Ingersoll-Rand

OPERATING, MAINTENANCE, PARTS MANUAL

COMPRESSOR MODELS

HP1300WCU **HP1600WCU**

Code: C **Code:**

This manual contains important safety information.
Do not destroy this manual.
This manual must be available to the personnel who operate and maintain this machine.

Ingersoll-Rand
Portable Power
P.O. Box 868 - 501 Sanford Ave
Mocksville, N.C. 27028

Doosan purchased Bobcat Company from Ingersoll-Rand Company in 2007. Any reference to Ingersoll-Rand Company or use of trademarks, service marks, logos, or other proprietary identifying marks belonging to Ingersoll-Rand Company in this manual is historical or nominative in nature, and is not meant to suggest a current affiliation between Ingersoll-Rand Company and Doosan Company or the products of either.

Book 54757919 (10/29/01)
Revised (09-12)

QUALITY POLICY

We will supply products and services that consistently meet the requirements of our customers and each other.

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

Foreword

Machine models represented in this manual may be used in various locations worldwide. Machines sold and shipped into European common market countries requires that the machine display the EC Mark and conform to various directives. In such cases, the design specification of this machine has been certified as complying with EC directives. Any modification to any part is absolutely prohibited and would result in the CE certification and marking being rendered invalid. A declaration of that conformity follows:

Declaration of Conformity

WITH EC DIRECTIVE

98/37/EC

89/336/EEC

Ingersoll-Rand Company
P.O. Box 868
501 Sanford Avenue
Mocksville, North Carolina 27028

We

Represented In EC By:

Ingersoll-Rand Company Limited
Swan Lane, Hindley Green
Wigan WN2 4EZ
United Kingdom

Declare that, under our sole responsibility for manufacture and supply, the product(s)

HP1300WCU	VHP825WCU	XHP900WCAT	VHP750WCAT	XHP1170WCU
XP1400WCU	HP935WCU	XHP650WCAT	VHP850WCAT	XHP1070WCU
P1600WCU	XP1050WCU	XHP750WCAT	HP900WCAT	HP1600WCU
XP900WCU	HP825WCU	XHP825WCAT	XP1000WCAT	HP1300WCU
NXP1300WCU	NHP1500WCU	XHP1070CAT	10/425	XHP1170SCAT

To which this declaration relates, is (are) in conformity with the provisions of the above directives using the following principal standards

EN1012-1, EN29001, EN292, EN60204-1
PN8NTC2, EN 50081, EN50082

Issued at Mocksville on 1-1-95

Ric Lunsford
Manager of Quality Control

Issued at Hindley Green on 1-1-95

H. Seddon, Q.A. Manager

Nothing contained in this document is intended to extend any promise, warranty or representation, expressed or implied, regarding the Ingersoll-Rand products described herein. Any such warranties or other terms and conditions of sale of products shall be in accordance with the standard terms and conditions of sale for such products, which are available upon request.

This manual contains instructions and technical data to cover all routine operation and scheduled maintenance tasks by operation and maintenance staff. Major overhauls are outside the scope of this manual and should be referred to an authorized Ingersoll-Rand service department.

All components, accessories, pipes and connectors added to the compressed air system should be:

- of good quality, procured from a reputable manufacturer and, wherever possible, be of a type approved by Ingersoll-Rand.
- clearly rated for a pressure at least equal to the machine maximum allowable working pressure.
- compatible with the compressor lubricant/coolant.
- accompanied with instructions for safe installation, operation and maintenance.

Details of approved equipment are available from Ingersoll-Rand Service departments.
The use of repair parts other than those included within the Ingersoll-Rand approved parts list may create hazardous conditions over which Ingersoll-Rand has no control. Therefore, Ingersoll-Rand cannot be held responsible for equipment in which non-approved repair parts are installed.

Ingersoll-Rand reserves the right to make changes and improvements to products without notice and without incurring any obligation to make such changes or add such improvements to products sold previously.

The intended uses of this machine are outlined below and examples of unapproved usage are also given. However, Ingersoll-Rand cannot anticipate every application or work situation that may arise. **If in doubt, consult supervision.**

This machine has been designed and supplied for above ground operation to be used for compression of normal ambient air containing no additional gases, vapors or particles within the ambient temperature range specified in the general data section of this manual.

This machine should not be used:

A. For direct or indirect human consumption of the compressed air.

B. Outside the ambient temperature range specified in the general data section of this manual.

C. When an actual or foreseeable risk of hazardous levels of flammable gases or vapors exists.

D. With other than Ingersoll-Rand approved components.

E. With guards, or controls or switches missing or disabled.

F. For storage or transportation of materials inside or on the enclosure.

This company accepts no responsibility for errors in translation of this manual from the original English version.

You as the customer are expected to provide certain service and maintenance items. Your Ingersoll-Rand dealer will provide all other more detailed service and maintenance items on a special preventive maintenance schedule for each machine. It is very important that the minimum service and maintenance requirements explained in this manual be performed at the required intervals. Exceeding these intervals may reduce the reliability of the machine.

The purpose of this manual is to train the operator with functions, operation, and basic service and maintenance requirements of the compressor. During the preparation of this manual, every effort was made to ensure the adequacy and accuracy of the contents.

Your Ingersoll-Rand dealer will assist with setup and initial startup of the compressor. He will also provide brief operating and service instructions and will insure that a copy of this manual is included with the machine. Before starting the compressor, this manual and instructions should be carefully read to obtain a thorough knowledge of the duties to be performed. Please take pride in the compressor, keep it clean, and in good mechanical condition.

To enable proper maintenance records, Ingersoll-Rand provides a Noise Emission Control Maintenance Log Book (PCD Form 685) with each compressor shipped from the factory. This Log Book contains a recommended schedule and space so that the serviceman can note what service and maintenance was done, by whom, where, and when.

TABLE OF CONTENTS

SECTION 1 ..... SAFETY

SECTION 2 ..... WARRANTY/REGISTRATION

SECTION 3 ..... GENERAL DATA

SECTION 4 ..... OPERATION

SECTION 5 ..... MAINTENANCE

SECTION 6 ..... LUBRICATION

SECTION 7 ..... TROUBLESHOOTING

SECTION 8 ..... ELECTRICAL

SECTION 9 ..... SYSTEM DIAGRAMS

SECTION 10 ..... PARTS ORDERING

SECTION 11 ..... PARTS LIST

SECTION 12 ..... ENGINE (operation, maintenance, lubrication, troubleshooting)

SECTION 1- SAFETY

SAFETY PRECAUTIONS

General Information

Ensure that the operator reads and understands the decals and consults the manuals before maintenance or operation.

Ensure that the Operation and Maintenance manual, and the manual holder if equipped, are not removed permanently from the machine.

Ensure that maintenance personnel are adequately trained, competent and have read the manuals.

Make sure that all protective covers are in place and that the canopy/doors are closed during operation.

The specification of this machine is such that the machine is not suitable for use in flammable gas risk areas. If such an application is required then all local regulations, codes of practice and site rules must be observed. To ensure that the machine can operate in a safe and reliable manner, additional equipment such as gas detection, exhaust spark arrestors, and intake (shut-off) valves may be required, dependent on local regulations or the degree of risk involved.

Air discharged from this machine may contain carbon monoxide or other contaminants which will cause serious injury or death. Do not breathe this air.

Compressed air can be dangerous if incorrectly handled. Before doing any work on the unit, ensure that all pressure is vented from the system and that the machine cannot be started accidentally.

Ensure that the machine is operating at the rated pressure and that the rated pressure is known to all relevant personnel.

All air pressure equipment installed in or connected to the machine must have safe working pressure ratings of at least the machine safety valve rating.

If more than one compressor is connected to one common downstream plant, effective check valves and isolation valves must be fitted and controlled by work procedures, so that one machine cannot accidentally be pressurized or over pressurized by another.

Compressed air must not be used for a feed to any form of breathing apparatus or mask.

The discharged air contains a very small percentage of compressor lubricating oil and care should be taken to ensure that downstream equipment is compatible.

If the discharged air is to be ultimately released into a confined space, adequate ventilation must be provided.

When using compressed air, always use appropriate personal protective equipment.

All pressure containing parts, especially flexible hoses and their couplings, must be regularly inspected, be free from defects and be replaced according to the Manual instructions.

Avoid bodily contact with compressed air.

Never operate unit without first observing all safety warnings and carefully reading the operation and maintenance manual shipped from the factory with this machine.

Never operate the engine of this machine inside a building without adequate ventilation. Avoid breathing exhaust fumes when working on or near the machine. Do not alter or modify this machine.

A battery contains sulfuric acid and can give off gases which are corrosive and potentially explosive. Avoid contact with skin, eyes and clothing. In case of contact, flush area immediately with water.

Exercise extreme caution when using booster battery. To jump battery, connect ends of one booster cable to the positive (+) terminal of each battery. Connect one end of other cable to the negative (-) terminal of the booster battery and other end to a ground connection away from dead battery (to avoid a spark occurring near any explosive gases that may be present). After starting unit, always disconnect cables in reverse order.

Never operate unit without first observing all safety warnings and carefully reading the operation and maintenance manual shipped from the factory with this machine.

This machine may include such materials as oil, diesel fuel, antifreeze, brake fluid, oil/air filters and batteries which may require proper disposal when performing maintenance and service tasks. Contact local authorities for proper disposal of these materials.

High Pressure Air can cause serious injury or death. Relieve pressure before removing filler plugs/caps, fittings or covers.

Air pressure can remain trapped in air supply line which can result in serious injury or death. Always carefully vent air supply line at tool or vent valve before performing any service.

This machine produces loud noise with the doors open or service valve vented. Extended exposure to loud noise can cause hearing loss. Always wear hearing protection when doors are open or service valve is vented.

Never inspect or service unit without first disconnecting battery cable(s) to prevent accidental starting.

Do not remove the pressure cap from a HOT radiator. Allow radiator to cool down before removing pressure cap.

Do not use petroleum products (solvents or fuels) under high pressure as this can penetrate the skin and result in serious illness. wear eye protection while cleaning unit with compressed air to prevent debris from injuring eye(s).

Disconnected air hoses whip and can cause serious injury or death. Always attach a safety flow restrictor to each hose at the source of supply or branch line in accordance with OSHA Regulation 29CFR Section 1926.302(b).

Hot pressurized fluid can cause serious burns. Do not open radiator while hot.

Rotating fan blade can cause serious injury. Do not operate without guard in place.

Use care to avoid contacting hot surfaces (engine exhaust manifold and piping, air receiver and air discharge piping, etc.).

Ether is an extremely volatile, highly flammable gas. USE SPARINGLY! Do NOT use ETHER if unit has GLOW Plug starting aid. Engine damage will result.

Never allow the unit to sit stopped with pressure in the receiver-separator system. As a precaution, open the manual blowdown valve.

Never operate unit with guards, covers or screens removed. Keep hands, hair, clothing, tools, blow gun tips, etc. well away from moving parts.

Make sure wheels, tires and tow bar connectors are in safe operating condition and tow bar is properly connected before towing.

Whenever the machine is stopped, air will flow back into the compressor system from devices or systems downstream of the machine unless the service valve is closed. Install a check valve at the machine service valve to prevent reverse flow in the event of an unexpected shutdown when the service valve is open.

Hazardous Substance Precaution

The following substances are used in the manufacture of this machine and may be hazardous to health if used incorrectly.

Precaution: Avoid ingestion, skin contact and breathing fumes for the following substances: Antifreeze, Compressor Oil, Engine Lubricating Oil, Preservative Grease, Rust Preventative, Diesel Fuel and Battery Electrolyte.

The following substances may be produced during the operation of this machine and may be hazardous to health:

Avoid build-up of Engine Exhaust Fumes in confined spaces.

Avoid breathing Exhaust Fumes.

Avoid breathing Brake Lining Dust during maintenance.

SAFETY LABELS

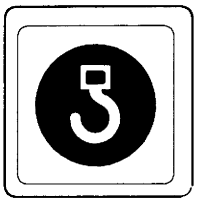
Look for these signs on machines shipped to international markets outside North America, which point out potential hazards to the safety of you and others. Read and understand thoroughly. Heed warnings and follow instructions. If you do not understand, inform you supervisor.



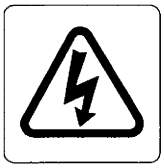
Corrosion risk



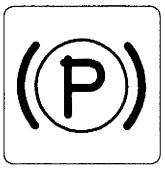
Hot Surface



Lifting point



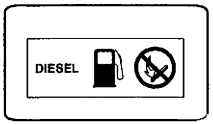
WARNING: Electrical shock risk.



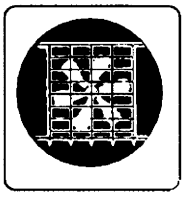
Parking Brake



No open flame



Diesel Fuel.
No open flame.



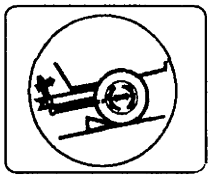
Do not operate the machine without guard being fitted.



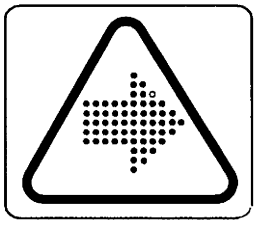
Lifting point



WARNING - Flammable liquid.



When parking use prop stand, handbrake and wheel chocks.



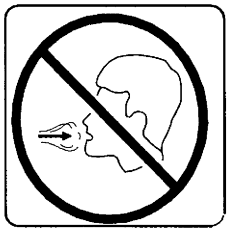
Air/gas flow or Air discharge.



WARNING - Hot and harmful exhaust gas.



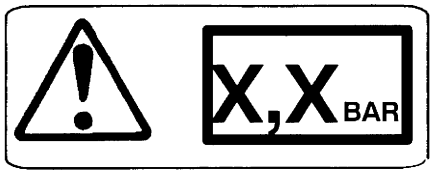
Tie down point



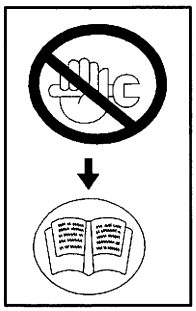
Do not breathe the compressed air from this machine.



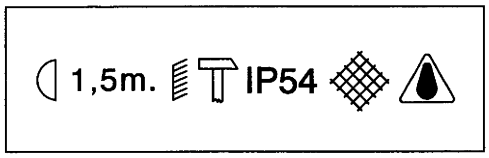
Read the Operation and Maintenance manual before operation or maintenance of this machine is undertaken.



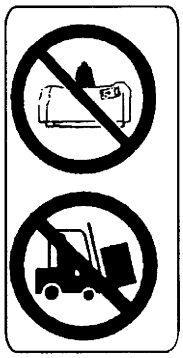
WARNING - Maintain correct tire pressure. (Refer to the *GENERAL INFORMATION* section of this manual).



WARNING: Consult the operation and maintenance manual before performing any maintenance.

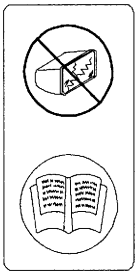


Rough Service Designation
Wet Location Operation

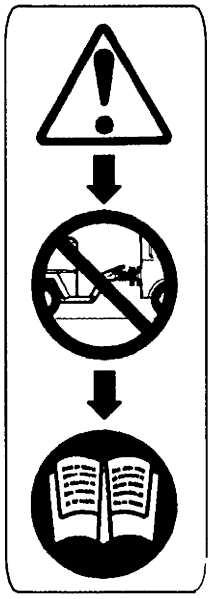


Do not stack

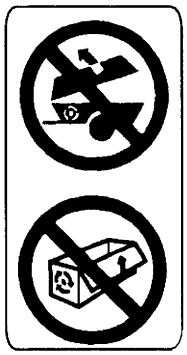
Do not use fork lift truck from this side



Replace any cracked protective shield.



WARNING - Before connecting the tow bar or when preparing to tow, consult the operation and maintenance manual.



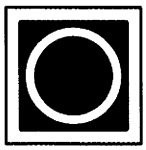
Do not operate with the doors or enclosure open.



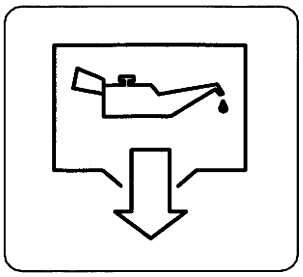
On (power).



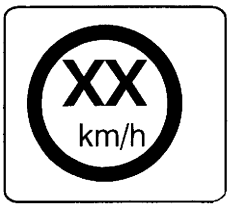
Off (power).



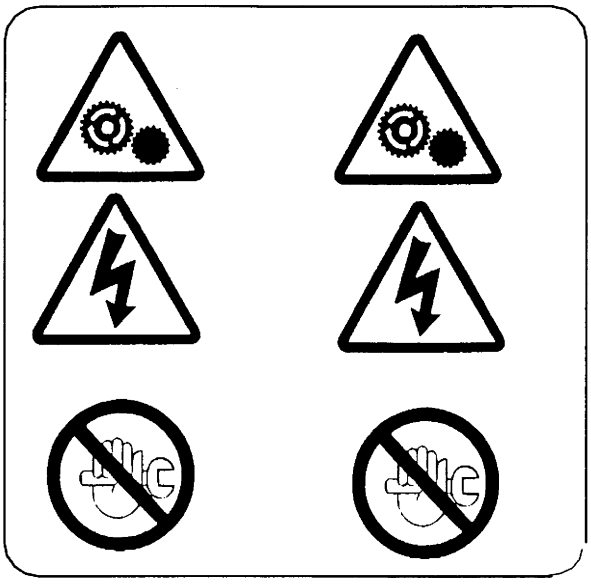
Emergency stop.



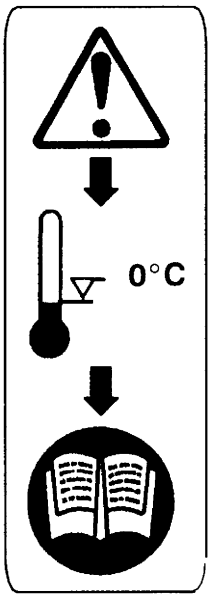
Oil Drain



Do not exceed the speed limit.



WARNING - Do not undertake any maintenance on this machine until the electrical supply is disconnected and the air pressure is totally relieved.



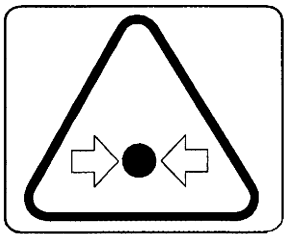
WARNING - For operating temperature below 0°C, consult the operation and maintenance manual.



Read the Operation and Maintenance manual before operation or maintenance of this machine is undertaken



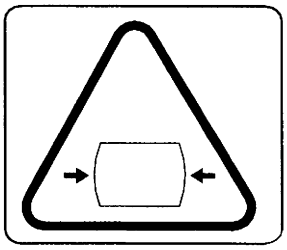
Do not remove the Operating and Maintenance manual and manual holder from this machine.



Pressurized vessel.



Use fork lift truck from this side only.



Pressurized component or system.

Look for these signs on machines shipped to markets in North America, which point out potential hazards to the safety of you and others. Read and understand thoroughly. Heed warnings and follow instructions. If you do not understand, inform you supervisor.

⚠DANGER

(Red Background)

Indicates the presence of a hazard which WILL cause serious injury, death or property damage, if ignored.

⚠WARNING

(Orange Background)

Indicates the presence of a hazard which CAN cause serious injury, death or property damage, if ignored.

⚠CAUTION

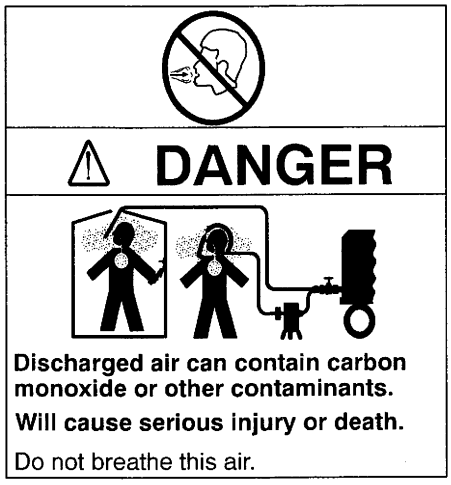
(Yellow Background)

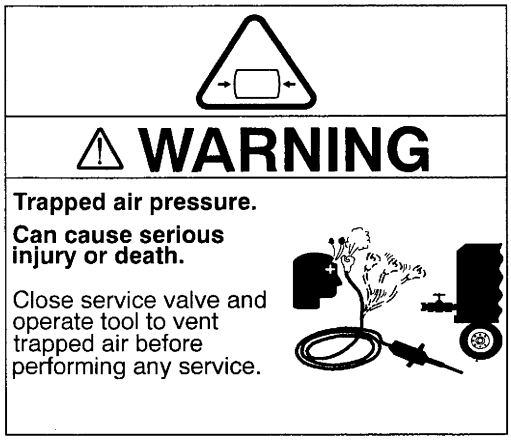
Indicates the presence of a hazard which WILL or can cause injury or property damage, if ignored.

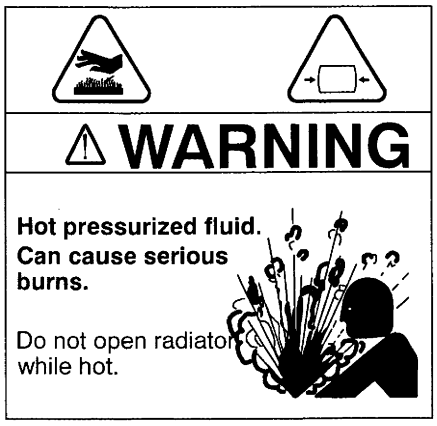
NOTICE

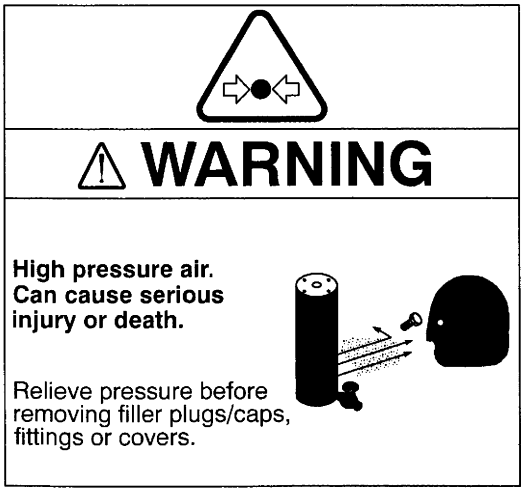
(Blue Background)

Indicates important set-up, operating or maintenance information.









⚠ WARNING

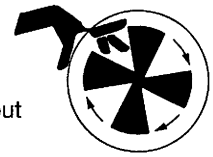
Improper operation of this equipment.
Can cause serious injury or death.
Read Operator's Manual supplied with this machine before operation or servicing.

Modification or alteration of this machine.
Can cause serious injury or death.
Do not alter or modify this machine without the express written consent of the manufacturer.

⚠ WARNING

Rotating fan blade.
Can cause serious injury.

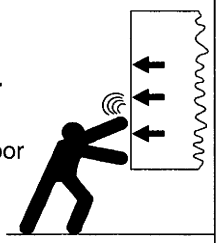
Do not operate without guard in place.



⚠ WARNING

Door under pressure.
Can cause serious injury.

Use both hands to open door when machine is running.



CAUTION

DO NOT WELD.

ELECTRONIC DAMAGE WILL OCCUR.

This engine is equipped with an electronic engine controller and other electronic components.

105 km/h

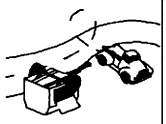
⚠ WARNING

Collapsing jackstand.
Can cause serious injury.

Insert locking pin completely.



Excessive towing speed.
Can cause serious injury or death.
Do NOT exceed 65 mph (105 km/hr.)



⚠ WARNING

Falling off machine.

Can cause serious injury or death.

Access lifting bail from inside machine.

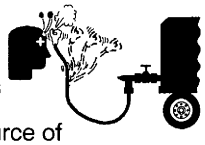


⚠ WARNING

Disconnected air hoses whip.

Can cause serious injury or death.

When using air tools attach safety device (OSHA Valve) at source of air supply for each tool.



⚠ WARNING

Combustible gas.

Can cause serious burns, blindness or death.

Keep sparks and open flames away from batteries.



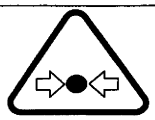


CAUTION

DO NOT USE ETHER.

ENGINE DAMAGE WILL OCCUR.

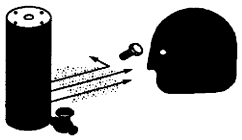
This engine is equipped with an electric heater starting aid.

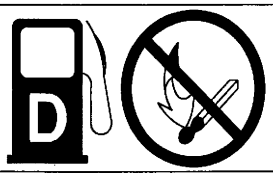


⚠ WARNING

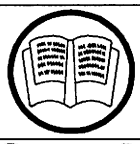
High pressure air. Can cause serious injury or death.

Relieve pressure before removing filler plugs/caps, fittings or covers.





USE DIESEL FUEL ONLY



NOTICE

COOLANT FILL INSTRUCTIONS

Adding:

Do NOT remove radiator cap. Top off at overflow reservoir. Use same anti-freeze mixture as in radiator.

Replacing:

With system cool, remove radiator cap. Drain coolant and close drain. At radiator, refill system. Replace radiator cap. At reservoir, fill to "Hot" level. Run for 30 minutes. Stop and allow to cool. At reservoir, add coolant as necessary to reach "Cold" level.

FREE SAFETY DECALS!

To promote communication of Safety Warnings on products manufactured by the Portable Compressor Division in Mocksville, N.C., Safety Decals are available **free** of charge. Safety decals are identified by the decal heading: **DANGER, WARNING or CAUTION.**

Decal part numbers are on the bottom of each decal and are also listed in the compressor's parts manual. Submit orders for Safety Decals to the Mocksville Parts Service Department. The no charge order should contain only Safety Decals. Help promote product safety! Assure that decals are present on the machines. Replace decals that are not readable.

SECTION 2 - Warranty

Ingersoll-Rand, through its distributor, warrants that each item of equipment manufactured by it and delivered hereunder to the initial user will be free of defects in material and workmanship for a period of three (3) months from initial operation or six (6) months from the date of shipment to the initial user, whichever occurs first.

With respect to the following types of equipment, the warranty period enumerated below will apply in lieu of the foregoing warranty period.

A. **Aftercoolers** - The earlier of nine (9) months from date of shipment to or six (6) months from start up by initial user.

B. **Portable Compressors, Portable Generator Sets (GENSET) 8KW, 11KW, 20KVA thru 575KVA, Portable Light Towers and Air Dryers** - The earlier of twelve (12) months from shipment to or the accumulation of 2,000 hours of service by the initial user.
3.5KW thru 7.0KW and 10KW– The earlier of twelve (12) months from shipment to or the accumulation of 2,000 hours of service by the initial user, whichever occurs first. Ingersoll-Rand will provide a new part or repaired part, at it's election, in place of any part which is found to be defective in material or workmanship during the period described above. Labor cost to replace the part is the responsibility of the user.

C. **Portable Compressor Air Ends -** The earlier of twenty-four (24) months from shipment to or the accumulation of 4,000 hours of service by the initial user. For Air Ends, the warranty against defects will include replacement of the complete Air End, provided the original Air End is returned assembled and unopened.

C.1 **Portable Compressor Airend Limited Optional Warranty** - The earlier of sixty (60) months from shipment to or the accumulation of 10,000 hours of service. The optional warranty is limited to defects in rotors, housings, bearings and gears and provided all the following conditions are met:
1. The original air end is returned assembled and unopened.
2. Continued use of genuine Ingersoll-Rand parts, fluids, oil and filters.
3. Maintenance is performed at prescribed intervals.

Oil-Free airends are fee-based and may require a maintenance agreement. Formal enrollment is required.

D. **Genset Generators 8KW, 11KW, 20KVA thru 575KVA -** The earlier of twenty-four (24) months from shipment to or the accumulation of 4,000 hours of service by the initial user.
3.5KW thru 7.0KW and 10KW - The earlier of twelve (12) months from shipment to or the accumulation of 2,000 hours of service.

E. **Portable Light Tower Generators-** The earlier of twelve (12) months from shipment to or the accumulation of 2,000 hours of service by the initial user. Light Source model only, the earlier of twenty-four (24) months from shipment to or the accumulation of 4,000 hours of service.

F. **Ingersoll-Rand Engines -** The earlier of twenty-four (24) months from shipment to or the accumulation of 4,000 hours of service.

G. **Ingersoll-Rand Platinum Drive Train Warranty (Optional)** – Platinum drive train pertains to the Ingersoll-Rand Engine and Airend combination. The earlier of sixty (60) months from shipment to, or the accumulation of 10,000 hours of service. The starter, alternator, fuel injection system and all electrical components are excluded from the extended warranty. The airend seal and drive coupling are included in the warranty (airend drive belts are not included). The optional warranty is automatically available when meeting the following conditions:

1. The original airend is returned assembled and unopened.
2. Continued use of genuine Ingersoll-Rand parts, fluids, oil and filters.
3. Maintenance is performed at prescribed intervals.

It is the obligation of the user to provide verification that these conditions have been satisfied when submitting warranty claims.

F. **Spare Parts**– Six (6) months from date of shipment.

Ingersoll-Rand will provide a new part or repaired part, at its election, in place of any part which is found upon its inspection to be defective in material and workmanship during the period prescribed above. Such part will be repaired or replaced without charge to the initial user during normal working hours at the place of business of an Ingersoll-Rand distributor authorized to sell the type of equipment involved or other establishment authorized by Ingersoll-Rand. User must present proof of purchase at the time of exercising warranty.

The above warrantees do not apply to failures occurring as a result of abuse; misuse, negligent repairs, corrosion, erosion and normal wear and tear, alterations or modifications made to the product without express written consent of Ingersoll-Rand; or failure to follow the recommended operating practices and maintenance procedures as provided in the product's operating and maintenance publications.

Accessories or equipment furnished by Ingersoll-Rand, but manufactured by others, including, but not limited to, engines, tires, batteries, engine electrical equipment, hydraulic transmissions, carriers, shall carry whatever warranty the manufacturers have conveyed to Ingersoll-Rand and which can be passed on to the initial user.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES EXPRESSED OR IMPLIED, (EXCEPT THAT OF TITLE),AND THERE ARE NO WARRANTIES OF MERCHANTABILITY OR OF FITNESS FOR A PARTICULAR PURPOSE.

GENERAL WARRANTY INFORMATION

GENERAL WARRANTY			Extended Coverage
Portable Compressor	Package	1 year/2000 hrs	
	Airend	2 yrs/4000 hrs	5 yrs/10,000 hrs Limited warranty, major components (refer to operator's manual).

Portable Genset 8kW, 11KW, 20KVA thru 575KVA	Package	1 yr/2000 hrs	None
	Generator	2 yrs/4000 hrs	None

Portable Genset 3.5KW thru 7.0KW and 10KW	Package	1 yr/2000 hrs (parts only)	None
	Generator	1 yrs/2000 hrs (parts only)	None

Light Tower	Package	1 yr/2000 hrs	
	Generator	1 yr/2000 hrs	2 years/4000 hours, for Lightsource introduced 8/16/99.

ENGINES			
CATERPILLAR	**Months**	**Hours**	**Extended Coverage**
	12	unlimited	Available at dealer
CUMMINS	24	2000	Major components 3 yrs/10,000 hrs Available at dealer
JOHN DEERE (in compressors)	24	2000	5 yrs/5000 hrs using OEM fluids and filters with $250 deductible
(in generators as of 1/1/01)	24	2000	2 yrs/4000 hrs using IR fluids and filters
DEUTZ	24	2000	Available at dealer
INGERSOLL-RAND	24	4000	5 yrs/10,000 hrs when using genuine Ingersoll-Rand fluids and parts. Refer to operator's manual.
KUBOTA (North America only)	24	2000	Major components 36 mo/3000 hrs (parts only)
(Western Europe & Oceania)	24	2000	None
(Central & South America, Asia, Middle East & Africa)	12	1000	None
MITSUBISHI	24	2000	2 yrs/4000 hrs using IR fluids & filters
VOLVO	24	2000	2 yrs/4000 hrs using ir fluids & filters
HONDA	12	unlimited	None
VANGUARD	24	unlimited	None

PARTS			
	Months	**Hours**	**Coverage**
Ingersoll-Rand	6	No Limit	Parts Only

AIREND EXCHANGE			
	Months	**Hours**	**Extended Coverage**
Airend	12	2000 hours	2 yrs/4000 hrs - available from IR.

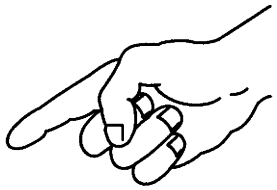
Note: Actual warranty times may change. Consult the manufacturer's warranty policy as shipped with each new product.

WARRANTY REGISTRATION

Complete Machine Registration

Machines shipped to locations within the United States do not require a warranty registration unless the machine status changes (i.e. change of ownership).

Machines shipped outside the United States require notification be made to initiate the machine warranty.



Fill out the Warranty Registration Form in this section, keep a copy for your records and mail form to:

Ingersoll-Rand Company
Portable Compressor Division
P.O. Box 868
Mocksville, North Carolina 27028

Attn: Warranty Department

Note: Completion of this form validates the warranty.

Selling Distributor	Servicing Distributor	WARRANTY REGISTRATION
Name _____	Name _____	Owner/User Name _____
Address _____	Address _____	Address _____
City _____	City _____	City _____
County _____	County _____	County _____
State _____	State _____	State _____
Zip Code _____	Zip Code _____	Zip Code _____
Telephone _____	Telephone _____	Telephone _____

Complete the Applicable Blocks

Owner/User Type of Business (check one only)

☐ Construction-Heavy (highway, excavation, etc.)	☐ Asphalt Contractor	☐ Coal Mining	☐ Other Mining
☐ Construction-Light (carpentry, plumbing, pools, mason, etc.)	☐ Government (municipal, state, county, etc.)	☐ Quarry	☐ Shallow Oil & Gas
☐ Rental (rental center, rental fleet, etc.)	☐ Building Contractor	☐ Waterwell	☐ Utility Company (gas, electric, water, etc.)
☐ Industrial (plant use)	☐ Other specify _____	☐ Exploration	☐ Utility Contractor

Model	Unit S/N	Engine S/N	Date Delivered

Unit-Hours	Airend S/N	Truck S/N	Truck Engine S/N

SERVICING DISTRIBUTOR/USER ACKNOWLEDGEMENT

1. The Purchaser has been instructed and/or has read the manual and understands proper preventative maintenance, general operation and safety precautions.
2. The warranty and limitation of liability has been reviewed and understood by the owner/user.
3. In the event that this unit is to be used within a nuclear facility, the owner/user shall notify Ingersoll-Rand of such use so that Ingersoll-Rand may arrange for appropriate nuclear liability protection from the owner-licensee of the facility.
4. Ingersoll-Rand reserves the right to make design changes or modifications of Ingersoll-Rand products at anytime without incurring any obligation to make similar changes or modifications on previously sold units.

Ingersoll-Rand Company
Portable Compressor Division
P.O. Box 868
Mocksville, North Carolina 27028

Attention: Warranty Department

- fold -

SECTION 3 - GENERAL DATA

UNIT MODELS	HP1600WCU	HP1300WCU
Air Delivery - cfm (litres/sec)	1600 (756)	1300 (614)

COMPRESSOR

Rated Operating Pressure - psi (kPa)	80-150 (552-1034)

ENGINE (Diesel)

Manufacturer	Cummins
Model	QSX-15
Rated Horsepower at 1800 rpm	560
Electrical System	24 VDC
Full Load Speed - rpm	1800
No Load Speed - rpm	1200

FLUID CAPACITIES - U.S. Gallons (litres)

Compressor Lubricant	55 (208)
Engine Lube (including filter)	10.5 (40)
Engine Coolant (Radiator)	15.2 (57.5)
Fuel Tank (Clean DIESEL fuel)	230 (870)

UNITS MEASUREMENTS/WEIGHTS Feet (Meters)	HSRG	Wagon RG	LRG
Overall Length	24.2 (7.4)	19.0 (5.79)	19.0 (5.79)
Overall Height	8.33 (2.54)	8.33 (2.54)	7.25 (2.21)
Overall Width	7.5 (2.29)	7.5 (2.29)	7.5 (2.29)
Gross Weight - pounds (kg)	17,200 (7810)	17,200 (7810)	16,700 (7590)
(including fluids-no fuel)	est		est

RUNNING GEAR

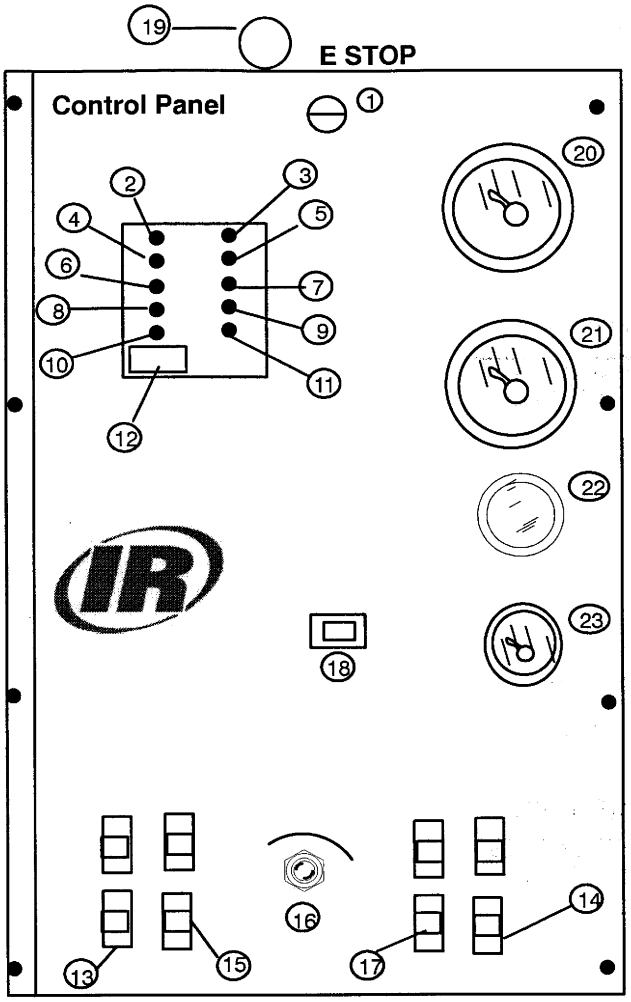
Tire Size	215/75R17.5H	215/75R17.5H	NA
Towing Speed (Maximum) mph	65	20	NA
Inflation Pressure	125 psig	125 psig	NA

EXPENDABLE SERVICE PARTS

Part Number	Description	Where Used	Quantity
36860336	Filter, Oil	Airend	2
36754406	Separator, Oil HP	Airend	1
36864361	Filter, Inlet Primary	Engine & AE inlet	2
36864379	Filter, Inlet Secondary	Engine & AE inlet	2
54662028	Filter Oil, Engine	QSX15	1
54662051	Filter Coolant, Engine	QSX15	1
54662036	Filter Fuel, Engine	QSX15	1

CAUTION: Any departure from the specifications may make this equipment unsafe.

SECTION 4 - OPERATING INSTRUCTIONS



OPERATING CONTROLS AND INSTRUMENTS

The operating controls and instruments are arranged on the control panel as shown on previous page. A description of each panel device is as follows:

1. **Panel Light:** Illuminates PHE instrument and control panel controlled by Switch 14.
2. **High Compressor Temp**: Fault indicator lamp. Indicates shutdown due to high compressor temperature.
3. **Low Radiator Coolant Level:** Alarm indicator lamp. Indicates engine coolant needs service.
4. **Low Engine Oil Pressure**: Fault indicator lamp. Indicates shutdown due to low engine oil pressure.
5. **Restricted Air Filter**: Alarm indicator lamp. Indicates engine/compressor air inlet filters need service.
6. **High Engine Coolant Temp:** Fault indicator lamp. Indicates shutdown due to high engine water temperature.
7. **Restricted IQ Air Filters:** Fault indicator lamp. Indicates shutdown due to high Pon IQ air filters (if equipped).
8. **Low Fuel Level:** Fault indicator lamp. Indicates shutdown due to low fuel level. Lamp blinks at low fuel warning.
9. **Compressor Malfunction:** Fault indicator lamp. Indicates shutdown due to compressor system fault. Refer to Fault Code List.
10. **Low Battery Voltage**: Alarm indicator lamp. Indicates battery or charging system requires service.
11. **Engine Malfunction:** Engine Fault code. Refer to service card or engine manual for codes and service requirements.
12. **Malfunction Code (4 Digit)**: Compressor or engine fault. Refer to manual for list of codes and service requirements.
13. **Ether Inject**: Injects a measured shot of ether for aid in cold weather starting of engine. Caution: Use Sparingly.
14. **Panel Light Switch**: Controls panel lamp # 1.
15. **Service Air Switch:** Momentary contact switch. Allows engine to warm up at low compressor pressure.
16. **Main Power Control Switch:** ON/OFF Start Switch.
17. **Heaters:** ON/OFF Power Switch for regulation and IQ heaters. Prevents freeze up in cold weather.
18. **Hourmeter:** Indicates machine operating hours.
19. **E-STOP**: Emergency Stop Push Button (ESA units only). Push to stop, turn to release.
20. **Discharge Air Pressure Gage:** Indicates pressure in receiver tank, normally from 0 psi(kPa) to the rated pressure of the machine.
21. **Engine Tachometer:** Indicates engine speed in RPM from 0 when stopped to full speed.
22. **Systems Gage:** Engine Water Temp
    Compressor Oil Temp
    Engine Oil Pressure
    Battery Voltage
23. **Fuel Level Gage:** Indicate fuel level in tank.

WARNING

Do not climb on top of unit.

LIFTING UNIT

Central Lifting Bail

- Hoist/crane per machines gross weight (see general data)

BEFORE TOWING

Ensure that the tires, wheels and running gear are in good condition and secure.

Wagon Style Running Gear

- Do not tow this unit in exess of 20 mph (32km/hr).
- Use a tow vehicle whose towing capacity is greater than the gross weight of this unit. (see general data).
- Machine is not designed to be Highway Towable.
- Set parking brake or chock wheels before disconnecting from towing vehicle.
- Optional Parking Brake - located beside towbar on front of unit, if equipped.

High Speed Running Gear

- Use jack to raise or lower lunette eye.
- Use tow vehicle whose towing capacity is greater than the gross weight of this unit (see general data).
- Do not tow this unit in excess of 65 mph.
- Place wheel chocks under tires before disconnecting from towing vehicle.
- When raising or lowering lunette eye, always stand to one side.

Wheel Chock - HSRG

- Located inside of front towbar
- Secure unit with chocks before disconnecting drawbar from tow vehicle.

SETTING UP (ALL UNITS)

Place the unit in an open, well-ventilated area. Position as level as possible. The design of these units permits a maximum 15 degree limit on out-of-level operation.

When the unit is to be operated out-of-level it is important: (1) to keep the engine crankcase oil level near the high level mark (with the unit level), and (2) to have the compressor oil level gauge show no more than mid-scale (with the unit running at full load). Do not overfill either the engine crankcase or the compressor lubricating oil system.

Chock wheels or set parking brake.

This unit is equipped with on-board fuel tanks with a total capacity of 230 gallons which provides 10 hours of full load operation.

Compressor Mounting

Portable compressors, which are modified to remove the running gear and mount the machine direct to trailers, truck beds or frames, etc. may experience failure of the enclosure, frame, and/or other components. It is necessary to isolate the compressor package from the carrier base with a flexible mounting system. Such a system must also prevent detachment of the package from the carrier base in the event the isolators fail. Contact Ingersoll-Rand representative for flexible mounting kits.

Warranty does not cover failures attributable to mounting of the compressor package to the carrier base unless it is an Ingersoll-Rand provided system.

WARNING

Do not connect the air discharge on this unit onto a common header with any other unit of any description, or any other source of compressed air, without first making sure a check-valve is used between the header and the unit. If this unit is connected in parallel with another unit of higher discharge pressure and capacity, a safety hazard could occur in a back-flow condition.

WARNING

Unrestricted air flow from a hose will result in a whipping motion of the hose which can cause serious injury or death. A safety device must be attached to the hose at the source of supply to reduce pressure in case of hose failure or other sudden pressure release. Reference: OSHA regulation 29 CFR Section 1926.302 (b).

Air hose restraining cable installation:

Secure hose restraining cable at each end to prevent accidental hose whipping. At the machine-side of the air hose, install and secure one end of the hose restraining cable on the 3" nipple on the inlet side of the 3" service valve. Install the other end of the hose restraining cable over the main hose connector.

Install suitable 3" air hose between service valve on unit and point of air use. The air hose must be rated for outdoor use and for pressurized air service. Minimum rating is 250°F (121°C) and 200 psig (HP) or 425 psig (XHP).

BEFORE STARTING

Open service valves.

Inspect the complete installation including remote fuel lines (if any) and air hose routing and connections.

Check battery for proper connections and condition.

WARNING

Combustible gas can cause severe burns, blindness or death. Keep sparks and open flame away from battery.

- Check the compressor lubricating oil level. The proper oil level is labeled on the compressor sump sight glass.
- Check engine oil level. The proper level is labeled on the engine dipstick. Add oil when required. Do not overfill.
- To jump-start, connect the positive booster/charger cable to the 24VDC positive (+) terminal of the battery. Then connect the negative booster/charger cable to the engine block...Not to the negative (-) terminal of the weak battery. After starting, disconnect the negative (-) cable from engine block; then from the booster battery/charger. Disconnect positive (+) cable from both batteries.

WARNING

Do not remove the cap from a HOT engine radiator. The sudden release of pressure from a heated cooling system can result in a loss of coolant and possible severe personal injury.

WARNING

Hot pressurized fluid can cause serious burns. Do not open radiator while hot.

Check coolant to assure coolant level is at minimum level when the unit is cold.

Check engine coolant level by removing the radiator top cap and looking for coolant in the filler neck of the radiator. Add coolant as required. Insure that radiator cap is installed properly and tightened.

Note: This machine will not allow engine starting if engine coolant is low.

NOTICE: If the appropriate mixture of antifreeze is not used during freezing temperatures, failure to drain the engine may cause costly engine damage. Never use water only as corrosion inhibitors are required in engine coolant fluid.

CAUTION

No smoking, sparks, or open flame near fuel.

Check the fuel level. Add only CLEAN DIESEL fuel for maximum service from the engine. Refer to the Engine Operator's Section for fuel specifications.

NOTICE

To minimize condensation (water) in the fuel tank, it is recommended to fill the tank at the end of each day.

WARNING

This machine produces loud noise with doors open. Extended exposure to loud noise can cause hearing loss. Wear hearing protection when doors or valve(s) are open.

- Close the side doors to maintain a cooling air path and to avoid recirculation of hot air. This will maximize the life of the engine and compressor and protect the hearing of surrounding personnel.

- Make sure no one is IN or ON the compressor unit.

STARTING -

NOTICE

This unit is equipped with a battery disconnect switch which removes power from the machine controller for long term storage. The switch is located on the side of the engine near the battery.

This switch must be turned ON to provide power to the control panel for starting this unit.

1. Turn the keyswitch to the "ON" position (first position). All diagnostic lamps and the LED display will light for two (2) seconds. Then all lamps should go off except for ALTERNATOR NOT CHARGING and LOW ENGINE OIL PRESSURE.
2. In freezing weather (below 32°F/0°C), flip HEATERS switch "ON" and wait sixty (60 seconds). This applies heat to the control system components for easier starting. Leave this switch "ON" while operating at these temperatures.
3. When the keyswitch is turned to "START" the engine starter will be engaged. **Do not operate the engine starter motor for more than ten (10) seconds without allowing at least one minute cooling time between start attempts.**

CAUTION

Ether is an extremely volatile, high flammable gas. Use Sparingly! If too much is injected, the uncontrolled explosion may result in costly damage to the engine.

4. In cold weather, as required, press the ETHER INJECT button once or twice only while the engine is cranking. This injects a measured amount of ETHER to the engine.
5. Following a successful start, the engine will accelerate to idle speed of 1200 RPM for warm-up. Compressor discharge pressure will be maintained at 60 psi during warm-up.
6. Press the LOAD button. The engine will increase speed up to 1800 rpm until the pressure reaches the desired set point.

NORMAL OPERATION

The Operator may observe and monitor operating parameters using the gages on the panel. In the event the machine controller detects a parameter outside normal operating limits, the unit will shutdown.

In the event the machine controller detects a parameter at a dangerously high or low level, the machine will be automatically be stopped with the cause of the SHUTDOWN shown on the diagnostic lights.

Delivered air volume at set point pressure is accomplished by two methods:

1). The compressor is loaded (inlet valve fully open or modulated partially open), or unloaded (inlet valve fully closed).

2) Engine speed varies between 1200 RPM and 1800 RPM while compressor is loaded to match the required volume flow.

Operation - Loaded

Assume engine has been started and is running in the unload state at 1200 RPM. If there is air demand (pressure falls below the load point pressure), compressor will load at 1200 RPM by opening the inlet valve. As air demand rises and falls, engine speed is controlled between 1200 RPM and 1800 RPM to match the required flow while maintaining rated pressure.

Operation - Unloaded

If there is no air demand at 1200 RPM (Pressure rises above the unload point prssure), the compressor will unload by closing the inlet valve. The unit then runs at 1200 RPM unloaded with no air delivery. If air demand increases (pressure falls to below the load point pressure), the compressor reloads to meet the required air demand.

STOPPING

- Close air service valve(s).
- Allow the unit to run at "no load" for 3 to 5 minutes to reduce the engine temperatures.
- Turn the keyswitch to the "OFF" position.

NOTICE

Once the engine stops, the automatic blowdown valve will continue to relieve all pressure from the check valve to discharge valve piping.

NOTICE

Failure to allow turbo cool down prior to stopping can cause turbocharger damage.

WARNING

Even after pressure is relieved from the piping system, any air supply line from the compressor to a tool or machine could remain under pressure and cause serious personal injury or death. After the compressor stops, carefully open a valve at any tool or machine to exhaust the pressure in any line prior to removal or servicing.

CAUTION

Never allow the unit to sit stopped with pressure in the receiver-separator system. As a precaution, open the service valve.

IQ System

The IQ System is a complete, self-contained system which provides cooler, cleaner air than from a standard portable compressor. The system utilizes an integral aftercooler, high-efficiency filtration, and a patented condensate disposal system to provide the cool, clean air. The condensate disposal system injects all liquid condensed from the moisture separator and filters into the engine exhaust system where it is vaporized by heat. This eliminates the need for collecting the condensate, and the added cost of disposing of the condensate, which is often regulated by local, state, and/or federal regulations.

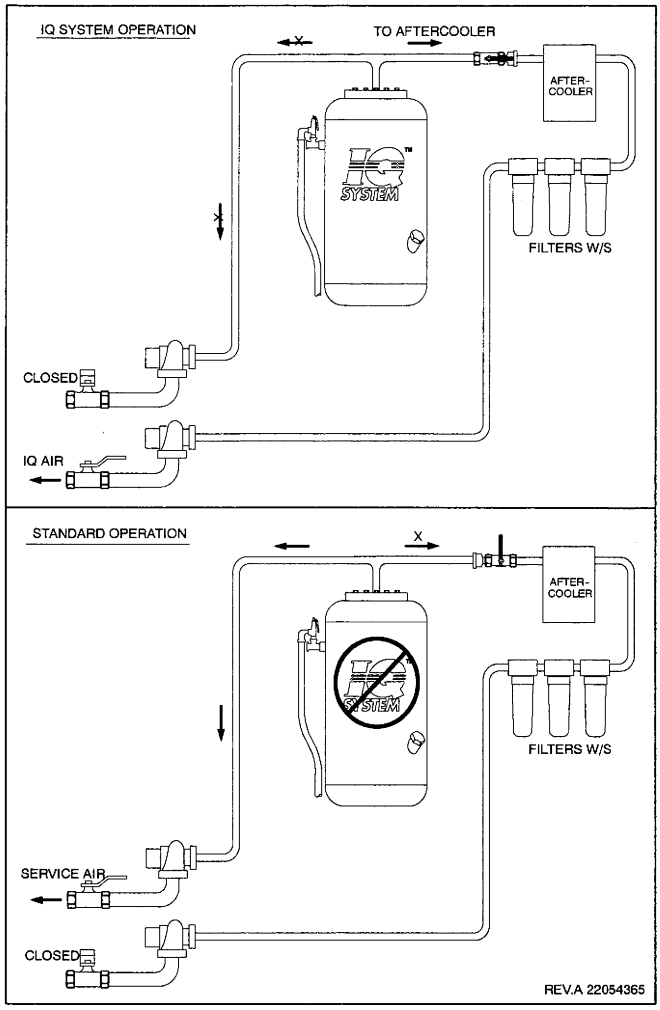
When equipped with the low ambient feature, the IQ System automatically adjusts movable louvers to control airflow through the aftercooler, ensuring that the compressed air temperature always remains above freezing temperatures (typically 45ºF) at any ambient temperature down to -20ºF. This prevents the need for 120V AC heat tracing systems, or any manual adjustment to prevent freezing of the compressed air system. All drain points for the condensate handling system are heated with 24VDC heat tracing, which is integral to the compressor heater system.

Theory of Operation

The compressed air exits the separator tank through the top cover piping, and can then travel along one of two paths, selectable via manual valving.

One path allows Standard Operation, which bypasses the IQ System, and delivers air quality equivalent to a standard oil-flooded portable compressor. If the IQ System is enabled by proper setting of the selector valve, the compressed air first enters the aftercooler.

The aftercooler is cooled by the incoming compressor package air, which is controlled by movable louvers mounted on the aftercooler (if equipped with low ambient option). At most conditions, the louvers are fully open, and maximum aftercooling is available. The compressed air and condensate (water with a small amount of compressor lubricant) exits the aftercooler and enters the moisture separator, where most of the condensate is removed. The compressed air then flows through two stages of filtration, where the aerosol water and oil is removed down to approximately 0.01 ppm, and all particulates are removed down to 0.01 micron.



At the bottom of the moisture separator and both filters are strainers and constant-bleed orifices, which are sized to allow the maximum flow of condensate while minimizing compressed air loss.

The condensate lines are then piped together, and the condensate is injected at a single point into the engine exhaust piping. The compressed air then travels through the minimum pressure valve, and out through the service air valve. The air pressure gauge on the instrument panel indicates the pressure inside the separator tank. A service air pressure gauge is located inside the front door of the compressor on the filter support.

If the IQ System is bypassed (Standard Operation selected), the delivered air pressure will be approximately equal to the separator tank pressure. If the IQ System operation is selected, the delivered air pressure will be slightly less, depending on the restriction of the filters.

CAUTION

The compressor regulation system is adjusted to maintain regulated pressure at the separator tank. DO NOT adjust regulation to provide full regulation pressure at the service valve when the IQ System is enabled. This will result in operation at excessive horsepower levels, causing overheating, reduced engine life, and reduced airend life.

Low Ambient Option Operation

When the ambient temperature falls to the point that the aftercooler outlet temperature is approaching 45ºF, the Temperature Control Unit (TCU), mounted on the rear of the control panel, will automatically adjust the louvers to control the cooling airflow through the aftercooler.

In the event that the unit is operating under abnormal conditions (i.e., an enclosure door open) which would cause excessive cooling of the aftercooler, a temperature sensor in the aftercooler outlet header will signal the TCU to further close the louvers if the compressed air temperature falls to approximately 36ºF or lower.

There are no user selectable or serviceable components in the TCU. Contact Ingersoll-Rand Service if any abnormal operation of the freeze protection control system occurs.

MAINTENANCE

Daily Maintenance:

Verify, during full-load (maximum compressed air delivery) that the IQ System filter restriction indicators do not show excessive restriction. Restriction indicators for the filters are mounted inside the control panel, and will shut down the compressor if restriction exceeds recommended values.

CAUTION

Excessively restricted filter elements may cause an increase in the amount of aerosol water and oil carryover, which could result in damage to downstream equipment. Normal service intervals should not be exceeded.

Weekly Maintenance:

- Remove Y-strainer screens at the bottom of the moisture separator and both filters and clean out any residue.
- Verify that the orifices below the Y-strainers are not clogged.
- Verify that the piping from the orifice purge points to the exhaust system is not clogged.

CAUTION

Blockage of the Y-strainers, orifices, or piping can result in flooding of the vessels with condensate. If flooding occurs, excessive condensate may enter the air stream and could result in damage to downstream equipment.

Yearly Maintenance:

The normal maintenance interval on the primary and secondary IQ System filters is one year, or earlier if pressure drop becomes excessive. Restriction indicators for the filters are mounted on the filter support inside the front door, and will shut down the compressor if restriction exceeds recommended values.

CAUTION

Excessively restricted filter elements may cause an increase in the amount of aerosol water and oil carryover, which could result in damage to downstream equipment. Normal service intervals should not be exceeded.

Filter Replacement

• With engine stopped, ensure pressure is relieved from air system.

• Remove all wires and hoses connected to drains on bottom of each filter housing. Inspect fittings and hoses for any blockage. Clean if necessary.

• Using a chain wrench or similar tool, loosen the housing. The housing should be removed by hand after loosening, taking care to prevent the housing from falling to the floor panel.

• Lower the housing to floor panel and lean it against the airend. Remove and replace the filter element, being careful not to damage outer wrap.

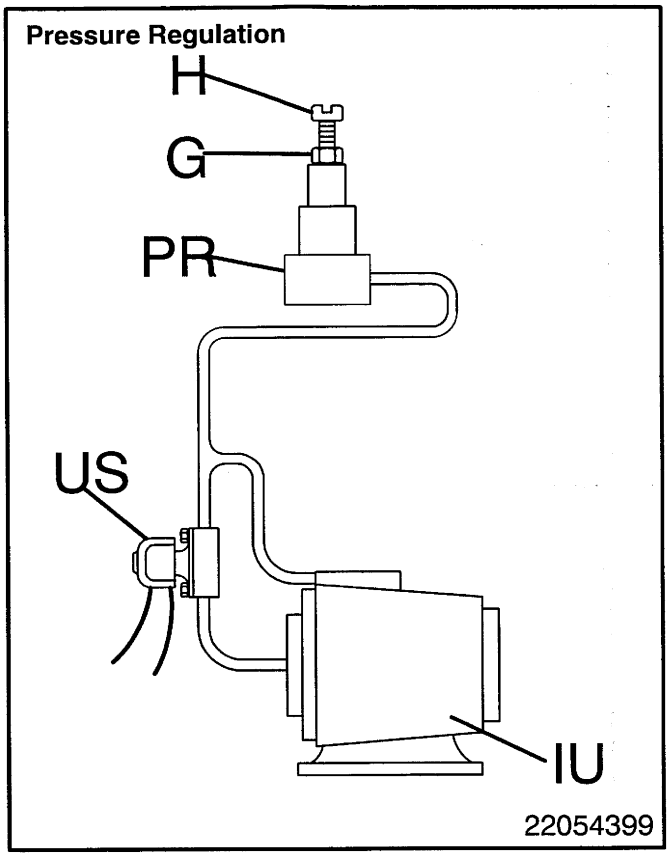
Verify the part number of new element vs. old element, as the two IQ filters are of different media.

• Put a small amount of petroleum jelly or other non-synthetic grease on the element o-ring to aid installation into the filter head.

• Replace housing making sure to not overtighten.

• Repeat the above procedure on the remaining filter element.

• Reconnect all wires and hoses to drains on bottom of each filter housing.



Normally, regulation requires no adjusting, but if proper adjustment is lost, proceed as follows:

Before Starting Unit -

1. Atop separator cover at pressure regulator (PR) loosen locknut (G) counterclockwise. Turn adjustment screw counterclockwise on full turn.

After Starting Unit -

2. Allow unit to warm up, then push "Service Air Switch" on control panel.

3. Open and adjust service valve on outside of the unit to obtain the rated operating pressure on the discharge pressure gauge.

Note: If the rated operating pressure cannot be maintained with engine at full load speed, turn regulator adjustment screw (H) clockwise and adjust service valve until engine maintains rated full load speed.

4. Insure that pressure is maintained at rated pressure, then turn regulator adjustment screw (H) counterclockwise until engine speed just begins to be reduced.

Note: Turning regulator adjustment screw (H) clockwise will raise pressure at full speed.

5. Close service valve (engine will slow to no load or idle speed).

6. If necessary, repeat steps 3 and 4.

7. At pressure regulator (PR) tighten lock nut (G).

8. To adjust the unloaded pressure to any pressure between 80 PSI (550 kPa) and the rated operating pressure, turn adjustment screw (H) of pressure regulator (PR) to obtain desired discharge pressure at full load engine speed. Always lock and protect pressure setting of adjusting screw (H) with locknut (G).

9. Ensure unloader solenoid (US) acts to hold pressure in inlet unloader (IU) after shutdown. After start-up, the compressor controller will open unloader solenoid (US).

SECTION 5 - MAINTENANCE

GENERAL

In addition to periodic inspections, many of the components in these units require periodic servicing to provide maximum output and performance. Servicing may consist of pre-operation and post-operation procedures to be performed by the operating or maintenance personnel. The primary function of preventive maintenance is to prevent failure, and consequently, the need for repair. Preventive maintenance is the easiest and the least expensive type of maintenance. Maintaining your unit and keeping it clean at all times will facilitate servicing.

CONTAINMENT BASE

This unit uses a containment base large enough to hold the fluid contents of the engine oil, coolant, fuel or compressor oil systems.

Drain plugs are located at strategic positions in this base to drain accumulated fluids and also to allow access to system drain plugs in the fuel tanks and compressor oil resevoir for flushing.

A central drain system is provided for normal service of engine, fuel, or compressor system.

The containment base should be drained and flushed monthly or following any fluid discharge into the base.

SCHEDULED MAINTENANCE

The maintenance schedule is based on normal operation of the unit. This page can be reproduced and used as a checklist by the service personnel. In the event unusual environmental operating conditions exist, the schedule should be adjusted accordingly.

COMPRESSOR OIL LEVEL

The oil level is most consistent when the unit is running unloaded and should be checked at this time.The oil level should be between the high/low indicators on the sight glass located on the side of the receiver tank.

COMPRESSOR OIL

This machine was factory filled with Ingersoll-Rand Fluid.

By continued use of Ingersoll-Rand compressor fluids and filters, optional warranty will be extended for the base airend (rotors, housings, gears and bearings) when substantiated with proof of conformance to recommended maintenance intervals and purchase of OEM Ingersoll-Rand filters and fluids.

Optional Warranty - The earlier of 60 months from shipment to, or the accumulation of 10,000 hours of service by the initial user. The optional warranty is limited to defects in major components (rotors, housings and bearings), and is automatically available to the original user when he meets the following two conditions:

1. Submissions of proof that Ingersoll-Rand fluid, filters and separators have been used. Refer to the Operation and Parts manual for the correct fluids, filters and separator elements required.

2. Submission of proof that maintenance intervals have been followed.

WARRANTY	TIME	*BARE AIREND	**AIREND COMPONENTS
STANDARD	2 yrs/4000 hrs	100% parts and labor	100% parts and labor

Bare Airend - Pertains to major airend parts (rotors, housings, and bearings).

Airend Components - Pertains to auxiliary attachments to the bare airend (drive coupling, seals, pumps, valves, tubes, hoses, fittings and filter housing).

The compressor oil must be replaced every 1000 hours of operation or six (6) months, whichever comes first.

Refer to the fluids and lubricants chart for ambient temperature ranges and specifications, in the lubrication section of this manual.

Refer to the fluids and lubricants chart for ambient temperature ranges and specifications in the lubrication section of this manual.

AIR CLEANER

This unit is equipped with an AIR FILTERS RESTRICTED lamp on the instrument panel.

When this message is viewed, both the engine and airend filters should be replaced.

Also, each week, squeeze the rubber valve (precleaner dirt dump) on each air cleaner housing to ensure that they are not clogged.

NOTICE: Holes or cracks downstream of the air cleaner housing will cause the restriction indicators to be ineffective.

To service the air cleaners on all units proceed as follows:

1. Loosen outer wing nut and remove with outer element. Inspect red window on special inner wing nut to find small dot. If dot is not visible, remove cotter pin and special wing nut and inner (safety) element.
2. Inspect air cleaner housing for any condition that might cause a leak and correct as necessary.
3. Wipe inside of air cleaner housing with a clean, damp cloth to remove any dirt accumulation, especially in the area where the element seals against the housing.
4. If a new air filter element is to be used check it closely for shipping damage. To reset the signal indicator in the special wing nut, apply suction to the red window.
5. Install cleaned or new elements in the reverse order to the above. Tighten wing nuts firmly and replace cotter pin.
6. Inspect to ensure that the end cap seals tightly 360 degrees around the air cleaner body.

The air cleaner system (housing and piping) should be inspected every month for any leakage paths or inlet obstructions. Make sure the air cleaner mounting bolts and clamps are tight. Check the air cleaner housing for dents or damage which could lead to a leak. Inspect the air transfer tubing from the air cleaner to the compressor and the engine for holes. Make sure that all clamps and flange joints are tight.

GAUGES

The instruments or gauges are essential for safety, maximum productivity and long service life of the machine. Inspect the gauges and test any diagnostic lamps prior to start-up. During operation observe the gauges and any lamps for proper functioning. Refer to Operating Controls for the normal readings.

FUEL TANK

This unit is equipped with dual tanks that can be filled from either side. Using clean fuel in the fuel tanks is important and every precaution should be taken to ensure that only clean fuel is either poured or pumped into the tank. When filling the fuel tank on this unit, by methods other than a pump and hose, use a CLEAN non-metallic funnel.

Every six months the drain plugs should be removed from the tanks so that any sediment or accumulated condensate may be drained. When replacing the drain plugs, make sure they are tightened securely.

BATTERY

Heavy-duty, diesel cranking type batteries were installed at the factory and these should be inspected weekly. Keep the battery posts-to-cable connections clean, tight and lightly coated with a grease. Also the electrolyte level in each cell should cover the top of the plates. If necessary, top-up with clean distilled water.

COMPRESSOR OIL and FUEL COOLERS

The coolers are cooled by means of the fin and tube-type oil cooler. The compressor oil and fuel flow internally through the core sections. Fluid is cooled by the air stream from the cooling fan flowing past the core section. When grease, oil and dirt accumulate on the exterior surfaces of the coolers, their efficiency is impaired.

Each month it is recommended that the coolers be cleaned by directing compressed air which contains a nonflammable safety solvent through the core of the coolers. This should remove the accumulation of grease, oil and dirt from the exterior surfaces of the cooler core so that the entire cooling area can transmit the heat of the fluid to the air stream.

If foreign deposits, such as sludge and lacquer, accumulate in the coolers, high temperature is likely to occur, causing shut down of the unit.

RADIATOR

WARNING

Do not remove the cap from a HOT engine radiator. The sudden release of pressure from a heated cooling system can result in serious personal injury.

The engine cooling system is filled at the factory with a 50/50 mixture of water and ethylene glycol. This permanent type antifreeze contains rust inhibitors and provides protection to -35° F (-37°C).

The use of such a mixture is recommended for both summer and winter operation. When using water alone, be sure to add a reputable brand of rust inhibitor to prevent internal corrosion.

It is recommended to test the freezing protection of the coolant every six months or prior to freezing temperatures. Replenish with a fresh mixture every twelve months. A drain for the system is located in the bottom radiator tank.

Each month, inspect the radiator exterior for obstructions (dirt, bugs, etc.). If present, blow water or compressed air containing a nonflammable solvent between the fins in a direction opposite the normal air flow. Should the radiator be clogged internally, standard automotive practices should be followed.

ENGINE CHARGE AIR COOLER

This cooler is a fin and tube-type oil cooler. The engine intake air flows internally through the core section. It is cooled by the air stream from the cooling fan flowing past the core section. When grease, oil and dirt accumulate on the exterior surfaces of the cooler, efficiency is impaired.

Each month it is recommended that the cooler be cleaned by directing compressed air which contains a nonflammable safety solvent through the core of the cooler. This should remove the accumulation of grease, oil and dirt from the exterior surfaces of the cooler core so that the entire cooling area can transmit the heat of the fluid to the air stream.

Ensure that the air connections do not leak. Leaks or loss of cooling will result in low engine power.

ENGINE CRANKCASE VAPOR CONDENSATE

The engine is equipped with a system to collect engine crankcase vapor condensate (oil and water) for disposal. Check the collection bottle near the engine oil pan before starting the unit. If the bottle is more than half full, remove it and empty the contents in a proper waste container. Replace the empty bottle on the unit.

WARNING

Do not allow the bottle to overflow. Engine damage may result.

HOSES

Each month it is recommended that all of the intake lines to and from the air cleaners, the charge air coolers, the engine cooling system hoses and all of the flexible hoses used for air, oil, and fuel be inspected.

To prevent leaks, regular inspection of these connections for wear or deterioration is a definite "must" if regulator servicing of the air cleaners is not to prove futile.

Premature wear of both the engine and compressor is ASSURED if dust-laden air is permitted to enter the engine or the compressor.

The flexible hoses used in the fuel, oil and air lines on these units are primarily used for their ability to accommodate relative movement between components. It is extremely important they be periodically inspected for wear and deterioration. Clamps are used to prevent hose cover abrasion through vibration. This abrasion may occur when two hose lines cross, or when a hose line rubs against a fixed point; therefore, it is necessary that all clamps be replaced if missing. It is also important the operator does not use the hoses as convenient hand hold or steps. Such use can cause early cover wear and hose failure.

NOTICE

Piping systems operating at less than 150 psi (1050 kPa) may use a special nylon tubing. The associated fittings are also of a special "push-in" design.

Pulling on the tubing will cause the inner sleeve to withdraw and compress, thus tightening the connection. The tubing can be withdrawn only while holding the sleeve against the fitting. The tubing can be removed and replaced numerous times without losing its sealing ability.

To install the nylon tubing, make a mark (with tape or grease pencil) approximately 7/8 inch from the end of the tubing. Insert the tubing into the sleeve and "push-in" past the first resistance to the bottom. The mark should be approximately 1/16 inch from the sleeve, for the 3/8 inch O.D. tubing; 1/8 inch for the 0.25 inch O.D. tubing. This will ensure that the tubing is fully engaged in the sealing mechanism.

COMPRESSOR OIL FILTERS

The compressor lubrication oil systems include spin-on, throw away type oil filters, each with an internal bypass valve. With a clean, new filter element, all of the oil flows through the full element area, from the outside/inside. As each element becomes contaminated with dirt, a pressure differential is created in the filter housing between the oil inlet and outlet ports. As this differential approaches 25 psi (175 kPa), the bypass valve starts to open, thus permitting a small quantity of oil to bypass the filter. As the contaminants continue to build up, more and more of the oil bypasses the filter media itself.

This bypass does not provide any filtration but does allow a maximum flow of compressor lubricating oil to preclude any possible damage from loss of oil. Also the design of the filter prevents any washing-off of any dirt during oil bypassing.

NOTICE

The oil filter must be replaced every 1000 hours of operation.

To service the oil filters it will first be necessary to shut the unit down. Wipe off any external dirt and oil from the exterior of the filter to minimize any contamination from entering the lubrication system. Proceed as follows:

WARNING

High pressure air can cause severe injury or death from hot oil and flying parts. Always relieve pressure before removing caps, plugs, covers or other parts from pressurized air system.

1. Open the service air valve(s) to ensure that system is relieved of all pressure. Close the valve(s).

2. Turn the spin-on filter element counterclockwise to remove it from the filter housing. Inspect the filter element and then discard.

Note: If there is any indication of formation of varnishes, shellacs or lacquers on the oil filter element, it is a warning the compressor lubricating oil has improper characteristics and should be immediately changed.

3. Inspect the oil filter head to be sure the gasket was removed with the oil filter element. Clean the gasket seal area on the oil filter head.

Installing a new oil filter element when the old gasket remains on the oil filter head will cause an oil leak and can cause property damage.

4. Lubricate the new filter gasket with the same oil being used in the machine.

5. Install new filter by turning element clockwise until gasket makes initial contact. Tighten an additional 1/2 to 3/4 turn.

6. Start unit and allow to build up to rated pressure. Check for leaks before placing unit back into service.

FASTENERS

Visually check entire unit in regard to bolts, nuts and screws being properly secured. Spot check several capscrews and nuts for proper torque. If any are found loose, a more thorough inspection must be made. Take corrective action.

COMPRESSOR OIL

The lubricating and cooling oil must be replaced every 1000 hours of operation or six (6) months, whichever comes first.

ENGINE COOLING FAN DRIVE

The heat exchanger or cooling fan is driven by a single belt arrangement from the engine. Inspect the cooling fan belt weekly. These belts should be maintained at the proper tension by the auto tension system on the engine.

EXTERIOR FINISH CARE

This unit was painted and heat cured at the factory with a high quality, thermoset polyester powder coating. The following care will ensure the longest possible life from this finish.

1. **If necessary to remove dust, pollen, etc. from housing, wash with water and soap or dish washing liquid detergent. Do not scrub with a rough cloth, pad, etc.**
2. **If grease removal is needed, a fast evaporating alcohol or chlorinated solvent can be used. Note: This may cause some dulling of the paint finish.**

3. **If the paint has faded or chalked, the use of a commercial grade, non-abrasive car wax may partially restore the color and gloss.**

Field Repair of Texture Paint

1. **The sheet metal should be washed and clean of foreign material and then thoroughly dried.**
2. **Clean and remove all grease and wax from the area to be painted using Duponts 3900S Cleaner prior to sanding.**
3. **Use 320 grit sanding paper to repair any scratches or defects necessary.**
4. **Scuff sand the entire area to be painted with a red scotch brite pad.**
5. **Wipe the area clean using Duponts 3900S.**
6. **Blow and tack the area to be painted.**
7. **Apply a smooth coat of Duponts 1854S Tuffcoat Primer to all bare metal areas and allow to dry.**
8. **Apply 2 medium - wet coats of Duponts 222S Adhesion Promoter over the entire area to be painted, with a 5 minute flash in between coats.**
9. **To apply the texture coat, use Duponts 1854S Tuffcoat Primer. The proper technique to do this is to spray the Tuffcoat Primer using a pressure pot and use about 2-5 pounds of air pressure. This will allow the primer to splatter causing the textured look. Note: you must be careful not to put too much primer on at one time, this will effect the amount of texture that you are trying to achieve. Allow the texture coat to flash for 20 minutes or until dry to touch.**
10. **Apply any of Duponts Topcoat Finishes such as Imron™ or Centari™ according to the label instructions.**

Note: To re-topcoat the textured surfaces when sheet metal repairs are not necessary, follow steps 1, 2, 4, 5, 6, 8 and 10.

CAUTION

- Any unauthorized modification or failure to maintain this equipment may make it unsafe and out of factory warranty.
- If performing more than visual inspections, disconnect battery cables and open manual blowdown valve.
- Use extreme care to avoid contacting hot surfaces (engine exhaust manifold and piping, air receiver and air discharge piping, etc.).
- Never operate this machine with any guards removed.
- Inch and metric hardware was used in the design and assembly of this unit. Consult the parts manual for clarification of usage.

Notice: Disregard any maintenance pertaining to components not provided on your machine.

NOTICE

Drain the frame after power-washing/cleaning or heavy rains.

MAINTENANCE SCHEDULE

These time periods should be reduced if operating in extreme conditions (very hot, cold, dusty or wet).

	Daily	Weekly	Monthly	3 MOS .	6 MOS.	12 MOS.
SMALL UNITS (P100-P600)				250 hours	500 hours	1000 hours
LARGE UNITS (HP600-P1600)				500 hours	1000 hours	2000 hours
**Hydraulic Oil Level		C			R	
Compressor Oil Level	C					
Engine Oil Level	C					
**Radiator Coolant Level	C					
Gauges/Lamps	C					
Air Cleaner Service Indicators	C					
Fuel Tank (fill at end of day)	C				DRAIN	
**Fuel/Water Separator DRAIN	C					
Air Cleaner Precleaner Dumps		C				
Fan/Alternator Belts		C				
Battery Connections/Electrolyte		C				
**Tire Pressure and Surface		C				
**Wheel Lug Nuts			C			
Hoses (oil, air, intake, etc.)			C			
Automatic Shutdown System Test			C			
Air Cleaner System Visual			C			
Compressor Oil Cooler Exterior			C	CLEAN		
**Engine Radiator Exterior			C	CLEAN		
Fasteners, Guards				C		
Air Cleaner Elements				WI		
** Fuel/Water Separator Element					R	
*Compressor Oil Filter Element				B	A	
*Compressor Oil					R	
**Wheels (bearings, seals, etc)					C	C
Engine Coolant Test					C	R
Shutdown Switch Settings Test						C
Scavenge Orifice & related parts						CLEAN
Oil Separator Element						R
**Lights (running, brake, & turn)	CBT					
**Pintle Eye Bolts	CBT					
Engine (oil changes, oil & fuel filters, etc)				R		

**Disregard if not appropriate for this particular machine.

*NXP Units - consult manual

R=replace, **C**=check (adjust if necessary), **WI**=OR when indicated, **CBT** = check before towing.

A = Small Units

B = Large Units

Refer to specific sections of the operator's manual for more information.

SECTION 6 - LUBRICATION

GENERAL INFORMATION

Lubrication is an essential part of preventive maintenance, affecting to a great extent the useful life of the unit. Different lubricants are needed and some components in the unit require more frequent lubrication than others. Therefore, it is important that the instructions regarding types of lubricants and the frequency of their application be explicitly followed. Periodic lubrication of the moving parts reduces to a minimum the possibility of mechanical failures.

The Preventive Maintenance Schedule shows those items requiring regular service and the interval in which they should be performed. A regular service program should be developed to include all items and fluids. These intervals are based on average operating conditions. In the event of extremely severe (hot, cold, dusty or wet) operating conditions, more frequent lubrication than specified may be necessary. Details concerning lubrication of the running gear are in Maintenance Section.

All filters and filter elements for air and compressor lubricant must be obtained through Ingersoll-Rand to assure the proper size and filtration for the compressor.

COMPRESSOR OIL CHANGE

These units are normally furnished with an initial supply of oil sufficient to allow operation of the unit for approximately 6 months or 1000 hours, whichever comes first. If a unit has been completely drained of all oil, it must be refilled with new oil before it is placed in operation. Refer to specifications in Lubrication Table.

NOTICE

Some oil types are incompatible when mixed and result in the formation of varnishes, shellacs, or lacquers which may be insoluble. Such deposits can cause serious troubles including clogging of the filters. Where possible, do NOT mix oils of different types and avoid mixing different brands. A type or brand change is best made at the time of a complete oil drain and refill.

If the unit has been operated for the time/ hours mentioned above, it should be completely drained of oil. If the unit has been operated under adverse conditions, or after long periods in storage, an earlier change period may be necessary as oil deteriorates with time as well as by operating conditions.

WARNING

High pressure air can cause severe injury or death from hot oil and flying parts. Always relieve pressure before removing caps, plugs, covers or other parts from pressurized air system. Ensure the following conditions are met:

- Discharge air pressure gauge reads zero (0).
- No air discharging from an "open" manual blowdown valve.

An oil change is good insurance against the accumulation of dirt, sludge, or oxidized oil products.

Completely drain the reservoir, piping, and cooler. If the oil is drained immediately after the unit has been run for some time, most of the sediment will be in suspension and, therefore, will drain more readily. However, the fluid will be hot and care must be taken to avoid contact with the skin or eyes.

After the unit has been completely drained of all old fluid, close the drain valve, install new oil filter elements. Add oil in the specified quantity at the filler plug. Tighten the filler plug and run the machine to circulate the oil. Check the oil level. DO NOT OVERFILL.

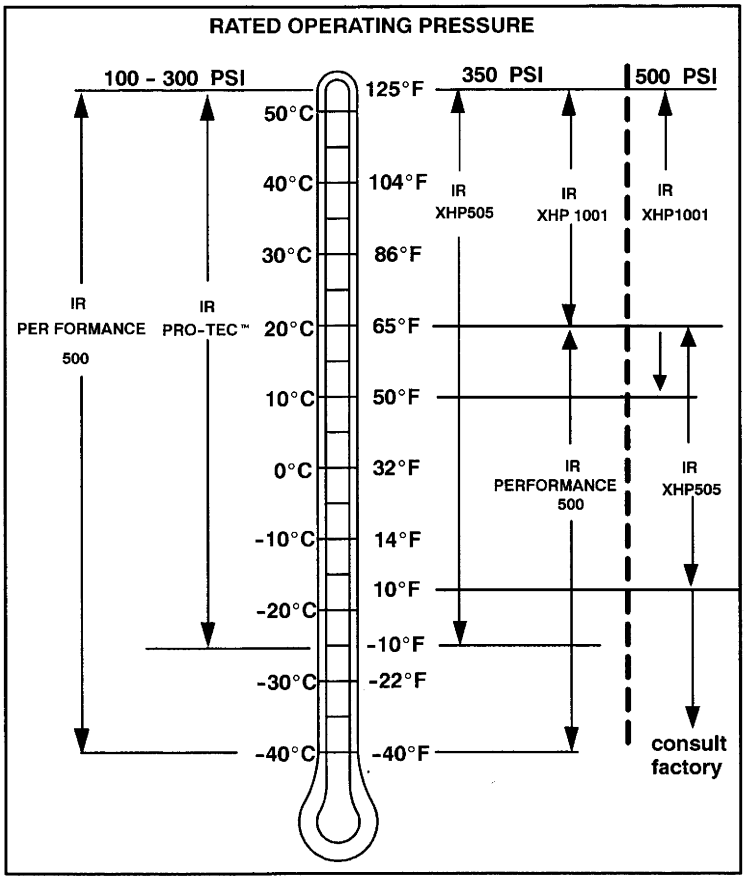
NOTICE

Ingersoll-Rand provides compressor oil specifically formulated for Portable Compressors and requires the use of these fluids in order to obtain extended limited airend warranty.

COMPRESSOR LUBRICATION

Portable Compressor Fluid Chart

Refer to these charts for correct compressor fluid required. Note that the selection of fluid is dependent on the design operating pressure of the machine and the ambient temperature expected to be encountered before the next oil change.



Design Operating Pressure	Ambient Temperature	Specification
100 psi to 300 psi	-10°F to 125°F (-23°C to 52°C)	IR Pro-Tec™ Mil –PRF 2104G SAE 10W
100 psi to 300 psi	-40°F to 125°F (-40°C to 52°C)	IR Performance 500 Mil-L-46167
350 psi	-10°F to 125°F (-23°C to 52°C)	IR XHP 505
	65°F to 125°F (18°C to 52°C)	IR XHP1001
	-40°F to 65°F (-40°C to 18°C)	IR Performance 500 Mil-L-46167
500 psi	50°F to 125°F (10°C to 52°C)	IR XHP1001
	10°F to 65°F (-12°C to 18°C)	IR XHP 505
	below 10°F (-12°C)	Consult Factory

Recommended Ingersoll-Rand Fluids - Use of these fluids with original I-R filters can extend airend warranty. Refer to operator's manual warranty section for details or contact your I-R representative.

Recommended Fluid	1 Gal. (3.8 Litre)	5 Gal. (19.0 Litre)	55 Gal. (208.2 Litre)
IR Pro-Tec™	36899698	36899706	36899714
IR XHP 505		35365188	35365170
IR Performance 500	35382928	35382936	35382944
IR XHP1001		35612738	35300516

Premium grade oils API, CG -4 or CH-4 are recommended for the QSX15 engine.

SECTION 7 - Trouble Shooting

INTRODUCTION

Trouble shooting for a portable air compressor is an organized study of a particular problem or series of problems and a planned method of procedure for investigation and correction. The trouble shooting chart that follows includes some of the problems that an operator may encounter during the operation of a portable compressor.

The chart does not attempt to list all of the troubles that may occur, nor does it attempt to give all of the answers for correction of the problems. The chart does give those problems that are most apt to occur. To use the trouble shooting chart:

A. Find the "complaint" depicted as a bold heading.

B. Follow down that column to find the potential cause or causes. The causes are listed in order (1,2,3 etc.) to suggest an order to follow in trouble shooting.

ACTION PLAN

A. Think Before Acting

Study the problem thoroughly and ask yourself these questions:

(1) What were the warning signals that preceded the trouble?
(2) Has a similar trouble occurred before?
(3) What previous maintenance work has been done?
(4) If the compressor will still operate, is it safe to continue operating it to make further checks?

B. Do The Simplest Things First

Most troubles are simple and easily corrected. For example, most complaints are "low capacity" which may be caused by too low an engine speed or "compressor over- heats" which may be caused by low oil level.

Always check the easiest and most obvious things first; following this simple rule will save time and trouble.

Note: For trouble shooting electrical problems, refer to the Wiring Diagram Schematic found in Parts List Section.

C. Double Check Before Disassembly

The source of most compressor troubles can be traced not to one component alone, but to the relationship of one component with another. Too often, a compressor can be partially disassembled in search of the cause of a certain trouble and all evidence is destroyed during disassembly. Check again to be sure an easy solution to the problem has not been overlooked.

D. Find And Correct Basic Cause

After a mechanical failure has been corrected, be sure to locate and correct the cause of the trouble so the same failure will not be repeated. A complaint of "premature breakdown" may be corrected by repairing any improper wiring connections, but something caused the defective wiring. The cause may be excessive vibration.

General Information

The WEDGE controller records and displays diagnostic fault codes for the compressor system and the electronic engine. These codes are displayed on the 4-digit LED display on the machine control panel. Two of the ten LED diagnostic lamps on the control panel are used with fault codes display. One lamp is designated "Engine Fault" and the other "Compressor Fault". When the engine fault lamp is on, all codes displayed are engine faults. When the compressor fault lamp is on, all codes displayed are compressor or package related faults.

A list of compressor and engine faults is attached with the placards inside the machine control panel and provided in this section. The table of Alert/Sutdown conditions in this section also lists the compressor fault codes and a list of the engine fault codes is provided.

The engine diagnostic fault codes can also be read with the manufacturer's service tool. A service tool connector is mounted on the engine. This connector provides a connection to the J1939 CAN network. For advanced engine troubleshooting, it is recommended that the manufacturer's service tools be used with accompanying service literature.

FAULT CODE	DESCRIPTION (QSX15 ENGINE FAULT CODES)
111	Engine Control Module - Critical Internal Failure
115	Engine Speed/Position Sensor Circuit - Lost both signals from Magnetic Pickup Sensor
121	Engine Speed/Position Sensor Circuit - Lost one or two signals from Magnetic PU Sensor
122	Intake Manifold Pressure Sensor #1 Circuit - Shorted High
123	Intake Manifold Pressure Sensor #1 - Circuit - Shorted Low
135	Engine Oil Pressure Sensor Circuit - Shorted High
141	Engine Oil Pressur Sensor Circuit - Shorted Low
143	Engine Oil Pressure Low - Warning
144	Engine Coolant Temperature Sensor Circuit - Shorted High
145	Engine Coolant temperature Sensor Circuit - Shorted Low
151	Engine Coolant temperature High - Critical
153	Intake Manifold Temperature Sensor #1 Circuit Shorted Low
154	Intake Manifold Temperature Sensor #1 Circuit Shorted High
155	Intake Manifold Temperature #1 High - Critical
186	Sensor Supply Voltage #2 Circuit - Shorted Low
212	Engine Oil Temperature Sensor Circuit - Shorted High
213	Engine Oil Temperature Sensor Circuit - Shorted Low
214	Engine Oil Temperature High - Critical
221	Ambient Air Pressure Sensor Circuit - Shorted High
222	Ambient Air Pressure Sensor Circuit - Shorted Low
223	Engine Oil Burn Valve Solenoid Circuit - Shorted Low
227	Sensor Supply Voltage #2 Circuit - Shorted High
234	Engine Speed High - Critical
235	Engine Coolant Level Low - Critical
241	Vehicle Speed Sensor Circuit - Data Incorrect
245	Fan Clutch Circuit - Shorted Low
254	Fuel Shutoff Valve Circuit - Shorted Low
255	Fuel Shutoff Valve Circuit - Shorted High
259	Fuel Shutoff Valve - Stuck Open
284	Engine Speed/Position Sensor #1 (Crankshaft) Supply Voltage Circuit - Shorted Low

FAULT CODE	DESCRIPTION
285	SAE J1939 Multiplexing PGN Timeout Error
286	SAE J1939 Multiplexing Configuration Error
287	SAE J1939 Multiplexing Remote Throttle Error
295	Ambient Air Pressure Sensor Circuit - Data Incorrect
299	Engine Shutdown Commanded By J1939
311	Injector Solenoid Valve Cylinder #1 Circuit Grounded Circuit
312	Injector Solenoid Valve Cylinder #5 Circuit Grounded Circuit
313	Injector Solenoid Valve Cylinder #3 Circuit Grounded Circuit
314	Injector Solenoid Valve Cylinder #6 Circuit Grounded Circuit
314	Injector Solenoid Valve Cylinder #2 Circuit Grounded Circuit
319	Real Time Clock - Power Interrupt
341	Engine Control Module - Data Lost
343	Engine Control Module - Warning Internal Hardware Failure
346	Engine Control Module - Warning Software Error
352	Sensor Supply Voltage #1 - Circuit - Shorted Low
378	Fueling Actuator #1 Circuit - Open Circuit
379	Fueling Actuator #1 Circuit - Grounded Circuit
386	Sensor Supply Voltage #1 Circuit - Shorted High
394	Timing Actuator #1 Circuit - Open Circuit
395	Timing Actuator #1 Circuit - Grounded Circuit
396	Fueling Actuator #2 Circuit - Open Circuit
397	Fueling Actuator #2 Circuit - Grounded Circuit
398	Timing Actuator #2 Circuit - Open Circuit
399	Timing Actuator #2 Circuit - Grounded Circuit
415	Engine Oil Pressure Low - Critical
418	Water In Fuel Indicator High - Maintenance
422	Engine Coolant Level Sensor Circuit - Data Incorrect
426	SAE J1939 Datalink - Cannot Transmit
428	Water in Fuel Sensor Circuit - Shorted High
429	Water in Fuel Sensor Circuit - Shorted Low
433	Intake Manifold Pressure Sensor Circuit - Data Incorrect
434	Power Lost Without Ignition OFF
435	Engine Oil Pressure Sensor Circuit - Data Incorrect
441	Battery #1 Voltage Low - Warning
442	Battery #1 Voltage High - Warning
449	Fuel Pressure High - Warning
451	Injector Metering Rail #1 Pressure Sensor Circuit - Shorted High
452	Injector Metering Rail 31 Pressure Sensor Circuit - Shorted Low
466	Turbocharger #1 Wastegate Control Circuit - Data Incorrect
482	Fuel Pressure Low - Warning
483	Injector Metering Rail #2 Pressure Sensor Circuit - Shorted High
484	Injector Metering Rail #2 Pressure Sensor Circuit - Shorted Low
485	Injector Metering Rail #2 Pressure High - Warning

FAULT CODE	DESCRIPTION
486	Injector Metering Rail #2 Pressure Low - Warning
496	Engine Speed/Position Sensor #2 (Camshaft) Supply Voltage
546	Fuel Delivery Pressure Sensor Circuit - Shorted High
547	Fuel Delivery Pressure Sensor Circuit - Shorted Low
553	Injector Metering Rail #1 Pressure High - Warning
581	Fuel Supply Pump Inlet Pressure Sensor Circuit - Shorted High
582	Fuel Supply Pump Inlet Pressure Sensor Circuit - Shorted Low
583	Fuel Supply Pump Inlet Pressure Low - Warning Level
595	Turbocharger #1 Speed High - Warning Level
596	Electrical Charging System Voltage High - Warning Level
597	Electrical Charging System Voltage Low - Warning Level
598	Electrical Charging System Voltage Low - Critical Level
611	Engine Hot Shutdown
753	Engine Speed/Position #2 Cam Sync Error
754	Injector Metering Rail #1 Pressure Malfunction
758	Injector Metering Rail #2 Pressure Malfunction
951	Cylinder Power Imbalance Between Cylinders

	ALERT		SHUTDOWN		
	CODE	**LIGHT (BLINKS)**	**CODE**	**LIGHT (STEADY)**	**DELAY (sec)**
Low Engine Speed (RPM<800)			1	CPRSR Malf.	30
High Engine Speed (RPM >1900)			2	CPRSR Malf.	30
Engine Crank Time Exceeded			3	CPRSR Malf.	0
Low Fuel Level		Fuel Level		Fuel Level	3
Engine Oil Temperature > 252 deg. F	5	CPRSR Malf.			
Intake Manifold Temperature > 180 deg. F	6	CPRSR Malf.			
High Discharge Temp. (RT2>247 deg. F)				High Comp Temp.	3
Low AE Oil Pressure (HP1600 only)			31	CPRSR Malf.	3
Disch. Temp (RT2) Sensor Fault			32	CPRSR Malf.	10
High Separator Tank Temp (RT1>247 deg.F)			50	CPRSR Malf.	3
Machine ID Not Valid			51	CPRSR Malf.	0
IQ Filter Restriction				IQ Filt. Rest	3
Sep. Tank Temp (RT1) Sensor Fault			53	CPRSR Malf.	10
Sep. Tank Pressure (PT1) Sensor Fault	33	CPRSR Malf.			
Reg. System Pressure PT2) Sensor Fault	54	CPRSR Malf.			
Air Filter Restriction		Soiled Filter			
Low Battery Voltage		Battery Charging Condition			
Serial Comm. Problem	70	CPRSR Malf.			
CAN Bus Problem	71	CPRSR Malf.			
Engine Coolant Temp > 215 deg. F		High Engine Temp			
Engine Oil Pressure < 10 psi		Low Engine Oil Pressure			
Separator Tank Pressure > 20 psi during start attempt (engine will not crank)			34	CPRSR Malf.	0
Engine Temp > 220 deg. F				High Engine Temp	10

TROUBLE SHOOTING CHART

Bold Headings depict the COMPLAINT - Subheadings suggest the CAUSE

Note: Subheadings suggest sequence to follow troubleshooting.

1. Unit Shutdown:

	Corrective Action
Out of Fuel	Add CLEAN diesel Fuel
Compressor Oil Temp. Too High	See Complaint 10
Engine Water Temp. Too High	Check coolant level. If necessary, Add.
Engine Oil Pressure Too Low	See Complaint 3 and Complaint 4.
Broken Engine Fan Belt	Replace fan belt.
Loose Wire Connection	Wiggle wires at switches & connector blocks. Make repairs.
Low Fuel Level Shutdown	Replace fuel sender.
Defective Sensor	Replace sensor.
Malfunctioning Relay	Replace relay.
Blown Fuse	Replace fuse.
Engine Malfunctioning	See Trouble Shooting in Engine Manual.
* Airend Malfunctioning	See Complaint 10.

2. Won't Start/Run:

Low Battery Voltage	Check electrolyte level. Check connections.
Blown Fuse	Replace fuse.
Malfunctioning Start Switch	Replace switch.
Clogged Fuel Filters	Service filters. See Engine Operator's Manual.
Out of Fuel	Add CLEAN fuel.
Compressor Oil Temp. Too High	See Complaint 10.
Engine Water Temp. Too High	Check fluid level. If necessary, Add.
Engine Oil Pressure Too Low	See Complaint 3 and Complaint 4.
Loose Wire Connection	Repair or replace connection.
Defective Sensor	Replace sensor.
Malfunctioning Relay	Replace relay.
Engine Malfunctioning	See Trouble Shooting in Engine Manual.
Airend Malfunctioning	See Complaint 10.

3. High Engine Temperature

Broken Engine Fan Belt	Replace fan belt set.
* Ambient Temp. >115°F	Above spec limit.
Dirty Operating Conditions	Move unit to cleaner environment.
Dirty Cooler	Clean exterior of cooler.
* Out of Level >15 degrees	Relocate or reposition unit.
Operating Pressure Too High	Reduce pressure to spec.
Recirculation of Cooling Air	Close side doors.
Loose Wire Connection	Repair or replace.

* : > = greater than, < = less than

4. Low Engine Oil Pressure		**Corrective Action**
	Low Oil Level	Add oil.
	Out of Level >15 degrees	Relocate or reposition.
	Wrong Lube Oil	See Engine Oil Spec. Change oil.
	Clogged Oil Filter Element(s)	Replace element(s).
	Engine Malfunctioning	See Trouble Shooting in Engine Manual.
	Loose Wire Connection.	Repair or replace.
5. Alternator Low Voltage		
	Loose or Broken Belts	Tighten or replace belt set.
	Loose Wire Connection	Repair or replace connection.
	Low Battery Voltage	Check electrolyte level. Add if necessary.
		Check connectors. Clean & tighten.
		Recharge battery.
	Malfunctioning Alternator	Repair or replace alternator.
6. High Compressor Discharge Temperature:		**Corrective Action**
	Ambient Temp. > 115°F	Above spec limit.
	Out of Level > 15 degrees	Relocate or reposition unit.
	Low Oil Level	Add oil. Look for any leaks.
	Wrong Lube Oil	Check spec in this manual.
	Dirty Cooler	Clean exterior surfaces.
	Dirty Operating Conditions	Move unit to cleaner environment.
	Clogged Oil Filter Elements	Replace elements. Change oil.
	Loose or Broken Belts	Tighten or replace belt set.
	Operating Pressure Too High	Reduce pressure to spec.
	Recirculation Of Cooling Air	Close side doors. Replace belly pan.
	Malfunctioning Thermostat	Replace thermostat in bypass valve.
	Malfunctioning Fan	Check fan belt tension. Tighten or replace belt set.
	Defective Oil Cooler Relief Valve	Replace valve.
	Defective Minimum Pressure Valve	Repair or replace valve.
	Blocked or Restricted Oil Lines	Clean by flushing or replace.
	Airend Malfunctioning	See Complaint 11, 12, 13, 15, 16 or 18.
7. Engine RPM Down:		
	Clogged Fuel Filter (primary)	Replace primary filter. Replace final filter. Drain tanks. Add CLEAN fuel.
	Operating Pressure Too High	Reduce pressure to spec limit.
	Dirty Air Filter	Clean or replace elements.
	Wrong Air Filter Element	Install correct element.
	Engine Malfunctioning	See Trouble Shooting in Engine Manual.
	Airend Malfunctioning	Refer to Factory.

	Corrective Action
8. Excessive Vibration:	
Rubber Mounts, Loose or Damaged	Tighten or replace.
Defective Fan	Replace fan.
Drive Coupling Defective	Replace coupling.
Engine Malfunctioning	See Trouble Shooting in Engine Manual.
Airend Malfunctioning	See Complaint 15 and 17.
Engine idle speed too low.	See Engine Manual.
9. Low CFM:	
Dirty Air Filter	Clean or replace elements.
Incorrect Linkage Adjustment	Make adjustment per Section 6.
Malfunctioning Inlet Unloader/Butterfly Valve	Inspect valve. Make adjustment per Section 6.
Wrong Air Filter Element	Install correct element.
10. Short Air Cleaner Life:	
Dirty Operating Conditions	Move unit to cleaner environment.
Inadequate Element Cleaning	Install new element.
Incorrect Stopping Procedure	Read procedure in this manual.
Wrong Air Filter Element	Install proper element.
11. Will Not Unload:	
Malfunctioning Inlet Butterfly Valve	Inspect valve fit. Re-adjust per Section 6.
Ice in Regulation Lines/Orifice	Apply heat to line(s) and or orifice.
Load Solenoid Leak	Replace load solenoid.
Plugged Vent Leak	Clean and/or replace.
12. Safety Valve Relieves:	
Operating Pressure Too High	Reduce pressure to spec limit.
Malfunctioning Inlet Unloader/Butterfly Valve	Inspect valve fit. Readjust per Section 6.
Defective Safety Valve	Replace safety valve.
Unit Will Not Unload Fast Enough	Apply heat to lines and/or orifice.

SECTION 8 - ELECTRICAL

GENERAL INFORMATION AND OPERATIONAL THEORY

General

The HP1600/1300 machine has an electronic monitor and control system to provide discharge air pressure control and engine and package monitor functions. The system uses the WEDGE controller to perform these functions. The electrical system connects all the necessary switches, sensors and transducers to the WEDGE controller in order for it to perform the monitor and control functions.

WEDGE Controller

The WEDGE controller is the heart of the machine monitor and control system. It provides data collection, alarming and control functions for compressor operations. It is a microcontroller based unit with analog and digital inputs and outputs.

The WEDGE controller is attached to the back of the control panel. The LED annunciators are part of the front panel of the WEDGE. They can be seen through the laminate on the front of the control panel. The WEDGE is attached to the control panel with four #10 size nuts.

The first function of the WEDGE is to scan all analog and digital inputs at a fixed interval. These inputs are scanned every 50 milliseconds. The analog values are then compared against minimum and maximum values and an ALERT or SHUTDOWN is issued, if a value is out of range. The various ALERTS and SHUTDOWNS are listed in this section.

The second function of the WEDGE controller is machine discharge pressure control. The WEDGE monitors the regulation system air pressure and varies the engine throttle to maintain the setpoint discharge airpressure. The setpoint pressure is set using the regulator on the separator tank.

The third function of the WEDGE controller is to communicate with the diesel engine via the J1939 CAN network. The WEDGE controller provides the engine throttle setting (software versions 2.0 and greater) to the engine controller via the J1939 CAN Network and retrieves diagnostic information from the engine.

Software versions under 2.0 use the frequency throttle to communicate with the engine. A square wave frequency signal from 150 Hz to 375 Hz is sent from the WEDGE controller to the engine controller.

The signal is linear from 150 Hz at engine idle (1200 RPM) to 375 Hz at maximum run speed (1800 RPM).

Figure 8-2 shows the signals between the engine controller and the WEDGE controller.

Sensors and Transducers

The electronics system contains sensors and transducers that are used to collect process data from the compressor. The temperature is measured by a thermister. This device exhibits a change in resistance as the temeprature changes. The resistance causes an input voltage change to the WEDGE controller input and is interpreted as a temperature change.

The electronics system also uses pressure transducers to measure process pressure changes. These devices have an output signal of .45 VDC to 4.5 VDC, corresponding to 0 psi and the maximum measured psi for a particular device. The maximum pressure transducer ranges are 100 or 225 psi. The 100 and 225 psi devices are gauge rpessure devices. These transducers are provided with 5VDC excitation to power the device. These are three wire devices: excitation, signal and ground (return) connections.

Digital Inputs and Outputs

The WEDGE controller scans digital inputs such as switch contacts. These are either "ON" (24VDC) or "OFF" (0 VDC). These digital inputs are connected to switches within the package such as the key start switch, air filter switches and IQ filter switches.

The WEDGE controller provides 24 VDC digital outputs to control solenoids, start compressor and DC heaters. These are 24 VDC "ON" and O VDC "OFF". They are current limited and short circuit protected.

Controller Outputs:
The WEDGE controller has three different types of outputs: frequency, pulse width modulated (PWM) and 24 VDC digital (ON / OFF). The frequency output is used as a throttle signal for the engine (software versions less than 2.0).

The WEDGE controller varies the frequency from 150 Hz to 375 Hz, corresponding to 1200 to 1800 rpm. The frequency signal is a 50% duty cycle, 24VDC, square wave. This throttle signal is used with the Cummins engine.

The PWM signal is used as a throttle signal for the Caterpillar engine. It has a base frequency of 500 Hz and the duty cycle varies from 10% to 90%.

Pressure Control
The discharge pressure is controlled by manipulating the engine speed and compressor inlet valve position. The inlet valve position is controlled pneumatically and the engine speed is determined by the WEDGE controller. The WEDGE measures the pneumatic system regulation pressure and computes an engine throttle setting. This throttle setting is sent to the engine via the frequency throttle, PWM or J1939 throttle, depending on which technique is used. The engine controller will control engine speed to this throttle setting.

Electronic Engine
The HP1600/1300 machine contains an emissions certified diesel engine. In order to meet the emissions requirements, the engine has an electronic control system.

The control system handles all monitor, alarm and control functions for the engine. The WEDGE controller communicates with the engine controller over the J1939 CAN network.

The WEDGE controller sends throttle settings to the engine (software versions 2.0 and greater) and receives diagnostic and run time data from the engine over the J1939 CAN network. A frequency throttle interface with the engine is used for software versions earlier than 2.0.

Figure 8-2 shows the connections between the WEDGE controller and the engine controller.

J1939 Data Link - The CAN network is a single pair shielded cable within the W1 main harness. Figure 8-3 shows a layout of the CAN harness or "backbone" as it is referred to. The termination resistors (Terminator) are important to prevent reflections on the transmission line and must be in place for the network to function properly. The shield from the cable is connected to the machine metal at the WEDGE controller end.

The connection must be properly made with good metal to metal contact between the wire terminal and the machine metal.

The engine diagnostics connector is located on the left side of the engine. This is used to connect the engine manufacturer's service tools to the CAN network. This connector also provides 24 VDC power to these service tools.

Electrical System
The electrical system consists of the wiring harnesses and associated electrical devices such as relays, switches, lights, solenoids and alarm horn.
The electrical system consists of the wiring harnesses and associated electrical devices such as relays, switches, lights, solenoids and alarm horn. There are two wiring harnesses in the HP1600 machine. They are as follows:

54654918 W1 Chassis Main Wiring Harness

22060594 Control Panel Wiring Harness

The schematic diagrams show the connections for these harnesses. Figure 8-1 is a system diagram showing harness connection with devices and controllers.

The electrical circuits are protected using ATC style fuses. A fuse should only be replaced with one of the same rating. Replacing a fuse with one of a large rating could lead to harness damage. If a fault occurs and the circuit does not have the appropriate size fuse, wires could be burned in the harness and damage other circuits.

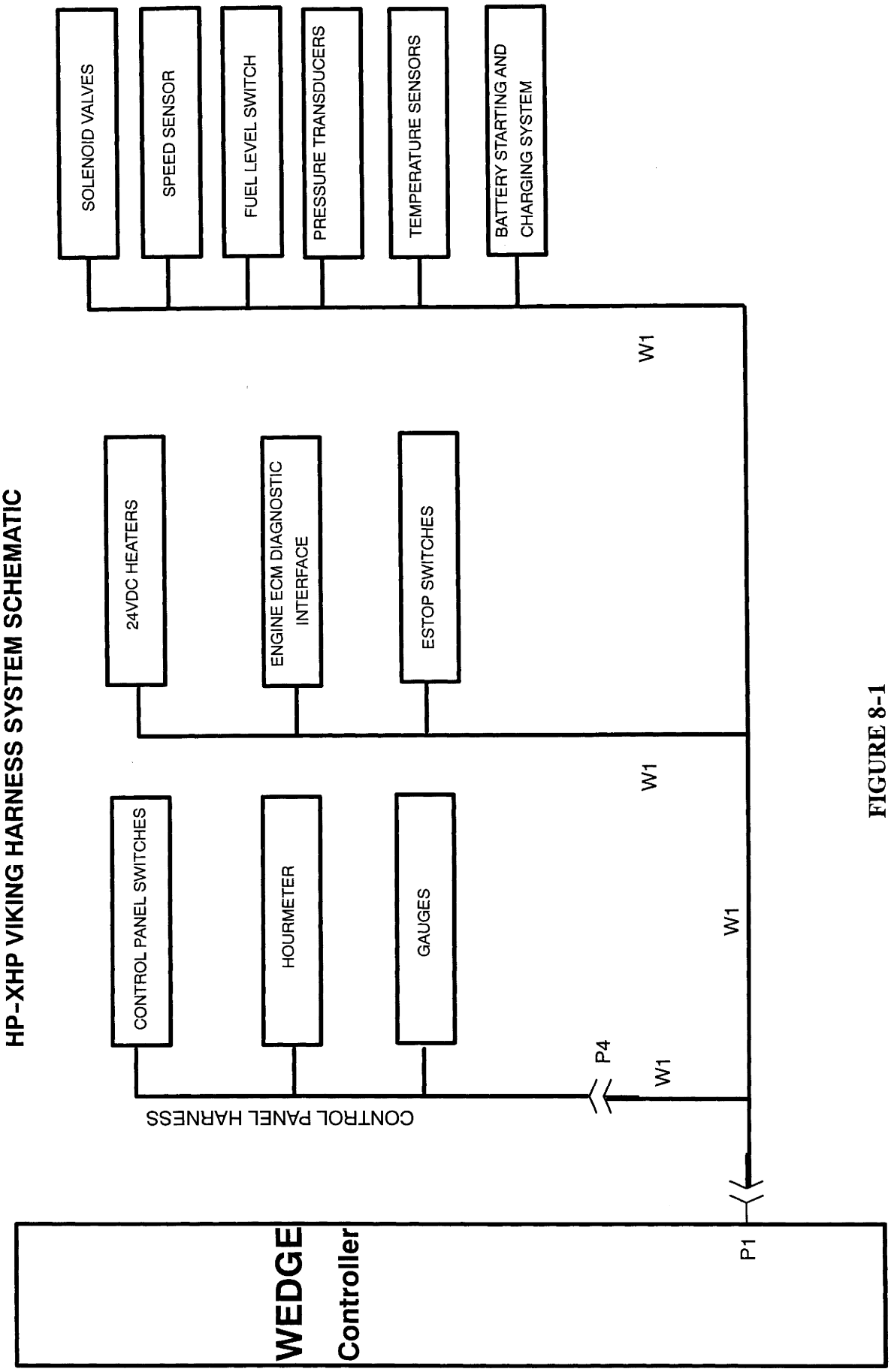

HP-XHP VIKING HARNESS SYSTEM SCHEMATIC
SOLENOID VALVES
SPEED SENSOR
FUEL LEVEL SWITCH
PRESSURE TRANSDUCERS
TEMPERATURE SENSORS
BATTERY STARTING AND CHARGING SYSTEM
W1
24VDC HEATERS
ENGINE ECM DIAGNOSTIC INTERFACE
ESTOP SWITCHES
W1
CONTROL PANEL SWITCHES
HOURMETER
GAUGES
W1
P4
W1
CONTROL PANEL HARNESS
P1
WEDGE
Controller

FIGURE 8-1

HP-XHP VIKING J1939 CAN COMMUNICATIONS SCHEMATIC

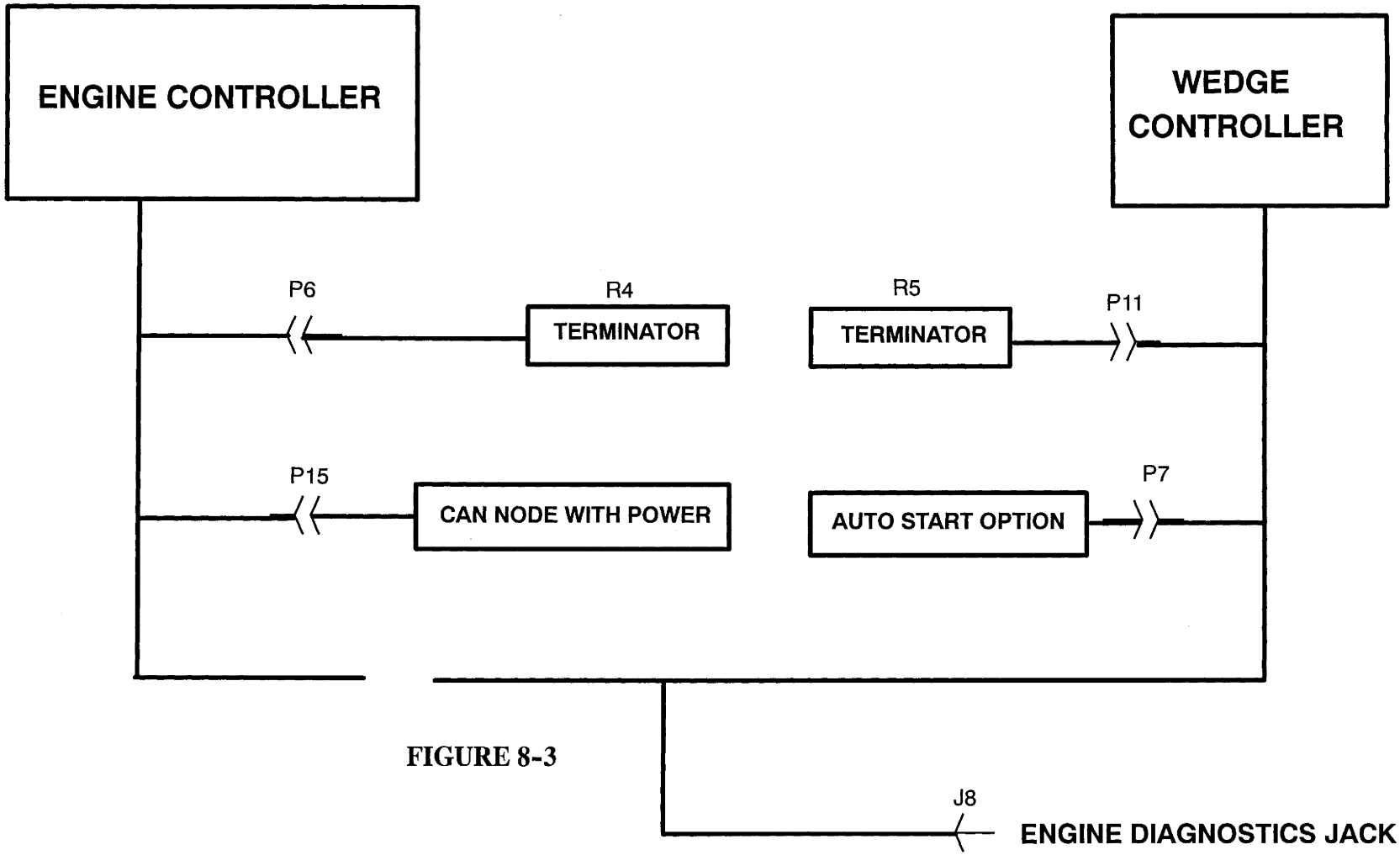


FIGURE 8-3

KEY ELECTRICAL COMPONENTS FUNCTION

PT1:

PT1 is a 0-225 psi gauge pressure transducer that measures discharge air pressure.

PT2:

PT2 is a 0-100 psi gauge pressure transducer that measures regulation system pressure.

U1:

U1 is resistive level detector that measures the fuel level in the fuel tank.
It provides a continuous reading of fuel level. It also has a switch for low fuel level and low fuel shutdown.
These switches connect to WEDGE.

RT1:

RT1 is a 10K ohm Thermistor temperature sensor that measures separator tank temperature.
Its range is -30 to 255° F.

RT2:

RT2 is a 10K ohm Thermistor temperature sensor that measures airend discharge temperature.
Its range is -30 to 255°F.

K1:

K1 is SPST, 24VDC relay used to activate the engine starter.

K2:

K2 is a SPDT, 24VDC relay used to activate the start compressor.

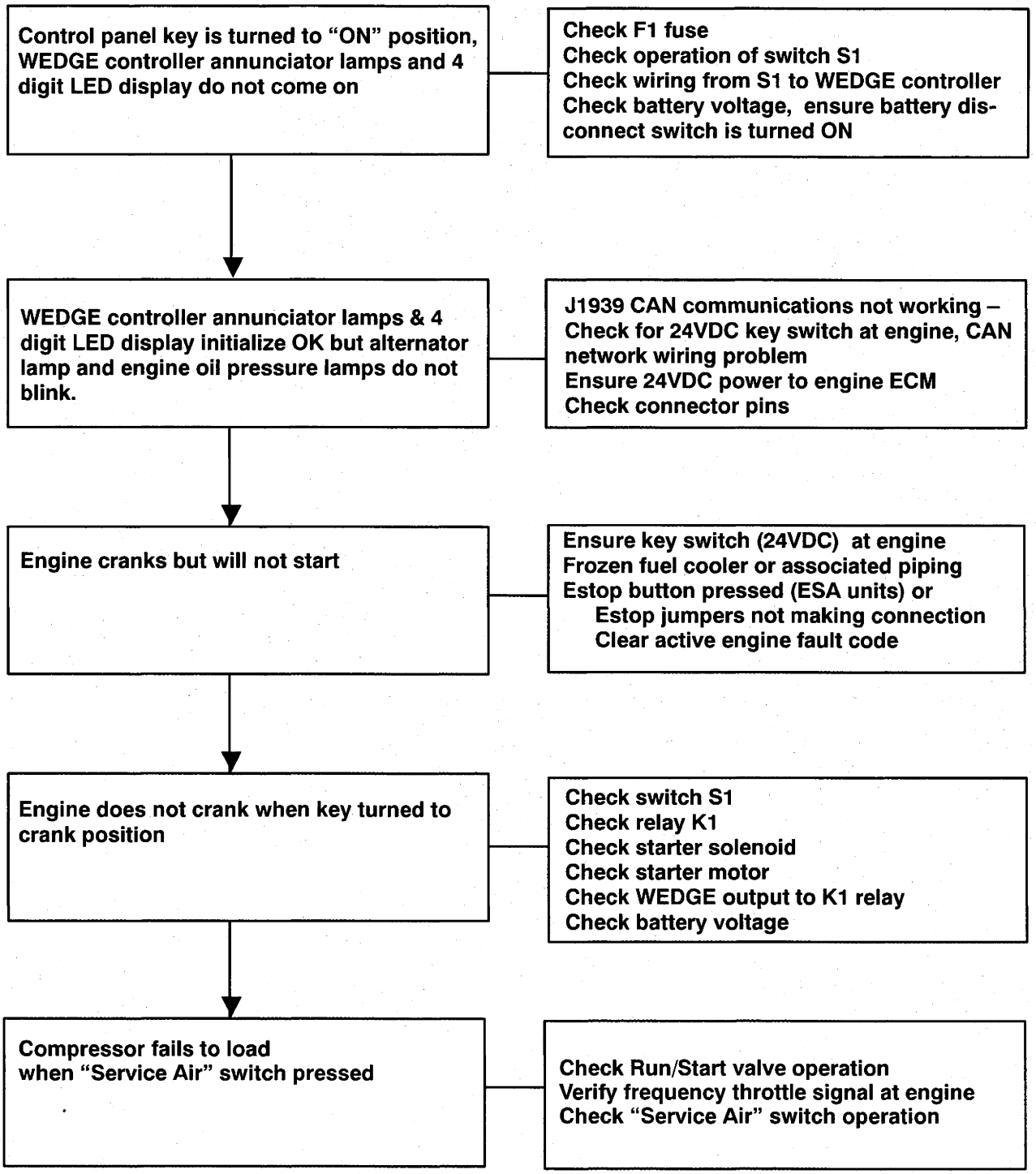
K3:

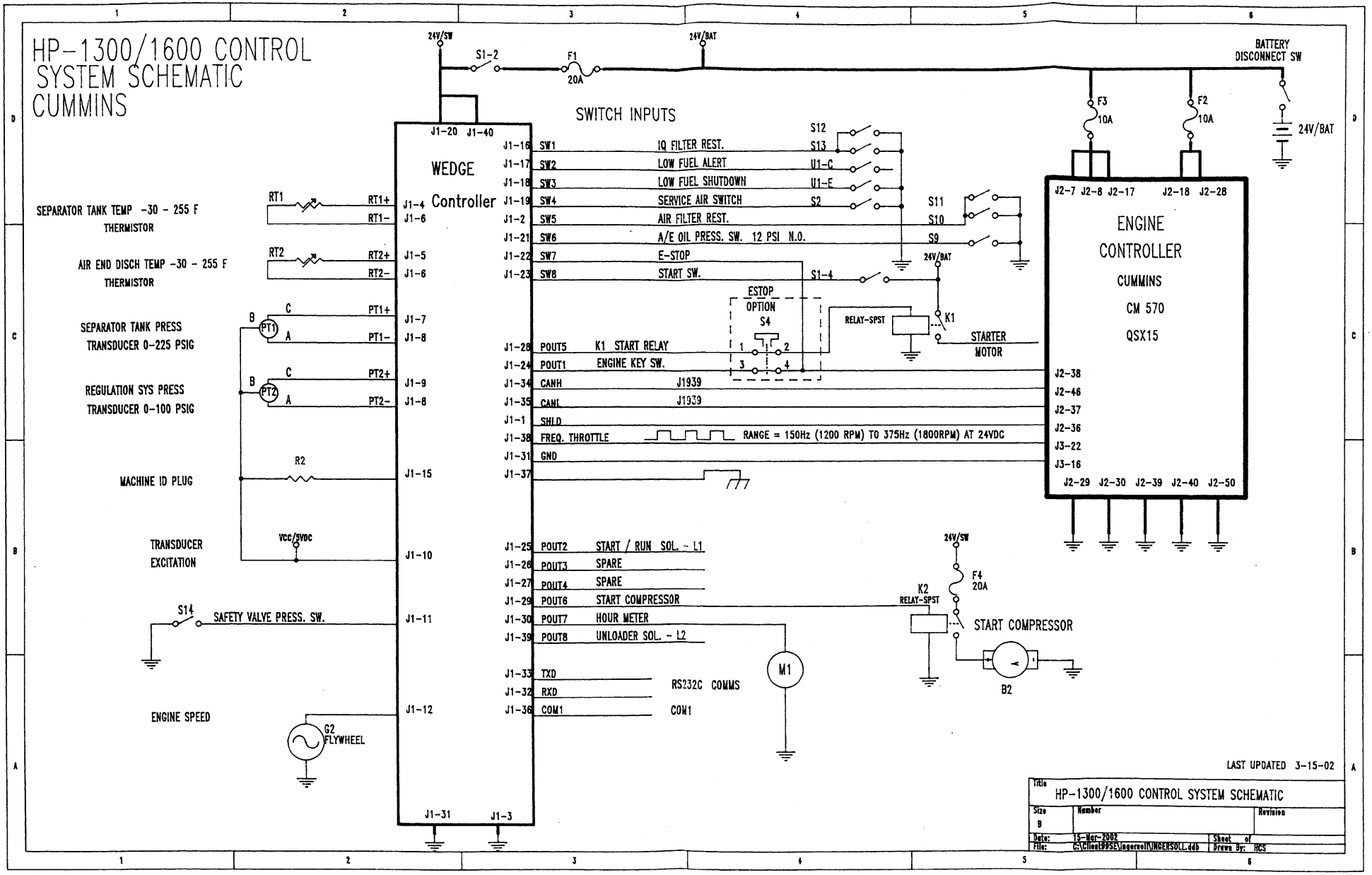
K3 is a SPDT, 24VDC relay used to power the IQ system.

ELECTRICAL PARTS LIST

Ref Designator	Description		Part Number
	IQ Wiring Harness		54757224
U2	Coolant Level Switch		54474572
	Battery Disconnect Switch		36896975
PT1	0-225 psi pressure transducer		54496973
PT2	0-100 psi Pressure Transducer		36920825
K2	Relay, 24VDC SPDT		36892362
G2	Mag Speed Sensor		36785319
RT1	Thermistor Temperature Sensor		36898922
L1	Start / Run Solenoid Valve		36842300
L2	Unloader Solenoid Valve		36842318
S10, S11	Air Filter Switch		36847838
RP1	Engine Oil Press Sender		36870608
RT3, RT4	Temperature Sender		36841138
S9	Airend Oil Press Switch		36757581
S14	Safety Valve Press Switch		36757581
B2	Startup Compressor		36850691
K1	Auxiliary Start Relay		35577873
R3	Control Orifice Heater		36841526
R1	Regulator Heater		36864677
R2	Machine ID Plug		54765953
U1	Fuel Level Sender	(Wagon)	54672803
		(High Speed)	54672811
D1-D4	Diode		35376169
	WEDGE Controller		54688411
W1	Chassis Harness		54654918
	W1 Control Panel Harness		22060594
	Negative Battery Cable		54765367
	Positive Battery Cable		54765375
	Positive Jumper Cable		54765383
	Battery Jumper		35128982
F2, F3	10 Amp ATC Fuse		22071591
F4	15 Amp Fuse		22071575
F1	20 Amp Fuse		36792083
	IQ Heater Harness		54775887
	IQ Orifice Heaters		36841526
	Actuator		36898310
RT5	Thermistor Temperature Sensor		36898922
K3	Relay, 24VDC SPDT		36892362
TCU	Controller		36920643
S12	Filter Switch		36899615
S13	Filter Switch		36899599

TROUBLE SHOOTING FLOW CHART



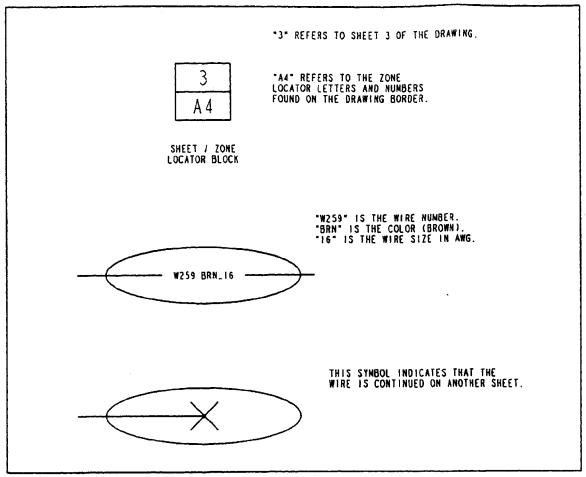

HP-1300/1600 CONTROL SYSTEM SCHEMATIC CUMMINS
24V/SW
S1-2
F1 20A
24V/BAT
BATTERY DISCONNECT SW
F3 10A
F2 10A
24V/BAT
SWITCH INPUTS
J1-20 J1-40
WEDGE Controller
J1-4
J1-6
J1-5
J1-6
J1-7
J1-8
J1-9
J1-8
J1-15
J1-10
J1-11
J1-12
J1-31
J1-3
SEPARATOR TANK TEMP -30 - 255 F THERMISTOR
RT1
RT1+
RT1-
AIR END DISCH TEMP -30 - 255 F THERMISTOR
RT2
RT2+
RT2-
SEPARATOR TANK PRESS TRANSDUCER 0-225 PSIG
PT1
PT1+
PT1-
REGULATION SYS PRESS TRANSDUCER 0-100 PSIG
PT2
PT2+
PT2-
MACHINE ID PLUG
R2
TRANSDUCER EXCITATION
VCC/5VDC
S14
SAFETY VALVE PRESS. SW.
ENGINE SPEED
G2 FLYWHEEL
J1-16 SW1 IQ FILTER REST.
J1-17 SW2 LOW FUEL ALERT
J1-18 SW3 LOW FUEL SHUTDOWN
J1-19 SW4 SERVICE AIR SWITCH
J1-2 SW5 AIR FILTER REST.
J1-21 SW6 A/E OIL PRESS. SW. 12 PSI N.O.
J1-22 SW7 E-STOP
J1-23 SW8 START SW.
S12
S13
U1-C
U1-E
S2
S11
S10
S9
S1-4
24V/BAT
ESTOP OPTION S4
RELAY-SPST
K1
STARTER MOTOR
J1-28 POUT5 K1 START RELAY
J1-24 POUT1 ENGINE KEY SW.
J1-34 CANH J1939
J1-35 CANL J1939
J1-1 SHLD
J1-38 FREQ. THROTTLE RANGE = 150Hz (1200 RPM) TO 375Hz (1800RPM) AT 24VDC
J1-31 GND
J1-37
J1-25 POUT2 START / RUN SOL. - L1
J1-26 POUT3 SPARE
J1-27 POUT4 SPARE
J1-29 POUT6 START COMPRESSOR
J1-30 POUT7 HOUR METER
J1-39 POUT8 UNLOADER SOL. - L2
J1-33 TXD
J1-32 RXD
J1-36 COM1
RS232C COMMS
COM1
M1
24V/SW
F4 20A
K2 RELAY-SPST
START COMPRESSOR
B2
J2-7 J2-8 J2-17 J2-18 J2-28
ENGINE CONTROLLER
CUMMINS
CM 570
QSX15
J2-38
J2-46
J2-37
J2-36
J3-22
J3-16
J2-29 J2-30 J2-39 J2-40 J2-50
LAST UPDATED 3-15-02
Title HP-1300/1600 CONTROL SYSTEM SCHEMATIC
Size B
Number
Revision
Date: 15-Mar-2002
Sheet of
File: C:\Client99SE\ingersoll\INGERSOLL.ddb
Drawn By: HCS

REVISIONS						
ZONE	REV	ECN	DESCRIPTION	DATE	DWN	APV
-	A	CPR30810	ORIGINAL RELEASE	01-07-17	DRP	DGS
-	A	CPR31908	ADDED SHT 4		DRP	

REFERENCE DESIGNATORS USED FOR CONNECTORS:

P "P" MEANS PLUG. THIS IS USUALLY THE MOST MOBILE SIDE OF A MATING CONNECTOR SET.

J "J" MEANS JACK. THIS IS USUALLY THE MORE FIXED SIDE OF A MATING CONNECTOR SET.



HOW TO READ THIS DIAGRAM

UNLESS OTHERWISE SPECIFIED, TOLERANCES ON DIMENSIONS ARE AS SPECIFIED ON DRAWING 36865731

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UNLESS OTHERWISE SPECIFIED, ALL DIMENSIONS ARE IN MILLIMETERS

REMOVE ALL BURRS AND SHARP CORNERS

CAD GENERATED DRAWING, NO MANUAL REVISIONS ALLOWED

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ROUM CODE

THIRD ANGLE PROJECTION

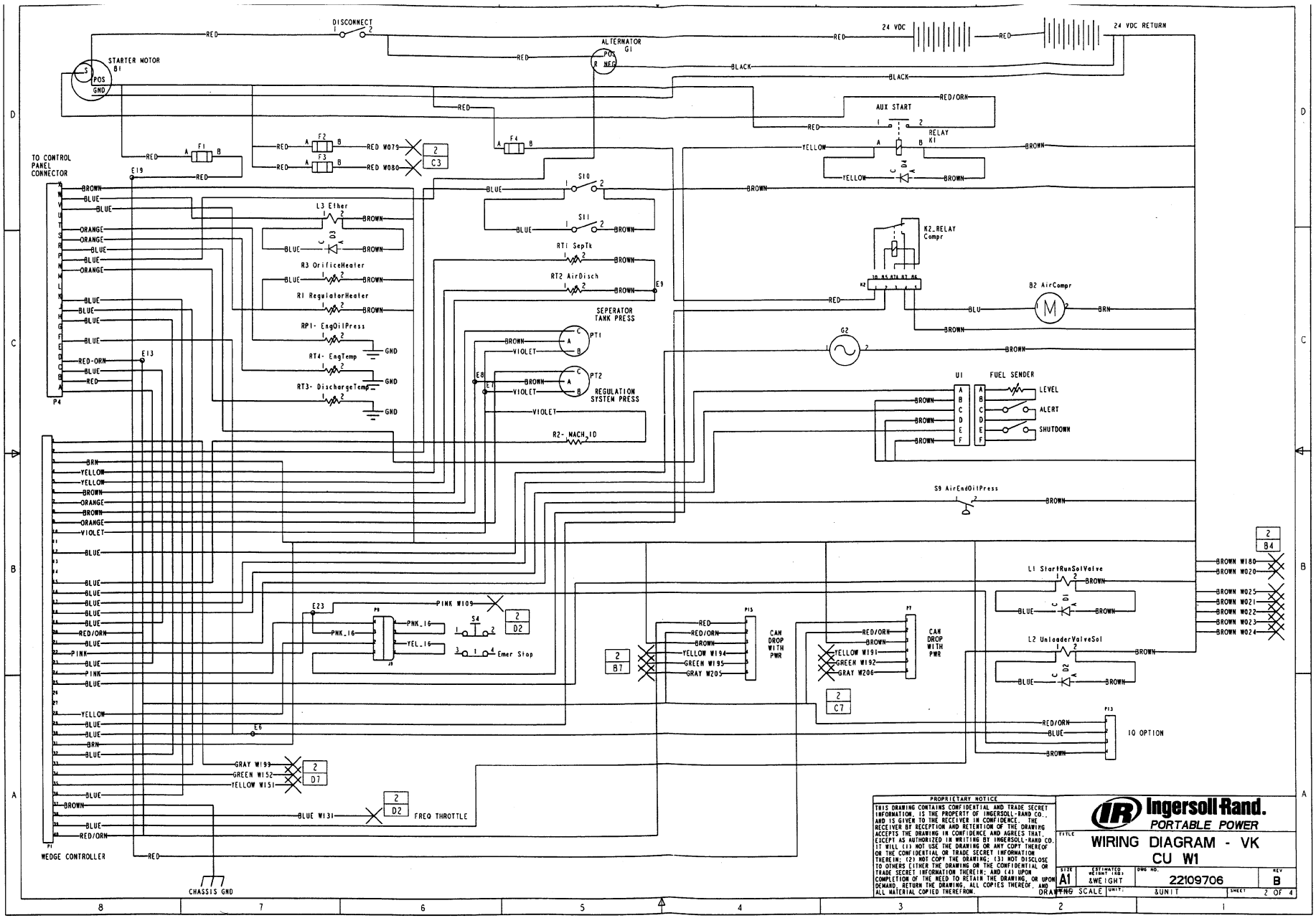
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CHECKED	DRP	01-07-17
APPROVED	DRP	01-07-17

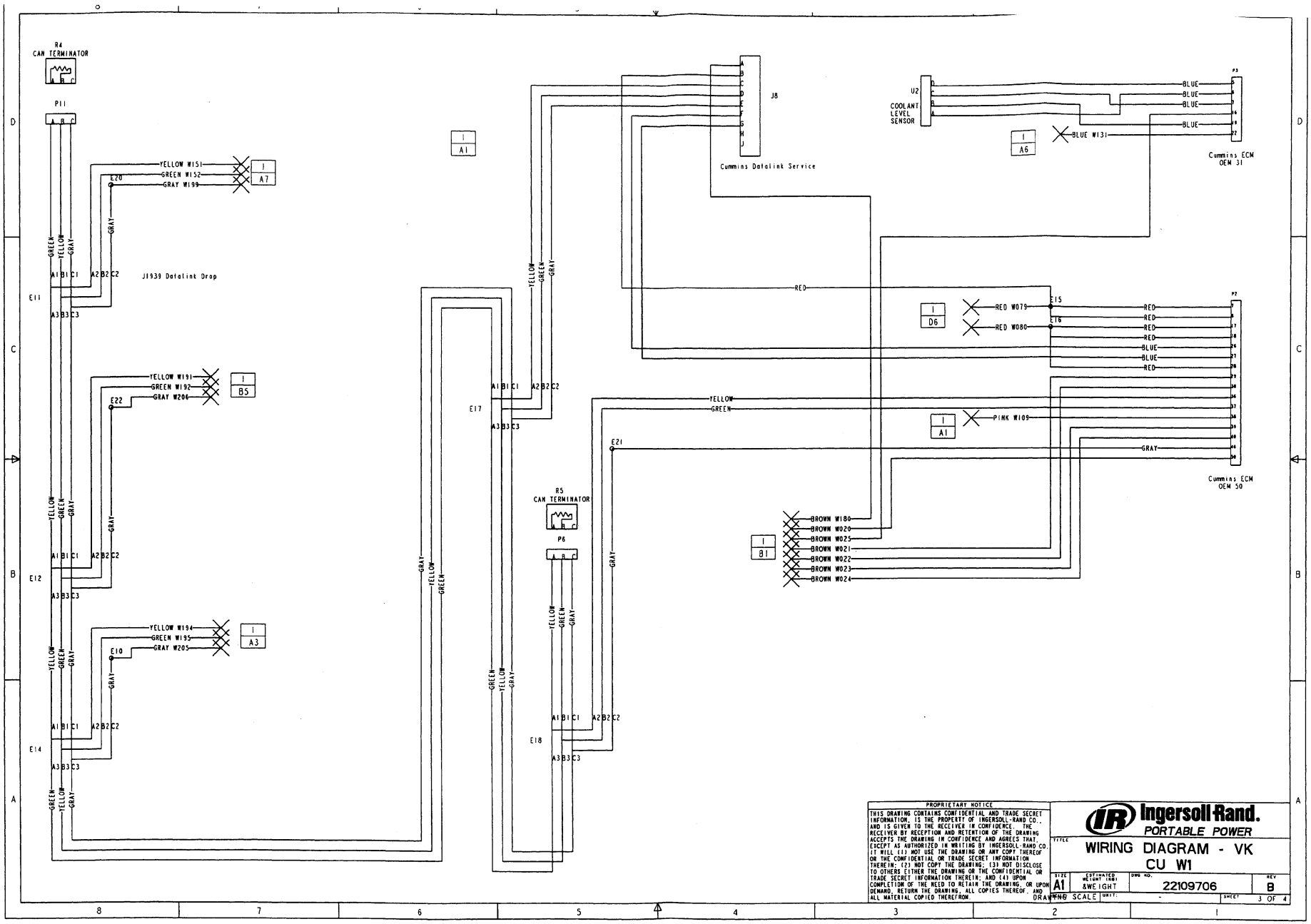
Ingersoll Rand. PORTABLE POWER

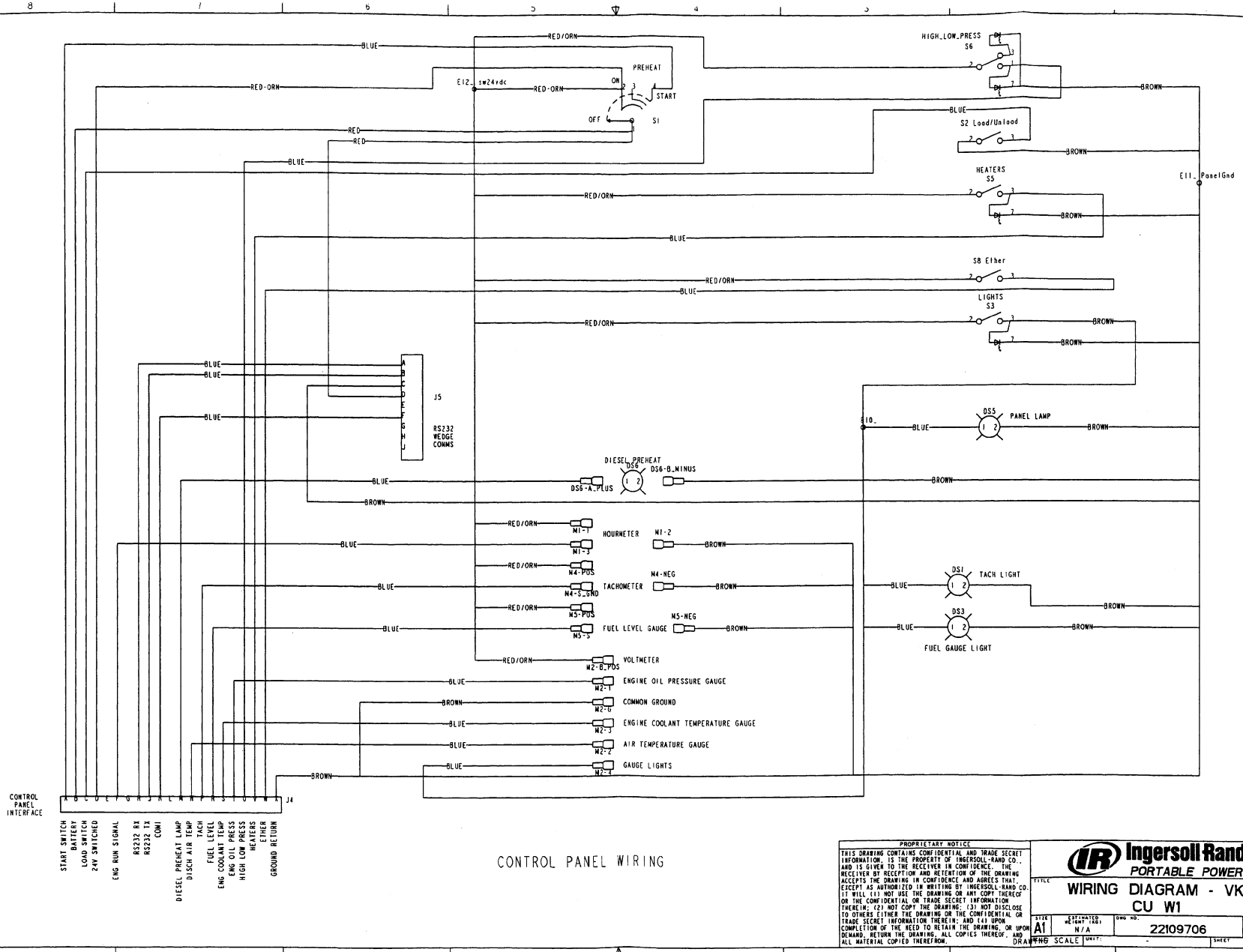
TITLE: WIRING DIAGRAM - VK CU W1

SIZE	ESTIMATED WEIGHT (KGS)	DWG NO.	REV
A1		22109706	B

SCALE | UNIT: NHP | SHEET 1 OF 4


DISCONNECT
STARTER MOTOR B1
ALTERNATOR G1
24 VDC
24 VDC RETURN
AUX START
RELAY K1
TO CONTROL PANEL CONNECTOR
L3 Ether
R3 OrificeHeater
R1 RegulatorHeater
RP1- EngOilPress
RT4- EngTemp
RT3- DischargeTemp
RT1 SepTk
RT2 AirDisch
SEPERATOR TANK PRESS
REGULATION SYSTEM PRESS
R2- MACH_ID
K2_RELAY Compr
B2 AirCompr
U1 FUEL SENDER
LEVEL
ALERT
SHUTDOWN
S9 AirEndOilPress
L1 StartRunSolValve
L2 UnloaderValveSol
S4 Emer Stop
CAN DROP WITH PWR
IO OPTION
FREQ THROTTLE
WEDGE CONTROLLER
CHASSIS GND
PROPRIETARY NOTICE
Ingersoll-Rand.
PORTABLE POWER
WIRING DIAGRAM - VK CU W1
22109706
SIZE A1
REV B
SHEET 2 OF 4


R4
CAN TERMINATOR
P11
YELLOW W151
GREEN W152
GRAY W199
E20
J1939 Datalink Drop
E11
YELLOW W191
GREEN W192
GRAY W206
E22
E12
YELLOW W194
GREEN W195
GRAY W205
E10
E14
J8
Cummins Datalink Service
U2
COOLANT LEVEL SENSOR
BLUE
BLUE W131
P3
Cummins ECM OEM 31
RED
RED W079
RED W080
E15
E16
P7
Cummins ECM OEM 50
YELLOW
GREEN
PINK W108
E21
GRAY
BROWN W180
BROWN W020
BROWN W025
BROWN W021
BROWN W022
BROWN W023
BROWN W024
E17
R5
CAN TERMINATOR
P6
E18
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Ingersoll-Rand.
PORTABLE POWER
TITLE
WIRING DIAGRAM - VK
CU W1
SIZE A1
ESTIMATED WEIGHT (KG) &WEIGHT
DWG NO. 22109706
REV B
DRAWING SCALE -
UNIT:
SHEET 3 OF 4



CONTROL PANEL WIRING

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TITLE: WIRING DIAGRAM - VK CU W1

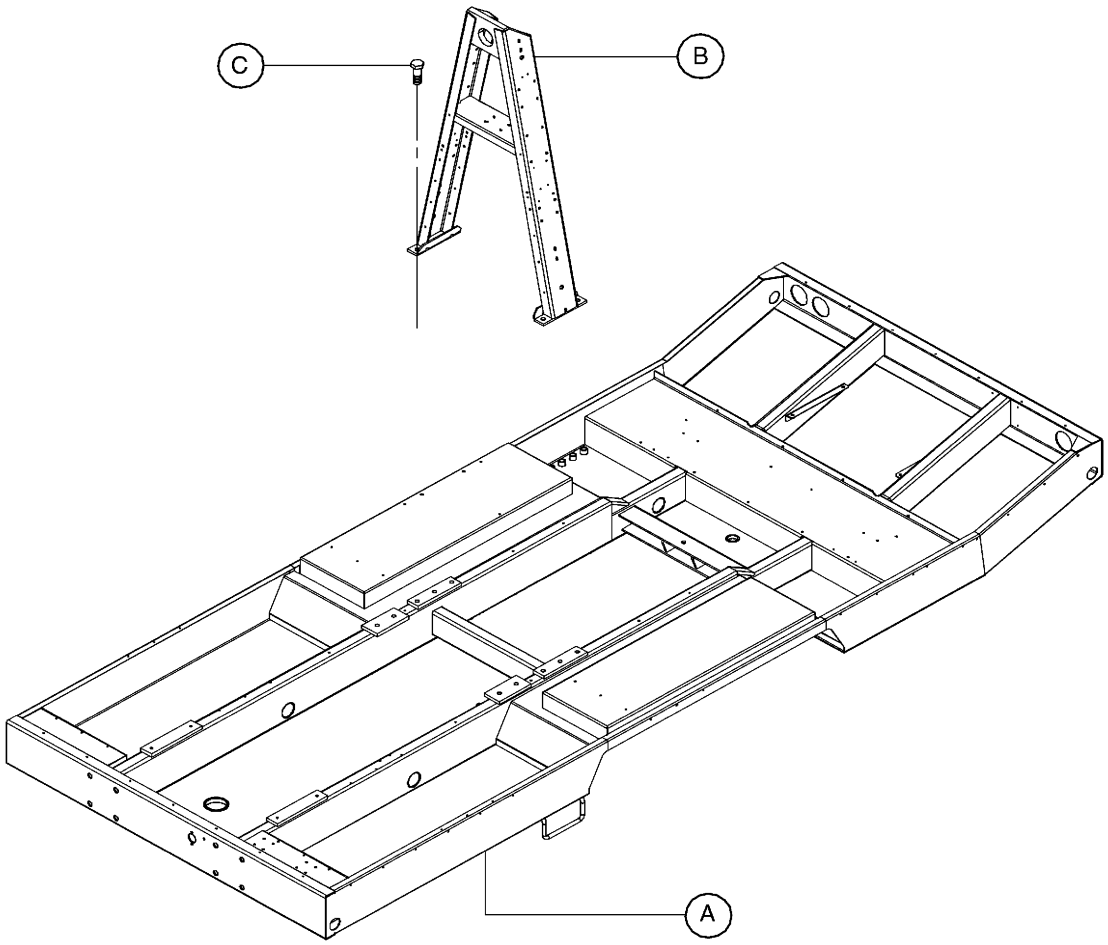
SIZE	ESTIMATED WEIGHT (KG)	DWG NO.	REV
A1	N/A	22109706	B

DRAWING SCALE: - | SHEET 4 OF 4

INDEX

FRAME ASSEMBLY (FAST TRACK)
FRAME ASSEMBLY (WAGON WHEEL)
RUNNING GEAR ASSEMBLY (FAST TRACK)
RUNNING GEAR ASSEMBLY (WAGON WHEEL)
ENGINE ASSEMBLY
EXHAUST COMPLETE
AIR END COMPLETE
AIR END ASSEMBLY
UNLOADER ASSEMBLY
STARTING AID ASSEMBLY
RADIATOR AND PIPING ASSEMBLY
FUEL TANK ASSEMBLY
AIR INTAKE ASSEMBLY
SEPARATOR TANK ASSEMBLY
AIR PIPING
OIL PIPING
MINIMUM PRESSURE / CHECK VALVE
OIL TEMPERATURE BYPASS VALVE
INSTRUMENT / CONTROL PANEL
BATTERY AND MOUNTING
ENCLOSURE ASSEMBLY
ACOUSTIC ASSEMBLY
WIRING DIAGRAM
PARKING BRAKE ASSEMBLY
SEPARATOR AIR PIPING
AIR CHARGE PIPING
IQ AIR PIPING
IQ COOLER PIPING
IQ FILTER PIPING
IQ INDICATOR PIPING
CENTRAL DRAIN PIPING
DECAL LOCATION
RECOMENDED SPARE PARTS LIST

FAST TRACK FRAME ASSEMBLY

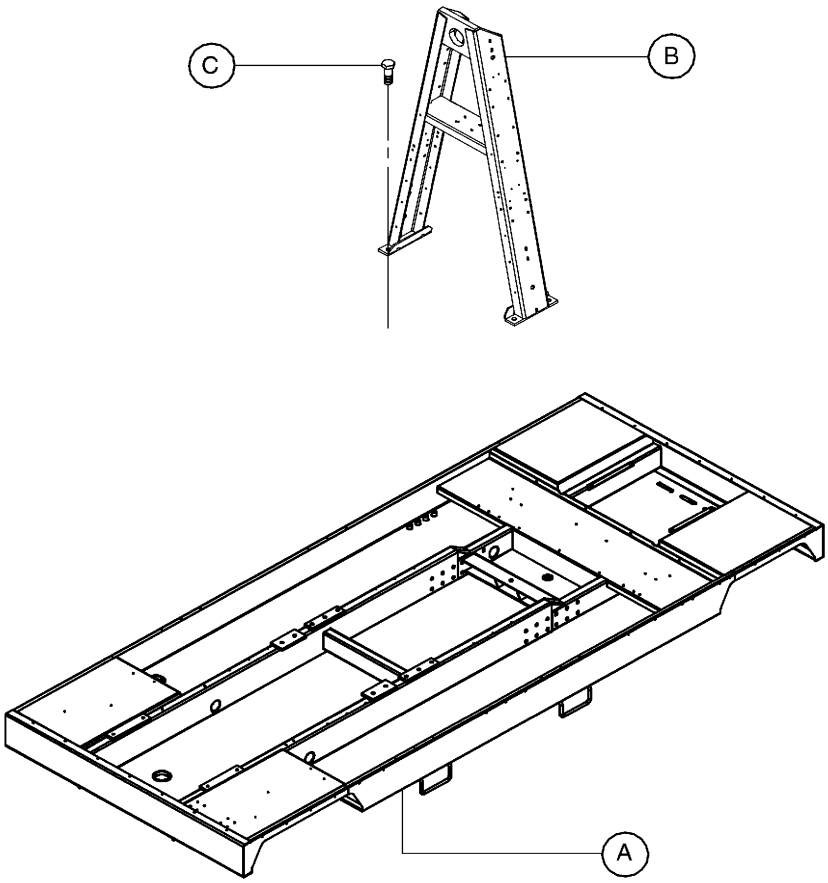


ITEM	CPN	QTY	DESCRIPTION
A	54760202	1	FRAME ASSEMBLY
B	54542543	1	BAIL , LIFTING
C	96720610	4	SCREW

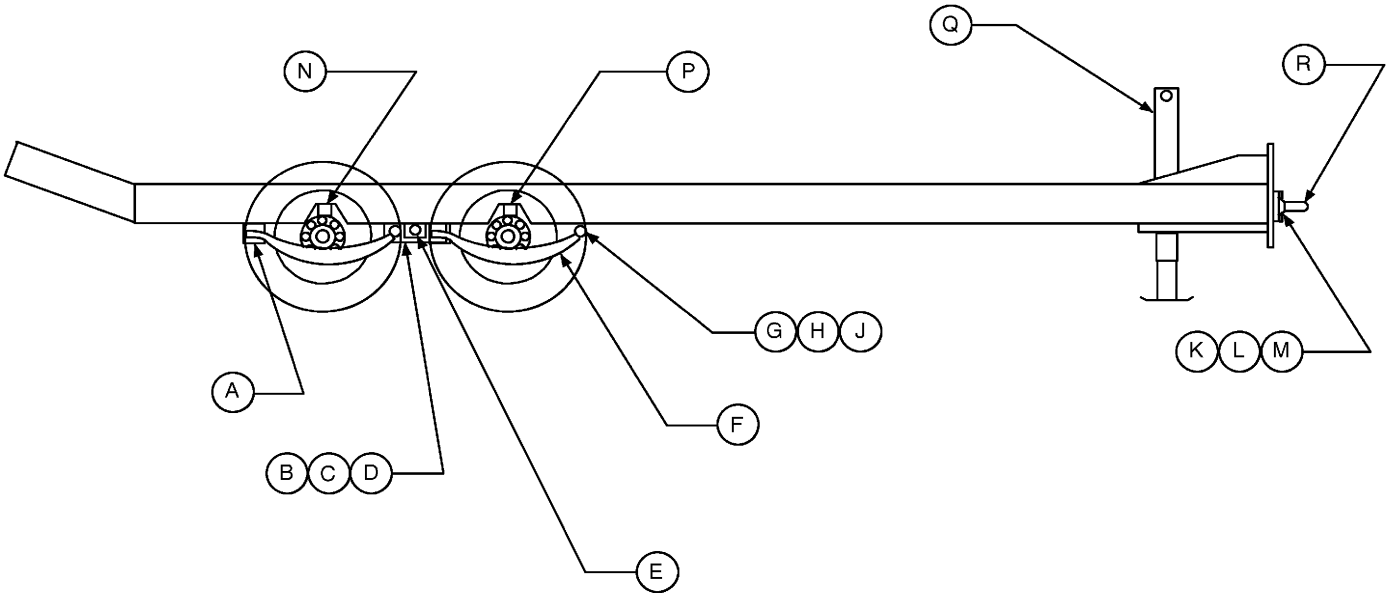
LESS RUNNING GEAR OPTION (PARTS)

CPN	QTY	DESCRIPTION
22053870	2	MIDDLE SUPPORT ASSEMBLY
22053888	4	LARGE EDGE SUPPORT ASSEMBLY
96727896	4	SCREW (THRU EDGE ASSY. TO FRAME)
36879203	4	NUT (THRU EDGE ASSY. TO FRAME)
36879492	8	SCREW (THRU SIDES OF EDGE SUPPORTS)
36879203	8	NUT (THRU SIDES OF EDGE SUPPORTS)
22054118	2	LARGE FRONT SUPPORT ASSY.
95939914	8	SCREW (THRU SLOTS OF THE SUPPORT)
95941084	8	NUT (TO SCREWS THRU SUPPORTS)
54594098	1	TANK , R.H. FUEL
35279025	24	SCREW (FUEL TANKS TO FRAME)
54594080	1	TANK , L.H. FUEL
22060156	1	HOSE ASSY. (FUEL COOLER TOP TO L.H. TANK)
35136548	1	HOSE ASSY. (R.H. TANK PICK-UP TO ENGINE)

WAGON WHEEL FRAME ASSEMBLY



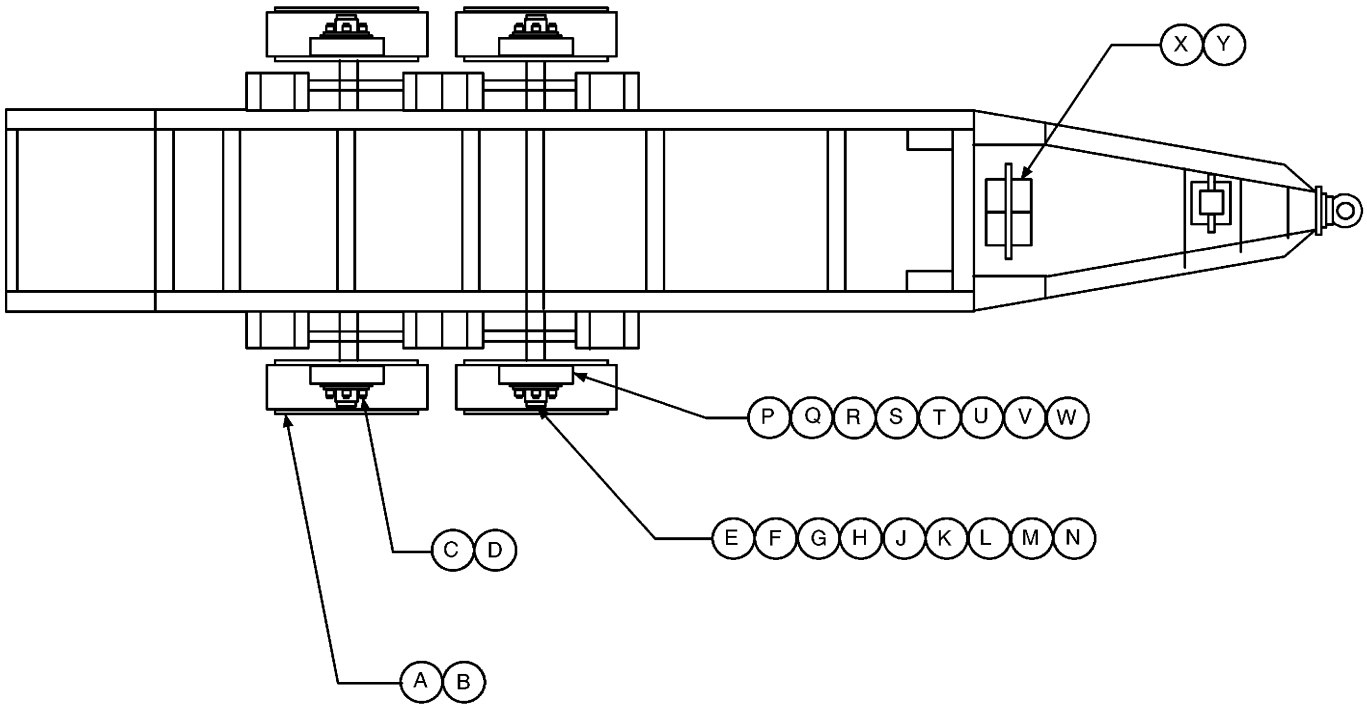
ITEM	CPN	QTY	DESCRIPTION	CPN	QTY	DESCRIPTION
A	54501796	1	FRAME ASSEMBLY	LESS RUNNING GEAR OPTION (PARTS)		
B	54542543	1	BAIL , LIFTING	22051304	4	SUPPORT (BETWEEN FRAME)
C	96720610	4	SCREW	39179072	16	BOLT (SUPPORTS TO FRAME)
				96701750	16	NUT (SUPPORTS TO FRAME)
				22053706	2	CROSSMEMBER (BETWEEN SUPPORTS)
				39179072	8	BOLT (CROSSMEMBER TO SUPPORT LEGS)
				96701750	8	NUT (CROSSMEMBER TO SUPPORT LEGS)
				54594114	1	TANK , R.H. FUEL TANK
				35279025	12	SCREW (FUEL TANK TO FRAME)
				54594106	1	TANK , L.H. FUEL TANK
				22060149	1	HOSE ASSEMBLY (FUEL COOLER TOP TO L.H. TANK)
				35325083	1	HOSE ASSEMBLY (RH FUEL PICK-UP TO ENGINE)



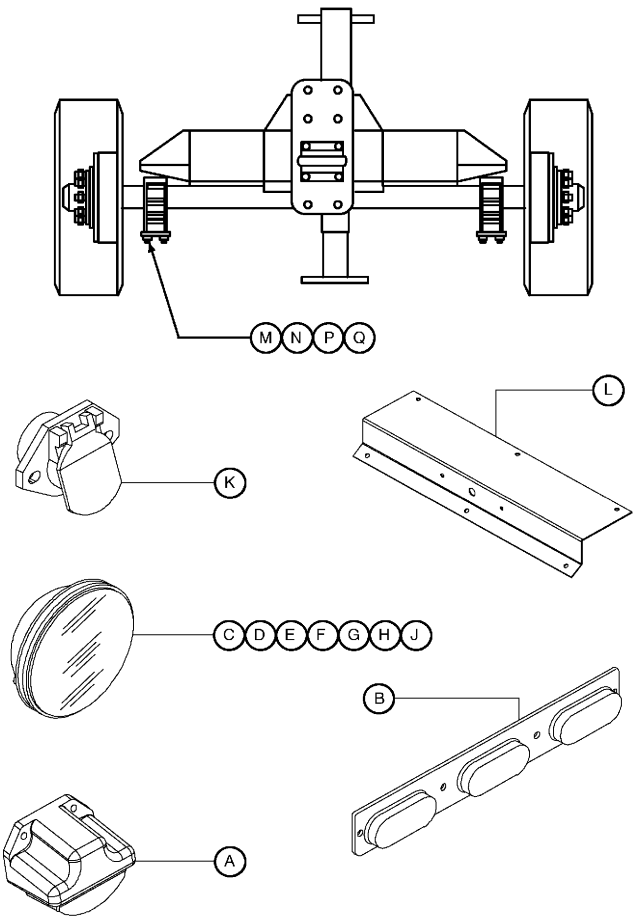
ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	36880235	2	HANGER , REAR				
B	36880219	2	BAR , EQUALIZER				
C	36880243	2	BOLT , EQUALIZER				
D	36880250	2	LOCKNUT				
E	36880193	2	HANGER , CENTER				
F	36880284	4	SPRING , LEAF				
G	36880201	2	HANGER , FRONT				
H	36880227	8	BOLT , SHACKLE				
J	35336700	8	LOCKNUT				
K	36880136	4	BOLT				
L	95935011	4	WASHER				
M	95077608	4	LOCKNUT				
N	35144336	8	SCREW				
P	36880151	4	BUMPER , RUBBER				
Q	36880144	1	JACK , DROPLEG				
R	36880128	1	EYE , PINTLE				

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 4 08/01 A

HIGH SPEED RUNNING GEAR

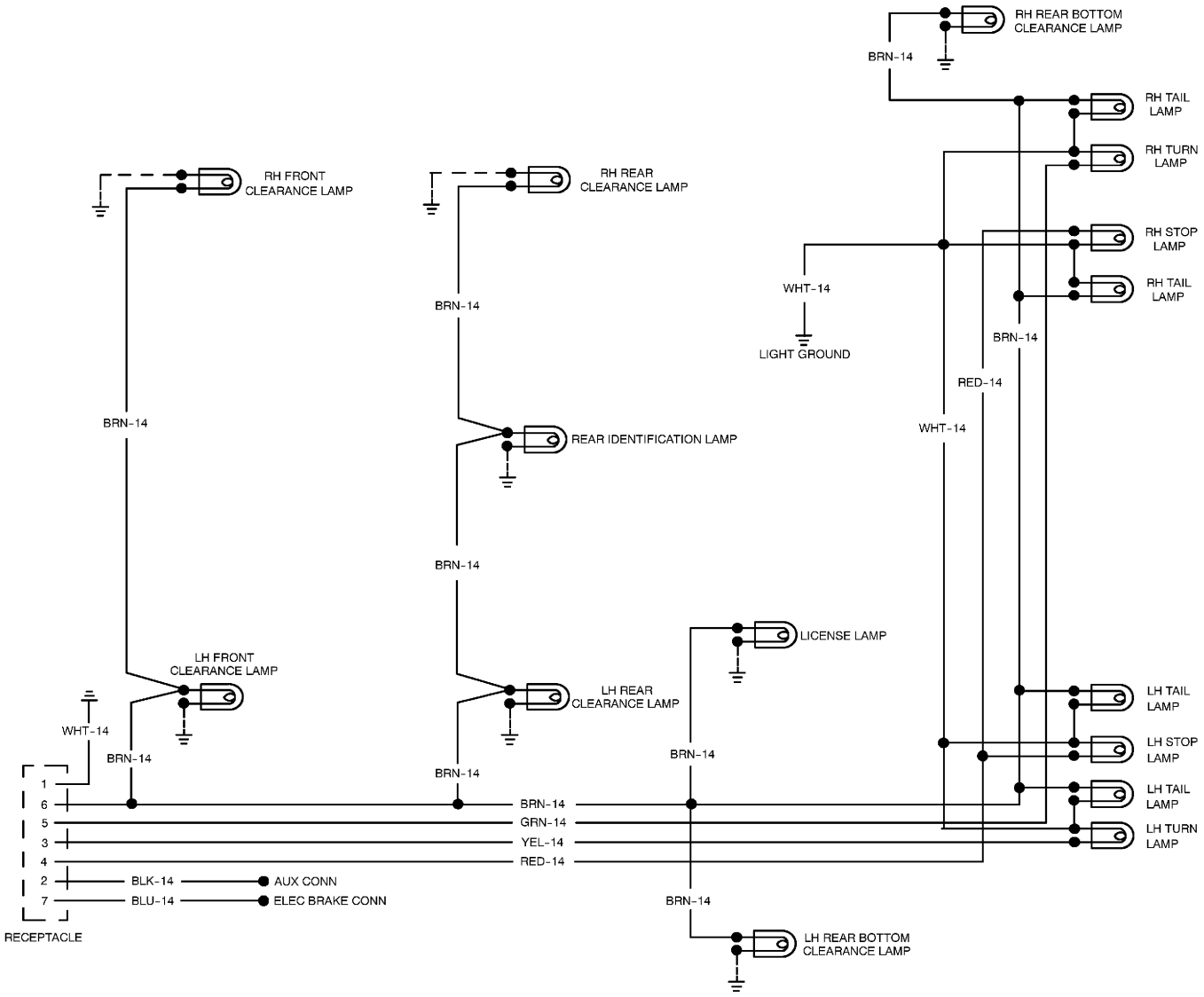


ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	36877991	4	TIRE				
B	22077515	4	WHEEL				
	36878049	4	CLAMP , PLATE				
C	35272150	8	STUD				
D	36880276	8	NUT				
E	36853091	4	NUT				
F	36853109	2	WASHER				
G	36853117	2	WASHER , LOCK				
H	36851624	1	INNER BEARING CUP				
J	36851616	1	OUTER BEARING CUP				
K	36851608	1	INNER BEARING				
L	36851590	1	OUTER BEARING				
M	36851632	1	SEAL				
N	36776813	8	CAP , DUST				
P	36880268	4	HUB ASSEMBLY				
Q	36880292	2	L.H. ELECTRIC BRAKE				
R	36880300	2	R.H. ELECTRIC BRAKE				
S	36880318	4	SHIELD , BOTTOM DUST				
T	36880326	4	SHIELD , TOP DUST				
U	36880334	7	BOLT				
V	95939955	7	WASHER , LOCK				
W	36880342	7	LOCKNUT				
X	35603190	2	CHOCK , WHEEL				
Y	35333830	2	STRAP , RUBBER				

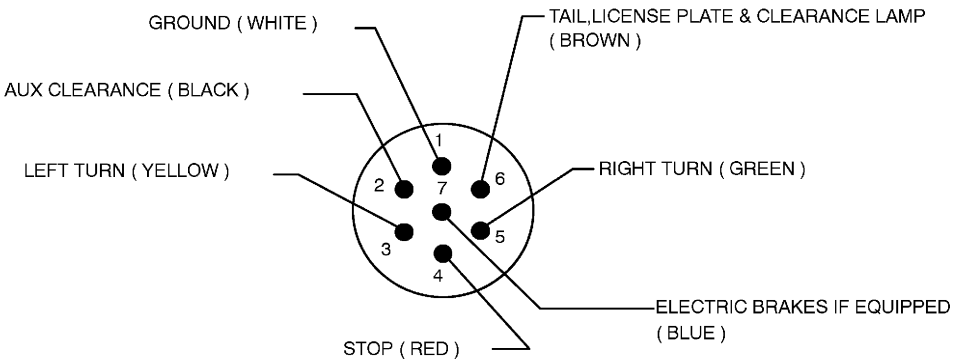


ITEM	CPN	QTY	DESCRIPTION
A	36895860	1	LIGHT , LICENSE PLATE
B	36922144	1	3 LIGHT ASSEMBLY
C	36788081	2	STOP , TURN AND TAIL LIGHT
D	36787968	6	GROMMET (USE ON ITEM C & E)
E	36859320	4	STOP , TURN AND TAIL LIGHT
F	35367051	4	YELLOW LIGHT
G	36893642	2	GROMMET (USE ON ITEM F)
H	36893634	2	GROMMET (USE ON ITEM F)
J	35367044	4	RED CLEARANCE LIGHT
K	36894129	1	7-WAY CONNECTOR
L	36896306	1	ID BRACKET
M	36880169	2	PLATE , U-BOLT
N	36880177	4	U-BOLT
P	36880185	8	NUT
Q	95934741	8	WASHER , LOCK

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 6 08/01 A



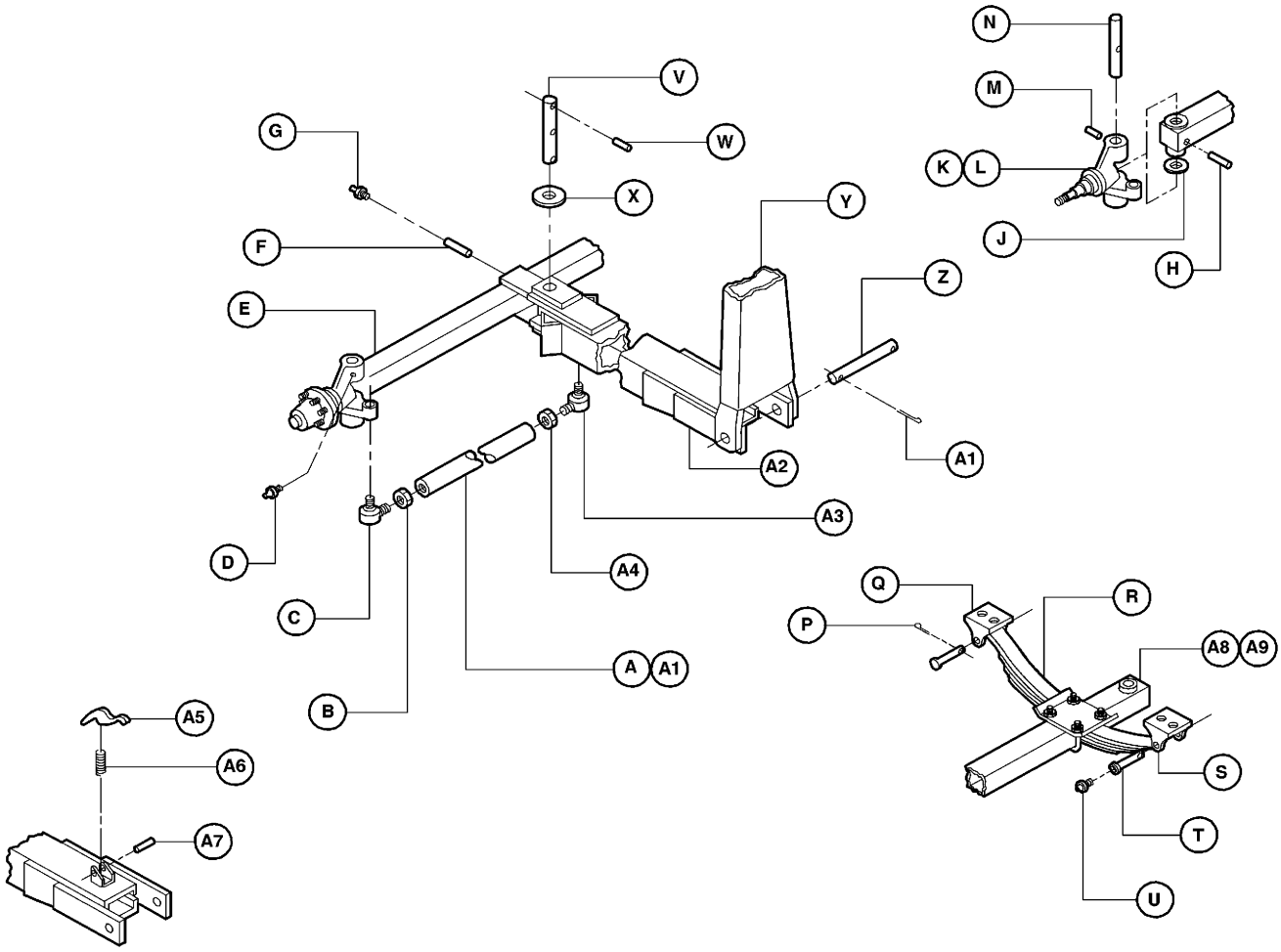
MANUAL NO. — DRAWING NO. DATE / REV:
54757919 7 08/01 A



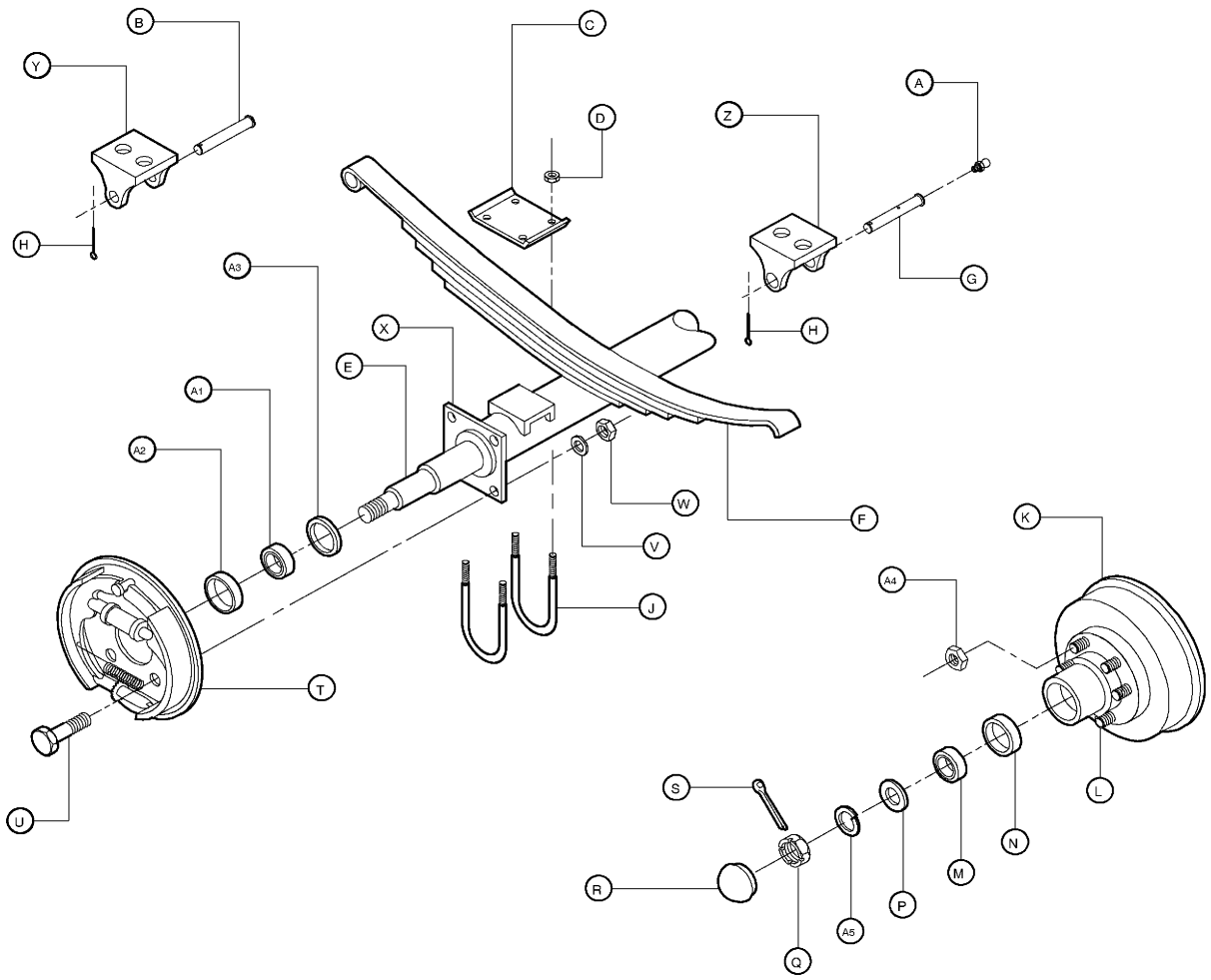
STOP,TAIL & TURN LIGHT OPTION
(AS VIEWED FROM REAR OF SOCKET)

LIST OF MATERIALS									
CKT	TERMINATION A	TYPE	SIZE	TERMINATION B	TYPE	SIZE	GAUGE	LENGTH	COLOR
1	RECEPTACLE 1	E		GROUND	A	1/4	14	46	WHT
2	RECEPTACLE 6	E		SPLICE 1	D		14	24	BRN
3	SPLICE 1			LH FRT CLEARANCE	B		14	95	BRN
4	LH FRT CLEAR W/CKT 3B			RH FRT CLEARANCE	B		14	89	BRN
5	SPLICE 1 W/CKT 3A			SPLICE 2	D		14	218	BRN
6	RECEPTACLE 3	E		RH TURN	G		14	342	YEL
7	RECEPTACLE 5	E		LH TURN	G		14	255	GRN
8									
9									
10	RH TURN/TAIL W/CKT 27B			RH REAR CLEAR BOT	B		14	22	BRN
11									
12	SPLICE 2			LH REAR CLEARANCE	B		14	19	BRN
13	LH REAR CLEAR W/CKT 12B			LH REAR TOP CLEAR	B		14	74	BRN
14	LH REAR TOP CLEAR W/CKT 13B			REAR ID W/CKT 15A	B		14	61	BRN
15	R ID W/CKT 14B			RH REAR TOP CLEAR	B		14	56	BRN
16	SPLICE 2 W/CKT 12A			LICENSE LAMP	B		14	31	BRN
17	SPLICE 2 W/CKT 12A			LH TURN/TAIL	G		14	13	BRN
18	RECEPTACLE 4	E		LH STOP LAMP	G		14	261	RED
19	LIGHT GRD W/CKT 24A			LIGHT GROUND			14	36	WHT
20	LEFT STOP LAMP W/CKT 18B			RIGHT STOP LAMP	G		14	99	RED
21	RECEPTACLE 7	E		ELECTRIC BRAKES			14	29	BLU
22	LEFT TURN GRD			LH ST/GRD W/CKT 23A	G		14	30	WHT
23	LEFT STOP GRD			RT ST/GRD W/CKT 24A	G		14	99	WHT
24	RIGHT STOP GRD			RH TURN GRD	G		14	30	WHT
25	LH TURN/TAIL W/CKT 17B			LEFT STOP/TAIL	G		14	30	BRN
26	LH STOP/TAIL W/CKT 25B			RIGHT STOP/TAIL	G		14	99	BRN
27	RH STOP/TAIL W/CKT 26B			RIGHT TURN/TAIL	G		14	30	BRN
28	RECEPTACLE 2	E		AUX	B		14	29	BLK

WAGON WHEEL RUNNING GEAR

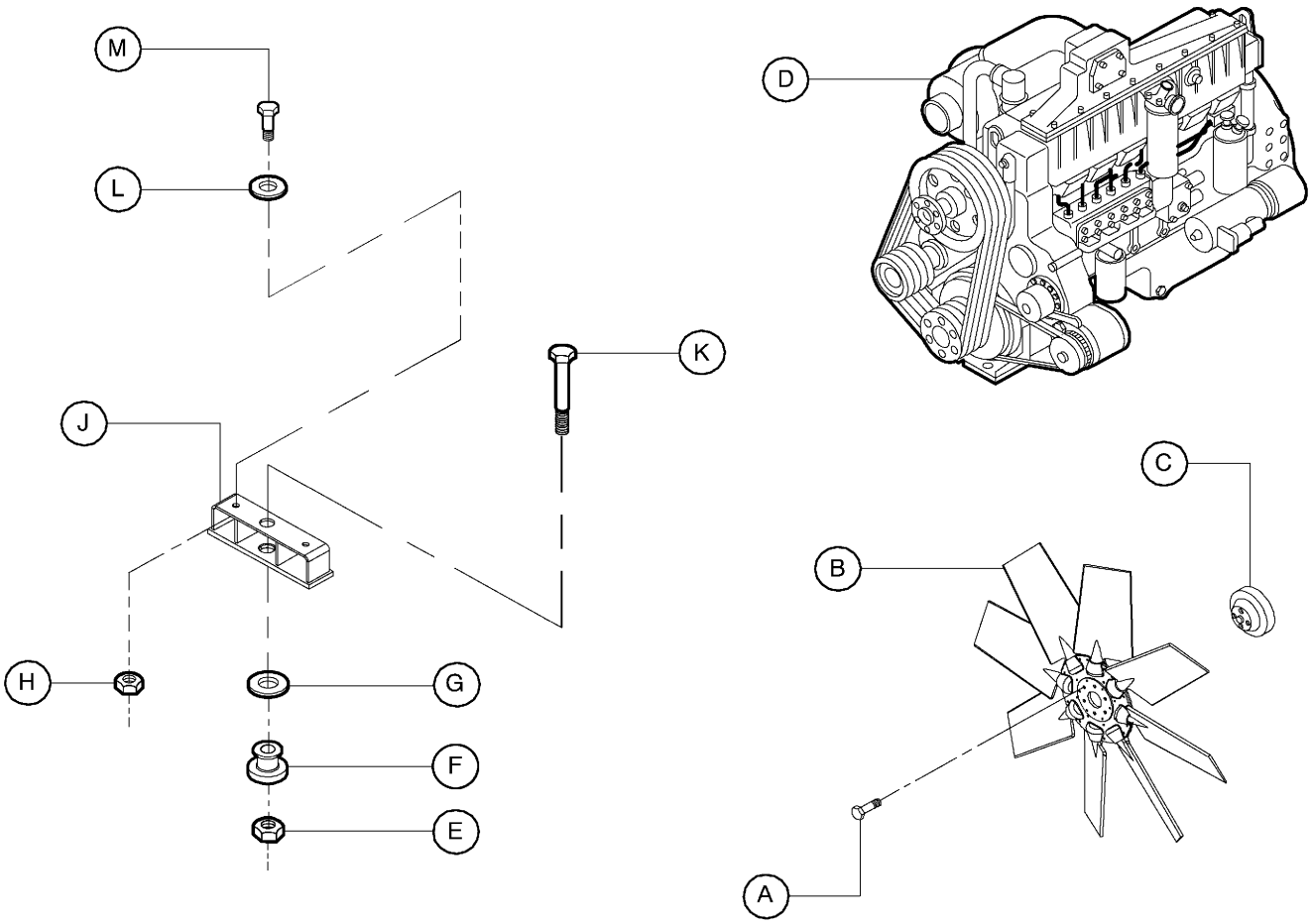


ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	36504389	2	ROD , TIE	X	95934956	2	WASHER
B	36140730	2	NUT , JAM	Y	36719557	1	DRAWBAR
C	35588961	2	BALL JOINT , OUTER	Z	35107168	1	PIN , HINGE
D	35221894	2	FITTING , LUBE	A1	95201455	2	PIN , COTTER
E	36753259	1	AXLE , FRONT	A2	36753242	1	ARM , CENTER
F	95717369	1	PIN , ROLL	A3	35588953	2	BALLJOINT , INNER
G	35221894	1	FITTING , LUBE	A4	35140722	2	NUT , JAM
H	95338554	2	PIN , ROLL	A5	36719219	1	LATCH
J	95239927	4	WASHER	A6	35141167	1	SPRING
K	36851566	1	L.H. KNUCKLE ASSEMBLY	A7	95098703	2	PIN , ROLL
L	36851574	1	R.H. KNUCKLE ASSEMBLY	A8	36851376	1	FRONT AXLE ASSEMBLY
M	95673042	2	PIN , ROLL	A9	36851384	1	REAR AXLE ASSEMBLY
N	35319045	2	PIN , KING	B1	36853042	2	TIE ROD ASSEMBLY
P	95018982	2	PIN , COTTER				(INCLUDES A,B,C,A3,A4)
Q	36719169	2	BRACKET		22077515	4	WHEEL
R	36719466	2	SPRING		36877991	4	TIRE
S	36719177	2	BRACKET		36878049	4	RING , CLAMP
T	35111590	2	BOLT , SHACKLE				
U	95318556	2	FITTING , LUBE				
V	35588755	1	PIN , CENTER				
W	95717377	2	PIN , ROLL				



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	95318556	2	FITTING , LUBE	X	36776839	2	FLANGE , BRAKE MTG
B	35588839	2	RIVET	Y	36719177	2	BRACKET
C	35589241	2	PLATE , CLAMP	Z	36719169	2	BRACKET
D	35111566	8	NUT	A1	36851608	2	INNER BEARING
E	36851640	1	AXLE , REAR	A2	36851624	2	INNER RACE
F	36719466	2	SPRING	A3	36851632	2	SEAL
G	35111590	2	BOLT , SHACKLE	A4	36776821	8	NUT , STUD
H	95018982	2	PIN , COTTER	A5	36853117	2	WASHER , LOCK
J	35834621	4	U-BOLT				
K	36851665	2	HUB ASSEMBLY (INCLUDES ITEMS N, L, A2)				
L	36764983	8	STUD				
M	36851590	2	OUTTER BEARING				
N	36851616	2	OUTER RACE				
P	36853109	2	WASHER , FLAT				
Q	36853091	2	NUT				
R	36776813	2	CAP , GREASE				
S	95272902	2	PIN , COTTER				
T	--------	1	PARKING BRAKE ASSEMBLY				
U	36A2D326Z1	8	BOLT				
V	95934741	8	WASHER , FLAT				
W	95916573	8	NUT				

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 10 08/01 A



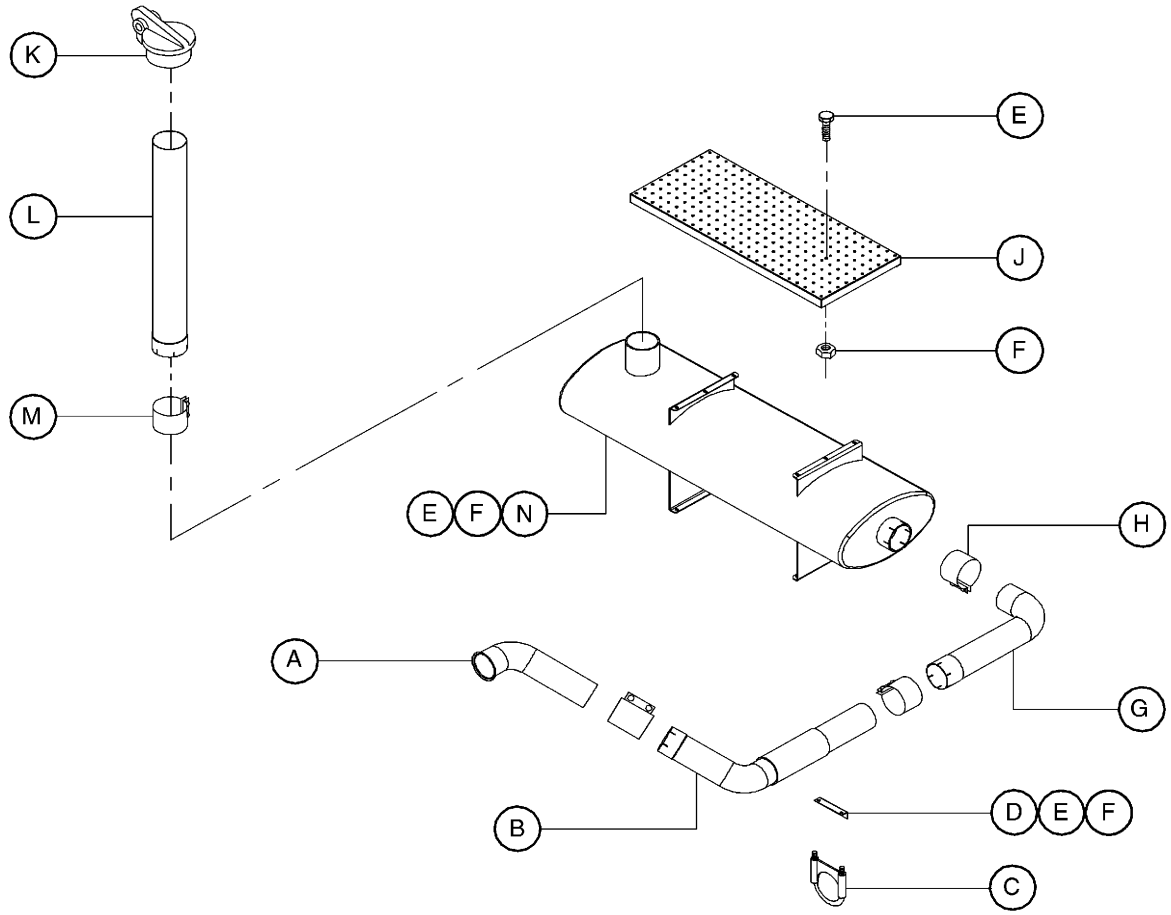
ITEM	CPN	QTY	DESCRIPTION
A	95940920	6	SCREW
B	36884047	1	FAN ASSEMBLY
C	54409339	1	SPACER , FAN
D	54661533	1	ENGINE , QSX-15 CUMMINS
E	35297340	1	NUT
F	35584556	1	MOUNT , RUBBER
G	35273937	1	WASHER
H	35297340	2	NUT
J	54570122	1	BRACKET , ENGINE
K	96700919	1	SCREW
L	95935011	2	WASHER
M	36763670	2	SCREW

ENGINE FILTERS

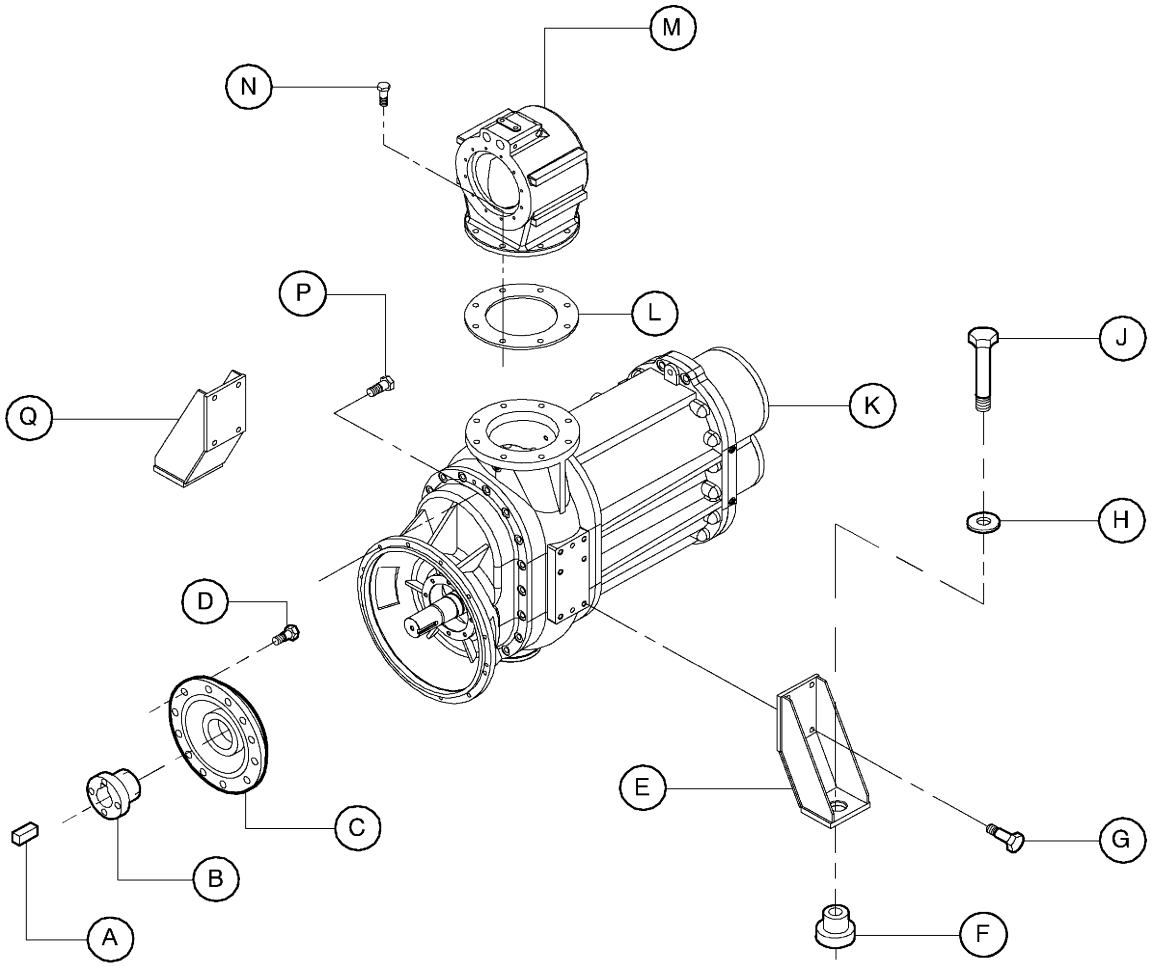
35362243	ENGINE FUEL FILTER
35362235	ENGINE OIL FILTER
35362268	ENGINE WATER SEPARATOR FILTER
35362250	PRIMARY FUEL FILTER

MANUAL NO. — DRAWING NO. DATE / REV:
22063556 11 09/01 A

EXHAUST ASSEMBLY

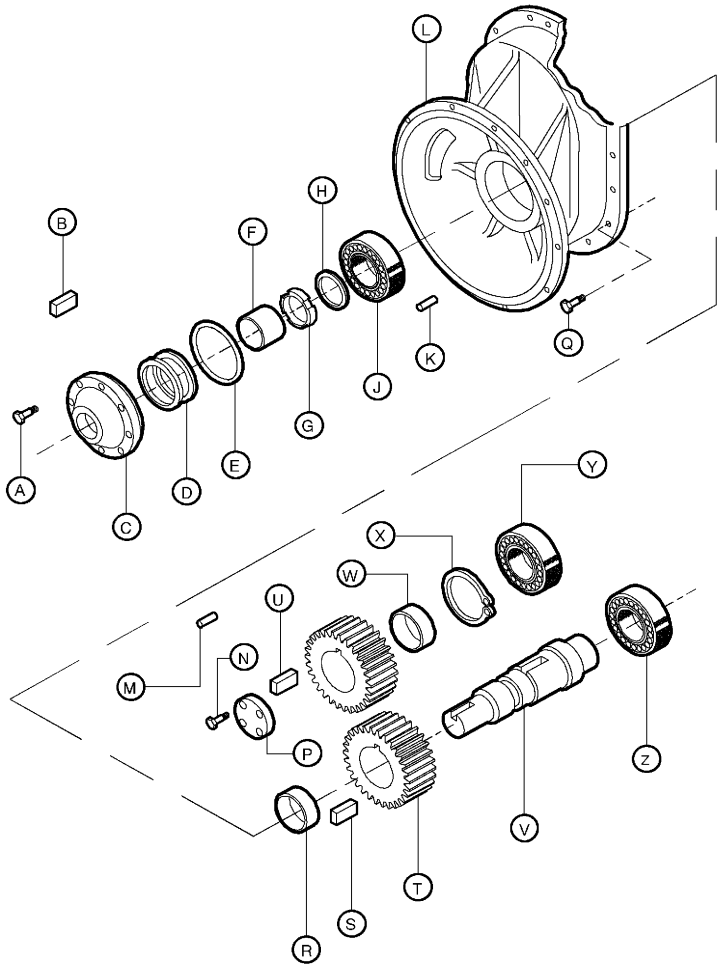


ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	54603774	1	PIPE , ENGINE TURBO				
B	54616552	1	PIPE , EXHAUST (STANDARD)				
	54738752	1	PIPE , EXHAUST (IQ)				
C	35127653	1	CLAMP				
D	35611235	1	SUPPORT , PIPE				
E	36880995	12	SCREW				
F	36879195	12	NUT				
G	54616560	1	PIPE , EXHAUST				
H	35307131	3	CLAMP , SEAL				
J	54629589	1	STEP				
K	35851351	1	CAP , RAIN				
L	54629126	1	PIPE , EXHAUST				
M	36799807	1	CLAMP , SEAL				
N	54603204	1	MUFFLER				
	54662010	1	WRAP , EXHAUST				
	54721105	1	KIT , WRAP WIRE KIT				



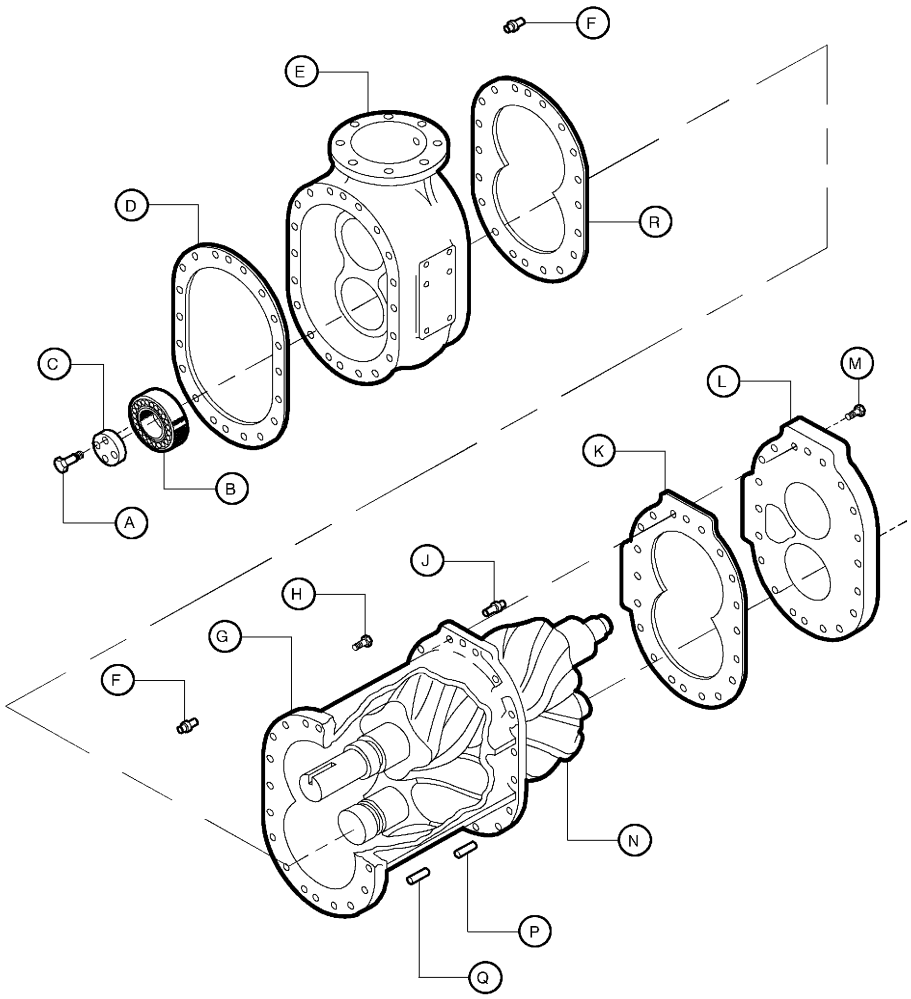
ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	35116086	1	KEY , BUSHING				
B	35307784	1	BUSHING				
C	54540141	1	COUPLING				
D	95941092	12	SCREW				
E	54542535	2	BRACKET , AIR END				
F	35584556	2	MOUNT , RUBBER				
G	35375385	8	SCREW				
H	35273937	2	WASHER				
J	96700919	2	SCREW				
K	42469809	1	AIR END ASSEMBLY				
L	36754059	1	GASKET				
M	36729531	1	UNLOADER ASSEMBLY				
N	35375377	8	SCREW				

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 13 08/01 A



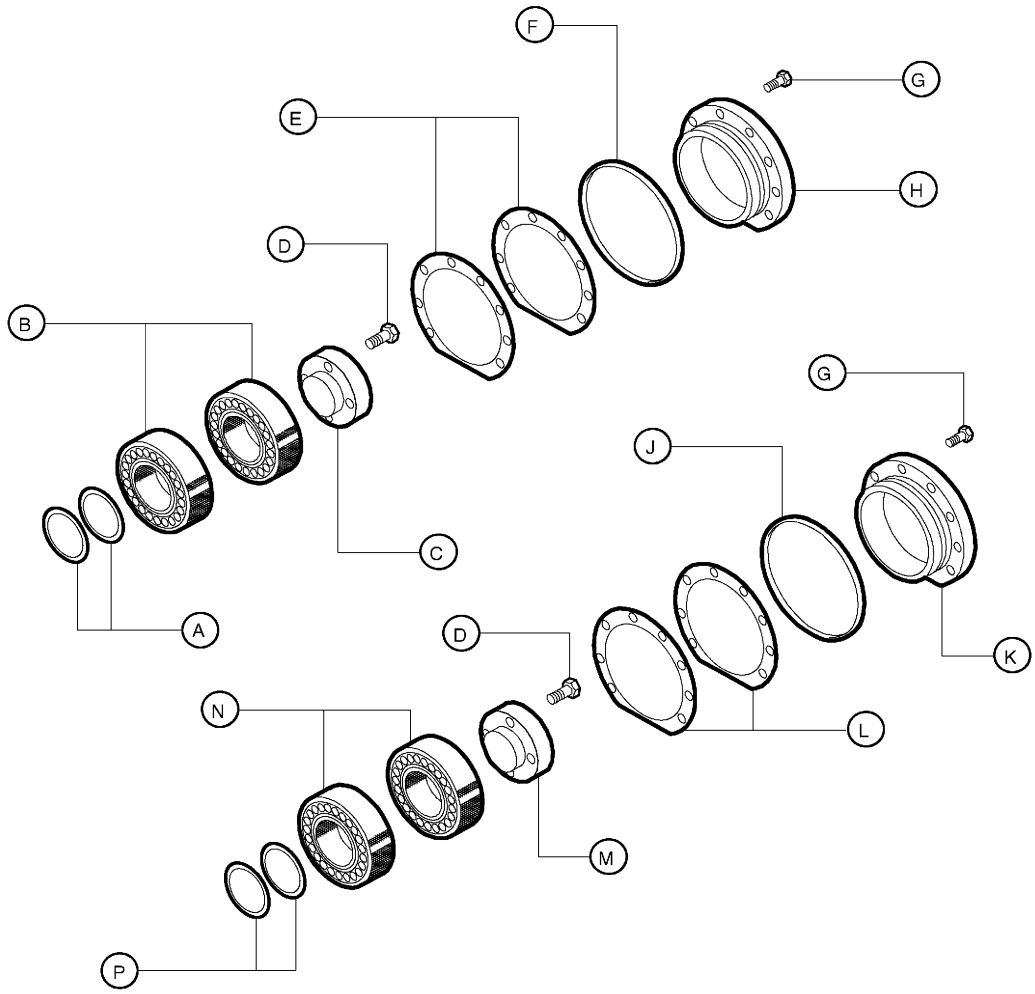
ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION	
A	35271139	8	SCREW	S	35300136	1	KEY	
B	35367069	1	KEY	T	35298470	1	GEAR SET	HP-1300
C	35849348	1	COVER		36758142	1	GEAR SET	P-1600
D	35299536	1	SHIM	U	35300144	1	KEY	
E	95358214	1	O-RING	V	35851195	1	SHAFT	
F	35596626	1	SEAL	W	35610286	1	SPACER	
G	35299775	1	LOCKNUT	X	95285599	1	RETAINING RING	
H	35300227	1	SPACER	Y	35610591	1	BEARING	
J	35299379	1	BEARING	Z	35299379	1	BEARING	
K	35365261	1	PIN					
L	36711083	1	GEAR CASE					
M	35295336	1	DOWEL					
N	35299569	4	SCREW					
P	35300177	1	PLATE , CLAMP					
Q	35295344	18	SCREW					
R	35300227	1	SPACER					

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 14 08/01 A



ITEM	CPN	QTY	DESCRIPTION
A	35293869	4	SCREW
B	35610609	1	BEARING
C	35373877	1	PLATE , CLAMP
D	35820646	1	GASKET
E	36754141	1	HOUSING , FRONT BEARING
F	35365279	2	PIN
G	36711109	1	HOUSING , ROTOR
H	35272533	18	SCREW
J	35365279	1	DOWEL
K	35820661	1	GASKET
L	36760890	1	HOUSING , REAR BEARING
M	39101472	18	SCREW
N	35092246	1	ROTOR SET
P	35295336	1	DOWEL
Q	35305325	1	DOWEL
R	35820653	1	GASKET

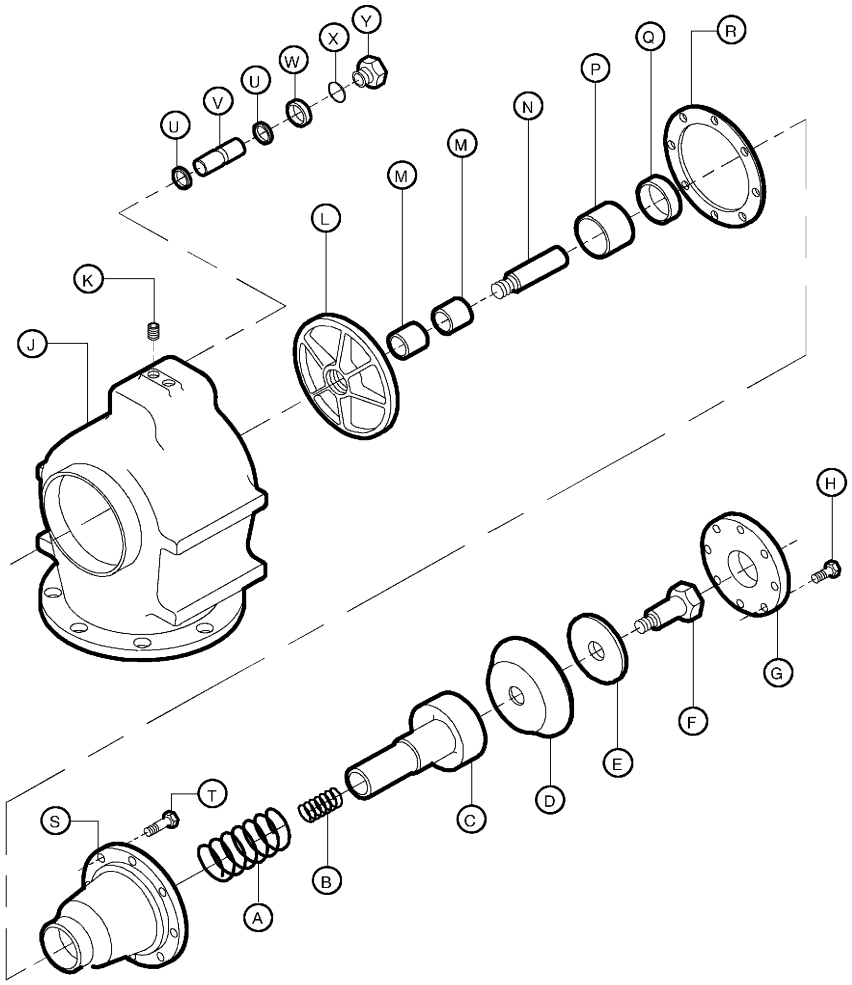
MANUAL NO. — DRAWING NO. DATE / REV:
54757919 15 08/01 A



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	35299510	SET	SHIM				
B	35299403	2	BEARING				
C	35610278	1	PLATE , CLAMP				
D	35299569	4	SCREW				
E	35373141	SET	SHIM				
F	95358446	1	O-RING				
G	35321520	8	SCREW				
H	36504330	1	CAP				
J	95870432	1	O-RING				
K	36504355	1	CAP				
L	35373133	SET	SHIM				
M	35606920	1	PLATE , CLAMP				
N	35299429	2	BEARING				
P	35299528	SET	SHIM				

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 16 08/01 A

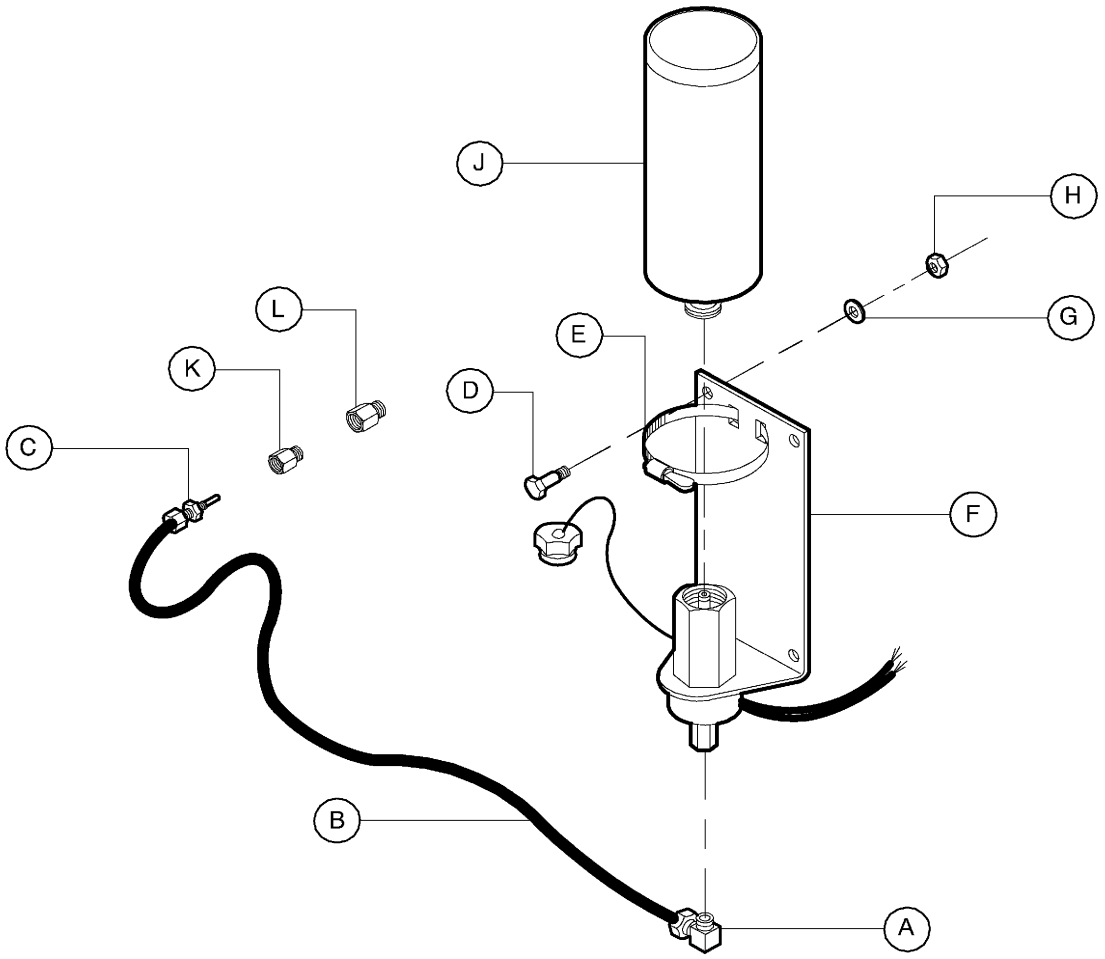
UNLOADER ASSEMBLY



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	35594878	1	SPRING , PISTON	W	35332626	1	SPACER
B	35594910	1	SPRING , VALVE	X	39102355	1	O-RING
C	35594829	1	PISTON	Y	35280528	1	PLUG
D	35594837	1	DIAPHRAGM				
E	35332618	1	WASHER , PISTON				
F	35A2D217	1	SCREW				
G	35594811	1	COVER , PISTON				
H	35374834	8	SCREW				
J	36729416	1	BODY , UNLOADER				
K	34A7SZ4	1	PLUG				
L	35594860	1	VALVE , UNLOADER				
M	35332659	1	BUSHING				
N	35332675	1	STEM , VALVE				
P	35332634	1	BUSHING , HOUSING				
Q	35332642	1	SEAL				
R	35594845	1	GASKET				
S	36729465	1	HOUSING , PISTON				
T	35374842	12	SCREW				
U	35331586	2	GROMMET				
V	35328210	1	VALVE				

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 17 08/01 A

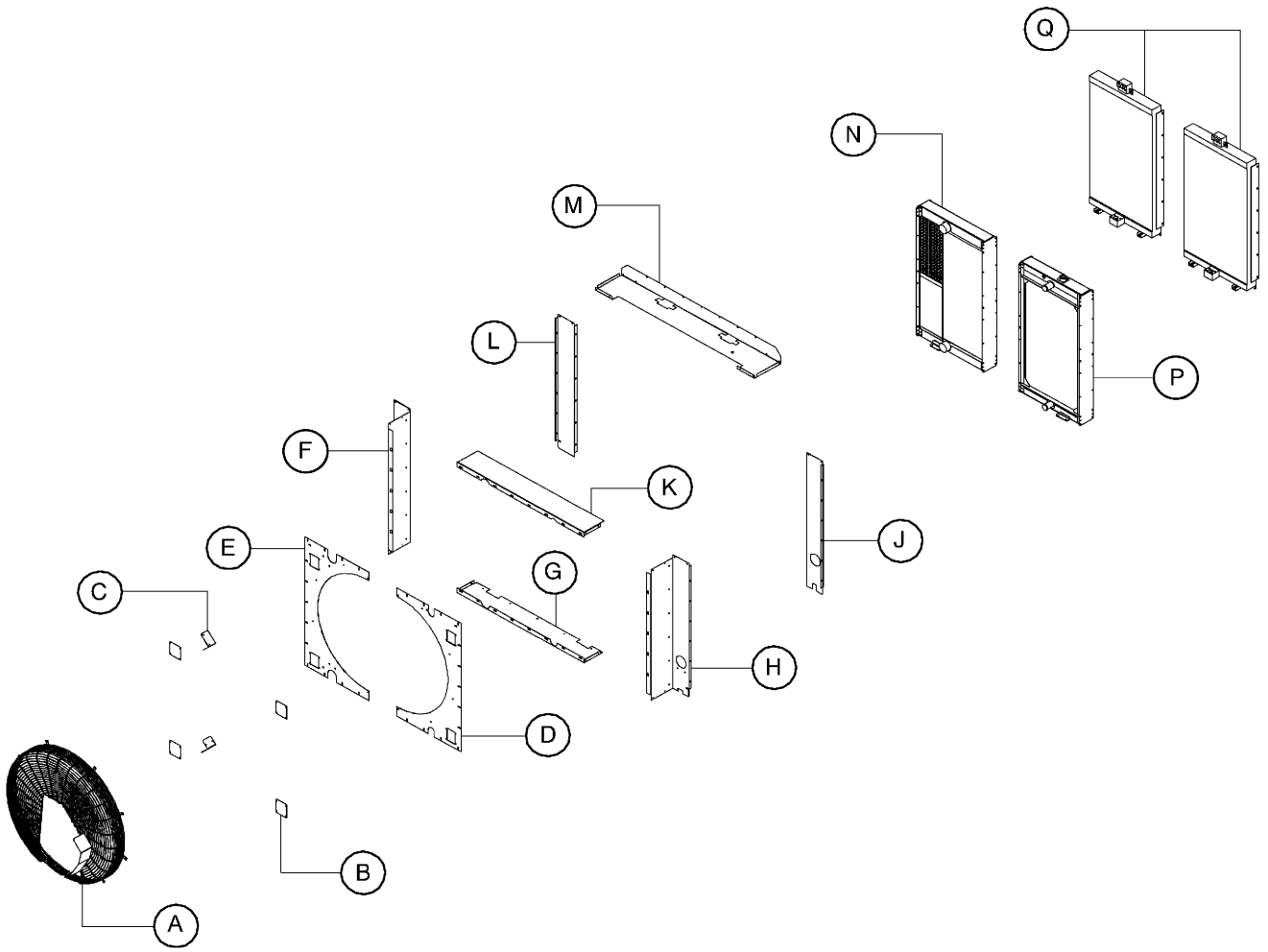
STARTING AID ASSEMBLY



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	35103498	1	ELBOW				
B	35132166	1	TUBING (84 INCHES)				
C	35602812	1	ATOMIZER				
D	35322908	4	SCREW				
E	35103506	1	CLAMP				
F	35357052	1	VALVE AND BRACKET ASSEMBLY				
G	95043196	4	WASHER				
H	92304500	4	NUT				
J	35112911	1	CYLINDER , ETHER				
K	95930301	1	BUSHING				
L	54720719	1	ADAPTER (TO ENGINE CHARGE AIR RETURN)				

MANUAL NO. — DRAWING NO. DATE / REV:
54665302 18 04/01 A

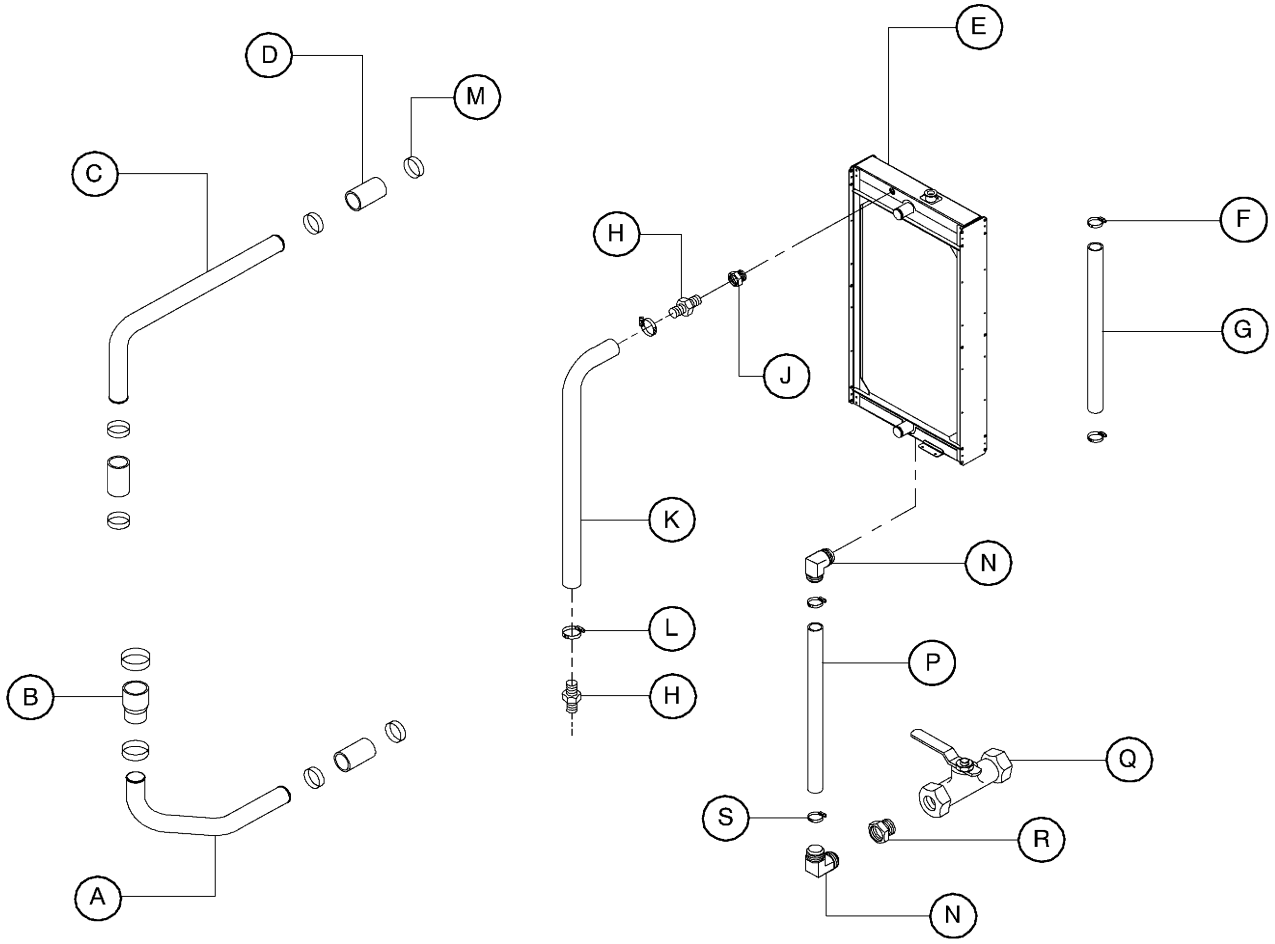
RADIATOR AND OIL COOLER



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	54501085	1	FAN GUARD ASSEMBLY				
B	54661426	4	PLATE , COVER				
C	54661459	2	BRACKET				
D	54507488	1	ORIFICE , L.H. FAN				
E	54507470	1	ORIFICE , R.H. FAN				
F	54507454	1	SUPPORT , R.H. SHROUD				
G	54507447	1	SUPPORT , BOTTOM SHROUD				
H	54507462	1	SUPPORT , L.H. SHROUD				
J	54521422	1	SUPPORT , L.H. REAR SHROUD				
K	54501439	1	SUPPORT , TOP SHROUD				
L	54521430	1	SUPPORT , R.H. REAR SHROUD				
M	54521448	1	SUPPORT , TOP REAR SHROUD				
N	54501846	1	COOLER , A/C FUEL				
P	54501838	1	RADIATOR				
Q	54501853	2	COOLER , OIL				

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 19 08/01 A

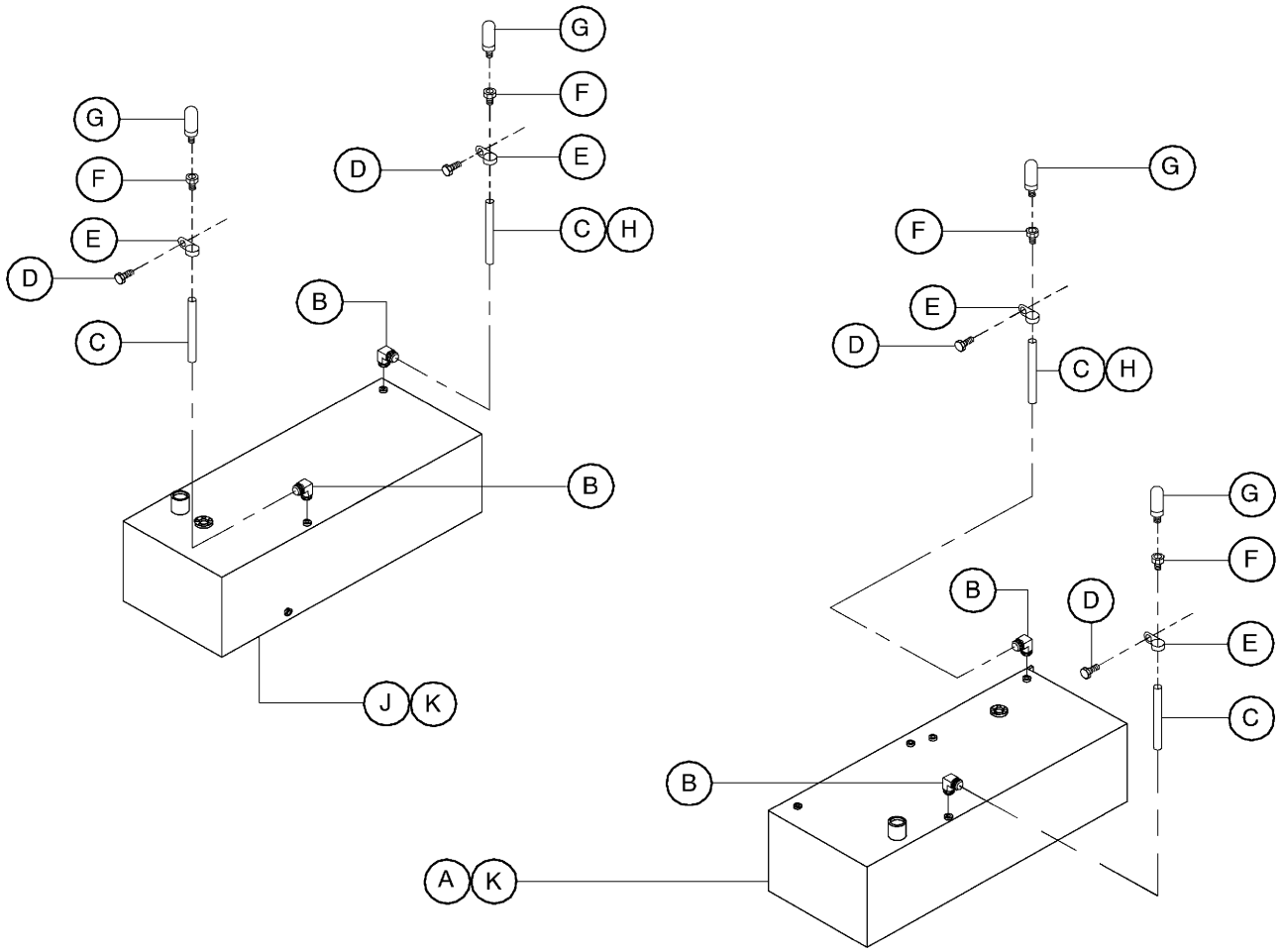
RADIATOR PIPING



ITEM	CPN	QTY	DESCRIPTION
A	54642350	1	TUBE , LOWER RADIATOR
B	36767903	1	HOSE , REDUCER
C	54642343	1	TUBE , UPPER RADIATOR
D	35330570	3	HOSE , CONNECTOR
E	54501838	1	RADIATOR
F	95235131	2	CLAMP
G	35135458	1	HOSE , BY-PASS (55 INCHES)
H	35363662	1	FITTING , BARBED
J	43212216	1	ADAPTER
K	35285600	1	HOSE , VENT (52 INCHES)
L	95264776	2	CLAMP
M	35222017	8	CLAMP
N	35366665	1	ELBOW
P	35326578	1	HOSE , DRAIN (115 INCHES)
Q	35576115	1	VALVE , BALL
R	95953949	1	ADAPTER
S	95220844	2	CLAMP
	54474572	1	SWITCH , LEVEL

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 20 08/01 A

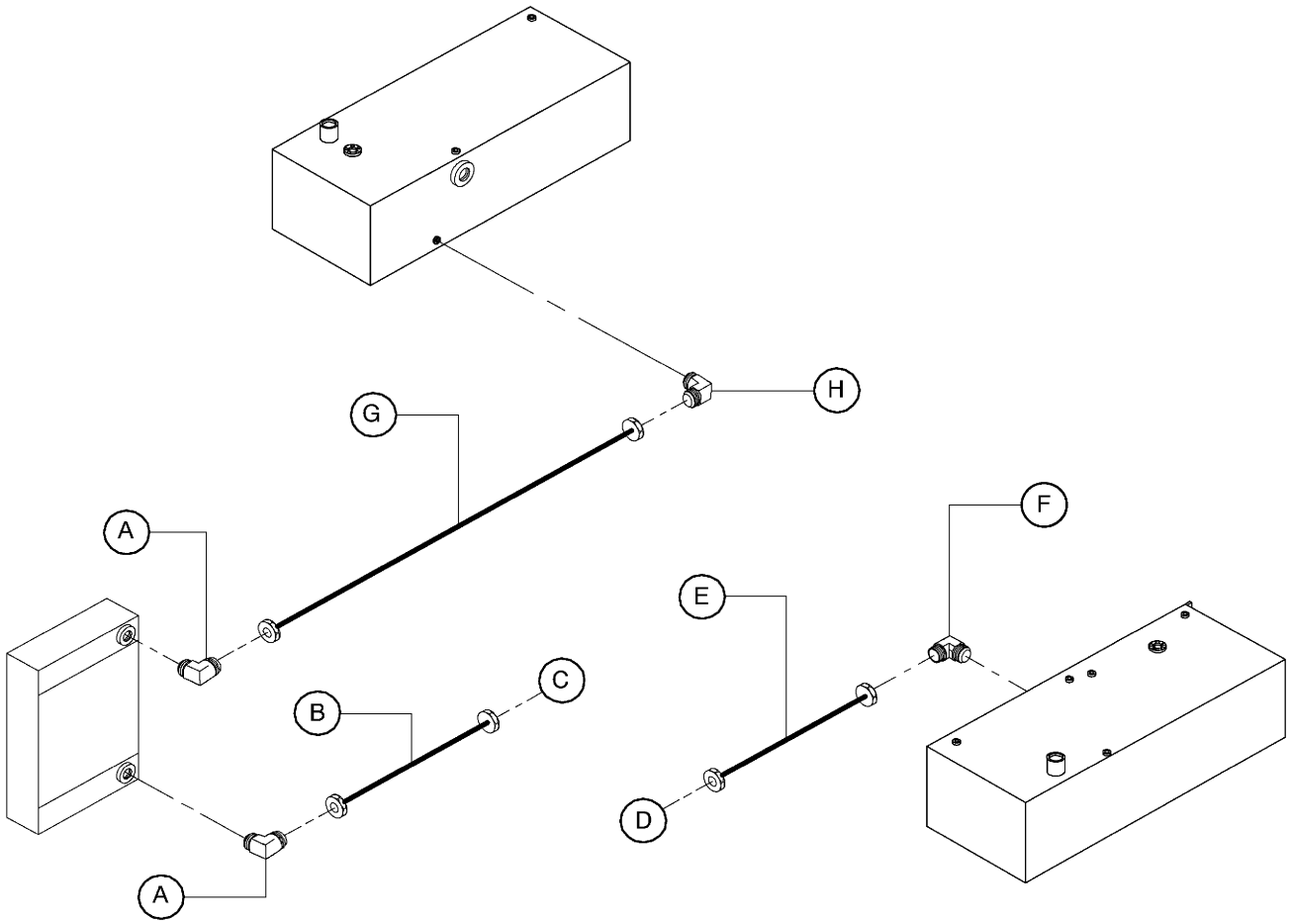
FUEL TANK VENT PIPING



ITEM	CPN	QTY	DESCRIPTION
A	54594098	1	TANK , R.H. FUEL
B	35369354	1	ELBOW
C	35356484	1	TUBING (23 INCHES)
D	92368687	1	SCREW
E	35253038	1	CLAMP
F	35369339	1	REDUCER
G	35322395	1	BREATHER
H	35356484	1	TUBING (40 INCHES HSRG)
J	54594080	1	TANK , L.H. FUEL
K	35279025	12	SCREW

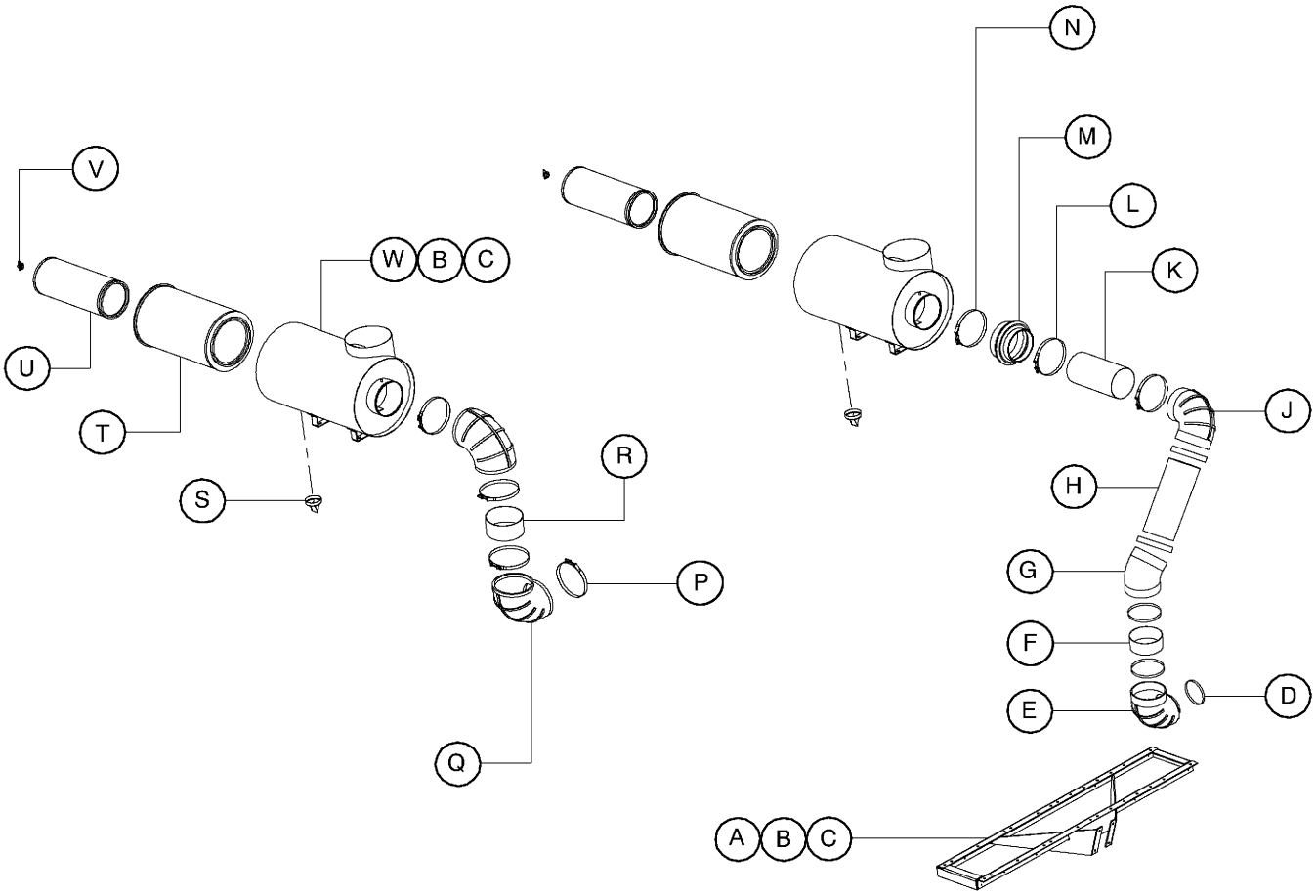
MANUAL NO. — DRAWING NO. DATE / REV:
54757919 21 08/01 A

FUEL PIPING



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	35279081	1	ELBOW				
B	35305499	1	HOSE ASSEMBLY				
C	OUT OF FUEL PUMP ON ENGINE						
D	INTO FUEL PUMP ON ENGINE						
E	35136548	1	HOSE ASSEMBLY (HSRG)				
	35325083	1	HOSE ASSEMBLY (WAGON WHEEL)				
F	35286756	1	ELBOW				
G	22060156	1	HOSE ASSEMBLY (HSRG)				
	22060149	1	HOSE ASSEMBLY (WAGON WHEEL)				
H	35309210	1	ELBOW				
	36845014	1	CAP , FUEL TANK				
	54672811	1	SENDER , FUEL LEVEL				

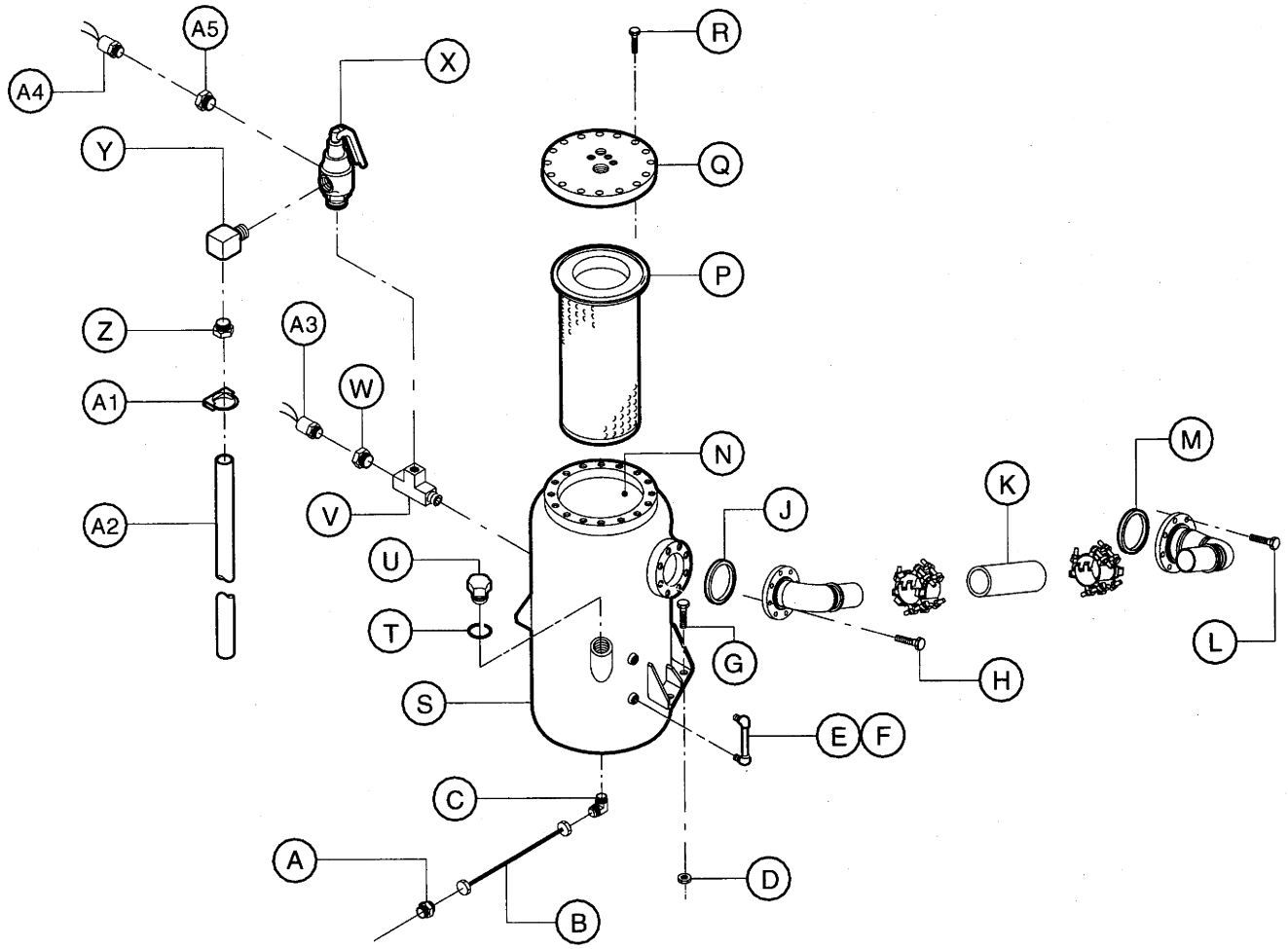
MANUAL NO. — DRAWING NO. DATE / REV:
54757919 22 08/01 A



ITEM	CPN	QTY	DESCRIPTION
A	36879815	1	BRACKET , AIR CLEANER
B	36880995	12	SCREW
C	36879195	12	NUT
D	35161025	1	CLAMP
E	54599956	1	ELBOW , RUBBER
F	35112648	1	TUBE
G	35509074	1	ELBOW , RUBBER
H	35123272	1	TUBE
J	35112630	1	ELBOW , RUBBER
K	35505866	1	TUBE
L	35119858	1	CLAMP
M	35141290	1	HOSE , HUMP
N	35129071	1	CLAMP
P	35129071	4	CLAMP
Q	36862886	2	ELBOW , RUBBER
R	35300110	1	TUBE
S	36867778	2	EVACUATOR
T	36864361	2	ELEMENT , PRIMARY
U	36864379	2	ELEMENT , SAFETY
V	35388982	2	NUT , WING
W	36864346	2	AIR CLEANER ASSEMBLY
	36847838	2	SWITCH , AIR FILTER

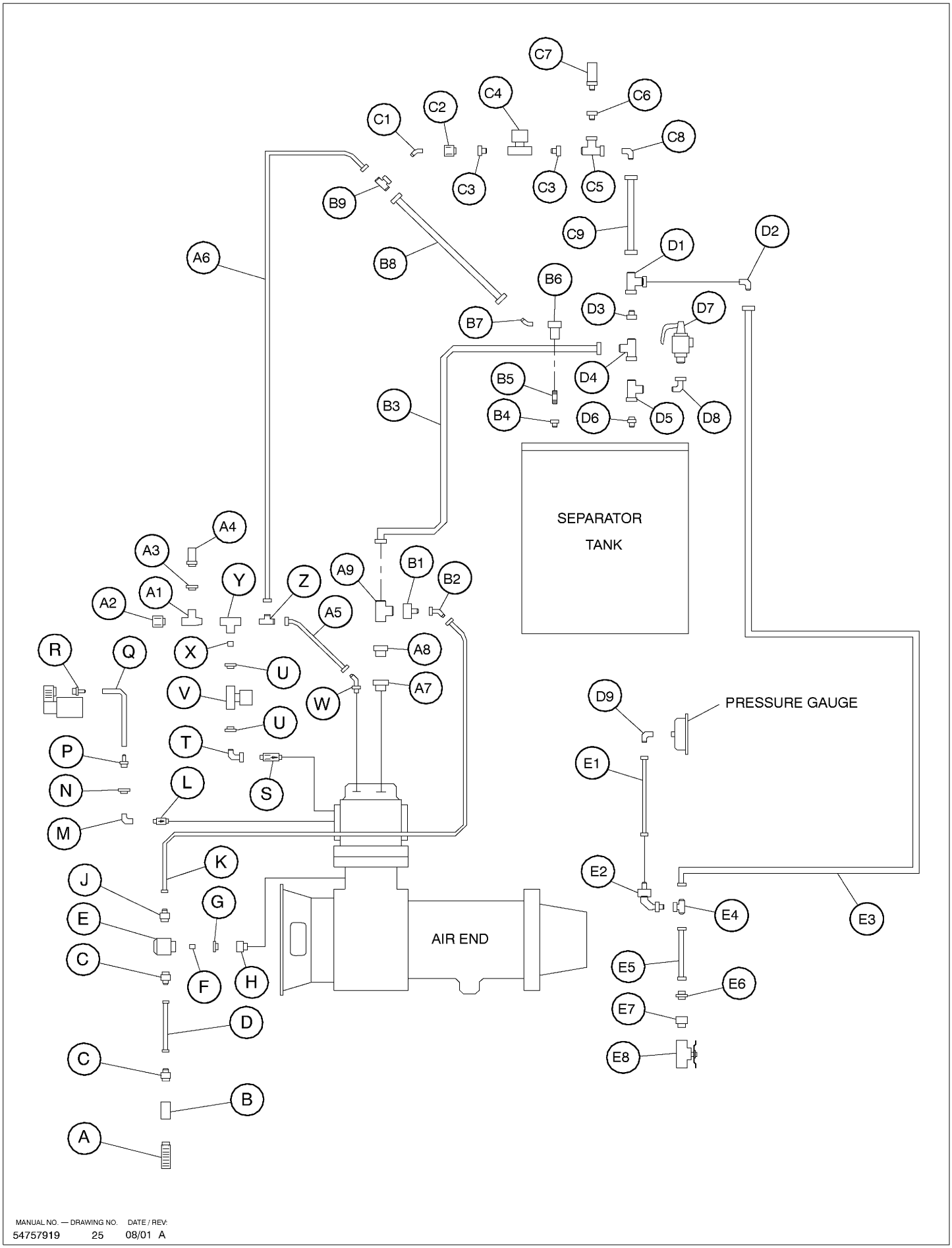
MANUAL NO. — DRAWING NO. DATE / REV:
54757919 23 08/01 A

SEPARATOR TANK ASSEMBLY



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	95219747	1	CONNECTOR	A3	36898922	1	SENSOR , TEMPERATURE
B	36878254	1	HOSE ASSEMBLY	A4	95930301	1	BUSHING
C	35294750	1	ELBOW	A5	36757581	1	SWITCH , PRESSURE
D	36879203	2	NUT				
E	22189831	1	GLASS , SIGHT				
F	54627799	2	ELBOW				
G	36877793	2	SCREW				
H	36765121	8	SCREW				
J	36856656	1	GASKET				
K	54612437	1	DISCHARGE HOSE ASSEMBLY				
L	36765121	8	SCREW				
M	36762961	1	GASKET				
N	36754414	1	LINER , SHELL				
P	36754406	1	ELEMENT , SEPARATOR				
	35610617	1	GASKET				
Q	54612429	1	COVER , TANK				
R	95934170	16	SCREW				
S	54612403	1	TANK , SEPARATOR				
T	35277797	1	O-RING				
U	35802933	1	PLUG , OIL FILL				
V	95954285	1	TEE				
W	95942108	1	ADAPTER				
X	36764371	1	VALVE , SAFETY				
Y	95953311	1	ELBOW				
Z	36764389	1	ADAPTER				
A1	35192178	1	CLAMP				
A2	54744149	1	PIPE , SAFETY VALVE				

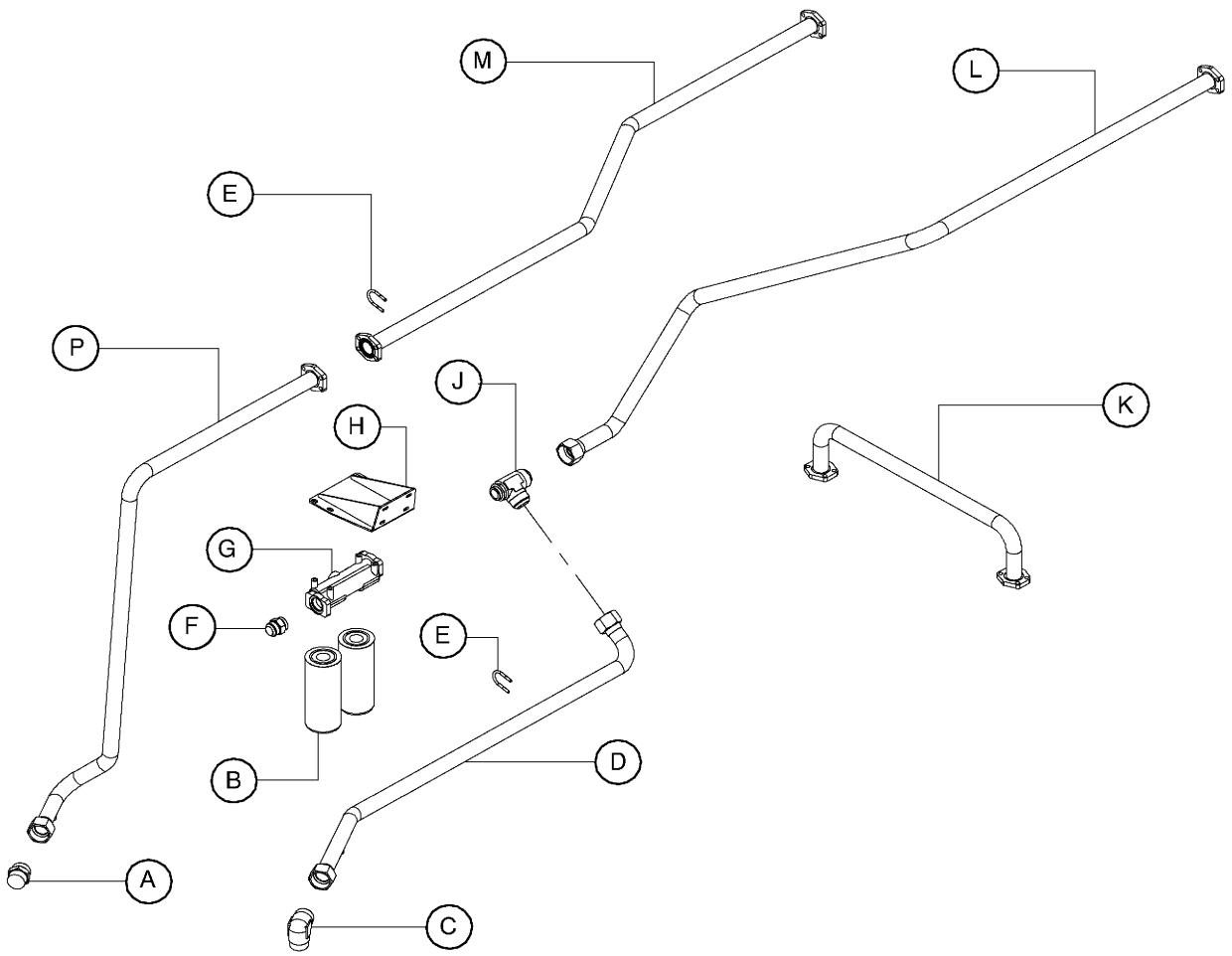
AIR PIPING



MANUAL NO. — DRAWING NO. DATE / REV:
54757919 25 08/01 A

AIR PIPING

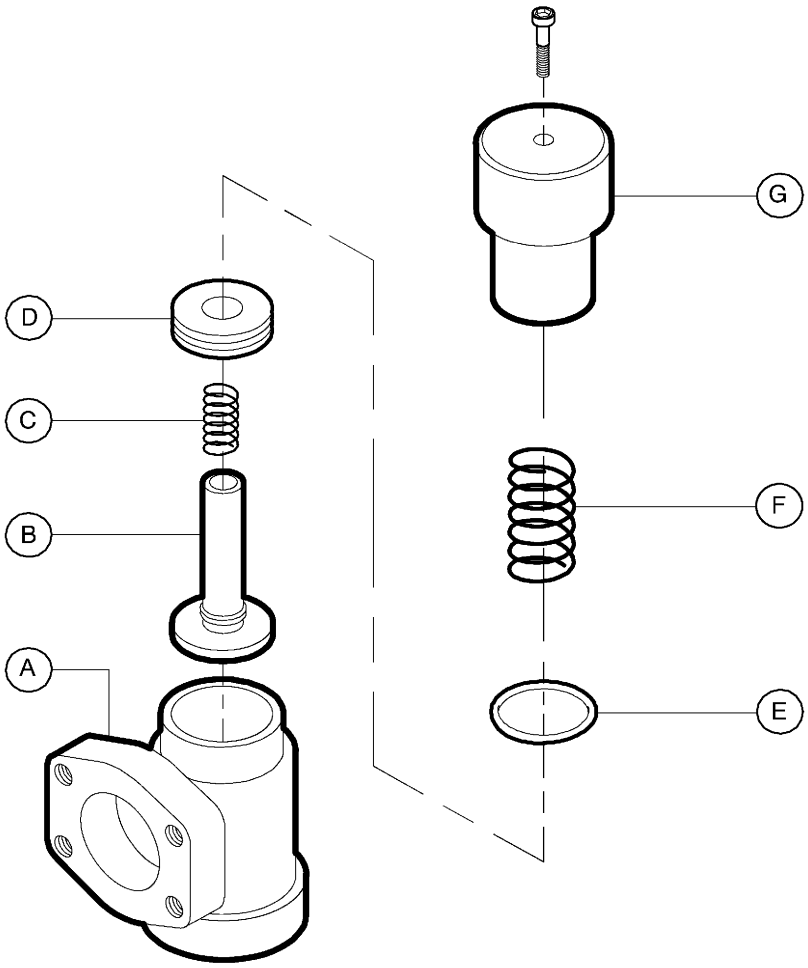
A	35132299	SILENCER
B	95989554	COUPLING
C	35290147	CONNECTOR
D	35282987	HOSE ASSEMBLY
E	35335017	VALVE , BLOWDOWN
F	95944575	NIPPLE
G	95944633	BUSHING
H	35279116	ADAPTER
J	35283126	CONNECTOR
K	35298512	HOSE ASSEMBLY
L	35248145	VALVE , CHECK
M	95954095	ELBOW
N	95930301	BUSHING
P	95287629	ADAPTER
Q	35283241	HOSE ASSEMBLY
R	95287629	ADAPTER
S	36840460	VALVE , CHECK
T	35294453	ELBOW
U	95940748	BUSHING
V	36840841	VALVE , SOLENOID
W	35279835	ELBOW
X	95944575	NIPPLE
Y	95954194	TEE
Z	35283050	TEE
A1	95944690	TEE
A2	35322346	ORIFICE , .156
A3	95930301	BUSHING
A4	36920825	TRANSDUCER , PRESSURE
A5	36841815	TUBE ASSEMBLY
A6	35284538	HOSE ASSEMBLY
A7	35280510	ADAPTER
A8	95944617	BUSHING
A9	35330117	TEE
B1	35365774	REDUCER
B2	35287911	ELBOW
B3	35323807	HOSE ASSEMBLY
B4	95944625	BUSHING
B5	95944575	NIPPLE
B6	36854495	REGULATOR
B7	35290253	ELBOW
B8	35282953	HOSE ASSEMBLY
B9	35283092	TEE
C1	35290253	ELBOW
C2	35123124	ORIFICE
C3	95940748	BUSHING
C4	36840841	VALVE , SOLENOID
C5	95944690	TEE
C6	95930301	BUSHING
C7	54496773	TRANSDUCER , PRESSURE
C8	35290253	ELBOW
C9	35282961	HOSE ASSEMBLY
D1	35283050	TEE
D2	35324839	VALVE , BALL
D3	95944633	REDUCER
D4	95954210	TEE
D5	35330117	TEE
D6	36863702	ADAPTER
D7	22061394	VALVE , SAFETY
D8	35301506	ELBOW
D9	35280098	ELBOW
E1	35282979	HOSE ASSEMBLY
E2	36852499	ELBOW
E3	35310994	HOSE ASSEMBLY
E4	35283092	TEE
E5	35282961	HOSE ASSEMBLY
E6	35336139	FITTING , BULKHEAD
E7	35367846	CONNECTOR



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	35335124	1	CONNECTOR				
B	36897346	1	ELEMENT , FILTER				
C	95286910	1	ELBOW				
D	54625348	1	TUBE ASSEMBLY				
E	36506756	1	CLAMP				
F	35296409	1	CONNECTOR				
G	39871306	1	HEAD , FILTER				
H	54625173	1	BRACKET , FILTER				
J	36756906	1	TEE				
K	54628185	1	TUBE ASSEMBLY				
L	54625363	1	TUBE ASSEMBLY				
M	54628177	1	TUBE ASSEMBLY				
N	54625355	1	TUBE ASSEMBLY				

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 27 08/01 A

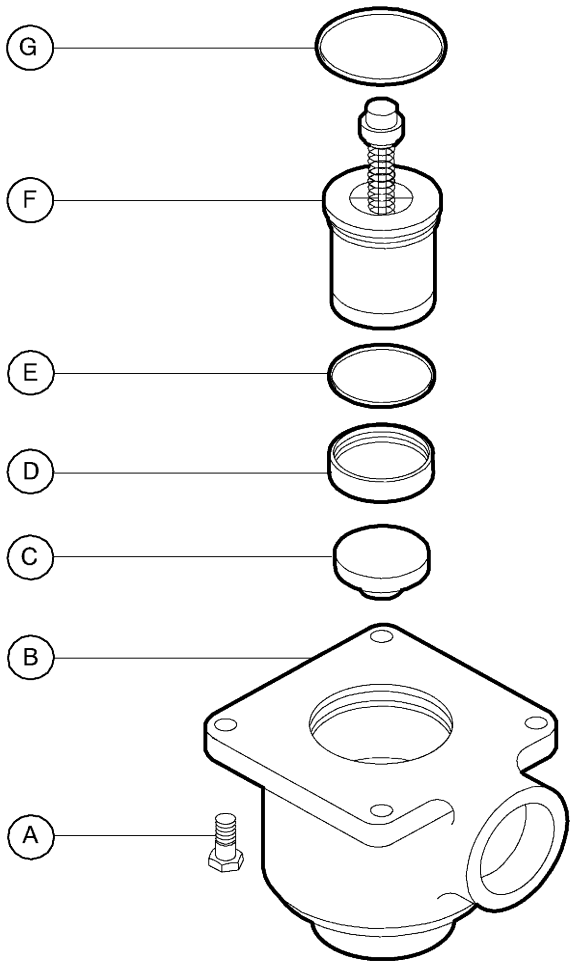
MINIMUM PRESSURE CHECK VALVE ASSEMBLY



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	54699731	1	BODY , CHECK VALVE				
B	36792380	1	CHECK VALVE ASSEMBLY				
C	54699749	1	SPRING , CHECK VALVE				
D	36792927	1	PISTON				
E	54699756	1	O-RING				
F	36794790	1	SPRING , MAIN				
G	36794808	1	CAP				

MINIMUM PRESSURE CHECK VALVE ASSEMBLY 54642152

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 28 08/01 A

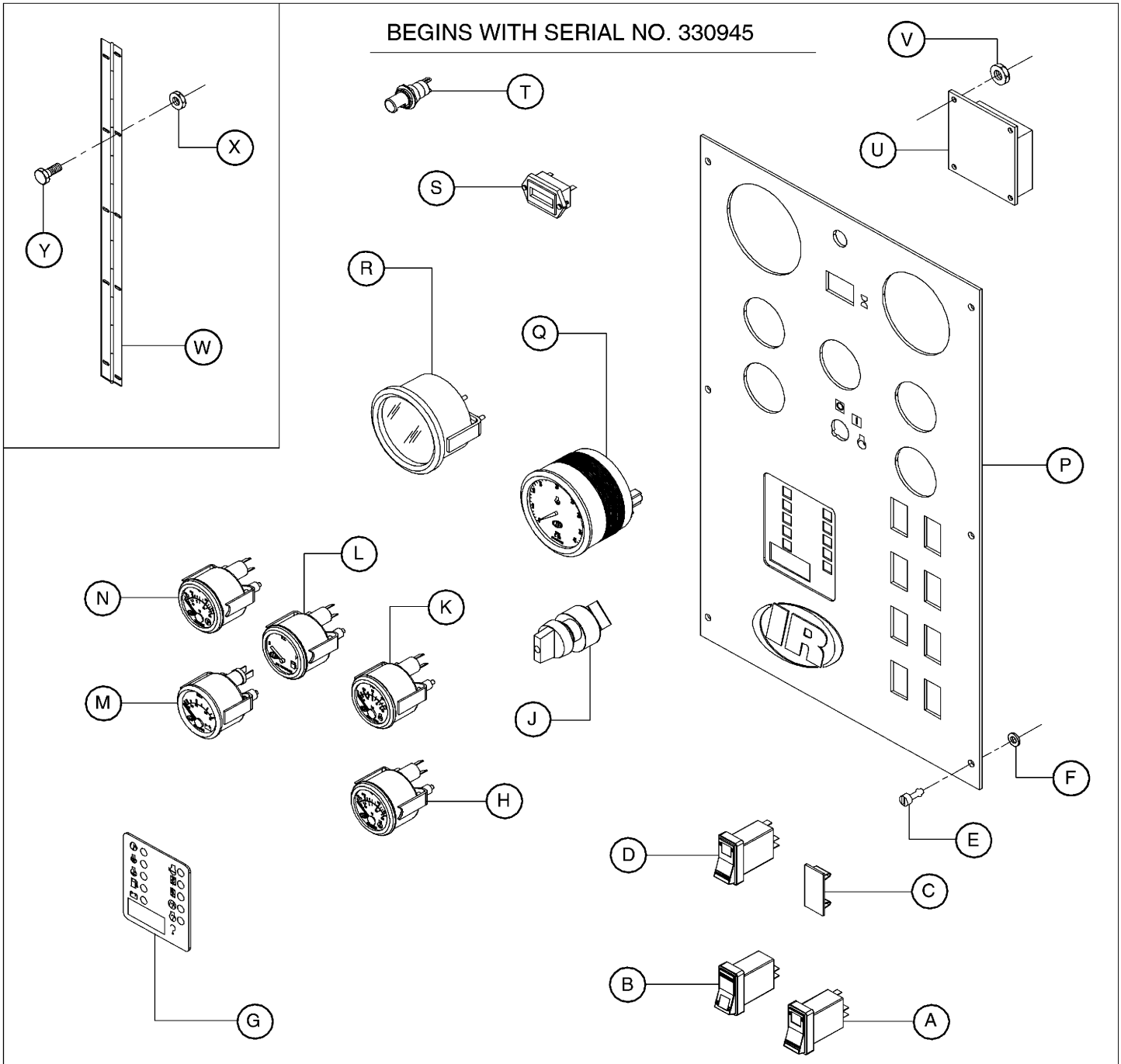


ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	95920674	4	SCREW				
B	35307537	1	BODY , VALVE				
C	35307545	1	SEAT , VALVE				
D	35307552	1	SLEEVE , VALVE				
E	35307560	1	SEAL , VALVE				
F	35307578	1	ELEMENT , VALVE				
G	35307586	1	GASKET , VALVE				

35825595 - OIL TEMPERATURE BY-PASS VALVE ASSEMBLY

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 29 08/01 A

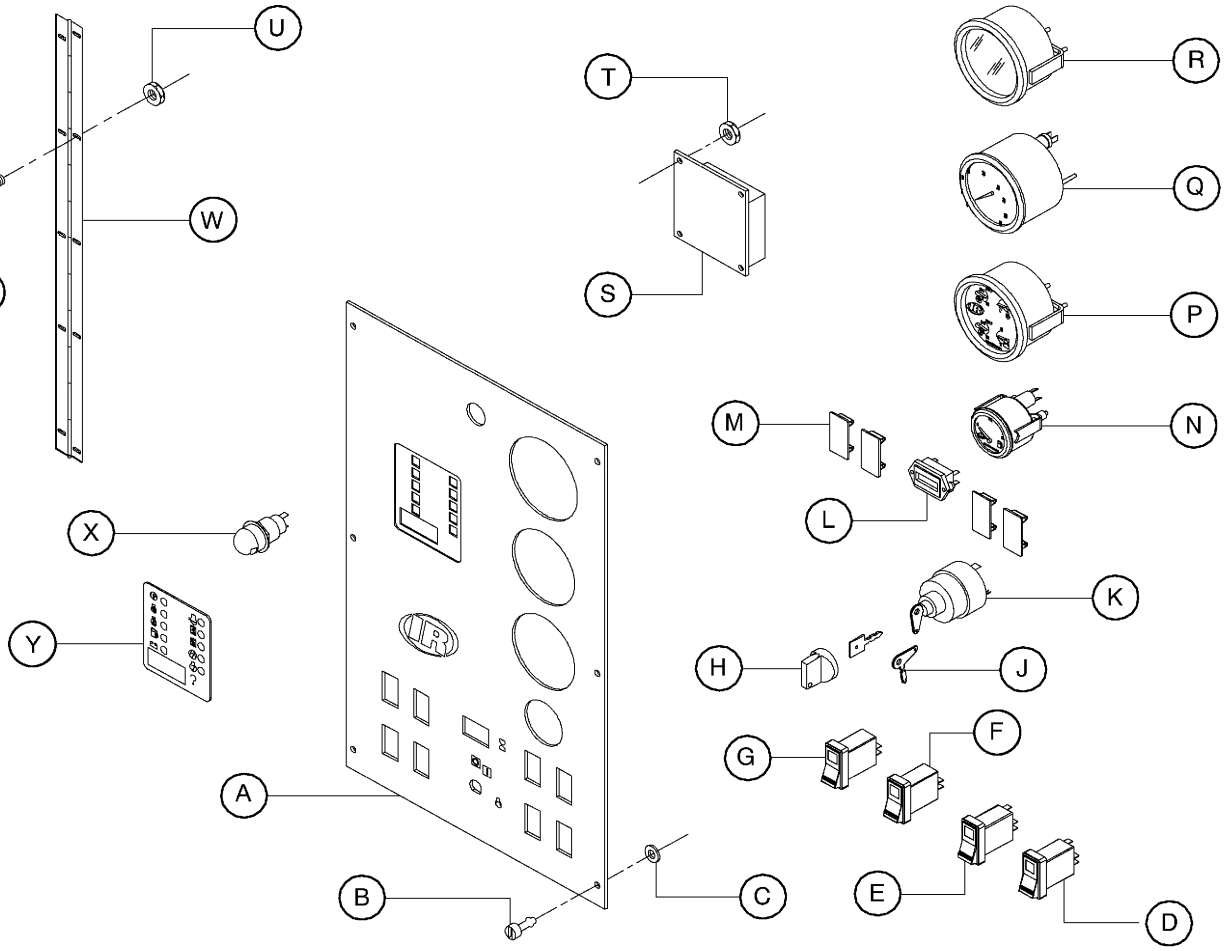
INSTRUMENT PANEL ASSEMBLY



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	22053896	1	SWITCH , LAMPS	M	36841153	1	GAGE , VOLTAGE
B	22054050	1	SWITCH , HEATER	N	22105613	1	GAGE , AIR DISCHARGE
C	22054142	5	PLUG , SWITCH	P	22105571	1	PANEL , INSTRUMENT
D	22054076	1	SWITCH , AFTER WARM-UP	Q	22055883	1	TACHOMETER
E	36844124	3	SCREW , QUARTER TURN	R	22105639	1	GAGE , 300 PSI PRESSURE
F	35369180	3	RETAINER	S	54766704	1	HOURMETER
G	22055800	1	OVERLAY , MODULE	T	36852622	1	LIGHT , PANEL
H	36870590	1	GAGE , OIL PRESSURE		22113880	1	BULB , LIGHT
J	22127385	1	SWITCH ASSEMBLY	U	54688411	1	MODULE , WEDGE
	22127377	1	SWITCH , START	V	95928800	4	NUT
	22134118	1	KNOB ASSEMBLY	W	36840908	1	HINGE
K	22105621	1	GAGE , WATER TEMPERATURE	X	35144492	3	NUT
L	22050991	1	GAGE , FUEL LEVEL	Y	35365386	3	SCREW
					22137426	7	BULB , GAGE LIGHT

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 30A 7/02 A

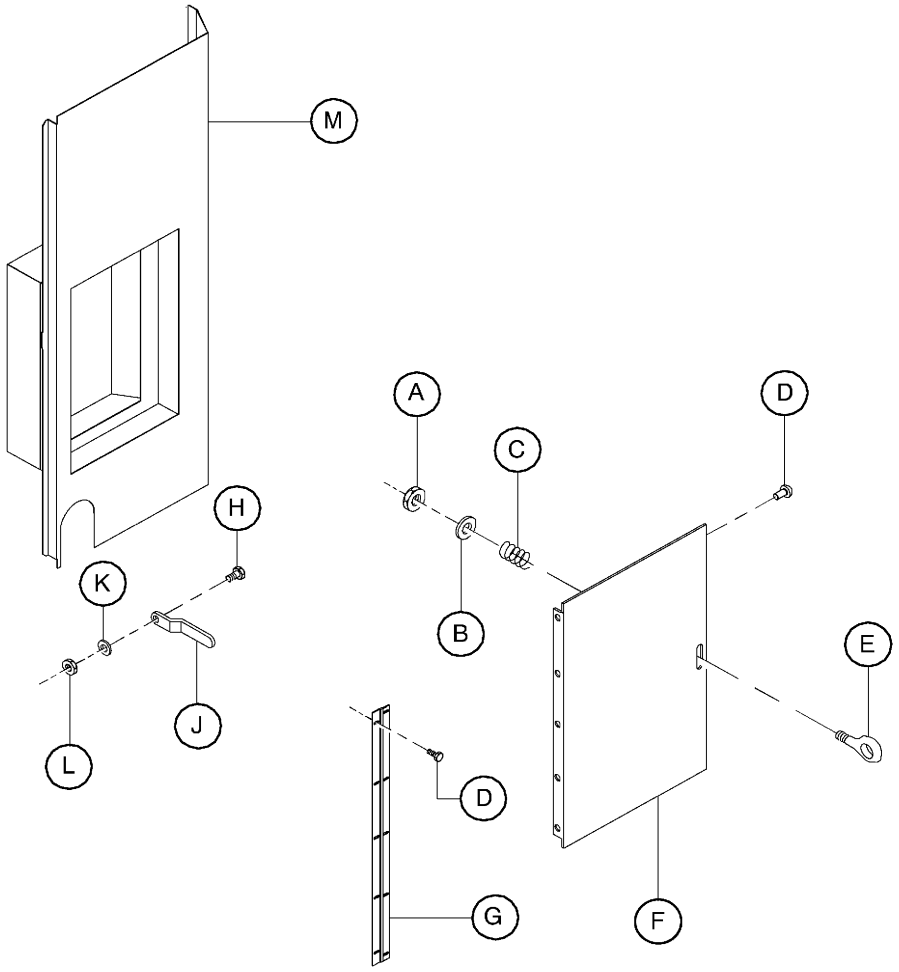
INSTRUMENT PANEL ASSEMBLY



ITEM	CPN	QTY	DESCRIPTION
A	54755590	1	PANEL , INSTRUMENT
B	36844124	3	SCREW , QUARTER TURN
C	35369180	3	RETAINER
D	22053896	1	SWITCH , LAMPS
E	22054050	1	SWITCH , HEATER
F	22054076	1	SWITCH , AFTER WARM-UP
G	22054068	1	SWITCH , ETHER
H	54774104	1	COVER , KEY
J	22054167	1	KEY , SWITCH
K	92086719	1	SWITCH , START
L	54766704	1	METER , HOUR
M	22054142	4	PLUG , SWITCH
N	22050991	1	GAUGE , FUEL LEVEL
P	22056394	1	GAUGE , 4 IN 1
Q	36861177	1	TACHOMETER
R	36840767	1	GAUGE , PRESSURE
S	54688411	1	MODULE , WEDGE
T	95928800	4	NUT
U	35144492	3	NUT
V	35365386	3	SCREW
W	36840908	1	HINGE
X	36841252	1	LIGHT , PANEL
Y	22055800	1	OVERLAY , MODULE

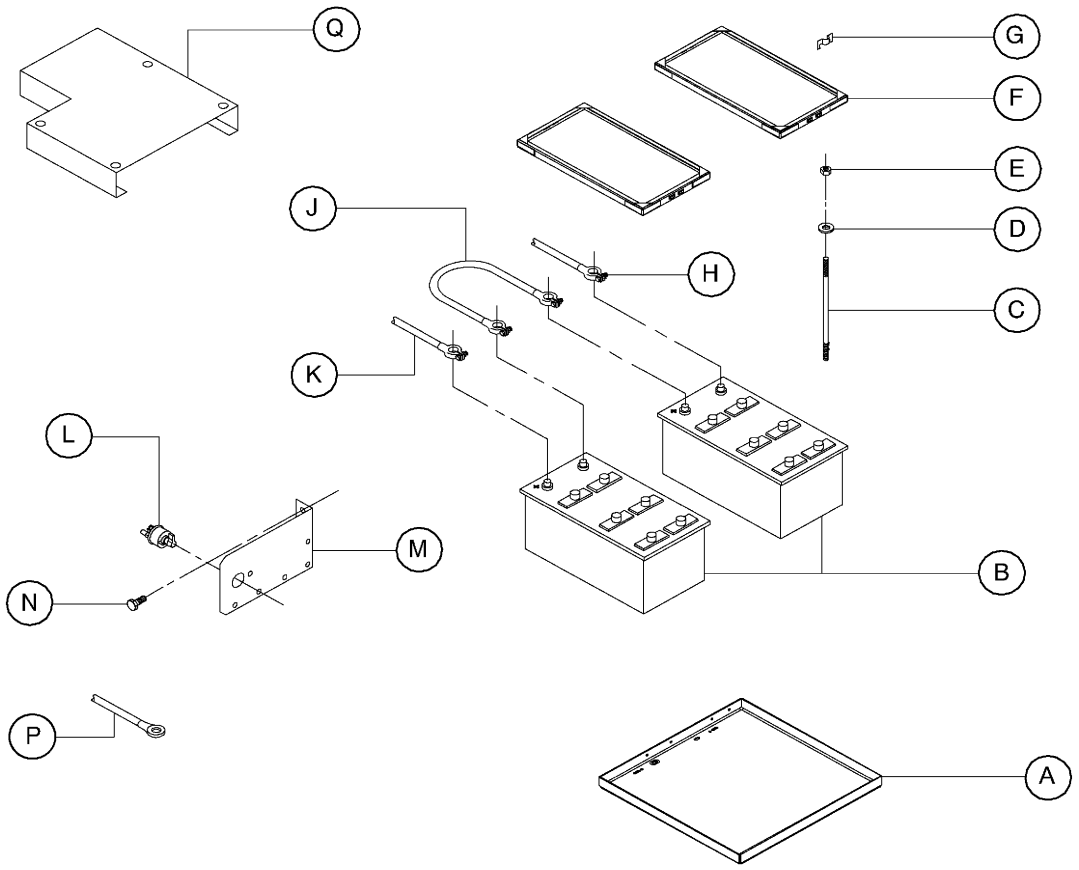
MANUAL NO. — DRAWING NO. DATE / REV:
54757919 30 08/01 A

INSTRUMENT PANEL ASSEMBLY



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	95923314	1	NUT				
B	95934998	1	WASHER				
C	35327311	1	SPRING				
D	92368687	7	SCREW				
E	35327303	1	EYEBOLT				
F	36738565	1	DOOR , INSTRUMENT PANEL				
G	36740405	1	HINGE				
H	35357995	1	STUD				
J	35603349	1	HOLDER , DOOR				
K	95935037	1	WASHER				
L	35273366	1	NUT				
M	54576939	1	PANEL , VERTICAL				

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 31 08/01 A

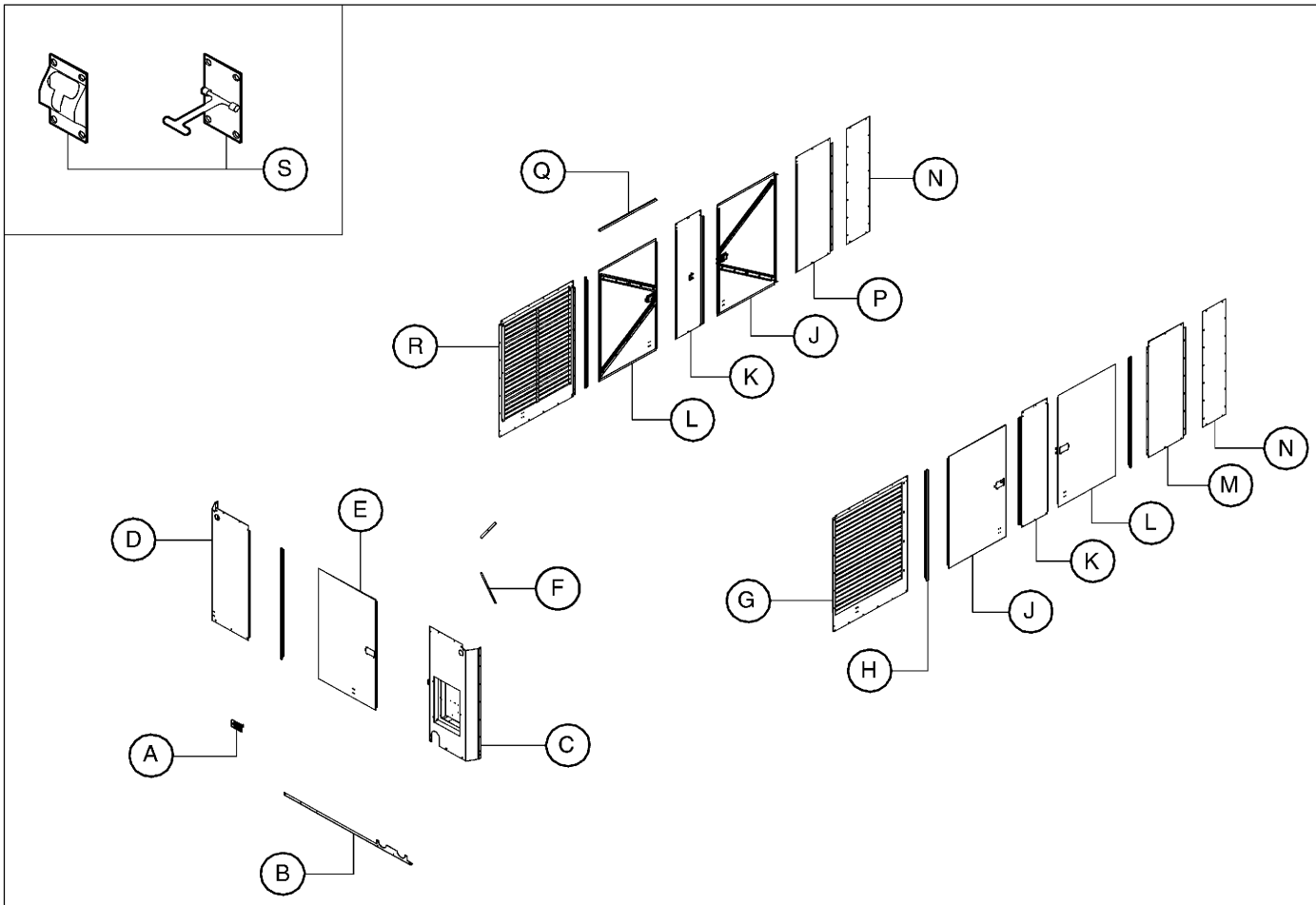


ITEM	CPN	QTY	DESCRIPTION
A	36870350	1	TRAY , BATTERY
B	35225788	2	BATTERY
C	54715479	4	STUD
D	95935037	8	WASHER
E	95923322	8	NUT
F	35562156	2	FRAME
G	35108216	4	CLIP
H	54765367	1	CABLE , NEGATIVE
J	35128982	1	CABLE , JUMPER
K	54765375	1	CABLE , POSITIVE
L	36896975	1	SWITCH , MASTER CUT-OFF
M	54737400	1	BRACKET , SWITCH
N	35279025	2	SCREW
P	54765383	1	CABLE , MASTER SWITCH
Q	54706825	1	COVER , BATTERY
	35578194	1	GROUND STRAP FROM STARTER
	35293075	1	GROUND STRAP TO RH OF ENGINE

ITEM	CPN	QTY	DESCRIPTION

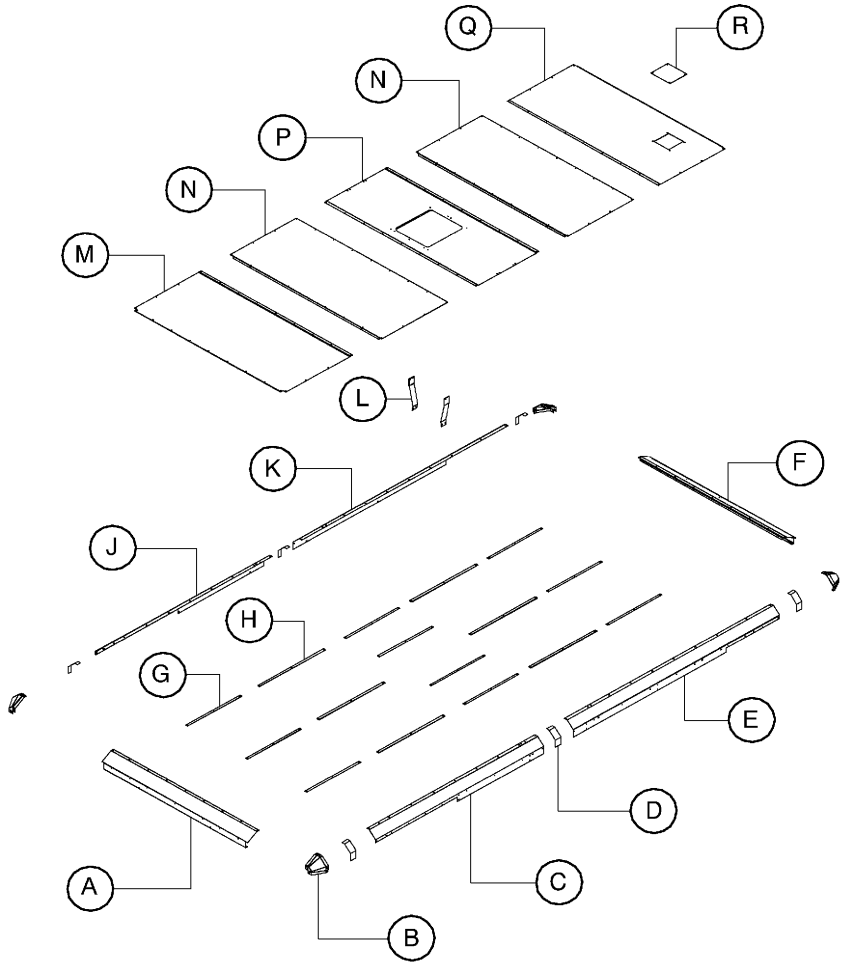
MANUAL NO. — DRAWING NO. DATE / REV:
54757919 32 08/01 A

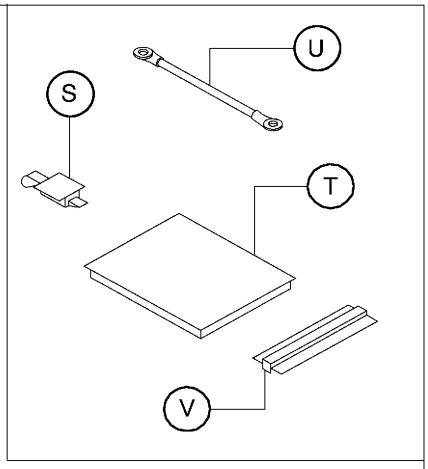
COMMON ENCLOSURE ASSEMBLY



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	36793602	5	LATCH , DOOR SLAM				
B	54576871	1	BRACE , FRONT PANEL				
C	54576939	1	PANEL , L.H. FRONT				
	54744479	1	PANEL , L.H. FRONT (IQ UNITS)				
D	54576947	1	PANEL , R.H. FRONT				
	22055750	1	PANEL , R.H. FRONT (IQ UNITS)				
E	36863363	1	DOOR , FRONT				
F	54718184	2	BRACE , FRONT				
G	54587944	1	GRILLE , L.H. FRONT SIDE				
H	36863413	5	HINGE				
J	36863660	1	DOOR , SIDE				
K	54587969	1	PANEL , CENTER				
L	36863652	1	DOOR , SIDE				
M	54587977	1	PANEL , L.H. REAR SIDE				
N	54663240	1	PANEL , REAR SIDE				
P	54587985	1	PANEL , R.H. REAR SIDE				
Q	36863371	5	ANGLE , DOOR DRIP				
R	54587951	1	GRILLE , R.H. FRONT SIDE				
S	36849925	5	LATCH , DOOR				

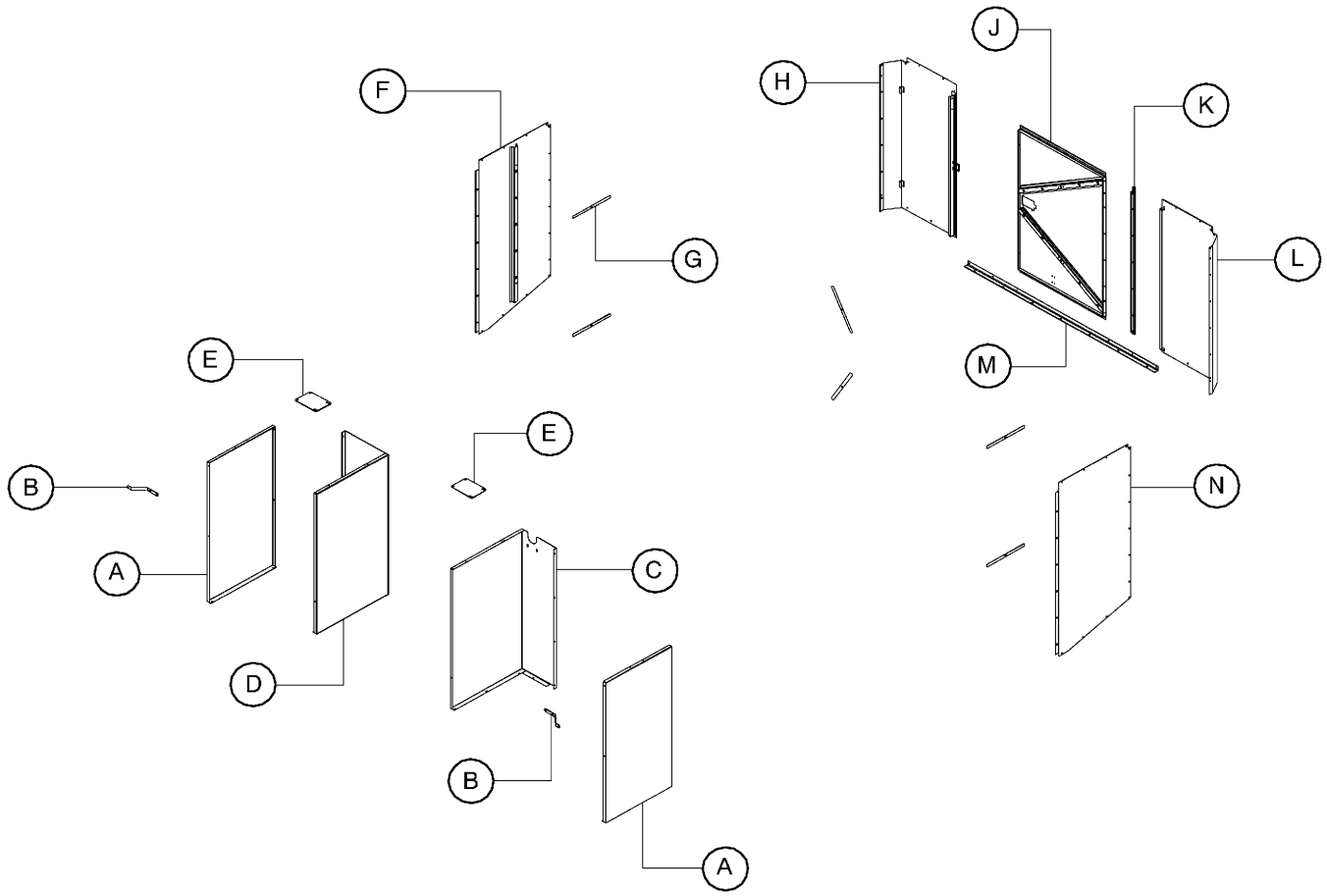
TOP ENCLOSURE ASSEMBLY





ITEM	CPN	QTY	DESCRIPTION
A	54576970	1	CAP , FRONT END
B	36755981	4	CAP , CORNER
C	54690110	1	CAP , L.H. FRONT SIDE
D	36755742	6	BRACKET , FILLER
E	54690128	1	CAP , L.H. REAR SIDE
F	54584784	1	CAP , REAR END
G	54747316	8	BRACE , TOP FOAM
H	54747324	8	BRACE , TOP FOAM
J	54663224	1	CAP , R.H. FRONT TOP
K	54663232	1	CAP , R.H. REAR TOP
L	54700091	2	BRACE , CENTER ROOF
M	54599915	1	PANEL , FRONT TOP
N	54599923	1	PANEL , 2ND AND 4TH TOP
P	54599931	1	PANEL , CENTER TOP
Q	54599949	1	PANEL , REAR TOP
R	54690136	1	PLATE , RADIATOR FILL
S	35131051	1	LATCH , DOOR
T	36864403	1	DOOR , ROOF
U	36864304	1	CABLE
V	36864288	1	HINGE , DOOR

MANUAL NO. — DRAWING NO.		DATE / REV:
54757919	34	08/01 A

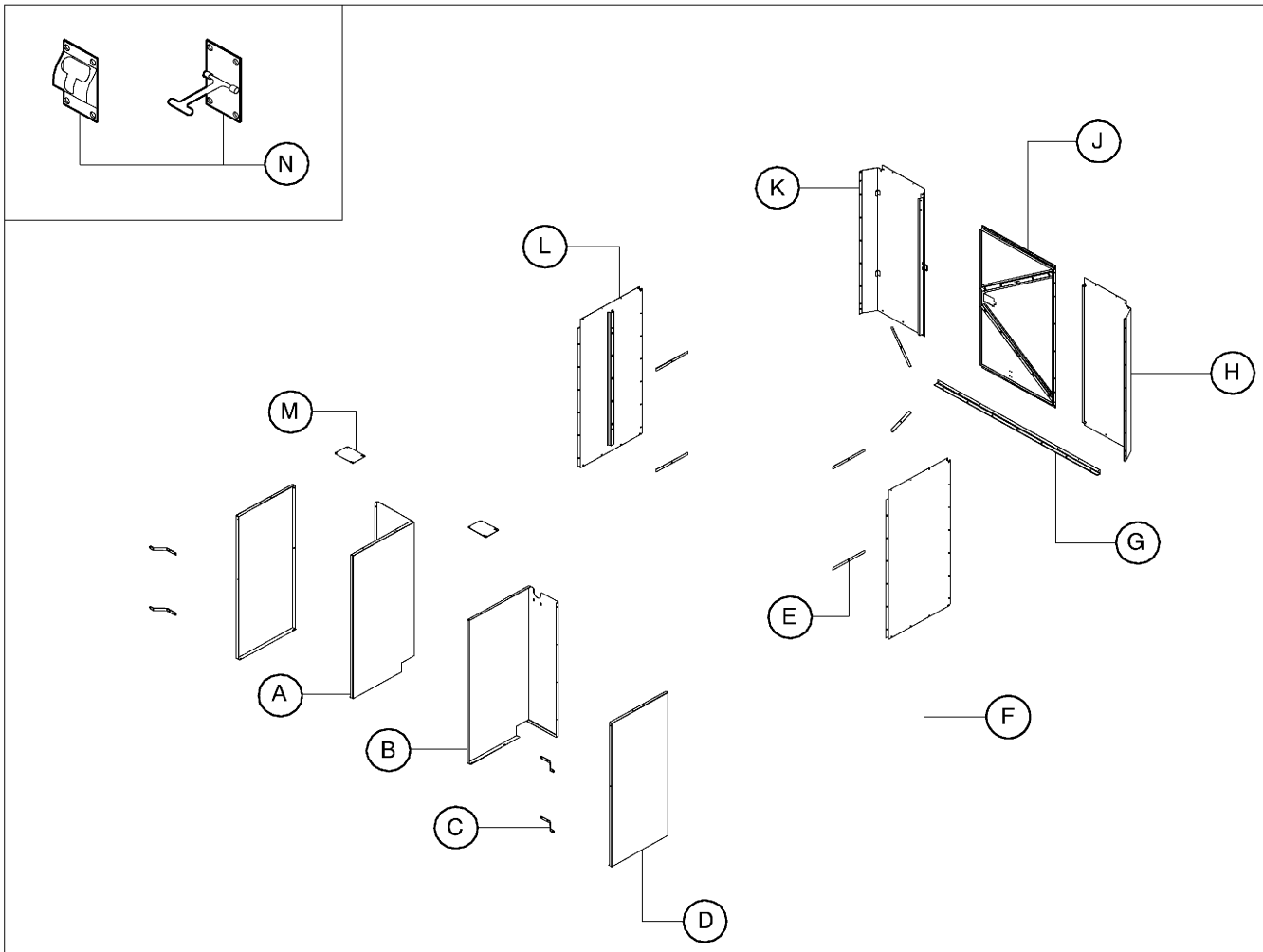


ITEM	CPN	QTY	DESCRIPTION
A	54640982	1	BAFFLE , L.H. OUTSIDE
B	54641022	1	STRIP , SUPPORT
C	54640966	1	BAFFLE , L.H. INSIDE
D	54640974	1	BAFFLE , R.H. INSIDE
E	54641006	1	PLATE , TIE
F	54672761	1	PANEL , R.H. REAR
G	54718184	6	STRIP , FOAM RETENTION
H	54663299	1	PANEL , R.H. REAR CORNER
J	54672779	1	DOOR , REAR
	36793602	1	LATCH , DOOR SLAM
K	54692744	1	HINGE
L	54663281	1	PANEL , L.H. REAR CORNER
M	54576921	1	STRIP , PANEL SUPPORT
N	54672753	1	PANEL , L.H. REAR SIDE

NOTE: ALL OTHER ENCLOSURE PARTS ARE SHOWN ON COMMON ENCLOSURE DRAWING.

MANUAL NO. 54757919 DRAWING NO. 35 DATE / REV: 08/01 A

WAGON WHEEL ENCLOSURE

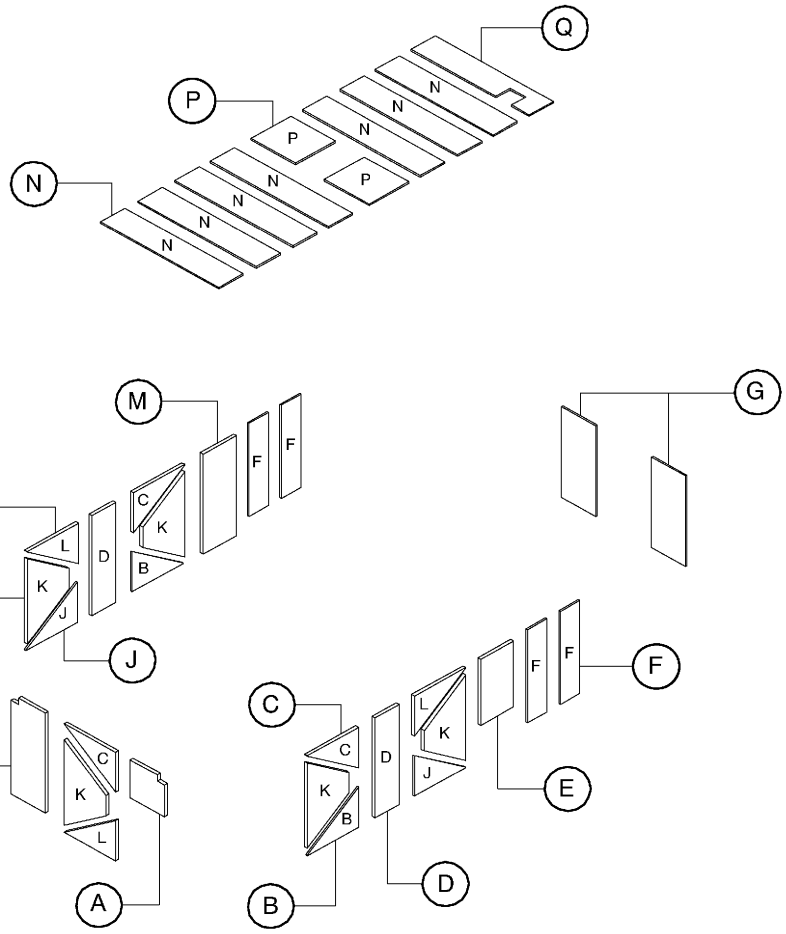


ITEM	CPN	QTY	DESCRIPTION
A	54688239	1	BAFFLE , R.H.
B	54688221	1	BAFFLE , L.H.
C	54641022	4	SUPPORT , BAFFLE
D	54688247	2	BAFFLE , OUTSIDE
E	54718184	6	STRAP , FOAM
F	54663265	1	PANEL , L.H. REAR SIDE
G	54576921	1	ANGLE , REAR MOUNTING
H	54576954	1	PANEL , L.H. REAR
J	36863363	1	DOOR , REAR
	36793602	1	LATCH , SLAM
	36863413	1	HINGE
K	54576962	1	PANEL , R.H. REAR
L	54663273	1	PANEL , R.H. SIDE
M	54641006	2	PLATE , TIE
N	36849925	1	HOLDER , DOOR

NOTE: ALL OTHER ENCLOSURE PARTS ARE SHOWN ON COMMON ENCLOSURE DRAWING.

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 36 08/01 A

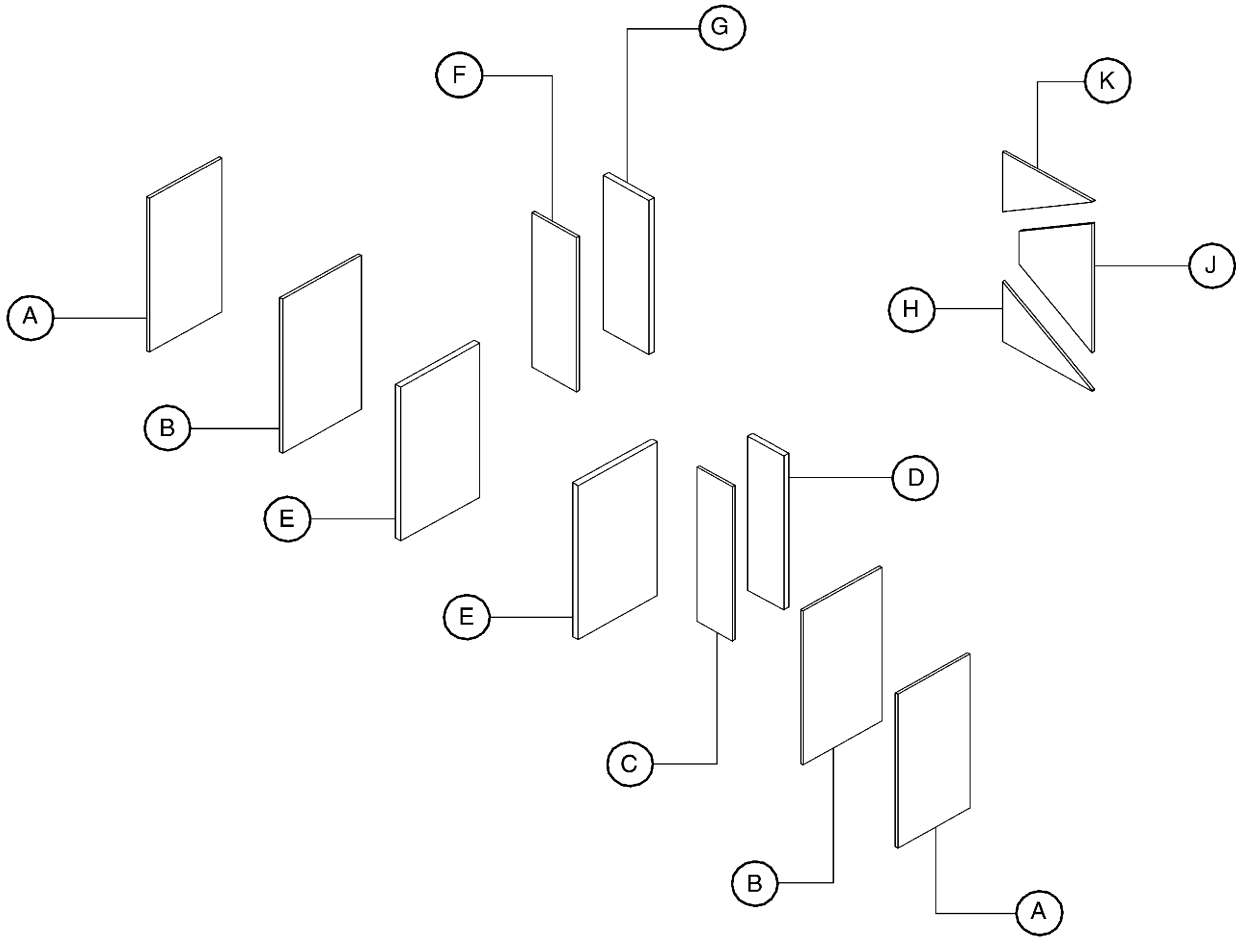
COMMON FOAM



ITEM	CPN	QTY	DESCRIPTION
A	54721204	1	FOAM , L.H. FRONT TOP
B	54719703	2	FOAM , DOOR
C	54719711	3	FOAM , DOOR
D	54719646	2	FOAM , CENTER PANEL
E	54719695	1	FOAM , L.H. SIDE
F	54759519	4	FOAM , R.H. / L.H. REAR SIDE
G	54759527	2	FOAM , REAR
H	54721675	1	FOAM , R.H. FRONT
J	54720065	2	FOAM , DOOR
K	54719661	5	FOAM , CENTER DOOR
L	54720057	3	FOAM , DOOR
M	54719653	1	FOAM , R.H. REAR SIDE
N	54699046	7	FOAM , TOP
P	54699087	2	FOAM , CENTER TOP
Q	54710041	1	FOAM , REAR TOP

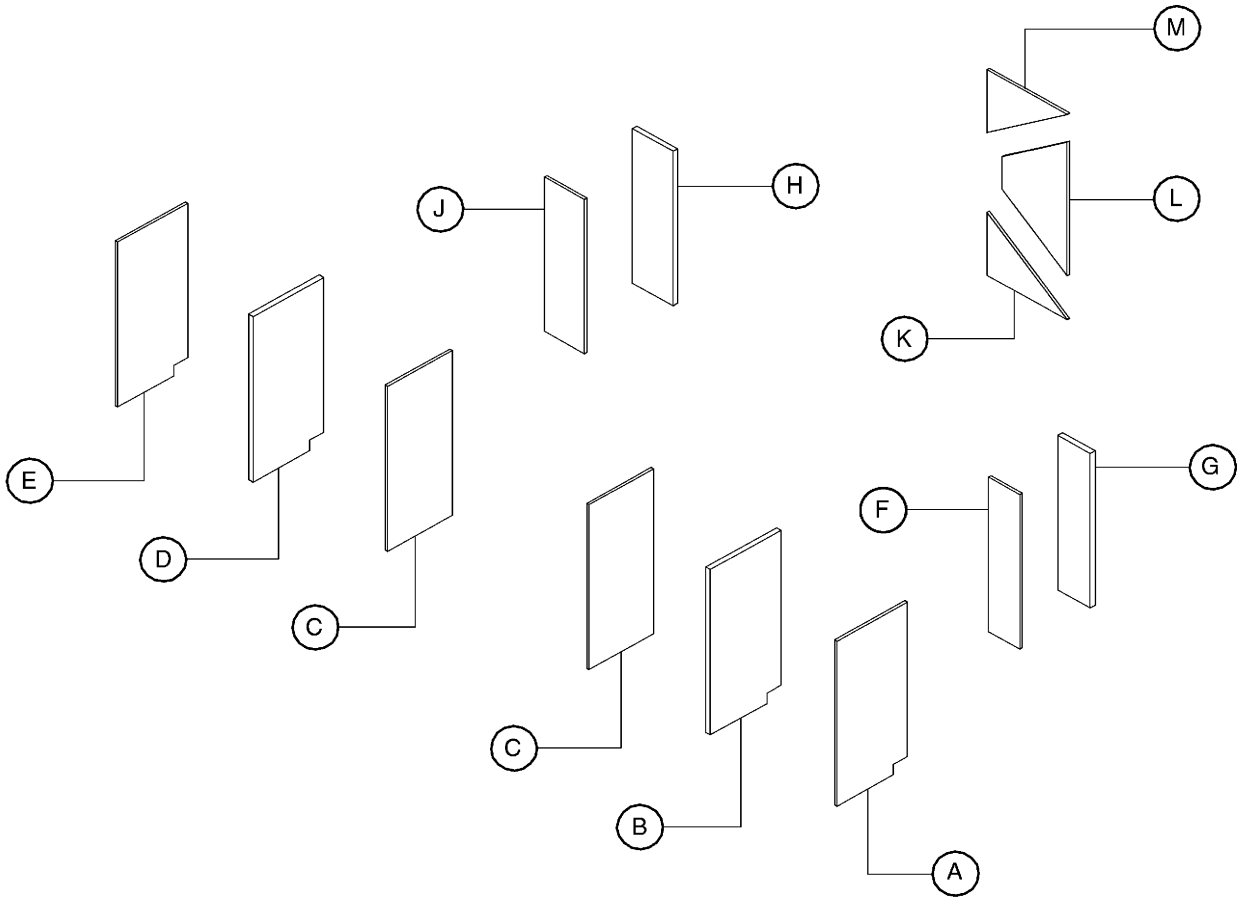
MANUAL NO. — DRAWING NO. DATE / REV:
54757919 37 08/01 A

HIGH SPEED RUNNING GEAR FOAM



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	54675848	1	FOAM , SPLITTER BAFFLE				
B	54675830	1	FOAM , SPLITTER BAFFLE				
C	54675822	1	FOAM , L.H. BAFFLE				
D	54675806	1	FOAM , L.H. BAFFLE				
E	54675814	1	FOAM , L.H.				
F	54685334	1	FOAM , R.H.				
G	54685326	1	FOAM , R.H.				
H	54759550	1	FOAM , BOTTOM DOOR				
J	54759543	1	FOAM , CENTER DOOR				
K	54759535	1	FOAM , TOP DOOR				
	54737606	1	FOAM , L.H. BAFFLE (IQ UNITS)				
	54737598	1	FOAM , L.H. BAFFLE (IQ UNITS)				

WAGON WHEEL FOAM



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	54691134	1	FOAM , L.H. SPLITTER BAFFLE				
B	54691175	1	FOAM , L.H. SPLITTER BAFFLE				
C	54691118	1	FOAM , SPLITTER BAFFLE				
D	54691191	1	FOAM , R.H. SPLITTER BAFFLE				
E	54691159	1	FOAM , R.H. SPLITTER BAFFLE				
F	54691126	1	FOAM , L.H. BAFFLE				
G	54691167	1	FOAM , L.H. BAFFLE				
H	54691183	1	FOAM , R.H. BAFFLE				
J	54691142	1	FOAM , R.H. BAFFLE				
K	54670459	1	FOAM , BOTTOM DOOR				
L	54760442	1	FOAM , MIDDLE DOOR				
M	54760434	1	FOAM , TOP DOOR				
	54737606	1	FOAM , L.H. BAFFLE (IQ UNITS)				
	54737598	1	FOAM , L.H. BAFFLE (IQ UNITS)				

VIKING ELECTRICAL COMPONENTS

PART NO.	QTY	DESCRIPTION
54757224	1	IQ WIRING HARNESS
54474572	1	COOLANT LEVEL SWITCH
36896975	1	BATTERY DISCONNECT SWITCH
36920825	1	0-100 PSI PRESSURE TRANSDUCER
✳54765946	1	0-500 PSI PRESSURE TRANSDUCER
36892362	1	24V SEALED RELAY
36785319	1	MAG SPEED SENSOR
36898922	2	THERMISTOR TEMPERATURE PROBE
✳36842300	1	START / RUN SOLENOID
✳36842318	1	COMPRESSOR SOLENOID
✳✳36840841	2	SOLENOID VALVE
36847838	2	AIR FILTER SWITCH
36870608	1	ENGINE OIL PRESSURE SENDER
36841138	2	ENG. & COMP. TEMP SENDER
✳✳36757581	1	COMP. OIL PRESSURE SWITCH
36850691	1	START-UP COMPRESSOR
✳✳54496773	1	0-225 PSI PRESS. TRANSDUCER
36792083	2	FUSE 20 AMP BLADE
22071591	2	FUSE 10 AMP BLADE
35376169	4	DIODE

PART NO.	QTY	DESCRIPTION
35577873	1	AUXILARY START RELAY
54720701	1	ENG. TEMP. SENDER ADAPTOR
36841526	1	CONTROL ORIFICE HEATER
✳✳36864677	1	REGULATOR HEATER
54765367	1	NEGATIVE BATTERY CABLE
54765375	1	POSITIVE BATTERY CABLE
54765383	1	POSITIVE JUMPER BATTERY CABLE
35128982	1	BATTERY JUMPER
35578194	1	FRAME GROUND STRAP
35293075	1	ENGINE GROUND STRAP
54672803	1	FUEL LEVEL SENDER (WAGON WHEEL)
54672811	1	FUEL LEVEL SENDER (HIGH SPEED)
54688411	1	WEDGE CONTROLLER
54654918	1	W1 CHASSIS HARNESS
✳54765953	1	ADDRESS PLUG
✳✳54765649	1	ADDRESS PLUG
✳36841526	1	REGULATOR-HEATER
22060594	1	CONTROL PANEL HARNESS

IQ OPTION

PART NO.	QTY	DESCRIPTION
54757224	1	IQ WIRING HARNESS
54775887	1	IQ HEATER HARNESS
36841526	5	IQ ORIFICE HEATERS
36898310	1	ACTUATOR
36898922	1	THERMISTOR TEMP. PROBE
36892362	1	24V SEALED RELAY
36920643	1	TCU
36899599	1	IQ FILTER SWITCH - 20 PSI
36899615	1	IQ FILTER SWITCH - 25 PSI

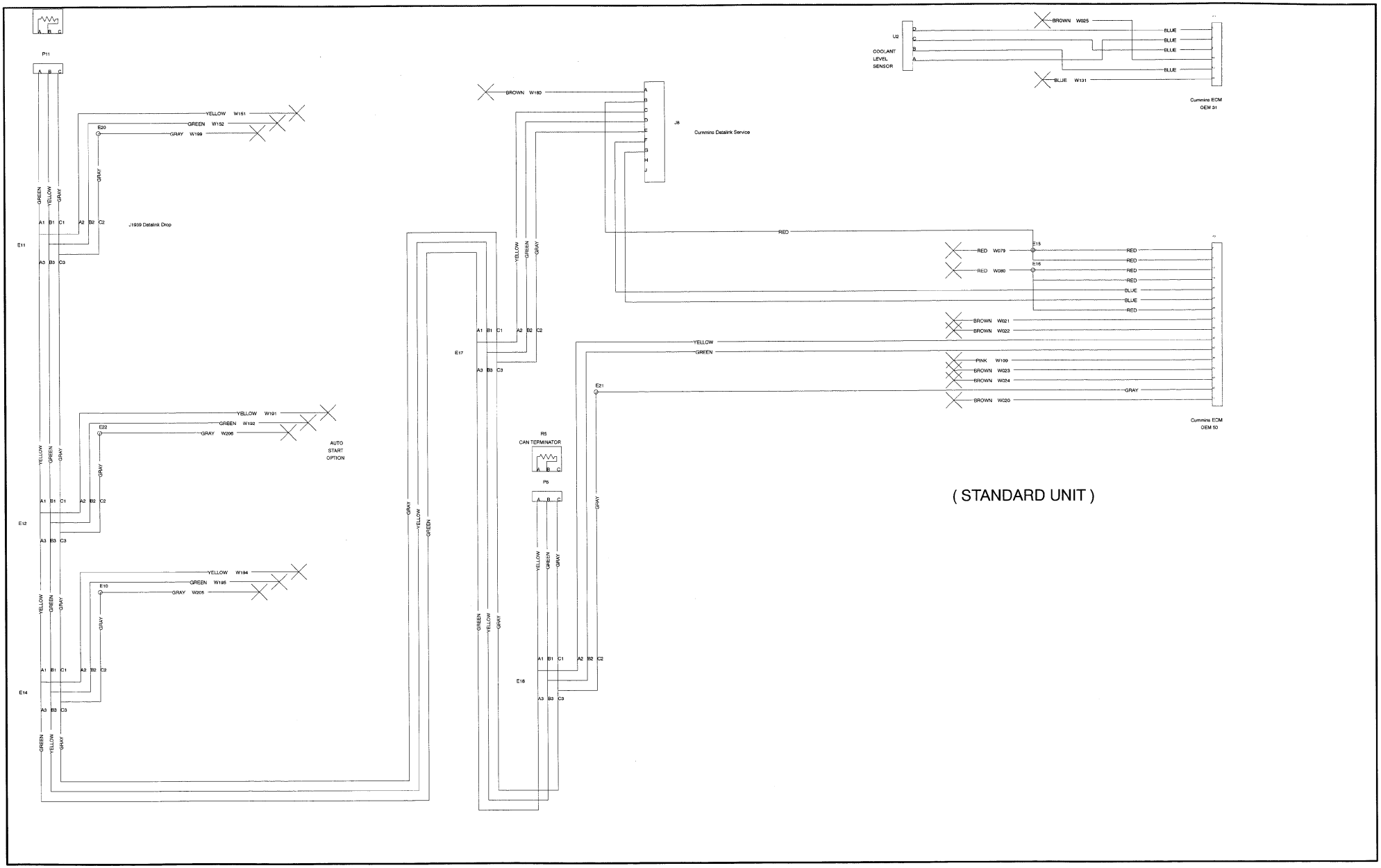
✳ DENOTES XHP MACHINES ONLY

✳✳ DENOTES HP MACHINES ONLY

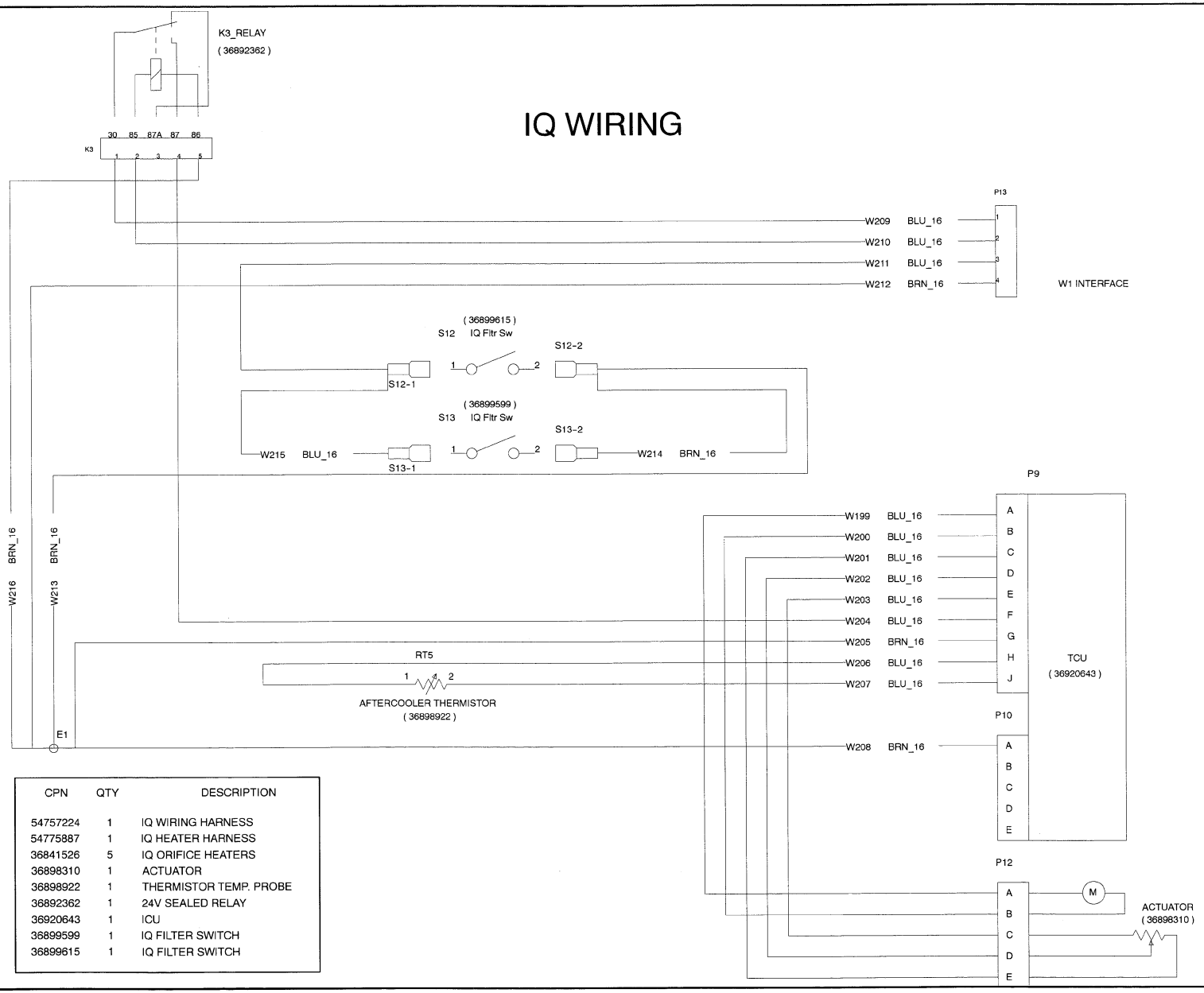
AC HEATER KIT

PART NO.	QTY	DESCRIPTION
36851533	1	BRACKET , PRESSURE SWITCH
36880995	2	SCREW (ATTACH BRACKET)
36879195	2	NUT (ATTACH BRACKET)
54464607	1	AC POWERED COLD START ASSY.
54464664	1	HARNESS , PRESSURE SWITCH
54480298	1	WELL , THERMOSTAT
54464623	1	HEATER , OIL PAN
36920346	1	PAD , HEATER 8D BATTERY
36920338	1	PAD , HEATER 8D BATTERY
35283464	1	ELBOW (IN THREADED PORT OF PRESS. SWITCH)
35114545	1	TEE (IN ADAPTER AT ENG. OIL PORT)
35283472	1	CONNECTOR (IN TEE FACING LIFTING BAIL)

(FOR TEMPERATURES BELOW 10 F° USE IR PERFORMANCE 500 OIL 35382944 / 55 GAL.)

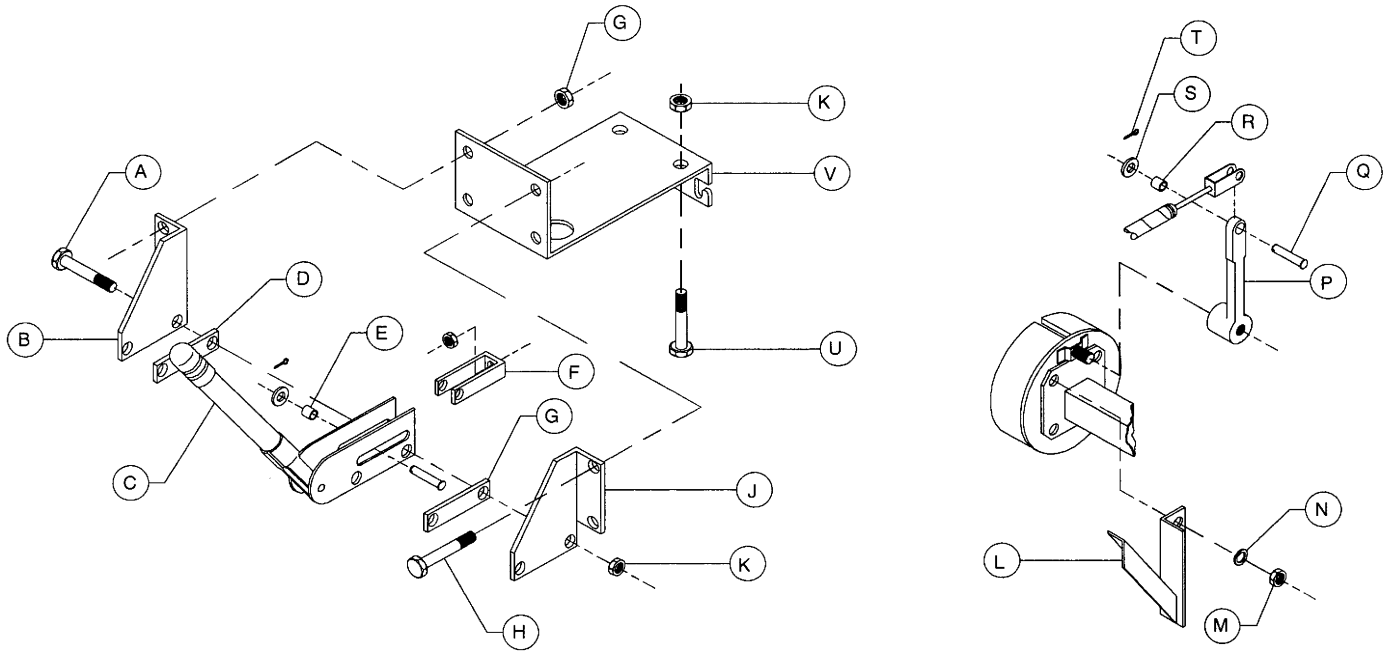

P11
A B C
YELLOW W151
GREEN W152
GRAY W199
E20
J1939 Datalink Drop
E11
A1 B1 C1 A2 B2 C2
A3 B3 C3
YELLOW W191
GREEN W192
GRAY W206
E22
AUTO START OPTION
E12
YELLOW W194
GREEN W195
GRAY W205
E10
E14
BROWN W180
J8
Cummins Datalink Service
E17
R5
CAN TERMINATOR
P5
E18
E21
U2
COOLANT LEVEL SENSOR
BROWN W025
BLUE W131
Cummins ECM OEM 01
RED W079
RED W080
E15
E16
BROWN W021
BROWN W022
PINK W109
BROWN W023
BROWN W024
BROWN W020
Cummins ECM OEM 02
(STANDARD UNIT)

IQ WIRING



CPN	QTY	DESCRIPTION
54757224	1	IQ WIRING HARNESS
54775887	1	IQ HEATER HARNESS
36841526	5	IQ ORIFICE HEATERS
36898310	1	ACTUATOR
36898922	1	THERMISTOR TEMP. PROBE
36892362	1	24V SEALED RELAY
36920643	1	ICU
36899599	1	IQ FILTER SWITCH
36899615	1	IQ FILTER SWITCH

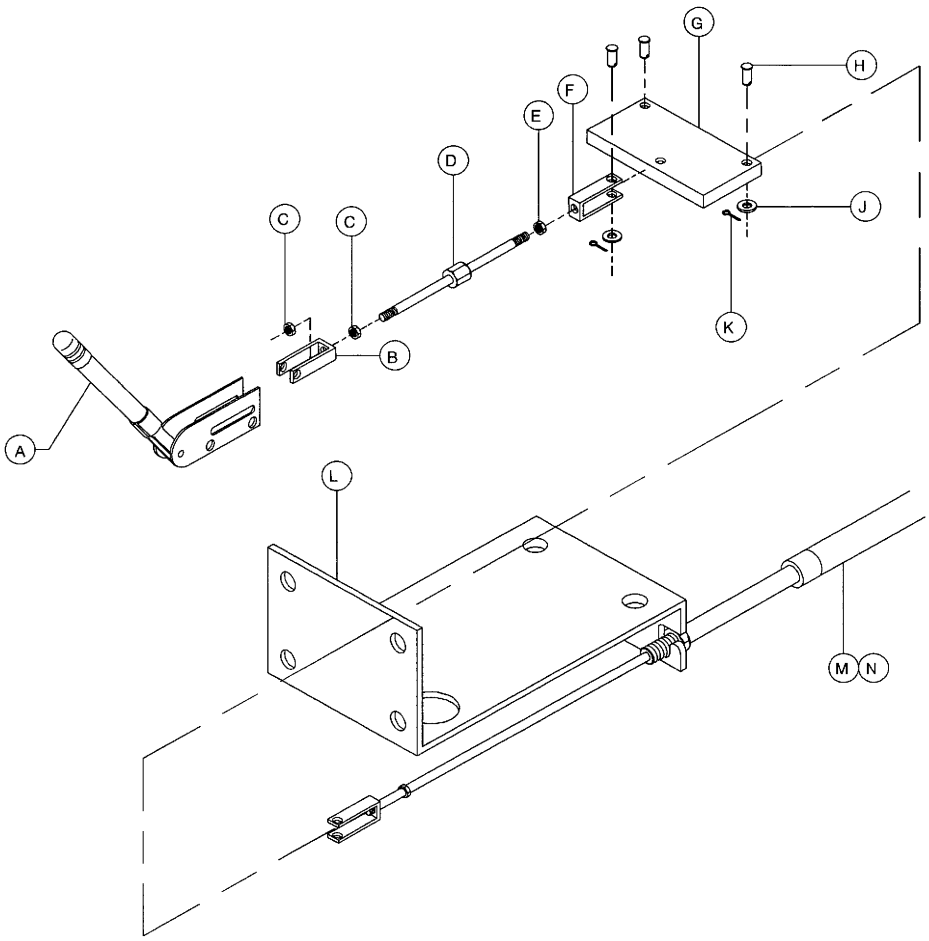
WAGON WHEEL PARKING BRAKE ASSEMBLY



ITEM	CPN	QTY	DESCRIPTION
A	95941100	2	SCREW
B	36847432	1	BRACKET , RH LEVER
C	36782878	1	LEVER , BRAKE
D	35603224	2	PLATE , SPACER
E	--------	2	FURNISHED WITH LEVER
F	35603208	1	CLEVIS , BRAKE LEVER
G	35252618	4	NUT
H	36877793	4	SCREW
J	36847440	1	BRACKET , LH LEVER
K	36879195	4	NUT
L	36786887	1	BRACKET , LH CABLE LATCH
	36786895	1	BRACKET , RH CABLE LATCH
M	95916573	8	NUT
N	95934741	8	WASHER
P	36782035	2	ARM , BRAKE
Q	36783785	2	PIN , CLEVIS
R	36786697	2	BUSHING
S	95935037	2	WASHER
T	95928867	2	PIN , COTTER
U	36880995	2	SCREW
V	36783306	1	BRACKET , FRONT CABLE LATCH

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 44 08/01 A

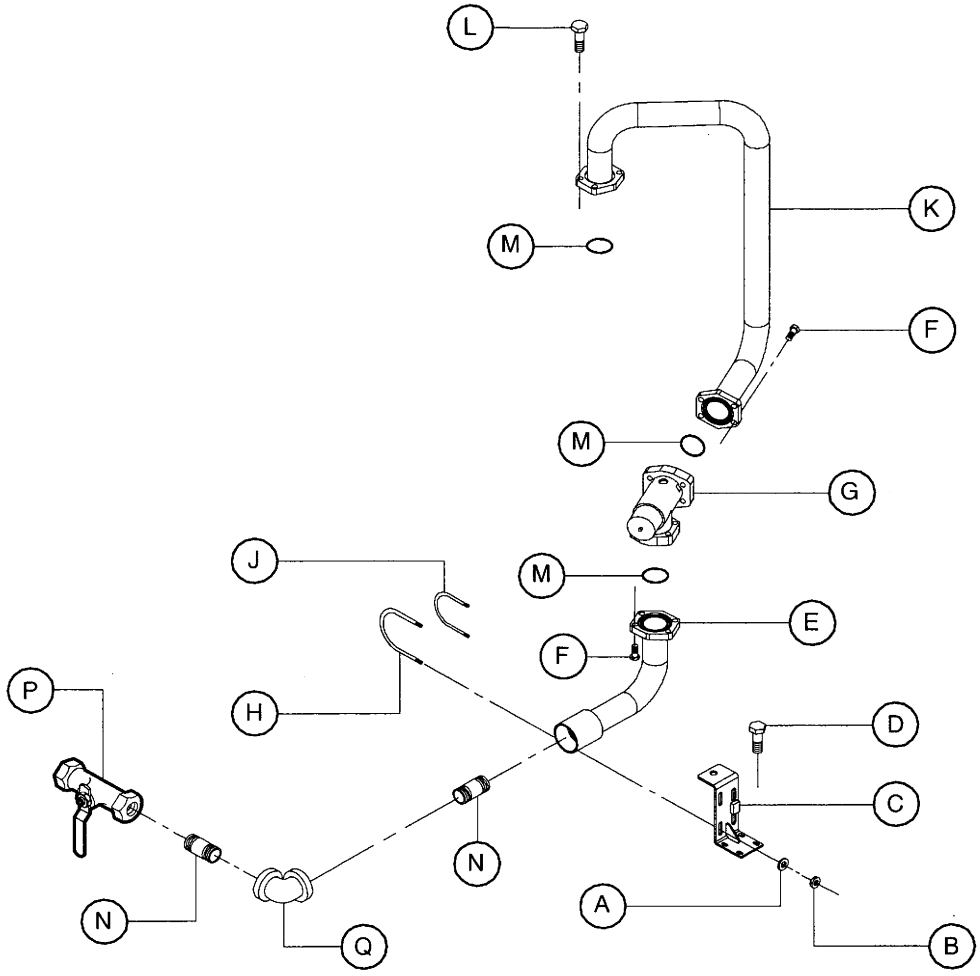
WAGON WHEEL PARKING BRAKE ASSEMBLY



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	36782878	1	LEVER , BRAKE				
B	35603208	1	CLEVIS , BRAKE LEVER				
C	35118728	2	NUT				
D	35603182	1	ROD , LINK				
E	95935086	2	NUT				
F	35603216	1	EQUALIZER , CLEVIS				
G	35602846	1	EQUALIZER , CABLE				
H	35357151	3	PIN , CLEVIS				
J	95934998	3	WASHER				
K	95928867	3	PIN , COTTER				
L	36783306	1	BRACKET , FRONT CABLE LATCH				
M	22064141	1	CABLE , LH BRAKE				
N	22064000	1	CABLE , RH BRAKE				

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 45 08/01 A

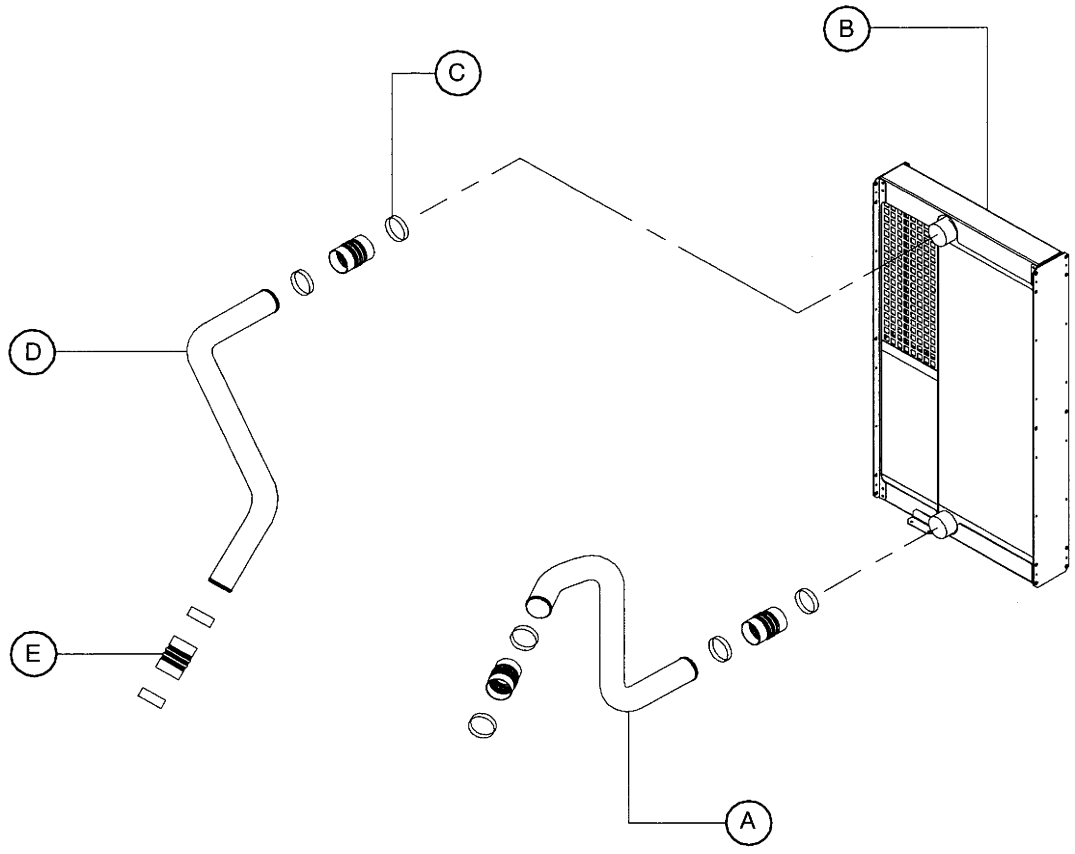
SEPARATOR AIR PIPING



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	95935003	4	WASHER				
B	95922902	4	NUT				
C	54668314	1	SUPPORT , PIPE				
D	35130293	4	SCREW				
E	36898120	1	PIPE				
F	95927273	8	SCREW				
G	54642152	1	VALVE , MINIMUM PRESSURE				
H	36799419	1	CLAMP				
J	35586288	1	CLAMP				
K	54642137	1	PIPE				
L	95929089	4	SCREW				
M	95358040	1	O-RING				
N	95940946	2	NIPPLE				
P	36922995	1	VALVE , BALL				
Q	95916581	1	ELBOW				

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 46 08/01 A

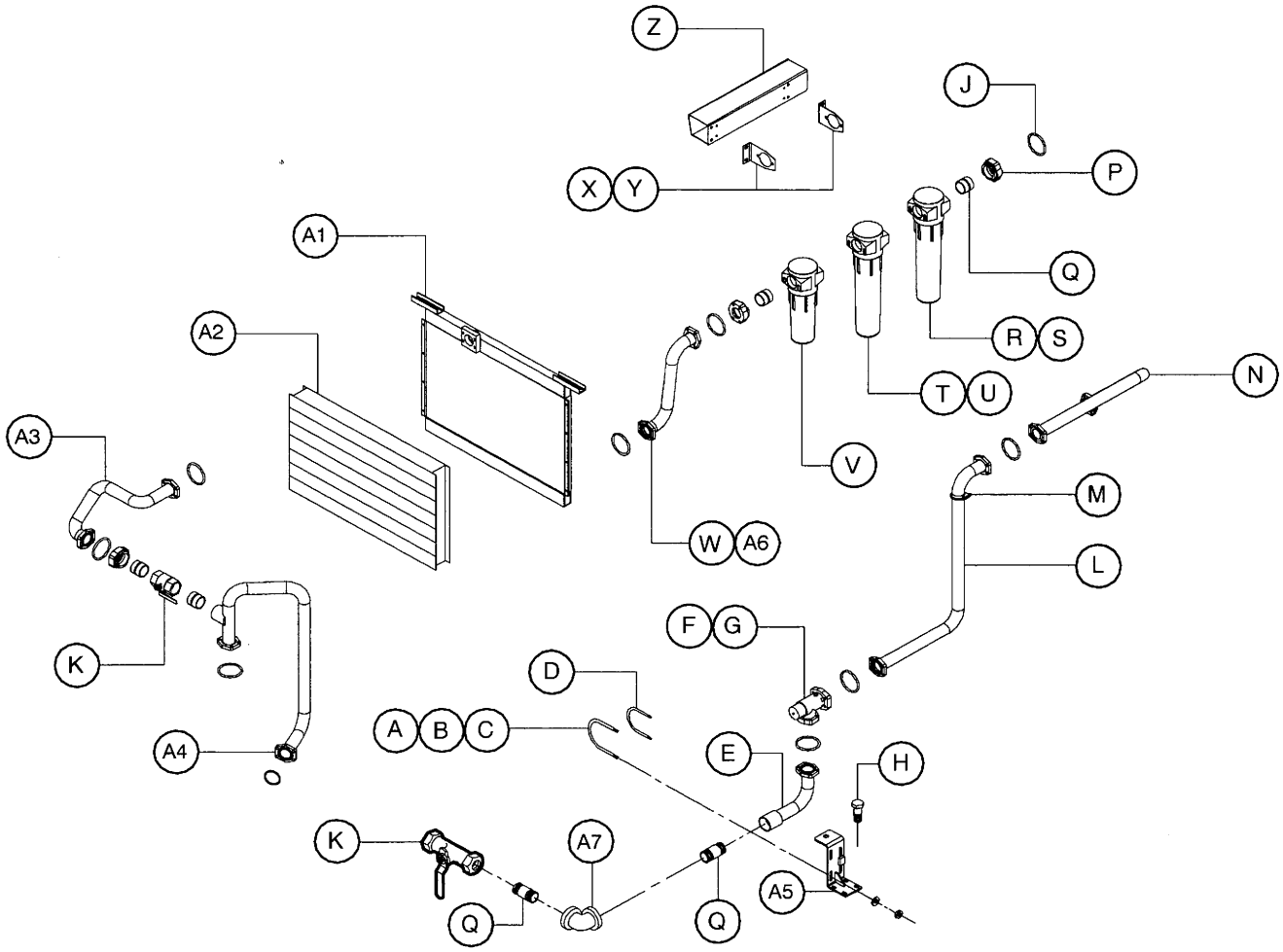
AIR CHARGE PIPING



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	54632690	1	TUBE , BOTTOM A/C				
B	54501846	1	COOLER , AIR CHARGE				
C	54444427	8	CLAMP				
D	54632682	1	TUBE , UPPER A/C				
E	54422522	4	HOSE , RIBBED				

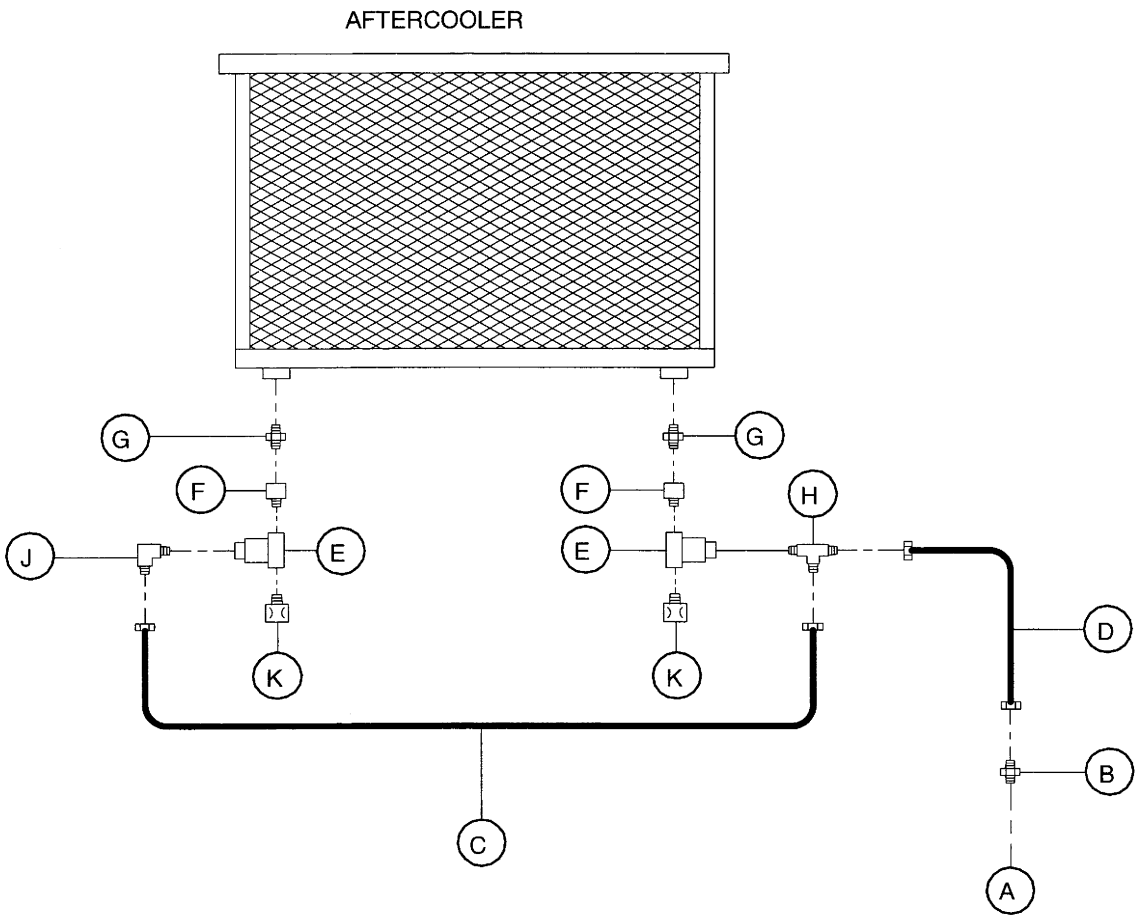
MANUAL NO. — DRAWING NO. DATE / REV:
54757919 47 08/01 A

IQ AIR PIPING



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	36799419	2	U-BOLT	A4	54741087	1	PIPE , MANIFOLD
B	95935003	8	WASHER	A5	54668314	1	SUPPORT , PIPE
C	95922902	8	NUT	A6	95929089	32	SCREW
D	35586288	2	CLAMP	A7	95916581	2	ELBOW
E	36898120	2	PIPE , SERVICE				
F	54642152	2	VALVE , MINIMUM PRESSURE				
G	95927273	36	SCREW				
H	35130293	8	SCREW				
J	95358040	11	O-RING				
K	36922995	3	VALVE , BALL				
L	54735055	1	PIPE				
M	35113646	1	CLAMP				
N	54734983	1	PIPE				
P	36893220	3	ADAPTER , FLANGE				
Q	95940946	8	NIPPLE				
R	54738984	1	FILTER , SECONDARY				
S	54739065	1	ELEMENT , FILTER				
T	54738976	1	FILTER , PRIMARY				
U	54739057	1	ELEMENT , FILTER				
V	54738968	1	SEPARATOR , WATER				
W	54734090	1	PIPE				
X	54739016	1	KIT , BRACKET / WEDGE				
Y	54739024	1	KIT , WEDGE				
Z	54732250	1	BRACKET , FILTERS				
A1	54699129	1	COOLER ASSEMBLY				
A2	54700943	1	LOUVER ASSEMBLY				
A3	547482490	1	PIPE				

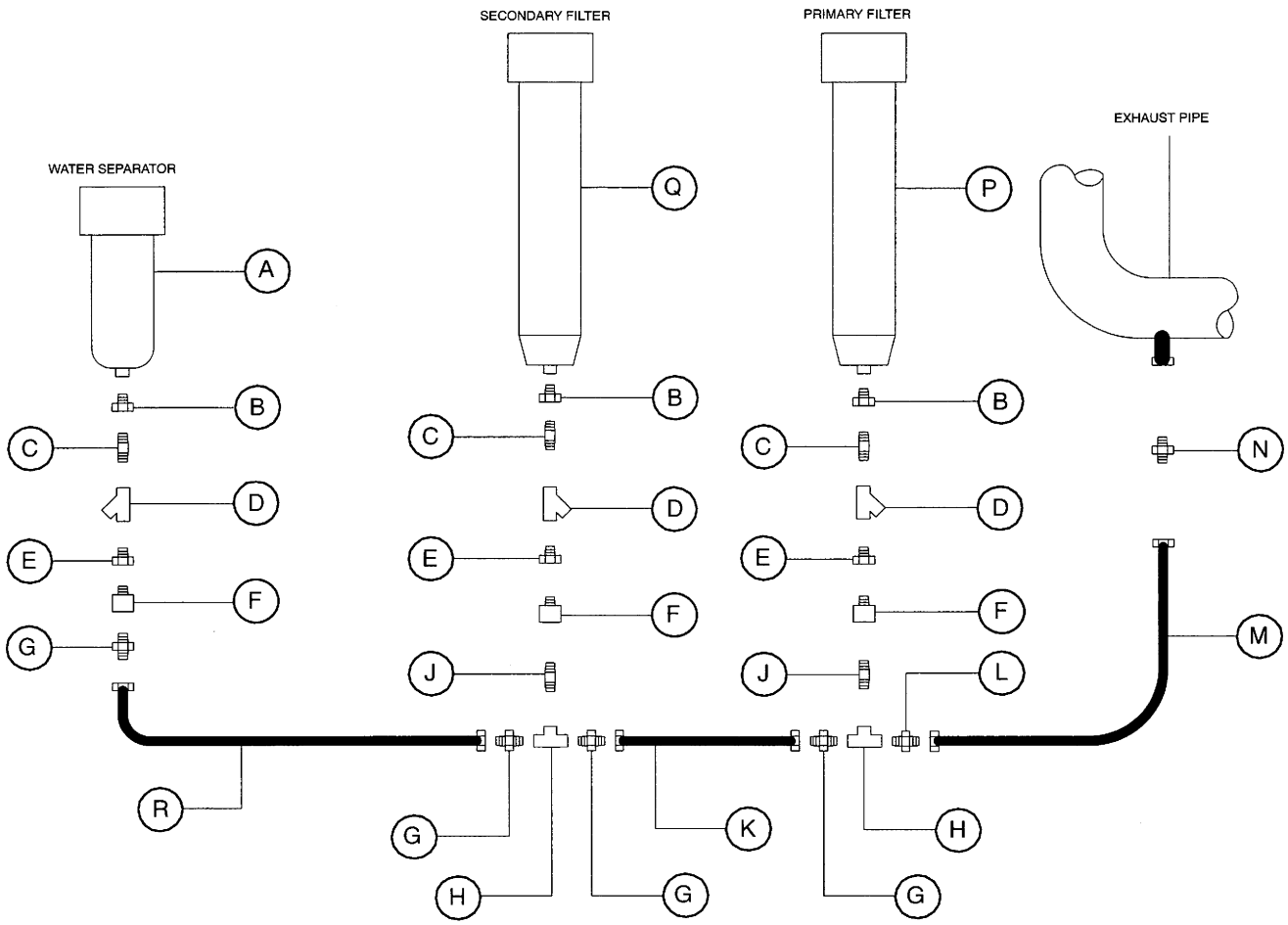
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54757919 48 08/01 A



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	TO AIR END INLET HOUSING AT REAR						
B	95365078	1	CONNECTOR				
C	36844074	1	HOSE ASSEMBLY				
D	35294701	1	HOSE ASSEMBLY				
E	35322379	1	VALVE , BLOWDOWN				
	35379064	1	DIAPHRAM KIT				
F	35367846	1	REDUCER				
G	35284082	1	CONNECTOR				
H	35283050	1	TEE				
J	35279934	1	ELBOW				
K	35248319	1	ORIFICE , .094				
	36898922	1	PROBE , TEMPERATURE				

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 49 08/01 A

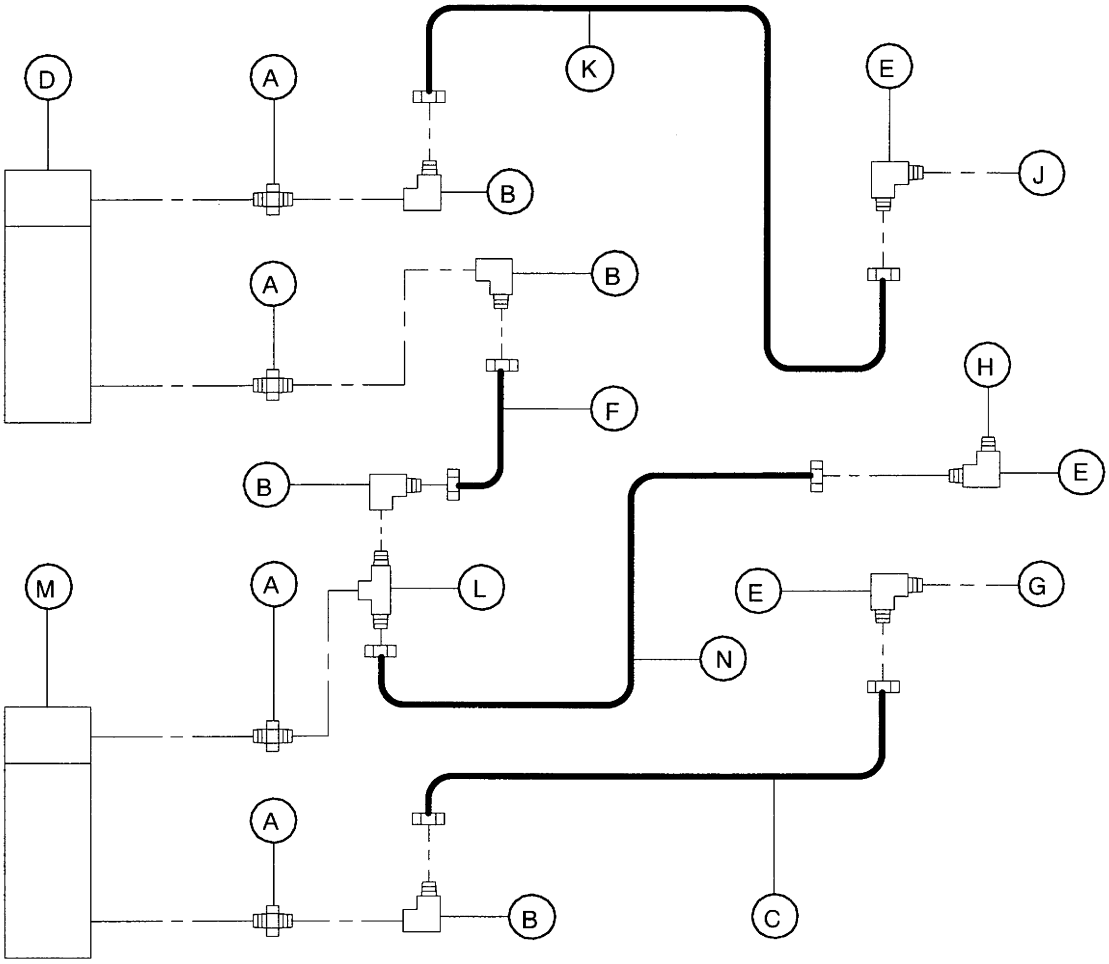
IQ FILTER PIPING



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	54738968	1	SEPARATOR , WATER				
B	95245353	1	ADAPTER				
C	95772562	1	NIPPLE				
D	36844579	1	Y-STRAINER				
E	95940748	1	ADAPTER				
F	37081528	1	REDUCER				
G	35283472	1	CONNECTOR				
H	36882223	1	TEE				
J	95452025	1	NIPPLE				
K	35310960	1	HOSE ASSEMBLY				
L	35284082	1	CONNECTOR				
M	35296110	1	HOSE ASSEMBLY				
N	35321983	1	CONNECTOR				
P	54738976	1	FILTER , PRIMARY				
Q	54738984	1	FILTER , SECONDARY				
R	35283241	1	HOSE ASSEMBLY				

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 50 08/01 A

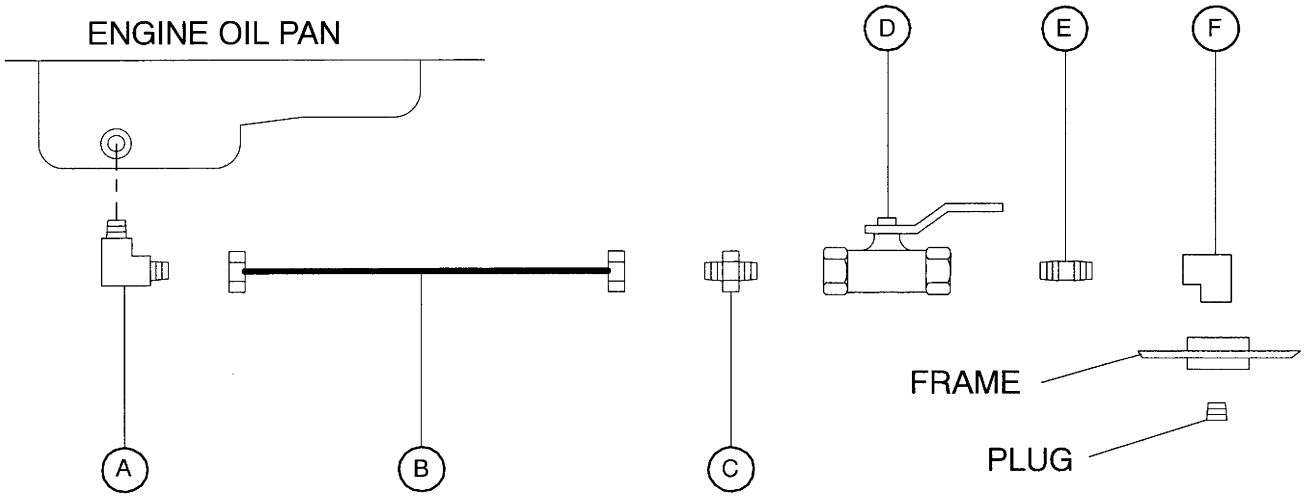
IQ INDICATOR PIPING



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	36898401	1	CONNECTOR				
B	35290352	1	ELBOW				
C	35310226	1	HOSE ASSEMBLY				
D	36899599	1	INDICATOR , 20 PSI				
E	35283464	1	ELBOW				
F	35310960	1	HOSE ASSEMBLY				
G	TO WATER SEPARATOR TUBE						
H	TO FILTER CROSSOVER TUBE						
J	TO FILTER OUTLET TUBE						
K	35323757	1	HOSE ASSEMBLY				
L	35323591	1	TEE				
M	36899615	1	INDICATOR , 25 PSI				
N	36920650	1	HOSE ASSEMBLY				

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 51 08/01 A

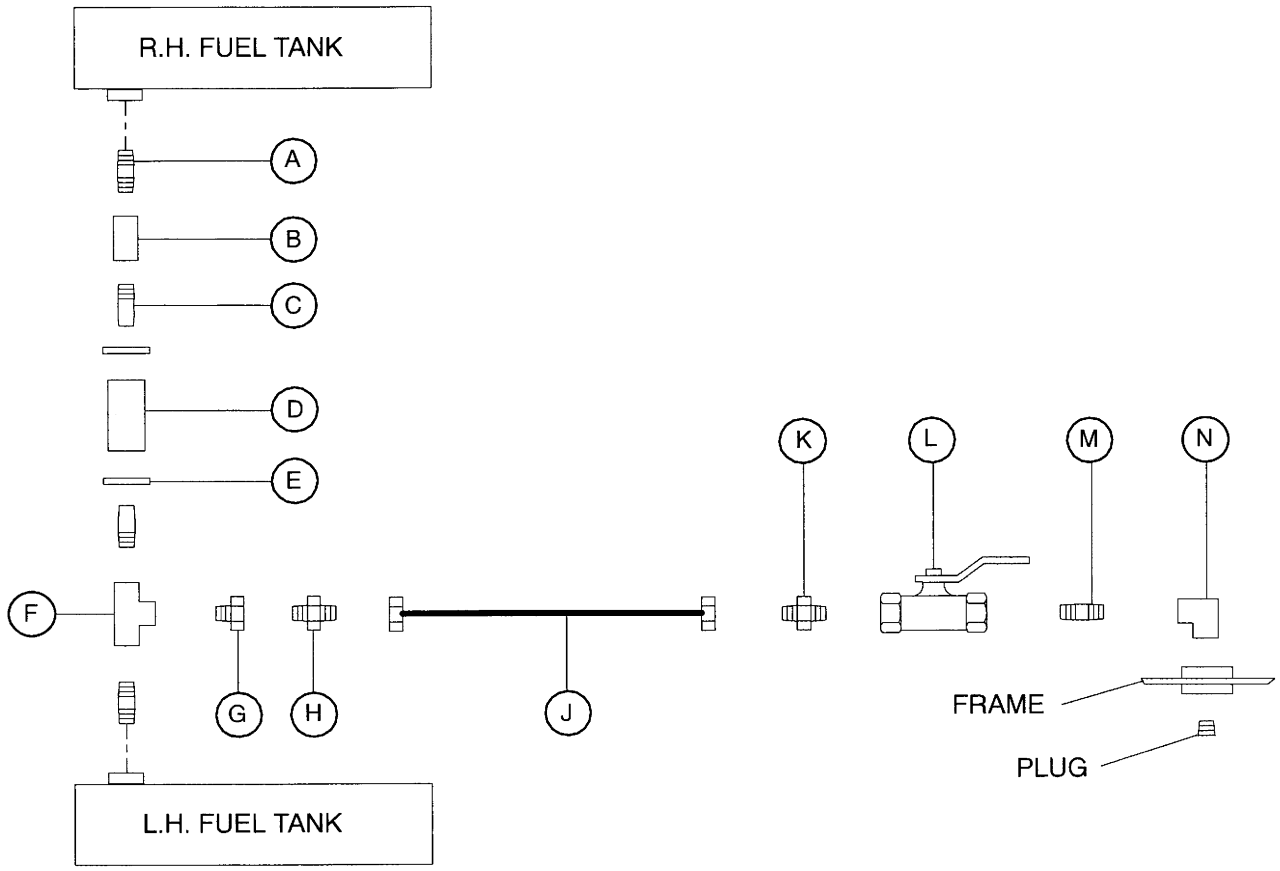
ENGINE OIL DRAIN PIPING



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	35294750	1	ELBOW				
B	35323880	1	HOSE ASSEMBLY				
C	95219747	1	CONNECTOR				
D	35576115	1	VALVE , BALL				
E	95647939	1	NIPPLE				
F	95928172	1	ELBOW				

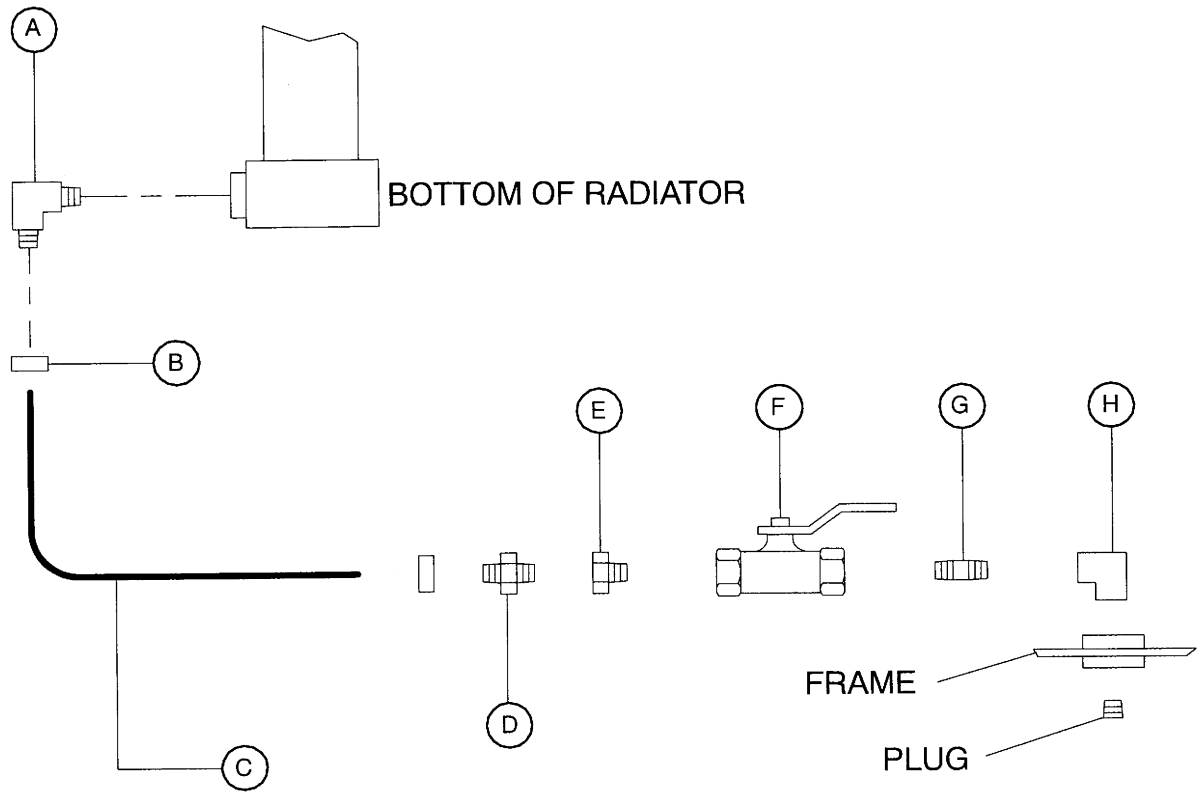
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54757919 52 08/01 A

FUEL TANK DRAIN PIPING



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	95953535	2	NIPPLE				
B	95937454	1	CONNECTOR				
C	54762190	2	FITTING , HOSE				
D	54762182	1	HOSE (19 INCHES)				
E	35221662	2	CLAMP				
F	95954285	1	TEE				
G	95953873	1	REDUCER				
H	95219747	1	CONNECTOR				
J	36893828	1	HOSE ASSEMBLY				
K	95219747	1	CONNECTOR				
L	35576115	1	VALVE , BALL				
M	95647939	1	NIPPLE				
N	95928172	1	ELBOW				

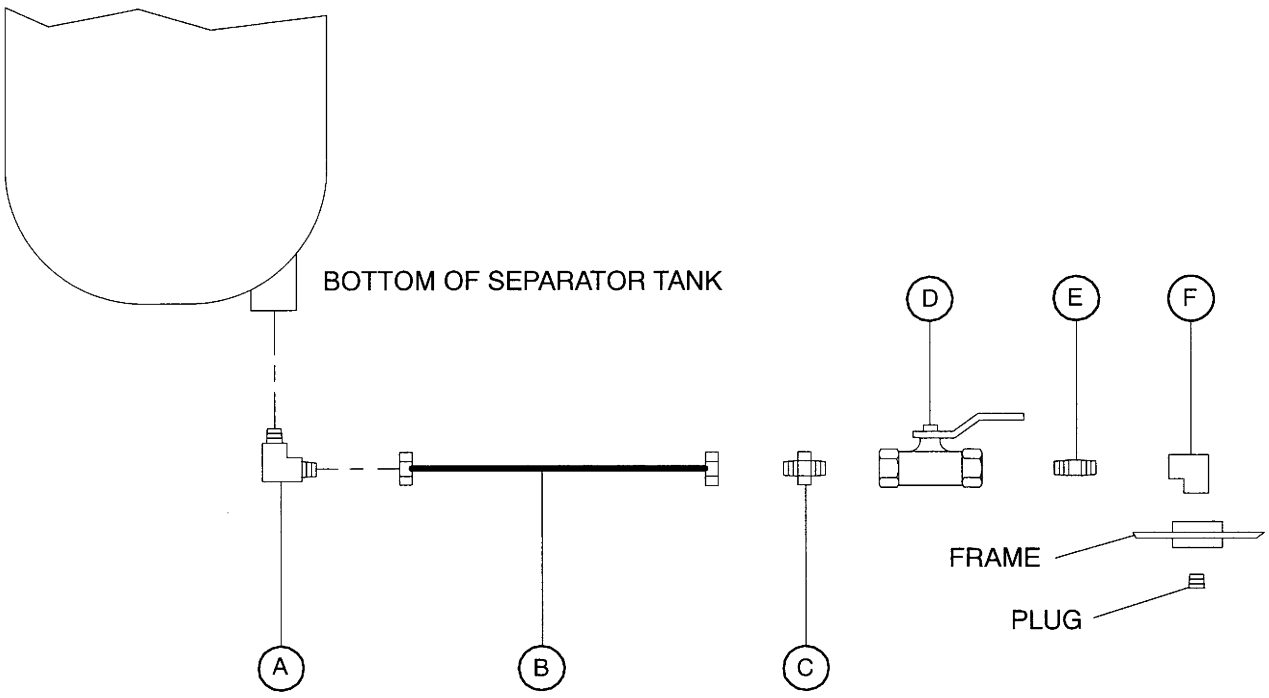
MANUAL NO. — DRAWING NO. DATE / REV:
54757919 53 08/01 A



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	35366665	1	ELBOW				
B	95220844	2	CLAMP				
C	35326578	1	HOSE (115 INCHES)				
D	35326560	1	FITTING , HOSE				
E	95953949	1	REDUCER				
F	35576115	1	VALVE , BALL				
G	95647939	1	NIPPLE				
H	95928172	1	ELBOW				

MANUAL NO. — DRAWING NO. DATE / REV:
54757919 54 08/01 A

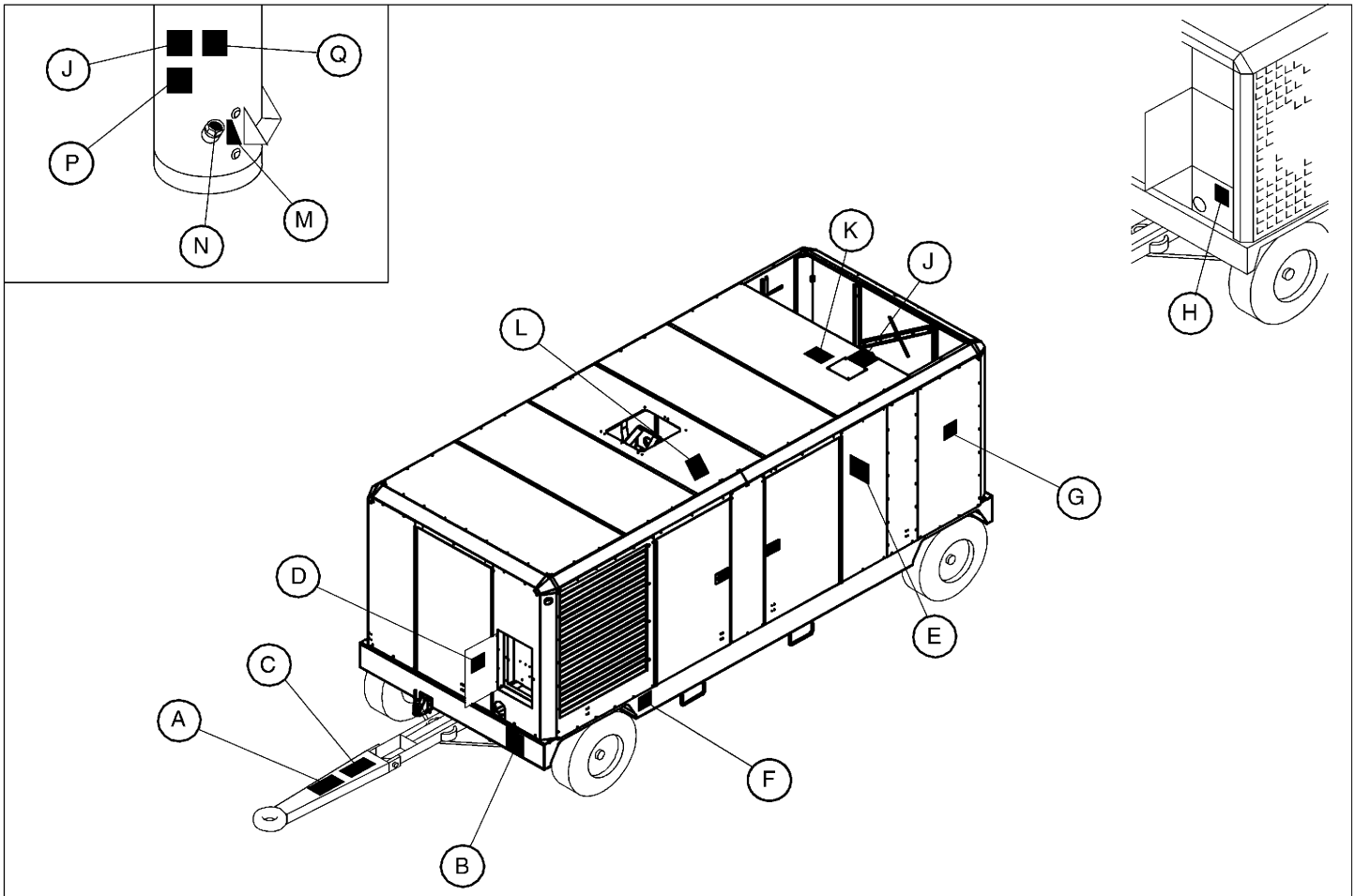
SEPARATOR TANK DRAIN PIPING



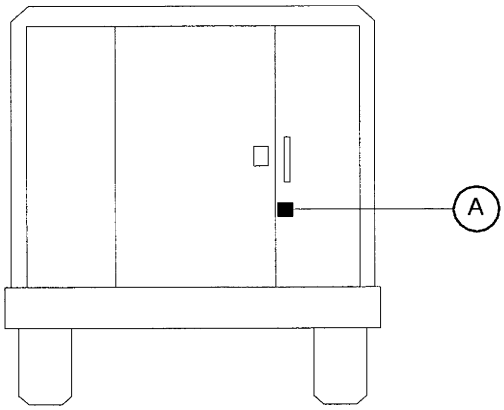
ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	35294750	1	ELBOW				
B	36878254	1	HOSE ASSEMBLY				
C	95219747	1	CONNECTOR				
D	35576115	1	VALVE , BALL				
E	95647939	1	NIPPLE				
F	95928172	1	ELBOW				

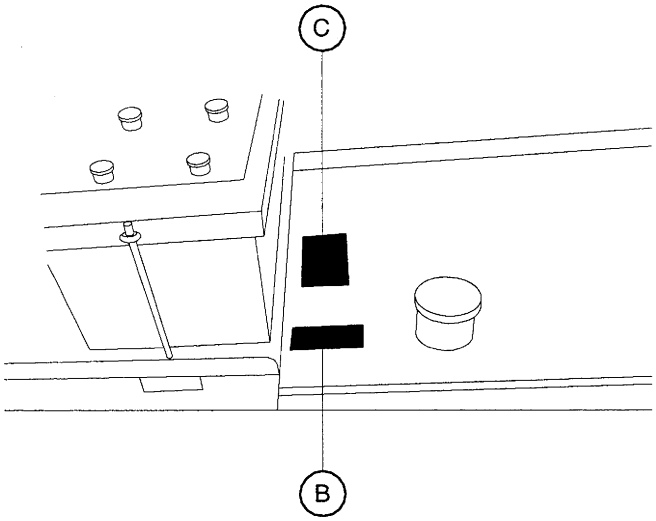
MANUAL NO. — DRAWING NO. DATE / REV:
54757919 55 08/01 A

DECAL LOCATION



ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	54568803	1	TOWING DECAL (HIGH SPEED RUNNING GEAR)				
B	54629902	1	3-PART WARNING DECAL				
C	22055701	1	TOWING DECAL (WAGON WHEEL)				
D	54568787	1	IMPROPER OPERATION DECAL				
E	54568779	4	ROTATING FAN DECAL				
F	54749205	4	NO WELD DECAL				
G	54604939	4	FALL OFF UNIT DECAL				
H	36514602	1	NOISE EMISSION DECAL				
J	54568761	2	HIGH PRESSURE FLUID DECAL				
K	54604962	1	RADIATOR FILL DECAL				
L	54699400	2	LIFT POINT DECAL				
M	22053847	1	OIL LEVEL DECAL				
N	54604970	1	OIL FILL DECAL				
P	54568795	1	HIGH PRESSURE AIR DECAL				
Q	22054365	1	IQ OPERATION DECAL				





ITEM	CPN	QTY	DESCRIPTION	ITEM	CPN	QTY	DESCRIPTION
A	54604988	1	DOOR UNDER PRESSURE DECAL				
B	54625207	2	DIESEL FUEL DECAL				
C	54568753	1	BATTERY GAS DECAL				

MANUAL NO. — DRAWING NO. DATE / REV.
54757919 57 08/01 A

Recommended Spare Parts

Machine Model: HP1300CWCU, HP1600WCU

Part Number	Description	1 Machine 2 Years	5 Machines 2 Years
36850691	Electric Compressor	0	2
35328210	Unloader Valve	0	2
22056394	Gauge	2	4
36779742	Thermal Relay	1	2
35331586	Unloader Seal	0	2
35332634	Unloader Bushing	0	2
35588961	R/Gear Ball Joint	0	2
35588953	R/Gear Ball Joint	0	2
54474572	Low Water Sender	0	2
35376169	Diode	2	4
54662028	Eng. Lube Element	12	48
54662036	Eng. Fuel Element	12	48
54662051	Eng. Water Element	12	48
35596626	Air End Seal	0	2
95358214	Air End Cover O Ring	0	2
35594837	Unloader Diaphragm	0	2
35594845	Unloader Gasket	0	2
36754059	Unloader Gasket	0	2
35584556	Rubber Eng. Mount	0	2
35584556	Rubber Airend Mount	0	2
36845014	Fuel Tank Cap	1	3
35358159	Fuel Sender Gasket	0	2
54672811	Fuel Sender (HSRG)	1	2
54672803	Fuel Sender (Wagon)	1	2
35322395	Pneumatic Silencer	0	2
36754406	Separator Element	3	12
54627799	Sight Tube Fitting	2	4
54629464	Sight Tube	2	6
36864361	Air Element	12	48
36834379	Air Element	12	48
36854677	Heater	1	2
36847838	Switch, Air Filter	1	2
35335017	Blow Down Valve	1	2
36762623	Pneumatic Silencer	1	2
35322346	Muffler Orifice (.156)	1	2
36840841	Solenoid	1	2
35248145	In-line Checkvalve	1	3
36840460	Check Valve Orifice	1	2

Machine Model: HP1300CWCU, HP1600WCU Cont....

Part Number	Description		1 Machine 2 Years	5 Machines 2 Years
54612437	Discharge Pipe Assy.		0	2
35307578	Thermostat		1	2
35307586	Thermostat Gasket		0	2
36897346	Com. Lube Element		12	48
35260439	Press. Relief Valve		1	2
36861177	Tachometer		1	2
54766704	Hourmeter		1	2
36840767	Pressure Gauge		1	2
35290089	Panel Bulb		1	2
36841526	Heater		1	2
35586130	Relay		1	2
35583442	Relay		1	2
36841138	Temp. Sender		2	4
36870608	Oil Press. Sender		2	4
35332642	Unloader Seal		1	2
35577873	Mag. Switch		1	2
36757581	Pressure Switch		1	2
35610617	Sep. Element Gasket		1	2
35332659	Unloader Bushing		0	2
35594878	Unloader Spring		0	2
36757573	Pressure Switch		1	2
36877298	Radiator Cap		1	2
22050991	Fuel Gauge		1	2
95358040	Fitting O Ring		0	2
35379056	Blow Down Valve Kit		1	2
36762961	Intake Flange Gasket		0	2
54642152	Min. Press. Checkvalve		0	1
35307560	Thermostat Seal		1	2
36841252	Panel Light		1	2
36792083	Fuse (20 amp)		5	25
36920825	0-100 psi Press. Xducer		1	2
36785319	Mag Speed Sensor		1	2
36898922	Thermistor Temp Sensor		1	2
54496773	0-225 psi Press. Xducer		1	2
54688411	Wedge Controller		0	1
22071591	Fuse (10 amp)		5	25
36854495	Pressure Reg.		1	2
36899714	Pro Tec Comp. Fluid	55 GALLONS	2	20
54612437	Air Hose		2	10
36875938	Pro Tec Eng. Fluid	5 GALLONS	16	80

Machine Model: HP1300CWCU, HP1600WCU

Maintenance Interval and Filter Kits

36064970 Kit, Filter Change

Contains	Description	Qty.
36897346	ELEMENT, OIL FILT	2
36864361	ELEMENT PRIMARY	2
36864379	ELEMENT SAFETY	2
54662028	FILTER, OIL QXS15	1
54662036	FILTER, FUEL QXS15	1
54662051	FILTER, COOLANT	1

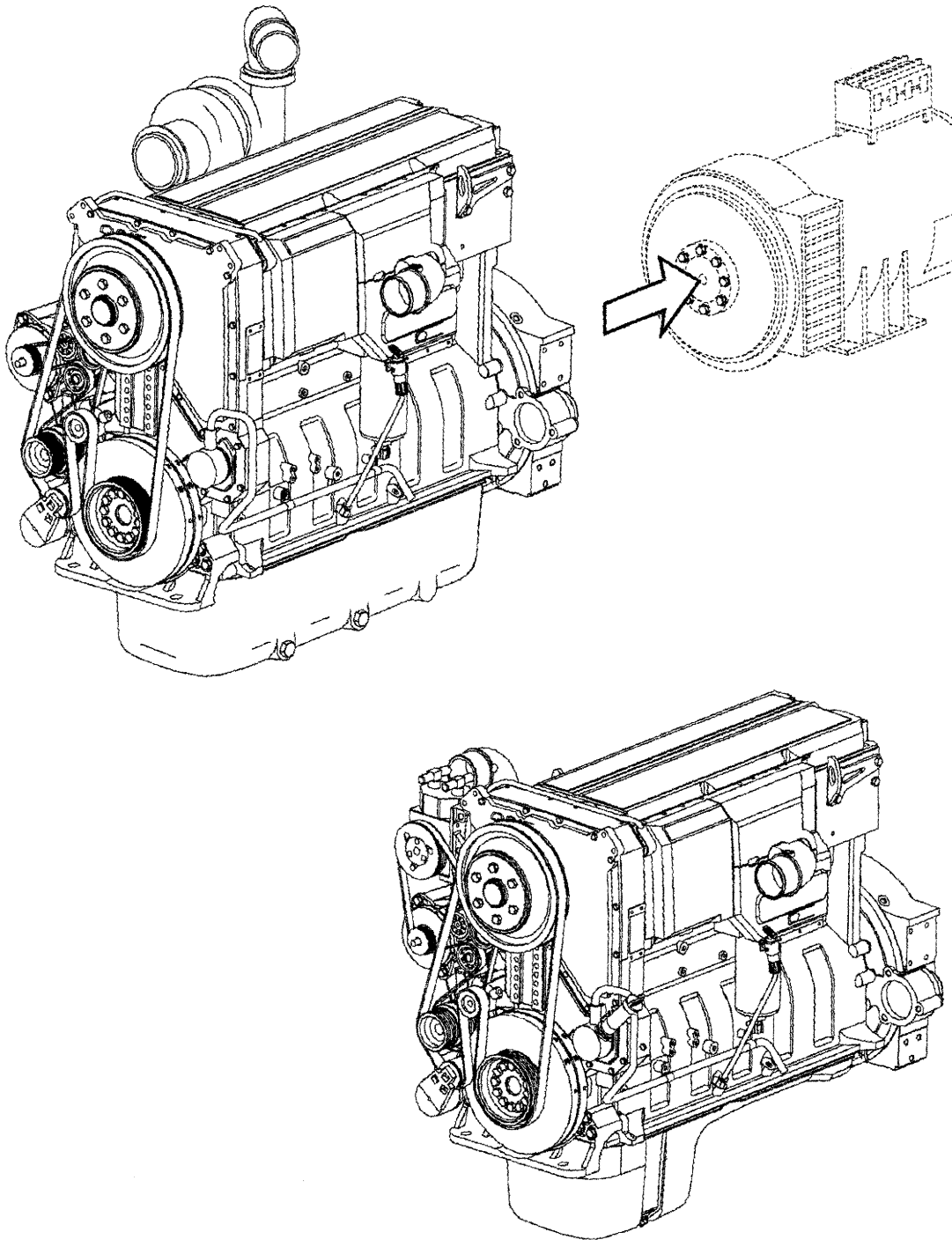
36064988 Kit, Filter

Contains	Description	Qty.
36897346	ELEMENT, OIL FILT	4
36864361	ELEMENT PRIMARY	2
36864379	ELEMENT SAFETY	2
54662028	FILTER, OIL QXS15	4
54662036	FILTER, FUEL QXS15	6
54662051	FILTER, COOLANT	6

36064996 Kit, Maintenance Interval

Contains	Description	Qty.
36897346	ELEMENT, OIL FILT	2
36864361	ELEMENT PRIMARY	2
36864379	ELEMENT SAFETY	2
54662028	FILTER, OIL QXS15	1
54662036	FILTER, FUEL QXS15	1
54662051	FILTER, COOLANT	1
36754406	ELEM SEP TK	1

Operation and Maintenance Manual
Industrial and Power Generation
QSX15 Engines



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Foreword

This manual contains information for the correct operation and maintenance of your Cummins engine. It also includes important safety information, engine and systems specifications, troubleshooting guidelines, and listings of Cummins Authorized Repair Locations and component manufacturers.

Read and follow all safety instructions. Refer to the WARNING in the General Safety Instructions in Section i - Introduction.

Keep this manual with the equipment. If the equipment is traded or sold, give the manual to the new owner.

The information, specifications, and recommended maintenance guidelines in this manual are based on information in effect at the time of printing. Cummins Engine Company, Inc. reserves the right to make changes at any time without obligation. If you find differences between your engine and the information in this manual, contact your local Cummins Authorized Repair Location or call 1-800-DIESELS (1-800-343-7357) toll free in the U.S. and Canada.

The latest technology and the highest quality components were used to produce this engine. When replacement parts are needed, we recommend using only genuine Cummins or ReCon® exchange parts. These parts can be identified by the following trademarks:



Note: Warranty information is located in Section W. Make sure you are familiar with the warranty or warranties applicable to your engine.

Table of Contents

	Section
Introduction	i
Engine Identification	E
Operating Instructions	1
Maintenance Guidelines	2
Maintenance Procedures at Daily Interval	3
Maintenance Procedures at 625 Hours or 6 Months	4
Maintenance Procedures at 1500 Hours or 1 Year	5
Maintenance Procedures at 3000 Hours or 2 Years	6
Maintenance Procedures at 10,000 Hours or 5 Years	7
Adjustment, Repair, and Replacement	A
System Diagrams	D
Service Literature	L
Component Manufacturers	M
Service Assistance	S
Troubleshooting Symptoms	TS
Maintenance Specifications	V
Warranty	W
Index	X

Important Reference Numbers

Fill in the part name and number in the blank spaces provided below. This will give you a reference whenever service or maintenance is required.

Part Name	Part Number	Part Number
Engine Model		
Engine Serial Number (ESN)		
Control Parts List (CPL)		
Fuel Pump Part Number		
Electronic Control Module (ECM)		
Electronic Control Module Serial Numbers (ECM)		
Filter Part Numbers:		
• Air Cleaner Element		
• Lubricating Oil Filter		
• Fuel		
• Fuel-Water Separator		
• Coolant		
• Remote Gas		
Governor Control Module (GCM) (if applicable)		
Belt Part Numbers:		
•		
•		
•		
Clutch or Marine Gear (if applicable):		
• Model		
• Serial Number		
• Part Number		
• Oil Type		
• Sea Water Pump		
– Model		
– Part Number		

Section i - Introduction

Section Contents

Page

About the Manual i-1

Acronyms and Abbreviations i-6
General Information i-6

General Repair Instructions i-5
General Information i-5
Welding on a Vehicle with an Electronic Controlled Fuel System i-5

General Safety Instructions i-4
Important Safety Notice i-4

How to Use the Manual i-1

Illustrations i-3
General Information i-3

Symbols i-2
General Information i-2

To the Owner and Operator i-1

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To the Owner and Operator

Preventative maintenance is the easiest and least expensive type of maintenance. Follow the maintenance schedule recommendations outlined in Maintenance Guidelines (Section 2).

Keep records of regularly scheduled maintenance.

Use the correct fuel, oil, and coolant in your engine as specified in Maintenance Specifications (Section V).

Cummins Engine Company, Inc. uses the latest technology and the highest quality components to produce its engines. Cummins recommends using **only** genuine Cummins parts and ReCon® exchange parts.

Personnel at Cummins Authorized Repair Locations have been trained to provide expert service and parts support. If you have a problem that can **not** be resolved by a Cummins Authorized Repair Location, follow the steps outlined in Service Assistance (Section S).

About the Manual

This manual contains information needed to correctly operate and maintain your engine as recommended by Cummins Engine Company, Inc. Additional service literature can be ordered from your Cummins distributor. For problems with literature orders, contact 1-800-DIESELS (1-800-343-7357) (for U.S.A. and Canada).

This manual does **not** cover vehicle or equipment maintenance procedures. Consult the vehicle or equipment manufacturer for specific maintenance recommendations.

Both metric and U.S. customary values are listed in this manual. The metric value is listed first, followed by the U.S. customary in brackets.

Numerous illustrations and symbols are used to aid in understanding the meaning of the text. Refer to the complete listing of symbols and their definitions in this section.

Each section is preceded by a Section Contents to aid in locating information.

How to Use the Manual

This manual is organized according to intervals at which maintenance on your engine is to be performed. A table that states the required intervals and the checks to be made is located in Section 2. Locate the interval at which you are performing maintenance. Then, follow the steps given in that section for all the procedures to be performed. In addition, all of the procedures done under previous maintenance intervals **must** be performed.

Keep a record of all the checks and inspections made. A record form for recording date, miles/kilometers or hours, and which maintenance checks were performed is located in Section 2.

Refer to Section TS for a guide to troubleshooting your engine. Follow the directions given in Section TS to locate and correct the cause of the symptom.

Refer to Section V for specifications recommended by Cummins Engine Company, Inc., for your engine. Specifications and torque values for each engine system are given in that section.

Symbols

General Information

The following symbols have been used in this manual to help communicate the intent of the instructions. When one of the symbols appears, it conveys the meaning defined below:



WARNING - Serious personal injury or extensive property damage can result if the warning instructions are **not** followed.



CAUTION - Minor personal injury can result or a part, an assembly, or the engine can be damaged if the caution instructions are **not** followed.



Indicates a **REMOVAL or DISASSEMBLY** step.



Indicates an **INSTALLATION or ASSEMBLY** step.



INSPECTION is required.



CLEAN the part or assembly.



PERFORM a mechanical or time **MEASUREMENT**.



LUBRICATE the part or assembly.



Indicates that a **WRENCH or TOOL SIZE** will be given.



TIGHTEN to a specific torque.



PERFORM an electrical **MEASUREMENT**.



Refer to another location in this manual or another publication for additional information.



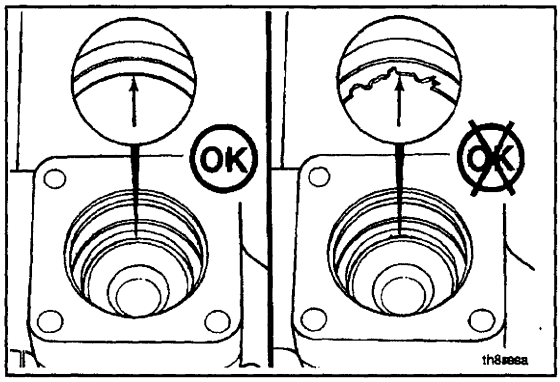
The component weighs 23 kg [50 lb] or more. To avoid personal injury, use a hoist or get assistance to lift the component.

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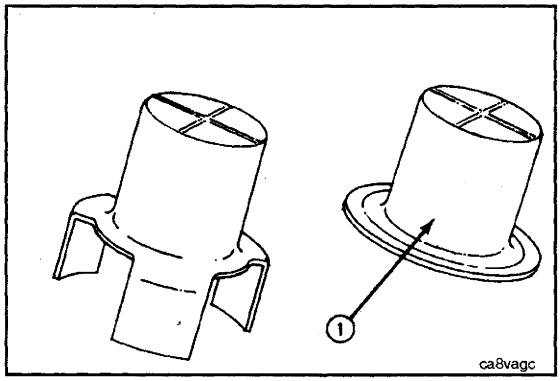
Illustrations

General Information

Some of the illustrations throughout this manual are generic and will **not** look exactly like the engine or parts used in your application. The illustrations can contain symbols to indicate an action required and an acceptable or **not** acceptable condition.



The illustrations are intended to show repair or replacement procedures. The procedure will be the same for all applications, although the illustration can differ.



General Safety Instructions

Important Safety Notice

⚠ WARNING ⚠

Improper practices or carelessness can cause burns, cuts, mutilation, asphyxiation or other bodily injury or death.

Read and understand all of the safety precautions and warnings before performing any repair. This list contains the general safety precautions that **must** be followed to provide personal safety. Special safety precautions are included in the procedures when they apply.

- Make sure the work area surrounding the product is dry, well lit, ventilated, free from clutter, loose tools, parts, ignition sources and hazardous substances. Be aware of hazardous conditions that can exist.
- **Always** wear protective glasses and protective shoes when working.
- Rotating parts can cause cuts, mutilation or strangulation.
- Do **not** wear loose-fitting or torn clothing. Remove all jewelry when working.
- Disconnect the battery (negative [-] cable first) and discharge any capacitors before beginning any repair work. Disconnect the air starting motor if equipped to prevent accidental engine starting. Put a "Do **Not** Operate" tag in the operator's compartment or on the controls.
- Use ONLY the proper engine barring techniques for manually rotating the engine. Do **not** attempt to rotate the crankshaft by pulling or prying on the fan. This practice can cause serious personal injury, property damage, or damage to the fan blade(s) causing premature fan failure.
- If an engine has been operating and the coolant is hot, allow the engine to cool before you slowly loosen the filler cap and relieve the pressure from the cooling system.
- Do **not** work on anything that is supported ONLY by lifting jacks or a hoist. **Always** use blocks or proper stands to support the product before performing any service work.
- Relieve all pressure in the air, oil, fuel and the cooling systems before any lines, fittings, or related items are removed or disconnected. Be alert for possible pressure when disconnecting any device from a system that utilizes pressure. Do **not** check for pressure leaks with your hand. High pressure oil or fuel can cause personal injury.
- To prevent suffocation and frostbite, wear protective clothing and ONLY disconnect fuel and liquid refrigerant (freon) lines in a well ventilated area. To protect the environment, liquid refrigerant systems **must** be properly emptied and filled using equipment that prevents the release of refrigerant gas (fluorocarbons) into the atmosphere. Federal law requires capturing and recycling refrigerant.
- To avoid personal injury, use a hoist or get assistance when lifting components that weigh 23 kg [50 lb] or more. Make sure all lifting devices such as chains, hooks, or slings are in good condition and are of the correct capacity. Make sure hooks are positioned correctly. **Always** use a spreader bar when necessary. The lifting hooks **must not** be side-loaded.
- Corrosion inhibitor, a component of SCA and lubricating oil, contains alkali. Do **not** get the substance in your eyes. Avoid prolonged or repeated contact with skin. Do **not** swallow internally. In case of contact, immediately wash skin with soap and water. In case of contact, immediately flood eyes with large amounts of water for a minimum of 15 minutes. IMMEDIATELY CALL A PHYSICIAN. KEEP OUT OF REACH OF CHILDREN.
- Naptha and Methyl Ethyl Ketone (MEK) are flammable materials and **must** be used with caution. Follow the manufacturer's instructions to provide complete safety when using these materials. KEEP OUT OF REACH OF CHILDREN.
- To avoid burns, be alert for hot parts on products that have just been turned off, and hot fluids in lines, tubes, and compartments.
- **Always** use tools that are in good condition. Make sure you understand how to use them before performing any service work. Use ONLY genuine Cummins or Cummins ReCon® replacement parts.
- **Always** use the same fastener part number (or equivalent) when replacing fasteners. Do **not** use a fastener of lesser quality if replacements are necessary.
- Do **not** perform any repair when fatigued or after consuming alcohol or drugs that can impair your functioning.
- Some state and federal agencies in the United States of America have determined that used engine oil can be carcinogenic and can cause reproductive toxicity. Avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil.
- Coolant is toxic. If **not** reused, dispose of in accordance with local environmental regulations.

General Repair Instructions

General Information

This engine incorporates the latest technology at the time it was manufactured; yet, it is designed to be repaired using normal repair practices performed to quality standards.

- **Cummins Engine Company, Inc. does not recommend or authorize any modifications or repairs to engines or components except for those detailed in Cummins Service Information. In particular, unauthorized repair to safety-related components can cause personal injury or death. Below is a partial listing of components classified as safety-related:**

Air Compressor
Air Controls
Air Shutoff Assemblies
Balance Weights
Cooling Fan
Fan Hub Assembly
Fan Mounting Bracket(s)
Fan Mounting Capscrews
Fan Hub Spindle
Flywheel
Flywheel Crankshaft Adapter
Flywheel Mounting Capscrews
Fuel Shutoff Assemblies
Fuel Supply Tubes
Lifting Brackets
Throttle Controls
Turbocharger Compressor Casing
Turbocharger Oil Drain Line(s)
Turbocharger Oil Supply Line(s)
Turbocharger Turbine Casing
Vibration Damper Mounting Capscrews

- **Follow all safety instructions noted in the procedures**
  - — Follow the manufacturer's recommendations for cleaning solvents and other substances used during the repair of the engine. Some solvents and used engine oil have been identified by government agencies as toxic or carcinogenic. Avoid excessive breathing, ingestion and contact with such substances. **Always** use good safety practices with tools and equipment.
- **Provide a clean environment and follow the cleaning instructions specified in the procedures**
  - — The engine and its components **must** be kept clean during any repair. Contamination of the engine or components will cause premature wear.
- **Perform the inspections specified in the procedures**
- **Replace all components or assemblies which are damaged or worn beyond the specifications**
- **Use genuine Cummins new or ReCon® service parts and assemblies**
  - — The assembly instructions have been written to use again as many components and assemblies as possible. When it is necessary to replace a component or assembly, the procedure is based on the use of new Cummins or Cummins ReCon® components. All of the repair services described in this manual are available from all Cummins Distributors and most Dealer locations.
- **Follow the specified disassembly and assembly procedures to avoid damage to the components**

Complete rebuild instructions are available in the shop manual which can be ordered or purchased from a Cummins Authorized Repair Location. Refer to Section L — Service Literature for ordering instructions.

Welding on a Vehicle with an Electronic Controlled Fuel System

△ CAUTION △

Disconnect both the positive (+) and negative (-) battery cables from the battery before welding on the vehicle. Attach the welder ground cable no more than 0.61 meters [2 feet] from the part being welded. Do not connect the ground cable of the welder to the ECM cooling plate or ECM. Welding on the engine or engine mounted components is not recommended.

Acronyms and Abbreviations

General Information

AFC	Air Fuel Control
API	American Petroleum Institute
ASA	Air Signal Attenuator
ASTM	American Society of Testing and Materials
°C	Celsius
CARB	California Air Resources Board
C.I.D.	Cubic Inch Displacement
CNG	Compressed Natural Gas
CPL	Control Parts List
cSt	Centistokes
ECM	Electronic Control Module
ECS	Emission Control System
EPA	Environmental Protection Agency
EPS	Engine Position Sensor
°F	Fahrenheit
GVW	Gross Vehicle Weight
Hg	Mercury
hp	Horsepower
H_2O	Water
ICM	Ignition Control Module
km/l	Kilometers per Liter
kPa	Kilopascal
LNG	Liquid Natural Gas
LTA	Low Temperature Aftercooling
MIP	Mixer Inlet Pressure
MPa	Megapascal
mph	Miles Per Hour
mpq	Miles Per Quart
N•m	Newton-meter
NG	Natural Gas
OEM	Original Equipment Manufacturer
ppm	Parts Per Million
psi	Pounds Per Square Inch
PTO	Power Takeoff
rpm	Revolutions Per Minute
SAE	Society of Automotive Engineers
SCA	Supplemental Coolant Additive
STC	Step Timing Control
VS	Variable Speed
VSS	Vehicle Speed Sensor

Section E - Engine Identification

Section Contents

Page

Engine Diagrams E-6
Engine Views E-6

Engine Identification E-1
ECM Dataplate E-1
Engine Dataplate E-1

Specifications E-2
Air Intake System E-3
Batteries (Specific Gravity) E-4
Cooling System E-3
Electrical System E-4
Exhaust System E-4
Fuel System E-2
General Specifications E-2
Lubricating Oil System E-2

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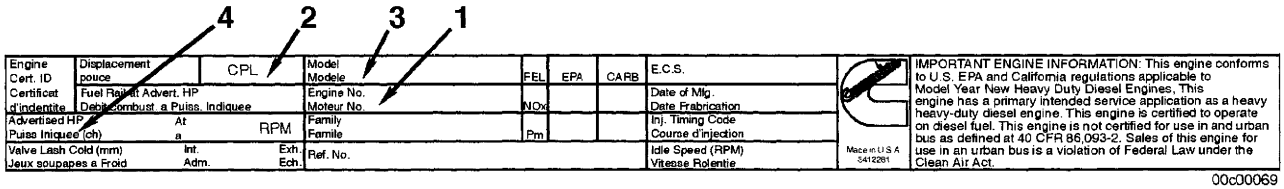
Engine Identification

Engine Dataplate

The engine dataplate, located on top of the rocker lever cover, provides the model identification and other important data about the engine.

Have the following engine data available when communicating with a Cummins Authorized Repair Location. The data on the dataplate are **mandatory** when sourcing service parts:

1. Engine serial number (ESN)
2. Control parts list
3. Model
4. Advertised horsepower and rpm.



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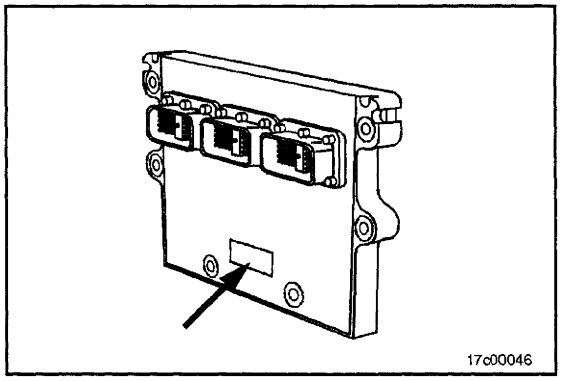
ECM Dataplate

Industrial

The electronic control module (ECM) dataplate is located on the front of the ECM.

The abbreviations on the dataplate are explained as follows:

- P/N = Part number
- S/N = Serial number
- D/C = Date code.

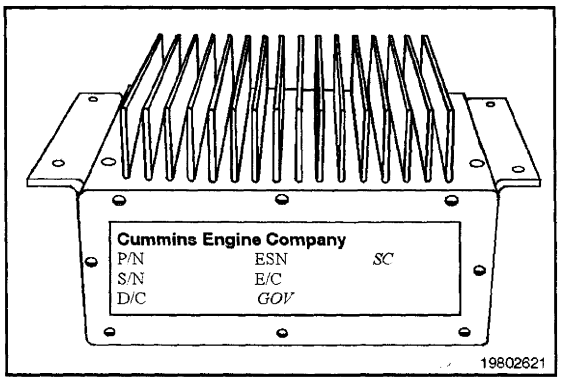

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Power Generation

The electronic control module (ECM) dataplate is located on the front of the ECM.

The abbreviations on the dataplate are explained as follows:

- P/N = Part number
- S/N = Serial number
- D/C = Date code.



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Specifications

General Specifications

Listed below are general specifications for this engine.

Horsepower ..... Refer to the engine dataplate

Engine Speed ..... Refer to the engine dataplate

Displacement ..... 15 liters [912 C.I.D.]

Bore and Stroke ..... 137 mm [5.40 in] x 169 mm [6.65 in]

Dry Engine Weight:
- Power Generation ..... 1370 kg [3020 lb]
- Industrial ..... 1524 kg [3360 lb]

Wet Engine Weight:
- Power Generation ..... 1475 kg [3250 lb]
- Industrial ..... 1628 kg [3590 lb]

Firing Order 1-5-3-6-2-4

Crankshaft Rotation (viewed from front of engine) ..... **Clockwise**

Overhead Adjustment:
- Intake Valve Adjustment ..... 0.36 mm [0.014 in]
- Exhaust Valve Adjustment ..... 0.69 mm [0.027 in]
- Injector Lash Adjustment Torque ..... 8 N•m [70 in-lb]
- Engine Brake Adjustment ..... 7.0 mm [0.276 in]

Fuel System

Maximum Allowable Restriction to Pump with or without Fuel Cooler:
- With Clean Filter ..... 203 mm Hg [8 in Hg]
- With Dirty Filter ..... 305 mm Hg [12 in Hg]

Maximum Allowable Fuel Return Line Restriction ..... 229 mm Hg [9.0 in Hg]

Minimum Allowable Fuel Tank Vent Capability ..... 2.0 m^3/hr [70 ft^3/hr]

Maximum Allowable Fuel Inlet Temperature ..... 71°C [160°F]

Fuel Shutoff Solenoids' Resistance ..... 7 to 8 ohms

Lubricating Oil System

Oil Pressure at Idle (minimum allowable at 93°C [200°F] oil temperature) ..... 103 kPa [15 psi]

Oil Pressure at No-Load Governed Speed (industrial **only**) ..... 241 to 276 kPa [35 to 40 psi]

Oil Capacity of Standard Engine:
- Combination Full-Flow/Bypass Filter Capacity ..... 3.78 liters [1 gal]
- Oil Pan Capacity:
  - Power Generation (OP 1493)
  - High ..... 94.6 liters [25 gal]
  - Low ..... 83.3 liters [22 gal]
  - Oil Change Capacity (oil pan and filter filled to capacity) ..... 98.4 liters [26 gal]
- Oil Pan Capacity:
  - Industrial
  - High ..... 41.6 liters [11 gal]
  - Low ..... 34.1 liters [9 gal]
  - Oil Change Capacity (oil pan and filter filled to capacity) ..... 45.4 liters [12 gal]

Total Lubricating Oil System Capacity Including Filter:
- Power Generation (OP 1493) ..... 98.4 liters [26 gal]
- Industrial ..... 45.4 liters [12 gal]

Oil Pressure Range:
- Cold Engine ..... Up to 900 kPa [130 psi]
- Warm Engine ..... 241 to 276 kPa [35 to 40 psi]

Cooling System

Coolant Capacity (engine **only**) ..... 24 liters [25 qt]

Standard Modulating Thermostat Range ..... 82 to 93°C [180 to 200°F]

Maximum Coolant Pressure
(exclusive of pressure cap - closed thermostat at the maximum no-load governed speed) ..... 227 kPa [33 psi]

Coolant Alarm Activation Temperature (industrial **only**) ..... 110°C [230°F]

Maximum Allowable Top Tank Temperature:
Industrial ..... 102°C [215°F]
Power Generation (Standby/Prime) ..... 110°C [230°F]/104°C [220°F]

Minimum Recommended Top Tank Temperature ..... 70°C [158°F]

Minimum Allowable Drawdown or 11 Percent of System Capacity (whichever is greater) ..... 2.6 liters [2.75 qt]

Minimum Recommended Pressure Cap
Industrial ..... 50 kPa [7 psi]
Power Generation ..... 70 kPa [10 psi]

Minimum Fill Rate (without low-level alarm) ..... 19 liters/min [5 gpm]

Maximum Deaeration Time ..... 25 minutes

Fan-on Coolant Temperature (industrial **only**) ..... 95°C [203°F]

Fan-on Intake Air Temperature (industrial **only**) ..... 66°C [150°F]

Shutter Opening Temperature (industrial **only**):
Coolant ..... 85°C [185°F]
Intake Air ..... 60°C [140°F]

Air Intake System

△ CAUTION △

Engine intake air must be filtered to prevent dirt and debris from entering the engine. If air intake piping is damaged or loose, unfiltered air will enter the engine and cause premature wear.

Maximum Temperature Rise between Ambient Air and Engine Air Inlet (ambient above 0°C [32°F]):
Industrial ..... -1°C [30°F]
Power Generation ..... 6°C [43°F].

Maximum Inlet Restriction (clean filter) Normal-Duty Element: ..... 381 mm H_2O [15 in H_2O]

Maximum Inlet Restriction (dirty filter) ..... 635 mm H_2O [25 in H_2O]

Maximum Allowable Pressure Drop across Charge Air Cooler:
Industrial
psi ..... 14 kPa [2 psi]
Hg (mercury) ..... 102 mm Hg [4 in Hg]

Maximum Allowable Pressure Drop from Turbo Outlet to Intake Manifold:
Power Generation
psi ..... 14 kPa [2 psi]
Hg (mercury) ..... 102 mm Hg [4 in Hg]

Four-Step Wastegate Controller Solenoid Resistance (industrial **only**) ..... 7 to 8 ohms

Exhaust System

Maximum Allowable Exhaust Back Pressure Created by Piping and Silencer:

Industrial
- Hg (mercury) ..... 76 mm Hg [3 in Hg]
- H_2O (water) ..... 1016 mm H_2O [40 in H_2O]

Power Generation
-Hg (mercury) ..... 51 mm Hg [2 in Hg]
-H_2O (water) ..... 682 mm H_2O [27 in H_2O]

Exhaust Pipe Size (normally acceptable inside diameter):

Industrial ..... 127 mm [5 in]
Power Generation ..... 152 mm [6 in]

Electrical System

Minimum Recommended Battery Capacity:

System Voltage		Ambient Temperatures -18°C [0°F]	
		Cold Cranking Amperes	Reserve Capacity* Amperes
12 VDC	Industrial	2700	360
	Power Generation	1800	540
24 VDC**	Industrial	1350	360
	Power Generation	900	270

* The number of plates within a given battery size determines reserve capacity. Reserve capacity determines the length of time that sustained cranking can occur.

**CCA ratings are based on two 12-VDC batteries in series.

A minimum of 6 VDC at the OEM connector is required to power up the ECM.

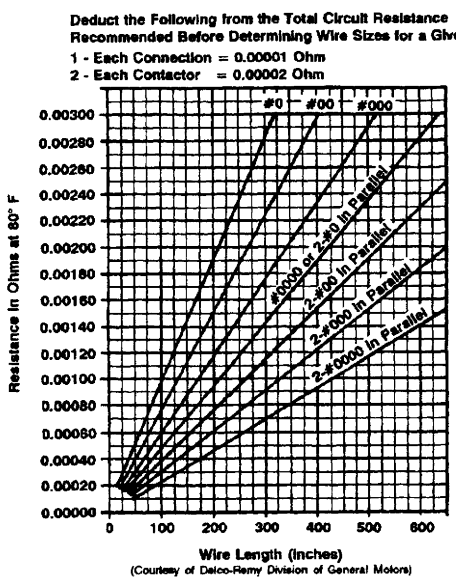
Batteries (Specific Gravity)

Specific Gravity at 27°C [80°F]	State of Charge
1.26 to 1.28	100%
1.23 to 1.25	75%
1.20 to 1.22	50%
1.17 to 1.19	25%
1.11 to 1.13	Discharged

Maximum resistance of starting motor circuit:

12-VDC Starting Motor (ohms) 0.00075
24-VDC Starting Motor (ohms) 0.002

Cable resistances can be obtained in the accompanying Battery Cable Resistance Chart. If the frame is in ground circuit, the frame length **must** be considered to be a cable of the same size as that used in the balance of the system.



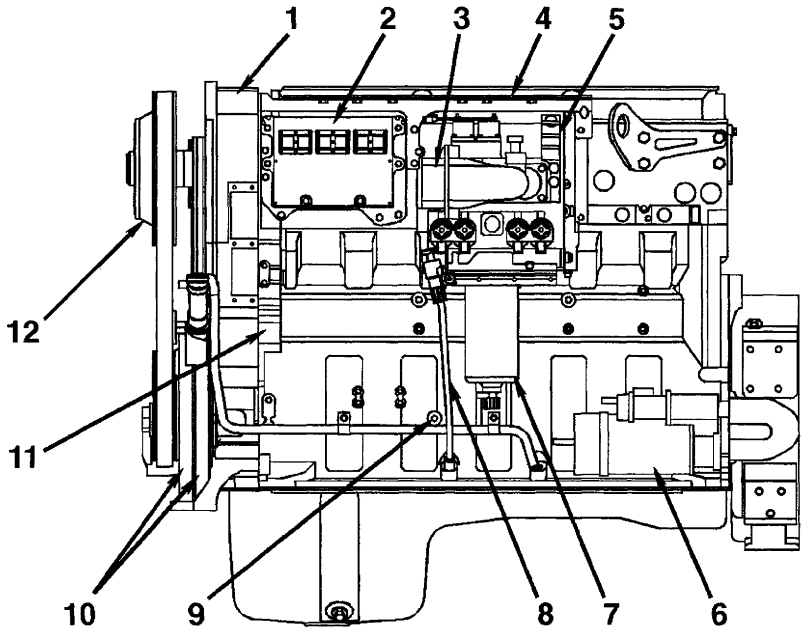
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Item	Resistance Ohms
Connection	0.00001
Additional Contacter (Series-Parallel Switch, Relays, etc.)	0.00020

Engine Diagrams

Engine Views

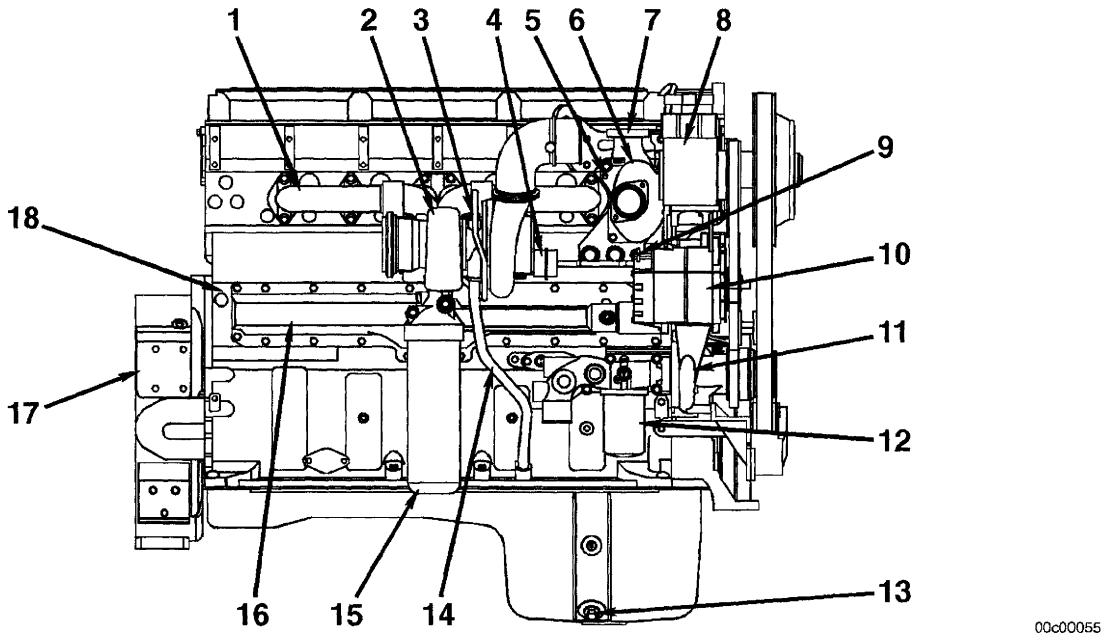
The following illustrations show the locations of the major external engine components, filters, and other service and maintenance points. Some external components will be at different locations for different engine models.



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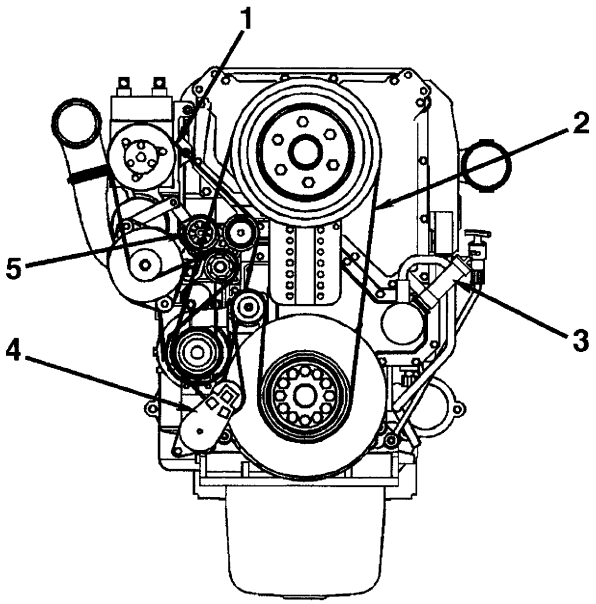
Intake Side
Industrial

1. Gear Housing
2. Electronic Control Module (ECM)
3. Air Intake
4. Engine Dataplate
5. Fuel Pump
6. Starter
7. Fuel Filter
8. Lubricating Oil Dipstick
9. Crankshaft Timing Pin Port
10. Vibration Dampers
11. Barring Device/Air Compressor
12. Fan Hub.



Exhaust Side
Industrial

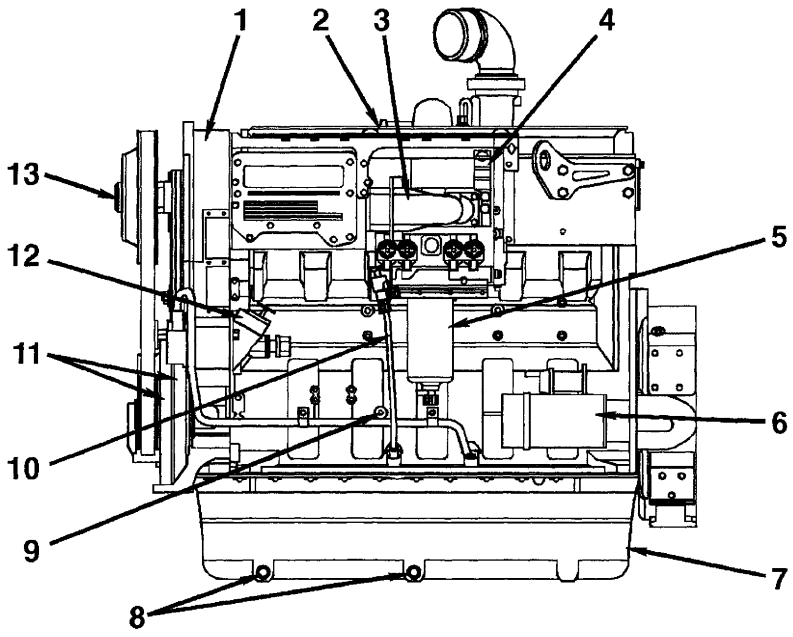
1. Exhaust Manifold
2. Turbocharger
3. Oil Inlet to Turbocharger
4. Wastegate Actuator
5. Thermostat Housing Vent
6. Thermostat Housing
7. Engine Coolant Outlet (to Radiator)
8. Freon Compressor
9. Coolant Temperature Sensor
10. Alternator
11. Water Pump
12. Coolant Filter
13. Lubricating Oil Drain
14. Turbocharger Oil Drain
15. Combination Full Flow/Bypass Lubricating Oil Filter
16. Lubricating Oil Cooler Assembly
17. Flywheel Housing
18. Engine Serial Number.



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Front
Industrial

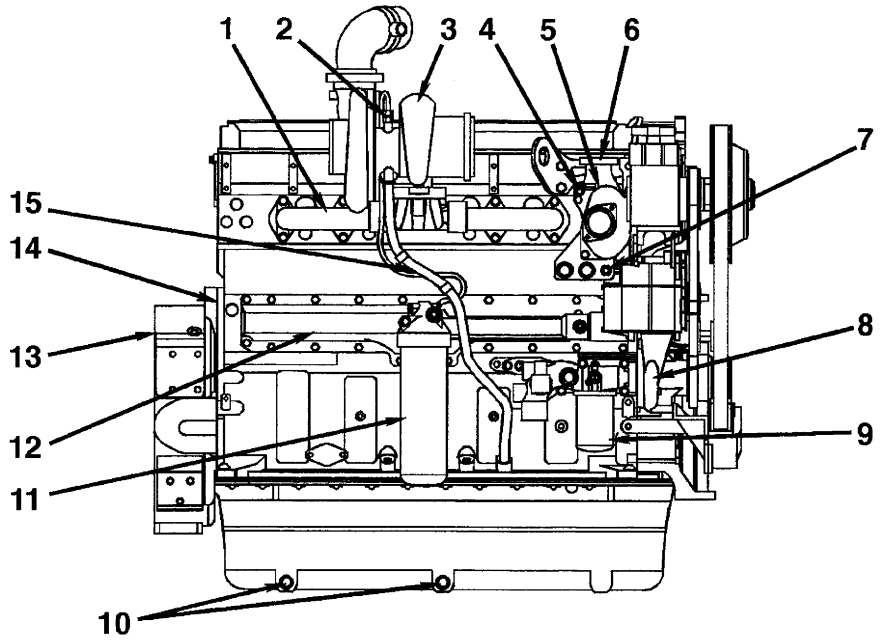
1. Accessory Drive Belt
2. Water Pump/Fan Drive Belt
3. Lubricating Oil Fill
4. Water Pump/Fan Drive Belt Tensioner
5. Accessory Drive Belt Tensioner.



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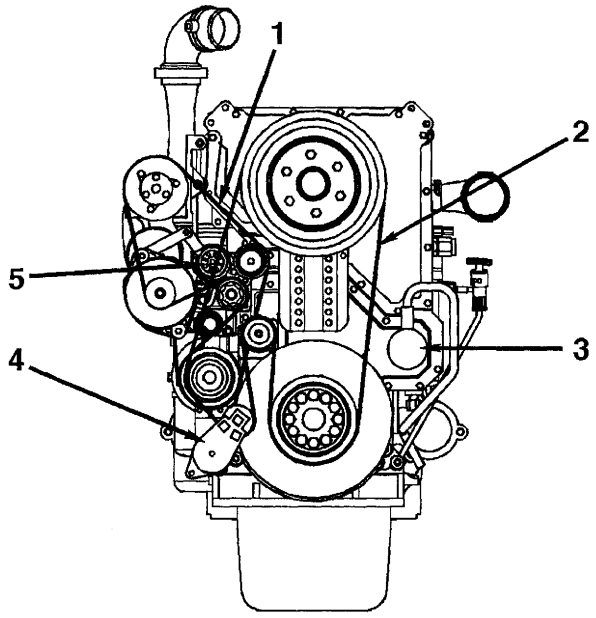
Intake Side
Power Generation

1. Gear Cover
2. Engine Dataplate
3. Air Intake
4. Fuel Pump
5. Fuel Filter
6. Starter
7. Lubricating Oil Pan
8. Lubricating Oil Drains
9. Crankshaft Timing Pin Port
10. Lubricating Oil Dipstick
11. Vibration Dampers
12. Lubricating Oil Fill/Barring Device
13. Fan Hub.



Exhaust Side
Power Generation

1. Exhaust Manifold
2. Lubricating Oil Inlet to Turbocharger
3. Turbocharger
4. Thermostat Housing Vent
5. Thermostat Housing
6. Engine Coolant Outlet (to Radiator)
7. Coolant Temperature Sensor
8. Water Pump
9. Coolant Filter
10. Lubricating Oil Drains
11. Combination Full Flow/Bypass Lubricating Oil Filter
12. Lubricating Oil Cooler Assembly
13. Flywheel Housing
14. Engine Serial Number
15. Turbocharger Lubricating Oil Drain.



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Front
Power Generation

1. Accessory Drive Belt
2. Water Pump/Fan Drive Belt
3. Crankcase Breather
4. Water Pump/Fan Drive Belt Tensioner
5. Accessory Drive Belt Tensioner.

NOTES

Section 1 - Operating Instructions

Section Contents

Page

Cold Weather Operation 1-8
General Information 1-8

Cold Weather Starting Using Starting Fluid 1-4
With Mechanical or Electrical Metering Equipment (Ether) 1-4

Electromagnetic Interference (EMI) 1-36
General Information 1-36
System EMI Radiation Levels 1-36
System EMI Susceptibility 1-36

Electronic Controlled Fuel System 1-11
Diagnostic Fault Codes 1-29
Industrial 1-29
Power Generation 1-33
Engine Protection System 1-35
Fuel System Description 1-13
Electronic Control Module (ECM) Dataplate 1-15
Electronic Control Module Inputs 1-15
Engine Diagrams 1-13
General Information 1-11
Industrial 1-11
Power Generation 1-12
Programmable Features 1-18
Industrial 1-18
Power Generation 1-24

Engine Braking System 1-9
General Information 1-9

Engine Operating Range 1-7
General Information 1-7

Engine Shutdown 1-9
General Information 1-9

Fuel Shutoff Valve 1-4
General Information 1-4

Normal Starting Procedure 1-2
General Information 1-2

Operating Instructions - General Information 1-1

Operating the Engine 1-6
General Information 1-6

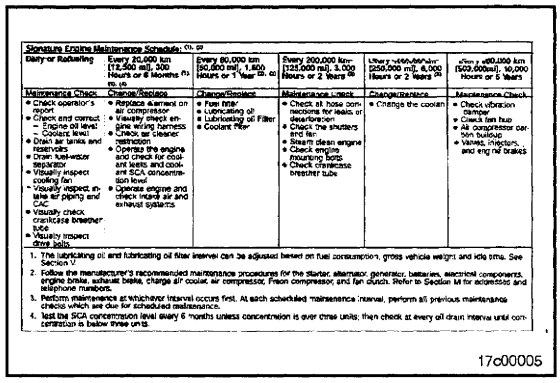
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Operating Instructions - General Information

Correct care of your engine will result in longer life, better performance, and more economical operation.

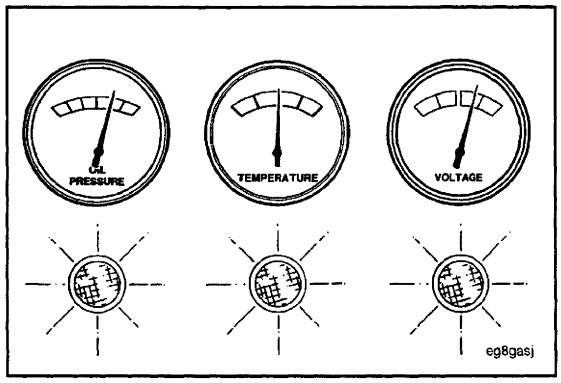
Follow the daily maintenance checks listed in Maintenance Guidelines, Section 2.

The **new** Cummins engine associated with this manual does **not** require a break-in procedure. Section 1 of this manual provides all of the necessary information required for correct engine operation.



Check the oil pressure indicators, temperature indicators, warning lights, and other gauges daily to make sure they are operational.

Avoid exposure of your engine to corrosive chemicals.



⚠ WARNING ⚠

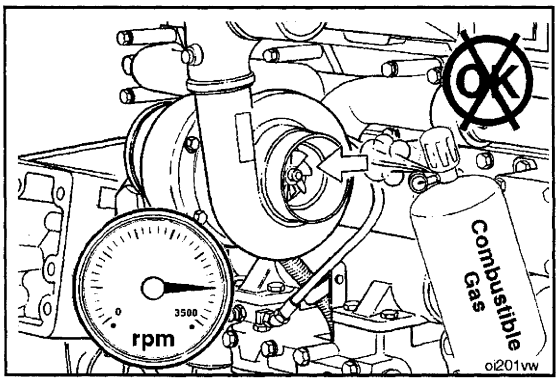
Do not operate a diesel engine where there are or can be combustible vapors. These vapors can be sucked through the air intake system and cause engine acceleration and overspeeding, which can result in a fire, an explosion, and extensive property damage.

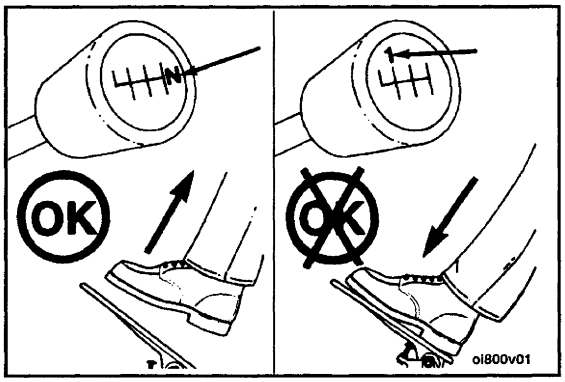
⚠ WARNING ⚠

Numerous safety devices are available, such as air intake shutoff devices, to minimize the risk of overspeeding in which an engine, because of application, might operate in a combustible environment (from a fuel spill or gas leak, for example).

⚠ WARNING ⚠

Cummins Engine Company, Inc., does not know how you will use your engine. The equipment owner and operator, therefore, is responsible for safe operation in a hostile environment. Consult your Cummins Authorized Repair Location for further information.





Normal Starting Procedure

General Information

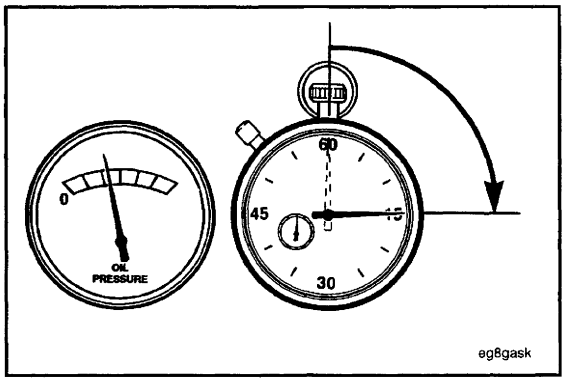
⚠ CAUTION ⚠

To prevent damage to the starter, do not engage the starting motor for more than 30 seconds. Wait 2 minutes between each attempt to start (electrical starting motors only).

Disengage the driven unit, or, if equipped, put the transmission in neutral. On generator sets, open the main circuit breaker.

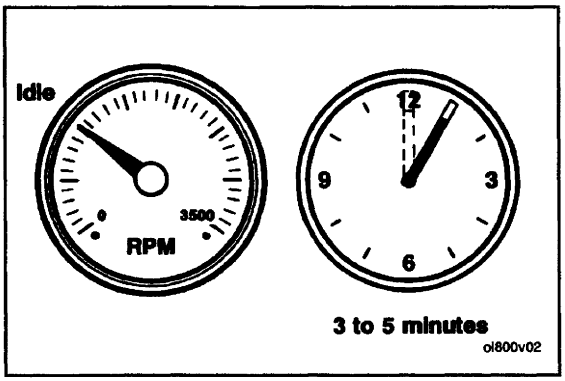
Start the engine with the throttle in the idle position.

NOTE: Engines equipped with air starting motors require a minimum of 480 kPa [70 psi].

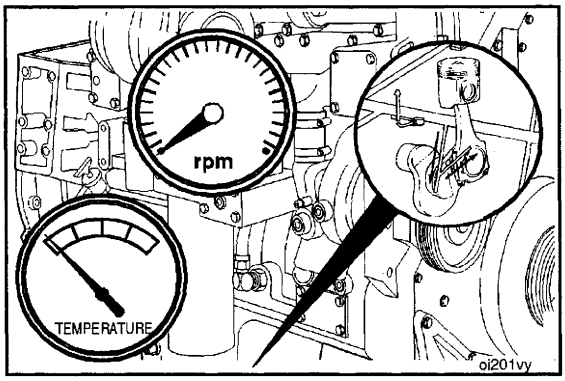


⚠ CAUTION ⚠

The engine must have adequate oil pressure within 15 seconds after starting. If the warning light indicating low oil pressure has not gone out or there is no oil pressure indicated on a gauge within 15 seconds, shut off the engine immediately to avoid engine damage. Confirm the correct oil level in the oil pan.



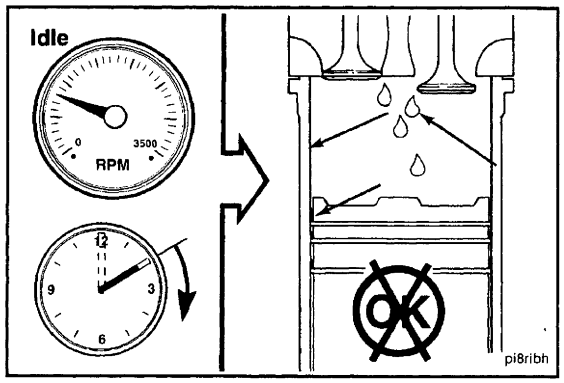
Idle the engine 3 to 5 minutes before operating with a load.



Increase the engine speed (rpm) slowly to provide adequate lubrication to the bearings and to allow the oil pressure to stabilize. Allowing the oil pressure to stabilize before applying a load can greatly increase the service life of the engine.

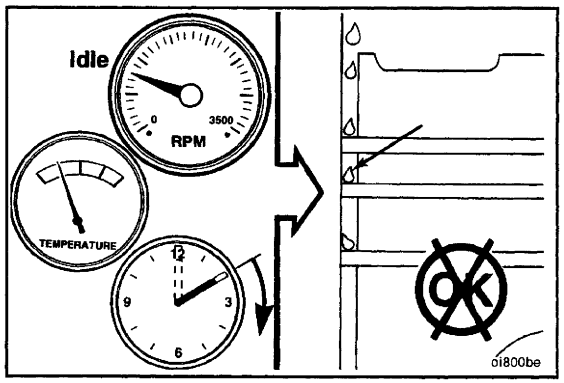
⚠ CAUTION ⚠

Do not keep the engine at low idle for long periods. Long periods (more than 10 minutes) at low idle can damage an engine because combustion chamber temperatures drop so low the fuel will not burn completely. This will cause carbon to build up around the injector spray holes and piston rings and can cause the valves to stick.



⚠ CAUTION ⚠

If the engine coolant temperature becomes too low, 60°C [140°F], raw fuel will wash the lubricating oil off the cylinder walls and dilute the crankcase oil. Fuel dilution weakens lubricating oil properties and can shorten engine life. Operating the engine at rated speed reduces the possibility of these undesirable effects.



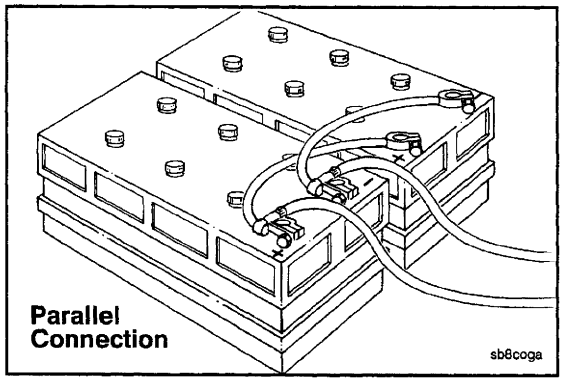
⚠ WARNING ⚠

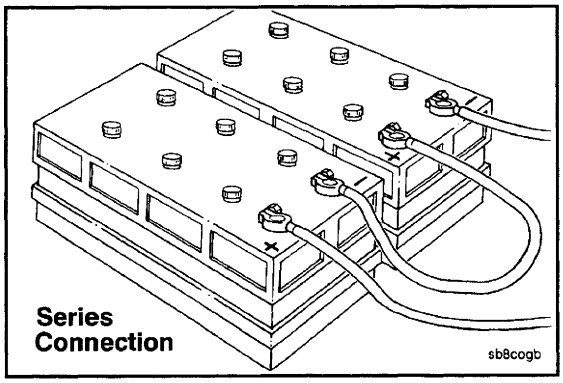
Batteries can emit explosive gases. To avoid personal injury, always ventilate the compartment before servicing the batteries. To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

⚠ CAUTION ⚠

When using jumper cables to start the engine, make sure to connect the cables in parallel: Positive (+) to positive (+) and negative (-) to negative (-). When using an external electrical source to start the engine, turn the keyswitch to the OFF position. Remove the key before attaching the jumper cables.

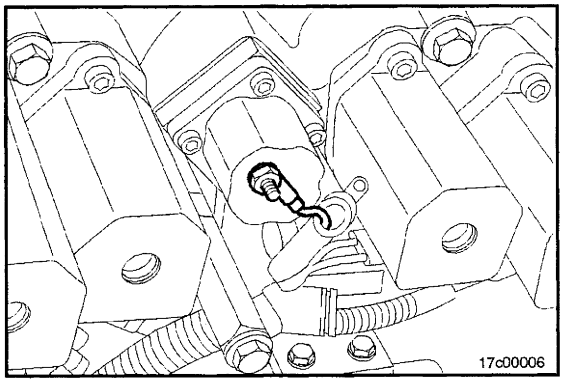
The accompanying illustration shows a typical parallel battery connection. This arrangement doubles the cranking amperage.





This illustration shows a typical series battery connection. This arrangement, positive (+) to negative (-), doubles the voltage.

NOTE: Power Generation uses a 24-VDC electrical system.



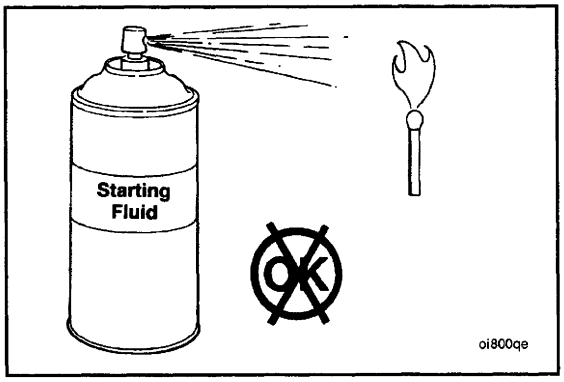
Fuel Shutoff Valve

General Information

⚠ CAUTION ⚠

The QSX15 ECM provides a voltage output in the harness to control the fuel shutoff valve solenoid. The output voltage is equal to the battery voltage (system voltage). This must be the only wire connected to the fuel shutoff valve solenoid. Excessive current draw will cause possible engine shutdowns and fault codes to be logged.

NOTE: Power Generation engines have two wires connected to the fuel shutoff valve solenoid. The output voltage is 12 VDC. These **must** be the **only** wires attached to the solenoid.

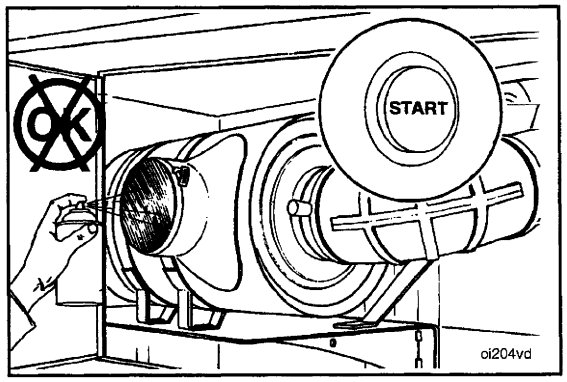


Cold Weather Starting Using Starting Fluid

With Mechanical or Electrical Metering Equipment (Ether)

⚠ WARNING ⚠

Because of the potential for an explosion, do not use volatile cold starting aids in underground mine or tunnel operations. Ask the local U.S. Bureau of Mines inspector for instructions.

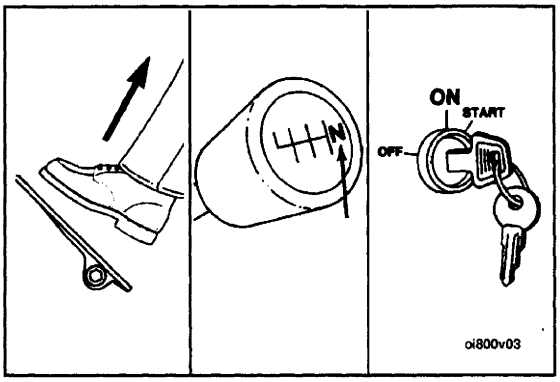


⚠ WARNING ⚠

Starting fluid is highly flammable and explosive. Do not smoke anywhere near the vicinity. Keep flames, sparks, and arcing equipment and switches away from starting fluid.

Because of increased safety hazards and potential for engine damage, do **not** use starting fluid without metering equipment.

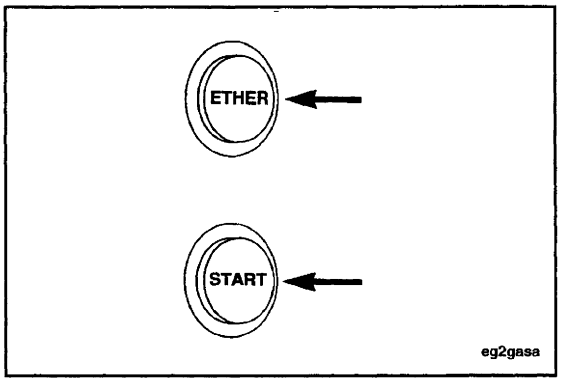
1. Set the throttle at idle.
2. Disengage any driven accessories and, if equipped, put the transmission in NEUTRAL.
3. Turn on the keyswitch to power up the electronic control module (ECM).



⚠ CAUTION ⚠

Do not use excessive amounts of starting fluid when starting an engine. The use of too much starting fluid will cause engine damage.

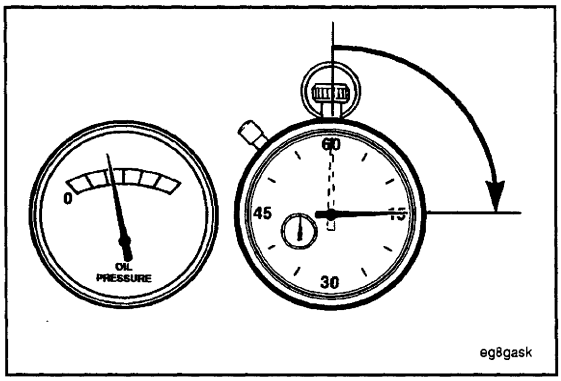
4. While cranking the engine, inject a metered amount of starting fluid.



⚠ CAUTION ⚠

The engine must have adequate oil pressure within 15 seconds after starting. If the warning light indicating low oil pressure has not gone out or there is no oil pressure indicated on a gauge within 15 seconds, shut off the engine immediately to avoid engine damage.

Confirm the correct oil level in the oil pan.

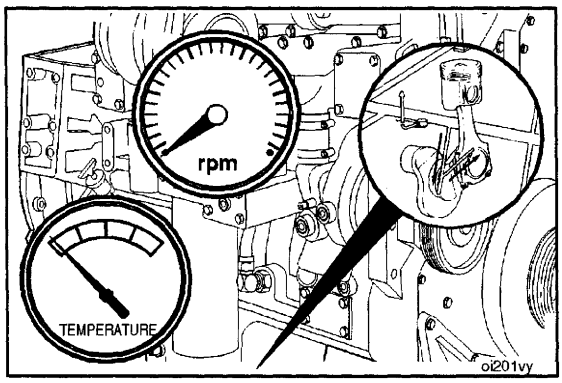


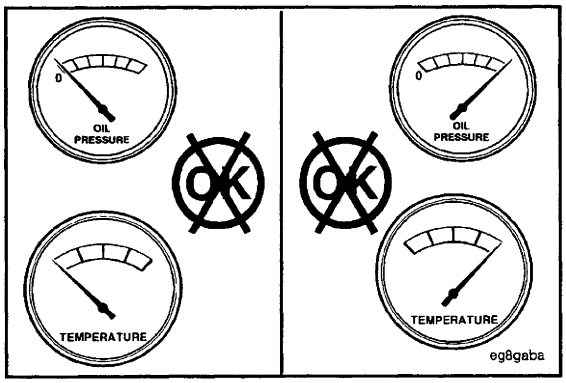
Do **not** increase the engine speed above low idle until the coolant temperature gauge needle starts to move or 10 minutes have elapsed. This will provide adequate lubrication to the bearings.

Monitor the oil pressure after normal operation is initiated.

For the first start after a significant maintenance action, running the engine initially at low idle can reduce leaks due to improperly seated gaskets.

NOTE: For Generator Set Engines, operating the engine at low-idle speed is **not** necessary.



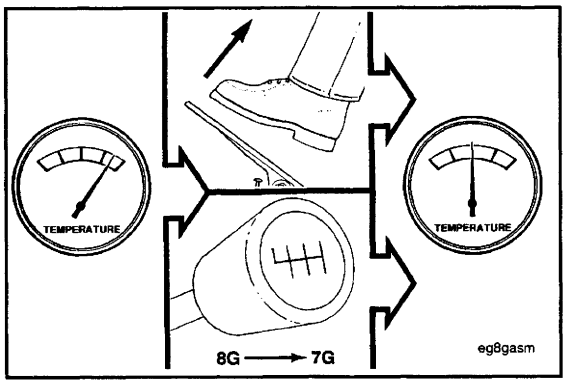


Operating the Engine

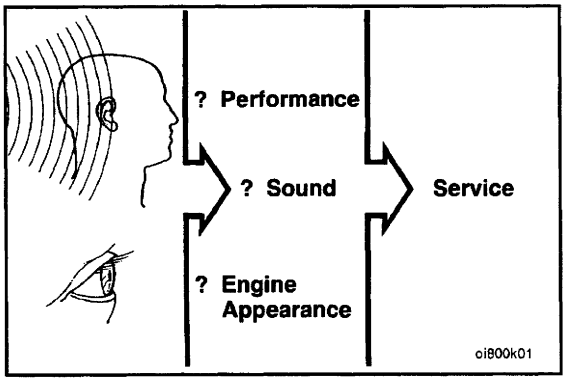
General Information

Monitor the oil pressure and coolant temperature gauges frequently. Refer to Lubricating Oil System Specifications and Cooling System Specifications in Section V for recommended operating pressures and temperatures. Shut off the engine if any pressure or temperature does **not** meet the specifications.

NOTE: Continuous operation with a low coolant temperature, below 60°C [140°F], or a high coolant temperature, above 110°C [230°F], can damage the engine.

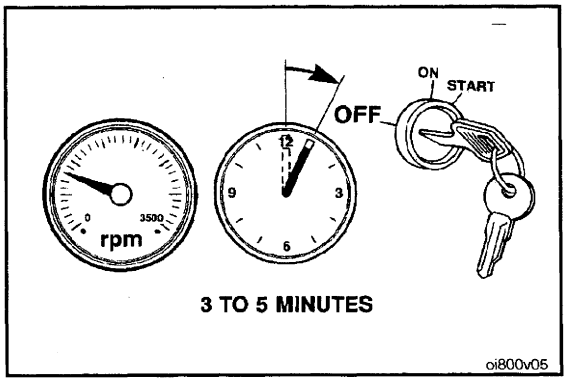


If an overheating condition starts to occur, reduce the load on the engine by releasing the throttle pedal pressure or shifting the transmission to a lower gear, or both, until the temperature returns to the normal operating range. If the engine temperature does **not** return to normal, shut off the engine and refer to Section TS, or contact a Cummins Authorized Repair Location.



Most failures give an early warning. Look and listen for changes in performance, sound, or engine appearance that can indicate service or engine repair is needed. Some changes to look for are as follows:

- Engine misfires
- Vibration
- Unusual engine noises
- Sudden changes in engine operating temperatures or pressures
- Excessive smoke
- Loss of power
- An increase in oil consumption
- An increase in fuel consumption
- Fuel, oil, or coolant leaks.



Allow the engine to idle 3 to 5 minutes before shutting it off after a full-load operation. This allows adequate cooldown of pistons, cylinder liners, bearings, and turbocharger components.

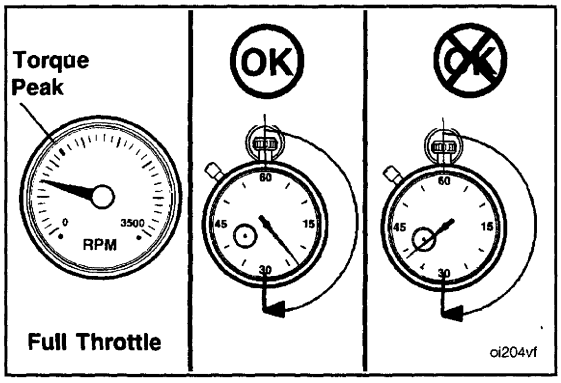
Engine Operating Range

General Information

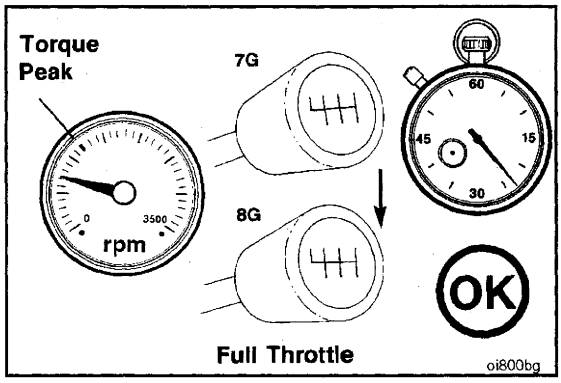
⚠ CAUTION ⚠

Do not operate the engine at full throttle below peak torque rpm (refer to engine dataplate for peak torque rpm) for more than 30 seconds. This condition will shorten engine life to overhaul, can cause serious engine damage, and is considered driver abuse.

Cummins engines are designed to operate successfully at full throttle under transient conditions down to peak torque engine speed. This is consistent with recommended operating practices.



Operation of the engine below peak torque rpm can occur during gear shifting because of the difference in ratios between transmission gears, but engine operation **must not** be sustained for more than 30 seconds at full throttle below peak torque rpm.

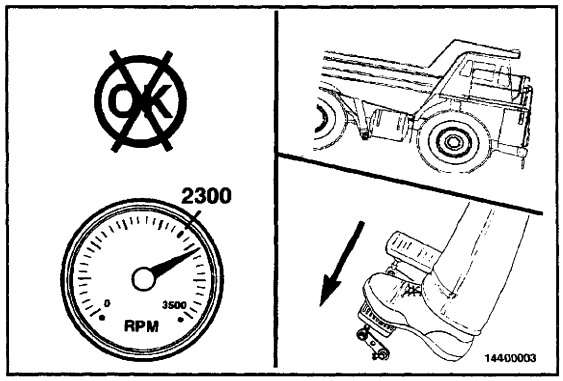


⚠ CAUTION ⚠

Do not operate the engine beyond high-idle speed. Operating the engine beyond high-idle speed can cause severe engine damage. The engine speed must not exceed 2300 rpm under any circumstances. When descending a steep grade, use a combination of transmission gears and engine or service brakes to control the vehicle and engine speed.

⚠ CAUTION ⚠

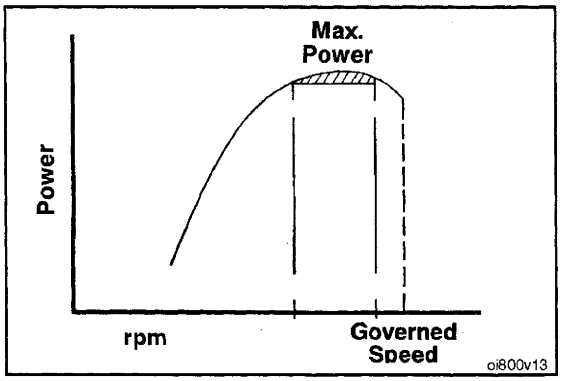
To prevent damage to the camshaft and the valve train when using an engine compression brake, do not exceed governed speed.



QSX15 engines produce maximum power at an rpm less than governed engine speed. Placement of maximum power has been changed on QSX15 engines to encourage operation in the most fuel efficient engine speed range.

To obtain optimum engine performance under load, allow the engine speed to load down to near torque peak. This will result in an engine operating speed in the maximum power zone.

Refer to the engine dataplate for torque peak rpm and governed speed rpm.



Cold Weather Operation

General Information

It is possible to operate diesel engines in extremely cold environments if they are properly prepared and maintained. The correct lubricants, fuels, and coolants **must** be used for the cold weather range for which the vehicle is being operated. Refer to the chart below for recommendations for different operating ranges.

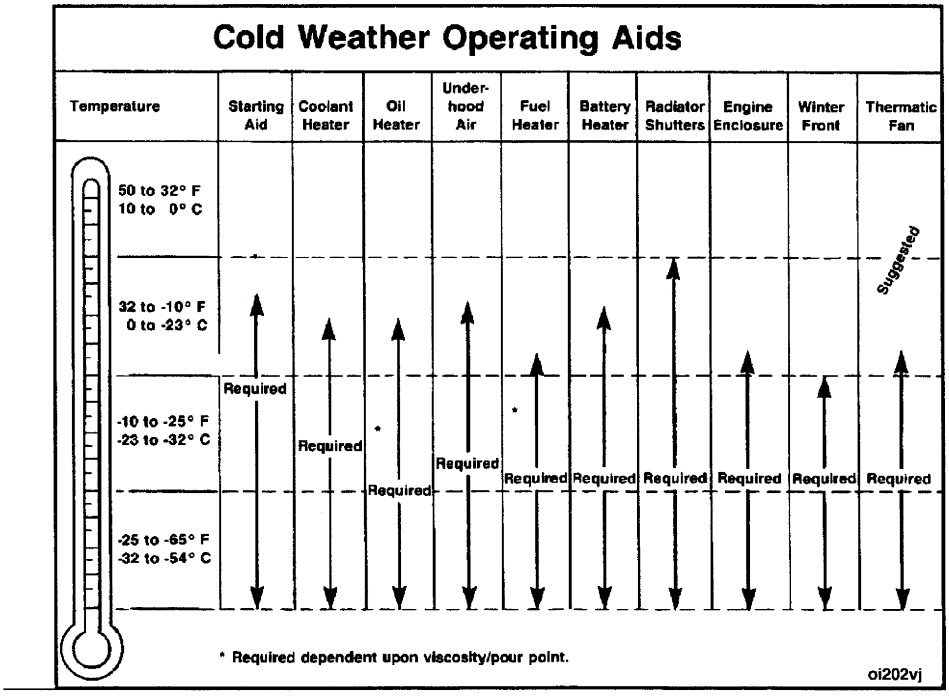
Winterize 0 to -32°C [32 to -25°F]	Arctic Specifications -32 to -54°C [-25 to -65°F]
Use 50-percent ethylene or propylene glycol antifreeze and 50-percent water mixture.	Use 60-percent ethylene or propylene glycol antifreeze and 40-percent water mixture.
Use multiviscosity oil meeting CES 20,076*.	Use arctic oil meeting CES 20,076*.
Fuel to have maximum cloud and pour points 6°C [10°F] lower than ambient temperatures in which engine operates.	Fuel to have maximum cloud and pour points 6°C [10°F] lower than ambient temperature in which engine operates.

* For information on CES (Cummins Engineering Standard) 20,076, write or call toll free:

Cummins Customer Assistance Center - 41403
Cummins Engine Company, Inc.
Box 3005
Columbus, IN 47202-3005

1-800-DIESELS
(1-800-343-7357)

The following cold weather operating aids are often required for cold weather situations, depending on engine application:

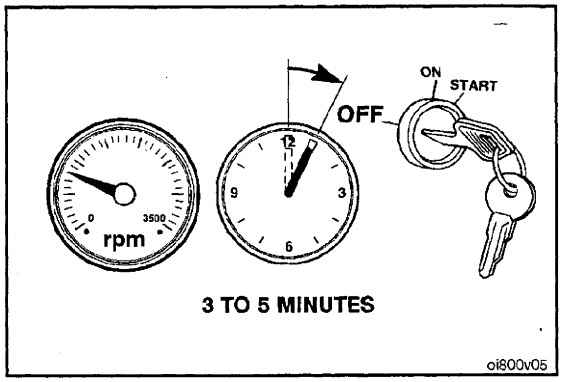


NOTE: Generator Sets do **not** require underhood air, radiator shutters, winterfronts, or thermatic fan.

Engine Shutdown

General Information

1. Allow the engine to idle 3 to 5 minutes before shutting it off after a full-load operation. This allows adequate cooldown of pistons, cylinders, bearings, and turbocharger components.
2. Turn the ignition keyswitch to the OFF position.



Engine Braking System

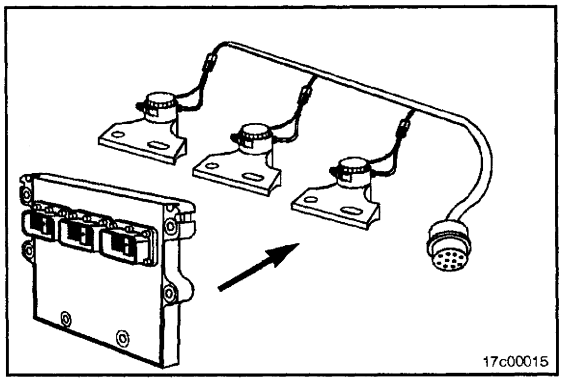
General Information

⚠ CAUTION ⚠

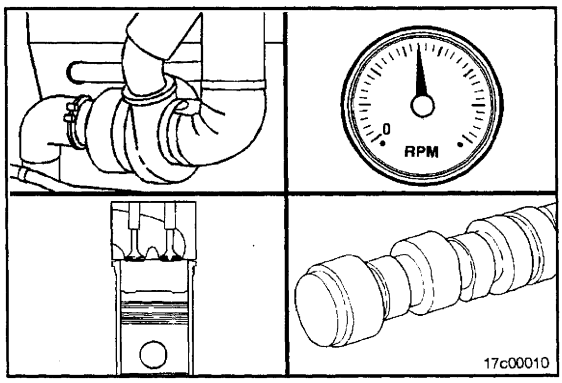
Do not exceed governed engine speed when operating engine brakes. Engine damage can occur. The engine brakes are designed to assist the vehicle's service brakes to slow down the vehicle.

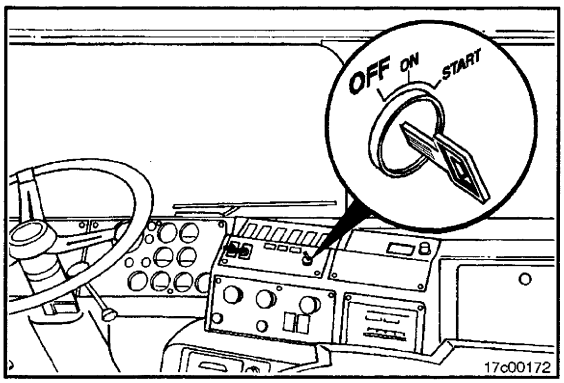
The Intebrake™ system (engine brakes) are optional on QSX15 engines.

Engine brakes use the energy of engine compression to provide vehicle retardation by converting the engine to an energy-absorbing device to reduce vehicle speed. This is accomplished by a hydraulic circuit that opens the exhaust valves near the end of the compression stroke.



The amount of braking power available on QSX15 engines is up to 600 hp. Braking power is managed by the Intebrake™ system (engine brakes).





⚠ CAUTION ⚠

Do not operate the engine if the engine brakes will not deactivate. To do so will cause severe engine damage.

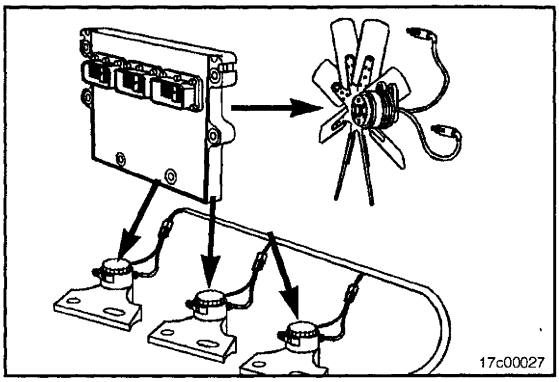
If the engine brakes will **not** shut off, shut off the engine immediately, and contact a Cummins Authorized Repair Facility.

Electronic Controlled Fuel System

General Information

Industrial

The QSX15 fuel system is an electronically controlled system designed to optimize engine contol and reduce exhaust emissions. The QSX15 fuel system controls engine speed and fuel pressure based on input from the electric throttle and other equipment-specific and/or model-specific features.



QSX15 Fuel System

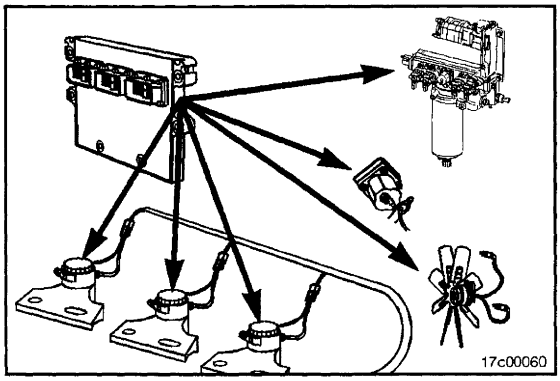
- Optimized Engine Control
- Reduced Exhaust Emissions.

The QSX15 engine has the capability of controlling the fan clutch actuator if an electronically controlled fan clutch is used.

The QSX15 engine also allows the engine brakes to be activated by controlling the engine brake solenoids, if applicable.

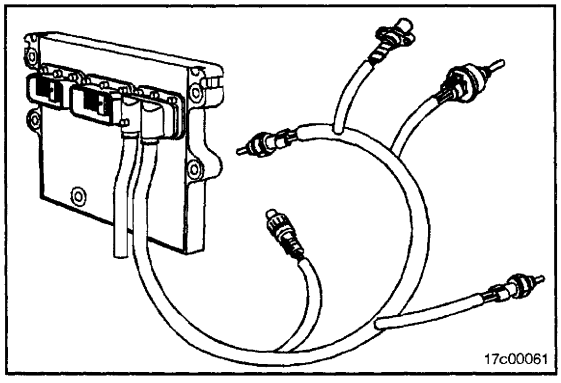
The ECM sends signals to the following components to control the vehicle:

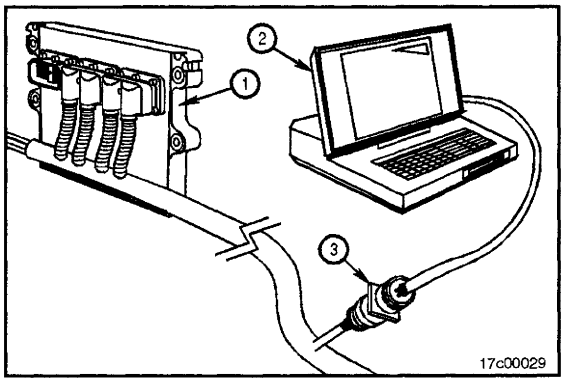
- Fuel shutoff valve solenoid
- Integrated fuel system module
- Fan clutch
- Engine brake solenoid valves, if applicable.



The following sensors are connected to the ECM with the engine wiring harness:

- Intake air pressure/temperature sensor
- Oil pressure/temperature sensor
- Coolant temperature
- Ambient air pressure sensor
- Fuel pressure sensor
- Water-in-fuel sensor
- Crankshaft position sensor
- Camshaft position sensor
- Wet tank pressure sensor.

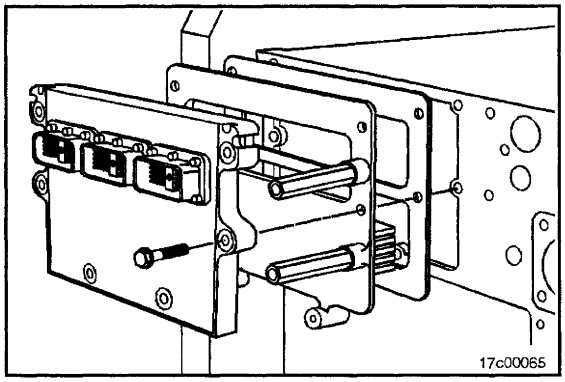




The ECM (1) has a datalink (2) for electronic service tools (3). Electronic service tools can be used to read and program owner-specified information into the ECM by a Cummins Authorized Repair Location. The electronic service tools can also be used to aid in troubleshooting the engine in the event of a failure, by reading and displaying fault codes.

The datalink connector is located on the OEM harness and can be one of several designs:

- 2-pin Weather-Pack
- 6-pin Deutsch
- 8-pin AMP
- 9-pin Deutsch.



The engine has a cooling plate that is mounted to the cylinder head within the air intake port. The ECM is mounted to the cooling plate. The intake air flows over the cooling plate and cools the electronics in the ECM.

Power Generation

The QSX15 fuel system is an electronic control system designed to optimize engine control and reduce exhaust emissions. This system is based on the PT fuel system design, yet it is specific to the QSX15 products. It controls engine speed and fuel pressure utilizing electronic sensors within the Quantum™ system.

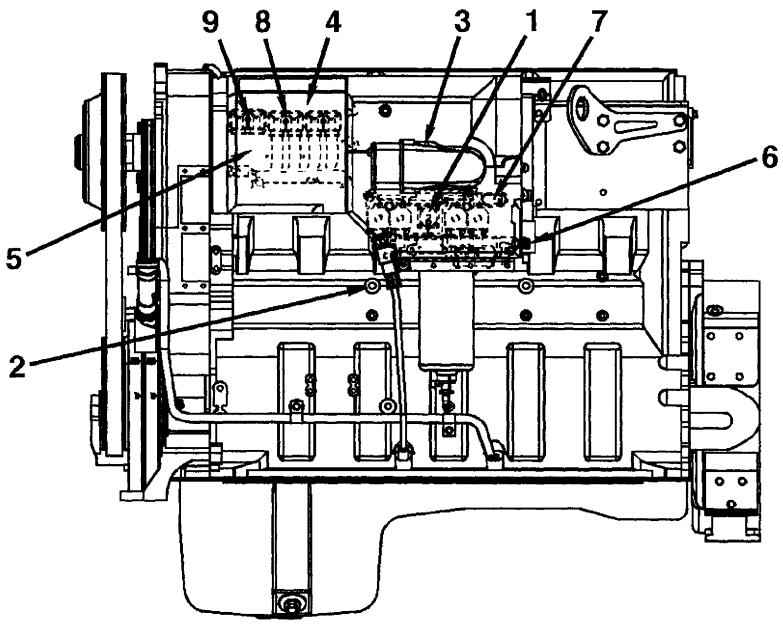
QSX15 Fuel System

- Optimized Engine Control
- Reduced Exhaust Emissions.

Fuel System Description

Engine Diagrams

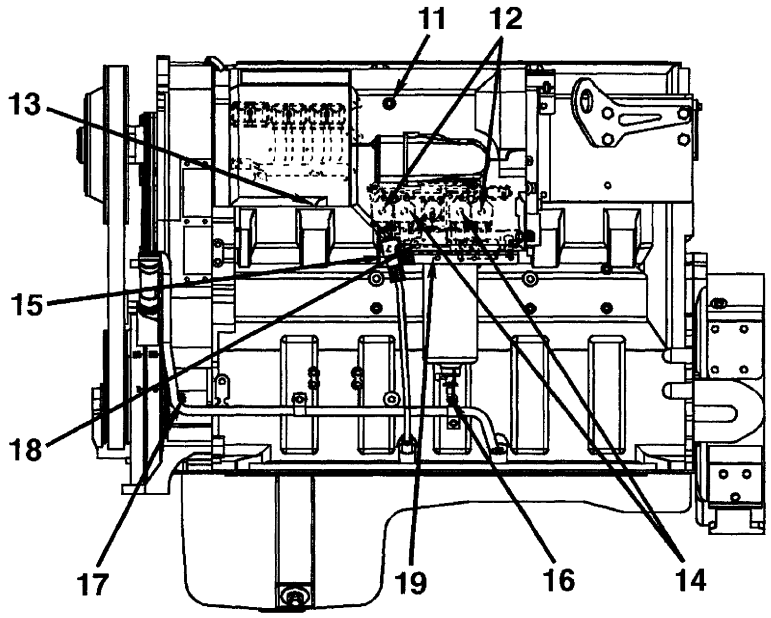
The illustrations that follow show the locations of the major fuel system components.



19c00616

The QSX15 electronically controlled fuel system consists of:

1. Fuel Shutoff Valve
2. Oil Pressure/Temperature Sensor
3. Intake Manifold Pressure/Temperature Sensor
4. Cooling Plate (behind ECM)
5. Electronic Control Module
6. Fuel In
7. Fuel Out
8. ECM Actuator Harness Port (Industrial only)
9. ECM OEM Harness Port (Industrial only).



19c00617

The QSX15 electronically controlled fuel system consists of:

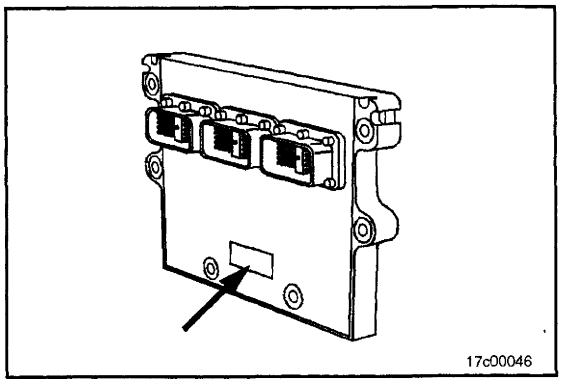
11. Camshaft Position Sensor
12. Fueling Actuators
13. Ambient Air Pressure Sensor
14. Timing Actuators
15. Fuel Pressure Sensor
16. Water-in-Fuel Separator
17. Crankshaft Position Sensor
18. Front and Rear Rail Pressure Sensor
19. Fuel Inlet Restriction Sensor
20. Coolant Level Sensor (In Radiator) - Optional*.

*** Not in this view.**

Electronic Control Module (ECM) Dataplate

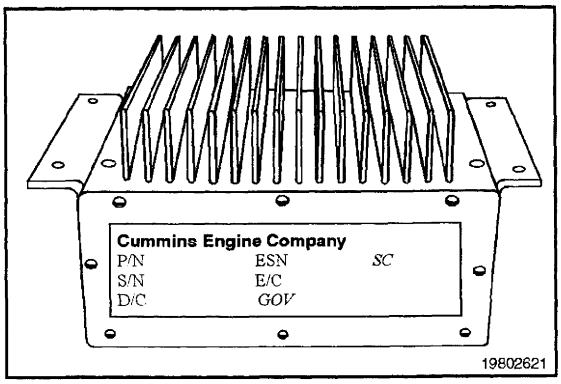
Industrial

The data tag for the ECM is located on the front of the module housing.



Power Generation

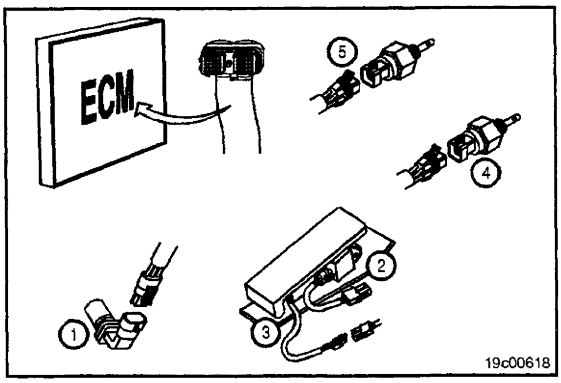
The data tag for the ECM is located on the side of the ECM opposite the ECM connectors.



Electronic Control Module Inputs

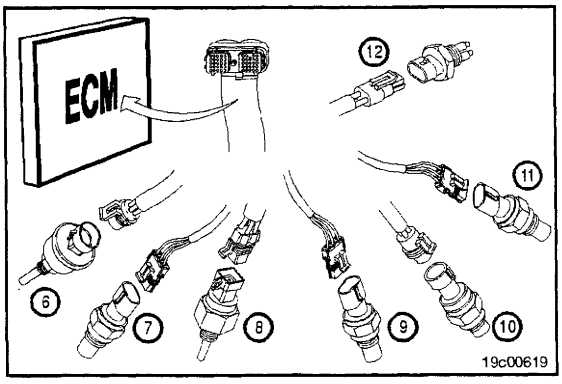
Electronic Control Module (ECM) Inputs:

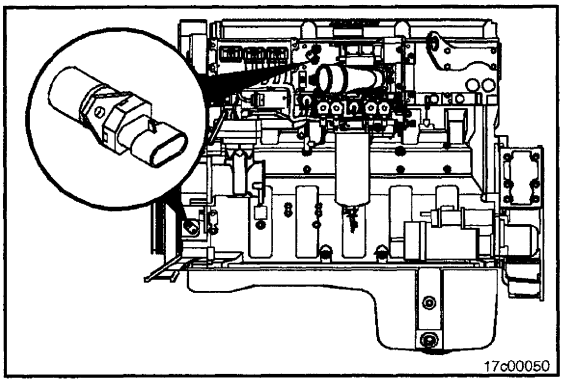
1. Engine Camshaft or Crankshaft Position Sensor
2. Throttle Position Sensor (industrial **only**)*
3. Idle Validation Switch*
4. Intake Air Pressure/Temperature Sensor
5. Coolant Temperature Sensor



6. Coolant Level Sensor*
7. Ambient Air Pressure Sensor
8. Oil Pressure/Temperature Sensor
9. Wet Tank Pressure Sensor*
10. Unintended Fuel Diagnostic Sensor (industrial **only**)
11. Fuel Pressure Sensor
12. Water-in-Fuel Sensor (industrial **only**).

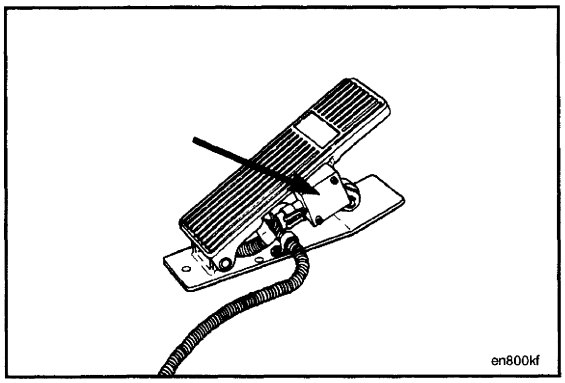
*These are OEM sensors that are **not** installed on the engine.



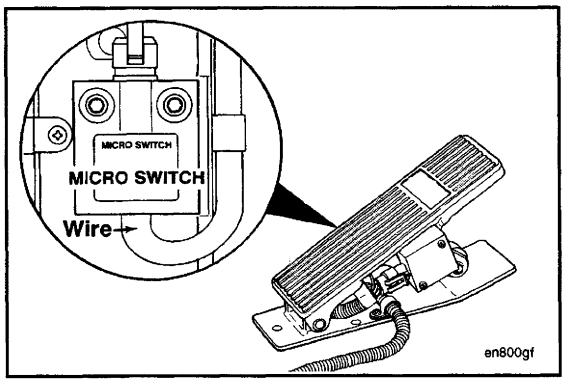


The **engine cam and crank position sensors** provide engine speed and position information.

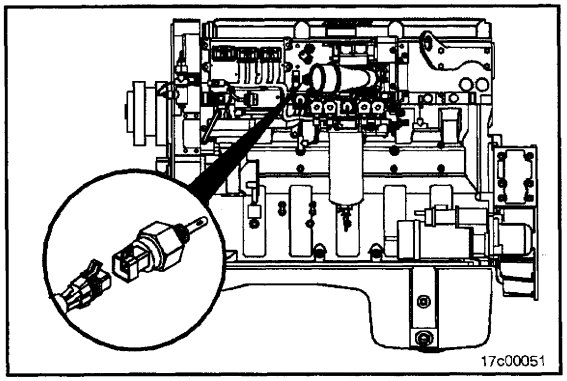
The cam position sensor is located between the ECM and fuel pump. The crank position sensor is located below the air compressor drive or the barring device.



The **throttle position sensor (industrial only)** is located in the throttle foot pedal assembly. When the foot pedal is at idle, the engine brakes can be activated. When the throttle pedal is depressed, the sensor deactivates the engine brakes and the PTO. The accelerator pedal can override the cruise control and PTO (if the throttle override in PTO is enabled).

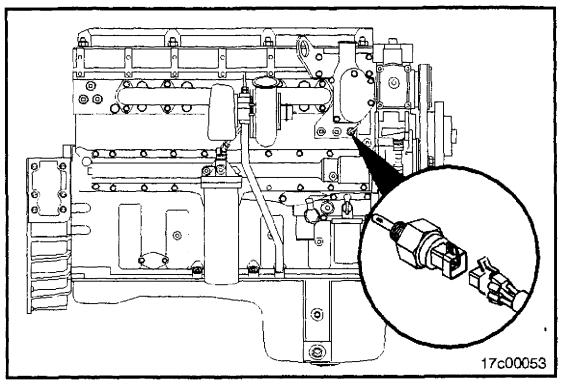


The **idle validation switch** is added to the throttle pedal assembly and will verify that the throttle pedal is in the low-idle position.



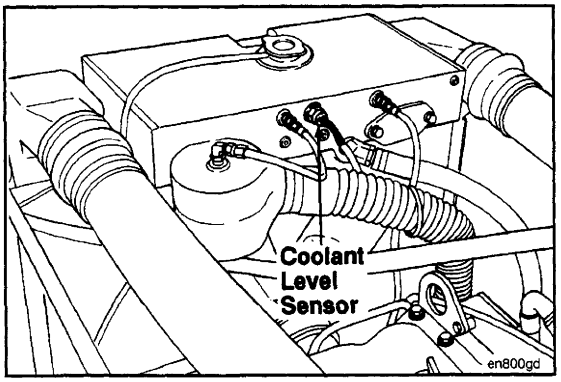
The **intake air pressure/temperature sensor**, located in the front of the intake air connection, monitors positive manifold pressure and turbocharged intake air temperature. Both are used in the fuel control function. The intake air pressure/temperature sensor is also used in the engine protection system.

The **engine coolant temperature sensor**, located in the thermostat housing, monitors engine coolant temperature used in the fuel control function and engine protection system.

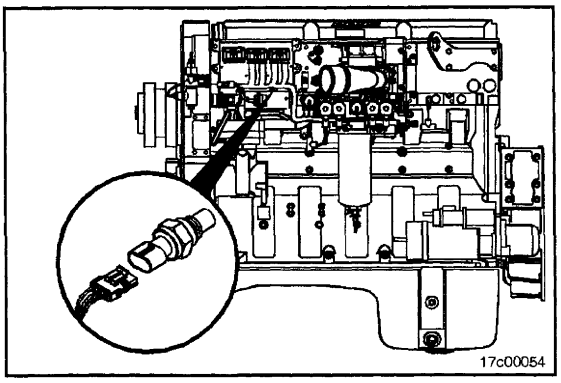


The **coolant level sensor** is mounted in the radiator top tank or surge tank, depending on the OEM. It is a fluid-level-actuated switch required for the engine protection system.

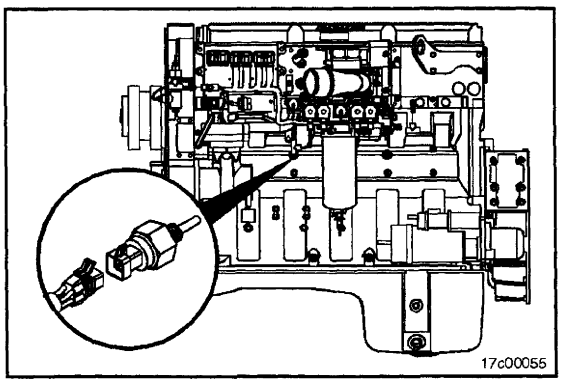
NOTE: This is an optional sensor that will or will **not** be on all vehicles.

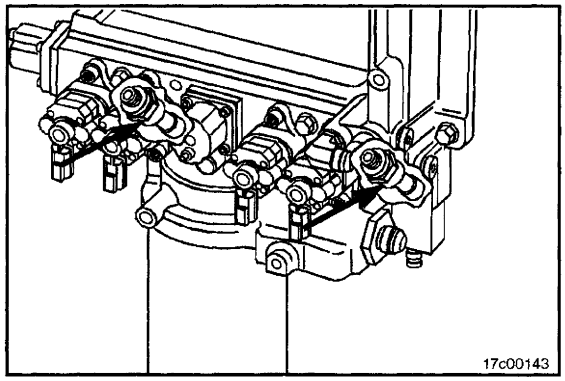


The **ambient air pressure sensor** is located on the fuel pump side of the engine, just below the ECM. It is used to control fueling.

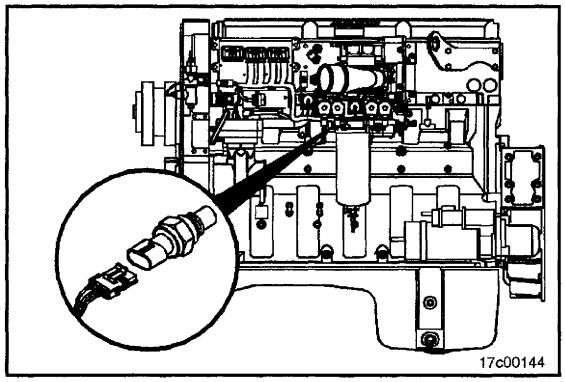


The **oil pressure/temperature sensor**, located on the fuel pump side of the engine, monitors lubricating oil pressure and temperature for the engine protection system.

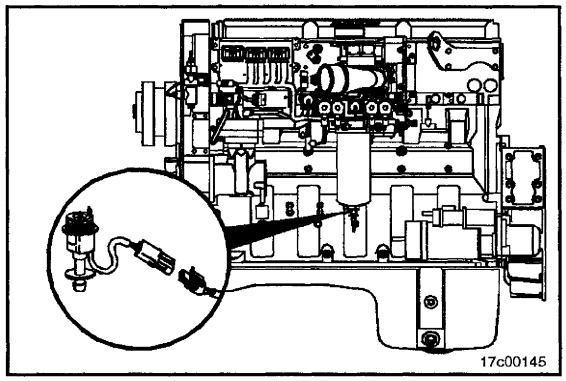




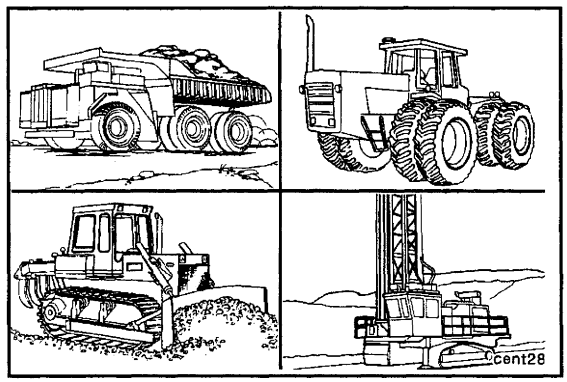
The **unintended fuel diagnostic sensors** (industrial **only**), located behind the fuel actuators on the integrated fuel system module, monitor the fuel actuator's passage pressure.



The **fuel pressure sensor**, located on the integrated fuel system module, monitors actuator supply rail pressure.



The **water-in-fuel sensor** (industrial **only**), located on the fuel filter, monitors water in fuel.



Programmable Features

Industrial

The QSX15 fuel system has been designed to be flexible to meet the wide variety of engine control specifications for off-highway equipment.

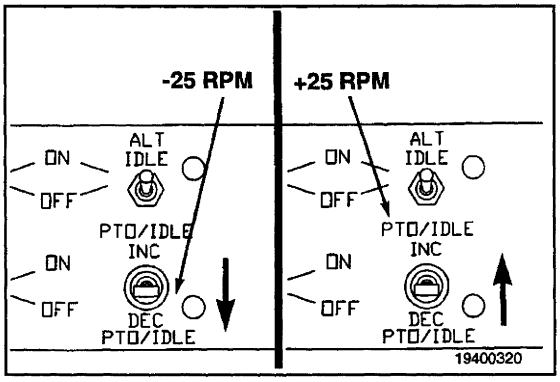
Automotive/Variable-Speed (VS) Governor

The automotive/variable-speed (VS) governor provides a choice of engine governors. The automotive governor operates like a conventional pressure-timed (PT®) governor, which provides constant fueling for a given throttle position (engine speed varies with load). The VS governor maintains a constant engine speed for a given throttle position under varying load conditions. Governor type can be selected by using electronic service tool.

Automatic Governor	Variable-Speed Governor
Engine Speed Varies with Load	Engine Speed Is Constant Under Varying Loads

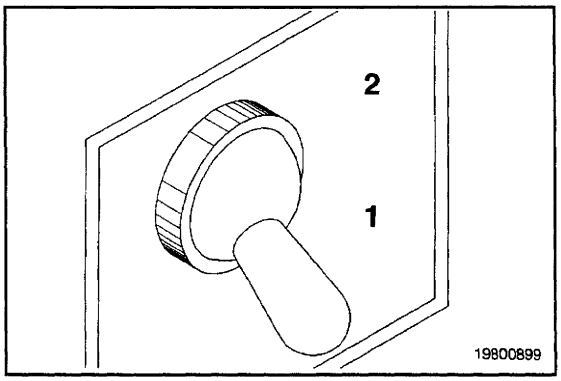
Low-Idle Adjustment

This feature allows the idle or intermediate-speed control 1 (ISC1) speed to be increased or decreased in 25-rpm increments through an operator-controlled switch. This switch can be disabled by turning this feature off with INSITE™. If this feature is turned off, the low-idle speed can still be adjusted using an electronic service tool.

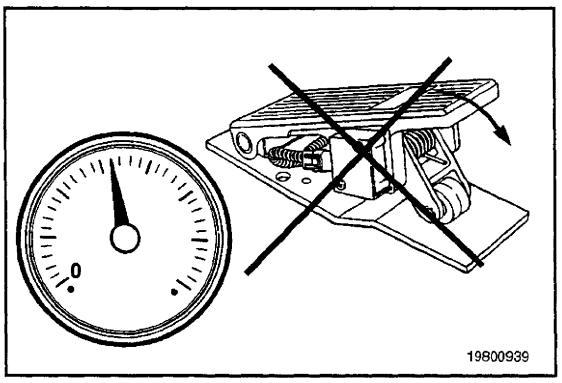


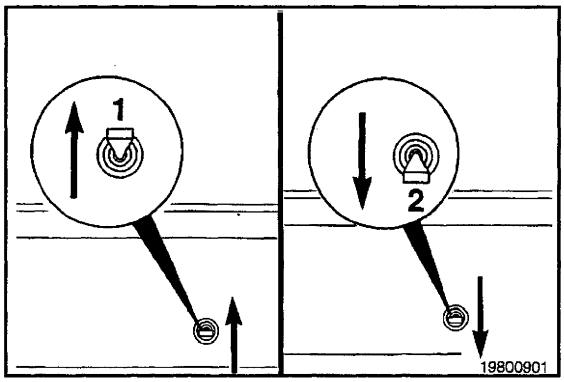
Intermediate-Speed Control (ISC)

This feature provides, depending on OEM availability, the ability to select an ISC set speed by way of an OEM-provided switch (1 = off, 2 = on).



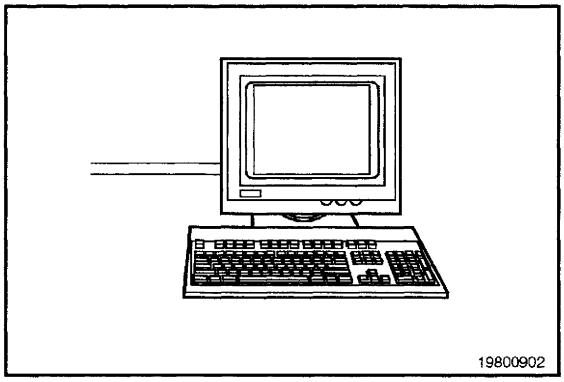
The intermediate-speed control feature will override the throttle and control the engine speed to its setting.



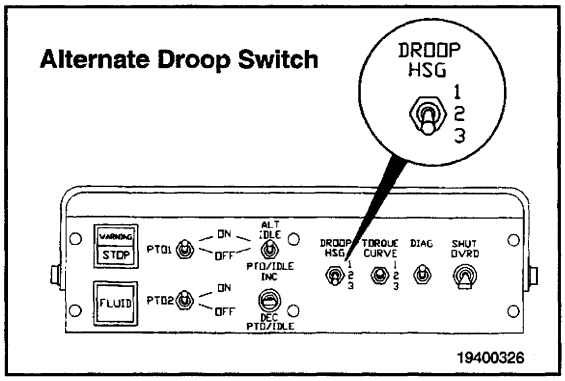


The intermediate-speed control set speed can be adjusted by the idle/intermediate-speed control increment/ decrement switch. Set speed changes using this switch will be saved to the ECM at key off.

To increase the intermediate-speed control set speed, position the switch up (1). To decrease the set speed, position the switch down (2).



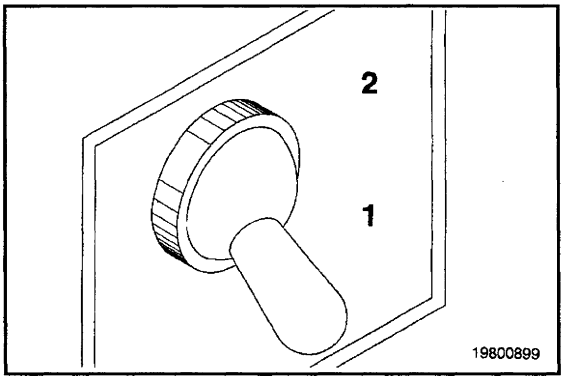
The intermediate-speed control feature can be enabled or disabled by an electronic service tool. The intermediate-speed control set speeds, maximum intermediate-speed control speed, and the intermediate-speed control droop can also be adjusted by an electronic service tool.



Alternate Droop

The alternate droop feature allows droop characteristics to be changed for high engine-governed speeds or the high-speed governor (HSG) and for the variable-speed governor (VSG). Droop is usually expressed as a percentage. Less governor droop provides a more responsive governor for more precise engine control. More governor droop provides smoother shifting and smoother mechanical clutch engagement.

The alternate droop feature provides, depending on OEM availability, the ability to select up to two additional alternate droop settings by way of an OEM-provided switch.

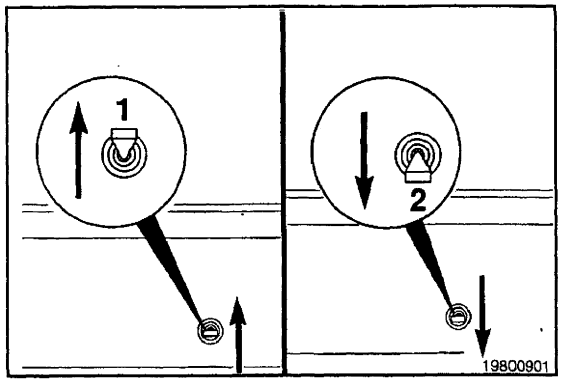


Alternate Low-Idle Speed Control

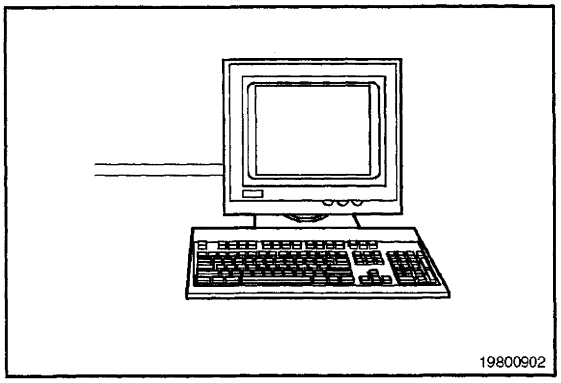
This feature allows the operator to switch between the low-idle speed setting and an alternate low-idle speed setting.

The alternate low-idle speed control feature provides, depending on OEM availability, the ability to select an alternate-idle speed by way of an OEM-provided switch (1 = off, 2 = on).

The alternate low-idle speed can **not** be adjusted by the idle/intermediate-speed control increment/decrement switch.



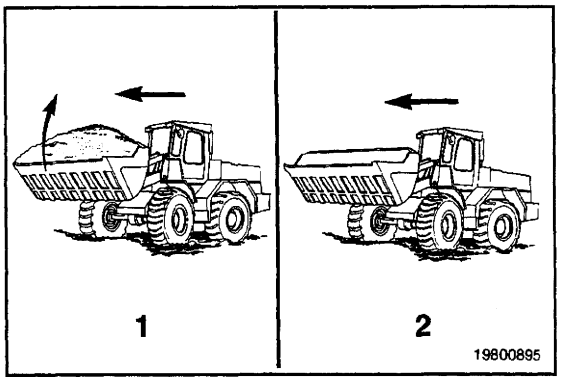
The alternate low-idle speed can **only** be adjusted with an electronic service tool.



Alternate Torque Control

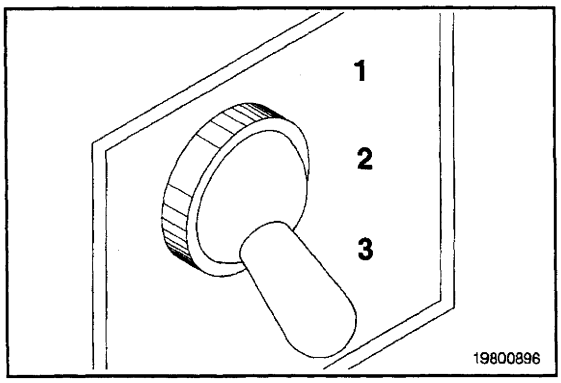
The alternate torque control feature allows the operator to switch between the 100-percent throttle torque curve and up to two derated torque curves.

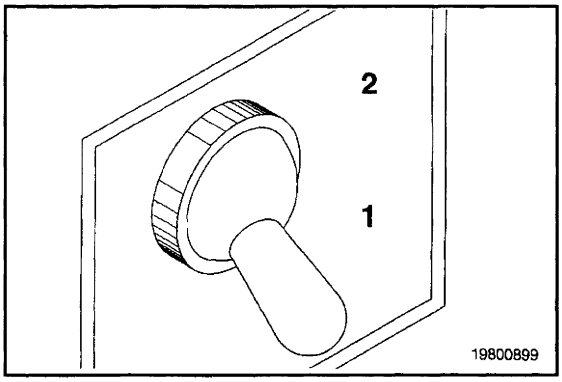
This feature improves operating efficiency in loaded (1) versus unloaded (2) conditions.



The alternate torque control feature provides, depending on OEM availability, the ability to select up to two additional derated torque curves by way of an OEM-provided switch.

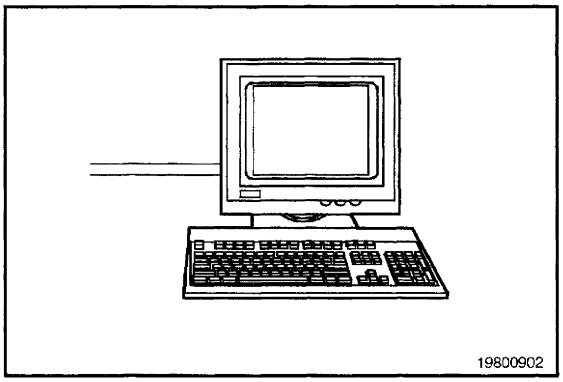
The alternate torque control can **only** be adjusted with an electronic service tool.





Auxiliary-Speed Governor (ASG)

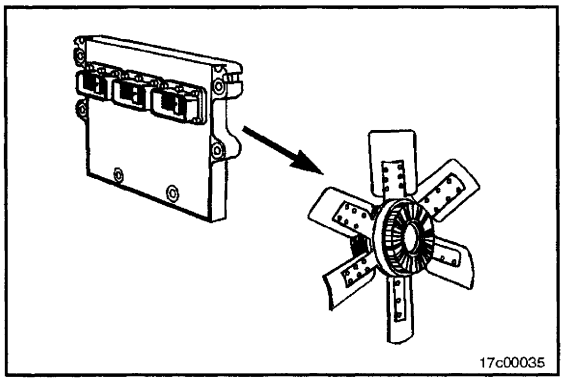
The auxiliary-speed governor is an application-specific feature that allows the engine to be governed by either an auxiliary speed or pressure signal. The feature uses a manual switch input to turn the governor operation on (2) or off (1).



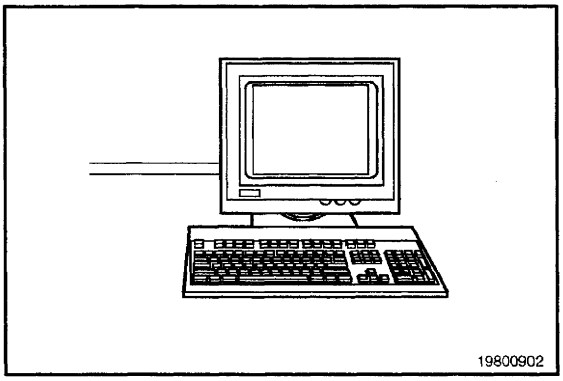
Boost Power

Boost power is a torque curve that is calibrated for higher than rated torque/power. If the feature is enabled, boost power can be engaged by a cab-mounted switch or automatically if the automatic boost power feature is enabled. The additional power is limited by a calibrated time period, as well as thresholds for intake manifold temperature, coolant temperature, and engine speed.

An electronic service tool can enable or disable the boost power feature. The service tool can also monitor the cab-mounted boost power switch and boost power engaged, which is the status of the additional power provided by the boost power feature.



The electronic fan clutch feature provides a pulse width modulated signal to control a variable-speed fan clutch based on the need provided by five possible sensor inputs, or an input from an electronic service tool. This feature can reduce fuel consumption by minimizing fan-on time and lengthening belt life by eliminating belt hop and slippage.



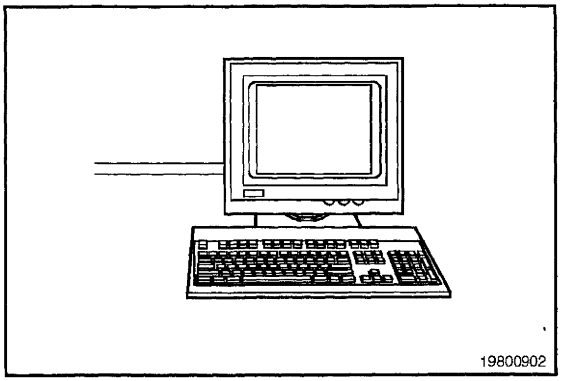
Fuel Consumption Rate Logger

The fuel consumption rate logger allows a Cummins electronic service tool to access, display, and reset fuel consumption data. This includes a resettable short-term fuel consumption history, the current point being recorded in the short-term history, the current instantaneous fuel consumption, and a lifetime history.

Hot Shutdown Monitor

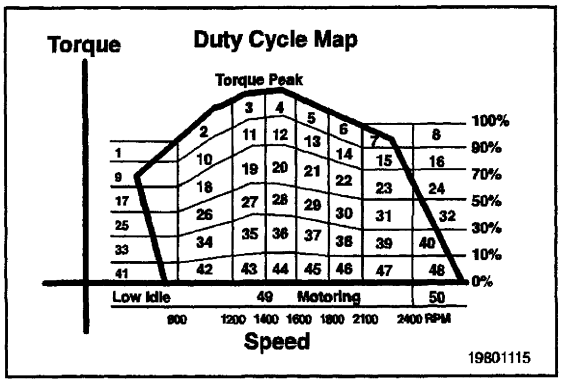
The hot shutdown monitor is a selectable feature within an electronic service tool. If this feature is enabled, the ECM will log an inactive fault when the engine is turned off while still "hot" by the operator or by the engine protection feature.

An engine is considered "hot" when the hot shutdown load percent of the engine is above the threshold set by the electronic service tool. The hot shutdown load percent is based on the duty-cycle load factor, which is determined from engine fueling levels.

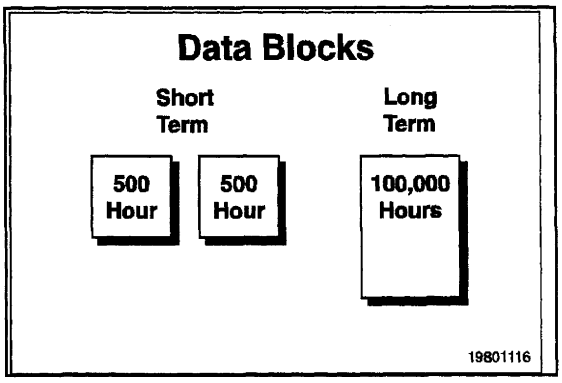


Duty Cycle Monitor

The duty-cycle monitor tracks the time the engine spends in 50 different operating regions. These operating regions are based on engine speed and engine torque.



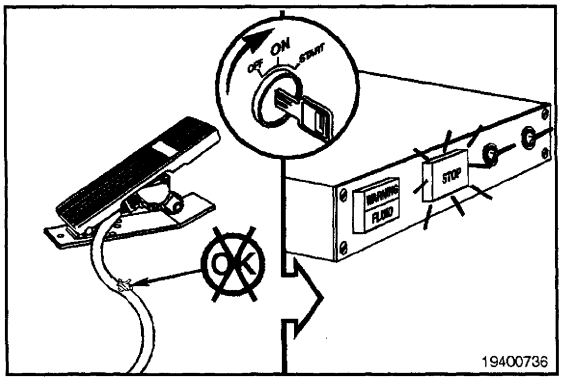
This feature provides two short-term, 500-hour resettable data blocks and one long-term, 100,000-hour nonresettable data block.

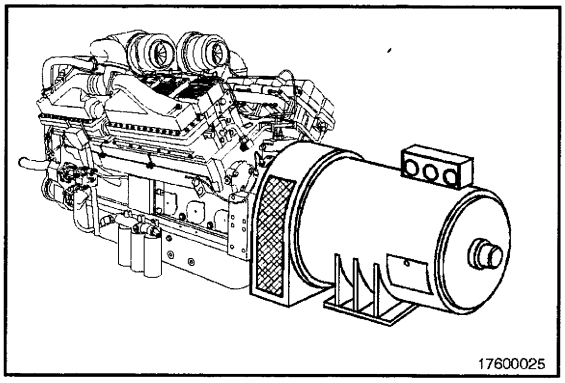


Throttle-Activated Diagnostic Switch

The throttle-activated diagnostic switch is intended to eliminate the need for a dash-mounted diagnostic switch, which is used to activate the diagnostic mode to display active fault codes in a sequence of flashing lamps. The throttle-activated diagnostic switch feature eliminates the need for a dash-mounted diagnostic switch by providing a simple sequence of throttle movements that activate the diagnostic mode.

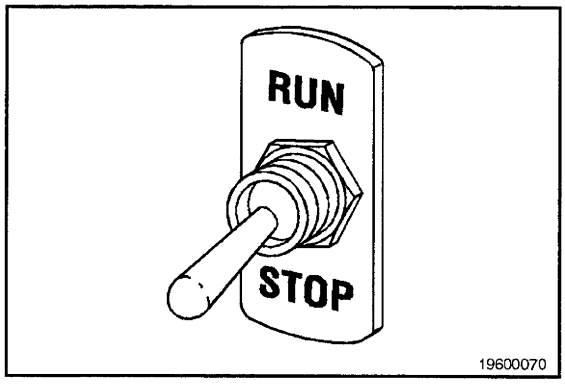
NOTE: This feature will work with all throttle types.




17600025

Power Generation

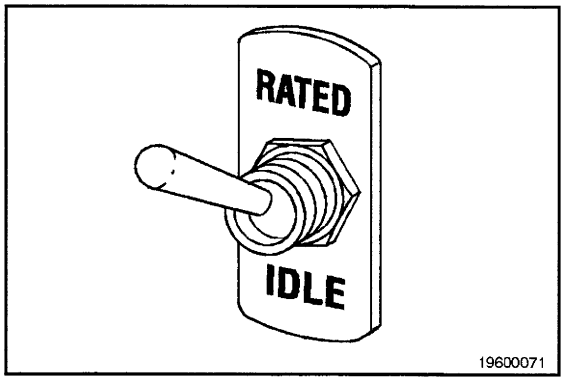
The QSX15 fuel system has been designed to be flexible to meet the wide variety of engine control specifications for power generation.



19600070

Run/Stop Switch

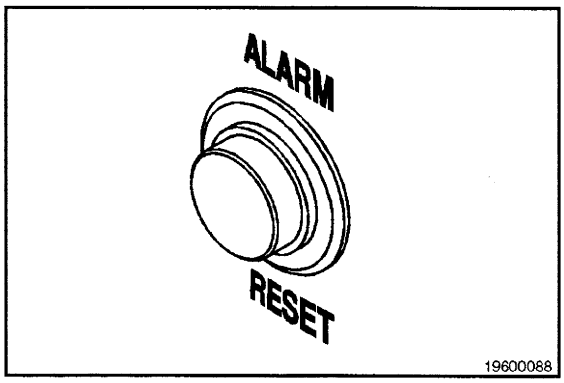
A customer-supplied run/stop input switch supplies 24-VDC battery positive (switched B+) to the ECM. B+ supplied to the ECM allows the ECM to energize the fuel shutoff valve when cranking. This switch can be monitored via the electronic service tool.



19600071

Idle/Rated Speed Switch

A customer-supplied idle/rated switch allows the selection of idle or rated speed mode. This switch can be monitored via the electronic service tool.



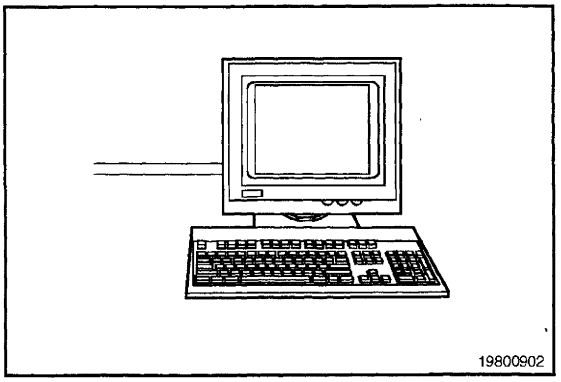
19600088

Alarm Reset Switch

A customer-supplied switch resets all shutdown/warning functions and inactive fault codes. Warning relay drivers and relay contacts can be reset while the engine is running or shut down. Shutdown relay drivers and contacts, and inactive fault codes can be reset **only** when the engine is shut down. Before restarting the engine after a fault induced shutdown, check the ECM for fault codes via the electronic service tool.

Programmable Idle Speed

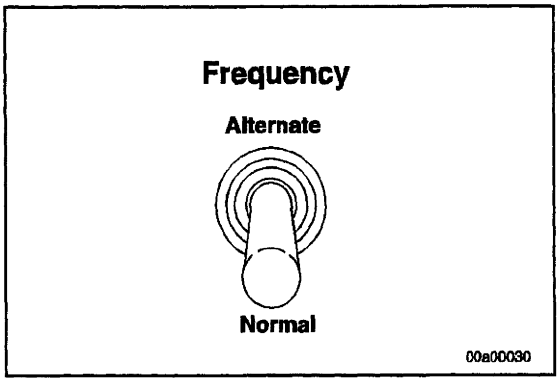
Idle speed is adjustable via the electronic service tool. Refer to the manual for the electronic service tool for details on the feature.



Alternate Frequency Switch

A customer-supplied alternate frequency switch allows the selection of 50 or 60 Hz rated speed operation without requiring an electronic service tool recalibration. This switch can be monitored via the electronic service tool.

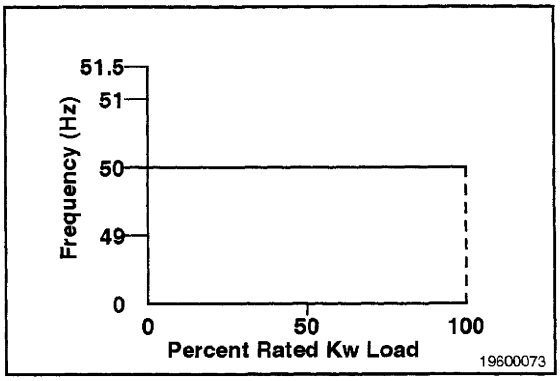
To change frequencies, the engine **must** first be shut down, or brought to idle, then back to rated speed.



Isochronous and Droop Speed Governing

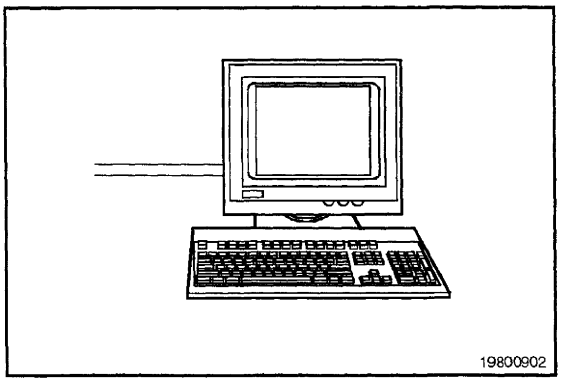
For isochronous speed operation, the governor droop setting needs to be set at 0 percent.

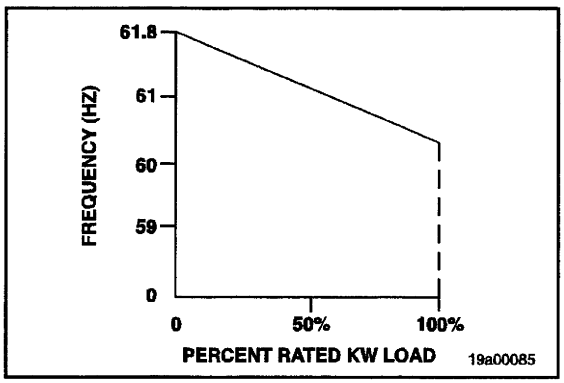
If required, the governor droop setting can be adjusted using the electronic service tool. Refer to the electronic service tool manual for details on the feature.



For droop speed operation, the governor droop setting is adjustable between 0 and 10 percent.

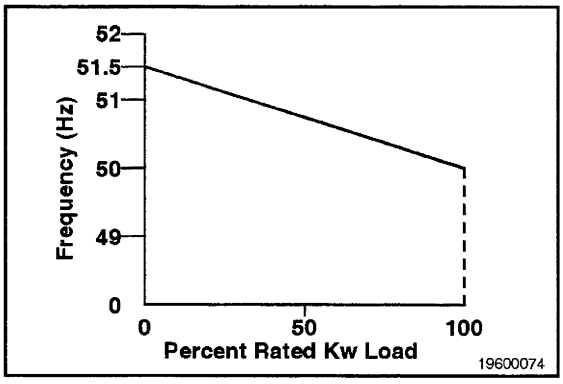
If required, the governor droop setting can be adjusted using the electronic service tool. Refer to the electronic service tool manual for details on the feature.





Engine-generator sets that are to operate at 60-Hz full load **must** have the engine no-load governed speed adjusted to:

61.8 Hz [1854 rpm] for 3-percent speed droop
or
63.0 Hz [1890 rpm] for 5-percent speed droop



Engine-generator sets that are to operate at 50-Hz full load **must** have the engine no-load governed speed adjusted to:

51.5 Hz [1545 rpm] for 3-percent speed droop
or
52.5 Hz [1575 rpm] for 5-percent speed droop

Percent speed droop on the engine-generator set can be verified by noting no-load and full-load speeds and using the speed droop formula.

$$\%S_{Droop} = \frac{(S_{NL} - S_{FL}) \times 100}{S_{FL}}$$

Where: $\%S_{Droop}$ = Percent Speed Droop
S_{FL} = Full-Load Speed
S_{NL} = No-Load Speed

$$\text{Example: } \frac{1854 \text{ rpm} - 1800 \text{ rpm}}{1800 \text{ rpm}} \times 100 = 3\%$$

Droop governed speed under the available load can be calculated when full-load kW is **not** available using this formula.

$$S_{al} = S_{nl} - \left(\left(\frac{\text{Available kW Load}}{\text{Rated kW}}\right) \times (S_{nl} - S_{fl})\right)$$

Where:

S_{al} = Speed at Available kW Load
S_{fl} = Speed at Full kW Load
S_{nl} = Speed at No Load

Example:

Available kW Load = 400
Rated kW = 500 (Generator rating)
Speed at Full kW Load = 1800
Speed at No Load = 1854

$$1854 \text{ rpm} - \left(\left(\frac{400 \text{ kW}}{500 \text{ kW}}\right) \times (1854 - 1800)\right)$$

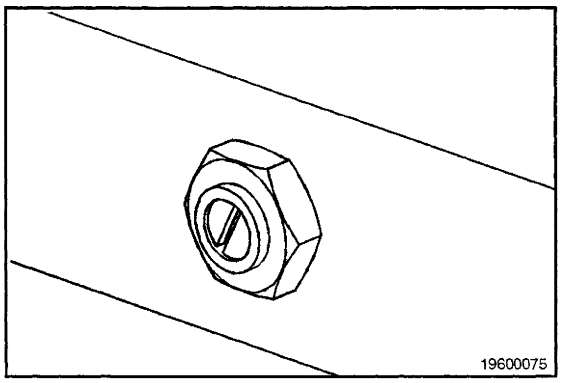
$$1854 \text{ rpm} - (0.8 \times 54) = 43.2 \text{ rpm}$$

$$1854 \text{ rpm} - 43.2 \text{ rpm} = 1810.8 \text{ or } 1811 \text{ rpm}$$

Droop Adjust

The droop adjust potentiometer, located in the control panel, allows the adjustment of the engine speed governor droop without the aid of the electronic service tool.

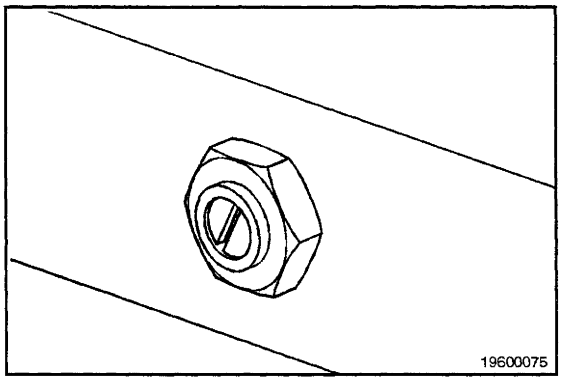
See isochronous and droop speed governing for more information on droop.



Frequency Adjust

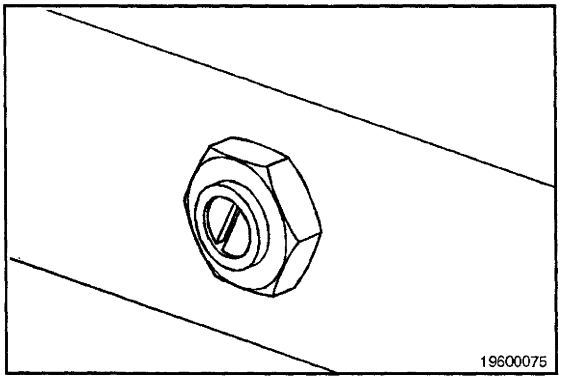
The frequency adjust potentiometer, located in the control panel, allows the adjustment of the engine speed without the aid of the electronic service tool.

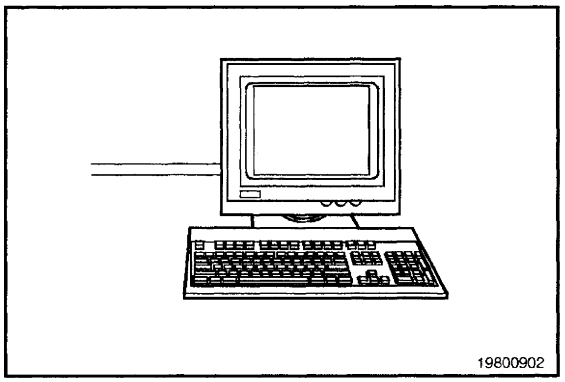
NOTE: This is **only** a fine adjustment with minimal range.



Gain Adjust

The gain adjust potentiometer, located in the control panel, allows the adjustment of the governor gain without the aid of the electronic service tool.

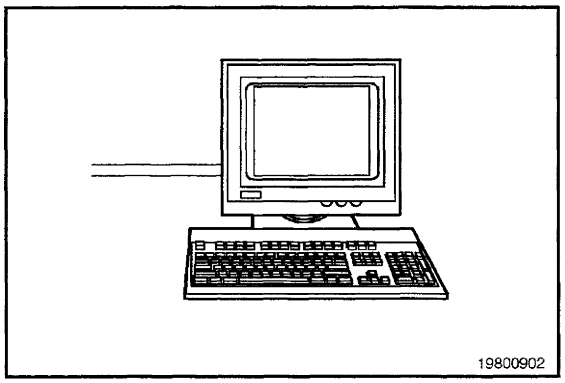




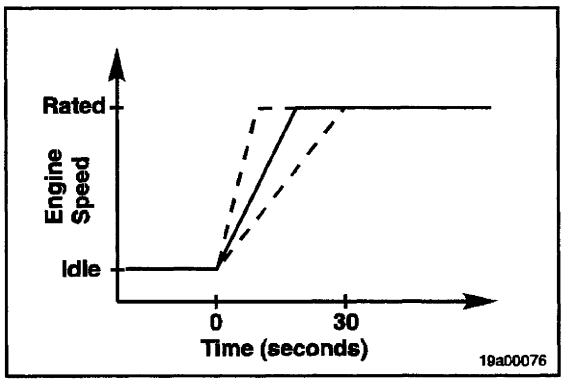
⚠ CAUTION ⚠

It takes a few seconds to initiate each gain adjustment (via the potentiometer or electronic service tool). It is recommended that any increases in the governor gain setting be made in increments not exceeding 3 percent. This will prevent prolonged periods of unwanted instability.

Governor gain can be adjusted for optimum engine performance. The governor gain is adjustable between 1 and 100 percent using the electronic service tool.



NOTE: Typical engine-generator combinations will **not** require adjustments to the Governor Gain settings as both 1500- and 1800-rpm generator sets ordinarily exhibit satisfactory steady state stability and acceptable transient performance with the gain value as set from the factory.



Speed Ramp Adjustments

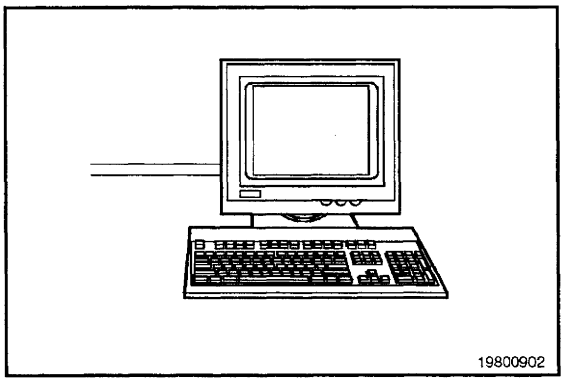
The ECM provides for two speed acceleration ramp functions that are adjustable using the electronic service tool.

- Crank to Rated - Ramp Time
- Idle to Rated - Ramp Time
- Rated to Idle - Ramp Time.

Crank-to-rated ramp time provides for speed ramping between cranking and rated speeds.

Idle-to-rated ramp time provides for speed ramping between idle and rated speeds.

Rate-to-idle ramp time provides for speed ramping between rate and idle speeds.



Refer to the electronic service tool manual for details on the features and for a table that lists the ramp times.

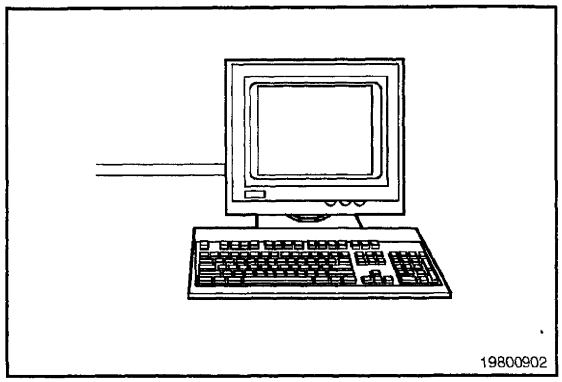
NOTE: Ramp times (in seconds) are dependent on idle and rated speed settings. Desired ramp times are selected by choosing ramp numbers, **not** ramp times directly.

Barber-Colman & Woodward Speed Bias Inputs

The feature provides the ability to integrate the ECM with either a Barber-Colman or Woodward Load Sharing, Auto Synchronizing, Load Commander, and so forth.

The hardware can be either analog or digital.

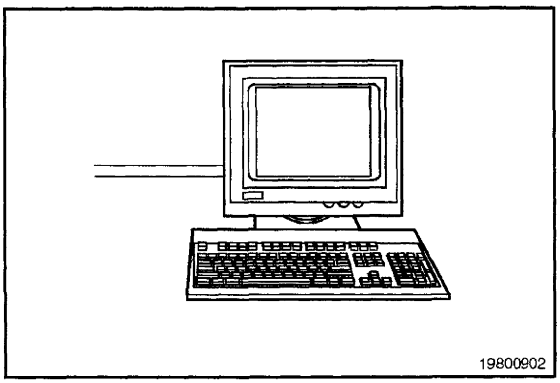
The feature is selectable via the electronic service tool. Refer to the electronic service tool manual for details on this feature.



Internal Engine Hour Meter

This feature is monitorable via the electronic service tool. It allows viewing how many hours the engine generator has been in service.

Fault code snapshots will be stamped with a corresponding time stamp.

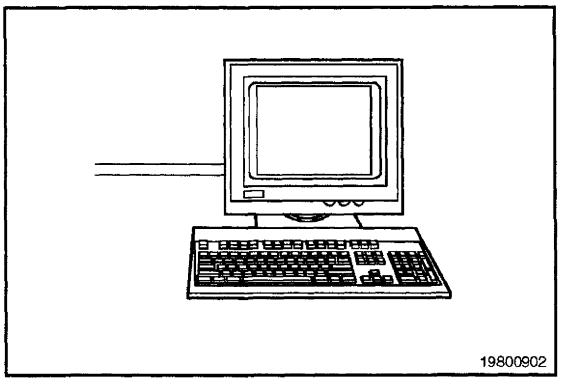


Customer-Selectable Sensor Options

This feature allows the customer to add features to the electronic sensor package if desired. The optional sensors are:

- Oil Level Switch
- Coolant Level Switch
- Aftercooler Water Inlet Temperature Sensor.

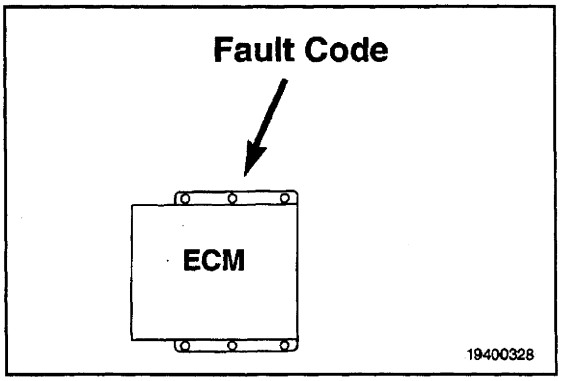
These sensors can be activated via the electronic service tool. Refer to the electronic service tool manual for details on how to activate each of the sensors.



Diagnostic Fault Codes

Industrial

The QSX15 fuel system can display and record certain detectable fault conditions. These failures are displayed as fault codes, which make troubleshooting easier. The fault codes are retained in the electronic control module (ECM).

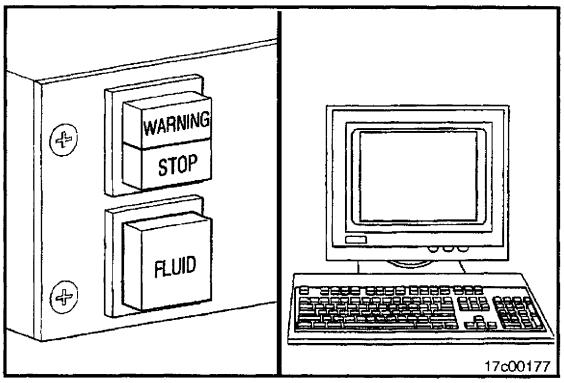


There are two types of fault codes. There are engine electronic fuel system fault codes and engine protection system fault codes.

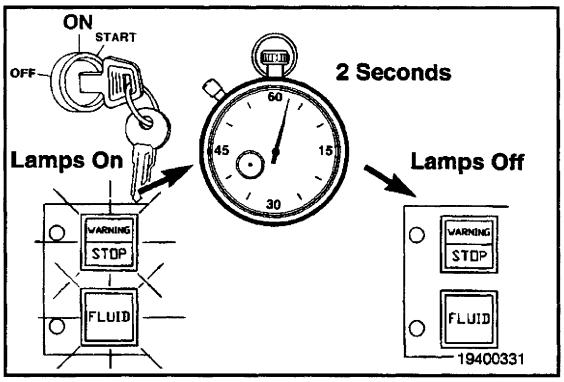
All fault codes recorded will either be active (fault code is presently active on the engine) or inactive (fault code was active at some time, but is **not** presently active).

Diagnostic Fault Codes

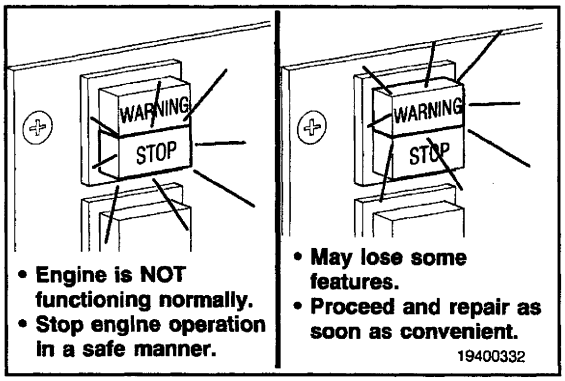
- Engine Electronic Fuel System Fault Codes
- Engine Protection System Fault Codes.



Active fault codes can be read using the warning (amber) and stop lamps (red) in the cab panel or electronic service tool. Inactive fault codes can **only** be viewed with an electronic service tool.



When the vehicle keyswitch is turned on and the diagnostic switch is off, the fault code lamps (red, yellow, and maintenance) will illuminate for approximately 2 seconds, one after the other, to check their operation.



The lights will remain off until a fault code is recorded. If a stop (red) light comes on while the engine is in operation, the fault can be engine-disabling. Stop the engine in a safe manner as soon as possible.

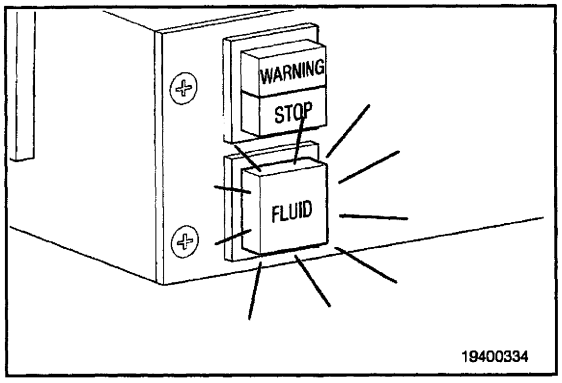
If the warning (amber) light illuminates, the engine can still be operated, but it can lose some system features that can sometimes result in a power loss. The failure **must** be repaired as soon as is convenient.

The engine protection system records separate fault codes when an out-of-range condition is found for any of the sensors in the engine protection system. Engine protection is **only** available when the engine protection feature is enabled.

- Coolant Temperature
- Coolant Level
- Intake Manifold Temperature
- Oil Pressure.

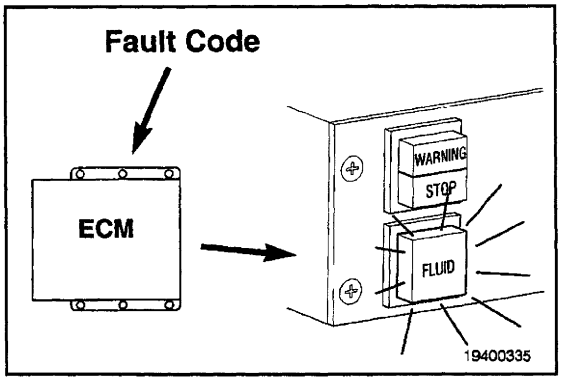
The engine protection system will light the maintenance lamp (orange) when an out-of-range condition occurs.

NOTE: Lamp colors and labels will vary by OEM.



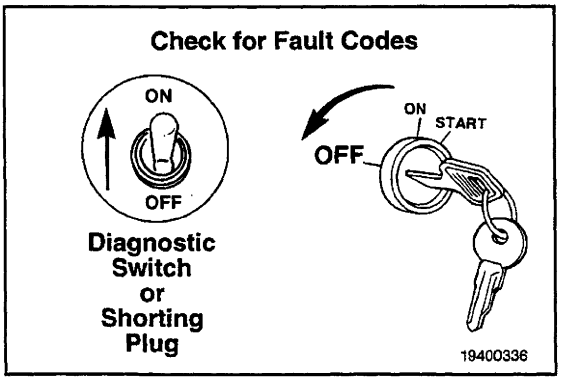
If the engine protection maintenance lamp comes on while driving, it means that a fault code has been recorded. The light will remain on as long as the fault is occurring.

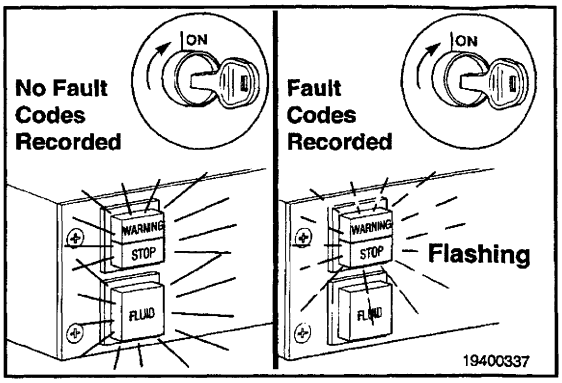
The light will begin to flash if the condition continues to get worse. The engine power and/or speed will be gradually reduced. If the engine protection shutdown feature is enabled, the engine will shut down to prevent engine damage.



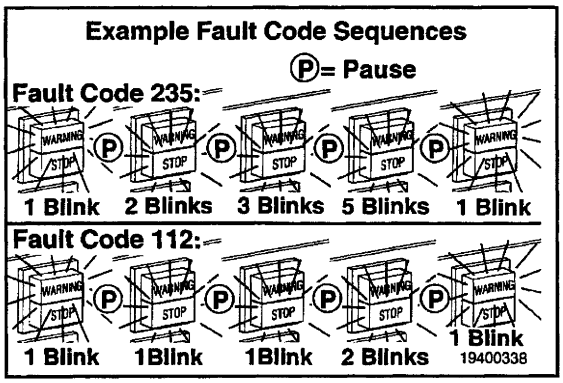
To check for active fault codes, first turn the vehicle keyswitch to the OFF position. Move the diagnostic switch to the ON position.

NOTE: Some OEMs use a shorting plug.

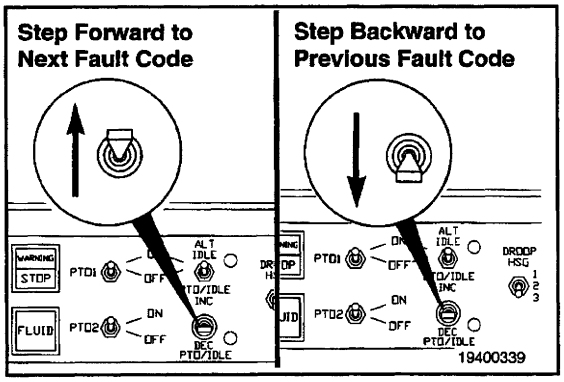




Turn the vehicle keyswitch to the ON position. If no active fault codes are recorded, all three lights will come on and stay on. If active fault codes are recorded, all three lights will come on momentarily. The amber (warning) and red (stop) lights will begin to flash the code of the recorded fault.



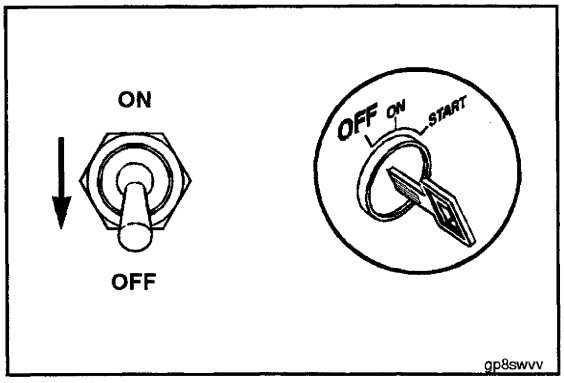
The fault code will flash in the following sequence. First, the amber (warning) lamp will flash. Then there will be a short 1-second pause when both the amber and red lights are off. Then the numbers of the recorded fault code will flash in red. There will be a 1-second pause between each number. When the number has stopped flashing, an amber light will appear again. The number will repeat in the same sequence.



The lights will continue to flash the same fault code until the system has advanced to the next active fault code. To go to the second fault code, move the idle-speed adjust switch to " + ," then release it. You can also go back to the previous fault code by moving the switch to "-," then releasing it. To check the third or fourth fault code, move the switch to " + ," then release it when all active fault codes have been viewed. Moving the switch to " + " will go back to the first fault code.

The explanation and correction of all fault codes is in the troubleshooting charts of the QSX15 fuel manual. Refer to Troubleshooting and Repair Manual, Electronic Control System, Signature, ISX and QSX15 Engines, Bulletin No. 3666259.

Electronic fault code troubleshooting trees are in ascending numerical order. An index is located at the beginning of the section.

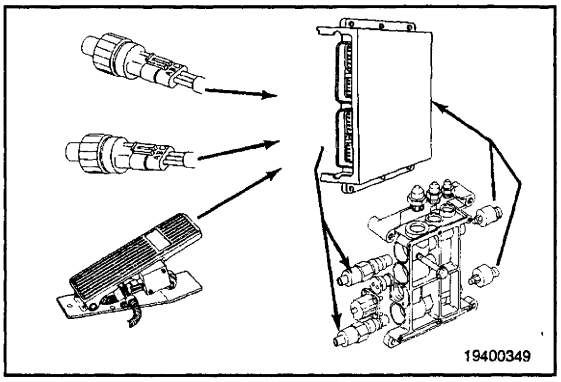


To stop the diagnostic system, move the diagnostic switch to the OFF position, or remove the shorting plug. Turn the vehicle keyswitch to the OFF position.

NOTE: Some OEMs use a shorting plug.

Fault Code Snapshot Data

When a diagnostic fault code is recorded in the ECM, ECM input and output data are recorded from all sensors and switches. Snapshot data allow the relationships between ECM inputs and outputs to be viewed and used during troubleshooting.



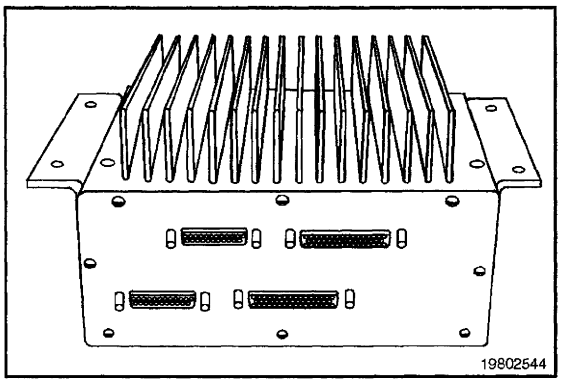
Power Generation

The QSX15 fuel system can display and record certain detectable fault conditions. These failures are displayed as fault codes, which make troubleshooting easier. The fault codes are retained in the ECM.

There are two types of diagnostic codes:

Information codes are to inform the operator and electronic system (paralleling controllers, smart switch gear) that an event has occurred.

Fault codes are to report to the operator and the electronic system that there is a problem or potential problem with the engine or fuel system.



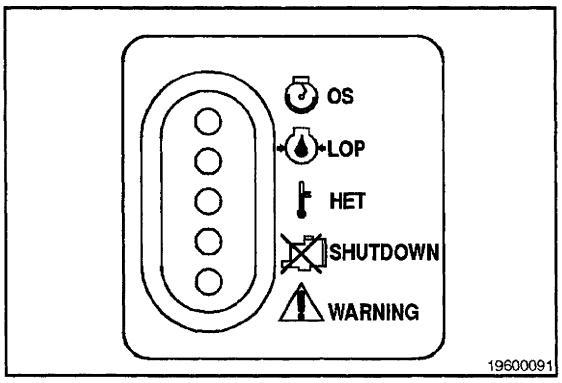
Fault codes can be accessed in three different ways:

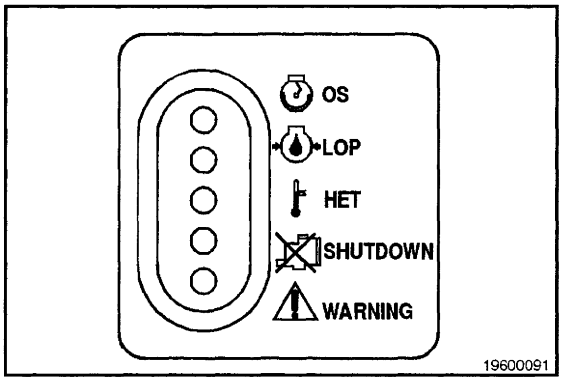
1. Flash Out
2. Electronic Service Tool
3. Operator Interface Panel.

Generator-Drive Control System ECM Diagnostic Lamps

The generator-drive control system ECM has five LEDs for diagnostics. Typical lights will include:

1. OS - Overspeed
2. LOP - Low Oil Pressure
3. HET - High Engine Temperature
4. Shutdown - Engine Protection Shutdown Has Occurred
5. Warning - Engine Protection Warning Condition Exists.

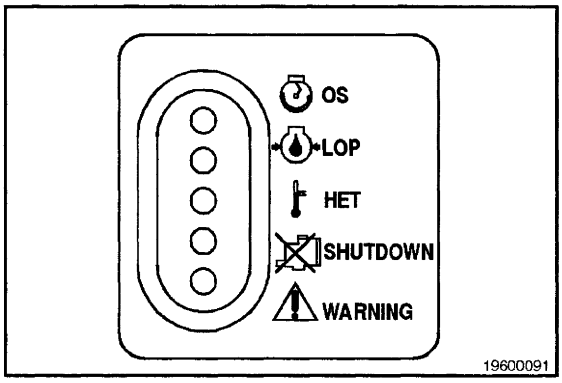




Generator-Drive Control System Relay Drivers

The generator-drive control system has seven relay drivers for customer-supplied relays.

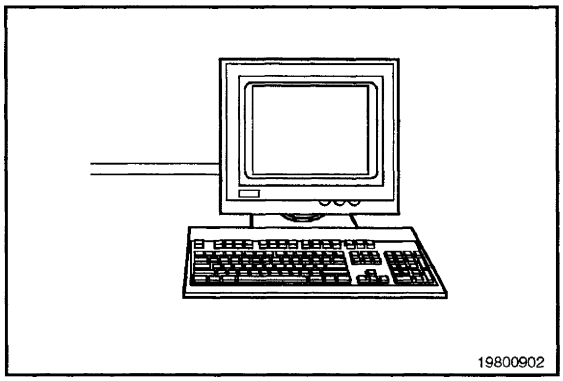
- Overspeed
- Low Oil Pressure
- High Engine Temperature
- Engine Protection Shutdown Has Occurred
- Engine Protection Warning Condition Exists
- Prelow Oil Pressure
- Prehigh Engine Temperature.



Fault Code Flash-out

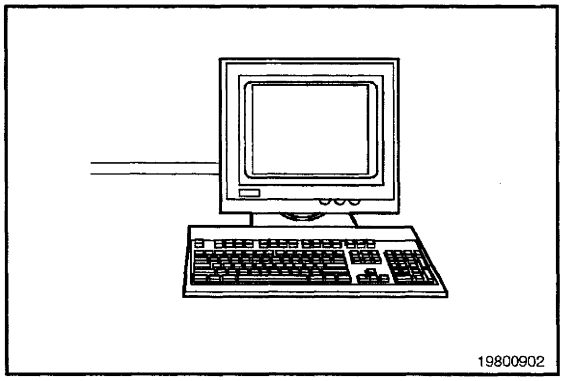
To "flash out" a fault code, the ECM **must** be put into the diagnostic mode. Enter the diagnostic mode by removing the diagnostic connector shorting the plug from the engine harness, turning the plug, and reinserting it, or using the diagnostic mode switch.

The warning lamp will flash (signifying the start of a new fault code), and then the fault code will flash out on the shutdown lamp.



Fault Codes - Electronic Service Tool

The electronic service tool can be used to read the fault codes. Connect a personal computer, with the electronic service tool installed, to the engine using the service harness, Part No. 3163156. Refer to the electronic service tool manual for specifics about how to use the tool to read the fault codes.

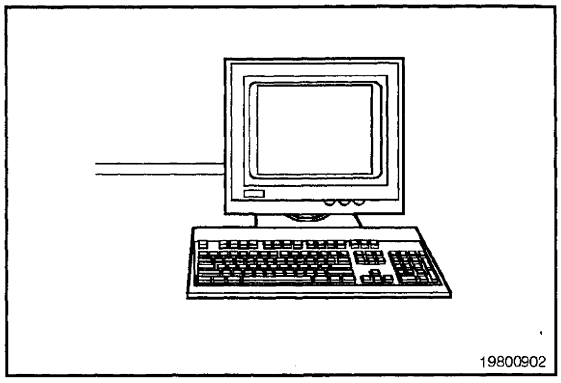


Fault Code - Operator Interface Panel

If the customer supplied an operator interface panel, it has been integrated with the generator-drive control system using the RS485 datalink. The ability to display fault codes is one plus of this panel; refer to the manuals supplied with the unit for more details.

Fault Code Snapshot Data

When a diagnostic fault code is recorded in the ECM, the ECM input and output data are recorded from all sensors and switches. Snapshot data allow the relationships between ECM inputs and outputs to be viewed and used during troubleshooting.



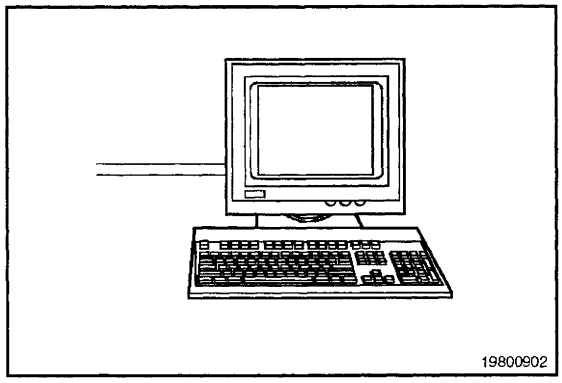
To Clear a Fault Code

Only inactive fault codes can be cleared. There are two ways to clear an inactive fault code:

1. The **reset switch** on the operator interface panel
2. The **electronic service tool**.

NOTE: The engine **must** be shut down to clear inactive shutdown faults.

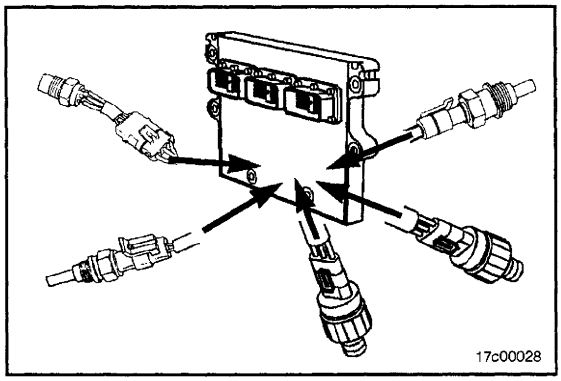
All fault codes recorded will either be active (fault code is presently active on the engine) or inactive (fault code was active at some time, but is **not** presently active).



Engine Protection System

QSX15 engines are equipped with an engine protection system. The system monitors critical engine temperatures and pressures and will log diagnostic faults when an abnormal operating condition occurs. If an out-of-range condition exists and engine derate action is to be initiated, the operator will be alerted by an in-cab warning light. The warning light will blink or flash when out-of-range conditions continue to worsen. The driver **must** pull to the side of the road, when it is safe to do so, to reduce the possibility of engine damage.

NOTE: Engine power and speed will be gradually reduced, depending on the level of severity of the observed condition. The engine protection system will **not** shut down the engine unless the engine protection shutdown feature has been selected. If the feature has been selected and the engine does shut down, the engine can be started again by turning off the keyswitch and then turning it back on.



Electromagnetic Interference (EMI)

General Information

Some heavy-duty diesel engine applications utilize accessories (CB radios, mobile transmitters, etc.) that generate and use radio frequency energy that, if **not** installed and used correctly, can cause electromagnetic interference (EMI) between the accessory and Cummins QSX15 electronically controlled fuel system. Cummins **is not** liable for any performance problems with either the QSX15 fuel system or the accessory that are due to EMI. EMI **is not** considered by Cummins to be an engine failure and therefore **is not** warrantable.

System EMI Susceptibility

Your Cummins product has been designed and tested for minimum sensitivity to incoming electromagnetic energy. Testing has shown that there is no engine performance degradation at relatively high energy levels; however, if very high energy levels are encountered, then some noncritical diagnostic fault code logging can occur. The QSX15 fuel system EMI susceptibility level will protect your engine from most, if **not** all, electromagnetic energy-emitting devices that meet the FCC legal requirements.

System EMI Radiation Levels

Your Cummins product has also been designed and tested to emit minimum electromagnetic energy. Testing has shown that the QSX15 fuel system, when properly installed on vehicles, meets or exceeds by a wide margin Part 15 of the FCC Rules and SAE J1551 specifications. Other accessories **must** be designed with the correct filtering to reject electromagnetic noise emission from their system. Experience has shown that the QSX15 electronic fuel system on vehicles will **not** interfere with onboard communication equipment for urban and suburban background electromagnetic noise levels; however, the system, if used with accessories that are **not** installed correctly or do **not** utilize adequate filtering designs, can interfere with onboard communications equipment in rural applications where background radio frequency noise levels are very low. If an interference condition is observed, follow the suggestions below to reduce the amount of interference:

1. Locate the receiving antenna as far away from the engine and as high as possible.
2. Locate the receiving antenna as far away as possible from all metal obstructions (exhaust stacks, etc.).
3. Consult a representative of the accessory supplier in your area to:
   - Accurately calibrate the device for correct frequency, power output, and sensitivity (both base- and remote-site devices **must** be correctly calibrated)
   - Obtain antenna reflective energy data measurements to determine the optimal antenna location
   - Obtain optimum antenna type and mounting arrangement for your application
   - Make sure your accessory equipment model is built for maximum filtering to reject incoming electromagnetic noise.

Section 2 - Maintenance Guidelines

Section Contents

Page

Maintenance Guidelines - General Information 2-1
Maintenance Record Form 2-8
Maintenance Schedule 2-2
Page References for Maintenance Instructions 2-7
Tool Requirements 2-1

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Maintenance Guidelines - General Information

Cummins Engine Company, Inc. recommends that the engine be maintained according to the Maintenance Schedule in this section.

If the engine is operating in ambient temperatures consistently below -18°C [0°F] or above 38°C [100°F], perform maintenance at shorter intervals. Shorter maintenance intervals are also required if the engine is operated in a dusty environment or if frequent stops are made. See your Cummins Authorized Repair Location for recommended intervals.

NOTE: Some of these maintenance procedures require special tools or **must** be completed by qualified personnel. These procedures are outlined in the specific manuals as follows:

Procedure	Bulletin No.	Description
• Repair and rebuild components*	—	
• Troubleshoot and repair engines	3666239	*Troubleshooting and Repair Manual, Signature Engines/ISX/QSX*
• Troubleshoot and repair fuel system and electronics	3666259	*Troubleshooting and Repair Manual, QSM11/ QSX Fuel System, Signature Engines*
	3666393	*Troubleshooting and Repair Manual Generator-Drive Control System QSX, QSK45 and QSK60 Engines*
	3666394	*Troubleshooting and Repair Manual PowerCommand Control QSX, QSK45 and QSK60 Generator Sets*

Use the chart provided in this section as a convenient way to record maintenance.

* If your engine is equipped with a component or an accessory **not** manufactured by Cummins Engine Company, Inc., refer to the component manufacturer's maintenance recommendations. A listing of suppliers' addresses and telephone numbers is provided in Component Manufacturers, Section M.

Tool Requirements

Most of the maintenance operations described in this manual can be performed with common hand tools (metric and SAE wrenches, sockets, and screwdrivers).

The following is a list of special service tools required for some maintenance operations:

3376807	Coolant Filter Wrench
3375049	Oil and Fuel Filter Wrench
3375044	Torque Wrench
3163530	Brake Feeler Gauge - 7.00 mm [0.276 in]

Refer to the appropriate sections for a description of the tools and how to use them.

Contact your nearest Cummins Authorized Repair Location for the required service tools.

Maintenance Schedule

QSX15 Engine Maintenance Schedule: (1), (2)				
Daily or Refueling	**Every 625 Hours or 6 months(1), (4)**	**Every 1500 Hours or 1 Year (2), (3)**	**Every 3000 Hours or 2 Years (3)**	**Every 10,000 Hours or 5 Years (3)**
Maintenance Check/Drain	**Change/Replace**	**Change/Replace**	**Change/Replace**	**Maintenance Check/Adjust**
• Check operators report • Drain air tanks and reservoirs • Drain fuel-water separator • Check and correct – Engine oil level – Coolant level • Inspect cooling fan • Inspect drive belts • Inspect intake air piping and CAC • Check crankcase breather tube.	• Lubricating oil • Lubricating oil filter • Operate the engine and check for coolant leaks and coolant SCA concentration level.	• Coolant filter • Fuel filter • Inspect automatic belt tensioner • Operate engine and check intake air and exhaust systems • Check air cleaner restriction • Replace element on air compressor • Check engine wiring harness.	• Check all hose connections for leaks or deterioration • Check the shutters and fan • Steam-clean engine • Check engine mounting bolts • Clean crankcase breather tube • Check the vibration dampers • Adjust valves, injectors, and engine brakes(5).	• Check the fan hub • Check air compressor carbon buildup.

1. Lubricating oil drain intervals can be adjusted based on fuel consumption and engine duty cycle. Refer to Section 2 in this manual for more details.
2. Follow the manufacturer's recommended maintenance procedures for the starter, alternator, generator, batteries, electrical components, charge air cooler. Refer to Section M for addresses and telephone numbers.
3. Perform maintenance at whichever interval occurs first. At each scheduled maintenance interval, perform all previous maintenance checks that are due for scheduled maintenance.
4. Test the SCA concentration level every 6 months unless concentration is over 3 units; then check at every oil drain interval until concentration is below 3 units.
5. The valves, injectors and engine brakes should be adjusted every 3000 hours. It is **not** necessary to adjust the valve, injectors, or engine brakes every 2 years.

Oil Drain Intervals

Industrial Engines Only

For industrial engines, the oil drain intervals are based on the duty cycle (as reflected by fuel consumption) and lubricating oil quality. The table below specifies the maximum oil drain interval for the listed lubricating oil classifications based on the three different duty cycles: heavy, medium, and light.

— Follow oil drain interval heavy if your equipment uses more than 57 l (15 gal) of fuel per hour.

— Follow oil drain interval medium if your equipment uses between 42 to 57 l (11 to 15 gal) of fuel per hour.

— Follow oil drain interval light if your equipment uses less than 42 l (11 gal) of fuel per hour.

NOTE: Extending the oil and filter change interval beyond the recommendation will decrease engine life due to factors such as corrosion, deposits, and wear.

Oil Classification	Duty Cycle (Fuel Consumption)		
	Heavy > 57 liters/hour [15 gallons/hour]	**Medium** 42 to 57 liters/hour [11 to 15 gallons/hour]	**Light** < 42 liters/hour [11 gallons/hour]
API CD-4, CE-4, CF-4 [1,3]	125	250	375
API CG-4[3]	250	375	500
API CH-4[3]	400	525	650
CES 20,076[2,3]	500	625	750

NOTE:

1. The oil classifications CD, CE, and CF have been obsolete by API and should **not** be used, as their specifications are no longer controlled.
2. Valvoline Premium Blue and Premium Blue 2000 meet CES 20,076 standards.
3. Refer to the lubricating oil filter specification table in Section V.

The table below list typical duty cycles by application.

NOTE: The actual duty cycle can vary from the below chart. In those cases, it is necessary to change the lubricating oil as a function of average fuel consumption. Therefore, select a column based on the representative fuel consumption range.

Typical Duty Cycles by Applications		
Heavy	**Medium**	**Light**
Air Compressor	Articulated Dump Truck	Crane
Combine	Irrigation Equipment	Rear Dump Truck
Dozer	Scraper	
Dragline	Skidder	
Excator		
Farm Tractors		
Forage Harvester		
Front-End Loader		
Rock Drill		
Tub Grinder		

Generator Drive Engines Only

This service interval is based on load factor (as reflected by fuel usage), lubricating oil quality, lubricating system capacity, and operating speed 1500 rpm (50 Hz) or 1800 rpm (60 Hz). Premium grade oils (API CG-4, CH-4, and CES 20,076) are recommended for the QSX15 engine. The oil grades CD, CE, and CF have been obsoleted by API and should **not** be used, as their specifications are no longer controlled. There are two recommended methods for determining the proper oil change interval:

- Fixed hour method; based on fixed hours of operation or months of service, whichever occurs first.
- Chart method; based on known fuel consumption rates.

Fixed Hour Method

If the chart method is **not** used or, for all stand-by power applications, the oil should be changed at a regular interval or 12 months, whichever occurs first:

Operating Speed	Sump Size	Change Interval
1500 rpm (50 Hz)	12 gal	125 hrs or 12 months
	25 gal	250 hrs or 12 months
1800 rpm (60 Hz)	12 gal	250 hrs or 12 months
	25 gal	500 hrs or 12 months

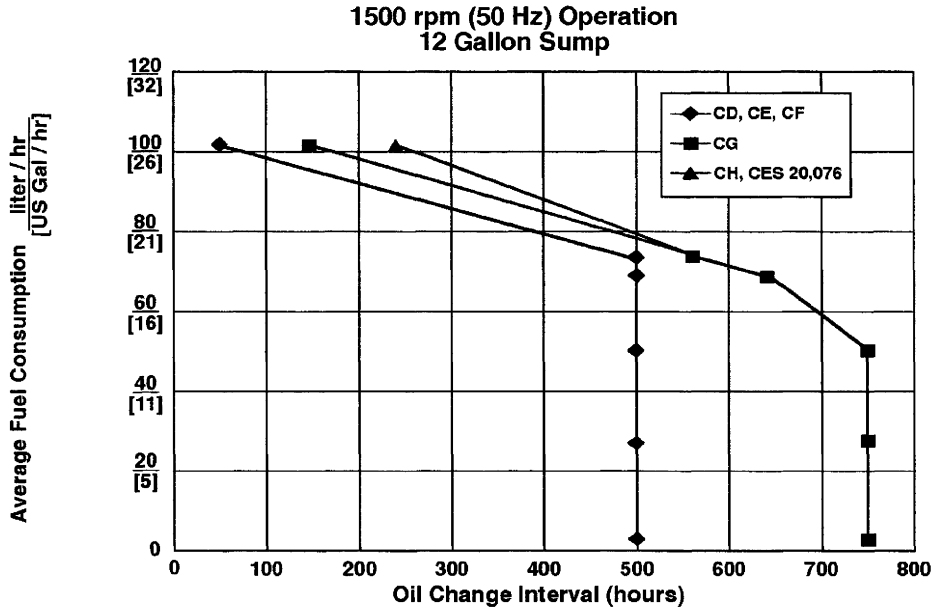
Chart Method

The chart method is recommended to provide the lowest total cost of operation while still protecting the engine. Due to differing availability outside North America, lower grade oils (CD, CE, and CF) are also depicted, however their classifications have been obsoleted by API, and oil change intervals are greatly reduced.

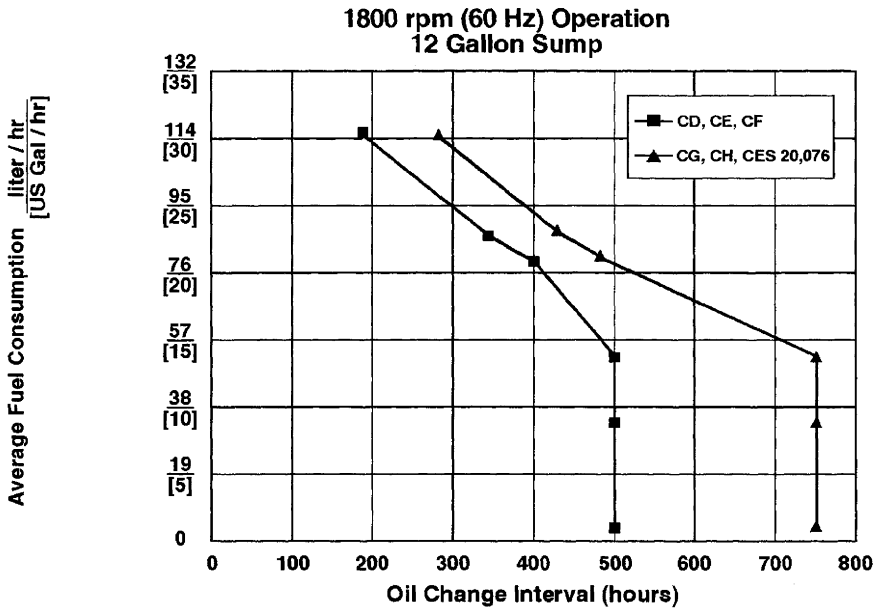
The charts should be used as guidelines because actual oil drain intervals will also depend on operation and maintenance practices. It is suggested that oil analysis should be used periodically for prime power applications (every 100 hours) to ensure the proper oil change interval is being applied.

To use the charts, locate the chart for the appropriate sump size and operating speed. Find the fuel consumption rate in U.S. gallons per hour or liters per hour on the left vertical axis. Draw a horizontal line from left to right across the chart, parallel with the bottom of the chart, until it intersects the curve.

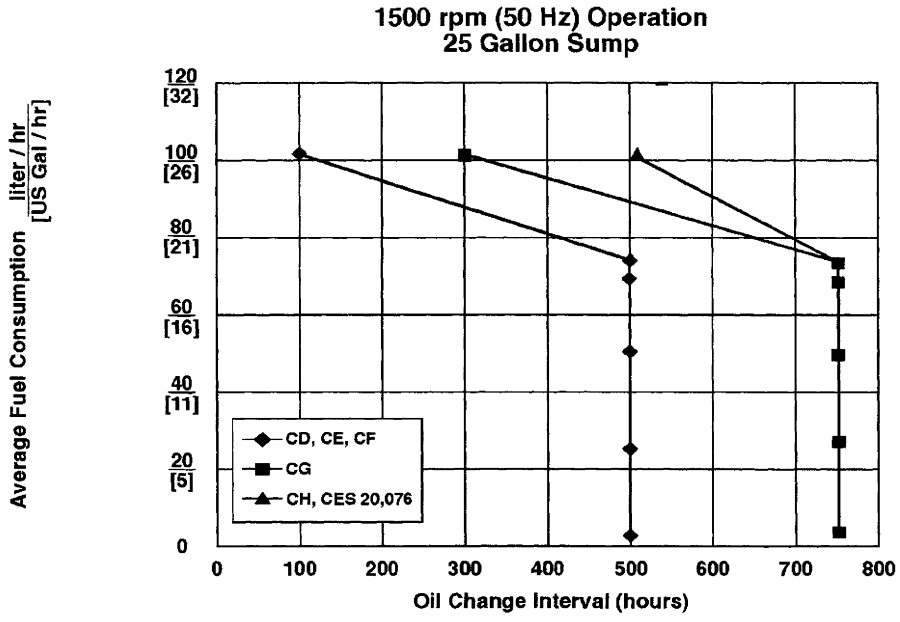
From the intersection point on the curve, draw a line perpendicular to the bottom of the chart. The number the line intersects across the bottom of the chart represents the recommend oil change interval in hours.



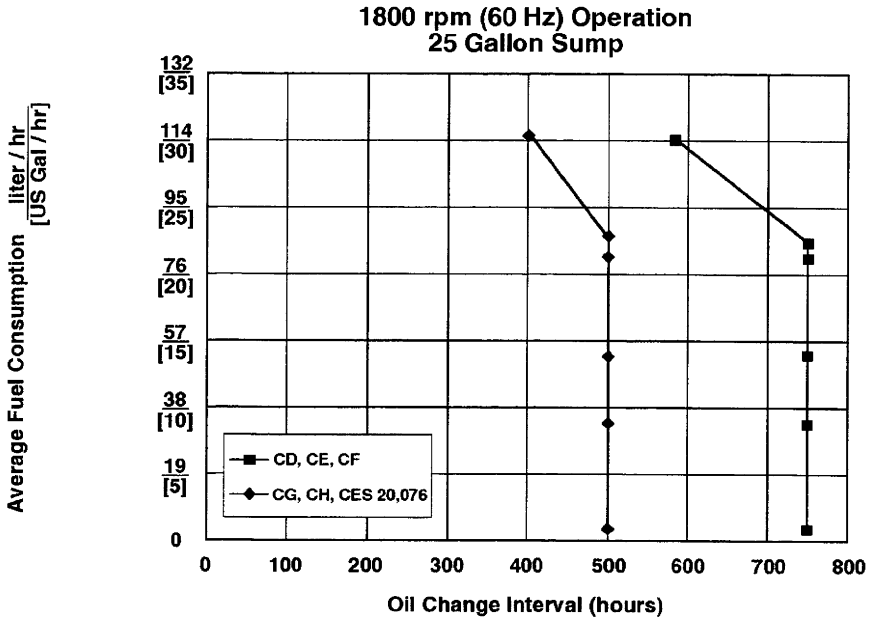
17c00173



17c00174



17c00175


1800 rpm (60 Hz) Operation
25 Gallon Sump
Average Fuel Consumption liter / hr [US Gal / hr]
132 [35]
114 [30]
95 [25]
76 [20]
57 [15]
38 [10]
19 [5]
0
0
100
200
300
400
500
600
700
800
Oil Change Interval (hours)
CD, CE, CF
CG, CH, CES 20,076

17c00176

Page References for Maintenance Instructions

For your convenience, listed below are the page numbers that contain specific instructions for performing the maintenance checks listed in the maintenance schedule.

Daily or Refueling
- Air Intake Piping - Maintenance Check 3-4
- Air Tanks and Reservoirs - Drain 3-5
- Charge-Air Piping - Maintenance Check 3-4
- Coolant Level - Maintenance Check 3-2
- Cooling Fan - Maintenance Check 3-3
- Crankcase Breather Tube - Maintenance Check 3-5
- Drive Belts - Maintenance Check 3-4
- Fuel-Water Separator - Drain 3-2
- Lubricating Oil Level - Maintenance Check 3-2

Every 250 Hours or 6 Months
- Lubricating Oil - Drain and Fill 4-2
- Lubricating Oil Filter - Replace 4-2
- Supplemental Coolant Additive (SCA) - Maintenance Check 4-5

Every 1500 Hours or 1 Year
- Air Cleaner Restriction - Maintenance Check 5-7
- Air Leaks, Air Intake and Exhaust Systems - Maintenance Check 5-6
- Automatic Belt Tensioner - Inspect 5-4
- Coolant Filter - Replace (if necessary) 5-2
- Engine Wiring Harness - Maintenance Check 5-8
- Fuel Filter (Spin-on Type) - Remove and Install 5-3

Every 3000 Hours or 2 Years
- Cold Weather Starting Aids (Shutters and Thermatic Fan)- Maintenance Check 6-2
- Crankcase Breather Tube - Inspect 6-3
- Engine Brake Assembly - Adjust 6-11
- Engine Hoses - Maintenance Check 6-2
- Engine Mounting Bolts - Maintenance Check 6-3
- Engine Steam Cleaning - Clean 6-2
- Vibration Damper - Maintenance Check 6-5
- Overhead Set - Adjust 6-5

Every 10,000 Hours or 5 Years
- Air Compressor Carbon Buildup - Maintenance Check 7-2
- Belt Driven Fan Hub - Maintenance Check 7-2

Maintenance Record Form

Maintenance Record	
Engine Serial No.:	Engine Model:
Owner's Name:	Equipment Name/Number:

Key to table headings:

A = Date
B = km [Miles], Hours or Time Interval
C = Actual km [Miles] or Hours
D = Maintenance Check Performed
E = Check Performed By
F = Comments

A	B	C	D	E	F

Section 3 - Maintenance Procedures at Daily Interval

Section Contents

Page

Air Intake Piping 3-4
Maintenance Check 3-4

Air Tanks and Reservoirs 3-5
Drain 3-5

Charge-Air Piping 3-4
Maintenance Check 3-4

Coolant Level 3-2
Maintenance Check 3-2

Crankcase Breather Tube 3-5
Maintenance Check 3-5

Daily Maintenance Procedures - General Information 3-1

Drive Belts 3-4
Maintenance Check 3-4

Fan, Cooling 3-3
Maintenance Check 3-3

Fuel-Water Separator 3-2
Drain 3-2

Lubricating Oil Level 3-2
Maintenance Check 3-2

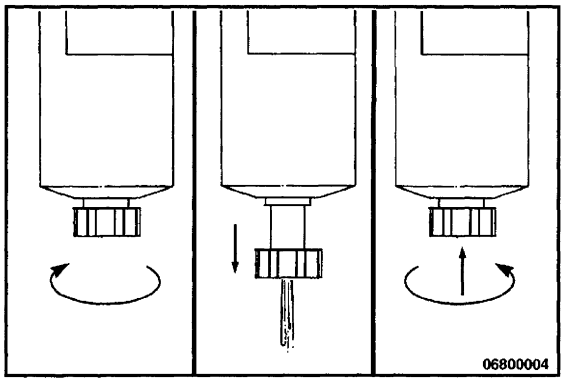
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Daily Maintenance Procedures - General Information

Preventative maintenance begins with day-to-day awareness of the condition of the engine and its systems.

Before starting the engine, check the oil and coolant levels. Look for:

- Leaks
- Loose or damaged parts
- Worn or damaged belts
- Any change in engine appearance.



Fuel-Water Separator

Drain

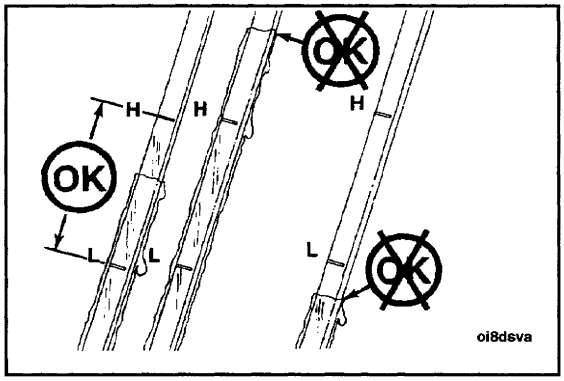
NOTE: Water and sediment can contain petroleum products. Please consult the local environmental agency for recommended disposal guidelines.

Cummins requires that a fuel-water separator or fuel filter and water separator be installed in the fuel supply system. Drain the water and sediment from the separator daily.

Shut off the engine. Loosen the drain valve nut completely so the valve drops down from the filter 1 inch. Drain the filter sump of water until clear fuel is visible.

NOTE: The thumb nut **must** be loosened enough so that the valve drops down to expose the vent slots in the valve.

Tighten the drain valve nut to stop draining.



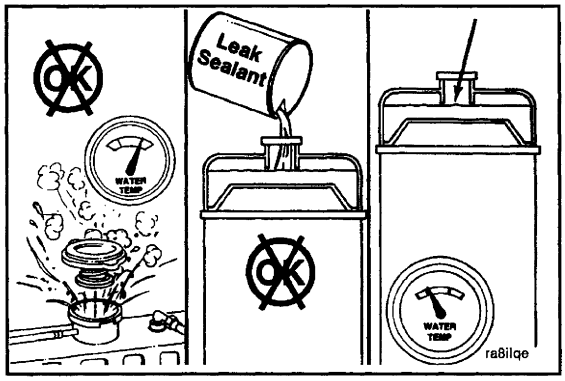
Lubricating Oil Level

Maintenance Check

Check the oil level daily.

Never operate the engine with the oil level below the L (low) mark or above the H (high) mark. Wait at least 15 minutes after shutting off the engine to check the oil. This allows time for the oil to drain to the oil pan.

NOTE: The engine **must** be level when checking the oil level to make sure the measurement is correct.



Coolant Level

Maintenance Check

⚠ WARNING ⚠

Do not remove the pressure cap from a hot engine. Wait until the temperature is below 50°C [120°F] before removing the pressure cap. Failure to do so can result in personal injury from heated coolant spray or steam. Remove the filler cap slowly to relieve coolant system pressure.

Never use a sealing additive to stop leaks in the coolant system. This can result in coolant system plugging and inadequate coolant flow, causing the engine to overheat.

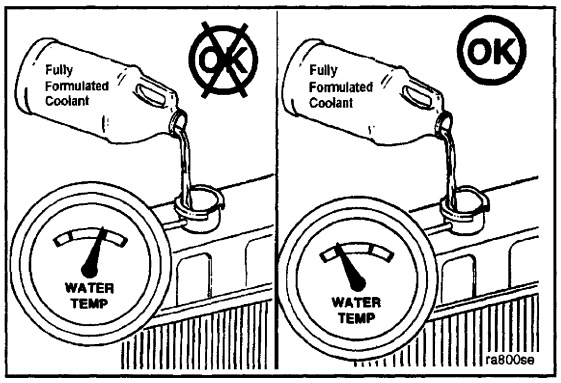
The coolant level **must** be checked daily.

⚠ CAUTION ⚠

Do not add cold coolant to a hot engine. Engine castings can be damaged. Allow the engine to cool to below 50°C [120°F] before adding coolant.

Makeup coolant added to the engine **must** be mixed with the correct proportions of antifreeze, supplemental coolant additive, and water to avoid engine damage.

Refer to Coolant Recommendations and Specifications in Section V for details on correct mixing of coolant.

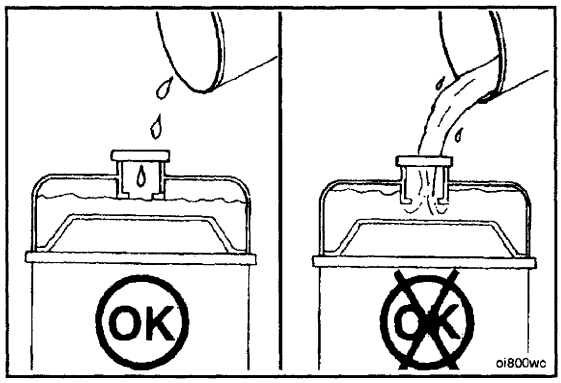


⚠ WARNING ⚠

Coolant is toxic. If not reused, dispose of in accordance with local environmental regulations.

Fill the cooling system with coolant to the bottom of the fill neck in the radiator fill or expansion tank.

NOTE: Some radiators have two fill necks, both of which **must** be filled when the cooling system is drained.

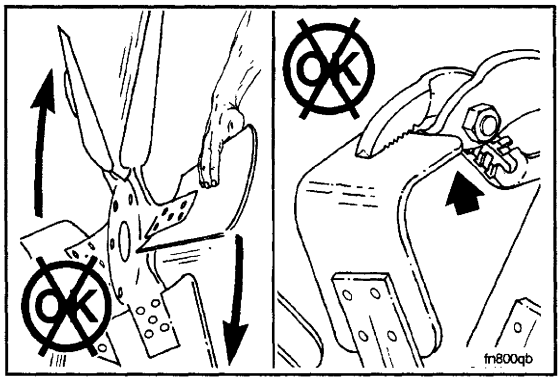


Fan, Cooling

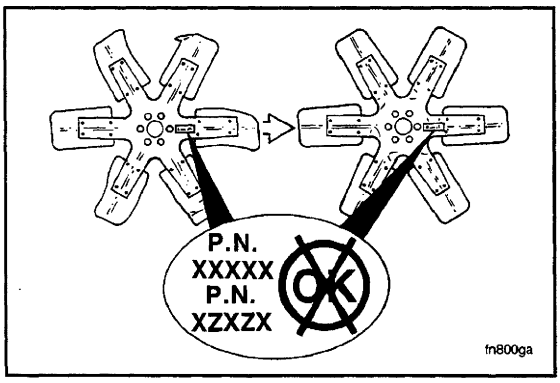
Maintenance Check

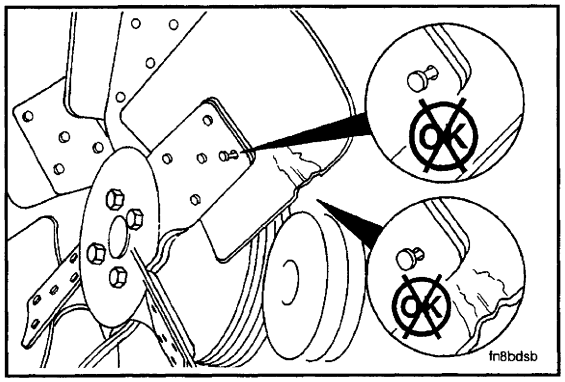
⚠ WARNING ⚠

Do not straighten a bent fan blade or continue to use a damaged fan. A bent or damaged fan blade can fail during operation and cause personal injury or property damage.



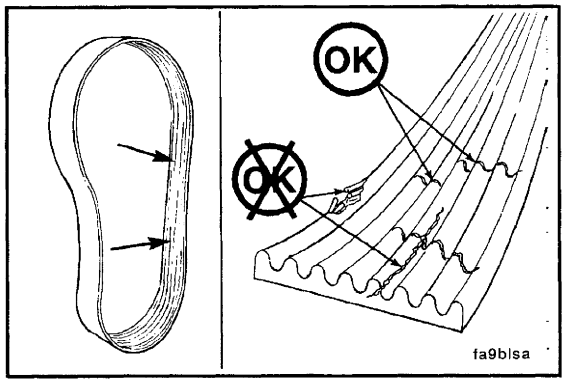
NOTE: Replace the original equipment fan with a fan of the identical part number. Cummins Engine Company, Inc. **must** approve any other fan changes.





An inspection of the cooling fan is required daily. Check for cracks, loose rivets, bent or loose blades, and for contact between the fan blade tips and the fan shroud. Check the fan to make sure it is securely mounted. Tighten the capscrews if necessary. Replace any fan that is damaged.

Refer to the vehicle manufacturer's specifications for fan capscrew torque value.



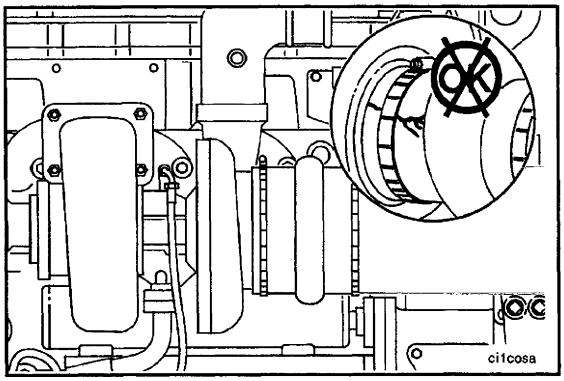
Drive Belts

Maintenance Check

Inspect the belts for damage, daily. Transverse (across the belt width) cracks are acceptable. Longitudinal (direction of belt length) cracks that intersect with transverse cracks are **not** acceptable. Replace the belt if it has unacceptable cracks, is frayed, or has pieces of material missing.

Belt damage can be caused by:

- Incorrect tension
- Incorrect size or length
- Pulley misalignment
- Incorrect installation
- Severe operating environment
- Oil or grease on the belts.



Air Intake Piping

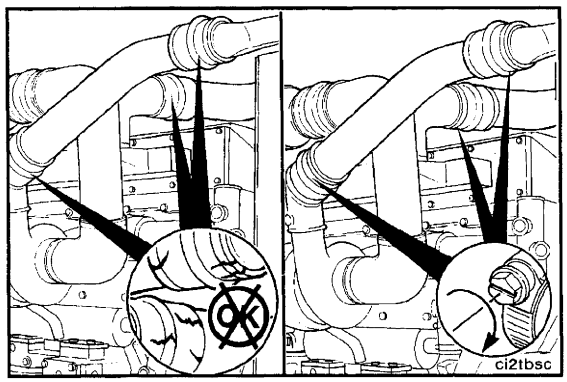
Maintenance Check

Inspect the intake piping, daily, for cracked hoses, loose clamps, or punctures that can damage the engine.

Tighten or replace parts, as necessary, to make sure the air intake system does **not** leak.

Torque Value: 8.5 N•m [75 in-lb]

Check for corrosion of the intake system piping under the clamps and hoses. Corrosion can allow corrosive products and dirt to enter the intake system. Disassemble and clean as required.

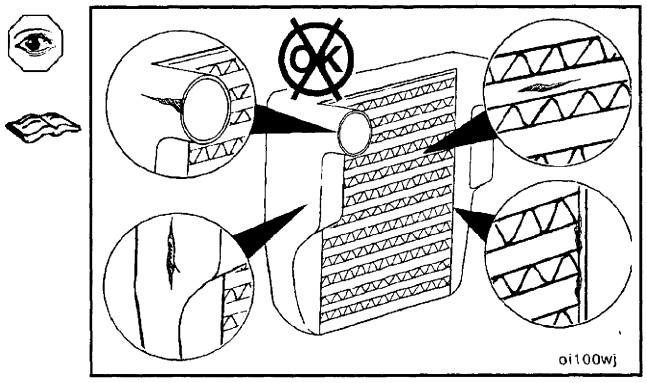


Charge-Air Piping

Maintenance Check

Inspect the charge air piping and hoses, daily, for leaks, holes, cracks, or loose connections. Tighten the hose clamps if necessary. Refer to the manufacturer's specifications for the correct torque value.

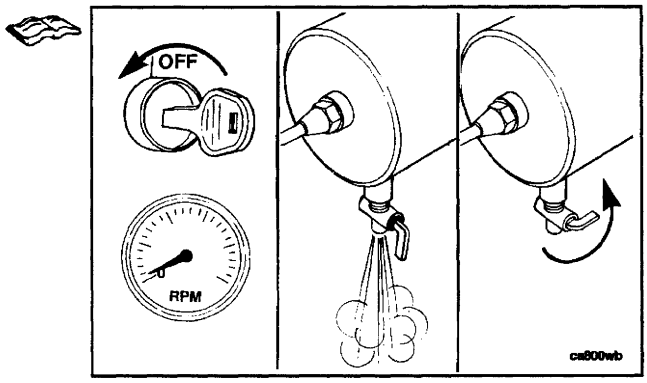
Inspect the charge air cooler for dirt and debris blocking the fins. Check for cracks, holes, or other damage. If damage is found, refer to the OEM dealer.



Air Tanks and Reservoirs

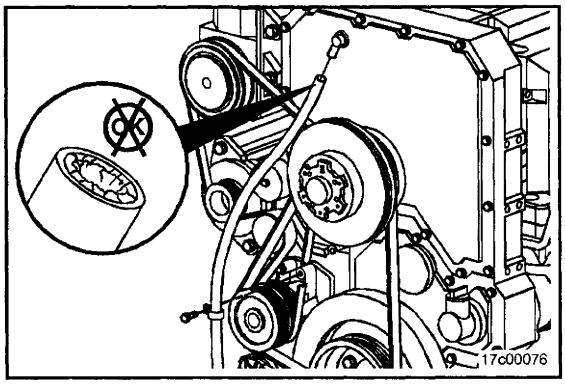
Drain

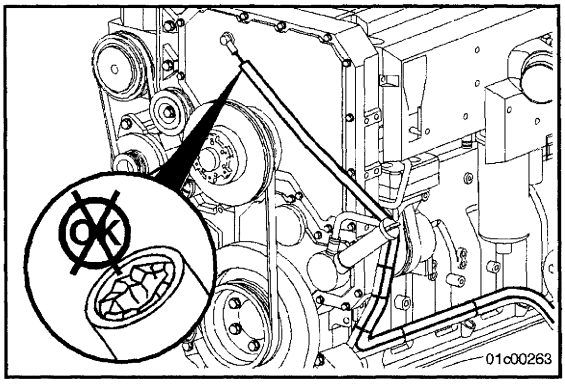
Open the draincock on the wet tank to drain any moisture accumulated in the air system. If oil is present, the air compressor **must** be checked. Refer to the *Signature /ISX/ QSX15 Troubleshooting and Repair Manual*, Bulletin No. 3666239.



Crankcase Breather Tube

Maintenance Check





Inspect the breather tube for sludge or debris on or in the tube.

Inspect the tube more frequently in icy conditions.

NOTES

Maintenance Procedures at 625 Hours or 6 Months

Section Contents

Page

Lubricating Oil and Filters 4-2
Drain 4-2
Fill 4-3
Remove 4-2

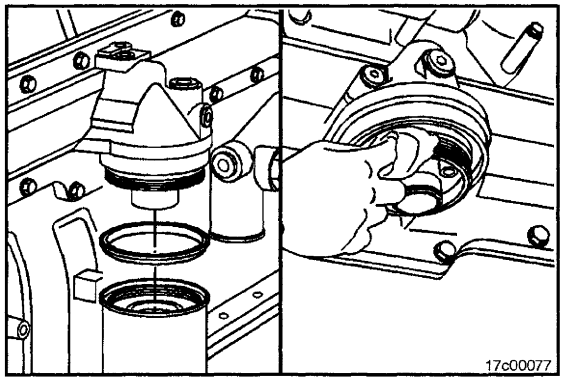
Maintenance Procedures - General Information 4-1

Supplemental Coolant Additive (SCA) 4-5
Maintenance Check 4-5

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Maintenance Procedures - General Information

All checks or inspections listed under daily or previous maintenance intervals **must** also be performed at this time, in addition to those listed under this maintenance interval.



Lubricating Oil and Filters

Remove

Clean the area around the lubricating oil filter head. Remove the filter. Clean the gasket surface of the filter head.

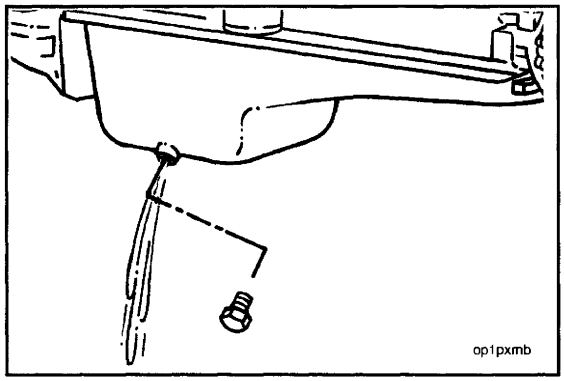
Use oil filter wrench, Part No. 3375049.

NOTE: The o-ring can stick on the filter head. Make sure it is removed.

NOTE: If the lubricating oil filter head adapter comes off during the removal of the lubricating oil filter, then reinstall the oil filter head adapter. Use a small amount of loctite on the threads of the oil filter head adapter and tighten.

Torque Value: 203 N•m [150 ft-lb]

NOTE: Refer to the Lubricating Oil Filter Specifications Chart in Section V.



Drain

⚠ WARNING ⚠

Some state and federal agencies in the United States of America have determined that used engine oil can be carcinogenic and can cause reproductive toxicity. Avoid inhalation of vapors, ingestion, and prolonged contact with used engine oil. Always use the proper procedures to dispose of the oil.

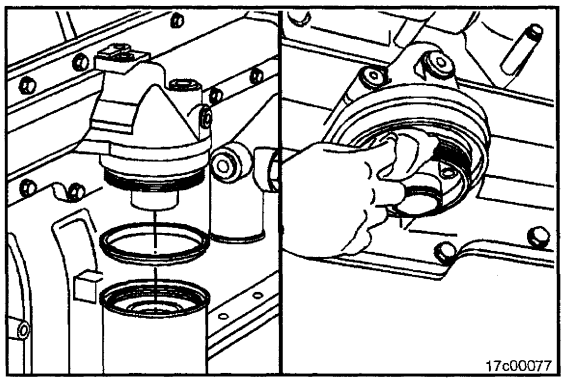
⚠ WARNING ⚠

To avoid personal injury, avoid direct contact of hot oil with your skin.

Change the lubricating oil and filters at every oil change interval.

The oil drain intervals outlined in Section V are based on duty cycles for severe-duty, normal-duty, and light-duty operation. Refer to Oil Drain Intervals in Section V to determine which interval fits your application.

Operate the engine until the water temperature reaches 60°C [140°F]. Shut off the engine. Remove the oil drain plug. Drain the oil immediately to make sure all the oil and suspended contaminants are removed from the engine.



Clean the area around the lubricating oil filter head. Remove the filter. Clean the gasket surface of the filter head.

Use oil filter wrench, Part No. 3375049.

NOTE: The o-ring can stick on the filter head. Make sure it is removed.

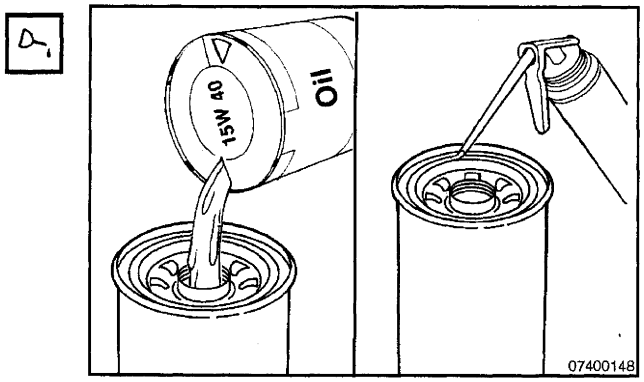
NOTE: Refer to the Lubricating Oil Filter Specifications Chart in Section V.

Fill

⚠ CAUTION ⚠

Fill the oil filter with clean lubricating oil before installing it on the engine. Lack of engine lubrication while the filter is being pumped full of oil is harmful to the engine.

Use the correct oil filter for your engine.



Combination Full-Flow/Bypass Lubricating Oil Filter

Apply a thin film of lubricating oil to the filter gasket before installing the new filter.

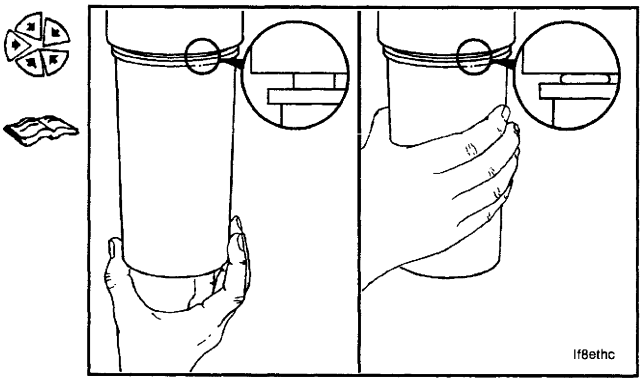
Oil filter **must** meet Cummins Engine Company Source Approval Method 10,765.

Install

⚠ CAUTION ⚠

Mechanical overtightening can distort the threads or damage the filter element seal.

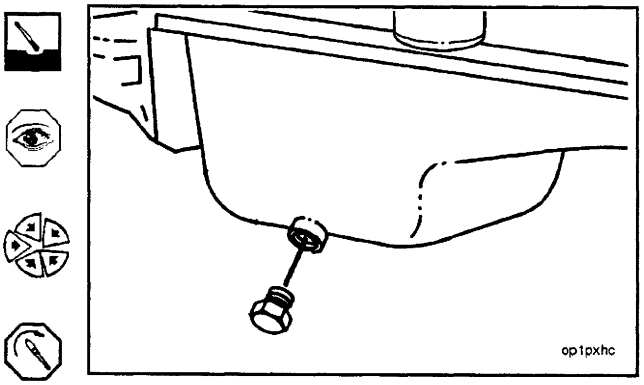
Tighten the filter an additional 3/4 of a turn after the gasket contacts the filter head surface, or as specified by the manufacturer.

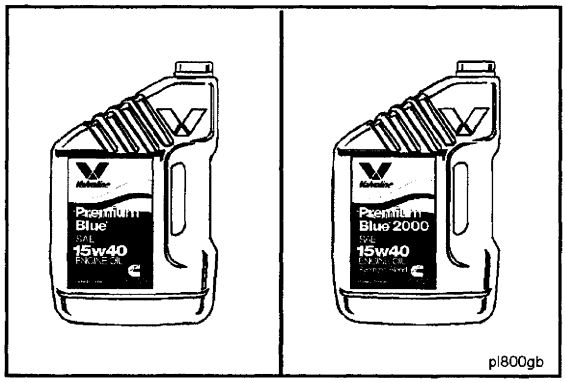


Clean and check the oil drain plug threads, o-ring, and the seal surface.

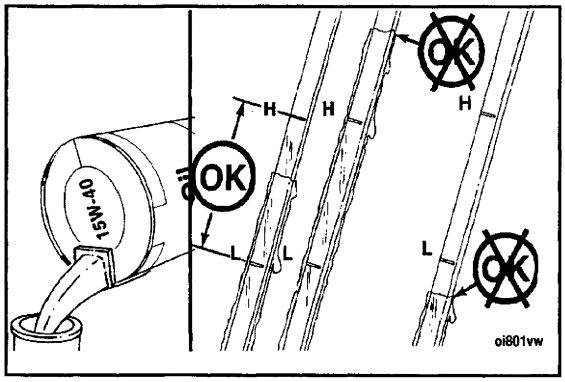
Install and tighten the oil drain plug.

Torque Value: 47 N•m [35 ft-lb]





Use a high-quality 15W-40 multiviscosity oil that meets Cummins Engineering Standard 20,076, such as Valvoline® Premium Blue® or Premium Blue® 2000, in Cummins engines. Choose the correct oil for your operating climate as outlined in Section V.

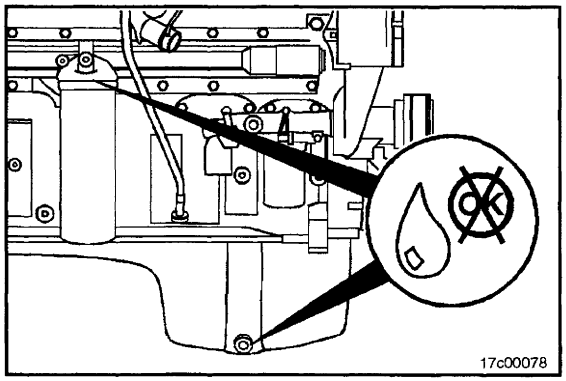


Fill the engine with clean oil to the correct level. Total system capacity for the standard engine including filter is 49.2 liters [12 gal].

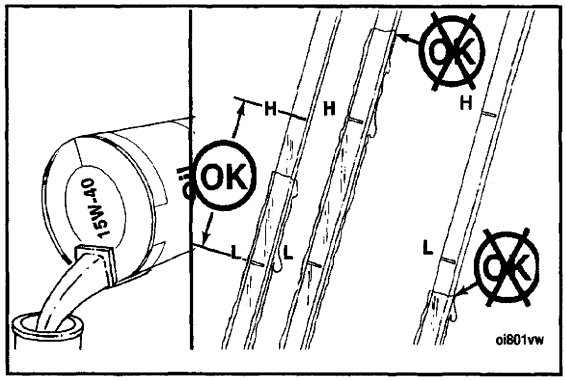
Total system capacity with the full sump pan including filter is 98.4 liters [26 gal].

After an oil change, the standard engine requires approximately 45.4 liters [11 gal] to fill the oil pan and another 3.8 liters [1 gal] to fill the new oil filter.

The engine with the full sump pan requires approximately 94.6 liters [25 gal] to fill the oil pan and another 3.8 liters [1 gal] to fill the new oil filter.



Operate the engine at idle speed to inspect for leaks at the oil filter and the drain plug.



Shut off the engine. Wait approximately 15 minutes to let the oil drain from the upper parts of the engine. Check the oil level again.

Add oil, as necessary, to bring the oil level to the H (high) mark on the dipstick.

Supplemental Coolant Additive (SCA)

Maintenance Check

⚠ WARNING ⚠

Coolant is toxic. If not reused, dispose of in accordance with local environmental regulations.

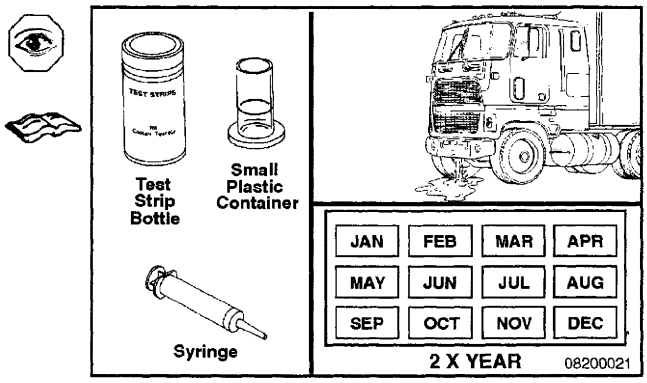
⚠ CAUTION ⚠

Insufficient concentration of the coolant additives can result in liner pitting and engine failure. Insufficient concentration can also cause damage to aluminum components such as the water inlet connection, thermostat housing, and air compressor cylinder head.

Check the SCA concentration level at least every 6 months, and anytime the coolant condition is unknown or corrosion is apparent within the cooling system.

Use Fleetguard® Nelson® coolant test kit, CC2602, to check the concentration level. Instructions are included with the test kit.

Refer to Coolant Recommendations and Specifications in Section V for more information.



NOTES

Maintenance Procedures at 1500 Hours or 1 Year

Section Contents

Page

Air Cleaner Restriction 5-7
Maintenance Check 5-7

Air Leaks, Air Intake and Exhaust Systems 5-6
Maintenance Check 5-6

Belt Tensioner, Automatic 5-4
Inspect for Reuse 5-4

Coolant Filter 5-2
General Information 5-2
Install 5-2
Remove 5-2

Engine Wiring Harness 5-8
Maintenance Check 5-8

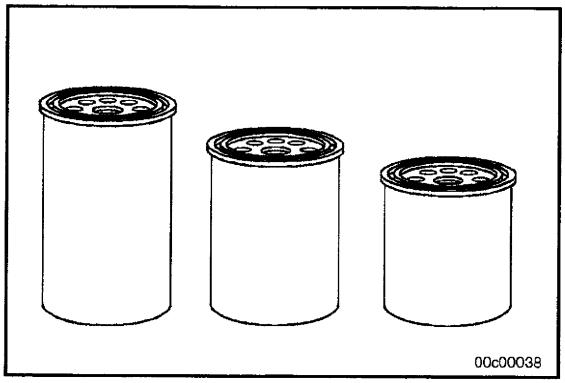
Fuel Filter (Spin-On Type) 5-3
Install 5-4
Remove 5-3

Maintenance Procedures - General Information 5-1

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Maintenance Procedures - General Information

All checks or inspections listed under daily or previous maintenance intervals **must** also be performed at this time, in addition to those listed under this maintenance interval.

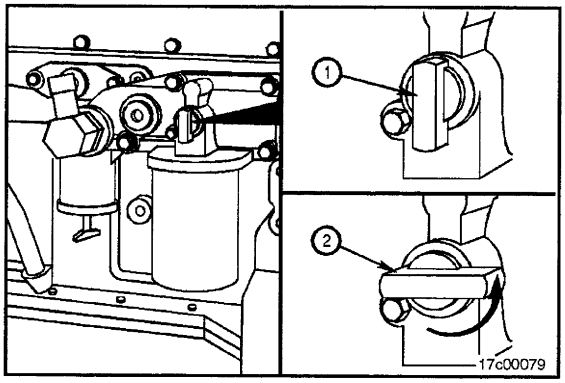


Coolant Filter

General Information

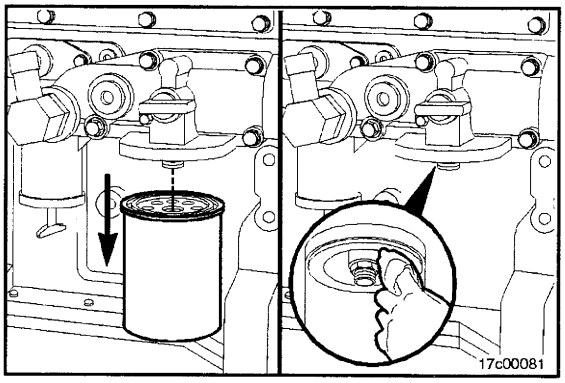
Change the coolant filter at every coolant maintenance interval. Since coolant filter change (service) intervals are being extended, a fully formulated, heavy-duty antifreeze that meets TMC 329 or 330 **must** be used.

Refer to Coolant Recommendations and Specifications in Section V.



An on/off valve is provided to prevent coolant leakage while changing the coolant filter.

With the valve in the ON position (1), the coolant flows to and from the coolant filter. In the OFF position (2), the coolant flow is cut off to and from the coolant filter.



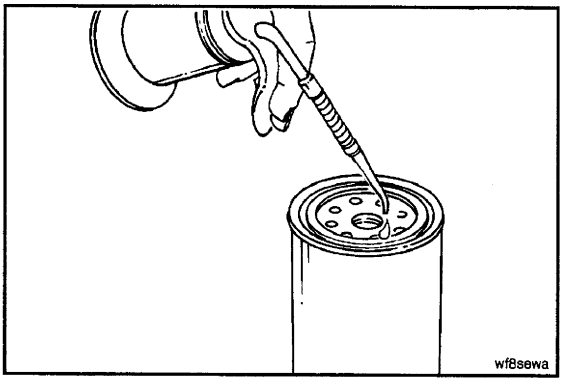
Remove

⚠ WARNING ⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [120°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

NOTE: To remove the coolant filter, the on/off valve **must** be in the OFF position.

Remove and discard the coolant filter. Clean the gasket surface on the filter head.



Install

Apply a thin film of clean engine oil, or its equivalent, to the coolant filter gasket sealing surface before installing the coolant filter.

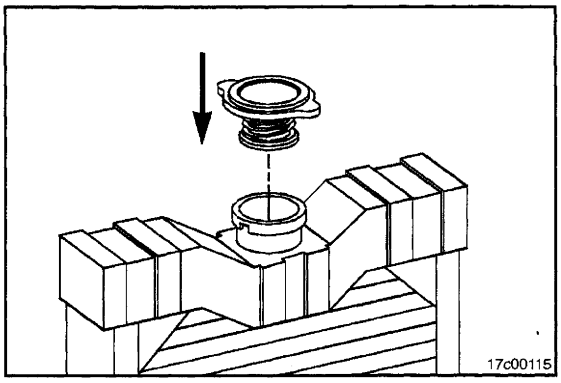
△ CAUTION △

Mechanical overtightening can distort the threads or damage the filter head.

NOTE: After installing the coolant filter, the ON mark on the coolant filter collar **must** be properly aligned. If necessary, rotate the collar by hand to the proper position.

Tighten the coolant filter 1/2 to 3/4 of a turn after initial gasket contact, or as specified by the manufacturer.

Install the radiator pressure cap.

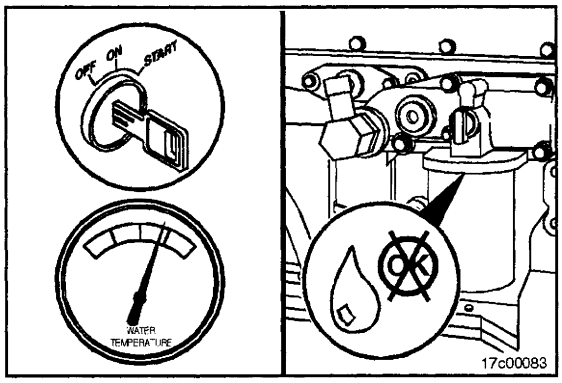


⚠ WARNING ⚠

Do not remove the pressure cap from a hot engine. Wait until the coolant temperature is below 50°C [120°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

Operate the engine until the coolant temperature is above 82°C [180°F], and check for coolant leaks.

After the air has been purged from the system, check the coolant level again.



Fuel Filter (Spin-On Type)

Remove

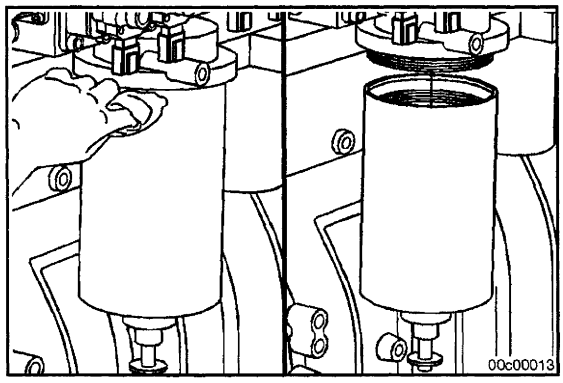
⚠ WARNING ⚠

Fuel is flammable. Keep all cigarettes, flames, pilot lights, arcing equipment, and switches out of the work area and areas sharing ventilation to avoid severe personal injury or death when working on the fuel system.

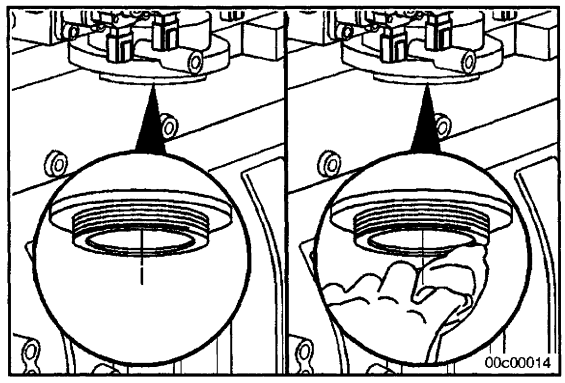
Every 1500 hours or 1 year, whichever comes first, the fuel filter **must** be replaced.

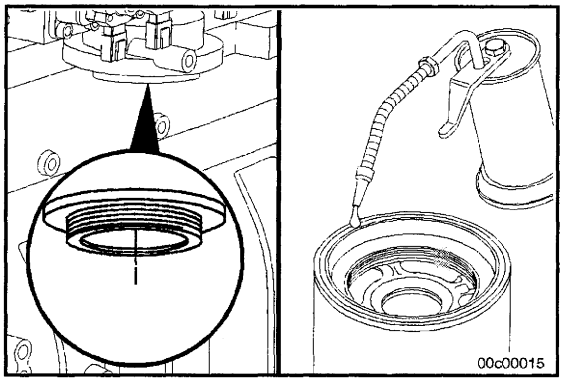
Clean the area around the fuel filter head and filter. Disconnect the wiring harness from the water-in-fuel sensor.

Remove the fuel filter with filter wrench, Part No. 3375049.



Use a clean, lint-free towel to clean the filter head gasket surface.

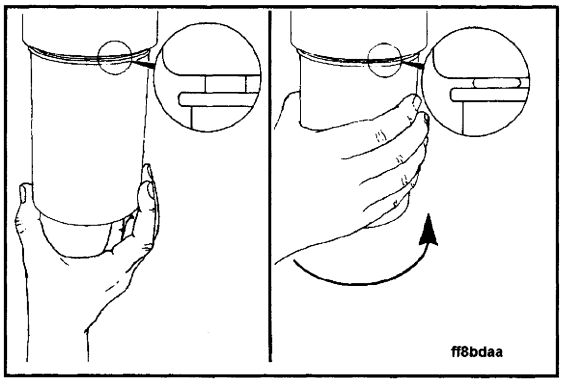




Install

Use the correct filter(s) for your engine. Cummins Engine Company requires a fuel-water separator be installed in the fuel supply system. It **must** meet Cummins Engineering Standards 14,223 and 14,225, and remove a minimum of 95 percent of free and emulsified water. It **must** also have a minimum of 98.7 percent at 10-micron particle-removal efficiency.

Apply a thin coating of clean engine oil to the filter gasket surface.



⚠ CAUTION ⚠

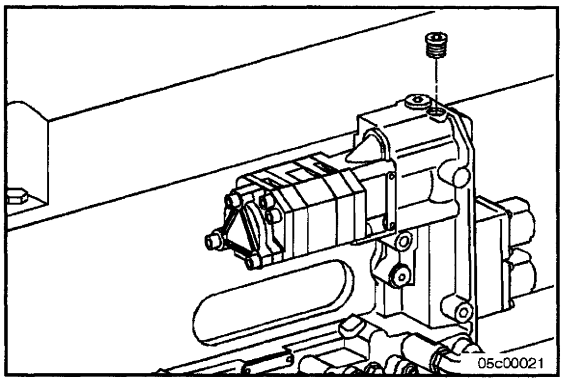
Mechanical overtightening of the filter can distort the threads or damage the filter element seal.

NOTE: Fill the filter with clean fuel prior to installation.

Install the filter onto the filter head. Turn the filter until the gasket contacts the filter head surface.

Tighten the filter an additional 3/4 of a turn after the gasket contacts the filter head surface, or as specified by the filter manufacturer.

NOTE: Rotate the water-in-fuel sensor on the filter to desired location, and connect the wiring harness.



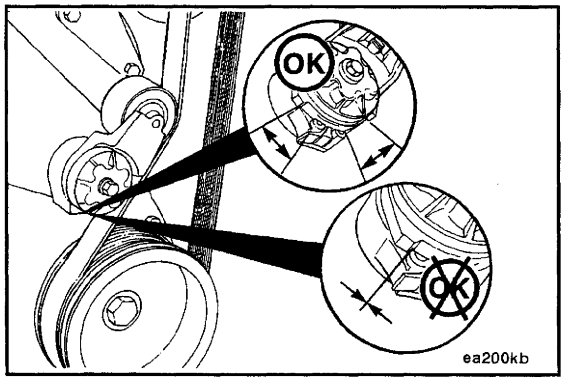
Remove the external hex plug on the top of the integrated fuel system module. Crank the engine until a solid stream of fuel comes out of the port.

Reinstall the hex plug.

Crank the engine for 20 seconds. If the engine does **not** start within 20 seconds, wait 2 minutes. It will probably be necessary to remove the filter, fill the filter with clean fuel, and install the filter.

Repeat these steps until the engine starts.

NOTE: The engine will, perhaps, run rough for several minutes until the air is out of the system.



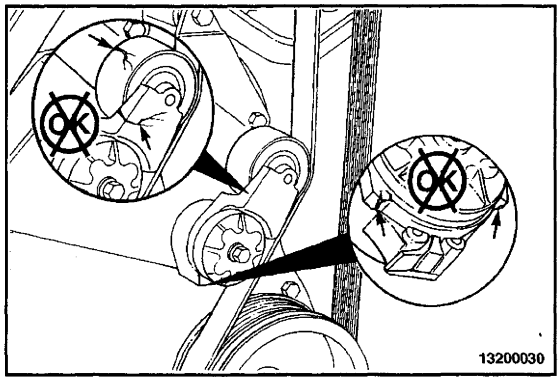
Belt Tensioner, Automatic

Inspect for Reuse

With the engine turned off, verify that neither the top nor bottom tensioner arm stop is touching the cast boss on the tensioner body. If either of the stops is touching a boss, the alternator belt **must** be replaced. Check to make sure the correct belt part number is being used if either condition exists.

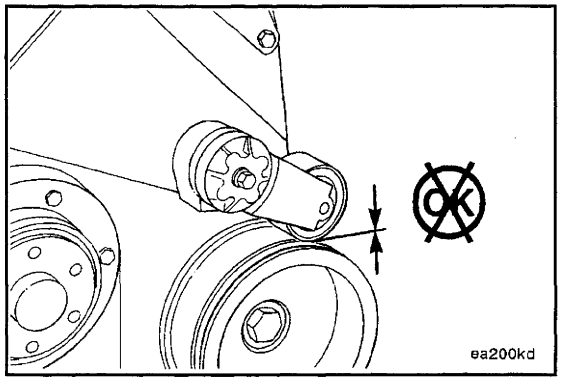
Check the tensioner pulley and body for cracks. If any cracks are noticed, the tensioner **must** be replaced.

Check the tensioner for dirt buildup. If this condition exists, the tensioner **must** be removed and steam-cleaned.



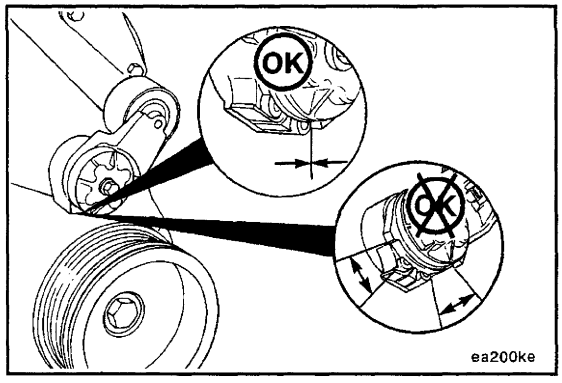
Remove the alternator belt.

If the tensioner pulley touches the accessory drive pulley after the tensioner has been fully relaxed, the bottom tensioner arm stop boss has broken and the tensioner **must** be replaced.

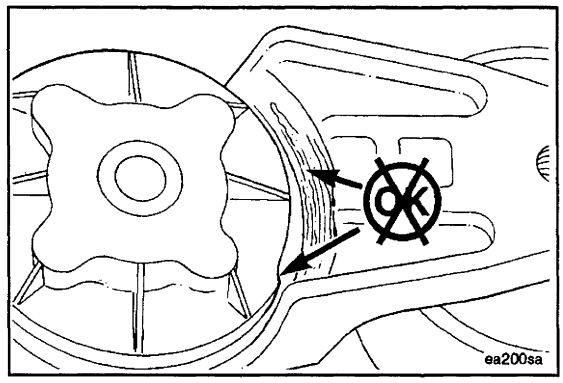


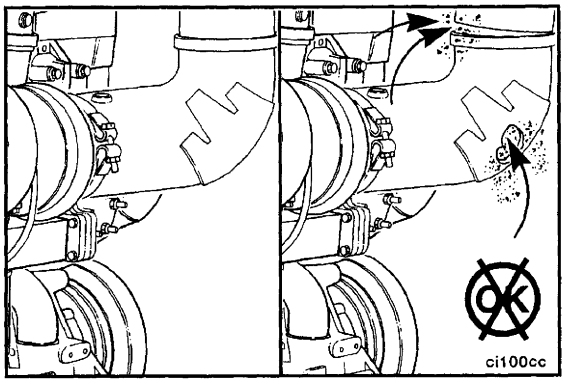
Check that the bottom tensioner arm stop is in contact with the bottom tensioner arm stop boss on the tensioner body. If these two are **not** contacting, the tensioner **must** be replaced.

Install the alternator belt.



Inspect the tensioner for evidence of the pivoting tensioner arm contacting the stationary circular base. If there is evidence of these two areas contacting, the pivot tube bushing has failed and the tensioner **must** be replaced.





Air Leaks, Air Intake and Exhaust Systems

Maintenance Check

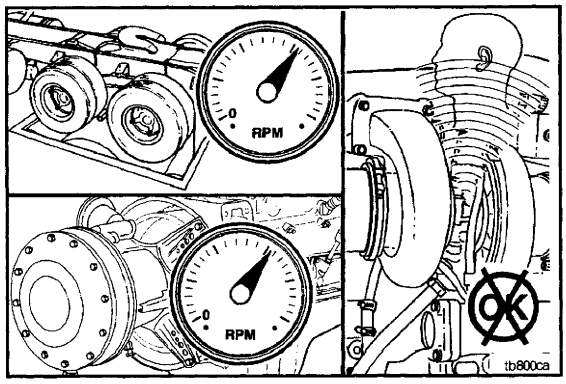
△ CAUTION △

Engine intake air must be filtered to prevent dirt and debris from entering the engine. If intake air piping is damaged or loose, unfiltered air will enter the engine and cause premature wear.

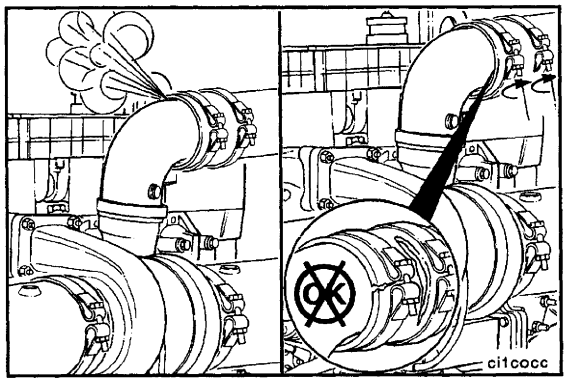
Inspect for loose clamps or damage between the intake air piping, air cleaner, turbocharger, CAC, and intake manifold.

Replace damaged pipes, and tighten loose clamps.

Torque Value: 9 N•m [80 in-lb]



Operate the engine at full throttle and maximum load, and check for air leaks. Listen for whistling noise caused by high-pressure air leaks.

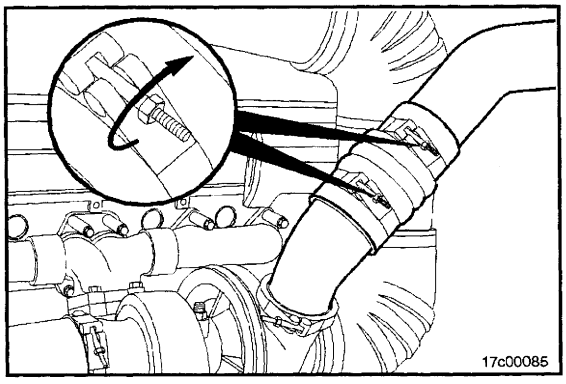


The noise can be caused by an air leak from the following:

Turbocharger-to-CAC elbow connection.

- Inspect the connection and o-ring seal for damage.
- Tighten the v-band clamps.

Torque Value: 14 N•m [120 in-lb]



Any CAC piping or connecting hose.

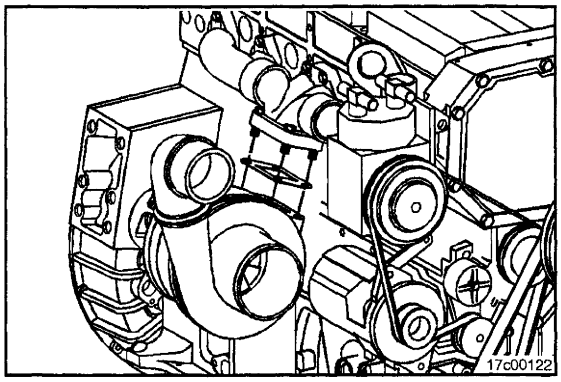
- Inspect the hose and piping for damage.
- Tighten the hose clamps.

Torque Value: 9 N•m [80 in-lb]

Turbocharger-to-exhaust-manifold mounting gasket.

- Replace the gasket.

Refer to Procedure 010-033 in the Troubleshooting and Repair Manual, Signature, ISX, and QSX15 Engines, Bulletin No. 3666239, for turbocharger removal and installation.

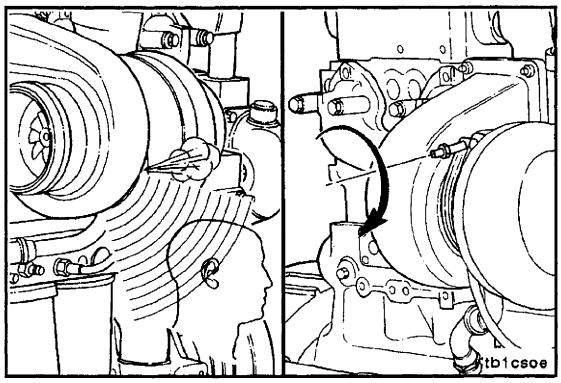


Turbine housing sealing surface air leak.

- Tighten the v-band clamp.

Torque Value: 14 N•m [120 in-lb]

- Check for an air leak.
- If an air leak is still present, remove and replace the turbocharger.

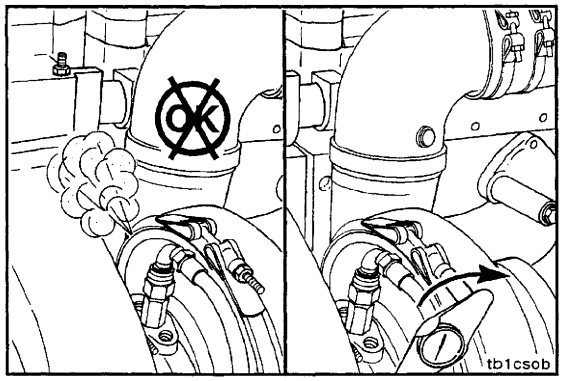


Compressor housing sealing surface air leak.

- Tighten the v-band.

Torque Value: 9 N•m [80 in-lb]

- Check for an air leak.
- If an air leak is still present, remove and replace the turbocharger.

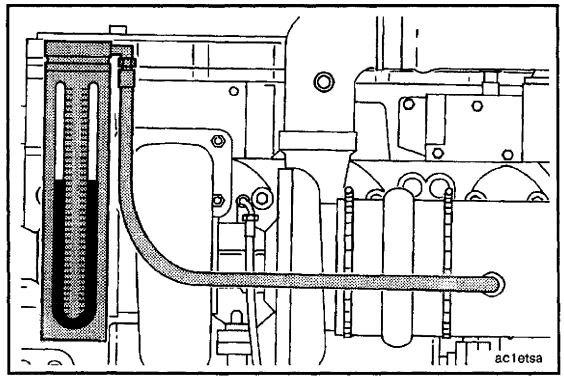


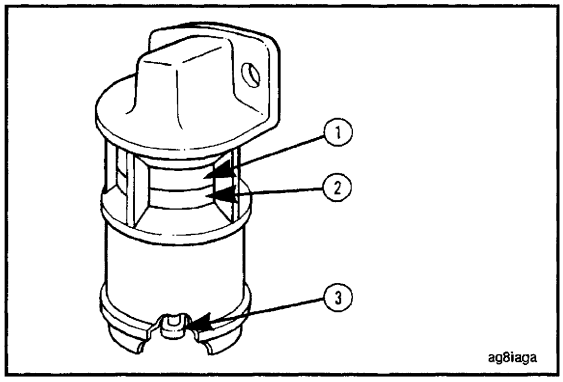
Air Cleaner Restriction

Maintenance Check

Every 300 hours or 6 months (whichever comes first), check the air cleaner restriction. Maximum intake air restriction is 64 cm H_2O [25.0 in H_2O].

The engine **must** be operated at maximum horsepower rpm and full load to check maximum intake air restriction. Replace or clean the air cleaner element when the restriction reaches the maximum available limit.



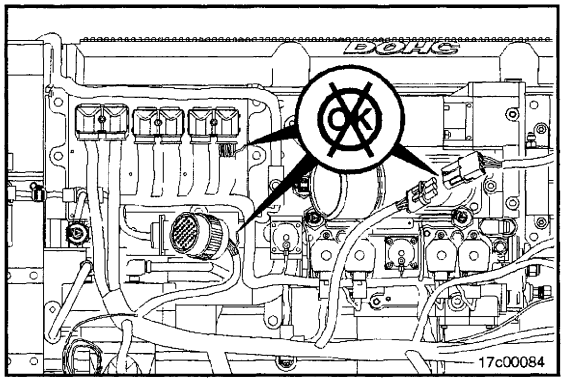


NOTE: Never operate the engine without an air cleaner. Intake air **must** be filtered to prevent dirt and debris from entering the engine and causing premature wear.

Follow the manufacturer's instructions when cleaning or replacing the air cleaner element.

Check the air cleaner service indicator, if equipped. Change the filter element when the red indicator flag (2) is at the raised position in the window (1).

After the air cleaner has been serviced, reset the button (3) in the end of the service indicator.



Engine Wiring Harness

Maintenance Check

⚠ WARNING ⚠

To avoid personal injury, do not touch the wiring connections when the keyswitch is turned on. Electrical shock can result.

Check all wire connections and the wiring harness for damage. Faulty wiring can cause improper engine operation and poor performance.

Maintenance Procedures at 3000 Hours or 2 Years

Section Contents

Page

Cold Weather Starting Aids 6-2
Maintenance Check 6-2

Crankcase Breather Tube 6-3
Assemble 6-4
Disassemble 6-3

Engine Brake Assembly 6-10
Adjust 6-10

Engine Mounting Bolts 6-3
Maintenance Check 6-3

Engine Steam Cleaning 6-2
Clean 6-2

Hoses, Engine 6-2
Maintenance Check 6-2

Maintenance Procedures - General Information 6-1

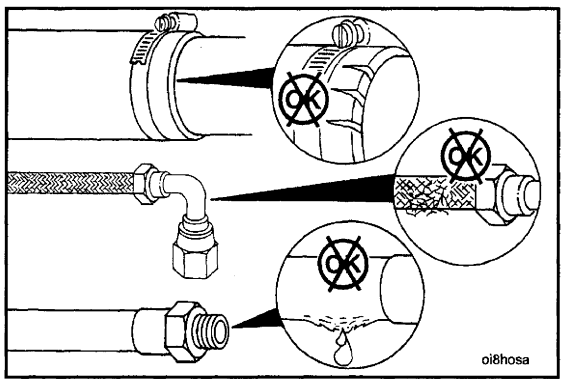
Overhead Set 6-4
Adjust 6-5
General Information 6-4

Vibration Damper 6-4
Maintenance Check 6-4

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Maintenance Procedures - General Information

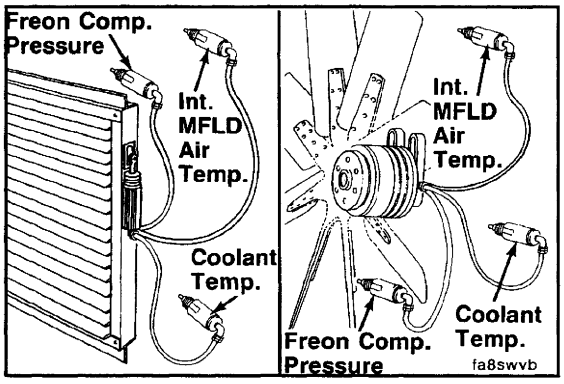
All checks or inspections listed under daily or previous maintenance intervals **must** also be performed at this time, in addition to those listed under this maintenance interval.



Hoses, Engine

Maintenance Check

Inspect the cooling system hoses and hose connections for leaks or deterioration. Particles of deteriorated hose can be carried through the cooling system and slow or partially stop circulation.



Cold Weather Starting Aids

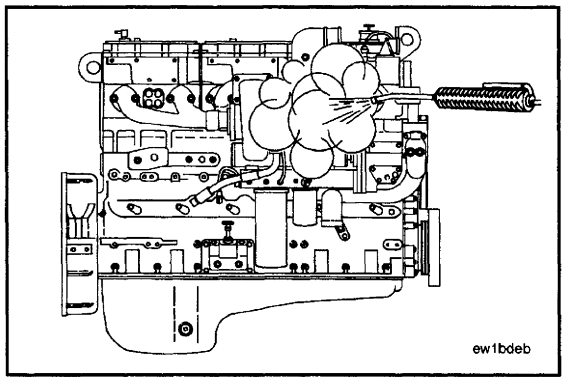
Maintenance Check

Check the shutterstats and the thermatic fan.

NOTE: Parallel control systems are required for automatic radiator **shutters** and **thermatic fans**. Shutters **must** open and fans turn on whenever the intake manifold air temperature, the engine coolant outlet temperature, or the freon compressor pressure rises above their sensor set points. Any one of the following conditions **must** activate the shutters and/or fan:

- High coolant temperature
- High intake manifold temperature
- High freon compressor pressure.

Shutterstat and thermatic fan controls **must** operate in the same temperature range as the thermostat with which they are used. Refer to the Thermal Control Settings Graph in this section.



Engine Steam Cleaning

Clean

⚠ WARNING ⚠

When using a steam cleaner, wear safety glasses or a face shield, as well as protective clothing. Hot steam can cause serious personal injury.

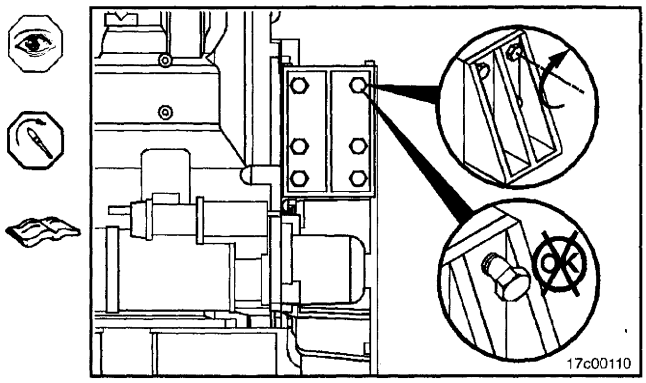
The engine **must** be steam-cleaned annually. Steam is the best method of cleaning a dirty engine or a piece of equipment. If steam is **not** available, use a solvent to wash the engine.

Protect all electrical components, openings, and wiring from the full force of the cleaner spray nozzle.

Engine Mounting Bolts

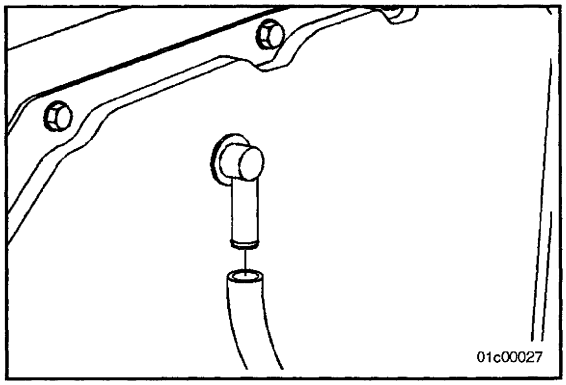
Maintenance Check

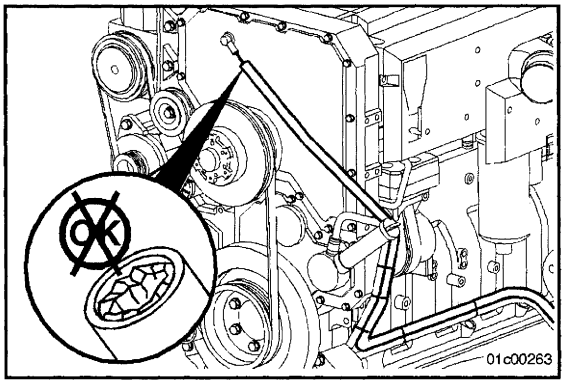
Check the torque on the engine-mounting nuts and bolts. Tighten any that are loose. Refer to the equipment manufacturer for torque specifications. Inspect the rubber for deterioration and age hardening. Replace any broken or lost bolts, capscrews, or damaged rubber.



Crankcase Breather Tube

Disassemble





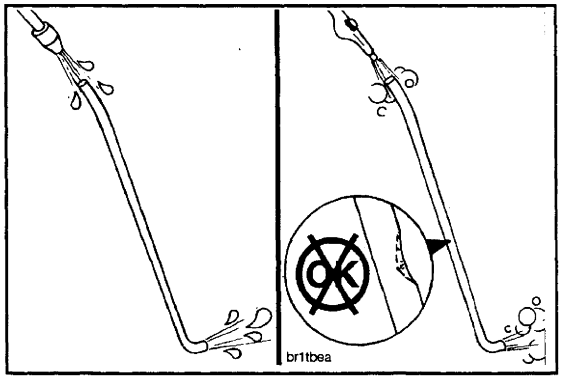
Every 3000 hours or 2 years, clean and check the crankcase breather tube.

Remove the crankcase breather tube from the breather vent tube.

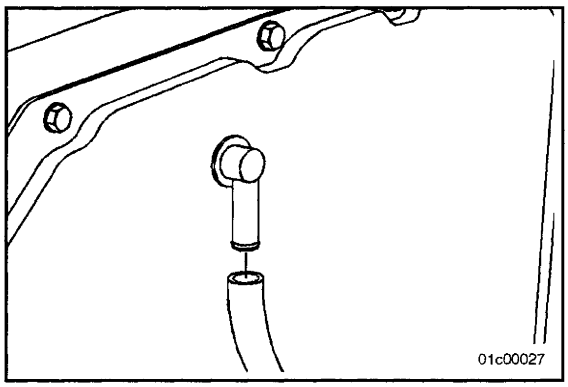
Use solvent to clean the inside of the crankcase breather tube, and dry with compressed air.

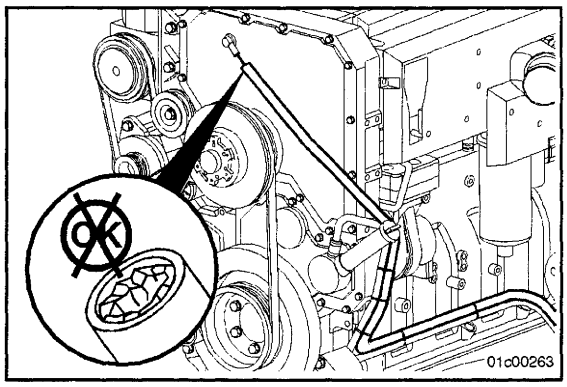
Use air pressure to blow through the vent tube.

Replace the vent tube if it is clogged.

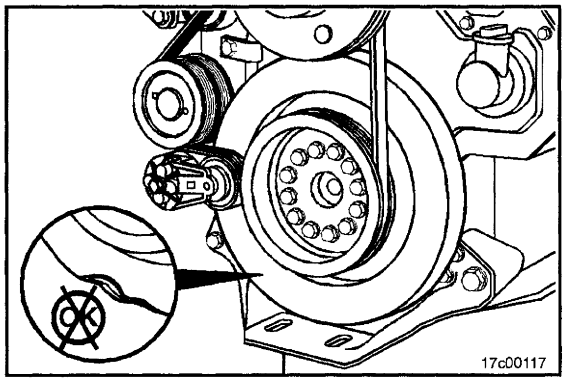


Assemble





Install the crankcase breather tube on the engine.







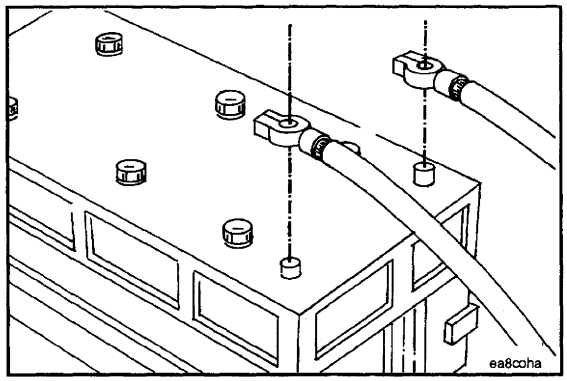
Vibration Damper

Maintenance Check

⚠ CAUTION ⚠

The silicone fluid in the damper will become solid after extended service and will make the damper inoperative. An inoperative damper can cause major engine or driveline failures.

Check the dampers for evidence of fluid loss, dents, and wobble. Inspect the vibration damper thickness for any deformation or raising of the damper front cover plate.





Overhead Set

General Information

⚠ WARNING ⚠

Batteries can emit explosive gases. To avoid personal injury, always ventilate the compartment before servicing the batteries. To avoid arcing, remove the negative (-) battery cable first and attach the negative (-) battery cable last.

Disconnect the battery.

NOTE: Read the entire procedure for overhead adjustment before attempting to perform this operation.

Valves, injectors, and engine brake (if equipped) **must** be correctly adjusted for the engine to operate efficiently. Valve, injector, and engine brake adjustment **must** be performed using the values listed in this section.

Adjust the valves, injectors, and engine brakes every 3,000 hours. Adjustment should be made after any major repair. After a major repair, the adjustment interval again becomes every 3000 hours.

QSX15
Valve, Brake, and Injector Adjustment Values

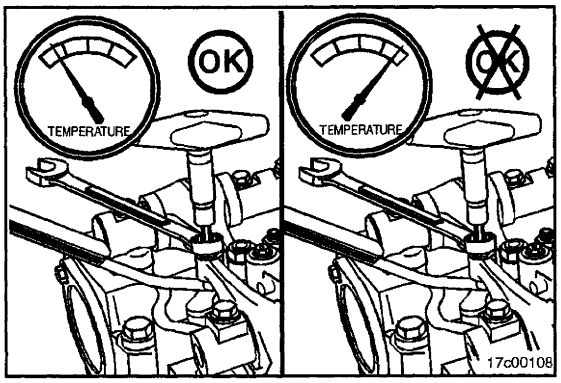
QSX15 Injector Adjustment is 8 N•m [70 in-lb].

	mm	in
Intake Valve	0.35	0.014
Exhaust Valve	0.68	0.027
Engine Brake	7.00	0.276

17c00178

Adjust

All overhead valve, injector, and brake adjustments **must** be made when the engine is cold (any stabilized coolant temperature at 60°C [140°F] or below).



17c00108

⚠ CAUTION ⚠

Do not use solvent to clean the rocker cover gasket. Solvent can damage the gasket material and cause it to swell.

Locate the valve set marks on the outside of the vibration damper.

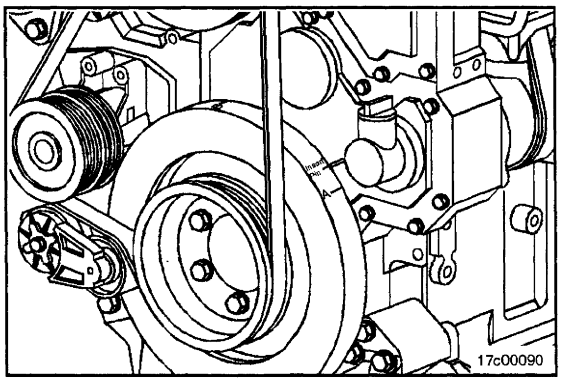
The set marks are A, B, and C:

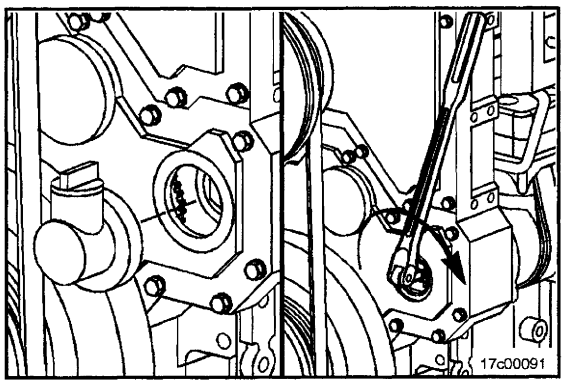
Set to mark A to adjust cylinders 1 or 6.

Set to mark B to adjust cylinders 2 or 5.

Set to mark C to adjust cylinders 3 or 4.

NOTE: Two complete revolutions are required to set all valves and injectors.


17c00090

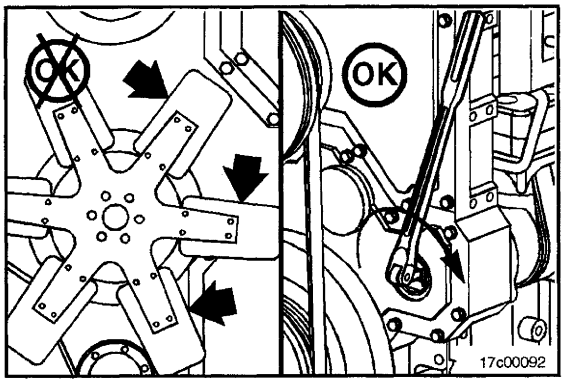


With Air Compressor

Remove the oil fill connector from the lower gear case cover.

Use a 3/4-inch drive breaker bar and extension, and insert it into the air compressor drive.

Rotate the air compressor drive **clockwise** when viewed from the front of the engine.



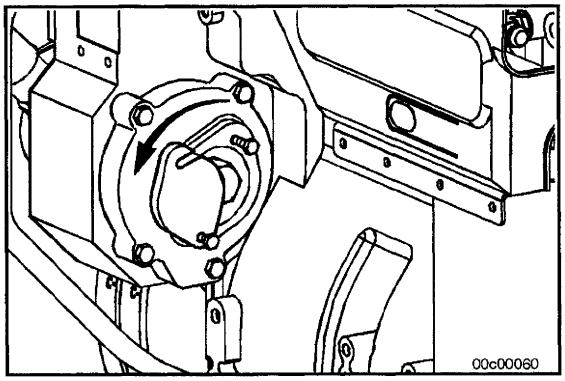
⚠ WARNING ⚠

Do not straighten a bent fan blade or continue to use a damaged fan. A bent or damaged fan blade can fail during operation and cause personal injury or property damage.

The crankshaft rotation is **clockwise** as viewed from the front of the engine.

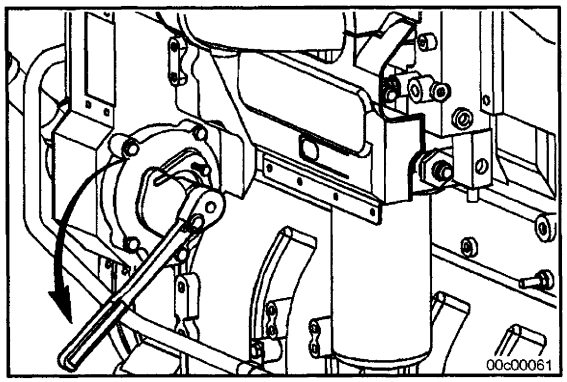
The cylinders are numbered from the front of the engine (1-2-3-4-5-6).

The engine firing order is 1-5-3-6-2-4.



Barring Device

Remove one capscrew and loosen the second capscrew, then rotate cover.

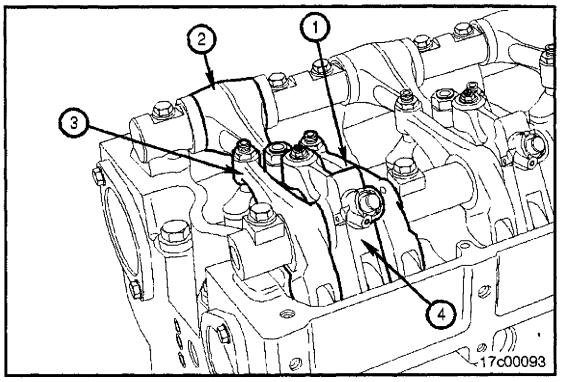


Use a 1-1/2-inch socket, and bar engine over **counter-clockwise**.

NOTE: Rock the barring device back and forth until it disengages.

Each cylinder has four rocker levers:

- The exhaust valve rocker lever (1)
- The injector rocker lever (2)
- The intake valve rocker lever (3)
- The engine brake rocker lever (4).



The valves and the injectors on the same cylinder are adjusted at the same index mark on the vibration damper.

QSX15
Injector and Valve Adjustment Sequence

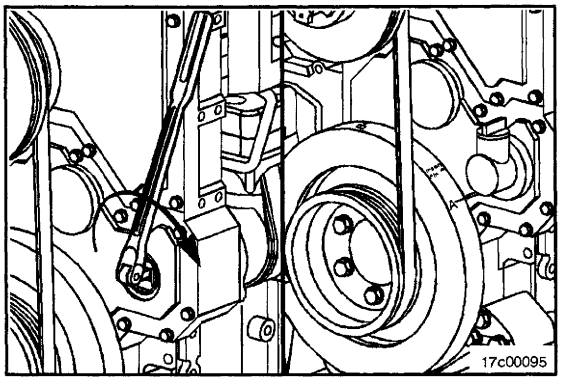
Bar Engine in Direction of Rotation	Pulley Position	Set Cylinder Injector	Valve
Start	A	1	1
Advance to	B	5	5
Advance to	C	3	3
Advance to	A	6	6
Advance to	B	2	2
Advance to	C	4	4

Firing Order: 1-5-3-6-2-4

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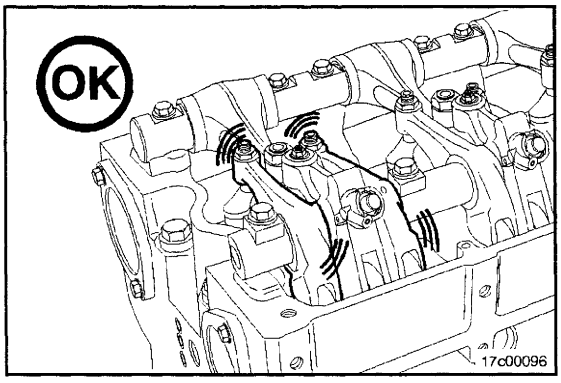
Rotate the air compressor drive in the direction of engine rotation, **clockwise**. Align the A mark on the vibration damper with the pointer on the gear cover.

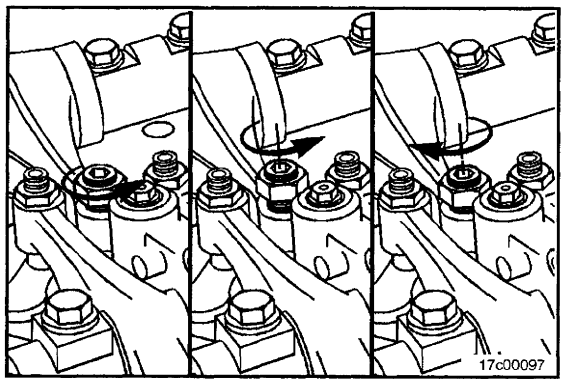
NOTE: For illustrative purposes, position A is shown as the first step. It is **not** necessary to start with position A, as long as the proper sequence is followed.



Check the valve rocker levers on the given cylinder to see if both exhaust valves are closed.

NOTE: Both valves are closed when both rocker levers are loose. If both valves are **not** closed, rotate the compressor drive gear one complete revolution, and align the A mark on the front damper with the pointer again.





Loosen the injector adjusting screw locknut on the cylinder.

Use a dial-type torque wrench, Part No. 3375044 with a range of 0 to 150 in-lb to tighten the injector rocker lever adjusting screw. If the screw chatters during setting. Repair the screw and lever as required.

NOTE: Do **not** use a click-type torque wrench.

Back out the adjusting screw one or two turns.

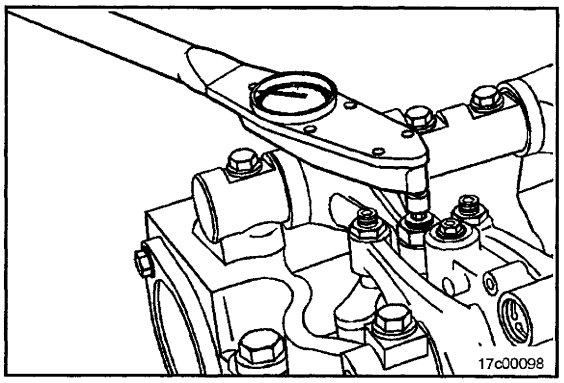
Hold the torque wrench in a position that allows you to look in a direct line at the dial. This is to make sure the dial with be read accurately.

Make sure the parts are aligned, and squeeze the oil out of the valve and injector train by tightening the adjusting screw.

NOTE: Use this initial adjustment to preload the valve train and injector.

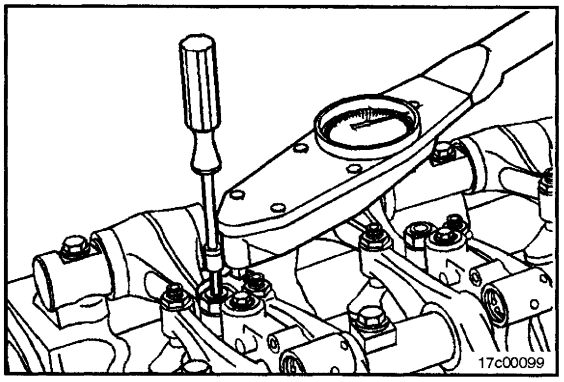
Tighten the injector adjusting screw.

Torque Value: 8 N•m [70 in-lb]



Tighten the injector lever adjusting screw.

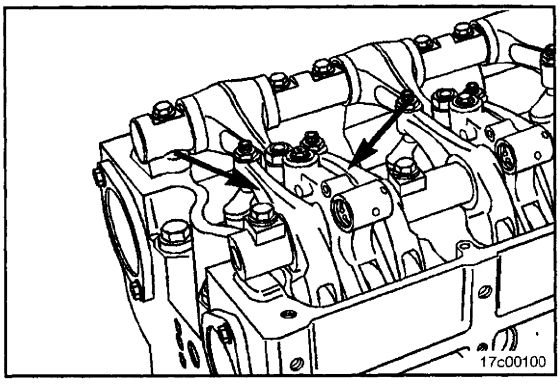
Torque Value: 8 N•m [70 in-lb]



Hold the injector lever adjusting screw, and tighten the adjusting screw locknut.

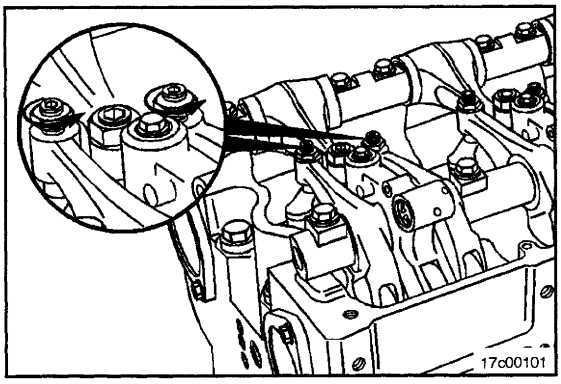
Torque Value: 75 N•m [55 ft-lb]

After setting the injector on a cylinder, set the valves on the same cylinder.



With the set mark aligned with the pointer on the gear cover and both valves closed on the cylinder, loosen the locknuts on the intake and exhaust valve adjusting screws.

Back out the adjusting screw one or two turns.

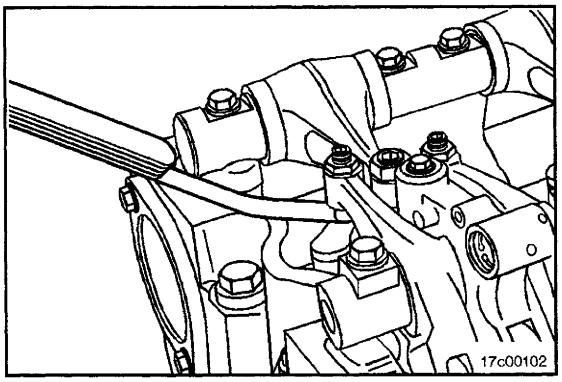


Select a feeler gauge for the correct valve lash specification.

Valve Lash Specifications

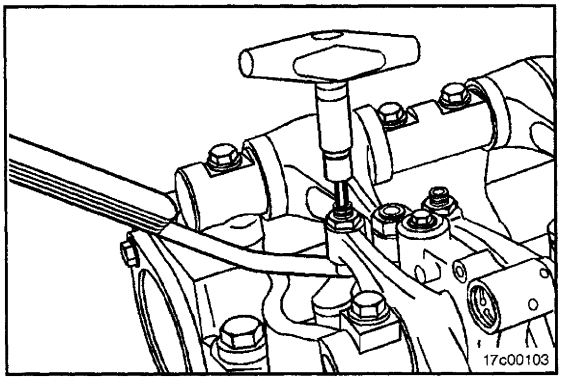
Intake	Exhaust
0.36 mm [0.014 in]	0.69 mm [0.027 in]

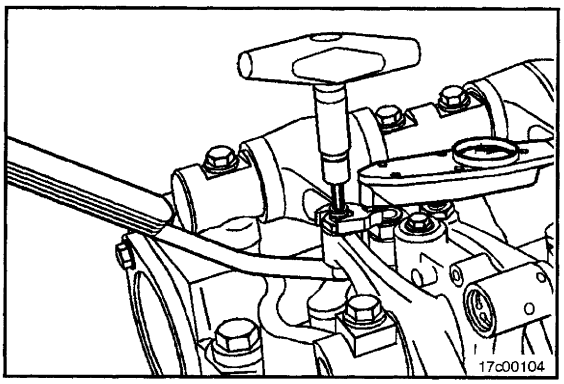
Insert the feeler gauge between the top of the crosshead and the rocker lever nose pad.



Tighten the adjusting screw.

Torque Value: 0.6 N•m [5 in-lb]

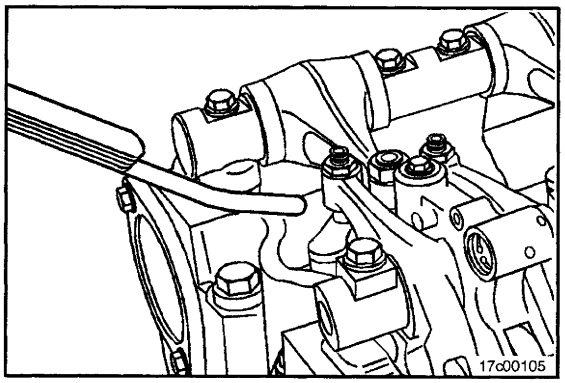




NOTE: Use torque wrench adapter, Part No. 3375044, to tighten the locknut.

Hold the adjusting screw in this position. The adjusting screw **must not** turn when the locknut is tightened.

Torque Value: 45 N•m [33 ft-lb]



After tightening the locknut to the correct torque value, remove the feeler gauge.

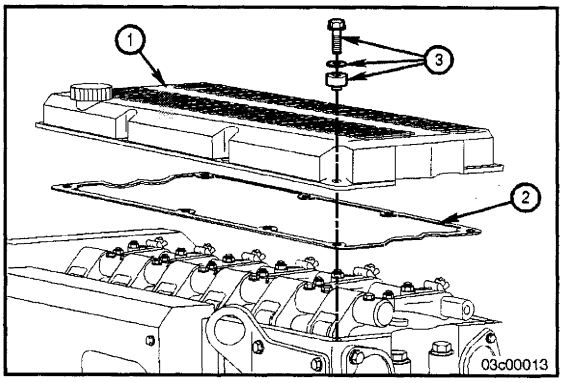
QSX15
Injector and Valve Adjustment Sequence

Bar Engine in Direction of Rotation	Pulley Position	Set Cylinder Injector	Set Cylinder Valve
Start	A	1	1
Advance to	B	5	5
Advance to	C	3	3
Advance to	A	6	6
Advance to	B	2	2
Advance to	C	4	4

Firing Order: 1-5-3-6-2-4

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Repeat the process to adjust all injectors and valves according to the chart shown earlier in this procedure.



Engine Brake Assembly

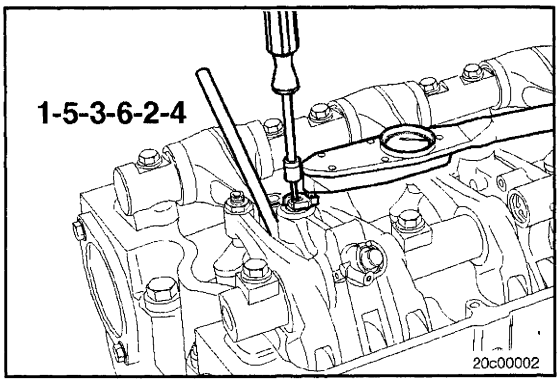
Adjust

△ CAUTION △

To get maximum brake operating efficiency and to prevent engine damage, you must follow the instructions in this section.

Remove the eight capscrews and isolator assemblies (3), rocker lever cover (1), and rocker lever cover gasket (2).

The engine brake setting is to be made in the same sequence as the firing order (1-5-3-6-2-4).



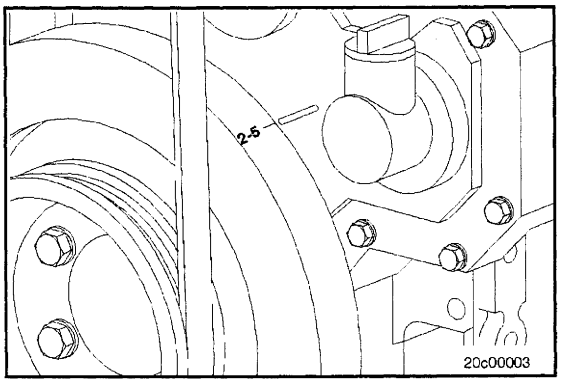
Locate the engine brake set marks on the outside of the vibration damper.

The set marks are BRAKE SET 1 - 6, BRAKE SET 2 - 5, and BRAKE SET 3 - 4:

"BRAKE SET 1 - 6": cylinder 1 or 6 adjust

"BRAKE SET 2 - 5": cylinder 2 or 5 adjust

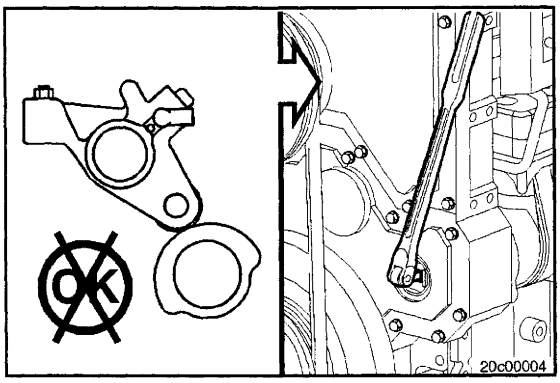
"BRAKE SET 3 - 4": cylinder 3 or 4 adjust



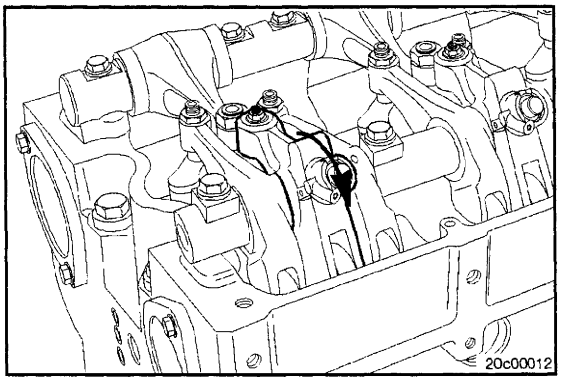
Remove the oil filler tube.

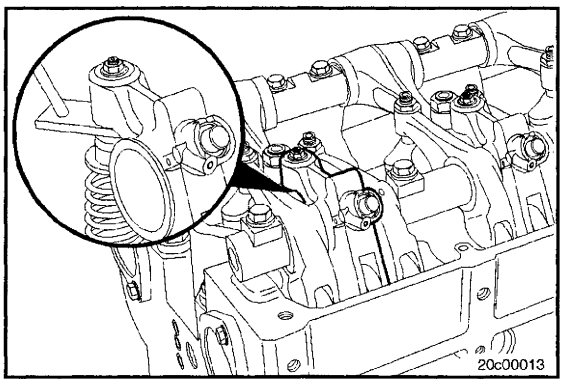
Using a 3/4-inch drive breaker bar with extension, rotate the engine **clockwise** until set mark 1-6 on the vibration damper aligns with the stamped mark on the front gear cover.

Check the engine brake lever on the given cylinder. When adjusting cylinder No. 1, both the intake and exhaust valves on cylinder No. 1 **must** be closed. The camshaft follower of the engine brake lever **must** be on the inner base circle of the valve camshaft lobe. If **not**, rotate the engine one full revolution to set mark 1-6.



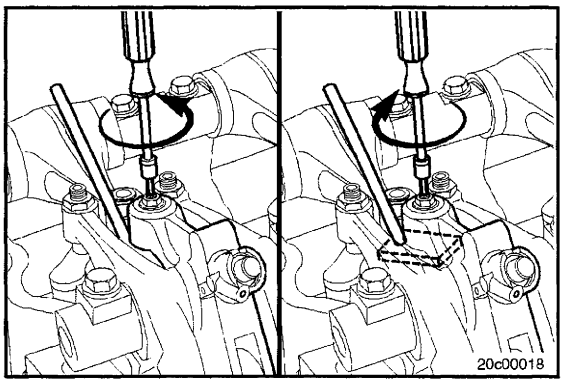
Press the engine brake lever down to verify that the camshaft follower is in contact with the camshaft.



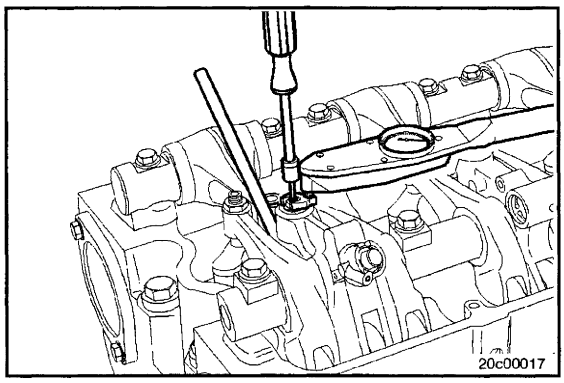


Loosen the locknut on the brake lever adjusting screw, and back out the adjusting screw one turn.

Insert the feeler gauge, Part No. 3163530, between the bottom of the engine brake piston and top of exhaust valve pin on exhaust valve crosshead.



Tighten adjusting screw until drag on feeler gauge is felt. Proper drag means that there is no motion of the brake lever camshaft follower against the cam lobe.

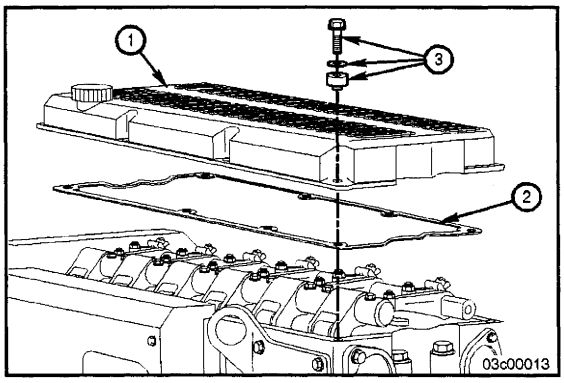


Hold engine brake lever adjusting screw, and tighten the locknut.

Torque Value: 20 N•m [15 ft-lb]

Remove the feeler gauge.

NOTE: Repate the previous steps on the remaining cylinders.



Install the rocker lever cover gasket (2), rocker lever cover (1), and the eight isolators and capscrews (3). Tighten the capscrews.

Torque Value: 25 N•m [18 ft-lb]

Maintenance Procedures at 10,000 Hours or 5 Years

Section Contents

Page

Air Compressor Carbon Buildup 7-2
Maintenance Check 7-2

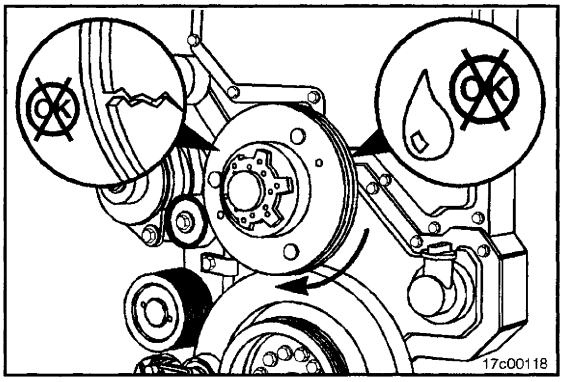
Fan Hub, Belt Driven 7-2
Maintenance Check 7-2

Maintenance Procedures - General Information 7-1

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Maintenance Procedures - General Information

All checks or inspections listed under daily or previous maintenance intervals **must** also be performed at this time, in addition to those listed under this maintenance interval.



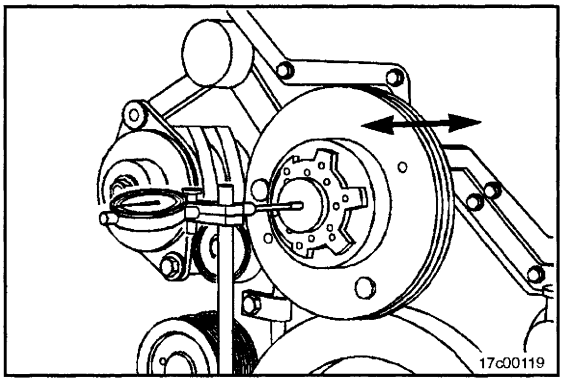
Fan Hub, Belt Driven

Maintenance Check

Inspect the fan hub for the following:

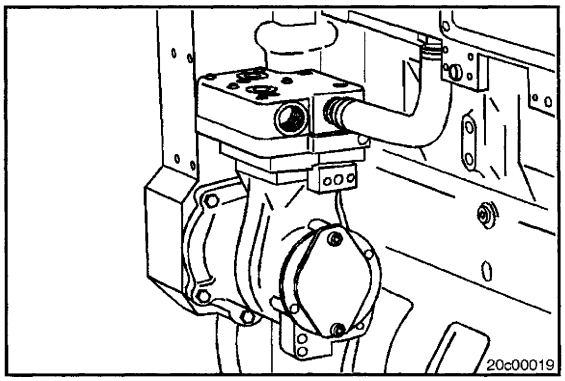
- Freedom of rotation
- Cracks
- Grease seal leakage.

Repair or replace the fan hub if the fan hub does **not** rotate freely or if there is evidence of cracks or grease seal leakage.



Measure the fan hub end clearance. Fan hubs with "step-bore" shafts and no bearing spacers **must** be 0.08 to 0.25-mm [0.003 to 0.010-in] end clearance.

Fan hubs with "through-bore" shafts with inner and outer bearing spacers **must** be 0.08 to 0.41-mm [0.003 to 0.016-in] end clearance.

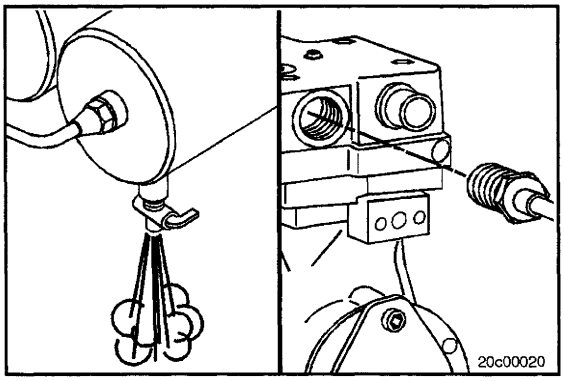


Air Compressor Carbon Buildup

Maintenance Check

Complete air compressor inspection is required every 800,000 km [500,000 mi], 10,000 hours, or 5 years.

NOTE: All air compressors have a small amount of oil carryover that lubricates the piston rings and moving parts. When this oil is exposed to normal air compressor operating temperatures over time, it will form varnish or carbon deposits. If the following inspections are **not** done, the air compressor piston rings can be affected by high operating temperatures and pressures and possibly will **not** seal correctly.

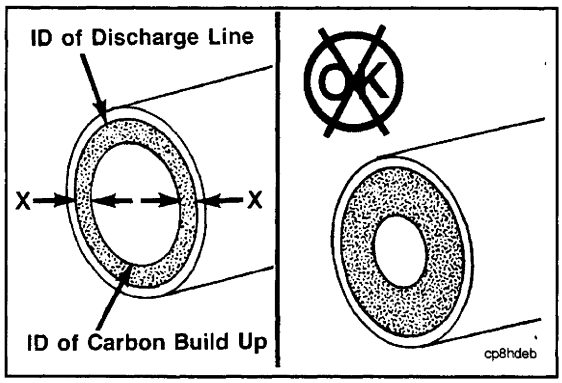


Air Compressor Discharge — Inspection

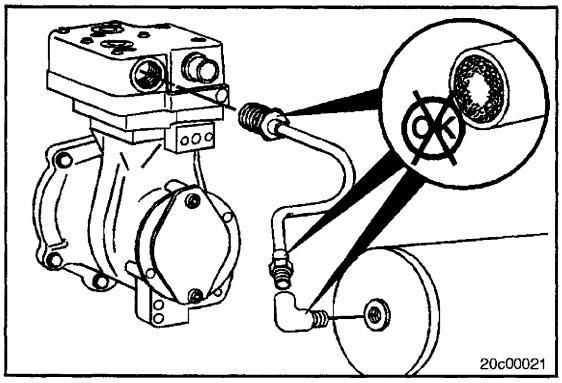
Drain the air system wet tank to release the system air pressure. Remove the air discharge line from the air compressor.

Measure the total carbon deposit thickness inside the air discharge line as shown. If the total carbon deposit (X + X) exceeds 2 mm [1/16 in], inspect the cylinder head assembly and the discharge line. Replace if necessary.

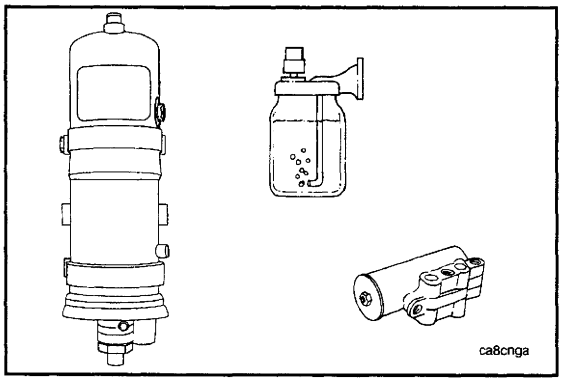
NOTE: If cylinder head replacement does **not** correct the problem, replace the compressor assembly.



If the total carbon deposit exceeds specifications, continue checking the air discharge line connections, up to the first tank, until total carbon deposit is less than 2 mm [1/16 in]. Replace any lines or connections that exceed this specification.



Inspect any air driers, downstream air valves, and the air governor for carbon deposits or malfunctioning parts. Inspect for air leaks. Maintain and repair the parts according to the manufacturer's specifications.



NOTES

Section A - Adjustment, Repair, and Replacement

Section Contents

Page

Air Starting Motor A-1
General Information A-1

Battery Cables and Connections A-2
General Information A-2

Engine Storage - Long Term A-5
General Information A-5

Turbocharger A-2
Install A-3
Remove A-2

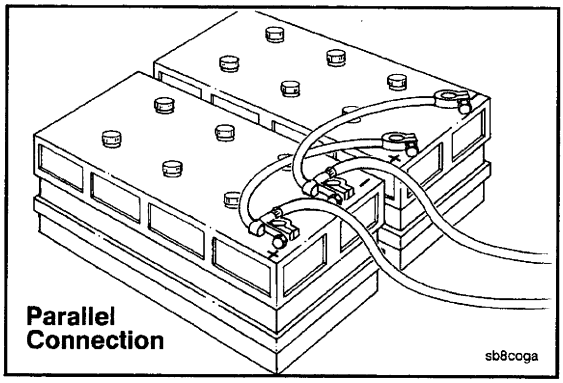
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Air Starting Motor

General Information

The air starting motor system (tanks, line sizes, and valves) is designed and installed by the original equipment manufacturers and the starting motor suppliers. Refer any questions about the air starting systems to the manufacturer.

- Do **not** operate the air starting motor with air pressure lower than 480 kPa [70 psi].
- Maintain the air starting motor according to the manufacturer's recommendations.
- For maximum efficiency, the hoses, tubes, and lines **must not** leak.
- Refer to the original equipment manufacturers' and starting motor manufacturers' manuals for specific information regarding the starting motors, valves, and systems.



Battery Cables and Connections

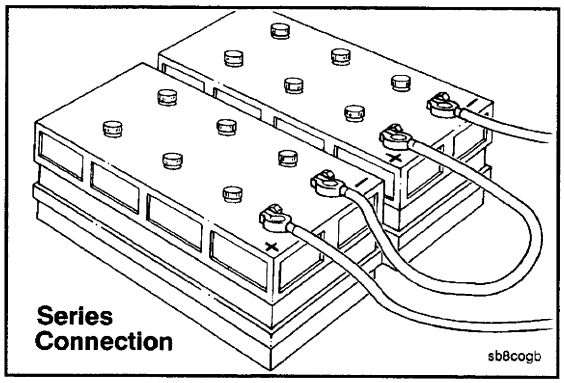
General Information

Parallel and Series Connections

⚠ WARNING ⚠

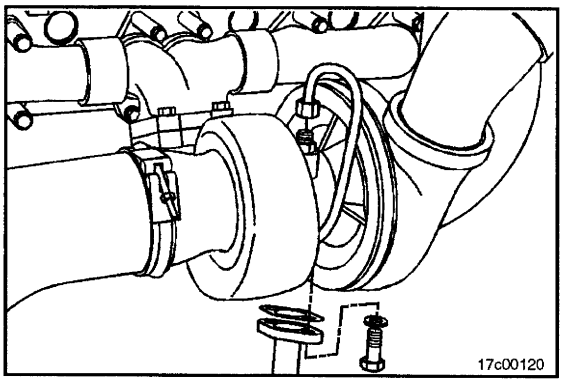
To avoid electrical shock and potential eye danger when using jumper cables to start the engine, make sure to connect the cables in parallel: Positive (+) to positive (+) and negative (-) to negative (-). When using an external electrical source to start the engine, turn the disconnect switch to the OFF position, and remove the key before attaching the jumper cables.

The accompanying illustration shows a typical parallel battery connection. This arrangement doubles the cranking amperage.



This illustration shows a typical series battery connection. This arrangement, positive (+) to negative (-), doubles the voltage.

For optimum electrical system and starting motor performance, keep battery connections clean and tight.

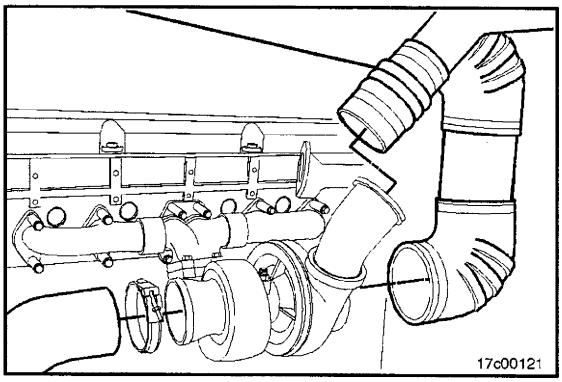


Turbocharger

Remove

Remove the oil supply and the oil drain tubes from the turbocharger.

Remove the wastegate actuator, if equipped.



Remove the intake and the exhaust pipes from the turbocharger.

Remove the CAC piping from the discharge elbow.

⚠ WARNING ⚠

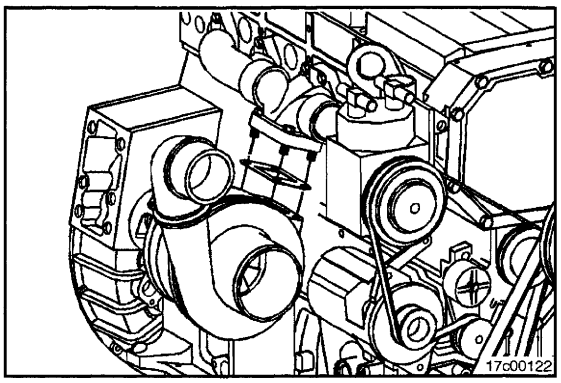
This component weighs 23 kg [50 lb] or more. To avoid personal injury, use a hoist or get assistance to lift this component.

NOTE: In some applications the turbocharger will **not** clear the lubricating oil cooler assembly during removal and installation. It will, perhaps, be necessary to remove the exhaust manifold and turbocharger together, then separate the two components.

Remove the four turbocharger mounting nuts.

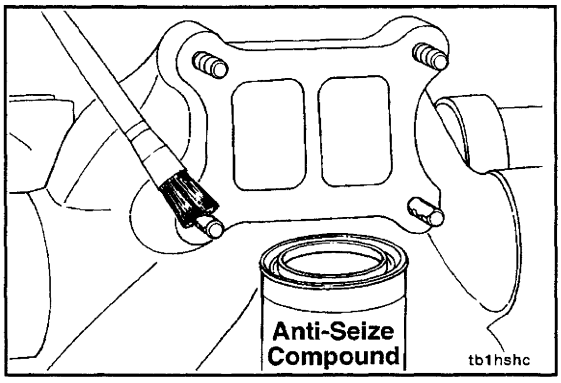
Remove the turbocharger, and discard the gasket.

NOTE: If the turbocharger mounting nuts do **not** loosen freely, split the nuts to avoid breaking a mounting stud.



Install

Apply a film of high-temperature anti-seize compound, Part No. 3823097, to the turbocharger mounting studs.



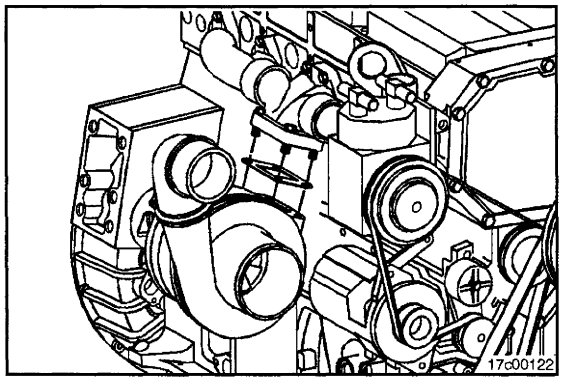
⚠ WARNING ⚠

This component weighs 23 kg [50 lb] or more. To avoid personal injury, use a hoist or get assistance to lift this component.

Install a new mounting gasket, the turbocharger, and the four mounting nuts.

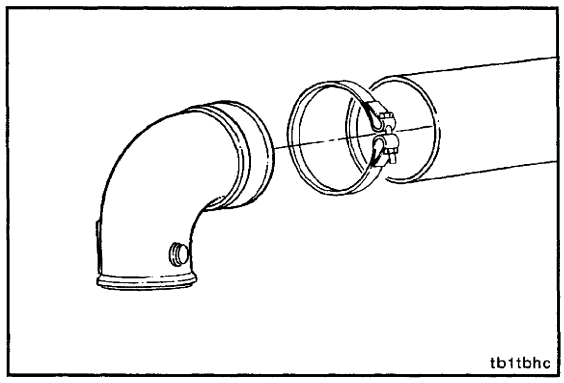
Tighten the mounting nuts.

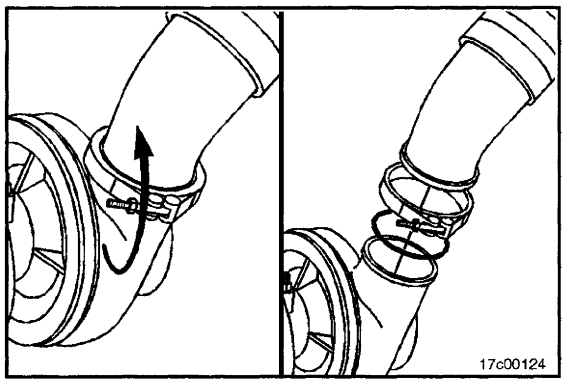
Torque Value: 60 N•m [45 ft-lb]



Install the discharge elbow and clamp onto the CAC pipe connection.

NOTE: Do **not** tighten the clamp until the elbow is installed on the turbocharger.

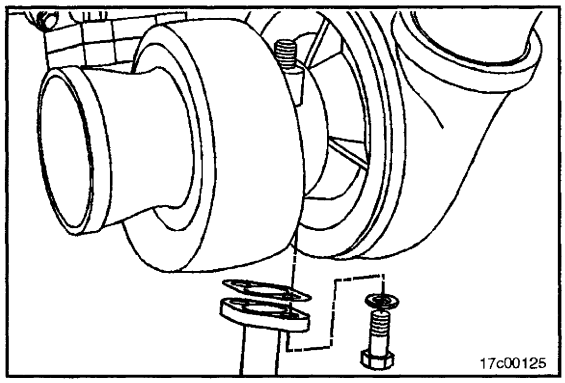




Install a new o-ring seal, the clamp, and the discharge elbow to the turbocharger.

Tighten the clamps.

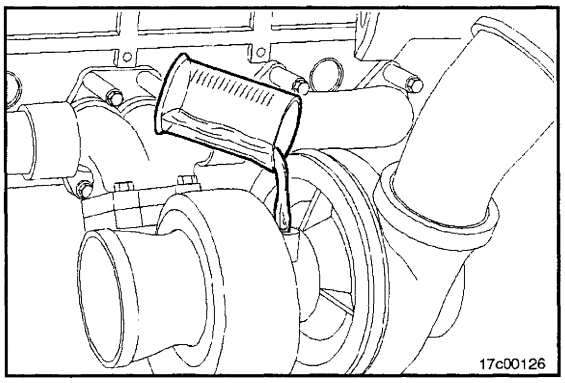
Torque Value: 9 N•m [75 in-lb]



Install a new gasket, oil drain tube, and capscrews.

Tighten the capscrews.

Torque Value: 25 N•m [18 ft-lb]



Install wastegate actuator hose, if equipped.

Pour 50 to 60 cc [2 to 3 oz] of clean engine oil into the turbocharger oil supply opening.

⚠ CAUTION ⚠

Proper routing of the turbocharger oil supply tube is critical to prevent failure. Avoid any tube-to-metal contact. (The inlet supply fitting must be oriented slightly off vertical to allow proper alignment.)

If installing a new turbocharger, make sure the turbocharger is aligned, loosen the turbocharger v-bands, and adjust as needed. Tighten the v-bands.

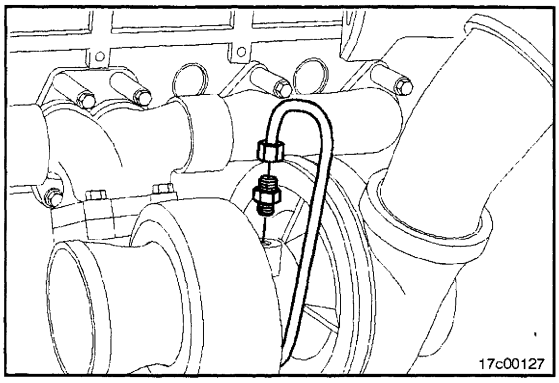
Torque Value: 9 N•m [75 in-lb]

If installing a new turbocharger, install the male union elbow.

Torque Value: 30 N•m [22 ft-lb]

Install the turbocharger oil supply tube on the elbow.

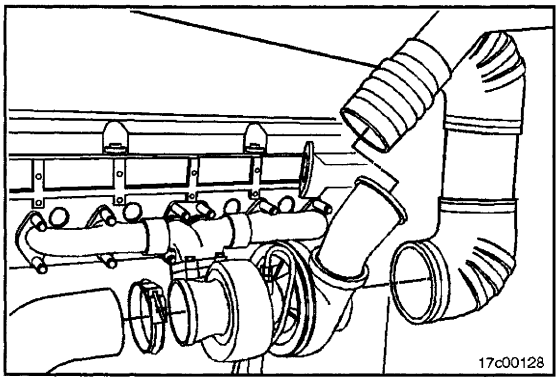
Torque Value: 30 N•m [22 ft-lb]



Install the intake and exhaust pipes to the turbocharger, and tighten the clamps.

Torque Value: 9 N•m [75 in-lb]

Operate the engine, and check for air and oil leaks.



Engine Storage - Long Term

General Information

If the engine will be out of service longer than 6 months, take special precautions to prevent rust. Contact the nearest Cummins Authorized Repair Location for information concerning engine storage procedures.

NOTES

Section D - System Diagrams

Section Contents

Page

Flow Diagram, Air Intake System D-8

Flow Diagram, Compressed Air System D-10
General Information D-10

Flow Diagram, Cooling System D-6

Flow Diagram, Engine Brake Oil D-12
General Information D-12

Flow Diagram, Exhaust System D-9

Flow Diagram, Fuel System D-2

Flow Diagram, Lubricating Oil System D-3

System Diagrams - General Information D-1

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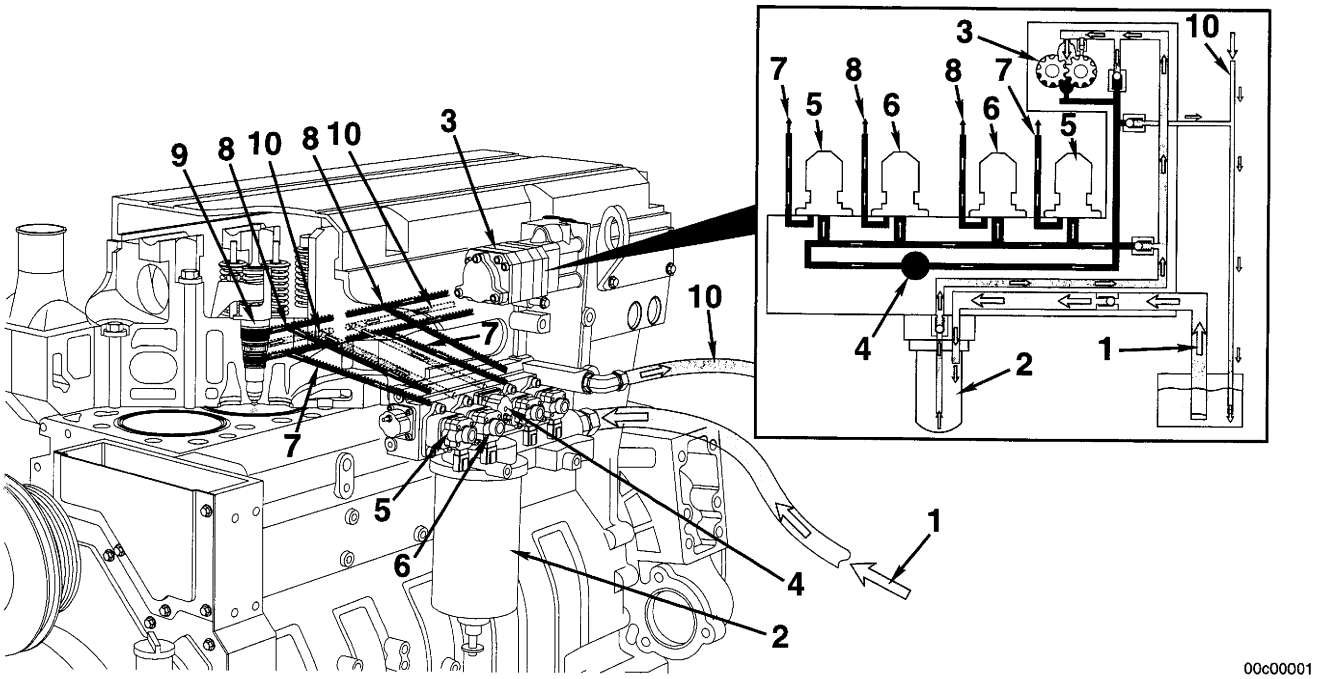
System Diagrams - General Information

The following drawings show the flow through the engine systems. Although parts can change between different applications and installations, the flow remains the same. The systems shown are:

- Fuel system
- Lubricating oil system
- Cooling system
- Air intake system
- Exhaust system
- Compressed air system
- Engine brake oil.

Knowledge of the engine systems can help you in troubleshooting, service, and general maintenance of your engine.

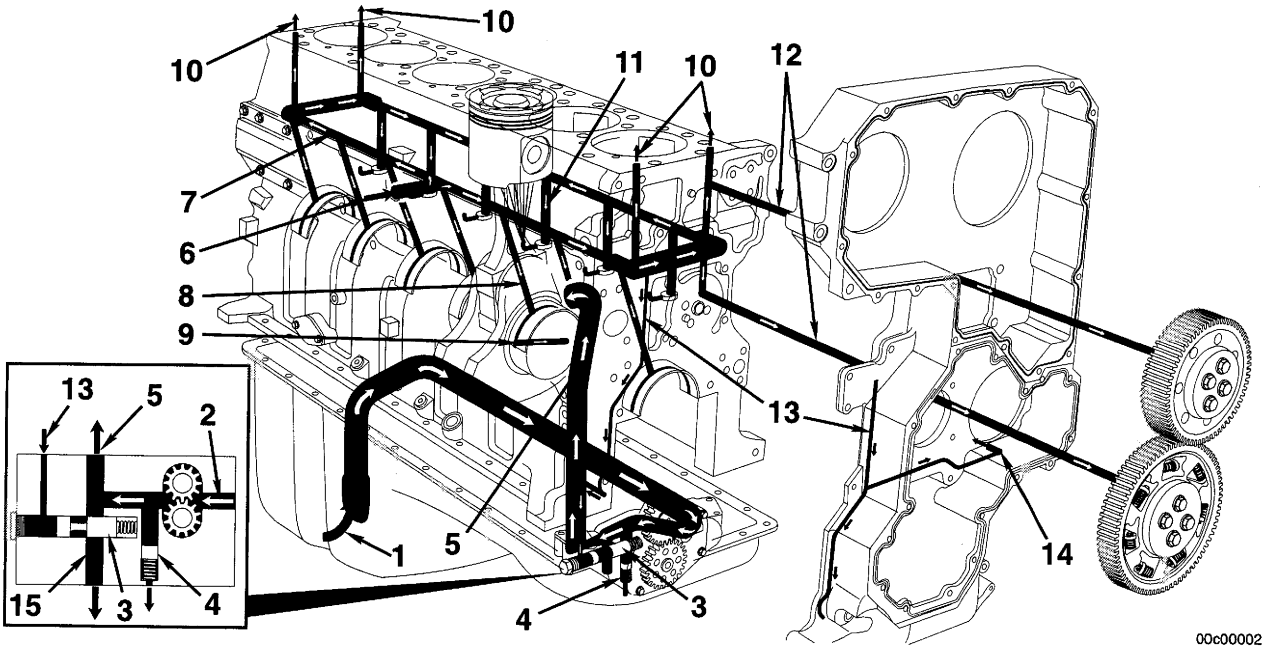
Flow Diagram, Fuel System



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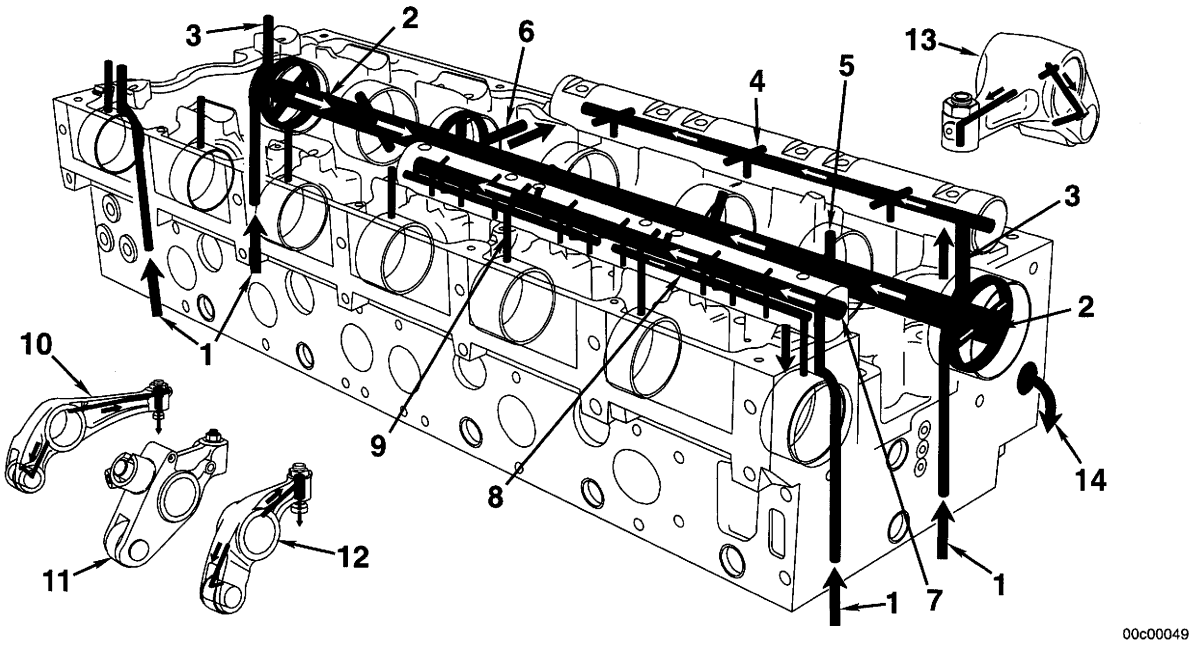
1. Fuel Supply from Tank
2. Fuel Filter
3. Gear Pump
4. Fuel Shutoff Valve
5. Rail Metering Actuator
6. Timing Actuator
7. Rail Metering Supply to Injector
8. Timing Fuel Supply to Injector
9. Injector
10. Fuel Drain to Tank.

Flow Diagram, Lubricating Oil System



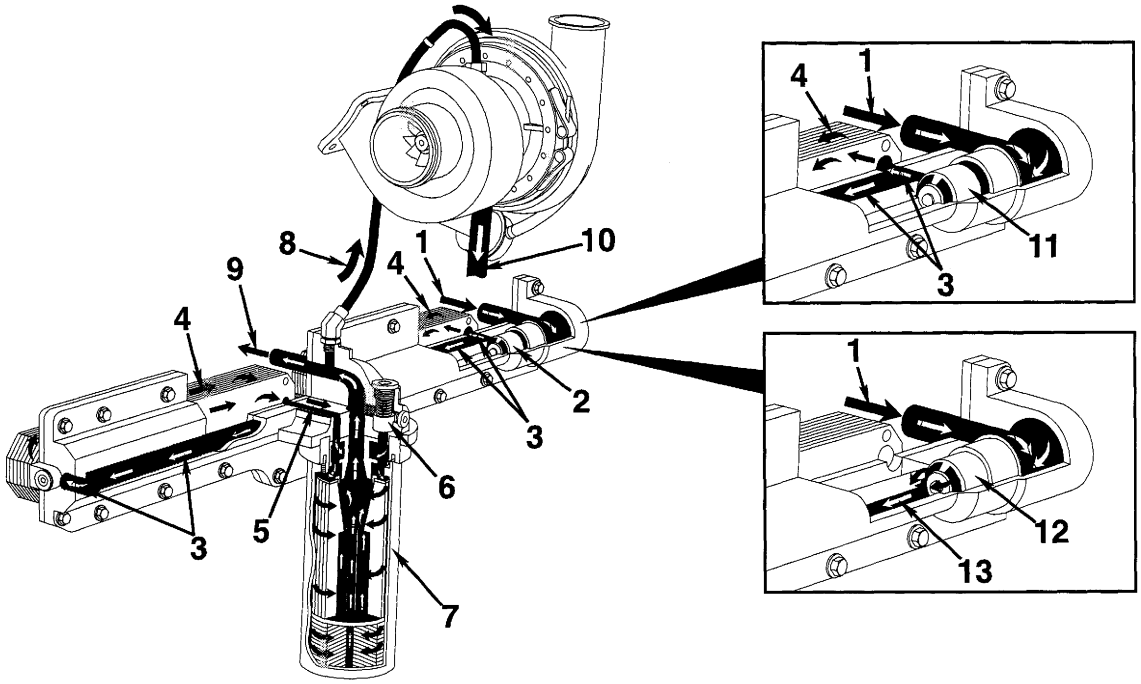
1. Lubricating Oil Flow from Oil Pan through Suction Tube
2. Flow from Suction Tube to Oil Pump
3. Pressure Regulator
4. High-Pressure Relief Valve
5. Flow from Oil Pump to Oil Cooler/Filter Head Housing
6. Oil Return from Oil Cooler/Filter Head Housing to Main Oil Rifle
7. Main Oil Rifle
8. Flow to Main Bearing
9. Flow from Main Bearing to Crankshaft
10. Flow to Cylinder Head
11. Flow to Piston Cooling Nozzle
12. Flow to Idler Gears
13. Oil Transfer from Main Oil Rifle
14. Flow to Air Compressor
15. Rifle Sensing Regulator Pump to Inlet.

Flow Diagram, Lubricating Oil System



1. Lubricating Oil Flow from Cylinder Block to Cylinder Head
2. Flow around Grooved Head to Drilled Camshaft and Rocker Lever Shafts
3. Flow to Injector Rocker Lever Shafts
4. Flow to Injector Rocker Levers
5. Flow to Injector Camshaft Journal Bearings
6. Flow to Fuel Pump
7. Flow to Valve Rocker Lever Shaft
8. Flow to Valve Rocker Levers
9. Flow to Valve Camshaft Journal Bearings
10. Intake Valve Rocker Lever
11. Engine Brake Lever
12. Exhaust Valve Rocker Lever
13. Injector Rocker Lever
14. Oil Drain from Overhead (Front and Rear).

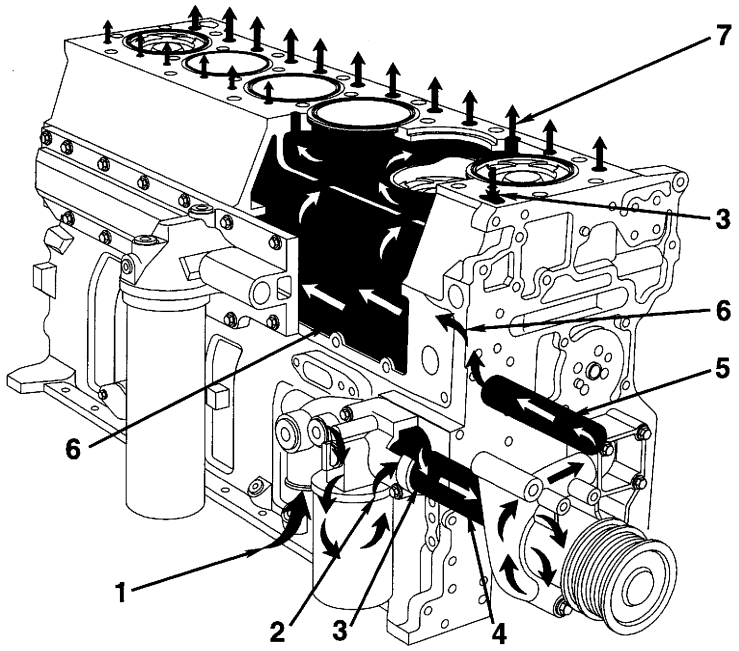
Flow Diagram, Lubricating Oil System



00c00003

1. Lubricating Oil Flow from Oil Pump
2. Thermostat
3. Oil Cooler Bypass Flow
4. Flow through Oil Coolers
5. Flow Return to Filter Head
6. Filter Bypass Valve
7. Oil Filter
8. Flow to Turbocharger
9. Flow to Main Oil Rifle
10. Oil Drain from Turbocharger
11. Thermostat Open - Oil Flows through Oil Coolers
12. Thermostat Closed - Oil Flows Directly to Oil Filter
13. Flow to Oil Filter.

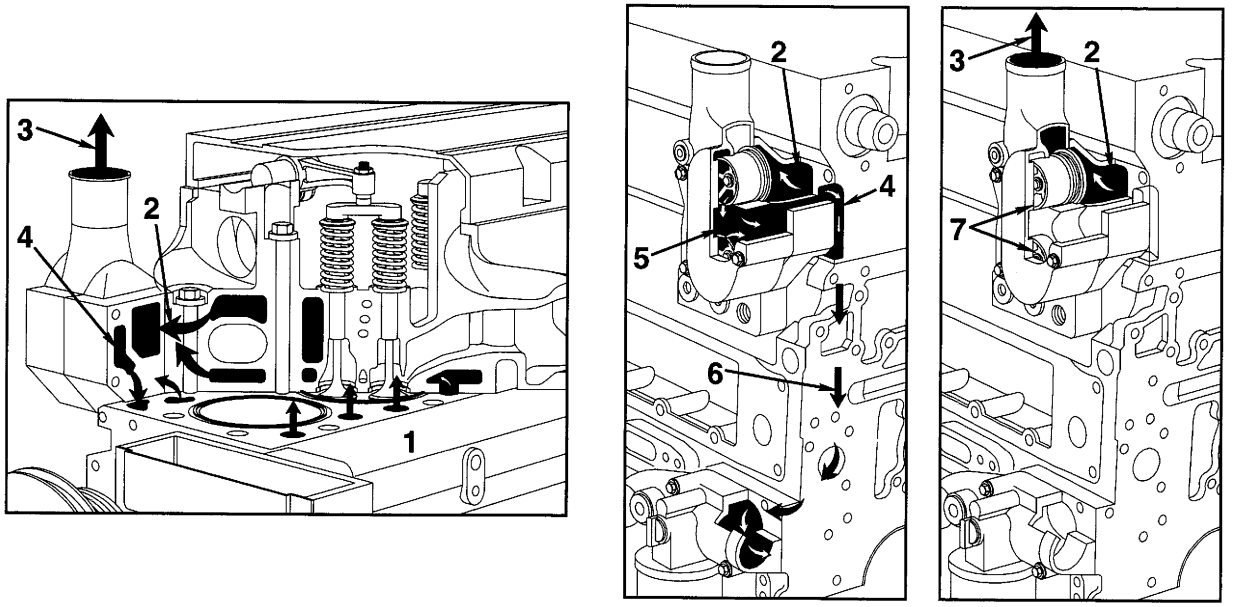
Flow Diagram, Cooling System



00c00041

1. Coolant Inlet
2. Coolant Flow from Coolant Filter
3. Coolant Bypass Flow from Thermostat
4. Coolant Flow to Water Pump
5. Coolant Flow from Water Pump
6. Coolant Flow past Oil Cooler
7. Coolant Flow to Cylinder Head.

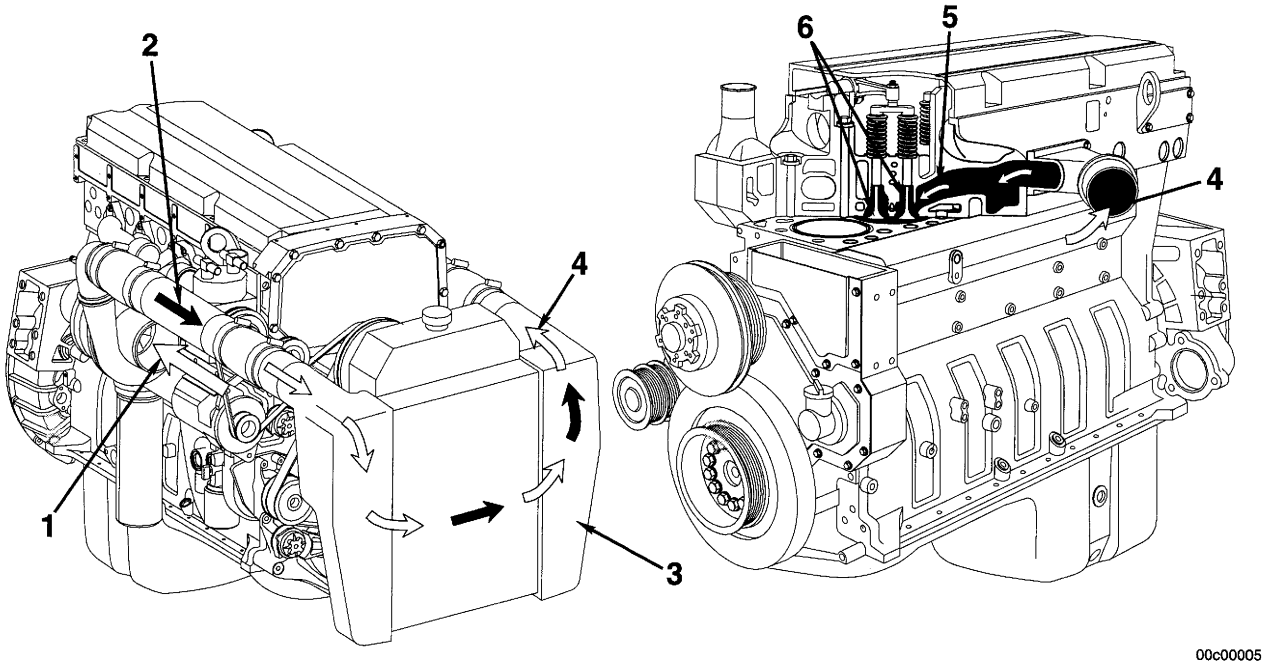
Flow Diagram, Cooling System



00c00042

1. Coolant Flow from Cylinder Block to Cylinder Head
2. Coolant Flow from Cylinder Head to Thermostat Housing
3. Coolant Flow to Radiator
4. Coolant Bypass Passage
5. Coolant Bypass Flow to Water Pump
6. Coolant Bypass Closed
7. Thermostats.

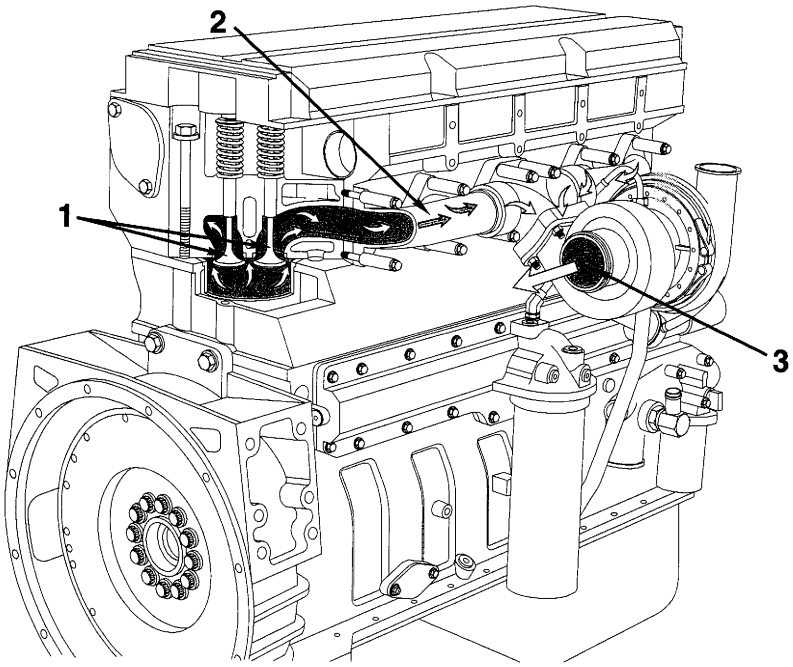
Flow Diagram, Air Intake System



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1. Intake Air Inlet to Turbocharger
2. Turbocharger Air to Charge Air Cooler
3. Charge Air Cooler
4. From Charge Air Cooler to Intake Manifold
5. Intake Valve Port
6. Intake Valves.

Flow Diagram, Exhaust System

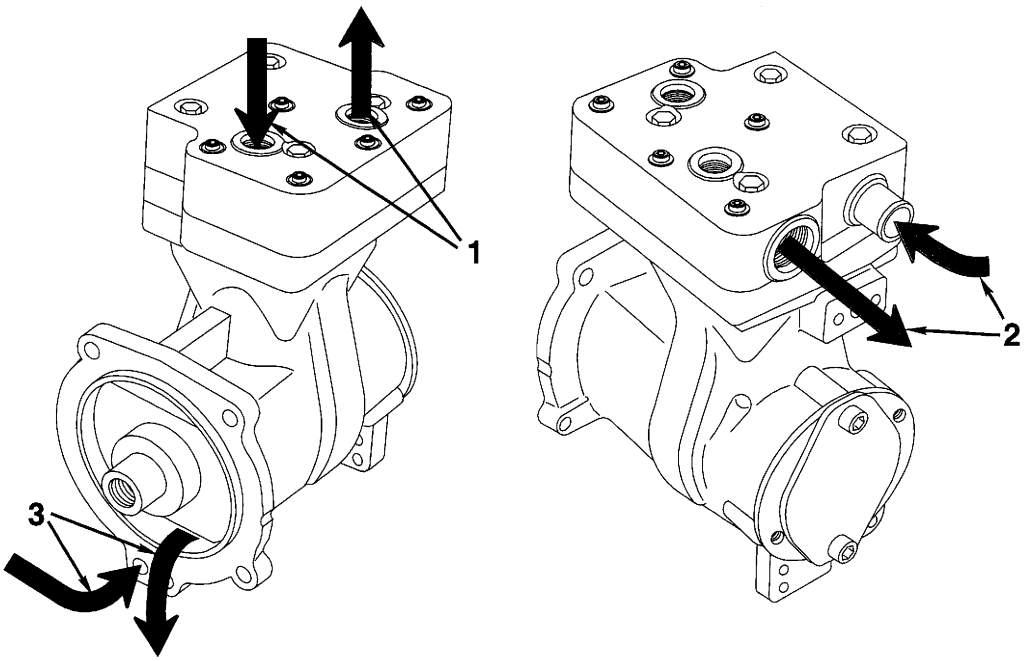


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1. Exhaust Valve Ports
2. Exhaust Manifold
3. Turbocharger Turbine.

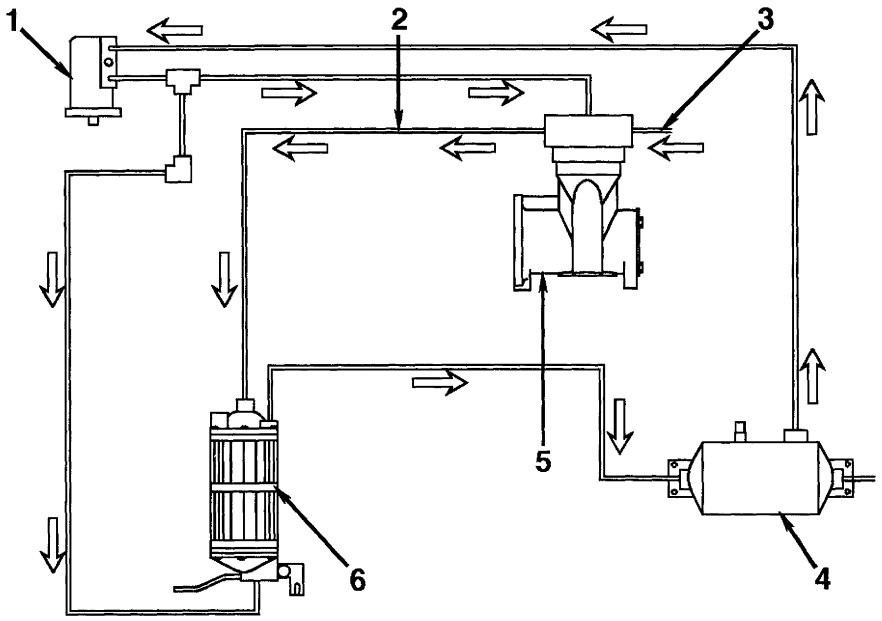
Flow Diagram, Compressed Air System

General Information



00c00007

1. Coolant
2. Air
3. Lubricant.

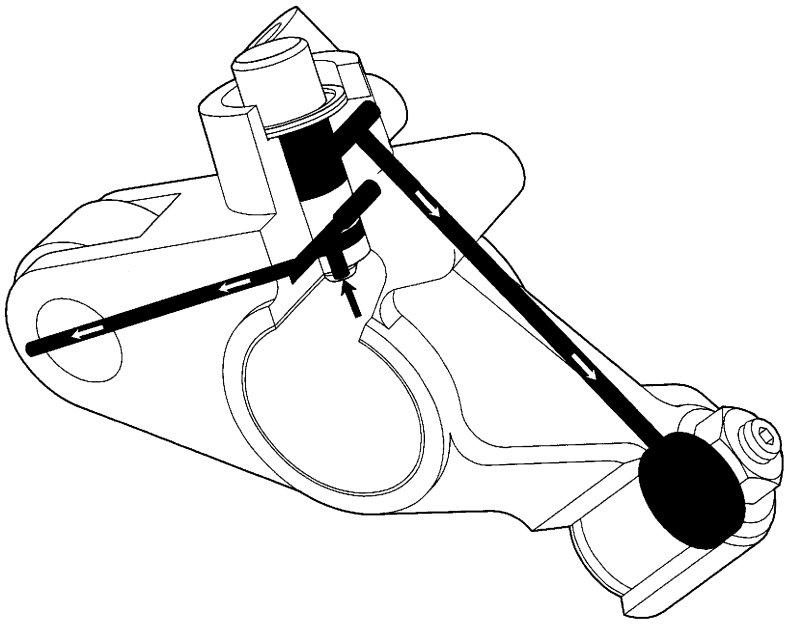


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1. Governor
2. Discharge
3. Intake
4. Wet Tank Reservoir
5. Air Compressor
6. Air Dryer.

Flow Diagram, Engine Brake Oil

General Information



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Section L - Service Literature

Section Contents

Page

Additional Service Literature L-1

Service Literature Ordering Location L-2

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Additional Service Literature

The following publications can be purchased from your local Cummins distributor:

Bulletin No.	Title of Publication
3379001	Fuel For Cummins Engines
3379034	Publications and Training Aids Price List
3387251	Coolant Additives and Filtration
3387266	Cold Weather Operation
3666239	Troubleshooting and Repair Manual, Signature, ISX, and QSX15 Engines
3666259	Fuel System Troubleshooting and Repair Manual, Signature, ISX, and QSX15 Engines
3666209	Cooling System Maintenance Extended Interval
3666393	Troubleshooting and Repair Manual Generator-Drive Control System QSX15, QSK45, and QSK60 Engines
3666394	Troubleshooting and Repair Manual PowerCommand Control QSX15, QSK45, and QSK60 Generator Sets
3672139	Cummins Customized Parts Catalog
3810340	Cummins Engine Oil Recommendations

Service Literature Ordering Location

Region	Ordering Location
United States and Canada	Cummins Distributors or Contact 1-800-DIESELS (1-800-343-7357)
U.K., Europe, Mid-East, Africa, and Eastern European Countries	Cummins Engine Co., Ltd. Royal Oak Way South Daventry Northants, NN11 5NU, England
South and Central America (excluding Brazil and Mexico)	Cummins Americas, Inc. 16085 N.W. 52nd Avenue Hialeah, FL 33104
Brazil and Mexico	Cummins Engine Co., Inc. International Parts Order Dept., MC 40931 Box 3005 Columbus, IN 47202-3005
Far East (excluding Australia and New Zealand)	Cummins Diesel Sales Corp. Literature Center 8 Tanjong Penjuru Jurong Industrial Estate Singapore
Australia and New Zealand	Cummins Diesel Australia Maroondah Highway, P.O.B. 139 Ringwood 3134 Victoria, Australia

Obtain current price information from your local Cummins Distributor.

Section M - Component Manufacturers

Section Contents

Page

Component Manufacturers' Addresses M-1
Air Compressors M-1
Air Cylinders M-1
Air Heaters M-1
Air Starting Motors M-1
Alternators M-1
Auxiliary Brakes M-1
Belts M-1
Catalytic Converters M-1
Clutches M-1
Coolant Heaters M-2
Coolant Level Switches M-1
Drive Plates M-2
Electric Starting Motors M-2
Electronic Switches M-2
Engine Protection Controls M-2
Fan Clutches M-2
Fans M-2
Fault Lamps M-2
Filters M-2
Flexplates M-2
Fuel Coolers M-2
Fuel Pumps M-2
Fuel Warmers M-2
Gauges M-3
Governors M-3
Heat Sleeves M-3
Hydraulic and Power Steering Pumps M-3
In-Line Connectors M-3
Oil Heaters M-3
Prelubrication Systems M-3
Radiators M-3
Throttle Assemblies M-3
Torque Converters M-3

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Component Manufacturers' Addresses

NOTE: The following list contains addresses and telephone numbers of suppliers of accessories used on Cummins engines. Suppliers can be contacted directly for any specifications **not** covered in this manual.

Air Compressors

Bendix Heavy Vehicles Systems
Div. of Allied Automotive
901 Cleveland Street
Elyria, OH 44036
Telephone: (216) 329-9000

Holset Engineering Co., Inc.
1320 Kemper Meadow Drive
Suite 500
Cincinnati, OH 45240
Telephone: (513) 825-9600

Midland-Grau
Heavy Duty Systems
Heavy Duty Group Headquarters
10930 N. Pamona Avenue
Kansas City, MO 64153
Telephone: (816) 891-2470

Air Cylinders

Bendix Ltd.
Douglas Road
Kingswood
Bristol
England
Telephone: 0117-671881

Catching Engineering
1733 North 25th Avenue
Melrose Park, IL 60160
Telephone: (708) 344-2334

TEC - Hackett Inc.
8909 Rawles Avenue
Indianapolis, IN 46219
Telephone: (317) 895-3670

Air Heaters

Fleetguard, Inc.
1200 Fleetguard Road
Cookeville, TN 38502
Telephone: (615) 526-9551

Kim Hotstart Co.
P.O. Box 11245
Spokane, WA 99211-0245
Telephone: (509) 534-6171

Air Starting Motors

Ingersoll Rand
Chorley New Road
Horwich
Bolton
Lancashire
England
BL6 6JN
Telephone: 01204-65544

Ingersoll-Rand Engine
Starting Systems
888 Industrial Drive
Elmhurst, IL 60126
Telephone: (708) 530-3875

StartMaster
Air Starting Systems
A Division of Sycon Corporation
9595 Cheney Avenue
P. O. Box 491
Marion, OH 43302
Telephone: (614) 382-5771

Alternators

Robert Bosch Ltd.
P.O. Box 98
Broadwater Park
North Orbital Road
Denham
Uxbridge
Middlesex UD9 5HG
England
Telephone: 01895-833633

Butec Electrics
Cleveland Road
Leyland
PR5 1XB
England
Telephone: 01744-21663

C.A.V. Electrical Equipment
P.O. Box 36
Warple Way
London
W3 7SS
England
Telephone: 01-743-3111

A.C. Delco Components Group
Civic Offices
Central Milton Keynes
MK9 3EL
England
Telephone: 01908-66001

C. E. Niehoff & Co.
2021 Lee Street
Evanston, IL 60202
Telephone: (708) 866-6030

Delco-Remy America
2401 Columbus Avenue
P.O. Box 2439
Anderson, IN 46018
Telephone: (317) 646-3528

Leece-Neville Corp.
400 Main Street
Arcade, NY 14009
Telephone: (716) 492-1700

Auxiliary Brakes

The Jacobs Manufacturing Company
Vehicle Equipment Division
22 East Dudley Town Road
Bloomfield, CT 06002
Telephone: (203) 243-1441

Belts

Dayco Rubber U.K.
Sheffield Street
Stockport
Cheshire
SK4 1RV
England
Telephone: 061-432-5163

T.B.A. Belting Ltd.
P.O. Box 77
Wigan
Lancashire
WN2 4XQ
England
Telephone: 01942-59221

Dayco Mfg.
Belt Technical Center
1955 Enterprize
Rochester Hills, MI 48309
Telephone: (810) 853-8300

Gates Rubber Company
900 S. Broadway
Denver, CO 80217

Goodyear Tire and
Rubber Company
Industrial Products Div.
2601 Fortune Circle East
Indianapolis, IN 46241
Telephone: (317) 898-4170

Catalytic Converters

Donaldson Company, Inc.
1400 West 94th Street
P.O. Box 1299
Minneapolis, MN 55440
Telephone: (612) 887-3835

Nelson Division
Exhaust and Filtration Systems
1801 U.S. Highway 51 P.O. Box 428
Stoughton, WI 53589
Telephone: (608) 873-4200

Walker Manufacturing
3901 Willis Road
P.O. Box 157
Grass Lake, MI 49240
Telephone: (517) 522-5500

Coolant Level Switches

Robertshaw Controls Company
P.O. Box 400
Knoxville, TN 37901
Telephone: (216) 885–1773

Clutches

Twin Disc International S.A.
Chaussee de Namur
Nivelles
Belguim
Telephone: 067-224941

Twin Disc Incorporated
1328 Racine Street
Racine, WI 53403
Telephone: (414) 634-1981

Coolant Heaters

Fleetguard, Inc.
1200 Fleetguard Road
Cookeville, TN 38502
Telephone: (615) 526-9551

Drive Plates

Detroit Diesel Allison
Division of General Motors
Corporation
P.O. Box 894
Indianapolis, IN 46206-0894
Telephone: (317) 242-5000

Electric Starting Motors

Butec Electrics
Cleveland Road
Leyland
PR5 1XB
England
Telephone: 01744-21663

C.A.V. Electrical Equipment
P.O. Box 36
Warple Way
London
W3 7SS
England
Telephone: 01-743-3111

A.C. Delco Components Group
Civic Offices
Central Milton Keynes
MK9 3EL
England
Telephone: 0908-66001

Delco-Remy America
2401 Columbus Avenue
P.O. Box 2439
Anderson, IN 46018
Telephone: (317) 646-3528

Leece-Neville Corp.
400 Main Street
Arcade, NY 14009
Telephone: (716) 492-1700

Nippondenso Inc.
2477 Denso Drive
P.O. Box 5133
Southfield, MI 48086
Telephone: (313) 350-7500

Electronic Switches

Cutler-Hammer Products
Eaton Corporation
4201 N. 27th Street
Milwaukee, WI 53216
Telephone: (414) 449–6600

Engine Protection Controls

Flight Systems Headquarters
Hempt Road
P.O. Box 25
Mechanicsburg, PA 17055
Telephone: (717) 697–0333

The Nason Company
2810 Blue Ridge Blvd.
West Union, SC 29696
Telephone: (803) 638-9521

Teddington Industrial
Equipment
Windmill Road
Sunburn on Thames
Middlesex
TW16 7HF
England
Telephone: 09327-85500

Fan Clutches

Kysor Cooling Systems N.A.
6040 West 62nd Street
Indianapolis, IN 46278
Telephone: (317) 328–3330

Holset Engineering Co. Ltd.
P.O. Box A9
Turnbridge
Huddersfield, West Yorkshire
England HD6 7RD
Telephone: 01484-22244

Horton Industries, Inc.
P.O. Box 9455
Minneapolis, MN 55440
Telephone: (612) 378-6410

Rockford Clutch Company
1200 Windsor Road
P.O. Box 2908
Rockford, IL 61132-2908
Telephone: (815) 633-7460

Fans

Truflo Ltd.
Westwood Road
Birmingham
B6 7JF
England
Telephone: 021-557-4101

Hayes-Albion Corporation
Jackson Manufacturing Plant
1999 Wildwood Avenue
Jackson, MI 49202
Telephone: (517) 782-9421

Engineered Cooling Systems, Inc.
201 W. Carmel Drive
Carmel, IN 46032
Telephone: (317) 846-3438

Brookside Corporation
P.O. Box 30
McCordsville, IN 46055
Telephone: (317) 335-2014

TCF Aerovent Company
9100 Purdue Rd., Suite 101
Indianapolis, IN 46268-1190
Telephone: (317) 872-0030

Kysor-Cadillac
1100 Wright Street
Cadillac, MI 49601
Telephone: (616) 775-4681

Schwitzer
6040 West 62nd Street
P.O. Box 80-B
Indianapolis, IN 46206
Telephone: (317) 328-3010

Fault Lamps

Cutler-Hammer Products
Eaton Corporation
4201 N. 27th Street
Milwaukee, WI 53216
Telephone: (414) 449–6600

Filters

Fleetguard International Corp.
Cavalry Hill Industrial Park
Weedon
Northampton NN7 4TD
England
Telephone: 01327-41313

Fleetguard, Inc.
1200 Fleetguard Road
Cookeville, TN 38502
Telephone: 1–800–22–Filters
(1–800–223–4583)

Flexplates

Corrugated Packing and
Sheet Metal
Hamsterley
Newcastle Upon Tyne
England
Telephone: 01207-560-505

Allison Transmission
Division of General Motors
Corporation
P.O. Box 894
Indianapolis, IN 46206-0894
Telephone: (317) 242-5000

Midwest Mfg. Co.
29500 Southfield Road, Suite 122
Southfield, MI 48076
Telephone: (313) 642-5355

Wohlert Corporation
708 East Grand River Avenue
P.O. Box 20217
Lansing, MI 48901
Telephone: (517) 485-3750

Fuel Coolers

Hayden, Inc.
1531 Pomona Road
P.O. Box 848
Corona, CA 91718–0848
Telephone: (909) 736–2665

Fuel Pumps

Robert Bosch Corp.
Automotive Group
2800 South 25th Ave.
Broadview, IL 60153

Fuel Warmers

Fleetguard, Inc.
1200 Fleetguard Road
Cookeville, TN 38502
Telephone: (615) 526-9551

Gauges

A.I.S.
Dyffon Industrial Estate
Ystrad Mynach
Hengoed
Mid Glamorgan
CF8 7XD
England
Telephone: 01443-812791

Grasslin U.K. Ltd.
Vale Rise
Tonbridge
Kent
TN9 1TB
England
Telephone: 01732-359888

Icknield Instruments Ltd.
Jubilee Road
Letchworth
Herts
England
Telephone: 04626-5551

Superb Tool and Gauge Co.
21 Princip Street
Birmingham
B4 61E
England
Telephone: 021-359-4876

Kabi Electrical and Plastics
Cranborne Road
Potters Bar
Herts
EN6 3JP
England
Telephone: 01707-53444

Datcon Instruments
P.O. Box 128
East Petersburg, PA 17520
Telephone: (717) 569-5713

Rochester Gauges, Inc.
11616 Harry Hines Blvd.
P.O. Box 29242
Dallas, TX 75229
Telephone: (214) 241-2161

Governors

Woodward Governors Ltd.
P.O. Box 15
663/664 Ajax Avenue
Slough
Bucks
SL1 4DD
England
Telephone: 01753-26835

Woodward Governor Co.
P.O. Box 1519
Fort Collins, CO 80522
Telephone: (303) 482-5811
(800) 523-2831

Barber Colman Co.
1354 Clifford Avenue
Loves Park, IL 61132
Telephone: (815) 637-3000

United Technologies
Diesel Systems
1000 Jorie Blvd.
Suite 111
Oak Brook, IL 69521
Telephone: (312) 325-2020

Heat Sleeves

Bentley Harris Manufacturing Co.
100 Bentley Harris Way
Gordonville, TN 38563
Telephone: (313) 348-5779

Hydraulic and Power Steering Pumps

Hobourn Automotive
Temple Farm Works
Priory Road
Strood
Rochester
Kent, England
ME2 2BD
Telephone: 01634-71773

Honeywell Control Systems Ltd.
Honeywell House
Charles Square
Bracknell
Berks RG12 1EB
Telephone: 01344-4245

Sundstrand Hydratec Ltd.
Cheney Manor Trading Estate
Swindon
Wiltshire
SN2 2PZ
England
Telephone: 01793-30101

Sperry Vickers
P.O. Box 302
Troy, MI 48084
Telephone: (313) 280-3000

Z.F.
P.O. Box 1340
Grafvonsoden Strasse
5-9 D7070
Schwaebisch Gmuend
Germany
Telephone: 7070-7171-31510

In-Line Connectors

Pioneer-Standard Electronics, Inc.
5440 Neiman Parkway
Solon, OH 44139
Telephone: (216) 349–1300

Deutsch
Industrial Products Division
37140 Industrial Avenue
Hemet, CA 92343
Telephone: (714) 929–1200

Oil Heaters

Fleetguard, Inc.
1200 Fleetguard Road
Cookeville, TN 38502
Telephone: (615) 526-9551

Kim Hotstart Co.
P.O. Box 11245
Spokane, WA 99211-0245
Telephone: (509) 534-6171

Prelubrication Systems

RPM Industries, Inc.
Suite 109
55 Hickory Street
Washington, PA 15301
Telephone: (412) 228–5130

Radiators

JB Radiator Specialties, Inc.
P.O. Box 292087
Sacramento, CA 95829–2087
Telephone: (916) 381–4791

The G&O Manufacturing Company
100 Gando Drive
P.O. Box 1204
New Haven, CT 06505–1204
Telephone: (203) 562–5121

Young Radiator Company
2825 Four Mile Road
Racine, WI 53404
Telephone: (910) 271–2397

L and M Radiator, Inc.
1414 East 37th Street
Hibbing, MN 55746
Telephone: (218) 263–8993

Throttle Assemblies

Williams Controls, Inc.
14100 SW 72nd Avenue
Portland, OR 97224
Telephone: (503) 684–8600

Torque Converters

Twin Disc International S.A.
Chaussee de Namur
Nivelles
Belgium
Telephone: 067-224941

Twin Disc Incorporated
1328 Racine Street
Racine, WI 53403-1758
Telephone: (414) 634-1981

Rockford Powertrain, Inc.
Off-Highway Systems
1200 Windsor Road
P.O. Box 2908
Rockford, IL 61132-2908
Telephone: (815) 633-7460

Modine Mfg. Co.
1500 DeKoven Avenue
Racine, WI 53401
Telephone: (414) 636-1640

NOTES

Section S - Service Assistance

Section Contents

Page

Service Assistance S-1
Distributors - International S-19
Distributors and Branches - Australia S-13
Distributors and Branches - Canada S-11
Distributors and Branches - New Zealand S-15
Distributors and Branches - United States S-4
Division and Regional Offices S-3
Emergency and Technical Service S-1
Problem Solving S-2
Regional Offices - International S-16
Routine Service and Parts S-1

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Service Assistance

Routine Service and Parts

Personnel at Cummins Authorized Repair Locations can assist you with the correct operation and service of your engine. Cummins has a worldwide service network of more than 5,000 Distributors and Dealers who have been trained to provide sound advice, expert service, and complete parts support. Check the telephone directory yellow pages or refer to the directory in this section for the nearest Cummins Authorized Repair Location.

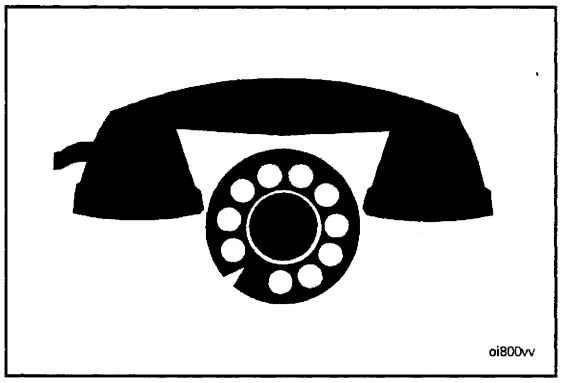
Emergency and Technical Service

The Cummins Customer Assistance Center provides a 24-hour, toll free telephone number to aid in technical and emergency service when a Cummins Authorized Repair Location can **not** be reached or is unable to resolve an issue with a Cummins product.

If additional assistance is required, call Toll-Free:

1-800-DIESELS
(1-800-343-7357)

- Includes all 50 states, Bermuda, Puerto Rico, Virgin Islands, and the Bahamas.
- Outside of North America contact your Regional Office. Telephone numbers and addresses are listed in the International Directory.



Problem Solving

Normally, any problem that arises with the sale, service, or repair of your engine can be handled by a Cummins Authorized Repair Location in your area. Refer to the telephone directory yellow pages for the one nearest you. If the problem has **not** been handled satisfactorily, follow the steps outlined below:

1. If the disagreement is with a Dealer, talk to the Cummins Distributor with whom he has his service agreement.
2. If the disagreement is with a Distributor, call the nearest Cummins Division or Regional Office; however, most problems are solved below the Division or Regional office level. Telephone numbers and addresses are listed in this section. Before calling, write down the following information:
   a. Engine model and serial number
   b. Type and make of equipment
   c. Total kilometers [miles] or hours of operation
   d. Warranty start date
   e. Nature of problem
   f. Summary of the current problem arranged in the order of occurrence
   g. Name and location of the Cummins Distributor or Dealer
3. If a problem can **not** be resolved satisfactorily through your Cummins Authorized Repair Location or Division Office, write to:

Cummins Customer Assistance Center - 41403, Cummins Engine Company, Inc., Box 3005, Columbus, IN 47202-3005

Division and Regional Offices

NOTE: The following list contains offices in U.S., Canada, Australia, New Zealand, and Puerto Rico.

United States

Southern Division Office
Cummins Engine Company, Inc.
425 Franklin Road S.W.
Suite 500
Marietta, GA 30067
Telephone: (770) 423-1108
FAX: (770) 499-8240

Plains Regional Office
Cummins Engine Company, Inc.
1901 Central Drive
Suite 356
Bedford, TX 76021
Telephone: (817) 267-3172
FAX: N/A

Canada

Canadian Division Office
Cummins Diesel of Canada, Ltd.
5575 North Service Road
Burlington, Ontario L726M1
Telephone: (905) 331-5944
FAX: (905) 331-0276

Western Canada Regional Office
Cummins Diesel of Canada, Ltd.
18452 - 96th Avenue
Surrey, B.C. V3T 4W2
Telephone: (604) 882-5727
FAX: (604) 882-9110

Eastern Canada Regional Office
Cummins Diesel of Canada Ltd.
7200 Trans Canada Hwy.
Pt. Cuaire, Quebec H9R 1C0
Telephone: (514) 695-2402
FAX: (514) 695-8917

Central Canada Regional Office
Cummins Diesel of Canada Ltd.
4887 – 35th Street SE
Calgary, Alberta T2B 3C6
FAX: (403) 569-9974

Australia Regional Office

Cummins Engine Company Pty. Ltd.
2 Caribbean Drive
Scoresby, Victoria 3179
Australia
Telephone: (61-3) 9765-3222
FAX: (61-3) 9763-0079

NOTE: This office also serves New Zealand.

Cummins Americas Regional Office

Cummins Latin America
3088 N. Commence Parkway
MPC #14, Building A
Miramar, FL 33025
Telephone: (305) 621-1300

NOTE: This office serves Puerto Rico and South America excluding Brazil.

Distributors and Branches - United States

Alabama

Birmingham Distributor
Cummins Alabama, Inc.
2200 Pinson Highway
P.O. Box 1147
Birmingham, AL 35201
Telephone: (205) 841-0421
FAX: (205) 849–5926

Mobile Branch
Cummins Alabama, Inc.
1924 N. Beltline Hwy.
Mobile, AL 36601–1598
Telephone: (334) 456-2236
FAX: (334) 452–6419

Mobile Onan/Marine Branch
Cummins Alabama, Inc.
3422 Georgia Pacific Avenue
Mobile, AL 36617
Telephone: (334) 452-6426
FAX: (334) 473-6657

Montgomery Branch
Cummins Alabama, Inc.
2325 West Fairview Avenue
Montgomery, AL 36108
Telephone: (205) 263-2594
FAX: (205) 263–2594

Alaska

Anchorage - (Branch of Seattle)
Cummins Northwest, Inc.
2618 Commercial Drive
Anchorage, AK 99501-3095
Telephone: (907) 279-7594
FAX: (907) 276-6340

Arizona

Phoenix Distributor and Branch
Cummins Southwest, Inc.
2239 N. Black Canyon Hgwy
Phoenix, AZ 85009
Telephone: (602) 252-8021
FAX: (602) 253–6725

Tucson Branch
Cummins Southwest, Inc.
1912 West Prince Road
Tucson, AZ 85705
Telephone: (520) 887-7440
FAX: (520) 887–4173

Arkansas

Little Rock - (Branch of Memphis)
Cummins Mid-South, Inc.
6600 Interstate 30
Little Rock, AR 72209
Telephone:
Sales: (501) 569-5600
Service: (501) 569–5656
Parts: (501) 569–5613
FAX: (501) 565–2199

California

San Leandro Distributor
Cummins West, Inc.
14775 Wicks Blvd.
San Leandro, CA 94577–6779
Telephone: (510) 351-6101
FAX: (510) 352–3925

Arcata Branch
Cummins West, Inc.
4801 West End Road
Arcata, CA 95521
Telephone: (707) 822–7392
FAX: (707) 822–7585

Bakersfield Branch
Cummins West, Inc.
4601 East Brundage Lane
Bakersfield, CA 93307
Telephone: (805) 325-9404
FAX: (805) 861–8719

Fresno Branch
Cummins West, Inc.
2740 Church Avenue
Fresno, CA 93706
Telephone: (209) 495–4745
FAX: (209) 486–7402

Redding Branch
Cummins West, Inc.
20247 Charlanne Drive
Redding, CA 96001
Telephone: (916) 222–4070
FAX: (916) 224–4075

Stockton Branch
Cummins West, Inc.
41 West Yokuts Avenue
Suite 131
Stockton, CA 95207
Telephone: (209) 473–0386
FAX: (209) 478–2454

West Sacramento Branch
Cummins West, Inc.
2661 Evergreen Avenue
West Sacramento, CA 95691
Telephone: (916) 371-0630
FAX: (916) 371–2849

Los Angeles Distributor
Cummins Cal Pacific Inc.
1939 Deere Avenue (Irvine)
Irvine, CA 92606
Telephone: (949) 253–6000
FAX: (949) 253–6080

Montebello Branch
Cummins Cal Pacific Inc.
1105 South Greenwood Avenue
Montebello, CA 90640
Telephone: (323) 728–8111
FAX: (323) 889–7422

Bloomington Branch
Cummins Cal Pacific Inc.
3061 S. Riverside Avenue
Bloomington, CA 92377
Telephone: (909) 877-0433
FAX: (909) 877-3787

San Diego Branch
Cummins Cal Pacific Inc.
310 N. Johnson Avenue
El Cajon, CA 92020
Telephone: (619) 593-3093
FAX: (619) 593–0600

Ventura Branch
Cummins Cal-Pacific Inc.
3958 Transport St.
Ventura, CA 93003
Telephone: (805) 644–7281
FAX: (805) 644–7284

Colorado

Denver Distributor
Cummins Rocky Mountain, Inc.
5100 East 58th Avenue
Commerce City, CO 80022
Telephone: (303) 287-0201
FAX: (303) 288–7080

Denver Onan/Industrial Branch
Cummins Rocky Mountain, Inc.
5100 East 58th Ave.
Commerce City, CO 80022
Telephone: (303) 286-7697
FAX: (303) 287–4837

Durango Branch
Cummins Rocky Mountain, Inc.
13595 County Road 213
Durango, CO 81301
Telephone: (970) 259–7470
FAX: (970) 259–7482

Grand Junction Branch
Cummins Rocky Mountain, Inc.
2380 U.S. Highway 6 & 50
P.O. Box 339
Grand Junction, CO 81501
Telephone: (303) 242-5776
FAX: (303) 243–5495

Connecticut

Rocky Hill - (Branch of Bronx)
Cummins Metropower, Inc.
914 Cromwell Ave.
Rocky Hill, CT 06067
Telephone: (860) 529–7474
FAX: (860) 529–7524

Florida

Tampa Distributor
Cummins Southeastern Power, Inc.
Corporate Office
5421 N. 59th Street
Tampa, FL 33610
Telephone: (813) 621-7202
FAX: (813) 621–8250

Ft. Myers Branch
Cummins Southeastern Power, Inc.
2671 Edison Avenue
Ft. Myers, FL 33902
Telephone: (941) 337–1211
FAX: (941) 337-5374

Jacksonville Branch
Cummins Southeastern Power, Inc.
755 Pickettville Rd.
Jacksonville, FL 32220
Telephone: (904) 378-1902
FAX: (904) 378–1904

Hialeah (Miami) Branch
Cummins Southeastern Power, Inc.
9900 N.W. 77th Avenue
Hialeah Gardens, FL 33016
Telephone: (305) 821-4200
FAX: (305) 557-2992

Ocala Branch
Cummins Southeastern Power
321 Southwest 52nd Ave.
Ocala, FL 34474–1892
Telephone: (352) 861–1122
FAX: (352) 861–1130

Orlando Branch
Cummins Southeastern Power, Inc.
4020 North
Orange Blossom Trail
Orlando, FL 32810
Telephone: (407) 298-2080
FAX: (407) 290-8727

Tampa Branch
Cummins Southeastern Power, Inc.
5912 E. Hillsborough Avenue
Tampa, FL 33610
Telephone: (813) 626-1101
FAX: (813) 628–4183

Georgia

Atlanta Distributor
Cummins South, Inc.
5125 Georgia Highway 85
College Park, GA 30349
Telephone: (404) 763-0151
FAX: (404) 766–2132

Albany Branch
Cummins South, Inc.
1915 W. Oakridge Drive
Albany, GA 31707–4938
Telephone: (912) 888-6210
FAX: (912) 883–1670

Atlanta Branch
Cummins South, Inc.
100 University Avenue, S.W.
Atlanta, GA 30315-2202
Telephone: (404) 527-7800
FAX: (404) 527–7832

Augusta Branch
Cummins South, Inc.
1255 New Savannah Road
Augusta, GA 30901-3891
Telephone: (706) 722-8825
FAX: (706) 722–7553

Savannah Branch
Cummins South, Inc.
8 Interchange Court
Savannah, GA 31401–1627
Telephone: (912) 232-5565
FAX: (912) 232–5145

Hawaii

Kapolei Distributor
Cummins Hawaii Diesel Power, Inc.
91–230 Kalaeloa Blvd.
Kapolei, HI 96707
Telephone: (808) 682–8110
FAX: (808) 682–8477

Idaho

Boise - (Branch of Salt Lake City)
Cummins Intermountain, Inc.
2851 Federal Way City
Boise, ID 83705
Telephone: (208) 336-5000
FAX: (208) 338-5436

Pocatello - (Branch of Salt Lake City)
Cummins Intermountain, Inc.
14299 Highway 30 West
Pocatello, ID 83201
Telephone: (208) 234-1661
FAX: (208) 234–1662

Illinois

Chicago Distributor
Cummins Northern Illinois, Inc.
7145 Santa Fe Drive
Hodgkins, IL 60525
Telephone: (708) 579-9222
FAX: (708) 352-7547

Bloomington-Normal – (Branch of Indianapolis)
Cummins Mid-States Power, Inc.
(at U.S. 51 N and I-55)
414 W. Northtown Road
Bloomington-Normal, IL 61761
Telephone: (309) 452-4454
FAX: (309) 452–1642

Onan Branch
Cummins/Onan Northern Illinois
8745 W. 82nd Place
Justin, IL 60458
Telephone: (708) 563–7070
FAX: (708) 563–7095

Harrisburg (Branch of St. Louis)
Cummins Gateway, Inc.
Highway 45 North
Harrisburg, IL 62946
Telephone: (618) 273-4138
FAX: (618) 273–4531

Rock Island - (Branch of Omaha)
Cummins Great Plains Diesel, Inc.
7820 - 42nd Street West
Rock Island, IL 61204
Telephone: (309) 787-4300
FAX: (309) 787–4397

Onan Branch
Cummins Gateway, Inc.
#1 Extra Mile Drive
Collinsville, IL 62234
Telephone: (618) 345–0123
FAX: (314) 531–6604

Indiana

Indianapolis Distributor
Cummins Mid-States Power, Inc.
P.O. Box 42917
3762 West Morris Street
Indianapolis, IN 46242-0917
Telephone: (317) 243-7979
FAX: (317) 240–1925

Evansville - (Branch of Louisville)
Cummins Cumberland, Inc.
7901 Highway 41 North
Evansville, IN 47711
Telephone: (812) 867-4400
FAX: (812) 421–3282

Ft. Wayne Branch
Cummins Mid-States Power, Inc.
3415 Coliseum Blvd. West
(At Jct. I-69 & 30/33)
Ft. Wayne, IN 46808
Telephone: (219) 482-3691
FAX: (219) 484–8930

Gary - (Branch of Chicago)
Cummins Northern Illinois, Inc.
1440 Texas Street
Gary, IN 46402
Telephone: (219) 885-5591
FAX: (219) 883-4817

Indianapolis Branch
Cummins Mid-States Power, Inc.
P. O. Box 42917
3621 West Morris Street
Indianapolis, IN 46242-0917
Telephone: (317) 244-7251
FAX: (317) 240–1215

Onan Branch
Mid-States Power, Inc.
4301 W. Morris Street
P.O. Box 42917
Indianapolis, IN 46240–0917
Telephone: (317) 240–1967
FAX: (317) 240–1975

Iowa

Cedar Rapids - (Branch of Omaha)
Cummins Great Plains Diesel, Inc.
625 - 33rd Avenue SW
Cedar Rapids, IA 52406
Telephone: (319) 366-7537 (24 hours)
FAX: (319) 366–7562

Des Moines - (Branch of Omaha)
Cummins Great Plains Diesel, Inc.
1680 N.E. 51st Avenue
P.O. Box B
Des Moines, IA 50313
Telephone: (515) 262-9591
Parts: (515) 262-9744
FAX: (515) 262–0626

Des Moines - (Branch of Omaha)
Midwestern Power Products
Division of Cummins Great Plains Diesel, Inc.
5194 N.E. 17th Street
Des Moines, IA 50313
Telephone: (515) 264-1650
FAX: (515) 264-1651

Kansas

Colby - (Branch of Kansas City, Missouri)
Cummins Mid-America, LLC.
1880 South Range
Colby, KS 67701
Telephone: (785) 462-3945
FAX: (785) 462-3970

Garden City - (Branch of Kansas City, Missouri)
Cummins Mid-America, Inc.
1285 Acraway
Garden City, KS 67846
Telephone: (316) 275-2277
FAX: (316) 275–2533

Wichita - (Branch of Kansas City, Missouri)
Cummins Mid-America, Inc.
5101 North Broadway
Wichita, KS 67201
Telephone: (316) 838-0875
FAX: (316) 838–0704

Kentucky

Louisville Distributor
Cummins Cumberland, Inc.
(Corporate Office)
2301 Nelsonville Parkway
Louisville, KY 40223
Telephone: (502) 254-3363
FAX: (502) 254–9272

Hazard Branch
Cummins Cumberland, Inc.
Highway 15 South
P.O. Box 510
Hazard, KY 41701
Telephone: (606) 436-5718
FAX: (606) 436–5038

Louisville Branch
Cummins Cumberland, Inc.
9820 Bluegrass Parkway
Louisville, KY 40299
Telephone: (502) 491-4263
FAX: (502) 499–0896

Louisiana

Morgan City - (Branch of Memphis)
Cummins Mid-South, Inc.
Hwy. 90 East
P.O. Box 1229
Amelia, LA 70340
Telephone: (504) 631-0576
FAX: (504) 631–0081

New Orleans - (Branch of Memphis)
Cummins Mid-South, Inc.
110 E. Airline Highway
Kenner, LA 70062
Telephone: (504) 468-3535
FAX: (504) 465–3408

Maine

Bangor (Branch of Boston)
Cummins Northeast, Inc.
221 Hammond Street
Bangor, ME 04401
Telephone: (207) 941-1061
FAX: (207) 945–3170

Scarborough - (Branch of Boston)
Cummins Northeast, Inc.
10 Gibson Road
Scarborough, ME 04074
Telephone: (207) 883-8155
FAX: (207) 883–5526

Maryland

Baltimore Distributor
Cummins Power Systems, Inc.
1907 Parkwood Drive
MD 21061
Telephone: (410) 590–8700
FAX: (410) 590–8723

Massachusetts

Boston Distributor
Cummins Northeast, Inc.
100 Allied Drive
Dedham, MA 02026
Telephone: (781) 329-1750
FAX: (781) 329–4428

Springfield Branch
Cummins Northeast, Inc.
177 Rocus Street
Springfield, MA 01104
Telephone: (413) 737-2659
FAX: (413) 731–1082

Mexico

Tijuana - (Branch of Los Angeles)
Distribuidora Cummins De Baja
Blvd. 3ra. Oeste No. 17523
Fracc. Industrial
Garita de Otay C.P. 22400
Tijuana, Baja California
Mexico
Telephone: 011–52–66–238433
FAX: 011–52–66–238649

Michigan

Detroit (Novi) Distributor
Cummins Michigan, Inc.
41216 Vincenti Court
Novi, MI 48375
Telephone: (248) 478-9700
FAX: (248) 478-1570

Blissfield, Michigan
Diesel Fuel Systems, Inc.
Subsidiary of Cummins Michigan Inc.
211 N. Jipson Street
Blissfield, MI 49228
Telephone: (517) 486-4324
FAX: (517) 486-3614

Dearborn Branch
Cummins Michigan, Inc.
3760 Wyoming Avenue
Dearborn, MI 48120
Telephone: (313) 843-6200
FAX: (313) 843-6070

Grand Rapids Branch
Cummins Michigan, Inc.
3715 Clay Avenue, S.W.
Grand Rapids, MI 49508
Telephone: (616) 538-2250
FAX: (616) 538-3830

Grand Rapids Branch
Standby Power, Inc.
7580 Expressway Drive S.W.
Grand Rapids, MI 49548
Telephone: (616) 281-2211
FAX: (616) 281-3177

Iron Mountain - (Branch of De Pere)
Cummins Great Lakes, Inc.
1901 Stevenson Avenue
Iron Mountain, MI 49801
Telephone: (906) 774-2424
(800) 236-2424
FAX: (906) 774-1190

Novi Branch
Cummins Michigan, Inc.
25100 Novi Road
Novi, MI 48375
Telephone: (248) 380-4300
FAX: (248) 380-0910

Power Products (Branch of Detroit)
Cummins Michigan, Inc.
41326 Vincenti Ct.
Novi, MI 48375
Telephone: (248) 426-9300
FAX: (248) 473-8560

Saginaw Branch
Cummins Michigan, Inc.
722 N. Outer Drive
Saginaw, MI 48605
Telephone: (517) 752-5200
FAX: (517) 752-4194

Standby Power - (Branch of Detroit)
Cummins Michigan, Inc.
12130 Dixie
Redford, MI 48239
Telephone: (313) 538-0200
FAX: (313) 538-3966

Minnesota

St. Paul Distributor
Cummins North Central, Inc.
3030 Centre Pointe Drive
Suite 500
Roseville, MN 55113
Telephone: (651) 636-1000
FAX: (651) 638-2442

Duluth Branch
Cummins Diesel Sales, Inc.
3115 Truck Center Drive
Duluth, MN 55806–1786
Telephone: (218) 628-3641
FAX: (218) 628–0488

St. Paul Branch
Cummins North Central, Inc.
2690 Cleveland Ave. North
St. Paul, MN 55113
Telephone: (651) 636-1000
FAX: (651) 638-2497

Mississippi

Jackson - (Branch of Memphis)
Cummins Mid-South, Inc.
325 New Highway 49 South
Jackson, MS 39288-4224
Telephone:
Admin.: (601) 932-7016
Parts: (601) 932-2720
Service: (601) 939-1800
FAX: (601) 932–7399

Missouri

Kansas City Distributor and Branch
Cummins Mid-America, Inc.
8201 NE Parvin Road
Kansas City, MO 64161
Telephone: (816) 414–8200
FAX: (816) 414–8299

Joplin Branch
Cummins Mid-America, Inc.
3507 East 20th Street
Joplin, MO 64801
Telephone: (417) 623-1661
FAX: (417) 623–1817

Springfield Branch
Cummins Mid-America, Inc.
3637 East Kearney
Springfield, MO 65803
Telephone: (417) 862-0777
FAX: (417) 862-4429

St. Louis Distributor
Cummins Gateway, Inc.
7210 Hall Street
St. Louis, MO 63147
Telephone: (314) 389-5400
FAX: (314) 389–9671

Columbia Branch
Cummins Gateway, Inc.
5221 Highway 763 North
Columbia, MO 65202
Telephone: (314) 449-3711
FAX: (314) 449–3712

Sikeston Branch
Cummins Gateway, Inc.
101 Keystone Drive
Sikeston, MO 63801
Telephone: (314) 472-0303
FAX: (314) 472–0306

Industrial Power Branch
Cummins Gateway, Inc.
3256 E. Outer Road
Scott City, MO 63788
Telephone: (573) 335-9399
FAX: (573) 335-7062

Montana

Billings - (Branch of Denver)
Cummins Rocky Mountain, Inc.
5151 Midland Road
Billings, MT 59101
Telephone: (406) 245-4194
FAX: (406) 245–7923

Great Falls - (Branch of Denver)
Cummins Rocky Mountain, Inc.
415 Vaughn Road
Great Falls, MT 59404
Telephone: (406) 452-8561
FAX: (406) 452–9911

Missoula - (Branch of Seattle)
Cummins Northwest, Inc.
4950 North Reserve Street
Missoula, MT 59802-1498
Telephone: (406) 728-1300
FAX: (406) 728-8523

Nebraska

Omaha Distributor and Branch
Cummins Great Plains Diesel, Inc.
5515 Center Street
P.O. Box 6068
Omaha, NE 68106
Telephone: (402) 551-7678 (24 Hours)
FAX: (402) 551–1952

Kearney Branch
Cummins Great Plains Diesel, Inc.
515 Central Avenue
Kearney, NE 68847
Telephone: (308) 234-1994
FAX: (308) 234–5776

Nevada

Elko - (Branch of Salt Lake City)
Cummins Intermountain, Inc.
5370 East Idaho Street
Elko, NV 89801
Telephone: (775) 738-6405
FAX: (775) 738–1719

Las Vegas - (Branch of Salt Lake City)
Cummins Intermountain, Inc.
2750 Losee Road
North Las Vegas, NV 89030
Telephone: (702) 399-2339
FAX: (702) 399–7457

Sparks - (Branch of Salt Lake City)
Cummins Intermountain, Inc.
150 Glendale Avenue
Sparks, NV 89431
Telephone: (775) 331-4983
FAX: (775) 331–7429

New Jersey

Newark - (Branch of Bronx)
Cummins Metropower, Inc.
41-85 Doremus Ave.
Newark, NJ 07105
Telephone: (973) 491–0100
FAX: (973) 578–8873

New Mexico

Albuquerque - (Branch of Phoenix)
Cummins Southwest, Inc.
1921 Broadway N.E.
Albuquerque, NM 87102
Telephone: (505) 247-2441
FAX: (505) 842–0436

Farmington - (Branch of Phoenix)
Cummins Southwest, Inc.
1101 North Troy King Road
Farmington, NM 87401
Telephone: (505) 327-7331
FAX: (505) 326–2948

New York

Bronx Distributor
Cummins Metropower, Inc.
890 Zerega Avenue
Bronx, NY 10473
Telephone: (718) 892-2400
FAX: (718) 892–0055

Albany - (Branch of Boston)
Cummins Northeast, Inc.
101 Railroad Avenue
Albany, NY 12205
Telephone: (518) 459-1710
FAX: (518) 459–7815

Buffalo - (Branch of Boston)
Cummins Northeast, Inc.
480 Lawrence Bell Dr.
Williamsville, NY 14221-7090
Telephone: (716) 631-3211
FAX: (716) 626–0799

Syracuse - (Branch of Boston)
Cummins Northeast, Inc.
29 Eastern Avenue
Syracuse, NY 13211
Telephone: (315) 437-2751
FAX: (315) 437-8141

North Carolina

Charlotte Distributor
Cummins Atlantic, Inc.
11101 Nations Ford Road (28273)
P.O. Box 240729
Charlotte, NC 28224-0729
Telephone: (704) 588-1240
FAX: (704) 587-4870

Charlotte Branch
Cummins Atlantic, Inc.
3700 North Interstate 85
Charlotte, NC 28206
Telephone: (704) 596-7690
FAX: (704) 596–3038

Greensboro Branch
Cummins Atlantic, Inc.
513 Preddy Boulevard (27406)
P.O. Box 22066
Greensboro, NC 27420-2066
Telephone: (336) 275-4531
FAX: (336) 275–8304

Wilson Branch
Cummins Atlantic, Inc.
1514 Cargill Avenue (27893)
P.O. Box 1177
Wilson, NC 27894-1117
Telephone: (252) 237-9111
FAX: (252) 237–9132

North Dakota

Fargo - (Branch of St. Paul)
Cummins North Central, Inc.
3801 - 34th Ave. SW
Fargo, ND 58104
Telephone: (701) 282-2466
FAX: (701) 277–5399

Grand Forks - (Branch of St. Paul)
Cummins North Central, Inc.
4728 Gateway Drive
Grand Forks, ND 58201
Telephone: (701) 775-8197
FAX: (701) 775–4833

Minot - (Branch of St. Paul)
Cummins North Central, Inc.
1501 - 20th Avenue, S.E.
Minot, ND 58702
Telephone: (701) 852-3585
FAX: (701) 852–3588

Ohio

Columbus Distributor and Branch
Cummins Interstate Power, Inc.
4000 Lyman Drive
Hilliard (Columbus), OH 43026
Telephone: (614) 771-1000
FAX: (614) 771–0769

Columbus Distributor
Cummins Interstate Power, Inc.
2297 Southwest Bldv., Suite K
Grove City, OH 43123
Telephone: (614) 771-1000
FAX: (614) 527-2576

Cincinnati Branch
Cummins Interstate Power, Inc.
10470 Evendale Drive
Cincinnati, OH 45241
Telephone: (513) 563-6670
FAX: (513) 563–0594

Cleveland Branch
Cummins Interstate Power, Inc.
7585 Northfield Road
Cleveland, OH 44146
Telephone: (440) 439-6800
FAX: (440) 439–7390

Strasburg Branch
Cummins Interstate Power, Inc.
777 South Wooster Avenue
Strasburg, OH 44680
Telephone: (216) 878-5511
FAX: (216) 878–7666

Toledo Branch
Cummins Interstate Power, Inc.
801 Illinois Avenue
Maumee
(Toledo), OH 43537
Telephone: (419) 893-8711
FAX: (419) 893–5362

Youngstown Branch
Cummins Interstate Power, Inc.
7145 Masury Road
Hubbard
(Youngstown), OH 44425
Telephone: (216) 534-1935
FAX: (216) 534–5606

Oklahoma

Oklahoma City - (Branch of Arlington)
Cummins Southern Plains, Inc.
5800 West Reno
Oklahoma City, OK 73127
Telephone: (405) 946-4481 (24 hours)
FAX: (405) 946–3336

Tulsa - (Branch of Arlington)
Cummins Southern Plains, Inc.
16525 East Skelly Drive
Tulsa, OK 74116
Telephone: (918) 234–3240
FAX: (918) 234–2342

Oregon

Bend - (Branch of Seattle)
Cummins Northwest, Inc.
3500 N. Highway 97 (97701-5729)
P.O. Box 309
Bend, OR 97709-0309
Telephone: (541) 389-1900
FAX: (541) 389–1909

Coburg/Eugene - (Branch of Seattle)
Cummins Northwest, Inc.
91201 Industrial Parkway
Coburg, OR 97401
(Mailing Address)
P.O. Box 10877
Eugene, OR 97440-2887
Telephone: (541) 687-0000
FAX: (541) 687–1977

Medford - (Branch of Seattle)
Cummins Northwest, Inc.
4045 Crater Lake Highway
Medford, OR 97504-9796
Telephone: (541) 779-0151
FAX: (541) 772–2395

Pendleton - (Branch of Seattle)
Cummins Northwest, Inc.
223 S.W. 23rd Street
Pendleton, OR 97801-1810
Telephone: (541) 276-2561
FAX: (541) 276-2564

Portland - (Branch of Seattle)
Cummins Northwest, Inc.
4711 N. Basin Avenue
P. O. Box 2710 (97208-2710)
Portland, OR 97217-3557
Telephone: (503) 289-0900
FAX: (503) 286-5938

Pennsylvania

Philadelphia Distributor
Cummins Power Systems, Inc.
2727 Ford Road
Bristol, PA 19007
Telephone: (215) 785-6005 and
(609) 563–0005
FAX: (215) 785-4085

Bristol Branch
Cummins Power Systems, Inc.
2727 Ford Road
Bristol, PA 19007
Telephone: (215) 785-6005 and
(609) 563–0005
FAX: (215) 785–4728

Pittsburgh Branch
Cummins Power Systems, Inc.
3 Alpha Drive
Pittsburgh, PA 15238–2901
Telephone: (412) 820–8300
FAX: (412) 820–8308

Harrisburg Branch
Cummins Power Systems, Inc.
4499 Lewis Road
Harrisburg, PA 17111-2541
Telephone: (717) 564-1344
FAX: (717) 558-8217

Puerto Rico

Puerto Nuevo - (Branch of Tampa)
Cummins Diesel Power, Inc.
#31 Calle "C"
El Matadero
Puerto Nuevo, Puerto Rico 00920
Telephone: (787) 793–0300
FAX: (787) 793–1072

South Carolina

Charleston - (Branch of Charlotte)
Cummins Atlantic, Inc.
3028 West Montague Avenue
Charleston, SC 29418–5593
Telephone: (843) 554-5112
FAX: (843) 745–0745

Charleston - (Branch of Charlotte)
Cummins Atlantic Inc.
231 Farmington Road
Charleston, SC 29483
Telephone: (843) 851-9819
FAX: (843) 875–4338

Columbia - (Branch of Charlotte)
Cummins Atlantic, Inc.
1233 Bluff Road (29201)
P.O. Box 13543
Columbia, SC 29201–3543
Telephone: (803) 799-2410
FAX: (803) 779–3427

South Dakota

Sioux Falls - (Branch of Omaha)
Cummins Great Plains Diesel, Inc.
701 East 54th Street North
Sioux Falls, SD 57104
Telephone: (605) 336-1715
FAX: (605) 336–1748

Tennessee

Memphis Distributor & Distribution Center
Cummins Mid-South, Inc.
666 Riverside Drive
Memphis, TN 38703
Telephone: (901) 577-0666
FAX: (901) 522–8758

Chattanooga - (Branch of Atlanta)
Cummins South, Inc.
1509 East 26th Street
Chattanooga, TN 37407-1095
Telephone: (615) 629-1447
FAX: (615) 629–1494

Knoxville - (Branch of Louisville)
Cummins Cumberland, Inc.
1211 Ault Road
Knoxville, TN 37914
Telephone: (423) 523-0446
FAX: (423) 523-0343

Memphis Branch
Cummins Mid-South, Inc.
1784 E. Brooks Road
Memphis, TN 38116
Telephone:
Sales/Admin.: (901) 345-7424
Parts: (901) 345-1784
Service: (901) 345-6185
FAX: (901) 346–4735

Nashville - (Branch of Louisville)
Cummins Cumberland, Inc.
706 Spence Lane
Nashville, TN 37217
Telephone: (615) 366-4341
FAX: (615) 366–5693

Texas

Arlington Distributor
Cummins Southern Plains, Inc.
600 N Watson Road
Arlington, TX 76004-3027
Telephone: (817) 640-6801
FAX: (817) 640-6852

Amarillo Branch
Cummins Southern Plains, Inc.
5224 Interstate 40 -
Expressway East
P.O. Box 31570
Amarillo, TX 79120-1570
Telephone: (806) 373-3793 (24 hours)
FAX: (806) 372–8547

Dallas Branch
Cummins Southern Plains, Inc.
3707 Irving Boulevard
Dallas, TX 75247
Telephone: (214) 631-6400 (24 hours)
FAX: (214) 631–2322

El Paso - (Branch of Phoenix)
Cummins Southwest, Inc.
14333 Gateway West
El Paso, TX 79927
Telephone: (915) 852-4200
FAX: (915) 852-3295

Fort Worth Branch
Cummins Southern Plains, Inc.
3250 North Freeway
Fort Worth, TX 76111
Telephone: (817) 624-2107 (24 hours)
FAX: (817) 624–3296

Houston Branch
Cummins Southern Plains, Inc.
4750 Homestead Road
P.O. Box 1367
Houston, TX 77251-1367
Telephone: (713) 675-7421 (24 hours)
FAX: (713) 675–1515

Mesquite Branch
Cummins Southern Plains, Inc.
2615 Big Town Blvd.
Mesquite, TX 75150
Telephone: (214) 321-5555 (24 hours)
FAX: (214) 328–2732

Odessa Branch
Cummins Southern Plains, Inc.
1210 South Grandview
P.O. Box 633
Odessa, TX 79760-0633
Telephone: (915) 332-9121 (24 hours)
FAX: (915) 333–4655

San Antonio Branch
Cummins Southern Plains, Inc.
6226 Pan Am Expressway North
P.O. Box 18385
San Antonio, TX 78218–0385
Telephone: (512) 655-5420 (24 hours)
FAX: (512) 655–3865

Houston Onan Branch
Southern Plains Power
A Division of Cummins Southern Plains
1155 West Loop North
Houston, TX 77055
Telephone: (713) 956-0020
FAX: (713) 956-0266

Utah

Salt Lake City Distributor
Cummins Intermountain, Inc.
1030 South 300 West
Salt Lake City, UT 84101
Telephone: (801) 355-6500
FAX: (801) 524–1351

Vernal Branch
Cummins Intermountain, Inc.
1435 East 335 South
Vernal, UT 84078
Telephone: (435) 789-5732
FAX: (435) 789-2853

Virginia

Cloverdale - (Branch of Charlotte)
Cummins Atlantic, Inc.
263 Simmons Drive
Cloverdale, VA 24077
Telephone: (540) 966-3169
FAX: (540) 966-3749

Richmond - (Branch of Charlotte)
Cummins Atlantic, Inc.
3900 Deepwater Terminal Road
Richmond, VA 23234
Telephone: (804) 232-7891
FAX: (804) 232-7428

Tidewater - (Branch of Charlotte)
Cummins Atlantic, Inc.
Atlantic Power Generation
3729 Holland Blvd.
Chesapeake, VA 23323
Telephone: (757) 485-4848
FAX: (757) 485-5085

Washington

Seattle Distributor
Cummins Northwest, Inc.
811 S.W. Grady Way (98055-2944)
P.O. Box 9811
Renton, WA 98057–9811
Telephone: (425) 235-3400
FAX: (425) 235–8202

Chehalis Branch
Cummins Northwest, Inc.
926 N.W. Maryland
Chehalis, WA 98532-0339
Telephone: (360) 748-8841
FAX: (360) 748–8843

Spokane Branch
Cummins Northwest, Inc.
11134 W. Westbow Blvd.
Spokane, WA 99204
Telephone: (509) 455–4411
FAX: (509) 624–4681

Tacoma Branch
Cummins Northwest, Inc.
3701 Pacific Highway East
Tacoma, WA 98424-1135
Telephone: (253) 922-2191
FAX: (253) 922–2379

Yakima Branch
Cummins Northwest, Inc.
1905 East Central Avenue (98901-3609)
P.O. Box 9129
Yakima, WA 98909-0129
Telephone: (509) 248-9033
FAX: (509) 248–9035

West Virginia

Charleston - (Branch of Louisville)
Cummins Cumberland, Inc.
3100 MacCorkle Ave. SW
P.O. Box 8456
South Charleston, WV 25303
Telephone: (304) 744-6373
FAX: (304) 744-8605

Fairmont - (Branch of Louisville)
Cummins Cumberland, Inc.
South Fairmount Exit, I-79
145 Middletown Road
Fairmont, WV 26554
Telephone: (304) 367-0196
FAX: (304) 367–1077

Wisconsin

DePere Distributor
Cummins Great Lakes, Inc.
Corporate Office
875 Lawrence Drive
P.O. Box 5070
DePere, WI 54115–5070
Telephone: (920) 337-1991
FAX: (920) 337-9746

Chippewa Falls Branch
Cummins Great Lakes, Inc.
2030 St. Highway 53
Chippewa Falls, WI 54729
Telephone: (715) 720-0680
FAX: (715) 720–0685

DePere Branch
Cummins Great Lakes, Inc.
939 Lawrence Drive
P. O. Box 5070
DePere, WI 54115–5070
Telephone: (920) 336-9631
(800) 236–1191
FAX: (920) 336–8984

Milwaukee Branch
Cummins Great Lakes, Inc.
9401 South 13th Street
P.O. Box D
Oak Creek, WI 53154
Telephone: (414) 768-7400
(800) 472-8283
FAX: (414) 768-9441

Wausau Branch
Cummins Great Lakes, Inc.
4703 Rib Mountain Drive
Wausau, WI 54401
Telephone: (715) 359-6888
(800) 236-3744
FAX: (715) 359-3744

Wyoming

Gillette - (Branch of Denver)
Cummins Rocky Mountain, Inc.
2700 Hwy. 14 & 16 North
P.O. Box 1207 (82717)
Gillette, WY 82716
Telephone: (307) 682-9611
FAX: (307) 682–8242

Rock Springs - (Branch of Salt Lake City)
Cummins Intermountain, Inc.
2000 Foothill Blvd.
P.O. Box 1634
Rock Springs, WY 82901
Telephone: (307) 362-5168
FAX: (307) 362–5171

Distributors and Branches - Canada

Alberta

Edmonton Distributor and Branch
Cummins Alberta
11751 - 181 Street
Edmonton, AB T5S 2K5
Telephone: (780) 455-2151
FAX: (780) 454-9512

Calgary Branch
Cummins Alberta
4887 - 35th Street S.E.
Calgary, Alberta T2B 3H6, Canada
Telephone: (403) 569-1122
FAX: (403) 569-0027

Grande Prairie
Cummins Alberta - Grande Praire
RR2, Site 9, Box 22
Sexsmith, AB CN T0H 3C0
Telephone: (780) 568-3359
FAX: (780) 568-2263

Hinton Branch
Cummins Alberta
135 Veats Avenue
Hinton, Alberta T7V 1S8, Canada
Telephone: (780) 865-5111
FAX: (780) 865-5714

Lethbridge Branch
Cummins Alberta
240 - 24th Street North
Lethbridge, Alberta T1H 3T8, Canada
Telephone: (403) 329-6144
FAX: (403) 320-5383

British Columbia

Vancouver Distributor
Cummins British Columbia
18452 - 96th Avenue
Surrey, B.C., Canada
V4N 3P8
Telephone: (604) 882-5000
FAX: (604) 882-5080

Kamloops Branch
Cummins British Columbia
976 Laval Crescent
Kamloops, B.C. Canada V2C 5P5
Telephone: (250) 828-2388
FAX: (250) 828-6713

Prince George Branch
Cummins British Columbia
102- 3851- 18th Avenue
Prince George, B.C. V2N 1B1
Telephone: (250) 564-9111
FAX: (250) 564-5853

Sparwood Branch
Cummins British Columbia
731 Douglas Fir Road
Sparwood, B.C. VOB 2GO, Canada
Telephone: (250) 425-0522
FAX: (250) 425–0323

Tumbler Ridge Branch
Cummins British Columbia
Industrial Site, Box 226
Tumbler Ridge, B.C.
Canada VOC 2WO
Telephone: (250) 242-4217
FAX: (250) 242–4906

Manitoba

Winnipeg Distributor
Cummins Mid-Canada Ltd.
489 Oak Point Road
P.O. Box 1860
Winnipeg, MB R3C 3R1, Canada
Telephone: (204) 632-5470
FAX: (204) 697–0267

New Brunswick

Fredericton - (Branch of Montreal)
Cummins Eastern Canada, Inc.
R.R.#1 Doak Road
P.O. Box 1178, Station 'A'
Fredericton,
New Brunswick E3B 4X2, Canada
Telephone: (506) 451-1929
FAX: (506) 451-1921

Newfoundland

St. John's - (Branch of Montreal)
Cummins Eastern Canada, Inc.
122 Clyde Avenue
Donovans Industrial Park
Mount Pearl, Newfoundland A1N 2C2
Canada
Telephone: (709) 747-0176
FAX: (709) 747–2283

Wabush - (Branch of Montreal)
Cummins Eastern Canada, Inc.
Wabush Industrial Park
Wabush, Newfoundland A0R 1B0
Telephone: (709) 282-3626
FAX: (709) 282–3108

Nova Scotia

Halifax - (Branch of Montreal)
Cummins Eastern Canada, Inc.
50 Simmonds Drive
Dartmouth, Nova Scotia B3B 1R3
Telephone: (902) 468-7938
FAX: (902) 468–5177
Parts: (902) 468–6560

Ontario

Toronto Distributor
Cummins Ontario, Inc.
7175 Pacific Circle
Mississauga, ON L5T 2A5
Telephone: (905) 795–0050
FAX: (905) 795–0021

Kenora - (Branch of Winnipeg)
Cummins Mid-Canada Ltd.
Highway 17 East
P.O. Box 8
Kenora, Ontario P9N 3X1
Telephone: (807) 548–1941
FAX: (807) 548–8302

Ottawa Branch
Cummins Ontario Inc.
3189 Swansea Crescent
Ottawa, Ontario K1G 3W5,
Telephone: (613) 736-1146
FAX: (613) 736-1202

Thunder Bay Branch
Cummins Ontario Inc.
1400 W. Walsh Street
Thunder Bay
Ontario P7E 4X4
Telephone: (807) 577-7561
FAX: (807) 577–1727

Whitby Branch
Cummins Ontario Inc.
1311 Hopkins Street
Whitby, Ontario L1N 2C2, Canada
Telephone: (905) 668-6886
FAX: (905) 668-1375

Quebec

Montreal Distributor
Cummins Eastern Canada, Inc.
7200 Trans Canada Highway
Pointe Claire, Quebec H9R 1C2,
Telephone: (514) 695-8410
FAX: (514) 695–8917

Montreal Branch
Cummins Eastern Canada, Inc.
7200 Trans Canada Highway
Pointe Claire, Quebec H9R 1C2,
Canada
Telephone: (514) 695-8410
Sales: (514) 695-4555
Parts: (514) 694-5880
FAX: (514) 695–8917

Dorval Onan Branch
Cummins, Eastern Canada, Inc.
580 Lepihe
Dorval, Quebec H9H 1G2
Telephone: (514) 631-5000
FAX: (514) 631-0104

Quebec City Branch
Cummins Diesel
Branch of Cummins Americas, Inc.
2575 Dalton Street
Ste. Foy, Quebec G1P 3S7
Telephone: (418) 653-6411
FAX: (418) 653-5844

Val D'Or Branch
Cummins, Eastern Canada, Inc.
1025 Rue Del
Val D'Or, Quebec 59P 4P6
Telephone: (819) 825-0993
FAX: (819) 825-8488

Saskatchewan

Lloydminster - (Branch of Winnipeg)
Cummins Mid-Canada Ltd.
4005 52nd
Lloydminster, SK S9V 0Y9
Telephone: (305) 825–2062
FAX: (305) 825–6702

Regina - (Branch of Winnipeg)
Cummins Mid-Canada Ltd.
110 Kress Street
P.O. Box 98
Regina, SK S4P 2Z5
Telephone: (306) 721-9710
FAX: (306) 721–2962

Saskatoon - (Branch of Winnipeg)
Cummins Mid-Canada, Ltd.
3001 Faithful Avenue
P.O. Box 7679
Saskatoon, SK S7K 4R4, Canada
Telephone: (306) 933-4022
FAX: (306) 242–1722

Distributors and Branches - Australia

Branches:

Gepps Cross
Cummins Engine Company, Pty. Ltd.
P.O. Box 108
Blair Athol, 5084
South Australia, Australia
Location:
45-49 Cavan Road
Gepps Cross, 5094
Telephone: (61-8) 8262-5211

Dosra
Cummins Engine Company, Pty. Ltd.
P.O. Box 124
Darra, 4076
Queensland, Australia
Location:
33 Kimberley Street
Darra, 4076, Australia
Telephone: (61-7) 3375-3277

Bunbury
Cummins Engine Company, Pty. Ltd.
P.O. Box 1751
Bunbury, WA 6230
Australia
Location:
11 Dryanda Court
Picton, WA 6230
Telephone: (61-8) 9725-6777
FAX: (61-8) 9725-6444

Cairns
Cummins Engine Company, Pty. Ltd.
P.O. Box 7189
Cairns Mail Centre, 4870
Queensland, Australia
Location:
Liberty Street
Cairns, 4870
Telephone: (61-7) 935-2999

Campbellfield
Cummins Engine Company, Pty. Ltd.
Private Bag 9
Campbellfield, 3061
Victoria, Australia
Location:
1788-1800 Hume Highway
Campbellfield, 3061
Telephone: (613) 9357-9200

Dandenong
Cummins Engine Company, Pty. Ltd.
Lot 7 Greens Road
Dandenong, 3175
Victoria, Australia
Telephone: (613) 9706-8088

Darwin
Cummins Engine Company, Pty. Ltd.
P.O. Box 37587
Winnellie, 0821
Northern Territory, Australia
Location:
Lot 1758 Graffin Crescent
Winnellie, 0821
Telephone: (61-8) 8947-0766

Devonport
Cummins Engine Company, Pty. Ltd.
P.O. Box 72E
Tasmania, Australia
Location:
2 Matthews Way
Devonport, 7310
Telephone: (61-3) 6424-8800

Emerald
Cummins Engine Company, Pty. Ltd.
P.O. Box 668
Emerald, 4720
Queensland, Australia
Location:
Capricorn Highway
Emerald, 4720
Telephone: (61-7) 4982-4022

Grafton
Cummins Engine Company, Pty. Ltd.
P.O. Box 18
South Grafton, 2461
New South Wales, Australia
Location:
18-20 Induna Street
South Grafton, 2461
Telephone: (61-2) 6642-3655

Hexham
Cummins Engine Company, Pty. Ltd.
21 Galleghan Street
Hexham
New South Wales, Australia
Telephone: (61-2) 4964-8466
FAX: (61-2) 4964-8616

Kalgoorlie
Cummins Engine Company, Pty. Ltd.
P.O. Box 706
Kalgoorlie, 6430
Western Australia, Australia
Location:
16 Atbara Street
Kalgoorlie, 6430
Telephone: (61-8) 9021-2588

Karratha
Cummins Engine Company, Pty. Ltd.
P.O. Box 377
Karratha, WA 6714
Australia
Location:
1490 Lambert Road
Karratha, WA 6714
Australia
Telephone: (61-8) 9144-4646
FAX: (61-8) 9143-1507

Laverton
Cummins Engine Company, Pty. Ltd.
Locked Bag 1
Laverton, Victoria 3028
Australia
Location:
195 Boundary Road
Laverton North, Victoria 3028
Australia
Telephone: (61-3) 9360-0800
FAX: (61-3) 9360-0438

Leeton
Cummins Engine Company, Pty. Ltd.
P.O. Box 775
Leeton, NSW 2705
Australia
Location:
29 Brady Way
Leeton, NSW 2705
Australia
Telephone: (61-2) 6953-3077
FAX: (61–2) 6953-3109

Mackay
Cummins Engine Company, Pty. Ltd.
P.O. Box 842
Mackay, 4740
Queensland, Australia
Location:
4 Presto Avenue
Mackay, 4746
Telephone: (61-7) 4955-1222

Mount Gambier
Cummins Engine Company, Pty. Ltd.
P.O. Box 2219
Mount Gambier, 5290
South Australia, Australia
Location:
2 Avey Road
Mount Gambier, 5290
Telephone: (61-87) 25-6422

Penrith
Cummins Engine Company, Pty. Ltd.
P.O. Box 132
Cambridge Park, 2747
New South Wales, Australia
Location:
7 Andrews Road
Penrith, 2750
Telephone: (61-2) 4729-1313

Queanbeyan
Cummins Engine Company, Pty. Ltd.
P.O. Box 527
Queanbeyan, 2620
New South Wales, Australia
Location:
15-27 Bayldon Road
Queanbeyan, 2620
Telephone: (61-2) 6297-3433
FAX: (61-2) 6297-6709

Regency Park
Cummins Engine Company, Pty. Ltd.
P.O. Box 2147
Regency Park, SA 5942
Australia
Location:
11 Manton Street
Hindmarsh, SA 5942
Australia
Telephone: (61-8) 8346-3832
FAX: (61-8) 8340-2045

Swan Hill
Cummins Engine Company, Pty. Ltd.
P.O. Box 1264
Swan Hill, 3585
Victoria, Australia
Location:
5 McAllister Road
Swan Hill, 3585
Telephone: (61-3) 5032-1511

Tamworth
Cummins Engine Company, Pty. Ltd.
P.O. Box 677
Tamworth, 2320
New South Wales, Australia
Location:
Lot 65 Gunnedah Road
Tamworth, 2340
Telephone: (61-2) 6765-5455

Townsville
Cummins Engine Company, Pty. Ltd.
P.O. Box 7339
Garbutt Business Centre, QLD4814
Australia
Location:
704-710 Ingham Road
Townsville, QLD 4814
Telephone: (61-7) 4774-7733
FAX: (61-7) 4774-7640

Welshpool
Cummins Engine Company, Pty. Ltd.
P. O. Box 52
Welshpool, 6986
Western Australia, Australia
Location:
50 Kewdale Road
Welshpool, 6106
Telephone: (61-8) 9458-5911

Wetherill Park
Cummins Engine Company, Pty. Ltd.
Private Bag 150
Wetherill Park, NSW 2164
Australia
Location:
492-494 Victoria Street
Wetherill Park, NSW 2164
Australia
Telephone: (61-2) 9616-5300
FAX: (61-2) 9616-5399

Wodonga
Cummins Engine Company, Pty. Ltd.
P.O. Box 174
Wodonga, 3690
Victoria, Australia
Location:
9-11 McKoy Street
Wodonga, 3690
Telephone: (61-2) 6024-3655

Distributors and Branches - New Zealand

Auckland

Cummins Diesel Sales & Service (NZ) Ltd.
Private Bag 92804
Penrose, Auckland, New Zealand
Location:
440 Church Street
Penrose
Telephone: (64-9) 579-0085

Branches:

Auckland

Cummins Diesel Engines
Private Bag 92804
Penrose, Auckland, New Zealand
Location:
440 Church Street
Penrose
Telephone: (64-9) 579-0085

Christchurch

Cummins Diesel Engines
P.O. Box 16-149
Hornby, Christchurch, New Zealand
Location:
35 Parkhouse Road
Sockburn, Christchurch
Telephone: (64-3) 348-8170

Mt. Maunganui

Cummins Diesel Engines
P.O. Box 4005
Mt. Maunganui, New Zealand
Location:
101 Totara Street
Mt. Maunganui
Telephone: (64-7) 575-0545

Palmerston North

Cummins Diesel Engines
P.O. Box 9024
Palmerston North, New Zealand
Location:
852-860 Tremaine Avenue
Telephone: (64-6) 356-2209

Regional Offices - International

North Africa Regional Office - Algiers

Cummins Corporation
Bureau de Liaison
38, Lotissement Benachour Abdelkader
Cheraga
42300 Wilaya de Tipasa
Algeria
Telephone: (213) 2374326

Country Covered: Algeria

European Regional Office - Mechelen

Cummins Diesel N.V.
Blarenberglaan 4
Industriepark Noord 2
2800 Mechelen
Brussels
Telephone: (32-15) 20003

Countries Covered:

- Austria
- Belgium
- Czech Republic
- Denmark
- Finland
- Greece
- Hungary
- Iceland
- Israel
- Luxembourg
- Netherlands
- Norway
- Portugal
- Slovakia
- Spain
- Sweden
- Switzerland

Cumbrasa Regional Office - Brazil

Cummins Brasil S.A.
Rua Jati, 266
07180-900 Guarulhos
Sao Paulo, Brazil

Mailing Address:
P.O. Box 13
07180-900 Guarulhos
Sao Paulo, Brazil
Telephone: (55-11) 945-9811

Country Covered: Brazil

Beijing Regional Office - China

Cummins Corporation
China World Tower, Suite 917
China World Trade Center
No. 1 Jian Guo Men Wai
Beijing 100004
People's Republic of China
Telephone: (86-1) 505-4209/10

Countries Covered:

- China
- Mongolia

Bogota Regional Office - Columbia

Cummins Engine Co. de Colombia S.A.
Carrera 11A No. 90-15 Of. 601/602
Bogota, D.E., Colombia
Telephone: (57-1) 610-4849

Mailing Address:
Apartado Aereo 90988
Bogota D.E., Colombia

Countries Covered:

- Argentina
- Bolivia
- Chile
- Colombia
- Ecuador
- Paraguay
- Peru
- Uruguay

Lyon Regional Office - France

Cummins Diesel Sales Corporation
39, rue Ampere - Zone Industrielle
69680 Chassieu
France
Telephone: (33) 72-22-92-72

Countries Covered:

- Algeria
- France
- Guadeloupe
- Guyana
- Martinique
- New Caledonia
- Reunion

Gross-Gerau Regional Office - Germany

Cummins Diesel Deutschland GmbH
Odenwaldstr. 23
D-6080 Gross-Gerau
Germany
Telephone: (49-6152) 174-0

Countries Covered:

- Albania
- Bulgaria
- *Czech Republic
- Germany
- Luxembourg
- Poland
- Romania
- Southeastern Europe
- Slovika

*Marine Only

Hong Kong Regional Office - Hong Kong

Cummins Engine H.K. Ltd.
Unison Industrial Centre
15th Floor, Units C & D
27-31 Au Pui Wan Street
P. O. Box 840 Shatin
Fo Tan, Shatin, N.T.
Hong Kong
Telephone: (852) 606-5678

Country Covered: Hong Kong

Pune Kirloskar Regional Office - India

Kirloskar Cummins Limited
Kothrud
Pune - 411 029, India
Telephone: (91-212) 33-0240, 33-5435, 33-1105

Countries Covered:

- Bhutan
- India
- Nepal

Milan Regional Office - Italy

Cummins Diesel Italia S.P.A.
Piazza Locatelli 8
Zona Industriale
20098 San Giuliano Milanese
Milan, Italy
Telephone: (39-2) 982-81235/6/7

Country Covered: Italy

North Asia Regional Office - Japan

Cummins Diesel Sales Corporation
1-12-10 Shintomi
Chuo-ku, Tokyo 104
Japan
Telephone: (81-3) 3555-3131/2/3/4/5

Country Covered: Japan

Seoul Regional Office - Korea

Cummins Korea Ltd.
5th Floor, Hye Sung Building
35-26 Sam Sung Dong, Kang Nam Ku
Seoul, South Korea
Telephone: (82-2) 516-0431/2/3, 517-3370/1

Country Covered: South Korea

Cummsa Regional Office - Mexico

Cummins, S.A. de C.V.
Arquimedes No. 209
Col. Polanco
11560 Mexico, D.F.
Mexico
Telephone: (52-5) 254-3822/3783/3622

Mailing/Shipping Address:
Gonzalez de Castilla Inc.
P.O. Box 1391
4605 Modern Lane
Modern Industrial Park
Laredo, TX 78040
Telephone: (512) 722-5207

Country Covered: Mexico

Moscow Regional Office - Russia

Cummins Engine Co., Inc.
Park Place
Office E708
Leninsky Prospect 113
Russia 11798
Telephone: (7-502) 256-5122 or 256-5123

Countries Covered:

Armenia	Lithuania
Azerbaijan	Moldova
Bolarus	Russia
Estonia	Tadzhikstan
Georgia	Turkmenistan
Kirghizia	Ukraina
Latvia	Uzbekistan

South And East Asia Area Office - Singapore

Cummins Diesel Sales Corporation
8 Tanjong Penjuru
Jurong Industrial Estate
Singapore 2260
Telephone: (65) 265-0155

Countries Covered:

Bangladesh	Malaysia
Brunei	Mongolia
Burma/Mynamar	Philippines
Cambodia	Singapore
China	Sri Lanka
Hong Kong	Taiwan
Indonesia	Thailand
Laos	Vietnam
Macau	

Taipei Regional Office - Taiwan

Cummins Corporation - Taiwan
12th Floor, No. 149
Min-Sheng E. Road
Section 2
Taipei, Taiwan
R.O.C. 104
Telephone: (886-2) 515-0891

Country Covered: Taiwan

Turkey and Iran Regional Office - Turkey

Cummins Corporation
Istanbul Office
Buyukdere Cad.
Beytem Han, Kat 11
Sisli 80220
Istanbul
Telephone: (90-1) 246-2575/2775/2545

Countries Covered:
Iran
Turkey

Middle East Regional Office - Daventry (U.K.)

Cummins Engine Company Ltd.
Royal Oak Way South
Daventry, Northants NN11 5NU
England
Telephone: (44-1327) 76000

Countries Covered:

MIDEAST

Afghanistan	Jordan	Saudi Arabia
Bahrain	Kuwair	Sudan
Cyprus	Lebanon	Syria
Djibouti	Oman	U.A.E.
Egypt	Pakistan	Yemen
Iraq	Qatar	

Africa Regional Office - Daventry (U.K.)

Cummins Engine Company Ltd.
Royal Oak Way South
Daventry, Northants NN11 5NU
England
Telephone: (44-1327) 76000

Countries Covered:

NORTH/WEST AFRICA

Benin	Gabon	Mauritania
Burkina-Paso	Gambia	Morocco
Cameroon	Ghana	Niger
Cape Verde	Guinea	Nigeria
Central African Republic	Guinea-Bissau	Sao Tome & Principe
Chad	Liberia	Senegal
Cote d'Ivoire	Libya	Siera Leone
Equatorial Guinea	Mali	Togo
	Malta	Tunisia

SOUTH AFRICA

Botswana	Namibia	Swaziland
Lesotho	South Africa	

New Malden Regional Office - U.K.

Cummins Engine Company Limited
46-50 Coombe Road
New Malden
Surrey KT3 4QL
England
Telephone: (44-81) 949-6171

Countries Covered:
Ireland
United Kingdom

Latin America Regional Office - Miramar (U.S.A.)

Cummins Americas, Inc.
Miramar Park of Commerce
3450 Executive Way
Miramar, FL 33025
Telephone: (305) 431-5511

Countries Covered:

Argentina	Guatemala
Bolivia	Honduras
Chile	Nicaragua
Colombia	Panama
Costa Rica	Paraguay
Dominican Republic	Peru
El Salvador	Uruguay
Eucador	Venezuela

Caracas Regional Office - Venezuela

Cummins Engine Company
Oficina de Delegado
Torre La Primera, Oficina 5-D
Av. Francisco de Miranda
Chacao, Caracas 1060

Mailing Address:
Cummins Engine Company M-227
c/o Jet Cargo International
P.O. Box 020010
Miami, FL 33102-0010 U.S.A.
Telephone: (58-2) 32-0563, 32-718

Counties Covered:

Costa Rica	Honduras
Dominican Republic	Nicaragua
El Salvador	Panama
Guatemala	Venezuela

East/Southern Africa Regional Office - Harare, Zimbabwe

Cummins Zimbabwe (Private) Limited
72 Birmingham Road
Southerton
Harare, Zimbabwe

Mailing Address:
P.O. Box ST363
Southerton
Harare, Zimbabwe
Telephone: (263-4) 67645, 60553, 69220

Countries Covered:

Angola	Reunion
Burundi	Rwanda
Comoros Island	Seychelles
Congo	Somalia
Ethiopia	Tanzania
Kenya	Uganda
Madagascar	Zaire
Malawi	Zambia
Mauritius	Zimbabwe
Mozambique	

Distributors - International

ABU DHABI
- See United Arab Emirates

AFGHANISTAN
- See Middle East Regional Office

ALBANIA
- See Germany Regional Office - Gross-Gerau

ALGERIA

Algiers
Cummins Corporation
Bureau de Liaison
38, Lotissement Benachour Abdelkader
Cheraga
43200 Wilaya de Tipasa
Algeria
Telephone: (213) 237-43-26

AMERICAN SAMOA
- See South Pacific Regional Office

ANDORRA
- See European Regional Office - Mechelen

ANTIGUA
Miami (Office In U.S.A.)
Cummins Southeastern Power, Inc.
9900 N.W. 77 Court
Hialeah Gardens, FL 33016
Telephone: (305) 821-4200

ARGENTINA

Buenos Aires
Distribuidora Cummins, S.A. (DICUMAR)
Av. Del Libertador 602 Piso 5
Buenos Aires, Argentina
Telephone: (54-1)814-1895/1395/1393

ARUBA, ISLAND OF
- See Netherlands Antilles

AUSTRIA

Neudoerfl
Cummins Diesel Motorenvertriebsges m.b.H. Trenner & Co.
Bickfordstr. 25
A-7201 Neudoerfl
Austria
Telephone: (43-2622) 77418/77625

BAHAMAS

Miami (Office in U.S.A.)
Cummins Southeastern Power, Inc.
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Hialeah Gardens, FL 33016
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BAHRAIN

Bahrain
Yusuf Bin Ahmed Kanoo W.L.L.
P.O. Box 45, Manama
Bahrain
Telephone: (973) 400414/400506

BALEARIC ISLANDS

Madrid (Office in Spain)
Cummins Ventas y Servicio, S.A.
Torrelaguna, 56
28027 Madrid, Spain
Telephone: (34-91) 367-2000
376-2404

BANGLADESH

Dhaka
Equipment & Engineering Co., Ltd.
G.P.O. Box 2339
Dhaka 1000, Bangladesh
Location:
56, Dilkusha Commercial Area
2nd Floor/Eastern Block
Telephone: (880-2) 234357, 234060

BARBADOS

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Cummins Southeastern Power, Inc.
9900 N.W. 77 Court
Hialeah Gardens, FL 33016
Telephone: (305) 821-4200

BELGIUM

Brussels
Cummins Distributor
Belgium S.A.
623/629 Chaussee de Haecht
B-1030 Brussels, Belgium
Telephone: (24 hr.)
(32-2) 216-81-10

BELIZE

Tampa (Office in U.S.A.)
Cummins Southeastern Power, Inc.
5421 N. 59th Street
Tampa, FL 33610
Telephone: (813) 621-7202

BENIN
- See Togo

BERMUDA

Bronx (Office in U.S.A.)
Cummins Metropower, Inc.
890 Zerega Avenue
Bronx, NY 10473
Telephone: (718) 892-2400

BHUTAN

Pune (Office in India)
Cummins Diesel Sales & Service (India) Ltd.
35A/1/2, Erandawana
Pune - 411 038, India
(State of Maharashtra) India
Telephone: (91-212) 331234/331554/
331635/330066/
330166/330356/
31703

BOLIVIA

La Paz
Machinery & Auto Service
Casilla 4042
La Paz, Bolivia
Location:
Av. 20 de Octubre Esq.
Rosendo Gutierrez
Telephone: (591-2) 379650, 366394

BONAIRE, ISLAND OF
- See Netherlands Antilles

BOTSWANA
- See East and Southern Africa Regional Office - Harare

BRAZIL

Ananindeua
Marcos Marcelino & Companhia Ltda.
Rodovia BR-316, Km 9
67020-010 Ananindeua, Para,
Brazil
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4143/4012

Belo Horizonte
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31950-640 Olhos D'Agua Norte
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Campo Grande
Distribuidora Cummins Mato Grosso Ltda.
Rodovia BR 163 Km 01
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Curitiba
Distribuidora Cummins Parana S.A.
Rua Brasilio Itibere, 2195
80230 Curitiba, Parana
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Fortaleza
Distribuidora Cummins Diesel
Do Nordeste Ltda.
Av. da Abolicao, 3882,
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60165-081 Fortaleza, Ceara
Brazil
Telephone: (55-85) 263-1212

Goianian
Distribuidora de Motores Cummins
Centro Oeste Ltda.
Av. Caiapo 777 - Setor Sta. Genoveva
74672-400 Goiania, Goias
Brazil
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Manaus
Distribuidora Cummins
Amazonas Ltda.
Estrada da Ponta Negra, 6080 - Sao Jorge
69037 Manaus, Amazonas,
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Porto Alegre
Distribuidora Cummins
Meridional S.A.
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Rio Grande do Sul, Brazil
Telephone: (55-51) 340-8222

Rio de Janeiro
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Leste Ltda.
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Sao Paulo
Companhia Distribuidora
de Motores Cummins
Rua Martin Burchard, 291 - Bras
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Sao Paulo, Brazil
Telephone: (55-11) 270-2311

BRITISH VIRGIN ISLANDS
- See Puerto Rico

BRUNEI
- See Malaysia

BURKINA - FASO
- See North/West Africa Regional Office - Daventry

BULGARIA
-See Germany Regional Office - Gross-Gerau

BURMA

Kuala Lumpur (Office In Malaysia)
Contact: Scott &
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50710 Kuala Lumpur
West Malaysia
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16 Jalan Chan Sow Lin
55200 Kuala Lumpur
West Malaysia
Telephone: (60-3) 2211033

BURUNDI

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Bia, S.A.
Rameistraat, 123
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CAMBODIA
- See South & East Asia Regional Office - Singapore

CANARY ISLANDS

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Torrelaquna, 56
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CAPE VERDE
- See North/West Africa Regional Office - Daventry

CENTRAL AFRICAN REPUBLIC
- See North/West Africa Regional Office - Daventry

CEYLON
- See Sri Lanka

CHAD
- See North/West Africa Regional Office - Daventry

CHILE

Santiago
Distribuidora Cummins Diesel
S.A.C.I.
Casilla Postal 1230
Calle Bulnes 1203
Santiago, Chile
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Santiago, Chile
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697-3566/7/8,
697-2709

CHINA, PEOPLE'S REPUBLIC
- See China Regional Office - Beijing

COLOMBIA

Barranquilla
Cummins de Colombia S.A.
Apartado Aereo 5347
Barranquilla, Colombia
Location: Calle 30, No. 19 - 21
Telephone: (57-58) 40-02-06/40-13-46

Bogota
Cummins Colombiana Ltda.
Apartado Aereo No. 7431
Bogota, D.E. Colombia
Location:
Av. Americas X Carrera
42C No. 19-45
Telephone: (57-1) 244-5688/5882

Bucaramanga
Cummins API, Ltda.
Apartado Aereo 352
Bucaramanga, Colombia
Location:
Autopista a Giron, Km 7
Telephone: (57-76) 468060

Cali
Distribuidora Cummins del Valle, Ltda.
Apartado Aereo No. 6398
Cali, Colombia
Location:
Av. 3a. # 39-35 - Vipasa
Telephone: (57-3) 65-4343

Medellin
Equipos Tecnicos Ltda.
Apartado Aereo No. 2046
Medellin, Colombia
Location: Carrera 52 No. 10-184
Telephone: (57-4) 255-4200

Pereira
Equipos Tecnicos Ltda. C.Q.R.
Apartado Aereo No. 1240
Pereira, Colombia
Location: Carrera 8a. No. 45-39
Telephone: (57-63) 366341

COMOROS
- See East and Southern Africa Regional Office - Harare

CONGO, PEOPLE'S REPUBLIC

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CORSICA
- See France

COSTA RICA

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Servicios Unidos, S.A.
P.O. Box 559
San Jose, Costa Rica
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100 metros al este de
Excelsior Antiguo
Curridabat, San Jose
Telephone Office: (506) 53-93-93
Telephone Service Shop:
(506) 26-00-76

CUBA

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Hialeah Gardens, FL 33016
Telephone: (305) 821-4200

CYPRUS

Nicosia
Alexander Dimitriou & Sons Ltd.
P.O. Box 1932
Nicosia, Cyprus
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4 Salamis Avenue
Telephone: (357-2) 349450

CZECH REPUBLIC

- See European Regional Office - Mechelen

DENMARK

Glostrup
Preben Lange Industrimaskiner A/S
Post Box 166
2605 Broendby, Denmark
Location:
Midtager 22
Telephone: (45-43) 96-21-61

DJIBOUTI

- See Middle East Regional Office - Daventry

DOMINICA

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Cummins Southeastern Power, Inc.
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Hialeah Gardens, FL 33016
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DOMINICAN REPUBLIC

Santo Domingo
Argico C. Por A.
P.O. Box 292-2 Feria
Santo Domingo
Dominican Republic, ZP-6
Location:
Calle Jose A. Soler
No. 3, ESQ.
Avenida Lope de Vega
Telephone: (809) 562-6281

DUBAI

- See United Arab Emirates

ECUADOR

Guayaquil
Motores Cummins (MOTCUM) S.A.
P.O. Box 1062
Guayaquil, Ecuador
Location:
Avenida Carlos Julio
Arosemena Km. 4
Telephone: (593-4) 203995/201177

Quito
Rectificadora Botar S.A.
P.O. Box 17-01-3344
Quito, Ecuador
Location:
Av. 10 de Agosto No. 5980
Telephone: (593-2) 465-176/177/
178/195/197

EGYPT

Cairo
ADAT
P.O. Box 1572
Cairo, Egypt
Sales and Service Location:
25, Pyramid Road
Giza, Cairo, Egypt
Telephone: (20-2) 384-6607/384-6609
385-4001/2/4/5/6/8/9

EL SALVADOR

San Salvador
Salvador Machinery
Company, S.A. de C.V.
P.O. Box 125
San Salvador, El Salvador
Location:
Blvd. Ejercito Nacional
Telephone: (503) 711022, 228388

ENGLAND

- See United Kingdom

EQUATORIAL GUINEA

- See North/West Africa Regional Office - Daventry

ESTONIA

- See Moscow Regional Office - Moscow

FAROE ISLANDS

Wellingborough (Office in United Kingdom)
Cummins Diesel
Denington Industrial Estate
Wellingborough
Northants NN8 2QH,
England
Telephone: (44-933) 276231

FERNANDO PO

- See Spain

FIJI

- See Cummins Diesel Sales & Service New Zealand Ltd.

FINLAND

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Machinery OY
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SF 00511 Helsinki, Finland
Location:
Teollisuuskatu 29
Telephone: Int: (358-9) 77221

FRANCE

Lyon
Cummins Diesel
Sales Corporation
39, rue Ampere Z.I.
69680 Chassieu, France
Telephone: (33) 72-22-92-72
Parts and Service Telephone:
(33) 72-22-92-69

GABON

- See North/West Africa Regional Office - Daventry

GAMBIA

Senegal (Matforce)

GEORGIA

- See Moscow Regional Office - Moscow

GERMANY

Gross-Gerau
Cummins Diesel Deutschland GmbH
P.O. Box 1134
D-6080 Gross-Gerau,
Germany
Location: Odenwaldstr. 23
Telephone: (49-6152) 174-0

GHANA

Accra
Leyland DAF (Ghana) Ltd.
P.O. Box 2969
Accra, Ghana
Location:
39/40 Ring Road South
Industrial Estate
Telephone: (233-21) 22-88-06

GREECE

Athens
Eliopoulos Brothers Ltd.
P.O.B. 51528
14 Km. National Rd.
Athens-Lamia
14510 Kifissia, Greece
Telephone: (30-1) 6202401/6202066/
6201955

GREENLAND

- See Denmark

GRENADA

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Hialeah Gardens, FL 33016
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GUADELOUPE

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Cummins Southeastern Power, Inc.
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Hialeah Gardens, FL 33016
Telephone: (305) 821-4200

GUAM

Barrigada
Mid-Pac Far East, Inc.
Airport Industrial Park
825 Tiyan Parkway
Barrigada, Guam 96921
Telephone: (671) 632-5160

GUATEMALA

Guatemala City
Maquinaria y Equipos, S.A.
P.O. Box 2304
Guatemala City, Guatemala
Location:
Carretera Amatitlan
Km 12 zona 12
Telephone: (502-2) 773334/7/9

GUINEA BISSAU
- See North/West Africa Regional Office - Daventry

GUYANA

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HAITI

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HOLLAND
- See Netherlands

HONDURAS

Tegucigalpa
Comercial Laeisz
Honduras, S.A.
P.O. Box 1022
Tegucigalpa, D.C., Honduras
Location:
Zona La Burrera,
Blvd. Toncontin
Frente a Gasolinera Esso.
Telephone: (504) 333570/335615

HONG KONG

Kowloon
Cummins Engine H. K. Ltd.
P.O. Box 840 Shatin
N.T., Hong Kong
Location:
Unison Industrial Centre
15th Floor, Units C & D
27-31 Au Pui Wan Street
Fo Tan, Shatin, Hong Kong
Telephone: (852) 606-5678

INDIA

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Cummins Diesel Sales &
Service (India) Ltd.
35A/1/2, Erandawana
Pune - 411 038, (State of Maharashtra)
India
Telephone: (91-212) 331234, 331554,
331635, 330066,
330166, 330356,
331703

Bombay
Cummins Diesel Sales &
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298, Perin Nariman Street, Fort,
Bombay 400001, India
Telephone: (91-22) 2863566/2862247

Calcutta
Cummins Diesel Sales &
Service (I) Ltd.
94, Tivoli Court, I/C Ballygunge
Circular Road
Calcutta 700 019 (West Bengal), India
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2470774

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Plot No. 15, Jalashay Marg
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Telephone: (91-771) 24994/23157/29498

Ranchi
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Service (I) Ltd.
'Shanti Kunj' C-202, Vidyalaya Marg
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Ranchi 834 002 (Bihar)
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Telephone: (91-651) 301948/303623

INDONESIA

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P.T. Alltrak 1978
P.O. Box 64/KBYL
Jakarta Selatan 12330, Indonesia
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Bintaro, Rempoa
Telephone: (62-21) 736-1978/736-3302

IRAN

Tehran
Technical Service Development
Company
P.O. Box 13445/741
No. 152 Sohravardi Crossing
Dr. Beheshti Avenue
Tehran, Iran
Telephone:
Head Office: (98-21) 846666, 851021-7
Work Shop: (98-21) 995021-2/993240

IRAQ
- See Middle East Regional Office - Daventry

IRELAND

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Levinson Brothers Engineers
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IVORY COAST
- See Cote d' Ivoire

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Cummins Diesel (Japan) Ltd.
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JORDAN

Amman
S.E.T.I. Jordan Limited
P.O. Box 8053
Amman, Jordan
Telephone: (962-6) 621867/621884

KENYA

Nairobi
Werrot & Company Limited
P.O. Box 41216
Nairobi, Kenya
Location:
Lusaka Road
Telephone: (254-150) 20316

KOREA, SOUTH

Seoul
Hwa Chang Trading Co., Ltd.
Central P.O. Box No. 216
Seoul, South Korea
Location:
143-11 Doksan-dong, Kuro-ku
Telephone: (82-2) 854-0071/2/3/4/5,
869-1411/2/3

KUWAIT

Kuwait
General Transportation &
Equipment Co.
(Sales Department)
P.O. Box 1096
13011 Safat, Kuwait
Location:
Shuwaikh Behind
Canada Dry Factory
Telephone: (965) 4833380/1/2

Kuwait
General Transportation &
Equipment Co.
(Service Department)
East Ahmadi Area
13011 Safat, Kuwait
Telephone: (965) 3981577

LAOS
- See South and East Asia Regional Office - Singapore

LATVIA
- See Moscow Regional Office - Moscow

LEBANON

Beirut
S.E.T.I. Charles Keller
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B.P. 16-6726
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Location:
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LESOTHO
- See South Africa

LIBYA
- See North/West Africa Regional Office
- Daventry

LIECHTENSTEIN
- See Switzerland

LUXEMBOURG

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Cummins Diesel Deutschland GmbH
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MACAU
- See Hong Kong

MADAGASCAR
- See East and Southern Africa Regional Office - Harare

MADEIRA ISLANDS
- See Portugal

MALAYSIA

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Cummins Diesel Sales & Service
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50710 Kuala Lumpur, West Malaysia
Location:
16 Jalan Chan Sow Lin
55200 Kuala Lumpur
Telephone: (60-3) 2211033

MALI
- See Senegal (Matforce)

MALTA

Valletta
Plant & Equipment Ltd.
Regency House
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Valletta, Malta
Telephone: (356) 23-26-20, 23-33-43,
23-16-23, 24-75-17

MARTINIQUE

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MEXICO

Guadalajara
Cummins Del Occidente, S.A.
Lazaro Cardenas No. 2950
Fracc. Alamo Industrial
45560 Guadalajara, Jal. Mexico
Telephone: (52-3) 670-93-06, 670-53-38,
670-63-61, 670-62-33

Monterrey
Tecnica Automotriz, S.A.
Av. Alfonso Royes
No. 3637 Nte.
Monterrey, Nuevo Leon, Mexico
Telephone: (52-83) 51-41-51, 51-46-56

Merida
Cummins Del Sureste, S.A. de C.V.
Av. Aviacion Civil No. 647
Esquina Calle 100
Col. Sambula
97259 Merida, Yucatan, Mexico
Telephone: (52-99) 24-11-55, 24-00-15

Puebla
Cummins de Oriente, S.A. de C.V.
Av. Reforma No. 2112,
Puebla, Pue. Mexico
Telephone: (52-22) 48-76-74, 48-76-75

Queretaro
Distribuidor Cummins Del Centro, S.A.
de C.V.
Blvd. Bernardo Quintana No. 518
Col. Arboledas
C.P. 76140 Queretaro, Qro., Mexico
Telephone: (52-42) 12-41-90, 12-58-90,
12-62-94, 14-04-16,
14-08-81, 14-15-91

Tlalnepantla
Distribuidor Cummins
Metropolitana, S.A. DE C.V.
Sor Juana Ines de la Cruz No. 555
54000 Tlalnepantla, Edo. de Mexico,
Mexico
Telephone: (52-5) 327-38-00, 390-64-37,
390-12-27

MOROCCO

Casablanca
Societe Auto-Hall, S.A.
44 Avenue Lalla Yacout
Casablanca, Morocco
Telephone: (212) 31-84-60, 31-70-52, 31-90-56, 31-70-44

MOZAMBIQUE
- See East and Southern Africa Regional Office - Harare

NAMIBIA (Southwest Africa)

Windhoek
Propower, Namibia
P.O. Box 3637, Windhoek 9000
Namibia (Southwest Africa)
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35A/1/2, Erandawana
Pune, - 411 038, (State of Maharashtra) India
Telephone: (91-212) 331234, 331554, 331635, 330066, 330166, 330356, 331703

NETHERLANDS

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NETHERLANDS ANTILLES

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Cummins Southeastern Power, Inc.
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NEW CALEDONIA
- See South Pacific Regional Office - Melbourne

NEW GUINEA
- See Papua New Guinea

NICARAGUA

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NIGERIA

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Isolo
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Paris (Office in France)
SCOATRAC MOSEL
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NORTHERN IRELAND
- See United Kingdom

NORWAY

Oslo
Cummins Diesel Salg & Service A/S
P.O. 6288
Etterstad 0603, Oslo 6
Norway
Location:
Verkseler Furulunds vei 11
Telephone: (47) 22326110

OMAN

Ruwi
Universal Engineering Services L.L.C.
P.O. Box 5688
Ruwi
Sultanate of Oman
Telephone: (968) 590830, 591304

PAKISTAN

Karachi
- See Middle East Regional Office - Daventry

PANAMA

Panama City
Grupo Tiesa, S.A.
Apartado Postal #55-0549
Partillo, Panama
Telephone: (507) 67-3866

PAPUA NEW GUINEA

Sydney (Office in Australia)
Cummins Diesel Sales & Service
P.O. Box 150
Cabramatta, 2166
New South Wales, Australia

PARAGUAY

Asuncion
Automotores y Maquinaria, S.R.L.
Yegros y Fulgencio R. Moreno
P.O. Box 1160
Asuncion, Paraguay
Telephone: (595-21) 493111, 493115

PERU

Lima
Comercial Diesel del Peru S.A.
P.O. Box 14-0234
Lima, Peru
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Ave. V.R. Haya de la Torre 2648
Lima 3, Peru
Telephone: (51-14) 74-3173/4374/3144/2281

PHILIPPINES

EDSA
Power Systems, Inc. EDSA
P.O. Box 3241
Manila
Philippines 1501
Location:
79E. Delos Santos Ave.
Mandaluyong, Metro Manila
Telephone: (63-2) 791769, 791771, 5311945, 5315448, 5311934, 5312531, 53414513

POLAND
- See Germany Regional Office - Gross-Gerau

PORTUGAL

Lisbon
Electro Central Vulcanizadora, Lda.
P.O. Box 3077
1302 Lisbon, Portugal
Location:
Rua Conselheiro Martins de Carvalho
Lote 1480
1400 Lisboa (Restelo)
Telephone: (351-1) 3015361

QATAR

Doha
Jaidah Motors & Trading Co.
P.O. Box 150
Doha, Qatar (Arabian Gulf)
Telephone: (974) 810000

REUNION
- See Lyon Regional Office - Lyon

RIO DE ORO
- See Spain

ROMANIA

- See Germany Regional Office - Gross-Gerau

RUSSIA

- See Moscow Regional Office - Moscow

RWANDA

Brussels (Office in Belgium)
Bia, S.A.
Rameistraat, 123
B-3090 - Overijse, Belgium
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ST. LUCIA

Miami (Office in U.S.A.)
Cummins Southeastern Power, Inc.
9900 N.W. 77 Court
Hialeah Gardens, FL 33016
Telephone: (305) 821-4200

ST. VINCENT

Miami (Office in U.S.A.)
Cummins Southeastern Power, Inc.
9900 N.W. 77 Court
Hialeah Gardens, FL 33016
Telephone: (305) 821-4200

SAN MARINO

- See Italy

SAO TOME AND PRINCIPE

- See North/West Africa Regional Office - Daventry

SAUDI ARABIA

Dammam
General Contracting Company
P.O. Box 5111
Dammam 31422, Saudi Arabia
Telephone: (966-3) 842-1216

SCOTLAND

- See United Kingdom

SENEGAL

Dakar
Matforce
B.P. 397
Dakar, Senegal
Location:
10 Avenue Faidherbe
Telephone: (221) 22-30-40

SEYCHELLES

- See East/Southern Africa Regional Office - Harare

SIERRA LEONE

- See North/West Africa Regional Office - Daventry

SINGAPORE

Singapore
Applied Diesel Sales & Service Pte Ltd
8 Tanjong Penjuru
Jurong Industrial Estate
Singapore 2260
Telephone: (65) 261-3555

SLOVAKIA

- See European Regional Office - Mechelen

SOLOMON ISLANDS

- See South Pacific Regional Office - Melbourne

SOMALIA

- See East and Southern Africa Regional Office - Harare

SOUTH AFRICA

Johannesburg
Propower Pty. Ltd.
Private Bag X4
Wendywood 2144
South Africa
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13 Eastern Service Roade
Kelvin 2054
Telephone: (27-11) 444-3225

SOUTHWEST AFRICA

- See Namibia

SPAIN

Madrid
Cummins Ventas y
Servicio S.A.
Torrelaguna, 56
28027 Madrid, Spain
Telephone: (34-91) 367-2000/3672404

SPANISH GUINEA

- See Spain

SRI LANKA

Colombo
Trade Promoters Ltd
P.O. Box 321
69, Walukarama Road
Colombo 3
Sri Lanka
Telephone: (94-1) 573927, 574651, 575005

SUDAN

Khartoum
Bittar Engineering Ltd.
P.O. Box 1011
Gamhouria Street
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SURINAM

Miami (Office in U.S.A.)
Cummins Southeastern Power, Inc.
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Hialeah Gardens, FL 33016
Telephone: (305) 821-4200

SWAZILAND

- See South Africa

SWEDEN

Stockholm
SMA Maskin AB
Aggelundavagen 7
S-17562 Jarfalla
Sweden
Telephone: (46-8) 621-25-00

SWITZERLAND

Regensdorf
Robert Aebi AG
Riedthofstrasse 100
8105 Regensdorf
Switzerland
Telephone: (41-1) 842-5111

SYRIA

Damascus
Puzant Yacoubian & Sons
P.O. Box 3617
Damascus, Syria
Location:
Abou Baker El Saddik Street
Kafar Sousse Square
Telephone: (963-11) 231547/8/9

TAHITI, ISLAND OF

- See French Polynesia

TAIWAN

Taipei
Cummins Corporation - Taiwan Branch
12th Floor, No. 149
Min-Sheng E. Road, Sec. 2
Taipei, Taiwan
Telephone: (886-2) 515-0891

TANZANIA

Dar es Salaam
Riddoch Motors 1987 Ltd
P.O. Box 40040
Dar es Salaam
Tanzania
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92 Kipawa-Pugu Road
Dar es Salaam
Telephone: (255-51) 44493, 41140

THAILAND

Bangkok
Diethelm & Company Ltd.
1696 New Petchburi Road
Bangkok 10310, Thailand
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TOGO (and BENIN)

Lome
Togomat
B.P. 1641
Lome, Togo
Location:
Zone Industrielle CNPPME
Telephone: (228) 21-23-95

TONGA, ISLAND OF
- See South Pacific Regional Office - Melbourne

TRINIDAD and TOBAGO

Miami (Office in U.S.A.)
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Hialeah Gardens, FL 33016
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TURKEY

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Ticaret T.A.S.
P.K. 136
80222 Sisli
Istanbul, Turkey
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Buyukdere Caddesi, 13/A
80260 Sisli
Istanbul, Turkey
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UKRAINA
- See Moscow Regional Office - Moscow

UNITED ARAB EMIRATES

Abu Dhabi
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Abu Dhabi,
United Arab Emirates
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UNITED KINGDOM

Wellingborough
Cummins Diesel
Denington Estate
Wellingborough
Northants NN8 2QH, England
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UPPER VOLTA
- See Burkina - Faso

URUGUAY

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Santaro S.A.
P.O. Box 379
Montevideo
Uruguay
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Avenida Millan No. 2441
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U.S.S.R.
- See Moscow Regional Office - Moscow

VATICAN CITY
- See Italy

VENEZUELA

Caracas
Sudimat
Apartado Postal 1322
Carmelitas
Caracas 1010
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Urb. la Quebradita
Caracas 1061
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VIETNAM

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Ho Chi Minh City
Diethelm & Co. Ltd. Engineering
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1 Me Linh Square
District 1
Ho Chi Minh City, Vietnam
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WESTERN SAMOA
- See South Pacific Regional Office - Melbourne

YEMEN ARAB REPUBLIC

Sana'a
Zubieri Trading Co.
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Zubieri Street
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YEMEN, SOUTH
- See Middle East Regional Office - Daventry

YUGOSLAVIA
- See Southeastern Europe

ZAIRE

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ZAMBIA

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ZIMBABWE

Harare
Cummins Zimbabwe (Pvt) Ltd.
P.O. Box ST363
Southerton
Harare, Zimbabwe
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72 Birmingham Road
Southerton, Harare
Telephones: (263-4) 67645, 69220

Section TS - Troubleshooting Symptoms

Section Contents

Page

Troubleshooting Procedures and Techniques TS-1
General Information TS-1

Troubleshooting Symptoms Charts TS-2
Air Compressor Air Pressure Rises Slowly TS-3
Air Compressor Noise is Excessive TS-4
Air Compressor Pumping Excess Lubricating Oil into the Air System TS-5
Air Compressor Will Not Maintain Adequate Air Pressure (Not Pumping Continuously) TS-6
Air Compressor Will Not Stop Pumping TS-7
Alternator Not Charging or Insufficient Charging TS-8
Coolant Loss – External TS-10
Coolant Loss – Internal TS-11
Coolant Temperature Above Normal – Gradual Overheat TS-12
Coolant Temperature is Above Normal – Sudden Overheat TS-14
Coolant Temperature is Below Normal TS-16
Crankcase Gases (Blowby) Excessive TS-18
Engine Brake Does Not Operate TS-19
Engine Brake — One or More Cylinders Braking with Power Switch Off TS-21
Engine Brake – Low Retarding Power or Slow to Activate TS-20
Engine Decelerates Slowly TS-22
Engine Difficult to Start or Will Not Start (Exhaust Smoke) TS-23
Engine Difficult to Start or Will Not Start (No Exhaust Smoke) TS-25
Engine Noise Excessive TS-27
Engine Noise Excessive — Combustion Knocks TS-29
Engine Power Output Low TS-30
Engine Runs Rough at Idle TS-32
Engine Runs Rough or Misfires TS-33
Engine Shuts Off Unexpectedly or Dies During Deceleration TS-34
Engine Speed Surges at Low or High Idle TS-35
Engine Speed Surges Under Load or in Operating Range TS-36
Engine Starts But Will Not Keep Running TS-37
Engine Vibration Excessive TS-38
Engine Will Not Crank or Cranks Slowly TS-39
Engine Will Not Shut Off TS-40
Fuel Consumption Excessive TS-41
Fuel in Coolant TS-43
Fuel in the Lubricating Oil TS-44
General Information TS-2
Intake Manifold Air Temperature Above Specification TS-45
Lubricating Oil Consumption Excessive TS-46
Lubricating Oil Contaminated TS-48
Lubricating Oil Pressure High TS-49
Lubricating Oil Pressure Low TS-50
Lubricating Oil Sludge in the Crankcase Excessive TS-51
Lubricating Oil Temperature Above Specification TS-52
Lubricating or Transmission Oil in the Coolant TS-53
Operating Fuel Pressure is Low TS-54
Smoke, Black — Excessive TS-55
Smoke, White — Excessive TS-56
Turbocharger Boost Pressure Low TS-57
Turbocharger Leaks Engine Oil or Fuel TS-58

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Troubleshooting Procedures and Techniques

General Information

This guide describes some typical engine operating problems, their causes, and some acceptable corrections to those problems. Unless noted otherwise, the problems listed are those which an operator can diagnose and repair.

⚠ WARNING ⚠

Performing troubleshooting procedures NOT outlined in this section can result in equipment damage or personal injury or death. Troubleshooting must be performed by trained, experienced technicians. Consult a Cummins Authorized Repair Location for diagnosis and repair beyond that which is outlined, and for symptoms not listed in this section. Before beginning any troubleshooting, refer to General Safety Instructions in Section i of this manual.

Follow the suggestions below for troubleshooting:

- Study the complaint thoroughly before acting
- Refer to the engine system diagrams
- Do the easiest and most logical things first
- Find and correct the cause of the complaint

Troubleshooting Symptoms Charts

General Information

Use the following charts to aid in diagnosing specific engine symptoms. Read each row of blocks from top to bottom. Follow the arrows through the chart to identify corrective action.

⚠ WARNING ⚠

Troubleshooting presents the risk of equipment damage, personal injury or death. Troubleshooting must be performed by trained experienced technicians.

Air Compressor Air Pressure Rises Slowly

This is symptom tree t004.

Cause	Correction
Air intake system restriction to air compressor is excessive	Replace the air compressor air cleaner (if installed). Check the air intake piping. Check engine air intake restriction if the air compressor inlet is plumbed to the vehicle or equipment intake system. Refer to Section 5.
OK ▼	
Air system leaks	Block the vehicle wheels and check the air system for leaks with spring brakes applied and released. Check for leaks from the air compressor gaskets and the air system hoses, fittings, and valves. Refer to the OEM service manual.
OK ▼	
Air governor is malfunctioning or **not** set correctly	Check the air governor for correct operation. Refer to the OEM service manual.
OK ▼	
Carbon buildup is excessive in the air discharge line, downstream air valves, or cylinder head	Check for carbon buildup. Replace the air compressor discharge line and cylinder head assembly if necessary. Refer to Section 7.
OK ▼	
Air system component is malfunctioning	Check the operation of air system valves, air dryers, and other OEM-installed air system components. Refer to the manufacturer's instructions.

Air Compressor Noise is Excessive

This is symptom tree t006.

Cause	Correction
Carbon buildup is excessive in the air discharge line, downstream air valves, or cylinder head	Check for carbon buildup. Replace the air compressor discharge line and cylinder head assembly if necessary. Refer to Section 7.
OK ▼	
Ice buildup in the air system components	For all models, check for ice in low spots of the air discharge line, dryer inlet, and elbow fittings. On Holset® models, also check the Econ valve (if equipped). Refer to the OEM service manual.
OK ▼	
Air compressor is sending air pulses into the air tanks	Install a ping tank between the air dryer and the wet tank and check discharge line size for the application. Refer to the manufacturer's instructions.
OK ▼	
Contact a Cummins Authorized Repair Facility	

Air Compressor Pumping Excess Lubricating Oil into the Air System

This is symptom tree t007.

Cause	Correction
Lubricating oil drain interval is excessive	Verify the correct lubricating oil drain interval. Refer to Section V.
OK ↓	
Air intake system restriction to air compressor is excessive	Replace the air compressor air cleaner (if installed). Check the air intake piping. Check engine air intake restriction if the air compressor inlet is plumbed to the vehicle or equipment intake system. Refer to Section 5.
OK ↓	
Contaminants are building up in the system reservoirs	Drain the reservoirs daily. Refer to Section 3.
OK ↓	
Carbon buildup is excessive in the air discharge line, air system valves, or cylinder head	Check for carbon buildup. Replace the air compressor discharge line, cylinder head, or air compressor. Check the turbocharger for oil leaks. Check the intake tube for oil. Refer to Section 7.
OK ↓	
Engine angularity during operation exceeds specification	Refer to the Engine Specification data sheet.
OK ↓	
Air compressor runs hot	If coolant temperature is above normal. Refer to the Coolant Temperature Above Normal - Gradual Overheat Symptom Tree.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Air Compressor Will Not Maintain Adequate Air Pressure (Not Pumping Continuously)

This is symptom tree t008.

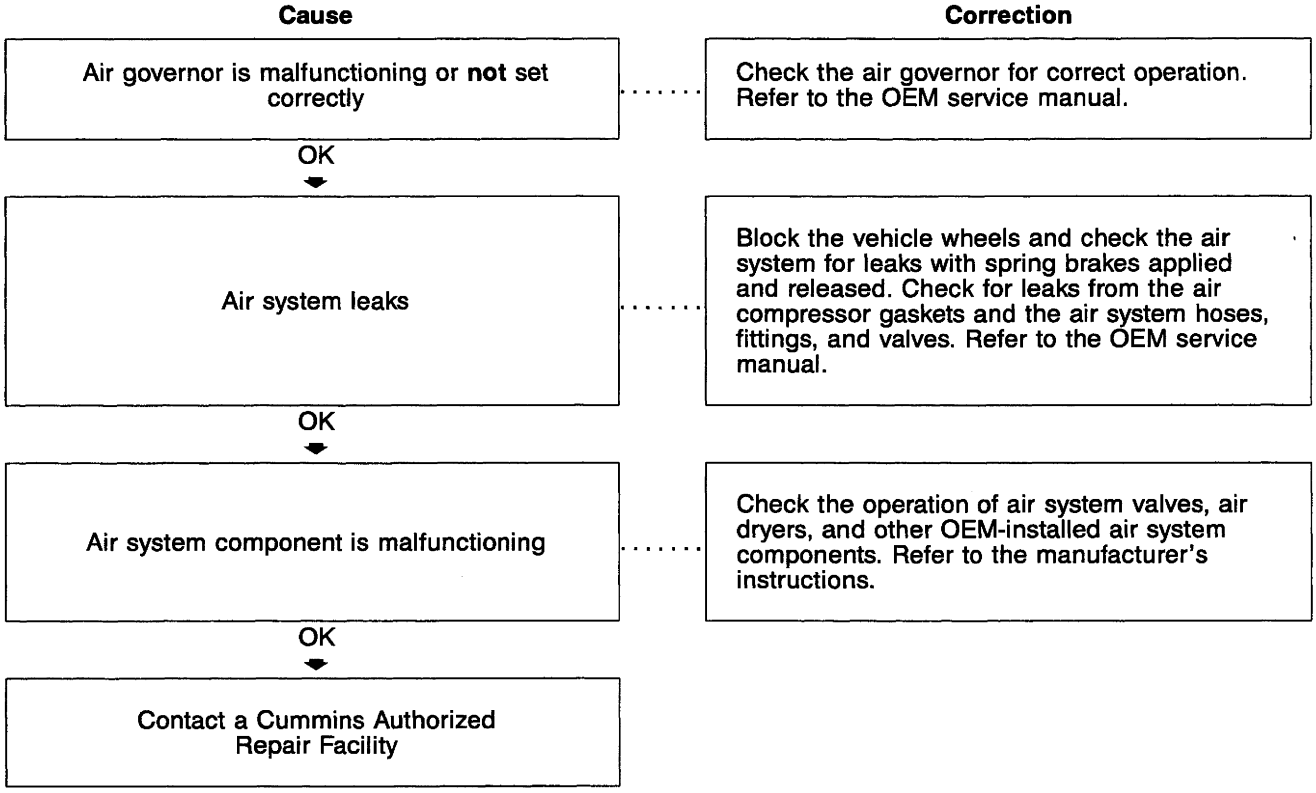
Cause	Correction
Air system leaks	Block the vehicle wheels and check the air system for leaks with spring brakes applied and released. Check for leaks from the air compressor gaskets and the air system hoses, fittings, and valves. Refer to the OEM service manual.

OK

Contact a Cummins Authorized Repair Facility

Air Compressor Will Not Stop Pumping

This is symptom tree t010.



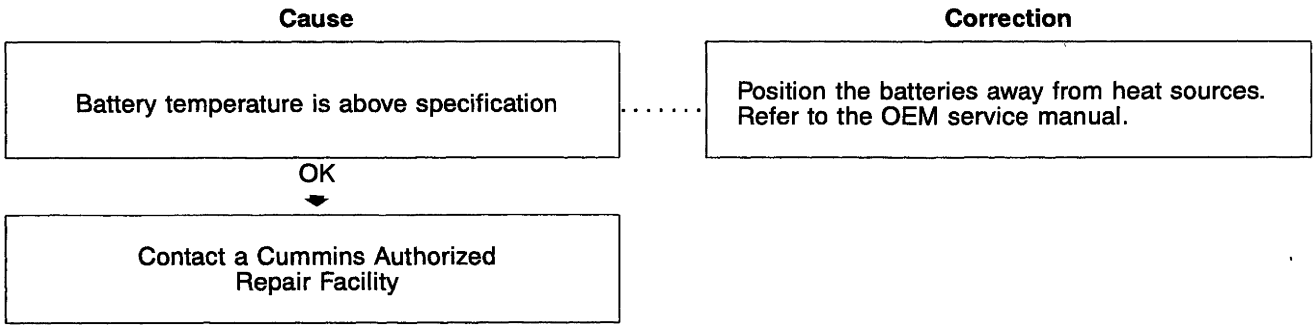
Alternator Not Charging or Insufficient Charging

This is symptom tree t013.

Cause	Correction
Alternator belt is loose	Check the alternator belt tension. Adjust as necessary. Refer to Section V.
OK ↓	
Alternator drive pulley is loose on the water pump shaft	Make sure the drive pulley is tight on the shaft. Refer to manufacturer's specifications.
OK ↓	
Battery cables or connections are loose, broken, or corroded (excessive resistance)	Check the battery cables and connections.
OK ↓	
Batteries have failed	Check the condition of the batteries. Replace the batteries, if necessary. Refer to the OEM service manual.
OK ↓	
Vehicle gauge is malfunctioning	Check the vehicle gauge. Refer to the OEM service manual.
OK ↓	
Alternator or voltage regulator is malfunctioning	Test the alternator output. Replace the alternator or voltage regulator if necessary. Refer to the OEM service manual.
OK ↓	
Electrical system is "open" (blown fuses, broken wires, or loose connections)	Check the fuses, wires, and connections. Refer to the OEM service manual and the manufacturer's wiring diagrams.
OK ↓	
Alternator is overloaded or alternator capacity is below specification	Install an alternator with a higher capacity. Refer to the OEM service manual.
OK ↓	

(Continued)

Alternator Not Charging or Insufficient Charging (Continued)



Coolant Loss – External

This is symptom tree t020.

Cause	Correction
Coolant level is above specification	Check the coolant level. Refer to the OEM service manual.
OK ↓	
External coolant leak	Inspect the engine for coolant leaking from hoses, drain cocks, water manifold, expansion and pipe plugs, fittings, radiator core, air compressor and cylinder head gaskets, lubricating oil cooler, water pump seal, and OEM-mounted components that have coolant flow.
OK ↓	
Radiator cap is **not** correct, is malfunctioning, or has low-pressure rating	Check the radiator pressure cap. Refer to the OEM service manual.
OK ↓	
Fill line or vent lines are restricted, obstructed, or **not** routed correctly	Check the vent lines and the fill line for correct routing and for restriction. Refer to the OEM service manual.
OK ↓	
Cooling system hose is collapsed, restricted, or leaking	Inspect the radiator hoses. Refer to Section 6.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Coolant Loss – Internal

This is symptom tree t021.

Cause	Correction
Fuel heater is leaking coolant	Check the fuel heater for coolant leaks. Refer to the manufacturer's instructions.
OK ▼	
Transmission oil cooler or torque converter cooler is leaking (Marine keel-cooled engine **only**)	Check the transmission oil cooler and torque converter cooler for coolant leaks. Refer to the manufacturer's instructions.
OK ▼	
Contact a Cummins Authorized Repair Facility	

Coolant Temperature Above Normal – Gradual Overheat

This is symptom tree t022.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ▼	
Coolant level is below specification	Inspect the engine and cooling system for external coolant leaks. Repair if necessary. Add coolant. Refer to Section 3.
OK ▼	
Charge-air cooler (CAC) fins, radiator fins, or air conditioner condenser fins are damaged or obstructed with debris	Inspect the CAC, air conditioner condenser, and radiator fins. Clean, if necessary. Refer to Section 3.
OK ▼	
Cold weather radiator cover or winterfront is closed	Open the cold weather radiator cover or the winterfront. Maintain a minimum of 784 cm^2 [120 in^2], or approximately 28 x 28 cm [11 x 11 in], of opening at all times. Refer to Section 1.
OK ▼	
Cooling system hose is collapsed, restricted, or leaking	Inspect the radiator hoses. Refer to Section 6.
OK ▼	
Lubricating oil level is above or below specification	Check the oil level. Add or drain oil, if necessary. Refer to Section 3.
OK ▼	
Fan shroud is damaged or missing, or the air recirculation baffles are damaged or missing	Inspect the shroud and the recirculation baffles. Repair, replace, or install if necessary. Refer to the OEM service manual.
OK ▼	
Radiator cap is **not** correct, is malfunctioning, or has low-pressure rating	Check the radiator pressure cap. Refer to the OEM service manual.
OK ▼	

(Continued)

Coolant Temperature Above Normal – Gradual Overheat (Continued)

Cause	Correction
Intake manifold air temperature is above specification	Refer to the Intake Manifold Air Temperature Above Specification symptom tree.
OK ↓	
Coolant temperature gauge is malfunctioning	Test the temperature gauge. Repair or replace the gauge if necessary. Refer to the OEM service manual.
OK ↓	
Thermostat is **not** correct or is malfunctioning	Check the thermostat for the correct part number and for correct operation. Contact a Cummins Authorized Repair Facility.
OK ↓	
Radiator shutters are **not** opening completely, or the shutterstat setting is wrong	Inspect the radiator shutters. Repair or replace if necessary. Refer to the manufacturer's instructions. Check the shutterstat setting.
OK ↓	
Radiator swing check valve is malfunctioning (if equipped)	Check the swing check valve for correct operation. Refer to the OEM service manual.
OK ↓	
Vehicle cooling system is **not** adequate	Verify that the engine and vehicle cooling systems are using the correct components. Refer to the OEM service manual.
OK ↓	
Torque converter is malfunctioning	Check the torque converter. Refer to the OEM service manual.
OK ↓	
Contact a Cummins Authorized Repair Facility	

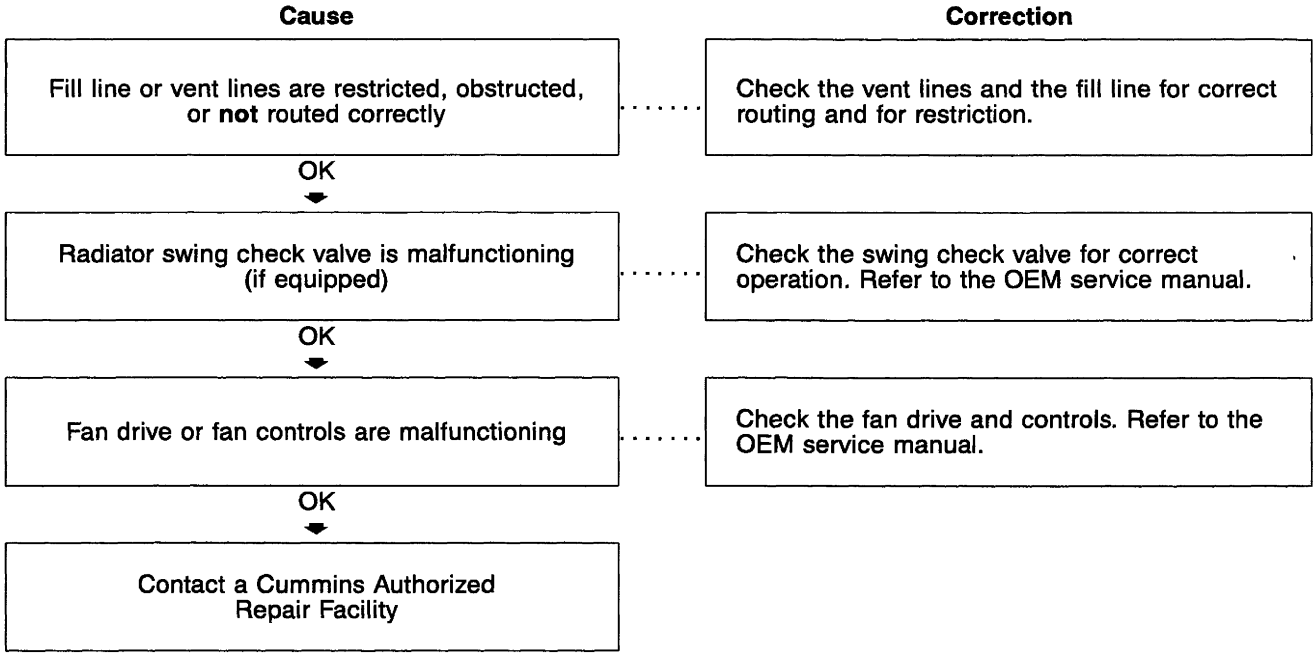
Coolant Temperature is Above Normal – Sudden Overheat

This is symptom tree t023.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ▼	
Fan drive belt is broken	Check the fan drive belt. Replace the belt, if necessary. Refer to Section 3.
OK ▼	
Coolant level is below specification	Inspect the engine and cooling system for external coolant leaks. Repair if necessary. Add coolant. Refer to Section 3.
OK ▼	
Charge-air cooler (CAC) fins, radiator fins, or air conditioner condenser fins are damaged or obstructed with debris	Inspect the CAC, air conditioner condenser, and radiator fins. Clean, if necessary. Refer to Section 3.
OK ▼	
Cooling system hose is collapsed, restricted, or leaking	Inspect the radiator hoses. Refer to Section 6.
OK ▼	
Radiator cap is **not** correct, is malfunctioning, or has low-pressure rating	Check the radiator pressure cap. Refer to the OEM service manual.
OK ▼	
Radiator shutters are **not** opening completely, or the shutterstat setting is wrong	Inspect the radiator shutters. Repair or replace if necessary. Refer to the manufacturer's instructions. Check the shutterstat setting.
OK ▼	
Cold weather radiator cover or winterfront is closed	Open the cold weather radiator cover or the winterfront. Maintain a minimum of 784 cm^2 [120 in^2], or approximately 28 x 28 cm [11 x 11 in], of opening at all times. Refer to Section 1.
OK ▼	

(Continued)

Coolant Temperature is Above Normal – Sudden Overheat (Continued)



Coolant Temperature is Below Normal

This is symptom tree t024.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ▼	
Engine is operating at low ambient temperature	Check the winterfront, shutters, and underhood air. Refer to Cold Weather Operation, Bulletin No. 3387266. Use intake air from under the hood in cold weather.
OK ▼	
Coolant fill line is **not** routed correctly	Check the routing of the coolant fill line. Refer to the OEM service manual.
OK ▼	
Coolant temperature gauge is malfunctioning	Refer to the OEM service manual.
OK ▼	
Radiator shutters are stuck open or opening early	Check the shutter operation. Repair or replace the shutters if necessary. the OEM service manual Refer to Section 1.
OK ▼	
Radiator swing check valve is malfunctioning (if equipped)	Check the swing check valve for correct operation. Refer to the OEM service manual.
OK ▼	
Fan drive or fan controls are malfunctioning	Check the fan drive and controls. Refer to the OEM service manual.
OK ▼	
Thermostat is **not** correct or is malfunctioning	Check the thermostat for the correct part number and for correct operation. Contact a Cummins Authorized Repair Facility.
OK ▼	

(Continued)

Coolant Temperature is Below Normal (Continued)

Cause	Correction
Coolant flow through the radiator is **not** correct	Refer to the OEM service manual.
OK ▼	
Contact a Cummins Authorized Repair Facility	

Crankcase Gases (Blowby) Excessive

This is symptom tree t027.

Cause	Correction
Crankcase ventilation system is plugged	Check and clean the crankcase breather and vent tube.
OK ▼	
Turbocharger oil seal is leaking	Check the turbocharger compressor and turbine seals. Contact a Cummins Authorized Repair Facility.

Engine Brake Does Not Operate

This is symptom tree t036.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ↓	
Engine brakes disabled	Enable the engine brake feature using an electronic service tool. Refer to the appropriate Electronic Service Tool manual.
OK ↓	
Programmable parameters or selected features are **not** correct	Check the programmable parameters and the selected features with an electronic service tool. Set the parameters and features again if necessary. Refer to the appropriate electronic service tool manual.
OK ↓	
Service brake pressure switch or circuit is malfunctioning	Check the service brake pressure switch and circuit. Refer to the OEM service manual.
OK ↓	
Clutch switch or circuit is malfunctioning	Check the clutch switch adjustment, switch, and circuit. Refer to the OEM service manual.
OK ↓	
Throttle position sensor or circuit is malfunctioning	Check for foot pedal restriction. Check the throttle position sensor and circuit.
OK ↓	
Engine electrical ground is malfunctioning	Check engine ground to chassis and chassis ground to battery negative-post. Refer to the OEM service manual.
OK ↓	
Engine brake adjustment is **not** correct	Adjust the engine brakes. Refer to Section 6.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Engine Brake – Low Retarding Power or Slow to Activate

This is symptom tree t037.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ↓	
Engine is cold	Allow the engine to warm to operating temperature. If the engine will **not** reach operating temperature, refer to the Coolant Temperature Below Normal symptom tree.
OK ↓	
Programmable parameters or selected features are **not** correct	Check the programmable parameters and the selected features with an electronic service tool. Set the parameters and features again if necessary. Refer to the appropriate electronic service tool manual.
OK ↓	
Lubricating oil pressure is below specification	Check the oil pressure. If the pressure is low, refer to the Lubricating Oil Pressure Low symptom tree.
OK ↓	
Air in the lubricating oil system	Check the oil level. If level is high, contact a Cummins Authorized Repair Facility.
OK ↓	
Engine brake adjustment is **not** correct	Adjust the engine brakes. Refer to Section 6.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Engine Brake — One or More Cylinders Braking with Power Switch Off

This is symptom tree t038.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ↓	
Engine brake adjustment is **not** correct	Adjust the engine brakes. Refer to Section 6.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Engine Decelerates Slowly

This is symptom tree t041.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ↓ Accelerator pedal is sticking	Check for a sticking accelerator pedal. Refer to the OEM service manual.
OK ↓ Air in the fuel system	Prime the fuel pump. Refer to the OEM service manual.
OK ↓ Contact a Cummins Authorized Repair Facility	

Engine Difficult to Start or Will Not Start (Exhaust Smoke)

This is symptom tree t043.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ▼	
Fuel level is low in the tank	Fill the supply tank. Refer to the OEM service manual.
OK ▼	
Engine cranking speed is too slow	If the cranking speed is slower than 150 rpm, refer to the Engine Will Not Crank or Cranks Slowly symptom tree.
OK ▼	
Battery voltage is low	Check the batteries and the unswitched battery supply circuit. Refer to the OEM service manual.
OK ▼	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ▼	
Engine is operating at low ambient temperature	Check the winterfront, shutters, and underhood air. Refer to Cold Weather Operation, Bulletin No. 3387266. Use intake air from under the hood in cold weather.
OK ▼	
Fuel inlet restriction	Check the fuel filter. Refer to Section 3.
OK ▼	
Air in the fuel system	Prime the fuel pump. Refer to the OEM service manual.
OK ▼	

(Continued)

Engine Difficult to Start or Will Not Start (Exhaust Smoke) (Continued)

Cause	Correction
Vehicle parasitics are excessive	Refer to the OEM service manual.
OK ↓	
Air intake system restriction is above specification	Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Section 5.
OK ↓	
Overhead adjustments are **not** correct	Measure and adjust the overhead settings. Refer to Section 6.
OK ↓	
Engine brakes are malfunctioning	Check the engine brake operation, adjustment, and solenoid resistance. Repair or adjust as necessary. Refer to Section 6.
OK ↓	
Exhaust system restriction	Check the exhaust system for any restrictions. Refer to Section V for specifications.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Engine Difficult to Start or Will Not Start (No Exhaust Smoke)

This is symptom tree t044.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ↓	
Vehicle antitheft feature active	Enter the correct "PIN" or verify the antitheft feature is disabled using electronic service tool INSITE™.
OK ↓	
Keyswitch circuit is malfunctioning	Check the vehicle keyswitch circuit. Refer to the OEM service manual.
OK ↓	
Fuel level is low in the tank	Fill the supply tank. Refer to the OEM service manual.
OK ↓	
Air in the fuel system	Prime the fuel pump. Refer to the OEM service manual.
OK ↓	
Battery voltage is low	Check the batteries and the unswitched battery supply circuit. Refer to the OEM service manual.
OK ↓	
Fuel inlet restriction	Check the fuel filter. Refer to Section 3.
OK ↓	
Electronic control module (ECM) is locked up	Disconnect the battery cables for 30 seconds. Connect the battery cables, and start the engine.
OK ↓	

(Continued)

Engine Difficult to Start or Will Not Start (No Exhaust Smoke) (Continued)

Cause	Correction
Moisture in the wiring harness connectors	Dry the connectors with Cummins electronic cleaner, Part No. 3824510.

OK

Contact a Cummins Authorized Repair Facility

Engine Noise Excessive

This is symptom tree t047.

Cause	Correction
Lubricating oil pressure is below specification	Check the oil pressure. If the pressure is low, refer to the Lubricating Oil Pressure Low symptom tree.
OK ▼	
Lubricating oil level is below specification	Check the oil level. Refer to Section 3.
OK ▼	
Coolant temperature is above specification	Refer to the Coolant Temperature is Above Normal - Sudden Overheat or the Coolant Temperature is Above Normal - Gradual Overheat symptom tree.
OK ▼	
Lubricating oil is thin or diluted	Refer to Section V.
OK ▼	
Fan drive belt is loose, tight, or **not** in alignment	Check the fan drive belt. Refer to Section 3.
OK ▼	
Fan is loose, damaged, or **not** balanced	Check the fan. Refer to Section 3.
OK ▼	
Engine mounts are worn, damaged, or **not** correct	Inspect the engine mounts. Refer to the OEM service manual.
OK ▼	
Air intake or exhaust piping is contacting the chassis or cab	Inspect the air piping, chassis, and cab for contact points. Refer to Section 5.
OK ▼	
Air intake or exhaust leaks	Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting. Refer to Section 5.
OK ▼	

(Continued)

Engine Noise Excessive (Continued)

Cause	Correction
Turbocharger noise	Turbocharger fluttering noises can be heard during deceleration or quick throttle closing. This noise is normal.
OK ↓	
Overhead adjustments are **not** correct	Measure and adjust the overhead settings. Refer to Section 6.
OK ↓	
Vibration damper is damaged	Inspect the vibration damper. Refer to Section 6.
OK ↓	
Air compressor noise is excessive	Refer to the Air Compressor Noise Is Excessive - Air Compressor symptom tree.
OK ↓	
Fan clutch, hydraulic pump, or freon compressor noise is excessive	Isolate each component, and check for noise. Refer to the OEM service manual.
OK ↓	
Drivetrain noise is excessive	Disconnect the drivetrain. Check for engine noise. Refer to the OEM service manual.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Engine Noise Excessive — Combustion Knocks

This is symptom tree t048.

Cause	Correction
Engine is operating at low ambient temperature	Check the winterfront, shutters, and underhood air. Refer to Cold Weather Operation, Bulletin No. 3387266. Use intake air from under the hood in cold weather.
OK ▼	
Ether starting aid is malfunctioning	Repair or replace the ether starting aids. Refer to the manufacturer's instructions.
OK ▼	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ▼	
Air in the fuel system	Prime the fuel pump. Refer to the OEM service manual.
OK ▼	
Coolant temperature is below specification	Refer to the Coolant Temperature Below Normal symptom tree.
OK ▼	
Overhead adjustments are **not** correct	Measure and adjust the overhead settings. Refer to Section 6.
OK ▼	
Contact a Cummins Authorized Repair Facility	

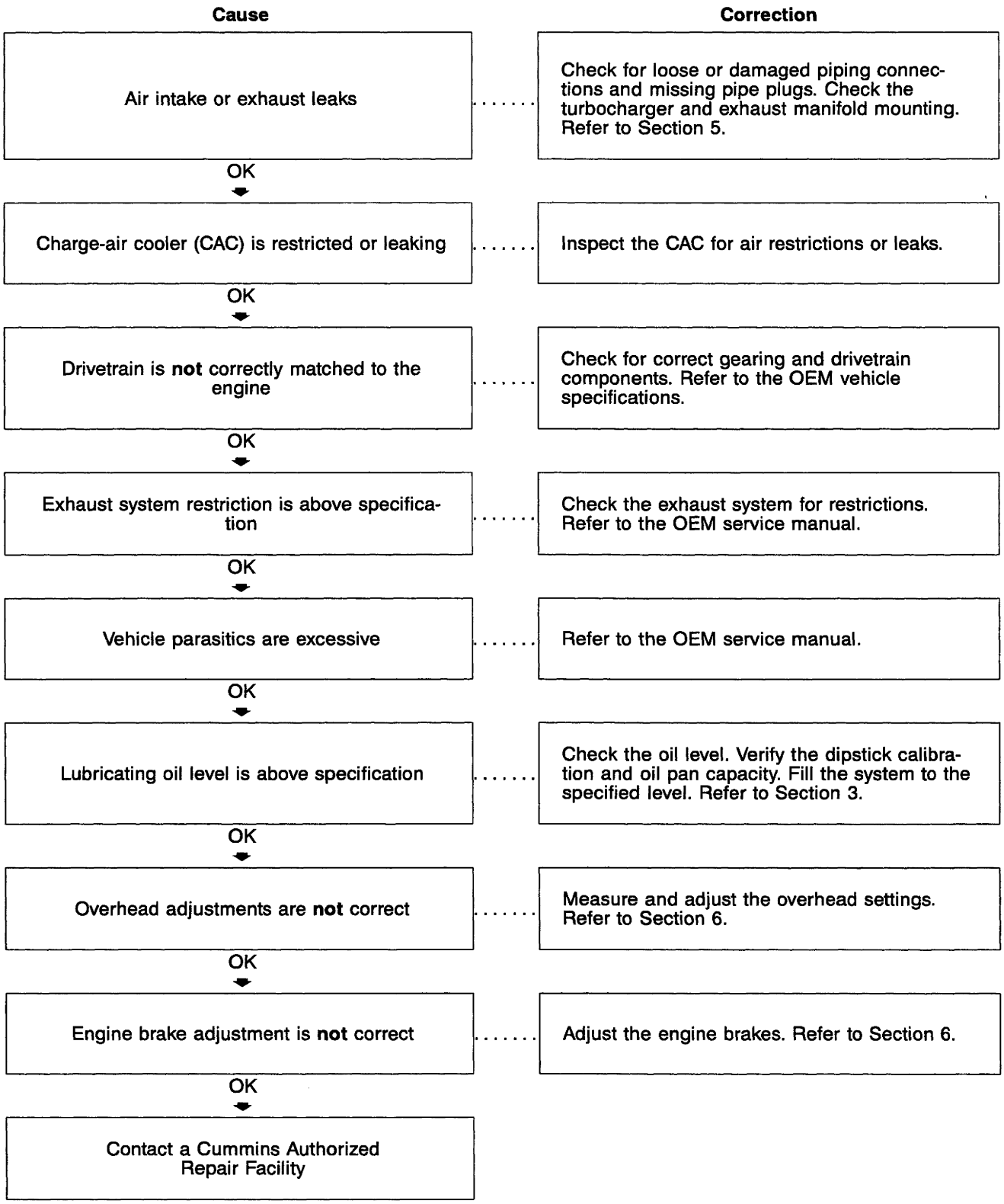
Engine Power Output Low

This is symptom tree t057.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ↓	
Accelerator pedal is sticking	Check for a sticking accelerator pedal. Refer to the OEM service manual.
OK ↓	
Tachometer or speedometer is **not** calibrated or is malfunctioning	Compare the vehicle tachometer and speedometer readings with an electronic service tool reading. Check the calibration values for the flywheel teeth, rear axle ratio, and tire revolutions. Adjust the values if necessary. Refer to the OEM service manual.
OK ↓	
Programmable parameters or selected features are **not** correct	Check the programmable parameters and the selected features with an electronic service tool. Set the parameters and features again if necessary. Refer to the appropriate electronic service tool manual.
OK ↓	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ↓	
Fuel inlet restriction	Check the fuel filter. Refer to Section 3.
OK ↓	
Air in the fuel system	Prime the fuel pump. Refer to the OEM service manual.
OK ↓	
Air intake system restriction is above specification	Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Section 3.
OK ↓	

(Continued)

Engine Power Output Low (Continued)



Engine Runs Rough at Idle

This is symptom tree t061.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Trouble-shooting and Repair Manual listed in Section L.
OK ▼	
Engine is operating at low ambient temperature	Check the winterfront, shutters, and underhood air. Refer to Cold Weather Operation, Bulletin No. 3387266. Use intake air from under the hood in cold weather.
OK ▼	
Engine mounts are worn, damaged, or **not** correct	Check the engine mounts. Refer to the OEM service manual.
OK ▼	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ▼	
Air in the fuel system	Prime the fuel pump. Refer to the OEM service manual.
OK ▼	
Fuel inlet restriction	Check the fuel filter. Refer to Section 3.
OK ▼	
Overhead adjustments are **not** correct	Measure and adjust the overhead settings. Refer to Section 6.
OK ▼	
Vibration damper is damaged	Inspect the vibration damper. Refer to Section 6.
OK ▼	
Contact a Cummins Authorized Repair Facility	

Engine Runs Rough or Misfires

This is symptom tree t062.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ▼	
Engine is operating at low ambient temperature	Check the winterfront, shutters, and underhood air. Refer to Cold Weather Operation, Bulletin No. 3387266. Use intake air from under the hood in cold weather.
OK ▼	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ▼	
Air in the fuel system	Prime the fuel pump. Refer to the OEM service manual.
OK ▼	
Fuel inlet restriction	Check the fuel filter. Refer to Section 3.
OK ▼	
Engine brake adjustment is **not** correct	Adjust the engine brakes. Refer to Section 6.
OK ▼	
Overhead adjustments are **not** correct	Measure and adjust the overhead settings. Refer to Section 6.
OK ▼	
Vibration damper is damaged	Inspect the vibration damper. Refer to Section 6.
OK ▼	
Contact a Cummins Authorized Repair Facility	

Engine Shuts Off Unexpectedly or Dies During Deceleration

This is symptom tree t064.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ▼	
Engine will **not** restart	Refer to the Engine Difficult to Start or Will Not Start symptom tree.
OK ▼	
Keyswitch circuit is malfunctioning	Check the vehicle keyswitch circuit. Refer to the OEM service manual.
OK ▼	
Battery voltage is low	Check the batteries and the unswitched battery supply circuit. Refer to the OEM service manual.
OK ▼	
Fuel inlet restriction	Check the fuel filter. Refer to Section 3.
OK ▼	
Air in the fuel system	Prime the fuel pump. Refer to the OEM service manual.
OK ▼	
Contact a Cummins Authorized Repair Facility	

Engine Speed Surges at Low or High Idle

This is symptom tree t066.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ↓	
Fuel level is low in the tank	Fill the supply tank. Refer to the OEM service manual.
OK ↓	
Fuel inlet restriction	Check the fuel filter. Refer to Section 3.
OK ↓	
Air in the fuel system	Prime the fuel pump. Refer to the OEM service manual.
OK ↓	
Idling with excessive load	Use the PTO feature for loaded conditions at low engine speeds. Refer to Section 1.
OK ↓	
Alternator is malfunctioning	Temporarily disconnect the alternator and run the engine. Replace the alternator if necessary. Refer to the OEM service manual.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Engine Speed Surges Under Load or in Operating Range

This is symptom tree t067.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ↓	
Engine speed also surges at idle	Refer to the Engine Speed Surges at Low or High Idle symptom tree..
OK ↓	
Air in the fuel system	Prime the fuel pump. Refer to the OEM service manual.
OK ↓	
Fuel drain line restriction	Check the fuel drain lines for restriction. Refer to the OEM service manual.
OK ↓	
Fuel inlet restriction	Check the fuel filter. Refer to Section 3.
OK ↓	
Air intake system restriction is above specification	Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Section 3.
OK ↓	
Exhaust system restriction is above specification	Check the exhaust system for restrictions. Contact a Cummins Authorized Repair Facility.

Engine Starts But Will Not Keep Running

This is symptom tree t072.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Trouble-shooting and Repair Manual listed in Section L.
OK ↓	
Idle shutdown or PTO shutdown features are activated	Turn the keyswitch to the OFF position for 30 seconds. Turn the keyswitch to the ON position and check fault code operation.
OK ↓	
Fuel level is low in the tank	Fill the supply tank. Refer to the OEM service manual.
OK ↓	
Battery voltage is low	Check the batteries and the unswitched battery supply circuit. Refer to the OEM service manual.
OK ↓	
Fuel inlet restriction	Check the fuel filter. Refer to Section 3.
OK ↓	
Keyswitch circuit is malfunctioning	Check the vehicle keyswitch circuit. Refer to the OEM service manual.
OK ↓	
Vehicle parasitics are excessive	Check for transmission malfunctioning, cooling fan operation cycle time, and engine-driven units. Refer to the OEM service manual.
OK ↓	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Engine Vibration Excessive

This is symptom tree t075.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ↓	
Engine is misfiring	Refer to the Engine Runs Rough or Misfires symptom tree.
OK ↓	
Engine idle speed is set too low (electronically controlled fuel systems)	Verify the correct idle speed setting. Increase the idle speed with the idle increment switch or an electronic service tool.
OK ↓	
Fan is loose, damaged, or **not** balanced	Check the fan. Refer to Section 3.
OK ↓	
Engine mounts are worn, damaged, or **not** correct	Check the engine mounts. Refer to the OEM service manual.
OK ↓	
Vibration damper is damaged	Inspect the vibration damper. Refer to Section 6.
OK ↓	
Drivetrain components are malfunctioning or are **not** correct	Compare the Drivetrain components to the engine and equipment specifications. Isolate the Drivetrain components, and check for vibrations. Refer to the OEM specifications.
OK ↓	
Power take-off (PTO) is damaged	Check the PTO for damage and correct installation. Refer to the manufacturer's instructions.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Engine Will Not Crank or Cranks Slowly

This is symptom tree t077.

Cause	Correction
Starting motor is malfunctioning or starting motor is **not** correct	Check the starting motor operation. Compare the starting motor with the engine and the vehicle specifications. Refer to the manufacturer's instructions.
OK ▼	
Starting motor pinion or ring gear is damaged	Remove the starting motor and visually inspect the gear. Refer to the manufacturer's instructions.
OK ▼	
Engine driven units are engaged	Disengage engine driven units.
OK ▼	
Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Section 4. Use the oil type recommended in Section V.
OK ▼	
Lubricating oil level is above specification	Check the oil level. Verify the dipstick calibration and the oil pan capacity. Fill the system to the specified level. Refer to Section 3.
OK ▼	
Crankshaft rotation is impaired	Check the crankshaft for ease of rotation.
OK ▼	
Contact a Cummins Authorized Repair Facility	

Engine Will Not Shut Off

This is symptom tree t081.

Cause	Correction
Keyswitch circuit is malfunctioning	Check the vehicle keyswitch circuit. Refer to the OEM service manual.
OK ▼	
Engine is running on fumes drawn into the air intake	Check the air intake ducts. Locate and isolate the source of the fumes. Repair as necessary. Refer to the OEM service manual.
OK ▼	
Turbocharger oil seal is leaking	Check the turbocharger compressor and turbine seals. Contact a Cummins Authorized Repair Facility.

Fuel Consumption Excessive

This is symptom tree t087.

Cause	Correction
Fuel leak	Check the fuel lines, fuel connections, and fuel filters for leaks. Check the fuel lines to the supply tanks. Refer to the OEM service manual.
OK ↓	
Hubometer or odometer is miscalibrated	Check the hubometer and odometer calibrations. Calibrate or replace the hubometer or odometer, if necessary. Calculate fuel consumption with new mileage figures.
OK ↓	
Operator technique is **not** correct	Refer to Section 1, Operating Instructions.
OK ↓	
Equipment and environmental factors are affecting fuel consumption	Consider ambient temperatures, wind, tire size, axle alignment, routes, and use of aerodynamic aids when evaluating fuel consumption.
OK ↓	
Drivetrain is **not** correctly matched to the engine	Check for correct gearing and drivetrain components. Refer to the OEM vehicle specification
OK ↓	
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual in Section L.
OK ↓	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ↓	
Lubricating oil level is above specification	Check the oil level. Verify the dipstick calibration and oil pan capacity. Fill the system to the specified level. Refer to Section 3.
OK ↓	

(Continued)

Fuel Consumption Excessive (Continued)

Cause	Correction
Air intake system restriction is above specification	Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Section 3.
OK ↓	
Exhaust system restriction is above specification	Check the exhaust system for restrictions. Refer to the OEM service manual.
OK ↓	
Overhead adjustments are **not** correct	Measure and adjust the overhead settings. Refer to Section 6.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Fuel in Coolant

This is symptom tree t091.

Cause	Correction
Bulk coolant supply is contaminated	Check the bulk coolant supply. Drain the coolant, and replace with noncontaminated coolant. Replace the coolant filters.
OK ▼	
Fuel heater is malfunctioning (if equipped)	Check the fuel heater and replace, if necessary. Refer to the manufacturer's instructions.
OK ▼	
Contact a Cummins Authorized Repair Facility	

Fuel in the Lubricating Oil

This is symptom tree t092.

Cause	Correction
Bulk oil supply is contaminated	Check the bulk oil supply. Drain the oil and replace with noncontaminated oil. Replace the oil filters.
OK ↓	
Engine idle time is excessive	Low oil and coolant temperatures can be caused by long idle time (greater than 10 minutes). Shut off the engine rather than idle for long periods. If idle time is necessary, raise the idle speed.
OK ↓	
Fuel drain line is restricted	Inspect the fuel drain lines for restrictions. Remove any restrictions found. Refer to the OEM service manual.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Intake Manifold Air Temperature Above Specification

This is symptom tree t096.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ↓	
Intake manifold temperature gauge is malfunctioning, if equipped	Test the temperature gauge. Refer to the OEM service manual.
OK ↓	
Radiator shutters are **not** opening completely, or the shutterstat setting is wrong	Inspect the radiator shutters. Repair or replace if necessary. Refer to the manufacturer's instructions. Check the shutterstat setting.
OK ↓	
Cold weather radiator cover or winterfront is closed	Open the cold weather radiator cover or the winterfront. Maintain a minimum of 784 cm^2 [120 in^2], or approximately 28 x 28 cm [11 x 11 in], of opening at all times. Refer to Section 1.
OK ↓	
Charge-air cooler (CAC) fins, radiator fins, or air conditioner condenser fins are damaged or obstructed with debris	Inspect the CAC, air conditioner condenser, and radiator fins. Clean, if necessary. Refer to Section 3.
OK ↓	
Fan shroud is damaged or missing, or the air recirculation baffles are damaged or missing	Inspect the shroud and the recirculation baffles. Repair, replace, or install if necessary. Refer to the OEM service manual.
OK ↓	
Fan drive or fan controls are malfunctioning	Check the fan drive and controls. Refer to the OEM service manual.
OK ↓	
Fan is **not** an adequate size for the application	Verify that the fan is the correct size. Refer to the engine and OEM specifications.
OK ↓	
Contact a Cummins Authorized Repair Facility	

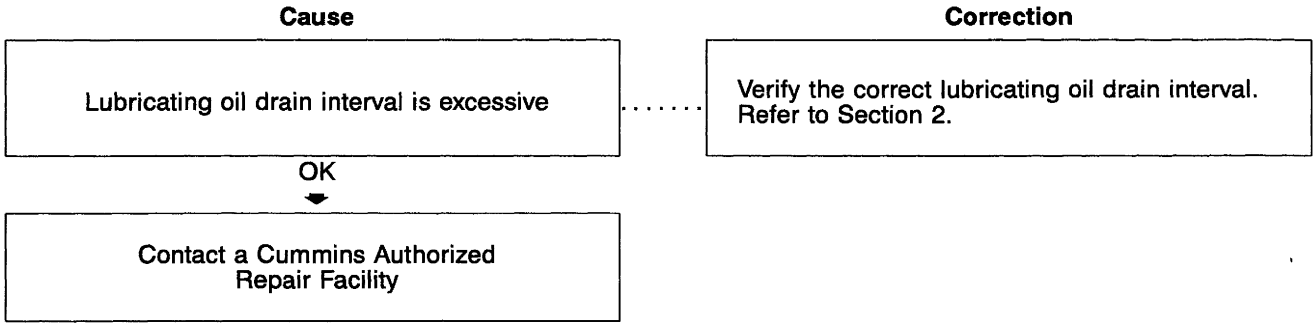
Lubricating Oil Consumption Excessive

This is symptom tree t102.

Cause	Correction
Verify the oil consumption rate	Check the amount of oil added versus the mileage.
OK ↓	
Lubricating oil leak (external)	Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to Section V for specifications.
OK ↓	
Crankcase ventilation system is plugged	Check and clean the crankcase breather and vent tube.
OK ↓	
Air compressor is pumping lubricating oil into the air system	Check the air lines for carbon buildup and lubricating oil. Refer to Section 3.
OK ↓	
Turbocharger oil seal is leaking	Check the turbocharger compressor and turbine seals. Contact a Cummins Authorized Repair Facility.
OK ↓	
Lubricating oil temperature is above specification	Contact a Cummins Authorized Repair Facility.
OK ↓	
Lubricating oil is contaminated with coolant or fuel	Contact a Cummins Authorized Repair Facility.
OK ↓	
Lubricating oil dipstick calibration is **not** correct	Check the dipstick calibration. Refer to Section 3.
OK ↓	
Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to the appropriate Troubleshooting and Repair Manual. Use the oil type recommended in Section V.
OK ↓	

(Continued)

Lubricating Oil Consumption Excessive (Continued)



Lubricating Oil Contaminated

This is symptom tree t103.

Cause	Correction
Bulk oil supply is contaminated	Check the bulk oil supply. Drain the oil and replace with noncontaminated oil. Replace the oil filters.
OK ↓	
Internal coolant leaks	Refer to the Coolant Loss - Internal symptom tree.
OK ↓	
Lubricating oil sludge is excessive	Refer to the Lubricating Oil Sludge in the Crankcase Is Excessive symptom tree.
OK ↓	
Fuel in the lubricating oil	Refer to the Fuel in the Lubricating oil symptom tree.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Lubricating Oil Pressure High

This is symptom tree t104.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ↓	
Lubricating oil pressure switch, gauge, or sensor is malfunctioning or is **not** in the correct location	Check the oil pressure switch, gauge, or sensor for correct operation and location. Refer to the OEM service manual.
OK ↓	
Coolant temperature is below specification	Refer to the Coolant Temperature Below Normal symptom tree.
OK ↓	
Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Section 4. Use the oil type recommended in Section V.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Lubricating Oil Pressure Low

This is symptom tree t105.

Cause	Correction
Lubricating oil level is above or below specification	Check the oil level. Add or drain oil, if necessary. Refer to Section 3.
OK ▼	
Lubricating oil leak (external)	Inspect the engine for external oil leaks. Tighten the capscrews, pipe plugs, and fittings. Replace gaskets, if necessary. Refer to Section V for specifications.
OK ▼	
Engine angularity during operation exceeds specification	Refer to the Engine Specification data sheet.
OK ▼	
Lubricating oil pressure switch, gauge, or sensor is malfunctioning or is **not** in the correct location	Check the oil pressure switch, gauge, or sensor for correct operation and location. Refer to the OEM service manual.
OK ▼	
Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Section 4. Use the oil type recommended in Section V.
OK ▼	
Lubricating oil is contaminated with coolant or fuel	Contact a Cummins Authorized Repair Facility.
OK ▼	
Lubricating oil filter is plugged	Change the oil and filter. Refer to Section 4. Review the oil change interval.
OK ▼	
Lubricating oil temperature is above specification	Contact a Cummins Authorized Repair Facility.

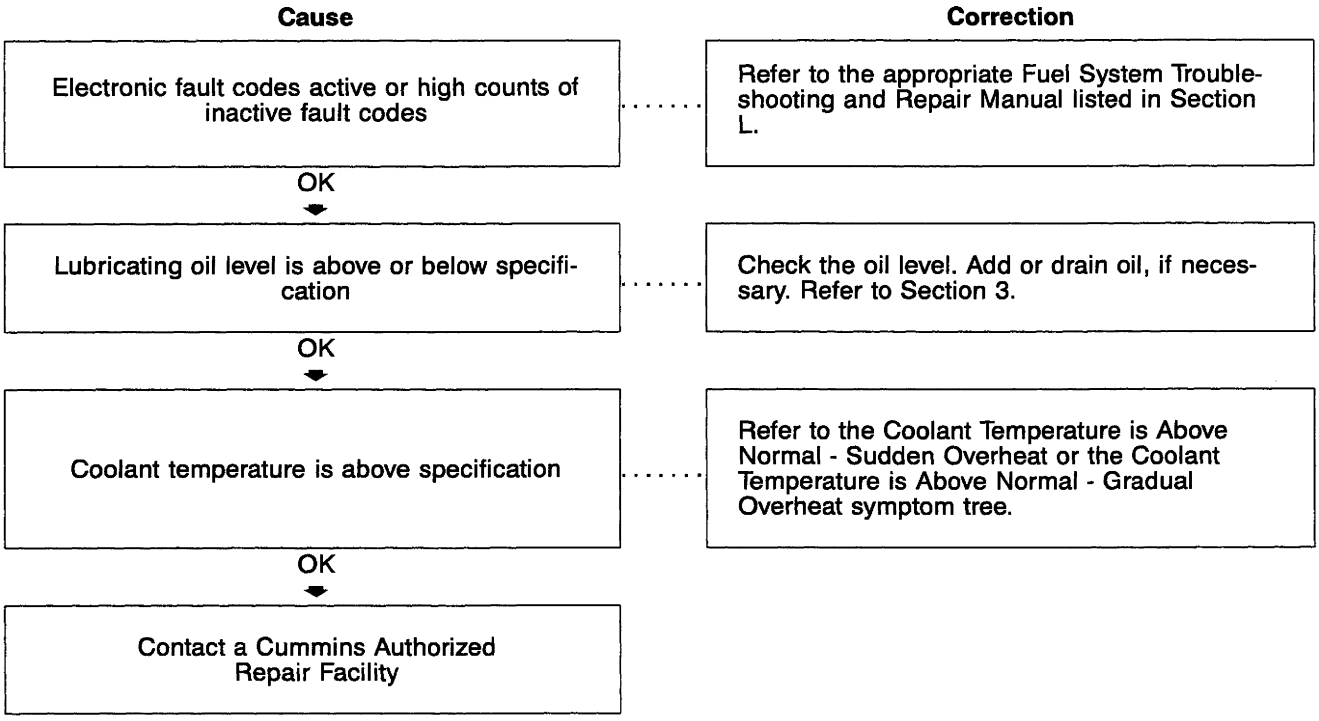
Lubricating Oil Sludge in the Crankcase Excessive

This is symptom tree t106.

Cause	Correction
Bulk oil supply is contaminated	Check the bulk oil supply. Drain the oil and replace with noncontaminated oil. Replace the oil filters.
OK ▼	
Lubricating oil does **not** meet specifications for operating conditions	Change the oil and filters. Refer to Section 4. Use the oil recommended in Section V.
OK ▼	
Lubricating oil drain interval is excessive	Verify the correct lubricating oil drain interval. Refer to Section 2.
OK ▼	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ▼	
Coolant temperature is below specification	Refer to the Coolant Temperature Below Normal symptom tree.
OK ▼	
Lubricating oil is contaminated with coolant or fuel	Contact a Cummins Authorized Repair Facility.
OK ▼	
Crankcase ventilation system is plugged	Check and clean the crankcase breather and vent tube.
OK ▼	
Contact a Cummins Authorized Repair Facility	

Lubricating Oil Temperature Above Specification

This is symptom tree t107.



Lubricating or Transmission Oil in the Coolant

This is symptom tree t108.

Cause	Correction
Bulk coolant supply is contaminated	Check the bulk coolant supply. Drain the coolant, and replace with noncontaminated coolant. Replace the coolant filters.
OK ▼	
Torque converter cooler or hydraulic oil cooler is malfunctioning	Remove and inspect the cooler cores and o-rings. Refer to the OEM service manual.
OK ▼	
Contact a Cummins Authorized Repair Facility	

Operating Fuel Pressure is Low

This is symptom tree t109.

Cause	Correction
Air in the fuel system	Prime the fuel pump. Refer to the OEM service manual.
OK ▼	
Fuel inlet restriction	Check the fuel filter. Refer to Section 3.

Smoke, Black — Excessive

This is symptom tree t116.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ↓	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ↓	
Air intake or exhaust leaks	Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting Refer to Section 5.
OK ↓	
Air intake system restriction is above specification	Check the air intake system for restriction. Clean or replace the air filter and inlet piping as necessary. Refer to Section 3.
OK ↓	
Exhaust system restriction is above specification	Check the exhaust system for restrictions. Refer to the OEM service manual.
OK ↓	
Charge-air cooler (CAC) is restricted or leaking	Inspect the CAC for air restrictions or leaks.
OK ↓	
Overhead adjustments are **not** correct	Measure and adjust the overhead settings. Refer to Section 6.
OK ↓	
Turbocharger oil seal is leaking	Check the turbocharger compressor and turbine seals. Contact a Cummins Authorized Repair Facility.
OK ↓	
Contact a Cummins Authorized Repair Facility	

Smoke, White — Excessive

This is symptom tree t118.

Cause	Correction
Electronic fault codes active or high counts of inactive fault codes	Refer to the appropriate Fuel System Troubleshooting and Repair Manual listed in Section L.
OK ▼	
Engine is cold	Allow the engine to warm to operating temperature. If the engine will **not** reach operating temperature, refer to the Coolant Temperature Below Normal symptom tree.
OK ▼	
Engine is operating at low ambient temperature	Check the winterfront, shutters, and underhood air. Refer to Cold Weather Operation, Bulletin No. 3387266. Use intake air from under the hood in cold weather.
OK ▼	
Fuel inlet restriction	Check for fuel inlet restriction. Contact a Cummins Authorized Repair Facility.
OK ▼	
Fuel grade is **not** correct for the application, or the fuel quality is poor	Operate the engine from a tank of high-quality fuel. Refer to Fuel Recommendations and Specifications in Section V.
OK ▼	
Overhead adjustments are **not** correct	Measure and adjust the overhead settings. Refer to Section 6.
OK ▼	
Contact a Cummins Authorized Repair Facility	

Turbocharger Boost Pressure Low

This is symptom tree t121.

Cause	Correction
Intake and exhaust system restricted	Check the intake and exhaust systems for restrictions. Inspect the intake air filter and replace as necessary.
OK ⬇	
Air intake or exhaust leaks	Check for loose or damaged piping connections and missing pipe plugs. Check the turbocharger and exhaust manifold mounting Refer to Section 5.
OK ⬇	
Contact a Cummins Authorized Repair Facility	

Turbocharger Leaks Engine Oil or Fuel

This is symptom tree t122.

Cause	Correction
Engine is operating for extended periods under light- or no-load conditions (slobbering)	Review the engine operating instructions in Section 1.
OK ▼	
Turbocharger oil seal is leaking	Check the turbocharger compressor and turbine seals. Contact a Cummins Authorized Repair Facility.

Section V - Maintenance Specifications

Section Contents

Page

Arctic Operation V-9
General Information V-9

Capscrew Markings and Torque Values V-16
Capscrew Markings and Torque Values - Metric V-17
Capscrew Markings and Torque Values - U.S. Customary V-18

Coolant Recommendations and Specifications V-10
Coolant Replacement Requirements V-15
Cooling System Sealing Additives V-12
Cooling System Soluble Oils V-12
Fleetguard® Nelson® DCA4 Service Filters and Liquid Precharge V-13
Fully Formulated Coolant/Antifreeze V-10
General Information V-10
Supplemental Coolant Additive (SCA) V-13
Test Intervals V-14
Testing SCA Concentration Level CC-2602 Test Kit V-13

Drive Belt Tension V-19

Engine Component Torque Values V-16

Fuel Recommendations and Specifications V-6
General Information V-6

Lubricating Oil Filter (Spin-On) V-9
General Specifications V-9

Lubricating Oil Recommendations and Specifications V-6
General Information V-6
New Engine Break-in Oils V-8
Oil Drain Intervals V-8
Industrial Applications V-8

Specifications V-1
Air Intake System V-2
Batteries (Specific Gravity) V-3
Cooling System V-2
Cummins/Fleetguard®/Nelson Filter Specifications V-5
Electrical System V-3
Exhaust System V-3
Fuel System V-1
General Specifications V-1
Lubricating Oil System V-1

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Specifications

General Specifications

Listed below are general specifications for this engine.

Horsepower ..... Refer to the engine dataplate

Engine Speed ..... Refer to the engine dataplate

Displacement ..... 15 liters [912 C.I.D.]

Bore and Stroke ..... 137 mm [5.40 in] x 169 mm [6.65 in]

Dry Engine Weight:
- Power Generation ..... 1370 kg [3020 lb]
- Industrial ..... 1524 kg [3360 lb]

Wet Engine Weight:
- Power Generation ..... 1475 kg [3250 lb]
- Industrial ..... 1628 kg [3590 lb]

Firing Order 1-5-3-6-2-4

Crankshaft Rotation (viewed from front of engine) ..... **Clockwise**

Overhead Adjustment:
- Intake Valve Adjustment ..... 0.36 mm [0.014 in]
- Exhaust Valve Adjustment ..... 0.69 mm [0.027 in]
- Injector Lash Adjustment Torque ..... 8 N•m [70 in-lb]
- Engine Brake Adjustment ..... 7.0 mm [0.276 in]

Fuel System

Maximum Allowable Restriction to Pump with or without Fuel Cooler:
- With Clean Filter ..... 203 mm Hg [8 in Hg]
- With Dirty Filter ..... 305 mm Hg [12 in Hg]

Maximum Allowable Fuel Return Line Restriction ..... 229 mm Hg [9.0 in Hg]

Minimum Allowable Fuel Tank Vent Capability ..... 2.0 m^3/hr [70 ft^3/hr]

Maximum Allowable Fuel Inlet Temperature ..... 71°C [160°F]

Fuel Shutoff Solenoids' Resistance ..... 7 to 8 ohms

Lubricating Oil System

Oil Pressure at Idle (minimum allowable at 93°C [200°F] oil temperature) ..... 103 kPa [15 psi]

Oil Pressure at No-Load Governed Speed (industrial **only**) ..... 241 to 276 kPa [35 to 40 psi]

Oil Capacity of Standard Engine:
- Combination Full-Flow/Bypass Filter Capacity ..... 3.78 liters [1 gal]
- Oil Pan Capacity:
  - Power Generation (OP 1493)
    - High ..... 94.6 liters [25 gal]
    - Low ..... 83.3 liters [22 gal]
    - Oil Change Capacity (oil pan and filter filled to capacity) ..... 98.4 liters [26 gal]
- Oil Pan Capacity:
  - Industrial
    - High ..... 41.6 liters [11 gal]
    - Low ..... 34.1 liters [9 gal]
    - Oil Change Capacity (oil pan and filter filled to capacity) ..... 45.4 liters [12 gal]

Total Lubricating Oil System Capacity Including Filter:
- Power Generation (OP 1493) ..... 98.4 liters [26 gal]
- Industrial ..... 45.4 liters [12 gal]

Oil Pressure Range:
- Cold Engine ..... Up to 900 kPa [130 psi]
- Warm Engine ..... 241 to 276 kPa [35 to 40 psi]

Cooling System

Coolant Capacity (engine **only**) ..... 24 liters [25 qt]

Standard Modulating Thermostat Range ..... 82 to 93°C [180 to 200°F]

Maximum Coolant Pressure
(exclusive of pressure cap - closed thermostat at the maximum no-load governed speed) ..... 227 kPa [33 psi]

Coolant Alarm Activation Temperature (industrial **only**) ..... 110°C [230°F]

Maximum Allowable Top Tank Temperature:
- Industrial ..... 102°C [215°F]
- Power Generation (Standby/Prime) ..... 110°C [230°F]/104°C [220°F]

Minimum Recommended Top Tank Temperature ..... 70°C [158°F]

Minimum Allowable Drawdown or 11 Percent of System Capacity (whichever is greater) ..... 2.6 liters [2.75 qt]

Minimum Recommended Pressure Cap
- Industrial ..... 50 kPa [7 psi]
- Power Generation ..... 70 kPa [10 psi]

Minimum Fill Rate (without low-level alarm) ..... 19 liters/min [5 gpm]

Maximum Deaeration Time ..... 25 minutes

Fan-on Coolant Temperature (industrial **only**) ..... 95°C [203°F]

Fan-on Intake Air Temperature (industrial **only**) ..... 66°C [150°F]

Shutter Opening Temperature (industrial **only**):
- Coolant ..... 85°C [185°F]
- Intake Air ..... 60°C [140°F]

Air Intake System

△ CAUTION △

Engine intake air must be filtered to prevent dirt and debris from entering the engine. If air intake piping is damaged or loose, unfiltered air will enter the engine and cause premature wear.

Maximum Temperature Rise between Ambient Air and Engine Air Inlet (ambient above 0°C [32°F]):
- Industrial ..... -1°C [30°F]
- Power Generation ..... 6°C [43°F].

Maximum Inlet Restriction (clean filter) Normal-Duty Element: ..... 381 mm H_2O [15 in H_2O]

Maximum Inlet Restriction (dirty filter) ..... 635 mm H_2O [25 in H_2O]

Maximum Allowable Pressure Drop across Charge Air Cooler:
- Industrial
  - psi ..... 14 kPa [2 psi]
  - Hg (mercury) ..... 102 mm Hg [4 in Hg]

Maximum Allowable Pressure Drop from Turbo Outlet to Intake Manifold:
- Power Generation
  - psi ..... 14 kPa [2 psi]
  - Hg (mercury) ..... 102 mm Hg [4 in Hg]

Four-Step Wastegate Controller Solenoid Resistance (industrial **only**) ..... 7 to 8 ohms

Exhaust System

Maximum Allowable Exhaust Back Pressure Created by Piping and Silencer:
Industrial
- Hg (mercury) ..... 76 mm Hg [3 in Hg]
- H_2O (water) ..... 1016 mm H_2O [40 in H_2O]

Power Generation
-Hg (mercury) ..... 51 mm Hg [2 in Hg]
-H_2O (water) ..... 682 mm H_2O [27 in H_2O]

Exhaust Pipe Size (normally acceptable inside diameter):
Industrial ..... 127 mm [5 in]
Power Generation ..... 152 mm [6 in]

Electrical System

Minimum Recommended Battery Capacity:

System Voltage		Ambient Temperatures -18°C [0°F]	
		Cold Cranking Amperes	Reserve Capacity* Amperes
12 VDC	Industrial	2700	360
	Power Generation	1800	540
24 VDC**	Industrial	1350	360
	Power Generation	900	270

* The number of plates within a given battery size determines reserve capacity. Reserve capacity determines the length of time that sustained cranking can occur.

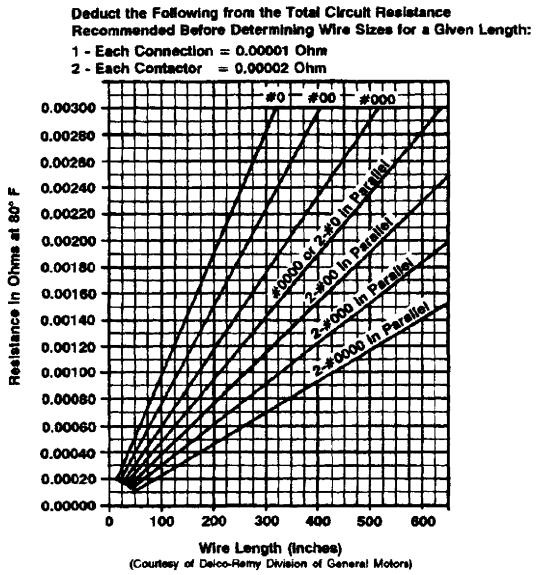
**CCA ratings are based on two 12-VDC batteries in series.

A minimum of 6 VDC at the OEM connector is required to power up the ECM.

Batteries (Specific Gravity)

Specific Gravity at 27°C [80°F]	State of Charge
1.26 to 1.28	100%
1.23 to 1.25	75%
1.20 to 1.22	50%
1.17 to 1.19	25%
1.11 to 1.13	Discharged

Maximum resistance of starting motor circuit:



oi800v07

12-VDC Starting Motor (ohms) 0.00075
24-VDC Starting Motor (ohms) 0.002

Cable resistances can be obtained in the accompanying Battery Cable Resistance Chart. If the frame is in ground circuit, the frame length **must** be considered to be a cable of the same size as that used in the balance of the system.

Item	Resistance Ohms
Connection	0.00001
Additional Contacter (Series-Parallel Switch, Relays, etc.)	0.00020

Cummins/Fleetguard®/Nelson Filter Specifications

⚠ CAUTION ⚠

QSX engine fuel filters must have an efficiency of 98.7 percent at 10 microns.

Fleetguard® Nelson® is a subsidiary of Cummins Engine Company, and Fleetguard® Nelson® filters are developed through joint testing at Cummins and Fleetguard® Nelson®. Fleetguard® Nelson® filters are standard on new Cummins engines and Cummins recommends their use.

Fleetguard® Nelson® products meet all of Cummins source approval test standards to provide the quality filtration necessary to achieve the engine's design life. If other brands are substituted, the purchaser **must** insist on products that the supplier has tested to meet CES 14,223 and 14,225, such as Fleetguard® Nelson® FS1007. For information on CES 14,223 and 14,225, write or call toll free:

Cummins Customer Assistance Center - 41403
Cummins Engine Company, Inc.
Box 3005
Columbus, IN 47202-3005

1-800-DIESELS
(1-800-343-7357)

Cummins can **not** be responsible for problems caused by nongenuine filters that do **not** meet Cummins' performance or durability requirements.

Fuel Recommendations and Specifications

General Information

⚠ WARNING ⚠

Do not mix gasoline, alcohol, or gasahol with diesel fuel. This mixture can cause an explosion.

Cummins Engine Company, Inc. recommends the use of ASTM No. 2 D fuel. The use of No. 2 diesel fuel will result in optimum engine performance. At operating temperatures below 0°C [32°F], acceptable performance can be obtained by using blends of No. 2 D and No. 1 D. The use of lighter fuels can reduce fuel economy.

The viscosity of the fuel **must** be kept above 1.3 cSt at 100°C [212°F] to provide adequate fuel system lubrication.

For a more detailed description of fuel properties, refer to *Fuel for Cummins Engines*, Bulletin No. 3379001. See ordering information in the back of this manual.

Lubricating Oil Recommendations and Specifications

General Information

The use of quality engine lubricating oils, combined with appropriate oil drain and filter change intervals, is a critical factor in maintaining engine performance and durability.

Cummins Engine Company, Inc. recommends the use of a high-quality 15W-40 multiviscosity heavy-duty engine oil that meets the requirements of Cummins Engineering Specification CES 20071 or CES 20076 (such as Valvoline® Premium Blue® or Premium Blue® 2000). American Petroleum Institute (API) specification CH-4 can be used as an alternative to CES 20071. Oils that meet API specification CG-4 can be used, but at a reduced drain interval according to the Oil Drain Intervals chart listed in Section 2. The oil grades CC, CD, CE, and CF have been obsoleted by API and should **not** be used.

Shortened drain intervals can be required with monograde oils as determined by close monitoring of the oil condition with scheduled oil sampling. Use of single-grade oils can affect engine oil control.

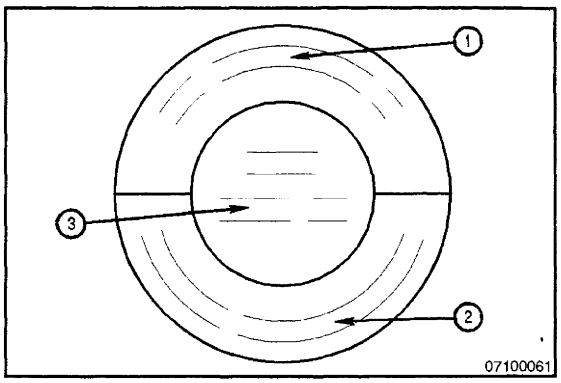
Synthetic engine oils, API category III, are recommended for use in Cummins engines operating in ambient temperature conditions consistently below -25°C[-13°F]. Above this temperature it is recommended that the petroleum-based multigrade lubricants be used. Synthetic 0W-30 oils that meet API category III can be used in operations where the ambient temperature **never** exceeds 0°C [32°F]. Multiviscosity oils rated 0W-30 do **not** offer the same level of protection against fuel dilution as do higher multigrade oils. Higher cylinder wear can be experienced when using 0W-30 oils in high-load situations.

For further details and an explanation of engine lubricating oils for Cummins engines, refer to Cummins Engine Oil Recommendations, Bulletin No. 3810340.

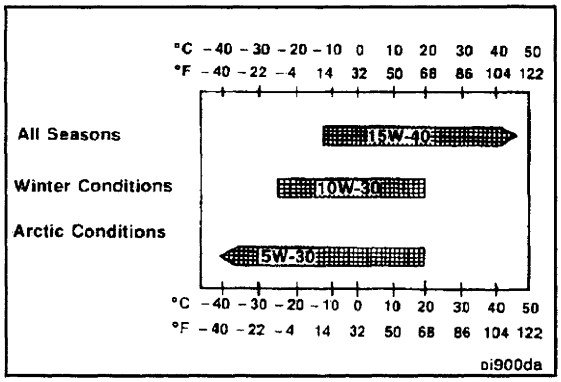
Additional information regarding lubricating oil availability throughout the world is available in the Engine Manufacturing Association (EMA) Lubricating Oils Data Book for Heavy-Duty Automotive and Industrial Engines. The data book can be ordered from Engine Manufacturers Association, One Illinois Center, 111 East Wacker Drive, Chicago, IL, U.S.A. 60601; (312) 644-6610.

The API service symbols are shown in the accompanying illustration.

1. The upper half of the symbols displays the appropriate oil categories.
2. The lower half contains words to describe oil energy-conserving features.
3. The center section identifies the SAE oil viscosity grade.

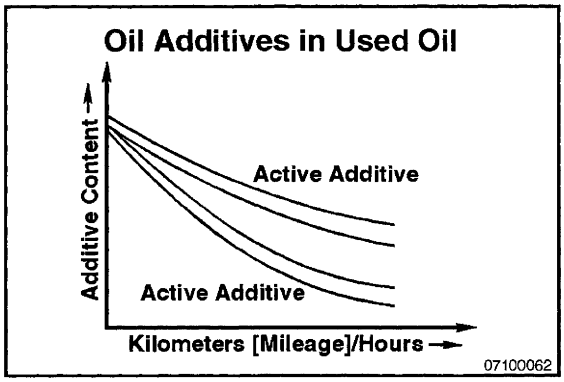


Oil viscosity should be chosen according to the typical climate conditions experienced by the user. Use of 15W-40 is recommended for the best engine durability at higher ambient temperature. For temperate or cold conditions, 10W-30 or 5W-30 viscosity can be used for easier starting, improved oil flow, and improved fuel economy.



New Engine Break-in Oils

Special "break-in" engine lubricating oils are **not** recommended for new or rebuilt Cummins engines. In general, use the same oil during break-in as that used in normal operation. Synthetic or partially synthetic engine lubricating oils, however, can **not** be used during break-in of a new or rebuilt engine. To make sure the piston rings seat properly, use a high-quality, petroleum-based engine lubricating oil during the first engine oil drain period.



Oil Drain Intervals

Industrial Applications

As the engine oil becomes contaminated, essential oil additives are depleted. Lubricating oils protect the engine as long as these additives are functioning properly. Progressive contamination of the oil between oil and filter change intervals is normal. The amount of contamination will vary depending on the operation of the engine, kilometers or miles on the oil, fuel consumed, and new oil added.

NOTE: Extending the oil and filter change interval beyond the recommendation will decrease engine life due to factors such as corrosion, deposits, and wear.

Refer to the oil drain chart in Section 2 to determine which oil drain interval to use for your application.

△ CAUTION △

The use of synthetic-base oil does not justify extended oil change intervals. Extended oil change intervals can decrease engine life due to factors such as corrosion, deposits, and wear.

Maximum oil drain intervals are based upon the use of fuel with 0.05-percent sulfur. Refer to Cummins Engine Oil Recommendations, Bulletin No. 3810340, for further details. If there are any questions about fuel sulfur content, ask your fuel supplier to provide a written analysis of the fuel.

The lubricating oil filter is to be replaced at each oil drain with a high-quality filter that meets the Cummins Source Approval Method 10,765 specification, including the cold-flow specifications.

Aftermarket Oil Additive Usage

Cummins Engine Company does **not** recommend the use of aftermarket oil additives. Present high-quality fully additive engine lubricating oils are very sophisticated, with precise amounts of additives blended into the lubricating oil to meet stringent requirements defined by Cummins Engineering Specification CES 20071 that is similar to API CH-4 and in CES 20076. These furnished oils meet performance characteristics that conform to the lubricant industry's standards. Aftermarket lubricating oil additives are **not** necessary to enhance engine oil performance and in some cases can reduce the finished oil's capability to protect the engine.

Arctic Operation

General Information

If an engine is operated in ambient temperatures consistently below -23°C [-10°F] and there are no provisions to keep the engine warm when it is **not** in operation, use a synthetic CF-4/SG or CG-4/SH engine oil with adequate low-temperature properties, such as 5W-30.

The oil supplier **must** be responsible for meeting the performance service specifications.

△ CAUTION △

The use of a synthetic-base oil does not justify extended oil change intervals. Extended oil change intervals can decrease engine life due to factors such as corrosion, deposits, and wear. Use oil meeting CES 20,076 for maximum oil change interval.

Lubricating Oil Filter (Spin-On)

General Specifications

Cummins Engine Company, Inc. requires a lubricating oil filter be used that meets Cummins Source Approval Method 10,765.

NOTE: Lubricating oil filter LF9000 (Cummins Part No. 3406810) meets these specifications.

For information on Cummins Source Approval Method 10,765, write or call toll free:

Cummins Customer Assistance Center - 41403
Cummins Engine Company, Inc.
Box 3005
Columbus, IN 47202-3005

1-800-DIESELS
(1-800-343-7357)

or contact Fleetguard® Nelson® at:

1-800-22FILTER
(1-800-223-4583)

Cummins can **not** be responsible for problems caused by nongenuine filters that do **not** meet Cummins performance or durability requirements.

Coolant Recommendations and Specifications

General Information

Cummins **strongly** recommends the use of fully formulated antifreeze or coolant containing a precharge of supplemental coolant additive (SCA). The antifreeze or coolant **must** meet the specifications outlined in The Maintenance Council (TMC) Recommended Practice (RP) 329 (ethylene glycol) or RP 330 (propylene glycol). The use of fully formulated antifreeze or coolant significantly simplifies cooling system maintenance.

Copies of TMC specifications can be obtained through Cummins Engine Company, Inc., or by contacting:

The Maintenance Council
American Trucking Association
2200 Mill Road
Alexandria, VA 22314-5388
Phone: (703) 838-1763
Fax: (703) 836-6070

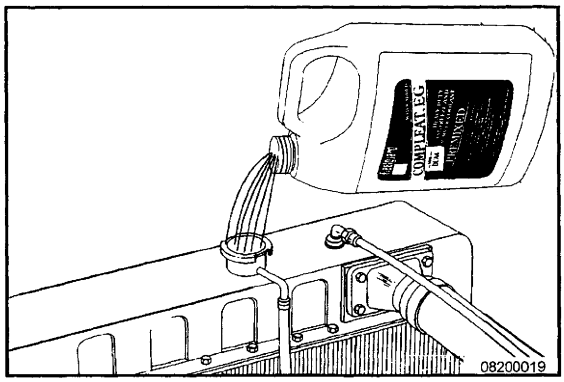
Fully formulated **antifreeze** contains balanced amounts of antifreeze, SCA, and buffering compounds, but does **not** contain 50-percent water. Fully formulated **coolant** contains balanced amounts of antifreeze, SCA, and buffering compounds already premixed 50/50 with deionized water.

Fleetguard® Nelson®'s Extended Service (ES) Cooling System maintenance is described in Cummins Service Bulletin 3666209.

The following pages will give an explanation of water, antifreeze, and SCA. They will also explain how to test antifreeze and SCA levels.

△ CAUTION △

The QSX15 engine uses aluminum parts that are in contact with the coolant. Improper coolant, coolant filter selection, and maintenance will likely result in perforation of one of these parts.



Fully Formulated Coolant/Antifreeze

Cummins Engine Company, Inc. recommends using either a 50/50 mixture of good-quality water and fully formulated antifreeze, or fully formulated coolant when filling the cooling system. The fully formulated antifreeze or coolant **must** meet TMC RP329 or TMC RP330 specifications.

NOTE: Use of products meeting TMC RP329 or RP330 is necessary for 50,000-mile and 150,000-mile service intervals.

NOTE: Low-silicate antifreeze meeting ASTM D4985 is inadequate for these extended service intervals.

Water Quality	
Calcium Magnesium (Hardness)	Maximum 170 ppm as ($CaCO_3$ + $MgCO_3$)
Chloride	40 ppm as(Cl)
Sulfur	100 ppm as (SO_4)

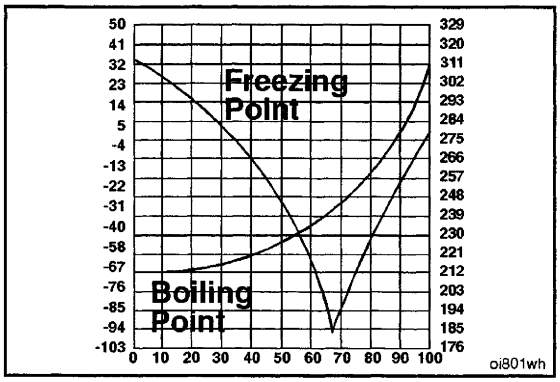
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Good-quality water is important for cooling system performance. Excessive levels of calcium and magnesium contribute to scaling problems, and excessive levels of chlorides and sulfates cause cooling system corrosion.

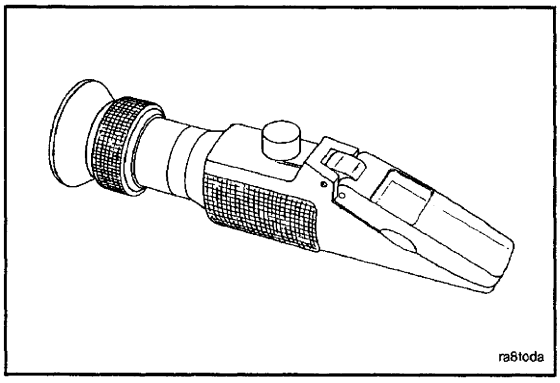
Cummins Engine Company, Inc. recommends using Fleetguard® Nelson® Compleat. It is available in glycol forms (ethelyne and propylene) and complies with TMC RP329 and RP330 standards.



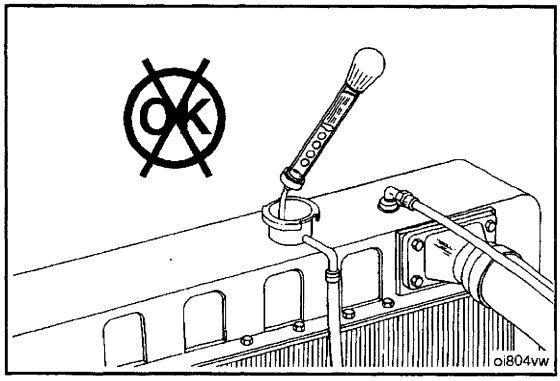
Fully formulated antifreeze **must** be mixed with quality water at a 50/50 ratio (40-percent to 60-percent working range). A 50/50 mixture of antifreeze and water gives a -36°C [-34°F] freezing point and a 110°C [228°F] boiling point, which is adequate for locations in North America. The actual lowest freezing point of ethylene glycol antifreeze is 68 percent. Using higher concentrations of antifreeze will raise the freezing point of the solution and increase the possibility of a silica gel problem.

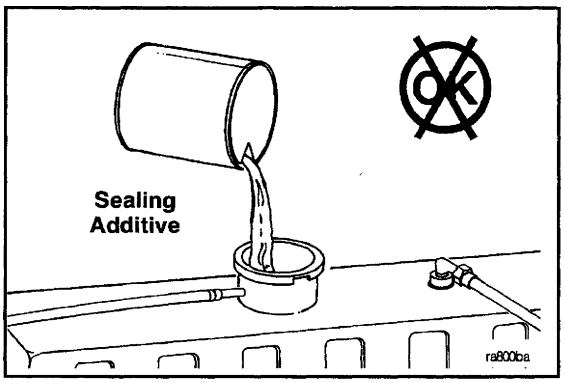


A refractometer **must** be used to measure the freezing point of the coolant **accurately**.



Do **not** use a floating ball hydrometer. Using a floating ball hydrometer can give an incorrect reading.

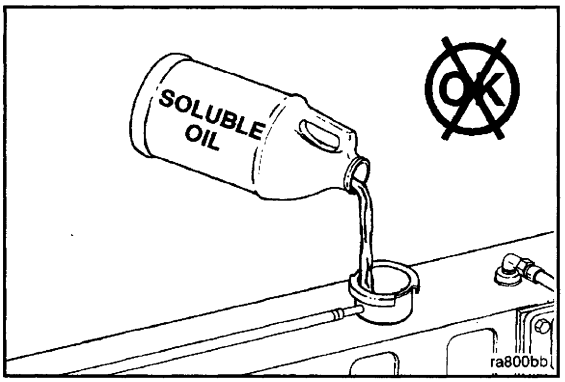




Cooling System Sealing Additives

Do **not** use sealing additives in the cooling systems. The use of sealing additives can:

- Build up in coolant low-flow areas
- Clog coolant filters
- Plug radiator and oil cooler.



Cooling System Soluble Oils

Do **not** use soluble oils in the cooling system. The use of soluble oils can:

- Allow cylinder liner pitting
- Corrode brass, aluminum, and copper
- Damage heat transfer surfaces
- Damage seals and hoses.

Fleetguard® Nelson® DCA4 Service Filters and Liquid Precharge

QSX Series Coolant Filter Options

WF2125 – This filter is designed for use with Fleetguard® Nelson®'s extended service cooling system, which extends cooling system service to 1 year, 150,000 miles, or 4000 hours, whichever comes first. This filter is used for cooling systems up to 20 gallons. Refer to Cummins Service Bulletin No. 3666209. Fleetguard® Nelson® ES coolant **must** be used for all fill and top-off, which is critical for extended cooling system maintenance intervals.

WF2126 – This filter is designed for extended service intervals up to 50,000 miles when using TMC RP329 or RP330 coolants and is used for cooling systems up to 20 gallons. Refer to Cummins Service Bulletin No. 3666132, Section 3.

WF2127 – This filter has been designed for extended service intervals of 50,000 to 150,000 miles. It has no chemical additives and can be used in the following systems:

- Cooling systems above 20 gallons in capacity.
- See maintenance chart below.

When using WF2127 filter, the following volumes of treatment must be added at the designated mileages:

Cooling System Capacity	50,000-Mile Service Interval with RP329/330 Coolant or Treated Water (Fleetcool or DCA4)	150,000-Mile Service Interval with ES Coolant (ES Liquid)
0 to 20 gallons	1 qt (10 units)	1 qt (15 units)
20 to 40 gallons	2 qt (20 units)	2 qt (30 units)
40 to 60 gallons	3 qt (30 units)	3 qt (45 units)
60 to 80 gallons	4 qt (40 units)	4 qt (60 units)
80 to 100 gallons	5 qt (50 units)	5 qt (75 units)

NOTE: Filters **must** meet Cummins SAM 10,769. Fleetguard® Nelson® filters meet Cummins SAM 10,769.

NOTE: The standard filter for the Signature engine is Fleetguard® Nelson® WF2126.

NOTE: For systems larger than 100 gallons, use 1 quart per 20 gallons.

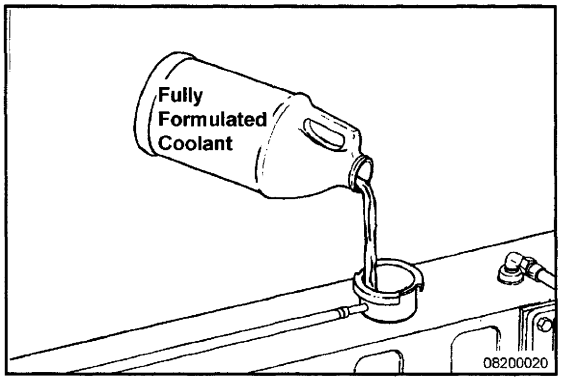
NOTE: Consult vehicle manufacturer for total cooling system capacity.

Supplemental Coolant Additive (SCA)

⚠ CAUTION ⚠

The QSX engine uses aluminum parts that are in contact with the coolant. Improper coolant, coolant filter selection, and maintenance will likely result in perforation of one of these parts. Insufficient concentration of the coolant additives will result in liner pitting and engine failure.

Fully formulated products contain SCAs and are required to protect the cooling system from scale and fouling, solder blooming, and general corrosion. The coolant filter is required to protect the cooling system from abrasive materials, debris, and precipitated coolant additives.



Testing SCA Concentration Level CC-2602 Test Kit

Carefully follow the instructions to test the coolant and take the appropriate action recommended by the kit.

- The coolant sample to be tested **must** be between 10 and 54 °C [50 and 130 °F]. If the sample is too cold or too hot, you will get incorrect results.
- To get the best color match results, compare test strip pads to the color chart in daylight or under cool white fluorescent lighting. If unsure about a specific color match when a test does fall between two colors on the color chart, choose the lower numbered block. It is safer to underestimate your results than to overestimate.
- The test strips do have a limited shelf life and are sensitive to humidity and extreme heat. Proper handling and storage is necessary to protect the life of the strips.
- Keep the cap tightly sealed on the test strip bottle **except** when removing a strip. Store away from direct sunlight and in an area where the temperature will generally stay below 32°C [90°F].
- Do **not** use the test strips after the expiration date stamped on the bottle.

- Discard the kit if any of the pads on the unused strips have turned light brown or pink.
- Use one strip at a time and take care **not** to touch any of the pads on the strip. Doing so will contaminate the pads and skew the test results.
- If the strip container is left uncapped for 24 hours, moisture in the air will render the strips useless, even though no discoloration will be evident.
- **Only** use the color chart supplied with the kit.
- Clean and dry the sample cup and syringe after each use. This will prevent contaminating future samples.
- Following the correct test times is very important. Use a clock or stopwatch.
- Do **not** utilize the test kit to maintain minimum SCA concentration levels (i.e., 1.5 units).
- When performing service that requires draining the cooling system, take special precautions to collect coolant in a clean container, seal coolant to prevent contamination, and save for reuse.

Coolant Testing

- Probablizer:
  3318169S Plug – Installs on the engine for easy coolant sampling
  3318168S Cap – Use with Monitor C bottle to sample coolant
  CC2700 Monitor C™– Lab analysis of coolant samples for more detailed analysis.

CC2602 Coolant Test Kit

- Works with any SCA formulation. (Call 1-800-521-4005 if you have this test kit and the color chart does **not** show the number of units of SCA gallon of coolant.)



Test Intervals

⚠ WARNING ⚠

Do not remove the pressure cap from a hot engine. Wait until coolant temperature is below 50°C [120°F] before removing the pressure cap. Heated coolant spray or steam can cause personal injury.

Testing is recommended if the operator is **not** sure of his cooling system condition due to leaks, uncontrolled topping off of the system, or major coolant loss.

If the concentration is below 1.2 units per gallon, replace the filter and precharge with liquid.

Check the SCA concentration level at least every 6 months, and anytime the coolant condition is unknown or corrosion is apparent within the cooling system.

Use Fleetguard® Nelson® coolant test kit, CC2602, to check the concentration level. Instructions are included with the test kit.

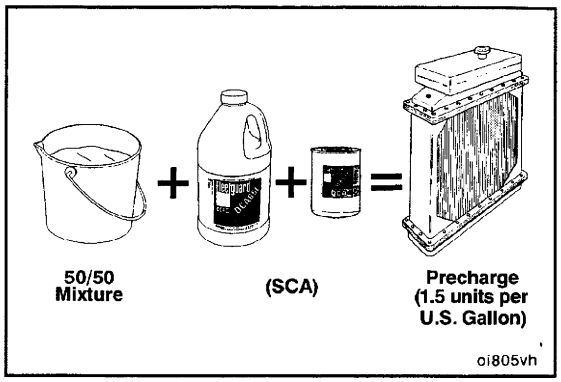
Call the following numbers to get answers to any questions you have about cooling system maintenance:

Cummins	Fleetguard® Nelson®
1-800-DIESELS	1-800-22FILTER
1-800-343-7357	1-800-223-4583

Coolant Replacement Requirements

Drain and flush the cooling system after 6000 hours or 3 years of service. However, if Fleetguard® Nelson®'s ES coolant and ES filters are used, check chloride, sulfate, and pH levels according to Service Bulletin to determine whether the coolant **must** be replaced. Refer to Bulletin No. 3666209. Refill with either new fully formulated coolant or ES coolant.

NOTE: Dispose of used coolant/antifreeze in accordance with federal, state, and local laws and regulations.



Engine Component Torque Values

Component	Wrench Size	Torque Value	
		N•m	ft-lb
Oil Pan Drain Plug		47	35
Rocker Cover Capscrews	10 mm	25	16
Air Intake Piping V-Band Clamps	7/16	8.5	75 in-lb
Injector Adjusting Screw Locknut	24 mm	75	55
Injector Adjusting Screw	8 mm	8	70 in-lb
Valve Adjusting Screw	6 mm	0.6	5 in-lb
Valve Adjusting Screw Locknut	19 mm	45	33
Engine Brake Adjusting Screw	3 mm	N/A	N/A
Engine Brake Adjusting Screw Locknut	13 mm	20	15
Turbocharger Oil Drain Capscrews	13 mm	25	16
Turbocharger Male Union Elbow	22 mm	30	22
Turbocharger Oil Supply Line Fitting	21 mm	30	22
Turbocharger V-Band Clamps	7/16	8.5	75 in-lb
Turbocharger Mounting Nuts	15 mm	60	45

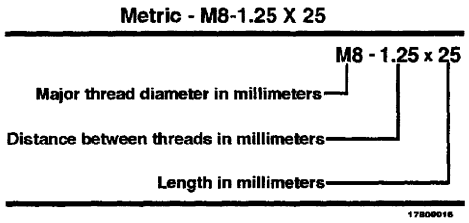
Capscrew Markings and Torque Values

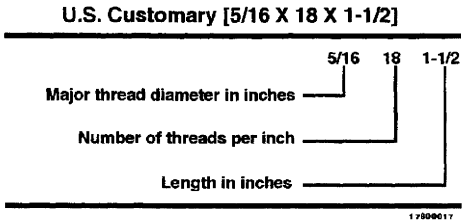
△ CAUTION △

When replacing capscrews, always use a capscrew of the same measurement and strength as the capscrew being replaced. Using the wrong capscrews can result in engine damage.

Metric capscrews and nuts are identified by the grade number stamped on the head of the capscrew or on the surface of the nuts. U.S. Customary capscrews are identified by radial lines stamped on the head of the capscrew.

The following examples indicate how capscrews are identified:

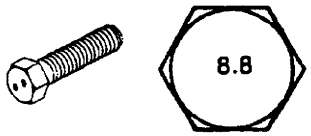
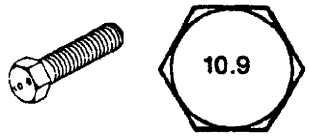
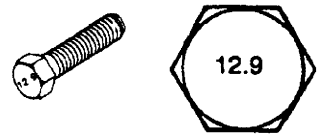




NOTES:

1. **Always** use the torque values listed in the following tables when specific torque values are **not** available.
2. Do **not** use the torque values in place of those specified in other sections of this manual.
3. The torque values in the table are based on the use of lubricated threads.
4. When the ft-lb value is less than 10, convert the ft-lb value to in-lb to obtain a better torque with an in-lb torque wrench. Example: 6 ft-lb equals 72 in-lb.

Capscrew Markings and Torque Values - Metric

Commercial Steel Class	8.8	10.9	12.9
Capscrew Head Markings			

Body Size	Torque				Torque				Torque			
Diameter	Cast Iron		Aluminum		Cast Iron		Aluminum		Cast Iron		Aluminum	
mm	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
6	9	5	7	4	13	10	7	4	14	9	7	4
7	14	9	11	7	18	14	11	7	23	18	11	7
8	23	17	18	14	33	25	18	14	40	29	18	14
10	45	33	30	25	65	50	30	25	70	50	30	25
12	80	60	55	40	115	85	55	40	125	95	55	40
14	125	90	90	65	180	133	90	65	195	145	90	65
16	195	140	140	100	280	200	140	100	290	210	140	100
18	280	200	180	135	390	285	180	135	400	290	180	135
20	400	290	—	—	550	400	—	—	—	—	—	—

Capscrew Markings and Torque Values - U.S. Customary

SAE Grade Number	5	8
Capscrew Head Markings These are all SAE Grade 5 (3 line)		



Capscrew Body Size	Capscrew Torque - Grade 5 Capscrew				Capscrew Torque - Grade 8 Capscrew			
	Cast Iron		Aluminum		Cast Iron		Aluminum	
	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb	N•m	ft-lb
1/4 - 20	9	7	8	6	15	11	8	6
1/4 - 28	12	9	9	7	18	13	9	7
5/16 - 18	20	15	16	12	30	22	16	12
5/16 - 24	23	17	19	14	33	24	19	14
3/8 - 16	40	30	25	20	55	40	25	20
3/8 - 24	40	30	35	25	60	45	35	25
7/16 - 14	60	45	45	35	90	65	45	35
7/16 - 20	65	50	55	40	95	70	55	40
1/2 - 13	95	70	75	55	130	95	75	55
1/2 - 20	100	75	80	60	150	110	80	60
9/16 - 12	135	100	110	80	190	140	110	80
9/16 - 18	150	110	115	85	210	155	115	85
5/8 - 11	180	135	150	110	255	190	150	110
5/8 - 18	210	155	160	120	290	215	160	120
3/4 - 10	325	240	255	190	460	340	255	190
3/4 - 16	365	270	285	210	515	380	285	210
7/8 - 9	490	360	380	280	745	550	380	280
7/8 - 14	530	390	420	310	825	610	420	310
1 - 8	720	530	570	420	1100	820	570	420
1 - 14	800	590	650	480	1200	890	650	480

Drive Belt Tension

SAE Belt Size	Belt Tension Gauge Part No.		Belt Tension New		Belt Tension Range Used*	
	Click-type	Burroughs	N	lbf	N	lbf
0.380 in	3822524		620	140	270 to 490	60 to 110
0.440 in	3822524		620	140	270 to 490	60 to 110
1/2 in	3822524	ST-1138	620	140	270 to 490	60 to 110
11/16 in	3822524	ST-1138	620	140	270 to 490	60 to 110
3/4 in	3822524	ST-1138	620	140	270 to 490	60 to 110
7/8 in	3822524	ST-1138	620	140	270 to 490	60 to 110
4 rib	3822524	ST-1138	620	140	270 to 490	60 to 110
5 rib	3822524	ST-1138	670	150	270 to 530	60 to 120
6 rib	3822525	ST-1293	710	160	290 to 580	65 to 130
8 rib	3822525	ST-1293	890	200	360 to 710	80 to 160
10 rib	3822525	3823138	1110	250	440 to 890	100 to 200
12 rib	3822525	3823138	1330	300	530 to 1070	120 to 240
12 rib K section	3822525	3823138	1330	300	890 to 1070	200 to 240

NOTE: This chart does not apply to automatic belt tensioners.

* A belt is considered used if it has been in service for ten minutes or longer.
* If used belt tension is less than the minimum value, tighten the belt to the maximum used belt value.

NOTES

Section W - Warranty

Section Contents

Page

California Emission Control System Warranty, Off-Highway W-9
Moteurs tout terrain Etats-Unis et Canada W-11
Off-Highway Engines International W-4
Off-Highway Engines United States and Canada W-1
Worldwide Generator Drive W-6

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Off-Highway Engines United States and Canada

Coverage

Products Warranted

This warranty applies to new Engines sold by Cummins and delivered to the first user on or after April 1, 1999, that are used in industrial (off-highway) applications in the United States* and Canada, except for Engines used in marine, generator drive and certain defense applications, for which different warranty coverage is provided.

Base Engine Warranty

This warranty covers any failures of the Engine, under normal use and service, which result from a defect in material or factory workmanship (Warrantable Failures).

Coverage begins with the sale of the Engine by Cummins. Coverage continues for two years or 2,000 hours of operation, whichever occurs first, from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first. If the 2,000 hour limit is exceeded during the first year, Coverage continues until the end of the first year.

Extended Major Components Warranty

The Extended Major Components Warranty covers Warrantable Failures of the Engine cylinder block, camshaft, crankshaft and connecting rods (Covered Parts).

Bushing and bearing failures are not covered.

This Coverage begins with the expiration of the Base Engine Warranty and ends three years or 10,000 hours of operation from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or from when the Engine has been operated for 50 hours, whichever occurs first.

Consumer Products

The warranty on Consumer Products in the United States is a LIMITED warranty. **CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.** Any implied warranties applicable to Consumer Products in the United States terminate concurrently with the expiration of the express warranties applicable to the product. In the United States, some states do not allow the exclusion of incidental or consequential damages, or limitations on how long an implied warranty lasts, so the limitations or exclusions herein may not apply to you.

These warranties are made to all Owners in the chain of distribution, and Coverage continues to all subsequent Owners until the end of the periods of Coverage.

Cummins' Responsibilities

During The Base Engine Warranty

Cummins will pay for all parts and labor needed to repair the damage to the Engine resulting from a Warrantable Failure.

Cummins will pay for the lubricating oil, antifreeze, filter elements, and other maintenance items that are not reusable due to the Warrantable Failure.

Cummins will pay reasonable costs for mechanics to travel to and from the equipment site, including meals, mileage and lodging, when the repair is performed at the site of the failure.

Cummins will pay reasonable labor costs for Engine removal and reinstallation when necessary to repair a Warrantable Failure.

During The Extended Major Components Warranty

Cummins will pay for the repair or, at its option, replacement of the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Covered part.

Owner's Responsibilities

During The Base Engine Warranty

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items provided during warranty repairs unless such items are not reusable due to the Warrantable Failure.

During The Extended Major Components Warranty

Owner is responsible for the cost of all labor needed to repair the Engine, including the labor to remove and reinstall the Engine. When Cummins elects to repair a part instead of replacing it, Owner is not responsible for the labor needed

to repair the part.

Owner is responsible for the cost of all parts required for the repair except for the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Covered Part.

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items replaced during repair of a Warrantable Failure.

During The Base Engine and Extended Major Components Warranties

Owner is responsible for the operation and maintenance of the Engine as specified in the applicable Cummins Operation and Maintenance Manual. Owner is also responsible for providing proof that all recommended maintenance has been performed.

Before the expiration of the applicable warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the Engine available for repair by such facility. Locations in the United States and Canada are listed in the Cummins Off Highway Authorized Dealer Directory.

Owner is responsible for communication expenses, meals, lodging and similar costs incurred as a result of a Warrantable Failure.

Owner is responsible for non-Engine repairs, "downtime" expenses, cargo damage, fines, all applicable taxes, all business costs and other losses resulting from a Warrantable Failure.

Limitations

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine. Cummins is also not responsible for failures caused by incorrect oil or fuel or by water, dirt or other contaminants in the fuel or oil.

For power units and fire pumps (package units), this warranty applies to accessories, except for clutches and filters, supplied by Cummins which bear the name of another company.

Except for power units and fire pumps, this warranty does not apply to accessories which bear the name of another company. Such non-warranted accessories include, but are not limited to: alternators, starters, fans**, air conditioning compressors, clutches, filters, transmissions, torque converters, steering pumps, and non-Cummins fan drives, engine compression brakes and air compressors.

Cummins Compusave units are covered by a separate warranty.

Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

Failures of belts and hoses supplied by Cummins are not covered beyond the first 500 hours or one year of operation, whichever occurs first.

Parts used to repair a Warrantable Failure may be new Cummins parts, Cummins-approved rebuilt parts, or repaired parts. Cummins is not responsible for failures resulting from the use of parts not approved by Cummins.

A new Cummins or Cummins-approved rebuilt part used to repair a Warrantable Failure assumes the identity of the part it replaced and is entitled to the remaining coverage hereunder.

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

THESE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS IN REGARD TO THESE ENGINES. CUMMINS MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Emission Warranty

Products Warranted

This emission warranty applies to new Engines marketed by Cummins that are used in the United States* in vehicles designed for Industrial off-highway use. This warranty applies to Engines delivered to the ultimate purchaser on or after April 1, 1999 for engines up to 750 horsepower, on or after January 1, 2000 for engines 751 horsepower and over.

Coverage

Cummins warrants to the ultimate purchaser and each subsequent purchaser that the Engine is designed, built and equipped so as to conform at the time of sale by Cummins with all U.S. Federal emission regulations applicable at the time of manufacture and that it is free from defects in workmanship or material which would cause it not to meet these regulations within the longer of the following periods: (A) Five years or 3,000 hours of operation, whichever occurs first, as measured from the date of delivery of the Engine to the ultimate purchaser, or (B) The Base Engine Warranty.

If the vehicle in which the Engine is installed is registered in the state of California, a separate California Emission Warranty also applies.

Limitations

Failures, other than those resulting from defects in materials, or workmanship, are not covered by this warranty.

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolant or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine. Cummins is also not responsible for failures caused by incorrect fuel or by water, dirt or other contaminants in the fuel.

Cummins is not responsible for non-Engine repairs, "downtime" expenses, cargo damage, fines, all business costs or other losses resulting from a Warrantable Failure.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

* Includes American Samoa, the Commonwealth of Northern Mariana Islands, Guam, Puerto Rico, and the U.S. Virgin Islands.

** Alternators, starters, and fans ARE covered for the duration of the base engine warranty on B3.3 engines.

Off-Highway Engines International

Coverage

PRODUCTS WARRANTED

This warranty applies to new Engines sold by Cummins and delivered to the first user on or after April 1, 1999, that are used in industrial (off-highway) applications anywhere in the world where Cummins-approved service is available, except the United States* and Canada. Different warranty coverage is provided for Engines used in marine, generator drive and certain defense applications.

BASE ENGINE WARRANTY

This warranty covers any failures of the Engine, under normal use and service, which result from a defect in material or factory workmanship (Warrantable Failure).

Coverage begins with the sale of the Engine by Cummins. Coverage continues for two years or 2,000 hours of operation, whichever occurs first, from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first. If the 2,000 hour limit is exceeded during the first year, coverage continues until the end of the first year.

EXTENDED MAJOR COMPONENTS WARRANTY

The Extended Major Components Warranty covers Warrantable Failures of the Engine cylinder block, camshaft, crankshaft and connecting rods (Covered Parts).

Bushing and bearing failures are not covered.

This coverage begins with the expiration of the Base Engine Warranty and ends three years or 10,000 hours of operation, from the date of delivery of the Engine to the first user, or from the date the unit is first leased, rented or loaned, or from when the Engine has been operated for 50 hours, whichever occurs first.

These warranties are made to all Owners in the chain of distribution, and Coverage continues to all subsequent Owners until the end of the periods of Coverage.

Cummins' Responsibilities

DURING THE BASE ENGINE WARRANTY

Cummins will pay for all parts and labor needed to repair the damage to the Engine resulting from a Warrantable Failure.

Cummins will pay for the lubricating oil, antifreeze, filter elements, and other maintenance items that are not reusable due to a Warrantable Failure.

Cummins will pay reasonable costs for mechanics to travel to and from the equipment site, including meals, mileage and lodging, when the repair is performed at the site of the failure.

Cummins will pay reasonable labor costs for Engine removal and reinstallation when necessary to repair a Warrantable Failure.

DURING THE EXTENDED MAJOR COMPONENTS WARRANTY

Cummins will pay for the repair or, at its option, replacement of the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Covered part.

Owner's Responsibilities

DURING THE BASE ENGINE WARRANTY

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items replaced during warranty repairs unless such items are not reusable due to the Warrantable Failure.

DURING THE EXTENDED MAJOR COMPONENTS WARRANTY

Owner is responsible for the cost of all labor needed to repair the Engine, including the labor to remove and reinstall the Engine. When Cummins elects to repair a part instead of replacing it, Owner is not responsible for the labor needed to repair the part.

Owner is responsible for the cost of all parts required for the repair except for the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Covered Part.

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items replaced during repair of a Warrantable Failure.

DURING THE BASE ENGINE AND EXTENDED MAJOR COMPONENTS WARRANTIES

Owner is responsible for the operation and maintenance of the Engine as specified in the applicable Cummins Operation and Maintenance Manual. Owner is also responsible for providing proof that all recommended maintenance has been performed.

Before the expiration of the applicable warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the product available for repair by such facility. Locations are listed in the Cummins International Sales and Service Directory.

Owner is responsible for communication expenses, meals, lodging and similar costs incurred as a result of a Warrantable Failure.

Owner is responsible for non-Engine repairs, "downtime" expenses, cargo damage, fines, all applicable taxes, all business costs and other losses resulting from a Warrantable Failure.

Limitations

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications of the Engine. Cummins is also not responsible for failures caused by incorrect oil or fuel or by water, dirt or other contaminants in the fuel or oil.

For power units and fire pumps (package units) the warranty applies to accessories, except for clutches and filters supplied by Cummins which bear the name of another company.

Starters, alternators, power steering pumps and non-Cummins air compressors supplied by Cummins on B or C Series Engines that are not supplied as part of a package unit are covered for six months* from the date of delivery of the Engine to the first user, or the date the Engine is first leased, rented or loaned, or from when the Engine has been operated for 50 hours, whichever occurs first.

Except for the accessories noted previously, Cummins does not warrant accessories which bear the name of another company. Such non-warranted accessories include, but are not limited to: alternators, starters, fans*, air conditioning compressors, clutches, filters, transmissions, torque converters, steering pumps, non-Cummins fan drives, and air cleaners.

Cummins Compusave units are covered by a separate warranty.

Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

Failures of belts and hoses supplied by Cummins are not covered beyond the first 500 hours or one year of operation, whichever occurs first.

Parts used to repair a Warrantable Failure may be new Cummins parts, Cummins-approved rebuilt parts, or repaired parts. Cummins is not responsible for failures resulting from the use of parts not approved by Cummins.

A new Cummins or Cummins-approved rebuilt part used to repair a Warrantable Failure assumes the identity of the part it replaced and is entitled to the remaining coverage hereunder.

CUMMINS DOES NOT COVER WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

THESE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS IN REGARD TO THESE ENGINES. CUMMINS MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

In case of consumer sales, in some countries, the Owner has statutory rights which cannot be affected or limited by the terms of this warranty.

Nothing in this warranty excludes or restricts any contractual rights the Owner may have against third parties.

* Alternators, starters, and fans ARE covered for the duration of the base engine warranty on B3.3 engines.

Worldwide Generator Drive

Engines Warranted

This warranty applies to new Engines sold by Cummins and delivered to the first user on or after April 1, 1999 that are used in generator drive application anywhere in the world where Cummins approved service is available. These Engines will have the following rating designations:

Standby Power Rating

Engines of this rating are applicable for supplying emergency power for the duration of the utility power outage. No overload capability is available for this rating. Under no condition is an Engine allowed to operate in parallel with the public utility at the Standby Power rating. This rating should be applied where reliable utility power is available. A standby rated engine is to be sized for a maximum of an 80 percent average load factor and 200 hours of operation per year. This includes less than 25 hours per year at the Standby Power rating. Standby rating should never be applied except in true emergency power outages. Negotiated power outages contracted with a utility company are not considered an emergency.

Unlimited Time Running Prime Power Rating

Engines with this rating are available for an unlimited number of hours per year in a variable load application. Variable load is not to exceed a 70 percent average of the Prime Power Rating during any operating period of 250 hours. Total operating time at 100 percent Prime Power shall not exceed 500 hours per year.

A 10 percent overload capability is available for a period of one hour within a twelve hour period of operation. Total operating time at the 10 percent overload power shall not exceed 25 hours per year.

Limited Time Running Prime Power Rating

Engines of this rating are available for a limited number of hours in a non-variable load application. It is intended for use in situations where power outages are contracted, such as in utility power curtailment. Engines may be operated in parallel to the public utility up to 750 hours per year at power levels never to exceed the Prime Power rating.

Limited Time Running Prime Power ratings differ from Unlimited Time Running in that even though the maximum power output of the engines are the same, the Limited Time Running allows the Engine to be parallel to Public Utility and run at the full Prime Power rating and must never exceed the Prime Power rating.

Continuous/Base Power Rating

Engines with this rating are available for supplying utility power at a constant 100 percent load for an unlimited number of hours per year. No overload capability is available for this rating.

Continuous/Base Power ratings differ from Unlimited Time Running Prime Power ratings in that the Continuous/Base Load ratings are significantly reduced from the Prime Power ratings. Continuous/Base Load ratings have no load factor or application restrictions.

Coverage

Base Engine Warranty

This warranty covers any failures of the Engine, under normal use and service, which result from a defect in material or factory workmanship (Warrantable Failure).

Coverage begins with the sale of the Engine by Cummins and continues for the Duration stated below. The Duration commences either on the date of delivery of the Engine to the first user, or on the date the Engine is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first.

Base Engine Warranty

	Duration Whichever Occurs First	
Rating	**Months**	**Hours**
Standby Power	24	400
Unlimited Prime Power	12	Unlimited
Limited Prime Power	12	750
Continuous/Base Power	12	Unlimited

Extended Major Components Warranty

The Extended Major Components Warranty applies to Engines other than B and C series and covers Warrantable Failures of the Engine cylinder block, camshaft, crankshaft and connecting rods (Covered Parts). Bushing and bearing failures are not covered. This coverage begins with the expiration of the Base Engine Warranty and continues for the following stated Duration. The Duration commences either on the date of delivery of the Engine to the first user, or on the date the Engine is first leased, rented or loaned, or when the Engine has been operated for 50 hours, whichever occurs first.

Extended Major Components Warranty

	Duration Whichever Occurs First	
Rating	**Months**	**Hours**
Standby Power	36	600
Unlimited Prime Power	36	10,000
Limited Prime Power	36	2,250
Continuous/Base Power	36	10,000

Consumer Products

This warranty on Consumer Products in the United States is a LIMITED warranty. **CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.** Any implied warranties applicable to Consumer Products terminate concurrently with the expiration of the express warranties applicable to the product. In the United States, some states do not allow the exclusion of incidental or consequential damages, or limitations on how long an implied warranty lasts, so the limitations or exclusions herein may not apply to you.

These warranties are made to all Owners in the chain of distribution, and Coverage continues to all subsequent Owners until the end of the periods of Coverage.

Cummins Responsibilities

During Base Engine Warranty

Cummins will pay for all parts and labor needed to repair the damage to the Engine resulting from a Warrantable Failure when performed during normal business hours. All labor costs will be paid in accordance with Cummins published Standard Repair Time guidelines.

Cummins will pay for the lubricating oil, antifreeze, filter elements, and other maintenance items that are not reusable due to the Warrantable Failure.

Cummins will pay reasonable travel expenses for mechanics to travel to and from the Engine site, including meals, mileage, and lodging when the repair is performed at the site of the failure.

Cummins will pay reasonable labor costs for Engine removal and reinstallation when necessary to repair a Warrantable Failure.

During the Extended Major Components Warranty

Cummins will pay for the repair or, at its option, replacement of the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Covered Part.

Owner's Responsibilities

During the Base Engine Warranty

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items replaced during warranty repairs unless such items are not reusable due to the Warrantable Failure.

During the Extended Major Components Warranty

Owner is responsible for the cost of all labor needed to repair the Engine, including the labor cost for Engine removal and reinstallation. When Cummins elects to repair a part instead of replacing it, the Owner is not responsible for the labor needed to repair the part.

Owner is responsible for the cost of all parts required for the repair except for the defective Covered Part and any Covered Part damaged by a Warrantable Failure of the defective Covered Part.

Owner is responsible for the cost of lubricating oil, antifreeze, filter elements and other maintenance items replaced during repair of a Warrantable Failure.

During the Base Engine and Extended Major Components Warranties

Owner is responsible for the operation and maintenance of the Engine as specified in the applicable Cummins Operation and Maintenance Manual. Owner is also responsible for providing proof that all recommended maintenance has been performed.

Before the expiration of the applicable warranty, Owner must notify a Cummins distributor, authorized dealer or other repair location approved by Cummins of any Warrantable Failure and make the Engine available for repair by such facility. Locations in the United States* and Canada are listed in the Cummins United States and Canada Sales and Service Directory; other locations are listed in the Cummins International Sales and Service Directory.

Owner is responsible for communication expenses, meals, lodging and similar costs incurred as a result of a Warrantable Failure.

Owner is responsible for non-Engine repairs, "downtime" expenses, fines, all applicable taxes, all business costs and other losses resulting from a Warrantable Failure.

Owner is responsible for providing sufficient access to and reasonable ability to remove the Engine from the installation in the event of a Warrantable Failure.

Owner is responsible for maintaining an operating Engine hourmeter. If the hourmeter is not operational, engine usage will be estimated at 400 hours per month.

Limitations

Cummins is not responsible for failures or damage resulting from what Cummins determines to be abuse or neglect, including, but not limited to: operation without adequate coolants or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or intake systems; improper storage, starting, warm-up, run-in or shutdown practices; unauthorized modifications to the Engine. Cummins is also not responsible for Engine performance problems or failures caused by incorrect oil or fuel, or by water, dirt or other contaminants in the fuel or oil.

This warranty does not apply to accessories supplied by Cummins which bear the name of another company. Such non-warranted accessories include, but are not limited to: alternators, starters, fans**, air conditioning compressors, clutches, filters, transmissions, air cleaners and safety shutdown switches.

Before a claim for excessive oil consumption will be considered, Owner must submit adequate documentation to show that consumption exceeds Cummins published standards.

Failure of belts and hoses supplied by Cummins are not covered beyond the first 500 hours or one year of operation, whichever occurs first after the warranty start date.

Parts used to repair a Warrantable Failure may be new Cummins parts, Cummins approved rebuilt parts, or repaired parts. Cummins is not responsible for failures resulting from the use of parts not approved by Cummins.

A new Cummins or Cummins-approved rebuilt part used to repair a Warrantable Failure assumes the identity of the part it replaced and is entitled to the remaining coverage hereunder.

Cummins is not responsible for Engine performance problems or failures resulting from:

1. Use or application of the Engine inconsistent with its rating designation as set forth above.
2. Inadequate or incorrect installations deviating from Cummins Generator Drive Installation Guidelines.

CUMMINS IS NOT RESPONSIBLE FOR WEAR OR WEAROUT OF COVERED PARTS.

CUMMINS IS NOT RESPONSIBLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES.

THE WARRANTIES SET FORTH HEREIN ARE THE SOLE WARRANTIES MADE BY CUMMINS IN REGARD TO THESE ENGINES. CUMMINS MAKES NO OTHER WARRANTIES, EXPRESS OR IMPLIED, OR OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

In the United States* and Canada, this warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Outside the United States* and Canada, in case of consumer sales, in some countries, the Owner has statutory rights which cannot be affected or limited by the terms of this warranty.

Nothing in this warranty excludes or restricts any contractual rights the owner may have against third parties.

* Includes American Samoa, the Commonwealth of Northern Mariana Islands, Guam, Puerto Rico, and the U.S. Virgin Islands.

** Alternators, starters, and fans ARE covered for the duration of the base engine warranty on B3.3 engines.

California Emission Control System Warranty, Off-Highway

Products Warranted

This Emission Control System Warranty applies to off-road diesel engines certified with the California Air Resources Board beginning with the year 1996 for engines up to 750 horsepower, beginning with the year 2000 for 751 horsepower and over, marketed by Cummins, and registered in California for use in industrial off-highway applications.

Your Warranty Rights and Obligations

The California Air Resources Board and Cummins Engine Company, Inc., are pleased to explain the emission control system warranty on your engine. In California, new off-road diesel engines must be designed, built and equipped to meet the State's stringent anti-smog standards. Cummins must warrant the emission control system on your engine for the periods of time listed below provided there has been no abuse, neglect or improper maintenance of your engine.

Your emission control system may include parts such as the fuel injection system and the air induction system. Also included may be hoses, belts, connectors and other emission-related assemblies.

Where a warrantable condition exists, Cummins will repair your off-road diesel engine at no cost to you including diagnosis, parts and labor.

Manufacturer's Warranty Coverage

This warranty coverage is provided for 5 years or 3,000 hours of engine operation, whichever first occurs from the date of delivery of the engine to the first user. If any emission-related part on your engine is defective, the part will be repaired or replaced by Cummins.

Coverage

This emission control system warranty applies only to the following emission control parts:

Turbocharger
- Compressor Wheel
- Turbine Wheel
- Turbine Oil Seal
- Wastegate Valve
- Wastegate Actuator/Controller

Intake Manifold
- Charge Air Cooler

Exhaust Manifold

Fuel System
- Actuators (Fueling & Timing)
- Fuel Pressure Sensor

Injectors (TP)
- Barrel/Plunger
- Cup
- Brass Spring
- Nozzle Spring
- Timing C.U.
- Fueling C.U.
- Spill Ring

Electronic Control System
- Control Module
- Intake Manifold Pressure Sensor
- Coolant Temperature Sensor

Owner's Warranty Responsibilities

As the off-road diesel engine owner, you are responsible for the performance of the required maintenance listed in your Cummins Operation and Maintenance Manual. Cummins recommends that you retain all receipts covering maintenance on your off-road diesel engine, but Cummins cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

You are responsible for presenting your off-road diesel engine to a Cummins dealer as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.

As the off-road diesel engine owner, you should also be aware that Cummins may deny you warranty coverage if your off-road diesel engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

Your engine is designed to operate on diesel fuel only. Use of any other fuel may result in your engine no longer operating in compliance with California's emissions requirements.

If you have any questions regarding your warranty rights and responsibilities, you should contact Cummins Customer Assistance Department at 1-800-343-7357 (1-800-DIESELS) or the California Air Resources Board at 9528 Telstar Avenue, El Monte, CA 91731.

Prior to the expiration of the applicable warranty, Owner must give notice of any warranted emission control failure to a Cummins distributor, authorized dealer or other repair location approved by Cummins and deliver the engine to such

facility for repair. Repair locations are listed in Cummins United States and Canada Service Directory.

Owner is responsible for incidental costs such as: communication expenses, meals, lodging incurred by Owner or employees of Owner as a result of a warrantable failure.

Owner is responsible for business costs and losses, "downtime" expenses, and cargo damage resulting from a warrantable failure. CUMMINS IS NOT RESPONSIBLE FOR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES, INCIDENTAL OR CONSEQUENTIAL DAMAGES INCLUDE BUT ARE NOT LIMITED TO FINES, THEFT, VANDALISM OR COLLISIONS.

Replacement Parts

Cummins recommends that any service parts used for maintenance, repair or replacement of emission control systems be new, genuine Cummins or Cummins approved rebuilt parts and assemblies, and that the engine be serviced by a Cummins distributor, authorized dealer or the repair location approved by Cummins. The owner may elect to have maintenance, replacement or repair of the emission control parts performed by a facility other than a Cummins distributor, an authorized dealer or a repair location approved by Cummins, and may elect to use parts other than new genuine Cummins or Cummins approved rebuilt parts and assemblies for such maintenance, replacement or repair; however, the cost of such service or parts will not be covered under this emission control system warranty.

Cummins Responsibilities

Repairs and service will be performed by any Cummins distributor, authorized dealer or other repair location approved by Cummins using new, genuine Cummins or Cummins approved rebuilt parts and assemblies. Cummins will repair any of the emission control parts found by Cummins to be defective without charge for parts or labor (including diagnosis which results in determination that there has been a failure of a warranted emission control part).

Emergency Repairs

In the case of an emergency where a Cummins distributor, authorized dealer, or other repair location approved by Cummins is not available, repairs may be performed by any available repair location using any replacement parts. Cummins will reimburse the Owner for expenses (including diagnosis), not to exceed the manufacturer's suggested retail price for all warranted parts replaced and labor charges based on the manufacturer's recommended time allowance for the warranty repair and the geographically appropriate hourly labor rate. A part not being available within 30 days or a repair not being complete within 30 days constitutes an emergency. Replaced parts and paid invoices must be presented at a Cummins authorized repair facility as a condition of reimbursement for emergency repairs not performed by a Cummins distributor, authorized dealer, or other repair location approved by Cummins.

Warranty Limitations

Cummins is not responsible for failures resulting from Owner or operator abuse or neglect, such as: operation without adequate coolant, fuel or lubricants; overfueling; overspeeding; lack of maintenance of lubricating, cooling or air intake systems; improper storage, starting, warm-up, run-in or shutdown practices.

The manufacturer warrants to the ultimate purchaser and each subsequent purchaser that the engine is designed, built, and equipped so as to conform with all applicable regulations adopted by the Air Resources Board, and that it is free from defects in materials and workmanship which cause the failure of a warranted part.

Any warranted part which is not scheduled for replacement as required maintenance, or which is scheduled only for regular inspection to the effect of "repair or replace as necessary" is warranted for the warranty period.

Any warranted part which is scheduled for replacement as required maintenance is warranted for the period of time prior to the first scheduled replacement point for that part.

The owner will not be charged for diagnostic labor which leads to the determination that a warranted part is defective, if the diagnostic work is performed at a warranty station.

The manufacturer is liable for damages to other engine components caused by the failure under warranty of any warranted part.

Cummins is not responsible for failures resulting from improper repair or the use of parts which are not genuine Cummins or Cummins approved parts.

These warranties, together with the express commercial warranties and emission warranty are the sole warranties of Cummins. There are no other warranties, express or implied, or of merchantability or fitness for a particular purpose.

Moteurs tout terrain Etats-Unis et Canada

Garantie

Produits garantis

La présente garantie s'applique aux nouveaux moteurs vendus par Cummins et livrés au premier utilisateur à compter du 1er avril 1999 pour un usage dans des applications industrielles (tout terrain) aux Etats-Unis* et au Canada, à l'exception des moteurs utilisés dans des applications marines et d'entraînement de générateur, ainsi que dans certaines applications militaires, pour lesquelles une couverture de garantie différente est fournie.

Garantie de base du moteur

La présente garantie couvre toute panne du moteur, dans des conditions normales d'utilisation et d'entretien, provenant d'un défaut de matériau ou de fabrication en usine (pannes couvertes).

La garantie prend effet à dater de la vente du moteur. Elle s'étend sur une période de deux ans ou 2 000 heures d'utilisation, suivant lequel de ces termes intervient en premier, à compter de la date de livraison du moteur au premier utilisateur ou de la date à laquelle le moteur est mis en location de courte ou longue durée ou en prêt pour la première fois, ou encore lorsque le moteur a été utilisé pendant 50 heures, suivant lequel de ces termes intervient en premier. En cas d'une utilisation dépassant 2 000 heures durant la première année, la période de garantie s'étend jusqu'à la fin de la première année.

Garantie étendue des composants principaux

La Garantie prolongée des principaux éléments couvre les pannes justifiables du bloc-cylindre, de l'arbre à cames, du vilebrequin, des bielles du moteur (pièces couvertes).

Les pannes de bagues et roulement de paliers ne sont pas garanties.

Cette couverture prend effet à la date d'expiration de la garantie de base du moteur et se termine trois ans ou 10 000 heures d'utilisation après la date de livraison du moteur au premier utilisateur ou à compter de la date à laquelle le moteur est mis en location de courte ou longue durée ou en prêt pour la première fois, ou encore lorsque le moteur a été utilisé pendant 50 heures, suivant lequel de ces termes intervient en premier.

Produits de consommation

La garantie sur les produits de consommation aux États-Unis est LIMITEE. CUMMINS N'EST PAS RESPONSABLE DES DOMMAGES INDIRECTS OU INDUITS Aux États-Unis, toute garantie implicite applicable aux produits de consommation vient à échéance à l'expiration des garanties expresses applicables au produit. Certains Etats d'Amérique réfutent l'exclusion des détériorations provoquées par des dommages indirects ou induits, ou les limitations de durée de garanties implicites.

Ces garanties s'appliquent à tous les propriétaires du circuit de distribution et la couverture s'applique à tous les propriétaires ultérieurs jusqu'à la fin de la période de couverture.

Responsabilités Cummins

Pendant la garantie de base du moteur

Cummins réglera tous les frais des pièces détachées et de la main d'oeuvre nécessaires à la réparation du produit endommagé en raison d'une panne justifiable.

Cummins prend en charge l'huile, l'antigel, les cartouches de filtre ainsi que d'autres pièces ou fournitures d'entretien non réutilisables en raison d'une panne sous garantie.

Cummins paie la majeure partie des frais de déplacement des mécaniciens ce qui comprend les frais de repas, les frais kilométriques et les frais d'hébergement, dans le cas où une réparation doit être effectuée sur les lieux de la panne.

Cummins prend en charge une partie des frais de main d'oeuvre lorsqu'il est nécessaire de déposer et de remonter le moteur lors d'une panne sous garantie.

Pendant la garantie étendue des principaux composants

Cummins réglera la réparation ou, s'il préfère, le remplacement de la pièce couverte défectueuse et de toute pièce couverte endommagée par une panne justifiable de la pièce couverte défectueuse.

Responsabilités du propriétaire

Pendant la garantie de base du moteur

Le propriétaire doit régler l'huile de graissage, l'antigel, les éléments filtrants et les autres articles d'entretien remplacés au cours des réparations effectuées dans le cadre de la garantie à moins que ces articles ne puissent plus être utilisés en raison d'une panne justifiable.

Pendant la garantie étendue des principaux composants

Le propriétaire est responsable de tous les frais de la main-d'oeuvre nécessaire à la réparation du moteur, y compris les frais de main-d'oeuvre pour démonter et réinstaller le moteur. Lorsque Cummins choisit de réparer une pièce plutôt que de la remplacer, le propriétaire n'est pas responsable de la main-d'oeuvre nécessaire à la réparation de la pièce.

Le propriétaire supporte les frais occasionnés par le remplacement des pièces excepté pour la pièce défectueuse sous garantie et toute pièce garantie dont la détérioration a été provoquée par une panne sous garantie de la pièce défectueuse sous garantie.

Le propriétaire supporte les frais de remplacement de l'huile, de l'antigel, des cartouches de filtre ainsi que des autres pièces ou fournitures lors d'une réparation en raison d'une panne sous garantie.

PENDANT LA PÉRIODE DE GARANTIE DE BASE DU MOTEUR ET DE GARANTIE ETENDUE DES COMPOSANTS PRINCIPAUX

Le propriétaire est responsable de l'utilisation et de l'entretien du moteur comme il est spécifié dans le manuel d'utilisation et d'entretien Cummins. Le propriétaire doit également pouvoir prouver que tous les travaux d'entretien recommandés ont été effectués.

Avant la date d'expiration de la garantie en vigueur, le propriétaire doit avertir un concessionnaire Cummins, un concessionnaire agréé ou un autre site de réparation homologué, de toute panne sous garantie et pouvoir confier le moteur afin qu'il puisse être réparé. Les sites de réparation aux États-Unis ainsi qu'au Canada sont énumérés dans le répertoire des concessionnaires moteur tout terrain Cummins agréé.

Le propriétaire supporte les frais de communication, de repas, d'hébergement et d'autres frais similaires occasionnés par une panne sous garantie.

Le propriétaire est responsable des réparations autres que celles du moteur, des dépenses de temps mort, des dommages au chargement, des amendes, de toutes les taxes en vigueur, de tous les coûts commerciaux et de toute autre dépense résultant d'une panne sous garantie.

Limites

Cummins décline toute responsabilité en cas de pannes ou de détériorations résultant de ce que Cummins considère comme un abus ou une négligence de la part du propriétaire, notamment et non limitativement: une utilisation sans les lubrifiants ou les liquides de refroidissement appropriés; surremplissage de carburant; vitesse trop élevée; négligence d'entretien des systèmes d'admission, de refroidissement ou de lubrification; mauvaises conditions d'entreposage, pratiques inappropriées de démarrage, de chauffage, de rodage ou d'arrêt; modifications non homologuées du moteur. Cummins n'est également pas responsable des pannes provoquées par l'utilisation d'une huile, d'un carburant ou d'une eau non appropriés, ainsi que des pannes provoquées par la présence de dépôts dans le carburant ou dans l'huile.

Pour les générateurs de courant et les pompes à incendie (unités conditionnées), cette garantie s'applique aux accessoires, sauf pour les embrayages et filtres fournis par Cummins qui portent le nom d'une autre société.

Mis à part les générateurs de courant et les pompes à incendie, Cummins ne garantit pas les accessoires portant le nom d'une autre société. Ces accessoires comprennent: les alternateurs, les démarreurs, les ventilateurs**, les compresseurs d'air conditionnés, les embrayages, les filtres, les transmissions, les convertisseurs de couple, les pompes d'assistance de direction, les entraînements ventilateurs d'une marque différente de celle de Cummins, les freins de compression moteur et les compresseurs d'air.

Les unités Compusave Cummins sont assujetties à une garantie différente.

Avant qu'une réclamation concernant une consommation excessive en huile soit prise en compte, le propriétaire doit fournir une documentation adéquate afin de pouvoir prouver que la consommation dépasse celle définie par Cummins.

Les détériorations des courroies et flexibles fournis par Cummins ne sont pas garanties au-delà des 500 premières heures ou après un an d'utilisation, suivant lequel de ces termes intervient en premier.

Les pièces utilisées pour la réparation d'une panne sous garantie peuvent être des pièces Cummins neuves, des pièces reconditionnées homologuées ou des pièces réparées. Cummins n'est pas responsable des pannes résultant de l'utilisation de pièces non homologuées.

Une nouvelle pièce Cummins ou une pièce reconditionnée homologuée utilisée pour la réparation d'une panne sous garantie est alors identifiée comme la pièce originale remplacée en vertu de cette garantie.

CUMMINS NE COUVRE PAS L'USURE DES PIECES COUVERTES.

CUMMINS N'EST PAS RESPONSABLE DES DOMMAGES INDIRECTS OU INDUITS

LES PRESENTES GARANTIES SONT LES GARANTIES EXCLUSIVES DE CUMMINS CONCERNANT CES MOTEURS. CUMMINS NE CONSENT AUCUNE AUTRE GARANTIE EXPRESSE OU IMPLICITE ET AUCUNE GARANTIE DE BONNE QUALITÉ COMMERCIALE OU D'ADAPTATION A UN USAGE SPÉCIFIQUE.

Cette garantie vous procure certains droits qui peuvent varier d'un État à l'autre.

Garantie concernant l'émission de polluants

Produits garantis

Cette garantie s'applique aux nouveaux moteurs commercialisés par Cummins et utilisés aux États-Unis* sur des véhicules à usage industriel tout-terrain. La présente garantie s'applique aux moteurs livrés à l'acheteur final à compter du 1er avril 1999 pour les moteurs jusqu'à 750 chevaux ou à compter du 1er janvier 2000 pour les moteurs d'au moins 751 chevaux.

Garantie

Cummins garantit au dernier acheteur et à chaque futur acheteur que le moteur a été conçu, construit et équipé selon les lois américaines en vigueur portant sur la pollution et qu'il ne comporte aucun défaut de fabrication des composants, ce qui engendrerait une non-conformité du moteur pendant les périodes suivantes: (A) cinq ans ou 3 000 heures d'utilisation, suivant lequel de ces termes intervient en premier, et à dater de la livraison du moteur à l'acquéreur final ou (B) la garantie de base des moteurs.

Si le véhicule muni du moteur Cummins est enregistré dans l'Etat de Californie, une autre garantie du système antipollution s'applique également.

Limites

Les pannes autres que celles résultant d'un défaut de matériaux ou de main d'oeuvre, ne sont pas garanties.

Cummins décline toute responsabilité en cas de pannes ou de détériorations résultant de ce que Cummins considère comme un abus ou une négligence de la part du propriétaire, notamment et non limitativement: une utilisation sans les lubrifiants ou les liquides de refroidissement appropriés; surremplissage de carburant; vitesse trop élevée; négligence d'entretien des systèmes d'admission, de refroidissement ou de lubrification; mauvaises conditions d'entreposage, pratiques inappropriées de démarrage, de chauffage, de rodage ou d'arrêt; modifications non homologuées du moteur. Cummins n'est également pas responsable des pannes provoquées par l'utilisation d'une huile, d'un carburant ou d'une eau non appropriés, ainsi que des pannes provoquées par la présence de dépôts dans le carburant ou dans l'huile.

Cummins n'est pas responsable des réparations autres que celles du moteur, des dépenses de temps mort, des dommages au chargement, des amendes, de toutes les taxes en vigueur, de tous les coûts commerciaux et de toute autre dépense résultant d'une panne sous garantie.

CUMMINS N'EST PAS RESPONSABLE DES DOMMAGES INDIRECTS OU INDUITS

*Doivent être pris en compte l'archipel américain Samoa, le Commonwealth des îles Mariana du nord, les îles Guam, Porto Rico et les îles américaines Vierges.

** Les alternateurs, les démarreurs et les ventilateurs SONT couverts pendant la durée de la garantie de base des moteurs B3.3.

NOTES

About the Manual i-1
Acronyms and Abbreviations i-6
General Information i-6
Additional Service Literature L-1
Air Cleaner Restriction 5-7
Maintenance Check 5-7
Air Compressor Carbon Buildup 7-2
Maintenance Check 7-2
Air Intake Piping 3-4
Maintenance Check 3-4
Air Leaks, Air Intake and Exhaust Systems 5-6
Maintenance Check 5-6
Air Starting Motor A-1
General Information A-1
Air Tanks and Reservoirs 3-5
Drain 3-5
Arctic Operation V-9
General Information V-9
Battery Cables and Connections A-2
General Information A-2
Belt Tensioner, Automatic 5-4
Inspect for Reuse 5-4
California Emission Control System Warranty, Off-Highway . W-9
Capscrew Markings and Torque Values V-16
Capscrew Markings and Torque Values - Metric V-17
Capscrew Markings and Torque Values - U.S. Customary V-18
Charge-Air Piping 3-4
Maintenance Check 3-4
Cold Weather Operation 1-8
General Information 1-8
Cold Weather Starting Aids 6-2
Maintenance Check 6-2
Cold Weather Starting Using Starting Fluid 1-4
With Mechanical or Electrical Metering Equipment (Ether) 1-4
Component Manufacturers' Addresses M-1
Air Compressors M-1
Air Cylinders M-1
Air Heaters M-1
Air Starting Motors M-1
Alternators M-1
Auxiliary Brakes M-1
Belts M-1
Catalytic Converters M-1
Clutches M-1
Coolant Heaters M-2
Coolant Level Switches M-1
Drive Plates M-2
Electric Starting Motors M-2
Electronic Switches M-2
Engine Protection Controls M-2
Fan Clutches M-2
Fans M-2
Fault Lamps M-2
Filters M-2
Flexplates M-2
Fuel Coolers M-2
Fuel Pumps M-2
Fuel Warmers M-2
Gauges M-3
Governors M-3
Heat Sleeves M-3
Hydraulic and Power Steering Pumps M-3
In-Line Connectors M-3
Oil Heaters M-3
Prelubrication Systems M-3
Radiators M-3
Throttle Assemblies M-3
Torque Converters M-3
Coolant Filter 5-2
General Information 5-2
Install 5-2
Remove 5-2
Coolant Level 3-2
Maintenance Check 3-2
Coolant Recommendations and Specifications V-10
Coolant Replacement Requirements V-15
Cooling System Sealing Additives V-12
Cooling System Soluble Oils V-12
Fleetguard® Nelson® DCA4 Service Filters and Liquid Precharge V-13
Fully Formulated Coolant/Antifreeze V-10
General Information V-10
Supplemental Coolant Additive (SCA) V-13
Test Intervals V-14
Testing SCA Concentration Level CC-2602 Test Kit V-13
Crankcase Breather Tube 6-3
Assemble 6-4
Disassemble 6-3
Maintenance Check 3-5
Daily Maintenance Procedures - General Information 3-1
Drive Belt Tension V-19
Drive Belts 3-4
Maintenance Check 3-4
Electromagnetic Interference (EMI) 1-36
General Information 1-36
System EMI Radiation Levels 1-36
System EMI Susceptibility 1-36
Electronic Controlled Fuel System 1-11
Diagnostic Fault Codes 1-29
Industrial 1-29
Power Generation 1-33
Engine Protection System 1-35
Fuel System Description 1-13
Electronic Control Module (ECM) Dataplate 1-15
Electronic Control Module Inputs 1-15
Engine Diagrams 1-13
General Information 1-11
Industrial 1-11
Power Generation 1-12
Programmable Features 1-18
Industrial 1-18
Power Generation 1-24
Engine Brake Assembly 6-10
Adjust 6-10
Engine Braking System 1-9
General Information 1-9
Engine Component Torque Values V-16
Engine Diagrams E-6
Engine Views E-6
Engine Identification E-1
ECM Dataplate E-1
Engine Dataplate E-1
Engine Mounting Bolts 6-3
Maintenance Check 6-3
Engine Operating Range 1-7
General Information 1-7
Engine Shutdown 1-9
General Information 1-9
Engine Steam Cleaning 6-2
Clean 6-2
Engine Storage - Long Term A-5
General Information A-5
Engine Wiring Harness 5-8
Maintenance Check 5-8
Fan, Cooling 3-3
Maintenance Check 3-3
Fan Hub, Belt Driven 7-2
Maintenance Check 7-2
Flow Diagram, Air Intake System D-8
Flow Diagram, Compressed Air System D-10
General Information D-10
Flow Diagram, Cooling System D-6
Flow Diagram, Engine Brake Oil D-12
General Information D-12
Flow Diagram, Exhaust System D-9
Flow Diagram, Fuel System D-2
Flow Diagram, Lubricating Oil System D-3
Fuel Filter (Spin-On Type) 5-3
Install 5-4
Remove 5-3
Fuel Recommendations and Specifications V-6
General Information V-6
Fuel Shutoff Valve 1-4
General Information 1-4

Fuel-Water Separator 3-2
Drain 3-2
General Repair Instructions i-5
General Information i-5
Welding on a Vehicle with an Electronic Controlled Fuel System . i-5
General Safety Instructions i-4
Important Safety Notice i-4
Hoses, Engine 6-2
Maintenance Check 6-2
How to Use the Manual i-1
Illustrations i-3
General Information i-3
Lubricating Oil and Filters 4-2
Drain 4-2
Fill 4-3
Remove 4-2
Lubricating Oil Filter (Spin-On) V-9
General Specifications V-9
Lubricating Oil Level 3-2
Maintenance Check 3-2
Lubricating Oil Recommendations and Specifications V-6
General Information V-6
New Engine Break-in Oils V-8
Oil Drain Intervals V-8
Industrial Applications V-8
Maintenance Guidelines - General Information 2-1
Maintenance Procedures - General Information 4-1
Maintenance Record Form 2-8
Maintenance Schedule 2-2
Moteurs tout terrain Etats-Unis et Canada W-11
Normal Starting Procedure 1-2
General Information 1-2
Off-Highway Engines International W-4
Off-Highway Engines United States and Canada W-1
Operating Instructions - General Information 1-1
Operating the Engine 1-6
General Information 1-6
Overhead Set 6-4
Adjust 6-5
General Information 6-4
Page References for Maintenance Instructions 2-7
Service Assistance S-1
Distributors - International S-19
Distributors and Branches - Australia S-13
Distributors and Branches - Canada S-11
Distributors and Branches - New Zealand S-15
Distributors and Branches - United States S-4
Division and Regional Offices S-3
Emergency and Technical Service S-1
Problem Solving S-2
Regional Offices - International S-16
Routine Service and Parts S-1
Service Literature Ordering Location L-2
Specifications E-2
Air Intake System ..... E-3 , V-2
Batteries (Specific Gravity) ..... E-4 , V-3
Cooling System ..... E-3 , V-2
Cummins/Fleetguard®/Nelson Filter Specifications V-5
Electrical System ..... E-4 , V-3
Exhaust System ..... E-4 , V-3
Fuel System ..... E-2 , V-1
General Specifications ..... E-2 , V-1
Lubricating Oil System ..... E-2 , V-1
Supplemental Coolant Additive (SCA) 4-5
Maintenance Check 4-5
Symbols i-2
General Information i-2
System Diagrams - General Information D-1
To the Owner and Operator i-1
Tool Requirements 2-1
Troubleshooting Procedures and Techniques TS-1
General Information TS-1
Troubleshooting Symptoms Charts TS-2
Air Compressor Air Pressure Rises Slowly TS-3
Air Compressor Noise is Excessive TS-4
Air Compressor Pumping Excess Lubricating Oil into the Air System TS-5
Air Compressor Will Not Maintain Adequate Air Pressure (Not Pumping Continuously) TS-6
Air Compressor Will Not Stop Pumping TS-7
Alternator Not Charging or Insufficient Charging TS-8
Coolant Loss - External TS-10
Coolant Loss - Internal TS-11
Coolant Temperature Above Normal - Gradual Overheat TS-12
Coolant Temperature is Above Normal - Sudden Overheat . TS-14
Coolant Temperature is Below Normal TS-16
Crankcase Gases (Blowby) Excessive TS-18
Engine Brake Does Not Operate TS-19
Engine Brake — One or More Cylinders Braking with Power Switch Off TS-21
Engine Brake - Low Retarding Power or Slow to Activate TS-20
Engine Decelerates Slowly TS-22
Engine Difficult to Start or Will Not Start (Exhaust Smoke) .. TS-23
Engine Difficult to Start or Will Not Start (No Exhaust Smoke) TS-25
Engine Noise Excessive TS-27
Engine Noise Excessive — Combustion Knocks TS-29
Engine Power Output Low TS-30
Engine Runs Rough at Idle TS-32
Engine Runs Rough or Misfires TS-33
Engine Shuts Off Unexpectedly or Dies During Deceleration. TS-34
Engine Speed Surges at Low or High Idle TS-35
Engine Speed Surges Under Load or in Operating Range .. TS-36
Engine Starts But Will Not Keep Running TS-37
Engine Vibration Excessive TS-38
Engine Will Not Crank or Cranks Slowly TS-39
Engine Will Not Shut Off TS-40
Fuel Consumption Excessive TS-41
Fuel in Coolant TS-43
Fuel in the Lubricating Oil TS-44
General Information TS-2
Intake Manifold Air Temperature Above Specification TS-45
Lubricating Oil Consumption Excessive TS-46
Lubricating Oil Contaminated TS-48
Lubricating Oil Pressure High TS-49
Lubricating Oil Pressure Low TS-50
Lubricating Oil Sludge in the Crankcase Excessive TS-51
Lubricating Oil Temperature Above Specification TS-52
Lubricating or Transmission Oil in the Coolant TS-53
Operating Fuel Pressure is Low TS-54
Smoke, Black — Excessive TS-55
Smoke, White — Excessive TS-56
Turbocharger Boost Pressure Low TS-57
Turbocharger Leaks Engine Oil or Fuel TS-58
Turbocharger A-2
Install A-3
Remove A-2
Vibration Damper 6-4
Maintenance Check 6-4
Worldwide Generator Drive W-6

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