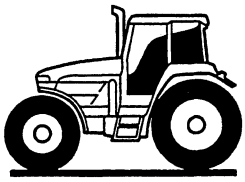
**Please cut where indicated and insert the label into the plastic pocket on the spine of the binder.**

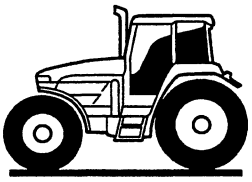


**60 SERIES TRACTOR REPAIR**

**8160, 8260, 8360, 8560**

**Vol. 1**

**40816040**



**60 SERIES TRACTOR REPAIR**

**8160, 8260, 8360, 8560**

**Vol. 2**

**40816040**

**06907001**

# 8160, 8260, 8360, 8560 TRACTOR REPAIR MANUAL CONTENTS

# SECTION 0
# INTRODUCTION

## CHAPTER 1
## INTRODUCTION

## CONTENTS

# FOREWORD

Appropriate service methods and correct repair procedures are essential for the safe, reliable operation of all equipment, as well as the personal safety of the individual performing the repair.

This Service Manual provides troubleshooting, overhaul, and pressure-testing instructions using recommended procedures and equipment. Following these instructions will ensure the safe, efficient, and timely completion of the service or repair.

There are numerous variations in procedures, techniques, tools, and parts for servicing machines, as well as in the skill of the individual doing the work. This manual cannot possibly anticipate all such variations and provide advice or cautions as to each. Accordingly, anyone who departs from the instructions provided in this manual must first establish that their personal safety, the safety of others, and the integrity of the machine will not be compromised by the choice of methods, tools or parts.

The manual is divided into sections which are subdivided into chapters. Each chapter contains information on general operating principles, detailed inspection, overhaul and, where applicable, specific troubleshooting, special tools, and specifications.

Any reference in this manual to right, left, rear, front, top, or bottom is as viewed from the operator's seat, looking forward.

All data and illustrations in this manual are subject to variations in build specification. This information was correct at the time of issue, but New Holland policy is one of continuous improvement, and the right to change specifications, equipment, or design at any time, without notice, is reserved.

# PRECAUTIONARY STATEMENTS

## PERSONAL SAFETY

Throughout this manual and on machine decals, you will find precautionary statements ("CAUTION", "WARNING", and "DANGER") followed by specific instructions. These precautions are intended for the personal safety of you and those working with you. Please take the time to read them.

**CAUTION: THE WORD "CAUTION" IS USED WHERE A SAFE BEHAVIORAL PRACTICE ACCORDING TO OPERATING AND MAINTENANCE INSTRUCTIONS AND COMMON SAFETY PRACTICES WILL PROTECT THE OPERATOR AND OTHERS FROM ACCIDENT INVOLVEMENT.**

**WARNING: THE WORD "WARNING" DENOTES A POTENTIAL OR HIDDEN HAZARD WHICH HAS A POTENTIAL FOR SERIOUS INJURY. IT IS USED TO WARN OPERATORS AND OTHERS TO EXERCISE EVERY APPROPRIATE MEANS TO AVOID A SURPRISE INVOLVEMENT WITH MACHINERY.**

**DANGER: THE WORD "DANGER" DENOTES A FORBIDDEN PRACTICE IN CONNECTION WITH A SERIOUS HAZARD.**

**FAILURE TO FOLLOW THE "CAUTION", "WARNING", AND "DANGER" INSTRUCTIONS MAY RESULT IN SERIOUS BODILY INJURY OR DEATH.**

## MACHINE SAFETY

Additional precautionary statements ("ATTENTION" and "IMPORTANT") are followed by specific instructions. These statements are intended for machine safety.

*ATTENTION: The word "ATTENTION" is used to warn the operator of potential machine damage if a certain procedure is not followed.*

*IMPORTANT: The word "IMPORTANT" is used to inform the reader of something he needs to know to prevent minor machine damage if a certain procedure is not followed.*

# SAFETY PRECAUTIONS

Practically all service work involves the need to drive the tractor. The operator's manual, supplied with each tractor, contains detailed safety precautions relating to driving, operating, and servicing that tractor. These precautions are as applicable to the service technician as they are to the operator and should be read, understood and practiced by all personnel.

Prior to undertaking any maintenance, repair, overhaul, dismantling or reassembly operations, whether within a workshop facility or in the field, consideration should be given to factors that may have an effect upon safety, not only upon the mechanic carrying out the work, but also upon bystanders.

## PERSONAL CONSIDERATIONS

The wrong clothes or carelessness in dress can cause accidents. Check to see that you are suitably clothed.

Some jobs require special protective equipment.

### Skin Protection

Used motor oil may cause skin cancer. Follow work practices that minimize the amount of skin exposed and length of time used oil stays on your skin.

### Eye Protection

The smallest eye injury may cause loss of vision. Injury can be avoided by wearing eye protection when engaged in chiselling, grinding, discing, welding, and painting.

### Breathing Protection

Fumes, dust, and paint spray are unpleasant and harmful. These can be avoided by wearing respiratory protection.

### Hearing Protection

Loud noise may damage your hearing, and the greater the exposure the worse the damage. If the noise is excessive, wear ear protection.

### Lifting Protection

Avoid injury by correctly handling components. Make sure you are capable of lifting the object. If in doubt get help.

### Hand Protection

It is advisable to use a protective cream before work to prevent irritation and skin contamination. After work clean your hands with soap and water. Solvents such as mineral spirit and kerosene may harm the skin.

### Foot Protection

Substantial or protective footwear with reinforced toe caps will protect your feet from falling objects. Additionally, oil-resistant soles will help to avoid slipping.

### Special Clothing

For certain work it may be necessary to wear flame or acid-resistant clothing.

## EQUIPMENT CONSIDERATIONS

### Machine Guards

Before using any machine, check to ensure that the machine guards are in position and serviceable. These guards not only prevent parts of the body or clothing coming in contact with the moving parts of the machine, but also ward off objects that might fly off the machine and cause injury.

### Lifting Devices

Always ensure that lifting equipment, such as chains, slings, lifting brackets, hooks and eyes, are thoroughly checked before use. If in doubt, select stronger equipment than is necessary.

Never stand under a suspended load or raised implement.

### Compressed Air

The pressure from a compressed-air line often exceeds 100 PSI (690 kPa). It is perfectly safe if used correctly. Any misuse may cause injury.

Never use compressed air to blow dust, filing, and dirt away from your work area unless the correct type of nozzle is fitted.

Compressed air is not a cleaning agent; it will only move dust from one place to another. Look around before using an air hose as bystanders may get grit into their eyes, ears, or skin.

### Hand Tools

Many cuts, abrasions and injuries are caused by defective tools. Never use the wrong tool for the job, as this generally leads either to some injury or to a poor job.

When removing or replacing hardened pins, use a copper or brass drift rather than a hammer.

For dismantling, overhaul, and assembly of major and sub-components, always use the Special Service Tools recommended. These will reduce the work effort, labor time, and the repair cost.

### Electricity

Electricity has become so familiar in day to day usage, that its potentially dangerous properties are often overlooked. Misuse of electrical equipment can endanger life.

Before using any electrical equipment - particularly portable appliances - make a visual check to make sure that the wiring is not worn or frayed and that the plugs and sockets are intact. Make sure you know where the nearest isolating switch for your equipment is located.

## GENERAL CONSIDERATIONS

### Solvents

Use cleaning fluids and solvents that are known to be safe. Certain types of fluids can cause damage to components, such as seals, and can cause skin irritation. Solvents should be checked that they are suitable not only for the cleaning of components and individual parts, but also that they do not affect the personal safety of the user.

### Housekeeping

Many injuries result from tripping over or slipping on objects or material left lying around by a careless worker. Prevent these accidents from occurring. If you notice a hazard, don't ignore it – remove it.

A clean, hazard-free place of work improves the surroundings and daily environment for everybody.

### Fire

Fire has no respect for persons or property. The destruction that a fire can cause is not always fully realized. Everyone must be constantly on guard.

Extinguish matches, cigars, and cigarettes before throwing them away.

Work cleanly, disposing of waste material into proper containers.

Locate the fire extinguishers and find out how to operate them.

Do not panic – warn those near and raise the alarm.

Do not allow or use an open flame near the tractor fuel tank, battery, or component parts.

### First Aid

In the type of work that mechanics are engaged in, dirt, grease, and fine dusts settle upon the skin and clothing. If a cut, abrasion or burn is disregarded it may become infected within a short time. Seek medical aid immediately.

### Cleanliness

Cleanliness of the tractor hydraulic system is essential for optimum performance. When carrying out service and repairs, plug all hose ends and component connections to prevent dirt entry.

Clean the exterior of all components before carrying out any form of repair. Dirt and abrasive dust can reduce the efficiency and working life of a component and lead to costly replacement. Use of a high-pressure washer or steam cleaner is recommended.

## OPERATIONAL CONSIDERATIONS

Stop the engine, if at all possible, before performing any service.

Place a warning sign on tractors which, due to service or overhaul, would be dangerous to start. Disconnect the battery leads if leaving such a unit unattended.

Do not attempt to start the engine while standing beside the tractor or attempt to bypass the safety start switch.

Avoid prolonged running of the engine in a closed building or in an area with inadequate ventilation as exhaust fumes are highly toxic.

Always turn the radiator cap to the first stop to allow pressure in the system to dissipate when the coolant is hot.

Never work beneath a tractor which is on soft ground. Always take the unit to an area which has a hard working surface, preferably concrete.

If it is found necessary to raise the tractor for ease of servicing or repair, make sure that safe and stable supports are installed beneath axle housings, casings, etc., before starting work.

Certain repair or overhaul procedures may necessitate separating the tractor, either at the engine/transmission or transmission/rear axle location. These operations are simplified by the use of the Tractor Splitting Stands. Should this equipment not be available, every consideration must be given to stability, balance and weight of the components, especially if a cab is installed.

Use footsteps or working platforms when servicing those areas of a tractor that are not within easy reach.

Before loosening any hoses or tubes connecting implements to remote control valves, etc., switch off the engine, remove all pressure in the lines by operating levers several times. This will remove the danger of personal injury by oil pressure.

Prior to pressure testing, make sure all hoses and connectors of the tractor and the test equipment are in good condition and tightly sealed. Pressure readings must be taken with the gauges specified. The correct procedure should be rigidly observed to prevent damage to the system or the equipment, and to eliminate the possibility of personal injury.

**WARNING: ESCAPING HYDRAULIC/DIESEL FLUID UNDER PRESSURE CAN PENETRATE THE SKIN CAUSING SERIOUS INJURY.**

**DO NOT USE YOUR HAND TO CHECK FOR LEAKS. USE A PIECE OF CARDBOARD OR PAPER TO SEARCH FOR LEAKS.**

**STOP THE ENGINE AND RELIEVE PRESSURE BEFORE CONNECTING OR DISCONNECTING LINES.**

**TIGHTEN ALL CONNECTIONS BEFORE STARTING THE ENGINE OR PRESSURIZING LINES.**

**IF ANY FLUID IS INJECTED INTO THE SKIN, OBTAIN MEDICAL ATTENTION IMMEDIATELY OR GANGRENE MAY RESULT.**

Use "position control" when equipment or implements are required to be attached to the hydraulic linkage either for testing purposes or for transportation.

Always lower equipment to the ground when leaving the tractor.

If high lift attachments are installed on a tractor, beware of overhead power, electric or telephone cables when traveling. Drop the attachment near to ground level to increase stability and minimize risks.

Do not park or attempt to service a tractor on an incline. If unavoidable, take extra care and block all wheels.

Observe recommended precautions as indicated in this Service Manual when dismantling the air-conditioning system as escaping refrigerant can cause frostbite.

Prior to removing wheels and tires from a tractor, check to determine whether additional ballast (liquid or weights) has been added. Seek assistance and use suitable equipment to support the weight of the wheel assembly.

When inflating tires, beware of over inflation – constantly check the pressure. Overinflation can cause tires to burst and result in personal injury.

# HEALTH AND SAFETY PRECAUTIONS

Many of the procedures associated with vehicle maintenance and repair involve physical hazards or other risks to health. This section lists, alphabetically, some of these hazardous operations, materials and equipment associated with them. The precautions necessary to avoid these hazards are identified.

The list is not inclusive; all operations, procedures, and handling of materials should be carried out with health and safety in mind.

## ACIDS AND ALKALIS (See Battery Acids, i.e., Caustic Soda, Sulfuric Acid)

Used in batteries and cleaning materials.

Irritating and corrosive to the skin, eyes, nose and throat. Causes burns.

Avoid splashes to the skin, eyes, and clothing. Wear suitable protective gloves and goggles. Can destroy ordinary protective clothing. Do not breathe mists.

Ensure access to water and soap is readily available for splashing accidents.

## ADHESIVES AND SEALERS (See Fire)

**CAUTION: HIGHLY FLAMMABLE, COMBUSTIBLE.**

Generally should be stored in "NO SMOKING" areas; cleanliness and tidiness while in use should be observed, i.e., from applications where possible, disposable paper should be dispensed to cover benches. Containers, including secondary containers, should be labeled.

### Solvent-Based Adhesives/Sealers (See Solvents)

Follow manufacturer's Instructions

### Water-Based Adhesives/Sealers

Those based on polymer emulsions and rubber lattices may contain small amounts of volatile toxic and harmful chemicals.

Skin and eye contact should be avoided, and adequate ventilation provided during use.

Follow manufacturer's Instructions

### Resin-Based Adhesive/Sealers (i.e., Epoxide and Formaldehyde Resin Based)

Mixing should only be carried out in well- ventilated areas as harmful or toxic volatile chemicals may be released.

Skin contact with uncured resins and hardeners can result in irritation, dermatitis, and absorption of toxic, or harmful chemicals through the skin. Splashes can damage the eyes.

Provide adequate ventilation; avoid skin and eye contact. Follow manufacturer's instructions.

### Anaerobic, Cyanoacrylate and other Acrylic Adhesives

Many are irritating, sensitizing, or harmful to the skin. Some are eye irritants.

Skin and eye contact should be avoided and the manufacturer's instructions followed.

Cyanoacrylate adhesives (super-glues) must not contact the skin or eyes. If skin or eye tissue is bonded, cover with a clean moist pad and get medical attention. Do not attempt to pull tissue apart. Use in well-ventilated areas as vapors can cause irritation of the nose and eyes.

For two-part systems: See Resin-Based Adhesive/Sealers

### Isocyanate (Polyurethane) Adhesive/Sealers (See Resin-Based Adhesives)

Individuals suffering from asthma or respiratory allergies should not work with, or near, these materials as sensitivity reactions can occur.

Any spraying should preferably be carried out in exhaust ventilated booths removing vapors and spray droplets from the breathing zone. Individuals working with spray applications should wear supplied air respirators.

## ANTIFREEZE (See Fire, Solvents, i.e., Isopropanol, Ethylene Glycol, Methanol)

**CAUTION: HIGHLY FLAMMABLE, COMBUSTIBLE.**

Used in vehicle coolant systems, brake air pressure systems, and windshield washing solutions.

Vapors given off from coolant antifreeze (Glycol) arise only when heated.

Antifreeze may be absorbed through the skin in toxic or harmful quantities. Swallowed antifreeze is fatal if not treated; medical attention must be sought immediately.

## BATTERY ACIDS (See Acids and Alkalis)

Gases released during charging are explosive. Never use an open flame or allow sparks near charging or recently charged batteries.

## BRAKE AND CLUTCH LININGS AND PADS (See Legal Aspects)

These items may contain asbestos which, if inhaled, may cause lung damage and, in some cases, cancer.

The normal handling and fitting of these items should not cause any hazard, but any drilling, grinding, or filling of friction materials may produce asbestos dust and should only be carried out under strictly controlled conditions.

The dust in brake drums, etc., contains very little asbestos, but care should be taken to avoid inhalation of this dust during servicing of brakes and clutches. The use of drum cleaning units, vacuum cleaning, or damp wiping is preferred to the use of air jets for "blowing-out."

The dust should be collected in a sealed plastic bag and disposed appropriately, according to local laws and regulations.

## BRAZING (See Welding)

## CHEMICAL MATERIALS - GENERAL (See Legal Aspects)

Chemical materials such as solvents, sealers, adhesives, paints, resin foams, battery acids, antifreeze, oils, and grease should always be used with caution, stored and handled with care. They may be toxic, harmful, corrosive, irritating, or highly flammable, causing hazardous fumes and dusts.

The effects of excessive exposure to chemicals may be immediate or delayed, briefly experienced or permanent, cumulative, superficial, life threatening, or may reduce life expectancy.

## CLUTCH LININGS AND PADS (See Brake and Clutch Linings and Pads)

## CORROSION PROTECTION MATERIALS (See Solvents, Fire)

**CAUTION: HIGHLY FLAMMABLE COMBUSTIBLE.**

These materials are varied; the manufacturer's instructions should be followed. They may contain solvents, resins, and petroleum products. Skin and eye contact should be avoided. They should only be sprayed in conditions of adequate ventilation, and not in confined spaces.

## CUTTING (See Welding)

## DEWAXING (See Solvents and Fuels - Kerosene)

## DO'S

**Do** remove chemical materials from the skin and clothing as soon as practicable. Change heavily soiled clothing and have it cleaned.

**Do** carefully read and observe hazard and precaution warnings given on material containers (labels) and in any accompanying leaflets, poster or other instructions. Material health and safety data sheets can be obtained from manufacturers.

**Do** organize work practices by wearing protective clothing and safety devices to avoid contact with chemical materials; breathing vapors, aerosols, dusts, and fumes; inadequate container labeling; or fire and explosion hazards.

**Do** wash before job breaks, before eating, smoking, drinking, or using toilet facilities when handling chemical materials.

**Do** keep work areas clean, uncluttered, and free of spills.

**Do** store according to national and local regulations.

**Do** keep chemical materials out of reach of children.

## DON'TS

**Do not** mix chemical materials except under the manufacturer's instructions; some chemicals can form other toxic or harmful chemicals, releasing toxic or harmful fumes, or be explosive when mixed together.

**Do not** spray chemical materials, particularly those based on solvents, in confined spaces, i.e., when people are inside a vehicle.

**Do not** apply heat or flame to chemical materials, except under the manufacturer's instructions. Some are highly flammable, and some may release toxic or harmful fumes.

**Do not** leave containers open. Escaping fumes can build up to toxic, harmful, or explosive concentrations. Some fumes are heavier than air and will accumulate in confined areas, pits, etc.

**Do not** transfer chemical materials to unlabeled containers.

**Do not** clean hands or clothing with chemical materials. Chemicals, particularly solvents and fuels, will dry the skin, and may cause irritation with dermatitis. Some can be absorbed through the skin in toxic or harmful quantities.

**Do not** use emptied containers for other materials, except when they have been cleaned under supervised conditions.

**Do not** sniff or smell chemical materials. Brief exposure to high concentrations of fumes can be harmful or toxic.

## DUSTS

Powder or dusts may be an irritant, harmful or toxic. Avoid breathing dusts from powdery chemical materials, or those arising from dry abrasion operations. Wear respiratory protection if ventilation is inadequate.

## ELECTRIC SHOCK

Electric shocks can result from the use of faulty electrical equipment or from the misuse of equipment even in good condition.

Ensure electrical equipment is maintained in good condition and frequently tested.

Ensure flexes, cables, plugs and sockets are not frayed, kinked, cut, cracked, or otherwise damaged.

Ensure electric equipment is protected by the correct rated fuse.

Never use electrical equipment or any other equipment which is in any way faulty. The results could be fatal.

Use reduced voltage equipment for inspection and working lights, where possible.

Ensure the cables of mobile electrical equipment cannot get trapped and damaged, such as in a vehicle hoist.

In Cases of Electrocution:

- Switch off electricity before approaching victim.
- If this is not possible, push or drag the victim from the source of electricity using dry non-conductive material.
- Commence resuscitation if trained to do so.
- **SUMMON MEDICAL ASSISTANCE IMMEDIATELY**

## EXHAUST FUMES

These contain asphyxiating, harmful and toxic chemicals, and particles such as carbon oxides, nitrogen oxides, aldehydes, lead, and aromatic hydrocarbons. Engines should only run under conditions of adequate extraction, or general ventilation, not in confined spaces.

**Diesel Engine**

Soot, discomfort, and irritation usually give adequate warning signs of hazardous fume concentration.

## FIBER INSULATION (See Dusts)

Used in noise and sound insulation.

The fibrous nature of surfaces and cut edge can cause skin irritation. This is usually a physical, not a chemical effect.

Precautions should be taken to avoid excessive skin contact through careful organization of work practices and the use of gloves.

## FIRE (See Welding, Foams, Legal Aspects)

Many of the materials found on, or associated with, the repair of vehicles are highly flammable. Some release toxic or harmful fumes if burned.

Observe strict fire safety when storing and handling flammable materials or solvents, particularly near electrical equipment or welding processes.

Before using electrical or welding equipment, be sure there is no fire hazard present.

Have a suitable fire extinguisher available when using welding or heating equipment.

## FIRST AID

Apart from meeting any legal requirements, it is desirable for someone in the workshop to be trained in first aid procedures.

Splashes in the eye should be flushed with clean water for at least ten minutes.

Soiled skin should be washed with soap and water.

Inhalation affected individuals should be removed to fresh air immediately.

If chemicals are swallowed, consult a doctor immediately with (label) information on material used.

Do not induce vomiting, unless indicated by manufacturer.

## FOAMS - Polyurethane (See Fire)

Used in sound and noise insulation. Cured foams are used in seat and trim cushioning.

Follow manufacturer's instructions.

Unreacted components are irritating and may be harmful to the skin and eyes. Wear gloves and goggles.

Individuals with chronic respiratory diseases, asthma, bronchial medical problems, or histories of allergic diseases should not work with or near uncured materials.

The component's vapors and spray mists can cause direct irritation and/or sensitivity reactions and may be toxic or harmful.

Vapors and spray mists must not be breathed. These materials must be applied with adequate ventilation and respiratory protection. Do not remove respirator immediately after spraying, wait until vapor/mists have cleared.

Burning of the uncured components and the cured foams can generate toxic and harmful fumes.

Smoking, open flames, or the use of electrical equipment should not be allowed during foaming operations until vapors/mists have completely cleared. Any heat cutting of cured foams or partially cured foams should be conducted with extraction ventilation (see Legal Aspects).

## FUELS (See Fire, Legal Aspects, Chemicals - General, Solvents)

Used as fuels and cleaning agents.

**Gasoline (Petrol)**

**CAUTION: HIGHLY FLAMMABLE, COMBUSTIBLE.**

Swallowing can result in mouth and throat irritation; absorption from the stomach can result in drowsiness and unconsciousness. Small amounts can be fatal to children. Aspiration of liquid into the lungs, i.e., through vomiting, is a very serious hazard.

Prolonged or repeated contact with gasoline dries the skin and causes irritation and/or dermatitis. Liquid in the eye causes severe pain.

Motor gasoline may contain high quantities of benzene which is toxic upon inhalation; the concentrations of gasoline vapors must be kept very low. High concentrations will cause eye, nose and throat irritation, nausea, headache, depression and symptoms of drunkenness. Very high concentrations will result in rapid loss of consciousness.

Ensure there is adequate ventilation when handling and using gasoline. Great care must be taken to avoid the serious consequences of inhalation in the event of vapor buildup arising from spillages in confined spaces.

Special precautions apply to cleaning and maintenance operations on gasoline storage tanks.

Gasoline should not be used as a cleaning agent. It must not be siphoned by mouth.

**Kerosene (Paraffin)**

Used also as heating fuel, solvent, and cleaning agent.

**CAUTION: FLAMMABLE**

Irritation of the mouth and throat may result from swallowing. The main hazard from swallowing arises if liquid aspiration into the lungs occurs. Liquid contact dries the skin and can cause irritation and/or dermatitis. Splashes in the eye may be slightly irritating.

In normal circumstances, the low volatility does not give rise to harmful vapors. Exposure to mists and vapors from kerosene at elevated temperatures should be avoided (mists may arise in dewaxing). Avoid skin and eye contact; be sure there is adequate ventilation.

**Diesel Fuel (Gas-Oil) (See Fuels -Kerosene)**

**CAUTION: COMBUSTIBLE**

Gross or prolonged skin contact with high boiling gas oils may cause serious skin disorders, including skin cancer.

## GAS CYLINDERS (See Fire)

Gases such as oxygen, acetylene, carbon dioxide, argon, and propane are normally stored in cylinders at pressures of up to 2000 PSI (137.8 bar). Great care should be taken in handling these cylinders to avoid mechanical damage to them or the valve gear attached. The contents of each cylinder should be clearly identified by appropriate markings.

Cylinders should be stored in well-ventilated enclosures and protected from ice, snow, or direct sunlight. Fuel gases, i.e., acetylene and propane, should not be stored in close proximity to oxygen cylinders.

Care should be exercised to prevent leaks from gas cylinders and lines and to avoid sources of ignition.

Only trained personnel should undertake work involving gas cylinders.

## GASES (See Gas Cylinder)

## GAS SHIELDING WELDING (See Welding)

## GAS WELDING (See Welding)

## GENERAL WORKSHOP TOOLS AND EQUIPMENT

It is essential that all tools and equipment are maintained in good condition and the correct safety equipment used where required.

Never use tools or equipment for any purpose other than for which they were designed.

Never overload equipment such as hoists, jacks, axle and chassis stands, or lifting slings. Damage caused by overloading is not always immediately apparent and may result in a fatal failure the next time the equipment is used.

Do not use damaged, defective tools or equipment, particularly high-speed equipment such as grinding wheels. A damaged grinding wheel can disintegrate without warning causing serious injury.

Wear suitable eye protection when using grinding, chiseling, or sandblasting equipment.

Wear a suitable breathing mask when using sandblasting equipment, working with asbestos based materials, or using spraying equipment.

## GLUES (See Adhesive and Sealers)

## HIGH-PRESSURE AIR, LUBRICATION AND OIL TEST EQUIPMENT (See Lubricants and Greases)

Always keep high-pressure equipment in good condition and regularly maintained, particularly joint and unions.

Never direct a high-pressure nozzle at the skin, as the fluid may penetrate to the underlying tissue and can cause serious injury.

## LEGAL ASPECTS

Many laws and regulations make requirements relating to health and safety in the use of materials and equipment in workshops.

Workshops should be familiar, in detail, with these laws and regulations.

## LUBRICANTS AND GREASES

Avoid all prolonged and repeated contact with mineral oils, especially used oils. Gross and prolonged skin contact with used oils contaminated during service, i.e., routine service change sump oils, are more irritating and more likely to cause serious effects, including skin cancer.

Wash skin thoroughly after work involving oil. Proprietary hand cleaners may be of value provided they can be removed from the skin with water. Do not use petrol, paraffin, or other solvents to remove oil from the skin.

Lubricants and greases may be slightly irritating to the eyes.

Repeated or prolonged skin contact should be avoided by wearing protective clothing, if necessary. Particular care should be taken with used oils and greases containing lead. Do not allow work clothing to be contaminated with oil. Dry clean or launder such clothing at regular intervals. Discard oil-soaked shoes.

Do not use previously used engine oils as lubricants or for any application where major skin contact is likely to occur. Used oils may only be disposed of in accordance with local regulations.

## NOISE INSULATION MATERIAL (See Foams, Fiber Insulation)

## PAINTS (See Solvents and Chemical Materials - General)

**CAUTION: HIGHLY FLAMMABLE**

Paints can contain harmful or toxic pigments, driers, and other components, as well as solvents. Spraying should only be carried out with adequate ventilation.

Two-part or catalyzed paints can also contain harmful and toxic unreacted resins and resin-hardening agents. The manufacturer's instructions should be followed and the section on resin-based adhesives, isocyanate containing adhesive and foams should be consulted.

Spraying should preferably be carried out in exhausted ventilated booths, removing vapor and spray mists from the breathing zone. Individuals working in booths should wear respiratory protection. Those doing small-scale repair work in the open shop should wear supplied air respirators.

## PAINT THINNERS (See Solvents)

## PRESSURIZED EQUIPMENT (See High-Pressure Air, Lubrication and Oil Test Equipment)

## RESISTANCE WELDING (See Welding)

## SEALERS (See Adhesives and Sealers)

## SOLDER (See Welding)

Solders are mixtures of metals in which the melting point of the mixture is below that of constituent metals (normally lead and tin). Solder application does not normally give rise to toxic lead fumes, provided a gas/air flame is used. Oxyacetylene flames should not be used, as they are much hotter and will cause lead fumes to be released.

Some fumes may be produced by the application of any flame to surfaces coated with grease, etc., and inhalation of these should be avoided.

Removal of excess solder should be undertaken with care to ensure fine lead dust is not produced, which can cause toxic effects if inhaled. Respiratory protection may be necessary.

Solder spillage and filing should be collected and removed promptly to prevent general air contamination by lead.

High standards of personal hygiene are necessary in order to avoid ingestion of lead or inhalation of solder dust from clothing.

## SOLVENTS (See Chemical Materials - General, Fuels [Kerosene], Fire)

Acetone, White spirit, Toluene, Xylene, Trichlorethane.

Used in cleaning materials, dewaxing, paints, plastics, resins, thinners, etc.

**CAUTION: HIGHLY FLAMMABLE**

Skin contact will degrease the skin and may result in irritation and/or dermatitis following repeated or prolonged contact. Some can be absorbed through the skin in toxic or harmful quantities.

Splashes in the eye may cause severe irritation and could lead to loss of vision.

Brief exposure to high concentrations of vapors or mists will cause eye and throat irritation, drowsiness, dizziness, headaches and, in the worst circumstances, unconsciousness.

Repeated or prolonged exposures to excessive, but lower concentrations of vapors or mists, for which there might not be adequate warning indications, can cause more serious toxic or harmful effects. Aspiration into the lungs, i.e., through vomiting, is the most serious consequence.

Avoid splashes to the skin, eyes, and clothing. Wear protective gloves, goggles, and clothing if necessary.

Ensure good ventilation when in use, avoid breathing fumes, vapors, and spray mists. Keep containers tightly sealed. Do not use in confined spaces.

When the spraying material contains solvents, e.g., paints, adhesives, and coatings, use extraction ventilation or personal respiratory protection in the absence of adequate general ventilation.

Do not apply heat or flame, except under specific and detailed manufacturer's instructions.

## SOUND INSULATION (See Fiber Insulation, Foams)

## SPOT WELDING (See Welding)

## SUSPENDED LOADS

There is always a danger when loads are lifted or suspended. Never work under an unsupported, suspended, or raised load, e.g., jacked-up vehicle, suspended engine, etc.

Always ensure lifting equipment such as jacks, hoists, axle stands, slings, etc., are adequate and suitable for the job, in good condition, and regularly maintained.

Never improvise lifting tackle.

## UNDER SEAL (See Corrosion Protection)

## WELDING (See Fire, Electric Shock, Gas Cylinders)

Welding processes include Resistance Welding (Spot Welding), Arc Welding, and Gas Welding.

### Resistance Welding

This process may cause particles of molten metal to be emitted at high velocity; the eyes and skin must be protected.

### Arc Welding

This process emits a high level of ultraviolet radiation which may cause eye and skin burns to the welder and to other persons nearby. Gas-shielded welding processes are particularly hazardous in this respect. Personal protection must be worn and screens used to shield other people.

Metal spatter will also occur; appropriate eye and skin protection is necessary.

The heat of the welding arc will produce fumes and gases from the metals being welded and from any applied coatings or contamination of the surfaces being worked on. These gases and fumes may be toxic; inhalation should always be avoided. The use of extraction ventilation to remove the fumes from the working area may be necessary, particularly in cases where the general ventilation is poor, or where considerable welding work is anticipated. In extreme cases where adequate ventilation cannot be provided, supplied air respirators may be necessary.

**Gas Welding**

Oxyacetylene torches may be used for welding and cutting; special care must be taken to prevent leakage of these gases, subsequently reducing the risk of fire and explosion.

The process will produce metal spatter; eye and skin protection is necessary.

The flame is bright and eye protection should be used, but the ultraviolet emission is much less than that from arc welding, and lighter filters may be used.

The process itself produces few toxic fumes, but such fumes and gases may be produced from coatings on the work, particularly during cutting away of damaged parts. Inhalation of the fumes should be avoided.

In brazing, toxic fumes may be released from the metals in the brazing rod. A severe hazard may arise if brazing rods containing cadmium are used. In this event, particular care must be taken to avoid inhalation of fumes; an expert's advice may be required.

SPECIAL PRECAUTIONS MUST BE TAKEN BEFORE ANY WELDING OR CUTTING TAKES PLACE ON VESSELS WHICH HAVE CONTAINED COMBUSTIBLE MATERIALS, I.E., "BOILING" OR "STEAMING OUT" THE INSIDE OF FUEL TANKS.

**WHITE SPIRIT (See Solvents)**

# PRODUCT IDENTIFICATION

The tractor and major components are identified using serial numbers and/or manufacturing codes. Tractor identification data must be supplied to the dealer when requesting parts or service and will also be needed to aid in identifying the tractor if it is ever stolen.

The following provides the locations of the identification data.

**Vehicle Identification Plate**
The vehicle identification plate, 1, is located on the front of the air cleaner, at the right-hand end, as shown. Record the information on the sample identification plate provided below.

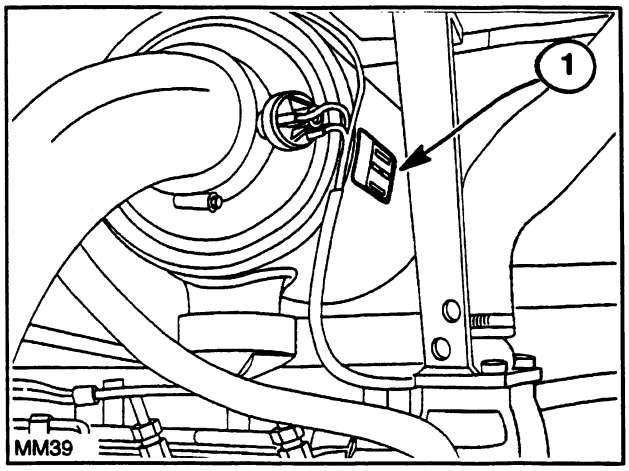
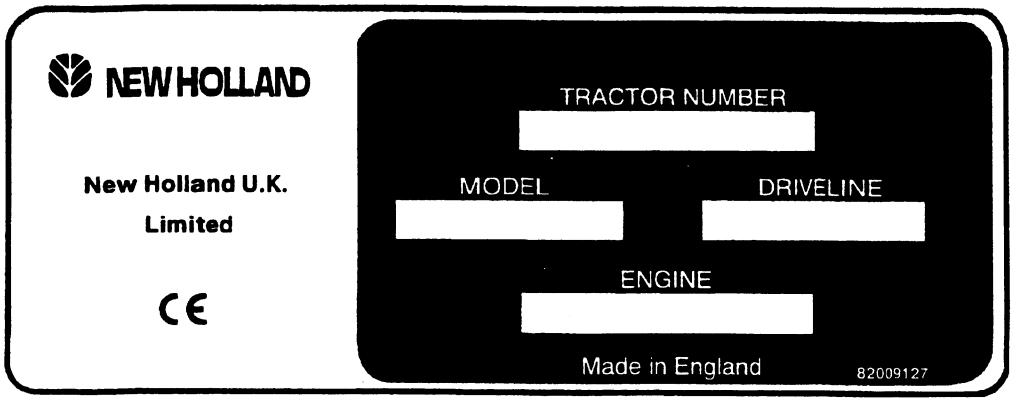



**Figure 0-1-1**




**Tractor Identification**
The serial number and model identification information is stamped on the top of the front support (1). These numbers are also repeated on the vehicle identification plate reproduced above.

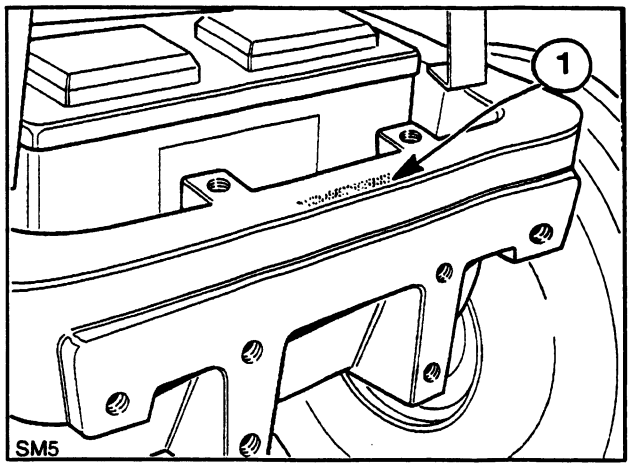



**Figure 0-1-2**

**Engine Identification**
The engine serial number and date code are stamped on a lug (1) protruding from the rear, right-hand side of the engine. This information is repeated on the vehicle identification plate. Record the information below for quick reference.

Serial No. _____

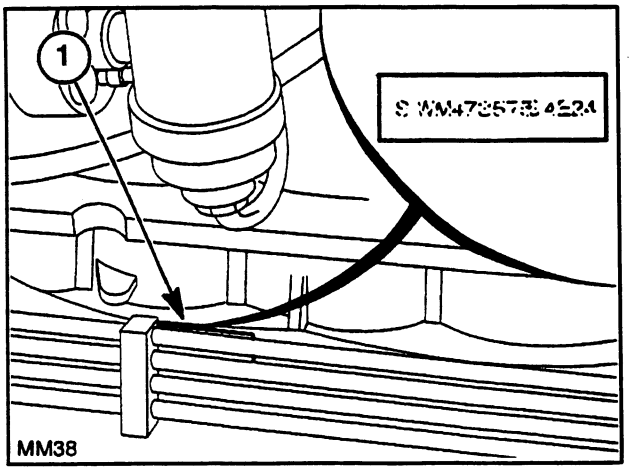



**Figure 0-1-3**

The engine identification plate is located on the right-hand side of the rocker cover, toward the rear of the engine. Record the information on the identification plate reproduced.

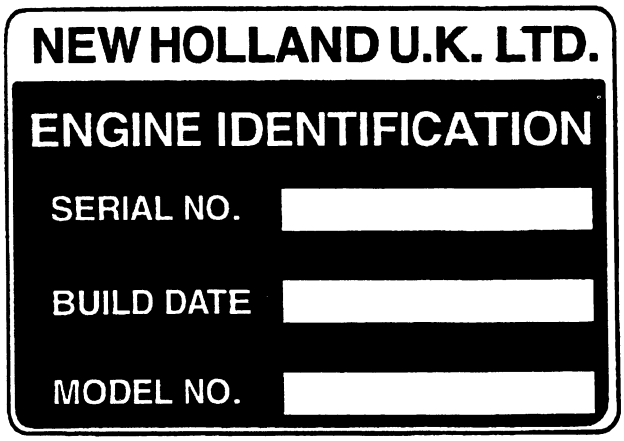



**Figure 0-1-4**

**Driveline Identification**
The serial number is stamped on the right-hand side of the axle housing on the lug (1) to which the bracket (2), that supports the cab/platform and auxiliary fuel tank, is bolted. There is no need to remove this bracket since the information is repeated on the vehicle identification plate (Figure 0-1-1). Record the information below for quick reference.

Serial No. _____

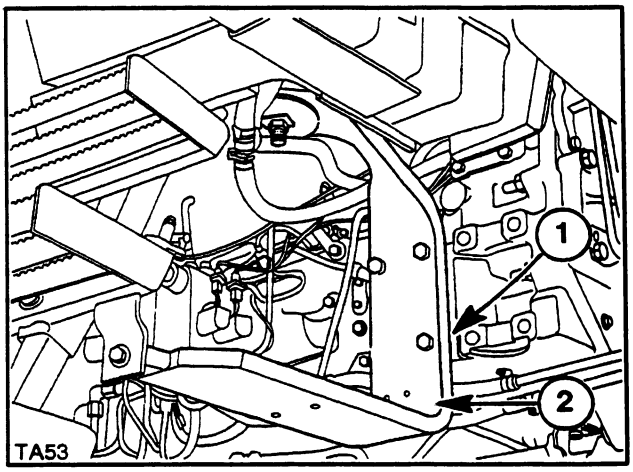



**Figure 0-1-5**

# SERVICE TECHNIQUES

## GENERAL

Clean the exterior of all components before carrying out any form of repair. Dirt and abrasive dust can reduce the efficient working life of a component and lead to costly replacement.

Time spent on the preparation and cleanliness of working surfaces will pay dividends in making the job easier and safer and will result in overhauled components being more reliable and efficient in operation.

Use cleaning fluids which are known to be safe. Certain types of fluid can cause damage to O rings and cause skin irritation. Solvents should be checked that they are suitable for the cleaning of components and also that they do not risk the personal safety of the user.

Replace O rings, seals or gaskets whenever they are disturbed. Never mix new and old seals or O rings, regardless of condition. Always lubricate new seals and O rings with hydraulic oil before installation.

When replacing component parts, use the correct tool for the job.

## HOSES AND TUBES

Always replace hoses and tubes if the cone end or the end connections on the hose are damaged.

When installing a new hose, loosely connect each end and make sure the hose takes up the designed position before tightening the connection. Clamps should be tightened sufficiently to hold the hose without crushing and to prevent chafing.

After hose replacement to a moving component, check that the hose does not foul by moving the component through the complete range of travel.

Be sure any hose which has been installed is not kinked or twisted.

Hose connections which are damaged, dented, crushed or leaking, restrict oil flow and the productivity of the components being served. Connectors which show signs of movement from the original swaged position have failed and will ultimately separate completely.

A hose with a chafed outer cover will allow water entry. Concealed corrosion of the wire reinforcement will subsequently occur along the hose length with resultant hose failure.

Ballooning of the hose indicates an internal leakage due to structural failure. This condition rapidly deteriorates and total hose failure soon occurs.

Kinked, crushed, stretched or deformed hoses generally suffer internal structural damage which can result in oil restriction, a reduction in the speed of operation and ultimate hose failure.

Free-moving, unsupported hoses must never be allowed to touch each other or related working surfaces. This causes chafing which reduces hose life.

## O RING FLAT FACE SEAL FITTINGS

When repairing O ring face seal connectors, the following procedures should be observed.

**WARNING: NEVER DISCONNECT OR TIGHTEN A HOSE OR TUBE THAT IS UNDER PRESSURE. IF IN DOUBT, ACTUATE THE OPERATING LEVERS SEVERAL TIMES WITH THE ENGINE SWITCHED OFF PRIOR TO DISCONNECTING A HOSE OR TUBE.**

1. Release the fittings and separate the hose or tube assembly, then remove and discard the O ring seal from the fitting.
2. Dip a new O ring seal into clean hydraulic oil prior to installation. Install a new O ring into the fitting and, if necessary, retain in position using petroleum jelly.
3. Assemble the new hose or tube assembly and tighten the fitting finger tight, while holding the tube or hose assembly to prevent it from turning.
4. Use two suitable wrenches and tighten the fitting to the specified torque according to the size of the fitting. Refer to the following torque chart.

   **NOTE: To ensure a leak-free joint is obtained, it is important that the fittings are not over or under torqued.**

### O RING FLAT FACE SEAL FITTING TORQUE VALUES

| Nominal O.D (in.) | Nominal Tube (mm) | Dash Size | Thread Size In. | Swivel Nut Torque Ft. Lbs. | Swivel Nut Torque N·m |
|---|---|---|---|---|---|
| 0.250 | 6.35 | -4 | 9/16-18 | 12 | 16 |
| 0.375 | 9.52 | -6 | 11/16-16 | 18 | 24 |
| 0.500 | 12.70 | -8 | 13/16-16 | 37 | 50 |
| 0.625 | 15.88 | -10 | 1-14 | 51 | 69 |
| 0.750 | 19.05 | -12 | 1 3/16-12 | 75 | 102 |
| 0.875 | 22.22 | -14 | 1 3/16-12 | 75 | 102 |
| 1.000 | 25.40 | -16 | 1 7/16-12 | 105 | 142 |
| 1.250 | 31.75 | -20 | 1 11/16-12 | 140 | 190 |
| 1.500 | 38.10 | -24 | 2-12 | 160 | 217 |

# SEALER SPECIFICATIONS

The following sealers should be used as directed in the manual:

| | |
|---|---|
| Anaerobic sealer | LOCTITE GASKET ELIMINATOR 518 |
| RTV silicone sealer | LOCTITE SUPERFLEX 593, 595 or 596<br>LOCTITE ULTRA BLUE 587<br>DOW CORNING SILASTIC 732<br>GENERAL ELECTRIC RTV 103 OR 108 |
| Pipe sealant | PST 592 PIPE SEALANT WITH TEFLON |
| Thread-locking compound | LOCTITE 271 THREADLOCKER/SEALANT (red) |

# HARDWARE TORQUE VALUES

Check the tightness of hardware periodically.

Use the following charts to determine the correct torque when checking, adjusting or replacing hardware on the tractor.

*IMPORTANT: DO NOT use the values listed in the charts if a different torque value or tightening procedure is specified in this manual for a specific application. Torque values listed are for general use only.*

Make sure fastener threads are clean and not damaged.

**NOTE: A torque wrench is necessary to properly torque hardware.**

# MINIMUM HARDWARE TIGHTENING TORQUE

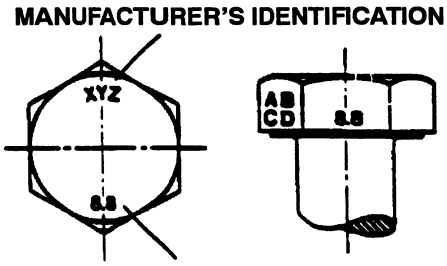
## IN FOOT POUNDS (NEWTON-METERS) FOR NORMAL ASSEMBLY APPLICATIONS

## METRIC HARDWARE AND LOCKNUTS

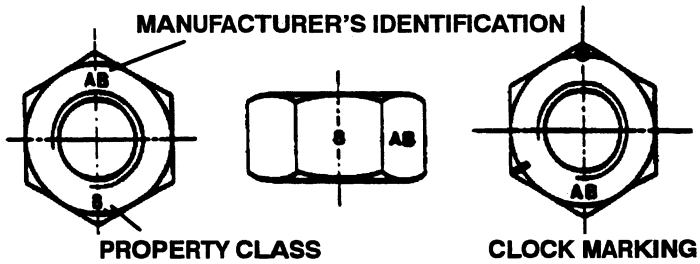
| NOMINAL SIZE | CLASS 5.8 | | CLASS 8.8 | | CLASS 10.9 | | LOCKNUT CL.8 W/CL8.8 BOLT |
|---|---|---|---|---|---|---|---|
| | UNPLATED | PLATED W/ZnCr | UNPLATED | PLATED W/ZnCr | UNPLATED | PLATED W/ZnCr | |
| M4 | 15* (1.7) | 19* (2.2) | 23* (2.6) | 30* (3.4) | 33* (3.7) | 42* (4.8) | 16* (1.8) |
| M6 | 51* (5.8) | 67* (7.6) | 79* (8.9) | 102* (12) | 115* (13) | 150* (17) | 56* (6.3) |
| M8 | 124* (14) | 159* (18) | 195* (22) | 248* (28) | 274* (31) | 354* (40) | 133* (15) |
| M10 | 21 (28) | 27 (36) | 32 (43) | 41 (56) | 45 (61) | 58 (79) | 22 (30) |
| M12 | 36 (49) | 46 (63) | 55 (75) | 72 (97) | 79 (107) | 102 (138) | 39 (53) |
| M16 | 89 (121) | 117 (158) | 137 (186) | 177 (240) | 196 (266) | 254 (344) | 97 (131) |
| M20 | 175 (237) | 226 (307) | 277 (375) | 358 (485) | 383 (519) | 495 (671) | 195 (265) |
| M24 | 303 (411) | 392 (531) | 478 (648) | 619 (839) | 662 (897) | 855 (1160) | 338 (458) |

**NOTE: Torque values shown with * are inch pounds.**

### IDENTIFICATION
### HEX CAP SCREW AND CARRIAGE BOLTS
### CLASSES 5.6 AND UP




### HEX NUTS AND LOCKNUTS
### CLASSES 05 AND UP



# MINIMUM HARDWARE TIGHTENING TORQUE

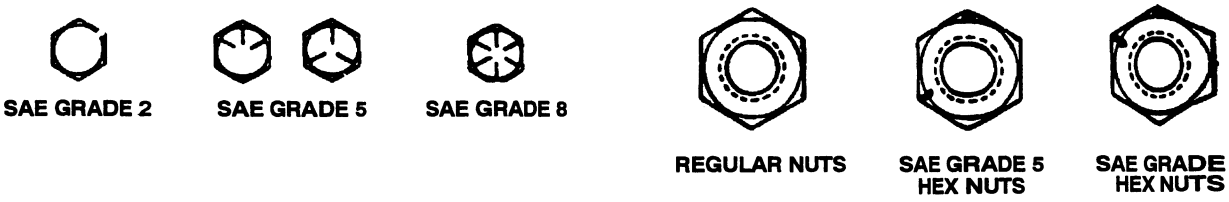
## IN FOOT POUNDS (NEWTON-METERS) FOR NORMAL ASSEMBLY APPLICATIONS

## INCH HARDWARE AND LOCKNUTS

| NOMINAL SIZE | SAE GRADE 2 | | SAE GRADE 5 | | SAE GRADE 8 | | LOCKNUTS | | NOMINAL SIZE |
|---|---|---|---|---|---|---|---|---|---|
| | UNPLATED or PLATED SILVER | PLATED W/ZnCr GOLD | UNPLATED or PLATED SILVER | PLATED W/ZnCr GOLD | UNPLATED or PLATED SILVER | PLATED W/ZnCr GOLD | GR.B w/GR5 BOLT | GR.C w/GR8 BOLT | |
| 1/4 | 55* (6.2) | 72* (8.1) | 86* (9.7) | 112* (13) | 121* (14) | 157* (18) | 61* (6.9) | 86* (9.8) | 1/4 |
| 5/16 | 115* (13) | 149* (17) | 178* (20) | 229* (26) | 250* (28) | 324* (37) | 125* (14) | 176* (20) | 5/16 |
| 3/8 | 17 (23) | 22 (30) | 26 (35) | 34 (46) | 37 (50) | 48 (65) | 19 (26) | 26 (35) | 3/8 |
| 7/16 | 27 (37) | 35 (47) | 42 (57) | 54 (73) | 59 (80) | 77 (104) | 30 (41) | 42 (57) | 7/16 |
| 1/2 | 42 (57) | 54 (73) | 64 (87) | 83 (113) | 91 (123) | 117 (159) | 45 (61) | 64 (88) | 1/2 |
| 9/16 | 60 (81) | 77 (104) | 92 (125) | 120 (163) | 130 (176) | 169 (229) | 65 (88) | 92 (125) | 9/16 |
| 5/8 | 83 (112) | 107 (145) | 128 (174) | 165 (224) | 180 (244) | 233 (316) | 90 (122) | 127 (172) | 5/8 |
| 3/4 | 146 (198) | 189 (256) | 226 (306) | 293 (397) | 319 (432) | 413 (560) | 160 (217) | 226 (306) | 3/4 |
| 7/8 | 142 (193) | 183 (248) | 365 (495) | 473 (641) | 515 (698) | 667 (904) | 258 (350) | 364 (494) | 7/8 |
| 1 | 213 (289) | 275 (373) | 547 (742) | 708 (960) | 773 (1048) | 1000 (1356) | 386 (523) | 545 (739) | 1 |

**NOTE: Torque values shown with * are inch pounds.**

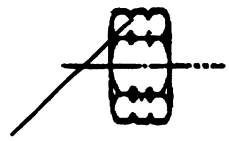
## IDENTIFICATION
## CAP SCREWS AND CARRIAGE BOLTS



SAE GRADE 2 | SAE GRADE 5 | SAE GRADE 8

REGULAR NUTS | SAE GRADE 5 HEX NUTS | SAE GRADE 8 HEX NUTS

## LOCKNUTS



GRADE IDENTIFICATION

GRADE A NO NOTCHES

GRADE B ONE CIRCUMFERENTIAL NOTCH

GRADE C TWO CIRCUMFERENTIAL NOTCHES

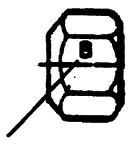
GRADE IDENTIFICATION

GRADE A NO MARKS

GRADE B THREE MARKS

GRADE C SIX MARKS

MARKS NEED NOT BE LOCATED AT CORNERS




GRADE A NO MARK
GRADE B LETTER B
GRADE C LETTER C

GRADE IDENTIFICATION

# INDEX

# SECTION 1

# ENGINES

## CHAPTER 1

## ENGINE

## CONTENTS

## GROUP 10 – GENERAL FEATURES AND SPECIFICATIONS

| Model ( T=Turbocharged ) | | 8160 | 8260 | 8360 (T) | 8560 (T) |
|---|---|---|---|---|---|
| No of Cylinders | | 6 | 6 | 6 | 6 |
| Bore | ins | 4.4 | 4.4 | 4.4 | 4.4 |
| | (mm) | 111.8 | 111.8 | 111.8 | 111.8 |
| Stroke | ins | 5.0 | 5.0 | 5.0 | 5.0 |
| | (mm) | 127.0 | 127.0 | 127.0 | 127.0 |
| Displacement | cu in | 456 | 456 | 456 | 456 |
| | (cu cm) | 7472 | 7472 | 7472 | 7472 |
| Compression Ratio | | 17:5–1 | 17:5–1 | 17:5–1 | 17:5–1 |
| Cylinder Bore Compression at cranking speed of 200 R.P.M | lbs/in$^2$ | 375 | 375 | 375 | 375 |
| | bar | 25.5 | 25.5 | 25.5 | 25.5 |
| Firing Order | | 153624 | 153624 | 153624 | 153624 |
| Idle Speed R.P.M | | 700 800 | 700 800 | 700 800 | 700 800 |
| Maximum no Load Speed R.P.M | | 2370–2420 | 2370–2420 | 2370–2420 | 2480 2530 |
| Rated Engine Speed | | 2200 | 2200 | 2200 | 2300 |

### CYLINDER BLOCK

Taper of Cylinder Bore
0.001 in (0.025mm) Repair Limit
0.005 in (0.127mm) Wear Limit

Cylinder Bore out of Round
0.0015 in (0.030mm) Repair Limit
0.0050 in (0.127mm) Wear Limit

Cylinder Bore Diameters
4.4007–4.4032 in (111.778–111.841mm)

Rear Oil Seal Bore Diameter
5.542–5.546 in (140.77–140.87mm)

Block to Head Surface Flatness
0.003 in (0.08mm) in any 6 in (152mm)
0.001 in (0.03mm) in any 1 in (25.40mm)

### CYLINDER HEAD

Valve Guide Bore Diameter
0.3728–0.3738 in (9.469–9.495mm)

Head to Block Surface Flatness
0.001 in (0.03mm) in any 1 in (25.40mm),
or 0.005 in (0.127mm) overall limit

**EXHAUST VALVES**

| | |
|---|---|
| Face Angle | 44°15'–44°30' Relative to the Head of Valve |
| Stem Diameter | Std : 0.3701–0.3709 in (9.401–9.421mm) |
| | 0.003 in (0.076mm) Oversize : 0.3731–0.3739 in (9.477–9.497mm) |
| | 0.015 in (0.38mm) Oversize : 0.3851–0.3859 in (9.781–9.802mm) |
| | 0.030 in (0.76mm) Oversize : 0.4001–0.4009 in (10.163–10.183mm) |
| Head Diameter | 1.688–1.698 in (42.88–43.13mm) |
| Stem to Guide Clearance | 0.0019–0.0037 in (0.048–0.094mm) |
| Lash Clearance (Cold) | 0.017–0.021 in (0.43–0.53mm) |

**INTAKE VALVES**

| | |
|---|---|
| Face Angle | 29°15'–29°30' Relative to Head of Valve |
| Stem Diameter | Std : 0.3711–0.3719 in (9.426–9.446mm) |
| | 0.003 in (0.076mm) Oversize : 0.3741–0.3749 in (9.502–9.522mm) |
| | 0.015 in (0.381mm) Oversize : 0.3861–0.3869 in (9.807–9.827mm) |
| | 0.030 in (0.762mm) Oversize : 0.4011–0.4019 in (10.188–10.208mm) |
| Head Diameter | 1.865–1.875 in (47.37–47.63mm) |
| Stem to Guide Clearance | 0.0009–0.0027 in (0.023–0.069mm) |
| Lash Clearance (Cold) | 0.014–0.018 in (0.36–0.46mm) |

**VALVE SPRINGS**

| | |
|---|---|
| Number per Valve | 1 |
| Free Length | 2.390 in (60.70mm) |
| Length, loaded at 62–68 lb (28–31kg) | 1.900 in (48.26mm) |
| Length, loaded at 135–153 lb (61–69kg) | 1.405 in (35.69mm) |

**VALVE TIMING**

| | |
|---|---|
| Intake Opening | 12° Before Top Dead Center |
| Intake Closing | 38° After Bottom Dead Center |
| Exhaust Opening | 48° Before Bottom Dead Center |
| Exhaust Closing | 12° After Top Dead Center |

**VALVE INSERTS**

| Insert Oversize | Exhaust Valve Insert Counterbore Diameter in Cylinder Head | Intake Valve Seat Insert Counterbore Diameter in Cylinder Head |
|---|---|---|
| 0.010 in (0.254mm) | 1.739–1.740 in (44.17–44.20mm) | 1.969–1.970 in (50.01–50.04mm) |
| 0.020 in (0.508mm) | 1.749–1.750 in (44.42–44.45mm) | 1.979–1.980 in (50.27–50.29mm) |
| 0.030 in (0.762mm) | 1.759–1.760 in (44.68–44.70mm) | 1.989–1.990 in (50.52–50.55mm) |

**VALVE SEATS**

| | |
|---|---|
| Exhaust Valve Seat Angle | 45°00' – 45°30' |
| Intake Valve Seat Angle | 30°00' – 30°30' |
| Interference Valve Face Angle to Valve Seat Angle | 0°30' – 1°15' |
| Concentricity With Guide Diameter | 0.002 in (0.051mm) Total Indicator Reading Max |
| Seat Width Exhaust Valve<br>Intake Valve | 0.072–0.092 in (1.8–2.3mm)<br>0.078–0.098 in (1.9–2.5mm) |

**CAMSHAFT IDLER GEAR**

| | |
|---|---|
| Number of teeth | 47 |
| End Play | 0.003–0.014 in (0.076–0.35mm) |
| Bushing Inside Diameter | 2.005–2.0015 in (50.813–50.838mm) |
| Adaptor Outside Diameter | 1.9985–1.9990 in (50.762–50.775mm) |
| Backlash with Crankshaft Gear | 0.004–0.014 in (0.10–0.35mm) |
| Backlash with Camshaft Gear | 0.008–0. 022 in (0.20–0.56mm) |
| Backlash with Fuel Injection Pump | 0.004–0.006 in (0.10–0.15 mm) |

**CAMSHAFT GEAR**

| | |
|---|---|
| Number of Teeth | 52 |
| Timing Gear Backlash | 0.001–0.015 in (0.025–0.38mm) |

**ROCKER ARM SHAFT**

| | |
|---|---|
| Shaft Diameter | 1.000–1.001 in (25.40–25.43mm) |
| Shaft Support Internal Diameter | 1.002–1.004 in (25.45–25.20mm) |

**ROCKER ARM**

| | |
|---|---|
| Inside Diameter | 1.003–1.004 in (25.48–25.50mm) |

**TAPPETS**

| | |
|---|---|
| Clearance to Bore | 0.0006–0.0021 in (0.015–0.053 mm) |

| | |
|---|---|
| Tappet Diameter | 0.9889–0.9894 in (25.118–25.130mm) |
| Tappet Bore Diameter | 0.9900–0.9910 in (25.15–25.17mm) |
| **CAMSHAFT** | |
| Bearing Journal Diameter | 2.3895–2.3905 in (60.693–60.719mm) |
| Bearing Clearance | 0.0010–0.0030 in (0.025–0.076mm) |
| End Play | 0.0020–0.0070 in (0.051–0.18mm) |
| **CONNECTING RODS** | |
| Small End Bushing (Internal Diameter)<br>Normally Aspirated<br>Turbocharged | <br>1.5005–1.5008 in (38.113–38.120mm)<br>1.6255–1.6258 in (41.288–41.259mm) |
| Clearance Bushing to Piston Pin | 0.0005–0.0010 in (0.013–0.025mm) |
| Side Float | 0.0050–0.0130 in (0.13–0.33mm) |
| Maximum Twist | 0.0120 in (0.30mm) |
| Maximum Bend | 0.0040 in (0.10mm) |
| **PISTON PIN** | |
| Outside Diameter<br>Normally Aspirated Engine<br>Turbocharged Engine | <br>1.4998–1.5000 in (38.095–38.100mm)<br>1.6248–1.6250 in (41.270–41.275mm) |
| **PISTONS** | |
| Skirt to Cylinder Clearance Naturally Aspirated | 0.0055–0.0067 in (0.140–0.171mm) New or unrun engine<br>0.0055–0.011 in. (0.140–0.28mm) For run engines |
| Skirt to Cylinder Clearance Turbocharged | 0.0065–0.0077 in (0.166–0.196mm) New or unrun engine<br>0.0065–0.011 in (0.166–0.28mm) For run engines |
| Grading Diameter (at Right Angles to Piston Pin) | 4.3951–4.3991 in (111.64–111.74mm)<br>in increments of 0.0005 in (0.0127mm) |
| Piston Pin Clearance | 0.00012–0.00055 in (0.0030–0.0140mm)<br>at 70°F (21°C) |
| Piston Crown to Block Face,<br>Naturally Aspirated<br>Turbocharged | <br>0.011–0.023 in (0.28–0.58mm)<br>0.0–0.012 in (0.0–0.3mm) |
| **PISTON RINGS** | |
| Compression,<br>Number and Location | <br>2 of,1st and 2nd from the top of the piston |
| Naturally Aspirated,<br>Top Compression Ring<br>2nd Compression Ring | <br>Parallel Sides–Barrelled face<br>Lower side internal chamfer – tapered face |
| Turbocharged,<br>Top Compression Ring<br>2nd Compression Ring | <br>Keystone Tapered sides – Barrelled face<br>Lower side internal chamfer – tapered face |
| Oil Control,<br>Number and Location<br>Type | <br>1 of,–Directly above the Piston Pin,<br>Slotted With Expander |

| | |
|---|---|
| Side Face Clearance To Ring Groove, | |
| Top Compression Ring | 0.0041–0.0060in (0.103–0.153mm) |
| 2nd Compression Ring – Turbocharged | 0.0030–0.0049in (0.075–.125mm) |
| – N.A. | 0.0022–0.0042in (0.055–0.105mm) |
| Oil Control Ring | 0.0016–0.0035in (0.040–0.090mm) |
| Gap Width, | |
| Top Compression Ring – Turbocharged | 0.016–0.036in (0.40–0.90mm) |
| – N.A. | 0.015–0.033in (0.38–0.84mm) |
| 2nd Compression Ring | 0.016–0.036in (0.40–0.90mm) |
| Oil Control Ring | 0.016–0.036in (0.40–0.90mm) |

**CRANKSHAFT**

| | |
|---|---|
| Main Journal Diameter–Blue | 3.3713–3.3718 in (85.631–85.644mm) |
| –Red | 3.3718–3.3723 in (85.644–85.656mm) |
| Main Journal Length (except thrust, rear, or intermediate) | 1.455–1.465 in (36.96–37.21mm) |
| Main Journal Wear Limits | 0.005 in (0.127mm) Maximum |
| Main and Crankpin Fillet Radius | 0.12–0.14 in (3.048–3.556mm) |
| Thrust Bearing Journal Length | 1.459–1.461 in (37.06–37.11mm) |
| Intermediate Bearing Journal Length | 1.455–1.465 in (36.96–37.21mm) |
| Rear Bearing Journal Length | 1.495–1.515 in (37.97–38.48mm) |
| Crankpin Journal Length | 1.678–1.682 in (42.62–42.72mm) |
| Crankpin Diameter – Blue | 2.749–2.7500 in (69.840–69.850mm) |
| – Red | 2.750–2.7504 in (69.850–69.860mm) |
| End Play | 0.004–0.008 in (0.10–0.20mm) |
| Crankpin Out of Round | 0.0002 in (0.005mm) Total Indicator Reading |
| Taper Surface Parallel to Center Line of Main Journal | 0.0002 in (0.005mm) |
| Crankshaft Rear Oil Seal Journal Diameter | 4.808–4.814 in (122.12–122.28mm) |
| Crankshaft Pulley Journal Diameter | 1.750–1.751 in (44.45–44.48mm) |
| Crankshaft Timing Gear Journal Diameter | 1.820–1.821 in (46.23–46.25mm) |
| Crankshaft Flange Runout | 0.0015 in (0.038mm) Max |

**CRANKSHAFT DRIVE GEAR**

| | |
|---|---|
| Number of teeth | 26 |

**MAIN BEARING**

| | |
|---|---|
| Liner length (except thrust liner) | 1.10–1.11 in (27.94–28.19mm) |
| Liner Length (Thrust Liner) | 1.453–1.455 in (39.91–39.96mm) |
| Vertical Assembled Bearing Clearance | 0.0021–0.0046 in (0.055–0.117mm) |

**CRANKPIN BEARINGS**

| | |
|---|---|
| Liner Length | 1.40–1.41 in (35.56–35.81mm) |
| Vertical Assembled Bearing Clearance | 0.0014–0.0037 in (0.035–0.094mm) |