

**DIAGNOSTIC MANUAL**

**N9 and N10 Engine**

**Navistar, Inc.**

2701 Navistar Drive, Lisle, IL 60532 USA



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## 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.

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

This manual includes necessary information and specifications for technicians to maintain Navistar diesel engines. See vehicle manuals and Technical Service Information (TSI) bulletins for additional information.

### Technical Service Literature

4328224	N9 and N10 <i>Engine Operation and Maintenance Manual</i>
0000004021	N9 and N10 <i>Engine Service Manual</i>
0000003721	N9 and N10 <i>Engine Diagnostic Manual</i>
0000003481	N9 and N10 <i>Engine and Aftertreatment Wiring Schematic Form</i>

Technical Service Literature is revised periodically. If a technical publication is ordered, the latest revision will be supplied.

**NOTE:** To order technical service literature, contact your International® dealer.

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## 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*
  - Engine and Aftertreatment Wiring Schematic Form
  - Service Bulletins
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## Safety Information

This manual provides general and specific maintenance 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

#### 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.

#### Vehicle

- Make sure the vehicle is in neutral, the parking brake is set, and the wheels are blocked before servicing engine.
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- Clear the area before starting the engine.

**Engine**

- The engine should be operated or serviced only by qualified individuals.
- Provide necessary ventilation when operating engine in a closed area.
- Keep combustible material away from engine exhaust system and exhaust manifolds.
- Install all shields, guards, and access covers before operating engine.
- Do not run engine with unprotected air intakes or exhaust openings. If unavoidable for service reasons, put protective screens over all openings before servicing engine.
- Shut engine off and relieve all pressure in the system before removing panels, housing covers, and caps.
- If an engine is not safe to operate, tag the engine and ignition key.

**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**

- 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**

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

**Tools**

- Make sure all tools are in good condition.
  - Make sure all standard electrical tools are grounded.
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- 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.
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TC2WG (Turbocharger 2 Wastegate Position).....	1997
TOSS (Transmission Output Shaft Speed) Sensor.....	2008
VREF (Voltage Reference).....	2025
WIF Sensor (Water In Fuel).....	2074

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**Diagnostic Trouble Code (DTC's) List**

SPN	FMI	Sub-section	Condition Description
27	0	EGR (page 1074)	EGRP fault: over temperature
27	14	EGR (page 1074)	EGR internal circuit failure
51	3	ETP (page 1187)	ETP signal Out of Range HIGH
51	4	ETP (page 1187)	ETP signal Out of Range LOW
51	7	ETP (page 1187)	ETP does not agree with commanded position
91	2	APP (page 402)	APP1 and APP2 signal conflict
91	3	APP (page 402)	APP1 signal Out of Range HIGH
91	4	APP (page 402)	APP1 signal Out of Range LOW
94	0	EFP (page 1065)	Fuel Delivery Pressure above Critical
94	1	EFP (page 1065)	Fuel Delivery Pressure below Critical
94	3	FDP (page 1247)	FDP signal Out of Range HIGH
94	4	FDP (page 1247)	FDP signal Out of Range LOW
94	17	FDP (page 1247)	Fuel Delivery Pressure below minimum
94	18	FDP (page 1247)	Fuel Delivery Pressure below min during cranking
96	3	FLI (page 1265)	Fuel Level signal Out of Range HIGH
96	4	FLI (page 1265)	Fuel Level signal Out of Range LOW
96	19	FLI (page 1265)	Fuel Level not detected on J1939
100	1	EWPS (page 1210)	Engine Oil System below Critical Pressure
100	3	EOP (page 1152)	EOP signal Out of Range HIGH
100	4	EOP (page 1152)	EOP signal Out of Range LOW
100	18	EWPS (page 1210)	Engine Oil System below Warning Pressure
102	2	IMP (page 1322)	IMP signal erratic, intermittent, or incorrect
102	3	IMP (page 1322)	IMP signal Out of Range HIGH
102	4	IMP (page 1322)	IMP signal Out of Range LOW
102	7	IMP (page 1322)	IMP signal not responding as expected
102	10	IMP (page 1322)	Boost slow response fault
102	16	IMP (page 1322)	Overboost
102	18	IMP (page 1322)	Underboost
105	2	IMT (page 1349)	IMT signal Erratic, Intermittent, or Incorrect
105	3	IMT (page 1349)	IMT signal Out of Range HIGH
105	4	IMT (page 1349)	IMT signal Out of Range LOW
108	2	ECM (page 1000)	BARO signal erratic, intermittent, or incorrect
108	3	ECM (page 1000)	BARO signal Out of Range HIGH
108	4	ECM (page 1000)	BARO signal Out of Range LOW

SPN	FMI	Sub-section	Condition Description
110	0	EWPS(page 1210)	Engine Cooling System above Critical Temperature
110	2	ECT1 (page 1033)	ECT1 signal erratic, intermittent, or incorrect
110	3	ECT1 (page 1033)	ECT1 signal Out of Range HIGH
110	4	ECT1 (page 1033)	ECT1 signal Out of Range LOW
110	15	EWPS (page 1210)	Engine Cooling System above Warning Temperature
110	16	EWPS (page 1210)	ECT1 stuck in range High
110	17	ECT1 (page 1033)	ECT1 stuck in range Low
110	18	ECT1 (page 1033)	Engine Coolant System Below closed loop minimum temperature
111	1	EWPS (page 1210)	ECL below Warning / Critical Level
111	2	EWPS (page 1210)	ECL signal erratic, intermittent, or incorrect
132	0	MAF (page 1782)	Engine Intake Air Mass Flow Rate High
132	1	MAF (page 1782)	Engine Intake Air Mass Flow Rate Low
132	4	MAF (page 1782)	MAF signal Out of Range LOW
132	11	MAF (page 1782)	MAF Sensor Calibration – Insufficient number of data points
132	13	MAF (page 1782)	MAF Sensor Calibration Needed
132	14	MAF (page 1782)	MAF Sensor Calibration Failed
132	31	MAF (page 1782)	MAF Frequency out of range HIGH
158	15	ECM (page 1000)	Battery Voltage above 16 volts
158	17	ECM (page 1000)	Battery Voltage below 9 volts
164	0	ICP (page 1286)	ICP above KOEO Spec
164	1	ICP (page 1286)	ICP Unable to Build During Engine Cranking
164	3	ICP (page 1286)	ICP signal Out of Range HIGH
164	4	ICP (page 1286)	ICP signal Out of Range LOW
164	15	ICP (page 1286)	ICP too high during test
164	16	ICP (page 1286)	ICP above desired level
164	17	ICP (page 1286)	ICP unable to build during test
164	18	ICP (page 1286)	ICP below desired level
171	2	AAT (page 143)	AAT signal erratic, intermittent, or incorrect
171	3	AAT (page 143)	AAT Signal Out of Range HIGH
171	4	AAT (page 143)	AAT Signal Out of Range LOW
172	2	MAF (page 1782)	IAT Signal Erratic, Intermittent, or Incorrect
172	3	MAF (page 1782)	IAT signal Out of Range HIGH
172	4	MAF (page 1782)	IAT Signal Out of Range LOW
173	2	EGT (page 1115)	EGT signal erratic, intermittent, or incorrect
173	3	EGT (page 1115)	EGT signal Out of Range HIGH



SPN	FMI	Sub-section	Condition Description
173	4	EGT (page 1115)	EGT signal Out of Range LOW
175	2	EOT (page 1163)	EOT signal erratic, intermittent, or incorrect
175	3	EOT (page 1163)	EOT signal Out of Range HIGH
175	4	EOT (page 1163)	EOT signal Out of Range LOW
175	7	EOT (page 1163)	EOT not warming along with engine
175	15	EWPS (page 1210)	Engine Oil System above Warning Temperature
188	0	Engine (page 1132)	Engine Low Idle RPM above normal
188	1	Engine (page 1132)	Engine Low Idle RPM below normal
190	0	EWPS (page 1210)	Engine Overspeed - Most Severe Level
191	3	TOSS (page 2008)	TOSS/VSS signal out of range HIGH
191	4	TOSS (page 2008)	TOSS/VSS signal out of range LOW
191	5	TOSS (page 2008)	TOSS/VSS Open Circuit fault
191	14	TOSS (page 2008)	TOSS/VSS Error invalid signal
521	2	BODY (page 428)	Brake applied while APP applied
593	31	EWPS (page 1210)	Engine stopped by IST
596	19	BODY (page 428)	Cruise Control Enable Switch not detected on J1939
597	2	BODY (page 428)	Brake switch or circuit fault
597	19	BODY (page 428)	Brake Switch not detected on J1939
609	19	DCU (page 475)	ACM (CES) not detected on J1939
628	12	ECM (page 1000)	ECM Memory Error
629	0	ECM (page 1000)	ECM Error - CPU Load Excessively HIGH
629	8	ECM (page 1000)	ECM Error - Engine Off Timer fault
629	12	ECM (page 1000)	ECM Internal chip Error
636	2	CMP (page 470)	CMP and CKP Synchronization Error
636	7	CMP (page 470)	CMP to CKP incorrect reference
637	8	CKP (page 465)	CKP signal noise
637	10	CKP (page 465)	CKP signal Inactive
639	14	J1939 (page 1779)	J1939 Data Link Error (ECM unable to transmit)
651	4	INJ (page 1365)	Injector 1 open coil - short circuit
651	5	INJ (page 1365)	Injector 1 open coil - open circuit
651	7	INJ (page 1365)	Injector 1 Spool Motion Compensation Max Authority Reached
651	14	INJ (page 1365)	Injector 1 Fuel quantity / timing error
652	4	INJ (page 1365)	Injector 2 open coil - short circuit
652	5	INJ (page 1365)	Injector 2 open coil - open circuit

SPN	FMI	Sub-section	Condition Description
652	7	INJ (page 1365)	Injector 2 Spool Motion Compensation Max Authority Reached
652	14	INJ (page 1365)	Injector 2 Fuel quantity / timing error
653	4	INJ (page 1365)	Injector 3 open coil - short circuit
653	5	INJ (page 1365)	Injector 3 open coil - open circuit
653	7	INJ (page 1365)	Injector 3 Spool Motion Compensation Max Authority Reached
653	14	INJ (page 1365)	Injector 3 Fuel quantity / timing error
654	4	INJ (page 1365)	Injector 4 open coil - short circuit
654	5	INJ (page 1365)	Injector 4 open coil - open circuit
654	7	INJ (page 1365)	Injector 4 Spool Motion Compensation Max Authority Reached
654	14	INJ (page 1365)	Injector 4 Fuel quantity / timing error
655	4	INJ (page 1365)	Injector 5 open coil - short circuit
655	5	INJ (page 1365)	Injector 5 open coil - open circuit
655	7	INJ (page 1365)	Injector 5 Spool Motion Compensation Max Authority Reached
655	14	INJ (page 1365)	Injector 5 Fuel quantity / timing error
656	4	INJ (page 1365)	Injector 6 open coil - short circuit
656	5	INJ (page 1365)	Injector 6 open coil - open circuit
656	7	INJ (page 1365)	Injector 6 Spool Motion Compensation Max Authority Reached
656	14	INJ (page 1365)	Injector 6 Fuel quantity / timing error
679	3	IPR (page 1768)	IPR short to PWR
679	4	IPR (page 1768)	IPR Open or short to GND
729	3	IAHC (page 1272)	IAHC short to PWR
729	4	IAHC (page 1272)	IAHC short to GND
729	5	IAHC (page 1272)	IAHC open load / circuit
729	18	IAHC (page 1272)	IAH Monitor fault: Lack of Heat in the Intake Manifold
931	3	EFP (page 1065)	EFP short to PWR
931	4	EFP (page 1065)	EFP open load / circuit or short to GND
974	3	RAPP (page 1904)	Remote APP signal Out of Range HIGH
1136	0	ECM (page 1000)	ECM Error – over temperature
1173	2	TC2CIT (page 1978)	TC2CIT signal erratic, intermittent, or incorrect
1173	3	TC2CIT (page 1978)	TC2CIT signal Out of Range HIGH
1173	4	TC2CIT (page 1978)	TC2CIT signal Out of Range LOW

SPN	FMI	Sub-section	Condition Description
1173	16	TC2CIT (page 1978)	TC2CIT signal above desired (Low Pressure CAC Interstage under cooling)
1189	3	TC2WC (page 1997)	TC2WC short to PWR
1189	4	TC2WC (page 1997)	TC2WC Open or short to GND
1209	0	AMS (page 381)	EBP above desired level
1209	1	EBP (page 914)	EBP below desired level
1209	2	EBP (page 914)	EBP signal erratic, intermittent, or incorrect
1209	3	EBP (page 914)	EBP signal Out of Range HIGH
1209	4	EBP (page 914)	EBP signal Out of Range LOW
1209	7	AMS (page 381)	EBP signal not responding as expected
1322	31	Engine (page 1132)	Misfire - Multiple Cylinders
1323	31	Engine (page 1132)	Misfire - Cylinder 1
1324	31	Engine (page 1132)	Misfire - Cylinder 2
1325	31	Engine (page 1132)	Misfire - Cylinder 3
1326	31	Engine (page 1132)	Misfire - Cylinder 4
1327	31	Engine (page 1132)	Misfire - Cylinder 5
1328	31	Engine (page 1132)	Misfire - Cylinder 6
1378	31	EWPS (page 1210)	Change Engine Oil Service Interval
1387	31	ECM (page 1000)	Altitude Reference Adder Fault
1569	31	DEFTLT (page 746)	SCR Tamperproof Warning & Protection System Inducement Severe
1659	20	ECT1 (page 1033)	ECT1 below expected: Check Thermostat
1761	1	DEFTLT (page 746)	DEFTL Inducement (Level 3 - 4)
1761	3	DEFTLT (page 746)	DEFTL signal Out of Range HIGH
1761	4	DEFTLT (page 746)	DEFTL signal Out of Range LOW
1761	10	DEFTLT (page 746)	DEF Level abnormal rate of change
1761	11	DEFTLT (page 746)	DEFTL signal erratic, intermittent, or incorrect
1761	17	DEFTLT (page 746)	DEFTL Inducement Level 1
1761	18	DEFTLT (page 746)	DEFTL Inducement Level 2
1761	19	DEFTLT (page 746)	DEFTL not detected on J1939
2623	3	APP (page 402)	APP2 signal Out of Range HIGH
2623	4	APP (page 402)	APP2 signal Out of Range LOW
2630	2	CACOT (page 439)	CACOT signal erratic, intermittent, or incorrect
2630	3	CACOT (page 439)	CACOT signal Out of Range HIGH
2630	4	CACOT (page 439)	CACOT signal Out of Range LOW
2630	16	CACOT (page 439)	CACOT Undercooling

SPN	FMI	Sub-section	Condition Description
2659	10	AMS (page 381)	EGR Slow Response Fault
2659	14	AMS (page 381)	EGR System flow rate error during Air Management Test
2659	20	AMS (page 381)	EGR High Flow Rate detected
2659	21	AMS (page 381)	EGR Low Flow Rate detected
2791	2	EGR (page 1074)	EGR feedback communication fault
2791	3	EGR (page 1074)	EGRV supply voltage is too HIGH
2791	4	EGR (page 1074)	EGRV supply voltage is too LOW
2791	7	EGR (page 1074)	EGR Valve unable to achieve commanded position
2791	8	EGR (page 1074)	EGR valve not receiving ECM PWM signal
2791	12	EGR (page 1074)	EGR Valve Internal self test fault
2791	14	EGR (page 1074)	EGR valve Initialization Fault
2797	6	INJ (page 1365)	Injector Control Group 1 - short circuit (INJ 1, 2, 3)
2798	6	INJ (page 1365)	Injector Control Group 2 - short circuit (INJ 4, 5, 6)
3031	2	DEFTLT (page 746)	DEFTT signal erratic, intermittent or incorrect
3031	3	DEFTLT (page 746)	DEFTT signal Out of Range HIGH
3031	4	DEFTLT (page 746)	DEFTT signal Out of Range LOW
3055	2	INJ (page 1365)	ICP / IPR Adaptation In-Range Fault
3061	31		CSER Exhaust warm up time fault
3216	4	NO <sub>x</sub> (page 1827)	NOxIN signal Out of Range LOW
3216	10	NO <sub>x</sub> (page 1827)	NOxIN signal abnormal rate of change
3216	13	NO <sub>x</sub> (page 1827)	NOxIN Out of Calibration
3216	19	NO <sub>x</sub> (page 1827)	NOxIN not detected on J1939
3216	20	NO <sub>x</sub> (page 1827)	NOxIN signal drifted HIGH
3216	21	NO <sub>x</sub> (page 1827)	NOxIN signal drifted LOW
3218	2	NO <sub>x</sub> (page 1827)	NOxIN power supply signal erratic, intermittent or incorrect
3226	2	NO <sub>x</sub> (page 1827)	NOxOUT signal erratic, intermittent or incorrect
3226	4	NO <sub>x</sub> (page 1827)	NOxOUT signal Out of Range LOW
3226	10	NO <sub>x</sub> (page 1827)	NOxOUT signal abnormal rate of change
3226	13	NO <sub>x</sub> (page 1827)	NOxOUT Out of Calibration
3226	19	NO <sub>x</sub> (page 1827)	NOxOUT not detected on J1939
3226	20	NO <sub>x</sub> (page 1827)	NOxOUT signal drifted HIGH
3226	21	NO <sub>x</sub> (page 1827)	NOxOUT signal drifted LOW
3228	2	NO <sub>x</sub> (page 1827)	NOxOUT power supply signal erratic, intermittent or incorrect
3242	0	DPFIT (page 876)	DPFIT above Critical Temperature
3242	2	DPFIT (page 876)	DPFIT signal erratic, intermittent, or incorrect

SPN	FMI	Sub-section	Condition Description
3242	3	DPFIT (page 876)	DPFIT signal Out of Range HIGH
3242	4	DPFIT (page 876)	DPFIT signal Out of Range LOW
3242	15	DPFIT (page 876)	DPFIT above Warning Temperature
3242	16	DPFIT (page 876)	DPFIT above Maximum Temperature
3246	0	DPFOT (page 898)	DPFOT above Critical Temperature
3246	2	DPFOT (page 898)	DPFOT signal erratic, intermittent, or incorrect
3246	3	DPFOT (page 898)	DPFOT signal Out of Range HIGH
3246	4	DPFOT (page 898)	DPFOT signal Out of Range LOW
3246	15	DPFOT (page 898)	DPFOT above Warning Temperature
3246	16	DPFOT (page 898)	DPFOT above Maximum Temperature
3251	0	AFT (page 156)	DPFDP excessively HIGH (Plugged filter)
3251	2	DPFDP / DPFOP (page 844)	DPFDP signal erratic, intermittent, or incorrect
3251	3	DPFDP / DPFOP (page 844)	DPFDP signal Out of Range HIGH
3251	4	DPFDP / DPFOP (page 844)	DPFDP signal Out of Range LOW
3251	15	AFT (page 156)	DPF Soot Load - Least Severe Level
3251	16	AFT (page 156)	DPF Soot Load - Moderately Severe Level
3361	2	DEF: SP (page 698)	DEFSP signal erratic, intermittent or incorrect
3361	3	DEF: SP (page 698)	DEFSP signal Out of Range HIGH
3361	4	DEF: SP (page 698)	DEFSP signal Out of Range LOW
3362	31	DEF: SP (page 698)	DEF dosing unable to prime
3363	3	DEFTHC (page 727)	DEF Tank Heater Control Valve short to PWR
3363	4	DEFTHC (page 727)	DEF Tank Heater Control Valve short to GND
3363	7	DEFTHC (page 727)	DEF Tank Heater Control Valve Mechanical system not responding
3363	16	DEFTHC (page 727)	DEF Tank Heater Control Valve stuck open fault
3363	18	DEFTHC (page 727)	DEF Tank Heater Control Valve unable to thaw frozen DEF
3364	31	ETP (page 1187)	Intake Throttle Valve short circuit fault
3471	1	AFTFPC (page 279)	AFT Fuel Pressure 1 below desired (Low system pressure)
3471	7	AFTFPC (page 279)	AFT Fuel Doser Valve not responding as expected
3471	10	AFTFPC (page 279)	AFT Fuel Pressure incorrect dosing pressure multiple events
3479	3	AFTFPC (page 279)	AFT Fuel Doser Valve Short to PWR
3479	4	AFTFPC (page 279)	AFT Fuel Doser Valve Short to GND
3479	5	AFTFPC (page 279)	AFT Fuel Pressure Valve Open or Short to GND low side
3479	6	AFTFPC (page 279)	AFT Fuel Doser Valve High Side Short circuit
3480	3	AFTFIS (page 226)	AFTFP1 signal Out of Range HIGH
3480	4	AFTFIS (page 226)	AFTFP1 signal Out of Range LOW