



# **GLOBAL SERVICE LEARNING**

## **TECHNICAL PRESENTATION**



## **140M/160M MOTOR GRADERS**

### **Service Training Meeting Guide (STMG)**

# 140M/160M MOTOR GRADERS

## AUDIENCE

Level II - Service personnel who understands the principles of machine system operation, diagnostic equipment, and procedures for testing and adjusting.

## CONTENT

This presentation provides information on the system operation of the electrical system, operator's station, engine, power train, all-wheel drive, implement, steering, fan, and brake systems.

## OBJECTIVES

After learning the information in this meeting guide, the technician will be able to:

1. Locate and identify the major components in the electrical system, operator's station, engine, power train, all-wheel drive, implement, steering, fan, and brake systems;
2. Explain the operation of the major components in the systems; and
3. Trace the flow of oil through the systems

## REFERENCES

140M Service Manual	RENR9010
160M Service Manual	RENR9020
C7 Engines for Caterpillar built machines	RENR9319
C9 Engines for Caterpillar built machines	RENR9830
140M Specalog	AEHQ5731
160M Specalog	AEHQ5732

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## INTRODUCTION

The 140M/160M Motor Graders have been designed as a direct replacement of the 140H/160H Motor Graders. The 140M/160M meets U.S. Environmental Protection Agency (EPA) Tier III and European Union Stage IIIa emissions control standards.

Key new features include:

- Improved operator's station
- C7/C9 ACERT™ Engine
- ECPC controlled power shift countershaft transmission
- Joystick steering
- Electro-hydraulic steering
- Electro-hydraulic implements
- Hydraulic braking system



## TECHNICAL SPECIFICATIONS

### **140M serial number prefix: B9M**

- Base machine weight: 15,130 kg (33,356 lb)
- Maximum machine weight: 23,077 kg (50,875 lb)
- Maximum ground speed forward: 46.6 km/h (29 mph)
- Maximum ground speed reverse: 36.8 km/h (22.9 mph)
- Engine: C7 ACERT™ with VHP (Variable Horse Power)
- Net power with VHP: 136 - 148 kW (183 - 198 hp)
- Net power with VHP Plus: 136 - 163 kW (183 - 218 hp)
- Derating Altitude: 3048 m (10,000 ft.)
- Length: 8.7 m (28 ft., 7 in)
- Width: 2.5 m (8 ft., 2 in)
- Height: 3.3 m (10 ft., 10 in)

### **160M serial number prefix: B9L**

- Base machine weight: 15,903 kg (35,060 lb)
- Maximum machine weight: 23,947 kg (52,795 lb)
- Maximum ground speed forward: 47.4 km/h (29.5 mph)
- Maximum ground speed reverse: 37.4 km/h (23.3 mph)
- Engine: C9 ACERT™ with VHP (Variable Horse Power)
- Net power with VHP: 159 - 170 kW (213 - 228 hp)
- Net power with VHP Plus: 159 - 185 kW (213 - 248 hp)
- Derating Altitude: 3048 m (10,000 ft.)
- Length: 8.7 m (28 ft., 7 in)
- Width: 2.5 m (8 ft., 2 in)
- Height: 3.3 m (10 ft., 10 in)

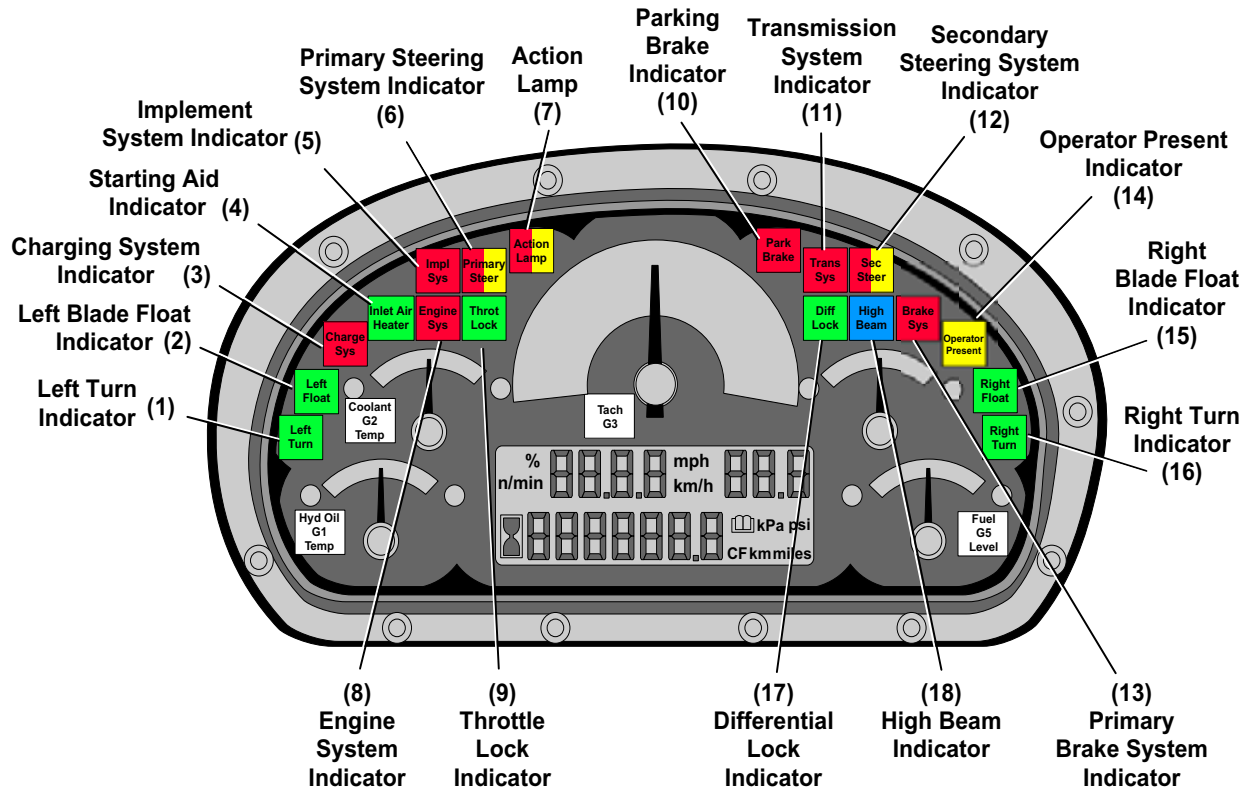


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## OPERATOR'S STATION

The redesigned operator's station provides better visibility to the work area. The "M" series operator's station also has new features and improvements over the "H" series.

## "M" SERIES MONITORING SYSTEM



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The "M" Series dash cluster contains the following:

- Left turn indicator (1): Illuminates when the left turn signal is operating.
- Left blade float indicator (2): Illuminates when the left blade control valve is in the float position.
- Charging system indicator (3): Illuminates when there is a problem with the charging system.
- Starting aid indicator (4): Illuminates when the starting aid is active.
- Implement system indicator (5): Illuminates when the Implement ECM or the optional AccuGrade™ system has an active diagnostic or event.
- Primary steering system indicator (6): Illuminates when the primary steering system has an active diagnostic.
- Action lamp (7): Illuminates when the machine has a serious issue that requires the operator's attention. The action lamp will flash whenever there is a level 2 or level 3 event in any of the machine systems.





- Engine system indicator (8): Illuminates when the Engine ECM has an active diagnostic or event.
- Throttle lock indicator (9): Informs the operator when the throttle lock is engaged.
- Parking brake indicator (10): Illuminates when the parking brake is engaged.
- Transmission system indicator (11): Illuminates when the Transmission/Chassis ECM has an active diagnostic or event.
- Secondary steering system indicator (12): Illuminates when the secondary steering system has an active diagnostic or event. This indicator will also illuminate when the secondary steering system is active.
- Primary brake system indicator (13): Illuminates when the brake system has an active diagnostic.
- Operator present indicator (14): Illuminates when the operator is not present. The operator is considered **present** if any of the following is true:
  - The operator is seated and the Operator in Seat switch recognizes operator as present.
  - The Transmission Output Speed (TOS) is not zero.
  - The Actual Gear is not Neutral.
  - The Inching Pedal is pressed more than 90%.

The operator is considered **not present** if all of the following are true:

- The Operator in Seat switch does not detect operator presence or the switch is faulted.
  - The TOS is zero.
  - The Actual Gear is Neutral.
  - The Inching Pedal is not pressed.
- 
- Right blade float indicator (15): Illuminates when the right blade control valve is in the float position.
  - Right turn indicator (16): Illuminates when the right turn signal is operating.
  - Differential lock indicator (17): Illuminates when the differential lock is engaged.
  - High beam indicator (18): Illuminates when the high beams are on.



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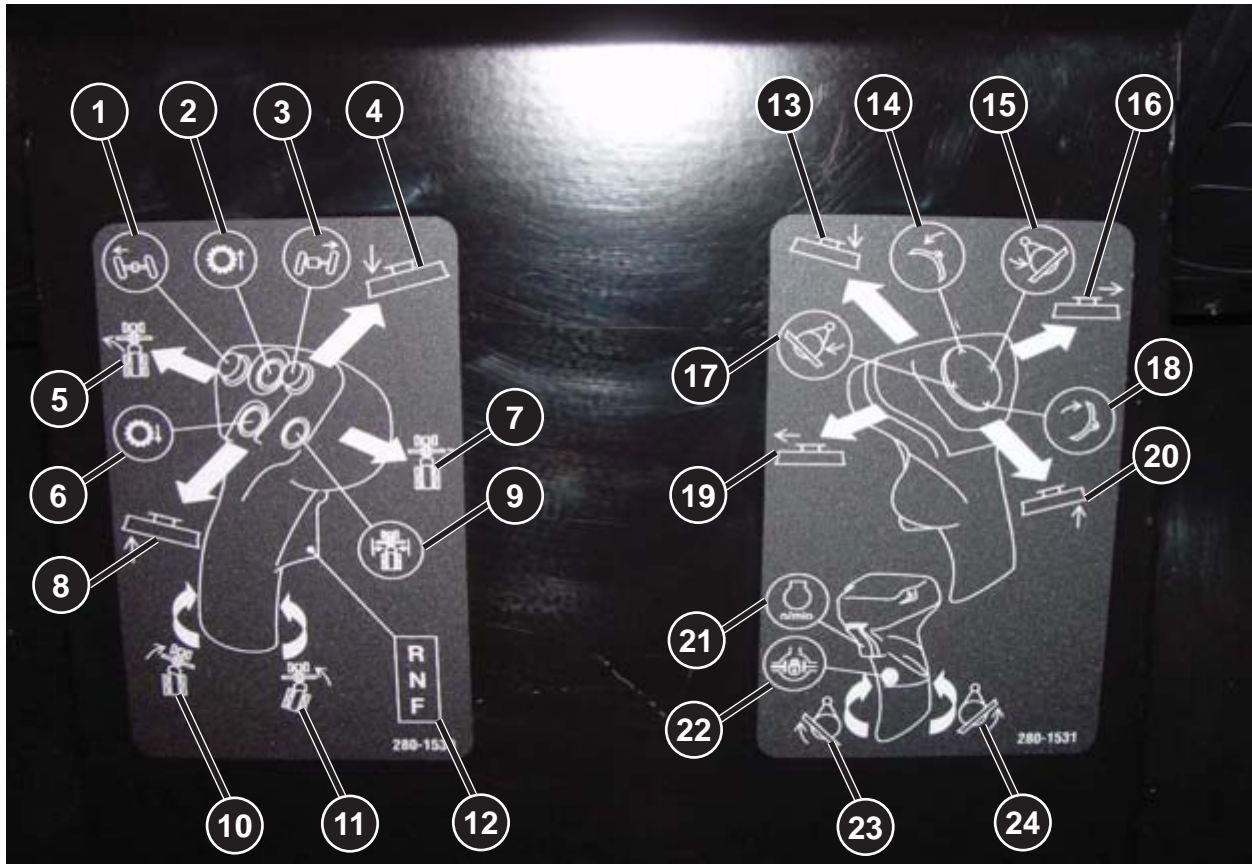
The front console contains the following:

- Secondary steering test switch (1)
- Hydraulic oil temperature gauge (2)
- Coolant temperature gauge (3)
- Tachometer (4)
- Articulation angle (5)
- Fuel gauge (6)
- Parking brake switch (7)
- Key start switch (8)

When the key start switch (8) is turned to the ON position, the dash cluster will perform a three second self-test. During this test all alert indicators will illuminate, and the gauges will do a single sweep.

Sometimes the data needed for an indicator is unknown. This can be due to data link communication problems or active sensor diagnostics. Effects of unknown data at the dash cluster are as follows:

- When data needed for an indicator is unknown, the indicator will be illuminated.
- When data needed for a gauge is unknown, the gauge will be driven to its red zone.
- When data needed for the LCD is unknown, the LCD will either be blank or display "---".
- When there is a Messenger to dash cluster communication problem, all indicators will be off, all gauges will point to the left, and the action lamp will blink amber.



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### Joystick Functions

The electronic joysticks work in conjunction with the Machine ECMs to give the operator precise control of the machine. The position sensors and switches in the joysticks provide an input signal to the ECMs. The ECMs will send a corresponding output signal if certain conditions are met.

The electronic functionality of the joysticks will be explained later in this presentation.

The left joystick controls are as follows:

- Wheel lean left (1)
- Transmission upshift (2)
- Wheel lean right (3)
- Left blade lower/float (4)
- Steer left (5)
- Transmission downshift (6)
- Steer right (7)



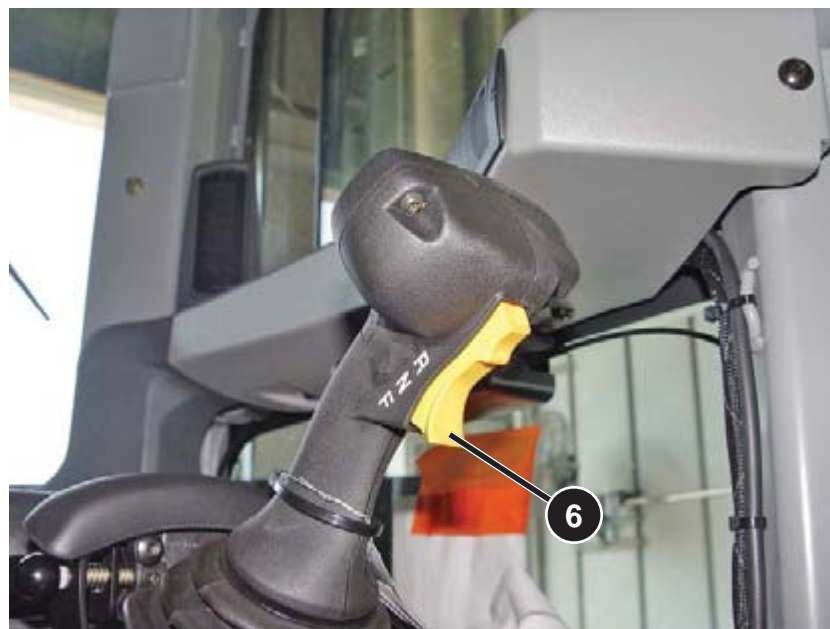
- Left blade raise (8)
- Articulation auto recenter (9)
- Articulate right (10)
- Articulate left (11)
- Transmission direction control (12)

The right joystick controls are as follows:

- Right blade lower/float (13)
- Blade tip forward (14)
- Centershift right (15)
- Blade sideshift right (16)
- Centershift left (17)
- Blade tip back (18)
- Blade sideshift left (19)
- Right blade raise (20)
- Throttle resume/decelerate switch (21)
- Differential lock (22)
- Circle drive clockwise (23)
- Circle drive counterclockwise (24)



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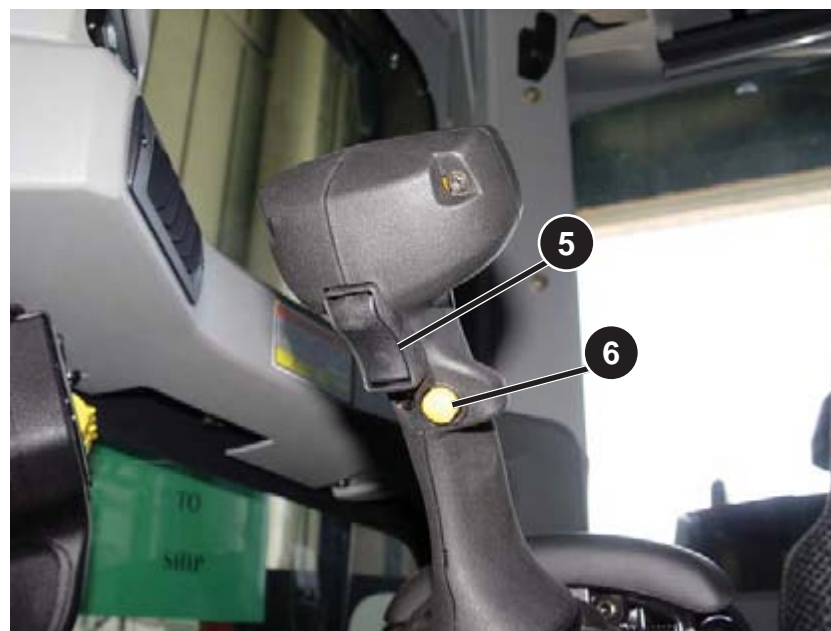
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The left joystick controls are as follows:

- Wheel lean left (1)
- Transmission upshift (2)
- Wheel lean right (3)
- Transmission downshift (4)
- Articulation auto recenter (5)
- Transmission direction control (6)



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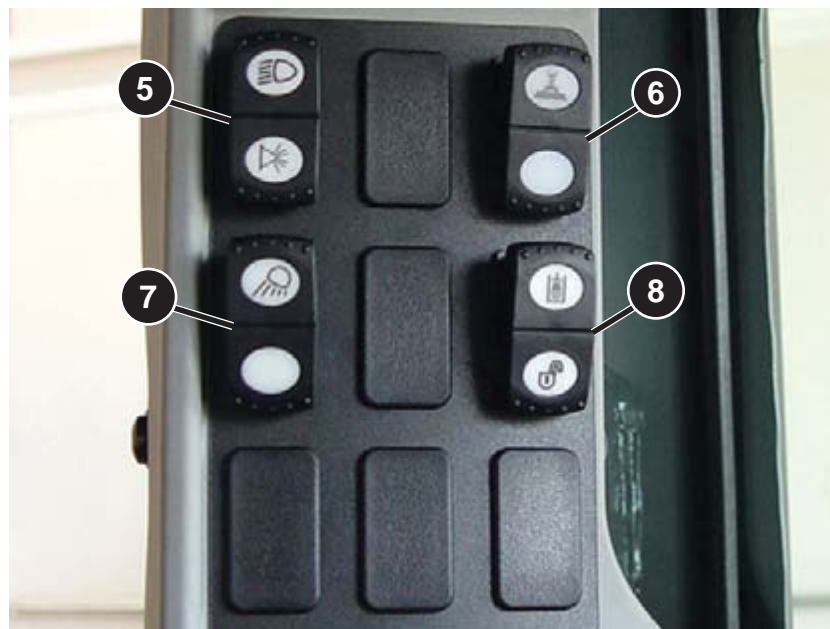
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The right joystick controls are as follows:

- Blade tip forward (1)
- Center shift left (2)
- Center shift right (3)
- Blade tip back (4)
- Throttle resume/decelerate switch (5)
- Differential lock (6)



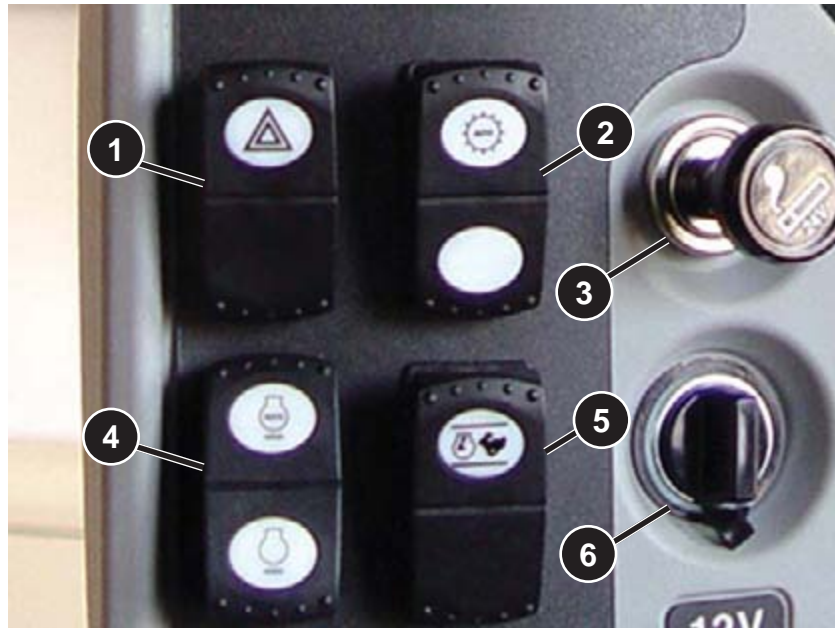
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The "M" Series cab switches are now located on a panel to the right of the operator's seat. The cab switches are as follows:

- Centershift lock switch (1)
- Defroster fan switch (2)
- All Wheel Drive (AWD) controls (3)
- Warning beacon switch (4)
- Headlights and tail lights switch (5)
- Blade cushion switch (6)
- Front and rear work lights switch (7)
- Hydraulic lockout switch (8)



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Additional controls shown are:

- Hazard flasher switch (1)
- Autoshift switch (2)
- Cigar lighter (24V) (3)
- Throttle control mode switch (4)
- Throttle set/accelerate Switch (5)
- Power port (12V) (6)





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Additional controls shown are:

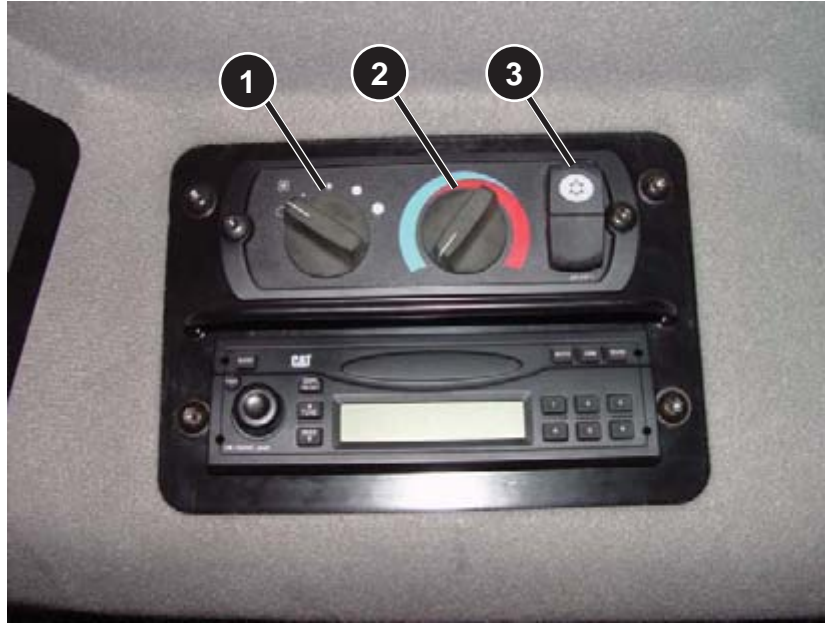
- Messenger display (arrow)



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The "M" Series window wiper switches are on the top right of the cab. The switches are as follows:

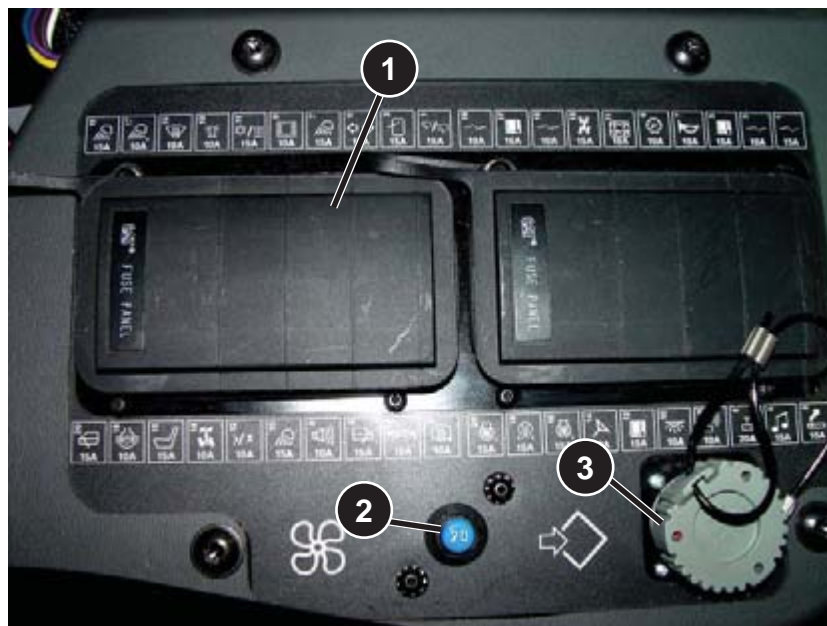
- Front window wiper (1)
- Left front window wiper (2)
- Rear window wiper (3)
- Right front window wiper (4)



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The "M" Series heating and air conditioning controls are now located on the top, right side of the cab. The controls are as follows:

- Fans speed switch (1)
- Variable temperature control (2)
- Air conditioning ON/OFF switch (3)



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The fuse panel (1) is located on the left side of the cab floor. The circuit breaker (2) is for the defroster fan motor. The diagnostic port (3) is used Caterpillar Electronic Technician (Cat ET).