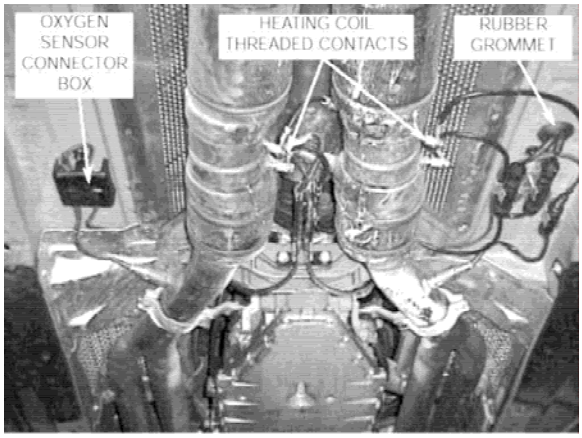
Catalytic Converter: Description and Operation
Electric Catalytic Converter (E-CAT)

ELECTRIC CATALYTIC CONVERTER (E-CAT) ASSEMBLIES

OVERVIEW



The name "Adsorber" identifies the first converter of each assembly as a unique critical component. The Adsorber has the unique ability to attract and retain residual hydrocarbon molecules as it cools, As it warms up it releases the residual HC allowing it to be converted as it passes through the heating coil, back-up metallic converter and twin main converters. This feature is what makes this catalytic converter so unique providing cleaner cold starts and LEV compliance.

The proportion of HC in the exhaust is very high just after a cold start. This is due to the rich fuel/air mixture and incomplete combustion. When initially driving away and during an increase in acceleration which follows, the HC proportion sharply increases again.

The electric catalytic converter's heating coil, which is installed directly behind the adsorber, is energized for a maximum of **30 seconds** immediately after the engine has started (engine speed > **400 rpm**).

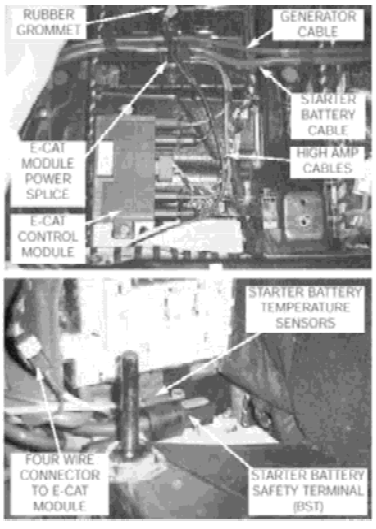
This ensures that the metallic back-up converter and the main catalytic converters downstream attain light-off much earlier.

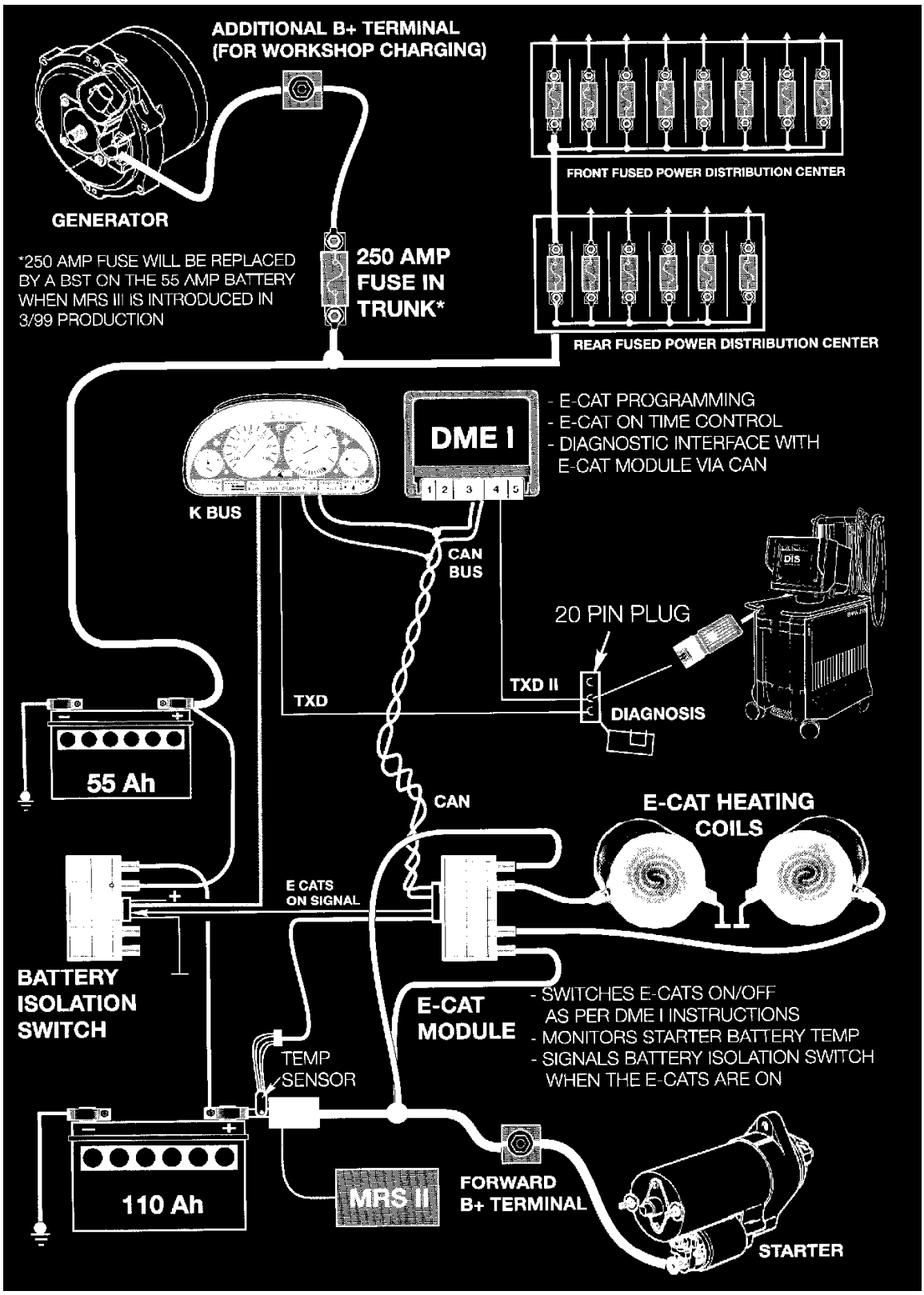
The heating coils are provided operating current from an E-CAT control module located under the passenger seat.

The coils are connected to the E-Cat control module by high amperage cables. The cables pass through a rubber grommet on the passenger side floor to the E-CAT module location.

E-CAT CONTROL

FUNCTIONAL OVERVIEW





The primary function of the E-CAT control module is to simultaneously control the heating of both E-CAT heating coils through high amperage (120A each) power output switches. DME I signals the E-CAT module via the CAN bus requesting activation and deactivation of the heating coils.

Heating time is for a maximum of **30 seconds** but can be shorter in duration depending on monitored conditions.

When on, the metallic back-up converters which are located just behind the heating coils, heat up rapidly. As a result, catalytic converter light-off starts almost immediately reducing cold start emissions in the crucial warm-up phase.

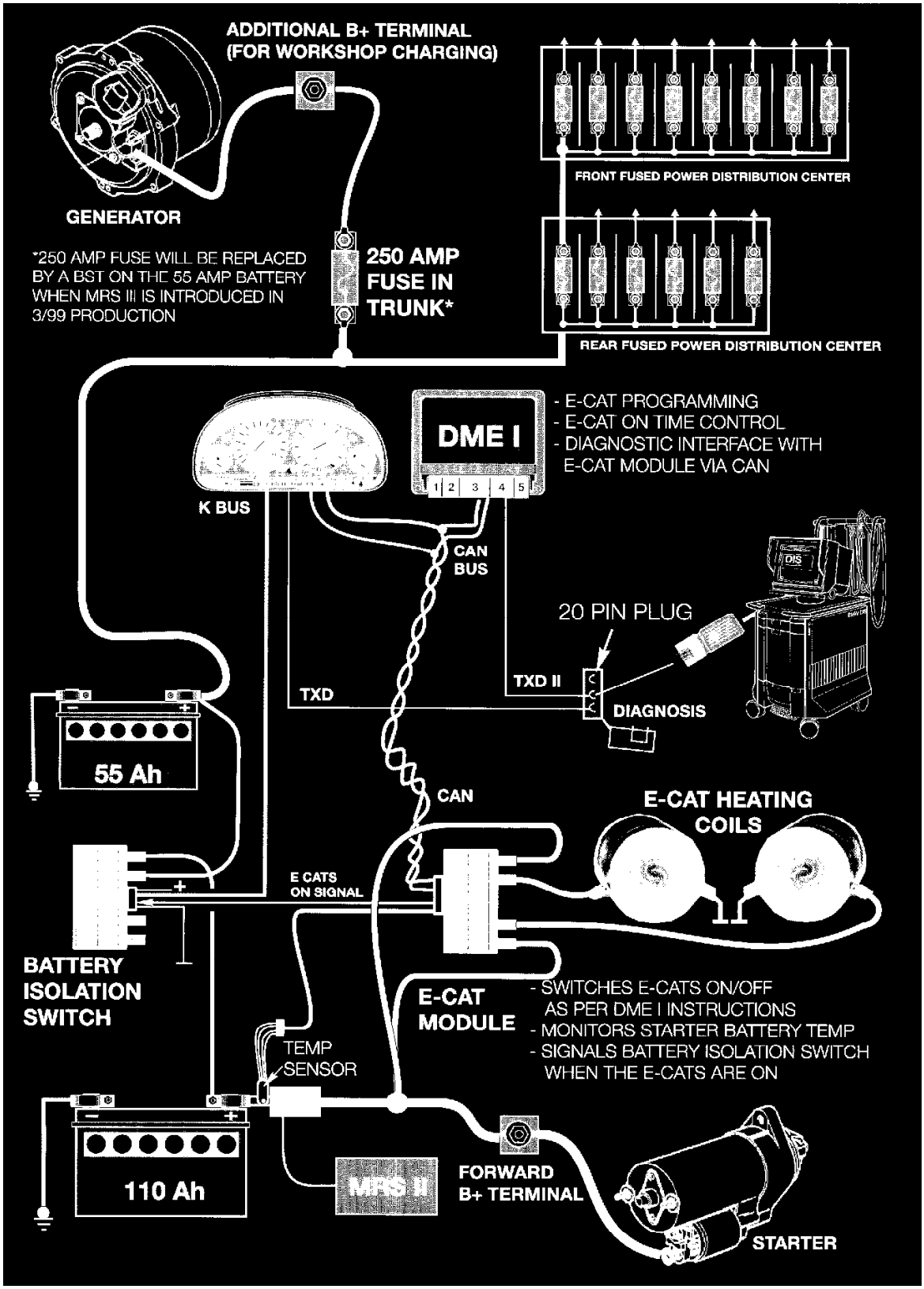
The E-CAT module receives two redundant starter battery temperature signals for monitoring the battery temperature.

The sensors are located in a sealed housing connected directly to the positive terminal of the battery.

If the starter battery temperature falls below **0 °C**, the E-CAT heating coils are not switched on.

Once the E-CATs are activated, the control module simultaneously provides the output control signal to the dual battery isolation switch (signal KATON) requesting the switch which opens the circuit between the starter battery and vehicle circuit battery. This ensures the E-Cat's operating power is supplied only from the starter battery (detailed description of two battery system further on).

CRITERIA FOR E-CAT HEATING COIL ACTIVATION



All conditions for switching the E-Cats on are monitored and activated by DME I. **Maximum** heating time is **30 seconds**. The degree of "on" time (calculated amount of necessary E-Cat heating) is dependent on the intake air and coolant temperatures as well as the duration of time the engine has

been off since the last trip.

Engine start recognition is determined by the DME on the basis of various input signals (mass air flow, engine speed etc.). All of the following criteria must be met for the coils to be switched on:

- Engine coolant temperature > **0 °C** and < **90 °C**
- Starter battery temperature > **0 °C**
- Distance travelled since last engine start > **1 mile**.
- Catalytic converter temperature < **300 °C** (programmed temperature map)
- > **30 min** since engine was previously switched off
- Vehicle road speed < **3 mph**
- Engine starting time < **5 seconds**
- Time after start recognition > **0.1 seconds**
- Throttle pedal not at WOT

The E-CAT's are immediately switched off when one or more of the following faults occur during an activation period:

- CAN bus fault -- Instrument Cluster
- CAN bus fault -- DME and E-CAT module
- Fuel injector fault
- Misfire detection faults which might damage catalytic converter
- Fault in output stage of secondary air injection components
- Fault in engine temperature signal
- Fault in engine speed sensor

DIAGNOSIS

The E-CAT module communicates fault information to DME I via the CAN bus. The DME relays the diagnostic communication to the DIS/MoDiC. A maximum of 14 E-CAT fault codes can be retrieved through DME I.

E-CAT specific faults with an illuminated "check engine" light indicates there have been two unsuccessful attempts to heat the catalytic converters.