutch components or assembly. Verify clutch air gap setting and adjust if needed.
17. Inspect and correct A/C compressor lubricant level.
18. Inspect, test, and replace A/C compressor.

► Evaporator, Condenser, and Related Components

19. Correct system lubricant level when replacing the evaporator, condenser, receiver/drier or accumulator/drier, and hoses.
20. Inspect, repair, or replace A/C system hoses, lines, filters, fittings, service ports and caps, O-rings and seals.
21. Inspect A/C condenser for proper air flow, including air flow control devices.
22. Inspect, test, and replace A/C system condenser and mountings.
23. Inspect and replace receiver/drier or accumulator/drier.
24. Inspect, test, and replace cab or sleeper expansion valve(s) and thermostatic switch (thermistor); check placement of thermal bulb (capillary tube).
25. Inspect and replace orifice tube.
26. Inspect, test, and replace cab or sleeper evaporator core.
27. Inspect, clean, and repair evaporator housing and water drain; check for proper evaporator air flow; inspect and service/replace evaporator air filter.
28. Diagnose system failures resulting in refrigerant loss from the A/C system high pressure relief device.

C. Heating and Engine Cooling Systems Diagnosis, Service, and Repair (6 questions)

1. Diagnose the cause of outlet air temperature control problems in the HVAC system; determine needed repairs.
2. Diagnose window fogging problems; determine needed repairs.
3. Perform engine cooling system tests for leaks, protection level, contamination, coolant level, temperature, coolant type, and conditioner concentration; determine needed repairs.

4. Inspect and replace engine cooling and heating system hoses, lines, fittings, and clamps.
5. Inspect, test, and/or replace radiator, pressure cap, and coolant recovery system components (expansion/surge tank).
6. Inspect and/or replace water pump and drive system.
7. Inspect, test, and/or replace thermostats, by-passes, housings, and seals.
8. Flush, refill, and bleed air from cooling system.
9. Inspect, test, and repair or replace engine cooling fan, hub, clutch, controls, thermostat, shroud, and air flow control devices.
10. Inspect, test, and replace heating system coolant control valve(s) and manual shut-off valves.
11. Inspect, check for proper air flow, flush and/or replace heater core.

D. Operating Systems and Related Controls Diagnosis and Repair (8 questions)

1. Diagnose the cause of failures in HVAC electrical, air and mechanical control systems; determine needed repairs.
2. Inspect, test, repair, and replace HVAC heater blower motors, resistors, switches, relays, modules, wiring, and protection devices.
3. Inspect, test, repair, and replace A/C compressor clutch relays, modules, wiring, sensors, switches, diodes, and protection devices.
4. Inspect and test HVAC-related electronic engine and body control systems (ECM, BCM); determine needed repairs.
5. Inspect, test, repair, and replace engine cooling/condenser fan motors, relays, modules, switches, sensors, wiring, and protection devices.
6. Inspect, test, repair, and replace electric and air actuator motors, relays/modules, switches, sensors, wiring, and protection devices.
7. Inspect, test, repair, or replace HVAC system electrical, air, or mechanical control panel assemblies.
8. Inspect, test, adjust, calibrate, repair, or replace HVAC system ducts, doors, outlets, control cables, linkages, and actuators/motors.
9. Diagnose constant/automatic temperature control system problems; determine needed repairs.
10. Inspect, test, and replace constant/automatic temperature control modules.
11. Diagnose HVAC control system operation, record diagnostic trouble codes (DTC) and perform system tests with appropriate electronic service tool.
12. Diagnose shore/auxiliary/HVAC auxiliary power units (APU) and controls; determine needed repairs. ■

Sample Questions
Heating, Ventilation, and Air Conditioning (HVAC) Systems (Test T7)

1. A truck's A/C system does not cool properly due to an icing evaporator problem.

   Technician A says that a stuck-closed cycling switch could be the cause.

   Technician B says that a refrigerant overcharge could be the cause.

   Who is right?

   * (A) A only
   (B) B only
   (C) Both A and B
   (D) Neither A nor B

2. The sleeper A/C unit is not cooling. A system check shows all pressures are normal. Which of these could be the cause?

   (A) A plugged receiver drier
   (B) A stuck-open expansion valve
   (C) A shorted high pressure switch
   * (D) A stuck-closed refrigerant solenoid valve

3. An A/C system has a low discharge pressure. Which of these could be the cause?

   * (A) A leaking compressor seal
   (B) A restricted refrigerant flow in the condenser
   (C) A restriced air flow over the condenser
   (D) A compressor clutch that will not engage

4. During replacement, it is noticed that the tubes on the inlet and outlet of a heater core are ruptured. The cause could be:

   (A) a low coolant level.
   (B) air in the cooling system.
   * (C) incorrect coolant protection.
   (D) a bad heater control valve.

5. No air is flowing from a truck's HVAC ducts.

   Technician A says that a failed blower motor could be the cause.

   Technician B says that a stuck recirculation air door could be the cause.

   Who is right?

   * (A) A only
   (B) B only
   (C) Both A and B
   (D) Neither A nor B

6. A recovery/recycle machine has been used to recycle a vehicle's refrigerant. The moisture indicator on the machine shows that moisture is present. The cause could be a:

   (A) full refrigerant storage tank.
   (B) faulty air purge valve.
   * (C) saturated filter/drier.
   (D) faulty storage tank pressure switch.

This question contains the word EXCEPT. Read the question carefully before choosing your answer.

7. A truck's A/C system has just been repaired and filled with the proper amount of refrigerant. The system blows cool, but not cold air. The high-side pressure is 250 psi, and the low-side pressure is 50 psi. Any of these could be the cause EXCEPT:

   (A) the cooling fan is inoperative.
   * (B) a partially restricted expansion valve.
   (C) a system overcharged with oil.
   (D) a missing radiator fan shroud.

Test Specifications and Task List
Preventive Maintenance and Inspection (PMI)
(Test T8)

Content Area	Questions in Test	Percentage of Test
A. Engine Systems	10	20%
B. Cab and Hood	5	10%
C. Electrical/Electronics	10	20%
D. Frame and Chassis 1. Brakes (10) 2. Drivetrain (4) 3. Steering, Tires, and Wheels (4) 4. Suspension, Frame, and 5th Wheel (4)	22	44%
E. Road/Operational Test	3	6%
Total	**50**	**100%**

A. Engine Systems (10 questions)

1. Review past maintenance/repair documents, driver vehicle condition reports, and brake/tire wear report. Check and record electronic diagnostic codes and trip/operational data. Clear codes and data.
2. Check engine operation (including unusual noises, vibration, and excessive exhaust smoke); record idle rpm, governed rpm, and PTO rpm (if applicable).
3. Inspect vibration damper.
4. Inspect condition of belt(s), tensioner(s), and pulley(s); check and adjust belt tension.
5. Check engine for oil, coolant, air, and fuel leaks (Engine Off and Engine Running).
6. Inspect engine mounts for looseness and deterioration.
7. Check engine oil level and condition; check dipstick seal and fill cap seal.
8. Check engine compartment wiring, harnesses, connectors, and seals for damage, mounting, and proper routing.
9. Check fuel tanks, vents, mountings, lines, caps, and seals; check anti-siphon device (if applicable).
10. Inspect water separator/fuel heater; drain water from separator; replace fuel filter(s); prime and bleed fuel system.
11. Inspect crankcase ventilation system.
12. Check exhaust system mountings for looseness and damage.
13. Check engine exhaust system for leaks, excessive noise, proper routing, and missing or damaged components (heat shields and guards).
14. Check air induction system piping, charge air cooler, hoses, clamps, mountings, proper routing, and indicators; check for air restrictions and leaks.

15. Inspect turbocharger(s) for noise, oil and exhaust leaks; check mountings and connections; check wastegate, variable geometry turbocharger (VGT), linkages, and hoses.
16. Service or replace air filter(s) as needed.
17. Inspect diesel emission control systems, including exhaust gas recirculation (EGR), exhaust gas recirculation (EGR) cooler, diesel particulate filter (DPF), and/or catalytic converter.
18. Check fan clutch/hub operation, bearing condition and noise (including viscous/thermostatic, air, and electric fan types); inspect fan assembly and shroud for missing and damaged components.
19. Inspect radiator (including air flow restriction, missing/corroded fins, leaks, and damage) and mountings.
20. Pressure test cooling system and radiator cap.
21. Inspect coolant hoses and clamps for leaks, damage, and proper routing.
22. Inspect coolant recovery system.
23. Identify coolant type; check coolant for contamination, supplemental coolant additives (SCAs), and protection level (freeze point).
24. Service coolant filter/conditioner.
25. Drain and refill cooling system; bleed air from system; recover coolant.
26. Inspect water pump for leaks and bearing play.
27. Change engine oil and filters; visually check oil for coolant or fuel contamination; inspect and clean magnetic drain plugs.
28. Take an engine oil sample.

B. Cab and Hood (5 questions)

1. Inspect key condition and check operation of ignition switch.
2. Check operation of indicator lights, warning lights and/or alarms.
3. Check operation of instruments/gauges and panel lighting.
4. Check operation of electronic power take off (PTO) and engine idle speed controls (if applicable).
5. Check operation of defroster, heater, ventilation, and A/C (HVAC) controls.
6. Check operation of all accessories.
7. Use diagnostic tool or on-board diagnostic system to read current and historic diagnostic trouble codes from electronic modules (including engine, transmission, brake, supplemental restraint, traction control and body control systems).
8. Check operation of electric and air horns.
9. Check condition of safety equipment, including flares, spare fuses, reflective triangles, fire extinguisher, and all required decals.
10. Inspect seat belts, seat tethers, and sleeper restraints.
11. Check supplemental restraint system (SRS) for proper warning light operation and diagnostic trouble codes (if applicable).
12. Inspect wiper blades and arms.
13. Check wiper and washer operation.
14. Check for all required vehicle permits, registration, decals, and inspection papers.
15. Inspect windshield glass for cracks, chips, clarity, discoloration/glazing, or other damage; check sun visor operation.

16. Check seat condition, operation, mounting, and suspension components.
17. Check door glass and window operation.
18. Inspect steps and grab handles.
19. Inspect mirror mountings, brackets, glass, heaters, and motors.
20. Inspect and record all observed physical damage.
21. Lubricate all cab and hood grease fittings.
22. Inspect and lubricate door and hood hinges, latches, strikers, lock cylinders, linkages, and cables.
23. Inspect cab mountings, hinges, latches, linkages; service as needed.
24. Inspect tilt cab hydraulic pump, lines, and cylinders for leakage; inspect tilt cab safety devices; service as needed.
25. Check accelerator, clutch, and brake pedal operation and condition.
26. Check cab ride height; inspect cab air suspension springs, mounts, hoses, valves, shock absorbers, and fittings for leaks and damage.
27. Inspect front bumper, fairings, and mounts.
28. Inspect A/C condenser and lines for condition and visible leaks; check mountings.
29. Inspect A/C compressor and lines for condition and visible leaks; check clutch; check mountings.
30. Check A/C system condition and operation.
31. Check HVAC air inlet filters and ducts; service as needed.
32. Check auxiliary power unit (APU) operation and mounting; inspect for damage, leaks, and belt tension.

C. Electrical/Electronics (10 questions)

1. Inspect battery box(es), cover(s), and mountings.
2. Inspect battery hold downs, connections, cables, and cable routing; service as needed.
3. Check and record battery state of charge (open circuit voltage) and condition.
4. Perform battery test (load and capacitance).
5. Inspect starter, mounting, connections, cables, and cable routing.
6. Engage starter; check for unusual noises, starter drag, and starting difficulty.
7. Inspect alternator, mounting, wiring, and wiring routing.
8. Perform alternator current output test.
9. Perform alternator voltage output test.
10. Check operation of interior lights; service as needed.
11. Check all exterior lights, lenses, and reflectors; check headlight alignment; service as needed.
12. Inspect and test trailer power cord connector, cable, and holder; service as needed.

D. Frame and Chassis (22 questions)

1. Brakes (10 questions)

1. Check air parking brake operation.
2. Check and record air governor cut-in and cut-out settings (psi).
3. Service air drier as needed. Check air drier purge valve operation and air drier heater, if equipped.
4. Check air system for leaks (brakes released).
5. Check air system for leaks (brakes applied).
6. Drain air tanks; test one-way and double-check valves.

7. Check low air pressure warning devices.
8. Check spring brake inversion/emergency (spring) brake control valve, if equipped.
9. Check tractor protection valve, if equipped.
10. Test air pressure build-up time.
11. Check condition and operation of hand brake (trailer) control valve, if equipped.
12. Perform antilock brake system (ABS) operational system self-test. Perform automatic traction control (ATC) operational system self-test, if equipped.
13. Inspect coupling air lines, holders, and gladhands.
14. Check brake chambers and air lines for secure mountings, damage, and missing caging plugs.
15. Inspect and record front and rear brake lining/pad condition and thickness.
16. Inspect condition of front and rear brake drums/rotors.
17. Check operation and adjustment of front and rear brake automatic slack adjusters.
18. Check S-camshaft and bushing condition.
19. Lubricate all air brake component grease fittings.
20. Check master cylinder for leaks and damage; check fluid level and condition.
21. Inspect hydraulic brake lines, fittings, flexible hoses, and valves for leaks and damage.
22. Check hydraulic parking brake operation; inspect parking brake application and holding devices.
23. Check operation of hydraulic system; pedal travel, pedal effort, and pedal feel (drift).
24. Inspect calipers and/or wheel cylinders for leaks and damage.
25. Inspect power brake booster(s), hoses, and control valves.
26. Check and/or adjust hydraulic drum brakes.
27. Check operation of hydraulic assist back-up system and warning devices.

2. Drivetrain (4 questions)

1. Check operation of release/throw out bearing and clutch brake.
2. Check clutch linkage/cable and levers for looseness or binding; lubricate release/throwout bearing as required.
3. Check clutch master cylinder fluid level; check clutch master cylinder, slave cylinder, lines, and hoses for leaks and damage.
4. Check and/or adjust clutch.
5. Check transmission and/or transfer case housing, fasteners, seals, filter, cooler, and cooler lines for cracks, leaks, and proper routing, if equipped.
6. Check transmission wiring, connectors, seals, and harnesses for damage and proper routing.
7. Inspect transmission breather, service as needed.
8. Inspect transmission mounts for looseness and deterioration.
9. Check transmission oil/fluid level and condition.
10. Inspect U-joints, yokes, driveshafts, and center bearings for looseness, damage, and proper phasing.
11. Inspect axle housing(s) for cracks and leaks.
12. Inspect axle breather(s); service as needed.
13. Lubricate all drivetrain grease fittings.
14. Check drive axle(s) oil level.
15. Change drive axle(s) oil and filter; check and clean magnetic plugs.

T8 List (continued)

16. Check power take-off (PTO) unit operation and mounting; check PTO U-joints and driveshaft for looseness, damage, and proper phasing, if equipped.
17. Change transmission oil/fluid and filters; check and clean magnetic plugs.
18. Take transmission oil sample.
19. Take drive axle(s) oil sample.

3. Steering, Tires, and Wheels (4 questions)

1. Check steering wheel and column operation for free play and binding.
2. Check power steering pump and hoses for leaks and mounting; check fluid level and condition.
3. Change power steering fluid and filter.
4. Inspect steering gear(s) or rack-and-pinion for leaks and mounting.
5. Inspect steering shafts and U-joints condition and for proper phasing; inspect pinch bolts, splines, Pitman arm-to-steering sector shaft, drag link, tie rod ends, cross tube, and wheel stops.
6. Check kingpin and thrust bearing wear.
7. Check front and rear wheel bearings/hub assemblies for looseness and noise, including extended service (sealed, close tolerance, and unitized) assemblies.
8. Check oil level and condition in all non-drive axle hubs; check for leaks.
9. Adjust wheel bearings as needed (including one- and two-nut types) in accordance with manufacturers' specifications.
10. Inspect tires for irregular wear patterns and proper mounting of directional tires.
11. Inspect tires for cuts, cracks, bulges, and sidewall damage.
12. Inspect valve caps and stems.
13. Measure and record tire tread depth; probe for imbedded debris.
14. Check and record tire air pressure; adjust as needed.
15. Check for loose lugs and/or slipped wheels; check mounting hardware condition; service as needed.
16. Retorque lugs/nuts in accordance with manufacturers' specifications.
17. Inspect wheels and spacers for cracks or damage.
18. Check tire matching (diameter and tread) on dual tire installations.
19. Lubricate all steering grease fittings.

4. Suspension, Frame, and 5th Wheel (4 questions)

1. Inspect front and rear suspension components (springs, hangers, shackles, spring U-bolts, insulators, radius rods, torque rods, load pads, walking beams, and equalizers); check U-bolt torque in accordance with manufacturers' specifications.
2. Inspect shock absorbers for leaks and mounting.
3. Inspect air suspension components (air springs/bags, mounts, arms, hoses, valves, linkage, and fittings) for leaks and damage; check suspension ride height.
4. Inspect operation of tag/pusher axle and components for mounting and damage.
5. Lubricate all suspension grease fittings.
6. Check tandem axle spacing.
7. Inspect fifth wheel mount, bolts, slider, air lines, locks, pivot pins, bushings, and stops.
8. Test operation of fifth-wheel locking device; adjust as needed.
9. Check mud flaps, brackets, and reflective devices.
10. Check pintle hook assembly, mounting bolts, and locks.

T8 List (continued)

11. Clean and inspect fifth-wheel plate for cracks and damage; lubricate fifth-wheel plate and all grease fittings.
12. Inspect frame and frame members for cracks and damage.
13. Inspect body attaching hardware.
14. Inspect cargo ramps. Inspect lift gates, cylinders, controls, hoses, wiring, and warning decals; check fluid level, service as needed.
15. Inspect rear (ICC/DOT) impact guard.

E. Road/Operational Test (3 questions)

1. Check operation of clutch and gear shift.
2. Check operation of all instruments, gauges, and lights.
3. Check steering wheel for play, binding, and centering.
4. Check operation of automatic or automated mechanical transmission.
5. Check road speed limiter.
6. Check cruise control.
7. Observe exhaust for excessive smoke.
8. Test service brakes.
9. Verify engine/exhaust brake or retarder operation.
10. Check operation of backup warning devices. ■

Sample Questions
Preventive Maintenance Inspection (PMI)
(Test T8)

1. Which of these is the minimum tire tread depth permitted by federal DOT standards on all steer axle tires on trucks, tractors, or buses?

   (A) 1/32 in.
   (B) 2/32 in.
   * (C) 4/32 in.
   (D) 5/32 in.

2. Technician A says that the low air brake pressure warning lamp should be lit when the supply system pressure is below 60 psi.

   Technician B says that the parking brakes should automatically apply when the supply system air pressure falls below 45 psi.

   Who is right?

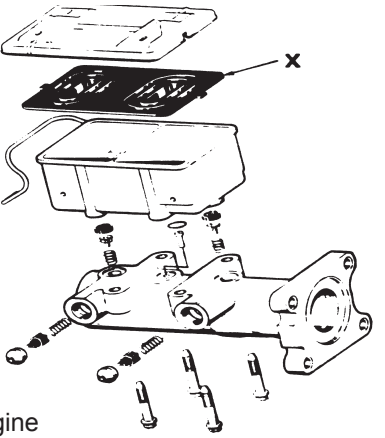
   (A) A only
   (B) B only
   * (C) Both A and B
   (D) Neither A nor B

3. The driver of a tractor/trailer reports that the engine's fan hits the shroud when accelerating under a load. The cause could be:

   (A) overspeeding the engine.
   (B) improper vehicle shifting.
   (C) excessive fan blade flexing.
   * (D) a broken engine mount.

4. A drive axle lubricant is a milky color. The cause could be:

   (A) metal contamination.
   (B) mixing lubricant types.
   (C) gasket sealer contamination.
   * (D) water contamination.



5. The PM inspector notices that part “X” in the illustration shown is swollen. This could cause:

   * (A) fluid contamination.
   (B) loss of static pressure.
   (C) excessive pedal effort.
   (D) brake warning lamp illumination.

6. When pressure testing a cooling system, the technician should apply:

   (A) 5 pounds of pressure with the engine running.
   * (B) the amount of pressure listed on the radiator cap.
   (C) pressure not to exceed the danger zone on the pressure gauge.
   (D) 5 pounds more pressure than listed on the radiator cap.

7. When performing a battery load test on a multiple battery vehicle:

   (A) connect the load test clamps to any positive battery post and ground.
   (B) disconnect the ground cable(s) from the frame.
   (C) connect the load test amps clamp around a negative vehicle battery cable.
   * (D) isolate the batteries from each other.

This question contains the word EXCEPT. Read the question carefully before choosing your answer.

8. A zero reading on an air restriction dash gauge could be caused by any of these EXCEPT:

   (A) a bad restriction gauge.
   * (B) a plugged air filter.
   (C) an opening in the intake system.
   (D) a torn air filter.

Test Specifications and Task List
Compressed Natural Gas Vehicle (Test F1)

Content Area	Questions in Test	Percentage of Test
A. Pre-Service Vehicle Inspection	5	9%
B. CNG System Equipment Inspection	8	15%
C. Leak Testing and Repairs	6	11%
D. Emissions and Performance Verification	11	20%
E. System Diagnosis, Maintenance, and Repair	16	29%
F. General Cylinder Safety and Maintenance	9	16%
Total	**55**	**100%**

Note: All CNG vehicle testing, service, and repair should be performed using vehicle and component manufacturer's guidelines and current NFPA 52 and/or local safety standards.

A. Pre-Service Vehicle Inspection (5 questions)

1. Inspect vehicle integrity including serviceability, alterations, and applicable emissions and safety standards.
2. Analyze vehicle/system performance; determine needed actions.
3. Inspect CNG cylinder(s) condition and expiration/end-of-life date; inspect CNG cylinder(s) shields/covers and determine needed actions.
4. Inspect for proper mounting of compressed natural gas cylinders and fuel system components.
5. Inspect for location, condition and compliance of venting system(s).

B. CNG System Equipment Inspection (8 questions)

1. Inspect fuel storage cylinders and system components.
2. Inspect fuel storage system brackets, isolators, reinforcements, and fasteners.
3. Inspect regulator assembly(ies) and coolant lines.
4. Inspect underhood fuel delivery system components.
5. Inspect system wiring.
6. Inspect electrical and electronic components.
7. Inspect fuel system gauges.
8. Inspect fuel lines, clamps, filters, and fittings.
9. Inspect valves, pressure-relief devices, venting systems, lines, fittings, and fasteners.
10. Inspect fuel fill receptacle(s) and check valve(s).
11. Verify/inspect required labels.

12. Complete system documentation as required.
13. Inspect defueling receptacle as required.

C. Leak Testing and Repairs (6 questions)

1. Check for low- and high-pressure system leaks; repair as needed.
2. Pressurize cylinders with CNG.
3. Check for coolant leaks; repair as needed.
4. Check venting system integrity; repair as needed.

D. Emissions and Performance Verification (11 questions)

1. Check regulator(s) pressure(s); determine needed repair.
2. Verify control module(s) (ECM/PCM) calibration.
3. Check operation of electronic components.
4. Check operation of fuel gauge; determine needed repairs.
5. Perform emission tests; make repairs and document where applicable.
6. Road test vehicle for acceptable driveability; check starting/restarting abilities.
7. Check manual and automatic fuel changeover operation (bi-fuel vehicles).
8. Check fuel system for abnormal noises.
9. Verify gaseous fuel management operation.

E. System Diagnosis, Maintenance, and Repair (16 questions)

Note: The following tasks apply to both bi-fuel and dedicated CNG vehicles.

1. Interpret and verify operational complaint; determine needed repair.
2. Visually inspect gaseous fuel system components; determine needed repairs.
3. Retrieve and interpret Diagnostic Trouble Codes (DTC) using appropriate diagnostic equipment/scan tool.
4. Diagnose driveability and emissions problems related to the ignition system; determine needed repairs.
5. Diagnose driveability and emissions problems related to fuel and air induction systems and exhaust systems; determine needed repairs.
6. Diagnose driveability and emissions problems related to electronic engine controls; determine needed repairs.
7. Check vacuum/electrical/electronic component operation; determine needed repairs.
8. Check gaseous fuel delivery system pressures and component operation; determine needed repairs.
9. Remove and/or replace fuel lines, manual and electrical valves, fittings, and pressure relief devices.
10. Defuel CNG system.
11. Check for signs of fuel contamination; inspect, replace and/or service fuel system filters as required.

F. General Cylinder Safety and Maintenance (9 questions)

1. Visually inspect fuel storage cylinder(s), shields, and mounting.
2. Remove and replace cylinders; defuel according to recommended procedures; replace shields, brackets, and hardware as required.
3. Handle and store cylinders in accordance with recommended procedures.

F1 Task List (continued)

4. Interpret cylinder label information; determine necessary action.
5. Inspect pressure relief devices (PRD) and related hardware; determine necessary action.
6. Inspect condition and operation of cylinders/tank valves; determine necessary action.
7. Decommission cylinders according to recommended procedures. ■

Sample Questions
Compressed Natural Gas Vehicle (Test F1)

1. The ignition firing voltage on a bi-fuel vehicle is being checked. During testing, a technician observes the voltage is higher when operating on CNG as compared to operating on gasoline. Which of these could be the cause?

   * (A) The air/fuel mixture is leaner when operating on CNG.
   (B) The air/fuel mixture is richer when operating on CNG.
   (C) The air/fuel mixture is leaner when operating on gasoline.
   (D) The air/fuel mixture is richer when operating on gasoline.

2. Which of these should be used to check the fuel line connections after a compressed natural gas system repair?

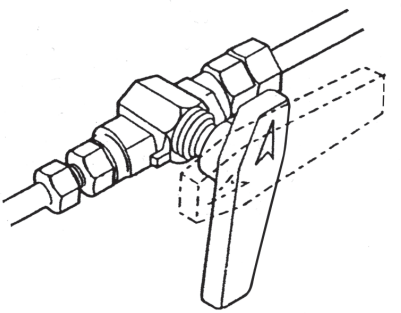
   (A) Nitrogen
   (B) Propane
   * (C) Non-ammonia soap
   (D) Carbon dioxide

3. After installing a new CNG fuel tank, the technician finds that the vehicle will not accept fuel. Which of these could be the cause?

   (A) A pinched O-ring on the receptacle line
   * (B) A failure to open the manual lock-down valve(s)
   (C) An open circuit on the in-tank solenoid valve
   (D) A short-to-ground in the solenoid wiring harness

4. A hoop-wrapped Type-2 cylinder shows evidence of stress corrosion cracking. What should the technician do?

   (A) Nothing, stress corrosion cracking is normal.
   (B) Repair the area using an approved coating.
   (C) Note the damage on the inspection form.
   * (D) Remove the cylinder from service.



5. A bi-fuel vehicle with the valve shown is in for a routine coalescent filter change.

   Technician A says that the valve should be closed to stop gasoline flow to the engine.

   Technician B says that the valve should be closed to stop CNG flow from the tank.

   Who is right?

   (A) A only
   * (B) B only
   (C) Both A and B
   (D) Neither A nor B

This question contains the word EXCEPT. Read the question carefully before choosing your answer.

6. A dedicated CNG vehicle has a no-start condition. All of these could be the cause EXCEPT:

   (A) no ignition source.
   * (B) high-ethanol gasoline.
   (C) no fuel pressure.
   (D) low battery voltage.

Test Prep & Training

Taking an ASE certification test doesn't have to be a high stress challenge. The ASE website contains test preparation and training information tailored to your specific needs. Visit **www.ase.com** and use the "Test Prep & Training" tab. We've loaded this section of our website with plenty of information to help boost both your knowledge and your confidence—two of your most important tools as a test-taker.

Official ASE Practice Tests

The easy way to try your hand at taking ASE-style certification exams, without the stress and high stakes of the real thing. **www.ase.com/practice**

Test Taking Tips

An easy, self-guided introduction to taking your ASE certification test, including examples of the types of questions you'll see and proven tips for success. **www.ase.com/testingtips**

Study Guides

Free, step-by-step guides to help you understand what's involved in each test—including sample questions and suggestions for further preparation. **www.ase.com/studyguides**

ASE Testing Demo

Are you new to ASE testing or has it been a few years? The demonstration at **www.ase.com/asedemo** will show you how the test platform works, so you'll feel right at home with the testing format.

In-service Training Providers

You can choose from a variety of training programs, both instructor-led and self-directed, that have been evaluated through a quality-assurance process and verified as ASE accredited training providers.

Community Colleges and Technical Training Schools

Get instructor-led, hands-on training at schools accredited by the ASE Education Foundation.

ATMC for more training options

The ASE Training Managers Council is a professional organization of individuals responsible for the development and delivery of training in the auto and truck industries. The ATMC administers the ASE Accredited Training Provider of Continuing Automotive Service Education program. A list of ASE accredited training providers can be found at **www.atmc.org** .

Other test prep and training programs

Many test-takers have used aftermarket test prep and training programs and found them helpful. Please note that ASE has neither reviewed nor approved the content of these programs and providers.

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National Institute for
AUTOMOTIVE SERVICE EXCELLENCE

Instructions for Completing the ASE Work Experience Form

To document your work experience, complete Sections 1 through 3. Provide the names and addresses of your current and previous employers, covering up to 3 years or more for Repair Technicians and at least 2 years for Service Consultants, Parts Specialists, and Collision Damage Estimators, and at least 4 to 6 years or more for high school and college automotive instructors.

If it is necessary to provide information for more than one previous employer to meet the minimum amount of experience required:

1. click the Previous Workplaces box located in Section 4; and
2. attach your additional previous employer information (e.g. Word document or scanned hand-written sheet).

Complete Sections 4 through 6. Click and check mark:

1. the applicable Attachments box(s) [i.e. formal education documentation, I-CAR Platinum certificate, self-employment documentation, military documentation, Canadian documentation, previous workplaces information, other documentation];
2. the experience detail boxes for which you have actual hands-on experience, or teaching experience where applicable; and
3. the box to certify that the information provided on this Work Experience Form, as well as any attached documentation, is true and correct.

Click the Attach File(s) button to include your attachment(s) which should show in the Files uploaded box, then click the Submit button to send your Work Experience Form and attachment(s) to ASE for review and processing.

Questions? Call ASE Customer Service at (703) 669-6609, 8 am to 5 pm ET, Monday through Friday, or send an email to contactus@ase.com (mailto:contactus@ase.com?Subject=Work%20Experience) with your full name, city, state, ASE ID (if known), and daytime phone number.

ASE Work Experience Requirements

To become ASE certified, you must pass an ASE test and have relevant hands-on work experience.

You can take most ASE tests even if you do not have the required work experience. You will receive a score report, but you will not earn certification or receive a certificate until you fulfill the related experience requirement.

To document your work experience, please complete the ASE Work Experience Form, attach applicable documentation, check the box in Section 6, and click the Submit button when you are ready to send your information to ASE for review and processing.

ASE reserves the right to verify all job history details and can deny certification to anyone who provides false or misleading work experience information.

ASE recognizes the following types of automotive service industry work experience:

Category	Description	Minimum amount of experience	Required for these Tests
Repair Technician	Hands-on experience maintaining, servicing, and/or repairing light-duty or heavy-duty motor vehicles.	1 year full-time (or part-time equivalent)	G1
		2 years full-time (or part-time equivalent)	A1-A9, B2-B5, E1-E3, F1, H1-H8, MIL2-MIL8, S1-S7, T1-T8, and X1
		3 years full-time (or part-time equivalent)	L1, L2, L3, and L4
Service Consultant	Hands-on experience as an automotive service writer/consultant or service manager.	2 years full-time (or part-time equivalent)	C1
Parts Specialist	Hands-on experience as a parts counterperson or managing a wholesale or retail parts store or in-house parts department.	2 years full-time (or part-time equivalent)	P1, P2, and P4
Collision Damage Estimator	Hands-on experience as an automotive collision damage estimator/adjuster.	2 years full-time (or part-time equivalent)	B6

Repair Technicians who have 2 years of experience will also automatically receive credit for the 1-year requirement. Repair Technicians who have 3 or more years of experience will also automatically receive credit for the 1-year and 2-year requirements.

Work experience as a Repair Technician does not satisfy the separate experience requirement for Service Consultant, Parts Specialist, Collision Damage Estimator, or the High School and College Instructors alternative method described below.

Formal Education: You can substitute high school, trade school, or community college education for part of the Repair Technician work experience requirement, as shown below. This credit can be combined with additional hands-on work experience if needed to meet the 1, 2, and 3-year Repair Technician requirements.

Formal Education / Training	Credit toward 1-year Repair Technician requirement	Credit toward 2-year Repair Technician requirement	Credit toward 3-year Repair Technician requirement
1) Complete any ASE-Accredited Program – Auto, M/H Truck or Collision-Refinish, including MLR, AST, MAST and all other current or grandfathered ASE standards	6 months	1 year	1 year
-or- 2) Complete an ASE-Accredited OEM-Sponsored Co-op Program	1 year	2 years	2 years
-or- 3) Pass 3 or more different ASE Entry-Level Certification Program Tests	6 months	1 year	1 year
-or- 4) All other training: 2 months of full-time training (or 200 program hours) equals 1 month credit	Up to 6 months	Up to 1 year	Up to 1 year

- These substitutes cannot be combined, and do not apply to the Service Consultant, Parts Specialist, or Collision Damage Estimator work experience categories.
- The ASE Education Foundation evaluates and accredits Automobile, Medium/Heavy Duty Truck, and Collision Repair and Refinish training programs based on industry-established standards. To learn more and

view the list of ASE-accredited programs, visit http://www.aseeducationfoundation.org (http://www.aseeducationfoundation.org).
- To receive credit in categories 1) and 2) above, you must complete the training program in its entirety, and it must be ASE-accredited at the time you complete it.
- Examples of OEM-sponsored co-op programs include GM ASEP, Ford ASSET, Toyota T-TEN, Honda PACT, Chrysler CAP, and Mercedes-Benz DRIVE. You must participate in the co-op hands-on work experience portion of the program.
- ASE Entry-Level Certification Program tests are not the same as the ASE professional certification tests. ASE Entry-Level certification tests are administered in schools. For more information, visit www.ase.com/entry-level (http://www.ase.com/entry-level).
- For categories 1) and 2), attach a copy of your program completion certificate. For category 3), attach copies of your ASE Entry-Level certification test certificates. For category 4), attach an official transcript that clearly shows the hours or weeks of completed training and the graduation/completion date.

I-CAR Platinum Individuals: This satisfies the Repair Technician and/or Collision Damage Estimator 2-year requirements, corresponding to the roles in which you hold I-CAR Platinum status. Attach a copy of your certificate.

Veterans and Active Military: Attach an AARTS, SMART, DD Form 2586 (VMET), DD Form 295, or DD Form 214. A variety of military MOS's can qualify to meet the experience requirements, particularly if the equipment being repaired is powered by a diesel engine.

Canadian Technicians: A valid provincial automotive trade certificate is acceptable evidence of sufficient work experience to satisfy the Repair Technician 1-year and 2-year requirements. Attach a copy of your provincial license.

Self-employment: You can receive credit for self-employment when you are the owner/operator of a licensed repair business working in the shop performing diagnosis and repairs. Indicate the types of service you provide (Section 5), how long you have-been self-employed, and attach a copy of your business license.

High School and College Instructors: Alternative method of meeting the work experience requirement: Full-time teaching as an instructor (not a teaching assistant) in a high school or post-secondary Auto, M/H Truck, or Collision-Refinish program for four academic years (or part-time equivalent), plus a minimum of 20 hours of technical update training in the last 12 months, satisfies the Repair Technician or Collision Damage Estimator 2-year requirement corresponding to the type of program in which you teach. Six years of qualified teaching (or part-time equivalent), plus a minimum of 20 hours of technical update training in the last 12 months, satisfies the Repair Technician 3-year requirement for L1, L2, L3, and L4. This option for meeting the ASE work experience requirements cannot be combined with, or partially satisfied by, traditional hands-on work experience or any of the Formal Education substitutions described above. A letter on school letterhead signed by your principal or dean that details your teaching experience and includes a list of your technical update training records must be attached to your work experience form. Check the “Other Documentation” box in the Attachments section on the Work Experience Form to upload those documents.

The fine print: ASE reserves the right to evaluate all substitution requests and to grant such credit as may be appropriate. Work experience other than that described above may also be credited toward fulfillment of the experience requirement where, in ASE’s judgment, the nature of the experience so warrants.

Questions? Call ASE Customer Service at (703) 669-6609, 8 am to 5 pm ET, Monday through Friday, or send an email to contactus@ase.com (mailto:contactus@ase.com?Subject=Work%20Experience) with your full name, city, state, ASE ID (if known), and daytime phone number.

APPENDIX D

Key Performance Measures

PARTS KEY PERFORMANCE MEASURES

Parts Inventory Size per VE	$120 -$238
Inventory Turn Ratio per Year	4-8
1 Parts Support Staff Ratio per Mechanic	8-10
Stock Movement Rate	<5%
Stock Reliance Rate	50% - 60%
Parts Markup	25% - 40%

KEY SHOP PERFORMANCE MEASURES

VEU Per Trade Worker	70-100
Work Order Hours Charged Per VE	10-15
Available Time Charged To WO	90-95%
Productive Hours per Worker per Year	1,400 -1,500
Shop Supervision per Mechanic	8-10
Maintenance & Repair (M&R) Cost Per VE	$1,265
Labor Component of M&R Cost	55% -70%
Parts Component of M&R Cost	20% - 30%
Sublet Component of M&R Cost	10% - 15%
Parts Consumption per VE	$315 - $475
Vehicle Replacement Backlog	15% - 20%
Annual Replacement Expenditure	100%
Scheduled Service Rate VS Unscheduled	60% - 65%
PM Program Compliance Rate	95%
% of Units Returned to Shop for Same Repair	<1% - 2%
% of OT Charged to WO	<5%
Road Call Rate	<2%
% of WO's Completed In One Day	80% - 90%
% of Total Fleet Available Per Day	95%

APPENDIX E

Vehicle Replacement Policy and Spreadsheet Tool

VEHICLE REPLACEMENT POLICY

The policy follows the guidelines established by APWA in their Planned Fleet Replacement handbook and uses a point system to determine when a vehicle should be replaced based on several use categories, including:

- Age
- Miles/Engine Hours
- Type of Service
- Reliability
- Maintenance and Repair Costs
- Condition

Points are assigned for each category based on the following guidance:

Age:
A vehicle gets 1 point added for every year of chronological age.

Miles/Engine Hours:
A vehicle gets 1 point added for each 10,000 miles or 1,000 engine hours.

Type of Service:
A vehicle typically gets 1, 3, or 5 points based on the type of service for the unit. Vehicles with more severe use such as a DPW loader would be given 5 points while a vehicle with less severe service like an administrative sedan would get 1 point.

Reliability[1]:
Points are again assigned as 1, 3, or 5 for a vehicle depending on the frequency that it is in the shop for repairs. A 5 would be assigned to a vehicle that is in the shop an average of 2 or more times per month, while a 1 would be assigned if a vehicle is in the shop an average of once every three months or less.

Maintenance and Repair (M&R) Costs[1]:
A vehicle is assigned 1 to 5 points based on the total life maintenance and repair costs (not including repairs due to accident damage). A 5 would be given to a vehicle with M&R costs equal to or greater than the vehicle's original purchase price while a 1 would be given to a vehicle with life M&R costs equal to 20% or less than the original purchase costs.

Condition[1]:
Points in this category are assigned to vehicles based on their body condition, rust, interior condition, accident history, anticipated repairs, etc. Points are given on a scale of 1 to 5 points with 5 points indicating poor condition.

Based on the total points accrued across all previously mentioned categories, the overall condition of the vehicle can be determined based on the following point ranges:

[1] Input from the Town mechanics and employees who use these vehicles is essential when assigning points for reliability, maintenance and repair costs, and condition.

- Excellent condition (less than 18 points, colored green in Spreadsheet Tool)
- Good condition (18-22 points, colored yellow in Spreadsheet Tool)
- Qualifies for replacement (23-27 points, colored gold in Spreadsheet Tool)
- Needs immediate replacement consideration (greater than 27 points, colored red in Spreadsheet Tool)

The Fleet Replacement Spreadsheet Tool was developed by Weston & Sampson to simplify the process of tallying points for each vehicle. The point tallying process is automated within the spreadsheet and the overall condition of every vehicle is displayed based on the previously listed point ranges. The Town may use this tool as a resource for creating and maintaining an updated vehicle inventory that also displays the overall condition of each vehicle. However, the vehicle replacement policy does not mandate the use of the Fleet Replacement Spreadsheet Tool when evaluating the condition of a vehicle.

Note that the point system is intended to be used as a guide, and the Town may find that adjustments may be warranted as the policy is implemented to account for vehicle and Town-specific needs.

Nantucket Vehicle Replacement Spreadsheet Tool

Item #	Department	Year	Age	Odometer	Engine Hours	Manufacturer	Model	Age Points	Miles/Hours Points	Type Of Service Points	Reliability Points	M&R Cost Points	Condition Points	Total Points	Overall Condition/Recommendation	VIN	Plate #
6	AIRPORT	1989	34			OSKOSH	FIRE	34	0					34	Needs Immediate Replacement Consideration	10T9L5BHK1037629	
8	AIRPORT	1988	35			JOHN DEERE		35	0					35	Needs Immediate Replacement Consideration	DW644EB518874	
11	AIRPORT	1994	29			FORD		29	0					29	Needs Immediate Replacement Consideration	1FDYK82E0RVA27067	
22	AIRPORT	1999	24			FORD	F250	24	0					24	Qualifies for Replacement	1FTNF21F4XEB69678	
25	AIRPORT	2001	22			EAG. BEAVER	FLATBED	22	0					22	Good	112HTN3041L055959	
33	AIRPORT	2003	20			JOHN DEERE		20	0					20	Good	DW724JX586227	
34	AIRPORT	2002	21			OSHKOSH		21	0					21	Good	10TBK8Z1025072137	
35	AIRPORT	2003	20			AM GENERAL	HUMMER	20	0					20	Good	137FA553X3E202023	
38	AIRPORT	2004	19			FORD	EXPEDITION	19	0					19	Good	1FMPU16L04LA05967	
40	AIRPORT	2004	19			STERLING		19	0					19	Good	2FZAAWAK24AM87574	
43	AIRPORT	2002	21			LOAD RITE		21	0					21	Good	5A4KRAL1X22050148	
46	AIRPORT	2004	19			FORD	F550	19	0					19	Good	1FDAF57P74ED45033	
47	AIRPORT	2005	18			FORD	F350	18	0					18	Good	1FDWF31P65EB93489	
55	AIRPORT	2006	17			FORD	RANGER	17	0					17	Excellent	1FTYR15E56PA10929	
64	AIRPORT	2006	17			FREIGHTLINER	FC80	17	0					17	Excellent	1FVAB6BV56DDW22321	
66	AIRPORT	2006	17			CARGO EXPRESS	ENCLOSED	17	0					17	Excellent	4U01C14226A029793	
67	AIRPORT	2007	16			FORD	EXPLORER	16	0					16	Excellent	1FMEU73E17UA47417	
100	AIRPORT	2010	13			JOHN DEERE	772c	13	0					13	Excellent	DW772GP627874	
104	AIRPORT	2011	12			ELDORADO	1871	12	0					12	Excellent	1FDEE3FL4BDB09630	
105	AIRPORT	2011	12			ELDORADO	1871	12	0					12	Excellent	1FDEE3FL6BDB09631	
132	AIRPORT	2014	9			JOHN DEERE	724K	9	0					9	Excellent	1DW724KZTED661804	
142	AIRPORT	2015	8			FORD	F250	8	0					8	Excellent	1FT7X2BT8FEB98500	
149	AIRPORT	2012	11			FORD	F350	11	0					11	Excellent	1FDRF3HT4CFC05586	
158	AIRPORT	2015	8			OSHKOS	FIRE	8	0					8	Excellent	10TADLJF8FA774072	
166	AIRPORT	2016	7			Ford	EXPLORER	7	0					7	Excellent	1FM5K8D8XGGB43646	
177	AIRPORT	2016	7			FORD	F250	7	0					7	Excellent	1FT7W2B63GEB89010	
184	AIRPORT	2016	7			FORD	F350	7	0					7	Excellent	1FDWE3FSXGDC55730	
196	AIRPORT	2014	9			JOHN DEERE	COMPACT LOADER	9	0					9	Excellent	1T0319EJTEJ263876	
	AIRPORT	2018	5			FORD	F150	5	0					5	Excellent	1FTMF1EBXJKE40622	
	AIRPORT	2019	4			FORD	EXPLORER	4	0					4	Excellent	1FM5K8D86KGA62426	
	AIRPORT	2019	4			FORD	F550	4	0					4	Excellent		
	AIRPORT	2021	2			FORD	E350	2	0					2	Excellent		
	AIRPORT	2021	2			FORD	F350	2	0					2	Excellent		
128	FINANCE/ASSESSORS	2014	9			FORD	EXPLORER	9	0					9	Excellent	1FM5K8AR1EGA70886	
133	FINANCE/ASSESSORS	2006	17			FORD	EXPLORER	17	0					17	Excellent	1FMEU74E06UB30012	
52	FIRE DEPT	2005	18			CHEVROLET	K2500 SILVERADO	18	0					18	Good	1GCH29U45E319247	
57	FIRE DEPT	2006	17			WELLS CARGO	UTILITY	17	0					17	Excellent	1WC200J2368009291	
62	FIRE DEPT	2006	17			WELLS CARGO	UTILITY	17	0					17	Excellent	1WC200J2568009650	
63	FIRE DEPT	2006	17			WELLS CARGO	UTILITY	17	0					17	Excellent	1WC200J2668009866	
102	FIRE DEPT	2010	13			FOAM	TANK	13	0					13	Excellent	1S9FT192X00407231	
167	FIRE DEPT	1998	25			STEWAR	M1088	25	0					25	Qualifies for Replacement	T010771BDJG	
168	FIRE DEPT	1998	25			STEWAR	M1088	25	0					25	Qualifies for Replacement	T010762BDJC	
169	FIRE DEPT	1992	31			AM GENERAL	HMMWV	31	0					31	Needs Immediate Replacement Consideration	3101609	
171	FIRE DEPT	2016	7			FORD	EXPEDITION	7	0					7	Excellent	1FMJU1G12FEG23463	
178	FIRE DEPT	1986	37			AM GENERAL	HMMWV	37	0					37	Needs Immediate Replacement Consideration	15711	
183	FIRE DEPT	2016	7			FORD	F150	7	0					7	Excellent	1FTX1EG3GFA34670	
185	FIRE DEPT	2016	7			FORD	EXPEDITION	7	0					7	Excellent	1FMJU1GTXGEF15529	
218	FIRE DEPT	2010	13			FORD	EXPEDITION	13	0					13	Excellent	1FMJU1G55AEA29042	
	FIRE DEPT	2019	4			FORD	EXPEDITION	4	0					4	Excellent		
	FIRE DEPT	2020	3			FORD	F550	3	0					3	Excellent		
1	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	1988	35			FORD	F800	35	0					35	Needs Immediate Replacement Consideration	1FDYK84A1JVA47293	
2	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	2002	21			FREIGHTLINER		21	0					21	Good	1FVDBWBV72HH85572	
42	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	2004	19			FREIGHTLINER	RESCUE	19	0					19	Good	1FVABXCS54HM57595	
58	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	2005	18			HME	1871-P2	18	0					18	Good	44KFT428X5WZ20647	
68	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	2007	16			FORD	FREIGHTLINER	16	0					16	Excellent	1FVDCYDJ77HX06683	
80	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	2007	16			FORD	CABCHASSIS	16	0					16	Excellent	3FRML55Z67V554788	
88	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	2008	15			FORD	F450	15	0					15	Excellent	1FDXF46R68EB78256	
97	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	2009	14			HME	SPO	14	0					14	Excellent	44KFT428X8WZ21477	
106	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	2011	12			HME		12	0					12	Excellent	44KFT4287BWZ22058	
130	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	2013	10			CHEVROLET	HORTON TYPE III	10	0					10	Excellent	1GB6G5CL8D1115362	
188	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	2016	7			FORD	F550	7	0					7	Excellent	1FDUF5HT8GEC26307	
220	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	2017	6			FORD	F550	6	0					6	Excellent	1FDWF54T24DA06877	
	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	2020	3			ROSENBAUER	CABOVER	3	0					3	Excellent		
	FIRE DEPT (EMERGENCY/SPECIALTY VEH)	2022	1			FREIGHTLINER	FIRE	1	0					1	Excellent		
107	HARBORMASTER	2011	12			FORD	F250	12	0					12	Excellent	1FTBF2B60BED08537	

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137	HARBORMASTER	2015	8			FORD	F250	8	0					8	Excellent	1FTBF2B69FEB32660	
152	HARBORMASTER	2015	8			FORD	F250	8	0					8	Excellent	1FTBF2B60FEC98873	
204	HARBORMASTER	2006	17			LOAD	BOAT	17	0					17	Excellent	4YPAB23216T041526	
83	HEALTH DEPT	2008	15			FORD	RANGER	15	0					15	Excellent	1FTYR11U68PA20658	
84	HEALTH DEPT	2008	15			FORD	RANGER	15	0					15	Excellent	1FTYR11U88PA19253	
173	HEALTH DEPT	2016	7			FORD	FUSION	7	0					7	Excellent	2FA6PU6GR189283	
	HEALTH DEPT	2019	4			FORD	RANGER	4	0					4	Excellent	1FTER1FH3KLA46003	
	HEALTH DEPT	2019	4			FORD	RANGER	4	0					4	Excellent		
18	LAND BANK	1997	26			LOAD RITE		26	0					26	Qualifies for Replacement	4L2KY4L16V2000178	
19	LAND BANK	1983	40			JOHN DEERE	2755	40	0					40	Needs Immediate Replacement Consideration	CD4239T920441	
21	LAND BANK	1997	26			FORD	F350	26	0					26	Qualifies for Replacement	1FDKF3867VEC42266	
23	LAND BANK	1994	29			CASE	MAXXUM	29	0					29	Needs Immediate Replacement Consideration	JJF1034294	
60	LAND BANK	2006	17			TOWMASTER	T-14DD	17	0					17	Excellent	4KNUT20276L160588	
61	LAND BANK	2006	17			ROADRUNNER		17	0					17	Excellent	IR9PD24236L427038	
75	LAND BANK	2007	16			VERMER	BRUSH CHIPPER	16	0					16	Excellent	1VRY1119X71009019	
89	LAND BANK	2008	15			LOAD RITE	UTILITY	15	0					15	Excellent	4ZEUT122381051314	
90	LAND BANK	2008	15			FORD	F550	15	0					15	Excellent	1FDAF57Y68EE22991	
121	LAND BANK	2013	10			LOAD	UTILITY	10	0					10	Excellent	4ZECH122XD1943041	
123	LAND BANK	2013	10			FORD	F150	10	0					10	Excellent	1FTPF1FF4DKF94714	
127	LAND BANK	1986	37			CHEVROLET	CUCV	37	0					37	Needs Immediate Replacement Consideration	1GCGD34J4GF443492	
140	LAND BANK	2015	8			FORD	F250	8	0					8	Excellent	1FTBF2B62FEC37959	
155	LAND BANK	2015	8			FORD	F150	8	0					8	Excellent	1FTMF1E82FFA60968	
156	LAND BANK	2015	8			FORD	F150	8	0					8	Excellent	1FTMF1E80FFA60967	
170	LAND BANK	1992	31			AM GENERAL	HMMWV	31	0					31	Needs Immediate Replacement Consideration	006978	
174	LAND BANK	2016	7			FORD	F150	7	0					7	Excellent	1F7MF1E89GFB30256	
213	LAND BANK	2017	6			LOADRITE	EP22	6	0					6	Excellent	5A4DCFV27H2011246	
	LAND BANK	2019	4			FORD	F550	4	0					4	Excellent		
	LAND BANK	2020	3			FORD	RANGER	3	0					3	Excellent		
	LAND BANK	2021	2			FORD	TRANSIT	2	0					2	Excellent		
	LAND BANK	2022	1			FORD	RANGER	1	0					1	Excellent		
	MARINE	2013	10			FORD	F250	10	0					10	Excellent		
	MARINE	2015	8			FORD	F350	8	0					8	Excellent		
	MARINE	2016	7			FORD	F250	7	0					7	Excellent		
	MARINE	2017	6			FORD	F250	6	0					6	Excellent		
16	NATURAL RESOURCE	1997	26			KARAVAN	BOAT	26	0					26	Qualifies for Replacement	186RLE2UBVF010992	
20	NATURAL RESOURCE	1997	26			KARAVAN	BOAT	26	0					26	Qualifies for Replacement	186B0C152VF014867	
91	NATURAL RESOURCE	2009	14			FORD	F250	14	0					14	Excellent	1FTSX21579EA10504	
172	NATURAL RESOURCE	2017	6			CHEVROLET	SILVERADO	6	0					6	Excellent	1GC1KUEG1GF147740	
214	NATURAL RESOURCE	2017	6			LOADRITE	UTILITY	6	0					6	Excellent	5A4DCFV2X2011161	
215	NATURAL RESOURCE	2017	6			LOADRITE	UTILITY	6	0					6	Excellent	5A4XJRJ18E2019918	
	NATURAL RESOURCE	2018	5			FORD	F150	5	0					5	Excellent	1FTFW1E50JKF08963	
	NATURAL RESOURCE	2019	4			FORD	F150	4	0					4	Excellent	1FTEW1EB7KFB91002	
49	OUR ISLAND HOME	2005	18			FORD	F250	18	0					18	Good	1FTNF21525EC51980	
49	OUR ISLAND HOME	2005	18			FORD	F250	18	0					18	Good	1FTNF21525EC51980	
72	OUR ISLAND HOME	2006	17			FORD	ECONOLINE	17	0					17	Excellent	1FDXE45S16DB03572	
162	OUR ISLAND HOME	2015	8			FORD	TRANSIT	8	0					8	Excellent	1FTNR2CM4FKB26221	
81	PLUS	2008	15			FORD	EXPLORER	15	0					15	Excellent	1FMFU73F58UA18729	
86	PLUS	2008	15			FORD	RANGER	15	0					15	Excellent	1FTYR11U18PA19255	
157	PLUS	2015	8			JEEP	PATRIOT	8	0					8	Excellent	1C4NJRBB3FD437420	
191	PLUS	2017	6			JEEP	PATRIOT	6	0					6	Excellent	1C4NJRBB2HD208584	
192	PLUS	2017	6			JEEP	PATRIOT	6	0					6	Excellent	1C4NJRBB0HD208583	
224	PLUS	2017	6			JEEP	RENEGADE	6	0					6	Excellent	ZACCJBAB7HPG30044	
28	POLICE	2002	21			CARGO	UTILITY	21	0					21	Good	1UK00E2321040839	
71	POLICE	2007	16			INTERNATIONAL	4300	16	0					16	Excellent	1HTMMAAL17H502020	
103	POLICE	2011	12			FORD	E250	12	0					12	Excellent	1FTNE2EL8BDA48136	
111	POLICE	2012	11			FORD	ESCAPE	11	0					11	Excellent	1FMCU9DGXCKB80976	
112	POLICE	2013	10			FORD	EXPLORER	10	0					10	Excellent	1FM5K8D87DGA51230	
113	POLICE	2012	11			FORD	E350	11	0					11	Excellent	1FBNE3BL2CDB25535	
114	POLICE	2012	11			HD	FLHTP	11	0					11	Excellent	1HD1FMM12CB668256	
115	POLICE	2012	11			HD	FLHTP	11	0					11	Excellent	1HD1FMM15CB663424	
117	POLICE	2012	11			FORD	F150	11	0					11	Excellent	1FTFX1EF1CFB96475	
118	POLICE	2013	10			FORD	EXPLORER	10	0					10	Excellent	1FM5K8D82DGB21023	
120	POLICE	2013	10			FORD	EXPLORER	10	0					10	Excellent	1FM5K8AR7DGA89022	
122	POLICE	2013	10			FORD	EXPLORER	10	0					10	Excellent	1FM5K8AR4DGA89057	
125	POLICE	2013	10			FORD	F250	10	0					10	Excellent	1FT7X2B61DEB00768	
129	POLICE	2014	9			FORD	EXPEDITION	9	0					9	Excellent	1FMJU1J55EEF15042	
143	POLICE	2015	8			FORD	K8D	8	0					8	Excellent	1FM5K8D83FGB62327	
151	POLICE	2015	8			FORD	EXPLORER	8	0					8	Excellent	1FM5K8AR0FGA88605	

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154	POLICE	2015	8			FORD	TRANSIT	8	0					8	Excellent	1FTSW3XM9FKA59577	
161	POLICE	2015	8			FORD	F350	8	0					8	Excellent	1FT8X3B68FEC82434	
189	POLICE	2016	7			FORD	F250	7	0					7	Excellent	1FT7X2B65GED29653	
193	POLICE	2016	7			FORD	EXPLORER	7	0					7	Excellent	1FM5K8AR2GGB89212	
198	POLICE	2016	7			FORD	EXPLORER	7	0					7	Excellent	1FM5K8AR4GGB89213	
202	POLICE	2016	7			FORD	EXPLORER	7	0					7	Excellent	1FM5K8ARAHGB34462	
207	POLICE	2017	6			FORD	EXPLORER	6	0					6	Excellent	1FM5K8D83HGC79098	
208	POLICE	2017	6			FORD	EXPLORER	6	0					6	Excellent	1FM5K8D81HGC79097	
209	POLICE	2017	6			FORD	250	6	0					6	Excellent	1FT7X2B62HED70677	
226	POLICE	2018	5			FORD	EXPLORER	5	0					5	Excellent	1FM5K8AR0JGA89956	
227	POLICE	2018	5			FORD	EXPLORER	5	0					5	Excellent	FM5K8AR2JGA89957	
228	POLICE	2018	5			FORD	EXPEDITION	5	0					5	Excellent	1FMJU1JTXJEA25771	
	POLICE	2018	5			FORD	EXPLORER	5	0					5	Excellent	1FM5K8AR3JGC17820	
	POLICE	2018	5			FORD	EXPLORER	5	0					5	Excellent	1FM5K8AR3JGC17821	
	POLICE	2018	5			FORD	EXPLORER	5	0					5	Excellent	1FM5K8AR3JGC17822	
	POLICE	2019	4			TOYOTA	CAMRY	4	0					4	Excellent		
	POLICE	2019	4			FORD	EXPLORER	4	0					4	Excellent		
	POLICE	2019	4			FORD	EXPLORER	4	0					4	Excellent		
	POLICE	2019	4			FORD	EXPLORER	4	0					4	Excellent		
	POLICE	2019	4			FORD	EXPLORER	4	0					4	Excellent		
	POLICE	2019	4			FORD	F150	4	0					4	Excellent		
	POLICE	2020	3			FORD	ESCAPE	3	0					3	Excellent		
	POLICE	2021	2			FORD	F150	2	0					2	Excellent		
3	PUBLIC WORKS	1989	34			GMC		34	0					34	Needs Immediate Replacement Consideration	1GDP7D1G5KV516286	
9	PUBLIC WORKS	1988	35			MGS	G5	35	0					35	Needs Immediate Replacement Consideration	16MG10912JD014914	
10	PUBLIC WORKS	1993	30			HEAVY	HAULER	30	0					30	Needs Immediate Replacement Consideration	1B9UF0815PC301165	
13	PUBLIC WORKS	1996	27			FORD	RANGER	27	0					27	Qualifies for Replacement	1FTCR11U6TTA11114	
14	PUBLIC WORKS	1995	28			INTERNTNL		28	0					28	Needs Immediate Replacement Consideration	1ZFUF1620SB004046	
24	PUBLIC WORKS	2000	23	68892		FORD	F350	23	7					30	Needs Immediate Replacement Consideration	1FDWF36S1YED76395	
27	PUBLIC WORKS	2001	22			HI STRIKET	DUNK	22	0					22	Good	72301	
30	PUBLIC WORKS	2003	20			FORD	RANGER	20	0					20	Good	1FTZR11U33TA05717	
31	PUBLIC WORKS	2001	22		9842	VOLVO		22	10					32	Needs Immediate Replacement Consideration	G86201022	
36	PUBLIC WORKS	2004	19	107848		FORD	RANGER	19	11					30	Needs Immediate Replacement Consideration	1FTZR11U94TA00894	
37	PUBLIC WORKS	2004	19	129006		FORD	RANGER	19	13					32	Needs Immediate Replacement Consideration	1FTZR11U04TA00895	
41	PUBLIC WORKS	2004	19			FORD	RANGER	19	0					19	Good	1FTZR45E74TA17231	
50	PUBLIC WORKS	2005	18			ELGIN	PELICAN	18	0					18	Good	S9297D	
51	PUBLIC WORKS	2002	21			FORD	RANGER	21	0					21	Good	1FTZR45E82TA67679	
54	PUBLIC WORKS	2006	17			FORD	RANGER	17	0					17	Excellent	1FTYR11UX6PA13838	
56	PUBLIC WORKS	2007	16			FORD	F550	16	0					16	Excellent	1FDAF57YX7EA99351	
65	PUBLIC WORKS	2006	17	16421		VOLVO	L70E	17	2					19	Good	L70EV61136	
69	PUBLIC WORKS	2007	16	113402		FORD	F350	16	11					27	Qualifies for Replacement	1FTWF31557EA99352	
73	PUBLIC WORKS	2007	16	102712		FORD	RANGER	16	10					26	Qualifies for Replacement	1FTYR15E37PA56051	
74	PUBLIC WORKS	2008	15			CROSS COUNTRY	FLATBED	15	0					15	Excellent	431FS202X81000106	
79	PUBLIC WORKS	2008	15			FORD	F150	15	0					15	Excellent	1FTVF14508KB29744	
92	PUBLIC WORKS	2009	14	68914		STERLING	DUMP	14	7					21	Good	2FZAAWBS29AAJ9157	
95	PUBLIC WORKS	2009	14	77773		FORD	ESCAPE	14	8					22	Good	1FMCU59329KB80753	
108	PUBLIC WORKS	2011	12			KUBOTA	M4070	12	0					12	Excellent	M7040DTC187798	
109	PUBLIC WORKS	2012	11	119095		FORD	F550	11	12					23	Qualifies for Replacement	1FDUF5GT1CEA71403	
119	PUBLIC WORKS	2005	18			BOBCAT	SKID	18	0					18	Good	525019209	
124	PUBLIC WORKS	2013	10	22761		INTL	DUMP	10	2					12	Excellent	1HTMMAAR7DH482615	
131	PUBLIC WORKS	2014	9			CARRY	UTILITY	9	0					9	Excellent	4YMUL1216EV053331	
135	PUBLIC WORKS	2015	8	25617		INTL	7400SBA	8	3					11	Excellent	3HAWHAZT3FL653595	
138	PUBLIC WORKS	2014	9			JOHN DEERE	5085M	9	0					9	Excellent	1LV5085MHEJ644262	
139	PUBLIC WORKS	2007	16	108524		FORD	F350	16	11					27	Qualifies for Replacement	1FTWF31597RA99354	
150	PUBLIC WORKS	2014	9			BOBCAT	LOADER	9	0					9	Excellent	ALJU1236005022014	
153	PUBLIC WORKS	2015	8	4599		TRACKLESS ROPS	ROPS	8	0					8	Excellent	MT61916	
159	PUBLIC WORKS	2008	15			CAT	420E	15	0					15	Excellent	CAT0420EHHLS07972	
160	PUBLIC WORKS	2015	8			DOWNE	TL718	8	0					8	Excellent	5RSLU1823FT00596	
164	PUBLIC WORKS	2015	8			VERME	CONST	8	0					8	Excellent	1VRY1119XF1022478	
175	PUBLIC WORKS	2016	7	41491		FORD	F350	7	4					11	Excellent	1FTRF3B65GEB89007	
176	PUBLIC WORKS	2016	7	18660		ELGIN	PELICAN	7	2					9	Excellent	NP30775	
179	PUBLIC WORKS	2016	7	67895		FORD	F550	7	7					14	Excellent	1FDUF5HY6GEB89009	
187	PUBLIC WORKS	2017	6			CAM	SUPERLINE	6	0					6	Excellent	5JPBU2521JP047291	
190	PUBLIC WORKS	2017	6	47421		CHEVROLET	SILVERADO	6	5					11	Excellent	1GCK2UEG1HZ158662	
195	PUBLIC WORKS	2017	6	49011		FORD	TRANSIT	6	5					11	Excellent	1FTYR2XM5HKA35095	
200	PUBLIC WORKS	2016	7			KM		7	0					7	Excellent	1K9BU2022GN246272	
201	PUBLIC WORKS	2016	7			KM		7	0					7	Excellent	1K9BU242XGN246353	
206	PUBLIC WORKS	2017	6	9801		FREIGHTLINER	114SD	6	1					7	Excellent	1FVHG3DV2HHJE5494	

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210	PUBLIC WORKS	2017	6			SATELITTE	RESTROOM	6	0					6	Excellent	4S98E19SXH2345573	
211	PUBLIC WORKS	2017	6	14001		FHT	DUMP	6	1					7	Excellent	1FVAGCY5HHJE5496	
216	PUBLIC WORKS	2006	17			ANDERSON	TAG ALONG	17	0					17	Excellent	4YNBN25266C039417	
219	PUBLIC WORKS	2017	6		921	NORAM	65E	6	1					7	Excellent	65ET10230	
222	PUBLIC WORKS	2018	5	30614		FORD	F550	5	3					8	Excellent	1FDUF5HY8JEB13783	
223	PUBLIC WORKS	2018	5	31548		FORD	F350	5	3					8	Excellent	1FTRF3B67JEB13781	
229	PUBLIC WORKS	2016	7			LOADRITE	UT8314	7	0					7	Excellent	4ZEUT1426G1115096	
230	PUBLIC WORKS	2016	7			LOADRITE	CH8316	7	0					7	Excellent	4ZECH1625G1115097	
	PUBLIC WORKS	2007	16			FORD	F150	16	0					16	Excellent	1FTPX14577FB44805	
	PUBLIC WORKS	2018	5			FREIGHLINER	M2106	5	0					5	Excellent	1ALACXFC5JDJN4111	
	PUBLIC WORKS	2018	5		287	CAT	299D2	5	0					5	Excellent	CAT0299DKDX203309	
	PUBLIC WORKS	2018	5			CAT	CS448	5	0					5	Excellent	CATCS44BPCS300638	
	PUBLIC WORKS	2019	4	19607		FORD	F550	4	2					6	Excellent	1FDUF5HY4KED88620	
	PUBLIC WORKS	2019	4	41808		FORD	F550	4	4					8	Excellent	1FDUF5HY8KED8861	
	PUBLIC WORKS	2019	4	7646		FREIGHTLINER	SD114	4	1					5	Excellent	1FVAG3FEXJHJs1193	
	PUBLIC WORKS	2019	4			CAM	UTILITY	4	0					4	Excellent	5JWCK3126KP071488	
	PUBLIC WORKS	2019	4			CAM	UTILITY	4	0					4	Excellent	5JWCG2421KP071843	
	PUBLIC WORKS	2019	4			SULLAIR	185DPQ-KU	4	0					4	Excellent	2018121	
	PUBLIC WORKS	2020	3			FORD	TRANSIT	3	0					3	Excellent		
48	SCHOOL	2005	18			BOBCAT	5600	18	0					18	Good	424811112	
110	SCHOOL	2012	11			FORD	F350	11	0					11	Excellent	1FDRF3H65CEA59404	
180	SCHOOL	2016	7			LOADRITE		7	0					7	Excellent	5A4GALJ10G2010548	
186	SCHOOL	2017	6			Ford	ESCAPE	6	0					6	Excellent	1FMCU9GD6HUA73291	
194	SCHOOL	2017	6			FORD	F350	6	0					6	Excellent	1FDRF3H68HEB23801	
	SCHOOL	2017	6			KUBOTA	RTVX1100CW	6	0					6	Excellent	A5KC2GDBEHG039014	
	SCHOOL	2017	6			KUBOTA	RTVX1100CW	6	0					6	Excellent	A5KC2GDBPHG039132	
	SCHOOL	2020	3			FORD	ECOSPORT	3	0					3	Excellent		
59	SEWER DEPARTMENT	2006	17			JOHN DEERE	5225	17	0					17	Excellent	LV5525H258095	
94	SEWER DEPARTMENT	2009	14			STERLING	LT8500	14	0					14	Excellent	2FZHAWBS39AAF7295	
99	SEWER DEPARTMENT	2010	13			FORD	F450	13	0					13	Excellent	1FDAF4HY3AEA24006	
101	SEWER DEPARTMENT	2011	12			FORD	F450	12	0					12	Excellent	1FD0X4HYXBEA65212	
116	SEWER DEPARTMENT	2013	10			INTL	7400	10	0					10	Excellent	1HTWDAZR2DH303202	
134	SEWER DEPARTMENT	2015	8			FORD	F450	8	0					8	Excellent	1FDUF4HY9FEA66118	
141	SEWER DEPARTMENT	2015	8			FRT	108SD	8	0					8	Excellent	1FVAG5CY3FHGD9453	
144	SEWER DEPARTMENT	2014	9			UTILITY		9	0					9	Excellent	1Z9BU1010DM026216	
145	SEWER DEPARTMENT	2014	9			UTILITY		9	0					9	Excellent	1Z9BU1012DM026217	
146	SEWER DEPARTMENT	2014	9			UTILITY		9	0					9	Excellent	1z9BU1014DM026218	
147	SEWER DEPARTMENT	2014	9			UTILITY		9	0					9	Excellent	1Z9PU1422EM026017	
148	SEWER DEPARTMENT	2014	9			FORD	EXPLORER	9	0					9	Excellent	1FM5K8B88EGB80047	
197	SEWER DEPARTMENT	2017	6			CHEVROLET	SILVERADO	6	0					6	Excellent	1GCVKNEC6HZ200727	
203	SEWER DEPARTMENT	2017	6			FTL	114SD	6	0					6	Excellent	1FVHG3DV7HHJE6513	
205	SEWER DEPARTMENT	2017	6			CHEVROLET	CITY EXP	6	0					6	Excellent	3N63M0YN3HK704793	
212	SEWER DEPARTMENT	2016	7			FORD	F350	7	0					7	Excellent	1FT7X2B8XGED47968	
221	SEWER DEPARTMENT	2018	5			FREIGHTLINER	M2106	5	0					5	Excellent	1FVACXFCXFC4JHJL8654	
	SEWER DEPARTMENT	2018	5			FORD	F350	5	0					5	Excellent	1FDRF3B64JEC70163	
	SEWER DEPARTMENT	2018	5			RAM	CAMERA PROMASTER	5	0					5	Excellent	3C6URVJG5JE134583	
	SEWER DEPARTMENT	2019	4			FORD	F350	4	0					4	Excellent	1FT7W2B64KEC48381	
	SEWER DEPARTMENT	2019	4			INTERNATIONAL	HV607	4	0					4	Excellent	3HTESTZT8KN322364	
	SEWER DEPARTMENT	2019	4			FORD	EXPLORER	4	0					4	Excellent		
	SEWER DEPARTMENT	2019	4			FORD	F250	4	0					4	Excellent		
	SEWER DEPARTMENT	2019	4			FORD	F350	4	0					4	Excellent		
	SEWER DEPARTMENT	2019	4			CAM	UTILITY	4	0					4	Excellent	5JWCK2728KP500695	
	SEWER DEPARTMENT	2019	4			VER-MAC	PCMS-320	4	0					4	Excellent	2S9US3111KS132133	
	SEWER DEPARTMENT	2020	3			HINO	195-20	3	0					3	Excellent		
	SEWER DEPARTMENT	2021	2			FORD	F650	2	0					2	Excellent		
	SEWER DEPARTMENT	2021	2			WESTERN STAR	4700	2	0					2	Excellent		
	TOURISM	2019	4			Nissan	Leaf	4	0					4	Excellent		
98	TOWN ADMINISTRATION	2009	14			FORD	ESCAPE	14	0					14	Excellent	1FMCU59359KC41349	
4	WATER COMPANY	1996	27			FORD	F450	27	0					27	Qualifies for Replacement	1FDLF47F3TEB09844	
5	WATER COMPANY	2006	17			HURCO	POWER WASH	17	0					17	Excellent	1C(BV13186B987040	
76	WATER COMPANY	2008	15			FORD	SPORT TRAC	15	0					15	Excellent	1FMEU53E78UA41272	
77	WATER COMPANY	2007	16			FORD	F150	16	0					16	Excellent	1FTPX14577FB44805	
78	WATER COMPANY	2008	15			FORD	RANGER	15	0					15	Excellent	1FTZR45E88PA38085	
87	WATER COMPANY	2008	15			LOADRITE		15	0					15	Excellent	5A4PNFH1182001349	
181	WATER COMPANY	2016	7			FORD	F250	7	0					7	Excellent	1FT7X2B68GEB79067	
182	WATER COMPANY	2016	7			FORD	TRANSIT	7	0					7	Excellent	NMOLS7E9F1176079	
217	WATER COMPANY	2017	6			FORD	F150	6	0					6	Excellent	1FTEX1E8XHFB28311	
	WATER COMPANY	1996	27			HOMEMADE	LE4000	27	0					27	Qualifies for Replacement	NONE	

Item #	Department	Year	Age	Odometer	Engine Hours	Manufacturer	Model	Age Points	Miles/Hours Points	Type Of Service Points	Reliability Points	M&R Cost Points	Condition Points	Total Points	Overall Condition/Recommendation	VIN	Plate #
	WATER COMPANY	2018	5			FORD	F150	5	0					5	Excellent	1FTEX1EP8JKF00202	
	WATER COMPANY	2020	3			FORD	F250	3	0					3	Excellent		

Key

	Unit Not Assessed
Less than 18 pts	Excellent
18-22 pts	Good
23-27 pts	Qualifies for replacement
Greater than 27 pts	Needs immediate replacement consideration

Replacement Point System

Age
1 point for every year of chronological age, based on in-service date, with adjustments based on service class

Miles/Hours
1 point for each 10,000 miles or 1,000 engine hours

Type Of Service:
1, 3, or 5 points are typically assigned based on the type of service for a unit. For instance a DPW loader with heavy use would be given a 5 because it is severe service and an administrative sedan would be given a 1.

Reliability
Points are assigned as 1, 3, or 5 depending on the frequency that a vehicle is in the shop for repair. A 5 would be assigned to a vehicle that is in the shop 2 or more times a month, on average.
A 1 would be assigned to a vehicle in the shop an average of once every 3 months, or less.

Maintenance & Repair (M&R) Costs
1 to 5 points are assigned based on total life M&R costs (not including repair of accident damage). A 5 is assigned to a vehicle with life M&R costs equal to or greater than the vehicle's original purchase price, while a 1 is given to a vehicle with life M&R costs equal to 20% or less than the original purchase cost.

Condition
This category takes into consideration body condition, rust, interior condition, accident history, anticipated repairs, and so on. A scale of 1 to 5 points is used with 5 being poor condition.

Point Ranges

Less than 18 points	Condition I	Excellent
18 - 22 points	Condition II	Good
23 - 27 points	Condition III	Qualifies for replacement
28 points and above	Condition IV	Needs immediate replacement consideration

APPENDIX F

Green Communities Fuel Efficient Vehicles Criterion

GREEN COMMUNITIES DESIGNATION and GRANT PROGRAM

Fuel efficient vehicles

Criterion 4

INTRODUCTION

Criterion Four of the Green Communities Program states that communities must purchase only fuel-efficient vehicles for municipal use whenever such vehicles are commercially available and practicable. The purpose behind this criterion is to reduce carbon dioxide emissions by municipal vehicles, which has a positive impact on the environment and saves municipalities money.

As background, the US Environmental Protection Agency's Green Vehicle Guide states that:

Vehicles with lower fuel economy create more carbon dioxide - the most prevalent greenhouse gas - than vehicles with higher fuel economy. Every gallon of gasoline your vehicle burns puts about 20 pounds of carbon dioxide into the atmosphere because air has weight and mass, and it takes a lot of it to burn a gallon of gasoline. One of the most important things you can do to reduce your contribution to global warming is to buy a vehicle with higher fuel economy. The difference between 25 miles per gallon and 20 miles per gallon can amount to the prevention of 10 tons of carbon dioxide over a vehicle's lifetime. Buying a more fuel-efficient vehicle will also help to reduce our nation's dependence on fossil fuels. And of course, you will save money by having to fuel up less often.

COMPLIANCE

To meet this criterion, municipalities need to adopt by action of the local official or body with authority to enact municipal policies a written Fuel-Efficient Vehicle Policy that requires municipal departments and divisions to purchase only fuel-efficient vehicles **(*See Appendix A, model policy*)**. Both general government and school districts are required to enact a fuel-efficient vehicle policy for a municipality to meet this requirement, and letters documenting adoption must be provided and signed by the appropriate municipal authorities, as noted below. Letters from other municipal officials are not acceptable.

For letters from the general government and school district:

- **General Government** – The general government must provide a letter from the Chief Executive Officer of the city or town stating that it has adopted the Fuel-Efficient Vehicle Policy. The Chief Executive Officer is defined as the manager in any city having a manager and in any

town having a city form of government, the Mayor in any other city, and the Board of Selectmen in any other town unless some other officer or body is designated to perform the functions of a Chief Executive Officer under the provisions of a local charter or laws having the force of a charter.

- **Public School Districts** - For a municipality to meet this requirement, its public school district must provide a letter from the School Superintendent stating that it has adopted the Fuel-Efficient Vehicle Policy. Please note that even if the school has no vehicles, or only has vehicles that are exempt from the Policy, adoption of the Policy by the school must be provided since the school may acquire non-exempt vehicles in the future.

- **Regional School Districts** – Regional School Districts are not required to be part of a municipality's Green Communities designation application. However, for regional school districts that wish to be part of a municipality's Green Communities designation (with approval by the municipality), the regional school district must also adopt the Fuel Efficient Vehicle Policy and provide a letter from the Superintendent stating that it has adopted the Policy.

Sample adoption letters are provided in Appendices B and C.

In addition, the municipality is required to develop and maintain a vehicle inventory for all four-wheeled vehicles, both exempt and non-exempt. A plan for replacing non-exempt vehicles with vehicles that meet the fuel efficiency ratings below must also be developed and maintained. This inventory of all vehicles and replacement plan for non-exempt vehicles must include school vehicles. The fuel efficiency ratings are set to ensure that at least five or more automatic transmission models of mass production are available for sale in Massachusetts (all from affordable brands; no luxury brands). Based on 2019 EPA data, vehicles are to have a combined city and highway MPG no less than the following:

- 2 wheel drive car: 30 MPG
- 4 wheel drive car: 29 MPG
- 2 wheel drive van 22 MPG
- 4 wheel drive van 20 MPG
- 2 wheel drive pick-up truck: 21 MPG
- 4 wheel drive pick-up truck: 18 MPG
- 2 wheel drive sport utility vehicle: 24 MPG
- 4 wheel drive sport utility vehicle: 21 MPG

Hybrid or electric vehicles in these vehicle classes will meet these criteria.

To inform your purchasing decisions, information on makes and models of vehicles, including fuel economy comparisons, can be found at: http://www.fueleconomy.gov We encourage use of this valuable resource for informing decisions.

In addition, many vehicles that meet the above criteria can be found on statewide contract VEH110,

"**Purchase of Light Duty Vehicles – Passenger Cars, SUVs, Trucks, Vans, SSVs and PPVs**," located in www.commbuys.com

***NOTE:** The EPA maintains a database on vehicle fuel efficiency that is updated occasionally throughout the year, as new models are released. As increasing numbers of fuel efficient vehicle models are released, the minimum combined MPG requirements of Criterion 4 will be revised upwards. **Thus, cities and towns must check the Criterion 4 Guidance for updates prior to ordering new vehicles.**

In order to encourage efficient driving practices, municipalities should implement a monitoring system to record miles driven, fuel consumption, etc. for each vehicle in every department. A monitoring system will help facilitate the municipality's reduction in aggregate energy consumption. If a municipality provides fuel for fleet vehicles, it should consider using a universal fleet card that provides a monitoring system for tracking fuel use.

VEHICLE RECYCLING

Recycling of vehicles – i.e., moving a previously purchased and used vehicle from one municipal department to another municipal department in need of a vehicle is only allowed if the vehicle being recycled to a new department is more fuel efficient than the vehicle it is replacing.

EXEMPTIONS

Vehicles that are exempt from the municipal Fuel Efficient Vehicle Policy include off-road vehicles, motorcycles and heavy-duty vehicles. Heavy-Duty vehicles are defined as having a manufacturer's gross vehicle weight rating (GVWR) of more than 8,500 pounds. Examples include fire engines, ambulances, and some public works vehicles.

In addition, police cruisers are currently exempt from this criterion due to market availability; however, **starting in FY 24 (July 1, 2023), police cruisers will no longer be exempt and new acquisitions will have to adhere to this policy. In addition to the three makes/models of police pursuit vehicles that meet the MPG requirements of this policy available on statewide contract, there are currently several hybrid and fully electric police vehicle models on the market. Municipalities are highly encouraged to consider purchasing these models as they replace existing cruisers.** Police and fire department administrative vehicles MUST meet fuel efficient requirements.

***PLEASE NOTE**: If a vehicle is found on www.fueleconomy.gov, then it has a GVWR of less than 8,500 pounds, is **NOT** a heavy-duty vehicle and is **NOT** exempt.*

ALTERNATIVE COMPLIANCE

If a municipality has a vehicle fleet composed of all exempt vehicles (e.g. heavy-duty vehicles and/or police cruisers), it must propose alternative means of reducing vehicle fuel consumption in order to comply with this criterion. Examples of Alternative Compliance include having in place policies and programs that reduce vehicle fuel consumption such as: the installation of idle-reduction devices on police cruisers and/or trucks, installation of electric vehicle charging stations, after-market hybrid conversion of existing vehicles, fleet right-sizing, adoption of an anti-idling policy, and/or use of alternative fuels such as biodiesel

blends from B-5 to B-20 for heavy duty fleets. While DOER encourages policies such as these for all municipalities, cities and towns that do not have any vehicles in their fleet subject to the MPG criteria MUST provide some form of Alternative Compliance. In addition, a municipality must note that, should it acquire non-exempt vehicles in the future, it is committed to purchasing non-exempt vehicles that meet the most recent guidance for Criterion 4 published by the MA Department of Energy Resources' Green Communities Division. See Appendix D for a model Fuel Efficient Vehicle Policy for Alternative Compliance.

An inventory of all vehicles must be provided.

Please note: Even if a municipality has only one non-exempt vehicle, it must have a Fuel Efficient Vehicle Policy in place. Alternative Compliance for meeting Criterion 4 can only be used if ALL vehicles in the fleet are exempt.

APPLICABILITY
All communities seeking Green Communities designation must adopt a fuel efficient vehicle policy that reflects the most recent MPG criteria published in this Guidance. If a municipality has adopted a policy that reflects old MPG criteria, it must have done so within the six months immediately preceding issuance of revised Guidance in order to qualify for credit under this criterion when applying for designation.

All designated Green Communities must review their Fuel Efficient Vehicle Policy on an annual basis and ensure that their policies reflect DOER's most recently published MPG minimums. The Annual Reporting required of Green Communities will include this information.

Future Financial Considerations
Contingency language regarding potential future budgetary constraints in Fuel Efficient Vehicle Policies will not be accepted. DOER recognizes that predicting and committing future budgets is difficult and will work with municipalities on a case-by-case basis should they encounter difficulty complying with their Fuel Efficient Policy due to a budget issue in a particular year.

FOR MORE INFORMATION

Websites:

www.mass.gov/energy/greencommunities

www.fueleconomy.gov

Statewide contract ***VEH110***
"**Purchase of Light Duty Vehicles: Passenger Cars, SUVs, Trucks, Vans, SSVs and PPVs**"
located on https://www.commbuys.com .
Contact your Regional Coordinator

APPENDIX A

This model policy was prepared to assist cities and towns in developing a fuel efficient vehicle policy. This model policy is intended for illustration purposes. Communities are free to utilize the format provided.

Municipality / School District **FUEL EFFICIENT VEHICLE POLICY**	
Effective Date	
Revisions	
Board of Selectman Approval Date	
School Superintendent Approval Date	

DEFINITIONS

Combined city and highway MPG (EPA Combined fuel economy): Combined Fuel Economy means the fuel economy from driving a combination of 55 percent city and 45 Percent highway miles and is calculated as follows:

=1/((0.55/City MPG)+(0.45/highway MPG))

Drive System: The manner in which mechanical power is directly transmitted from the drive shaft to the wheels. The following codes are used in the drive field:

- AWD = All Wheel Drive: 4 -wheel drive automatically controlled by the vehicle power train system
- 4WD = 4-Wheel Drive: driver selectable 4-wheel drive with 2-wheel drive option
- 2WD = 2-Wheel Drive

Heavy-duty vehicle: Vehicles with a manufacturer's gross vehicle weight rating (GVWR) of more than 8,500 pounds

POLICY STATEMENT

In an effort to reduce the (city/town/school district/other local entity)'s fuel consumption and energy costs the (policy making body) hereby adopts a policy to purchase only fuel efficient vehicles to meet this goal.

PURPOSE

To establish a requirement that the (city/town/school district/other local entity) purchase only fuel efficient vehicles for municipal/school use whenever such vehicles are commercially available and practicable.

APPLICABILITY

This policy applies to all divisions and departments of the (city/town/school district/other local entity). It applies to road-worthy passenger vehicles, pick up and utility trucks, and SUVs. It does not apply to specialized equipment or off-road vehicles.

GUIDELINES

All departments/divisions shall purchase only fuel efficient vehicles for municipal use whenever such vehicles are commercially available and practicable.

The (city/town/school district/other local entity) will maintain an annual vehicle inventory for ALL vehicles and a plan for replacing any non-exempt vehicles with vehicles that meet, at a minimum, the fuel efficiency ratings contained in the most recent guidance for Criterion 4 published by the MA Department of Energy Resources' Green Communities Division.

It is the responsibility of the (city/town/school district/other local entity) to check the Green Communities Division's Guidance for Criterion 4 for updates prior to ordering replacement vehicles.

Exemptions

- Heavy-duty vehicles: examples include fire-trucks, ambulances, and some public works trucks that meet the definition of heavy-duty vehicle.

- As of the adoption date (above) police cruisers are exempt from this criterion. Starting on July 1, 2023, police cruisers added to the fleet must meet the fuel efficiency ratings listed in the most recent guidance for Criterion 4. Police and fire department administrative vehicles are NOT exempt and must meet fuel efficient requirements.

Inventory

The following information shall be included in a vehicle inventory list and said list shall be updated on an annual basis and provided to the Green Communities Division:

Model	**Make**	**Model Year**	**Year/month Purchased**	**Drive System: 2 WD, 4WD or AWD**	**> 8500 pounds? (Y or N)**	**Exempt or non-exempt**	**MPG Rating**	**Vehicle Function**
Ford	F250	2016	08/2017	4WD	Y	Exempt	N/A	DPW - Maintenance
Ford	Focus	2014	07/2014	2WD	N	NE	32	Assessors
International	Dump Truck	2011	09/2011	RWD	Y	Exempt	N/A	Sander/Snowplowing

NOTE: Departments/Divisions may use EPA combined MPG estimates or actual combined MPG.

FUEL EFFICIENT VEHICLE REPLACEMENT PLAN

All non-exempt vehicles shall be replaced with fuel efficient vehicles that adhere to the most recent Green Communities Criterion 4 Guidance. Vehicles shall be replaced when they are no longer operable and will not be recycled from one municipal department to another unless the recycled replacement is more efficient than the vehicle it is replacing. In addition, when replacing exempt vehicles, the function of the vehicle will be reviewed for potential replacement with a more fuel efficient vehicle, including a fuel efficient non-exempt vehicle.

(city/town/school district/other local entity) will review on an annual basis the Vehicle Inventory, along with the Green Communities Criterion 4 Guidance, to plan for new acquisitions as part of planning for the new fiscal year budget.

QUESTIONS / ENFORCEMENT

All other inquiries should be directed to the department/division responsible for fleet management and/or fleet procurement. This policy is enforced by the Chief Administrative Officer and/or his/her designee(s).

Appendix B

Sample town adoption letter

Letter must be on Town Letterhead

MA Department of Energy Resources
Green Communities Division
100 Cambridge Street – Suite 1040
Boston, MA 02114

{date of letter}

At a public Board of Selectmen meeting held on [DATE], the Board of Selectmen voted to adopt the attached Fuel Efficiency Vehicle Policy.

Thank you.

Signature and Typed Name of Chair

Appendix C

Sample School Adoption Letter

Letter must be on School letterhead

MA Department of Energy Resources
Green Communities Division
100 Cambridge Street – Suite 1040
Boston, MA 02114

{date of letter}

Please be advised that the Public Schools of [Town] hereby adopted the attached Fuel Efficiency Vehicle Policy.

Thank you.

Signature and Typed Name of Superintendent of Schools

Appendix D

This model policy was prepared to assist cities and towns in developing an alternative compliance fuel efficient vehicle policy. This model policy is intended for illustration purposes. Communities are free to utilize the format provided.

(city/town/school district/other local entity name) **Alternative Compliance Fuel Efficient Vehicle Policy**

FEVP Effective Date	
Date of Municipal Approval	
Date of Board of Selectmen Approval	
Date of School Superintendent Approval	

INTRODUCTION

Criterion Four of the Green Communities Program states that a Green Community must purchase fuel efficient vehicles for municipal use, including schools, whenever such vehicles are commercially available and practicable. *(city/town/school district/other local entity name)* currently owns XX vehicles for municipal use. All vehicles fall into the exempt status according to the Green Community's Criterion 4 guidance. (*city/town/school district/other local entity name)* has adopted this Fuel Efficient Vehicle Policy (FEVP) to purchase the most fuel efficient vehicles for all departments/divisions whenever they become commercially available.

This policy is established to reduce the consumption of fossil fuels, which in turn will have a positive impact on the environment and save tax dollars. Under this policy *(city/town/school district/other local entity name)* hereby establishes a monitoring system to help facilitate the municipality's reduction in vehicle consumption*. (city/town/school district/other local entity name*) XX will establish and oversee the monitoring system in conjunction with the town and school officials and staff as appropriate.

ALTERNATIVE COMPLIANCE

(city/town/school district/other local entity name) has all exempt vehicles (see attachment A, vehicle inventory). Therefore, *(city/town/school district/other local entity)* is seeking Alternative Compliance for Criterion 4 based on the following actions *(must select at least two):*

1) The annual miles driven (or hours used) and total fuel consumption will be determined starting in the municipal fiscal years of 20XX, beginning on July 1, 20XX.*(city/town/school district/other local*

entity) will review this information in September of each year for potential ways to reduce consumption, including: reducing vehicle miles traveled, replacing exempt vehicles with fuel efficient non-exempt vehicles, replacing exempt vehicles with more efficient exempt vehicles.

2) *(city/town/school district/other local entity name)* has adopted an anti-idling policy, in accordance with MGL chapter 90, Section 16A (see Attachment B) applicable to all municipal vehicles to reduce vehicle fuel consumption and emissions. All town employees who drive municipal vehicles have been given this policy.
3) *(city/town/school district/other local entity name)* commits to using biodiesel blended fuels in light, medium or heavy duty fleet vehicles.
4) *(city/town/school district/other local entity name*) commits to installing a Level II charging station at a publicly accessible location.
5) *(city/town/school district/other local entity name)* will pursue after-market conversion of existing vehicles, which includes modifying a vehicle or engine to operate using a different fuel or power source that which it was originally designed for. Many conventional vehicles can be converted to run on fuels like electricity, propane or natural gas, helping to reduce petroleum consumption and GHG emissions and often significantly increasing the fuel efficiency of the vehicle.
6) *(city/town/school district/other local entity name)* will install vehicle parts and/or equipment to conserve fuel. There are many technologies available that, when added to existing vehicles, can help save fuel, reduce emissions, and save money. This includes engine idle management systems, telematics, cab and/or engine block heaters, auxiliary power units, and using synthetic oils.
7) *(city/town/school district/other local entity name)* commits to fleet right sizing, which refers to striking the optimal balance between fleet composition and operational requirements such that each asset within a fleet is not only fully utilized but the right size and type for the job. Right sizing is a management practice that can help vehicle fleet managers build and maintain sustainable, fuel efficient fleets. Fleet inventories often grow over time to include vehicles that are highly specialized, rarely used, or unsuitable for current applications.

POLICY STATEMENT

In an effort to reduce *(city/town/school district/other local entity name*)'s fuel consumption and energy costs, *(city/town/school district/other local entity name)*'s hereby adopts this policy to purchase the most fuel–efficient vehicles to meet this goal.

APPLICABILITY

This policy applies to all divisions and departments of (city/town/school district/other local entity name).

GUIDELINES

All departments/divisions will purchase the most fuel efficient vehicles for municipal use (including police, fire and highway) whenever such vehicles are commercially available and practicable.

(city/town/school district/other local entity name) will maintain an annual vehicle inventory for all vehicles and a plan for acquiring any non-exempt vehicles that meet, at a minimum, the fuel efficiency ratings contained in the most recent guidance for Criterion 4 published by the MA Department of Energy Resources' Green Communities Division. The fuel efficiency ratings contained therein are based on the most recently published US Environmental Protection Agency combined city and highway MPG ratings for vehicles. The most recent Green Communities Guidance for Criterion 4 will be checked for updates prior to ordering replacement vehicles.

Exemptions

- Heavy-duty vehicles: examples include fire-trucks, ambulances, and some public works trucks that meet the definition of heavy-duty vehicle.

- As of the adoption date (above) police cruisers are exempt from this criterion. However, starting on July 1, 2023, police cruisers are no longer exempt and must adhere to the fuel efficiency ratings listed in the Criterion 4 guidance**.** Police and fire department administrative vehicles are NOT exempt and must meet fuel efficient requirements.

Inventory

An inventory of all Town vehicles is contained in Attachment A and shall be updated on an annual basis.

FUEL EFFICIENT VEHICLE REPLACEMENT PLAN

Vehicles shall be replaced when they are no longer operable and will not be recycled from one municipal department to another unless the recycled replacement vehicle is more efficient than the vehicle it is replacing. In addition, when replacing exempt vehicles, the function of the vehicle will be reviewed for potential replacement with a more fuel efficient vehicle, including a fuel efficient non-exempt vehicle.

The Vehicle Inventory will be reviewed on an annual basis along with the Green Communities Criterion 4 Guidance to plan for new acquisitions as part of planning for the new fiscal year budget.

DEFINITIONS

Combined City and Highway MPG (EPA Combined fuel economy): Combined Fuel Economy means the fuel economy from driving a combination of 55 percent city and 45 percent highway miles and is calculated as follows:

Combined City and highway MPG = $\frac{1}{\left(\frac{0.55}{CityMPG}\right) + \left(\frac{0.45}{HighwayMPG}\right)}$

Drive System: The manner in which mechanical power is directly transmitted from the drive shaft to the wheels. The following codes are used in the drive field:

- AWD = All Wheel Drive: four-wheel drive automatically controlled by the vehicle power train system
- 4WD = 4 Wheel Drive: driver selectable four-wheel drive with 2-wheel drive option
- 2WD = 2-wheel Drive

Heavy-duty vehicle: A vehicle with a manufacturer's gross vehicle weight rating (GVWR) of more than 8,500 pounds.

QUESTIONS AND ENFORCEMRNT

All inquiries should be directed to the department/division responsible for fleet management and/or fleet procurement. This fuel Efficient Vehicle Replacement Plan is enforced by the Chief Administrative Officer and/or his/her designee(s).

ATTACHMENT A

(city/town/school district/other local entity name) MUNICIPAL VEHICLE INVENTORY

Make	Model	Model Year	Date Purchased (month/yr)	Drive System	GVWR> 8,500 pounds? (Y or N)	Exempt or Non-Exempt (E or NE)	MPG Rating	Function
Ford		2004	11/04	4WD	Y	E		Ambulance
GMC	Yukon	1999	12/10	4WD	N	E	14	Fire Chief – emergency response
Ford	Crown Vic	2018	8/17	2WD	N	E	16	police cruiser

ATTACHMENT B

This sample policy was taken from the MA DEP's idling reduction toolkit, found at http://www.mass.gov/dep/air/community/depirkit.doc.

(city/town/school district/other local entity name)**ANTI-IDLING POLICY**

This policy applies to [Insert target audience: residents, municipal fleet, school] vehicles operated by or within the town/city of [name of municipality].

OBJECTIVES

1) To eliminate unnecessary idling of vehicles in order to reduce the community's exposure to exhaust from gasoline and diesel engines.
2) To educate and inform municipal employees and residents about the health and environmental effects of gasoline and diesel exhaust.

PURPOSE

Idling vehicles pollute the air and present several health and environmental hazards. Gasoline and diesel vehicles produce carbon monoxide, carbon dioxide, volatile organic compounds (VOCs) and oxides of nitrogen (NOx). Carbon monoxide causes respiratory distress and in high concentrations can be lethal; carbon dioxide is a primary contributor to global warming; and VOCs and NOx and form ozone, ground-level smog and impair lung function. In addition, diesel exhaust contains fine particulate matter, which the U.S. Environmental Protection Agency has designated as a likely carcinogen. The elderly, chronically ill and children are all particularly vulnerable to these health effects because their lung function is respectively decreased, impaired or still in development.

In addition, Massachusetts General Law (MGL Chapter 90, Section 16A) and the Massachusetts Department of Environmental Protection (DEP) idling reduction regulation (310 CMR 7.11(1)(b)) both prohibit unnecessary vehicle idling by stating that the engine must be shut down if the vehicle will be stopped for more than five minutes. Exemptions include: 1) the vehicle is being serviced and the idling is required to repair the vehicle; or 2) the vehicle is making deliveries and needs to keep its engine running (to power refrigerators, for example); and, 3) the vehicle's accessory equipment needs to be powered, such as a fork lift or a truck's rear dump bed, or a wheelchair lift in a bus or van. To provide additional protections for children, MGL Chapter 90, Section 16B further restricts unnecessary idling in school zones.

In order to reduce the health and environmental effects of vehicle exhaust, comply with the state's idling reduction regulation and law, and decrease our use of fuel by reducing unnecessary idling, the following actions shall be implemented to the maximum extent practicable:

[*Municipality would insert specific actions it will implement in its Idling Reduction Campaign such as: posting of signs in public areas, educating municipal employees and residents, establishing best management practices for municipal vehicle operations, etc.*]

This policy is hereby approved by the [Governing Body], this [date], to eliminate unnecessary idling.

Signature:_____

Authorized Official

APPENDIX G

Select DPW Garage Photos

Existing 2-Post Lift (Out of Commission)

Parts Storage Area

Lube Room

Vehicle Rust

APPENDIX H

Work Order and Vehicle Inspection Checklist Examples

D.P.W

REPAIR & MAINTENANCE REQUEST

NO: 3997

VEHICLE NO:	#3 m94168
ODOMETER READING:	45547
DRIVER:	pm RG
DATE SERVICE REQUESTED:	10/7/22
DATE SERVICE COMPLETED:	10/7/22

FOR OFFICE USE ONLY
P.O. #:
Date:
Vendor:
Vendor number :
Department Number:
Account Number:
Posted By:

PROBLEM OR TROUBLE - DESCRIPTION:	COMMENTS:	HOURS:
265-75-17 End of service date		
	TOTAL HOURS:	

PARTS NEEDED

QTY.	ITEM	DESCRIPTION	UNIT PRICE	TOTAL
4	245-75-17	Good year Wrangler		
4	21060	Myers Tire Supply		

DPW EQUIPMENT CHECK LIST

Driver: Kevin Vehicle # 24 Beginning Mileage: _____ Date: Oct. 17, 22

Instructions: Inspect each item below on the vehicle:
- Place a √ if the status is OK.
- Circle the item if the status is defective, and report the problem in the "Problem Report" section below.

Engine/Fluid Levels

___Fuel Level
___Oil Level/Pressure
___Transmission Fluid Level
___Power Steering Fluid Level
___Brake Fluid Level
___Battery Charge
___Windshield Wiper Fluid
___Radiator Fluid Level
___Fluids Leaking Under veh.
___Engine Warning Lights
___Other

Interior Checks

___Mirrors
___Windshield Wipers
___Horn
___Parking Brake
___Fans/Defroster
___Heater/Air Conditioning
___Radio Equipment/Cellphone
___Passenger Door Operation
___Interior Lights
___Driver Seat & Belts
___Passenger Seats
___W/C Securing Ties/Devices
___First Aid Kit
___Fire Extinguisher
___Other Emergency Gear
___Windows Clean?
___Interior Clean?
___Waste receptacle emptied?
___Other

Exterior Checks

___Headlights (hi/low)
___Fog lamps/hazard lamps
___Windshield condition
___Directional Signals frt/rear
___Tail lights/running lights
___Brake lights/Back-Up Lights
___Tire condition/air pressure
___Lug nuts tight?
___Tail gate & engine compartment panels
___Exterior clean?
___Body condition/scratches/ dings/dents
___Other

Does any problem circled require the vehicle to be taken out of service?
YES / (NO)

Has a Supervisor been notified? (YES) / NO
Name: _____

Problem Report (Describe all problem areas circled above):
The lift buttom not working.

Date: 10/17/22 Driver Signature: [signature]

Maintenance Work Order Issued? YES / NO Work Order No. _____ Date Opened: _____

Date Vehicle Returned to Service: _____ Mechanic Signature: _____

Remarks: _____

APPENDIX I

Meeting Minutes

Client: Town of Nantucket, MA

Project Name: Nantucket Fleet Study

Project Number: ENG22-1058

Date: October 17, 2022

Time: 1:00 PM

Location: DPW

Attendees:

- Stephen Arcenequx (DPW Director)
- Paul Berard (Deputy Director of Facilities)
- Peter (DPW Mechanic)
- Ronnie (DPW Mechanic)
- Jamie Fair (Weston & Sampson)
- Zach Wallin (Weston & Sampson)

Meeting Notes:

- David Lafleur (Central Fleet Manager) can turn wrenches as a backup
- Preventative Maintenance (PM) schedule has been talked about but not established. Right now just playing catch up. Mechanics have only been here since May and they had a lot to get back up and running. Then they started on the PM. Still trying to figure out the best system. They have discussed ways to monitor usage.
- They have a service slip where data goes. What was done, who did it, how long did it take, etc. Eventually they will probably input this stuff into a database (Verizon Fleet).
- Oldest truck is a 2000 F350
- Oldest piece of equipment is a Volvo 2001 motor grader
- Front end loader is a 2006 and works every day. Reliable and still works well
- Vehicle replacement is better than it has been in a long time
- Would like a software package that spits out a summary bottom line (automated) for each vehicle to show when a vehicle needs to be replaced. Want to make sure it's clear that the data couldn't have been manipulated.

- Jamie mentioned that maybe software could tie into fuel management system to see what mileage is for each vehicle and help schedule maintenance.
- Steve thinks that maybe hiring someone to manage the implementation of fleet management system would be good, instead of having existing guys spend extra time trying to do it
- Steve is wondering if there is some sort of manual that gives a job and an estimated amount of time. Could say "we are doing oil changes in half the time, but pulling engines takes us double because we don't have the proper tools"
- CN Wood is expensive to get out here and very few people have equipment on the island that they would service
- Town won't compete with private industry for mechanic pay
- Low $30s/h for starting for Town vs $50/h for private (can even get that much pay doing landscaping)
- They have good benefits according to the mechanics
- They have a pension program. 10 years to get vested. 33 years for full 80% benefit. Takes into account military service.
- Town has very simple pay scale.
- “Building ship as you sail it” when it comes to Town organizational structure
- Mission statement would be a good idea
- All their 1 tons and pickups have plows, so not sure if warranties are affected
- All CAT vehicles (loader, skid steer, excavator, grader, backhoe, etc.) are serviced by CAT (8 total)
- There is a Ford dealership on the island, and also a Jeep/Dodge/Ram
- Waited a month for an alignment from Ford, or 14 months for a van with a CPU problem
- One state inspection bay on the island. Up to F650 gasoline, or F550 for diesel. Contract tri-state truck out of Woburn (mobile inspections) for heavy duty trucks.
- When vehicle is ready to be gotten rid of, they will do a surplus auction right here. Sealed bid auction. What is left will be disposed of. They are happy with what they are doing currently.
- In the past they were doing cruisers, fire trucks, other departments, but right now it is kind of a gray area.
- They would like a rating/scoring system for vehicle replacement

- Lots of salt rust damage to vehicles
- Steve wants professional development training for the mechanics, self paced if possible
- They said they can get us the "asset list" with all the small portable equipment
- Steve wants to do "100% inventory" but there is no time to do this (perishables, tools, vehicles, etc.)
- Trash truck #14 is their highest mileage truck
- They buy pretreated salt. They pretreat with treated salt ahead of time.
- Peter has a list of all vehicles that are used for snowfighting
- Peter thinks they may have 200 miles of road on the island
- Operators are supposed to do a pre-trip checklist (circle check form) - there as a guideline and a way to submit a repair order
    - This form is what initiates the repair
    - They can give us an example form
- Both scheduled and unscheduled repairs are common, or long-term issues that are finally being resolved
- Parts inventory/room needs attention/organizing. Steve thinks parts inventory should be a job all its own.
- They don't know how in depth they should go with repairs before they ship it off to get fixed
- Steve wants to establish a solid structure with rules, regulations, and systems
- They get parts, recalls, warranty work through Ford dealership and lots of other 3rd party vendors for parts. Go directly to manufacturers a lot of time. Bobcat has been difficult, Milton CAT has been good. Freightliner trucks - get parts from Tristate in Woburn. Use state bid list a lot too. Maybe having a clerk would be good to take the burden off David.
- No formal training for the mechanics. Peter has been working here since 2013.
- They have a diagnostics machine OBD-2 and diesel tech laptop.
- Have 3 different engine platforms
- Do not have Mitchel On Demand
- Manufacturers sometimes come out and give training when they get a piece of equipment. There was hands on training with the Elgin Street sweeper, but no mechanics training
- They sub out windshield glass replacement

- Have not done a transmission in-house in a while, but have done it in the past
- They have done crate engines
- Sub out painting and interior repairs
- Peter would like to do a painting program for the vehicles to help prevent corrosion
- They work on brake lines, air lines, bearings, calipers, brake cans, tires (car, truck, big truck)
    - They have tire changer and balancer as well as tools to do large tires
- Fuel tank got inspected by state inspector and said inner tank leaked but could still use it. Then next inspector said they cant use it again.
    - Harbor fuel gave them water contaminated fuel
    - Lemelin had previously given it a clean bill of health
    - Police department took the state permit for their fuel tank
    - Municipal fuel tank is at fire station on 131 Pleasant Street
        - They have one mobile tank in back of truck that they fill a couple times per week to fill the off road equipment
        - They get gas and diesel from the fire department
        - Waste a lot of time getting fuel there
        - Hard to get in there with larger vehicles or trailers
        - Just 1 vehicle can fuel at once
- Current lifts:
    - 4 post 19k mobile columns for large trucks. Put on jack stands for wheels
    - Want a 2 post lift. Their current one is broken.
- They do not maintain the school buses
- Harbor fuel and Yates gas have the big tank farm on Sun Island Road. They send tanker trucks off the boats every day
- Dave Fredricks - operations manager for Harbor Fuel
- Pay structure is rigid and goes a lot by years of service
- Hours of operation are 7am-3:30pm

Minutes submitted by: Zach Wallin

Client: Town of Nantucket, MA

Project Name: Nantucket Fleet Study

Project Number: ENG22-1058

Date: October 17, 2022

Time: 3:00 PM

Location: DPW

Attendees:

- Peter (DPW Mechanic)
- Ronnie (DPW Mechanic)
- Jamie Fair (Weston & Sampson)
- Zach Wallin (Weston & Sampson)

Meeting Notes:

- MaxiSys diagnostic system works and they like it
- They do not give carbon copies of service slips back to “customer”. They just keep them
- Floor drains go to a tight tank
- 53’ tire storage box outside and they store them inside as well
- Lube room is not big enough
- They think drum lube storage is good for their operations.
- No bay designations
- They were told that the 2 post lift has exceeded the number of lifts it can safely do
- There is no vehicle exhaust collection system
- There is no welding fume exhaust collection system
- They are lacking storage and organization
- Overall footprint of the building is fine for them in terms of size
- They store the vac truck in the garage in winter and they do have room to work on it
- DPW has 1 vac truck and sewer department has 2 vac trucks as well
- Most of their tools are provided by the Town
- They are getting a tire cage soon
- Peter is the only one with hot work training
    - More training for everyone would be helpful
- Want training for servicing air brakes
- Want to be able to paint chassis

- Their standby generator is propane and it powers the whole facility. Propane tanks are underground.

Minutes submitted by: Zach Wallin

Client: Town of Nantucket, MA

Project Name: Nantucket Fleet Study

Project Number: ENG22-1058

Date: October 18, 2022

Time: 8:15 AM

Location: DPW

Attendees:

- Paul Berard (Deputy Director of Facilities)
- Richard “Mo” Moore (Deputy DPW Director)
- Jamie Fair (Weston & Sampson)
- Zach Wallin (Weston & Sampson)

Meeting Notes:

- Paul was fleet manager for 7 months when Eric Johnson left, just before COVID. He came from Westford.
- David has been here about 2 years
- Town owns 95 buildings and lots of assets (flag pole, foot bridge, etc.)
- Mo has been in his position 7 years and has a grade 7 wastewater license
- Mo thinks putting OWS cleanings through treatment plant is a no go. They have a haz mat truck come out several times per year, so could just put in 55 gal drums
- Mo likes the Network Fleet software
- Mo thinks the maintenance garage is understaffed. He thinks being the fleet maintainers for the whole town is too much for the number of staff they have. Focus on PM and time critical fixes, but everything else should be subbed out.
- David is not in the union so there is only so much he can do in the shop. Technically not supposed to do mechanic work. His role is more geared towards scheduling, ordering, stocking shelves, etc.
- They do send vehicles to Ford, which is probably the only real option on the island. Mo is good with subbing out work, even off island. Mo agrees that expanding the maintenance agreement with CN Wood would be a good idea, and keeping with maintenance agreements with CAT, MHQ (supply and repair vehicles - off island), and other companies.
- He thinks garage should be more of a maintenance garage, not a big job garage like pulling engines

- Org chart that Paul sent us has positions on it that are not filled. He will mark it up and tell us which ones are not filled.
- Mo thinks the airport has a good facility and likes that they have a storm event room
- Mo thinks they should do the circle check at the beginning and the end of the day
- They do not have assigned vehicles in general. Mo has a vehicle that he uses a lot but Paul does not have one that is always available to him. He says he would do his job differently if he had a vehicle.
- Mo thinks they are catching up with the purchasing of vehicles
- They did not have any seasonal workers this last summer
- They do written weekly updates instead of doing weekly meetings
- Mo thinks Peter and Ronnie are doing a great job, given a tough situation. He has seen a difference in how fast work is getting done. He doesn't think they can do any more than they are doing.
- They do hear from other departments about long turnaround time is
- Things that would make maintenance operations better:
    - More people
    - More training
    - Higher hourly wage
- The ferries do not prioritize town needs
- They order 500 tons of salt that comes in on a barge. The salt shed they have holds 500 tons. They do not use that much per year though.
- Mo can get us salt usage numbers
- They want to be able to dump the salt directly into the salt shed
- They think inside storage would dramatically increase the lifespan of the vehicles
- 5 visitor parking spots would be more than enough for the new building
- There is a WPI operational study that they can point us to
- The two electric charging stations at the DPW are for personal vehicles since there are no E.V.s in the fleet right now
- Police station has their own fueling
- Old fire station has a fuel system and all Town departments other than police and fire use that (DPW, natural resources, school, etc.)
- Paul wants to make sure that they have the right vehicles for Facilities and says we should talk with the crew about this
- They are contracting out the maintenance of the ballfields and parks (Delta, Nobadeer, Tom Nevers, Children’s Beach, Coffin Park, Winter Park, Mill Hill, Grant Circle).
- Parks & Rec is a new department with no manpower right now. Department used to exist, got dissolved, then came back
- Operations is responsible for brush clearing. Could use a little more equipment like a brush cutter or sickle bar
- Weston & Sampson will email PDFs of the DPW photos we were looking at during the meeting

Minutes submitted by: Zach Wallin

Client: Town of Nantucket, MA

Project Name: Nantucket Fleet Study

Project Number: ENG22-1058

Date: October 18, 2022

Time: 1:00 PM

Location: DPW

Attendees:

- Don Whittaker (Facilities Foreman)
- Richard Thomas (Facilities Manager)
- Jamie Fair (Weston & Sampson)
- Zach Wallin (Weston & Sampson)

Meeting Notes:

- They do not have enough operable vehicles. 3 or 4 vehicles right now did not pass inspections
- Flow of work can be imbalanced
- They would very much like to have their own dump truck (F350 with dump body) and one or two F250s or F350s (with work boxes in the back behind the cab) so they do not need to borrow from other departments
- They do circle checks. Maybe not every day. If something is wrong, you write it down and bring to mechanics
- Sometimes they need to drive a vehicle that did not pass inspection, but they are afraid about the personal liability of that.
- They get hand me down vehicles
- They need tool boxes
- They need reliable equipment because they are responding to emergencies
- They have no backup vehicles
- Mechanic shortage is a major issue

- They think that every once in a while mechanics should drive all the vehicles to make sure everything sounds correct
- They want to have a designated wash space and an undercarriage wash
- They are short on manpower and motor vehicles. If they added more staff, the vehicle shortage would be even worse
- They only have Rangers, but no bigger pickups that they need. Operations lets them borrow larger vehicles.
- Sometimes they need to use a Bobcat but need a larger vehicle to pull a trailer

Minutes submitted by: Zach Wallin

Client: Town of Nantucket, MA

Project Name: Nantucket Fleet Study

Project Number: ENG22-1058

Date: October 18, 2022

Time: 2:00 PM

Location: DPW

Attendees:

- Michael Cranston (Fire Chief)
- Sean Mitchell (Deputy Fire Chief)
- Jamie Fair (Weston & Sampson)
- Zach Wallin (Weston & Sampson)

Meeting Notes:

- Want to make sure tax dollars being spent efficiently while also keeping vehicles on the road
- No mechanics on staff, but they do have fire fighters on staff that are diesel mechanics (2nd jobs)
- A little bit of everything happens for fire truck maintenance; using airport fire department resources, bringing mechanics on island, sending trucks off island
- They sub out work. Someone brings out a trailer on the ferry and fixes the trucks. Not always easy to get him here and sometimes a significant lag in time. Can be weeks to a month sometimes before he comes back to the island. He comes for the day, but sometimes does not finish the job before he gets back on the ferry, and he might not be back for weeks.
- Mike would prefer that all maintenance is centralized. He does not think they could justify one dedicated mechanic for fire alone, but having someone who knows how to serve fire and other departments at the same time.
- Mike said there is a big field behind the police/fire station that at one point was part of a plan to have a police/fire maintenance garage
- Sean agrees that central maintenance is a good idea too

- In July, Jeb Backus, former mechanic of the airport, personally helped get a couple of trucks back running to get them back into the garage. They had nowhere else to turn and had to ask him, just a resident at this point, to help them out.
- DPW does some tire work for them
- Fire and Police share their own fuel system at the station behind the building
    - They have a key fob that they plug in then swipe badge or type in account number
- They are all for a system that tracks PM based on the Fuelmaster input data
- Their mechanic comes out for PMs in spring and fall
- Ambulances go to Billy Built (Sun Island area on Tomahawk Rd) for maintenance, as well as pickup trucks
- They usually just schedule oil changes once per year because they do not drive the trucks that much, but they are going to look into that a little more
- They have not had any "incidents" per se, but have had trucks unusable for long periods of time
- Need to identify the key person who inputs the PM schedule into the software
- They have had trucks fail state inspection in the past. 6 or 7 trucks failed last October. They were fixed recently, then they will be re-inspected in January. They have been using them anyway.
- Charles Lacross - mobile fire apparatus mechanic
- Capital has a replacement schedule, but they have not sat down and put together a schedule for each truck personally. Sometimes it is a last minute judgment call though.
- There was probably a lack of proper PM in the past, which is why those 6 or 7 trucks all failed at the same time
- Target Solutions - iPad system where if they find something on their daily or weekly check on the truck, they can flag it for management. Has the ability to track costs. Sometimes the ticket goes in to Charles Lacross or someone else on the island.
- Charles works at Toscana. Maybe they could set up an agreement with Toscana to use his mechanic services.
- They have a very limited amount of parts inventory

Minutes submitted by: Zach Wallin

Client: Town of Nantucket, MA

Project Name: Nantucket Fleet Study

Project Number: ENG22-1058

Date: October 18, 2022

Time: 3:00 PM

Location: DPW

Attendees:

- Lauren Sinatra (Energy Coordinator)
- Jamie Fair (Weston & Sampson)
- Zach Wallin (Weston & Sampson)

Meeting Notes:

- They do not have much of a working relationship with Fleet
- Gas on the island is expensive and they can control electric costs, so she thinks it makes sense to go towards electric
- David Lafleur was identified as a liason
- She thinks fuel is delivered automatically on a monthly basis
- She will get us fuel usage data, but COVID may create some outlier data. Might have one year of pre-covid data.
- Planning Department has vehicles
- Keeping track of newly purchased vehicles has been difficult
- She is not involved in fleet maintenance, but Leslie, the Deputy Director would be more involved. Inspectors drive cars daily. She does not typically use town vehicles.
- She maintains electric vehicle charging stations. 1 EV (Nissan Leaf) and 1 hybrid station.
- There is no climate action plan mandating emissions goals. Just trying to keep in pace with MA goals for 2030 (i.e. no ICE vehicle sales as of 2035)
- NRTA falls under select board's direction

    - Have not shared a study that was performed for fleet electrification
    - She thinks they should be involved if there is an overall island initiative for electrification

- NGRID is an excellent partner to them.
- They are a "Green Community"
    - When purchasing vehicles, Libby has had to remind people to check with Lauren to make sure it is in accordance with Town efficiency standards. But there is not currently a standardized process or checklist for this process, which needs to be implemented
- She has had to flip breakers in the past for charging stations, which is not technically her job
- They have not done a full E.V. study
- Nantucket has a surging peak load issue. They are hoping to avoid a 3rd undersea power cable (2 currently). They come from Hyannis and Barnstable she thinks.
    - Adding more E.V.s would have to come with some sort of off peak usage initiative
- There are constraints on the island that dictate the amount of solar can be implemented
- There are environmental challenges with putting solar on the landfill
- She thinks there needs to be better tracking of their fleet and procurement. There is bad information in the spreadsheet, not enough information, missing information
- Airport is very proactive and efficient in terms of maintaining their assets

Minutes submitted by: Zach Wallin

Client: Town of Nantucket, MA

Project Name: Nantucket Fleet Study

Project Number: ENG22-1058

Date: October 19, 2022

Time: 10:00 AM

Location: Virtual Meeting

Attendees:

- Michelle Munroe (Our Island Home Assistant Administrator)
- Shantaw Bloise (Director of Culture & Tourism)
- Jamie Fair (Weston & Sampson)
- Zach Wallin (Weston & Sampson)

Meeting Notes:

- Michelle – her department's use of DPW fleet maintenance is pretty minimal. They have had 1 pickup truck that has been in the shop for a year (old vehicle). The other two vehicles have been serviced at Don Allen (local Ford Dealership) because of specialty needs or they send them off island (e.g. fixing the lift for the van).
    - Ford dealership does inspections and routine maintenance generally for the transit vans
    - They understand that there are other priorities for the DPW sometimes. She has to give a nudge to get status updates on vehicles when they are in the DPW shop
    - They don't really do a circle check
    - If there is an issue she would email Dave LaFleur and/or do an online request form (she has not done that yet though for vehicles, just for potholes and such)
    - She does not fuel the vehicles
    - They do not use DPW maintenance often. Only since they got the pickup truck from the DPW 4-5 years ago have they started using the DPW maintenance
    - They use the pickup for taking things to the dump

- Shantaw has never heard of David or any type of fleet management or fleet maintenance
    - She has an electric vehicle (Nissan Leaf)
    - She planned to take it somewhere to get it inspected
    - They use the vehicle as a mobile kiosk
    - The vehicle is going into its 3rd year
    - Janet drove it through the winter, but she was not on this call and not sure how it was
    - There are enough charging stations in town
    - Vehicle has never been to DPW fleet maintenance
    - No work at all has been done on it since they got it
- Need to think about how to track mileage and PM for electric vehicles

Minutes submitted by: Zach Wallin

Client: Town of Nantucket, MA

Project Name: Nantucket Fleet Study

Project Number: ENG22-1058

Date: October 19, 2022

Time: 11:00 AM

Location: Natural Resources Office

Attendees:

- Roberto Santamaria (Health & Human Services Director)
- Jeff Carlson (Natural Resources Director)
- Jamie Fair (Weston & Sampson)
- Zach Wallin (Weston & Sampson)

Meeting Notes:

- Mixed bag customer-wise for DPW Garage over the years due to high turnover with staffing at DPW. Dave LaFleur is the 3rd person in 5ish years
- Hard to know what services are available on a timely basis, as well as staffing capabilities
- David is a great mechanic but needs help with procurement. Haven't even started procurement with some of the vehicles
- They would love to be able to use the DPW for all PMs and have DPW schedule it and send reminders and such
- Roberto said they have a hybrid and it completely discharged (couldn't even open doors). DPW was able to fix it, but it took 3 days for a simple fix
- They agree that DPW is understaffed
- Overarching problem with central fleet is the Town replacement program is not good. The environment is extremely harsh on these vehicles. They want to formalize a program to make sure they are not spending more on a vehicle than it is worth. Just last year they got rid of a 2008 vehicle, and he thinks it should have been rotated out 4-5 years ago. They say part of the problem is getting proper funding.

- Roberto said they are still using a 2007 Ranger that the outside handles don't work anymore, and they need to leave a window open.
- Roberto said their 2016 Fusion has never been inspected until recently and only got an oil change for the first time this week.
- They are waiting too long to do PM until oil light goes on or check engine light goes on. Reactive maintenance vs PM.
- Lots of stop and go short distance driving that is very hard on the cars.
- Chris, the old mechanic, is at Don Allen and is paid 15/h more than the DPW. He was able to replace a whole engine that got water in it.
- They think there should be a contract with the car wash for the whole fleet. Natural Resources has an account with the car wash.
- They want to change the culture of how they procure and maintain vehicles
- It is a bad look on the Town to have rotting vehicles, but the opposite is also true where they get complaints about getting vehicles that are too nice
- Police replace their vehicles every 3 years. They think they have an account with Nantucket Autobody
- Jeff thinks central fleet should be able to handle the basic services that Don Allen could do, like brakes, fluids, belts, headlights, tires
- They have not standardized the fleet. Some department heads bought Jeeps and there is nowhere to take them but Don Allen. Not having a policy in place made this happen. If they standardized, they could order parts in bulk.
- Jeff views central fleet like IT. He wants to call them up and say he needs 2 vehicles that can do XYZ and they procure them and tell them when to bring the cars back for maintenance. They think fleet should be able to come get the vehicles if they are not being brought in in a timely manner.
- They have 7 unions with the Town and they all talk to each other to negotiate benefits and pay
- Town can't compete with private companies coming in and offering higher pay because they move too slow. One department head got offered double his salary.
- Private mechanics on the island are not readily available. One died, two only do Jeeps or Land Rovers. There is also Billy Built. Mechanics see the void as an opportunity to go private and make way more money.

- They think we need to make sure the DPW has the tools they need to do their job. Invest in good tools and equipment. It is an investment in morale. Could do a contract with Snap On to do a swapout every 2 years.
- Should they have a mechanic to just work on machines?
- Dave needs to manage expectations, and create a good system of prioritization
- Understaffed to a point where they try to cover everyone's role and they are not doing their own roles very well
- They think Dave has not been shown how to properly deal with systems and accounting
- Munis (financial program), NEOGOV (HR), EnerGov - lots of different programs
- Lots of trips to Nantucket Auto Supply to get parts
- They have never rotated their tires

Minutes submitted by: Zach Wallin

Client: Town of Nantucket, MA

Project Name: Nantucket Fleet Study

Project Number: ENG22-1058

Date: October 19, 2022

Time: 1:00 PM

Location: Sewer Department Conference Room

Attendees:

- David Gray (Sewer Director)
- Jamie Fair (Weston & Sampson)
- Zach Wallin (Weston & Sampson)

Meeting Notes:

- They are an enterprise fund, so they have some different abilities than other departments. DPW is part of the general fund, so funding is limited
- Right now, they have 2 trucks on the mainland because Ford could not take them and DPW could not take them
- A couple of guys on sewer staff can do minor repairs/maintenance
- A lot of their repairs/maintenance gets sent off, or tri-state comes and works on it
- The mechanics need more training
- Sewer Department brings people onto the island for training, and it is a big priority. They do not do any training at the DPW
- Need to spend money to keep equipment up to date
- He buys their parts through state bid or Sourcewell because it is specialized. Don't buy anything through DPW
- What can the town do?
    - Pay higher salary
- Up until 2016 Sewer was part of the DPW, then they separated

- Thinks they should pay for guys to get trained or go to school
- Ford garage is 1 month or 2 months wait. Belice Ford off island is much faster.
- The Town is not investing enough in software programs
- Need resources and funding. Town bought all the Snap-On tools.
- Pete and Ronnie do tire changes and oil changes
- Diesel mechanics on the island are few and far between, and probably will cost $50/h
- They buy parts often times for Dave because they have the accounts set up and then they get delivered to Dave
- Sewer department has plow blades and plow parts on their own, but they say the DPW is behind on their stuff
- CN Wood, Vacom, tri-state (large truck inspections), for subs who come onto the island
- They have an International truck and have a connection at ASV on the cape to get it serviced
- Freightliners used to be good trucks, but the metal is bad now. Now they will stick with Western Stars
- Burklers or RBO sometimes help
- Couldn't get into Ford for a front end steering recall for 2 months so sent it off island
- Thinks they are $200/h at the Ford garage
- Should other departments be paying the DPW to service vehicles? Would be difficult to manage
- Maybe set up a service contract on the mainland
- Tri-state great, CN Wood great, CAT has been good for maintenance. He thinks there are going to need to be multiple service contracts
- Buy all tires off island a cape tire works. DPW changes tires, but they bought all of them
- Not able to buy electric vehicles right now. No stock availability
- Buys all the big trucks on Sourcewell
- They are taking over stormwater from the DPW
- Chevy is a lot cheaper than Ford, but need to send away for maintenance
- Town needs to be more pro-active on maintenance

- Sewer helped out fire department fix some of their electrical issues in a truck recently
- Ladder truck broke down during the fire. Another truck broke down during the fire as well with a fuel issue.
- ITT Tech offers schooling

Minutes submitted by: Zach Wallin

Client: Town of Nantucket, MA

Project Name: Nantucket Fleet Study

Project Number: ENG22-1058

Date: October 19, 2022

Time: 2:00 PM

Location: Police Department Conference Room

Attendees:

- William Pittman (Chief of Police)
- Charles Gibson (Deputy Police Chief)
- Brendan Coakley (Police Lieutenant / Emergency Management Coordinator)
- Jamie Fair (Weston & Sampson)
- Zach Wallin (Weston & Sampson)

Meeting Notes:

- They tried using DPW for maintenance, but they were too busy
- Do all their maintenance work through the Ford dealership
- Go through the dealership for warranty work
- Waiting on 6 new cars
- Ford dealership service is not stellar
- Complicated work like transmission, they ship up to Marlborough (MHQ) because of same talent shortage
- Nonstop appointments on the calendar for basic PM and emissions work. They can always fill an appointment
- Check engine lights are constantly on
- Haven't had a replacement vehicle in roughly 2 years because of shortage
- They have money put in to replace the fuel tank in the capital budget $300k to put something similar in. Tank is cracked and full of water. Probably same capacity but a steel tank instead of a Convault.

- Tank at old fire station should be good for another couple of years. Police manages the technical part of it. Fuelmaster, steam gauge on top of tank, DEP certifications
- All town vehicles use proximity keys assigned by vehicle, but the police has the fuel rings
- Deputy Chief can get us fuel usage data for the town vehicles that have fobs
- Burned out light or flat tire is sometime taken care of by one of the police staff
- If DPW could do tire changes and oil changes, it would save the Police a lot of money
- Unions are interconnected
- Employee costs are starting to include housing
- Billy Built does some work on the island
- Ford garage does not prioritize police
- Local companies are paying much higher wages than the Town and make employee retention difficult
- They have 35 vehicles in the department. Harbormaster/Marine has 5 trucks that they keep for a long time and they buy from state contract from MHQ like police under state master contract.
- Getting vehicles on a boat during peak months is very difficult.
- SSA gets a franchise fee from other boats even
- Been waiting for parts for 6 months from Ford dealership for one of their cars

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APPENDIX J

Table for Vehicle Costs

Note: Table provided by Town and is used below for general cost tabulation only. See VEU analysis table for curated list of Town vehicles.											
1	**FIRE DEPT**	1988	FORD	F800		1FDYK84A1JVA47293	$110,000		79090	$500	$500
2	**FIRE DEPT**	2002	FREIGHTLINER		TRUCK	1FVDBWBV72HH85572	$229,650		79090	$500	$500
3	**PUBLIC WORKS**	1989	GMC		TANKER	1GDP7D1G5KV516286	$85,000		79090	$500	$500
4	**WATER COMPANY**	1996	FORD	F450	TRUCK	1FDLF47F3TEB09844	$21,750		21499	$500	$500
5	**WATER COMPANY**	2006	HURCO	POWER WASH	TRAILER	1C(BV13186B987040	$56,582		68499	$500	$500
6	**AIRPORT**	1989	OSKOSH	FIRE	TRUCK	10T9L5BHK1037629	$300,000		79090	$500	$500
7	**AIRPORT**	1988	JOHN DEERE		LOADER	DW644EB518874	$80,000		79650	$500	$500
8	**PUBLIC WORKS**	1988	MGS	G5	TRAILER	16MG10912JD014914	$3,500		68499	$500	$500
9	**PUBLIC WORKS**	1993	HEAVY	HAULER	TRAILER	1B9UF0815PC301165	$1,000		69499	N/A	N/A
10	**AIRPORT**	1994	FORD		DUMP	1FDYK82E0RVA27067	$64,394		31479	$500	$500
11	**PUBLIC WORKS**	1995	INTERNTNL		TRAILER	1ZFUF1620SB004046	$1,200		68499	N/A	N/A
12	**NATURAL RESOURCE**	1997	KARAVAN	BOAT	TRAILER	186RLE2UBVF010992	$4,340		68499	$500	$500
13	**LAND BANK**	1997	LOAD RITE		TRAILER	4L2KY4L16V2000178	$1,707		68499	N/A	N/A
14	**LAND BANK**	1983	JOHN DEERE	2755	TRACTOR	CD4239T920441	$60,000		79650	$500	$500
15	**NATURAL RESOURCE**	1997	KARAM	BOAT	TRAILER	186B0C152VF014867	$995		69499	N/A	N/A
16	**LAND BANK**	1997	FORD	F350	TRUCK	1FDKF3867VEC42266	$25,496		21479	$500	$500
17	**AIRPORT**	1999	FORD	F250	PICKUP	1FTNF21F4XEB69678	$38,046		01499	$500	$500
18	**LAND BANK**	1994	CASE	MAXXUM	TRACTOR	JJF1034294	$30,000		79650	$500	$500
19	**PUBLIC WORKS**	2000	FORD	F350	RACK	1FDWF36S1YED76395	$27,895		21499	$500	$500
20	**AIRPORT**	2001	EAG. BEAVER	FLATBED	TRAILER	112HTN3041L055959	$10,630		68499	$500	$500
21	**PUBLIC WORKS**	2001	HI STRIKET	DUNK	TRAILER	72301	$3,195		69499	$500	$500
22	**POLICE**	2002	CARGO	UTILITY	TRAILER	1UK00E2321040839	$60,000		68499	$500	$500
23	**PUBLIC WORKS**	2003	FORD	RANGER	PICKUP	1FTZR11U33TA05717	$20,000		01499	$500	$500
24	**PUBLIC WORKS**	2001	VOLVO		GRADER	G86201022	$99,126		79650	$500	$500
25	**AIRPORT**	2003	JOHN DEERE		LOADER	DW724JX586227	$189,920		79650	$500	$500
26	**AIRPORT**	2002	OSHKOSH		FIRE TRK	10TBK8Z1025072137	$528,671		79080	$500	$500
27	**AIRPORT**	2003	AM GENERAL	HUMMER	FIRE	137FA553X3E202023	$196,581		79090	$500	$500
28	**PUBLIC WORKS**	2004	FORD	RANGER	PICKUP	1FTZR11U94TA00894	$17,371		01499	$500	$500
29	**PUBLIC WORKS**	2004	FORD	RANGER	PICKUP	1FTZR11U04TA00895	$17,371		01499	$500	$500
30	**AIRPORT**	2004	STERLING		DUMP	2FZAAWAK24AM87574	$92,528		31479	$500	$500
32	**FIRE DEPT**	2004	FREIGHTLINER	RESCUE	TRUCK	1FVABXCS54HM57595	$223,584		79090	$500	$500
33	**AIRPORT**	2002	LOAD RITE		TRAILER	5A4KRAL1X22050148			68499	N/A	$500
34	**AIRPORT**	2004	FORD	F550	TRUCK	1FDAF57P74ED45033	$45,458		31499	$500	$500
36	**SCHOOL**	2005	BOBCAT	5600		424811112	$36,075		79650	$500	$500
37	**OUR ISLAND HOME**	2005	FORD	F250	PICKUP	1FTNF21525EC51980	$25,909		01499	$500	$500
38	**FIRE DEPT**	2005	CHEVROLET	K2500 SILVERADO	PICKUP	1GCH29U45E319247	$41,000		79080	$500	$500
39	**PUBLIC WORKS**	2006	FORD	RANGER	PICKUP	1FTYR11UX6PA13838	$16,021		01499	$500	$500
40	**AIRPORT**	2206	FORD	RANGER	PICKUP	1FTYR15E56PA10929	$18,370		1499	$500	$500
41	**PUBLIC WORKS**	2007	FORD	F550	DUMP	1FDAF57YX7EA99351	$44,847		21479	$500	$500
42	**FIRE DEPT**	2006	WELLS CARGO	UTILITY	TRAILER	1WC200J2368009291	$12,751		68499	$500	$500
43	**FIRE DEPT**	2005	HME	1871-P2	FIRE TRUCK	44KFT428X5WZ20647	$731,900		79090	$500	$500
44	**SEWER DEPARTMENT**	2006	JOHN DEERE	5225	TRACTOR	LV5525H258095	$51,042		79650	$500	$500
45	**LAND BANK**	2006	TOWMASTER	T-14DD	TRAILER	4KNUT20276L160588	$7,000		68499	$500	$500
46	**LAND BANK**	2006	ROADRUNNER		TRAILER	IR9PD24236L427038	$19,000		68499	$500	$500
47	**FIRE DEPT**	2006	WELLS CARGO	UTILITY	TRAILER	1WC200J2568009650	$8,419		68499	$500	$500

48	**FIRE DEPT**	2006	WELLS CARGO	UTILITY	TRAILER	1WC200J2668009866	$13,280		68499	$500	$500
49	**AIRPORT**	2006	FREIGHTLINER	FC80	SWEEPER	1FVAB6BV56DDW22321	$168,875		79650	$500	$500
50	**PUBLIC WORKS**	2006	VOLVO	L70E	WHEEL LOADER	L70EV61136	$119,999		79650	$500	$500
51	**AIRPORT**	2006	CARGO EXPRES	ENCLOSED	TRAILER	4U01C14226A029793	$4,725		68499	$500	$500
52	**AIRPORT**	2007	FORD	EXPLORER	UTILITY	1FMEU73E17UA47417	$30,119		73980	$500	$500
53	**FIRE DEPT**	2007	FORD	FREIGHTLINER	FIRE TRUCK	1FVDCYDJ77HX06683	$145,628		79090	$500	$500
54	**PUBLIC WORKS**	2007	FORD	F350	PICKUP	1FTWF31557EA99352	$26,231		21499	$500	$500
55	**POLICE**	2007	INTERNATIONAI	4300	TRUCK	1HTMMAAL17H502020	$570,569		79120	$500	$500
56	**OUR ISLAND HOME**	2006	FORD	ECONOLINE	BUS	1FDXE45S16DB03572	$46,639		64820	$500	$500
57	**PUBLIC WORKS**	2007	FORD	RANGER	PICKUP	1FTYR15E37PA56051	$21,709		01499	$500	$500
58	**PUBLIC WORKS**	2008	CROSS COUNTR	FLATBED	TRAILER	431FS202X81000106	$3,725		68499	$500	$500
59	**WATER COMPANY**	2008	FORD	SPORT TRAC	PICKUP	1FMEU53E78UA41272	$30,705		73980	$500	$500
60	**WATER COMPANY**	2008	FORD	RANGER	PICKUP	1FTZR45E88PA38085	$22,397		01499	$500	$500
61	**PUBLIC WORKS**	2008	FORD	F150	PICKUP	1FTVF14508KB29744	$19,697		01499	$500	$500
62	**FIRE DEPT**	2007	FORD	CABCHASSIS	TRUCK	3FRML55Z67V554788	$80,653		79090	$500	$500
63	**PLUS**	2008	FORD	EXPLORER	WAGON	1FMFU73F58UA18729	$24,341		73980	$500	$500
64	**HEALTH DEPT**	2008	FORD	RANGER	PICKUP	1FTYR11U68PA20658	$16,043		01499	$500	$500
65	**HEALTH DEPT**	2008	FORD	RANGER	PICKUP	1FTYR11U88PA19253	$15,720		01499	$500	$500
66	**PUBLIC WORKS**	2008	FORD	RANGER	PICKUP	1FTYR11UX8PA19254	$15,720		01499	$500	$500
67	**PLUS**	2008	FORD	RANGER	PICKUP	1FTYR11U18PA19255	$15,720		01499	$500	$500
68	**WATER COMPANY**	2008	LOADRITE		TRAILER	5A4PNFH1182001349	$1,685		68499	$500	$500
69	**LAND BANK**	2008	LOAD RITE	UTILITY	TRAILER	4ZEUT122381051314	$2,396		68499	$500	$500
70	**LAND BANK**	2008	FORD	F550	CHASSIS CAB	1FDAF57Y68EE22991	$38,515		21499	$500	$500
71	**NATURAL RESOURCE**	2009	FORD	F250	PICKUP	1FTSX21579EA10504	$25,118		01499	$500	$500
72	**PUBLIC WORKS**	2009	STERLING	DUMP	TRUCK	2FZAAWBS29AAJ9157	$92,450		31479	$500	$500
73	**SEWER DEPARTMENT**	2009	STERLING	LT8500	DUMP	2FZHAWBS39AAF7295	$120,032		40479	$500	$500
74	**PUBLIC WORKS**	2009	FORD	ESCAPE	UTILITY	1FMCU59329KB80753	$28,470		73980	$500	$500
75	**FIRE DEPT**	2008	HME	SPO	FIRE TRUCK	44KFT428X8WZ21477	$496,000		79090	$500	$500
76	**TOWN ADMINISTRATION**	2009	FORD	ESCAPE	UTILITY	1FMCU59359KC41349	$32,535		73980	$500	$500
77	**SEWER DEPARTMENT**	2010	FORD	F450	DUMP	1FDAF4HY3AEA24006	$44,940		21479	$500	$500
78	**AIRPORT**	2010	JOHN DEERE	772c	GRADER	DW772GP627874	$277,758		79650	$500	$500
79	**SEWER DEPARTMENT**	2011	FORD	F450	UTILITY	1FD0X4HYXBEA65212	$87,290		21479	$500	$500
80	**FIRE DEPT**	2010	FOAM	TANK	TRAILER	1S9FT192X00407231	$76,294		68499	$500	$500
81	**POLICE**	2011	FORD	E250	VAN	1FTNE2EL8BDA48136	$29,616		79120	$500	$500
82	**AIRPORT**	2011	ELDORADO	1871	BUS	1FDEE3FL4BDB09630	$45,131		65820	$500	$500
83	**AIRPORT**	2011	ELDORADO	1871	BUS	1FDEE3FL6BDB09631	$45,131		65820	$500	$500
84	**FIRE DEPT**	2011	HME		FIRE TRUCK	44KFT4287BWZ22058	$449,286		79090	$500	$500
85	**HARBORMASTER**	2011	FORD	F250	PICKUP	1FTBF2B60BED08537	$27,662		01499	$500	$500
86	**PUBLIC WORKS**	2011	KUBOTA	M4070	TRACTOR	M7040DTC187798	$31,295		79650	$500	$500
87	**PUBLIC WORKS**	2012	FORD	F550	PACKER	1FDUF5GT1CEA71403	$82,865		21499	$500	$500
88	**SCHOOL**	2012	FORD	F350	DUMP	1FDRF3H65CEA59404	$50,000		21479	$500	$500
89	**POLICE**	2013	FORD	EXPLORER	UTILITY	1FM5K8D87DGA51230	$37,036		79110	$500	$500
90	**POLICE**	2012	FORD	E350	VAN	1FBNE3BL2CDB25535	$27,934		79110	$500	$500
91	**POLICE**	2012	HD	FLHTP	M/C	1HD1FMM12CB668256	$16,552		79420	$500	$500
92	**POLICE**	2012	HD	FLHTP	M/C	1HD1FMM15CB663424	$16,552		79420	$500	$500
93	**SEWER DEPARTMENT**	2013	INTL	7400	VACUUM	1HTWDAZR2DH303202	$85,476		31499	$500	$500

94	**POLICE**	2013	FORD	EXPLORER	UTILITY	1FM5K8D82DGB21023	$37,036		79110	$500	$500
95	**PUBLIC WORKS**	2005	BOBCAT	SKID	LOADER	525019209	$17,500		79650	$500	$500
96	**POLICE**	2013	FORD	EXPLORER	UTILITY	1FM5K8AR7DGA89022	$36,736		79110	$500	$500
97	**LAND BANK**	2013	LOAD	UTILITY	TRAILER	4ZECH122XD1943041	$4,172		68499	$500	$500
98	**POLICE**	2013	FORD	EXPLORER	UTILITY	1FM5K8AR4DGA89057	$37,650		79110	$500	$500
99	**LAND BANK**	2013	FORD	F150	PICKUP	1FTPF1FF4DKF94714	$26,567		01499	$500	$500
100	**PUBLIC WORKS**	2013	INTL	DUMP	TRUCK	1HTMMAAR7DH482615	$160,204		31479	$500	$500
101	**POLICE**	2013	FORD	F250	PICKUP	1FT7X2B61DEB00768	$50,760		79120	$500	$500
102	**LAND BANK**	1986	CHEVROLET	CUCV	PICKUP	1GCGD34J4GF443492	$15,000		79110	$500	$500
103	**FINANCE/ASSESSORS**	2014	FORD	EXPLORER	UTILITY	1FM5K8AR1EGA70886	$32,940		79080	$500	$500
104	**POLICE**	2014	FORD	EXPEDITION	UTILITY	1FMJU1J55EEF15042	$32,173		79110	$500	$500
105	**FIRE DEPT**	2013	CHEVROLET	HORTON TYPE III	AMBULANCE	1GB6G5CL8D1115362	$159,950		79130	$500	$500
106	**PUBLIC WORKS**	2014	CARRY	UTILITY	TRAILER	4YMUL1216EV053331	$1,797		68499	$500	$500
107	**AIRPORT**	2014	JOHN DEERE	724K	LOADER	1DW724KZTED661804	$271,085		79650	$500	$500
108	**FINANCE/ASSESSORS**	2006	FORD	EXPLORER	UTILITY	1FMEU74E06UB30012	$32,425		01499	$500	$500
109	**SEWER DEPARTMENT**	2015	FORD	F450	TRUCK	1FDUF4HY9FEA66118	$87,583		21499	$500	$500
110	**PUBLIC WORKS**	2015	INTL	7400SBA	DUMP	3HAWHAZT3FL653595	$143,817		40479	$500	$500
111	**HARBORMASTER**	2015	FORD	F250	PICKUP	1FTBF2B69FEB32660	$31,908		79110	$500	$500
112	**PUBLIC WORKS**	2014	JOHN DEERE	5085M	TRACTOR	1LV5085MHEJ644262	$61,511		79650	$500	$500
113	**PUBLIC WORKS**	2007	FORD	F350	PICKUP	1FTWF31597RA99354	$26,231		01499	$500	$500
114	**LAND BANK**	2015	FORD	F250	PICKUP	1FTBF2B62FEC37959	$23,363		01499	$500	$500
115	**SEWER DEPARTMENT**	2015	FRT	108SD	TRUCK	1FVAG5CY3FHGD9453	$91,362		31499	$500	$500
116	**AIRPORT**	2015	FORD	F250	PICKUP	1FT7X2BT8FEB98500	$57,390		1499	$500	$500
117	**POLICE**	2015	FORD	K8D	SUV	1FM5K8D83FGB62327	$36,320		79110	$500	$500
118	**SEWER DEPARTMENT**	2014	UTILITY		TRAILER	1Z9BU1010DM026216	$15,167		68499	$500	$500
119	**SEWER DEPARTMENT**	2014	UTILITY		TRAILER	1Z9BU1012DM026217	$15,167		68499	$500	$500
120	**SEWER DEPARTMENT**	2014	UTILITY		TRAILER	1z9BU1014DM026218	$15,167		68499	$500	$500
121	**SEWER DEPARTMENT**	2014	UTILITY		TRAILER	1Z9PU1422EM026017	$27,012		68499	$500	$500
122	**SEWER DEPARTMENT**	2014	FORD	EXPLORER	UTILITY	1FM5K8B88EGB80047	$32,185		01499	$500	$500
123	**AIRPORT**	2012	FORD	F350	PICKUP	1FDRF3HT4CFC05586	$62,917		01499	$500	$500
124	**PUBLIC WORKS**	2014	BOBCAT	LOADER	LOADER	ALJU1236005022014	$71,177		79650	$500	$500
125	**POLICE**	2015	FORD	EXPLORER		1FM5K8AR0FGA88605	$40,099		79110	$500	$500
126	**HARBORMASTER**	2015	FORD	F250	PICKUP	1FTBF2B60FEC98873	$27,554		79110	$500	$500
127	**PUBLIC WORKS**	2015	TRACKLESS ROI	ROPS	CAB	MT61916	$127,365		79340	$500	$500
128	**POLICE**	2015	FORD	TRANSIT	VAN	1FTSW3XM9FKA59577	$36,235		79110	$500	$500
129	**LAND BANK**	2015	FORD	F150	PICKUP	1FTMF1E82FFA60968	$22,037		01499	$500	$500
130	**LAND BANK**	2015	FORD	F150	PICKUP	1FTMF1E80FFA60967	$22,037		01499	$500	$500
131	**PLUS**	2015	JEEP	PATRIOT	WAGON	1C4NJRBB3FD437420	$21,940		01499	$500	$500
132	**AIRPORT**	2015	OSHKOS	FIRE	TRUCK	10TADLJF8FA774072	$629,747		79090	$500	$500
133	**PUBLIC WORKS**	2008	CAT	420E	BACKHOE	CAT0420EHHLS07972	$74,000		79340	$500	$500
134	**PUBLIC WORKS**	2015	DOWNE	TL718	UTILITY	5RSLU1823FT00596	$3,999		68499	$500	$500
135	**POLICE**	2015	FORD	F350	VAN	1FT8X3B68FEC82434	$48,465		79110	$500	$500
136	**OUR ISLAND HOME**	2015	FORD	TRANSIT	VAN	1FTNR2CM4FKB26221	$33,190		64810	$500	$500
137	**PUBLIC WORKS**	2015	VERME	CONST	TRAIL	1VRY1119XF1022478	$35,036		68499	$500	$500
138	**AIRPORT**	2016	Ford	EXPLORER	SUV	1FM5K8D8XGGB43646	$37,005		01499	$500	$500
139	**FIRE DEPT**	1998	STEWAR	M1088	TRACTOR	T010771BDJG	$200,000		79090	$500	$500

140	**FIRE DEPT**	1998	STEWAR	M1088	TRACTOR	T010762BDJC	$200,000		79090	$500	$500
141	**FIRE DEPT**	1992	AM GENERAL	HMMWV	CARGO	3101609	$200,000		79090	$500	$500
142	**LAND BANK**	1992	AM GENERAL	HMMWV	CARGO	006978	$41,061		79090	$500	$500
143	**FIRE DEPT**	2016	FORD	EXPEDITION	SUV	1FMJU1G12FEG23463	$39,472		79080	$500	$500
144	**NATURAL RESOURCE**	2017	CHEVROLET	SILVERADO	PICKUP	1GC1KUEG1GF147740	$30,565		01499	$500	$500
145	**HEALTH DEPT**	2016	FORD	FUSION	SEDAN	2FA6PU6GR189283	$29,311		01499	$500	$500
146	**LAND BANK**	2016	FORD	F150	PICKUP	1F7MF1E89GFB30256	$27,037		01499	$500	$500
147	**PUBLIC WORKS**	2016	FORD	F350	PICKUP	1FTRF3B65GEB89007	$47,316		21499	$500	$500
148	**PUBLIC WORKS**	2016	ELGIN	PELICAN	SWEEPER	NP30775	$200,000		79650	$500	$500
149	**AIRPORT**	2016	FORD	F250	PICKUP	1FT7W2B63GEB89010	$42,483		01499	$500	$500
150	**FIRE DEPT**	1986	AM GENERAL	HMMWV	CARGO	15711	$110,000		79090	$500	$500
151	**PUBLIC WORKS**	2016	FORD	F550	TRUCK	1FDUF5HY6GEB89009	$59,037		21499	$500	$500
152	**SCHOOL**	2016	LOADRITE		TRAILER	5A4GALJ10G2010548	$2,049		68499	$500	$500
153	**WATER COMPANY**	2016	FORD	F250	PICKUP	1FT7X2B68GEB79067	$52,490		01499	$500	$500
154	**WATER COMPANY**	2016	FORD	TRANSIT	VAN	NMOLS7E9F1176079	$25,160		01499	$500	$500
155	**FIRE DEPT**	2016	FORD	F150	PICKUP	1FTX1EG3GFA34670	$31,932		79090	$500	$500
156	**AIRPORT**	2016	FORD	F350	VAN	1FDWE3FSXGDC55730	$57,824		21499	$500	$500
157	**FIRE DEPT**	2016	FORD	EXPEDITION	UTILITY	1FMJU1GTXGEF15529	$36,407		79080	$500	$500
158	**SCHOOL**	2017	Ford	ESCAPE	SEDAN	1FMCU9GD6HUA73291	$28,500		79260	$500	$500
159	**PUBLIC WORKS**	2017	CAM	SUPERLINE	TRAILER	5JPBU2521JP047291	$7,220		68499	$500	$500
160	**FIRE DEPT**	2016	FORD	F550	AMBULANCE	1FDUF5HT8GEC26307	$246,646		79130	$500	$500
161	**POLICE**	2016	FORD	F250	PICKUP	1FT7X2B65GED29653	$45,596		79100	$500	$500
162	**PUBLIC WORKS**	2017	CHEVROLET	SILVERADO	PICKUP	1GCK2UEG1HZ158662	$43,120		01499	$500	$500
163	**PLUS**	2017	JEEP	PATRIOT	UTILITY	1C4NJRBB2HD208584	$19,895		01499	$500	$500
164	**PLUS**	2017	JEEP	PATRIOT	UTILITY	1C4NJRBB0HD208583	$19,895		01499	$500	$500
165	**SCHOOL**	2017	FORD	F350	TRUCK	1FDRF3H68HEB23801	$48,305		21499	$500	$500
166	**PUBLIC WORKS**	2017	FORD	TRANSIT	VAN	1FTYR2XM5HKA35095	$38,594		01499	$500	$500
167	**AIRPORT**	2014	JOHN DEERE	COMPACT LOADER	LOADER	1T0319EJTEJ263876	$78,378		79650	$500	$500
168	**SEWER DEPARTMENT**	2017	CHEVROLET	SILVERADO	PICKUP	1GCVKNEC6HZ200727	$33,590		01499	$500	$500
169	**PUBLIC WORKS**	2016	KM		TRAILER	1K9BU2022GN246272	$30,670		68499	$500	$500
170	**PUBLIC WORKS**	2016	KM		TRAILER	1K9BU242XGN246353	$75,412		68499	$500	$500
171	**POLICE**	2016	FORD	EXPLORER	UTILITY	1FM5K8ARAHGB34462	$29,601		79110	$500	$500
172	**SEWER DEPARTMENT**	2017	FTL	114SD	REFUSE	1FVHG3DV7HHJE6513	$218,177		50453	$500	$500
173	**HARBORMASTER**	2006	LOAD	BOAT	TRAILER	4YPAB23216T041526	$2,000		68499	$500	$500
174	**SEWER DEPARTMENT**	2017	CHEVROLET	CITY EXP	UTILITY	3N63M0YN3HK704793	$26,134		01499	$500	$500
175	**PUBLIC WORKS**	2017	FREIGHTLINER	114SD	FIRE	1FVHG3DV2HHJE5494	$196,471		40479	$500	$500
176	**POLICE**	2017	FORD	EXPLORER	UTILITY	1FM5K8D83HGC79098	$39,116		79110	$500	$500
177	**POLICE**	2017	FORD	EXPLORER	UTILITY	1FM5K8D81HGC79097	$39,116		79110	$500	$500
178	**POLICE**	2017	FORD	250	PICKUP	1FT7X2B62HED70677	$49,055		79110	$500	$500
179	**PUBLIC WORKS**	2017	SATELITTE	RESTROOM	TRAILER	4S98E19SXH2345573	$49,165		68499	$500	$500
180	**PUBLIC WORKS**	2017	FHT	DUMP	TRUCK	1FVAGCY5HHJE5496	$186,369		31479	$500	$500
181	**SEWER DEPARTMENT**	2016	FORD	F350	PICKUP	1FT7X2B8XGED47968	$37,566		01499	$500	$500
182	**LAND BANK**	2017	LOADRITE	EP22	TRAILER	5A4DCFV27H2011246	$3,200		68199	$500	$500
183	**NATURAL RESOURCE**	2017	LOADRITE	UTILITY	TRAILER	5A4DCFV2X2011161	$2,835		68199	$500	$500
184	**NATURAL RESOURCE**	2017	LOADRITE	UTILITY	TRAILER	5A4XJRJ18E2019918	$750		68199	$500	$500
185	**PUBLIC WORKS**	2006	ANDERSON	TAG ALONG	TRAILER	4YNBN25266C039417	$7,660		68199	$500	$500

186	**WATER COMPANY**	2017	FORD	F150	PICKUP	1FTEX1E8XHFB28311	$43,633		01499	$500	$500
187	**FIRE DEPT**	2010	FORD	EXPEDITION	UTILITY	1FMJU1G55AEA29042	$37,985		79080	$500	$500
188	**PUBLIC WORKS**	2017	NORAM	65E	GRADER	65ET10230	$174,900		79650	$500	$500
189	**FIRE DEPT**	2017	FORD	F550	AMBULANCE	1FDWF54T24DA06877	$257,774		79130	$500	$500
190	**SEWER DEPARTMENT**	2018	FREIGHTLINER	M2106	SEWER TRUCK	1FVACXFCXFC4JHJL8654	$294,673		31499	$500	$500
191	**PUBLIC WORKS**	2018	FORD	F550	DUMP	1FDUF5HY8JEB13783	$68,539		21499	$500	$500
192	**PUBLIC WORKS**	2018	FORD	F350	TRUCK	1FTRF3B67JEB13781	$43,193		21499	$500	$500
193	**PLUS**	2017	JEEP	RENEGADE	UTILITY	ZACCJBAB7HPG30044	$21,855		01499	$500	$500
194	**POLICE**	2018	FORD	EXPLORER	UTILITY	FM5K8AR2JGA89957	$45,969		79110	$500	$500
195	**POLICE**	2018	FORD	EXPEDITION	UTILITY	1FMJU1JTXJEA25771	$55,513		79110	$500	$500
196	**PUBLIC WORKS**	2016	LOADRITE	UT8314	TRAILER	4ZEUT1426G1115096	$3,200		68499	$500	$500
197	**PUBLIC WORKS**	2016	LOADRITE	CH8316	TRAILER	4ZECH1625G1115097	$4,800		68499	$500	$500
198	**POLICE**	2018	FORD	EXPLORER	UTILITY	1FM5K8AR0JGA83705	$39,228		79110	$500	$500
199	**AIRPORT**	2018	FORD	F150	PICKUP	1FTMF1EBXJKE40622	30088		1499	$500	$500
200	**SCHOOL**	2017	KUBOTA	RTVX1100CW	UTILITY	A5KC2GDBEHG039014	$17,915		01499	$500	$500
201	**SCHOOL**	2017	KUBOTA	RTVX1100CW	UTILITY	A5KC2GDBPHG039132	$26,209		01499	$500	$500
202	**SEWER DEPARTMENT**	2018	RAM	CAMERA PROMASTE	VAN	3C6URVJG5JE134583	$217,035		01499	$500	$500
203	**NATURAL RESOURCE**	2018	FORD	F150	PICKUP	1FTFW1E50JKF08963	33167		01499	$500	$500
204	**WATER COMPANY**	2018	FORD	F150	PICKUP	1FTEX1EP8JKF00202	41850		01499	$500	$500
205	**SEWER DEPARTMENT**	2018	FORD	F350	PICKUP	1FDRF3B64JEC70163	$57,548		21499	$500	$500
206	**SEWER DEPARTMENT**	2019	FORD	F250	PICKUP	1FT7W2B64KEC48381	$51,953		01499	$500	$500
207	**SEWER DEPARTMENT**	2019	INTERNATIONAL	HV607	TRUCK	3HTESTZT8KN322364	$161,818		40499	$500	$500
208	**POLICE**	2018	FORD	EXPLORER	UTILITY	1FM5K8AR3JGC17820	$42,056		79110	$500	$500
209	**PUBLIC WORKS**	2018	FREIGHTLINER	M2106	TRUCK	1ALACXFC5JDJN4111	$137,730		31499	$500	$500
210	**PUBLIC WORKS**	2018	CAT	299D2	LOADER	CAT0299DKDX203309	$89,590		79120	$500	$500
211	**PUBLIC WORKS**	2018	CAT	CS448	COMPACTOR	CATCS44BPCS300638	$128,900		79120	$500	$500
212	**PUBLIC WORKS**	2019	CAM	UTILITY	TRAILER	5JWCK3126KP071488	$15,350		68499	$500	$500
213	**PUBLIC WORKS**	2019	CAM	UTILITY	TRAILER	5JWCG2421KP071843	$10,921		68499	$500	$500
214	**AIRPORT**	2019	FORD	EXPLORER	UTILITY	1FM5K8D86KGA62426	$42,691		01499	$500	$500
215	**PUBLIC WORKS**	2018	FREIGHTLINER	SD114	TRUCK	1FVAG3FEXJHJs1193	$356,500		34499	$500	$500
216	**SEWER DEPARTMENT**	2019	CAM	UTILITY	TRAILER	5JWCK2728KP500695	$21,900		68499	$500	$500
217	**POLICE**	2018	FORD	EXPLORER	UTILITY	1FM5K8AR3JGC17821	$35,562		79110	$500	$500
218	**POLICE**	2018	FORD	EXPLORER	UTILITY	1FM5K8AR3JGC17822	$36,584		79110	$500	$500
219	**PUBLIC WORKS**	2019	FORD	F550	DUMP	1FDUF5HY4KED88620	$72,439		21499	$500	$500
220	**WATER COMPANY**	1996	HOMEMADE	LE4000	TRAILER	NONE	$6,664		68499	$500	$500
221	**NATURAL RESOURCE**	2019	FORD	F150	PICKUP	1FTEW1EB7KFB91002	$32,065		01499	$500	$500
222	**PUBLIC WORKS**	2019	FORD	F550	TRUCK	1FDUF5HY8KED88619	$73,374		21499	$500	$500
223	**PUBLIC WORKS**	2019	SULLAIR	185DPQ-KU	TRAILER	20181210005	$12,000		68499	$500	$500
224	**HEALTH DEPT**	2019	FORD	RANGER	PICKUP	1FTER1FH3KLA46003	$25,935		01499	$500	$500
225	**SEWER DEPARTMENT**	2019	VER-MAC	PCMS-320	TRAILER	2S9US3111KS132133	$19,250		68499	$500	$500
226	**SEWER DEPARTMENT**	2019	CAT	SKID STEER		CAT0289DATAW1657	$104,500		79650	$500	$500
227	**SEWER DEPARTMENT**	2019	CAT	MIN EXCAVATOR		CAT0305EKH5M10436	$60,500		79650	$500	$500
228	**PUBLIC WORKS**	2019	CAT	938M WHEEL LOADER		CAT0938MHJ3T07659	$31,000		79650	$500	$500
229	**SEWER DEPARTMENT**	2020	BRAVO	SCOUT UTILITY	TRAILER	542BC1427LB030868	$6,995		68499	$500	$500
230	**SEWER DEPARTMENT**	2019	FORD	EXPLORER	UTILITY	1FM5K8DXKGA96904	$38,321		01499	$500	$500
231	**TOURISM**	2019	NISSAN	LEAF	HATCHBACK	1N4BZ1CP3KC310583	$41,450		01499	$500	$500
232	**LAND BANK**	2020	TOWMASTER	T-12DT	TRAILER	4KNBT2129LL160769	$8,298		68499	$500	$500

233	**HEALTH DEPT**	2019	FORD	RANGER	PICKUP	1FTER4FH1KLA65439	$35,225		01499	$500	$500
234	**AIRPORT**	2019	FORD	F550	DUMP	1FDUF5HY3KEG25016	$62,158		21499	$500	$500
235	**POLICE**	2019	FORD	F150	PICKUP	1FTFX1E43KKR17093	$35,000		79110	$500	$500
236	**POLICE**	2019	TOYOTA	CAMRY	SEDAN	4T1BZ1HK1KU509788	$25,000		79110	$500	$500
237	**PUBLIC WORKS**	2020	FORD	TRANSIT	UTILITY	NM0LS7E29L1458707	$25,967		01499	$500	$500
238	**FIRE DEPT**	2019	FORD	EXPEDITION	UTILITY	1FMJU1GT4KEA84260	$42,293		79080	$500	$500
239	**WATER COMPANY**	2020	FORD	F250	PICKUP	1FT7X2B66LED39070	$47,029		01499	$500	$500
240	**POLICE**	2019	FORD	EXPLORER	UTILITY	1FM5K8AR6KGA31867	$50,124		79110	$500	$500
241	**LAND BANK**	2019	FORD	F550	TRUCK	1FDUF5HTXKEG25101	$71,036		21499	$500	$500
242	**LAND BANK**	2019	VERMER	BRUSH CHIPPER	TRAILER	1VRY11195K1028554	$44,086		68499	$500	$500
243	**POLICE**	2019	FORD	EXPLORER	UTILITY	1FM5K8AR9KGA31880	$39,283		79100	$500	$500
244	**POLICE**	2019	FORD	EXPLORER	UTILITY	1FM5K8AR0KGA31881	$39,283		79100	$500	$500
245	**NATURAL RESOURCE**	2018	LOAD RITE		TRAILER	5ARS3T21J2007452	$6,340		68499	$500	$500
246	**SEWER DEPARTMENT**	2020	HINO	195-20	TRUCK	JHHKDM2H0LK001436	$206,000		21499	$500	$500
247	**LAND BANK**	2020	FORD	RANGER	PICKUP	1FTER1FH0LLA05037	$29,870		01499	$500	$500
248	**LAND BANK**	2019	JOHN DEERE	5100E	TRACTOR	1LV5100EPKK406941	$87,530		79650	$500	$500
249	**FIRE DEPT**	2020	FORD	F550	AMBULANCE	1FDUF5HT6LEC53399	$325,457		79090	$500	$500
250	**POLICE**	2020	FORD	ESCAPE	UTILITY	1FMCU9F68LUB73436	$27,240		79100	$500	$500
251	**POLICE**	2021	FORD	F150	PICKUP	1FTEWIP40LKF19500	$54,524		79100	$500	$500
252	**FIRE DEPT**	1994	STEWART	M1078	TRUCK	T0001708H	$200,000		31499	$500	$500
253	**AIRPORT**	2021	FORD	E350	VAN	1FDEE3FN9MDC30741	$73,291		65820	$500	$500
	AIRPORT	2021	FORD	F350	TRUCK	1FDRF3B6XMEC63173	$48,552		21499	$500	$500
	LAND BANK	2021	FORD	TRANSIT	VAN	1FTBR1Y89MKA35144	$32,877		01499	$500	$500
	SEWER DEPARTMENT	2021	FORD	F650	DUMP	1FDNF6AN0MDF06360	$84,040		31499	$500	$500
	SEWER DEPARTMENT	2021	WESTERN STAR	SEWER	TRUCK	5KKHAVDVXMLMU5366	$453,771		50499	$500	$500
	SCHOOL	2020	FORD	ECOSPORT	SUV	MAJ6S3JLXLC394016	$28,337		79420	$500	$500
	FIRE DEPT	2022	INTERSTATE	CARGO	TRAILER	1UK500K28N1105080	$12,014		$500	$500	$500
	SCHOOL	2021	BOBCAT	SKID STEER	TRACTOR	20179	$63,613		79650	$500	$500
						Total:	$18,656,359				