



Cairo Air Improvement Project
Compressed Natural Gas Component

Operations and Maintenance Manual for
CTA and GCBC CNG Garages

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Introduction

Purpose of This Manual

This Operations and Maintenance Manual, submitted herein, is comprised of *recommendations* specific to the CNG Pilot Fleet and *recommendations* regarding basic Fleet Maintenance and Management. These recommendations are offered only as a *guideline* for the proper operation and maintenance of the CNG Pilot Fleet according to international industry best standards and practices. This manual is part of CAIP's efforts to assist the Transit Authorities in the proper servicing, and ultimately, the long-term sustainability of the CNG Pilot Fleet.

How To Use This Manual

These recommendations are to be used in tandem with and *as a supplement to the service manuals provided by the component manufacturers for the CNG buses*. This manual addresses basic policy, procedure and maintenance issues, but not the specific servicing requirements for the various components of the CNG buses, nor the particular organizational circumstances of the Transit Companies. CAIP understands certain impediments may exist in implementing some of the recommendations and further realizes that the Transit Companies will choose to modify and implement recommendations based on their individual organizational infrastructures.

Contents of This Manual

The recommendations contained herein are laid out in three sections: I. Recommended Emergency, Operating and Safety Procedures; II. Recommended Management Policies; and III. Recommended Preventive Maintenance and Inspection Program. The necessity of establishing well-designed structures for all three cannot be overstated. Comprehensive Procedures, clear Policies and a strictly adhered to Preventive Maintenance and Inspection Program will reinforce each other and establish the foundation for the sustainability of the CNG Fleet.

Compartmentalizing areas of responsibility is key to the success of any business organization. In an organization where "everyone is responsible for everything," the result is that "no one" is responsible for "anything." The following Draft Procedures and Provisions are offered for consideration:

- Emergency Procedures
- Standard Operating Procedures
- General Safety Procedures
- Work Orders

Authority-specific policies should be considered critical to the sustainability of the CNG Pilot Fleet. Monitoring and enforcement of said policies would assist in ensuring that the CNG Pilot Fleet is safe and reliable. Policies must be clearly defined and communicated. Over time, recurrent situations will arise and require the creation of additional policies or the revision of existing policies in order to maintain the efficient operation of the CNG Fleet and the safety of the employees and the public. The following Draft Policies are submitted for consideration:

- Preventive Maintenance
- Record Keeping
- Towing
- Employee Orientation
- Training, Certification and Re-certification
- Safety
- Lincoln Composite CNG Cylinder and CNG Fuel System Policy

Properly performed inspections detect potential failures before they happen. The baseline information specific to maintenance schedules for the Fleet will need to be modified from time to time based on the actual experience of managing the CNG Pilot Fleet. The following Preventive Maintenance and Inspection Program was recommended by the manufacturers (OEM) and is offered for consideration:

- First Inspection after Acceptance/5,000km
- Daily Inspection Checklist
- 10,000km Maintenance Inspection
- 20,000km Maintenance Inspection
- 30,000km Maintenance Inspection

The information provided herein offers a *model structure* based on international best standards and practices for the management and maintenance of any CNG bus fleet. It will be the *experience* of managing the CNG Pilot Fleet over time that will necessitate the local decisions to modify these draft policies, procedures and the maintenance and inspection program, and ultimately, create the true sustainability of the CNG Pilot Fleet.

Operations and Maintenance Manual

SECTION I: Recommended Emergency, Operating and Safety Procedures

A. Emergency Procedures

Managers shall ensure that all employees have received training regarding CNG safety issues, and that employees know how to respond to emergencies and potential emergencies.

A.1. Facilities

Each CNG Bus Maintenance Facility is equipped with a CNG Leak Detection System.

A.1.1. First Stage Alarm

When the system senses a presence of natural gas at 20% of the lower explosive limit, visual and audible alarms will activate. The audible alarm will be intermittent. *Employees shall immediately move to a pre-designated assembly area for instructions.* Supervisors shall investigate the cause of the alarm and take appropriate action. Appropriate action shall include, but not be limited to:

- Assign Employees as needed to determine source of and stop CNG leak, if any.
- Contact Fire Department, if required.
- Shut down all facility electrical power.

A.1.2. Second Stage Alarm

When the system senses a presence of natural gas at 40% of the lower explosive limit, visual and audible alarms will activate. The audible alarm will be constant. *Employees shall immediately move to a pre-designated evacuation area unless instructed otherwise.* Supervisors shall investigate the cause of the alarm and take appropriate action. Appropriate action shall include, but not be limited to:

- Assign Employees as needed to determine source of and stop CNG leak, if any.
- Contact Fire Department, if required.
- Shut down all facility electrical power.

A.2. Vehicles

Each CNG Bus is equipped with a CNG Leak Detection System. When the system senses a leak, it will not allow the engine to start, *or* if the engine is running – the CNG Leak Detection System will shut off the fuel to the engine. All drivers and appropriate maintenance staff shall receive training on the function and use of the CNG Leak Detection System. Drivers must check the CNG Leak Detection System upon entering the bus to verify the system is functioning properly and verify there is no indication of a leak. Any indication of a system not functioning properly shall be reported immediately. Any indication of a leak shall prompt the following actions:

- Immediately evacuate the vehicle.
- Turn off the fuel at the Emergency CNG Fuel Shut-off Valve.
- Notify emergency-response and maintenance personnel.

A.3. CNG Fuel Venting Procedures

- Venting of CNG Cylinders shall be performed only by authorized, certified, trained staff.
- CNG venting requires the use of a grounding device.
- Venting of CNG requires an authorized person to stay with the vehicle during the entire venting process.
- No open flames and/or smoking within 50 meters of the fuel venting activity.
- A person shall be assigned and stationed near the vehicle to ensure that no unauthorized persons enter the vicinity of the bus being vented.
- All tanks shall be isolated so only the “target” tank will be vented.

A.4. CNG Emergency Response Procedures

In case of a vehicle accident or CNG Cylinder leak, the persons responding must be knowledgeable about the vehicle CNG system.

- Drivers should immediately turn off the fuel at the Emergency CNG Fuel Shut-off Valve and notify emergency response entities.
- Emergency-response staff should ensure fuel has been turned off at the Emergency CNG Fuel Shut-off Valve.

B. Standard Operating Procedures

As a condition of employment, employees are required to comply with all policies, rules and regulations governing employment with the Transit Authority. Violations shall be grounds for disciplinary action including, but not limited to, dismissal, demotion and/or suspension.

Additionally, garage managers may promulgate, with the approval of the Chairman, codes of conduct for employees in their departments that prescribe standards peculiar and appropriate to the function and purpose for which the department was created or exists. Department codes of conduct shall further govern the conduct of employees and, if violated, shall be grounds for disciplinary action including, but not limited to, dismissal, demotion and/or suspension.

The Standard Operating Procedures (SOP) herein govern the employees working in the Maintenance Division of the Transit Authority. Violation of the SOP's may be cause for disciplinary action up to and including termination. Therefore, it is the duty and responsibility of each employee to read and become familiar with the contents of all Transit Authority SOP's. It is the responsibility of the employee to read, understand and comply with all such rules and regulations. Any employee who does not understand any rule(s) or guideline(s) is required to ask his immediate supervisor for clarification. These rules and guidelines may be amended or changed as needed. Any changes will be made a part of this guidebook through the issue of revised pages.

Safety is of primary importance in the performance of each employee's duties. Our service to the public demands the faithful, intelligent and courteous performance of duties, with full realization that passengers are the Transit Authority's most valuable assets. Every effort should be directed toward ensuring that each passenger is safe and as comfortable as possible. Suggestions on matters concerning safety or improvement of the Transit Authority's operations are always welcomed. Such suggestions should be forwarded to your supervisor.

B.1. Major Infractions

In accordance with policy, major rule infractions may be cause for disciplinary action up to and including termination. Major rule infractions may include, but are not limited to, the following:

1. Gross misconduct.
2. Insubordination.
3. Use or possession of intoxicants, narcotics or drugs.
4. Physical altercations or threats.
5. Tampering.
6. Theft.
7. Falsification of sick reports or bereavement requests.
8. Absent without permission.
9. Excessive absenteeism.
10. Suspension of driver's license.

B.2. Knowledge of Rules and Guidelines

B.2.1. General

Employees assigned to the Transit Authority are subject to the rules and guidelines contained in this guidebook.

B.2.2. Additional Orders and Instructions

Additional special orders and instructions are issued from time to time in the form of bulletins, notices and memos.

B.2.3. Postings

1. It is the responsibility of each employee to become familiar with and to comply with all posted notices.
2. Ignorance of any rule, regulation or notice posted will not be accepted as an excuse for failure to comply.
3. Defacement or unauthorized removal of any posted material is considered gross misconduct.

B.2.4. Meaning Of

If any doubt exists concerning the meaning of any rule, guideline, special order, notice or instruction, it is the responsibility of each employee to obtain clarification or request additional information from his immediate supervisor.

B.2.5. Responsibility

1. Each employee is responsible for:
 - a. Being familiar with Transit Authority's SOP's.
 - b. Accepting responsibility.
 - c. Carrying out orders.
2. Each employee must comply with oral or written instructions given from proper officials in matters pertaining to their respective area of responsibility.
3. Specific oral instructions will take precedence over a written rule in matters of, but not limited to:
 - a. Work priorities.
 - b. Use of tools.
 - c. Repair procedures.
4. Oral or written reports required must be accurate and submitted in a timely manner.

B.2.6. Situations Not Covered

1. Whenever a situation requiring prompt action arises, which is not covered by the Transit Authority's SOP's, the employee involved must use his best judgment in selecting the best course of action to follow.
2. Any action taken must be reported to one's immediate supervisor at once. Failure to do so is considered gross misconduct.

B.3. General Policies**B.3.1. General**

1. Employees are subject to examinations and tests as deemed necessary to assure mental and/or physical fitness to perform their assigned duties.
2. Employees must report for duty at the time and location to which they are assigned and do so dressed in their proper work clothes prior to start time.

B.3.2. Standards of Performance

1. The Transit Authority has the right to establish and require tests and standards of performance, as it deems necessary to ensure safe, efficient and competent performance of duty by its employees.
2. Maintenance staff will be held accountable for performing tasks in acceptable timeframes and of acceptable quality.

B.3.3. Training and Instruction

Employees must attend training and instruction sessions, as deemed necessary, and must pass all tests, examinations and qualifications that are applicable. Employees who fail to meet the standards may be subject to discipline up to and including termination.

B.3.4. Laws and Ordinances

1. The operation of Transit Authority vehicles is governed by laws, ordinances and regulations of the Government of Egypt. Such laws and ordinances are hereby made a part of this SOP.
2. Employees who operate vehicles property are required to cooperate with law enforcement agencies and local fire departments at all times. If such cooperation creates a dangerous condition, employees must submit a report to their immediate supervisor at once.

B.3.5. Licenses

1. All employees subject to operating Transit Authority equipment must renew their driver's license required for their job classification prior to the expiration of the license.

2. All employees subject to operating Transit Authority equipment must maintain and carry a valid driver's license required for their job classification.
3. A court order of suspension, revocation, cancellation or disqualification of an employee's driving privileges, must be reported to his immediate supervisor or appropriate department head at once. Failure to do so is considered gross misconduct.

B.3.6. Equipment and Supplies

1. Employees are responsible for having any required tools and equipment for performing their duties when reporting for work and while on duty.
2. All tools must be maintained in a safe operating condition at all times.
3. Employees must notify their immediate supervisor of unsafe tools or equipment at once. Failure to do so is considered gross misconduct.

B.3.7. Records, Personal

Employees must submit any updates in the following information to their immediate supervisor:

1. Name.
2. Home address.
3. Telephone number.
4. Emergency telephone number and the name of the contact person.

B.3.8. Disclosure of Transit Authority Information

1. Employees are prohibited from releasing any Transit Authority information concerning emergencies (e.g., accident, crime, etc.), pending projects and activities, meetings and discussions and personnel matters without proper authorization.
2. Oral or written inquiries and requests for Transit Authority information shall be directed to your immediate supervisor for appropriate referral.

B.4. Transit Authority Property

B.4.1. General

1. All employees are personally responsible for safeguarding Transit Authority property in their possession or issued to them. The term property includes, but is not limited to, money, badges, keys, vehicles, tools, equipment, materials or facilities.
2. Property issued by the Transit Authority to employees remains the property of the Transit Authority and must be surrendered upon request.

3. The loss, damage or theft of any Transit Authority property must be reported at once to your immediate supervisor.
4. Information regarding unsafe conditions must be reported at once to your immediate supervisor.
5. All property issued by the Transit Authority must be surrendered when an employee terminates employment.
6. The value of property damaged, lost or not surrendered upon request may be charged against an employee's payroll account at replacement value.

B.4.2. Abuse of Transit Authority Property

All employees are prohibited from tampering, stealing, misusing, destroying, damaging or defacing Transit Authority property. Acts of this nature are considered gross misconduct.

B.4.3. Unauthorized Use of Transit Authority Property, Time or Personnel

Use of any Transit Authority property, time or personnel for personal gain or benefit, on non-Transit Authority business is prohibited at all times.

B.4.4. Computers and Data Processing Equipment

1. All Transit Authority data processing information generated (including, but not limited, to mainframe, personal computer, facsimile (fax) and Xerox information) is for Transit Authority business only.
2. Employees who handle Transit Authority data processing information are responsible for maintaining information confidentiality (e.g., clearing terminal screens when leaving work area, etc.).
3. Employees who handle Transit Authority data processing information are subject to termination for any of the following reasons:
 - a. Unauthorized use.
 - b. Abuse or tampering.
 - c. Inputting false information.

B.4.5. Removing and Exchanging Vehicle Parts

Unless authorized by the maintenance manager or designee, employees are prohibited from removing parts from one vehicle to install on another vehicle when parts are not in stock.

B.4.6. Lockers

1. If a Transit Authority-owned locker is assigned to an employee, the Transit Authority reserves the right to inspect the locker at any time.

2. Food items (other than lunches), flammables, firearms or other weapons, intoxicants, narcotics or other harmful drugs must not be stored in the lockers at any time.
3. The Transit Authority will not assume responsibility for the loss of any articles kept in the lockers or for the removal of locks from lockers.

B.4.7. Lost Articles

Articles found in Transit Authority vehicles or on Transit Authority property must be turned in by the finder to his immediate supervisor. The supervisor is responsible for turning in lost articles.

B.4.8. Employee Tools

Employees are responsible for securing and safeguarding their tools.

B.4.9. Private Vehicles

1. The Transit Authority reserves the right to search any privately owned vehicle parked on Transit Authority property.
2. Narcotics or other harmful drugs, intoxicants, firearms or other weapons, and illegal items are not to be brought on Transit Authority property.
3. Any privately owned vehicle parked on Transit Authority property is done so at the owner's own risk.

B.4.10. Personal Articles

The Transit Authority reserves the right to inspect any Employee's personal articles located on Transit Authority property at any time. The term personal articles includes, but is not limited to, toolboxes, lunch boxes, tote bags, etc.

B.4.11. Firearms and Weapons

Employees are forbidden from having firearms or other weapons on Transit Authority property at any time. Acts of this nature are considered as gross misconduct and will result in disciplinary action up to and including termination.

B.5. Absence from Work

B.5.1. General

Employees who fail to notify their immediate supervisor of their absence will not be compensated for time lost. Acts of this nature are considered as gross misconduct.

Employees are prohibited from feigning illness or injury in order to procure sick leave or to avoid working as assigned. Acts of this nature are considered as gross misconduct.

B.6. Personal Conduct

B.6.1. General

1. The Transit Authority expects its employees to be courteous and treat fellow employees with respect.
2. Words or acts of disrespect or hostility toward any Transit Authority supervisory personnel, fellow employees or patrons will not be tolerated.

B.6.2. Discipline

Employees must refrain from the following acts:

1. Carelessness of their own safety or that of others.
2. Indifference in the performance of their duties (e.g., poor work performance).
3. Conduct unbecoming an employee. The term conduct includes, but is not limited to, dishonesty (e.g., theft), intemperance, insubordination (e.g., refusing a direct order from supervisory personnel), abusive or obscene language, physical altercation, immoral behavior, gross carelessness or gross misconduct.
4. Violation of rules or willful neglect.
5. Falsification of any reports or statements.
6. Concealment of facts concerning matters under investigation.
7. Failure to report an on-duty accident of any nature.

B.6.3. Horseplay

1. Horseplay and/or pranks are prohibited while on duty or on Transit Authority property.
2. Employees who cause injuries because of horseplay and/or pranks may be held liable for compensation and medical expenses paid to the injured party and will be subjected to discipline.

B.6.4. Arrest

1. All cases of arrest of employees (either on or off duty) or citations for traffic violations while operating Transit Authority equipment must be reported at once to your immediate supervisor.
2. Employees convicted of a crime bringing discredit upon the Transit Authority may be subject to termination.

B.6.5. Smoking

Smoking is prohibited in all work areas designated as “No Smoking” and in any area where a fire hazard exists.

B.6.6. Accidents

1. Employees on the scene of a Transit Authority related accident must provide for the safety and comfort of persons involved in the accident and safeguard Transit Authority property until assistance arrives and they are relieved.
2. Employees must not move any injured person unless it is necessary to save the injured person’s life or protect them from further injury.
3. Employees must provide all information and documentation about an accident to authorized Transit Authority personnel immediately and under no circumstances shall the report be made any later than the same day of the occurrence.

C. General Safety Procedures

Safety is the exercise of good judgment declaring safe habits at work, at home and on the highway, and will protect you and your family from needless suffering and financial loss.

This section contains General Safety Provisions for all Transit Authority employees. This information is not intended to cover every hazard that might arise in the course of your duties. For those hazards that are not covered, you must use your good judgment. If you are not sure of the safest procedure, contact your supervisor immediately. It is mandatory that you read and become familiar with the rules in this SOP.

All employees shall comply with the rules contained in this section on a daily basis. Read them carefully and become fully acquainted with them as they are for your protection. Failure to comply with the rules may be cause for disciplinary action up to and including termination. No job is so urgent that you cannot take time to do it safely.

It is the Transit Authority's policy to provide safe working conditions for all employees and to promote continuing, vital safety for awareness at all levels, from top management to the individual worker. The Transit Authority strives to ensure that each employee is provided a safe and healthful work place with proper tools and machines to do the job without danger to life or health.

To attain maximum control, every employee must adhere to all safety rules and regulations. Because the Transit Authority considers *safety first*, the following safety rules common to most system areas must be adhered to by all employees.

Each employee must be familiar with and observe safety and conduct rules at all times while on Transit Authority property. Employees should not perform any maintenance function without a clear understanding from their supervisors about any existing hazards and the accompanying safe work practices for the task assigned. Employees must carry out their responsibilities for job safety as follows. Each employee fulfills his primary responsibility of personal safety by:

1. Knowing and complying with safety rules.
2. Immediately securing additional information or proper interpretation from the supervisor when any doubt exists regarding the exact meaning of a rule, notice or instruction.
3. Reporting hazardous and/or unsafe conditions immediately to the supervisor.
4. Reporting defective tools and equipment to the supervisor and marking them "Defective, Do Not Use."
5. Following good housekeeping practices.
6. Reporting at the earliest opportunity to the supervisor any personal injury. The employee should obtain medical attention as needed.
7. Handling situations not covered by rules or instructions:

- a. Whenever a situation arises, which is not covered by these rules, notices or instructions, employees must exercise their best judgment.
 - b. Situations involving unusual complications or accident hazards should be reported immediately to the supervisor.
8. Wearing appropriate safety equipment as required.

C.1. General Safety

1. Employees shall notify their supervisor for any of the following reasons:
 - a. An unsafe condition.
 - b. Any tools, machine or pieces of equipment not in good working order.
 - c. Any job-related personal injury.
2. In any situation not covered by rules, special orders, bulletins or other instructions, employees shall ask their immediate supervisor for direction.
3. Employees' conduct must be free from scuffling, practical jokes or horseplay while on duty or on any Transit Authority property.
4. Earplug phones equipped with radios shall not be worn.
5. Sunglasses, sun-sensor lenses (photo-gray lenses) or tinted prescription glasses shall not be worn indoors during any hours or outside during hours of darkness.
6. General precautions:
 - a. Exercise extra care on wet floors or other wet surfaces by reducing your speed and shortening your stride.
 - b. When working under a vehicle, be alert for changing clearances due to hanging equipment, valves and tanks.
 - c. Be alert for rough and uneven walking areas.
 - d. Employees must walk, NOT RUN.
7. Floors, walkways, steps and handrails must be kept free from oil or grease.
8. Employees shall immediately clean up any spilled oil, grease and or other fluid in their working area and notify their supervisor immediately of any spills that may cause a health or fire hazard.
9. The use of other than cleaning solvents, steam or manufacturer's recommended chemicals for cleaning parts, is prohibited.
10. Employees must not use solvents for cleaning their hands. Use hand cleaners furnished by the Transit Department.
11. Employees shall be alert at all times when working and when walking from one area to another. Watch for moving vehicles.

12. Employees using heating, cutting or welding equipment are required to be trained in the proper use of the equipment. No employee shall perform these operations without the use of a welding screen and proper training.
13. Employees are not permitted to turn off exhaust ventilation fans or systems without authorization.
14. Employees shall enter and exit Transit Authority property only at approved entrances and exits.
15. Employees shall handle high-pressure hose lines with a firm and steady grip to prevent hose from whipping about and causing injury.

C.2. Personal Protective Equipment

1. When performing a job requiring protective equipment use, employees shall wear the proper personal protective equipment. This equipment shall not be altered or abused in any way.
2. Eye protection devices shall be worn whenever there is a possibility of eye injury.
3. Safety glasses or safety spectacles provide minimum eye protection. Typical examples of when safety glasses or safety spectacles shall be worn include, but are not limited to, the following:
 - a. Operating grinders, using a drill press, power tools and wherever it is posted to wear safety glasses.
 - b. Welding goggles shall be worn when using welding equipment.
 - c. When performing any heli-arc or arc welding, a filter glass with the proper shade number shall be installed in the employee's welding helmet. A clear lens shall cover the filter glass to protect the filter plate.
4. Employees shall wear face protection devices whenever there is a possibility of facial injury.
 - a. Face shields shall be worn over suitable basic eye protection devices (i.e., safety glasses, spectacles or goggles). Typical examples of when shields shall be worn include, but are not limited to, the following:
 - i. woodworking, metal machining, buffing, polishing, wire brushing or any grinding operations where flying particles may strike the face.
 - ii. chassis and motor washing or with any high-pressure cleaning equipment.
 - b. Welding helmets shall be worn when using heli-arc or arc welding equipment.

C.3. Work Clothing

The following applies to employees working in Shops, Garages and Field locations:

1. Employees using welding, heating and cutting equipment shall wear long-sleeved clothing.
2. Leather welding jacket or apron must be worn when involved in welding operations.
3. When using oxygen, fuel, gas or arc welding equipment, employees shall not wear pants with cuffs.
4. When handling acids, caustics, toxics, chemicals, solvents or materials treated with creosote or other irritant:
 - a. Have all parts of the body covered.
 - b. Avoid spilling and remain clear of any spillage.
 - c. Avoid touching any parts of the body while handling or exposed to the irritant.

C.4. Electrical Safety

1. Purpose: To provide minimum safety requirements and assist in the elimination of accidents which may result from the operation, installation, removal, use and maintenance of electrical equipment and tools.
2. Energized Lines: Employees shall consider all electrical lines, cord plugs and outlet receptacles energized at all times.
3. Authorized Maintenance: Only Authorized and qualified person(s) shall make repairs or work on electrical equipment.
4. Frayed Wiring: Do not use any electrical equipment with deteriorated insulation.
5. Metal Ladders: No metal ladders shall be used within six (6) feet of live circuits.
6. "Keep Clear" Area: A clear space of at least one-meter shall be maintained in front of all electrical panels and switch gears.
7. Cord Protection: Protect electrical cords from oil, chemicals and rough surfaces.
8. Work Area: Do not attempt to use or start any electrical equipment if hands are wet or if standing on a wet surface. This includes diesel and gasoline, as well as water and other fluids.
9. Report any exposed electrical conduit or faulty electrical equipment to your supervisor.

C.5. Electric Welding and Cutting

The practices and procedures for electrical welding and cutting are the same as for gas welding/cutting except as indicated below.

1. **Work Area:** Where work permits, the work area shall be enclosed in an individual booth painted with a finish of low reflectivity, such as zinc oxide and lamp black, or must be enclosed with non-combustible screens having a similar low-reflectivity finish. Booths and screens must permit circulation of air at floor level. Workers or other persons adjacent to the welding areas must be protected from the rays by non-combustible or flameproof screens or shields, or must be required to wear appropriate goggles.
2. **Welding Machine:** Welding machines must be left on the outside of a confined space and heavy portable equipment must be blocked to prevent accidental movement. When operations are suspended for any substantial period of time, such as during lunch or overnight, welding machines must be shut off.
3. **Electrodes:** All electrodes must be removed from the holders and the holders must be carefully located to prevent accidental contact.
4. **Electrode Holders:** Current-carrying parts passing through the outer surfaces of the jaws of the holder must be insulated against the maximum voltage to ground.
5. **Cables/Connectors:** Only cable which is free from repair or splice for three meters from the electrode holder must be used.
6. **Defective Equipment:** Equipment having a defect must not be used and must be reported to the supervisor.
7. **Connectors/Regulators:** Only authorized connectors and regulators may be used. The procedures below must be followed:
 - a. Acetylene must not be generated, piped (except in approved cylinder manifolds), or utilized at a pressure in excess of one bar gauge pressure.
 - b. Back-flow protection must be provided by an approved device that will prevent oxygen from flowing into the fuel gas system or fuel from flowing into the oxygen system.
 - c. Mixtures of fuels, gases and air or oxygen may be explosive and must be guarded against. No device or attachment facilitating or permitting mixture of air or oxygen with combustible gases prior to consumption except at the burner or in a standard torch or blowpipe may be allowed unless approved for the purpose.
 - d. Oxygen may not be used from a cylinder or cylinder manifold unless a pressure-reducing device intended for use with oxygen, and so marked, is provided.
 - e. Fuel-gas must not be used from cylinders through torch or other devices equipped with shut-off valves without first reducing the pressure through a suitable regulator attached to the cylinder valve or manifold.

- f. Welding fuel-gas cylinders must be placed with the valve end up whenever they are in use. Nothing may be placed on top of an acetylene cylinder when in use that may damage the safety device or interfere with the quick closing of the valve.
 - g. Cylinders must be handled carefully. (*Note: Rough handling, knocks and falls are liable to damage the cylinder, valve or safety devices and result in leakage.*)
 - h. Before connecting a regulator to a cylinder valve, the valve must be opened slightly and closed immediately; this action is generally termed “cracking” and is intended to clear the valve of dust or dirt that might otherwise enter the regulator. The valve must be opened while standing to one side of the outlet; never in front of it. A fuel-gas cylinder valve must never be opened (cracked) near other welding work or near sparks, flames or other possible sources of ignition. *Exception: Hydrogen cylinders. See supplier’s instructions before connecting the regulator.*
 - i. Before a regulator is removed from a cylinder valve, the cylinder valve must be closed and the gas released from the regulator.
8. Greasy Materials: Oil or grease must not be permitted to come in contact with oxygen cylinders, valves, regulators or other fittings. Oxygen cylinders and apparatus must not be handled with oily hands or gloves, or greasy materials. A jet of oxygen must not be permitted to strike on oily surfaces and/or greasy clothes, or enter a fuel, oil or other storage tank.
 9. Shut-Off: When operations are suspended for any substantial period of time, such as during lunch or overnight, gas cylinders must be shut off.
 10. Hoses: Inspect hose lines frequently for leaks and obvious signs of deterioration.
 11. Torches: Torches in use must be inspected at the beginning of each working shift for leaking shut-off valves, hose couplings and tip connections. Defective torches must not be used. Clogged torch tip openings must be cleaned with suitable cleaning wires, drills or other devices designed for such purpose.
 12. Safety Devices: Safety devices must not be tampered with. The cylinder valve must always be opened slowly. An acetylene cylinder valve must not be opened more than one and one-half turns of the spindle and preferably no more than three-fourths of a turn.

C.6. Tools, Equipment and Machinery

1. Inspect tools, equipment and machines for defects prior to use. Report any defects to your immediate supervisor.
2. The proper tools shall be used in performance of the job.
3. Only authorized employees shall be permitted to operate power tools, power equipment or machinery.

4. Employees are not permitted to remove guards or modify machinery and power tools at any time.
5. Employees shall keep the machinery and power tools in proper adjustments as required. This includes tool rests for grinders.
6. Employees shall not brake or slow down moving machinery by foot, by hand or with any makeshift devices.
7. Employees shall keep workbenches in an orderly manner in order to prevent injuries and breakage.
8. Compressed gas cylinders shall be closed and pressure relieved from the regulator when work is finished or cylinders relocated.
9. Oxygen and fuel gas regulator shall have the proper check valve placed in line between the regulator and hose.
10. Employees are not permitted to use compressed air unless the following safety precautions are observed:
 - a. Before opening the air valve, be sure the coupling is tight and the hose is in good condition (no cracks or cuts).
 - b. When opening the air valve, hold the discharge end of the hose to prevent whipping.
 - c. Wear eye and other protective equipment suitable to the particular job.
 - d. When changing pneumatic tools do not kink the hose to shut off the air. Use the supply valve.
 - e. Use compressed air only for its intended purpose. Do not use for the following reasons:
 - i. To clean machines, tool tables, or other work surfaces.
 - ii. To blow dust off clothes.
 - iii. To dry off hands or body.
 - iv. To play practical jokes.
11. Employees shall keep their tools off the floor when not in use. When finished with a tool, it shall be returned to its proper place.
12. Only impact type sockets shall be used with impact wrenches. All impact wrench shanks, extensions and adapters must be equipped with locking devices.
13. Tools shall be disconnected from the power source when not in use, before servicing and when changing attachments.
14. When using a drill press, material being drilled shall be secured with a drill press vice or other securing equipment.

C.7. Hazardous Materials

1. Storage: All hazardous materials will be stored as prescribed by the manufacturer and/or law.
2. Spills: The supervisor shall be notified immediately of any hazardous material spills. Spills will be cleaned up as prescribed in the manufacturer and/or law.

C.8. Material Handling

1. Employees shall observe the following precautions when piling or stacking material:
 - a. Use proper blocking, spacers or supports.
 - b. Keep at a safe height.
2. Employees shall lift heavy objects in the following manner:
 - a. Bend their knees.
 - b. Keep their back straight.
 - c. Push upward with their legs.
3. Employees shall obtain help when moving objects that are too heavy for them to lift or push.
4. Tools, parts or equipment shall be handed to other employees.
5. Employees shall not carry material in such a manner that the employees' vision is obscured.
6. Employees handling compressed gas cylinders shall:
 - a. Not throw, bump, jolt or drag them.
 - b. Not handle cylinders without a protective cap over the valve on cylinders that require a valve cover.
 - c. Keep cylinders away from heat sources.
 - d. Not use cylinders as rollers.
 - e. Secure cylinders only with welded link chain to prevent them from falling over.

C.9. Refrigerant Safety Precautions

The following precautions shall be taken when maintaining and servicing refrigerant systems:

1. Wrap around safety goggles shall be worn.
2. Leather gloves or leather-palmed gloves shall be worn.
3. Smoking is prohibited in the presence of refrigerant. Refrigerant vapor is normally non-poisonous, but can become poisonous when coming in contact with an open flame. *The gas, which could be inhaled through the tobacco, would be poisonous.*

4. Open flames and/or high temperatures on charged refrigerant systems are prohibited.
5. Refrigerant cylinders shall be capped when not in use.
6. Cylinders shall be securely positioned at all times.

C.10. Ladders

1. Employees shall use a ladder for climbing. The use of barrels, boxes, chairs or any other makeshift equipment is not permitted. When using a ladder, the following precautions shall be observed:
 - a. Make sure the rungs and side rails are in good condition.
 - b. Place the ladder against a solid object, at the proper and safe angle, and on a secure footing.
2. Do not place a ladder in front of a door that opens toward the ladder, unless the door is locked, blocked or otherwise guarded.
3. Do not place a ladder against a windowpane or sash. Securely fasten a board (not with nails) across the top of the ladder to give a bearing at each side of the window.
4. When using a stepladder in an open area, the legs must be extended fully and locked in place.
5. The ladder shall extend at least one meter, above the alighting surface.
6. Always face the ladder when ascending or descending.
7. An employee shall not climb higher than the third rung from the top on a straight or extension ladder, or the second tread from the top on a stepladder.
8. If a ladder is equipped with safety devices, the devices must be kept in good working condition.
9. Employees shall not overextend themselves beyond the side rail of the ladder.
10. Employees shall not exert excessive force when working on a ladder.
11. When climbing or descending a ladder, hold on with both hands. If material must be handled, raise or lower it with a rope, either before going down or after climbing to the desired level.
12. Never allow more than one employee on a ladder at any one time.
13. Never use a ladder in the horizontal position.

14. Never extend the ladder range by setting it on blocks or other supports.
15. Portable metal ladders shall not be used for electrical work or where they may contact electrical circuits.
16. Damaged ladders shall be reported to your immediate supervisor and not used.

C.11. Forklift Trucks and Powered Hand Trucks

1. General: Safe operation of a forklift entails many of the basic safety measures observed when driving a car. Rules of the road, such as traffic signals, pedestrian right of way and other regulations, must be followed.
2. Faulty Equipment: Do not operate any equipment in need of repairs.
3. Vision: Do not obstruct your vision while driving with an oversized load. If necessary, drive in reverse. Carry loads at the lowest possible position.
4. Pedestrians: Always be alert for pedestrians. Sound the horn at corners and intersections. Come to a complete stop at blind corners.
5. Powered Hand Trucks: Where applicable, the operating rules for powered hand trucks are the same as for forklifts.
6. Parking/Storing Lifts: All forklift vehicles will be parked with forks lowered to the ground and the parking brake set. When not in use, the forks must be rested flat on the ground.

C.12. Yard Safety

1. General: Yard safety is a two-way responsibility. The employee operating the vehicle must be on the alert for pedestrians and pedestrians must be on the alert for moving vehicles. The following yard safety rules must be complied with at all time:
 - a. All traffic signs must be observed.
 - b. Vehicle headlights must be turned on whenever a vehicle is being moved. During the hours of darkness or when visibility is otherwise impaired, exterior markers (if so equipped) shall also be used, and all other interior lights must be extinguished.
 - c. Windshield wipers must be used during wet weather or when the windshield is wet.
 - d. Vehicles must be operated in the direction designated.
2. Parking: Vehicles must be parked only in assigned areas.
3. Pedestrian Traffic: Pedestrians must be on the alert when walking in the yard. Pedestrians must not challenge the movement of any vehicle and, if necessary, shall yield to the vehicle.

4. Parking Buses: When parking a bus, the following shall be done:
 - a. Park correctly in assigned lane.
 - b. Move shift to neutral position.
 - c. Set parking brake.
 - d. Turn engine off.

C.13. Fueling Vehicles

- a. A vehicle engine shall not be in operation when any fuel and/or engine oil is being added to the vehicle.
- b. Employees shall not clamp or block open fuel and/or oil nozzles.
- c. Employees shall keep fuel and/or oil nozzles in proper locations and off working surfaces.
- d. No employee shall fuel a CNG vehicle without appropriate training and certification.
- e. All employees driving in the vicinity of or through the fueling island shall drive slowly and with due caution.

C.14. Operation and Servicing of Vehicles

1. Reckless or unsafe operation of Transit Authority vehicles, which include, but is not limited to, buses, automobiles, trucks, vans, and industrial trucks (such as power sweepers and forklifts), is not permitted. This rule also applies to private vehicles operated on Transit Authority property.
2. Employees shall inspect vehicles before using and report immediately any defect or malfunctioning equipment to their immediate supervisor.
3. Employees shall observe the following rules and instructions when operating buses, vans, trucks and forklifts. Before starting an engine:
 - a. No attempt may be made to start vehicles that are tagged with “DO NOT START ENGINE” tags.
 - b. Check around and under the vehicle to make sure that no individual is working on it.
 - c. Adjust the seat and mirrors.
 - d. Make sure that parking brake is set and the shift selector is in neutral.
4. After starting a bus engine, do not move the bus until the air pressure has reached at least 100 PSI as indicated by the air pressure gauge or as indicated by the low air indicator light and buzzer alarm going off.
5. A bus may then be moved in the following manner:
 - a. Depress the brake pedal.

- b. Place shift selector in desired position.
 - c. Release the parking brake.
 - d. Before driving off a pit or hoist position, be sure hoist is fully depressed and check for obstructions or workers around or under the bus.
6. Make a complete stop at the following locations:
- a. Stop before entering or leaving a garage or shop building.
 - b. Stop before entering the fueling lanes, one bus length from fueling island entrance.
 - c. Stop before passing through any door openings.
 - d. Stop before entering or leaving a wash rack.
 - e. Stop at all “Stop” signs.
 - f. Stop one bus length behind an employee working at the rear of another bus, alert the employee of your presence and proceed forward with due caution if it is necessary to move the vehicle closer.
7. Take the following precautions when backing a vehicle:
- a. Before backing, circle the vehicle to make sure personnel, equipment and tools are clear.
 - b. Turn off any interior lights.
 - c. Turn on the distress flashers, headlights and markers, if any.
 - d. Back up at idle speed with your foot positioned lightly on the brake pedal (foot off the accelerator pedal).
 - e. Blow the horn three (3) times before the backing movement begins. The horn must be sounded at intervals until the movement is completed.
 - f. When in doubt regarding rearward visibility, use a spotter, always keeping the spotter in clear view.
8. Before leaving the operator’s seat, the shift selector shall be placed in park and the parking brake shall be applied. If the vehicle does not have a park position, the shift selector shall be placed in neutral and the parking brake applied.

D. Work Orders

Work Orders (W/O) are the most important document in the maintenance division. They control the flow of work, the stocking and issuing of parts and the assigning of vehicles and personnel. They are also the base-line document for failure analysis and they complete the audit trail within the accounting system. All employees are therefore required to exercise diligence to insure consistent compliance with these policies and procedures.

1. All work, which is beyond the scope of normal fueling island tasks, must have a W/O opened prior to any work being done.
2. The supervisor on duty shall run a computerized report of all open W/O's. This report shall include a written narrative of any W/O related problems.

D.1. Opening a Work Order

1. Only the maintenance supervisor on duty may open or close a W/O.
2. Prior to opening a new W/O the supervisor on duty *must*:
 - a. Physically compare the document, which generates the repair request, (i.e., Driver's Defect Card, Road Call Report, Accident Report or Preventative Maintenance Report), with the actual vehicle in order to insure:
 - Correct vehicle I.D. number
 - Correct serial numbers of affected parts, if applicable
 - The need for the requested repair, or what the problem is.

This information must be written clearly on the W/O.

- b. Check the computer and all open W/O's to insure that there is not a W/O already opened to that vehicle or task. No vehicle shall have more than one open W/O at any time. If the supervisor finds a W/O has already been opened to the vehicle in question, he may either:
 - Add the requested new work to the already open W/O, or
 - Complete the work on the old W/O, close it out and open a new W/O.

D.2. Assigning a Work Order

Supervisors are required to assign W/O's to employees in an efficient manner using common sense and in accordance with the following policies and procedures:

1. Supervisors will assign each W/O a priority by taking into consideration *all* of the following:
 - a. Work that is in progress must be finished before the mechanic or stall can be reassigned.
 - b. Pullout commitments must be met.
 - c. Preventative maintenance schedules must be adhered to.

- d. The availability of personnel with the ability to do the job and the availability of the parts required for completion of the repair; supervisors are required to minimize the number of times a vehicle is moved in and out of repair bays.
 - e. Only authorized staff may work on a CNG system.
2. Each supervisor coming on duty is required to review all open W/O's in order to determine the exact status and location of each W/O and vehicle, as well as reviewing all written notes accompanying the W/O left by the last supervisor on duty.
 3. Supervisors are required to know the job description of employees under their supervision and to know the abilities of each member of their staff. A list of the training and certifications of each employee will be posted in the supervisor's office.
 4. Supervisors shall not assign more than one W/O at a time to any employee. If any employee is unable to do the assigned task for any reason, they must first return the unfinished W/O to the supervisor before they can be assigned a new task or new W/O.
 5. No employee may have possession of more than one W/O at a time without the permission of a supervisor.
 6. All W/O's which cannot be completed during the regular shift of the assigned employee will be returned to the supervisor on duty prior to shift change.
 7. The supervisor going off duty, prior to leaving, must:
 - a. Inform the supervisor coming on duty the exact status and location of any open W/O's and the location of the vehicles involved. In the event there is not a supervisor coming on duty at that time, they will leave a written note for the next supervisor indicating the exact status of each open W/O by number and the exact location of each vehicle involved.
 - b. Check to insure that every W/O handled during the shift is physically present and entered into the computer.

D.3. Closing a Work Order

1. No supervisor shall go off duty before he has entered into the computer every W/O completed during his shift.
2. The supervisor on duty must review each W/O prior to closing it out (either on the computer or in the W/O log) in order to insure:
 - a. All dates and times are accurately listed.
 - b. The vehicle number, if any, is correctly listed.
 - c. The mileage, if any, is listed and correct.
 - d. The problem is clearly listed.
 - e. The cause of the failure is clearly listed.
 - f. The corrective or repair action is clearly listed.

- g. All parts issued are properly listed and are normal for the repair done.
- h. All labor man-hours spent are clearly listed and are normal for the repair done.
- i. The repair performed must match the problem listed.
- j. That the entire W/O is legible, understandable and complete.

The supervisor on duty must sign in the comments section that he has reviewed each W/O completed. His signature shall be considered personal certification that all entries on the W/O are true, complete and accurate and have been entered into the computer.

SECTION II: Recommended Management Policies

It is essential to the maintenance and sustainability of the CNG Pilot Fleet and for the safety of the Fleet Employees and the public at large that a well-designed and comprehensive policy structure be established and strictly followed. Monitoring and enforcement of said policies will assist in ensuring that the CNG Pilot Fleet is safe and reliable, and will facilitate the efficient management and operations of the Fleet and its staff.

Policies must be clearly defined and communicated to all staff. Employees must know exactly what is expected of them in all foreseeable situations, and management must demand strict adherence to said policies.

For example, it would be the policy of the Transit Authority to provide all required training to ensure the safe and efficient operation of all personnel performing maintenance on the CNG System. The policy would state: “that no person shall work on any part of a CNG System unless said person has received comprehensive training and has successfully demonstrated his comprehension of said training. The certification of said trained person shall have an expiration date and Transit Authority management shall ensure that person is re-trained and re-certified as appropriate. Managers shall ensure all work is assigned to trained and certified staff as appropriate.”

This example policy clearly defines its objective and the responsibilities of employees, management and the Transit Authority in fulfilling that objective.

A. Preventive Maintenance Policy

It is critical to the success of the maintenance operation to adhere to Preventive Maintenance schedules. It is therefore the Policy of the Transit Authority that all Preventive Maintenance shall be completed within 500km of the schedule.

Signed

Date

B. Record Keeping Policy

It is critical to the success of the maintenance operation to have accurate records of maintenance conducted on vehicles and equipment. It is therefore the Policy of the Transit Authority that managers will ensure all records accurately reflect all parts, labor, dates, equipment numbers, mileage and other criteria as indicated on appropriate forms and/or computerized maintenance record formats.

Signed

Date

C. Towing Policy

It is essential to the safety of the public and the Transit Authority that vehicles are towed only by properly trained staff. It is therefore the Policy of the Transit Authority that no person shall tow a Transit Authority vehicle without proper training and authorization.

Signed

Date

D. Employee Orientation Policy

It is important that all new employees be familiar with Standard Operating Procedures, Policies and Safe Equipment Operation. It is therefore the Policy of the Transit Authority that all newly hired maintenance staff shall receive all necessary training to ensure the safety of the public and the employee, and to ensure all vehicles and equipment are maintained in the safest and most efficient manner. All employees shall receive orientation training as appropriate when new technologies, vehicles and/or equipment are acquired.

Signed

Date

E. Training, Certification and Re-certification Policy

The Transit Authority utilizes trained staff as appropriate when conducting vehicle and/or equipment maintenance. It is the Policy of the Transit Authority to provide all required training to ensure a safe and efficient operation.

Signed

Date

F. Safety Policy

Safety of the public and the Transit Authority's employees is our top priority. It is the Policy of the Transit Authority that all employees shall receive comprehensive safety training as appropriate for their respective job duties. Managers are responsible to ensure that employees follow all safety rules.

Signed

Date

G. Lincoln Composite CNG Cylinder and CNG Fuel System Policy

It is the Policy of the Transit Authority that Lincoln Composite CNG Cylinders must be inspected, repaired and/or replaced only by authorized personnel. Responsibilities and authority for CNG Fuel System work is defined as follows:

Only *authorized* CTA/GCBC persons are allowed to:

- Inspect Lincoln Composite CNG Cylinders.
- Change or re-secure a CNG Line or CNG Cylinder Mounting Strap.
- Vent fuel.

Only *authorized* NGVC and Gas tech persons are allowed to:

- Inspect Lincoln Composite CNG Cylinders.
- Change or re-secure a CNG Line or CNG Cylinder Mounting Strap.
- Replace a Pressure Relief or Fuel Fill Valve.
- Vent fuel.
- Re-certify Lincoln Composite CNG Cylinders.
- Remove Lincoln Composite CNG Cylinders.
- Install Lincoln Composite CNG Cylinders.
- Repair Lincoln Composite CNG Cylinders.

Note: All Lincoln Composite CNG Cylinders shall be inspected and re-certified every 36 months by authorized personnel.

Signed

Date

SECTION III: Recommended Preventive Maintenance and Inspection Program

A. Establishing a Preventive Maintenance Program

A.1. Planning

A planned and properly executed Preventive Maintenance program is vital to ensure Vehicle Safety, Reliability and Cost Effectiveness. An effective Preventive Maintenance plan should take into account the activities recommended by manufacturers combined with actual experience in using the fleet.

The heart of an effective Preventive Maintenance program lies in:

1. Setting up inspection procedures.
2. Scheduling units for service to avoid under- or over-servicing.

A.2. Maintaining Useable Records

The Preventive Maintenance schedules attached are offered as a *guideline*. Through practical experience with the fleet, the frequency of inspections and maintenance may be modified along with the associated tasks. Each fleet operator faces different vehicle usage and different operating environments, consequently the need for a personalized program will be required.

A properly managed Preventive Maintenance program offers the following advantages:

1. Maximum vehicle availability.
2. Lowest possible maintenance costs.
3. Reduced road failures, greater dependability.
4. Fewer driver complaints.
5. Better fuel economy.
6. Reduced possibilities of accidents caused by faulty equipment.

A.3. Policy and Implementation

The Preventive Maintenance plan must include an enforceable policy, requiring *strict adherence* to scheduled maintenance. A useful Preventive Maintenance program is only as good as the effort put into it. No amounts of schedules, forms or records are worth the paper they are written on if the program is not followed conscientiously. All records should be updated as soon as the repairs are completed, whether kept on the computer or done manually.

Properly performed, the scheduled maintenance gives assurance that the bus has been thoroughly inspected and should be capable of being operated safely until the next inspection is due. Inspections should assist in detecting potential failures before they happen.

Examples:

1. A leak in the cooling system will result in scored pistons and liners, if not corrected.
2. A leaking pinion seal will result in a damaged ring and pinion gear set and bearings, if not corrected.

3. Rust streaks or stains around a bolt or bracket indicates it is not properly torqued.

The driver should have the responsibility of reporting anything that requires the attention of the maintenance department. Such a report gives protection to both the driver and the repair shop in the event of a controversy that may arise over a reported problem. These reports should be kept on file at least until the next Preventive Maintenance inspection to insure that all previously reported problems have been resolved.

The way in which vehicles are scheduled for inspections and maintenance can assist in minimizing costs. *Under Servicing* becomes obvious after a period of time with premature parts and/or component wear, excessive road failures and high maintenance and operating costs. *Over Servicing* is expensive and unnecessary.

The Preventive Maintenance schedules attached are based on vehicle usage, *not calendar dates* (except in instances noted, such as re-certification of a CNG cylinder). Using only date criteria for performing scheduled maintenance will increase operating costs and vehicle down time.

A.4. Using Maintenance Data

Devoting consistent, full-time effort to the task of fleet analysis will pay dividends. Diligent failure and trend analysis will identify premature parts failures, warranty and supplier issues, and give a good indication of maintenance performance and effectiveness.

Root cause analysis should be pursued regarding unscheduled maintenance. Example: a vehicle alternator fails. The technician replaces the alternator and the bus is released for service, now maintenance is finished. Is it? How long has the alternator been on the vehicle? Was it necessary to change it? Is there a quality control issue with the supplier? Is the alternator under warranty? Why did it fail? When was the last Preventive Maintenance inspection performed, and could something during that inspection have contributed to or prevented the failure (i.e., belt tension)? Using the data collected for analysis and subsequent follow-up can significantly minimize maintenance costs.

B. Maintenance Inspection Intervals

Properly performed inspections detect potential failures before they happen. Experience with the CNG Fleet over time will assist in local decisions to modify the basic information provided. The following Preventive Maintenance and Inspection Program is offered for consideration.

B1. First Inspection after Acceptance/5,000km

- Change ATF and filter
- Change oil and filter
- Change rear axle fluid
- Re-torque all suspension fasteners
- Re-torque rear suspension U-bolts

B2. Required Maintenance Inspections

Annex A includes all of the Maintenance Inspection schedules, as required by the CNG engine and chassis suppliers. They are as follows:

- Daily Inspection Checklist
- 10,000km Maintenance Inspection
- 20,000km Maintenance Inspection
- 30,000km Maintenance Inspection

ANNEX A

Required Maintenance Inspections

خطوات تنفيذ أعمال الصيانة التي تجرى كل 10000 كم

رقم السيارة.....

| | رقم المحرك..... | رقم التأسيس..... |
|---------------|--|--|
| | المسافة المقطوعة.....كم | اجمالي ساعات تشغيل المحرك.....ساعة |
| المحرك | | |
| ملاحظات فحص | عمل صيانة | علامة المرجع |
| | Check Driver's Report | مراجعة تقارير السائقين |
| | Change the Engine Lubricating Oil | تغيير زيت المحرك |
| | Change the Engine Lubricating Oil Filter | تغيير فلتر زيت المحرك |
| | Change the Closed Crankcase Ventilation Filter | تغيير فلتر صمامات المحرك |
| | Check Engine Coolant Level - Add if needed | التحقق من مستوى سائل التبريد - يضاف إذا لزم الأمر |
| | Check the Concentration of the Coolant | تحقق من تركيز سائل التبريد |
| | Change the Engine Coolant Filter | تغيير فلتر سائل التبريد |
| | Check the Operation of the Coolant Fan | راجع أداء تشغيل مروحة التبريد |
| | Check Condition of the Radiator Hoses | التحقق من حالة خرطوم التبريد |
| | Check the Condition of the Air Intake Piping | التحقق من حالة أنابيب إمداد الهواء للمحرك |
| | Drain the Fuel Filter | تفريغ سائل الوقود من فلتر الوقود |
| | Check the Engine Throttle Response | التأكد من استجابة المحرك لزيادة السرعة عند الضغط على دواسة الأكسيليريتور |
| | Check the operation of the HOS sensor Fan | التأكد من أن مروحة تبريد حساس الأكسيليريتور تعمل بكفاءة |
| | Check the Air Cleaner Restriction Indicator | راجع مؤشر التوقف عن الاستداد عند الحاجة |
| | Check for Damage or Blockage on the Outside of the Charge Air Cooler and the Piping of the Charge Air Cooler | التحقق من سلامة مبرد الهواء والتأكد من سلامتها وكذلك وصلاتها وأنابيب تبريد مبرد الهواء |
| | Check the Outside of the Catalyst Housing | التحقق من سلامة الشكمان والتأكد من سلامتهما |
| | Using The Laptop | باستخدام جهاز الكمبيوتر |
| | Check ECM and GCM for Stored Failure Codes | راجع بيانات الأعطال المخزنة بالذاكرة لكل من ECM & GCM |
| | Investigate and Record All Active Fault Codes | تحقق من أسباب الأعطال النشطة بالسجلات بالكمبيوتر |
| | Record and Clear All Active Fault Codes | سجل - مسح جميع أكواد الأعطال غير فعالة |

التشاسيه

| ملاحظات فحص | علامة الرجعة | عمل حدود |
|-------------|--------------|--|
| | | تشحيم بنور محور الامامي (أذرع التوجيه - كنج بيز) Grease All Greasing Nipples of Front Axle And Steering Bars |
| | | التأكد من ربط تثبيت مجموعة الفرامل Check the Tightening of the Brake System |
| | | التأكد من ربط تثبيت مسامير المحاور Check the Tightening of the Wheel Hub Bolts and Nuts |
| | | التأكد من ربط تثبيت اذرع التوصيل في بيض الدركسيون Check the Tightening of the Steering Arms Joints |
| | | التأكد من ربط اذرع التوجيه Check the Tightening Arms Bolts |
| | | الفحص بالنظر حالة تثبيت محور الامامي بالتشاسيه والتأكد من ربط مسامير التثبيت Check the Condition of Fixation of the Front Axle to the Chassis |
| | | الفحص حالة اوراق سوست التعطيق الامامية Inspect the condition of Front Suspension Leaf Spring |
| | | التأكد من سلامة اخشب الكاوتش لسوست التعطيق الامامية Check the Condition of the Rubber Bushings of the Front Suspension Leaf Spring |
| | | التأكد من حالة مساعدين السوست الامامية Check Front Shock Absorber For Oil Leak and Bend |
| | | الفحص بالنظر حالة تثبيت محور الخلفي بالتشاسيه والتأكد من ربط مسامير التثبيت Check the Fixation of the Rear Axle to the Chaises |
| | | الفحص حالة اوراق سوست التعطيق الخلفية Inspect the Condition of the Rear Suspension Leaf Spring |
| | | التأكد من سلامة اخشب الكاوتش لسوست التعطيق الخلفية Inspect the Condition of the Rubber Bushings of the Rear Suspension Leaf Springs |
| | | التأكد من حالة مساعدين السوست الخلفية Check the Rear shock Absorbers for Oil Leak and Bend |
| | | راجع خلوصات الرلمان بلي لجميع المحلات - اضبط اذا لزم الامر Check the Clearance of All Ball Bearings of the Wheels - Adjust if Necessary |
| | | تشحيم جميع مشاحم عمود الكردان وصلاب وصلات الكردان Grease all the Greasing Nipples of the Propeller Shaft and the Hooks Joints |
| | | التأكد من مجموعة الفرامل - حسب التعليمات المرفقة - Test Brake System Performance - According to the Attached Instructions |
| | | الفحص خرطوميه مجموعة الهيدروليك والتأكد من سلامتها Inspect the Hydraulic Oil Hoses |
| | | الفحص مستوى زيت الهيدروليك وبنه التزويد اذا لزم الامر Check the Hydraulic Oil Level - Add if needed |
| | | بنه تغيير زيت الهيدروليك في حالة تغير لونه الى اللون البيج او البني الغامق Change the Hydraulic Oil if its Color Changed |
| | | التأكد من خيوط اسطوانات الغاز من اية خدوش Inspect the CNG tanks for Scratches . Cuts and damage |
| | | التأكد من سلامة خرطوميه الغاز ووصلاتها وكذلك سلامة الجراب الواقى للخرطوميه Inspect the CNG Hoses |

| | | |
|--|--|--|
| | | تأكد من عدم وجود أي تسرب لغاز باستخدام أجهزة الكشف Using CNG hand Leak Detectors . Check for CNG Leak |
| | | فحص الأحزمة الكاوتش المطبقة لأحزمة تثبيت اسطوانات الغاز Inspect the Steel Belts and the Rubber Cushion that fix the CNG Tanks |
| | | املا صور العجل الخلفي - حسب التعليمات المرفقة- Fill the Rear Wheel Hub with Oil - According to Attached Instructions |

توقيع مهندس ارجح
.....

توقيع ملاحظ ارجح
.....

توقيع القائم بتنفيذ عمليات الصيانة
.....

تعليمات تفصيلية لتنفيذ بعض عمليات الصيانة

ماء صرة العجل الخلفي بالزيت

- ♦ املا صرر العجل بالزيت نترزيت رولمان بلي العجل باتباع الآتي:
- 1. استكمل زيت الكرونة من فتحة الملاء، ثم سد فتحة الملاء باستخدام الطية
- 2. ارفع السيارة من الجانب الأيمن للفرنسيل الخلفي، واحتفظ بهذا الوضع لمدة دقيقتان، لملء الصرة اليسرى للعجل
- 3. فك ضبة الملاء، وأضف كمية من الزيت مع الاحتفاظ بالسيارة في الوضع المائل
- 4. افقل ضبة الملاء، واعد السيارة الى الوضع المستوي مره أخرى
- 5. ارفع السيارة من الجانب الأيسر للفرنسيل - كرر الخطوات السابقة لملء الصرة اليمنى للفرنسيل
- 6. ضع السيارة في الوضع المستوي واستكمل مستوى الزيت في الكرونة، أو التخلص من الزيت الزائد عن المستوى
- 7. اربط ضبة الملاء

صيانة مجموعة الفرامل

- ♦ فك ضبابير العجل ونظفها جيدا بقطعه جافة من القماش أو فرشاه شعر - لا تستخدم هواء مضغوط أو فرشاه معدنية
- ♦ افحص الطنبور جيدا للتأكد من عدم وجود شروخ به أو عيوب (مثل وجود مساحات لامعة أو مساحات بنية اللون)
- ♦ تأكد من أن الطنبور كامل الاستدارة وليس بيبضاوي الشكل
- ♦ يتم قياس القطر الداخلي للطنبور وان القطر يقع في حدود الاستخدام المسموح بها (أكبر قطر لخرط الطنبور هو 421 مم ، أقصى قطر يمكن استخدام الطنبور عنده هو 422 مم)
- ♦ افحص تيل الفرامل بعد تنظيفه من الأتربه باستخدام قطعة جافة من القماش أو مبلله بالماء فقط، لا يستخدم الجاز أو السولار للنظافة
- ♦ راجع الخلوص بين التيل والطنابير
- ♦ أفرغ خزانات الهواء باستخدام الصنابير الموجوده بها للتخلص من أي سائل موجوده فيها
- ♦ افحص بالنظر كامة تشغيل الفرامل والبكرة المتحركة عليها وتأكد من عدم تاكل أي منهما
- ♦ قس مشوار حركة ذراع الفرامل - يجب أن يكون 43 مم
- ♦ قس الزاوية المحصورة بين ذراع الفرامل وذراع تشغيل الكامة، يجب أن تكون 90 " و 95 "
- ♦ الكشف على الصمام SR-1 :
- ♦ هذا الصمام موجود على كمره الشاسية اليمنى - خلف و أعلى المساعد الأمامي ، وللكشف على الصمام جري

الآتي :

- أدر المحرك
- انتظر حتى ملء خزانات الهواء لأعلى ضغط 120-130 رطل/ البوصة المربعة
- أفرغ خزان الهواء الرئيسي - حتى يصل مؤشر عداد الضغط الأبيض الى الصفر - بينما يظل مؤشر عداد الضغط الأحمر في مكانه
- اضغط فرملة اليد للداخل - اضغط على دواسه الفرامل عدة مرات - سيشير المؤشر الأحمر الى انخفاض الضغط حتى 35-40 رطل/بوصه مربعة ، عند هذا الحد تبدأ قباقيب الفرامل في الفتح وتظل مفتوحة.
- وهذا جزء مهم من وسائل الأمان للتأوبيس

خطوات تنفيذ أعمال الصيانة التي تجرى كل 20000 كم

رقم السيارة.....

| | رقم المحرك..... | رقم التسمية..... |
|--|-----------------|-----------------------------------|
| المحرك | نسبة المقصورة | جملي ساعات تشغيل المحرك..... ساعة |
| مراجعات فحص | علامة راحة | مراجعات فحص |
| راجع سجل التشغيل | | |
| Check Driver's Report | | |
| بعد فحص الزيت | | |
| Change the Engine Lubricating Oil | | |
| بعد فحص الزيت | | |
| Change the Engine Lubricating Oil Filter | | |
| بعد فحص الزيت | | |
| Change the Closed Crankcase Ventilation Filter | | |
| راجع فحص مستوى الزيت | | |
| Check Engine Coolant Level - Add if needed | | |
| راجع درجة تركيز الزيت | | |
| Check the Concentration of the Coolant | | |
| بعد فحص الزيت | | |
| Change the Engine Coolant Filter | | |
| راجع درجة تشغيل مروحة الزيت | | |
| Check the Operation of the Coolant Fan | | |
| فحص ضغط خرطوم مياه التبريد | | |
| Check Condition of the Radiator Hoses | | |
| فحص ضغط خرطوم مياه التبريد | | |
| Check the Condition of the Air Intake Piping | | |
| راجع ضغط مياه التبريد | | |
| Drain the Fuel Filter | | |
| راجع من خزان مياه التبريد | | |
| Check the Engine Throttle Response | | |
| راجع من خرطوم مياه التبريد | | |
| Check the operation of the HOS sensor Fan | | |
| راجع من خرطوم مياه التبريد | | |
| Check the Air Cleaner Restriction Indicator | | |
| فحص سرعة مرور الهواء وتأكد من سلامة وكفاءة وصلاتها وتوصيلها مع جسمه | | |
| Check for Damage or Blockage on the Outside of the Charge Air Cooler and the Piping of the Charge Air Cooler | | |
| فحص حالة التبريد وتأكد من سلامته | | |
| Check the Outside of the Catalyst Housing | | |
| فحص حالة مياه التبريد وتأكد من سلامته | | |
| Check the Condition of the Alternator Belt | | |
| فحص حالة مياه التبريد وتأكد من سلامته | | |
| Check the Condition of the Belt Tensioner | | |
| فحص سرعة مرور مياه التبريد وتأكد من سلامة برؤوسها | | |
| Check the Water Pump for Play in the Bearing | | |
| راجع ضغط خرطوم مياه التبريد | | |
| Check the Tightness of the Fuel Hoses | | |
| راجع ضغط خرطوم مياه التبريد | | |
| Change the Spark Plugs and the Boots | | |
| فحص برؤوس الإشعال وتأكد من عدم وجود تلف في وكالات وصلاتها الكهربائية | | |
| Check the Ignition Coils for Damage and Electrical Connection | | |

Change the Fuel Filter

Change the Air Cleaner Filter

Check and Adjust the Valve Overheads

Check the Fan Hub for Excessive Play in the Bearing

Using The Laptop

Check ECM and GCM for Stored Failure Codes

Investigate and Record All Active Fault Codes

Record and Clear All Active Fault Codes

| ملاحظات فحص | علامة مراجعة | ملاحظات |
|-------------|--------------|--|
| | | تسليم بورد عيوب الامامي (ادراج التوجيه - كنج بوز) |
| | | تأكد من رباط تثبيت مجموعة الترميل |
| | | تأكد من رباط عمود ميل تثبيت ظنور لأطارات |
| | | تأكد من رباط تثبيت ادراج الترميل في بيض تدوكسيون |
| | | تأكد من رباط ادراج التوجيه |
| | | فحص بالنظر حالة تثبيت عيوب الامامي بالشاسية وتأكد من رباط مسامير التثبيت |
| | | فحص حالة اوراق سوست التعيق الامامية |
| | | تأكد من سلامة اجسام الكاوتش سوست التعيق الامامية |
| | | تأكد من حالة مساعدين سوست الامامية |
| | | فحص بالنظر حالة تثبيت عيوب الخلفي بالشاسية وتأكد من رباط مسامير التثبيت |
| | | فحص حالة اوراق سوست التعيق الخلفية |
| | | تأكد من سلامة اجسام الكاوتش سوست التعيق الخلفية |
| | | تأكد من حالة مساعدين سوست الخلفية |
| | | راجع عدد عبات الترميل في جميع المحلات - اضبط اذا لزم الامر |
| | | تسليم اجمع مسامير عمود الكردان وصلات وصلات الكردان |
| | | تأكد من تسوية الترميل من - حسب التعميرات المرفقة - |
| | | فحص حواضم مجموعة ايدرونيك وتأكد من سلامتها |
| | | الفحص مستوى زيت فيدرونيك وبنم التزويد اذا لزم الامر |
| | | بنم تغيير زيت ايدرونيك في حالة تغير لونه الى اللون البني او الغامق |
| | | غير زيت صندوق التروس الاوتوماتيكي والفنمير الخاص به |
| | | تأكد من حقو استخوانات الغاز من به حدوث |
| | | تأكد من سلامة حواضم الغاز ووصلاتها وكذلك سلامة الخراب الواقية للحواضم |
| | | تأكد من عدم وجود اي تسرب للغاز باستخدام اجهزة الكشف |
| | | فحص الاجزامة الكاوتش لمنطقة الاجزامة تثبيت اسطوانات الغاز |
| | | املا صبرو الفحل الخلفي - حسب التعميرات المرفقة - |

توقيع القائم بتنفيذ عمليات الصيانة..... توقيع ملاحظ الخراج..... توقيع مهندس الخراج.....

تعليمات تفصيلية لتنفيذ بعض عمليات الصيانة

ملء صبة العجل الخلفي بالزيت

- املاً صرر العجل بالزيت نزييت رونمان بلي العجل باتباع الآتي:
 1. استكمل زيت الكرونة من فتحة المراء، ثم سد فتحة المراء باستخدام الطبة
 2. ارفع السيارة من الجانب الأيمن للفرنسيل الخلفي. واحتفظ بهذا الوضع لمدة دقيقتان. لملء الصرة اليسرى للعجل
 3. فك صبة المراء، وأضف كمية من الزيت مع الاحتفاظ بالسيارة في الوضع المائل
 4. اقفل صبة المراء. واعد السيارة الى الوضع المستوي مره أخرى
 5. ارفع السيارة من الجانب الأيسر للفرنسيل - كرر الخطوات السابقة لملء الصرة اليمنى للفرنسيل
 6. ضع السيارة في الوضع المستوي واستكمل مستوى الزيت في الكرونة، أو التخلص من الزيت الزائد عن المستوى
 7. اربط صبة المراء

صيانة مجموعة الفرامل

- فك صنابير العجل ونظفها جيدا بقطعه جافة من القماش أو فرش شعير - لا تستخدم هواء مضغوط أو فرش معدنية
- افحص الطنبور جيدا للتأكد من عدم وجود شروخ به أو عيوب (مثل وجود مساحات لامعة أو مساحات بنية اللون)
- تأكد من أن الطنبور كامل الاستدارة ونيس ببيضاوي الشكل
- يتم قياس القطر الداخلي للطنبور وان القطر يقع في حدود الاستخدام المسموح بها (أكبر قطر نخرط الطنبور هو 421 مم . اقصى قطر يمكن استخدام الطنبور عنده هو 422 مم)
- افحص تيل الفرامل بعد تنظيفه من الاتربه باستخدام قطعة جافة من القماش أو مبلله بالماء فقط، لا يستخدم الجاز أو السولار للتنظافة
- راجع الخلووس بين التيل والصنابير
- أفرغ خزانات الهواء باستخدام الصنابير الموجوده بها للتخلص من أي سوائل موجوده فيها
- افحص بالنظر كامة تشغيل الفرامل والبكرة المتحركة عليها وتأكد من عدم تآكل أيها منها
- قس مشوار حركة ذراع الفرامل - يجب أن يكون 43 مم
- قس الزاوية المحصورة بين ذراع الفرامل وذراع تشغيل الكامة، يجب أن تكون 90 " و 95 "
- الكشف على الصمام SR-1 :
- هذا الصمام موجود على كمره الشاسسة اليمنى - خلف و أعلى المساعد الأمامي ، وللكشف على الصمام يجرى

الآتي:

- أدر المحرك
- انتظر حتى ملء خزانات الهواء لأعلى ضغط 120-130 رطل/ البوصة المربعة
- أفرغ خزان الهواء الرئيسي - حتى يصل مؤشر عداد الضغط الأبيض الى الصفر - بينما يظل مؤشر عداد الضغط الأحمر في مكانه
- اضغط فرملة اليد للداخل - اضغط على دواسه الفرامل عدة مرات - سيشير المؤشر الأحمر الى انخفاض الضغط حتى 35 - 40 رطل/بوصه مربعة ، عند هذا الحد تبدأ قباقيب الفرامل في الفتح وتظل مفتوحة.
- وهذا جزء مهم من وسائل الأمان للأتوبيس

خطوات تنفيذ أعمال الصيانة التي تجرى كل 30000 كم

رقم السيارة.....

| التاريخ | رقم المحرك | رقم الشاسيه |
|------------------|--|--------------------------------|
| المسافة المقطوعة | كم | إجمالي ساعات تشغيل المحرك ساعة |
| المحرك | | |
| ملاحظات المحرك | عمل محط | علامة المراجعة |
| | مراجعة تقرير السائق | |
| | Check Driver's Report | |
| | تغيير زيت المحرك | |
| | Change the Engine Lubricating Oil | |
| | تغيير فلتر زيت المحرك | |
| | Change the Engine Lubricating Oil Filter | |
| | تغيير فلتر التهوية المغلقة | |
| | Change the Closed Crankcase Ventilation Filter | |
| | التحقق من مستوى سائل التبريد - رده إذا لزم الأمر | |
| | Check Engine Coolant Level - Add if needed | |
| | التحقق من تركيز سائل التبريد | |
| | Check the Concentration of the Coolant | |
| | تغيير فلتر سائل التبريد | |
| | Change the Engine Coolant Filter | |
| | التحقق من أداء المروحة التبريد | |
| | Check the Operation of the Coolant Fan | |
| | التحقق من حالة خرطوم سائل التبريد | |
| | Check Condition of the Radiator Hoses | |
| | التحقق من حالة خرطوم سحب الهواء للمحرك | |
| | Check the Condition of the Air Intake Piping | |
| | تفريغ سائل الوقود من فلتر الوقود | |
| | Drain the Fuel Filter | |
| | التأكد من استجابة المحرك لزيادة السرعة عند ضغط على دواسة الإكستمبر | |
| | Check the Engine Throttle Response | |
| | التأكد من أن مروحة تبريد حساس لأكسجين تعمل بكفاءة | |
| | Check the operation of the HOS sensor Fan | |
| | التحقق من كفاءة مؤشر سداد فلتر الهواء | |
| | Check the Air Cleaner Restriction Indicator | |
| | التحقق من سلامة مبرد الهواء والتأكد من سلامته وكثافته وصلاتها ووصلات الواسير المتصلة بها | |
| | Check for Damage or Blockage on the Outside of the Charge Air Cooler and the Piping of the Charge Air Cooler | |
| | التحقق من سلامة التوكامان والتأكد من سلامته | |
| | Check the Outside of the Catalyst Housing | |
| | التحقق من حالة سير التناهي والتأكد من سلامته | |
| | Check the Condition of the Alternator Belt | |
| | التحقق من حالة سير التناهي والتأكد من سلامته | |
| | Check the Condition of the Belt Tensioner | |
| | التحقق من دوران حزمة سائل التبريد والتأكد من سلامة البرونان على | |
| | Check the Water Pump for Play in the Bearing | |
| | التحقق من إحكام خرطوم الوقود | |
| | Check the Tightness of the Fuel Hoses | |
| | تغيير البوجيهات والبوصلة الكاوتش بركته عنها | |
| | Change the Spark Plugs and the Boots | |
| | التحقق من بوجيات الإشعال والتأكد من عدم وجود تلف لها وكثافت وصلاتها الكهربائية | |
| | Check the Ignition Coils for Damage and Electrical | |

