TECHNICAL MANUAL

UNIT, INTERMEDIATE DIRECT SUPPORT AND

INTERMEDIATE GENERAL SUPPORT MAINTENANCE MANUAL

DRILLING SYSTEM, WELL, ROTARY,
TRUCK MOUNTED, AIR TRANSPORTABLE,
600 FEET CAPACITY
MODEL LP-12
NSN 3820-01-246-4276

This technical manual is an authentication of the manufacturer's commercial literature and does not conform with the format and content requirements normally associated with Army technical manuals. This technical manual does, however, contain all essential information required to operate and maintain the equipment.

Approved for public release; distribution is unlimited.

HEADQUARTERS, DEPARTMENT OF THE ARMY
8 MAY 1989

CHANGE

No. 1

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C.4 October 1989

UNIT, INTERMEDIATE DIRECT SUPPORT AND
INTERMEDIATE GENERAL SUPPORT MAINTENANCE MANUAL

DRILLING SYSTEM, WELL, ROTARY
TRUCK MOUNTED, AIR TRANSPORTABLE,
600 FEET CAPACITY
MODEL LP-165F299
NSN 3820-01-246-4276

Approved for public release; distribution is unlimited.

TM 5-3820-256-24-3, 8 May 1989 is changed as follows.

1 Title is changed as shown above.
2 Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

WILLIAM J. MEEHAN, II
Brigadier General United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-25A, Unit, Direct Support and General Support Maintenance requirements for Drilling Machine, Well, Combination Rotary/Percussion, Semitrailer Mounted Diesel, 1500 Ft. Model CF-15-S

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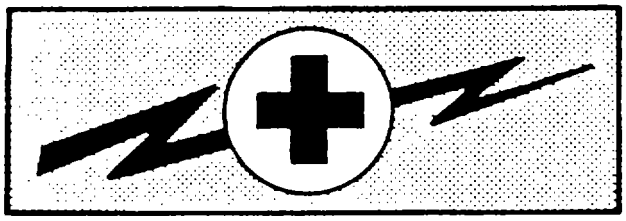
WARNING



MI 131637

ELECTRIC POWER LINES CAN KILL
Never raise mast or crane, or operate drill unit with less than 25 feet working clearance to any electrical power line.
Do not touch live electrical parts.

Check for buried utility lines before drilling.

WARNING

Crane and drilling operations have inherent hazards that cannot be mechanically safe guarded. Operator and maintenance personnel are required to wear hard hats and safety shoes.

Compressed air used for cleaning can create airborne particles that may enter the eyes. Pressure will not exceed 30 psi. Eye protection required.

Never operate engine in enclosed areas. Exhaust gases, particularly carbon monoxide, may build up. These gases are harmful and potentially lethal.

Cleaning solvent (PD-680, Type II) is toxic to skin, eyes and respiratory tract. Skin and eye protection required. Avoid repeated or prolonged contact. Good general ventilation is normally adequate.

Welding operations produce heat, highly toxic fumes, injurious radiation, metal slag and airborne particles. Protection equipment consisting of welding goggles with proper tinted lenses, apron or jacket, and welder's boots required. Good general ventilation is normally adequate.

Exercise care when using sharp or pointed tools to prevent injury to personnel.

Personnel will be trained in safe climbing practices. Climbing devices will be used on mast at all times. Safety climbing devices will be inspected prior to each use to insure good working order.

For Artificial Respiration, refer to FM 21-11.

WARNING

NOISE HAZARD

exist for all personnel within 15 Feet of an operating drilling unit. Personnel must wear approved ear protection equipment .Failure to do so may result in impairment or loss of hearing.

b

INTRODUCTION

1. SCOPE

This manual covers the 600 Feet Capacity Well Drilling System, Model LP-12, NSN 3820-01-246-4276. This manual consists of six volumes.

2 DRILLING SYSTEM

The Drilling System consists of three main components; a well drilling machine; a support vehicle (rig tender); and a well completion kit. Government furnished (GFE) incorporated as part of the system include a trailer mounted power unit and 3,000 gallon, collapsible, fabric water tank.

3. DRILLING MACHINE VOLUME 1

The drilling machine is a truck mounted rotary well drilling machine consisting of a 32 foot mast, three drum drawworks assembly, rotary table, mud pump and air compressor. The components of the drilling machine are powered by the truck engine.

4 SUPPORT VEHICLE VOLUME 2

The support vehicle is a truck mounted vehicle consisting of a 1,000 gallon water tank, hydraulically driven water pump, an electric fuel pump and fuel dispensing nozzle, a welder-generator assembly, and an electro-hydraulic crane. The support vehicle also provides a storage area for transport of drill pipe, collars, hand tools, operating and accessory equipment for the drilling machine, and the well completion equipment.

5 TRUCKS VOLUMES 3, 4 and 5

The drilling machine and support vehicle are mounted on truck chassis of the same model. The drilling machine truck has a special design low profile cab. The truck is a diesel engine powered, 6x6 vehicle with a transfer case to transfer engine power to truck mounted components.

6 WELL COMPLETION VOLUME 6

The well completion kit consists of equipment necessary for completion of a 600-ft.

water well.

7. OPERATION INSTRUCTIONS

Refer to TM5-3820-256-10 for Operation, Preventive Maintenance and Lubrication of the Well Drilling System.

8 REPAIR PARTS

For repair parts refer to TM5-3820-256-24P, Repair Parts and Special Tools List.

9 APPENDIXES VOLUME 6

Maintenance Allocation Chart is contained in Appendix A; Torque Requirements are contained in Appendix B.

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CHAPTER 1

GENERAL INFORMATION

1-1 INTRODUCTION

1-1.1 Cautions and warnings. You will find CAUTIONS and WARNINGS in this manual.

a. WARNINGS are to advise you to be particularly careful in order to avoid personal injury accidents.

b. CAUTIONS are provided to prevent you from making an error which could result in damage to the vehicle and could possibly cause personal injury or property damage.

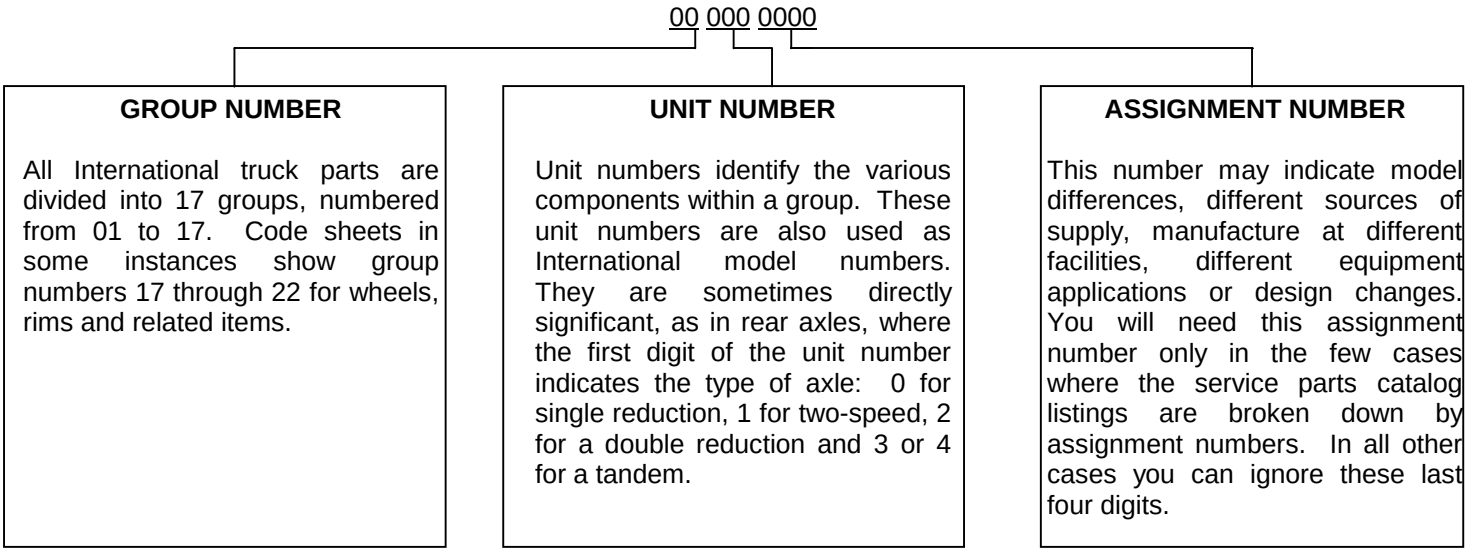
c. Read this manual before operating vehicle.

d. This manual will familiarize you with your vehicle and provide sufficent information to perform minor services necessary for continued efficient operation. Study this manual carefully before you operate the vehicle.

1-2 COMPONENT CODE NUMBERS

1-2.1 Codes are the basis for identifying the components used on Navistar trucks. They are used by sales personnel ordering the truck, by manufacturing to build that truck and by parts personnel to service the truck. Many items in this manual are identified by codes or by model. Therefore, it is important to understand their meaning.

1-2.2 THE CODE STRUCTURE IS AS FOLLOWS:



CHAPTER 2

All information in Chapter 2 is contained in TM 5-3820-256-10.

2-1/(2-2 blank)

CHAPTER 3

MAINTENANCE

3-1 PREFACE

3-1.1 As with any machine, care should be taken when making any check, doing any maintenance, or making any repair to avoid being injured. Improper or incomplete service could also lead to the vehicle itself not working properly which may result in personal injury or damage to the vehicle or its equipment. If you have any question about carrying out some service, have the service elevated to next higher maintenance level.

3-1.2 Your vehicle has been engineered and manufactured so that it can provide economical and trouble-free service. However, it is the operator's responsibility to see that the vehicle receives proper care and maintenance.

WARNING

Making modifications to various parts, components and systems of vehicle, such as brake and steering systems, can adversely affect the quality and reliability of your vehicle, possibly resulting in personal injury and accident. Such modifications must be avoided.

3-1.3 Follow the periodic lubrication procedures Chapter 4 and regular engine inspection intervals outlined in this Table 3-1. Remember that regular maintenance and replacement of worn parts will usually prevent serious problems from developing later.

3-1.4 The lubrication intervals present a good opportunity to inspect the vehicle. We suggest that the various points listed herein be checked at the recommended intervals.

WARNING

To help avoid personal injury, take care when performing any maintenance or making any check or repair. Some of the materials in this vehicle may also be hazardous if used, serviced, or handled improperly. Improper or incomplete service can also affect the vehicle which may in turn result in personal injury, or damage to the truck or its equipment, if you have any questions pertaining to the service, have the work done by a skilled technician.

CAUTION

Failure to properly perform maintenance and servicing procedures could result in damage to the vehicle and could cause personal injury or property damage.

3-2 AXLE -- FRONT

3-2.1 General

a. Maintaining front axle alignment to specifications is very important and should only be performed by a qualified mechanic. Toe-in adjustment is particularly important with radial tires.

b. Check to assure that axle mounting U-bolt nuts, attaching or mounting bolts and nuts are securely tightened.

c. Regularly check front axle for damaged, binding or worn parts, and adequate lubrication.

3-2.2 Toe-In Setting

a. Factory unladen vehicle toe-in setting is 1/16± 1/16 inch (1.59 ± 1.59 mm).

b. For optimum tire wear it is recommended that toe-in be adjusted to 1/16 inch (1.59 mm) after the body has been installed and before the vehicle is put into service.

c. Special applications may warrant a setting based on past experience with the type of tire operating loads and conditions. Radial tires are more sensitive to toe-in setting than bias ply tires.

d. It is essential that correct toe-in and tire pressure located above tire be maintained for optimum tire wear.

3-3 AXLE-REAR

3-3.1 General

a. Check to assure that axle mounting U-bolt nuts, attaching or mounting bolts and nuts are securely tightened. Refer to Springs, U-Bolt Nut Torque Chart, Table 3-3.

b. Regularly check rear axle for damaged, binding or worn parts.

3-4 BRAKES

WARNING

Excessive amounts of asbestos dust may be a potential health hazard that may cause seirous injury or possibly even death.

3-4.1 Asbestos Dust During Brake Servicing

a. Because studies have indicated that exposure to excessive amounts of asbestos dust may be a potential health hazard, the Occupational Safety and Health Administration (OSHA) has set maximum limits of levels of airborne asbestos dust to which workers may be exposed. Since most automotive friction materials normally

contain a sizeable amount of asbestos, it is important that people who handle brake linings be aware of the problem and know the precautions to be taken.

b. Areas where brake work is done should be set aside, if possible, and should be posted with an asbestos exposure sign as follows:

ASBESTOS DUST HAZARD
AVOID BREATHING DUST
WEAR ASSIGNED PROTECTIVE EQUIPMENT
DO NOT REMAIN IN AREA UNLESS YOUR
WORK REQUIRES IT
BREATHING ASBESTOS DUST MAY BE
HAZARDOUS TO YOUR HEALTH

c. OSHA standards should be consulted with respect to mandatory requirements as well as for suggested procedures to minimize exposure. (Reference: Title 29, Code of Federal Regulations, Section 1910.1001.)

3-4.2 Brake Inspection and Adjustment

a. A regular schedule for periodic cleaning, lubrication, adjustment and inspection should be established, based on the type of vehicle operation. Refer to lubrication and maintenance guide intervals, Chapter 4. It is difficult to predetermine an exact maintenance interval (time or mileage), since vehicles will be used in a wide variety of applications and conditions.

b. Periodic checking of push rod travel or brake adjustment is essential for good braking. Push rod travel should be checked every 2,000 mi. (3 000 km) to determine if adjustment is necessary. Vehicles with automatic slack adjusters should also be checked to ensure proper operation of the adjuster mechanism at the 2,000 mi. (3 000 km) interval. Push rod travel should be kept at a minimum without brakes dragging.

c. Inspect brake lining every 12,000 mi. (19 000 km) or every 12 months, whichever occurs first. Inspect more often during periods of severe service oepration or considerable stop-and-go operation. When brake lining or blocks are worn to within 1/16 inc. (1.6 mm) of rivets, brake lining must be replaced.

d. Once a year, the entire brake system must be inspected.

(1) Rubber may deteriorate wherever it is used. Rubber brake components should be inspected by a competent mechanic and replaced as necessary. Replacement intervals will vary according to the severity and length of service.

(2) Condition of drums, brake chambers and slack adjusters.

(3) Air leaks.

(4) Hose or pipes for rust, damage, deterioration.

(5) Operation of service and parking brake.

e. Some parts, such as air brake chamber diaphragm, should be inspected once a year or every 100,000 mi. (160 000 km) and replaced if considered unserviceable for further use.

3-5 CAB

3-5.1 Defrosters: Operate defroster controls to determine if sufficient air is being directed against windshield.

3-5.2 Door Latches: Check latches for positive closing, latching and locking.

3-5.3 Glass: Check for cracked, broken, scratched or dirty glass including rear view mirrors.

3-5.4 Seat Belts: Check entire seat belt assembly for wear and proper operation. Make certain anchor mountings are tight. Seat belts are to be worn at all times.

3-5.5 Cab Mouting: Check condition of cab mounting brackets, sheet metal and rubber mountings.

3-6 CARE OF VEHICLE

3-6.1 Washing

a. Frequent and regular washing will lengthen the life of your new vehicle's painted finish.

b. Wash your vehicle often with warm or cold water to remove dirt. Do not use hot water or strong soaps or detergents or wipe off dirt when the surface is dry as this will scratch the paint.

3-6.2 Upholstery Care

3-6.2.1 Use a whisk broom and vacuum cleaner to remove loose dust and dirt from upholstery and floor. Vinyl and woven plastic upholstery can be washed with warm water and mild soap. Wipe dry. If commercial cleaners are used, follow instructions supplied with cleaner.

3-7 CLUTCH

3-7.1 Pedal Free Travel

3-7.1.1 Each time the vehicle chassis is lubricated, check clutch pedal free travel. If free travel is less than 1-1/4 inch (32mm), the pedal linkage must be adjusted to be assured that the clutch is fully engaged.

NOTE

Clutch pedal free travel is the distance the clutch pedal moves to provide proper release bearing to clutch lever clearance.

3-7.2 Asbestos Dust During Clutch Servicing

WARNING

Excessive amounts of asbestos dust may be a potential health hazard that may cause serious injury or possibly even death.

a. Because studies have indicated that exposure to excessive amounts of asbestos dust may be a potential health hazard, the Occupational Safety and Health Administration (OSHA) has set maximum limits of levels of airborne asbestos dust to which workers may be exposed. Since most automotive friction materials normally contain a sizeable amount of asbestos, it is important that people who handle clutch linings be aware of the problem and know the precautions to be taken.

b. Areas where clutch work is done should be set aside, if possible, and should be posted with an asbestos exposure sign as follows:

ASBESTOS DUST HAZARD
AVOID BREATHING DUST
WEAR ASSIGNED PROTECTIVE EQUIPMENT
DO NOT REMAIN IN AREA UNLESS YOUR
WORK REQUIRES IT
BREATHING ASBESTOS DUST MAY BE
HAZARDOUS TO YOUR HEALTH

c. OSHA standards should be consulted with respect to mandatory requirements as well as for suggested procedures to minimize exposure. (Reference: Title 29, Code of Federal Regulations, Section 1910.1001.)

3-8 ELECTRICAL

3-8.1 Periodically inspect electrical connectors on the outside of the cab, on the engine and frame for corrosion and tightness. Exposed terminals such as water temperature, oil pressure, fuel sender, cranking motor and feed through studs should be cleaned and recoated with a suitable grease such as IH 472141-C1 or equivalent. This should include ground cable connections for batteries, engine and cab.

3-9 ENGINE

3-9.1 General

a. For effective emission control and low operating cost, it is important that maintenance operations listed on the following pages be performed at the specified periods or mileage intervals indicated (kilometers, miles, hours or months, whichever occurs first).

b. Service intervals are based upon average operating conditions. Where dusty, frequent start and stop or heavily laden operations are encountered, more frequent servicing will be required.

c. As the vehicle (engine) operator, you are responsible for the performance of all scheduled maintenance. Any replacement parts used for required maintenance services or repairs should be genuine Navistar Truck parts or equivalent in quality and performance to genuine Navistar Truck parts. Use of inferior replacement parts hinders operations of engine and emission controls and can reduce engine life.

WARNING

To avoid personal injury when performing maintenance and repairs to a turbocharged engine with engine air inlet piping disconnected, a turbocharger compressor air inlet protective shield should be installed over the turbocharger air inlet.

WARNING

Use only the following procedure to remove the pressure type cap from the radiator. Always allow the engine to cool first. Wrap a thick, heavy cloth around the cap. Push down, loosen cap slowly to its first notch position; then pause a moment. This will avoid possible scalding by hot water or steam. Continue to turn cap to the left and remove.

CAUTION

If the coolant should get extremely low and the engine very hot, let the engine cool for approximately 15 minutes before adding coolant; then, with the engine running add coolant slowly. Adding cold coolant to a hot engine may crack the cylinder head or crankcase. Never use water alone.

3-9.2 Cooling System. A complete drain, flush and refill with Internation or equivalent antifreeze and coolant is recommended once a year. This recommendation applies to all vehicles including those with low total annual mileage.

3-9.2.1 Anti-Freeze

a. The cooling system of your new vehicle is filled at the factory with permanenttype anti-freeze. Permanent-type anti-freeze may be added undiluted if protection below -20°F (-29° C) is required.

b. Properly inhibited coolant will keep the engine cooling system free of rust, scale deposits, and corrosion.

Table 3-1. Engine Maintenance Schedule Chart

Maintenance Operations (1)	Dally	Every 9 600 km, 6,000 Miles, 200 Hours or 3 Months	Every 19 200 km, 12,000 Mlles, 400 Hours or 6 Months	Inspection Interval Every 48 280 km, 30,000 Miles, 1,000 Hours or 12 Months	Every 144-841 km, 90,000 Miles 3,000 Hours or 24 Months	Every 241 500 to 322-000 km, 150,000 to 200,000 Miles or 5,000 to 6,700 Hours	Annually
Inspect/Charge Air Cooler (	X						
Inspect Coolant and Oil Levels	X						
Inspect Low Oil Pressure Alarm (	X						
Inspect for External Leakage	X						
Inspect Air Restriction Indicator (	X						
Drain Water Separator (Fuel System)	X						
Change Engine Oil and Filters (		X					
Inspect Throttle Linkage		X					
Measure Low and High Idle (		X					
Inspect and Adjust Belts ©		X					
Inspect Air Intake Piping and Clamps		X					
Inspect High Temperature Coolant Alarm ®		X					
Measure Air Intake Restriction (3) (6)				X			
Change Fuel Filters (4)				X			
Inspect Vibration Damper (7)				X			
Measure Crankcase Pressure (6)				X			
Pressurize Induction (6) System				X			
Clean Crankcase Breather				X			
Measure Nozzle Opening Pressure and Spray Pattern (6)						X	
Adjust Valve Lash (6)or (7)					X		
Measure Intake Manifold Pressure (6)					X		
Inspect Turbocharger						X	
Service Cooling System and Cooling System Filter Also see Cooling System Specifications							X
Inspect Thermostat							X
Inspect Electrical System							X

(1) Correct if necessary.
(2) If equipped.
(3) Service air cleaner elements as required.
(4) Or change according to transfer pump pressure minimum specifications.
(5) If fuel contains more than 0.5 percent sulfur, reduce
(6) Refer to Diesel Engine Diagnostic Manual CGES-240.
(7) Refer to 400 Series Engine Service Manual CGES-185.
(8) Refer to Fan and Accessory Belt Adjustment section in this manual

Sulfur Content, Percent	**Oil Change Interval**
Below 0.5	Normal
0.5 to 1.0	½ Normal
Above 1.0	¼ Normal

c. Anti-freeze concentration greater than 68% will adversely affect freeze protection, corrosion inhibitor additives and heat transfer rates.

IMPORTANT-- Anti-freeze made with methoxy propanol or propylene glycol is not recommended for use with IH engines. These types of anti-freeze can damage engine internal seals and coolant hoses and create a potential fire hazard due to lower flash points than ethylene glycol type anti-freeze.

d. All cooling system conditioners, including those in anti-freeze solutions, become depleted through normal operation. If conditioners in anti-freeze are allowed to become depleted, the anti-freeze becomes corrosive and attacks and coats metallic surfaces of the cooling system, which reduces heat transfer. To maintain an acceptable conditioner concentration, additional chemicals must be supplied to the cooling system. Your IH Dealer can assist you with cooling system conditioner service information.

3-9.2.2 Coolant Filter Element

NOTE

The original filter may be larger than the service filter. The original filter contained sufficient amount of corrosion inhibitor to precharge the cooling system to recommended concentration.

a. Maintenance to the coolant filter service element should be maintained at the interval listed in lubrication section of this manual Chapter 4. **Do not** treat the coolant system at earlier intervals or add additional inhibitors. Over treatment of the coolant system will cause radiator plugging and solder deterioration.

b. The coolant filters should only be used with ethylene glycol type anti-freezes that **do not** contain anti-leak additives. The anti-leak or stop leak additives are removed by the filter element which could restrict coolant flow from filter. Do not use methanol alcohol or methoxy propanol (Dow Therm 209) base antifreeze as they are not compatible with the treated service element.

3-9.2.3 Cleaning

a. Once a year the cooling system should be drained and thoroughly flushed. (Flush with cooling system conditioner every 24 months).

b. Unless the cooling system is treated with a corrosion preventative, rust and scale will eventually clog up passages in the radiator and water jackets. This condition is aggravated in some localities by formation of insoluble salts from the water used.

c. IH cleaning solutions are available which have proven very successful in removing accumulation of rust, scale, sludge and grease. This solution should be used according to the recommendation on the container.

IMPORTANT Do not use chemical mixtures to stop radiator leaks except in an emergency. Never use such solutions instead of needed radiator repair. Do not use soluble oil.

d. When draining the cooling solution, disconnect the radiator outlet hose, as large particle of sediment will not pass through the drain.

3-9.2.4 Radiator and Condenser Fins. Check the radiator and condenser fins periodically to make sure they are free of bugs, leaves and other debris, and that they are not bent or damaged. Clogged or damaged fins prohibit the flow of outside air to the radiator and hamper efficient cooling system operation. Use a fin comb to clean and straighten fins.

3-9.2.5 Coolant Hoses. The only coolants which are recommended for use in Navistar Truck cooling systems are those which contain an ethylene glycol base. Other base coolants may damage rubber hoses, especially those made of silicone rubber. Type of rubber can usually be determined by color. Silicone hoses are made in COLOR while other rubber hoses are BLACK. If coolants are not of ethylene glycol base, this may affect your engine warranty.

3-9.2.6 Thermostat

a. Your new truck is equipped at the factory with a high temperature (1800) thermostat.

b. Permanent type anti-freeze must be used with high temperature thermostats.

3-9.3 Fan and Accessory Drive Belts

a. Replace belt(s) if worn, cracked or grease and oil soaked. Replace worn pulleys.

b. New belts have a break-in period and lose tension during groove seating.

IMPORTANT New belt initial installation tension is higher than the re-tension value applied to a used belt (run five minutes or longer). This is done to minimize number of belt adjustments and prevent belt operation under low tension during break-in period.

c. Belt tension checks should be performed using a Belt Tension Gauge.

d. New belts should be checked at 300 miles (483 km) or 10 hours, then checked again after 1,500 miles (2 414 km) or 50 hours. The second service adjustment of belts establishes tension stabilizaiton.

e. Before adjusting belt tension, check the tension several times. Use an average of the readings.

f. Belt tension checks must be made at midpoint between pulleys at the longest belt span. Refer to Belt Tension Chart (Table 3-2).

NOTE

In multi-belt drives, the belt tension readings taken on the same span may vary considerably between belts. When this occurs, average readings to establish applied tension, except in the application of the power steering pump, where the values stated are for each belt.

Table 3-2. Belt Tension Chart

Tension Condition	Belt Tension
New Belt Installation	95-100 lb (423-444 N)
Steering Pump	80 lb (356N)
Re-tension	
New truck upon delivery	
After 10 hours (or 300 miles)	
After 50 hours (or 1,500 miles) 80-85 lb (356-378 N)	
After intervals of 200 hours	
(or 600 miles)	
Steering Pump	50 lb (222N)
Minimum Permissible Tension	60 lb (267N)
Steering Pump	50 lb (222N)

3-10 FRAME AND TOW HOOKS

3-10.1 Because Navistar chassis are manufactured with frame rails of either mild carbon steel, HSLA steel, heat-treated steel or aluminum alloy, each must be handle in a specific manner to assure maximum service life. Before attempting frame repair or modification, consult the service manual.

3-10.2 Front and rear tow hooks should be inspected for damage or a loose mounting.

This is of great importance, particularly on vehicles where the tow hooks are used frequently.

3-11 FUEL AND LUBRICANT ADDITIVES

3-11.1 Refer to Fuel and Lubricant Additives segment in Chapter 4 of this manual.

3-12 FUEL SYSTEM 3-12.1 Frequently check throttle linkage for proper operation.

3-12.2 Inspect condition of fuel tanks, fuel lines, clips and routing.

3-13 SUPPORTING VEHICLE FOR SERVICE 3-13.1 Set parking brake and/or block wheels to prevent vehicle from moving.

3-13.2 Select jack (floor jack preferred) with a rated capacity sufficient to lift and hold up the vehicle.

3-13.3 Raise vehicle with jack applied to axle(s). (DO NOT use bumper as a lifting point.) 3-13.4 Support vehicle with floor stands under axle(s). If axle or suspension components are to be serviced, support vehicle with floor stands under frame sidemembers, preferably between the axles.

WARNING

A jack should never be used alone to support vehicle while under-chassis service is being performed. The jack may lower and serious personal injury could result. Always support vehicle with floor stands.

3-14 PROPELLER SHAFT 3-14.1 At the regular lubrication interval, check universal joints for wear.

3-14.2 Caution should propeller shaft vibrations occur, stop the vehicle immediately to avoid possible hazardous consequences or damage to other components.

3-15 SPRINGS 3-15.1 Periodically check condition of spring leaves for evidence of fatigue, bending, or breakage.

3-15.2 Check condition of suspension mounting brackets or bushings.

3-15.3 Suspension alignment must be maintained at all times.

3-15.4 Check U-Bolts as follows:

a. After the chassis has been operating under load for 1000 miles (1 600 km) or six months, whichever comes first, the U-Bolt nuts must be retorqued.

b. The U-Bolt nuts thereafter must then be retorqued every 36,000 miles (57 936 km).

c. The U-Bolt (joint) should be cleaned and lubricated to assure a "like new" condition.

Table 3-3. U-Bolt Nut Chart

U-Bolt Dia. (Nominal)	Torque N-m	Torque Ft-Lbs
5/8" Flanged Lock Nut	176-217	130-160 %
3/4" Flanged Lock Nut	271-325	200-240
7/8" Hex Head w/Washer	305-373	225-275
1" Hex Head w/Washer	441-543	325-400

3-16 STEERING

3-16.1 General

a. Check tie rod and rage link end clamp bolts. They must be tight. Ask your service mechanic to examine the steering mechanism. Minor adjustments could head off further problems.

b. Check power steering system for leaks or hose chafing. Repair at once.

c. Maintain proper steering gear and power steering pump lubricant levels.

d. Regularly inspect steering column joint bolts and steering linkage, particularly for body-to-chassis clearance.

IMPORTANT -Have any steering problems corrected at once by a proper maintenance level.

WARNING

Failure to maintain the steering system in proper condition can cause reduced steering ability resulting in personal injury and property damage accidents.

3-16.2 Tightening Steering Column Joint Bolts

CAUTION--Do not overtighten bolts as it may damage equipment.

3-16.2.1 As a good maintenance practice, it is recommended that steering column joint bolts be checked for tightness every 50,000 miles (80 000 km) or annually, whichever occurs first. Tighten bolts to torque specified in table 3-4.

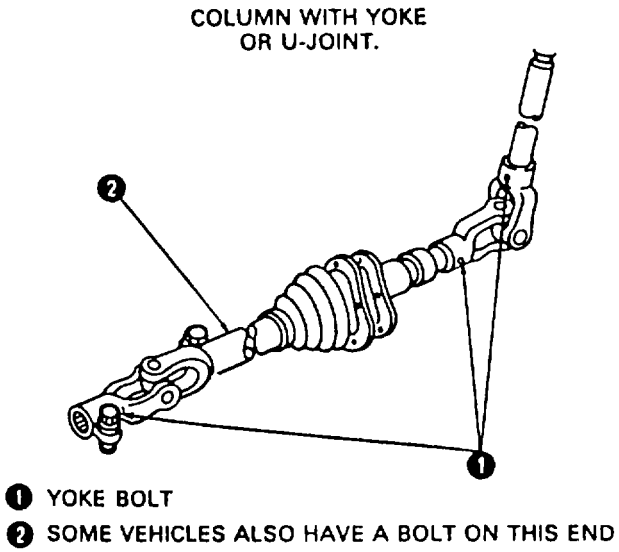


Figure 3-2. Steering Column Clamp or Yoke Bolt

Table 3-4. Steering Bolts Torque

Bolt Location	Specified Torque
3/8-24 (Shell Coupling)	30-35 ft-lbs (41-47 N.m)
3/8-24 (Yoke or U-Joint)	35-40 ft-lbs (47-54 N.m)
7/16-20	70-75 ft-lbs (95-102 N.m)

3-17 TIRES

3-17.1 General

a. Check condition of tires for abnormal wear patterns, and proper inflation pressures. Cut or broken tire casing must be repaired.

CAUTION

Always use proper equipment and follow correct procedures when mounting or demounting tires.

b. Proper tire inflation, toe-in adjustment, loads, and road speeds are important factors governing tire mileage, steering ease and maneuverability.

3-17.2 Inflation

a. Tire pressures should be checked at regular and frequent intervals and the pressures maintained to specifications. Use an accurate tire pressure gauge and check when tires are cool.

b. Over inflated or under inflated tires will reduce the service life of the tire.

c. Never "bleed" air from hot tires. The pressure will be reduced by an increase in temperature will result as soon as driving continues.

3-17.3 Loads. Loading tires beyond their rated capacity decreases tire life, requiring more frequent replacement of tires.

3-17.4 Matching

a. Dual tires should be matched using tires of equivalent size. Tires which differ more than 6.35 mm(1/4") in diameter or 19.05 mm (3/4") in circumference should not be mounted on the same dual wheel. The larger or less worn tire should be mounted on the outside.

b. When mounting tires on tandem drive axles follow the same instructions as specified for dual tires. However, never install the four largest tires on one driving axle and the four smallest on the other. This method of tire mounting will cause high axle lubricant temperatures which may lead to premature axle failures.

c. Replacement tires must have same rolling radius as original equipment tires in order to avoid damage to the drive train components.

3-17.5 Mixing. It is recommended that for best overall performance that only bias or only radial tires be used on a vehicle. However, different heavy truck tires may be used under the following conditions:

a. Bias or radial tires may be used on either axle of two-axle vehicles if the vehicle has dual rear wheels, or is equipped with wide base single tires.

b. Either bias or radial tires may be used on the steering axle of vehicles with three more axles.

c. Never mix different tire sizes or constructions on the same axle.

d. Never mix bias and radial tires in a tandem drive axle combination.

3-17.6 Rotation

a. Rotation is advisable:

(1) If front (steering) axle tires become irregularly worn, move to rear position.

(2) In a dual assembly, if one tire wears much faster than its mate, reverse position of tires.

b. Rotation is advisable:

(1) If tires are highway type tread design:

Front (Steering) Axle - When required, replace tire when tire thread is worn to 1/8 inch (3.175 mm) or less. Rotate worn tires to any other position. Retreaded or recapped tires are not to be used on steering axles.

Rear and Trailer Axles - Tires must be removed when thread is worn to no less than 1/16 inch (1.588 mm). However, tires identified by the word "regroovable" molded on the side wall can be regrooved.

(2) If rib or highway type tire is used on front axle and lug or off-road type on rear axle positions:

Front (Steering Axle) -- Install new tires at front wheels when thread is worn to 1/8 inch (3.175 mm) or less.

Rear and Trailer Axles - Tires must be removed when the thread is worn to 1/16 inch (1.588 mm) or less. Tires identified with the word "regroovable" molded on the sidewall can be regrooved.

3-17.7 Wheel and Tire Balancing. Out-of-round or out-of-balance wheels or tires can cause vehicle vibration, bounce and shimmy. Wheels should be replaced if damaged or out-of-round. Out-of-round tires can usually be "trued" by a tire checker. The tire and wheel assembly shiould then be dynamically balanced. Dynamic balances both statically and dynamically, static balancing only balances statically.

3-17.8 Wear. Radial tires can exhibit three types of normal wear patterns: 1 Even, 2 Erosion, 3 Shoulder.

a. Even Wear like a bias tire, radial tires which have an even wear pattern is a sign that is being properly used and maintained.

Figure 3-3. Circumferential Tread Channeling

b. Erosion Wear has also been called rolling wear, channel or river wear and can be found in both bias or radial tires. Erosion wear is found more often at free rolling tires. This is an indication that the tire is used in a slow wearing operation. What happens is that the belt plies are held very rigid and the tread is not allowed to distort as it passes through the contact area. Wear will only occur at the edge of the tread. The tire is not being worn fast enough through normal driving. No corrective action required. If erosion gets to be 1/16 inch (1.588 mm) or more, the tire should be rotated to a drive axle.

c. Shoulder Wear even with tires inflated properly is a normal wear of certain radial tire designs. If both inside and outside shoulders are wearing evenly around the tire, no further action is required. Do not over inflate tire to correct this effect. To do so could lead to premature failure when impact of road hazard is encountered.

3-18 TRANSMISSION

3-18.1 Check fluid level and shift linkage for proper operation.

IMPORTANT - If vehicle is equipped with an automatic transmission, have a qualified mechanic occasionally check operation of starter safety switch.

3-19 WHEELS

3-19.1 General

3-19.1.1 Wheel bearings should be inspected, lubricated and adjusted at regular intervals. This is especially important if operating in deep sand, mud, or water. Refer to lubrication section of this manual, Chapter 4.

3-19.2 Installation, Tightening and Alignment

a. When installing wheels, be certain that the threads on studs and nuts are clean to permit correct torquing of nuts. The mounting surfaces of rims, wheels, spacer rings and clamps must be free of dirt, rust or damage.

b. Use a wire brush to clean mounting contact surfaces. Do not use lubricant on threads.

c. After rim or wheel has been properly torqued, it should be checked for alignment. Rotate the wheel with a piece of chalk attached to a steady, firm surface and placed to just barely clear outside surface of tire bead seat. This procedure will point out the high spot. Keep in mind, however, that a high spot does not necessarily mean that lug nuts have been unevenly tightened. This condition or misalignment could be caused by a bent wheel.

d. Checking the all gnment of the wheel/rim installation is more important on cast spoke rims since the rims can be drawn out of alignment when improperly tightened. Use the following installation procedures.

(1) Slide inner rear of front tire and wheel in position over studs and push back far as possible. Use care to avoid damage to threads on studs.

(2) Install the outer wheel nut on front wheels and inner wheel nut on rear dual wheels. Run nuts on studs until the nuts start to contact the wheel. Rotate wheel a half turn to allow parts to seat naturally.

(3) Draw up stud nuts, alternately following the sequence (criss-cross pattern) illustrated in Figure 3-4. Do not fully tighten the nuts at this time. This procedure will allow a uniform seating of nuts and insure the even face-to-face contact of wheel and hub.

(4) Continue tightening the nuts to the torque specifications in the Torque Chart using the same alternating method shown.

(5) Install the outer rear wheel and repeat the preceding method. Be sure that both inner and outer tire valve stems are accessible.

(6) After operating the vehicle approximately 50 miles (80 km) check the stud nuts for tightness. Some natural seating of parts may be encountered and the torque on nuts will drop. Retighten all nuts to specified torque.

e. To check and tighten the inner wheel to proper torque, first loosen the outer wheel nuts several turns. Then tighten the inner nuts and retighten the outer nuts.

f. To prevent losing the seating of the outer wheel when checking the inner wheel torque, first loosen alternate outer nuts. Then tighten the inner nuts and re- tighten the outer nuts. Then loosen the remaining outer nuts, tighten the inner nuts and retighten the outer nuts.

g. Once each week inspect and retorque wheel stud nuts.

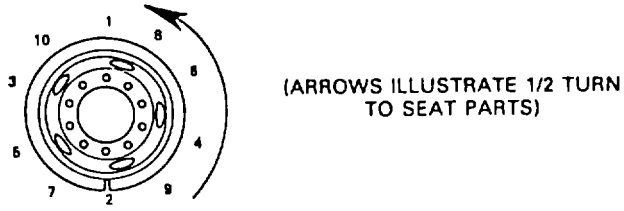


Figure 3-4. Disc Wheel Tightening Sequence

3-19.3 Precautions

WARNING

Failure to adhere to these precautions could result in personal injury.

a. Always loosen rim clamps before complete removal of nut from stud (cast spoke wheels). With loosened nuts on stud, strike clamps with a heavy hammer and be sure each clamp is loose.

b. Always deflate tires completely before removing locks or side rings.

c. Always inspect and clean all parts before assembly.

d. Always inflate tires in a safety cage. Keep all body parts dear of wheel rir

e. Always use a clip-on air chuck with remote control valve to inflate tires.

f. Never strike cast spokes of wheel assembly when loosening rim clamps.

g. Never mix rim side rings or lock rings of different types or size.

h. Never use cracked, bent or badly rusted parts.

i. Never reinflate flat tires on vehicles. Use the spare.

j. Never add air until each side or lock ring is fully seated.

k. Never hammer side or lock ring on a partially or fully inflated tire.

I. When installing the tire and rim assembly disc-braked axles, make sure the tire valve stem clears the brake caliper. The use of an IH valve stem retainer or a tire manufacturer's stem forming tool are the only acceptable methods of obtaining clearance when necessary.

3-19.4 Proper Torque. It is important to tighten and maintain wheel and rim mounting nuts to the proper torque. Loose nuts or overtightened nuts can lead to premature wear and possible failure of the wheel, rim and/or mounting hardware.

CHAPTER 4

LUBRICATION

4-1 LUBRICATION INSTRUCTIONS

4-1.1 Special Instructions

a. For engine oil specifications refer to Engine Oil Specifications in this section. Recommended engine oil filter service intervals will be located in Maintenance Section of this manual (Maintenance Charts).

b. Diesel engines: When air restriction reading (in inches of water vacuum) reaches 25 in. H20 or 635 mm Hg, clean or replace engine air cleaner. Refer to Engine Section of this manual. Only new air cleaner elements should be used to replace elements that have become restricted beyond the maximum recommended restriction level. These elements are not to be cleaned. Replacement of elements is not to be judged on appearance.

c. Axles. SP type lubricant or API GL-5 quality meeting MIL-L-2105B or C or better specifications including synthetic lubricants. For abnormally high temperature severe service (hot climate off-highway operation where vehicle is in low speed heavy hauling for prolonged periods), use SAE 140.

Ambient Temperature	Recommended Viscosity
-400F (-400C)	SAE 75W-90
-15° to 1000F (-26° to 380C)	SAE 80W-90
-150F (-260C) and above	SAE 80W-140
10°C to 1000F (-12° to 380C)	SAE 90
100F (-12°C) and above	SAE 85W-140
400F (+40C) and above	SAE 140

d. SAE lOW engine oil for temperatures 0°F (-180C) and up. For temperatures below 0°F (-180C) use three parts SAE 10W engine oil to one part kerosene. The mixture can safely be used in temperatures up to 320F (OOC). If severe or dusty conditions: change lubricant and filter 52,000 miles, 84 000 kilometers or 6 months.

e. Steering Gear. IH Power Steering Fluid (1 quart can No. 990625-C1).

f. Lubrication Procedures:

With chassis load on axle, force grease through thrust bearings. Then with axle lifted clear of floor, force grease between king pin and bushing surfaces. Use IH 251 H EP grease.

g. Use straight mineral oil SAE 90 for temperatures O°F (-180C) and up. Use SAE 80 for temperatures below 0°F (-180C). Special Recommendations: Where temperature is consistently below 0°F (-180C) and where parked vehicles are exposed to unusual cold for long periods, use SAE 75. Where temperatures are consistently above 900F (320C) or unusually hot, use SAE 140 straight mineral oil.

h. Spicer Transmission

Engine Oil (SF, CC or CD)	SAE 30	Below 0°F (-180C)
	SAE 30, 40, 50	Above OOF (-180C)
Mineral Oil (Rust and	SAE 80	Below 0°F (-180C)
Oxidation Inhibited)	SAE 90	Above 0°F (-180C)

i. Front Drive Axles -- Lubricate with IH 251 H EP Grease. Lube steering knuckle bearings and steering U-joints.

4-1.2 Engine Oil Specifications. Choosing an engine oil of correct quality and proper viscosity and following recommended oil change intervals are essential to Low Cost of Ownership (LCO). Using the recommended oil and change interval will result in good engine starting, performance and long-term durability. The responsibility for obtaining the proper oil rests with the engine operator. He should have his lubricant supplier confirm that the products being provided meet specific engine recommendations. Failure to use the proper lubricants and to follow recommended oil change intervals could result in Warranty denial.

a. Supplementary additives. There are many supplementary fuel and oil additives for sale. If the lubricant and oil change interval recommendations are followed, the engine will not require these additives.

b. Oil Quality

(1) Oil quality is described by API (American Petroleum Institute) engine service categories. API categories are defined by oil performance (deposits and wear) measured in standardized engine tests. API "S" Categories (SC, SE, SF) describe oils for spark ignition (gasoline) engines, while "C" categories (CC, CD) describe oils for diesel engines. Oil with both "S" and "C" categories (such as SF/CD) are suitable for both spark ignition and diesel engines. Sometimes, the S" and "C" categories are reversed (such as CD/SF).

(2) Oil quality is also described by two current U. S. Military Specifications, MtL-L-46152B and MIL-L-2104D. (MIL-L-2104D recently superseded MIL-L-2104C, which is now obsolete but which may still be widely used.)

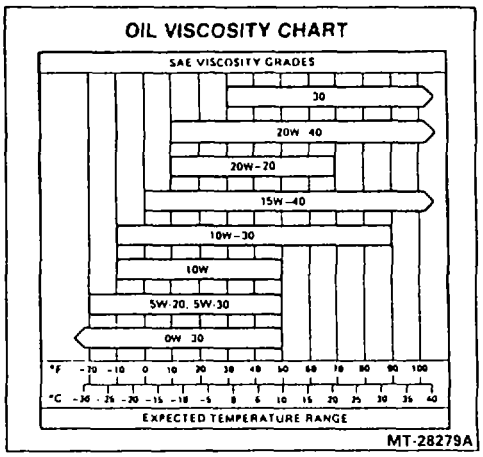
NOTE

Do NOT use oils specifically marketed by suppliers for stationary, marine, or railroad diesel engines, or for stationary natural gas engines, even though they are marked API category CD. Such oils can cause excessive valve train wear and combustion chamber deposits. (These oils are sold only in drums or bulk.)

(3) Use oils meeting API categories CD, SC/CD, SE/CD, or SF/CD, or Military specifications MIL-L-2104D or MIL-L-2104C. IH No. 1 Engine Oil meets these requirements.

c. Oil Viscosity

Oil viscosity (thickness) is described by SAE (Society of Automotive Engineers) Viscosity Grade. Colder temperatures require lower viscosity oils to ensure good flow during starting, while hotter temperatures require higher viscosity oils for satisfactory lubrication. Based upon the temperature range you expect before your next oil change, use the oil viscosity chart and the notes below to choose the proper viscosity grade. Using other viscosity grades, or using viscosity grades at temperatures outside the recommended ranges could result in engine damage.



NOTES:

1. **SAE 15W-40 IS THE PREFERRED VISCOSITY GRADE FOR 6.9L DIESEL ENGINES FOR ALL OPERATING CONDITIONS WHERE THE TEMPERATURE WILL NOT BE COLDER THAN +30°F (−1°C).**
2. **SOME INCREASE IN OIL CONSUMPTION MAY BE EXPECTED WHEN SAE 0W-30, 5W-20, 5W-30, 10W, 10W-30 AND 10W-40 OILS ARE USED. CHECK OIL LEVELS MORE FREQUENTLY.**
3. **SAE 5W-20 OILS ARE NOT RECOMMENDED FOR CONTINUOUS HIGH SPEED OPERATION.**

d. Oil Change Interval

(1) Refer to Maintenance Section of this manual for the recommended oil change interval. Use of oils exceeding the required quality level, synthetic oils, or other oils claiming longer service intervals does not justify extending oil change intervals beyond those recommended.

(2) For diesel engines, the recommended oil change intervals are based on the use of diesel fuels with a maximum sulfur content of 0.5 percent. Know your fuel sulfur content. (Ask your supplier, or have fuel analyzed). If fuel contains more than 0.5 percent sulfur, reduce the oil change interval as follows:

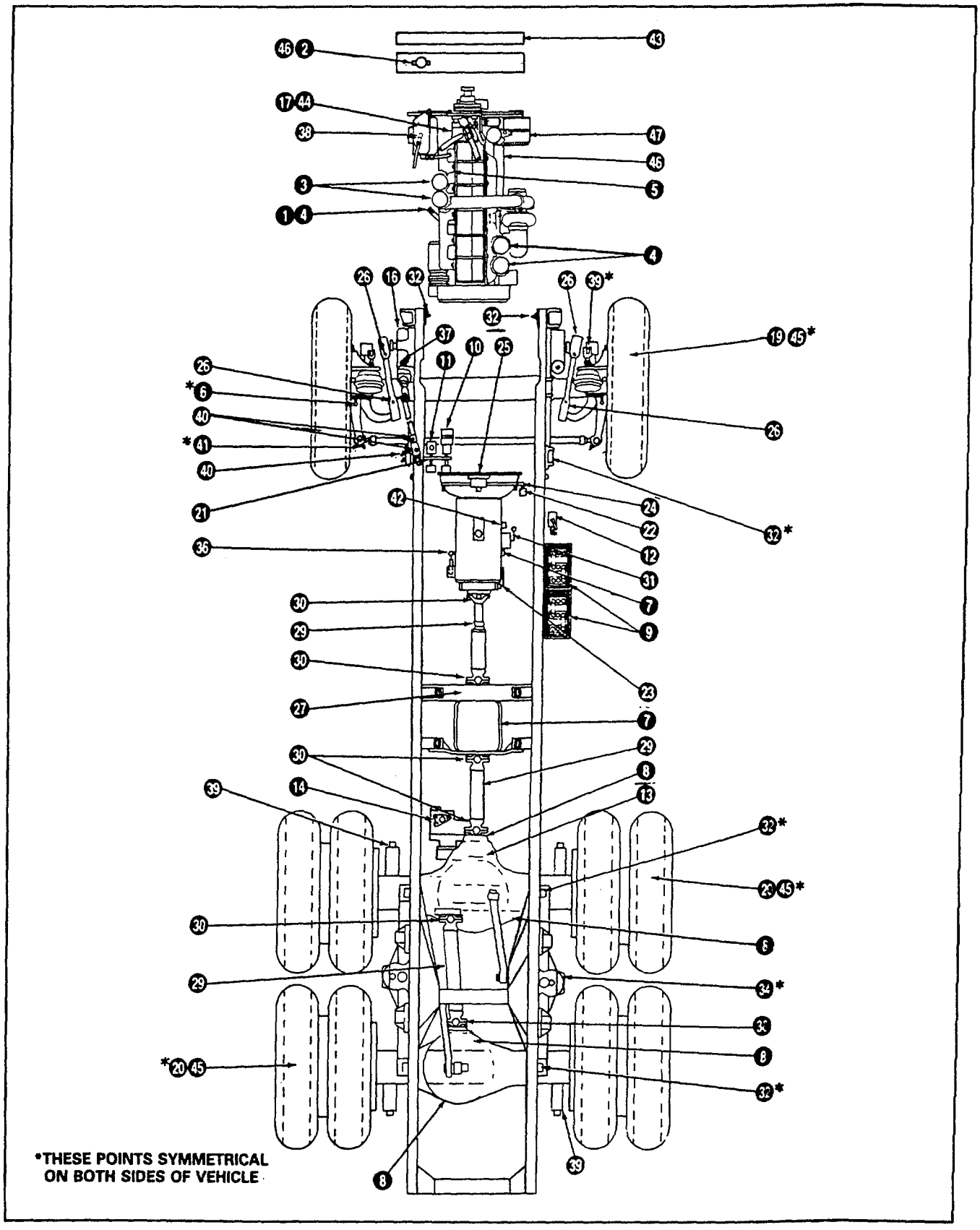
NOTE

It is **NOT** necessary to reduce filter change intervals when oil change intervals are reduced.

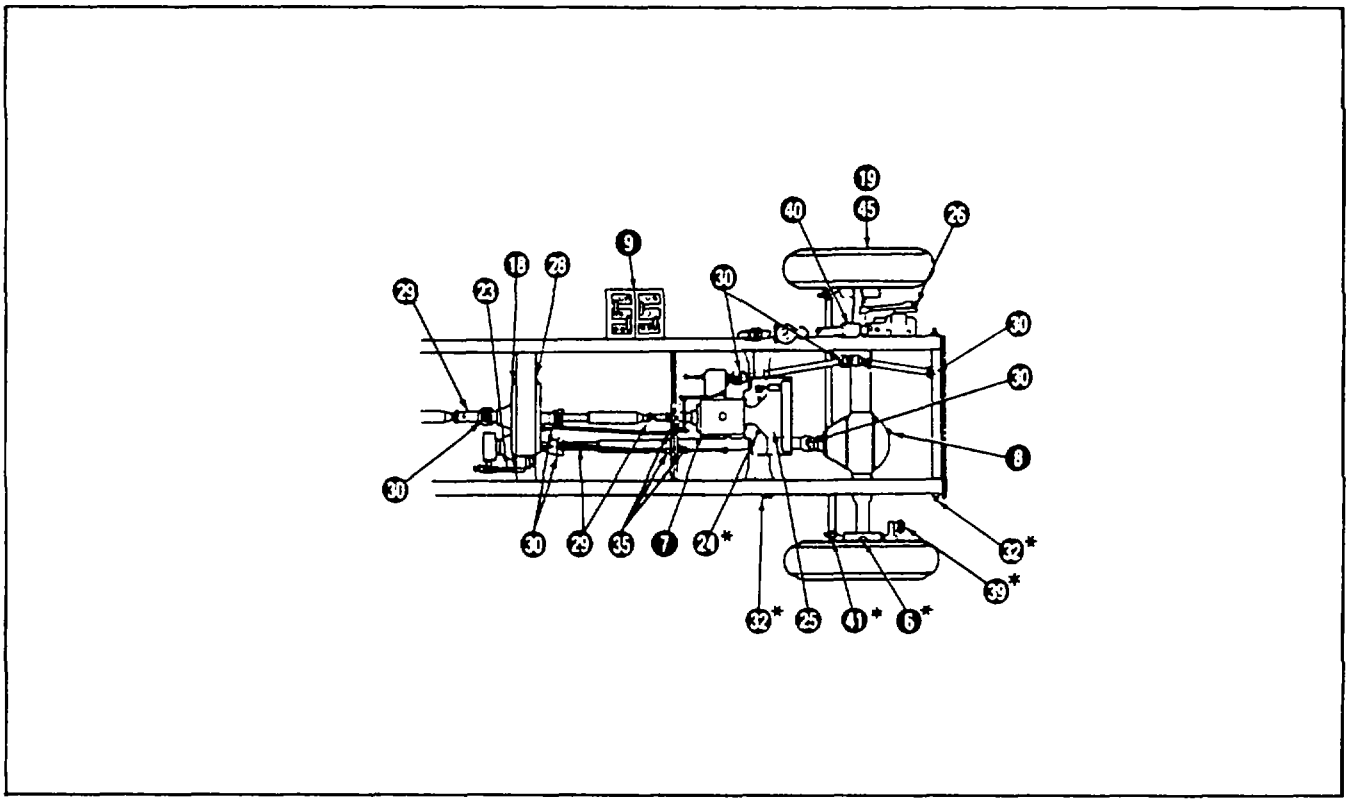
Sulfur Content, Percent	Oil Change Interval
Below 0.5	Normal
0.5 to 1.0	1/2 Normal
Above 1.0	1/4 Normal

e. Energy Conserving Oils. Oils marketed as "Energy Conserving" are intended to improve fuel economy in passenger car engines. Some of these oils contain friction modifier chemical additives. One additive, molybdenum dithioposphate, has been implicated in copper corrosion problems in some heavy- duty diesel engines. Therefore, until further information is available, do not use an "Energy Conserving" oil containing molybdenum dithiophosphate in any IH built engine. In addition, some "Energy Conserving" oils meet only API Category SF for spark ignition engines, and do not meet the oil quality requirements for diesel engines.

LUBRICATION DIAGRAM, TYPICAL



LUBRICATION DIAGRAM (CONTINUED)



LUBRICATION - MAINTENANCE GUIDE INTERVALS

KEY NO.	DESCRIPTION	OPERATION	USE OR REMARKS①
DAILY INSPECTION			
1	Engine Crankcase Level Change Interval	Check and Correct	A Refer to Maintenance Section
2	Coolant Level	Check and Correct on each Fuel Stop	Refer to Cooling System in Maintenance Section
NI	Low Oil Pressure Alarm	Correct as Necessary	Refer to Oil Viscosity Chart for Specified Lubricant
NI	External Leakage	Correct as Necessary	
NI	Air Cleaner Restriction Indicator	Correct as Necessary	B
3	Fuel/Water Separator	Drain and Replace Element as Necessary	
AS REQUIRED			
NI	Air Cleaner (Engine)	Clean or Replace	B
NI	Speedometer, Tachometer Cable	Lubricate	IH 251 H EP Grease or equivalent NLGI #2 Multi-purpose Lithium Grease. (Electronic Speedometer or Tachometer Not Required)
NI	Speedometer, Tachometer Head	Lubricate	Light Weight Oil (Not Required w/Electronic Speedometer or Tachometer)
3	Fuel Filters	Replace	Refer to Engine Maintenance Charts Found in this Manual or Separate Engine Supplements.
4	Engine Oil Filter	Replace	Refer to Engine Maintenance Charts Found in this Manual or Separate Engine Supplements.
5	Throttle Linkage	Lubricate	Light Engine Oil
6	Trunnion Bearing and Axle Shaft U-Joint-	Lubricate	O
10			
14			
NI	Seat Adjuster Slides	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease.
NI	Manifold Heat Control Valve	Lubricate	Penetrating Oil
1,000 MILES OR 1600 KILOMETERS			
6	Steering Knuckles and U-Joints FABCO Axles	Lubricate	O
7	Transmission	Change Initial Fill Lubricant	I
8	Differential	Change Initial Fill Lubricant	C Not to Exceed 3,000 Miles or 5000 Kilometers
4,000 MILES, 6000 KILOMETERS OR MONTHLY			
7	Transmission, Main and Auxiliary Spicer	Change Initial Fill	 K
7	Transmissions	Check Level and Correct as Required	
	Spicer (Main and Auxiliary)		K
8			

NI = Not Illustrated
①Letters indicate additional requirements of Special Instructions following this chart.

LUBRICATION - MAINTENANCE GUIDE INTERVALS

KEY NO.	DESCRIPTION	OPERATION	USE OR REMARKS①
4,000 MILES, 6000 KILOMETERS OR MONTHLY (CONTINUED)			
8	Differential (Front or Rear Axles)	Check Level and Correct as Required	C Q
9	Battery (with Caps)	Check Water Level	Distilled Water
9	Battery Posts	Clean	Grease After Cleaning
10	Brake Master Cylinder	Check Level and Correct as Required	Super Heavy-Duty "DOT 3" Brake Fluid.
11	Clutch Master Cylinder Cargostar and RH Drive S-Series	Check Level and Correct as Required	Super Heavy-Duty "DOT 3" Brake Fluid.
12	Cab Hydraulic Lift Pump	Check Level and Correct as Required	
13	Power Divider Shift Motors	Check Level and Correct as Required	E
14			
15			
15	Transmission Control Rods, U-Joint	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
16	Steering Gear (Manual): Ross	Check Level and Correct as Required	SAE 85W-150 Gear Lubricant or SAE 90 SP Type Lubricant Meeting MIL-L-2105C Class
17	Power Steering	Check Level and Correct as Required	F
18	Transfer Case	Check Level and Correct as Required	H
19	Wheel Bearings (Oil) Front	Check Level and Correct as Required	C Q or SAE 30 Engine Oil
20	Wheel Bearings (Oil) Rear	Check Level and Correct as Required	C Q
NI			
21	Clutch Pedal Linkage	Lubricate	Light Weight Engine Oil
22			
23	Parking Brake Linkage	Lubricate	Light Weight Engine Oil
NI	Door Check, Hinges, Latches, Strikers, S-Series, Cargostar	Lubricate	Light Weight Engine Oil
NI	Hood Linkage	Lubricate	Light Weight Engine Oil
NI			
24	Clutch Relay and Release Fork Cross Shaft	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
25	Clutch Release Sleeve, Bearing, Fork	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
NI			
NI	Clutch Control Cable	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
26	Drag Link	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
NI	Hood Tilt Linkage	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
NI	Power Divider Lock Yoke Pin	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
27	Prop Shaft Center Bearing	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease

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①Letters indicate additional requirements of Special Instructions following this chart.

KEY NO.	DESCRIPTION	OPERATION	USE OR REMARKS①
4,000 MILES, 6000 KILOMETERS OR MONTHLY (CONTINUED)			
28	Parking Brake Relay Lever	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
29	Prop Shaft Slip Joint	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
30	Prop Shaft U-Joint	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
31	Power Take Off Shift Control	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
32	Spring Pins	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
33			
34	Suspension Connecting Tube Bearing	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
35	Transfer Case Shift Linkage	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
NI			
36	Transmission Air Cylinder Linkage	Lubricate	E
12,000 MILES, 19 000 KILOMETERS OR 3 MONTHS			
7			
37			
NI	Water Filter (5 months)	Replace	
16,000 MILES, 26 000 KILOMETERS OR 5 MONTHS			
6			
7			
18	Transfer Case	Change Lubricant	H
26			
38	Air Cleaner (Air Compressor)	Clean or Replace	
39	Brake Camshafts and Manual Slack Adjusters	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
40	Steering Column U-Joints, Slip Joint	Lubricate	O IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
41	Tie Rod Ends	Lubricate	N IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease
NI			
42	Transmission Air and Oil Filter	Replace	
18,000 MILES, 29 000 KILOMETERS OR 600 HOURS			
46	Cooling System Filter	Change	

NI = Not Illustrated
①Letters indicate additional requirements of Special Instructions following this chart.

LUBRICATION - MAINTENANCE GUIDE INTERVALS

KEY NO.	DESCRIPTION	OPERATION	USE OR REMARKS①	
20,000 MILES, 32 000 KILOMETERS OR MONTHLY				
43	Radiator Shutters	Lubricate	Automatic Control Radiator Shutters Vane Bearings Are to be Coated with Light Duty or Penetrating Oil. Vehicles Which Have Been in Storage or out of Service for any Length of Time Are to Have Bearings Lubricated Prior to Going Back into Service.	
20,000 MILES, 32 000 KILOMETERS OR 20 MONTHS				
44	Power Steering Pump Filter Element	Replace		
24,000 MILES, 38 000 KILOMETERS OR 5 MONTHS				
7				
39	Brake Automatic Slack Adjusters	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease	
40	Steering Column Flexible Coupling Cargostar	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease	
NI	Brake Pedal to Brake Valve Linkage	Lubricate	Light Weight Engine Oil	
32,000 MILES OR 51 000 KILOMETERS				
7				
32,000 MILES, 51 000 KILOMETERS OR ANNUALLY				
45	Wheel Bearings (Grease)	Repack	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease	
ANNUALLY, 96,000 MILES OR 154 000 KILOMETERS				
19	Wheel Bearings (Oil) Front	Change Lubricant	C	SAE 30 or 50 Engine Oil
20	Wheel Bearings (Oil) Rear	Change Lubricant	C	
ANNUALLY, 100,000 MILES OR 160 000 KILOMETERS				
7	Transmission (Spicer) Main and Auxiliary (No monthly interval)	Change Lubricant	K	After Initial Lubricant Change
8	Differential (Front or Rear)			
17	Steering Gear (Power)	Change Lubricant and Filter	F	
46	Cooling System	Service Cooling System	Refer to Engine Maintenance Section of this manual.	
NI	Door Lock Cylinders	Lubricate	Lock Oil	
OVERHAUL				
47	Alternator	Lubricate	Cam and Ball Bearing Lubricant (Delco-Remy #1948791)	
NI	Brake Caliper and Anchor Plate	Lubricate	NLGI #1-1/2 (Part No. 990647CI)	
NI	Brake Shoe Anchor Pins	Lubricate	IH 251 H EP Grease or Equivalent NLGI #2 Multi-Purpose Lithium Grease	

NI = Not Illustrated
①Letters indicate additional requirements of Special Instructions following this chart.

4-2SPECIFICATIONS AND CAPACITIES

4-2.1 Abbreviations of Metric Terms.

Volume
cm^3 = Cubic Centimeter
L = liter

Length
m = meter
mm = millimeter
cm = centimeter
km = kilometer

Pressure
kPa = kilopascal

Velocity
km/h = Kilometers per hour

Power
kw = kilowatts

Mass
g = gram
kg = kilogram
gpl = grams per liter
gpg = grams per gallon

Torque
N•m = Newton meter

Temperature
C = Celsius

4-2.2 Unit Refill Capacities.

FRONT AXLE	17-3/4 Pts. (8.42L)
REAR AXLE (Forward)	31 Pts. (14.50L)
(Rear)	23 Pts. (10.66L)
COOLING SYSTEM	39 Qts. (36.9L)
CRANKCASE	18 Qts. (17L)
(w/Oil Filter)	22 Qts. (20.8L)
TRANSMISSION	17 Pts. (8L)
TRANSFER CASE	7 Qts.

4-2.3 Engine Specifications.

Number of Cylinders	6
Bore	4.30 in.(109.2mm)
Stroke	5.35 in.(135.9mm)
Displacement	466.1 cu. in.(7.61L)
Horsepower	210
Compression Ration	16.3:1
Firing Order	1-5-3-6-2-4

Valve Tappet Clearance (Cold or Hot)

Intake	0.025 in.(0.635 mm)
Exhaust	0.025 in.(0.635 mm)

Engine Weight - Dry w/o Access ..... 1441 lbs (654 kg)

Engine Lube Oil Pressure (Engine Operating Temp. with SAE 30 oil)

Low Idle	15-30 psi (103-207 kPa)
High Idle	40-65 psi (276-448 kPa)

TRANSMISSION

Speeds	5 Forward, 1 Reverse
Torque Capacity	To 600 ft lbs.

Gear Ratios

First	7.17
Second	3.88
Third	2.11
Fourth	1.29
Fifth	1.00
Reverse	7.17

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TEAR ALONG PERFORATED LINE

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE

BE EXACT. . .PIN-POINT WHERE IT IS

PAGE NO.	PARA-GRAPH	FIGURE NO.	TABLE NO.

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME, GRADE OR TITLE, AND TELEPHONE NUMBER

SIGN HERE:

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE.

P.S.—IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

The Metric System and Equivalents

Linear Measure

1 centimeter = 10 millimeters = .39 inch
1 decimeter = 10 centimeters = 3.94 inches
1 meter = 10 decimeters = 39.37 inches
1 dekameter = 10 meters = 32.8 feet
1 hectometer = 10 dekameters = 328.08 feet
1 kilometer = 10 hectometers = 3,280.8 feet

Weights

1 centigram = 10 milligrams = .15 grain
1 decigram = 10 centigrams = 1.54 grains
1 gram = 10 decigram = .035 ounce
1 dekagram = 10 grams = .35 ounce
1 hectogram = 10 dekagrams = 3.52 ounces
1 kilogram = 10 hectograms = 2.2 pounds
1 quintal = 100 kilograms = 220.46 pounds
1 metric ton = 10 quintals = 1.1 short tons

Liquid Measure

1 centiliter = 10 milliters = .34 fl. ounce
1 deciliter = 10 centiliters = 3.38 fl. ounces
1 liter = 10 deciliters = 33.81 fl. ounces
1 dekaliter = 10 liters = 2.64 gallons
1 hectoliter = 10 dekaliters = 26.42 gallons
1 kiloliter = 10 hectoliters = 264.18 gallons

Square Measure

1 sq. centimeter = 100 sq. millimeters = .155 sq. inch
1 sq. decimeter = 100 sq. centimeters = 15.5 sq. inches
1 sq. meter (centare) = 100 sq. decimeters = 10.76 sq. feet
1 sq. dekameter (are) = 100 sq. meters = 1,076.4 sq. feet
1 sq. hectometer (hectare) = 100 sq. dekameters = 2.47 acres
1 sq. kilometer = 100 sq. hectometers = .386 sq. mile

Cubic Measure

1 cu. centimeter = 1000 cu. millimeters = .06 cu. inch
1 cu. decimeter = 1000 cu. centimeters = 61.02 cu. inches
1 cu. meter = 1000 cu. decimeters = 35.31 cu. feet

Approximate Conversion Factors

To change	*To*	*Multiply by*	*To change*	*To*	*Multiply by*
inches	centimeters	2.540	ounce-inches	newton-meters	.007062
feet	meters	.305	centimeters	inches	.394
yards	meters	.914	meters	feet	3.280
miles	kilometers	1.609	meters	yards	1.094
square inches	square centimeters	6.451	kilometers	miles	.621
square feet	square meters	.093	square centimeters	square inches	.155
square yards	square meters	.836	square meters	square feet	10.764
square miles	square kilometers	2.590	square meters	square yards	1.196
acres	square hectometers	.405	square kilometers	square miles	.386
cubic feet	cubic meters	.028	square hectometers	acres	2.471
cubic yards	cubic meters	.765	cubic meters	cubic feet	35.315
fluid ounces	milliliters	29,573	cubic meters	cubic yards	1.308
pints	liters	.473	milliliters	fluid ounces	.034
quarts	liters	.946	liters	pints	2.113
gallons	liters	3.785	liters	quarts	1.057
ounces	grams	28.349	liters	gallons	.264
pounds	kilograms	.454	grams	ounces	.035
short tons	metric tons	.907	kilograms	pounds	2.205
pound-feet	newton-meters	1.356	metric tons	short tons	1.102
pound-inches	newton-meters	.11296			

Temperature (Exact)

°F	Fahrenheit temperature	5/9 (after subtracting 32)	Celsius temperature	°C

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