ENGINE SERVICE MANUAL

EGES-335-2

April 2011

Read all safety instructions in the "Safety Information" section of this Manual before doing any procedures.
Follow all warnings, cautions, and notes.
©April 2011 Navistar, Inc. All rights reserved

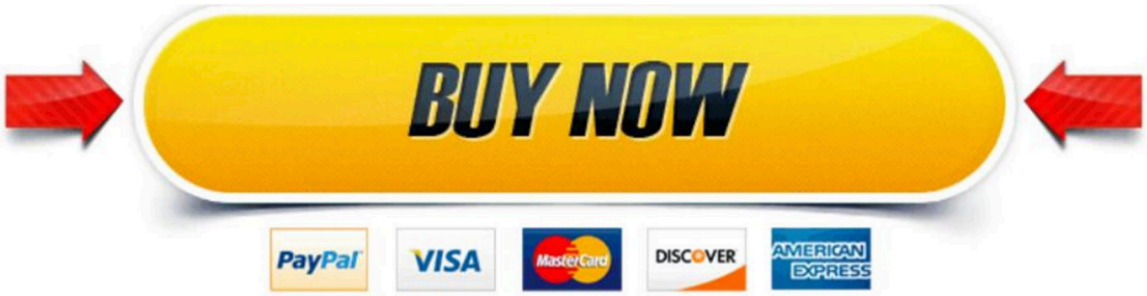

BUY NOW
PayPal
VISA
MasterCard
DISCOVER
AMERICAN EXPRESS

Table of Contents

Foreword....1
Service Diagnosis....2
Safety Information....3
Engine Systems....5
Mounting Engine on Engine Stand....55
Engine Electrical....65
Variable Geometry Turbocharger (VGT)....107
Exhaust Gas Recirculation (EGR) System....119
Intake, Inlet, and Exhaust Manifolds....141
Fuel and High-pressure Oil Systems....155
Diamond Logic® Engine Brake....185
Air Compressor and Power Steering Pump....201
Oil System Module Assembly.... 213
Oil Pan and Oil Suction Tube....231
Front Cover, Cooling System, and Related Components....243
Cylinder Head and Valve Train....291
Flywheel and Flywheel Housing....337
Power Cylinders....365
Crankcase, Crankshaft, and Camshaft....403
Abbreviations and Acronyms....443
Terminology....449
Appendix A - Specifications....457
Appendix B - Torques....475

Read all safety instructions in the "Safety Information" section of this Manual before doing any procedures.
Follow all warnings, cautions, and notes.
©April 2011 Navistar, Inc. All rights reserved

Appendix C - Special Service Tools.....487

Read all safety instructions in the "Safety Information" section of this Manual before doing any procedures.
Follow all warnings, cautions, and notes.
©April 2011 Navistar, Inc. All rights reserved

Foreword

Navistar, Inc. is committed to continuous research and development to improve products and introduce technological advances. Procedures, specifications, and parts defined in published technical service literature may be altered.

This *Service Manual* provides a general sequence of procedures for out-of-chassis engine overhaul (removal, inspection, and installation). For in-chassis service of parts and assemblies, the sequence may vary.

NOTE: Photo illustrations identify specific parts or assemblies that support text and procedures; other areas in photo illustrations may not be exact.

See vehicle manuals and Technical Service Information (TSI) bulletins for additional information.

Technical Service Literature

1171939R3	MaxxForce®DT, 9, and 10 *Engine Operation and Maintenance Manual*
EGES-335-1	MaxxForce®DT, 9, and 10 *Engine Service Manual*
EGES-370-1	MaxxForce®DT, 9, and 10 *Engine Diagnostic Manual*
EGED-375	MaxxForce® DT, 9, and 10 Hard Start/ No Start Diagnostic Form
EGED-380	MaxxForce® DT, 9, and 10 Performance Diagnostic Form
EGED-385	MaxxForce® DT, 9, and 10 Electronic Control Systems Form

Technical Service Literature is revised periodically and mailed automatically to “Revision Service” subscribers. If a technical publication is ordered, the latest revision will be supplied.

NOTE: To order technical service literature, contact your Navistar dealer.

Read all safety instructions in the "Safety Information" section of this Manual before doing any procedures.
Follow all warnings, cautions, and notes.
©April 2011 Navistar, Inc. All rights reserved

Service Diagnosis

Service diagnosis is an investigative procedure that must be followed to find and correct an engine application problem or an engine problem.

If the problem is engine application, see specific vehicle manuals for further diagnostic information.

If the problem is the engine, see specific *Engine Diagnostic Manual* for further diagnostic information.

Prerequisites for Effective Diagnosis

- Availability of gauges and diagnostic test equipment
- Availability of current information for engine application and engine systems
- Knowledge of the principles of operation for engine application and engine systems
- Knowledge to understand and do procedures in diagnostic and service publications

Technical Service Literature required for Effective Diagnosis

- *Engine Service Manual*
- *Engine Diagnostic Manual*
- Diagnostics Forms
- Electronic Control Systems Diagnostics Forms
- Service Bulletins

Read all safety instructions in the "Safety Information" section of this Manual before doing any procedures.
Follow all warnings, cautions, and notes.
©April 2011 Navistar, Inc. All rights reserved

Safety Information

This manual provides general and specific service procedures essential for reliable engine operation and your safety. Since many variations in procedures, tools, and service parts are involved, advice for all possible safety conditions and hazards cannot be stated.

Read safety instructions before doing any service and test procedures for the engine or vehicle. See related application manuals for more information.

Disregard for Safety Instructions, Warnings, Cautions, and Notes in this manual can lead to injury, death or damage to the engine or vehicle.

SAFETY TERMINOLOGY

Three terms are used to stress your safety and safe operation of the engine: Warning, Caution, and Note

Warning: A warning describes actions necessary to prevent or eliminate conditions, hazards, and unsafe practices that can cause personal injury or death.

Caution: A caution describes actions necessary to prevent or eliminate conditions that can cause damage to the engine or vehicle.

Note: A note describes actions necessary for correct, efficient engine operation.

SAFETY INSTRUCTIONS

Vehicle

- Make sure the vehicle is in neutral, the parking brake is set, and the wheels are blocked before doing any work or diagnostic procedures on the engine or vehicle.

Work area

- Keep work area clean, dry, and organized.
- Keep tools and parts off the floor.
- Make sure the work area is ventilated and well lit.
- Make sure a first aid kit is available.

Safety equipment

- Use correct lifting devices.
- Use safety blocks and stands.

Protective measures

- Wear protective safety glasses and shoes.
- Wear correct hearing protection.
- Wear cotton work clothing.
- Wear sleeved heat protective gloves.
- Do not wear rings, watches or other jewelry.
- Restrain long hair.

Fire prevention

- Make sure charged fire extinguishers are in the work area.

NOTE: Check the classification of each fire extinguisher to ensure that the following fire types can be extinguished.

1. Type A — Wood, paper, textiles, and rubbish
2. Type B — Flammable liquids
3. Type C — Electrical equipment

Batteries

Batteries produce highly flammable gas during and after charging.

- Always disconnect the main negative battery cable first.
- Always connect the main negative battery cable last.
- Avoid leaning over batteries.
- Protect your eyes.
- Do not expose batteries to open flames or sparks.
- Do not smoke in workplace.

Compressed air

- Limit shop air pressure for blow gun to 207 kPa (30 psi).
- Use approved equipment.
- Do not direct air at body or clothing.
- Wear safety glasses or goggles.
- Wear hearing protection.
- Use shielding to protect others in the work area.

Read all safety instructions in the "Safety Information" section of this Manual before doing any procedures.
Follow all warnings, cautions, and notes.
©April 2011 Navistar, Inc. All rights reserved

Tools

- Make sure all tools are in good condition.
- Make sure all standard electrical tools are grounded.
- Check for frayed power cords before using power tools.

Fluids under pressure

- Use extreme caution when working on systems under pressure.
- Follow approved procedures only.

Fuel

- Do not over fill the fuel tank. Over fill creates a fire hazard.
- Do not smoke in the work area.
- Do not refuel the tank when the engine is running.

Removal of tools, parts, and equipment

- Reinstall all safety guards, shields, and covers after servicing the engine.
- Make sure all tools, parts, and service equipment are removed from the engine and vehicle after all work is done.

©April 2011 Navistar, Inc. All rights reserved

Table of Contents

Engine Identification.....7
- **Engine Serial Number**.....7
- **Engine Emission Label**.....7
- **Engine Accessory Labels**.....7
- **Engine Description**.....8
  - **Standard Features**.....9
  - **Optional Features**.....10
  - **Chassis Mounted Features**.....10
- **Engine Component Locations**.....11

Air Management System.....16
- **Air Flow**.....17
- **Air Management Components**.....17
  - **Charge Air Cooler (CAC)**.....17
  - **Exhaust Gas Recirculation (EGR) System**.....18
  - **Variable Geometry Turbocharger (VGT)**.....20
  - **Aftertreatment (AFT) System**.....22

Fuel Management System.....23
- **ICP System**.....24
  - **High-Pressure Oil Flow**.....24
  - **ICP Closed Loop System**.....25
  - **ICP Control System**.....26
  - **Fuel Injector**.....27

Fuel Supply System.....29
- **Fuel Supply System Flow**.....30

Engine Lubrication System.....33
- **Oil Flow**.....34

Engine Cooling System.....36
- **Cooling System Flow**.....37
- **Cooling System Components**.....37
  - **Coolant Heater (optional)**.....37
  - **Thermostat Operation**.....38

Electronic Control System.....39
- **Electronic Control System Components**.....39
  - **Operation and Function**.....39
  - **Reference Voltage (VREF)**.....40
  - **Signal Conditioner**.....40
  - **Microprocessor**.....40
  - **Microprocessor Memory**.....40
  - **Actuator Control**.....41
- **Actuators**.....41

Read all safety instructions in the "Safety Information" section of this Manual before doing any procedures.
Follow all warnings, cautions, and notes.
©April 2011 Navistar, Inc. All rights reserved

EGR Valve.....41
IAH Relays.....41
Intake Throttle Actuator and Position Sensor.....41
Engine and Vehicle Sensors.....42
Thermistor Sensors.....42
Variable Capacitance Sensors.....44
Magnetic Pickup Sensors.....45
Micro Strain Gauge (MSG) Sensors.....46
Potentiometer.....47
Switches.....48
Intake Throttle Valve.....49

Diamond Logic® Brake System.....50
Brake Operation Modes.....51
Exhaust Brake System.....51
Engine Brake System.....52

Read all safety instructions in the "Safety Information" section of this Manual before doing any procedures.
Follow all warnings, cautions, and notes.
©April 2011 Navistar, Inc. All rights reserved

Engine Identification

Engine Serial Number



Figure 1 Engine serial number

The engine serial number is in two locations:

- Stamped on a crankcase pad on the right side of the crankcase below the cylinder head.
- On the engine emission label on the valve cover.

Engine Serial Number Examples

International® MaxxForce® DT: 466HM2U3000001

International® MaxxForce® 9 and 10: 570HM2U3000001

Engine Serial Number Codes

466 – Engine displacement
570 – Engine displacement
H – Diesel, turbocharged, Charge Air Cooler (CAC) and electronically controlled
M2 – Motor truck
U – United States
7 digit suffix – Engine serial number sequence beginning with 3000001

Engine Emission Label

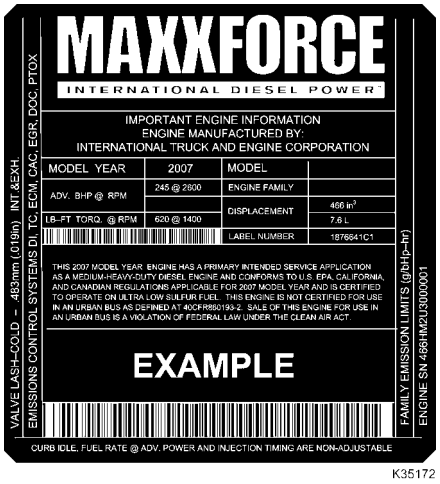


Figure 2 U.S. Environmental Protection Agency (EPA) exhaust emission label (example)

The U.S. Environmental Protection Agency (EPA) exhaust emission label is attached on top of the valve cover. The EPA label typically includes the following:

- Model year
- Engine family, model, and displacement
- Advertised brake horsepower and torque rating
- Emission family and control systems
- Valve lash specifications
- Engine serial number
- EPA, EURO, and reserved fields for specific applications

Engine Accessory Labels

The following engine accessories may have manufacturer's labels or identification plates:

- Air compressor
- Air conditioning compressor
- Alternator
- Cooling fan clutch
- Power steering pump
- Starter motor

Read all safety instructions in the "Safety Information" section of this Manual before doing any procedures.
Follow all warnings, cautions, and notes.
©April 2011 Navistar, Inc. All rights reserved

Engine Description

International® MaxxForce® DT, 9, and 10 Diesel Engines	
Engine configuration	4 stroke, inline six cylinder diesel
MaxxForce® DT displacement	7.6 L (466 in^3)
MaxxForce® 9 and 10 displacement	9.3 L (570 in^3)
Bore (sleeve diameter)	116.6 mm (4.59 in)
Stroke	
• MaxxForce® DT	119 mm (4.68 in)
• MaxxForce® 9 and 10	146 mm (5.75 in)
Compression ratio	
• MaxxForce® DT	16.9 : 1
• MaxxForce® 9 and 10	17.2 : 1
Aspiration	VGT turbocharged and Charge Air Cooled (CAC)
Rated power @ rpm[1]	
• MaxxForce® DT	245 bhp @ 2600 rpm
• MaxxForce® 9	310 bhp @ 2200 rpm
• MaxxForce® 10	310 bhp @ 2200 rpm
Peak torque @ rpm[1]	
• MaxxForce® DT	620 lbf·ft @ 1400 rpm
• MaxxForce® 9	950 lbf·ft @ 1200 rpm
• MaxxForce® 10	1050 lbf·ft @ 1200 rpm
Engine rotation (facing flywheel)	Counterclockwise
Combustion system	Direct injection turbocharged
Fuel system	Electro-hydraulic injection
Total engine weight (oil and accessories)	
• MaxxForce® DT	881 kg (1,943 lbs)
• MaxxForce® 9 and 10	905 kg (1,995 lbs)
Cooling system capacity (engine only)	12.8 L (13.5 qts US)
Lube system capacity (including filter)	28 L (30 qts US)
Lube system capacity (overhaul only, with filter)	33 L (35 qts US)
Firing order	1-5-3-6-2-4

[1] Example ratings shown. See Performance Specifications appendix in Diagnostic Manual for additional ratings.

Read all safety instructions in the "Safety Information" section of this Manual before doing any procedures.
Follow all warnings, cautions, and notes.
©April 2011 Navistar, Inc. All rights reserved