中国民用航空局 CIVIL AVIATION ADMINISTRATION OF CHINA

C A A C

AIRWORTHINESS DIRECTIVE

This directive is issued under "Airworthiness Directives of Civil Aircraft" (CCAR-39) of China Civil Aviation Regulations, its contents involve with flight safety and it is mandatory action. Related aircraft will no longer be airworthy, if it is not completed in accordance with this AD.

No. : CAD2021-B737-19 Amendment No. : 39-10792

1. **Title:** Corrective actions of Maneuvering Characteristics Augmentation System (MCAS) unsafe condition

2. **Applicability:**

This CAD applies to all manufacturer serial numbers of Boeing 737-8 airplanes.

3. **Reference:**

(1)CAD2018-B737-19(Amendment 39-9598), dated November 9, 2018
(2)CAD2018-B737-21(Amendment 39-9644), dated December 19, 2018
(3)Boeing Alert RB 737-22A1342 RB, dated November 17, 2020
(4)Boeing Alert SB 737-22A1342, dated November 17, 2020
(5)Boeing Alert RB 737-22A1342 RB Revision 1, dated December 23, 2020
(6)Boeing Alert SB 737-22A1342 Revision 1, dated December 23, 2020
(7)Boeing Special Attention SB 737-31-1860, dated June 12, 2020
(8)Boeing Special Attention SB 737-31-1860 Revision 1, dated July 2, 2020
(9)Boeing Special Attention SB 737-27-1318, dated June 10, 2020
(10)Boeing Special Attention SB 737-27-1318 Revision 1, dated June 24, 2020
(11)Boeing Special Attention SB 737-27-1318 Revision 2, dated November 10, 2020
(12)Boeing AMOC Notice 737-27-1318 AMOC 01, dated November 25,

2020
(13)Boeing AMOC Notice 737-27-1318 AMOC 02, dated December 23, 2020
(14)Boeing AMOC Notice 737-27-1318 AMOC 03, dated December 23, 2020
(15) Boeing SB 737-27-1320, dated October 14, 2020
(16) Boeing 737 MAX B-737-8/-8200/-9 MMEL Revision 3, dated April 12, 2021
(17) Boeing Special Attention SB 737-00-1028, dated July 20, 2020

4. Reason, action and prescription:

This CAD supersedes CAD2018-B737-19 39-9598 and
CAD2018-B737-21 39-9644

4.1 Reason

Boeing 737-8 airplanes were involved in the Lion Air and the Ethiopian Airlines fatal accidents. Investigations revealed that both of the two crashes were caused when Boeing 737-8 airplanes were under manual flight with flaps up condition, the single erroneously high angle of attack (AOA) input activated the MCAS repeatedly, and subsequently caused repetitive airplane nose-down trim of the horizontal stabilizer, with multiple alerts interference, the flight crew were unable to appropriately identify the cause of malfunction and take proper actions, finally resulting in the airplane loss of control.

To address this unsafe condition, Boeing initiated Flight Control Software and MAX Display Software design changes. CAAC completed review of the actions proposed by Boeing, including Flight Control Software design change, MAX Display Software design change, Aircraft Flight Manual revision, Horizontal Stabilizer Trim Wire Bundle Routing Change etc. After conducting sufficient assessment, CAAC considers the corrective actions are adequate to address this unsafe condition.

Based on the above description, in order to address the unsafe condition,

CAAC is issuing this CAD to supersede CAD2018-B737-19 and CAD2018-B737-21, which requires to accomplish the corrective actions including the installation and verification of Flight Control Computer (FCC) Operational Program Software (OPS), installation and verification of MAX Display System (MDS) Software, Horizontal Stabilizer Trim Wire Bundle Routing Change, Installation of Stall Warning System Stick Shaker Circuit Breakers Button (Colored Cap), Aircraft Flight Manual revision, MEL revision, AOA Sensor System Test and Operational Readiness Flight.

4.2 Required Actions and Compliance Times

Comply with this CAD within the compliance times specified, unless already done.

(1) Installation/Verification of Flight Control Computer (FCC) Operational Program Software (OPS)

Before further flight, in accordance with Boeing Alert RB 737-22A1342 RB, dated November 17, 2020 or 737-22A1342 RB Revision 1, dated December 23, 2020, install FCC OPS software version P12.1.2, part number (P/N) 2274-COL-AC2-26, or later-approved software versions on FCC A and FCC B, and do a software installation verification. During the installation verification, if the approved software part number is not shown as being installed on FCC A and FCC B, before further flight, do corrective actions until the approved software part number is installed on FCC A and FCC B. Later-approved software versions are only those Boeing software versions that are approved as a replacement for the applicable software, and are approved as part of the type design after the 737-22A1342 RB Revision 1, dated December 23, 2020.

Note1: Guidance for doing the installation and installation verification of the FCC OPS software can be found in Boeing 737-7/8/8200/9/10 Aircraft Maintenance Manual (AMM), Section 22-11-33.

Note2: Guidance for accomplishing the actions can also be found in Boeing

Alert SB 737-22A1342, dated November 17, 2020, which is referred to in Boeing Alert RB 737-22A1342 RB, dated November 17, 2020 or in Boeing Alert SB 737-22A1342 Revision 1, dated December 23, 2020, which is referred to in Boeing Alert RB 737-22A1342 RB Revision 1, dated December 23, 2020.

(2) Installation/Verification of MAX Display System (MDS) Software

Before further flight, do all applicable actions identified as "RC" in, and in accordance with, the Accomplishment Instructions of Boeing Special Attention SB 737-31-1860 Revision 1, dated July 2, 2020.

(3) Horizontal Stabilizer Trim Wire Bundle Routing Change

Before further flight, do all applicable actions identified as "RC" in, and in accordance with, the Accomplishment Instructions of Boeing Special Attention SB 737-27-1318 Revision 2, dated November 10, 2020, 737-27-1318 AMOC 01, dated November 25, 2020, 737-27-1318 AMOC 02, dated December 23, 2020.

(4) Installation of Stall Warning System Stick Shaker Circuit Breakers Button (Colored Cap)

Before further flight, install a button (colored cap) on each stick shaker circuit breaker in accordance with the Accomplishment Instructions of Boeing SB 737-27-1320, dated October 14, 2020.

(5)Airplane Flight Manual (AFM) Revisions

Before further flight, remove the information required by CAD2018-B737-19 and CAD2018-B737-21, revise the existing AFM to include the changes specified in paragraphs 2) through 12) of this CAD, or insert a copy of figure 1 to figure 11 into the existing AFM.

1) In the Certificate Limitations and Operating Procedures chapters, remove the information required by CAD2018-B737-19 and CAD2018-B737-21.

2) In the Operating Procedures chapter, revise the General paragraph to

include the information in figure 1 of this CAD.

Figure 1 AFM Revision: General paragraph

Definitions: **Required by CAD2021-B737-19**
Recall items are minimum immediate actions items. Reference items are accomplished after Recall items have been accomplished.

3) In the Operating Procedures chapter, replace the existing Airspeed Unreliable paragraph with the information in figure 2 to of this CAD.

Figure 2 AFM Revision: Airspeed Unreliable

Airspeed Unreliable (E) **Required by CAD2021-B737-19**
Airspeed or Mach indications are suspected to be unreliable: Recall: If autopilot is engaged, disengage. If autothrottle is engaged, disengage. Set both F/D switches to off. Set the following gear up pitch attitude and thrust: Flaps extended: 10° and 80% N1 Flaps up: 4° and 75% N1 Reference: PROBE HEAT switches check on. The following indications are reliable: attitude, N1, ground speed, and radio altitude. **Notes:** 1. Stick shaker, overspeed warning and airspeed low alerts may sound erroneously or simultaneously. 2. The flight path vector and pitch limit indicator may be unreliable on the PFD and HUD (as installed). 3. If the AOA indicator option is installed, the stick shaker indicator may be unreliable. AOA digital readout, analog needle, and approach reference band may be unreliable if the airspeed unreliable condition is caused by erroneous AOA. Attempt to determine a reliable airspeed indication. If a reliable airspeed indication can be determined: Use the reliable airspeed indication for the remainder of the flight. If only the standby airspeed indication is reliable do not use autopilot, autothrottle, or flight directors. If the captain's or first officer's airspeed indication is reliable, turn on the flight director

switch on the reliable side. If needed, engage autopilot on the reliable side. Do not use autothrottle.

Note: Autopilot may not engage or may disengage automatically.

If a reliable airspeed indication cannot initially be determined:

Using performance tables from an approved source, set the pitch attitude and thrust setting for the current airplane configuration and phase of flight. When in trim and stabilized, compare the captain, first officer, and standby airspeed indicators with the airspeed shown in the table. An airspeed indication that differs by more than 20 knots or 0.03 Mach from the airspeed shown in the table should be considered unreliable. Use the reliable airspeed indication for the remainder of the flight. If only the standby airspeed indication is reliable. **Note:** Do not use autopilot, autothrottle, or flight directors. If the captain's or first officer's airspeed indication is reliable, turn on the flight director switch on the reliable side, and autopilot if needed. Do not use autothrottle.

Note: Autopilot may not engage or may disengage automatically.

If a reliable airspeed indication cannot be determined:

Using the performance tables from an approved source, set pitch attitude and thrust for the airplane configuration and phase of flight as needed. Reference an approved source for landing distances.

Note: 1. Maintain visual conditions if possible.

2. Establish landing configuration early.

3. Radio altitude reference is available below 2500 feet.

4. Use electronic and visual glideslope indicators, where available, for approach and landing.

Attempt to determine a reliable altitude indication.

If the captain's or first officer's altitude indication is reliable:

Use the most reliable altitude indication for the remainder of the flight. The airplane may not meet RVSM requirements. Set transponder to reliable side and select traffic alerts only mode.

If captain's and first officer's altitude indications are both unreliable:

Turn off transponder altitude reporting.

Note: Airplane does not meet RVSM requirements.

A nuisance stick shaker may be deactivated at pilot's discretion. This

improves recognition of a stall warning on the opposite side.

Note: Elevator Feel Shift may be active, resulting in increased control column forces.

If deactivating stick shaker is needed: Only the active stick shaker should be deactivated. Deactivate nuisance stick shaker.

Note: 1. When the circuit breaker is pulled, increased control column forces due to Elevator Feel Shift activation are removed.

2. The stick shaker on the opposite side is not deactivated.

If deactivating stick shaker is not needed; end of procedure except deferred items.

In addition to the normal descent, approach and landing checklists, complete the following deferred items:

For approach, only set the BARO minimums on the reliable PFD. Remove the BARO minimums from the unreliable PFD.

Note: If BARO minimums are set only on the First Officer's PFD, DA/MDA aural callouts are not provided. Use the performance tables from an approved source to determine the go-around pitch attitude and thrust setting.

In the event of a go-around if either the captain's or first officer's airspeed indication is reliable, when TO/GA is pushed, the flight director pitch bar may automatically be removed. An AFDS pitch mode change, such as LVL CHG, restores the flight director pitch bar.

Note: Only use flight director guidance on the reliable PFD.

In the event of a go-around and the standby airspeed indication is the only reliable airspeed, do not use TO/GA.

4) In the Operating Procedures chapter, replace the existing Runaway Stabilizer paragraph with the information in figure 3 of this CAD.

Figure 3 AFM Revision: Runaway Stabilizer

Runaway Stabilizer (E) **Required by CAD2021-B737-19**

If uncommanded stabilizer movement occurs continuously or in a manner not appropriate for flight conditions:

Recall:

Firmly hold control column. Disengage autopilot if engaged. Disengage autothrottle if engaged. Use the control column and thrust levers to control airplane pitch attitude and airspeed. Use main electric

stabilizer trim to reduce control column forces.

If the runaway stops after autopilot is disengaged, do not re-engage autopilot or autothrottle; end of procedure.

If the runaway continues after autopilot is disengaged, place both STAB TRIM cutout switches to CUTOUT.

If the runaway continues, grasp and hold stabilizer trim wheel.

Reference:

Trim the stabilizer manually.

Notes:

1. A two-pilot effort may be used to correct an out of trim condition.

2. Reducing airspeed reduces airloads on the stabilizer which can reduce the effort needed to manually trim. Anticipate trim requirements. Do not re-engage autopilot or autothrottle.

In addition to the normal descent, approach and landing checklists, complete the following deferred item:

Establish landing configuration and in-trim condition early on final approach.

5) In the Operating Procedures chapter, replace the existing Stabilizer Trim Inoperative paragraph with the information in figure 4 of this CAD.

Figure 4 AFM Revision: Stabilizer Trim Inoperative

Stabilizer Trim Inoperative **Required by CAD2021-B737-19**

Loss of electric trim through the main electric stabilizer trim switches, or when directed by the Stabilizer Out of Trim procedure.

Place both STAB TRIM cutout switches to CUTOUT. The autopilot is not available. Trim stabilizer manually. A two-pilot effort may be used and will not cause system damage.

Notes:

1. Reducing airspeed reduces airloads on the stabilizer which can reduce the effort needed to manually trim.

2. If the failure could be due to ice accumulation, descend to a warmer temperature and attempt again to trim manually.

If the stabilizer can be trimmed manually, anticipate trim requirements.

If the stabilizer cannot be trimmed manually, expect higher than normal elevator forces during approach and landing. The thrust reduction at flare will cause a nose down pitch.

Plan a flaps 15 landing. Set Vref 15+10 knots.

Note: The maximum wind additive should not exceed 5 knots. Check the non-normal landing distance tables in an approved source.

In addition to the normal descent, approach and landing checklists, complete the following deferred items:

Review the normal go-around procedure. During a go-around, advance thrust to go-around smoothly and slowly to avoid excessive pitch-up.

Establish landing configuration early on final approach.

6) In the Operating Procedures chapter, add the information in figure 5 of this CAD.

Figure 5 AFM Revision: Speed Trim Fail

Speed Trim Fail **Required by CAD2021-B737-19**

The Speed Trim function and MCAS function are inoperative.

Continue normal operation.

Note: The Speed Trim System will not provide stabilizer trim inputs when deviating from a trimmed airspeed.

7) In the Operating Procedures chapter, add the information in figure 6 of this CAD.

Figure 6 AFM Revision: Stabilizer Out of Trim

Stabilizer Out of Trim **Required by CAD2021-B737-19**

The STAB OUT OF TRIM light illuminates for the following conditions:

On the ground: A partial failure of a Flight Control Computer.

In-flight: the autopilot does not set the stabilizer trim correctly.

If on ground, do not take off. End of procedure.

In flight, during large changes in trim requirements, the STAB OUT OF TRIM light may illuminate momentarily. If the stabilizer is trimming, continue normal operation; end of procedure.

In flight, if the stabilizer is not trimming, hold control column firmly. Disengage autopilot. Disengage autothrottle if engaged. Use main electric stabilizer trim as needed.

If the stabilizer responds to electric trim inputs, do not re-engage the autopilot or autothrottle; end of procedure.

If the stabilizer does not respond to electric trim inputs, accomplish the Stabilizer Trim Inoperative procedure.

8) In the Operating Procedures chapter, add the information in figure 7

of this CAD.

Figure 7 AFM Revision: AOA Disagree

AOA Disagree **Required by CAD2021-B737-19**
When AOA DISAGREE appears on the PFD, this indicates the left and right angle of attack vanes disagree. Accomplish the Airspeed Unreliable procedure.

9) In the Operating Procedures chapter, add the information in figure 8 of this CAD.

Figure 8 AFM Revision: ALT Disagree

ALT Disagree **Required by CAD2021-B737-19**
The ALT DISAGREE alert is displayed on the captain's and first officer's altitude tape on the PFD when the indications disagree. If the IAS DISAGREE alert is also shown on the speed tape of the PFD, accomplish the Airspeed Unreliable procedure. If the IAS DISAGREE is not shown, check all altimeters are set to correct barometric setting. If the ALT DISAGREE alert extinguishes, continue normal operation. If the ALT DISAGREE alert remains, standby altimeter is available, do not use the flight path vector, maintain visual conditions if possible and if a reliable altitude is determined, use the transponder for the reliable side. **Note:** Airplane does not meet RVSM requirements. If a reliable altitude is not determined, set the transponder to not transmit altitude. In addition to the normal descent, approach and landing checklists, complete the following deferred items: For approach, only set the BARO minimums on the reliable PFD. Remove the BARO minimums from the unreliable PFD. **Note:** If BARO minimums are set only on the First Officer's PFD, DA/MDA aural callouts are not provided. Establish landing configuration early. Radio altitude reference is available below 2,500 ft. Use electronic and visual glideslope indicators where available for approach and landing.

10) In the Operating Procedures chapter, add the information in figure 9 of this CAD.

Figure 9 AFM Revision: IAS Disagree

IAS Disagree **Required by CAD2021-B737-19**

When IAS DISAGREE appears on the PFD, this indicates the captain's and first officer's airspeed indicators disagree. Accomplish the Airspeed Unreliable procedure.

11) In the Operational Data chapter, add the information in figure 10 of this CAD.

Figure 10 AFM Revision: Practical Operational Flight Envelope (POFE)

Practical Operational Flight Envelope (POFE)

Required by CAD2021-B737-19

The Practical Operational Flight Envelope describes the boundaries where compliance to the controllability and maneuverability requirements of 14 CFR Part 25 are met with a single failure of any Stability Augmentation, Automatic, or Power-Operated System.

For Speed Trim System Inoperative, the controllability and maneuverability requirements of 14 CFR Part 25.672(c)(2) are met Flaps Up at load factors up to +1.8g or prior to initial buffet, at speeds up to Vmo/Mmo. Beyond this envelope, column forces may be slightly lower than normal.

12) In the Operational Data chapter, add the information in figure 11 of this CAD.

Figure 11 AFM Revision: AOA DISAGREE Alert Latching Logic

AOA DISAGREE Alert Latching Logic

Required by CAD2021-B737-19

1. AOA DISAGREE Alert Latching Passing 400AGL:

The AOA DISAGREE alert logic is active when the airplane is above 400 feet RA.

If the AOA DISAGREE alert is shown when descending through 400 feet RA, the alert remains until landing.

2. AOA DISAGREE Alert Latching with Radio Altitude Loss:

At all altitudes (above and below 400 feet), if the Radio Altitude data is lost, the AOA DISAGREE is displayed based on its previous state. If the AOA DISAGREE alert was displayed prior to loss of Radio Altitude, the AOA DISAGREE alert is latched as displayed. If the AOA DISAGREE alert was not displayed prior to loss of Radio Altitude, the

AOA DISAGREE alert is not displayed. The latching remains until landing or until Radio Altitude data is received by the MDS.

The only unique flight deck effect in this condition is that the AOA DISAGREE alert may only be displayed on one PFD.

3. AOA Indicator Option:

The AOA DISAGREE alert is based on vane angle and the AOA indicator is based on body angle.

(6) MEL Revision

Before further flight, in accordance with MMEL accepted by CAAC (Boeing 737 MAX B-737-8/-8200/-9 MMEL Revision 3, dated April 12, 2021 or later revision), revise MEL to include the requirement in figure 12. In the event that the airplane functions associated with the flight control system as modified by this CAD are inoperative, an airplane may be operated (dispatched) according to approved MEL.

Figure 12 MEL Provisions

(1) Dispatch is not permitted with both autopilot systems inoperative.

(2) The autopilot disengage aural warning system must be operative for dispatch.

(3) The STAB OUT OF TRIM light must be operative for dispatch.

(4) The speed trim function must be operative for dispatch.

(5) The SPEED TRIM FAIL light must be operative for dispatch.

(6) Dispatch is not permitted with both A/P ENGAGE Command (CMD) Switches (A and B) inoperative.

(7) Dispatch is not permitted with both A/P ENGAGE Command (CMD) switch lights inoperative.

(8) Dispatch is not permitted with both autopilot (A/P) disengage lights inoperative.

(9) Dispatch is not permitted with both Control Wheel Autopilot Disengage Switches inoperative. Dispatch may be made with one control wheel autopilot disengage switch inoperative provided the following conditions are met.

a) Mode Control Panel autopilot DISENGAGE bar operates normally.

b) Autopilot is not used below 1,500 feet AGL, and

c) Approach minimums do not require use of autopilot.
(10) Both control wheel trim switch systems must be operative for dispatch.

(7) AOA Sensor System Test

Before further flight, do all applicable actions identified as “RC” for the “Angle of Attack (AOA) Sensor System Test” specified in, and in accordance with, the Accomplishment Instructions of Boeing Special Attention SB 737-00-1028, dated July 20, 2020.

(8) Operational Readiness Flight

1) After accomplishment of all applicable required actions in paragraph4.2.(1)-(7) of this CAD, do all applicable actions identified as “RC” for the “Operational Readiness Flight” specified in, and in accordance with, the Accomplishment Instructions of Boeing Special Attention SB 737-00-1028, dated July 20, 2020. A special flight permit is not required to accomplish the “Operational Readiness Flight” required by this paragraph.

2) After the “Operational Readiness Flight” and before further flight, any mechanical irregularities that occurred during the “Operational Readiness Flight” must be resolved following the operator's approved maintenance or inspection program, as applicable.

(9) Special Flight Permit

Special flight permits may be issued in accordance with CCAR 21 to operate the airplane to a location where the actions of this CAD can be performed.

(10) Credit for Previous Actions

1) This paragraph provides credit for the actions specified in paragraph 4.2.(2) of this CAD, if those actions were performed before the effective date of this CAD using Boeing Special Attention SB 737-31-1860, dated June 12, 2020.

2) This paragraph provides credit for the actions specified in paragraph 4.2.(3) of this CAD, if those actions were performed before the effective date of this CAD using Boeing Special Attention SB 737-27-1318, dated June 10, 2020, or Revision 1, dated June 24, 2020 and 737-27-1318 AMOC 03, dated December 23, 2020, provided the 14 Installation Deviation Records (IDRs) identified in paragraph 1.D., “Description,” of Boeing Special Attention SB

737-27-1318 Revision 2, dated November 10, 2020, 737-27-1318 AMOC 01, dated November 25, 2020, 737-27-1318 AMOC 02, dated December 23, 2020 have been incorporated on the airplane. Accomplishment of approved Boeing IDRs not identified in paragraph 1.D., “Description,” of Boeing Special Attention SB 737-27-1318 Revision 2, dated November 10, 2020, before the effective date of this CAD, is acceptable for compliance with the corresponding “RC” steps specified in Special Attention SB 737-27-1318 Revision 1, dated June 24, 2020, provided those IDRs reference Boeing Special Attention SB 737-27-1318 Revision 1, dated June 24, 2020.

4.3 Other Requirement

N/A

4.4 Alternative Methods of Compliance

(1) An AMOC that provides an acceptable level of safety required by this CAD must be approved by airworthiness certification department.

(2) Before using any approved AMOC, notify appropriate principal inspector of the flight standard department.

5. Effective Date: 2021-12-02

6. Issue Date: 2021-12-02

7. Contact Person: Xing Guanghua

Shanghai Aircraft Airworthiness Certification Center of CAAC

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