Management Reference Guide

about the Boeing 737
Edition NG (6/7/8/900)

by Pat BOONE
The B737MRG covers all QRH non-normals and many more

(over 300 non-normals in total)
Toilet / Water System Malfunctions
Airstair Fail
BLEED TRIP OFF
Trim Air Fail
WING ANTI-ICE VALVE OPEN
MCP Faults
Radio Continuous Transmit (Stuck Microphone Switch)
BAT DISCHARGE
TR Failure - DC BUS OFF
EEC ALTERNATE MODE
Nitrogen Generator System Fail
LOW IDLE
CARGO FIRE DETECTOR FAULT
FSEU Fail
Stabilizer Trim Inoperative
CDS MAINT - CDS FAULT
Radio Altimeter Fail
IRS / ADIRU Drift
GEAR DISAGREE
PSEU
The **B737MRG** displays a logic gate for all amber, green, red and blue flight deck lights

(and there are many lights…)
Loss of DC power on DC BUS 1 / 2 for > 3"
Rate of cabin pressure change > 2,000 ft/min SLE
Cabin altitude above 15,800 feet
Differential pressure > 8.75 PSID
Fault in Outflow Valve Control
Fault in Pressurization Controller 1 / 2

(In FLT) Auto Brake Arm Conditions not met
(On GND) Auto Brake System Deactivated
Antiskid system INOP or OFF
Electric Power Fail (DC BUS 1-2)
Loss of Hydraulic System Pressure
Auto Brake Select Switch not in OFF

REV (amber)
One or both Thrust Reverser Sleeve(s) between 10% and 90%

REV (green)
Both Thrust Reverser Sleeves more than 90% to deploy

Two or more Circuit Cards (*) have failed in either DEU
One Circuit Card (*) has failed in both DEU
Total failure (*) of either DEU
N1-N2-EGT miscompare between DEU 1-2
Data Loader Selector in DEU 1 or 2 pos. (*)
Hot Batt Bus not powered during DEU init. (*)
The **B737MRG** displays a logic gate for many system operations

*(based on the Maintenance Manuals)*
Air/Gnd-Relay in FLT
One or both Main Landing Gear not UP & LOCKED
Landing Gear Lever in UP or OFF
Engine No 1 \( N2 \ < 56\% \) (CL) 50\% (NG)
System B Pressure supplied to LGTU Valve

Air/Gnd-Relay in FLT
TE Flaps extended 1 thru 10
EDP System B output pressure \(< \ 2,350\) PSI
Alternate Flaps Control Switch NOT down

RTO Mode ARMED
Both Thrust Levers retarded to IDLE
Wheel Speed Signal \( > 90 \) kts (CL) - 88 kts (NG)
No fault in the Normal Antiskid System
Rudder Pedal Pressure \(< \ 750\) PSI

Speed Brake Lever in ARMED position
Both Thrust Levers in IDLE
Main Wheel(s) Spin Up \( > 60 \) kt
Air/Gnd Sensor in GND Mode
RMLG Strut Depressed
Both Thrust Levers in IDLE
Speed Brake Lever in ARMED position

Speed Brake Lever moves to UP
FLT Spoilers Auto Extend

GND Spoilers Auto Extend
demo 4

The B737MRG has many full color drawings and diagrams

(all hand made by the author)
All antenna equipment is covered by MEL 23 [Communications] and MEL 34 [Navigation]. For missing or broken DME and Marker Beacon Antennas refer to CDL 23-61.
The B737MRG contains several full color flight deck panels

(I have spent maaaany hours on these drawings…)}
The WING-BODY OVERHEAT lights may take up to 10" to come on.
The **B737MRG** gives you guidelines how to manage non-normals

*(based on simulator and line experience)*
### ALL FLAPS UP LANDING

**FCTM 8.x** [Leading Edge or Trailing Edge Device Malfunctions]

<table>
<thead>
<tr>
<th>Section</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Approach</td>
<td>Request radar vectors for 15 miles final with wide turns due to 15° bank angle limit</td>
</tr>
<tr>
<td></td>
<td><strong>With a published procedure turn</strong>, adjust outbound leg heading or timing due to limited bank!</td>
</tr>
<tr>
<td></td>
<td>Expect impression of being high on profile due to a high nose-up attitude</td>
</tr>
<tr>
<td>Landing</td>
<td>Burn off fuel to practical minimum in order to reduce landing weight</td>
</tr>
<tr>
<td></td>
<td>No flare, positive landing. Apply forward column pressure after touchdown!</td>
</tr>
<tr>
<td></td>
<td>Autobrakes are not recommended, use maximum reverse thrust and gentle braking</td>
</tr>
<tr>
<td></td>
<td>High speed tires maximum 195 kts ground speed. Verify tire condition with external inspection.</td>
</tr>
<tr>
<td></td>
<td>Be ready to take over with nose wheel steering for directional control upon roll-out</td>
</tr>
<tr>
<td>Go-Around</td>
<td>Go-around with Flaps UP</td>
</tr>
<tr>
<td></td>
<td>Limit bank angle to 15° when speed is below Flaps UP-speed</td>
</tr>
<tr>
<td>ATC</td>
<td><strong>&quot;PAN-PAN : Technical problem - No flaps - Landing at high speed&quot;</strong></td>
</tr>
<tr>
<td></td>
<td>Request : - Weather forecast at ETA (= after fuel burn-off) and landing minima CAT I</td>
</tr>
<tr>
<td></td>
<td>- Refer to [PI [Adv. Info - Non-Normal Configuration Landing Distance]]</td>
</tr>
<tr>
<td></td>
<td>- Avoid wet runway and crosswind</td>
</tr>
<tr>
<td></td>
<td>- Verify obstacles for straight ahead go-around</td>
</tr>
<tr>
<td></td>
<td>Report : - Holding time required to burn-off fuel and prepare for approach</td>
</tr>
<tr>
<td></td>
<td>- Souls on board</td>
</tr>
<tr>
<td></td>
<td>- Fuel upon landing</td>
</tr>
<tr>
<td></td>
<td>- Any or no dangerous goods on board</td>
</tr>
<tr>
<td>Cabin Crew</td>
<td><img src="image" alt="OPS - Brief the CCM in line with company procedures" /></td>
</tr>
<tr>
<td></td>
<td>Refer to ![MRG p.Error! Bookmark not defined, [RISK LEVEL]] for guidelines: with a long dry RWY available, a precautionary landing is suggested.</td>
</tr>
<tr>
<td>Passengers</td>
<td><img src="image" alt="OPS - Reassure passengers in line with company guidelines" /></td>
</tr>
<tr>
<td></td>
<td>Example : &quot;Technical problem, airplane under control. Remain in holding for x time to reduce fuel. Follow Cabin Crew instructions.&quot;</td>
</tr>
</tbody>
</table>
ENGINE START PROBLEMS

NO AUTOMATIC STARTER CUTOUT
Condition: Start Switch does not move back to OFF at 46% (CL) - 56% (NG) N2
Manually position the Start Switch to OFF or AUTO. If the Start Valve does not close, accomplish the NNC [START VALVE OPEN]. In this case, do not shutdown the engine by recall, because you will blow-up the starter!

EARLY STARTER CUTOUT
Condition: Start Switch moves back to OFF before N2 reaches 46% (CL) - 56% (NG)
An early starter cutout may result in a HOT or HUNG start!
- Start Switch fails
  - Start valve \( \odot \) tripped: \( \odot \) P6-2A (CL) \( \odot \) P18-2B \( \odot \) P6-2C (NG)
  - N2-indicator failure (CL): \( \odot \) P6-2D \( \odot \) MEL 77-03 (NOGO - Eng. No 1)
Apply \( \odot \) MEL 80-02 [Engine Starter Auto Cutout]
The start valve is electrically controlled, pneumatically operated and spring-loaded closed. Premature removal of the ground or APU air source may also cause an early starter cutout.

NO ENGINE ROTATION
Condition: Engine RPM remains at zero with normal Start valve OPEN indication and normal duct pressure drop (CL) - rise (NG).
- N2 zero:
  - Mechanical failure in the starter (e.g. shaft shear) or inside the engine (N2 rotor seize up)
  - Failure of the N2 indicator / tachometer - \( \odot \) MEL 77-03 (CL) - Refer to \( \odot \) MRG p.
[Engine Indicating]
  - Excessive use of bleed air (make sure both packs and wing anti-ice are switched off!)
- N1 zero:
  - Mechanical failure in the engine (N1 rotor seize up)
  - Failure of the N1 indicator / tachometer - \( \odot \) MEL 77-02

FUEL FLOW ZERO or LOW
Condition: Fuel flow shows zero or below normal values (0.30 kg / 0.65 lbs per hour) when start lever is raised to IDLE.
- FCU fails:
  - None \( \nrightarrow \) NOGO
- Fuel SOV closed:
  - Verify \( \odot \) P6-3D (CL) - \( \odot \) P6-3B \( \odot \) P6-3C (NG)
Do NOT connect GEN on bus by recall!
A number of systems must first be switched OFF to avoid current peak

Do NOT abort takeoff
- Antiskid is INOP (V1 for antiskid INOP is roughly 20 kts lower)
- RTO is INOP
- No immediate awareness of aircraft speed versus V1
- No automatic extension of speed brakes
  - Switch on cockpit dome light bright as soon as practical
  - Monitor standby ASI for actual speed versus V1
  - The standby horizon displays a flag due to power loss, however instrument is reliable for rotation (gyro spooldown takes a while)

Once airborne
- Captain is PF
- Electrical trim INOP
- Maintain takeoff flaps setting (Flap Position Indicator INOP)
- Level-off at minimum safe altitude since airplane is unpressurized!
  (caution: there is no aural altitude alert to level-off!)
- Call ATC - "PAN-PAN" (3x) - Request radar vectors
- Fly raw navigation (full rose) due to possible IRS drift
- Autothrottle is disconnected!
- Maintain speed between speed-tape yellow bars on EADI

Once airborne, STBY AC BUS and STBY DC BUS automatically switch to their back-up source. The STANDBY PWR OFF amber light should not be illuminated!

APU .......... start and on bus
- connect preferable on GEN BUS No 2 to supply TR3
- if unable to connect the APU to GEN BUS No 2, connect it to GEN BUS No 1
- if the loss of both generators was caused by an engine failure, connect the APU to the bus of the operating engine in order to recover both hydraulic systems!
- only one APU start attempt is recommended to preserve battery life. A second start attempt could be considered below 25,000 feet, as the probability of a successful start increases. (especially Garret APU)

If unable to recover any GEN BUS:
- "MAYDAY" (3x)
- Land within 30 minutes (45 min with APU BAT installed)
- Above FL300 thrust deterioration or engine flameout may occur
The B737MRG leads you through basic maintenance tips & tricks to obtain more info on a failure

( or to reset a system)
On GND  Refer to MEL 24-16 [ELEC light] for the amber light itself. The ELEC amber light illuminated is a **NOGO**.

Additional information on the electrical fault can be obtained from the LAD on the electrical panel as follows:

(\text{I} \text{ indicates the fault is intermittent and not set at this time})

Select both **AC** and **DC Meter Selectors** to **TEST** and temporarily push the MAINT switch.

The BITE will first illuminate all segments of the LAD (takes about 15 seconds) and then show the fault information. To bypass the BITE display test, push the MAINT switch just after test begins. If there are no faults, the message **NO FAULTS STORED** will appear.

When pushing the MAINT switch again, the next fault will be displayed, if any. Continue until all faults have been displayed and **HOLD BUTTON CLEAR FAULTS** is announced.

Press the MAINT switch for approx. 6 seconds (until **FAULTS CLEARED** appears) to reset all faults. Except for GEN1-2 FAULT, the fault cannot be cleared by pressing the MAINT switch, when the fault still exists. In this case return to gate.
HYDRAULIC EMDP DOES NOT ENGAGE

ENGINE DRIVEN PUMP DOES NOT ENGAGE (with engine running)

- the depressurization solenoid valve remains powered while it should not be fed when the EDP switch is selected ON. This failure can be confirmed by removing electrical power from the solenoid: Pump Depress Valve P6-2AB

- the hydraulic pump is inoperative or the pump SOV is inadvertently closed:
  (the latter would be the case with the associated Engine Fire Switch not properly stowed, but then the engine would not be running…)

  Dispatch as per MEL 29-10 [System A Pumps]
  MEL 29-02 [System B Pumps]

Your company SOP may require the EDP for CAT II-III. Verify the Lower Landing Minimum Requirements Table.

ENGINE DRIVEN PUMP DOES NOT DISENGAGE (with engine not running)

- the pressure module check valve may be inoperative

  The pressure module check valve prevents hydraulic backflow through the pressure filter in case EDP output pressure is low. It also isolates the EDP pressure switch. If the check valve fails, the EDP pressure switch senses system pressure.
  Check valve failure is confirmed if the LOW PRESSURE amber light of the EDP illuminates by turning off the associated EMDP.

ELECTRIC MOTOR PUMP DOES NOT ENGAGE (when selected ON)

- the opposite Generator Bus (CL) - Transfer Bus (NG) is not powered

- the EMDP has tripped: (CL) P6-2A P6-11C P6-12C (NG) P91CF P92CF

- the pump is in "ground fault" or overcurrent:

  To reset the "ground fault":

(cont’d)
demo 8

The **B737MRG** alerts for subsequent failures

(can be nasty in the simulator)
**BLEED TRIP OFF**

**SUBSEQUENT FAILURE(S)**

**PACK TRIP OFF / PACK opposite side**
- Pressurization is lost
- Position the failed Pack Switch to OFF, causing the Isolation Valve to open. Use the remaining pack with the opposite engine.

**ENGINE FAILURE or BLEED TRIP OFF opposite side**
- Pressurization is lost
- Main Outflow Valve will drive to fully closed position
- Cabin pressure altitude will climb at 1,000 to 2,000 fpm
- Advise ATC for immediate descent
- Descend in the airway to single engine service altitude or 17,000 feet where the APU may be used as an alternate air source
- Select Engine No 1 Bleed Air to OFF (to extinguish DUAL BLEED amber light)

**WING-BODY OVERHEAT opposite side**
- The checklist calls to switch off the affected engine bleed air. However, since this will result in a loss of both packs and thus loss of pressurization, consider to:
  - Retard thrust on the respective engine
  - Advise ATC for immediate descent
  - Accomplish the NNC [WING-BODY OVERHEAT]
- Left WING-BODY OVERHEAT:
  - Descend to 10,000 feet (or minimum safe altitude if higher)
  - Continue unpressurized to destination or diversion field (trip fuel at 10,000 feet is approximately 10 x distance)
- Right WING-BODY OVERHEAT:
  - Descend to FL 170 in airway
  - Use the APU as an alternate air source
- If this event occurs at low altitude, you can indeed switch-off the affected engine bleed air immediately. The cabin pressure altitude will climb at 1,000 to 2,000 fpm, and it should not reach 10,000 feet before the airplane is at FL 100.

**WING ANTI-ICE VALVE OPEN opposite side**
- Checklist calls for switching off the affected engine bleed air and pack. However, since this will result in a loss of pressurization, consider to:

(cont'd)
demo 9

The **B737MRG** refers to DDG-MEL, QRH, JAR-FAR/FC, FCOM, FCTM, FAM, etc.

(according to the new Boeing SOP)
MEL 35-5 [Passenger Oxygen System] The aircraft can be dispatched at FL250 with passengers on board with the passengers oxygen system INOP. Flight crew oxygen, however, must always meet minimum dispatch requirements for smoke protection in flight.

DISPATCH REQUIREMENTS

- JAR 8.8.1 [Oxygen Requirements]
- FAR 91.211 [Supplemental Oxygen]

IN FLIGHT OXYGEN REQUIREMENTS

- JAR 8.8.1 - JAR OPS-1.770 - FAR 121.329/333 - Supplemental oxygen for emergency descent and first aid on turbine engine airplanes with pressurized cabin:

<table>
<thead>
<tr>
<th>FL</th>
<th>Flight Crew Oxygen required</th>
<th>Passenger Oxygen required</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td></td>
<td>30% pass. (*)</td>
</tr>
<tr>
<td>140</td>
<td></td>
<td>30% pass. (*)</td>
</tr>
<tr>
<td>130</td>
<td></td>
<td>10% pass. (*)</td>
</tr>
<tr>
<td>100</td>
<td>&gt; 30 min</td>
<td>(*)</td>
</tr>
<tr>
<td>SL</td>
<td></td>
<td>(*)</td>
</tr>
</tbody>
</table>

(*) For aircraft certification oxygen supply is required between FL100 and FL140 for 10% of the passenger capacity. Since the passenger oxygen system cannot comply with this requirement, the level-off altitude in the NNC [Emergency Descent] has been lowered to 10,000 feet while 14,000 feet for the B737-200.

- JAR/FAR 25.1447 requires that the flight crew oxygen dispensing unit can be placed from the stowed position on the face with one hand within five seconds.

OXYGEN BOTTLE REFILL OR REPLACEMENT

Special safety precautions apply when replenishing or replacing the crew oxygen bottle, including;
The **B737MRG** contains several tables with valuable numbers

*(based on FCOM, FPPM and AMM)*
<table>
<thead>
<tr>
<th>Sys</th>
<th>USG</th>
<th>Indication</th>
<th>USG</th>
<th>Ind.</th>
<th>Pressure</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(CL)</td>
<td>(NG)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>4.80</td>
<td>F 100%</td>
<td>5.70</td>
<td>100%</td>
<td>3000 PSI</td>
<td>Max. capacity - Overfill</td>
</tr>
<tr>
<td></td>
<td>4.20</td>
<td>RFL 88%</td>
<td>4.70</td>
<td>76%</td>
<td>3000 PSI</td>
<td>Refill limit</td>
</tr>
<tr>
<td></td>
<td>4.00</td>
<td>83%</td>
<td>4.00</td>
<td>70%</td>
<td>3000 PSI</td>
<td>Gear Up - In FLT</td>
</tr>
<tr>
<td></td>
<td>1.80</td>
<td>&lt;1/4 22%</td>
<td>2.30</td>
<td>20%</td>
<td>3000 PSI</td>
<td>Leak in EDP System OK</td>
</tr>
<tr>
<td></td>
<td>1.00</td>
<td>0 0%</td>
<td>1.00</td>
<td>0%</td>
<td>&gt; 0 PSI</td>
<td>Zero QTY indication</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td></td>
<td>0.00</td>
<td></td>
<td>0 PSI</td>
<td>Leak in EMDP or lines</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Loss of System A</td>
</tr>
<tr>
<td>B</td>
<td>7.20</td>
<td>F 100%</td>
<td>8.20</td>
<td>100%</td>
<td>3000 PSI</td>
<td>Full</td>
</tr>
<tr>
<td></td>
<td>6.40</td>
<td>RFL 88%</td>
<td>6.90</td>
<td>76%</td>
<td>3000 PSI</td>
<td>Refill Limit</td>
</tr>
<tr>
<td></td>
<td>4.95</td>
<td>&gt;1/2 64%</td>
<td>6.60</td>
<td>72%</td>
<td>3000 PSI</td>
<td>Leak in STBY System</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Loss of STBY System</td>
</tr>
<tr>
<td></td>
<td>3.50</td>
<td>&lt;1/2 40%</td>
<td>1.30</td>
<td>0%</td>
<td>&gt; 0 PSI</td>
<td>Leak in EDP System OK (CL)</td>
</tr>
<tr>
<td></td>
<td>1.30</td>
<td>&gt;0 5%</td>
<td>1.30</td>
<td>0%</td>
<td>&gt; 0 PSI</td>
<td>Leak in EMDP or lines</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Loss of System B but sufficient for PTU</td>
</tr>
<tr>
<td></td>
<td>1.00</td>
<td>0 0%</td>
<td>1.00</td>
<td>0%</td>
<td>&gt; 0 PSI</td>
<td>Zero QTY indication</td>
</tr>
<tr>
<td></td>
<td>0.00</td>
<td></td>
<td>0.00</td>
<td></td>
<td>0 PSI</td>
<td>Leak in PTU</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Loss of System B + PTU</td>
</tr>
<tr>
<td>STBY</td>
<td>2.80</td>
<td></td>
<td>3.60</td>
<td></td>
<td></td>
<td>Loss of STBY System</td>
</tr>
<tr>
<td></td>
<td>1.40</td>
<td>LOW QTY</td>
<td>1.80</td>
<td>LOW</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The B737MRG contains listings with all breakers and power sources

(based on the AMM and WDM)
**TRANSFER BUS 1 - 115 VAC**

Air Cond Isolation Valve
APU SCU
CDU 1 (*)
Engine 1 EEC
Equip Cool Supply Fan Power Altn
Galley Bus C-D
GPWS
Hyd Sys EMDP 1 Sys B
Radio Navigation DME 1 (*)
Radio Navigation Radio Altm 1
TCAS
TRU 1
Vacuum Waste Blower
Yaw Damper Indicator

**TRANSFER BUS 2 - 115 VAC**

AFCS Stabilizer Trim
AFCS Sys A Mach Trim AC
AFCS Sys A Sensor Excitation AC
ATC 1 (*)
Communications HF 1
Data Loader
Engine Anti-Ice Valve
Engine 1 Altn PWR Chan A - B
Engine 1 Ignition Left
Flight Recorder AC
FMCS Computer 1 (*)
FMCS MCDU 1 (*)
Heaters Alpha Vane Left
Heaters Captain Pitot (*)
Heaters Elev Pitot Left
Heaters Temp Probe
Lights - Ext. Anti Collision Red
Lights - Ext. Anti Collision White
Lights - Ext. Landing Left Fixed
Lights - Ext. Landing Right Retractable
Window Heat Control Left Front AC
Window Heat Control Right Side AC
Wing Anti-Ice Valves

**XFR BUS 1 SECT 1 - 28 VAC**

Lights - Pass. Cabin Reading Left
Yaw Damper AC

**XFR BUS 1 SECT 1 - 115 VAC**

Lights - Ext. Anti Collision Red
Lights - Ext. Anti Collision White
Lights - Ext. Landing Left Fixed
Lights - Ext. Landing Right Retractable
Window Heat Control Left Front AC
Window Heat Control Right Side AC
Wing Anti-Ice Valves
1. Airplane General, Emergency Equipment, Doors, Windows

Air Stair P18-1 C, D
Door Lock, Warning P6-3 C1, A2
Galley Aft P6-12 C7-9
Galley Forward P6-11 C7-9
Lavatory Flush Motors P18-4 B3,B6,C6
Lavatory Water Heaters P18-4 A5-7

Lights
- Anti Collision P18-3 C15-16
- Landing P18-3 A13-16
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Master Dim Bus Ind P6-3 B13-B15
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Overhead Panel P6-3 E9,E1
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Instrument Panel P6-3 B11-B12
C9,C11-12
Pass. Signs Control P18-3 A11
Galley P18-3 B8,C6
D6,E6,F12

Pass. Window P18-3 B6-7
Oxygen System P18-3 F6-9
Service Outlets P6-3 E1,F1
Vacuum/Cleaner Recep P18-4 C1-2
Water Quantity Ind P18-4 A2

2. Air Systems

Bleed Air Valves P6-4 B1-3
Cabin Air Recirculation P6-4 E5
Equipment Cooling P18-3 A18,B18
C18,D18
E18
Fan Control Supply P18-3 F17-18
Forward Outflow Valve P6-4 C5
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The **B737MRG** contains several flow charts to analyze the non-normal

(and to help you manage the non-normal)
**FUEL IMBALANCE**

Fuel Quantity Indicator error annunciation?  
- **Yes**: NNC [FUEL QTY IND INOP]  
- **No**: Crossfeed (was) open?  
  - **Yes**: Set equal \( \%N1 \)  
    - Disengage A/P  
    - Set aileron and rudder trim neutral  
  - **No**: Wings not level  

With all Main Tank Fuel Boost Pumps ON, different fuel pump output pressure may still cause a substantial fuel imbalance.  

Wings not level?  
- **Yes**: Compare FU (Fuel Used) between engines  
  - **FU equal**: Using fuel from CTR Tank?  
    - **Yes**: CTR and Main Tank Qty decreasing at same rate, equal to FF per one engine?  
      - **Yes**: Switch Main Tank Fuel Boost Pumps to OFF  
      - **No**: CTR Tank Fuel Boost Pump output pressure is below Main Tank Fuel Boost Pump output press. or CTR Tank Fuel Boost Pump is not ON  
    - **No**: FF and EGT not equal (with minor imbalance)  
      - Engines have a different fuel consumption  
      - (verify \( \triangle FU = \triangle FF \times \text{Time} \))  
      - Fuel leak btwn FF-transmitter and Engine Fuel Nozzle  
      - NNC [ENGINE FUEL LEAK]  
        - Accomplish the engine shutdown  
        - Fuel from all tanks is available for single engine  
        - When Fuel Qty in both tanks is back to balance, open crossfeed to maintain balance and to use all available fuel  
  - **No**: Fuel Qty Ind. malfunction  

Wings level? (with significant imbalance)  

Crossfeed (was) open?  
- **Yes**: Fuel Qty Ind. malfunction  
- **No**: Set equal \( \%N1 \)  

Compare FF (Fuel Flow) and EGT  
- **FF and EGT not equal**: With all Main Tank Fuel Boost Pumps ON, different fuel pump output pressure may still cause a substantial fuel imbalance.
Verify fuel leak after engine shutdown

Leak stops

IF

Leak continues

Leak in engine pylon between Spar Fuel SOV and FF - transmitter

Switch affected Main Fuel Tank Boost Pumps to OFF

IF

Leak continues at same rate

Fuel leak in Main Tank

Fuel leak in pipelines to Spar Fuel SOV

Switch boost pumps OFF to decrease the leak rate

Keep crossfeed closed!

Consider an engine relight using fuel from main tank until engine fuel starvation

If enough fuel remains until after landing, shutdown engine during roll-out to avoid fire

NNC [ENGINE FUEL LEAK]

The engine remains shutdown

Fuel from all tanks is available for single engine

When fuel qty in both tanks is back to balance, open crossfeed to maintain balance and to use all available fuel
demo 13

The **B737MRG** contains several rules of thumb

(both general and aircraft related)
Rule of Thumb to crosscheck proper pressurization of the cabin during climb:

At FL 100 the needles should point approximately 1 and 4

(valid for cruising levels > FL250)

Rule of Thumb to verify whether cabin pressure can follow airplane descent:

**CABIN ALT / 100 = NAUTICAL MILES REQUIRED**

e.g. The cabin altitude pressure shows 4,000 feet, then the controller requires circa 40 NM to descend to sea level
If distance to destination is 40 NM or more, remain in Auto Mode. If track miles to destination is less than 40 NM, select Standby Mode and increase rate of descent.

If destination elevation is well above SL, subtract Land ALT from the Cabin ALT:

**((CABIN ALT - LAND ALT) / 100 = NAUTICAL MILES REQUIRED)**

e.g. The cabin altitude pressure shows 4,000 feet and destination elevation is 1,500 feet, then the controller requires circa 25 NM to descend to airport elevation.
Memorize this 1/60 table (speed in NM / min)

<table>
<thead>
<tr>
<th>speed (kt)</th>
<th>120</th>
<th>150</th>
<th>180</th>
<th>210</th>
<th>240</th>
<th>270</th>
<th>300</th>
<th>330</th>
<th>360</th>
</tr>
</thead>
<tbody>
<tr>
<td>speed number</td>
<td>2</td>
<td>2½</td>
<td>3</td>
<td>3½</td>
<td>4</td>
<td>4½</td>
<td>5</td>
<td>5½</td>
<td>6</td>
</tr>
</tbody>
</table>

1) SAT out of TAT

SAT (°C) = TAT (°C) - 3 x Mach

TAT = -17 °C  Mach 0.64
SAT = -17 - (3 x 6) = -17 - 18 = -35 °C

2) SAT out of TAT for higher Mach and lower Temp

SAT (°C) = TAT (°C) - ((100 x Mach) - 50)

TAT = -31 °C  Mach 0.74 → You have 24 above M 0.50
SAT = -31 -24 = -55 °C

3) Level Off procedure if R/C ≤ 1,000 feet/min (also for descent R/D)

Δ feet = \( \frac{R/C (\text{feet/min})}{10} \)

Climbing to FL 210  R/C = 2,000 feet/min
Δ feet = 200 feet → start level off at 20,800 feet

4) Level Off procedure if R/C > 1,000 feet/min (also for descent R/D)

Δ feet = \( \frac{2 \times R/C (\text{feet/min})}{10} \)

Climbing to FL 300  R/C = 2,500 feet/min
Δ feet = 500 feet → start level off at 29,500 feet

5) Cruise Flight Level computation

Cruise FL = Trip Distance (NM)

EBBR-EBOS = 60 NM
Optimum is FL 60
The **B737MRG** contains additional management guidelines

(non-technical related non-normals)
Your airline may have special procedures for bomb search and handling.

FAM

JAR 10.2.4

STOP CLIMB

Determine type of bomb

Time delay IF

Pressure trip (or type unknown) IF

LAND ASAP - Diversion

Before (ETA - 1Hr) IF

After (ETA - 1Hr)

Pax info: "A threat has been received"

CAPT decision

Extend flaps and gear early

Between flight deck and wing IF

Behind wing

Slide plate underneath and move to AFT Service Door

BOMB SEARCH

Diversion

Continue to destination

Do NOT move bomb

MRG [Bomb Checklist - next page]

Controlled disembarkation carrying all hand-luggage (if slides are used, hand-luggage must be left behind)

Assemble the pass. at least 200 m upwind of the aircraft
FIRE DRILL


FIRE / SMOKE IN OVERHEAD STORAGE BIN

- move passengers away
- remove seat covers, life vests and other materials
- extinguish the fire / smoke
- remove objects from the adjacent bins
- remove the fire / smoke source from the bin

- Remove all flammable items in the vicinity that might catch fire, such as passenger hand-luggage, cushions, newspapers, etc. including seat covers and life vests.

- Push down all seat-backs for about 3 rows in vicinity and cover them with wet blankets. These blankets will not only protect the seats, but will also catch, muffle up and dampen any burning item falling out of the bin.

(Cont’d)

LASER ILLUMINATION

Although not inherently dangerous, continuous laser illumination can cause distraction, discomfort and injury to the eyes, including glare, temporary blindness and after-image.

- Do not stare at the laser in an attempt to locate its position
- Advise ATC and request a turn away from the laser source
- Hand-over flight controls to the non-exposed pilot and/or engage the autopilot
- Do not rub your eyes, this will make it worse and may cause corneal abrasion
- After flight, file a report on the event and seek medical help if necessary

Sunglasses and flight deck sun blinds do not provide protection against laser illumination!
end