Aircraft Operating Manual

By Coolsky, 2012
Version 1.0

DC-9 Classic – Aircraft Operating Manual

SECTIONS

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SECTION 1

EMERGENCY

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GENERAL

Philosophy

The emergency procedures included in this manual represent the best course of action for the given emergency. However, any time the procedure does not fit the emergency or is inadequate, the Captain's best judgment should prevail.

The Captain is in complete command of the aircraft and his orders must be obeyed, even if they deviate from the written procedures. If the First Officer is the Pilot Flying (PF), the Captain shall assume command. Only the Captain can initiate such emergency procedures as engine shutdown, fire extinguisher discharge, aborted takeoff, rejected landing, go-around, etc.

During an engine shutdown, the PF will guard the operating engine, while the PNF manipulates the controls of the engine to be shut down.

Fires are obviously in the category of the most urgent emergencies and require immediate action at the earliest stages for proper control. Any warning of fire must be treated as an actual fire and fire-fighting procedures should be initiated immediately.

Checklist

The emergency procedures are divided into memory items and secondary actions. Memory items include those actions which must be taken immediately and which are essential to safety. Secondary actions are those actions which, although part of the procedure, are not essential to safety and can be left until a more convenient time.

In the emergency procedure checklists, the memory items are contained within a box.

On the next few pages you will find the emergency procedure checklists. Following these are the expanded emergency procedure checklists, which go into detail about exactly what to do in the given situation.

For training purposes, you should use the expanded emergency procedure checklists and familiarize yourself with all the necessary steps required to handle the current situation. However, when operating a scheduled flight, the flight crew should know the emergency procedure checklist steps without having to resort to the expanded version in their initial response.

Time permitting, the flight crew can of course review the applicable expanded emergency procedure checklist. Some emergency procedure checklists also call for expanded emergency procedure checklist items to be performed, usually after time critical items have been performed.

When the emergency procedure checklists calls for "go to ➊", then that is a reference to the expanded emergency procedure checklist.

Abnormal situations are considered less time critical. The abnormal procedure checklists are therefore only found in the expanded version.

EMERGENCY CHECKLIST

TWO-ENGINE FLAMEOUT

EMERGENCY POWER SWITCH .... ON
IGNITION... OVRD

ATC .... ADVISE (IF POSSIBLE)
OUTFLOW VALVE....................................... MANUAL/CLOSE
AIRSPEED .... MIN MANEUVERING
(NOT LESS THAN 156 KIAS FOR RELIGHT)
THROTTLES ....IDLE
BATTERY SWITCH.. ON
DC START PUMP... ON
AC FUEL PUMPS... ALL ON
GEN SWITCHES.. OFF
ENG HYD PUMP SWITCHES... OFF
FUEL CONTROL LEVERS.. ON
FUEL CROSSFEED .... OFF
APU .... START

NOTE: If neither engine has started, attempt to restart the APU regardless of altitude and airspeed. If two-engine flameout was caused by fuel starvation, 0° and 1.5° right wing up is optimum attitude for fuel scavenging.

When one or both engines are started:
Go to Expanded Checklist ❶

Driftdown Performance (All Engines INOP)
Fly minimum Maneuvering Speed (225 KIAS).
Rule of Thumb: 2 miles for each 1,000 ft of altitude.

COCKPIT SMOKE OR FUMES EVACUATION

OXY MASKS & GOGGLES............. ON/100%/EMERGENCY
COMMUNICATIONS... ESTABLISH

COCKPIT AIR OUTLETS ....FULL OPEN
NO SMOKING/SEAT BELT SIGNS .... ON

Terrain and conditions permitting:
DESCEND BELOW 10,000 FEET.

CABIN PRESS LDG ALT SET KNOB........................10,000’
CABIN PRESS RATE LIMIT CTRL KNOB............ MAX RATE

When below 10,000 feet:
OUTFLOW VALVE.................................. MANUAL/OPEN
HYD PUMPS... ON/HIGH/ON

If smoke source in cockpit:
RAM AIR SWITCH .... ON
FLAP HANDLE ....15°
AIRSPEED ....165 KIAS
CAPT/FO CLEARVIEW WINDOW........... $^1/_2$ TO $^2/_3$ OPEN

Caution: With the window open, the noise level may make it difficult for the flight crew to communicate with each other and it may prevent the crew from hearing the landing gear warning horn.

NEAREST SUITABLE AIRPORT.................................. LAND

COMPLETE LOSS OF AC POWER

EMERGENCY POWER SWITCH .... ON

BATTERY SWITCH..CHECK ON

Caution: 45 minutes or less flying time is available from the battery in this configuration. Use only essential equipment.

GALLEY SWITCH.. OFF
OUTFLOW VALVE.................................MANUAL/STABILIZED
CKPT/CABIN TEMP SELECTORS..............................MANUAL
AC CROSSTIE SWITCH.. OPEN
L then R GEN or APU SWITCHES ....RESET/CHKD/ON

If voltage and frequency are not within limits:
Go to Expanded Checklist ❶

If voltage and frequency are within limits:
Go to Expanded Checklist ❷

APU FIRE

FIRE CONTROL SWITCH .... OFF & AGENT ARM

Note: If the APU does not shut down after placing the Fire Control switch to OFF & AGENT ARM, pull the APU control C/B on the overhead panel.

If fire warning persists:
FIRE AGENT SWITCH (1 or 2) .... DISCHARGE

If fire warning persists after 30 seconds:
REMAINING FIRE AGENT .... DISCHARGE
APU MASTER SWITCH...OFF
APU DOORS SWITCH .... AUTO

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ELECTRICAL SMOKE OF UNKNOWN ORIGIN

OXY MASKS & GOGGLES.............. ON/100%/EMERGENCY
COMMUNICATIONS...ESTABLISH
RADIO RACK SWITCH ....VENTURI
OUTFLOW VALVE.................................... MANUAL/LOCKED
EMERGENCY POWER SWITCH .... ON/CHCK

If emergency power is ABNORMAL:
Go to ❸ below.

If emergency power is NORMAL:
L & R GEN & APU L & R BUS SWITCHES.................... OFF

Caution: 45 minutes or less flying time is available from the battery in this configuration. Use only essential equipment.

If smoke stops and less than 45 minutes from landing:
Go to Expanded checklist ❶

If smoke stops and more than 45 minutes from landing:
Go to Expanded checklist ❷

❸ **If emergency power is ABNORMAL or smoke INCREASES:**

L & R GEN SWITCHES .... ON
OUTFLOW VALVE .... AUTO
EMERGENCY LIGHTS SWITCH .... OFF
ALT EMER AC BUS FEED (Right AC) .... PULL
EMER AC BUS FEED (Left AC)................................. PULL
DC TRANSFER BUS FEED (Left DC) .... PULL
EMER DC BUS FEED (Left DC)................................. PULL
CHARGER & TRANFER RELAY (Battery Direct)...... PULL

Caution: The next step will shut down the APU if operating.

BATTERY RELAY C/B (Battery Direct)...................... PULL
EMERGENCY INVERTER C/B (Battery Direct) .... PULL
EMERGENCY POWER SWITCH................................. OFF
BATTERY SWITCH .... OFF
BATTERY CHARGER C/B (Ground Service) .... PULL

If smoke increases or persists:
Go to Expanded Checklist ❺

If smoke decreases:
Go to Expanded Checklist ❻

CRASH LANDING OR DITCHING

If time permits, instruct crew to take appropriate actions and initiate transmission of emergency messages.

NO SMOKING/SEAT BELT SIGNS .... ON
AIR COND SUPPLY SWITCHES ....OFF
CABIN PRESSURIZATION.............DEPRESSURIZE MANUALLY

When depressurized:
OUTFLOW VALVE........... FORWARD/CLOSED/LOCKED
RADIO RACK SWITCH..FAN
LANDING GEAR:
CRASH LANDING .... DOWN
DITCHING...UP

NOTE: When ditching with the gear up, pull the TAKEOFF WARNING circuit breaker to silence the gear warning horn.

FLAPS/SLATS .... 25°/EXTENDED
GPWS .... AS REQUIRED

Prior to touchdown:
EMERGENCY LIGHTS SWITCH .... ON
EMERGENCY SIGNAL ....6 CHIMES

Prior to leaving cockpit:
FUEL CONTROL LEVERS..OFF
FIRE SHUTOFF HANDLES... PULL

EMERGENCY EVACUATION

TOWER ....NOTIFY
PARKING BRAKE ....SET
SPOILERS...RETRACT
FLAPS ....15°
EMERGENCY POWER... ON
EMERGENCY LIGHTS .... ON
EVACUATION COMMAND .... INITIATE
FUEL CONTROL LEVERS..OFF
FIRE SHUTOFF HANDLES .... PULL

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AIR CONDITIONING SMOKE

OXY MASKS & GOGGLES............. ON/100%/EMERGENCY
COMMUNICATIONS...ESTABLISH

If smoke in cabin:
Go to Expanded Checklist ❶

If smoke in cockpit:
L AIR COND SUPPLY SWITCH................................... OFF

If smoke persists in cockpit:
L AIR COND SUPPLY SWITCH................................ AUTO
R AIR CONDI SUPPLY SWITCH.................................. OFF

RUNAWAY STABILIZER

STAB TRIM BRAKE SWITCH... STOP

If runaway continues:

STAB TRIM BRAKE SWITCH...................................... NORMAL

TRIM SWITCHES or TRIM CTRL HANDLES....................RETRIM
AUTOPILOT & ALT LONG TRIM C/B (F12,F13,F14) ..... PULL 3

Continue flight using primary trim system.

If stabilizer trim brake switch had stopped runaway:
PRIMARY LONG TRIM C/B's (G23,G24,G25)...... PULL 3

Continue flight using alternate trim system. Allow for slower trim rate.

STABILIZER FLOAT

Should a rapid roll develop during extension of flaps beyond 25°, IMMEDIATELY:

FLAPS .... RETRACT TO 25°

RAPID DECOMPRESSION

OXYGEN MASKS ON/100%
COMMUNICATIONS..ESTABLISH
OUTFLOW VALVE ....MANUAL/CLOSED

PNEUMATIC CROSSFEED VALVES...........................CLOSED
AIR COND SUPPLY SWITCHES .... AUTO
RADIO RACK SWITCH ....FAN

If control of cabin altitude is regained:
Operate outflow valve manually. Depressurize prior to landing.

If cabin altitude is climbing rapidly above 10,000 feet:
PASS OXY MASKS.............................CHECK DEPLOYED
EMERGENCY DESCENT .... INITIATE

EMERGENCY DESCENT

ATC ....ADVISE/7700 (IF NECESSARY)
AUTOPILOT .... AS REQUIRED
THROTTLES ....IDLE
SPEEDBRAKES...EXTEND
TARGET SPEED ....80M/320-340 KIAS

Caution: Maximum deck angle is 10°. If structural damage is suspected or air is rough, limit speed to .76M/285 KIAS. Gear and/or speedbrakes may be used. Gear speed is .70M/300 KIAS.

NOTE: Retract speedbrakes prior to reaching minimum maneuvering speed.

TAIL COMPARTMENT TEMP HIGH

PNEU CROSSFEED VALVES......................................CLOSED
AIRFOIL ICE PROTECTION SWITCH(ES)............................OFF
AIR COND SUPPLY SWITCHES .... HP BLD OFF

If on final approach (5 minutes from touchdown):
Continue approach using minimum power setting.

If more than 5 minutes from touchdown and light remains illuminated:
Go to Expanded Checklist ❶

ENGINE FAILURE/INFLIGHT ENGINE SHUTDOWN

NOTE: If an engine fails on takeoff, the Captain will call for the MEMORY ITEM to be accomplished only after the aircraft has climbed to 1,000 feet AFE or obstacle clearance altitude, whichever is higher, and V_{FTO} has been established.

THROTTLE (Affected Engine) .... IDLE

1. Retard the throttle of the affected engine to IDLE.
2. In the event of an engine flameout, check to see if a relight has occurred before continuing with this checklist.

FUEL CONTROL LEVER (Affected Engine) .... OFF

3. Set the Fuel Control Lever of the affected engine to OFF (Aft, down position).

SECONDARY ACTIONS .... ACCOMPLISH

4. Accomplish SECONDARY ACTIONS of the ENGINE FIRE/SEVERE DAMAGE OR SEPARATION procedure in section 1 page 7.

ENGINE FIRE/SEVERE DAMAGE OR SEPARATION

This condition is recognized by the fire warning bell and an engine fire shutdown handle illuminated, and/or airframe vibration, with abnormal and/or inconsistent engine instrument indications, with or without yaw.

The first crew member to observe the fire warning light will call out “ENGINE FIRE” without identifying the engine.

The pilot not flying will silence the fire warning bell and identify the engine.

Accomplish the ENGINE FIRE/SEVERE DAMAGE OR SEPARATION checklist at the appropriate time.

NOTE: If an engine fails on takeoff, the Captain will call for the MEMORY ITEM to be accomplished only after the aircraft has climbed to 1,000 feet AFE or obstacle clearance altitude, whichever is higher, and V_{FTO} has been established.

At a minimum altitude of 500 feet AFE with the aircraft in trim, the autopilot may be engaged.

Follow the steps of this checklist methodically and pause between each step to evaluate the situation. If the emergency is positively corrected, the Captain should reevaluate the situation before proceeding with the next step.

THROTTLE (Affected Engine) .... IDLE
1. Retard the throttle of the affected engine to IDLE.

Engine fire:
In the event of an engine fire, the applicable fire shutoff handle will illuminate and the fire warning bell will sound. A fire may or may not appear with severe damage or engine separation.

Severe damage:
Indications of severe damage may include airplane vibration, N_1 and/or N_2 tachometer indicating 0%, rapid loss of hydraulic pressure, and sudden loss of generator power.

If fire warning stops, go to NOTE 2 at the end of this procedure.

If fire warning persists or damage suspected:

FUEL CONTROL LEVER (Affected Engine)..OFF

2. Set the Fuel Control Lever of the affected engine to OFF (Aft, down position).

FIRE SHUTOFF HANDLE (Affected Engine)... PULL/DISCHARGE

3. Pull the applicable fire shutoff handle and rotate it to discharge the fire extinguishing agent into the engine. The applicable AGENT LOW light will illuminate. Note: Right click with the mouse on the fire handles to pull them out, and then left click to rotate.

If the fire warning persists after 30 seconds:

REMAINING FIRE AGENT...DISCHARGE

4. Pull and rotate the fire shutoff handle to discharge the other fire extinguishing agent into the engine. The applicable AGENT LOW light will illuminate. Note: Right click with the mouse on the fire handles to pull them out, and then left click to rotate.

SECONDARY ACTIONS

THROTTLE (Affected Engine) .... MATCH GOOD ENGINE

5. Push the throttle of the affected engine forward to match the position of the good engine throttle.

PNEU CROSSFEED VALVE (Affected Engine) .... CLOSED

6. Set the pneumatic crossfeed handle of the affected engine to the down and closed position.

APU... START

7. Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position.
8. Set the APU Air switch to OFF.
9. Set the APU FIRE CONT switch to the NORM position.
10. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
11. Check that the APU RPM and APU EGT start rising.
12. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.
13. Check APU RPM and APU EGT stabilizing.
14. Turn the VOLT/FREQ SELECTOR to APU, and check that electrical power is within limits.

FUEL PUMPS/CROSSFEED .... SET TO MAINTAIN BALANCE

15. Set the fuel crossfeed lever to ON.
16. Verify all fuel pump switches are ON. However, if the center tank is empty, leave the center tank fuel pumps OFF.

IGNITION..AS REQUIRED

17. Set the ignition switch to BOTH.

APU BUS SWITCH..REPLACE FAILED GENERATOR

18. Connect the APU to the AC bus on the side of the failed engine.

GEN SWITCH (Affected Engine)..OFF

19. Set the generator switch on the side of the failed engine to OFF.

AIR COND SUPPLY SWITCH (Affected Engine) ....OFF

20. Set the air conditioning supply switch on the side of the failed engine to OFF.

ENG HYD PUMP (Affected Engine)..OFF

21. Set the engine hydraulic pump switch on the side of the failed engine to OFF.

AUX & ALT HYD PUMP (Affected Engine) ....OFF

22. Set the auxiliary and alternate hydraulic pump switches as required to power both hydraulic systems.

NOTE 1: The final flap setting for single engine landing is 25. Place GPWS in FLAP OVRD.

NOTE 2: If the affected engine is running but incapable of producing full power, plan landing using flaps 25 and place GPWS in FLAP OVRD.

TWO-ENGINE FLAMEOUT

EMERGENCY POWER SWITCH .... ON

1. Set the EMER PWR switch to ON.

IGNITION .... OVRD

2. Set the ignition switch to OVRD.

ATC .... ADVISE (IF POSSIBLE)

3. Time permitting, advise ATC of the current situation and your intentions.

OUTFLOW VALVE .... MANUAL/CLOSE

4. Set the CABIN ALTITUDE CONTROL lever to MANUAL (down position).
5. Rotate the CABIN PRESS CONTROL wheel forward and observe the outflow valve position indicator move forward to the CLOSED position.

AIRSPEED .... MIN MANEUVERING (NOT LESS THAN 156 KIAS FOR RELIGHT)

6. Reduce your airspeed to minimum maneuvering speed.

THROTTLES .... IDLE

7. Set both throttle handles to the IDLE position.

BATTERY SWITCH .... ON

8. Verify BATT switch ON.

DC START PUMP .... ON

9. Set the starter pump to ON.

AC FUEL PUMPS .... ALL ON

10. Set all main and center tank fuel pumps to ON.

GEN SWITCHES .... OFF

11. Set both generator switches to OFF.

ENG HYD PUMP SWITCHES .... OFF

12. Set both engine hydraulic pump switches to OFF.

FUEL CONTROL LEVERS .... ON

13. Make sure both fuel control levers are ON.

FUEL CROSSFEED .... OFF

14. Set the fuel crossfeed handle to OFF (down forward position).

APU.. START

15. Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position.
16. Set the APU Air switch to OFF.
17. Set the APU FIRE CONT switch to the NORM position.
18. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
19. Check that the APU RPM and APU EGT start rising.
20. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.
21. Check APU RPM and APU EGT stabilizing.
22. Turn the VOLT/FREQ SELECTOR to APU, and check that electrical power is within limits.
23. Set L & R APU PWR BUS switches to ON.
24. Set the APU Air switch to ON.

NOTE: If neither engine has started, attempt to restart the APU regardless of altitude and airspeed. If two-engine flameout was caused by fuel starvation, 0° pitch and 1.5° right wing up is optimum attitude for fuel scavenging.

❶ **When one or both engines are started:**

ELECTRICAL SYSTEM ....AS REQUIRED

25. Reconnect engine generator(s) to the AC bus.

ENG HYD PUMP SWITCHES...AS REQUIRED

26. Set engine hydraulic pump(s) to ON.

OUTFLOW VALVE ....AUTO

27. Set the CABIN ALTITUDE CONTROL lever to AUTO (up position).

DC START PUMP ....OFF

28. Set the starter pump to OFF.

ENG ANTI-ICE ....OFF

29. Set both engine anti-ice switches to OFF.

ENG IGN SELECTOR...AS REQUIRED

30. Set the ignition switch to BOTH.

Driftdown Performance (All Engines INOP)

Fly minimum Maneuvering Speed (225 KIAS).
Rule of Thumb: 2 miles for each 1,000 ft of altitude.

COMPLETE LOSS OF AC POWER

EMERGENCY POWER SWITCH.. ON
1. Set the EMER PWR switch to ON.

BATTERY SWITCH... CHECK ON
2. Verify the BATT switch is ON.

Buses powered when the BATT switch and EMER PWR switches are ON:
- BATTERY DIRECT BUS
- BATTERY BUS
- DC TRANSFER BUS
- AC EMERGENCY BUS
- DC EMERGENCY BUS

GALLEY SWITCH...OFF
3. Set the GALLEY switch to OFF.

OUTFLOW VALVE .... MANUAL/STABILIZED
4. Manually adjust the outflow valve to regulate and maintain cabin pressure as required.

CKPT/CABIN TEMP SELECTORS... MANUAL
5. Set both CKPT/CABIN TEMP selectors to MANUAL and then adjust as necessary to maintain desired cockpit and cabin temperatures.

AC CROSSTIE SWITCH .... OPEN
6. Set the AC CROSSTIE switch to OPEN.

L then R GEN or APU SWITCHES ....RESET/CHKD/ON
7. Set the L and R GEN switches to RESET.
8. Move the electrical selector indicator to the AC VOLT/FREQ position.
9. If voltage and frequency are within normal range, move L GEN to ON.
10. Attempt to reset R GEN and/or APU GEN in the same manner.

❶ **If voltage and frequency are not within limits:**

L & R GEN SWITCHES ....OFF
11. Set both GEN switches to OFF.

APU (If available).. WINDMILL START
12. Make sure the BATTERY switch and DC START PUMP switch are both ON.
13. Consider the APU oil temperature in selecting an airspeed. Note that with warm oil, the APU may be started successfully at airspeeds as low as 200 KIAS. However, oil that has been cold-soaked in flight for up to ½ hour may require airspeeds as high as 350 KIAS to get the APU started.

14. Windmill start of the APU is improbable after the APU has cold soaked for more than ½ hour. Higher airspeeds result in better success when attempting a windmill start of the APU.
15. Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position. The doors will automatically open for windmill start.
16. Set the APU Air switch to OFF.
17. Set the APU FIRE CONT switch to the NORM position.
18. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
19. Check that the APU RPM and APU EGT start rising.
20. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.
21. Check APU RPM and APU EGT stabilizing.

APU PWR AVAIL LIGHT .... ILLUMINATED

22. Verify the APU PWR AVAIL light illuminates. Note that it may be necessary to reset the APU GEN switch first. Set the APU GEN switch to RESET, then back to NORM.

APU L & R BUS SWITCHES (One at a time).. ON

23. Set both APU L & R BUS switches to ON.

ONE AIR COND SUPPLY SWITCH ....OFF

24. Prior to landing, set one of the AIR COND SUPPLY switches to OFF.

❷ **If voltage and frequency are within limits:**

AC CROSSTIE SWITCH ....AUTO

25. Set the AC CROSSTIE switch to AUTO.

CABIN ALT CONTROL LEVER..AUTO

26. Set the CABIN ALT control lever to AUTO.

CKPT/CABIN TEMP SELECTORS..AUTO

27. Set the CKPT and CABIN TEMP selectors to AUTO.

EMERGENCY POWER SWITCH..OFF

28. Set the EMER PWR switch to OFF.

GALLEY SWITCH (Electrical load permitting) .... ON

29. Set the GALLEY switch to ON, electrical load permitting.

SYSTEMS .... MONITOR

30. Check voltage and frequency regularly.

Inoperative items:

If one or both main electrical buses fail, the following systems will be inoperative:

LEFT BUS INOPERATIVE
- Primary trim
- Cockpit temperature control
- Left ground shift
- Left wing landing light
- Left nose gear lights
- Landing gear warning horn
- Captain's stall warning
- Anti-skid
- Spoiler control
- Tail anti-ice

RIGHT BUS INOPERATIVE
- Alternate trim
- Cabin temperature control
- Right ground shift
- Right wing landing light
- Right nose gear lights
- Gear door warning
- First Officer's stall warning
- Fuel quantity
- First Officer's flight instruments
- Airfoil anti-ice

COCKPIT/CABIN SMOKE OR FUMES EVACUATION

OXYGEN MASKS & GOOGLES.. ON/100%/EMERGENCY

1. Don the oxygen masks and smoke goggles (not simulated).
2. Make sure the regulator is set to 100% oxygen in order to ensure against toxic fumes entering the oxygen supply to the masks.
3. Set the flow switch to EMERGENCY if the smoke concentration affects vision. This will clear the mask and goggles of smoke (not simulated).

COMMUNICATION...ESTABLISH

4. Check the mask microphone is working properly (not simulated).

COCKPIT AIR OUTLETS.. FULL OPEN

5. Open up all the air outlets (not simulated).

NO SMOKING/SEAT BELT SIGN... ON

6. Set the NO SMOKING/SEAT BELT sign switch to ON.

Terrain and conditions permitting:

Descend below 10,000 feet.

CABIN PRESS LDG ALT SET KNOB ....10,000'

7. Set CABIN PRESS LDG ALT to 10,000 feet.

CABIN PRESS RATE LIMIT CNTL KNOB .... MAX RATE

8. Turn the RATE LIMIT knob all the way clockwise.

When below 10,000 feet:

OUTFLOW VALVE ....MANUAL/OPEN

9. Set the CABIN ALTITUDE CONTROL lever to MANUAL (down position).
10. Rotate the CABIN PRESS CONTROL wheel aft and observe the outflow valve position indicator move aft to the OPEN position.

HYD PUMP.. ON/HIGH/ON

11. Set the ALT HYD PUMP switch to ON.
12. Set both the L & R ENGINE HYD PUMP switches to HI.
13. Set the AUX HYD PUMP to ON.

If the smoke source is located in the PASSENGER CABIN:

Not simulated.

If the smoke source is located in the COCKPIT:

RAM AIR SWITCH .... ON

14. Set the RAM AIR switch to ON.

FLAPS HANDLE .... 15°

15. Set flaps 15.

AIRSPEED .... 165 KIAS

16. Slow down and maintain 165 KIAS.

CAPTAIN'S or FO's CLEARVIEW WINDOW .... 1/2 to 2/3 OPEN

17. Open the clearview window to evacuate the smoke. Caution: The noise level with the window open will make communication difficult and may also prevent the flight crew from hearing the landing gear warning horn (not simulated).

NEAREST SUITABLE AIRPORT .... LAND

18. Land the aircraft as soon as possible.

APU FIRE

FIRE CONTROL SWITCH .... OFF & AGENT ARM

1. Set the FIRE CONTROL switch to OFF & AGENT ARM.

Note: If the APU does not shut down after placing the Fire Control switch to OFF & AGENT ARM, pull the APU control C/B on the overhead panel.

If fire warning persists:

FIRE AGENT SWITCH (1 or 2) ....DISCHARGE

2. Place either FIRE AGENT discharge switch to the DISCH position.
3. Observe the AGENT LOW light illuminate. Note that if the right DC bus is not powered, the AGENT LOW light will not illuminate.

If fire warning persists after 30 seconds:

REMAINING FIRE AGENT..DISCHARGE

4. Place the unused FIRE AGENT discharge switch to the DISCH position.

APU MASTER SWITCH ....OFF

5. Turn off the APU by placing the APU MASTER switch in the OFF position.

APU DOORS SWITCH ....AUTO

6. Place the APU DOORS switch in the AUTO position (guard on).

CAUTION: **Do not use the aft ventral air stair or the aft emergency escape slide if an APU fire is suspected.**

ELECTRICAL SMOKE OF UNKNOWN ORIGIN

OXY MASKS & GOGGLES ON/100%/EMERGENCY

1. Don the oxygen masks and smoke goggles (not simulated).
2. Make sure the regulator is set to 100% oxygen in order to ensure against toxic fumes entering the oxygen supply to the masks.
3. Set the flow switch to EMERGENCY if the smoke concentration affects vision. This will clear the mask and goggles of smoke (not simulated).

4. If the source of the smoke can be identified, attempt to isolate the faulty circuit and extinguish the fire.
5. If the source of the smoke cannot be identified, continue with the procedure.

COMMUNICATIONS .... ESTABLISH

6. Check the mask microphone is working properly (not simulated).

RADIO RACK SWITCH .... VENTURI

7. Place the RADIO RACK switch in the VENTURI position.

OUTFLOW VALVE .... MANUAL/LOCKED

8. Move the OUTFLOW VALVE control to the MANUAL position (down position). Automatic cabin control is deactivated when both the AC and DC buses are de-energized. Cabin pressurization must be controlled manually. Prior to or immediately after landing, the cabin must be depressurized.

EMERGENCY POWER SWITCH .... ON/CHCK

9. Set the EMER PWR switch to ON.
10. Check that no warning flags are visible on the Captain's flight instruments.
11. Set the meter selector switch to BATT AMPs and check that readings are within the normal 10 to 30 amperes to the right.
12. Check that the white emergency power in use light is illuminated.
13. Check that the red AC and DC emergency bus off lights are extinguished.

If emergency power is ABNORMAL:

Go to ❸ below.

If emergency power is NORMAL:

L & R GEN and L & R APU BUS SWITCHES .... OFF

14. Set both the L & R GEN and the L & R APU bus switches to OFF.

CAUTION: 45 minutes or less flying time is available from the battery in this configuration. Use only essential equipment.

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❶ If smoke stops and less than 45 minutes from landing:

15. At the Captain's discretion, proceed directly to the nearest suitable airport and land.

- **If smoke stops and more than 45 minutes from landing:**

AC & DC BUS X-TIE SWITCHES .... OPEN
16. Set both the AC BUS X-TIE switch and the DC BUS X-TIE switch to OPEN.

If the smoke does not reappear:
Go to ❹

If the smoke reappears:

L GEN and APU L BUS SWITCHES .... ON/CHECK
17. Place or check that the L GEN and APU L BUS switches are ON.

R GEN and APU R BUS SWITCHES .... OFF
18. Set the R GEN and APU R BUS switches to OFF.

EMERGENCY POWER SWITCH .... OPEN
19. Set the EMER PWR switch to OFF.

NEAREST SUITABLE AIRPORT .... LAND
20. Land the aircraft as soon as possible.

❸ If emergency power is ABNORMAL or smoke INCREASES:

L & R GEN SWITCHES .... ON
21. Set both GEN switches to ON.

OUTFLOW VALVE .... AUTO
22. Set the cabin pressurization CABIN ALT CONTROL handle to AUTO.

EMERGENCY LIGHTS SWITCH .... OFF
23. Set the EMER LTS switch to OFF.

ALT EMER AC BUS FEED (Right AC) .... PULL
24. Pull the ALTERNATE EMER AC BUS FEED circuit breaker on row L.

EMER AC BUS FEED (Left AC) .... PULL
25. Pull the EMER AC BUS FEED circuit breaker on row K.

DC TRANSFER BUS FEED (Left DC) .... PULL

26. Pull the DC TRANSFER BUS FEED circuit breaker on row M.

EMER DC BUS FEED (Left DC)..PULL
27. Pull the EMER DC BUS FEED circuit breaker on row M.

CHARGER & TRANSFER RELAY (Battery Direct)..PULL
28. Pull the CHARGER & TRANSFER RELAY circuit breaker on the overhead panel.

Caution: The next step will shut down the APU if operating.

BATTERY RELAY C/B (Battery Direct)..PULL
29. Pull the BATTERY RELAY circuit breaker on the overhead panel.

EMERGENCY INVERTER C/B (Battery Direct)..PULL
30. Pull the EMERGENCY INVERTER circuit breaker on the overhead panel.

EMERGENCY POWER SWITCH..OFF
31. Place the EMER PWR switch in the OFF position.

BATTERY SWITCH..OFF
32. Place the BATT switch in the OFF position.

BATTERY CHARGER C/B (Row U, W, X)..PULL
33. Pull the BATTERY CHARGER circuit breakers (U21, W21, X21).

If smoke increases or persists:
Go to ❺

If smoke decreases:
Go to ❻

❹ **If smoke does not reappear:**

EMERGENCY POWER SWITCH..OFF
34. Set the EMER PWR switch to OFF.

NEAREST SUITABLE AIRPORT..LAND
35. Land the aircraft as soon as possible.

❺ If smoke increases or persists:

BATT DIRECT BUS FEED C/B .... PULL (at Captain's discretion)

36. The BAT DIRECT BUS FEED circuit breaker is located in the E & E compartment, located under the cockpit floor (not simulated).

ALT EMER AC BUS FEED C/B (Right AC) ....RESET

37. Reset the ALT EMER AC BUS FEED circuit breaker located on row K.

DC TRANSFER BUS FEED (Left DC) ....RESET

38. Reset the DC TRANSFER BUS FEED circuit breaker on row M.

EMER DC BUS FEED (Left DC)..RESET

39. Reset the EMER DC BUS FEED circuit breaker on row M.

EMERGENCY LIGHTS SWITCH .... ARM

40. Set the EMER LTS switch to ARM.

NEAREST SUITABLE AIRPORT...LAND

41. Land the aircraft as soon as possible.

❻ If smoke decreases:

DC TRANSFER BUS FEED (Left DC) ....RESET

42. Reset the DC TRANSFER BUS FEED circuit breaker on row M.

If the smoke does not reappear:

Go to ❼

If smoke reappears:

DC TRANSFER BUS FEED (Left DC) ....PULL

43. Pull the DC TRANSFER BUS FEED circuit breaker on row M.

ALT EMER AC BUS FEED C/B (Right AC) ....RESET

44. Reset the ALT EMER AC BUS FEED circuit breaker located on row K.

EMER DC BUS FEED (Left DC)..RESET

45. Reset the EMER DC BUS FEED circuit breaker on row M.

EMERGENCY LIGHTS SWITCH .... ARM

46. Set the EMER LTS switch to ARM.

NEAREST SUITABLE AIRPORT...LAND

47. Land the aircraft as soon as possible.

❼ **If smoke does not reappear:**

NEAREST SUITABLE AIRPORT...LAND
48. Land the aircraft as soon as possible.

CRASH LANDING OR DITCHING

If time permits, instruct crew to take appropriate actions and initiate transmission of emergency messages.

NO SMOKING/SEAT BELT SIGN.. ON

1. Turn on the no smoking/seat belt sign.

AIR COND SUPPLY SWITCHES ....OFF

2. Set both AIR COND SUPPLY switches to OFF.
3. This eliminates the source of pressurization and will ensure that all doors and exits can be readily opened. Setting the switches to off one at a time will reduce the severity of the pressure surge experienced by the passengers.
4. Initial cabin descent rate may be as high as 4,000 FPM until the outflow valve closes fully. After the outflow valve has fully closed, a cabin descent rate of 1,000 FPM can be expected due to bleeding through vents and drains as well as structural leaks.

CABIN PRESSURIZATION...DEPRESSURIZE MANUALLY

5. If the previous step did not fully depressurize the cabin, manually move the pressure control to obtain the desired descent rate, until fully depressurized.

When depressurized:

OUTFLOW VALVE .... FORWARD/CLOSED/LOCKED

6. Make sure the outflow valve is fully closed. In the event of a ditching, the outflow valve will be submerged. Closing the valve will reduce the rate of water entry into the fuselage.

RADIO RACK SWITCH..FAN

7. If the radio rack fan was set to VENTURI, this step will close the valve leaving a much smaller opening for entry of water following a ditching.

LANDING GEAR:

CRASH LANDING...DOWN

8. For a crash landing, the landing gear should be extended. The landing gear will absorb most, if not all, of the impact forces. In rough terrain the landing gear may separate from the aircraft. The landing gear has been designed to shear away from the aircraft without damaging the integral fuel tanks.

DITCHING...UP

9. The landing gear should be retracted for a water landing. Retracting the landing gear will present a smooth unobstructed fuselage surface for minimum drag upon contacting the water. An extended landing gear, with protruding gear and open wheel wells, would most likely cause a violent deceleration and possibly cause the nose to go under.

NOTE: When ditching, pull the TAKEOFF WARNING circuit breaker (P26) to silence the gear warning horn.

FLAPS/SLATS...25°/EXTENDED

10. Set flaps to 25 and extend stats (flaps and slats handles are locked together).
11. This setting will provide the best lift/drag ratio during both crash landing and ditching situations for both two-engine and single-engine cases.
12. The impact forces may carry away the flaps. The flaps hinges and attaching fittings are designed to fail without damaging the integral main fuel tanks.

GPWS...AS REQUIRED

13. Set the GPWS switch to FLAP OVERRIDE if flaps are less than 25° and the gear handle is down. If the landing gear handle is up, select INHIBIT.

Prior to touchdown:

EMERGENCY LIGHTS SWITCH... ON

14. The emergency cabin lights are powered by a separate battery pack, and will assist in evacuation of the aircraft.

EMERGENCY SIGNAL ....6 CHIMES

15. Press the attendant call button 6 times to alert the cabin crew and passengers to assume the brace position just prior to landing.

Prior to leaving cockpit:

FUEL CONTROL LEVERS...OFF

16. Set both FUEL CONTROL levers to OFF.

FIRE SHUTOFF HANDLES...PULL

17. Pull both fire handles (right click on handles). This will shut off fuel and hydraulic oil to the engines.
18. If the situation requires it, rotate the fire handles to discharge the extinguishing agent into the engine nacelles. The battery switch must be ON to discharge the fire extinguishing agent in this configuration as there is no generator or transformer/rectifier power available.

NOTE: **In a ditching situation, the aircraft will assume a slightly tail-down attitude in the water. Floor angle should not exceed 5° nose-up in any center of gravity configuration.**

At higher gross weights, for example right after takeoff, the wings will be awash. At lower gross weights, the upper wing surface will be clear of the water.

CAUTION: **In a ditching situation, use the overwing exit windows. DO NOT OPEN any external doors until it has been established that the doors are not submerged and you have a useable exit. DO NOT DEPLOY the tailcone.**

EMERGENCY EVACUATION

Types of evacuation:

There are two types of evacuations; planned and unplanned. In a planned evacuation, the Captain informs the crew of the nature of the emergency and what should be done. In an unplanned evacuation, the crew will not have time to coordinate a course of action. The cabin crew cannot count on the pilots for instructions or assistance in passenger evacuation. Unplanned evacuations typically happen during taxi, takeoff and landing, and account for around 80% or all evacuations.

Preparation procedures:

Time permitting; the following procedures will enhance passenger evacuation performance:

Captain:
- Determine the extent of the emergency.
- Notify ground station of emergency.
- If possible, delay the landing until emergency equipment and crews are standing by, and all passengers have been instructed in the evacuation procedures.
- Alert the cabin crew and passengers to assume the brace position just prior to landing with the standard 6-bell signal.

First Officer:
- Assist the Captain.
- Secure loose objects in the cockpit.
- Depressurize the aircraft on the Captain's command.
- Unlock the cockpit door.

Cabin crew:
- Notify the Captain when the cabin preparations are complete.

TOWER .... NOTIFY

1. The Captain or First Officer should, if possible, notify the control tower of the aircraft condition and intention for evacuation.

PARKING BRAKE .... SET

2. Make sure the aircraft has come to a full stop and set the parking brake before deploying the escape slides.

SPOILERS .... RETRACT

3. Make sure the ground spoilers are retracted (handle in the forward down position).

FLAPS .... 15°

4. Set the flaps to 15°.

EMERGENCY POWER.. ON

5. Set the EMER PWR switch to ON.

EMERGENCY LIGHTS... ON

6. Set the EMER LTS switch to ON.

EVACUATION COMMAND ....INITIATE

7. Instruct the cabin crew to initiate the evacuation of the passengers. State which exits are to be used. Inform the cabin crew of any conditions that may affect the evacuation, such as high winds, irregular terrain, structural damage, etc.

FUEL CONTROL LEVERS..OFF

8. Set both engine fuel control levers to OFF.

FIRE SHUTOFF HANDLES..PULL

9. Pull both fire handles (right click on handles). This will shut off fuel and hydraulic oil to the engines.
10. If the situation requires it, rotate the fire handles to discharge the extinguishing agent into the engine nacelles.

After completion of emergency evacuation checklist:

Captain:

- Take the portable fire extinguisher and proceed to the main cabin and assist the cabin crew in the evacuation of the passengers.
- When the passenger evacuation is complete, deplane by any suitable exit and take charge of ground operation.
- If unable to enter the cabin, exit the cockpit by either sliding window.

First Officer:

- Perform any additional duties as instructed by the Captain.
- Assist with the evacuation of the passengers.
- Circumstances may dictate that the FO quickly positions himself on the ground at the foot of the slide to prevent the piling up of evacuees, directing people away from the aircraft.

AIR CONDITIONING SMOKE

OXY MASKS & GOGGLES ON/100%/EMERGENCY

1. Don the oxygen masks and smoke goggles (not simulated).
2. Make sure the regulator is set to 100% oxygen in order to ensure against toxic fumes entering the oxygen supply to the masks.
3. Set the flow switch to EMERGENCY if the smoke concentration affects vision. This will clear the mask and goggles of smoke (not simulated).

COMMUNICATIONS .... ESTABLISH

4. Check the mask microphone is working properly (not simulated).

If smoke in cockpit:

L AIR COND SUPPLY SWITCH ....OFF

5. Set the left air conditioning supply switch to OFF.

If smoke stops:

Continue flight with left air conditioning supply switch OFF.

End troubleshooting here.

If smoke persists in cockpit:

L AIR COND SUPPLY SWITCH...AUTO

6. Set the left air conditioning supply switch to AUTO.

R AIR CONDI SUPPLY SWITCH ....OFF

7. Set the right air conditioning supply switch to OFF.

If smoke stops:

Continue flight with right air conditioning supply switch OFF.

End troubleshooting here.

RUNAWAY STABILIZER

A runaway stabilizer trim condition is indicated by the following:

- Stabilizer Motion warning horn.
- Steady motion of the stabilizer trim indicator without being initiated by pilot input to the trim control.
- Increasing forward or aft pressure required to maintain the desired airplane pitch attitude.

STAB TRIM BRAKE SWITCH..STOP

1. Set the STAB TRIM brake switch to STOP.

Note: If the runaway situation was caused by the PRIMARY TRIM system, movement of the stabilizer will stop as the primary trim motor is not capable of overcoming the brake. If the runaway situation continues, the fault is in the ALTERNATE TRIM system.

If runaway continues:

STAB TRIM BRAKE SWITCH..NORMAL

2. Set the STAB TRIM brake switch to NORMAL.

TRIM SWITCHES or TRIM CTRL HANDLES.. RETRIM

3. Trim out the aircraft as needed to neutralize any forward or aft pressure required on the control column to maintain the desired airplane pitch attitude.

AUTOPILOT & ALT LONG TRIM C/B (F12,F13,F14)..PULL 3

4. Pulling these three circuit breakers will interrupt power to the ALTERNATE TRIM system. Note that the autopilot will not be usable.

Continue flight using primary trim system.

If stabilizer trim brake switch had stopped runaway:

PRIMARY LONG TRIM C/B's (G23,G24,G25)...PULL 3

5. Pulling these three circuit breakers will interrupt power to the PRIMARY TRIM system, and prevent the primary trim motor from overheating.

Continue flight using alternate trim system. Allow for slower trim rate.

STABILIZER FLOAT

Should a rapid roll develop during extension of flaps beyond 25°, IMMEDIATELY:

FLAPS .... RETRACT TO 25°

1. Retract flaps to 25° immediately.
2. Adjust airspeed as necessary.

RAPID DECOMPRESSION

OXYGEN MASKS... ON/100%

1. Don the oxygen masks and smoke goggles (not simulated).
2. Make sure the regulator is set to 100% oxygen in order to ensure against toxic fumes entering the oxygen supply to the masks.

COMMUNICATIONS...ESTABLISH

3. Check the mask microphone is working properly (not simulated).

OUTFLOW VALVE .... MANUAL/CLOSED

4. Set the CABIN ALTITUDE CONTROL lever to MANUAL (down position).
5. Rotate the CABIN PRESS CONTROL wheel forward and observe the outflow valve position indicator move forward to the CLOSED position.

PNEUMATIC CROSSFEED VALVES.. CLOSED

6. Close both pneumatic crossfeed valves (aft down position). This will minimize the ducting that is pressurized.

AIR COND SUPPLY SWITCHES ....AUTO

7. Set both AIR COND SUPPLY switches to AUTO.

RADIO RACK SWITCH...FAN

8. Set the RADIO RACK switch to FAN.

If control of cabin altitude is regained:

Operate outflow valve manually. Depressurize prior to landing.

If cabin altitude is climbing rapidly above 10,000 feet:

PASS OXY MASKS.. CHECK DEPLOYED

9. Not simulated.

EMERGENCY DESCENT..INITIATE

10. Refer to the Emergency Descent checklist in this section.

EMERGENCY DESCENT

ATC .... ADVISE/7700 (IF NECESSARY)

1. Time permitting, advise ATC of the situation and your intentions.

AUTOPILOT ....AS REQUIRED

2. If the autopilot is to be used during an emergency descent, select mach hold or airspeed hold when the target airspeed (M.80/320-340 KIAS) has been obtained.

THROTTLES .... IDLE

3. Set both throttles to IDLE.

SPEEDBRAKES.. EXTEND

4. Extend the speed brakes.
5. If flying manually, push firmly and smoothly on the control column to start a descent at a maximum deck angle of 10% nose down and roll to 30° bank.

TARGET SPEED...M.80/320-340 KIAS

6. Maintain M.80/320-340 KIAS during the emergency descent.

Caution: **Maximum deck angle is 10°. If structural damage is suspected or air is rough, limit speed to .76M/285 KIAS. Gear and/or speedbrakes may be used. Gear speed is .70M/300 KIAS.**

NOTE: **Retract speedbrakes prior to reaching minimum maneuvering speed.**

TAIL COMPARTMENT TEMP HIGH

PNEU CROSSFEED VALVES .... CLOSED

1. Close both pneumatic crossfeed valves (aft down position). This will prevent hot air from flowing into the ice protection manifold.

AIRFOIL ICE PROTECTION SWITCH(ES) .... OFF

2. Ice protection is not available when the pneumatic crossfeed valves are closed. This eliminates the open signal to the augmentation valve.

AIR COND SUPPLY SWITCHES .... HP BLD OFF

3. Set both air conditioning supply switches to HP BLD OFF. This prevents 13th-stage high pressure bleed airflow, allowing only cooler 8th-stage air into the system for cabin pressurization.

If on final approach (5 minutes or less from touchdown):

Continue approach using minimum power setting.

❶ If more than 5 minutes from touchdown and light remains illuminated:

RADIO RACK SWITCH .... FAN

4. Set the RADIO RACK switch to FAN.

LEFT THROTTLE .... IDLE

5. Set the left throttle to IDLE.

TAIL COMPT TEMP HIGH LIGHT .... CHECK

6. Check the TAIL COMPT TEMP HIGH light.

If the light remains illuminated after 2 minutes:

Go to ❷

If the light extinguishes within 2 minutes:

L AIR COND SUPPLY SWITCH .... OFF

7. Set the left air conditioning supply switch to OFF.

LEFT THROTTLE .... RESTORE POWER

8. Set the left throttle to match the right throttle.

TAIL COMPT TEMP HIGH LIGHT .... CHECK

9. Check the TAIL COMPT TEMP HIGH light.

If the light illuminates:

Go to ❸

If the light remains extinguished:

R AIR COND SUPPLY SWITCH .... AUTO
10. Set the right air conditioning supply switch to AUTO.

TAIL COMPT TEMP HIGH LIGHT .... CHECK
11. Check the TAIL COMPT TEMP HIGH light.

If the light illuminates:

Go to ❹

If the light remains extinguished:

If required, restore airfoil ice protection from the right engine. It the TAIL COMPT TEMP HIGH light illuminates again, turn off airfoil ice protection and avoid flying into areas with known or suspected icing conditions.

❷ **If the light remains illuminated after 2 minutes:**

LEFT THROTTLE .... RESTORE POWER
12. Set the left throttle to match the right throttle.

RIGHT THROTTLE .... IDLE
13. Set the right throttle to IDLE.

TAIL COMPT TEMP HIGH LIGHT .... CHECK
14. Check the TAIL COMPT TEMP HIGH light.

If the light remains illuminated after 2 minutes:

Go to ❺

If the light extinguishes within 2 minutes:

R AIR COND SUPPLY SWITCH .... OFF
15. Set the right air conditioning supply switch to OFF.

RIGHT THROTTLE .... RESTORE POWER
16. Set the right throttle to match the left throttle.

TAIL COMPT TEMP HIGH LIGHT .... CHECK
17. Check the TAIL COMPT TEMP HIGH light.

If the light illuminates:

Go to ❻

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If the light remains extinguished:

Continue flight with the right system off and isolated. Fly at a reduced thrust setting to keep the light extinguished.

L AIR COND SUPPLY SWITCH ....AUTO

18. Set the left air conditioning supply switch to AUTO. This will restore air foil protection bleed air from the left engine if required.

❸ If the light illuminates:

LEFT THROTTLE.. IDLE

19. Set the left throttle to a reduced thrust setting or idle power and continue with the flight.

R AIR COND SUPPLY SWITCH..AUTO

20. Set the right air conditioning supply switch to AUTO.
21. If required, restore airfoil ice protection from the right engine. It the TAIL COMPT TEMP HIGH light illuminates again, turn off airfoil ice protection and avoid flying into areas with known or suspected icing conditions.

❹ If the light illuminates:

R AIR COND SUPPLY SWITCH..HP BLD OFF

22. Set the right air conditioning supply switches to HP BLD OFF.

L AIR COND SUPPLY SWITCH..AUTO

23. Set the left air conditioning supply switch to AUTO.
24. If required, restore airfoil ice protection from the left engine. It the TAIL COMPT TEMP HIGH light illuminates again, turn off airfoil ice protection and avoid flying into areas with known or suspected icing conditions.

❺ If the light illuminates:

RIGHT THROTTLE .... RESTORE POWER

25. Set the right throttle to match the left throttle.

NEAREST SUITABLE AIRPORT...LAND

26. Land the aircraft as soon as possible.

❻ If the light illuminates:

RIGHT THROTTLE .... IDLE

27. Set the right throttle to a reduced thrust setting or idle power and continue with the flight.

L AIR COND SUPPLY SWITCH...AUTO

28. Set the left air conditioning supply switch to AUTO.
29. If required, restore airfoil ice protection from the left engine. It the TAIL COMPT TEMP HIGH light illuminates again, turn off airfoil ice protection and avoid flying into areas with known or suspected icing conditions.

AIR CONDITIONING SUPPLY PRESSURE ZERO

A/C SUPPLY SWITCH (on affected side) ....OFF

1. Set the A/C SUPPLY switch on the affected side to OFF.

If duct temperature is above normal:

TEMP SELECTOR (on side with high temperature)..COOLER

2. Rotate the TEMP SELECTOR to COLD to manually set the TEMP CONTROL VALVE to let more cool air into the system.

If duct temperature is not above normal:

TEMP SELECTOR (on side with high temperature)...WARMER

3. Rotate the TEMP SELECTOR to HOT to manually set the TEMP CONTROL VALVE to let more warm air into the system.

Wait for the system to cool, then:

A/C SUPPLY SWITCH (on affected side)..HP BLD OFF

4. Set the A/C SUPPLY switch on the affected side to HP BLD OFF. This sets the system to auto but leaves the high pressure augmentation valve closed.

DUCT TEMPERATURE AND SUPPLY PRESSURE... CHECK NORMAL

5. Check the temperature and supply pressure (20-30PSI).

If temperature and supply pressure is still not normal:

Operate with one air conditioning pack.

A/C SUPPLY SWITCH (on affected side)..OFF

6. Set the A/C SUPPLY switch on the affected side to OFF.

MAXIMUM ALTITUDE FOR SINGLE PACK OPERATION ....25,000 FEET

7. Stay below 25,000 feet MSL.

If temperature and supply pressure is normal:

TEMP SELECTOR...AS DESIRED

8. Rotate the TEMP SELECTOR to AUTO or set as desired.

A/C SUPPLY SWITCH (on affected side)...AUTO

9. Set the A/C SUPPLY switch on the affected side to AUTO.

AIR CONDITIONING SUPPLY TEMP HI LIGHT ON

MASTER CAUTION LIGHT..RESET

1. Push the MASTER CAUTION light to reset it.

AIRFOIL SWITCH (on affected side, if on)..OFF

2. Make sure the AIRFOIL switch to OFF.

PNEU X-FEED VALVE LEVER (on affected side)..CLOSED (DOWN)

3. Set the PNEU X-FEED VALVE lever to the CLOSED position (aft down).

A/C SUPPLY SWITCH (on affected side)..HP BLD OFF

4. Set the A/C SUPPLY switch on the affected side to HP BLD OFF. This sets the system to auto but leaves the high pressure augmentation valve closed.

After one minute, if the AIR COND SUPPLY TEMP HI light has extinguished:

Continue the flight as normal.

After one minute, if the AIR COND SUPPLY TEMP HI light is still ON:

Check the supply duct temperature on the affected side:

If the temperature is normal:

Continue the flight as normal.

A/C SUPPLY SWITCH (on affected side)..HP BLD OFF

5. The A/C SUPPLY switch on the affected side can be left in the HP BLD OFF position.

If the temperature is high:

A/C SUPPLY SWITCH (on affected side)..OFF

6. Set the A/C SUPPLY switch on the affected side to OFF. Continue the flight with only one air conditioning pack operating.

MAXIMUM ALTITUDE FOR SINGLE PACK OPERATION..25,000 FEET

7. Stay below 25,000 feet MSL.

AUTOMATIC PRESSURIZATION CONTROL INOP OR ERRATIC

CABIN ALTITUDE CONTROL LEVER..MANUAL

1. Set the CABIN ALTITUDE CONTROL lever to MANUAL (down position).

CABIN ALTITUDE CONTROL WHEEL..ROTATE AS REQUIRED

2. Rotate the CABIN PRESS CONTROL wheel as required to maintain the desired cabin altitude.

During climb or descent, the cabin altitude must be manually adjusted with the cabin altitude control wheel. Prior to landing, the outflow valve indicator should be fully aft indicating the butterfly outflow valve is fully open to depressurize the aircraft.

DESCENT WITH ONLY ONE ENGINE HP BLEED AVAILABLE

If an idle power descent is made above 15,000 feet.

RADIO RACK SWITCH...FAN

1. Place the RADIO RACK switch in the FAN position.

If both air supply systems are operating:

BOTH PNEU X-FEED VALVE LEVERS.. OPEN

2. Place both the pneumatic crossfeed levers in the OPEN position (handle in the up/forward position).

If only one HP BLD is operating:

Slowly increase the thrust on the engine with the operating HP bleed unit until the supply pressure reaches 18 PSI. Adjust thrust as necessary to maintain approximately 18 PSI. Below 15,000 feet, idle thrust may be used.

FLOW LIGHT ON

RADIO RACK SWITCH..FAN

1. Place the RADIO RACK switch in the FAN position.

Slowly increase the thrust on the engine with the operating HP bleed unit until the supply pressure reaches 18 PSI. Adjust thrust as necessary to maintain approximately 18 PSI.

If the light remains illuminated and the cabin continues to depressurize, descend to an altitude where normal pressurization can be maintained.

Note: It is normal for the FLOW light to be illuminated on the ground when the engines are at idle power.

APU EGT HIGH

Normally, the APU EGT will have an idle operating temperature of approximately 360°C.

If the TAIL COMPT TEMP HI light is illuminated:

APU BLEED AIR SWITCH ....OFF

1. Set the APU BLEED AIR switch to OFF.

If the APU EGT temperature decreases to normal idle operating value and TEMP COMPT HI light extinguishes, use the APU for generator drive (electricity) only.

If the TAIL COMPT TEMP HI light is extinguished:

R PNEU X-FEED VALVE... CLOSED

2. Close the right pneumatic crossfeed valve by placing the PNEU X-FEED lever in the closed (down/aft) position.

If the APU EGT temperature is still high:

L PNEU X-FEED VALVE .... CLOSED

3. Close the left pneumatic crossfeed valve by placing the PNEU X-FEED lever in the closed (down/aft) position.

If the APU EGT temperature is still high:

APU BLEED AIR SWITCH ....OFF

4. Set the APU BLEED AIR switch to OFF.

Use the APU for generator drive (electricity) only.

APU WILL NOT SHUT DOWN

APU MASTER SWITCH..OFF

1. Set the APU MASTER switch to OFF.

APU FIRE CONTROL SWITCH .... OFF & AGENT ARM

2. Set the FIRE CONTROL switch to OFF & AGENT ARM.

When the APU has shut down:

APU FIRE CONTROL SWITCH ....NORMAL

3. Set the FIRE CONTROL switch to NORMAL.

APU INFLIGHT WINDMILL START

BATTERY SWITCH.. CHECK ON

1. Make sure the battery switch is ON.

DC START PUMP .... ON

2. Set the DC START PUMP switch to ON.

Use normal APU start procedure:

3. Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position. The doors will automatically open for windmill start.
4. Set the APU Air switch to OFF.
5. Set the APU FIRE CONT switch to the NORM position.
6. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
7. Check that the APU RPM and APU EGT start rising.
8. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.
9. Check APU RPM and APU EGT stabilizing.
10. Turn the VOLT/FREQ SELECTOR to APU, and check that electrical power is within limits.
11. Set L & R APU PWR BUS switches to ON.
12. Set the APU Air switch to ON.

After start:

The battery switch must be left in the ON position to sustain APU operation.

After AC boost pumps are available:

DC START PUMP ....OFF

13. Set the DC START PUMP switch to OFF.

APU OIL PRESSURE LOW AND/OR APU OIL TEMP HI LIGHT ON

MASTER CAUTION LIGHT..RESET

1. Reset the MASTER CAUTION light by pressing on the light.

APU AIR SWITCH..OFF

2. Set the APU AIR switch to OFF.

APU DOORS SWITCH..AUTO

3. Set the APU DOORS switch to AUTO.

APU MASTER SWITCH..OFF

4. Shut down the APU by placing the APU MASTER switch in the OFF position.

APU GENERATOR OFF

If the APU is running normally, but the APU generator is not connected to either left or right bus system, and the APU PWR AVAIL light is not illuminated:

APU BUS SWITCHES..OFF

1. Set both APU BUS switches to OFF.

APU GEN SWITCH..RESET, THEN NORMAL

2. Reset the APU generator: Place the switch in the RESET position. The switch is spring loaded back to the NORMAL position.

VOLTMETER SELECTOR..APU VOLT/FREQ

3. Set the voltmeter selector to APU VOLT/FREQ and check the indicators for normal values.

ANTI-SKID CAUTION LIGHT(S) ON DURING APPROACH

If there is no time to check the system (on short approach):

Go to ❶.

If there is time to check the system:

ANTI-SKID SWITCH .... CHECK ARMED

1. Verify the ANTI-SKID switch is set to ARM.

ANTI-SKID POWER & ANTI-SKID TEST CBs .... CHECK/RESET

2. Check that all ANTI-SKID circuit breakers are set (A11, P36, P37, R36, R37). Reset if necessary.

ANTI-SKID SWITCH .... OFF, THEN ARMED

3. Set the ANTI-SKID switch to OFF, then back to ARM.

If the anti-skid caution lights are still illuminated:

Go to ❶ below.

If the anti-skid caution lights are extinguished:

ANTI-SKID TEST SWITCH .... A

4. Hold the ANTI-SKID TEST switch to A and check that all the ANTI-SKID annunciator lights illuminates.
5. Release the ANTI-SKID TEST switch and verify that all the ANTI-SKID annunciator lights extinguishes.

If, following the test of system A, the anti-skid caution lights are extinguished:

Land normally. End checklist here.

If, following the test of system A, the anti-skid caution lights remain illuminated:

ANTI-SKID TEST SWITCH .... B

6. Hold the ANTI-SKID TEST switch to B and check that all the ANTI-SKID annunciator lights illuminates.
7. Release the ANTI-SKID TEST switch and verify that all the ANTI-SKID annunciator lights extinguishes.

If, following the test of system B, the anti-skid caution lights are still extinguished:

Land normally. End checklist here.

If, following the test of system B, the anti-skid caution lights remain illuminated:

ANTI-SKID SWITCH ....OFF, THEN ARMED

8. Set the ANTI-SKID switch to OFF, then back to ARM.

Go to ❶ below.

❶ Land normally using manual braking.

Continue the approach with the anti-skid switch in the ARM position. Land the aircraft normally. Operate the brakes as if in full manual mode.

During final rollout:

BRAKES ....RELEASE MOMENTARILY

1. During the final stage of rollout, just before leaving the runway for the taxiway, momentarily release the brakes, and…

ANTI-SKID SWITCH ....OFF

2. Set the ANTI-SKID switch to OFF.

BRAKE COOLING

After an aborted takeoff or after landing with heavy braking, consult the following chart for brake cool down times:

BRAKE COOLING SCHEDULE

Gross weight 1,000 LBS	INDICATED AIRSPEED AT BRAKE APPLICATION											
	70	80	90	100	110	120	130	140	150	160	170	180
50	-	-	-	3	8	16	23	30	39	42	57	67
60	-	-	2	6	16	23	32	41	52	62	73	DZ
70	-	1	7	14	23	32	42	52	64	DZ	DZ	DZ
80	-	4	12	20	29	40	51	63	DZ	DZ	DZ	DZ
90	-	8	16	25	37	48	60	74	DZ	DZ	DZ	DZ
100	3	12	21	31	42	56	70	DZ	DZ	DZ	DZ	DZ
110	5	15	25	37	45	64	DZ	DZ	DZ	DZ	DZ	DZ

Increase the cool down time with 5 minutes for every 2,000 feet altitude above sea level.

Increase the cool down time with 1.5 minutes for every knot of tailwind component on landing.

All times of 49 minutes or more (grey boxes) are CAUTION ZONE times.

All times of 75 minutes or more (marked DZ) are DANGER ZONE times.

CAUTION ZONE:
1. Clear the active runway.
2. Avoid using the brakes too much to maneuver.
3. Do not set the parking brake.
4. Allow the brakes to cool according to the BRAKE COOLING SCHEDULE chart.
5. After cooling, visually inspect the brakes.

DANGER ZONE:
1. Clear the active runway immediately.
2. Do not apply any artificial cooling agents or quench until the fuse plugs have released tire pressure.
3. Do not approach the landing gear for one-half hour or until the fuse plugs have blown.
4. Allow the brakes to cool for 2-3 hours when no artificial cooling agents are used.
5. Replace tires, wheels and brakes.

WINDSHIELD HEAT INOP

The following speed restrictions apply below 10,000 feet. There are no speed restrictions above 10,000 feet, and no speed restrictions at all on the clearview or eyebrow windows.

If the windshield heat is inoperative on:

• Center window	315 KIAS
• Captain's or First Officer's window	315 KIAS

CRACKED WINDSHIELD

NOTE: Do not operate windshield heat on a cracked windshield. Pull the respective WINDSHIELD ANTI-ICE circuit breaker (H25, H26 or J25) for a cracked outer glass (pane) ply, or the ANTI-FOG circuit breaker (H27, J26 or J27) for a cracked inner glass (pane) ply.

The following speed restrictions apply below 10,000 feet. There are no speed restrictions above 10,000 feet, and no speed restrictions at all on the clearview or eyebrow windows.

If the windshield is cracked on:

• Outer ply of the center, Captain's or First Officer's window	315 KIAS
• Inner ply of the center, Captain's or First Officer's window	235 KIAS

AC CROSSTIE LOCKOUT, AC BUS OFF, GEN OFF, AND DC BUS OFF LIGHT ON

MASTER CAUTION LIGHT..RESET

1. Reset the MASTER CAUTION light by pressing on the light.

AC LOAD INDICATORS..MONITOR

2. Monitor the AC LOAD indicators. Reduce electrical loads if necessary.

ALL FUEL BOOST PUMP SWITCHES..ON

3. Make sure all fuel boost pump switches are turned ON.

CABIN PRESSURIZATION..AS REQUIRED

4. Control cabin pressure manually, if necessary. Move the OUTFLOW VALVE control to the MANUAL position (down position) and rotate the CABIN ALT CONTROL WHEEL to adjust cabin pressurization manually.

GEN SWITCH (on affected side)..RESET, THEN OFF

5. Reset the failed generator by setting the GEN switch, on the affected side, to RESET and then to OFF.

GEN VOLTAGE & FREQUENCY..NORMAL

6. Rotate the VOLT/FREQ switch to AC VOLT/FREQ L or R as applicable. Check the voltage and frequency for normal readings.

If the generator voltage and frequency does not display normal values:

Go to ❶ below.

If the generator voltage and frequency displays normal values:

GEN SWITCH (on affected side)..ON

7. Set the GEN switch, on the affected side, to ON.

If the generator returned to normal operation:

No further action is required. Return to normal operation. Monitor voltage and frequency.

If the generator did not return to normal operation:

Go to ❷ below.

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❶ **If the generator voltage and frequency does not display normal values:**

APU BUS SWITCHES...OFF

8. Set both APU BUS switches to OFF.

APU...START

9. Start the APU: Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position.
10. Set the APU Air switch to OFF.
11. Set the APU FIRE CONT switch to the NORM position.
12. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
13. Check that the APU RPM and APU EGT start rising.
14. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.
15. Check APU RPM and APU EGT stabilizing.
16. Turn the VOLT/FREQ SELECTOR to APU, and check that electrical power is within limits.
17. Set L & R APU PWR BUS switches to ON.
18. Set the APU Air switch to ON.

At the Captain's discretion, an attempt may be made to place the APU bus switch ON for the side with the failed generator.

APU BUS SWITCH (on affected side) ....ON

19. Set the APU BUS switch on the side of the failed generator to ON.

If the APU is powering the side of the failed generator:

No further action is required. Monitor voltage and frequency.

If the APU is not powering the side of the failed generator:

If the APU would not start, would not power the bus on the side of the failed generator, or the Captain decided not to power the failed side:

DC X-TIE SWITCH ....CLOSE

20. Set the DC X-TIE switch to CLOSE.
21. Monitor the generator and opposite DC loadmeters.

❷ If the generator did not return to normal operation:

GEN SWITCH (on affected side)..OFF

22. Set the GEN switch, on the affected side, to OFF.

APU BUS SWITCHES..OFF

23. Set both APU BUS switches to OFF.

APU..START

24. Start the APU: Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position.
25. Set the APU Air switch to OFF.
26. Set the APU FIRE CONT switch to the NORM position.
27. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
28. Check that the APU RPM and APU EGT start rising.
29. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.
30. Check APU RPM and APU EGT stabilizing.
31. Turn the VOLT/FREQ SELECTOR to APU, and check that electrical power is within limits.

APU BUS SWITCH (on side of good generator)..ON

32. Set the APU BUS switch on the side of the still operating generator to ON as a backup.

DC X-TIE SWITCH..CLOSE

33. Set the DC X-TIE switch to CLOSE.
34. Monitor the generator and opposite DC loadmeters.

NOTE 1: After landing with a failed generator, turn the air conditioning supply switch to OFF for the side with the failed generator, as the ground blower will be inoperative.

NOTE 2: A generator should normally only be reset once for a given fault. If a fault trips the generator after reset, locate and correct the fault before attempting to place the generator back on its bus.

AC EMER BUS OFF LIGHT ON

MASTER WARNING LIGHT ....RESET

1. Reset the MASTER WARNING light by pressing on the light.

If the Captain's instruments are not affected:

EMER AC BUS SENSING CB (B5 overhead panel) ....CHECK/RESET

2. Check/reset the EMER AC BUS SENSING circuit breaker (B5 on the overhead panel).

If the Captain's instruments are affected:

If both the Captain's and First Officer's instruments are affected:

EMER PWR SWITCH .... ON

3. Set the EMER PWR switch to ON.
4. See note below.

If only the Captain's instruments are affected:

Continue the flight using the First Officer's instruments.

EMER AC BUS FEED CB (K10) ....CHECK

5. Check the status of the EMER AC BUS FEED circuit breaker (K10).

ALT EMER AC BUS FEED CB (L11) ....CHECK

6. Check the status of the ALT EMER AC BUS FEED circuit breaker (L11).

If both circuit breakers (K10 & L11) tripped:

ALT EMER AC BUS FEED CB (L11) ....RESET

7. Reset the ALT EMER AC BUS FEED circuit breaker (L11).

If the circuit breaker tripped again:

Continue the flight using the unaffected instruments or, at the Captain's discretion, place the EMER PWR switch ON. If the EMER AC BUS OFF light does not extinguish, place the EMER PWR switch back to OFF. See note below.

If the circuit breaker did not trip again:

Do NOT reset the EMER AC BUS FEED circuit breaker or place the EMER PWR switch to ON.

If the circuit breakers (K10 & L11) did not trip:

Continue the flight using the unaffected instruments or, at the Captain's discretion, place the EMER PWR switch ON. If the EMER AC BUS OFF light does not extinguish, place the EMER PWR switch back to OFF. See note below.

NOTE: When the EMER PWR switch is placed in the ON position, the batteries are not being charged which means you have about 45 minutes worth of electrical power left. Land the aircraft as soon as possible.

CSD OIL PRESSURE LOW LIGHT ON

MASTER CAUTION LIGHT...RESET

1. Reset the MASTER CAUTION light by pressing on the light.

APU.. START

2. Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position.
3. Set the APU Air switch to OFF.
4. Set the APU FIRE CONT switch to the NORM position.
5. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
6. Check that the APU RPM and APU EGT start rising.
7. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.
8. Check APU RPM and APU EGT stabilizing.
9. Turn the VOLT/FREQ SELECTOR to APU, and check that electrical power is within limits.

APU BUS SWITCH (affected side).. ON

10. Set the APU BUS switch on the side of the affected operating generator to ON.

If the APU voltage and frequency is not within normal limits, continue to operate the affected generator at the Captain's discretion. Monitor temperature and frequency closely.

GEN SWITCH (affected side) ....OFF

11. Set the GEN switch, on the affected side, to OFF.

CAUTION: ***The next step is irrevocable. Make absolutely certain that the switch to be activated is for the malfunctioning generator.***

CSD SWITCH (affected side)...DISC

12. Set the CSD switch, on the affected side, to DISC and hold for three seconds.
13. Check for generator disconnect (CSD needle dropping to the left, frequency zero, CSD OIL PRESS LOW light illuminates).

DC EMER BUS OFF LIGHT ON

MASTER WARNING LIGHT .... RESET

1. Reset the MASTER WARNING light by pressing on the light.

If the emergency lights did not illuminate:

EMER DC BUS SENS CB (Overhead B11) .... CHECK/RESET

2. Check/reset the EMER DC BUS SENS circuit breaker (overhead panel B11).

Continue the flight.

If the emergency lights illuminated:

EMER DC BUS FEED CB (M35) .... RESET

3. Reset the EMER DC BUS FEED circuit breaker (M35).
4. Note: Do not reset this circuit breaker more than once.

If the emergency DC bus feed circuit breaker trips again or will not reset, this indicates a bus fault. Do NOT place the EMER PWR switch ON.

Note: If unable to power the EMER DC bus, note that number 1 VHF/COMM and both overhead speakers will become inoperative. For communications select EMER on both audio control panels. Use headsets and communicate on number 2 VHF/COMM.

DC TRANSFER BUS OFF LIGHT ON

Perform a fire warning test to determine if the DC transfer bus is powered.

FIRE PROTECTION .... TEST

1. Press and hold the loop test button.
2. Check the fire bell sound and the following lights when holding the test button:
   a. Loop lights
   b. Fire Detection Loop
   c. APU Fire
   d. MASTER WARNING
   e. MASTER CAUTION
   f. Fire Shutoff Handles

If the fire warning test was successful:

DC TRANSFER BUS SENS CB (X37) .... CHECK/RESET

3. Check/reset the DC TRANSFER BUS SENS circuit breaker (X37).

Continue the flight.

If the fire warning test did not complete successfully:

DC TRANSFER BUS FEED CB (M34) .... CHECK/RESET

4. Check/reset the DC TRANSFER BUS FEED circuit breaker (M34). Reset one time only.
5. If the DC transfer bus feed trips again or did not reset, continue the flight with the affected equipment inoperative. Land at the nearest suitable airport, as the aircraft is not protected by fire detection.

L OR R GEN OFF LIGHT ON

MASTER CAUTION LIGHT..RESET

1. Reset the MASTER CAUTION light by pressing on the light.

If the AC CROSSTIE LOCKOUT, AC BUS OFF, and DC BUS OFF lights are illuminated:

Go to the AC CROSSTIE LOCKOUT, AC BUS OFF, GEN OFF, AND DC BUS OFF LIGHT ON procedure.

If the AC CROSSTIE LOCKOUT, AC BUS OFF, and DC BUS OFF lights are not illuminated:

GEN SWITCH (on affected side) ....RESET, THEN OFF

2. Reset the failed generator by setting the GEN switch, on the affected side, to RESET and then to OFF.

GEN VOLTAGE & FREQUENCY ....NORMAL

3. Rotate the VOLT/FREQ switch to AC VOLT/FREQ L or R as applicable. Check the voltage and frequency for normal readings.

If the generator voltage and frequency does not display normal values:

Go to ➊ below.

If the generator voltage and frequency displays normal values:

GEN SWITCH (on affected side).. ON

4. Set the GEN switch, on the affected side, to ON.

If the generator returned to normal operation:

No further action is required. Return to normal operation. Monitor voltage and frequency.

If the generator did not return to normal operation:

Go to ➊ below.

❶ If the generator voltage and frequency does not display normal values, or the generator did not return to normal operation:

GEN SWITCH (on affected side)..OFF

5. Set the GEN switch, on the affected side, to OFF.

APU BUS SWITCHES..OFF

6. Set both APU BUS switches to OFF.

APU..START

7. Start the APU: Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position.
8. Set the APU Air switch to OFF.
9. Set the APU FIRE CONT switch to the NORM position.
10. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
11. Check that the APU RPM and APU EGT start rising.
12. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.
13. Check APU RPM and APU EGT stabilizing.
14. Turn the VOLT/FREQ SELECTOR to APU, and check that electrical power is within limits.

APU BUS SWITCH (on side of good generator)..ON

15. Set the APU BUS switch on the side of the still operating generator to ON as a backup.

DC X-TIE SWITCH..CLOSE

16. Set the DC X-TIE switch to CLOSE.
17. Monitor the generator and opposite DC loadmeters.

NOTE 1: After landing with a failed generator, turn the air conditioning supply switch to OFF for the side with the failed generator, as the ground blower will be inoperative.

NOTE 2: A generator should normally only be reset once for a given fault. If a fault trips the generator after reset, locate and correct the fault before attempting to place the generator back on its bus.

CSD OIL OUTLET TEMP HIGH OR RISING (CAUTION ZONE)

If the generator frequency is out of limits or fluctuating:

GEN SWITCH (affected side)..OFF

1. Set the GEN switch, on the affected side, to OFF.

If the CSD temperature stabilized below the red radial:

Use the APU generator to replace the bad engine generator.

Go to ❶ below.

If the CSD temperature did not stabilized below the red radial:

CAUTION: ***The next step is irrevocable. Make absolutely certain that the switch to be activated is for the malfunctioning generator.***

CSD SWITCH (affected side) ....DISC

2. Set the CSD switch, on the affected side, to DISC and hold for three seconds.
3. Check for generator disconnect (CSD needle dropping to the left, frequency zero, CSD OIL PRESS LOW light illuminates).

Use the APU generator to replace the bad engine generator.

Go to ❶ below.

❶ Starting the APU:

APU.. START

1. Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position.
2. Set the APU Air switch to OFF.
3. Set the APU FIRE CONT switch to the NORM position.
4. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
5. Check that the APU RPM and APU EGT start rising.
6. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.
7. Check APU RPM and APU EGT stabilizing.
8. Turn the VOLT/FREQ SELECTOR to APU, and check that electrical power is within limits.
9. Set L or R APU PWR BUS switch to ON.

APU BUS SWITCH (affected side).. ON

10. Set the APU BUS switch on the side of the affected operating generator to ON.

DC POWER OFF LIGHT ON

Assuming both the left and right AC buses are powered, this fault indicates either a loss of two transformer rectifiers (T/R) or a shorted bus in one system.

DC LOAD METERS AND DC VOLTMETER .... CHECK

1. Check the DC load meter for normal indications (for affected bus).
2. Check the DC voltmeter for normal indications (for affected bus).

If the DC load meters and the DC voltmeter gives normal indications:

DC BUS SENSING C/B .... CHECK/RESET

1. Check the DC bus sensing circuit breaker (R24). If this circuit breaker has not tripped, assume a faulty DC bus sensing circuit or failure of the DC EMERG power transfer relay. Continue the flight.

If the DC load meters and the DC voltmeter gives abnormal indications:

This indicates a problem with the two transformer rectifiers for the affected DC bus.

AFFECTED T/R CBs .... CHECK

2. Check, but do not reset, the following circuit breakers:
3. Left DC bus: Left #1 (K1, K2, K3), left #2 (K4, K5, K6).
4. Right DC bus: Right #1 (L1, L2, L3), right #2 (not simulated).

If none of the transformer rectifier circuit breakers have tripped:

DC BUS X-TIE SWITCH .... CLOSE

5. Set the DC BUS X-TIE switch to CLOSE.

UNAFFECTED DC LOAD METERS .... MONITOR

6. Monitor the DC load meter on the good side. Continue the flight.

If one or more of the transformer rectifier circuit breakers have tripped:

AFFECTED T/R CBs .... RESET ONE TIME ONLY

7. Reset the following circuit breakers:
8. Left DC bus: Left #1 (K1, K2, K3), left #2 (K4, K5, K6).
9. Right DC bus: Right #1 (L1, L2, L3), right #2 (not simulated).

If the affected circuit breakers could not be reset:

This could indicate a possible shorted DC bus. Do NOT close the DC bus crosstie. Continue the flight.

If the affected circuit breakers have been reset:

DC LOAD METERS AND DC VOLTMETER..CHECK

10. Check the DC load meter for normal indications (for affected bus).
11. Check the DC voltmeter for normal indications (for affected bus).

If the DC load meters and the DC voltmeter gives normal indications:

Continue normal operation.

If the DC load meters and the DC voltmeter does not give normal indications:

DC BUS X-TIE SWITCH ....CLOSE

12. Set the DC BUS X-TIE switch to CLOSE.

UNAFFECTED DC LOAD METERS.. MONITOR

13. Monitor the DC load meter on the good side. Continue the flight.

NOTE: If there is a shorted DC bus and this is being crosstied to the good DC bus, the protective fuse will open in the E & E compartment, the DC BUS OFF light will illuminate again and no further crosstie will be possible (due to location of fuse in E & E compartment).

INTERMITTENT AC POWER INTERRUPTIONS

This type of fault can be identified by a loud buzzing/chattering sound from the Electric Power Center (EPC), and any combination of random circuit breaker trips, loss of some flight instruments, flashing cockpit annunciators, and loss of left or right AC bus(es).

AC BUS X-TIE SWITCH.. OPEN

1. Set the AC BUS X-TIE switch to OPEN.

L OR R GEN OFF LIGHT .... ON

2. Positively identify the faulty generator.

ASSOCIATED GEN SWITCH ....RESET/OFF

3. Set the GEN switch for the affected side to RESET, then to OFF.
4. Note that a generator must only be reset once for a given fault. If the generator is tripped again after reset, the fault must be located and corrected before an attempt can be made to place the generator back on its bus again.

GEN VOLTAGE & FREQUENCY...NORMAL

5. Rotate the VOLT/FREQ switch to AC VOLT/FREQ L or R as applicable. Check the voltage and frequency for normal readings.

If the voltage and frequency are within limits:

ASSOCIATED GEN SWITCH... ON

6. Set the GEN switch for the affected side to ON.

AC VOLT/FREQ/AC LOAD .... CHECKED

7. Check the voltage, frequency and AC load for normal readings.

If the readings are within allowable limits:

Monitor the system and continue the flight.

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If the voltage and frequency are not within allowable limits:

ASSOCIATED GEN SWITCH..........OFF

8. Set the GEN switch for the affected side to OFF.

CIRCUIT BREAKER(S)..........RESET

9. Reset any tripped circuit breakers.

NOTE: A 3 minute cooling period should be observed before resetting a circuit breaker.

CAUTION: A tripped circuit breaker should only be reset once for a given fault. If a circuit breaker trips again after it has been reset, the cause should be determined and corrected before attempting to reset the circuit breaker again.

APU BUS SWITCHES..........OFF

14. Set both APU BUS switches to OFF.

APU..........START

15. Start the APU: Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position.
16. Set the APU Air switch to OFF.
17. Set the APU FIRE CONT switch to the NORM position.
18. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
19. Check that the APU RPM and APU EGT start rising.
20. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.
21. Check APU RPM and APU EGT stabilizing.
22. Turn the VOLT/FREQ SELECTOR to APU, and check that electrical power is within limits.

APU BUS SWITCHES..........ON

23. Set the both APU BUS switches to ON.

CAUTION: Do not return the AC BUS X-TIE switch to AUTO.

FIRE DETECTOR LOOP LIGHT ON (NO FIRE INDICATION)

MASTER CAUTION LIGHT..RESET

1. Reset the MASTER CAUTION light by pressing on the light.

ENGINE FIRE DETECTOR SYSTEM PANEL...CHECK

2. Locate the illuminated detector loop light.

LOOPS SELECTOR SWITCH (for system with loop light on) .... SELECT OPPOSITE LOOP

3. Set the LOOP selector switch to the opposite (non-illuminated) loop. This will deactivate the possibly faulty fire detector loop and both affected loop lights should be extinguished.

SELECTED FIRE WARNING LOOP... TEST

4. Test the integrity of the fire warning system by pressing the TEST button.

If the fire warning system test was normal:

Continue normal operations, leaving the loop selector switch in the selected position.

If the fire warning system test was not normal:

LOOPS SELECTOR SWITCH.. SELECT OPERATIVE LOOP

5. Set the loop selector switch back to the previously illuminated loop.

NOTE: The failure of the fire warning system to test properly indicates that the selected system has malfunctioned and the initial fire detector loop light should be treated as an engine or APU fire, as appropriate.

ENGINE FIRE OR APU FIRE CHECKLIST .... ACCOMPLISH

6. Go to and accomplish the engine fire or APU fire checklist.

ABNORMAL RUDDER CONTROL

RUDDER HYD CONT LEVER .... MAN

1. Set the rudder hydraulic control lever to the MAN position (aft position).

YAW DAMPER .... OFF

2. Set the YAW DAMPER switch to OFF.

RUD A/P SERVO SWITCH .... OFF

3. Set the rudder A/P servo switch to OFF.

Attempt to restore as much system capability as possible. Engage one system at a time and observe:

RUD A/P SERVO SWITCH .... ON

4. Set the rudder A/P servo switch to ON.

YAW DAMPER .... ON

5. Set the YAW DAMPER switch to ON.

If the abnormal condition returns:

RUDDER .... TRIM TO NEUTRAL PEDESTAL FORCE

6. Trim the rudder to where the slip indicator is centered and pedal forces are neutral.

YAW DAMPER .... OFF

7. Set the YAW DAMPER switch to OFF.

RUDDER HYD CONT LEVER .... PWR

8. Set the rudder hydraulic control lever to the PWR position (forward position).

FLAP/RUDDER STOP INOP LIGHT ON IN FLIGHT

Note that this warning light may illuminate momentarily as the flaps travel through the 5° position.

If the RUDDER TRAVEL UNRESTRICTED light is illuminated:

Flaps position 5° or less:

Limit rudder movement to the least possible amount.

Flaps position 5° or more:

Less than normal rudder movement will be available for landing.

If the RUDDER TRAVEL UNRESTRICTED light is extinguished:

Continue the flight normally.

POWER RUDDER INOPERATIVE

A possible failure in the power rudder system is indicated by the RUDDER CONTROL MANUAL light when the RUDDER HYD lever is out of the MAN position.

RUDDER HYD CONT LEVER .... MAN

1. Set the rudder hydraulic control lever to the MAN position (aft position).

Continue the flight using manual control. Check the RUDDER CONTROL MANUAL light. When landing with manual rudder control, maintain at least 135 KIAS until landing is assured. Do not attempt a go-around or missed approach with manual rudder control from less than 135 KIAS. 135 KIAS is required to ensure V_{MCA}.

RUDDER CONTROL MANUAL LIGHT ON IN FLIGHT

RUDDER HYD CONT LEVER .... MAN

1. Set the rudder hydraulic control lever to the MAN position (aft position).

If the right hydraulic system quantity is low:

Go to and complete the HYDRAULIC QUANTITY INDICATING LOW OR DROPPING abnormal procedure.

If the right hydraulic system quantity is sufficient:

If the right hydraulic system pressure is sufficient:

Assume a failure in the RUDDER CONTROL MANUAL light warning circuits. Continue normal power rudder operation. Monitor the right hydraulic system quantity and pressure.

If the right hydraulic system pressure is low:

AUX HYD PUMP SWITCH .... ON

2. Set the Auxiliary Pump switch to On.

If the right hydraulic pressure is still not normal:

Leave the RUD HYD CONT lever in the MAN position. Go to and accomplish the POWER RUDDER INOPERATIVE abnormal checklist.

If the right hydraulic pressure is normal now:

RUDDER PEDALS.. NEUTRAL

3. Center the rudder pedals.

RUDDER TRIM .... ZERO

4. Center the rudder trim.

RUDDER HYD CONT LEVER..PWR

5. Set the rudder hydraulic control lever to the PWR position (forward position).

If the RUDDER CONTROL MANUAL light extinguishes:

Operate normally.

If the RUDDER CONTROL MANUAL light is still illuminated:

RUDDER HYD CONT LEVER .... MAN

6. Set the rudder hydraulic control lever to the MAN position (aft position).

When landing with manual rudder control, maintain at least 135 KIAS until landing is assured. Do not attempt a go-around or missed approach with manual rudder control from less than 135 KIAS. 135 KIAS is required to ensure V_{MCA}.

RUDDER TRAVEL UNRESTRICTED LIGHT NOT ON DURING LANDING

When landing with a restricted rudder, there are two main areas of concern. The first is the crosswind landing capability, and the second is the controllability with asymmetrical thrust. The restrictions outlined below assume the rudder is limited to the maximum restriction which will allow rudder pedal travel of about one inch.

The RUDDER TRAVEL UNRESTRICTED light should illuminate when slowing down below 153 KIAS.

RUDDER TRAVEL UNRESTRICTED LIGHT .... PRESS-TO-TEST

1. Press the RUDDER TRAVEL UNRESTRICTED light to test it.

If the RUDDER TRAVEL UNRESTRICTED light does not illuminate:

If rudder travel is normal:

Land normally.

If rudder travel is not normal:

Continue troubleshooting.

If the RUDDER TRAVEL UNRESTRICTED light illuminates:

If this is a two-engine landing:

Approach speed should be V_{REF} + 5 + wind additives, but not less than 135 KIAS until landing is assured. Crosswind landing limit is 12 knots (90° component). 12 knots crosswind will require approximately 5° of crab. Touchdown can be made with 5° of crab.

If this is a one-engine landing:

RUDDER .... CENTER MOMENTARILY

2. Center the rudder momentarily to enable the rudder limiter hook to retract (not simulated).

If the RUDDER TRAVEL UNRESTRICTED light is still extinguished:

For the approach, use flaps 25°/EXT, V_{REF} + 5 + wind additives, but not less than 135 KIAS until landing is assured. Crosswind landing limit is 12 knots (90° component). 12 knots crosswind will require approximately 5° of crab. Touchdown can be made with 5° of crab.

For go-around, use V2 or 135 KIAS, whichever is higher. During a go-around, up to 8° of bank into the good engine may be required to maintain heading.

If the RUDDER TRAVEL UNRESTRICTED light illuminates and rudder operation is normal:

Refer to the ONE ENGINE INOP APPROACH & LANDING abnormal procedure.

RUDDER TRAVEL UNRESTRICTED LIGHT ON (ABOVE 177 KIAS)

R ENG HYD PUMP SWITCH .... LOW

1. Set the right hydraulic pump switch to LOW.

AUX HYD PUMP SWITCH.. OFF

2. Set the auxiliary hydraulic pump switch to OFF.

If high hydraulic pressure is required at some point:

If for some reason high hydraulic pressure is required during the flight, it is important to limit rudder power first.

RUD HYD CONT LEVER.. MAN

3. Set the RUD HYD CONT lever to MAN. Use caution when operating the rudder. Yaw damper may be used.

AIRSPEED .... 175 KIAS OR LESS ON APPROACH

4. When the airspeed on approach is at or less than 175 KIAS, rudder power can be turned back on.

RUD HYD CONT LEVER.. PWR

5. Set the RUD HYD CONT lever to PWR.

AUTO SPOILERS DO NOT USE LIGHT ON

Do not arm the spoilers for landing. Land normally. Extend the spoilers manually immediately after landing (main wheel touchdown). It may be necessary to hold the spoiler handle in the AFT position.

NOTE: The cause of the illuminated AUTO SPOILER DO NOT USE light is most likely wheel spin during gear retraction after takeoff. Normally, wheel spin is automatically stopped by inflight brakes. To determine if the cause was wheel spin, pull and reset the auto-spoiler control circuit breaker (H19, P32). If the light remains extinguished, it was wheel spin; if it illuminates again, assume a circuit fault.

SPOILER PANEL WILL NOT RETRACT

Time permitting, visually inspect the wings to determine which panel(s) are extended and failing to retract. The outboard panels are powered by the right hydraulic system and the inboard panels are powered by the left hydraulic system. Check system quantity and pressure.

If there is no time to visually inspect the wings:

Go to ➊ below.

If there is time to visually inspect the wings:

Inspect the wings and determine which hydraulic system is affected.

SPEED BRAKE HANDLE .... 35°, THEN FULL FORWARD

1. Move the speed brake handle to the 35° position and then back to the fully forward position.

ENG HYD PUMP SWITCH (Affected side)...OFF

2. Turn OFF the hydraulic pump on the side of the affected system. Outboard spoiler panel = right hydraulic system. Inboard spoiler panel = left hydraulic system.

If the spoiler panel(s) retracted:

Go to ➋ below.

If the spoiler panel(s) did not retract:

SPEED BRAKE HANDLE ....FULL AFT, THEN FULL FORWARD

3. Move the speed brake handle to the fully aft position and then back to the fully forward position.

If the spoiler panel(s) retracted:

Go to ➋ below.

If the spoiler panel(s) did not retract:

ENG HYD PUMP SWITCH (Affected side) ....LOW OR HIGH, AS REQUIRED

4. Set the hydraulic pump switch on the side of the affected system to LOW or HIGH, as required.

Go to ❶ below.

❶ No time to inspect wings/spoiler panel(s) will not retract:

LANDING FLAPS...25°

5. Set flaps 25° for landing.

AIRSPEED...V_{REF} + 5

6. Landing airspeed should be V_{REF} + 5.

GND PROX WARN SWITCH ....FLAP OVRD

7. Set the GND PROX WARN switch to FLAP OVRD. This will prevent the GPWS from sounding the landing configuration warning.

Trim the aircraft as required. Spoilers may be armed for approach. Anticipate a longer than normal rollout. Expect to use full lateral trim and up to 60° to 70° of wheel angle at approach speeds.

❷ Spoiler panel(s) retracted:

Continue operation with the affected system depressurized.

HYD BRAKE SYSTEM SELECTOR HANDLE ....UNAFFECTED SYSTEM

8. Rotate the yellow HYD BRAKE SYSTEM selector handle to the side of the unaffected hydraulic system.

Spoiler may be armed for approach. Anticipate a longer than normal rollout.

OUT OF TRIM LIGHT REMAINS ON

If the stabilizer is trimming:

Wait for the out-of-trim light to go out. If it does, continue normal operation.

If the stabilizer is not trimming:

Overpower the autopilot and press the autopilot release button on either control wheel to disengage the autopilot.

Do not use the autopilot, or at the Captain’s discretion, disable the affected servo and continue the flight using the autopilot in split axis operation.

On approach, the aircraft should be in approach configuration prior to passing the outer marker.

STABILIZER TRIM INOPERATIVE IN FLIGHT

STABILIZER TRIM SWITCH (Red guard) ....NORMAL (GUARD DOWN)

1. Verify the stabilizer trim switch is in the normal guarded position.

PRIMARY LONGITUDINAL TRIM C/B'S (G23, G24, G25) ....CHECK/RESET

2. Check and/or reset the primary longitudinal trim circuit breakers (G23, G24, G25).

AUTOPILOT AND ALTERNATE LONGITUDINAL TRIM C/B'S (F12, F13, F14) ....CHECK/RESET

3. Check and/or reset the autopilot and alternate longitudinal trim circuit breakers (F12, F13, F14).

If the stabilizer is working properly again:

Use the alternate trimming system to trim the aircraft. Plan for slower than normal trimming.

If the stabilizer is still not working properly:

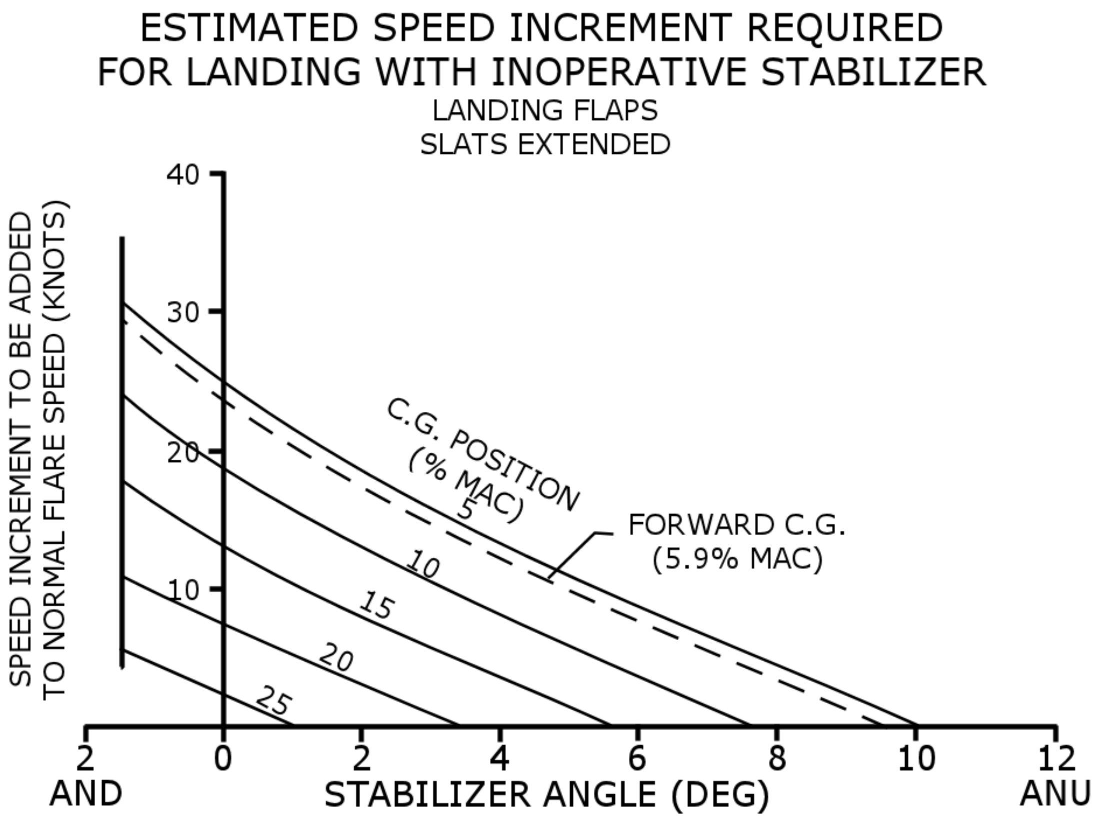
AUTOPILOT ....OFF

4. Disengage the autopilot.

APPROACH AND LANDING SPEEDS ....V_{REF} + 5 or V_{REF} + 20

5. If the stabilizer trim became inoperative on approach, use VREF + 5 knots.
6. If the stabilizer trim became inoperative in climb, cruise or descent, use VREF + 20 knots.

Time permitting; consult the chart below for more accurate estimates of speed increments required for landing.


ESTIMATED SPEED INCREMENT REQUIRED
FOR LANDING WITH INOPERATIVE STABILIZER
LANDING FLAPS
SLATS EXTENDED
SPEED INCREMENT TO BE ADDED TO NORMAL FLARE SPEED (KNOTS)
40
30
20
10
C.G. POSITION (% MAC)
5
10
15
20
25
FORWARD C.G. (5.9% MAC)
2
0
2
4
6
8
10
12
AND
STABILIZER ANGLE (DEG)
ANU

SLAT DISAGREEMENT LIGHT ON

FLAP/SLAT HANDLE.. RETURN TO PREVIOUS GOOD POSITION

1. Return the flap/slat handle to the position that restores slat symmetry or restores slat and handle position agreement.

If the slats are still not symmetrical:

AIRSPEED ....250 KIAS OR LESS

2. Fly the aircraft at 250 KIAS or less. Use chart approach speed for slats retracted.

If the slats are symmetrical again:

If the slats are retracted:

FLAP/SLAT HANDLE .... SPLIT

3. Open the flap/slat handle interlock (not simulated).

SLAT HANDLE ....FORWARD DETENT

4. Place the slat handle in the forward detent (not simulated).

If the slats are extended:

FLAP/SLAT HANDLE ....0° FLAP/SLAT EXTENDED

5. Do not move the flap/slat handle forward of the 0° flap/slat extended position.

AIRSPEED ....250 KIAS OR LESS

6. Fly the aircraft at 250 KIAS or less.

STALL INDICATION FAILURE LIGHT COMES ON DURING FLIGHT

STALL TEST SWITCH.. SYS 1 AND SYS 2 TEST

1. Test the stall warning system by placing the stall test switch in the SYS 1 and SYS 2 position to determine which channel is faulty.

If one or both channels failed:

STALL WARNING STICK SHAKER C/B (for affected side)...PULL

2. If SYS 1 failed, pull the STALL WARNING STICK SHAKER circuit breaker for the Captain's side (P35). If SYS 2 failed, pull the STALL WARNING STICK SHAKER circuit breaker for the First Officer's side (R35).

STALL TEST SWITCH .... TEST

3. Test the remaining stall warning channel for proper operation by placing the stall test switch in the SYS 1 or SYS 2 position as appropriate.

Continue the flight using the remaining stall warning channel.

If none of the channels failed:

Continue the flight using both channels. Be prepared for a malfunction at other airspeeds or configurations.

GPWS INOP LIGHT ON

GPWS C/B'S (F8, G8)....................CHECK/RESET

1. Check/reset the GPWS circuit breakers (F8, G8).

RADIO ALTIMETER C/B (D5)....................CHECK/RESET

2. Check/reset the radio altimeter circuit breaker (D5).

AIR DATA COMPUTER C/B'S (F1, F17, G1, G17)....................CHECK/RESET

3. Check/reset the air data computer circuit breakers (F1, F17, G1, G17).

If the GPWS light has extinguished:

Continue normal operations.

If the GPWS light is still illuminated:

The GPWS has failed.

GPWS WARN SWITCH....................INHIBIT

4. Set the GPWS warning switch to INHIBIT. The GPWS has failed. This action will prevent random erroneous alerts.

OVERSPEED WARNING SOUNDS EARLIER THAN SCHEDULED

If the indicated Mach number is above M.79:

Fly the aircraft below the speed that activates the overspeed warning sound.

If the indicated Mach number is below M.79:

Deactivate the overspeed warning system.

MAXIMUM AIRSPEED WARNING C/B'S (P27) ....PULL

1. Pull the MAXIMUM AIRSPEED WARNING circuit breakers (P27).

AIRSPEED 325 KIAS/M.79

2. Limit the airspeed to 325 KIAS or M.79, whichever is lower. Carefully monitor the Airspeed/Mach Indicator.

PITOT/STATIC SYSTEM MALFUNCTION

If the altimeters are affected:

Static System Failure.

Go to ❶ below.

If the altimeters are not affected:

Pitot System Failure.

AIR DATA PITOT SWITCH..OFF

1. Set the AIR DATA PITOT switch to OFF.

Go to ❷ below.

❶ Static System Failure:

CAPTAIN'S STATIC SELECTOR..ALT

2. Set the Captain's static selector switch to ALT.

If the malfunction was corrected:

Go to ❸ below.

If the malfunction was not corrected:

CAPTAIN'S STATIC SELECTOR..NORM

3. Return the Captain's static selector switch to NORM.

F/O'S STATIC SELECTOR..ALT

4. Set the First Officer's static selector switch to ALT.

If the malfunction was corrected:

Go to ❸ below.

If the malfunction was not corrected:

F/O'S STATIC SELECTOR .... NORM

5. Return the First Officer's static selector switch to NORM.

Go to ❷ below.

❷ Pitot/static anti-ice system check:

Verify that the pitot/static anti-ice system is operating properly. Make sure the METER SEL & HEAT switch is out of the OFF position. Check the following circuit breakers; P33, P34, R34, H23, J23 and overhead C11.

If the malfunction was corrected:

Go to ❸ below.

If the malfunction was not corrected:

Compare the pitot/static operated instruments with aircraft performance and determine which, if any, of the instruments are most correct. Speed command indicators can be used to check approach speed. Depressurizing the aircraft prior to approach may decrease the error in the instruments.

❸ If the malfunction was corrected:

Check the indications on the Mach/IAS indicator, altimeter and IVSI. If they all indicate within tolerance, continue normal operation.

LOSS OF RADOME

A complete or partial loss of the nose radome will disrupt the airflow over the nose of the aircraft. The resulting turbulent airflow may affect the pitot probes and thus the measured total pressure will become erroneous. This will affect all instruments and systems depending on total pressure, such as the airspeed and Mach indicators, overspeed warning and autopilot function.

Loss of the radome will also result in increased noise level, but only a relatively small loss of airplane performance. There will be no significant change in airplane handling characteristics, stall or buffet onset speeds due to radome damage.

If the radome damage was due to hail encounter, it may be accompanied by damage to the engine inlets and wing leading edges as well. Engine inlet damage may affect the EPR readout, while wing leading edge damage may affect the low speed handling characteristics at or near stall speeds.

Once this issue has been identified and the airspeed indicator readout is deemed unreliable, use pitch attitude as the primary reference and disregard airspeed readings. Information for pitch attitude flying is contained in the table below. Engine thrust settings are given as percent N_1 in order to allow for possible erroneous EPR data caused by damage to the engine inlets.

Note: If it can be determined that no significant wing leading edge damage has occurred and the speed command system is operational, the Captain may elect to use speed command in the terminal area for the approach.

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	FLAPS/ SLATS (DEG)	ALTITUDE (FEET)	GROSS WEIGHT (1000 LBS)	TARGET PITCH ATTITUDE (DEG)	APPROX. N_1 RPM REQUIRED (%)	APPROX. AIRSPEED (KIAS)	APPROX. RATE OF CLIMB/ DESCENT (FPM)
CRUISE Adjust to maintain pitch attitude	0/RET	20,000	60 80 100	0.7 1.4 2.2	78.1 79.3 81.0	285	0
	0/RET	25,000	60 80 100	0.6 1.3 2.1	80.2 81.3 83.1	285	0
	0/RET	30,000	60 80 100	0.6 1.3 2.0	82.2 84.0 86.5	285	0
	0/RET	35,000	60 80 100	0.8 1.7 2.5	83.7 87.3 93.3	268 (Mach 0.79)	0
GO AROUND 1.5 V_S + 10 KIAS. Fly to pitch attitude.	15/EXT	SL	60 80 100	24.5 19.6 16.8	92.3 92.5 92.6	126 140 154	3960 2950 2260
	15/EXT	5,000	60 80 100	21.9 17.6 15.2	93.3 93.3 93.3	126 140 154	3600 2620 1960
	15/EXT	10,000	60 80 100	19.1 15.5 13.6	93.6 93.6 93.6	126 140 154	3130 2190 1570
MAXIMUM CLIMB 1.5 V_S + 10 KIAS. Fly to pitch attitude.	0/RET	0	60 80 100	20.2 15.2 12.2	89.2 89.2 89.2	178 204 227	4950 3790 2990
	0/RET	5,000	60 80 100	17.6 13.3 10.7	89.6 89.6 89.6	178 204 227	4460 3360 2600
	0/RET	10,000	60 80 100	15.5 11.7 8.5	90.2 90.2 90.2	178 204 227	4000 2950 2220
	0/RET	15,000	60 80 100	13.4 10.2 8.3	91.0 91.0 90.9	178 204 227	3530 2540 1850
DESCENT Fly to pitch attitude.	0/RET	10,000	60 80 100	-5.6 -3.5 -2.0	Idle Thrust	285	3700 2980 2590
	0/RET	20,000	60 80 100	-4.6 -2.6 -1.0	Idle Thrust	285	3650 2940 2550
	0/RET	30,000	60 80 100	-4.3 -2.6 -1.4	Idle Thrust	285	3670 3000 2660
HOLDING Adjust power to maintain pitch attitude, level flight.	0/RET	10,000	60 80 100	3.0 4.5 6.0	64.3 67.2 70.8	210 210 210	0 0 0
TERMINAL AREA Adjust power to maintain pitch attitude, level flight.	0/RET	0	60 80 100	4.5 5.5 6.0	56.6 61.1 65.8	181 196 210	0 0 0
	15/EXT	0	60 80 100	6.0 7.0 7.5	58.0 64.1 69.3	136 151 164	0 0 0
	25/EXT	0	60 80 100	5.0 5.5 6.0	61.1 67.5 72.3	126 141 155	0 0 0
FINAL APPROACH Based on 3° glideslope. Adjust power to maintain pitch attitude. Fly to glideslope or if not available, fly to rate of descent.	50/EXT	0	60 80 100	-1.0 -1.0 -0.5	62.8 68.5 73.5	116 131 145	620 700 780

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CENTER TANK FAILS TO FEED

CTR AFT AND CTR FWD PUMP SWITCHES .... CHECK ON

1. Make sure both the center forward and aft pump switches are ON.

LEFT AFT AND LEFT FWD PUMP SWITCHES .... ONE OR BOTH ON

2. Set one or both of the left forward and aft pump switches to ON.

RIGHT AFT AND RIGHT FWD PUMP SWITCHES .... ONE OR BOTH ON

3. Set one or both of the right forward and aft pump switches to ON.

CTR FUEL TANK BOOST PUMP FWD & AFT CBs (Row J & H) .... CHECK/RESET

4. Check/reset the center fuel tank forward and aft boost pump circuit breakers (H9, H10, H11, J9, J10, J11).

If the issue has not been corrected:

FWD AND AFT PUMP SWITCHES (Either left or right) .... OFF

5. Turn OFF the forward and aft pump switches for either the left or right main fuel tank.

FUEL FLOW INSTRUMENTS .... CHECK FOR SUPPLY STABILIZATION

6. Check for steady continuous fuel supply to the engines.

If the INLET FUEL PRESS LOW light illuminates:

The center tank fuel is unavailable. Continue the flight using only the fuel remaining in the left and right main fuel tanks.

FWD AND AFT PUMP SWITCHES (Left and right) .... ONE OR BOTH ON

7. Turn ON one or both the forward and aft pump switches for both the left and right main fuel tanks.

If the INLET FUEL PRESS LOW light does not illuminate:

FWD AND AFT PUMP SWITCHES IN OTHER MAIN TANK .... OFF

8. Turn OFF both the forward and aft pump switches for the other main fuel tank.

CENTER TANK QUANTITY .... CHECK DECREASING

9. Check that fuel is being drawn from the center fuel tank.

When the center fuel tank quantity has been reduced to 500 LBS or less:

FWD AND AFT PUMP SWITCHES (In tank with greater quantity remaining) .... ON

10. For the main fuel tank with the greater quantity remaining, turn ON the forward and aft pump switches.

Maintain lateral balance. When either INLET FUEL PRESS LOW light illuminates, for that tank:

FWD AND AFT PUMP SWITCHES.. ON

11. Turn ON the forward and aft pump switches for the side of the illuminated INLET FUEL PRESS LOW light.

DEPLETED FUEL

If the total fuel remaining onboard the aircraft is down to 1,000 LBS of fuel per main tank, consider the usable fuel depleted to the point where a go-around and VFR circuit of the landing pattern will exhaust all remaining useable fuel. This is a conservative estimate. An immediate landing is required by this condition, and a go-around should only be executed in the event of an extreme emergency condition.

INLET FUEL PRESS LOW LIGHT ON, ONE BOOST PUMP ON IN EACH MAIN TANK

AFT AND FWD PUMP SWITCHES IN AFFECTED TANK .... BOTH ON

1. Turn ON both the forward and aft pump switches in the affected fuel tank.

If the INLET FUEL PRESS LOW light extinguishes:

Continue normal operation.

If the INLET FUEL PRESS LOW light did not extinguish:

AFFECTED FUEL TANK BOOST PUMP CBs (Row J & H) .... CHECK/RESET

2. Check/reset all the circuit breakers for the boost pumps in the affected fuel tank (H6, H7, H8, J6, J7, J8, or H12, H13, H14, J12, J13, J14).

If the fuel consumption is abnormal:

There might be a fuel leak. Conditions permitting, shut down the affected engine using the ENGINE FIRE/SEVERE DAMAGE emergency checklist. However, DOT NOT discharge the fire agent.

If the fuel consumption is normal:

Verify light indication by crossfeeding from the opposite tank:

FUEL X-FEED LEVER .... ON

3. Set the Fuel Crossfeed lever to ON.

If the INLET FUEL PRESS LOW light remains illuminated:

Assume both pumps in the affected tank have failed. If using J-A fuel, both engines should suction feed throughout the entire flight envelope. If using JP-4, restrictions apply. When operating on suction feed, the INLET FUEL PRESS LOW light will remain illuminated.

If the INLET FUEL PRESS LOW light extinguishes:

This indicates a faulty circuit.

FUEL X-FEED LEVER .... OFF

4. Set the Fuel Crossfeed lever back to OFF.

Resume normal fuel management.

MINIMUM FUEL APPROACH

When executing an approach with less than 1,000 lbs of fuel remaining in each main tank:

LEFT AND RIGHT AFT PUMP SWITCHES.. ON
1. Turn ON the left and right aft fuel boost pump switches.

LEFT AND RIGHT FWD PUMP SWITCHES..OFF
2. Turn OFF the left and right forward fuel boost pump switches.

CENTER AFT AND FWD PUMP SWITCHES..OFF
3. Turn OFF the aft and forward center fuel tank boost pump switches.

L AND R INLET FUEL PRESS LOW LIGHTS.. CHECK OFF
4. Check that both the L & R INLET FUEL PRESS LOW lights are extinguished.

After checking aft fuel pump operation:

ALL BOOST PUMPS... ON
5. Turn ON all fuel boost pump switches.

FUEL X-FEED LEVER .... ON
6. Set the Fuel Crossfeed lever to ON.

IGN SELECTOR ....BOTH
7. Set the Ignition Selector switch to BOTH.

MINIMUM FUEL GO-AROUND

When total fuel remaining in each main tank approaches 1,000 lbs, successful completion of a go-around cannot be assured.

Do not execute a go-around with 1,000 lbs or less remaining in each main fuel tank unless required by an extreme emergency condition. If an aft pump in a main tank is inoperative, the possibility of fuel starvation with less than 1,000 lbs in that tank is increased.

Do not under any circumstances execute a go-around with less than 500 lbs remaining in a main tank.

MAIN TANK PUMP SWITCHES.. ALL, CHECK ON

1. Turn ON the left and right aft fuel boost pump switches.

FUEL X-FEED LEVER .... ON

2. Set the Fuel Crossfeed lever to ON.

PITCH ATTITUDE .... LIMIT NOSE-UP ATTITUDE

3. Avoid excessive or sustained nose-up attitudes in excess of 10°.

FUEL LEAK

A fuel leak may be indicated by:

- Main tank fuel unbalance
- L or R inlet fuel press low light illuminated
- A significant difference between fuel quantity and fuel used
- Uncommanded filling of a tank

FUEL BOOST PUMP SWITCHES (for tank with lesser quantity) ....OFF

1. Turn OFF all the fuel boost pump switches for the tank with lesser fuel quantity.

FUEL BOOST PUMP SWITCHES (for tank with greater quantity) .... ON

2. Turn ON all the fuel boost pump switches for the tank with greater fuel quantity.

TYPE OF LEAK .... DETERMINE

3. Determine the type of leak.

If there is uncommanded filling of a tank (tank quantity increasing/decreasing at other than normal rate):

FUEL X-FEED LEVER.. ON

4. Set the Fuel Crossfeed lever to ON.

FUEL BOOST PUMP SWITCHES (for supplying tank)..ON, INTERMITTENTLY

5. Turn ON the forward and aft fuel boost pump switches for the supplying tank intermittently to make fuel available and to maintain balance.

If fuel is going overboard (difference between fuel quantity and fuel used):

FUEL X-FEED LEVER...OFF

6. Set the Fuel Crossfeed lever to OFF.

ENGINE OPERATION ....OBSERVE

7. Monitor the engine instruments closely.

If an engine using suction feed fails in-flight:

THROTTLE (affected engine).. IDLE

8. Pull the throttle of the affected engine back to IDLE.

FUEL CONTROL LEVER (affected engine) ....OFF

9. Move the fuel control lever of the affected engine to OFF.

ENGINE FIRE HANDLE (affected engine)..PULL

10. Pull the engine fire handle of the affected engine. Do not rotate the handle.

FUEL X-FEED LEVER...ON, AS REQUIRED

11. Set the Fuel Crossfeed lever to ON, or as required to maintain fuel balance.

LAND THE AIRCRAFT ....NEAREST SUITABLE AIRPORT

12. Land the aircraft at the nearest suitable airport.

If both engines are operating:

LAND THE AIRCRAFT ....NEAREST SUITABLE AIRPORT

13. Land the aircraft at the nearest suitable airport.

HYDRAULIC PRESS LOW LIGHT ON

MASTER CAUTION LIGHT...RESET

1. Push the MASTER CAUTION light to reset it.

HYD PRESS...CHECK

2. Check the hydraulic pressure gauge for the affected side.

HYD QUANTITY...CHECK

3. Check the hydraulic quantity gauge for the affected side.

If both the hydraulic pressure and quantity gauges indicate normally, there is either a fault in the light circuitry or a problem with the spoiler system. Continue normal operation and anticipate decreased spoiler/speedbrake effectiveness.

If the hydraulic quantity is low:

Refer to the HYDRAULIC QUANTITY LOW OR DROPPING abnormal checklist.

If the hydraulic quantity is normal:

Left system pressure low:

R ENG HYD PUMP ....HI

4. Set the right hydraulic boost pump switch to HI.

ALT HYD PUMP .... ON

5. Set the alternate hydraulic pump switch to ON, or as required for left system operation.

Right system pressure low:

AUX HYD PUMP... ON

6. Set the auxiliary hydraulic boost pump switch to HI.

HYDRAULIC QUANTITY LOW OR DROPPING

If system pressure is zero:

Go to ❶ below.

If system pressure is not zero:

If system pressure is about 1,500 PSI:

Go to ❶ below.

If system pressure is about 3,000 PSI:

Left system quantity low:

L ENG HYD PUMP .... LOW

1. Set the left hydraulic boost pump switch to LOW.

ALT HYD PUMP .... OFF

2. Set the alternate hydraulic pump switch to OFF.

Right system quantity low:

R ENG HYD PUMP .... LOW

3. Set the right hydraulic boost pump switch to LOW.

AUX HYD PUMP .... OFF

4. Set the auxiliary hydraulic pump switch to OFF.

If hydraulic quantity loss stopped:

HYD BRAKE SYSTEM SELECTOR HANDLE .... UNAFFECTED SYSTEM

5. Rotate the yellow HYD BRAKE SYSTEM selector handle to the side of the unaffected hydraulic system.

See chart of inoperable items.

If hydraulic quantity loss continues:

Go to ❶ below.

➊ **Shutting down affected hydraulic system.**

ENG HYD PUMP (Affected system) ....OFF

6. Set the hydraulic boost pump switch for the affected system to OFF.

AUX AND ALT HYD PUMP.. OFF/OFF

7. Set both the auxiliary and alternate hydraulic pump switches to OFF.

HYD BRAKE SYSTEM SELECTOR HANDLE ....UNAFFECTED SYSTEM

8. Rotate the yellow HYD BRAKE SYSTEM selector handle to the side of the unaffected hydraulic system.

For approach and landing:

If there is any usable hydraulic fluid left in the affected system:

Left system quantity low:

L ENG HYD PUMP... LOW

9. Set the left hydraulic boost pump switch to LOW.

Right system quantity low:

If the AUX HYD pump was operating when the hydraulic quantity loss occurred:

R ENG HYD PUMP.. LOW

10. Set the right hydraulic boost pump switch to LOW.

If the AUX HYD pump was not operating when the hydraulic quantity loss occurred:

AUX HYD PUMP .... ON

11. Set the auxiliary hydraulic pump switch to ON.

If a complete loss of hydraulic pressure occurs:

ENG HYD PUMP (Affected system)...OFF

12. Set the hydraulic boost pump switch for the affected system to OFF.

AUX AND ALT HYD PUMP .... OFF/OFF

13. Set both the auxiliary and alternate hydraulic pump switches to OFF.

HYD BRAKE SYSTEM SELECTOR HANDLE...UNAFFECTED SYSTEM

14. Rotate the yellow HYD BRAKE SYSTEM selector handle to the side of the unaffected hydraulic system.

If the right hydraulic system fails:

RUD HYD CONT LEVER .... MAN

15. Set the RUD HYD CONT lever to MAN. Use caution when operating the rudder. Yaw damper may be used.

WARNING: Minimum approach speed with manual rudder is 135 KIAS until the landing is assured.

Refer to the EMERGENCY LANDING GEAR EXTENSION abnormal procedure.

See chart of inoperable items.

Inoperable items:

LEFT SYSTEM AT 1,500 PSI	• Flap outboard cylinders • Left brake system (accumulator pressure only available) • Left nose steering • Alternate hydraulic pump
RIGHT SYSTEM AT 1,500 PSI	• Flap inboard cylinders • Right brake system (accumulator pressure only available) • Landing gear should be extended using the alternate hydraulic pump for pressure or by free fall, if the failure was in the landing gear hydraulic system
LEFT HYDRAULIC SYSTEM FAILURE	• Brakes (accumulator pressure only) • Reverser (accumulator pressure only) • Elevator (accumulator pressure only) • Inboard spoilers • Slat outboard cylinders • Flap outboard cylinders • Nose steering left cylinder
RIGHT HYDRAULIC SYSTEM FAILURE	• Brakes (accumulator pressure only) • Reverser (accumulator pressure only) • Rudder (will revert to manual) • Outboard spoilers • Slat inboard cylinders • Flap inboard cylinders • Nose steering left cylinder

HYD TEMP HI LIGHT ILLUMINATED

MASTER CAUTION LIGHT...RESET

1. Push the MASTER CAUTION light to reset it.

Left HYD TEMP HI light illuminated:

L ENG HYD PUMP...OFF

2. Set the left hydraulic boost pump switch to OFF.

ALT HYD PUMP...OFF

3. Set the alternate hydraulic pump switch to OFF.

Right HYD TEMP HI light illuminated:

R ENG HYD PUMP...OFF

4. Set the right hydraulic boost pump switch to OFF.

AUX HYD PUMP...OFF

5. Set the auxiliary hydraulic pump switch to OFF.

Allow the hydraulic system to cool down.

If the HYD TEMP HI light extinguishes:

ENG HYD PUMP (Affected side)...ON

6. Set the hydraulic boost pump switch for the affected side to ON.

If the HYD TEMP HI light stays illuminated:

Leave the pumps OFF until needed.

Approach and landing:

Turn on the pumps to power necessary systems for approach and landing (flaps, slats, spoilers, brakes). Carefully monitor hydraulic pressure and quantity.

LANDING WITH NO HYDRAULIC PRESSURE

LANDING GEAR CONTROL HANDLE ....DOWN

1. Place the landing gear control handle in the DOWN position.

EMER GEAR LEVER FLOOR COVER ....RAISE

2. Open the cover for the emergency landing gear extension lever.

EMER LANDING GEAR EXT LEVER ....PULL UP & LATCH

3. Pull the emergency landing gear extension lever up.
4. It may take up to 20 seconds for the landing gear to lock (three green).
5. It may be necessary to slow the aircraft down to 165 KIAS to allow the nose gear to latch down.
6. The GEAR DOOR OPEN light will stay illuminated as the main gear doors will not close without hydraulic pressure.

ANTI-SKID ....OFF

7. Set the ANTI-SKID switch to OFF.

HYD BRAKE SYSTEM SELECTOR HANDLE ....BOTH

8. Make sure the yellow HYD BRAKE SYSTEM selector handle is set to BOTH.

GND PROX WARN SWITCH ....FLAP OVRD

9. Set the GND PROX WARN switch to FLAP OVRD.

NOTE: The following items will be inoperative:

- Slats
- Flaps
- Spoilers
- Steering

Reverse thrust and brakes will operate from accumulator pressure.

After landing:

- Apply brakes steadily. Avoid repeated release and reapplication of the brakes.
- Use symmetrical reverse idle thrust. If more than idle thrust is required to stop the aircraft, carefully monitor and maintain symmetrical reverse thrust to avoid inducing adverse yaw. Increasing amounts of reverse thrust will reduce rudder effectiveness and thus increase the need to use differential braking to maintain directional control. In the event of directional control problems, reduce reverse thrust as required and select forward idle to regain directional control.
- Stop the aircraft on the runway.
- Set the parking brake before releasing the pedals.
- Close the main gear doors manually, install gear locking pins, and tow.

AIRFOIL ICE PROT PRESS ABNORMAL LIGHT ON/AIRFOIL ICE PROTECTION IN USE

PNEU X-FEED LEVER.. CHECK OPEN

1. Make sure the pneumatic crossfeed valves are open by placing the PNEU X-FEED levers in the OPEN (up/forward) position.

PNEU PRESS GAUGE ....CHECK ABOVE 20 PSI

2. The pneumatic pressure gauge should read above 20 PSI.

SUPPLY AIR PRESS REGULATOR VALVE CB (N27) ....CHECK/RESET

3. Check/reset the SUPPLY AIR PRESS REGULATOR VALVE circuit breaker (N27).

If the AIRFOIL ICE PROT PRESS ABNORMAL light extinguishes:

Continue normal flight.

If the AIRFOIL ICE PROT PRESS ABNORMAL light is still illuminated:

Ice protection is not available.

TAIL DEICE BUTTON ....PRESS TO OPERATE ONE CYCLE

4. Execute one cycle of tail deicing.

If the AIRFOIL ICE PROT PRESS ABNORMAL light is still illuminated:

PNEU X-FEED LEVER .... CLOSE

5. Place the PNEU X-FEED levers in the CLOSED (down/aft) position.

Avoid flying into icing conditions.

If ice is suspected on the tail:

Maintain a minimum of 5 knots above normal maneuvering speeds. Use flaps 25° on final approach with slats extended. Airspeed should be flaps 25° REF plus 5 knots.

GPWS...FLAP OVERRIDE

6. Set the GPWS switch to FLAP OVERRIDE.

If the AIRFOIL ICE PROT PRESS ABNORMAL light extinguishes:

Tail deice is available but airfoil ice protection is not available. Avoid flying into icing conditions.

To operate tail deice:

PNEU X-FEED LEVER.. OPEN

7. Place the PNEU X-FEED levers in the OPEN (up/forward) position.

TAIL DEICE BUTTON.. PRESS

8. Execute one cycle of tail deicing.

After the tail deice cycle is complete:

PNEU X-FEED LEVER.. CLOSED

9. Place the PNEU X-FEED levers in the CLOSED (down/aft) position.

When tail deicing is no longer required:

AIRFOIL ICE PROTECTION SWITCHES .... BOTH OFF

10. Set both airfoil ice protection switches to OFF.

AIRFOIL ICE PROT PRESS ABNORMAL LIGHT ON/AIRFOIL ICE PROT NOT IN USE

PNEU X-FEED LEVER..BOTH CLOSED

1. Make sure the both pneumatic crossfeed valves are closed by placing the PNEU X-FEED levers in the CLOSED (down/aft) position.

PNEU PRESS GAUGE..CHECK ZERO

2. The pneumatic pressure gauge should read zero pressure.

If the APU is to be used for electrical power:

APU AIR SWITCH..OFF

3. Set the APU AIR switch to OFF.

CAUTION: In this configuration, an engine start on the ground is not possible.

AIRFOIL ICE PROT REQUIRED WITH BLEED AIR AVAILABLE FROM ONE ENGINE

RADIO RACK SWITCH..FAN

1. Place the radio rack switch in the FAN position.

For engine not supplying bleed air:

PNEU X-FEED LEVER..CLOSED

2. Place the PNEU X-FEED levers in the CLOSED (down/aft) position for the side of the engine not supplying bleed air.

For the side supplying bleed air:

AIRFOIL L OR R SYSTEM SWITCH..ON

3. Place the AIRFOIL switch for the side supplying bleed air to ON.

ICE PROTECT SUPPLY PRESS HI LIGHT ON

BOTH PNEU X-FEED VALVES.. MODULATE TOWARD CLOSED

1. Modulate both PNEU X-FEED valve levers simultaneously towards closed to reduce the pneumatic pressure to the point where the ICE PROT SUPPLY PRESS HI light extinguishes.
   Note: This is accomplished in the simulator by right-clicking on the PNEU X-FEED handles.

ICE PROTECT TEMP HI LIGHT ON

AIRFOIL SWITCH (Affected side)..OFF

1. Place the AIRFOIL switch for the affected side to OFF.

PNEU X-FEED LEVER (Affected side).. CLOSED

2. Place the PNEU X-FEED levers in the CLOSED (down/aft) position for the affected side.

Avoid icing conditions.

ICE PROTECT TEMP LOW LIGHT ON

PNEU X-FEED LEVER (Affected side)... CHECK OPEN

1. Make sure the pneumatic crossfeed valve for the affected side is open by placing the PNEU X-FEED lever in the OPEN (up/forward) position.

THRUST (If low) .... INCREASE

2. If engine thrust is low, increase thrust slightly.

ICE PROTECT AUGMENT VALVE CB (Row M or N) .... CHECK/RESET

3. Check/reset the ICE PROTECT AUGMENT VALVE circuit breaker; left M29 or right N29.

If the ICE PROTECT TEMP LOW light extinguishes:

Continue normal operations.

If the ICE PROTECT TEMP LOW light remains illuminated:

AIRFOIL SWITCH (Affected side)...OFF

4. Place the AIRFOIL switch for the affected side to OFF.

PNEU X-FEED LEVER (Affected side) .... CLOSED

5. Place the PNEU X-FEED levers in the CLOSED (down/aft) position for the affected side.

Avoid icing conditions.

RAPID RISE IN CABIN PRESSURE (AIRFOIL ICE PROTECTION ON)

AIRFOIL L AND R SWITCHES ....OFF

1. Set both AIRFOIL switches to OFF.

PNEU X-FEED LEVERS.. BOTH CLOSED

2. Place both PNEU X-FEED levers in the CLOSED (down/aft) position.

Avoid icing conditions.

TAIL DEICE ON LIGHT DOES NOT COME ON

NOTE: Tail deice can only be used in-flight.

WING AND TAIL VALVES CB (M30) .... CHECK/RESET

1. Check/reset the WING AND TAIL VALVES circuit breaker (M30).

Maintain a minimum of 5 knots above normal maneuvering speeds. Use flaps 25° on final approach with slats extended. Airspeed should be flaps 25° REF plus 5 knots.

GPWS .... FLAP OVERRIDE

2. Set the GPWS switch to FLAP OVERRIDE.

TAIL DEICE ON LIGHT GOES OUT IMMEDIATELY WHEN TAIL PB IS RELEASED

The tail deice is not remaining on for the full 2 ½ minute cycle.

When tail deice is required:

TAIL PUSHBUTTON .... HOLD IN FOR 2 ½ MINUTES

1. Push and hold the TAIL pushbutton for 2 ½ minutes.

TAIL DEICE ON LIGHT REMAINS ON CONTINUOUSLY

If the TAIL DEICE ON light remains illuminated after the full 2 ½ minute deice cycle has elapsed, a stuck timer is indicated.

WING AND TAIL VALVES CB (M30) ....PULL

1. Pull the WING AND TAIL VALVES circuit breaker (M30).

NOTE: Wing and ram air scoop anti-ice will remain on until the circuit breaker is reset. Even if the WING AND TAIL VALVES circuit breaker has been pulled, the TAIL DEICE ON light may still remain illuminated.

WING SURFACES.. CHECK VISUALLY

2. Go back in the passenger cabin and visually inspect the wings (not simulated).

When tail deice is required:

WING AND TAIL VALVES CB (M30) .... RESET FOR 2 ½ MINUTES

3. Reset the WING AND TAIL VALVES circuit breaker (M30) for 2 ½ minutes to deice the tail.

TAIL DEICE ON LIGHT.. WILL ILLUMINATE IF NOT ON

4. The TAIL DEICE ON light will illuminate if not already on.

NOTE: The WING ANTI-ICE ON light may not illuminate. However, this does not necessarily mean that wing anti-ice is not operating properly. When the wing anti-ice valve loses power (when pulling circuit breaker M30) it automatically opens while the tail deice valve automatically closes. About 15 seconds after the WING AND TAIL VALVES circuit breaker (M30) has been pulled, the AIRFOIL ICE PROT PRESS ABNORMAL light will illuminate. This is normal, as the timer is stuck in the tail position and the airfoil heat is directed to the wing.

WING ANTI-ICE ON LIGHT FAILS TO COME ON

NOTE: It is not possible to operate the wing anti-ice system on the ground.

AIRFOIL ADVISORY AND PRESSURE ABNORMAL CAUTION CB (M27) .... CHECK/RESET

1. Check/reset the AIRFOIL ADVISORY AND PRESSURE ABNORMAL circuit breaker (M27).

PNEU X-FEED LEVERS .... CHECK BOTH CLOSED

2. Make sure both PNEU X-FEED levers are in the CLOSED (down/aft) position.

If the AIRFOIL ICE PROT PRESS ABNORMAL light is extinguished:

Go to ❶ below.

If the AIRFOIL ICE PROT PRESS ABNORMAL light illuminates:

PNEU X-FEED LEVERS .... OPEN BOTH

3. Place both PNEU X-FEED levers are in the OPEN (up/forward) position.

If the AIRFOIL ICE PROT PRESS ABNORMAL light remains illuminated:

Go to ❶ below.

If the AIRFOIL ICE PROT PRESS ABNORMAL light extinguishes:

Wing anti-ice is operating normally. The WING ANTI-ICE ON light has failed. Manually check the leading edges of the wings for proper anti-ice operation.

❶ **Airfoil anti-ice inoperative:**

AIRFOIL ICE PROTECTION SWITCHES .... OFF

4. Set both AIRFOIL switches to OFF.

PNEU X-FEED LEVERS .... CHECK BOTH CLOSED

5. Make sure both PNEU X-FEED levers are in the CLOSED (down/aft) position.

Avoid flying into icing conditions.

ENGINE VALVE (L OR R)

ENGINE ANTI-ICE SWITCH (Affected side) .... ON

1. Make sure the ENGINE ANTI-ICE switch is in the ON position.

When the engine anti-ice switch is in the ON position and the applicable ENGINE VALVE light is illuminated, this indicates that one or more valves failed to fully open. Ice protection is unknown and ice may accumulate on the engines.

ENGINE ANTI-ICE SWITCH (Affected side) .... CYCLE

2. Cycle the ENGINE ANTI-ICE switches in an attempt to properly open the engine valves.

ANTI-ICE VALVE CBs (S38 & T38) .... CHECK/RESET

3. Check/reset the ANTI-ICE VALVE CAUTION circuit breakers (S38 and T38).

If unable to extinguish the ENGINE VALVE light:

ENGINE ANTI-ICE SWITCH (Affected side) .... OFF

4. Set the ENGINE ANTI-ICE switch to OFF.

Monitor limiting EPR and avoid flying in icing conditions.

WINDSHIELD HEAT INOPERATIVE

Inoperative windshield heat is determined by checking the windshield anti-ice circuit breakers or by ice buildup on the windshield. However, ice buildup at the edges of the windshield is not a positive indication of inoperative windshield heat. The left and right windshields consist of primary and secondary deice areas. Under severe icing conditions, the secondary deice areas may not completely deice.

Do not operate windshield heat on cracked glass pane. Pull the windshield anti-ice circuit breaker for a cracked outer glass pane, and the anti-fog circuit breaker for a cracked inner glass pane. When below 10,000 feet altitude, limit speed to 315 KIAS with a cracked outer pane and 235 KIAS with a cracked inner pane.

Below 10,000 feet altitude:

Limit speed to 315 KIAS.

Above 10,000 feet altitude:

No restrictions.

LANDING GEAR EXTENSION REQUIRED AFTER RIGHT HYD QTY AND PRESS LOSS

LANDING GEAR CONTROL HANDLE ....DOWN

1. Place the landing gear control handle in the down position.

L ENG HYD PUMP SWITCH...HI

2. Set the left engine hydraulic pump switch to HI.

ALT HYD PUMP SWITCH .... ON

3. Set the left engine hydraulic pump switch to HI.

If the green LDG GEAR lights illuminated:

The amber GEAR DOOR OPEN light should extinguish within 30 seconds of LDG GEAR lights illumination.

If the green LDG GEAR lights do not illuminate:

EMERGENCY LANDING GEAR EXTENSION LEVER ....PULL UP & LATCH

4. Open the cover to the emergency landing gear extension lever.
5. Pull the emergency landing gear lever up.

If the green LDG GEAR lights still do not illuminate:

If the NOSE GEAR UNSAFE light is ON, slow down to approach speed. GEAR DOOR OPEN light will remain illuminated.

If the green LDG GEAR lights illuminate:

EMERGENCY LANDING GEAR EXTENSION LEVER... STOW

6. Stow the emergency landing gear extension lever. This will close the main landing gear doors.

If the GEAR DOOR OPEN light extinguished:

No further action required.

If the GEAR DOOR OPEN light remain illuminated:

ALT HYD PUMP SWITCH ....OFF

7. Set the left engine hydraulic pump switch to OFF.

EMERGENCY LANDING GEAR EXTENSION LEVER..................................PULL UP & LATCH

8. Open the cover to the emergency landing gear extension lever.
9. Pull the emergency landing gear lever up.

After landing, come to a complete stop on the runway. Close the main landing gear doors manually and have gear pins installed.

LANDING GEAR CONTROL HANDLE JAMMED IN UP POSITION

EMERGENCY LANDING GEAR EXTENSION LEVER..PULL UP & LATCH

1. Open the cover to the emergency landing gear extension lever.
2. Pull the emergency landing gear lever up.

Make a second attempt to place the landing gear handle in the down position.

If the landing gear handle will not move to the down position, the green LDG GEAR lights will not illuminate, the nose landing lights and anti-skid will be inoperative.

Visually check and verify the gear down locks are in place by looking through the viewing ports (not simulated).

GPWS WARN SWITCH.. INHIBIT

3. Set the GPWS warning switch to INHIBIT. This will prevent erroneous GPWS warnings as a result of the inoperative gear control handle.

LANDING GEAR INDICATOR AND WARNING CB (X34)..PULL

4. Pull the landing gear indicator and warning circuit breaker (X34) to silence the landing gear warning horn. Note that this will also disable the landing gear position indicator lights.

The main landing gear doors will not close after using the emergency landing gear extension lever.

After landing, close the main gear doors manually, install gear locking pins, and tow.

CAUTION: **Do not stow the emergency landing gear extension lever until the malfunction has been corrected or the landing gear door hydraulic bypass lever has been pulled (by maintenance).**

LANDING GEAR CONTROL HANDLE WILL NOT MOVE UP

NOSE WHEEL STEERING .... CHECK

1. Check to see if nose wheel steering is operative.

If nose wheel steering moves:

CAUTION: Do not retract the landing gear. Limit airspeed to 300 KIAS/Mach .70.

Note: If the landing gear was not retracted, the ground spoilers must be manually deployed.

Go to ❶ below.

If nose wheel steering did not move:

LANDING GEAR HANDLE RELEASE BUTTON .... PUSH

2. Push the landing gear handle release button.

LANDING GEAR HANDLE .... UP

3. Set the landing gear handle to the UP position.

Go to ❶ below.

❶ If the ground shift mechanism is still in GROUND mode:

Ground mode: Takeoff warning on climbout after flap/slat retraction.

GROUND CONTROL RELAY CBs (H18, J18) .... PULL

4. Pull the ground control relay circuit breakers (H18, J18).

Note that this will put the ground shift control relays in the FLIGHT mode. In FLIGHT mode, with the anti-skid armed, the brakes are disabled below 20 knots. Consider not pulling the circuit breakers if returning to land.

For approach and landing:

Make sure the aircraft is depressurized before landing.

During landing rollout above approximately 30 KIAS:

BRAKES...RELEASE MOMENTARILY

5. Momentarily release the brakes (while performing the next checklist step).

ANTI-SKID SWITCH ....OFF

6. Set the ANTI-SKID switch to OFF. This will make sure the brakes are not disabled below 20 KIAS.

During taxi to gate:

GROUND CONTROL RELAY CBs (H18, J18)..PULL

7. Pull the ground control relay circuit breakers (H18, J18).

LANDING GEAR UNSAFE LIGHT ON, GEAR HANDLE DOWN

RIGHT ENG HYD PUMP SWITCH ....HI

1. Set the right engine hydraulic pump switch to HI.

If the right hydraulic pressure is lower than 3,000 PSI:

Refer to the HYD PRESS LOW LIGHT ON abnormal procedure.

If the right hydraulic pressure is greater than or equal to 3,000 PSI:

EMERGENCY LANDING GEAR EXTENSION LEVER ....PULL UP & LATCH

2. Open the cover to the EMERGENCY LANDING GEAR EXTENSION LEVER.
3. Pull the emergency landing gear lever up.

NOTE: The airspeed may have to be as low as 165 KIAS for the nose landing gear to extend.

GEAR LIGHTS...OBSERVE

4. Observe the status of the gear lights.

If all three gear lights indicate down and locked (3 green):

EMERGENCY LANDING GEAR EXTENSION LEVER.. STOW

5. Stow the EMERGENCY LANDING GEAR EXTENSION LEVER by placing it in the down position and closing the cover.

GEAR DOOR OPEN LIGHT...OBSERVE

6. Observe the status of the GEAR DOOR OPEN light.

If the GEAR DOOR OPEN light is extinguished:

Land normally. End of procedure.

If the GEAR DOOR OPEN light is illuminated:

EMERGENCY LANDING GEAR EXTENSION LEVER..................................PULL UP & LATCH

7. Open the cover to the EMERGENCY LANDING GEAR EXTENSION LEVER.
8. Pull the emergency landing gear lever up.

WARNING: For a go-around, the EMERGENCY LANDING GEAR EXTENSION LEVER must be in the stowed position to retract the landing gear.

After landing, come to a complete stop on the runway. Close the main landing gear doors manually and have gear pins installed.

CAUTION: Do not stow the emergency landing gear extension lever until the malfunction has been corrected or the landing gear door hydraulic bypass lever has been pulled (by maintenance).

End of procedure.

If one or more gear lights indicate unsafe (red lights):

GEAR.. CHECK VISUALLY

9. Visually inspect the gear to verify all landing gears are down and locked (not simulated).

If all gear are down and locked:

Land normally. End of procedure.

If any gear is not down and locked:

Refer to the LANDING WITH ABNORMAL LANDING GEAR CONFIGURATION procedure.

LANDING GEAR UNSAFE LIGHT ON, GEAR HANDLE UP

RIGHT ENG HYD PUMP SWITCH .... HI
1. Set the right engine hydraulic pump switch to HI.

MAXIMUM AIRSPEED .... 300 KIAS (.70M)
2. Limit airspeed to 300 KIAS (.70M).

If the gear unsafe light remains illuminated:

AIRSPEED .... REDUCE TO 250 KIAS
3. Reduce the airspeed to 250 KIAS.

Allow time for the landing gear to retract.

If the gear unsafe light remains illuminated:

LANDING GEAR HANDLE .... UP
4. Set the landing gear handle to the UP position.

RIGHT ENG HYD PUMP SWITCH .... REMAINS IN HI
5. Leave the right engine hydraulic pump switch in the HI position.

MAXIMUM AIRSPEED .... 300 KIAS (.70M)
6. Limit airspeed to 300 KIAS (.70M).

LANDING WITH GEAR DOOR OPEN LIGHT ON (LANDING GEAR EXTENDED)

LANDING GEAR HANDLE .... DOWN

1. Set the landing gear handle to the DOWN position.

HYDRAULIC PRESSURE .... 3,000 PSI

2. Check the hydraulic pressure. It should read above 3,000 PSI.
3. If necessary, set the RIGHT HYD PUMP switch to the HI position.

GEAR LIGHTS .... THREE GREEN

4. Check the status of the gear lights.

EMERGENCY LANDING GEAR EXTENSION LEVER .... PULL UP & LATCH

5. Open the cover to the EMERGENCY LANDING GEAR EXTENSION LEVER.
6. Pull the emergency landing gear lever up.

WARNING: For a go-around, the EMERGENCY LANDING GEAR EXTENSION LEVER must be in the stowed position to retract the landing gear.

After landing, come to a complete stop on the runway. Close the main landing gear doors manually and have gear pins installed.

CAUTION: Do not stow the emergency landing gear extension lever until the malfunction has been corrected or the landing gear door hydraulic bypass lever has been pulled (by maintenance).

UNSATISFACTORY UPLATCH CHECK

An unsatisfactory uplatch is indicated by illuminated red landing gear lights when the landing gear control handle is placed in the uplatch position.

LANDING GEAR CONTROL HANDLE .... UP

1. Verify the landing gear control handle is set to the UP position.

MAXIMUM AIRSPEED .... 300 KIAS (.70M)

2. Limit maximum airspeed to 300 KIAS (.70M).

AIRSPEED .... REDUCE TO 250 KIAS

3. Reduce the airspeed to 250 KIAS.

LANDING GEAR CONTROL HANDLE .... RECYCLE

4. Recycle the landing gear. Place the landing gear handle in the DOWN position.
5. Wait for the gear to lock in the down position.
6. Place the landing gear handle in the UP position.

If the uplatch check is satisfactory (no red light(s) illuminated):

Continue the flight. Operate normally.

If the uplatch check is still unsatisfactory (red light(s) illuminated):

LANDING GEAR CONTROL HANDLE .... UP

7. Make sure the landing gear control handle is set to the UP position.

RIGHT ENG HYD PUMP SWITCH .... HI

8. Set the right engine hydraulic pump switch to HI.

Return to the departure airport or continue the flight at the Captain's discretion.

MAXIMUM AIRSPEED .... 300 KIAS (.70M)

9. Limit maximum airspeed to 300 KIAS (.70M).

LANDING GEAR INDICATOR LIGHTS FAILURE

An unsatisfactory uplatch is indicated by illuminated red landing gear lights when the landing gear control handle is placed in the uplatch position.

LANDING GEAR WARNING CBs (X34).. CHECK/RESET ONCE

1. Check the status of the LANDING GEAR INDICATOR AND WARNING circuit breaker (X34).

If the circuit breaker cannot be reset, check the status of the gear locking mechanism visually using the viewing ports (not simulated).

HIGH PNEUMATIC PRESSURE

A high pneumatic pressure condition exists when the PNEU PRESS gauge reads in excess of 72 PSI. This condition will only occur when one or both pneumatic X-feed valves are open.

LEFT PNEU X-FEED VALVE LEVER...CLOSE

1. Place the left PNEU X-FEED lever in the CLOSED (down/aft) position.

If the pneumatic pressure changed:

LEFT PNEU X-FEED VALVE LEVER...CLOSE

2. Leave the left PNEU X-FEED lever in the CLOSED (down/aft) position for the remainder of the flight.

LEFT AIRFOIL SWITCH...OFF

3. Set the left AIR FOIL switch to OFF.

If the pneumatic pressure did not change:

LEFT PNEU X-FEED VALVE LEVER...OPEN

4. Set the left PNEU X-FEED lever back to the OPEN (up/forward) position.

RIGHT PNEU X-FEED VALVE LEVER...CLOSE

5. Place the right PNEU X-FEED lever in the CLOSED (down/aft) position for the remainder of the flight.

RIGHT AIRFOIL SWITCH...OFF

6. Set the right AIR FOIL switch to OFF.

RADIO FAN OFF LIGHT ON

IN FLIGHT:

RADIO RACK SWITCH .... VENTURI

1. Place the RADIO RACK switch in the VENTURI position.

The RADIO FAN OFF light will extinguish.

During single pack operation, if desired differential pressure cannot be maintained:

When only a single pack is supplying air for cabin pressurization, air flow out of the radio rack venturi may be too great to maintain the desired cabin pressure. With the RADIO RACK switch in the VENTURI position, single pack operation should be able to maintain desired differential pressure up to about 18,000 feet, and dual pack operation up to about 30,000 feet.

RADIO RACK SWITCH .... FAN

2. Place the RADIO RACK switch in the FAN position. This will close the venturi and reduce the flow of air out of the aircraft.

The RADIO FAN OFF light will illuminate.

AFTER LANDING:

Turn off all unnecessary radio and electrical equipment.

NO EGT INDICATION ON STARTUP

If EGT does not rise within 20 seconds of placing the fuel control lever in the ON position:

FUEL CONTROL LEVER ....OFF

1. Place the FUEL CONTROL lever in the OFF position.

If the starter motor is disengaged:

Goto ❶ below.

If the starter motor is still engaged:

Continue to motor the engine for 10-15 seconds.

STARTER SWITCH ....OFF

2. Place the STARTER switch back in the OFF position.

IGNITION SWITCH ....OFF

3. Place the IGNITION switch in the OFF position.

Goto ❶ below.

❶ Continue checklist:

THROTTLE ....IDLE

4. Make sure both throttle handles are in the idle position.

Allow the engine to spool down and rotation to stop.

STARTER SWITCH ....ON

5. Place the STARTER switch in the ON position.

IGNITION CBs (Row U) ....CHECK/RESET

6. Check and/or reset the ignition circuit breakers (U41, U42).

If ignition SYS A or SYS B was selected:

IGNITION SWITCH .... OTHER SYSTEM OR BOTH

7. Set the IGNITION switch to the other system or BOTH.

NOTE: Do not change your selection of ignition system after placing the fuel control lever to the ON position.

FUEL CONTROL LEVER.. ON

8. Place the FUEL CONTROL lever in the ON position.

Attempt another start. If the EGT does not rise within 20 seconds of placing the fuel control lever in the ON position, discontinue the start.

If ignition SYS A or SYS B was not selected:

Attempt one additional start.

EGT BELOW NORMAL ON START

If the EGT is below normal on startup, be alert for the engine failing to accelerate to idle (hung start). If the engine starts normally, continue normal operation.

ABNORMAL FUEL FLOW INDICATION ON START (HOT START)

Fuel flow indications above 1,100 PPH indicates an abnormal start.

FUEL CONTROL LEVER .... OFF

1. Place the FUEL CONTROL lever in the OFF position.
2. The fuel control lever should be placed in the OFF position immediately before a hot start is experienced.
3. If the starter is still engaged, continue rotation for 10-15 seconds.

ENG STARTER SWITCH .... OFF

4. Set the ENG STARTER switch to OFF.

IGNITION SWITCH .... OFF

5. Place the IGNITION switch in the OFF position.

Before attempting a new engine start, proceed with the ENGINE CLEARING PROCEDURE.

ENGNE CLEARING PROCEDURE

FUEL CONTROL LEVER .... OFF

6. Make sure the FUEL CONTROL lever is in the OFF position.

THROTTLE .... IDLE

7. Make sure the throttle handles are all the way back in the idle detent.

N_2 TACHOMETER .... INDICATES ROTATION HAS CEASED

8. Wait until the N_2 tachometer indicates the high pressure spool has stopped rotating.

IGNITION SWITCH .... OFF

9. Place the IGNITION switch in the OFF position.

ENG STARTER SWITCH .... ON, HOLD FOR 20 SECONDS

10. Hold the engine starter switch to GND (on) for 20 seconds.

ENGINE FAILS TO ACCELERATE TO IDLE (HUNG START)

If none of the other engine indications are normal:

Shut down the affected engine.

If all other engine indications are normal:

ENG HYD PUMP SWITCH (Affected side)..OFF

1. Set the engine hydraulic pump switch for the affected side to OFF.

THRUST ....INCREASE OUT OF THE IDLE RANGE

2. Move the throttle handle for the affected side forward and out of the idle range.

If engine indications and responses are still not normal:

If the engine does not accelerate to idle within 2 minutes, shut down the affected engine.

If engine indications and responses are normal:

ENG HYD PUMP SWITCH (Affected side)... HIGH

3. Set the engine hydraulic pump switch for the affected side to HIGH.

If engine response is normal:

Continue normal operation.

If engine response is abnormal:

Shut down the affected engine.

NO ENGINE N_1 INDICATION ON START

Discontinue the start. Contact ground crew and have them confirm N_1 rotation on the next start attempt. If N_1 rotates, continue operation using the N_2 gauge and remaining engine indications.

NO ENGINE N_2 INDICATION ON START

If the START VALVE light is extinguished:

Refer to the STARTER VALVE FAIL TO FUNCTION abnormal procedure.

If the START VALVE light is illuminated:

If there is hydraulic pressure, engine oil pressure and N_1 rotation within 10 seconds indicating that N_2 is rotating:

Use 5% N_1 RPM as reference for selecting fuel ON and place the START switch to OFF at between 12% and 20% N_1 RPM.

If there is no hydraulic pressure, no engine oil pressure and no N_1 rotation within 10 seconds indicating that N_2 is rotating:

Set the START switch to OFF.

OIL PRESSURE LOW LIGHT ON AFTER START

OIL PRESSURE .... CHECK

1. Check and make a note of the indicated oil pressure.

If the oil pressure is below 40 PSI:

Shut down the engine and have maintenance correct the problem.

If the oil pressure is above 40 PSI:

Obtain a clearance to perform a run-up. Advance the throttles to about 75% N_2.

If the oil pressure and temperature indication are still below normal:

Shut down the engine and have maintenance correct the problem.

If the oil pressure and temperature indications are normal:

Continue normal operations.

NO OIL PRESSURE RISE ON START

Discontinue the start.

ENGINE OIL PRESSURE CB (Row A) .... CHECK/RESET

1. Check the state of the engine oil pressure circuit breaker (A1 or A9). Reset the circuit breaker if necessary.

If the circuit breaker was out (and reset), clear the engine if necessary and attempt another start.

If the circuit breaker was not out, contact maintenance to correct the malfunction.

OIL STRAINER CLOGGING LIGHT ON AFTER START

If the oil temperature is above 25°C:

Shut down the engine immediately. Contact maintenance.

If the oil temperature is below 25°C:

The light may remain on after start, but will normally extinguish within 5 minutes. If the light remains illuminated even after the oil temperature rises above 25°C, shut down the engine immediately and contact maintenance.

STARTER VALVE OPEN LIGHT ON AFTER START (ON THE GROUND)

AFFECTED PNEU X-FEED VALVE LEVER..CLOSE

1. Place the pneumatic crossfeed valve lever for the affected engine in the CLOSED position (aft, down).

NOTE: When closing the pneumatic crossfeed valve, the engine is isolated from the opposite engine and/or the APU pneumatic supply.

FUEL CONTROL LEVER (Affected engine) ....OFF

2. Set the fuel control lever for the affected engine in the OFF position (down).

ENGINE IGNITION SELECTOR..OFF

3. Set the engine ignition selector knob to OFF.

CAUTION: The affected engine should be completely shutdown prior to ground personnel approaching the engine.

Contact maintenance to have the malfunction corrected.

EGT INOP OR READS HIGH

THRUST ....REDUCE

1. Reduce engine thrust.

EPR, N1, N2, FUEL FLOW ....CHECK

2. As you reduce engine thrust, check engine indications.

If EGT remains the same, and all other indications decrease:

Assume a faulty EGT indicator.

If EGT exceeds 590°C and does not decrease with reduced thrust:

Shut down the engine.

If EGT exceeds 590°C but does not go over 610°C and thrust reduction decreases EGT to below 590°C and all other indications are normal

Continue engine operation. Monitor EGT. Do not allow EGT to exceed 590°C. Reduce thrust further if necessary.

If EGT has exceeded 610°C:

A precautionary engine shutdown should be accomplished at the Captain's discretion. See the ENGINE SHUTDOWN abnormal procedure in this section.

EPR ERRATIC OR FIXED

If no icing conditions exist:

EPR, N1, N2, FUEL FLOW .... CHECK

1. Check the other engine indications.

If the other engine indications are normal:

EPR CBs (Row K & L) .... CHECK/RESET

2. Check/reset the EPR circuit breakers (K25, L25).

If EPR remains inoperative:

Use N_1 to set power.

If icing conditions exist:

ENGINE IGNITION SELECTOR .... SYS A OR SYS B

3. Set the engine ignition selector knob to either SYS A or SYS B.

ENG ICE PROTECT SWITCHES .... ON, ONE AT A TIME

4. Turn on ice protection as required, one at a time.

EPR, N1, N2, FUEL FLOW .... CHECK

5. Check the other engine indications.

If EPR response is normal:

Continue normal operations.

If EPR response is still abnormal:

EPR, N1, N2, FUEL FLOW .... CHECK

6. Check the other engine indications.

If the other engine indications are normal:

EPR CBs (Row K & L) .... CHECK/RESET

7. Check/reset the EPR circuit breakers (K25, L25).

If EPR remains inoperative:

Use N_1 to set power.

FUEL FILTER PRESSURE DROP LIGHT ON

MASTER CAUTION LIGHT..RESET

1. Reset the MASTER CAUTION light.

If the fuel temperature is above 15°C:

The FUEL FILTER PRESS DROP light may be illuminated due to solid contaminants other than ice. Continued operation is allowed, if engine oil temperature is maintained within normal limits. Monitor engine oil temperature closely.

If the fuel temperature is below 15°C:

FUEL HEAT SWITCH (Affected side)..ON

2. Turn ON the fuel heat switch for the affected side.

FUEL TEMPERATURE (Affected side)..CHECK FOR RISE

3. Verify proper operation of the fuel heat system by observing a rise in fuel temperature.

If the FUEL FILTER PRESS DROP light remains illuminated, repeat the above procedure. While operating the fuel/oil heat exchanger, make sure the oil temperature stays within limits.

Repeat the above procedure for the other engine as a precaution.

FUEL FLOW INOPERATIVE

If fuel flow indications fail to respond to throttle changes and all other engine indications are normal:

FUEL FLOW INDICATOR CBs (Row K & L)..CHECK/RESET

1. Check/reset the fuel flow indicator circuit breakers (K24, L24).

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HIGH FUEL FLOW

If fuel flow indications fail to respond to throttle changes and all other engine indications are normal:

THRUST (Affected engine) .... IDLE

1. Reduce thrust on the affected engine to idle.

If fuel flow indication does not respond to change in thrust:

Go to INOPERATIVE FUEL FLOW abnormal procedure in this section.

If fuel flow indication responds to change in thrust, and other engine indications are normal:

Check fuel flow against the idle thrust fuel flow chart below. If fuel flow is higher than normal, crosscheck fuel remaining vs. time to confirm fuel usage.

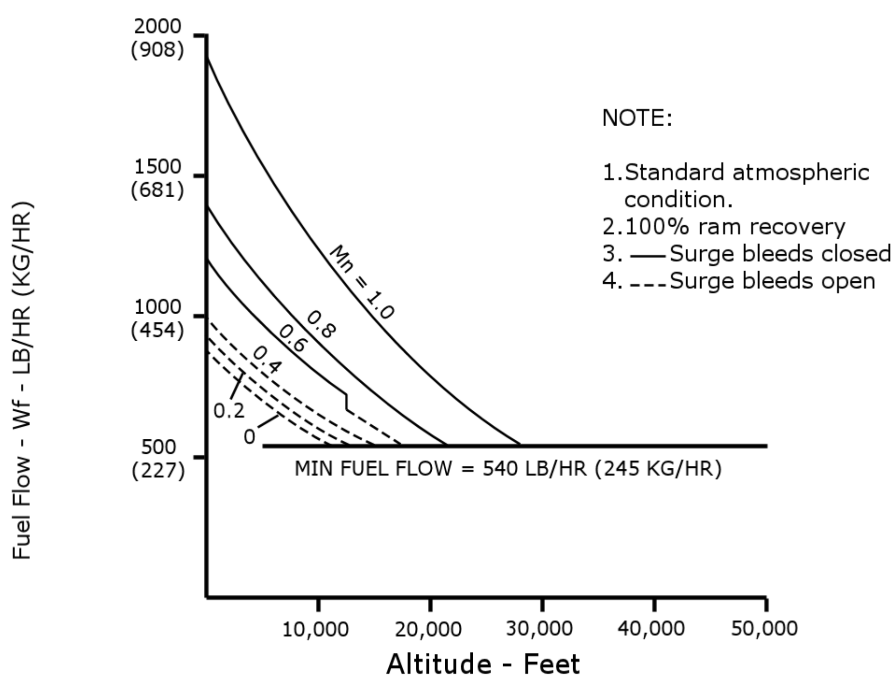
If fuel remaining confirms abnormal consumption:

Shut down the engine.

If fuel remaining confirms normal consumption:

Continue normal operations. Monitor fuel usage to maintain even distribution.

FUEL FLOW CHART



LOW OIL PRESSURE AND/OR OIL PRESSURE LOW LIGHT ON

OIL PRESSURE GAUGE .... CHECK

1. Check the indicated engine oil pressure on the oil pressure gauge.

If the indicated engine oil pressure is less than 35 PSI:

If the OIL PRESS LOW light is illuminated:

Shut down the engine.

If the OIL PRESS LOW light is extinguished:

OIL PRESS LOW light.. TEST

2. Press to test the OIL PRESS LOW light.

If the light tests ok and remains extinguished:

Continue the flight at reduced thrust.

If the light tests ok but remains illuminated:

Shut down the engine.

If the indicated engine oil pressure is between 35 and 40 PSI:

Reduce thrust. Observe oil temperature and quantity.

If conditions are normal:

Continue the flight at reduced thrust.

If conditions are still abnormal:

Shut down the engine.

If the indicated engine oil pressure is 40 PSI or higher (OIL PRESS LOW light illuminated):

Continue normal operations, if temperature and quantity are normal.

OIL PRESSURE ABOVE 55 PSI

If the oil quantity is increasing:

If the oil quantity increases to above the normal range, shut down the engine.

If the oil quantity does not increase:

Continue operation at reduced thrust, if all other engine indications are normal.

DECREASING OIL QUANTITY

OIL PRESSURE AND TEMPERATURE .... MONITOR

1. Closely monitor the indicated engine oil pressure and temperature.

If engine oil pressure and temperature are indicating normally:

Anticipate engine oil pump cavitation condition or oil pressure loss.

If the oil pressure fluctuates:

Reduce engine thrust.

If oil pressure drops below 35 PSI:

Shut down the engine.

INCREASING OIL QUANTITY

Closely monitor engine oil pressure and fuel flow.

If engine oil pressure exceeds 55 PSI:

Shut down the engine.

OIL STRAINER CLOGGING LIGHT ON IN FLIGHT

THRUST ....REDUCE

1. Reduce engine thrust.

If the OIL STRAINER CLOGGING light extinguishes:

Continue operations at the thrust setting which keeps the light extinguished.

If the OIL STRAINER CLOGGING light remains illuminated:

Shut down the engine or continue operation at the lowest possible thrust setting necessary to sustain flight.

HIGH OIL TEMPERATURE

THRUST .... INCREASE

1. Increase engine thrust.

If the oil temperature remains within time and temperature limits:

Continue operations.

NOTE: Increasing engine thrust will increase the fuel flow which in turn will improve oil cooling until lower fuel flow is capable of maintaining oil temperature within limits. It may take several minutes after increasing engine thrust before the oil temperature stabilizes.

If the oil temperature exceeds 120°C for more than 15 minutes or exceeds 157°C at any time:

Shut down the engine.

N_1 OR N_2 OVERSPEED

THRUST ....REDUCE

1. Immediately reduce engine thrust to lower N_1/N_2 below the maximum limit.

If N_1 has exceeded 100.1%, but not over 104.5%:

Or

If N_2 has exceeded 100%, but not over 102.4%:

If all other engine indications are normal, continue operation and record RPM above maximum limit.

If N_1 has exceeded 104.5%:

Or

If N_2 has exceeded 102.4%:

Accomplish a precautionary shutdown at the Captain’s discretion. Record RPM above maximum limit.

ENG REVERSE UNLOCK LIGHT ON IN FLIGHT

If the blue engine reverse light is illuminated:

Go to and perform the INADVERTENT IN FLIGHT THRUST REVERSER abnormal procedure.

If the blue engine reverse light is extinguished:

Check that the reverser lever is fully down. Continue normal operation.

INADVERTENT IN FLIGHT THRUST REVERSAL

This condition is indicated by the illumination of the ENG REVERSE THRUST and ENG REVERSE UNLOCK lights.

AFFECTED THROTTLE ....FORWARD IDLE

1. Make sure the affected throttle is in the forward idle position.

NOTE: The reverser may not stow at airspeeds above 170 KIAS. The throttle should be left in the idle position until the reverser is completely stowed. If the reverser stows, resume normal engine operation. End of procedure.

If the reverser did not stow:

AIRSPEED ....REDUCE TO 170 KIAS

2. Reduce the airspeed to below 170 KIAS.

If the reverser did not stow:

AFFECTED ENG HYD PUMP SWITCH..HI

3. Set the ENG HYD pump switch for the affected side to HI.

REVERSER ACCUMULATOR SHUTOFF CBs (Row S & T) .... PULL AND RESET ONE TIME ONLY

4. Pull and reset the REVERSER ACCUMULATOR SHUTOFF circuit breaker once (S29, T29). Do not leave the circuit breaker out for more than three seconds.

ENG REVERSE THRUST/LOCK LIGHTS ....OBSERVE

5. Check the status of the ENG REVERSE THRUST light and the ENG REVERSE LOCK light.

If the lights are extinguished and aircraft performance is normal:

Adjust throttles as required and continue the flight.

If the lights are illuminated and the aircraft is buffeting and/or yawing:

Continue the abnormal procedure.

AFFECTED ENGINE.. SHUTDOWN

6. Refer to the ENGINE SHUTDOWN abnormal procedure in this section.

NOTE: Land the aircraft at the nearest suitable airport. Executing a go-around is not recommended due to the reduced performance caused by drag. If a go-around is required, use normal go-around procedure.

REVERSER ACCUMULATOR LOW LIGHT ON

<u>IN FLIGHT:</u>

AFFECTED ENG HYD PUMP SWITCH..HI

1. Set the ENG HYD pump switch for the affected side to HI.

If the REVERSER ACCUMULATOR LOW light extinguishes:

This indicates a leak in the isolation valve. Return the ENG HYD pump switch to LOW if appropriate for the current phase of flight. Continue flight using normal procedures. If the light re-illuminates, it will extinguish again when the hydraulic pumps are set to HI prior to landing. End of procedure.

If the REVERSER ACCUMULATOR LOW light remains illuminated:

Continue with the next procedure step.

REV ACCUM SHUTOFF CBs (Row S & T) .... PULL AND RESET ONE TIME ONLY

2. Pull and reset the REVERSER ACCUMULATOR SHUTOFF circuit breaker once (S29, T29). Do not leave the circuit breaker out for more than three seconds.

If the REVERSER ACCUMULATOR LOW light remains illuminated or extinguishes and then re-illuminates within 5 minutes, and there is noticeable loss of hydraulic quantity:

This indicates a leak in the accumulator. The affected reverser may not extend properly upon deployment on landing and the hydraulic supply system may be subject to loss of quantity. Delay the activation of reversers until after nose touchdown to avoid directional control issues.

HYD BRAKE SYS SELECTOR (Unaffected side)..L or R

3. Turn the HYD BRAKE SYS SELECTOR handle to the unaffected side.

If the REVERSER ACCUMULATOR LOW light extinguishes remains extinguished for 5 minutes or more with no noticeable loss of hydraulic quantity:

Return the ENG HYD pump switch to LOW if appropriate for the current phase of flight. Continue flight using normal procedures.

ON THE GROUND:

AFFECTED HYD SYSTEM .... PRESSURIZE

4. Make sure the hydraulic system for the affected side is pressurized. Set the ENG HYD pump switch for the affected side to HI.

If the REVERSER ACCUMULATOR LOW light extinguishes:

Depressurize the affected hydraulic system by setting the ENG HYD pump switch for the affected side to OFF. If the light remains extinguished, no further action is required. Continue the flight using normal procedures.

If the REVERSER ACCUMULATOR LOW light remains illuminated:

Do NOT depart with this condition. Call maintenance to correct the problem.

FUEL HEAT ON LIGHT ON (UNCOMMANDED)

This condition is caused by the shutoff valve in the engine bleed air supply line to the air/fuel heat exchanger remaining in the open position.

If the left or right FUEL HEAT ON light does not extinguish after one minute:

FUEL HEAT CONTROL CBs (Row K & L) ....CYCLE

1. Cycle the FUEL HEAT CONTROL circuit breaker (K29 or L29) for the affected side.

If the FUEL HEAT ON light remains illuminated:

FUEL HEAT TIMER CBs (Row K & L)..PULL

2. Pull the FUEL HEAT TIMER circuit breaker (K30 or L30) for the affected side.

If the FUEL HEAT ON light remains illuminated:

OIL TEMPERATURE .... MONITOR & OBSERVE LIMITS

3. Monitor the oil temperature.

ENGINE SURGING OR POPPING (FORWARD THRUST)

THRUST ....REDUCE

1. Immediately reduce engine thrust until surging or popping stops. Reduce to idle if necessary.

If the surging or popping continues:

AFFECTED ENGINE .... SHUTDOWN

2. Refer to the ENGINE SHUTDOWN abnormal procedure in this section.

If the surging or popping stops:

PNEU X-FEED VALVE LEVER (Affected side)............................ OPEN

3. Set the pneumatic crossfeed valve lever on the affected side to OPEN.

AIRFOIL ANTI-ICE SWITCH (Affected side)............................ ON

4. Set the AIRFOIL ANTI-ICE switch for the affected side to ON.

THRUST (Affected side) .... INCREASE SLOWLY

5. Slowly increase thrust on the affected engine.

If surging or popping recurs:

Operate the engine at the thrust setting below that which surging and popping occurs. Alternatively, shut down the engine at the Captain's discretion.

If surging or popping does not recur:

Continue normal engine operation.

INFLIGHT ENGINE START

THROTTLE .... IDLE

1. Place the throttle handle in the IDLE position.

FUEL CONTROL LEVER .... OFF

2. Place the fuel control lever in the OFF position.

FIRE SHUTOFF HANDLE .... FULL FORWARD

3. Verify that the fire shutoff handle is in the full forward (in) position.

ENGINE ANTI-ICE .... OFF

4. Turn off engine anti-ice.

MAIN FUEL TANK PUMPS .... ON

5. Turn on both main fuel tank pumps.
6. Check the INLET FUEL PRESS LOW light. It should be extinguished.

AIRSPEED .... IN START ENVELOPE

7. Make sure the airspeed is within the relight area of the inflight start envelope. Increase or decrease airspeed as necessary. Consult the relight chart on the next page.

OIL PRESSURE .... INDICATING

8. Check that oil pressure reading is above zero.

IGNITION .... OVERRIDE

9. Set the ignition switch to OVERRIDE.

FUEL CONTROL LEVER .... ON

10. At 20% N_2, place the fuel control lever in the ON position (up).

ENGINE INSTRUMENTS .... STABILIZED

11. Check all engine instruments and wait for the engine to stabilize at idle thrust.

IGNITION .... AS REQUIRED

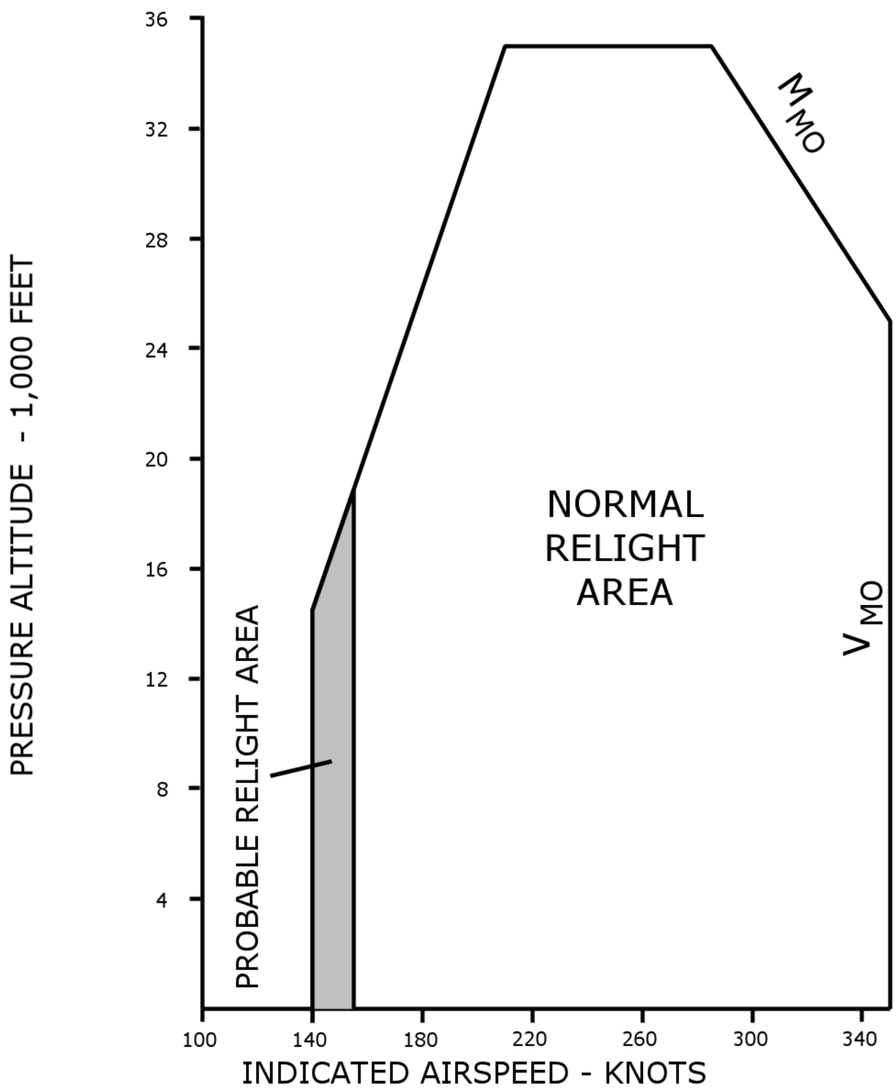
12. Set ignition as required (SYS A, SYS B, or BOTH).

HYD, ELEC, PNEU, AND FUEL .... AS REQUIRED

13. Set hydraulic switches as required.
14. Set electrical switches as required.
15. Set pneumatic levers as required.
16. Set fuel levers as required.

If there is no light off within 20 seconds, refer to the ENGINE SHUTDOWN abnormal procedure in this section.

INFLIGHT RELIGHT ENVELOPE
BASED ON SINGLE IGNITER OPERATION



ENGINE SHUTDOWN

THROTTLE .... IDLE

1. Place the throttle handle in the IDLE position.

Allow EGT to stabilize before continuing the shutdown procedure.

FUEL CONTROL LEVER ....OFF

2. Place the fuel control lever in the OFF position.

THROTTLE .... MATCH GOOD ENGINE

3. Move the throttle handle forward to match the throttle handle of the good engine.

PNEU CROSSFEED VALVE LEVER .... CLOSED

4. Place the pneumatic crossfeed valve lever in the CLOSED (aft, down) position.

APU .... START

5. Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position.
6. Set the APU Air switch to OFF.
7. Set the APU FIRE CONT switch to the NORM position.
8. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
9. Check that the APU RPM and APU EGT start rising.
10. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.
11. Check APU RPM and APU EGT stabilizing.
12. Turn the VOLT/FREQ SELECTOR to APU, and check that electrical power is within limits.
13. Set L & R APU PWR BUS switches to ON.
14. Set the APU Air switch to ON.

FUEL PUMPS/CROSSFEED .... SET TO MAINTAIN BALANCE

15. If center tank fuel remains: Set all fuel pumps (6) to ON and open the fuel crossfeed valve. Leave the center tank pumps on for landing.
16. If no center tank fuel remains: Set all main tank fuel pumps (4) to ON and open the fuel crossfeed valve. Maintain lateral balance within 1,000 lbs.

IGNITION .... AS REQUIRED

17. Set ignition as required (SYS A, SYS B, or BOTH).

APU BUS SWITCH.. REPLACE FAILED GENERATOR

18. Connect the APU bus to the side of the failed generator.

GEN SWITCH ....OFF

19. Set the generator switch for the failed side to OFF.

AIR COND SUPPLY SWITCH...OFF

20. Set the air conditioning supply switch for the failed side to OFF.

ENG HYD PUMP ....**OFF**

21. Set the engine hydraulic switch for the failed side to OFF.

AUX & ALT HYD PUMP ....**OFF**

22. Set the auxiliary and alternate hydraulic pump switches as required.

ONE ENGINE INOPERATIVE APPROACH AND LANDING

The single engine approach and landing technique is very similar to that of flying with both engines operative. There are a few exceptions though.

Single engine approach and landing technique:

1. Flaps 25°.
2. Final approach speed is flown at V_{REF} (1.3 V_S) + 5 knots + wind additive.
3. Initiate reverse thrust after nose wheel contact.
4. Apply reverse thrust gradually to avoid directional control issues.
5. If operating with only one AC generator (APU unavailable), turn off one AC pack to prevent overloading the available generator.

The following table lists recommended **minimum** runway lengths for flaps 25 landings.

Landing length for flaps 25

GROSS WEIGHT (LBS)	RECOMMENDED MINIMUM RUNWAY LENGTH (FEET)
95,000	6,400
96,000	6,450
97,000	6,500
98,000	6,600
99,000	6,650
100,000	6,700

TAILPIPE FIRE OR TORCHING DURING ENGINE START OR SHUTDOWN

Engine fires encountered on the ground are most likely tailpipe fires or internal fires which occur during engine start or engine shutdown. Often, the ground crew are the first to notice the fire, but there are clues in the cockpit as well, such as high EGT.

In the event of a fire warning indication in the cockpit, refer to the ENGINE FIRE/SEVERE DAMAGE OR SEPARATION emergency procedure.

DURING STARTUP:

ENGINE INDICATIONS...CHECK

1. Check all engine instruments for anomalies.

If engine indications are normal:

Do not terminate the start. Monitor EGT and fuel flow gauges to idle. Continue to operate the engine at idle.

If the torching/fire goes out:

Contact maintenance.

If engine indications are abnormal or the torching/fire continues:

FUEL CONTROL LEVER...OFF

2. Set the fuel control lever to OFF (down).

ENGINE START SWITCH ....CHECK POSITION

3. Check the position of the engine start switch.

If the engine start switch is ON:

Continue motoring the engine until the fire goes out.

ENGINE START SWITCH..OFF

4. Set the engine start switch back to OFF.

Contact maintenance.

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If the engine start switch is OFF:

Allow N_2 to decrease to 20%.

PNEU X-FEED VALVE .... OPEN

5. Set the pneumatic crossfeed valve lever to OPEN (up, forward position).

ENGINE START SWITCH .... ON

6. Set the engine start switch to ON.

Continue motoring the engine until the fire goes out.

ENGINE START SWITCH .... OFF

7. Set the engine start switch back to OFF.

Contact maintenance.

<u>DURING SHUTDOWN:</u>

FUEL CONTROL LEVER .... OFF

8. Set the fuel control lever to OFF (down).

PNEU X-FEED VALVE .... OPEN

9. Set the pneumatic crossfeed valve lever to OPEN (up, forward position).

N_2 RPM .... MONITOR

10. Allow N2 to decrease to 20%.

ENGINE START SWITCH .... ON

11. Set the engine start switch to ON.

Continue motoring the engine until the fire goes out.

NOTE: Motoring will not be possible if the other engine and the APU has been shutdown. In this case, ground equipment will be required to extinguish the fire.

ENGINE START SWITCH .... OFF

12. Set the engine start switch back to OFF.

Contact maintenance.

STARTER VALVE OPEN LIGHT ON IN FLIGHT

CAUTION: An inflight open starter valve can result in an uncontained starter failure and subsequent engine fire or severe damage.

THROTTLE (Affected engine) .... IDLE

1. Place the throttle handle in the IDLE position.

PNEU CROSSFEED VALVE LEVERS (Affected engine) .... CLOSED

2. Place the pneumatic crossfeed valve lever in the CLOSED (aft, down) position.

AIR COND SUPPLY SWITCHES (Affected engine) .... HP BLD OFF

3. Place the air conditioning supply switch for the affected engine in the HP BLD OFF position.

AIR COND SUPPLY SWITCHES (Unaffected engine) .... AUTO

4. Place the air conditioning supply switch for the unaffected engine in the AUTO position.

AIRFOIL ICE PROTECT SWITCHES (Affected engine) .... OFF

5. Place the airfoil ice protections switches for the affected engine in the OFF position.

AIRFOIL ICE PROTECT SWITCHES (Unaffected engine) .... AS REQUIRED

6. Place the airfoil ice protections switches for the unaffected engine as required.

START SWITCH (Affected engine) .... OFF

7. Make sure the start switch for the affected engine is in the OFF position.

ENGINE START VALVE CB (Row S & T) .... OPEN (PULL)

8. Pull the circuit breaker for the engine start valve (S33, T33).

Continue normal engine operation at the Captain's discretion. Monitor all engine instruments carefully for any possible indication of engine fire or severe damage.

ENGINE PNEUMATIC CROSSBLEED START

PARKING BRAKE .... SET

1. Set the parking brake.

PNEU CROSSFEED VALVE LEVERS .... BOTH OPEN

2. Place both pneumatic crossfeed valve levers in the OPEN (up, forward) position.

RAMP CHECK .... ENGINE HAZARD AREA CLEAR

3. Confirm with ground personnel that the area around the engine is clear.

OPERATING ENGINE THROTTLE .... ADVANCE TO OBTAIN REQUIRED PNEUMATIC PRESSURE

4. Push the throttle of the operating engine forward until the pneumatic pressure is high enough for engine starting.
5. Note that pneumatic pressure should not be allowed to exceed 45 PSI during a crossbleed start.

Proceed with normal engine starting procedure for the engine to be started.

SECTION 2

LIMITATIONS

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GENERAL

Minimum flight crew	Pilot and copilot
Maximum 90° crosswind component (including gust)	29 knots
Maximum 90° crosswind component (including gust) For CAT II approaches	10 knots
Maximum 90° crosswind component (including gust), for landing when visibility is less than ¾ mile or RVR 4000, runway is less than 7,000ft in length, and runway is wet or contaminated	10 knots
Limiting tailwind component	10 knots
Maximum operating altitude	35,000 feet
Maximum takeoff and landing altitude	8,500 feet
Minimum takeoff and landing altitude	-1,000 feet
Maximum takeoff and landing temperature	+50°C
Minimum takeoff and landing temperature	-54°C
Minimum takeoff temperature	
• **At or below 5,400 feet**	-54°C
• **Above 5,400 feet**	-40°C
Maximum enroute temperature	STD +35°C
Minimum enroute temperature	-76°C
Flight Load Acceleration Limits flaps up	+2.5g to -1.0g
Flight Load Acceleration Limits flaps down	+2.5g to 0.0g
Operational Limits	
Runway Slope	+1.7% to -2.0%
Limiting Tailwind Component	10 knots

AIRSPEEDS

Maximum Operating Airspeed (V_{MO}/M_{MO})	V_{MO} – 350kts (SL to 25,850 feet) M_{MO} – .84M (above 25,530 feet)	
Landing Gear Operation (V_{LO}/M_{LO})	Extension – 300kts/.70M Retraction – 250kts/.70M	
Landing Gear Extended (V_{LE}/M_{LE})	300kts/.70M	
Flap Placard Speeds (V_{FE}/M_{FE})	FLAP POSITION	LIMITING SPEED
	5	250kts/.57M
	15	240kts/.57M
	25	210kts/.57M
	40 or 50	180kts/.57M
Slats Extended	250kts/.57M	
Maximum speed with overspeed warning system inoperative	250kts/.57M	
Maximum speeds for aileron full throw		
• SL	235kts	
• 30,000 feet	270kts	
• 35,000 feet	255kts	
Turbulence Penetration Speed		
• Above 10,000 feet	285kts or .76M	
• Below 10,000 feet	250kts	

WEIGHTS

Maximum Ramp Weight	106,000 lbs
Maximum Take-Off Weight	105,000 lbs
Maximum Landing Weight	95,300 lbs
Maximum Zero Fuel Weight	87,000 lbs

SECTION 3

NORMAL OPERATING PROCEDURES

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GENERAL

Philosophy

The use of standardized procedures and terminology reduces the burden of in-flight planning and promotes crew communication and understanding throughout the various flight regimes. The proper use of the Normal Procedures Cockpit Checklist alleviates unsafe practices, carelessness, and the development of individualized procedures.

Normal Procedures Checklist

The Normal Procedure Checklists are used to ensure that all important safety items have been accomplished.

The items in the Checklist cannot be considered accomplished until all of the expanded procedures associated with that item have been accomplished.

The Normal Procedure Checklist has ten individual flight phase checklists:

- Safety & Power On
- Originating/Receiving
- Before Start
- After Start
- Before Takeoff
- After Takeoff
- Preliminary Landing
- Landing
- After Landing
- Parking & Securing

The Normal Procedure Checklists are not a do list, but rather a verification list ensuring checks and procedures for that particular phase of flight has been accomplished (except the Safety & Power on checklist).

Crew Duties

Normally crew duties are divided between the Captain and First Officer during ground operations and between pilot-flying and pilot-not-flying during flight. The Captain is responsible for ensuring that all normal procedure checklists are accomplished at the proper time.

Normally the pilot-not-flying will accomplish the appropriate checklist and notify the pilot-flying when the checklist has been completed.

Auto-Flight/Altitude Clearance Procedures

Normally when the autopilot is engaged, the pilot-flying will control the Flight Guidance panel. When the autopilot is not engaged, the pilot-flying will normally call for changes to be made to the Flight Guidance panel by the pilot-not-flying.

Both pilots should be aware of all communications traffic and clearances.

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Cabin Door Operation

The cabin door(s) shall be closed for departure and opened on arrival by the Gate Agent, using the cabin door exterior control. Except for emergencies, do not request the Flight Attendant to open or close the door(s). Call the Gate Agent.

Note: It is perfectly normal to have a gap between the cabin door and aircraft when the door is closed and the aircraft is unpressurized. This allows for negative pressure relief. The doors will become flush with the airframe when the aircraft pressurizes during the take-off roll.

To open and close the doors of this aircraft, go to the Ground Operations section of the Flight Center. Click the doors on the aircraft illustration to open/close the desired door. In addition to opening the main exit and forward right service doors, the Ground Operations section can also be used to operate the forward and aft air stairs, the forward and aft cargo doors, and to open the left and right engine cowlings.

The standard FSX keyboard combinations to open exits can be used to open the doors and air stairs as well:

SHIFT-E + 1: Main forward left door
SHIFT-E + 2: Cargo doors
SHIFT-E + 3: Forward left air stairs
SHIFT-E + 4: Aft fuselage air stairs
CTRL-SHIFT-K: Engine cowlings

Note: The forward right service door can only be opened from the Ground Operations center.

Anti-Collision Lights

The Anti-Collision lights shall be ON when the engines are about to be started or are running, and anytime the airplane is in motion, taxi or tow.

Checklist Format

TITLE

EXAMPLE:

❶ ❷
EMERGENCY LIGHTS .... ARMED
NO SMOKING/SEAT BELT SIGNS .... ON/OFF
❸ ICE PROTECTION .... CHKD
INSTRUMENT WARNING .... TESTED
ANNUNCIATOR PANEL LIGHTS .... TESTED

❹ ❺
AIR COND AUTO-SHUTOFF...... C .... ARM
T.O. MIN FUEL QTY .... FO/C .... REQ, OB
T.O. ANNOUNCEMENT .... FO .... COMPLETE

❻ (D) FUEL PUMPS .... C .... CHKD, ON

❶ The challenge.

❷ The response.

❸ Indented items are only found in the Originating/receiving checklist. On receiving flights, all items except indented items should be checked.

❹ A gap in the checklist indicates a break in the sequence. Some actions, such as pushback, selection of final flaps setting for landing, must occur before proceeding with the checklist.

❺ The response designator (e.g. C, FO, PNF, PF) indicates which crew member(s) is/are responsible for verifying a particular item or action has been accomplished and makes the verbal response.

❻ The (D) in the left margin denotes items for a delayed engine start. Starting the first engine, the Before Start and After Start checklists are completed in their entirety. When starting the delayed second engine, only the (D) items are accomplished.

NORMAL PROCEDURE CHECKLIST

DC-9-30

NORMAL PROCEDURES
COCKPIT CHECKLIST

SAFETY & POWER ON

MAINTENANCE STATUS ....CHK
BATTERY SWITCH.. CHK VOLTS/ON
AIR CONDITIONING SUPPLY... OFF
CABIN ALT CONTROL LEVER.. AUTO
AUX HYD PUMP... OFF
FIRE PROTECTION .... TEST
ELECTRICAL POWER & AIR CONDITIONING .... ESTABLISH

ORIGINATING/RECEIVING

ORIGINATING AND ALL EXTENDED OVERWATER FLIGHTS: CHECK ALL ITEMS

RECEIVING FLIGHTS: CHECK ALL ITEMS EXCEPT, INDENTED ITEMS.

PREFLIGHT INSPECTIONS..................................... COMPLETE
LOGBOKK, FORMS & MANUALS................................. CHKD
    GEAR PINS ....STOWED
BATTERY SWITCH...ON
AFT OVERHEAD PANEL .... CHKD
CIRCUIT BREAKERS .... CHKD
    VOICE RECORDER..TESTED
ELECTRICAL SYSTEM .... CHKD
    FUEL PUMPS/CROSSFEED..............................CHKD/OFF
EMERGENCY LIGHTS .... ARMED
NO SMOKING/SEAT BELT SIGNS .... ON/OFF
    ICE PROTECTION.. CHKD
    INSTRUMENT WARNING ....TESTED
    WINDSHEAR...TESTED
    ANTI-SKID .... TESTED & OFF
    STALL WARNING ....TESTED
    YAW DAMPER ....ON
    SPEED COMMAND ....TESTED
    MACH TRIM ....TESTED & NORMAL
    RADIO RACK...FAN
    CABIN PRESSURE PANEL .... CHKD
    RAM AIR...OFF
ANNUNCIATOR PANEL LIGHTS ....TESTED
    REVERSER & EXTERIOR LIGHTS.............................. CHKD
OXYGEN SYSTEM .... CHKD
    STATIC SEL/AIR DATA SHUTOFF ....NORMAL/ON
FLIGHT INSTRUMENTS.. CHKD
    GPWS, OVERSPEED & SLAT EXTEND LIGHT ....TESTED
    AUTOPILOT SERVOS..ON
    BRAKE SEL/PRESSURE..................................BOTH/CHKD
FIRE PROTECTION ....TESTED
    ENGINE INSTRUMENTS .... CHKD
    GEAR LIGHTS & HORN .... CHKD
    HYDRAULIC SYSTEM... CHKD
    RADAR & TRANSPONDER .... CHKD
    STAB, RUD & AIL TRIM .... CHKD
    SPOILERS .... DISARMED
    RUDDER HYD CONTROL ....POWERED
    CABIN ALT CONTROL............................. CHKD & AUTO
    FLAPS/SLATS ....UP/RETRACTED, LTS OUT
    FUEL CONTROL LEVERS...OFF
    RADIOS .... CHKD
ORIGINATING/RECEIVING CHECKLIST .... COMPLETE

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BEFORE START

	FUEL QTY	FO/C	REQ, OB
	OIL & HYD QTYS	C	CHKD
	SEAT BELT SIGN	C	ON
	PROBE/WINDSHIELD	C	ON CAPT/ON
(D)	FUEL PUMPS	C	CHKD, ON
	CABIN PRESSURE PANEL	C	SET
	ALTIMETERS	FO/C	SET
	RADIOS	C	SET
	T.O. WARNING	C	CHKD
	PARKING BRAKE	C	SET or OFF
	DEPARTURE REVIEW	C	COMPLETE
	ANTI-COLLISION LIGHTS	C	ON
(D)	IGNITION	C	A, B, or BOTH
(D)	AIR COND SUPPLY	C	OFF
(D)	PNEU X-FEED	C	OPEN/CHKD
	BEFORE START CHKLIST	FO	COMPLETE

AFTER START

(D)	ANNUNCIATOR PANEL	C	CHKD
(D)	IGNITION	C	OFF
(D)	ENGINE ANTI-ICE	C	ON or OFF
(D)	ELECTRICAL SYSTEM	C	CHKD
(D)	AIR COND SUPPLY	C	AUTO
(D)	HYDRAULIC SYSTEM	C	ON-HI-ON, CHKD
	DOOR LIGHTS & LOCK	FO	CHKD
	SHOULDER HARNESS	FO/C	ON
	AFTER START CHECKLIST	FO	COMPLETE

BEFORE TAKEOFF

STBY HORIZON & FLT INSTS	FO/C	CHKD
STAB/TRIM TABS	FO/C	0/0
FLAPS/SLATS	FO/C	BLUE LT
T.O. DATA & EPR	FO/C	SET
T.O. WARNING	C	CHKD
AIR COND AUTO-SHUTOFF	C	ARM
ANTI-SKID	C	ARM
APU	C	ON or OFF
FLIGHT CONTROLS	FO/C	CHKD
ANNUNCIATOR PANEL	C	CKHD
T.O. BRIEFING	C	COMPLETE
T.O. MIN FUEL QTY	FO/C	REQ, OB
T.O. ANNOUNCEMENT	FO	COMPLETE
RADAR/TRANSPONDER	C	TCAS or WZ/TA or RA
IGNITION	C	BOTH
BEFORE T.O. CHECKLIST	FO	COMPLETE

AFTER TAKEOFF

GEAR, FLAPS, SLATS	PNF	UP, LIGHTS OUT
IGNITION	PNF	ON or OFF
FUEL PUMPS	PNF	4 or 6 ON
A/C AUTO-SHUTOFF/PRESS	PNF	OVRD/CHKD
ANNUNCIATOR PANEL	PNF	CHKD
HYDRAULIC SYSTEM	PNF	CHKD
AFTER T.O. CHECKLIST	PNF	COMPLETE

PRELIMINARY LANDING

SEAT BELT SIGN	PNF	ON
CABIN PRESSURE PANEL	PNF	CHKD
HYDRAULIC SYSTEM	PNF	OK-HI-ON, CHKD
ALTIMETERS	PNF/PF	SET
LANDING DATA & EPR	PNF/PF	SET
SHOULDER HARNESS	PNF/PF	ON
APPROACH BRIEFING	C	COMPLETE
PRELIM LANDING CHECKS	FO	COMPLETE

LANDING

IGNITION	PNF	BOTH
GEAR	PNF/PF	DOWN, 3 GREEN
SPOILERS	PF	LIGHT OUT, ARMED
FLAPS/SLATS	PNF/PF	BLUE LT
ANNUNCIATOR PANEL	PNF	CHKD
LANDING CHECKLIST	PNF	COMPLETE

AFTER LANDING

ANTI-SKID	FO	OFF
APU	FO	ON or OFF
ICE PROTECTION	FO	ON or OFF
IGNITION	FO	OFF
FLAPS	FO	15
RADAR & TRANSPONDER	FO	STBY
AFTER LANDING CHECKLIST	FO	COMPLETE

PARKING & SECURING

PARKING BRAKE	SET or OFF
ELECTRICAL SYSTEM	SET
ICE PROTECTION	SET
FUEL CONTROL LEVERS	OFF
FUEL PUMPS	ONE ON or OFF
AIR CONDITIONING	SET
ANTI-COLLISION LIGHTS	OFF
FLAPS/SLATS	UP/LIGHT OUT
HYDRAULIC PUMPS	OFF-HI-OFF
ACARS MESSAGE	SENT
PARKING CHECKLIST	COMPLETE

THE FOLLOWING ITEMS SHOULD ONLY BE COMPLETED AT TERMINATION.

EMERGENCY LIGHTS	OFF
WINDSHIELD HEAT	OFF
ELECTRICAL SYSTEM	SET
BATTERY SWITCH	ON or OFF
SECURING CHECKLIST	COMPLETE

Checklist Guideline Table

Checklist	Initiated by	When	Read by	Response by
Safety & Power On (1)	First pilot onboard	Arriving at an aircraft with no electrical power operating.	First pilot onboard	First pilot onboard
Originating/ Receiving	Captain	Accomplish early enough to ensure all equipment is operating properly and if not, allow maintenance enough time to correct any irregularities. Originating: Aircraft's first flight of the day or prior to each extended overwater flight (2). Receiving: Any time a flight crew change is involved.	FO	Pilot accomplishing the item.
Before Start	Captain	After fueling is completed and ATC clearance is received.	FO	Response Designator
After Start	Captain	Before taxiing.	FO	Response Designator
Before Takeoff	Captain	After both engines have been started.	FO	Response Designator
After Takeoff	PF	After selecting flaps up and/or accelerating to climb speed.	PNF (3)	Response Designator
Preliminary Landing	PF	Before leaving 10,000 feet MSL. However, the approach briefing may be delayed until final ATIS or landing information has been received.	PNF	Response Designator
Landing	PF	After extending the landing gear.	PNF	Response Designator
After Landing	Captain	After the aircraft has cleared the active runway and, in case of an FO landing, after the Captain has assumed full control of the aircraft.	FO (3)	Response Designator
Parking & Securing	Captain	Parking: After every flight.	FO	Captain
	Last pilot deplaning	Securing: (1) After all passengers have deplaned and the aircraft will remain overnight.	Last pilot deplaning	Last pilot deplaning

(1) This is a "read and do" type checklist. Each item is completed silently. The Safety & Power On checklist is normally accomplished by the first pilot to arrive at the aircraft. The Securing checklist is normally accomplished by the last pilot to leave the aircraft.

(2) Any flight scheduled to operate more than 50 NM from the nearest point of land.

(3) Read and accomplished silently. However, verbalize appropriate "After Takeoff/Landing checklist complete".

SAFETY & POWER ON

MAINTENANCE STATUS .... CHK

Review the Maintenance logbook for aircraft airworthiness.

BATTERY SWITCH .... CHK VOLTS/ON

1. Set the volt/freq selector to BATT VOLT.
2. Check for 25 volts minimum.
3. Set the battery switch to ON.
4. Check battery direct bus, battery bus, and DC transfer bus are powered by observing illumination of the following lights on the overhead Annunciator Panel:
   a. AC & DC EMER BUS OFF (red)
   b. MASTER WARNING
   c. MASTER CAUTION

AIR CONDITIONING SUPPLY .... OFF

5. Set both SUPPLY switches to OFF.

CABIN ALT CONTROL LEVER .... AUTO

6. Set the lever in the up position.
7. Observe the indicator in the forward position.

AUX HYD PUMP .... OFF

8. Set the Auxiliary Pump switch to OFF.

FIRE PROTECTION .... TEST

9. L & R fire handles fully in, vertical position.
10. Set all loop selector switches to BOTH.
11. Press and hold the loop test button.
12. Check the fire bell sound and the following lights when holding the test button:
    a. Loop lights
    b. Fire Detection Loop
    c. APU Fire
    d. MASTER WARNING
    e. MASTER CAUTION
    f. Fire Shutoff Handles
13. Press both Agent 1 & 2 Low lights to test them.

ELECTRICAL POWER & AIR CONDITIONING .... ESTABLISH

14. Starting the APU:

    APU DOORS .... AUTO

    1. Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position.

    APU AIR .... OFF

    2. Set the APU Air switch to OFF.

    APU FIRE CONT .... NORM

3. Set the APU FIRE CONT switch to the NORM position.

START PUMP...AS REQUIRED

4. If AC electric power is not available (no ground power connected and no engine running), set the START PUMP switch to ON. Otherwise, leave the switch in the OFF position.

FUEL BOOST PUMPS ....AS REQUIRED

5. If AC electric power is available (ground power connected and/or engine(s) running), set the RH Aft Fuel Boost Pump switch to ON. Note that you do not need to have both the Start Pump and a Fuel Boost Pump running simultaneously; only one of them is required.

APU MASTER...START/RELEASE

6. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
7. Check that the APU RPM and APU EGT start rising.
8. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.

APU RUNNING AND ELECTRICAL POWER ESTABLISHED

9. When APU RPM and APU EGT has stabilized…
10. …and APU power has been connected to the AC buses, continue the APU Start procedure. (Both switches on and both lights on)

FUEL BOOST PUMPS ....AS REQUIRED

11. Normally, the RH Aft Fuel Boost Pump is used for APU operation. However, the center tanks may also be used for APU operation at the Captain's discretion. Set the RH Aft Fuel Boost Pump switch to ON.
12. Check R INLET FUEL PRESS LOW annunciator light extinguished.

START PUMP...AS REQUIRED

13. If the Start Pump was used to start the APU, set the Start Pump switch to OFF.
14. Check R INLET FUEL PRESS LOW annunciator light extinguished.

APU AIR...AS REQUIRED

15. Set the APU Air switch to ON.

Establish electrical power:

15. Turn OFF both the L & R APU/EXT PWR BUS switches.
16. The APU or EXT PWR AVAIL LIGHT should be illuminated.
17. Turn the VOLT/FREQ SELECTOR to either EXT PWR or APU, depending on the active power source and check that electrical power is within limits.
18. Set APU or EXT PWR L & R BUS switches to ON.
19. Check APU or external power L & R bus power in use light illuminate.
20. The AC & DC EMER BUS OFF Annunciator lights should extinguish.

21. Turn the GALLEY switch ON.
22. Make sure that air supply has been established by checking the pneumatic pressure gauge. It should indicate between 30 and 45 PSI.

23. Set both L & R PNEU X-FEED valve levers to the OPEN (up) position.
24. Set the L AIR COND SUPPLY SWITCH to AUTO.
25. After 15-30 seconds, set the R AIR COND SUPPLY SWITCH to AUTO. Selecting the second pack too quickly may cause the APU LOAD CONTROL valve to close or fail in a position less than full open. This will result in a reduced of no air flow (not simulated).
26. Set the Temperature Selectors to AUTO.
27. Set the RAM AIR switch to OFF.
28. If more cold air is required in the cabin, select the APU AIR switch to AIR COND COLDER.

When boarding begins:

29. Set the APU AIR switch to ON.
30. Set the R PNEU X-FEED lever to the closed position (down).
31. Verify that the outflow valve is open (indicator in forward position).
32. Set the RAM AIR switch to ON.
33. Set the R AIR COND SUPPLY switch to AUTO.
34. Adjust cockpit and cabin outlets as required (not simulated).

STARTING THE APU

(Procedure)

APU DOORS .... AUTO

1. Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position.

APU AIR .... OFF

2. Set the APU Air switch to OFF.

APU FIRE CONT .... NORM

3. Set the APU FIRE CONT switch to the NORM position.

START PUMP.. AS REQUIRED

4. If AC electric power is not available (no ground power connected and no engine running), set the START PUMP switch to ON. Otherwise, leave the switch in the OFF position.

FUEL BOOST PUMPS .... AS REQUIRED

5. If AC electric power is available (ground power connected and/or engine(s) running), set the RH Aft Fuel Boost Pump switch to ON. Note that you do not need to have both the Start Pump and a Fuel Boost Pump running simultaneously, only one of them is required.

APU MASTER .... START/RELEASE

6. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
7. Check that the APU RPM and APU EGT start rising.
8. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.

APU RUNNING AND ELECTRICAL POWER ESTABLISHED

9. When APU RPM and APU EGT has stabilized…
10. …and APU power has been connected to the AC buses, continue the APU Start procedure. (Both switches on and both lights on)

FUEL BOOST PUMPS .... AS REQUIRED

11. Normally, the RH Aft Fuel Boost Pump is used for APU operation. However, the center tanks may also be used for APU operation at the Captain's discretion. Set the RH Aft Fuel Boost Pump switch to ON.
12. Check R INLET FUEL PRESS LOW annunciator light extinguished.

START PUMP.. AS REQUIRED

13. If the Start Pump was used to start the APU, set the Start Pump switch to OFF.
14. Check R INLET FUEL PRESS LOW annunciator light extinguished.

APU AIR .... AS REQUIRED

15. Set the APU Air switch to ON.

ORIGINATING/RECEIVING

WALK-AROUND INSPECTION..COMPLETED

1. Complete the appropriate exterior and interior preflight inspections. (not simulated).

LOGBOOK, FORMS AND MANUALS.. CHKD

2. Check the aircraft logbooks and papers. (Not simulated)

GEAR PINS.. STOWED

3. Not simulated.

BATTERY SWITCH...ON

4. Set the battery switch to the ON position.

AFT OVERHEAD PANEL.. CHKD

5. Turn both APU and EXT PWR ground service bus switches to OFF.
6. Press to test both PWR AVAIL lights and both IN USE lights.
7. Set the Maintenance Interphone switch to OFF.
8. Open the guard and set the Flight Recorder Test switch to TEST.
9. If the FLIGHT RECORDER OFF light stays off, the Flight Recorder operates properly.
10. Set the Flight Recorder Test switch back to NORM and put the guard back on.
11. Set all LOOP switches on the ENGINE FIRE DETECT panel to BOTH.

CIRCUIT BREAKERS .... CHECK

12. Not simulated.

VOICE RECORDER .... TESTED

13. Press the TEST button and verify needle deflection on the meter.

ELECTRICAL SYSTEM .... CHKD

14. Set the CSD DISC switches to NORMAL (guard on).
15. Press the CSD OIL TEMP rise button and verify the indicator is operational.
16. If this is the first flight of the day, set both L & R GEN switches to RESET, then back to ON.
17. Check both L & R PWR AVAIL and IN USE lights are illuminated/extinguished as appropriate (depends on whether you have selected the APU or external power as the current power source).
18. Check that the APU and EXT BUS switches are ON/OFF as appropriate.
19. Set the Galley switch to ON.
20. Set the AC X-TIE switch to AUTO.
21. Set the DC X-TIE switch to OPEN.
22. Check that the DC Load meters are within limits (less than 1.0, which indicates 100% of rated generator capacity).
23. Set the VOLT/FREQ selector to BATT VOLT and check that voltage is within limits (29-34V).
24. Set the VOLT/FREQ selector to L AC VOLTS/FREQ to prepare for engine starting.
25. If this is the first flight of the day, set the EMERGENCY POWER switch to ON.
26. Check the following items:
    a. EMER POWER IN USE light illuminated
    b. AC & DC EMER BUS OFF lights extinguished
    c. Captain's gyro and compass flags out-of-view

d. Captain's RMI OFF flag out of view

27. Standby lights illuminated. Not simulated. This is a lighting system in the main cabin installed to provide lighting in the event the normal electrical supply fails.
28. Set the VOLT/FREQ selector to BATT VOLT and check that voltage is within limits (29-34V).
29. Set the VOLT/FREQ selector to BATT AMP and check that charging amperage is within limits (about 65 amperes). Note: If the needle is pulsing, it means the battery is fully charged.
30. Set the EMERGENCY POWER switch back to OFF.

FUEL PUMPS/CROSSFEED .... CHKD/OFF

31. Set the fuel crossfeed lever to OFF.
32. Set all fuel pump switches to OFF.
33. Check that the L & R INLET FUEL PRESS LOW lights are illuminated.
34. Check the START PUMP by turning it ON. The R INLET FUEL PRESS LOW light should extinguish and then illuminate again when you set the pump back to OFF.
35. Turn on one pump at a time and check that the appropriate INLET FUEL PRESS LOW light extinguishes when each pump is operated. Note that when operating the center tank pumps, both L & R INLET FUEL PRESS lights should extinguish. Leave one pump switch ON in the right main tank for APU operation when done.
36. Set the Fuel Crossfeed lever to ON and check that the L INLET FUEL PRESS LOW light extinguishes. This confirms that the crossfeed valve is open.
37. Set the Fuel Crossfeed lever back to OFF and check that the L INLET FUEL PRESS LOW light re-illuminates. This confirms that the crossfeed valve is closed.

NO SMOKING/SEAT BELT SIGNS...ON/OFF

38. Turn ON the no smoking/seat belt sign. Note: the DC-9 does not have a chime associated with the operation of the seat belt sign. A PA announcement in conjunction with seat belt sign selection will aid the flight attendants in complying with their duties.

ICE PROTECTION .... CHKD

39. Set the METER SEL & HEAT switch to OFF.
40. The PITOT STALL HEATER OFF light should illuminate on the annunciator panel.
41. Set the METER SEL & HEAT to CAPT.
42. Check that the PITOT STALL HEATER OFF light extinguishes.
43. Set the AIR FOIL switches to OFF.
44. Set the ANTI-FOG switch to OFF.
45. Set the WINDSHIELD ANTI-ICE switch to ON.
46. Set the ENGINE ANTI-ICE switches to OFF.
47. Check that both ENG ANTI-ICE ON lights are extinguished.

INSTRUMENT WARNING... TESTED

48. Depress the INST WARN TEST switch.
49. Check that both the GA and INST lights illuminate as well as all comparator lights (except THROTTLE, SPD CMD and GP EXT).
50. Press the INST WARN RESET button to reset the lights.

WINDSHEAR .... TESTED

51. Make sure the flaps are fully retracted.
52. Press the W/S FAIL light on the overhead panel. The W/S FAIL light should illuminate.
53. Check that the WINDSHEAR INOP warning light illuminates.

54. Check that both the windshear WARNING and CAUTION lights illuminate. The CAUTION light will first flash for 4 seconds, and then the WARNING light will flash for 4 seconds.
55. At the end of the test cycle, the aural warning WINDSHEAR should be heard on the speakers.

ANTI-SKID.. TESTED & OFF

56. Set the parking brake to OFF (down position).
57. Set the ANTI-SKID switch to ARM.
58. Check that the anti-skid annunciator lights extinguish.
59. Hold the ANTI-SKID TEST switch to either A or B and check that all the ANTI-SKID annunciator lights illuminates.
60. Release the ANTI-SKID TEST switch and verify that all the ANTI-SKID annunciator lights extinguishes.
61. Set the ANTI-SKID switch to OFF and check that all four anti-skid warning lights illuminate.
62. Set the parking brake as required.

STALL WARNING .... TESTED

63. Hold the STALL WARNING TEST switch to both SYS 1 and SYS 2 and verify that the STALL warning light starts flashing and the stall warning audio is heard on the speakers.
64. Also check that both stick shakers operate during the stall warning test. (not simulated)

YAW DAMPER .... ON

65. Set the YAW DAMPER switch to ON.

SPEED COMMAND .... TESTED

66. Rotate the flight director mode selector clockwise to HDG.
67. Press the SC light switch ON.
68. Place the SPD CMD TEST switch to SLOW and then FAST.
69. Check that the fast/slow needle indicates FAST/SLOW according to the test switch position.
70. Press the SC light switch OFF.

MACH TRIM .... TESTED & NORMAL

71. Set the MACH TRIM compensator switch to TEST.
72. Check both control columns move aft (not simulated).
73. Verify that the MACH TRIM INOP light illuminates (for about 10 seconds)
74. Check that the MACH TRIM INOP light is extinguished after the test.

RADIO RACK.. FAN

75. Place the RADIO RACK switch in the FAN position.
76. Check that the RADIO FAN OFF annunciator light is extinguished.

CABIN PRESSURE PANEL.. CHKD

77. Set field barometric pressure.
78. Set the increase knob to the index mark.
79. Adjust the altitude knob to whichever of the following yields the highest cabin altitude, but not more than 8,400 feet.
    a. Field elevation plus 1000 feet.
    b. Cruise altitude plus 1000 feet.
80. Check that the system selector switch is set to PRIMARY.

81. Check that both the TRANSFER LOCKOUT and STBY ON lights are extinguished.
82. Press to test the FLOW light. Note: It is normal for the FLOW light to be illuminated on the ground when the engines are at idle power.

RAM AIR.. OFF

83. Set the RAM AIR switch to OFF.

ANNUNCIATOR PANEL LIGHTS .... TESTED

84. Press the WARN/CAUTION LTS TEST button.
85. Check that all the annunciator lights illuminate (except for blanks).
86. Check that both the MASTER CAUTION and MASTER WARNING lights illuminate.

REVERSER & EXTERIOR LIGHTS .... CHKD

87. Press-to-test both ENG REV UNLOCK lights.
88. Press-to-test both ENG REV THRUST lights.
89. Set the POS lights switch to ON or BOTH.
90. Set all other exterior light switches as required.

OXYGEN SYSTEM .... CHKD

91. Set the oxygen SUPPLY lever to ON.
92. Set the DILUTER DEMAND CONTROL lever to NORMAL OXYGEN.
93. Check the pressure on the oxygen pressure gauge.
94. Check that the CABIN OXYGEN ON light is extinguished.
95. Check the crew oxygen bottle and masks (not simulated).

STATIC AIR... NORMAL

96. Place the Captain's STATIC AIR selector switch in the NORMAL position.

FLIGHT INSTRUMENTS.. CHKD

97. Set the MRK SENS switch to LO.
98. Test the marker beacon lights by pressing the three lights.
99. Set the clock to correct Zulu time. (Use the FS menu to set time)
100. Check the Airspeed Indicator:
    a. No warning flags.
    b. The needle should indicate zero knots.
101. Check the ADI:
    a. No warning flags.
    b. Check that pitch and bank indications match aircraft attitude.
    c. Rotate the Flight Director mode selector to HDG.
    d. Rotate the pitch command knob to set the V-command bars as desired. 10-15 degrees nose up for takeoff is good.
102. Check the altimeter:
    a. No visible warning flags.
    b. Set the barometric pressure and check the indicated altitude against the published field altitude.
103. Check the Radio Altimeter:
    a. Check that the warning flag is out of view.
    b. Check that the indicator needle indicates zero +/- 5 feet.
    c. Set the DH bug to 20 feet.

    d. Press and hold the test switch. The needle should indicate 250 feet and the warning flag should appear.
    e. Release the test switch. The needle should gradually go towards 0 feet and when it passes the DH bug at 20 feet, the DH audio should be heard on the speakers.

104. Check the Standby Horizon. It should be erect and level with no visible warning flags.
105. Check the HSI:
    a. Check that all flags are out of view.
    b. Check that the HDG light on the instrument warning panel is extinguished.
    c. Compare the indicated heading on the HSI with the heading on the RMI.
106. Check the RMI: Make sure all warning flags are out of view.
107. Check the Altitude Alerter:
    a. Set the baro counter to the same as the Captain's altimeter.
    b. Set the altitude counter to 1,000 feet or higher above aircraft altitude.
    c. Then rotate the altitude counter down towards the aircraft altitude.
    d. At 900 feet above aircraft altitude, the aural altitude alert sound should be heard and the altitude alert warning light should illuminate.
    e. At 300 feet above aircraft altitude the altitude alert warning light should extinguish.
    f. Now turn the altitude counter back up. At 300 feet above aircraft altitude, the beeper sounds and the altitude warning light illuminates.
    g. Reset the altitude counter as desired.

GPWS, OVERSPEED & SLAT EXTEND LIGHT .... CHECK

108. Check that the GPWS switch guard on the overhead panel is closed.
109. Check that the GPWS INOP annunciator light is extinguished.
110. Press the TERRAIN light. The light will illuminate together with the aural warning "WHOOP WHOOP, PULL UP, TERRAIN, GLIDESLOPE".
111. During the GPWS test, the GPWS INOP light should illuminate.
112. Press the MAX AIRSP'D WARN light. The light will illuminate and the max airspeed clacker sounds.
113. Press to test the SLAT EXTENDED light.

AUTOPILOT SERVOS .... ON

114. Turn on all three autopilot servo switches (up).
115. Press to test the OUT-OF-TRIM light.

BRAKE SEL/PRESSURE .... BOTH/CHKD

116. Set the brake selector handle to both.
117. Check that both brake pressure indicators indicate above the red radial. Note: If the parking brake has not been set, the pressure indicators will indicate zero pressure.

FIRE PROTECTION .... TESTED

118. The fire warning test here is the same as that accomplished in the SAFETY & POWER ON checklist and can be skipped if it has already been done.
119. L & R fire handles fully in, vertical position.
120. Set all loop selector switches to BOTH.
121. Press and hold the loop test button.
122. Check the fire bell sound and the following lights when holding the test button:
    a. Loop lights
    b. Fire Detection Loop

c. APU Fire
d. MASTER WARNING
e. MASTER CAUTION
f. Fire Shutoff Handles

123. Press both Agent 1 & 2 Low lights to test them.

ENGINE INSTRUMENTS.. CHKD

124. Check that the selector knob on RAT/EPR gauge is set to NORM-7.
125. Check all engine instruments for normal indications.
126. Check that minimum oil quantity for dispatch is on board.

GEAR LIGHTS & HORN.. CHKD

127. Pull aft on the landing gear handle (while in the DOWN position). This is accomplished in the simulator by right clicking on the landing gear handle.
128. Check that the green landing gear lights extinguish and the red gear unsafe lights illuminate.
129. Check that the ANTI-SKID annunciator lights extinguish during the landing gear test.
130. During the test, the landing gear warning horn sounds. This aural warning can be silenced with the GEAR HORN OFF button.

HYDRAULIC SYSTEM .... CHKD

131. Check the hydraulic quantities.
132. Set the ALT HYD PUMP to ON.
133. Set both the L & R ENGINE HYD PUMP switches to HI.
134. Set and hold the AUX HYD PUMP switch in the OVRD position and observe rising hydraulic pressure in both the left and right system.
135. Check that the GEAR DOORS OPEN light extinguishes.
136. Check that both the L & R HYD PRESS LOW annunciator lights go out while the systems are pressurized.
137. Set both the ALT and AUX HYD PUMP switches back to off.
138. Check that the L & R HYD PRESS LOW annunciator lights illuminates.
139. Check that the GEAR DOORS OPEN light illuminates.
140. Check that the RUDDER CONTROL MANUAL annunciator light illuminates.
141. Check that both BRAKE PRESS indicators still indicate above the red radial.

RADAR & TRANSPONDER.. CHKD

142. Set the TILT switch to 5 degrees up.
143. Set the STAB switch to ON.
144. Set the GAIN knob to AUTO.
145. Set the MODE SELECTOR switch to TEST. Check the test pattern displayed on the radar scope.
146. Set the MODE SELECTOR to STBY.
147. Set the FUNCTION SELECTOR to STBY.

STAB, RUD & AIL TRIM .... CHKD

148. Check the longitude trim handle for freedom of motion. Hold the handle either up or down and check that the trim indicator moves and the aural stabilizer motion tone sounds.
149. Set the STABILIZER TRIM BRAKE switch to STOP.
150. Move the longitude trim handle again, but this time the trim indicator should not move.

151. Set the STABILIZER TRIM BRAKE switch back to NORM and close the guard.
152. Set the stabilizer trim to the takeoff position, if known. Otherwise, set it to within the green band.
153. Check the rudder trim for freedom of movement and set the indicator to zero.
154. Check the aileron trim for freedom of movement and set the indicator to zero.

SPOILERS ....DISARMED

155. Check that the spoiler lever is in the full forward position and disarmed.

RUDDER HYD CONTROL ....POWERED

156. Check that the rudder hydraulic control lever is in the PWR position (forward position).

CABIN ALT CONTROL .... CHKD & AUTO

157. Set the CABIN ALTITUDE CONTROL lever to MANUAL (down position).
158. Rotate the CABIN PRESS CONTROL wheel forward and observe the outflow valve position indicator move forward.
159. Return the CABIN ALTITUDE CONTROL lever to AUTO (up position). Check that the outflow valve indicator moves back to its original position.

FLAPS/SLATS.. UP/RETRACTED, LTS OUT

160. Ensure that the flaps and slats handles are securely fastened together and in the fully forward up and retracted position.
161. Check that both flap position indicator needles display flaps up.
162. Check that the SLATS EXTENDED light is extinguished.
163. Check that the SLAT DISAGREEMENT light is extinguished.
164. Check that the FLAP/RUDDER STOP INOP light is extinguished.

FUEL CONTROL LEVERS...OFF

165. Check that both FUEL CONTROL levers are in the OFF position (down).

AUTOPILOT .... CHKD

166. Check that the SERVOS ENGAGE/DISENGAGE is set to DISENGAGE.
167. Set the TURN knob to the center detent.
168. Set the HDG SELECT switch to OFF.

RADIOS... CHKD

169. Check and set the radios as required.

ORIGINATION/RECEIVING CHECKLIST .... COMPLETE

BEFORE START

FUEL QTY.. FO/C .... ___REQ, ___OB

1. Press and hold the FUEL QTY TEST switch. Check that fuel indications decrease. Then release the switch.
2. Check the total fuel onboard against that required for the flight.
3. Set the FUEL USED RESET switch to RESET (momentarily) and verify that fuel used indications read zero.

OIL & HYD QTYS... C... CHKD

4. Check the total oil quantity onboard.
5. Check the total hydraulic quantity onboard.

SEAT BELT SIGN .... C..ON

6. Set the SEAT BELT sign switch to ON.

PROBE/WINDSHIELD HEAT... C....................................... ON CAPT/ON

7. Set the METER SELECTOR & HEAT switch to CAPT.
8. Set the WINDSHIELD ANTI-ICE switch to ON.

FUEL PUMPS.. C.. CHKD,___ON

9. If center tank fuel is present, turn on one center fuel tank pump switch at a time and check that the INLET FUEL PRESS LOW annunciator lights extinguish.
10. Leave one of the center fuel tank pumps on.
11. Turn on all the main tank fuel pump switches.
12. Check that the INLET FUEL PRESS LOW annunciator lights extinguish.

CABIN PRESSURE PANEL.. C..SET

13. Check that the system selector switch is set to PRIMARY.
14. Check that both the TRANSFER LOCKOUT and STBY ON lights are extinguished.
15. Set destination field elevation and barometric pressure.
16. Set the rate increase knob to the index mark.

ALTIMETERS.. FO/C ....SET

17. Set the local altimeter setting in the barometric pressure window and crosscheck the altimeter with field elevation.
18. Check that no flags are visible on the radio altimeter.

RADIOS.. C..SET

19. Set the COMM radios as required.
20. Set the NAV radios as required.
21. Set the transponder as required.

T.O. WARNING .... C.. CHKD

22. Set the parking brake to OFF (down position).
23. Set the stabilizer trim to within the green band.
24. The spoilers should be retracted (lever fully forward).
25. Set the flaps/slat lever to up/retracted.
26. Advanced both throttles to the vertical position, and check that the takeoff warning horn sounds.
27. Set both throttles to idle.

PARKING BRAKE .... C... SET or OFF

28. Check that the brake selector is set to BOTH.
29. Make sure the brake pressure is within limits. Note: If you released the parking brake without any hydraulic pumps on and thus released the pressure trapped inside the brake cylinders, you will have to start the AUX HYD PUMP to build up enough pressure to set the parking brake again.

DEPARTURE REVIEW .... C.. COMPLETE

30. Review the departure with emphasis on anticipated track and altitude restrictions. It is not necessary to brief normal or standard takeoff procedures since normal operating procedures will be used.
31. Brief the following items:
    a. ATC clearance
    b. SID or IFR departure
    c. Airport departure information
    d. Noise abatement procedures
    e. Engine failure during takeoff

Accomplish the following items after receiving clearance from ground personnel to start engines.

ANTI-COLLISION LIGHTS .... C...ON

32. Turn on the anti-collision lights to alert ground personnel and other aircraft of impending engine start and/or aircraft movement.

IGNITION .... C.. A, B, or BOTH

33. Select BOTH on the first flight of the day. For subsequent flights, alternate between SYS A and SYS B.

AIR COND SUPPLY .... C.. OFF

34. Turn off the air conditioning supply switch.

PNEU X-FEED/PRESS .... C.. OPEN/CHKD

35. Place only the pneumatic crossfeed lever for the engine to be started to the OPEN position (handle in the up/forward position).
36. Check the pneumatic pressure. Minimum pressure for starting is 36 PSI less 1 PSI per 1,000 feet above MSL.

BEFORE START CHECKLIST .... FO.. COMPLETE

ENGINE STARTING

(Procedure)

This engine starting guide assumes you have followed the standard checklist and have completed all steps including starting the APU for electrical power and pneumatic pressure necessary for starting. If not, go through the six steps below before commencing with the engine starting guide.

1. Before starting an engine you need a pneumatic pressure source. This can be bleed air from either the APU or bleed air from the other engine if that has already been started.
2. For a Crossbleed Start (bleed air from running engine) make sure both Pneumatic X-Feed handles are open (up position). Leave both handles closed (down) if starting with APU bleed air.
3. For APU bleed air start, the APU must be running and… (Please refer to the APU START procedure guide on how to start the APU)
4. …the APU Air switch must be set to ON…
5. …and the Pneumatic X-Feed handle for the engine you are about to start must be set to OPEN. Set the left Pneumatic X-Feed handle to OPEN (up).
6. Check the Pneumatic Pressure Gauge. Optimum starting pressure is about 30-38 PSI.

L ENG START SWITCH...ON & HOLD

7. Open the guard to the LEFT ENGINE STARTER switch and set the switch to GND.
8. Check that the L START VALVE OPEN light illuminates.
9. Check that the pneumatic pressure remains above 25 PSI. If the pneumatic pressure drops below 25 PSI, be alert for a hung or hot start.

ENGINE INSTRUMENTS... CHECK

10. Check for increasing N_2.
11. Check for increasing hydraulic pressure.
12. Check for increasing oil pressure.
13. Check for increasing N_1.

FUEL CONTROL LEVER ....ON

14. At maximum motoring (minimum 15-20% N_2)…
15. …set the left Fuel Lever to ON. (Under the throttle handle)
16. Monitor N_1, EGT, N_2 and Fuel Flow.

L ENG START SWITCH...OFF

17. At 35% N_2…
18. …set the Left Engine Starter switch back to OFF and put the guard back on.
19. Check that N_2 stabilizes at about 50-57%.

DC BUS VOLTS.. WITHIN LIMITS

20. Should be about 75% of max capacity.

AC BUS VOLTS & FREQ .... WITHIN LIMITS

21. Set the VOLT/FREQ selector to L AC VOLTS/FREQ.
22. The indicator should read about 120 V.
23. The frequency should be around 400 Hz.

CSD OUTLET TEMP .... INCREASING & STABILIZING IN THE NORMAL RANGE

24. The indicator should indicate temperature somewhere between the yellow arcs.

AC LOADMETER .... WITHIN LIMITS

25. Both engine AC load meters should indicate the generators supplying about 50% (0.5) of rated capacity.

APU/EXT PWR IN USE LIGHTS..EXTINGUISHED

26. APU PWR (L) Power In Use Light should be extinguished.
27. EXT PWR (L) Power In Use Light should be extinguished.

ENGINE INSTRUMENTS .... STABILIZED IDLE

28. When the engine has stabilized at idle RPM, check the following:
29. L CSD OIL PRESS LOW light should be extinguished.
30. L OIL PRESS LOW light should be extinguished.
31. L HYD PRESS LOW light should be extinguished.
32. N_1 RPM approximately 30%.
33. N_2 RPM approximately 50-57%.
34. EGT should indicate 300-480°C.
35. Fuel Flow should indicate 800-1,100 LBS/hour.
36. Oil pressure should indicate 40-55 PSI.

PNEU X-FEED LEVER .... CLOSE

37. Close the pneumatic crossfeed valve by placing the PNEU X-FEED lever in the closed (down/aft) position.

VOLT/FREQ SELECTOR SWITCH ....R AC VOLTS/FREQ

38. Set the VOLT/FREQ SELECTOR switch to R.

RIGHT ENGINE...START

39. To start right engine, repeat the engine start procedure for the right engine.
40. Continue with the Engine Starting procedure when the right engine has stabilized.

VOLT/FREQ SELECTOR SWITCH ....BATT AMP

41. If the ammeter indicates continuous charging, this must be correct before takeoff. The indicator should read zero and be pulsing.

ENGINE WARM-UP ....5 MINUTES

42. Allow both engines to operate for 5 minutes prior to applying takeoff thrust.

AFTER START

ANNUNCIATOR PANEL.. C.. CHKD

1. Check that the L & R START VALVE OPEN light is extinguished.
2. Check that the L & R OIL PRESS LOW light is extinguished.
3. Check for normal indications.

IGNITION.. C..OFF

4. Set the IGNITION switch to OFF.

ENGINE ANTI-ICE... C...ON or OFF

5. When required because of the weather conditions, turn on both ENGINE ANTI-ICE switches...
6. ...and both FUEL HEAT switches.

ELECTRICAL SYSTEM .... C..OFF

7. Set the VOLT/FREQ SELECTOR switch to BATT VOLT and check that the ammeter is pulsing before takeoff.
8. Set the L & R AIR COND SUPPLY switches to OFF.
9. Set the DC CROSSTIE switch to OPEN.
10. Set the AC CROSSTIE switch to AUTO.
11. Set the EXT POWER BUS switch to OFF.
12. Set the APU POWER BUS switch to OFF.
13. Set the L GEN CONTROL switch to OFF.
14. Check that the L GEN OFF annunciator light illuminates.
15. Check that the L AC LOAD meter reads zero and that the R AC LOAD meter indication approximately doubles.
16. Set the L GEN CONTROL switch back to ON.
17. Set the R GEN CONTROL switch to OFF.
18. Check that the R GEN OFF annunciator light illuminates.
19. Check that the R AC LOAD meter reads zero and that the L AC LOAD meter indication approximately doubles.
20. Set the R GEN CONTROL switch back to ON.
21. If the APU is going to be used during takeoff, leave both L & R APU BUS switches in the ON position. Otherwise, set both switches to OFF.

AIR COND SUPPLY... C...AUTO

22. Close both PNEU X-FEED VALVE levers (down/aft position).
23. Unless needed for a delayed engine start or supplemental air conditioning, the APU can be shut down.
24. Set the APU AIR switch to OFF.
25. Set the APU MASTER switch to OFF.

HYDRAULIC SYSTEM .... C................................ ON-HI-ON, CHKD

26. Set the ALT HYD PUMP switch to ON.
27. Set both L & R ENGINE-DRIVEN PUMP switches to HI.
28. Set the AUX HYD PUMP switch to ON.
29. Both L & R HYD PRESSURE indicators should read within the high green band.
30. Check that both L & R HYD FLUID QTY indicators read within normal range.

31. All hydraulic annunciator lights should be extinguished.
32. Check that the GEAR DOOR OPEN light is extinguished.
33. Set the HYD BRAKE SELECTOR handle to BOTH (upright level position).
34. Both hydraulic brake pressure gauges should indicate approximately the same pressure as the hydraulic pressure gauges.

DOOR LIGHTS & LOCK .... FO.. CHKD

35. Check all door annunciator lights are extinguished.
36. Check cockpit door is locked.

SHOULDER HARNESS .... FO/C ....ON

37. Both the Captain and the First Officer must fasten their shoulder harness before takeoff.

AFTER START CHECKLIST .... FO.. COMPLETE

BEFORE TAKEOFF

STBY HORIZON & FLT INSTS.. FO/C .... CHKD

1. Check all flags are out-of-view on the standby horizon.
2. Scan all flight instruments for flags out-of-view, normal indications and correct settings and modes.
3. Select speed command for the flight director.

STAB/TRIM TABS.. FO/C ....____/0-0

4. To set stabilizer trim, first locate the STAB setting on the Load Summary in the Dispatch Center.
5. Set stabilizer trim as indicated on the Load Summary in the Dispatch Center.
6. Check that rudder trim is set to zero.
7. Check that aileron trim is set to zero.

FLAPS/SLATS... FO/C .... ____/BLUE LT

8. Place the flap/slat handle to the takeoff setting.
9. Check that the flaps indicator and selected flap setting agree with no asymmetry.
10. Check the blue SLAT EXTEND light is illuminated.
11. Check the SLAT DISAGREEMENT and FLAP/RUDDER STOP INOP annunciator lights are extinguished.

T.O. DATA & EPR .... FO/C ....SET

12. Determine and state V_1, V_R and V_2 speeds. Set the speeds on the airspeed indicator bugs.
13. You can use the Speed Cards to automatically set the bugs on the airspeed indicator.
14. Select the TAKEOFF speed cards.
15. Select the takeoff weight.
16. Then click the takeoff flaps setting to transfer the takeoff speeds to the bugs on the airspeed indicator.
17. Set EPR bugs to maximum setting. Read maximum TO EPR on the EPR LIMIT indicator.
18. Set the bug on the EPR gauge to the maximum TO EPR.
19. The max EPR value can be transferred to the EPR gauges by clicking the transfer hotspots on the EPR LIMIT indicator.
20. To manual find and set the maximum EPR you must first find out whether EPR is limited by temperature or pressure altitude.
21. Temperature limited EPR can be read directly from the temperature pointer against the white scale.
22. Set the altimeter to 1013 or 29.92. Read the altitude. This is pressure altitude.
23. Find the pressure altitude limited EPR by reading the pressure altitude against the amber numbers (1 = 1,000 feet).
24. The lower of the two numbers (temperature or pressure altitude limited EPR) is the maximum allowable EPR limit.
25. Set the EPR limit on the EPR gauge bug by using the bug knob.

T.O. WARNING.. C... CHKD

26. Set the throttles to the vertical position (about 50% forward) momentarily, and then pull them back to idle. If there is no warning horn, the aircraft is properly configured for takeoff.

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AIR COND AUTO-SHUTOFF .... C.. ARM

27. Set the AIR COND AUTO-SHUTOFF switch to ARM.

ANTI-SKID... C.. ARM

28. Set the ANTI-SKID switch to ARM.
29. Check all four ANTI-SKID INOP lights are extinguished.

APU .... C...ON or OFF

30. It is recommended the APU be left running with the APU L & R BUS switches ON for takeoffs and landings in heavy rain, standing water on the runway, slush, or visibility less than 1,800 RVR.
31. If the APU is required:
    a. Set the APU AIR switch to OFF.
    b. Set the APU MASTER switch to ON.
32. If the APU is not required:
    a. Set the L & R APU BUS switches to OFF.
    b. Set the APU AIR switch to OFF.
    c. Set the APU MASTER switch to OFF.

FLIGHT CONTRLS.. FO/C .... CHKD

33. Check yaw damper operation for deflection of the Rudder Autopilot Indicator opposite to the direction of turn. If no deflection, check the Yaw Damper switch on the overhead panel.
34. Check ailerons for full range freedom of movement.
35. When the control wheel is deflected more than 5 degrees from center, check that the SPOILER DEPLOYED annunciator light illuminates.
36. Pull the control wheel fully aft and check the ELEVATOR PWR ON annunciator light is extinguished.
37. Move the control wheel fully forward and check the ELEVATOR PWR ON annunciator light is illuminated.

ANNUNCIATOR PANEL.. C.. CHKD

38. Check the annunciator panel to ensure RUDDER TRAVEL UNRESTRICTED light is on and all other lights are normal for the current conditions.

T.O. BRIEFING.. C.. COMPLETE

39. Brief the following items prior to takeoff:
    a. Initial heading and altitude
    b. Initial fix or route segment
    c. Special considerations; noise abatement, windshear, anti-icing, runway conditions, V_1, and other items deemed necessary.

Accomplish the following items after receiving clearance onto the runway.

T.O. MIN FUEL QTY... FO/C ....____REQ, ____OB

40. Crosscheck the fuel onboard against the required takeoff minimum for the planned route.

T.O. ANNOUNCEMENT .... FO... COMPLETE

41. Notify the Flight Attendants when takeoff is imminent.

RADAR/TRANSPONDER .... C... COMPLETE

42. Set the MODE SELECTOR to NORM.
43. Set the FUNCTION SELECTOR to ON.

IGNITION .... C.. BOTH

44. Set the IGNITION switch to BOTH.

BEFORE T.O. CHECKLIST .... FO... COMPLETE

AFTER TAKE-OFF

The After Take-off checklist should be performed after the aircraft has been cleaned up (gear, flaps and slats up/retracted) and when workload permits.

GEAR, FLAPS, SLATS... PNF ....UP, LIGHTS OUT

1. Check the gear handle is up and latched.
2. Check all gear lights are extinguished.
3. Check that flaps indicate 0 and the blue SLAT EXTEND light is extinguished.
4. Check the SLAT DISAGREEMENT annunciator light is extinguished.

IGNITION .... PNF ....ON or OFF

5. Leave the ignition switch ON if required by the weather condition (heavy rain, snow, icing, etc). Otherwise, turn it OFF.

FUEL PUMPS.. PNF .... 4 or 6 ON

6. All four (2 left and 2 right) main wing tank pumps should remain thought the flight.
7. If there is fuel in the center tank, turn on both fuel pumps for the center tank.
8. After the center tank is empty, the center tank fuel pumps should be turned OFF.

A/C AUTO-SHUTOFF/PRESS .... PNF .... OVRD/CHKD

9. Place the AIR COND AUTO-SHUTOFF switch in the OVRD position.
10. Verify the cabin is pressurizing normally.

ANNUNCIATOR PANEL... PNF .... CHKD

11. Observe annunciator panel light indications are normal.
12. Check RUDDER TRAVEL UNRESTRICTED annunciator light is extinguished above 177 KIAS.
13. If the APU is operating, but is no longer needed, this can be turned off.
14. Set the L & R APU BUS switches to OFF.
15. Place the APU MASTER switch in the OFF position.

HYDRAULIC SYSTEM .... PNF .... CHKD

16. Set the AUX HYD PUMP switch to OFF.
17. Set the ALT HYD PUMP switch to OFF.
18. Set the ENG HYD PUMP switches to LOW.

AFTER TAKEOFF CHECKLIST... PNF .... COMPLETE

The following procedural items must be performed when leaving 10,000 feet MSL.

CRUISE ANNOUNCEMENT... COMPLETE

19. Make a PA announcement/cabin chime to alert the Flight Attendants the aircraft is no longer in the sterile cockpit environment.

LANDING LIGHT SWITCHES ....OFF/RET

20. Set the NOSE LIGHTS switch to OFF.
21. Set the WING LANDING LIGHTS switches to RET.

PRELIMINARY LANDING

SEAT BELT SIGN .... PNF ....ON

1. Set the SEAT BELT SIGN switch to ON.

CABIN PRESSURE PANEL... PNF ....ON

2. Check landing pressure altitude and barometric pressure are properly set.
3. Verify the cabin rate, cabin altitude, and differential pressure indicate normal operation.

HYDRAULIC SYSTEM .... PNF .... ON-HI-ON, CHKD

4. Set the ALT HYD PUMP switch to ON.
5. Set both L & R ENGINE-DRIVEN PUMP switches to HI.
6. Set the AUX HYD PUMP switch to ON.
7. Both L & R HYD PRESSURE indicators should read within the high green band.
8. Check that both L & R HYD FLUID QTY indicators read within normal range.

ALTIMETERS... PNF/PF...SET

9. Ensure all altimeters are set to landing barometric pressure.
10. Set the altitude alerter to landing altitude.

LANDING DATA & EPR... PNF/PF...SET

11. Determine landing weight. Check landing weight is within limits for runway length and surface conditions. Determine flap setting for landing (flap 40 is standard).
12. Set the speed bugs on the ASI for the landing weight and selected flaps.

SHOULDER HARNESS .... FO/C ....ON

13. Both the Captain and the First Officer must fasten their shoulder harness before landing.

Accomplish the following items after receiving the appropriate information.

APPROACH BRIEFING .... C.. COMPLETE

14. The PF will brief the following items prior to each approach:
    a. Approach name and runway
    b. Primary navaid frequency
    c. Final approach course
    d. Final approach fix (FAF) altitude
    e. Decision height/minimum descent altitude
    f. Missed approach procedure
    g. Special considerations: noise abatement, windshear, anti-icing, runway condition and braking action

PRELIMINARY LANDING CHECKLIST........................... PNF .... COMPLETE

Note:

It is recommended the APU be left running with the APU L & R BUS switches ON for takeoffs and landings in heavy rain, standing water on the runway, slush, or visibility less than 1,800 RVR.

LANDING

Approximately 5 minutes before landing, alert the cabin crew that landing is imminent.

IGNITION .... PNF .... BOTH

1. Set the IGNITION switch to BOTH.

GEAR .... PNF/PF......................... DOWN, 3 GREEN

2. Make sure the speed brakes are retracted.
3. Place the landing gear in the down position.
4. Check for three green lights and no red lights.
5. The GEAR DOOR OPEN light remains illuminated until both main gear doors close.

SPOILERS .... PF............................. LIGHT OUT, ARMED

6. Ensure that the AUTO SPOILER DO NOT USE annunciator light is extinguished.
7. Lift the spoiler lever UP to arm the ground spoilers.

Accomplish the following items after landing flaps are set.

FLAPS/SLATS.. PNF/PF............................... ____/BLUE LT

8. Verify proper landing flaps are set and no asymmetry exists.
9. The blue SLAT EXTEND light should be illuminated.

ANNUNCIATOR PANEL... PNF .... CHKD

10. Check RUDDER TRAVEL UNRESTRICTED annunciator light illuminates by 153 KIAS.
11. Verify that no annunciator lights requiring corrective action are illuminated before landing.

LANDING CHECKLIST .... PNF .... COMPLETE

AFTER LANDING

ANTI-SKID .... FO .... OFF

1. Set the ANTI SKID switch to OFF.

APU .... FO .... ON or OFF

2. Start the APU: Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position.
3. Set the APU Air switch to OFF.
4. Set the APU FIRE CONT switch to the NORM position.
5. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
6. Check that the APU RPM and APU EGT start rising.
7. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.
8. Check APU RPM and APU EGT stabilizing.
9. Turn the VOLT/FREQ SELECTOR to APU, and check that electrical power is within limits.
10. Set L & R APU PWR BUS switches to ON.
11. Set the APU Air switch to ON.

ICE PROTECTION .... FO .... ON or OFF

12. Set the AIRFOIL ANTI-ICE switches to OFF.
13. Depending on the current weather and icing conditions, set the L & R ENG ANTI-ICE switches to ON or OFF.

IGNITION .... FO .... OFF

14. Set the IGNITION switch to OFF.

FLAPS .... FO .... OFF

15. Set the FLAPS to 15 for taxi to reduce ingestion of foreign objects into the engines. Flaps/slats should be fully retracted just prior to entering the ramp area.

RADAR & TRANSPONDER .... FO .... OFF

16. Set the MODE SELECTOR to STBY.

AFTER LANDING CHECKLIST .... FO .... COMPLETE

PARKING & SECURING

Note: Center the nose wheel for parking before forward motion stops.

PARKING BRAKE .... SET or OFF

1. Set the parking brake (knob up).
2. When the aircraft is stopped and the parking brake set, the Captain turns the seat belt sign OFF…
3. …and the First Officer gives the 2-bell signal to the cabin crew.
4. If wheel chocks are installed, wait for the ground crew signal and release the parking brake.
5. Note: To provide at least 8 hours of brake pressure during parking, make sure brake pressure is in the green band before setting the parking brake.

ELECTRICAL SYSTEM .... SET

6. Start the APU, if it hasn't already been started taxiing in:
7. Make sure the guarded switch is set to AUTO. Note that when the guard is on, the switch is in the AUTO position.
8. Set the APU Air switch to OFF.
9. Set the APU FIRE CONT switch to the NORM position.
10. Momentarily move the APU MASTER switch to START (spring loaded back to RUN).
11. Check that the APU RPM and APU EGT start rising.
12. Check that the APU OIL PRESS LOW light goes out at or prior to 95% RPM.
13. Check APU RPM and APU EGT stabilizing.
14. Set the APU Air switch to ON.

Establish electrical power:

15. Turn OFF both the L & R APU/EXT PWR BUS switches.
16. The APU or EXT PWR AVAIL LIGHT should be illuminated.
17. Turn the VOLT/FREQ SELECTOR to either EXT PWR or APU, depending on the active power source and check that electrical power is within limits.
18. Set APU or EXT PWR L & R BUS switches to ON.
19. Check APU or external power L & R bus power in use light illuminate.
20. The AC & DC EMER BUS OFF Annunciator lights should be extinguished.

ICE PROTECTION .... SET

21. Set the L & R ENG ANTI-ICE switches to OFF.
22. Set the WINDSHIELD ANTI-ICE switch to OFF if this is the last flight of the day. Normally, windshield heat should be left ON throughout the day during normal operations.
23. Set the WINDSHIELD ANTI-FOG switch to OFF.
24. Set the METER SEL & HEAT switch to OFF.

FUEL CONTROL LEVERS .... OFF

25. Set the FUEL CONTROL levers to OFF.

FUEL PUMPS .... ONE ON or OFF

26. If the APU is operating, leave one right main fuel pump switch ON.
27. If the APU is not operating, set all fuel pump switches to OFF.

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AIR CONDITIONING .... SET

28. Make sure that air supply has been established by checking the pneumatic pressure gauge. It should indicate between 30 and 45 PSI.
29. Set both L & R PNEU X-FEED valve levers to the OPEN (up) position.
30. Set the L & R AIR COND SUPPLY switch to AUTO.
31. Set the Temperature Selectors to AUTO.
32. Set the RAM AIR switch to OFF.
33. If more cold air is required in the cabin, select the APU AIR switch to AIR COND COLDER.

ANTI-COLLISION LIGHTS .... OFF

34. Turn the ANTI-COLLISION lights OFF to alert the ground crew the engines are shut down.

FLAPS/SLATS .... UP/LIGHT OUT

35. Check flaps and slats are fully retracted.
36. The blue SLAT EXTENDED light should be extinguished.

HYDRAULIC PUMPS .... OFF-HI-OFF

37. Set the ALT HYD PUMP switch to OFF.
38. Set the AUX HYD PUMP switch to OFF.
39. Set the L & R ENG HYD PUMP switches to HI.

PARKING CHECKLIST .... COMPLETE

The following items should be completed at termination only.

EMERGENCY LIGHTS .... OFF

40. Set the EMERGENCY LIGHTS switch to OFF.

WINDSHIELD HEAT .... OFF

41. Set the WINDSHIELD ANTI-ICE switch to OFF.

ELECTRICAL SYSTEM .... SET

42. Coordinate with ground crew to determine electrical power configuration. If the APU will remain operating, ensure ground crew has assumed responsibility prior to departing the aircraft. Start or shut down APU as appropriate.
43. Set the GROUND SERVICE APU or EXT PWR switch to ON.
44. Check APU/EXT PWR IN USE light illuminates.
45. Set the EMER PWR switch to OFF.
46. Set all the APU/EXT PWR BUS switches to OFF.
47. Set the VOLT/FREQ SELECTOR switch to BATT AMP.
48. Check for battery charging indication.
49. If the battery is charging or the APU is operating, leave the battery switch in the ON position. Otherwise, set the battery switch to OFF.

SECURING CHECKLIST .... COMPLETE

SECTION 4

PLANNING & PERFORMANCE

TABLE OF CONTENTS

GENERAL

Standard Take-Off Thrust

In general, standard take-off thrust should be used where permitted. The use of standard thrust will improve engine reliability, lengthen engine life, and substantially reduce operating costs by reducing peak pressures and temperatures

If an engine failure occurs during the take-off roll at or after V_1, standard thrust on the remaining engine will satisfy the take-off requirements.

Some conditions which prohibit the use of standard thrust:

- Tailwind
- Snow, slush, ice or standing water on the runway
- De-ice/anti-ice fluid has been applied and temperatures at or below 6°C/42°F
- Engine anti-ice ON
- MEL item that requires a take-off weight penalty
- Actual TOW from load close-out or ACARS is greater that assumed TOW

In the above conditions, a higher than standard thrust take-off setting may be required.

Cruise Information

Cruise EPR tables are provided for various Mach numbers and True airspeeds at standard temperature.

The Long Range Cruise table permits determination of the most economical cruise (most NM flow per thousand pounds of fuel burned).

A 320 knots cruise table is provided for use at altitudes below the 320 knots/Mach crossover altitude.

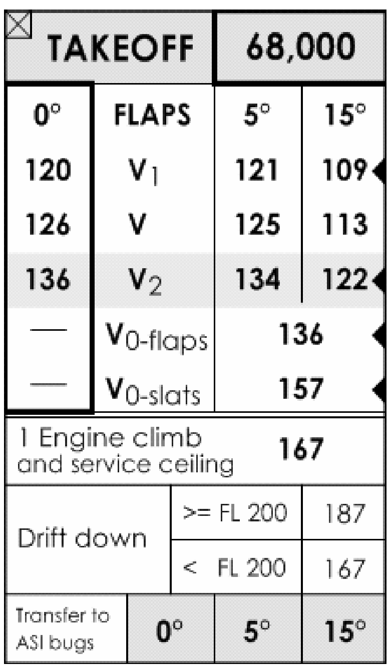
Speed Cards

Two sets of quick reference Speed Cards are available to the pilots. One set for take-off and a second set for landing.

The take-off Speed Cards provide the pilots with various take-off speeds, such as for example V_1, V_R and V_2, for various aircraft configurations and weights.

The landing Speed Cards provide the pilots with various landing speeds, such as for example V_{REF}, for various aircraft configurations and weights.

Sample speed card:



TAKEOFF		68,000	
0°	FLAPS	5°	15°
120	V_1	121	109
126	V	125	113
136	V_2	134	122
—	$V_{0\text{-flaps}}$	136	
—	$V_{0\text{-slats}}$	157	
1 Engine climb and service ceiling		167	
Drift down	>= FL 200	187	
	< FL 200	167	
Transfer to ASI bugs	0°	5°	15°

Using the Speed Cards:

1. Click the header to switch between Take-off and Maneuvering.
2. Click the weight to increase or decrease the aircraft weight.
3. Click the bottom flap setting boxes to transfer the speeds on the speed card, for the selected configuration, to the Airspeed Indicator bugs. The speeds pointed to by the black arrowheads will be transferred to the ASI.
4. For emergency and/or abnormal situations, the relevant speeds, V_2 for takeoff and V_{GA5} for landing, are highlighted in light red.

V-SPEEDS

V-Speed Corrections

1. **ELEVATION**
   SL to 2000: Add 1 knot to V_1 and V_R if OAT is over 29.4°C (85°F).
   Subtract 1 knot from V_2 if OAT is over 29.4°C (85°F).

   2001 to 4000: Add 1 knot to V_1 if OAT is 0°C to 29.4°C (85°F).
   Add 1 knot to V_R if OAT is over -0.6°C (31°F).
   Add 2 knots to V_1 if OAT is over 29.4°C (85°F).
   Subtract 1 knot from V_2 if OAT is over 9.4°C (49°F).

2. **SLOPE**
   For each 1.0% (+) uphill slope, add 1 knot to V_1 and 0.5 knots to V_R.
   Subtract 0.5 knots from V_2.

   For each 1.0% (-) downhill slope, subtract 1 knot from V_1 and 0.5 knots from V_R.
   Add 0.5 knots to V_2.

3. **WIND**
   For each 10 knots of headwind components, add 0.5 knots to V_1.
   For a 10 knot tailwind component, subtract 1 knot from V_1.

4. **If, after adjustments are made, V1 exceeds VR set V1 equal to VR.**

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Takeoff & V_{FTO} Speeds

Aircraft Gross Weight (LBS)	FLAPS 15/EXT					FLAPS 5/EXT					VFTO
	V_1	V_R	V_2	FLAPS RET	SLATS RET	V_1	V_R	V_2	FLAPS RET	SLATS RET	
70,000	107	111	121	131	156	121	124	134	134	159	167
75,000	109	113	122	132	157	121	124	134	134	159	173
80,000	114	117	126	136	161	123	127	136	136	161	179
85,000	118	121	129	139	164	128	131	139	139	164	184
90,000	122	125	132	142	167	132	135	143	143	168	189
95,000	126	129	135	145	170	136	139	146	146	171	195
100,000	129	132	138	148	173	140	143	150	150	175	200
105,000	133	135	141	151	176	144	147	153	153	178	204

Landing Speeds

Aircraft Gross Weight (LBS)	SLATS RETRACTED				SLATS EXTENDED			
	50	40	25	0	50	40	25	0
70,000	130	134	138	157	107	111	115	130
75,000	135	138	143	162	111	115	120	134
80,000	138	143	148	168	115	119	124	139
85,000	142	148	152	173	118	123	127	143
90,000	147	152	156	177	122	126	131	147
95,000	152	156	161	183	125	129	135	151
100,000	156	160	165	189	128	133	139	155
105,000	160	164	170	193	132	136	142	159

TAKEOFF & CLIMB

Takeoff EPR Bleed Corrections

Engine bleeds for A/C OFF	+0.02
Engine anti-ice ON *	-

* Do not use engine anti-ice at an OAT above 10°C (50°F).

Takeoff EPR

Static Setting (Set by 60 knots) Engine Bleeds for A/C ON							
OAT °C	PRESSURE ALTITUDE (FT)						
	S.L.	1,000	2,000	3,000	4,000	5,000	6,000 & Above
50	1.770	1.770	1.770	1.770	1.770	1.770	1.770
45	1.810	1.810	1.810	1.810	1.810	1.810	1.810
40	1.853	1.853	1.853	1.853	1.853	1.853	1.853
35	1.895	1.895	1.895	1.895	1.895	1.895	1.895
30	1.940	1.940	1.940	1.940	1.940	1.940	1.940
25	1.950	1.950	1.950	1.950	1.950	1.950	1.952
20	1.950	1.950	1.950	1.950	1.950	1.950	1.952
15	1.950	1.950	1.950	1.950	1.950	1.950	1.952
10	1.950	1.980	1.980	1.980	1.980	1.980	1.980
5	1.950	2.000	2.010	2.010	2.010	2.010	2.010
0	1.950	2.000	2.040	2.040	2.040	2.040	2.040
-5	1.950	2.000	2.050	2.066	2.066	2.066	2.066
-10	1.950	2.000	2.050	2.095	2.095	2.095	2.095
-15	1.950	2.000	2.050	2.095	2.120	2.120	2.120
-20	1.950	2.000	2.050	2.095	2.150	2.150	2.150
-25	1.950	2.000	2.050	2.095	2.157	2.177	2.177
-30	1.950	2.000	2.050	2.095	2.157	2.202	2.202
-35	1.950	2.000	2.050	2.095	2.157	2.220	2.230
-40	1.950	2.000	2.050	2.095	2.157	2.220	2.250
-45	1.950	2.000	2.050	2.095	2.157	2.220	2.273
-50	1.950	2.000	2.050	2.095	2.157	2.220	2.290

Takeoff EPR Crosscheck

Blockage of the PT2 probe with engine anti-ice OFF will result in an indicated EPR which is higher than the actual EPR. If engine anti-ice is ON, the indicated EPR will be lower than the actual EPR.

The following table can be used to check EPR during takeoff. The table contains the MINIMUM acceptable N_1 values during takeoff for a given EPR and outside temperature.

If during takeoff the chart values for N_1 are not obtained before 60 knots, a serious problem exists with either the engine thrust level of the engine instrument system.

JT8D-7 ENGINE				
EPR	MINIMUM N1, %RPM			
	OUTSIDE AIR TEMPERATURE			
	-20°C	-10°C	0°C	+10°C
2.15	91.5			
2.10	89.7	91.5	93.2	95.0
2.05	88.0	89.7	91.4	93.1
2.00	86.2	87.9	89.6	91.3
1.95	84.4	86.1	87.8	89.4
1.90	82.7	84.4	86.0	87.6
1.85	81.1	82.7	84.3	85.9
1.80	79.7	81.3	82.9	84.4
1.75	78.1	79.7	81.2	82.7

Note: To be used for EPR crosscheck during takeoff only.

Max Continuous EPR Bleed Corrections

Engine bleeds for A/C OFF	+0.07
Engine and airfoil anti-ice ON (one engine)	-0.13

Max Continuous EPR

	Engine Bleeds for A/C ON									
OAT °C	**PRESSURE ALTITUDE (FT)**									
	S.L.	**1,000**	**1,500**	**2,000**	**3,000**	**4,000**	**5,000**	**6,000**	**20,000**	**Above 20,000**
50	1.637	1.637	1.657	1.657	1.657	1.657	1.657	1.657	1.657	1.637
45	1.665	1.665	1.700	1.700	1.700	1.700	1.700	1.700	1.700	1.665
40	1.693	1.693	1.741	1.741	1.741	1.741	1.741	1.741	1.741	1.693
35	1.722	1.722	1.783	1.783	1.783	1.783	1.783	1.783	1.783	1.722
30	1.750	1.750	1.824	1.824	1.824	1.824	1.824	1.824	1.824	1.750
25	1.777	1.777	1.864	1.864	1.864	1.864	1.864	1.864	1.864	1.777
20	1.805	1.805	1.900	1.900	1.900	1.900	1.900	1.900	1.900	1.805
15	1.834	1.834	1.934	1.934	1.934	1.934	1.934	1.934	1.934	1.834
10	1.866	1.866	1.964	1.964	1.964	1.964	1.964	1.964	1.964	1.866
5	1.899	1.899	1.990	1.994	1.994	1.994	1.994	1.994	1.994	1.899
0	1.916	1.930	1.990	2.010	2.010	2.010	2.010	2.010	2.010	1.930
-5	1.916	1.962	1.990	2.010	2.020	2.020	2.020	2.020	2.020	1.963
-10	1.916	1.962	1.990	2.010	2.060	2.074	2.074	2.074	2.074	2.000
-15	1.916	1.962	1.990	2.010	2.060	2.100	2.100	2.100	2.100	2.035
-20	1.916	1.962	1.990	2.010	2.060	2.110	2.128	2.128	2.128	2.067
-25	1.916	1.962	1.990	2.010	2.060	2.110	2.152	2.152	2.152	2.097
-30	1.916	1.962	1.990	2.010	2.060	2.110	2.164	2.178	2.178	2.125
-35	1.916	1.962	1.990	2.010	2.060	2.110	2.164	2.200	2.200	2.153
-40	1.916	1.962	1.990	2.010	2.060	2.110	2.164	2.222	2.226	2.180
-45	1.916	1.962	1.990	2.010	2.060	2.110	2.164	2.222	2.250	2.208
-50	1.916	1.962	1.990	2.010	2.060	2.110	2.164	2.222	2.270	2.235

CRUISE

1.30 G-Load (40° Bank Angle) Low & High Speed Buffet Margins

GROSS WT. (LBS)		70,000	75,000	80,000	85,000	90,000	95,000	100,000	105,000
ALT(FT)		LO-HI	LO-HI	LO-HI	LO-HI	LO-HI	LO-HI	LO-HI	LO-HI
35,000	M	.541-.825	.566-.822	.591-.819	.613-.814	.636-.810	.657-.802	.678-.759	.699-.780
	IAS	179-281	187-280	196-279	204-277	212-276	219-272	227-270	234-264
33,000	M	.507-.828	.531-.825	.555-.823	.577-.819	.599-.816	.620-.810	.641-.805	.661-.795
	IAS	175-295	184-294	193-292	200-290	207-289	216-287	224-285	231-281
31,000	M	.475-.830	.498-.828	.521-.826	.542-.824	.564-.821	.584-.817	.605-.814	.624-.807
	IAS	171-309	179-308	189-307	197-306	205-305	213-304	220-303	228-300
29,000	M	.445-.832	.467-.830	.489-.829	.510-.827	.531-.826	.550-.823	.571-.821	.589-.817
	IAS	167-324	176-323	185-322	193-322	200-321	208-320	217-320	223-318
28,000	M	.432-.833	.453-.831	.474-.830	.494-.829	.515-.827	.534-.825	.554-.823	.572-.821
	IAS	166-331	175-330	182-329	191-329	198-328	206-328	214-328	222-327
27,000	M	.419-.834	.434-.832	.460-.831	.480-.830	.499-.829	.518-.827	.538-.826	.556-.825
	IAS	164-337	170-337	181-336	189-336	197-335	204-335	212-334	220-334
26,000	M	.406-.834	.426-.833	.446-.832	.465-.831	.484-.830	.503-.829	.523-.828	.539-.827
	IAS	163-344	171-344	179-344	187-343	196-343	202-342	211-341	217-341
25,000	M	.394-.835	.413-.834	.432-.833	.451-832	.470-.831	.488-.831	.507-.830	.524-.830
	IAS	161-353	169-353	177-352	185-352	193-351	200-351	208-350	216-350
24,000	M	.383-.835	.401-.834	.420-.834	.438-.833	.456-.832	.474-.832	.492-.831	.508-.831
	IAS	160-360	168-359	176-359	183-359	192-358	199-358	207-358	214-358

1.50 G-Load (48° Bank Angle) Low & High Speed Buffet Margins

GROSS WT. (LBS)		70,000	75,000	80,000	85,000	90,000	95,000	100,000	105,000
ALT(FT)		LO-HI	LO-HI	LO-HI	LO-HI	LO-HI	LO-HI	LO-HI	LO-HI
35,000	M IAS	.597-.818 197-277	.623-.812 206-275	.649-.806 215-273	.670-.796 223-269	.691-.787 231-266	.706-.775 236-261	- -	- -
33,000	M IAS	.563-.822 194-293	.589-.818 203-291	.614-.814 213-289	.634-.808 220-287	.655-.802 228-285	.673-.793 235-281	.692-.784 242-277	.709-.771 248-273
31,000	M IAS	.526-.825 189-307	.550-.822 198-305	.575-.819 208-304	.595-.815 215-302	.616-.811 223-301	.637-.806 231-299	.656-.802 239-297	.675-.796 248-294
29,000	M IAS	.497-.829 186-321	.521-.827 196-320	.544-.825 205-320	.564-.822 213-319	.585-.819 221-317	.605-.815 229-316	.625-.811 237-315	.640-.806 243-312
28,000	M IAS	.484-.830 185-329	.507-.828 194-328	.530-.826 204-327	.550-.824 212-326	.570-.821 220-325	.589-.812 227-324	.609-.815 235-323	.624-.811 242-321
27,000	M IAS	.469-.830 183-336	.492-.829 192-335	.515-.827 202-334	.524-.825 210-333	.554-.822 218-332	.572-.817 225-331	.592-.817 233-330	.617-.814 240-328
26,000	M IAS	.455-.831 181-343	.477-.830 190-342	.500-.829 200-341	.519-.827 208-340	.538-.825 216-340	.556-.822 223-339	.575-.820 231-338	.591-.897 238-336
25,000	M IAS	.440-.831 179-365	.461-.831 187-350	.483-.830 197-349	.502-.829 205-348	.521-.827 213-348	.539-.825 221-347	.556-.822 229-346	.573-.820 235-345
24,000	M IAS	.425-.832 177-358	.445-.832 185-358	.466-.823 194-358	.485-.831 202-357	.504-.829 211-356	.523-.827 211-356	.542-.825 227-355	.555-.823 233-354

LONG RANGE CRUISE – 11,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-21.8	-16.8	-11.8	-6.8	-1.8	3.2	8.2	13.2	18.2
104,000 LB	MACH/IAS	0.557/303	0.557/303	0.557/303	0.557/303	0.557/303	0.557/303	0.557/303	0.557/303	0.557/303
	EPR A/L	1.42/1.88	1.42/1.84	1.42/1.79	1.42/1.75	1.42/1.71	1.42/1.67	1.42/1.63	1.42/1.59	1.42/1.56
	N2/N1	82.5/75.4	83.3/76.4	84.9/77.1	84.9/77.8	85.7/78.6	86.5/79.3	87.3/80.0	88.0/80.7	88.8/81.4
	FF/EGT	3198/327	3237/339	3275/351	3313/363	3351/358	3390/386	3428/398	3468/410	3505/422
	RAT/TAS	-5.3/344	-0.1/348	5.2/351	10.5/354	15.7/358	21.0/361	26.2/364	31.5/367	36.8/371
	NAM/1,000	53.82	53.71	53.60	53.48	53.37	53.25	53.13	52.98	52.88
100,000 LB	MACH/IAS	0.542/295	0.542/295	0.542/295	0.542/295	0.542/295	0.542/295	0.542/295	0.542/295	0.542/295
	EPR A/L	1.40/1.88	1.40/1.84	1.40/1.80	1.40/1.76	1.40/1.71	1.40/1.67	1.40/1.64	1.40/1.60	1.40/1.57
	N2/N1	82.0/74.7	82.8/75.4	83.6/76.2	84.4/76.9	85.2/77.6	85.9/78.3	86.7/79.0	87.5/79.7	88.2/80.4
	FF/EGT	3056/320	3092/332	3129/344	3165/355	3202/367	3238/379	3274/391	3313/403	3349/414
	RAT/TAS	-6.0/320	-0.8/339	4.5/342	9.7/345	15.0/348	20.2/352	25.5/355	30.7/358	36.0/361
	NAM/1,000	54.86	54.75	54.64	54.52	54.40	54.28	54.17	54.01	53.90
96,000 LB	MACH/IAS	0.542/295	0.542/295	0.542/295	0.542/295	0.542/295	0.542/295	0.542/295	0.542/295	0.542/295
	EPR A/L	1.39/1.88	1. 39/1.84	1. 39/1.80	1. 39/1.76	1. 39/1.71	1. 39/1.67	1. 39/1.64	1. 39/1.60	1. 39/1.57
	N2/N1	81.9/74.5	82.7/75.3	83.5/76.0	84.3/76.7	85.1/77.4	85.9/78.1	86.6/78.8	87.4/79.5	88.1/80.2
	FF/EGT	3023/319	3059/330	3095/342	3134/354	3169/366	3203/377	3240/389	3276/401	3311/412
	RAT/TAS	-6.0/335	-0.8/339	4.5/342	9.7/354	15.0/348	20.2/352	25.5/355	30.7/358	36.0/361
	NAM/1,000	55.45	55.34	55.23	55.07	54.97	54.88	54.75	54.63	54.51
92,000 LB	MACH/IAS	0.526/286	0.526/286	0.526/286	0.526/286	0.526/286	0.526/286	0.526/286	0.526/286	0.526/286
	EPR A/L	1.37/1.89	1.37/1.85	1.37/1.81	1.37/1.77	1.37/1.72	1.37/1.68	1.37/1.64	1.37/1.61	1.37/1.57
	N2/N1	81.3/73.5	82.1/74.2	82.9/74.9	83.7/75.6	84.5/76.3	85.2/77.0	86.0/77.7	86.7/78.4	87.5/79.1
	FF/EGT	2886/312	2921/323	2955/335	2990/346	3024/358	3058/370	3092/381	3125/393	3161/404
	RAT/TAS	-6.8/325	-1.6/329	3.7/332	8.9/335	14.1/338	19.4/341	24.6/344	29.8/347	35.1/350
	NAM/1,000	56.37	56.26	56.14	56.02	55.90	55.78	55.66	55.57	55.42
88,000 LB	MACH/IAS	0.511/278	0.511/278	0.511/278	0.511/278	0.511/278	0.511/278	0.511/278	0.511/278	0.511/278
	EPR A/L	1.35/1.90	1.35/1.86	1.35/1.81	1.35/1.77	1.35/1.73	1.35/1.69	1.35/1.65	1.35/1.61	1.35/1.58
	N2/N1	80.7/72.5	81.5/73.2	82.3/73.9	83.0/74.6	83.8/75.3	84.6/75.9	85.3/76.6	86.1/77.3	86.8/77.9
	FF/EGT	2743/305	2776/316	2809/328	2841/339	2875/351	2907/362	2938/374	2969/385	3002/396
	RAT/TAS	-7.5/316	-2.3/319	2.9/332	8.2/325	13.4/328	18.6/331	23.8/334	29.0/337	34.3/340
	NAM/1,000	57.56	57.44	57.33	57.21	57.06	56.95	56.86	56.76	56.64

LONG RANGE CRUISE – 11,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-21.8	-16.8	-11.8	-6.8	-1.8	3.2	8.2	13.2	18.2
84,000 LB	MACH/IAS	0.511/278	0.511/278	0.511/278	0.511/278	0.511/278	0.511/278	0.511/278	0.511/278	0.511/278
	EPR A/L	1.35/1.90	1.35/1.86	1.35/1.81	1.35/1.77	1.35/1.73	1.35/1.69	1.35/1.65	1.35/1.61	1.35/1.58
	N2/N1	80.5/72.1	81.3/72.9	82.1/73.6	82.9/74.2	83.6/74.9	84.4/75.6	85.1/76.3	85.9/76.9	86.6/77.6
	FF/EGT	2707/303	2739/314	2772/326	2804/337	2835/349	2867/360	2898/371	2928/383	2960/394
	RAT/TAS	-7.5/316	-2.3/319	2.9/322	8.2/325	13.4/328	18.6/331	23.8/334	29.0/337	34.3/340
	NAM/1,000	58.34	58.22	58.10	57.98	57.87	57.76	57.66	57.57	57.44
80,000 LB	MACH/IAS	0.495/269	0.495/269	0.495/269	0.495/269	0.495/269	0.495/269	0.495/269	0.495/269	0.495/269
	EPR A/L	1.33/1.90	1.33/1.86	1.33/1.82	1.33/1.78	1.32/1.74	1.32/1.69	1.32/1.65	1.32/1.62	1.32/1.58
	N2/N1	79.8/71.0	80.6/71.7	81.4/72.4	82.2/73.0	82.9/73.7	83.7/74.4	84.4/75.0	85.1/75.7	85.9/76.3
	FF/EGT	2569/296	2600/307	2631/319	2661/330	2692/341	2721/352	2751/364	2780/375	2810/386
	RAT/TAS	-8.2/306	-3.0/309	2.2/312	7.4/315	12.6/318	17.8/321	23.0/324	28.3/327	33.5/330
	NAM/1,000	59.60	59.47	59.35	59.23	59.11	59.00	58.90	58.80	58.68
76,000 LB	MACH/IAS	0.480/260	0.480/260	0.480/260	0.480/260	0.480/260	0.480/260	0.480/260	0.480/260	0.480/260
	EPR A/L	1.31/1.91	1.31/1.87	1.30/1.83	1.30/1.79	1.30/1.74	1.30/1.70	1.30/1.66	1.30/1.63	1.30/1.59
	N2/N1	79.1/69.7	79.9/70.4	80.6/71.1	81.4/71.8	82.2/72.4	82.9/73.1	83.7/73.7	84.4/74.4	85.1/75.0
	FF/EGT	2435/289	2464/300	2493/311	2522/323	2550/334	2579/345	2607/356	2534/367	2663/378
	RAT/TAS	-8.9/297	-3.7/300	1.5/303	6.7/305	11.9/308	17.1/311	22.3/314	27.5/317	32.7/319
	NAM/1,000	60.93	60.80	60.67	60.55	60.43	60.31	60.20	60.10	59.98
72,000 LB	MACH/IAS	0.480/260	0.480/260	0.480/260	0.480/260	0.480/260	0.480/260	0.480/260	0.480/260	0.480/260
	EPR A/L	1.30/1.91	1.30/1.87	1.30/1.83	1.30/1.79	1.30/1.74	1.30/1.70	1.30/1.66	1.30/1.63	1.30/1.59
	N2/N1	78.9/69.4	79.7/70.1	80.4/70.7	81.2/71.4	81.9/72.1	82.7/72.7	83.4/73.3	84.2/74.0	84.9/74.6
	FF/EGT	2397/287	2426/298	2455/309	2484/320	2512/332	2539/343	2567/354	2594/365	2622/376
	RAT/TAS	-8.9/297	-3.7/300	1.5/303	6.7/305	11.9/308	17.1/311	22.3/314	27.5/317	32.7/319
	NAM/1,000	61.87	61.74	61.61	61.48	61.36	61.25	61.14	61.03	60.91

LONG RANGE CRUISE – 13,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-25.8	-20.8	-15.8	-10.8	-5.8	4.2	9.2	14.2	18.2
104,000 LB	MACH/IAS	0.574/302	0.574/302	0.574/302	0.574/302	0.574/302	0.574/302	0.574/302	0.574/302	0.574/302
	EPR A/L	1.46/1.90	1.46/1.86	1.46/1.82	1.46/1.78	1.46/1.73	1.45/1.69	1.45/1.65	1.45/1.62	1.45/1.58
	N2/N1	82.7/76.4	83.5/77.1	84.3/77.9	85.1/78.6	85.9/79.4	86.7/80.1	87.5/80.8	88.3/81.6	89.1/82.3
	FF/EGT	3131/328	3169/340	3207/352	3245/364	3283/376	3320/388	3358/400	3398/412	3434/424
	RAT/TAS	-8.6/352	-3.4/356	1.9/359	7.2/363	12.5/366	17.8/370	23.0/373	28.3/376	33.6/380
	NAM/1,000	56.25	56.13	56.02	55.90	55.90	55.66	55.54	55.38	55.28
100,000 LB	MACH/IAS	0.560/294	0.560/294	0.560/294	0.560/294	0.560/294	0.560/294	0.560/294	0.560/294	0.560/294
	EPR A/L	1.43/1.91	1.43/1.87	1.43/1.83	1.43/1.78	1.43/1.74	1.43/1.70	1.43/1.66	1.43/1.62	1.43/1.59
	N2/N1	82.1/75.5	83.0/76.2	83.8/77.0	84.6/77.7	85.4/78.4	86.2/79.2	87.0/79.9	87.7/80.6	88.5/81.3
	FF/EGT	2992/321	3028/333	3065/345	3101/357	3137/369	3172/381	3208/393	3244/405	3281/417
	RAT/TAS	-9.4/343	-4.1/347	1.2/350	6.4/354	11.7/357	17.0/360	22.2/364	27.5/367	32.8/370
	NAM/1,000	57.38	57.26	57.14	57.02	56.91	56.79	56.67	56.55	56.39
96,000 LB	MACH/IAS	0.560/294	0.560/294	0.560/294	0.560/294	0.560/294	0.560/294	0.560/294	0.560/294	0.560/294
	EPR A/L	1.42/1.91	1.42/1.87	1.42/1.83	1.42/1.78	1.42/1.74	1.42/1.70	1.42/1.66	1.42/1.62	1.42/1.59
	N2/N1	82.0/75.2	82.8/75.9	83.6/76.7	84.4/77.4	85.2/78.1	86.0/78.8	86.8/79.6	87.6/80.3	88.3/81.0
	FF/EGT	2951/319	2987/331	3023/343	3058/355	3094/366	3129/378	3164/390	3199/402	3236/414
	RAT/TAS	-9.4/343	-4.1/347	1.2/350	6.4/354	11.7/357	17.0/360	22.2/364	27.5/367	32.8/370
	NAM/1,000	58.17	58.06	57.94	57.82	57.70	57.58	57.46	57.33	57.18
92,000 LB	MACH/IAS	0.544/285	0.544/285	0.544/285	0.544/285	0.544/285	0.544/285	0.544/285	0.544/285	0.544/285
	EPR A/L	1.40/1.91	1.40/1.87	1.40/1.83	1.40/1.79	1.40/1.75	1.40/1.70	1.40/1.66	1.40/1.63	1.40/1.59
	N2/N1	81.4/74.2	82.2/74.9	83.0/75.7	83.8/76.4	84.6/77.1	85.4/77.8	86.2/78.5	86.9/79.2	87.7/79.9
	FF/EGT	2809/312	2843/323	2877/335	2911/347	2944/359	2978/370	3011/382	3045/394	3078/406
	RAT/TAS	-10.1/334	-4.9/337	0.4/341	5.7/344	10.9/347	16.2/350	21.4/354	26.7/357	31.9/360
	NAM/1,000	59.43	59.31	59.19	59.06	58.95	58.83	58.70	58.58	56.45
88,000 LB	MACH/IAS	0.529/277	0.529/277	0.529/277	0.529/277	0.529/277	0.529/277	0.529/277	0.529/277	0.529/277
	EPR A/L	1.38/1.92	1.38/1.88	1.38/1.84	1.38/1.80	1.38/1.76	1.38/1.71	1.38/1.67	1.38/1.63	1.38/1.60
	N2/N1	80.9/73.3	81.7/74.0	82.5/74.7	83.3/75.5	84.1/76.2	84.8/76.8	85.6/77.5	86.4/78.2	87.1/78.9
	FF/EGT	2682/305	2714/317	2746/328	2778/340	2809/351	2840/363	2873/375	2905/386	2936/398
	RAT/TAS	-10.8/324	-5.6/328	-0.4/331	4.9/334	10.1/337	15.4/340	20.6/343	25.8/347	31.1/350
	NAM/1,000	60.46	60.35	60.23	60.13	60.02	59.93	59.78	59.65	59.53

LONG RANGE CRUISE – 13,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-25.8	-20.8	-15.8	-10.8	-5.8	4.2	9.2	14.2	18.2
84,000 LB	MACH/IAS	0.529/277	0.529/277	0.529/277	0.529/277	0.529/277	0.529/277	0.529/277	0.529/277	0.529/277
	EPR A/L	1.37/1.92	1.37/1.88	1.37/1.84	1.37/1.80	1.37/1.76	1.37/1.71	1.37/1.67	1.37/1.63	1.37/1.60
	N2/N1	80.7/73.0	81.5/73.7	82.3/74.4	83.1/75.1	83.9/75.8	84.7/76.5	85.4/77.2	86.2/77.9	86.9/78.6
	FF/EGT	2650/303	2682/314	2713/326	2744/337	2777/349	2808/361	2840/372	2871/384	2903/395
	RAT/TAS	-10.8/324	-5.6/328	-0.4/331	4.9/334	10.1/337	15.4/340	20.6/343	25.8/347	31.1/350
	NAM/1,000	61.20	61.09	60.97	60.86	60.72	60.59	60.47	60.34	60.22
80,000 LB	MACH/IAS	0.513/268	0.513/268	0.513/268	0.513/268	0.513/268	0.513/268	0.513/268	0.513/268	0.513/268
	EPR A/L	1.35/1.93	1.35/1.89	1.35/1.85	1.35/1.81	1.35/1.76	1.35/1.72	1.35/1.68	1.35/1.64	1.35/1.61
	N2/N1	80.1/71.9	80.9/72.6	81.7/73.3	82.5/74.0	83.2/74.7	84.0/75.4	84.8/76.1/	85.5/76.7	86.3/77.4
	FF/EGT	2514/296	2545/307	2575/319	2605/330	2635/342	2664/353	2693/365	2722/376	2753/387
	RAT/TAS	-11.6/315	-6.3/318	-1.1/321	4.1/324	9.3/327	14.6/330	19.8/333	25.0/336	30.2/339
	NAM/1,000	62.55	62.42	62.29	62.17	62.06	61.94	61.83	61.73	61.58
76,000 LB	MACH/IAS	0.497/260	0.497/260	0.497/260	0.497/260	0.497/260	0.497/260	0.497/260	0.497/260	0.497/260
	EPR A/L	1.33/1.93	1.33/1.89	1.33/1.85	1.33/1.81	1.33/1.77	1.33/1.73	1.33/1.68	1.33/1.65	1.33/1.61
	N2/N1	79.4/70.7	80.2/71.4	81.0/72.1	81.7/72.8	82.5/73.5	83.3/74.2	84.0/74.8	84.8/75.5	85.5/76.1
	FF/EGT	2385/289	2414/300	2443/312	2471/323	2500/334	2528/346	2555/357	2853/368	2610/379
	RAT/TAS	-12.2/305	-7.0/308	-1.8/311	3.4/314	8.6/317	13.8/320	19.0/323	24.2/326	29.4/329
	NAM/1,000	63.94	63.81	63.68	63.56	63.44	63.20	63.20	63.09	62.99
72,000 LB	MACH/IAS	0.497/260	0.497/260	0.497/260	0.497/260	0.497/260	0.497/260	0.497/260	0.497/260	0.497/260
	EPR A/L	1.32/1.93	1.32/1.89	1.32/1.85	1.32/1.81	1.32/1.77	1.32/1.73	1.32/1.68	1.32/1.65	1.32/1.61
	N2/N1	79.2/70.4	80.0/71.1	80.8/71.7	81.5/72.4	82.3/73.1	83.1/73.8	83.8/74.4	84.5/75.1	85.3/75.7
	FF/EGT	2348/287	2377/298	2405/309	2433/321	2461/322	2488/343	2516/354	2543/366	2569/377
	RAT/TAS	-12.2/305	-7.0/308	-1.8/311	3.4/314	8.6/317	13.8/320	19.0/323	24.2/326	29.4/329
	NAM/1,000	64.95	64.82	64.69	64.56	64.44	64.32	64.20	64.09	63.98

LONG RANGE CRUISE – 15,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-29.7	-24.7	-19.7	-14.7	-9.7	4.7	0.3	5.3	10.3
104,000 LB	MACH/IAS	0.592/300	0.592/300	0.592/300	0.592/300	0.592/300	0.592/300	0.592/300	0.592/300	0.592/300
	EPR A/L	1.49/1.92	1.49/1.89	1.49/1.85	1.49/1.80	1.49/1.76	1.49/1.71	1.49/1.67	1.49/1.64	1.49/1.60
	N2/N1	82.8/77.1	83.7/77.9	84.5/78.6	85.3/79.4	86.1/80.2	86.9/80.9	87.8/81.7	88.5/82.4	89.3/83.1
	FF/EGT	3067/329	3105/341	3142/353	3180/366	3217/378	3254/390	3294/403	3329/415	33.63/427
	RAT/TAS	-11.9/360	-6.6/364	-1.3/368	4.0/371	9.3/375	14.6/378	19.9/382	25.2/385	30.5/389
	NAM/1,000	58.74	58.62	58.51	58.39	58.27	58.15	57.98	57.89	57.82
100,000 LB	MACH/IAS	0.577/292	0.577/292	0.577/292	0.577/292	0.577/292	0.577/292	0.577/292	0.577/292	0.577/292
	EPR A/L	1.47/1.93	1.47/1.89	1.47/1.85	1.47/1.81	1.47/1.77	1.47/1.72	1.47/1.68	1.47/1.64	1.47/1.61
	N2/N1	82.3/76.2	83.1/77.0	84.0/77.7	84.8/78.5	85.6/79.2	86.4/80.0	87.2/80.7	88.0/81.4	88.8/82.2
	FF/EGT	2929/322	2965/334	3000/346	3036/358	3071/370	3107/383	3143/395	3176/407	3212/419
	RAT/TAS	-12.7/351	-7.4/355	-2.1/358	3.2/362	8.5/365	13.7/369	19.0/372	24.3/376	29.6/379
	NAM/1,000	59.96	59.84	59.72	59.61	59.49	59.35	59.23	59.13	59.00
96,000 LB	MACH/IAS	0.577/292	0.577/292	0.577/292	0.577/292	0.577/292	0.577/292	0.577/292	0.577/292	0.577/292
	EPR A/L	1.46/1.93	1.46/1.89	1.46/1.85	1.46/1.81	1.46/1.77	1.46/1.72	1.46/1.68	1.46/1.64	1.46/1.61
	N2/N1	82.1/75.9	83.0/76.7	83.8/77.4	84.6/78.2	85.4/78.9	86.2/79.6	87.0/80.4	87.8/81.1	88.6/81.8
	FF/EGT	2886/319	2921/332	2956/344	2991/356	3026/368	3061/380	3095/392	3130/404	3165/416
	RAT/TAS	-12.7/351	-7.4/355	-2.1/358	3.2/362	8.5/365	13.7/369	19.0/372	24.3/376	29.6/379
	NAM/1,000	60.86	60.74	60.62	60.50	60.38	60.26	60.13	60.00	59.87
92,000 LB	MACH/IAS	0.563/284	0.563/284	0.564/284	0.564/284	0.564/284	0.564/284	0.564/284	0.564/284	0.564/284
	EPR A/L	1.44/1.94	1.44/1.90	1.44/1.86	1.44/1.82	1.43/1.77	1.43/1.73	1.43/1.69	1.43/1.65	1.43/1.61
	N2/N1	81.6/75.0	82.4/75.7	83.2/76.5	84.0/77.2	84.8/78.0	85.6/78.7	86.4/79.4	87.2/80.1	88.0/80.8
	FF/EGT	2754/312	2787/324	2820/336	2853/348	2887/360	2920/372	2953/384	2986/396	3019/408
	RAT/TAS	-13.4/342	-8.1/346	-2.8/349	2.4/353	7.7/356	13.0/360	18.2/363	23.5/366	28.8/369
	NAM/1,000	62.18	62.06	61.82	61.82	61.70	61.58	61.45	61.32	61.19
88,000 LB	MACH/IAS	0.547/276	0.547/276	0.547/276	0.547/276	0.547/276	0.547/276	0.547/276	0.547/276	0.547/276
	EPR A/L	1.41/1.94	1.41/1.90	1.41/1.87	1.41/1.82	1.41/1.78	1.41/1.74	1.41/1.69	1.41/1.66	1.41/1.62
	N2/N1	81.0/74.0	81.8/74.7	82.6/75.5	83.4/76.2	84.2/76.9	85.0/77.7	85.8/78.4	86.6/79.1	87.4/79.8
	FF/EGT	2620/305	2652/317	2683/329	2715/341	2746/352	2778/364	2809/376	2841/388	2872/400
	RAT/TAS	-14.1/333	-8.9/336	-3.6/340	1.6/343	6.9/346	12.1/350	17.4/353	22./356	27.9/359
	NAM/1,000	63.55	63.43	63.32	63.20	63.07	62.95	62.82	62.69	62.55

LONG RANGE CRUISE – 15,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-29.7	-24.7	-19.7	-14.7	-9.7	-4.7	0.3	5.3	10.3
84,000 LB	MACH/IAS	0.547/276	0.547/276	0.547/276	0.547/276	0.547/276	0.547/276	0.547/276	0.547/276	0.547/276
	EPR A/L	1.40/1.94	1.40/1.90	1.40/1.87	1.40/1.82	1.40/1.78	1.40/1.74	1.40/1.69	1.40/1.66	1.40/1.62
	N2/N1	80.8/73.7	81.6/74.4	82.4/75.1	83.3/75.9	84.0/76.6	84.8/77.3	85.6/78.0	86.4/78.7	87.2/79.4
	FF/EGT	2579/303	2611/315	2642/326	2678/338	2704/350	2735/362	2766/373	2797/385	2828/397
	RAT/TAS	-14.1/333	-8.9/336	-3.6/340	1.6/343	6.9/346	12.1/350	17.4/353	22.7/356	27.9/359
	NAM/1,000	64.55	64.43	64.31	64.19	64.06	63.94	63.81	63.67	63.54
80,000 LB	MACH/IAS	0.531/268	0.531/268	0.531/268	0.531/268	0.531/268	0.531/268	0.531/268	0.531/268	0.531/268
	EPR A/L	1.38/1.95	1.38/1.91	1.38/1.87	1.38/1.83	1.38/1.79	1.38/1.75	1.38/1.70	1.38/1.66	1.38/1.63
	N2/N1	80.3/72.7	81.1/73.4	81.9/74.2	82.7/74.9	83.5/75.6	84.3/76.3	85.0/77.0	85.8/77.7	86.6/78.4
	FF/EGT	2452/296	2484/307	2513/319	2542/331	2571/342	2599/354	2628/365	2659/377	2688/389
	RAT/TAS	-14.9/323	-9.6/326	-4.4/330	0.8/333	6.1/336	11.3/339	16.5/342	21.8/345	27.0/348
	NAM/1,000	65.85	65.69	65.57	65.46	65.35	65.24	65.14	64.96	64.82
76,000 LB	MACH/IAS	0.516/260	0.516/260	0.516/260	0.516/260	0.516/260	0.516/260	0.516/260	0.516/260	0.516/260
	EPR A/L	1.36/1.95	1.36/1.92	1.36/1.88	1.36/1.84	1.36/1.79	1.36/1.75	1.36/1.71	1.36/1.67	1.36/1.63
	N2/N1	79.6/71.6	80.4/72.3	81.2/73.1	82.0/73.8	82.8/74.5	83.6/75.2	84.4/75.8	85.1/76.5	85.9/77.2
	FF/EGT	2332/289	2362/300	2390/312	2418/323	2446/335	2474/346	2501/358	2528/369	2555/381
	RAT/TAS	-15.6/314	-10.3/317	-5.1/320	0.1/323	5.3/326	10.6/330	15.8/333	21.0/336	26.1/339
	NAM/1,000	67.29	67.12	66.99	66.86	66.74	66.61	66.49	66.38	66.27
72,000 LB	MACH/IAS	0.516/260	0.516/260	0.516/260	0.516/260	0.516/260	0.516/260	0.516/260	0.516/260	0.516/260
	EPR A/L	1.35/1.95	1.35/1.92	1.35/1.88	1.35/1.84	1.35/1.79	1.35/1.75	1.35/1.71	1.35/1.67	1.35/1.63
	N2/N1	79.4/71.3	80.2/72.0	81.0/72.7	81.8/73.4	82.6/74.1	83.4/74.8	84.1/75.5	84.9/76.1	85.6/76.8
	FF/EGT	2297/287	2324/298	2352/310	2380/321	2407/333	2434/344	2461/355	2488/367	2514/378
	RAT/TAS	-15.6/314	-10.3/317	-5.1/320	0.1/323	5.3/326	10.6/330	15.8/333	21.0/336	26.2/339
	NAM/1,000	68.33	68.21	68.08	67.95	67.69	67.69	67.57	67.45	67.35

LONG RANGE CRUISE – 17,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-33.7	-28.7	-23.7	-18.7	-13.7	-8.7	-3.7	1.3	6.3
104,000 LB	MACH/IAS	0.611/298	0.611/298	0.611/298	0.611/298	0.611/298	0.611/298	0.611/298	0.611/298	0.611/298
	EPR A/L	1.53/1.95	1.53/1.91	1.53/1.87	1.53/1.83	1.53/1.78	1.53/1.74	1.53/1.70	1.53/1.66	1.53/1.62
	N2/N1	83.0/77.8	83.8/78.6	84.7/79.4	85.5/80.2	86.3/80.9	87.2/81.7	88.0/82.5	88.8/83.2	89.6/84.0
	FF/EGT	3012/331	3049/343	3086/356	3123/368	3160/381	3196/393	3233/406	3270/418	3307/431
	RAT/TAS	-15.1/369	-9.8/373	-4.5/377	0.8/380	6.1/384	11.4/388	16.8/391	22.1/395	27.4/399
	NAM/1,000	61.23	61.11	61.00	60.89	60.77	60.64	60.52	60.39	60.26
100,000 LB	MACH/IAS	0.596/290	0.596/290	0.596/290	0.596/290	0.596/290	0.596/290	0.596/290	0.596/290	0.596/290
	EPR A/L	1.51/1.95	1.51/1.92	1.51/1.88	1.50/1.83	1.50/1.79	1.50/1.75	1.50/1.70	1.50/1.66	1.50/1.63
	N2/N1	82.4/76.9	83.3/77.7	84.1/78.5	85.0/79.3	85.8/80.0	86.6/80.8	87.4/81.5	88.2/82.3	89.0/83.0
	FF/EGT	2868/323	2903/335	2938/347	2973/360	3007/372	3042/384	3077/397	3112/409	3147/422
	RAT/TAS	-15.9/360	-10.6/363	-5.3/367	0.0/371	5.3/374	10.6/378	15.9/381	21.2/385	26.5/388
	NAM/1,000	62.69	62.57	62.46	62.34	62.22	62.10	61.97	61.84	61.70
96,000 LB	MACH/IAS	0.596/290	0.596/290	0.596/290	0.596/290	0.596/290	0.596/290	0.596/290	0.596/290	0.596/290
	EPR A/L	1.50/1.95	1.50/1.92	1.49/1.88	1.49/1.83	1.49/1.79	1.49/1.75	1.49/1.70	1.49/1.66	1.49/1.63
	N2/N1	82.3/76.7	83.4/77.4	84.0/78.2	84.8/78.9	85.6/79.7	86.4/80.5	87.2/81.2	88.0/82.0	88.8/82.7
	FF/EGT	2826/320	2860/333	2895/345	2929/357	2964/370	2998/382	3033/394	3067/407	3104/419
	RAT/TAS	-15.9/360	-10.6/363	-5.3/367	0.0/371	5.3/374	10.6/378	15.9/381	21.2/385	26.5/388
	NAM/1,000	63.62	63.50	63.39	63.26	63.14	63.01	62.88	62.74	62.57
92,000 LB	MACH/IAS	0.581/283	0.581/283	0.581/283	0.581/283	0.581/283	0.581/283	0.581/283	0.581/283	0.581/283
	EPR A/L	1.47/1.96	1.47/1.92	1.47/1.88	1.47/1.84	1.47/1.80	1.47/1.76	1.47/1.71	1.47/1.67	1.47/1.63
	N2/N1	81.7/75.7	82.6/76.5	83.4/77.3	84.2/78.0	85.1/78.8	85.9/79.5	86.7/80.3	87.5/81.0	88.3/81.7
	FF/EGT	2697/313	2730/326	2763/338	2796/350	2829/362	2862/374	2894/386	2927/399	2960/411
	RAT/TAS	-16.7/351	-11.4/354	-6.1/358	-0.8/362	4.5/365	9.8/369	15.1/372	20.3/376	25.6/379
	NAM/1,000	65.03	64.91	64.79	64.67	65.54	64.41	64.28	64.15	64.01
88,000 LB	MACH/IAS	0.565/275	0.565/275	0.565/275	0.565/275	0.565/275	0.565/275	0.565/275	0.565/275	0.565/275
	EPR A/L	1.45/1.96	1.45/1.93	1.45/1.89	1.45/1.85	1.45/1.81	1.45/1.76	1.45/1.72	1.44/1.68	1.44/1.64
	N2/N1	81.2/74.8	82.0/75.5	82.8/76.3	83.6/77.0	84.5/77.8	85.3/78.5	86.1/79.2	86.8/80.0	87.6/80.7
	FF/EGT	2563/306	2595/318	2626/330	2657/342	2688/354	2719/366	2751/378	2782/390	2813/402
	RAT/TAS	-17.4/341	-12.2/345	-6.9/348	-1.6/352	3.6/355	8.9/359	14.2/362	19.5/365	24.7/369
	NAM/1,000	66.54	66.42	66.30	66.18	66.05	65.92	65.78	65.65	65.51

LONG RANGE CRUISE – 17,000 FEET

GROSS	OPERATING	OAT °C AMBIENT								
WEIGHT	PARAMETERS	-33.7	-28.7	-23.7	-18.7	-13.7	-8.7	-3.7	1.3	6.3
	MACH/IAS	0.565/275	0.565/275	0.565/275	0.565/275	0.565/275	0.565/275	0.565/275	0.565/275	0.565/275
	EPR A/L	1.44/1.96	1.44/1.93	1.44/1.89	1.44/1.85	1.43/1.81	1.43/1.76	1.43/1.72	1.43/1.68	1.43/1.64
84,000	N2/N1	81.0/74.4	81.8/75.2	82.6/75.9	83.4/76.7	84.3/76.7	85.1/78.1	85.9/78.9	86.6/79.6	87.4/80.3
LB	FF/EGT	2522/303	2553/315	2583/327	2614/339	2614/351	2675/363	2706/375	2737/387	2768/399
	RAT/TAS	-17.4/341	-12.2/345	-6.9/348	-1.6/352	3.6/355	8.9/359	14.2/362	19.5/365	24.7/369
	NAM/1,000	67.63	67.51	67.39	67.26	67.13	67.00	66.86	66.72	66.58
	MACH/IAS	0.549/267	0.549/267	0.549/267	0.549/267	0.549/267	0.549/267	0.549/267	0.549/267	0.549/267
	EPR A/L	1.41/1.97	1.41/1.93	1.41/1.90	1.41/1.86	1.41/1.81	1.41/1.77	1.41/1.73	1.41/1.69	1.41/1.65
80,000	N2/N1	80.4/73.4	81.2/74.1	82.0/74.9	82.8/75.6	83.6/76.3	84.4/77.0	85.2/77.8	86.0/78.5	86.8/79.2
LB	FF/EGT	2391/296	2420/308	2449/319	2478/331	2507/343	2536/355	2565/367	2594/378	2623/390
	RAT/TAS	-18.2/331	-13.0/335	-7.7/338	-2.5/341	2.8/345	8.1/348	13.3/351	18.6/355	23.8/358
	NAM/1,000	69.27	69.14	69.02	68.89	68.76	68.62	68.49	68.34	68.20
	MACH/IAS	0.535/259	0.535/259	0.535/259	0.535/259	0.535/259	0.535/259	0.535/259	0.535/259	0.535/259
	EPR A/L	1.39/1.97	1.39/1.94	1.39/1.90	1.39/1.86	1.39/1.82	1.39/1.78	1.39/1.73	1.39/1.69	1.39/1.65
76,000	N2/N1	79.9/72.5	80.7/73.2	81.5/74.0	82.3/74.7	83.1/75.4	83.9/76.1	84.7/76.8	85.5/77.5	86.2/78.2
LB	FF/EGT	2283/289	2311/301	2338/313	2366/324	2394/336	2422/348	2451/359	2477/371	2503/383
	RAT/TAS	-18.9/323	-13.6/326	-8.4/329	-3.1/333	2.1/336	7.4/339	12.6/342	17.8/346	23.1/349
	NAM/1,000	70.69	70.57	70.44	70.31	70.17	70.03	69.85	69.74	69.64
	MACH/IAS	0.535/259	0.535/259	0.535/259	0.535/259	0.535/259	0.535/259	0.535/259	0.535/259	0.535/259
	EPR A/L	1.38/1.97	1.38/1.94	1.38/1.90	1.38/1.86	1.38/1.82	1.38/1.78	1.38/1.73	1.38/1.69	1.38/1.65
72,000	N2/N1	79.7/72.1	80.5/72.9	81.3/73.6	82.1/74.3	82.9/75.0	83.7/75.7	84.5/76.4	85.2/77.1	86.0/77.8
LB	FF/EGT	2245/287	80.5/72.9	2301/310	2328/322	2355/333	2382/345	2408/357	2436/368	2463/380
	RAT/TAS	-18.9/323	2273/299	-8.4/329	-3.1/333	2.1/336	7.4/339	12.6/342	17.8/346	23.1/349
	NAM/1,000	71.87	71.74	71.57	71.44	71.32	71.20	71.08	70.92	70.77

LONG RANGE CRUISE – 19,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-37.6	-32.6	-27.6	-22.6	-17.6	-12.6	-7.6	-2.6	2.4
104,000 LB	MACH/IAS	0.630/296	0.630/296	0.630/296	0.630/296	0.630/296	0.630/296	0.630/296	0.630/296	0.630/296
	EPR A/L	1.57/1.97	1.57/1.93	1.57/1.89	1.57/1.85	1.57/1.81	1.57/1.76	1.57/1.72	1.57/1.68	1.57/1.64
	N2/N1	83.1/78.4	84.0/79.2	84.8/80.0	85.7/80.8	86.5/81.6	87.4/82.4	88.2/83.2	89.0/84.0	89.8/84.7
	FF/EGT	2950/332	2987/344	3023/357	3060/370	3096/383	3132/395	3169/408	3208/421	3244/434
	RAT/TAS	-18.4/377	-13.0/381	-7.7/385	-2.4/389	3.0/393	8.3/397	13.6/400	19.0/404	24.3/408
	NAM/1,000	63.92	63.81	63.69	63.58	63.45	63.32	63.19	63.01	62.89
100,000 LB	MACH/IAS	0.615/288	0.615/288	0.615/288	0.615/288	0.615/288	0.615/288	0.615/288	0.615/288	0.615/288
	EPR A/L	1.55/1.97	1.55/1.94	1.55/1.90	1.55/1.86	1.55/1.82	1.55/1.77	1.55/1.73	1.55/1.69	1.54/1.65
	N2/N1	82.6/77.6	83.4/78.4	84.3/79.2	85.1/80.0	86.0/80.8	86.8/81.6	87.6/82.3	88.5/83.1	89.3/83.8
	FF/EGT	2813/324	2848/337	2883/350	2917/362	2952/375	2987/387	3021/400	3056/413	3091/425
	RAT/TAS	-19.2/368	-13.9/372	-8.5/376	-3.2/379	2.1/383	7.4/387	12.7/301	18.1/394	23.4/398
	NAM/1,000	65.39	65.28	65.16	65.04	64.91	64.78	64.65	64.52	64.38
96,000 LB	MACH/IAS	0.615/288	0.615/288	0.615/288	0.615/288	0.615/288	0.615/288	0.615/288	0.615/288	0.615/288
	EPR A/L	1.54/1.97	1.54/1.94	1.54/1.90	1.54/1.86	1.54/1.82	1.53/1.77	1.53/1.73	1.53/1.69	1.53/83.5
	N2/N1	82.4/77.3	83.3/78.1	84.1/78.9	85.0/79.7	86.8/80.5	86.6/81.2	87.5/82.0	88.3/82.8	3044/422
	FF/EGT	2771/322--	2805/335	2840/347	2874/360	2908/372	2942/385	2976/397	3010/410	23.4/398
	RAT/TAS	19.2/368	-13.9/372	-8.5/376	-3.2/379	2.1/383	7.4/387	12.7/391	18.1/394	65.35
	NAM/1,000	66.38	66.26	66.14	66.02	65.90	65.76	65.63	65.49	
92,000 LB	MACH/IAS	0.600/281	0.600/281	0.600/281	0.600/281	0.600/281	0.600/281	0.600/281	0.600/281	0.600/281
	EPR A/L	1.51/1.98	1.51/1.94	1.51/1.91	1.51/1.87	1.51/1.82	1.51/1.78	1.51/1.74	1.51/1.69	1.51/1.65
	N2/N1	81.8/76.3	82.7/77.1	83.5/77.9	84.4/78.7	85.2/79.5	86.0/80.2	86.8/81.0	87.6/81.8	88.4/82.5
	FF/EGT	2631/314	2664/327	2696/339	2729/351	2761/364	2793/376	2826/388	2858/401	2890/413
	RAT/TAS	-19.9/359	-14.6/363	-9.3/366	-4.0/370	1.3/374	6.6/378	11.9/381	17.2/385	22.5/388
	NAM/1,000	68.20	68.09	67.96	67.84	67.71	67.58	67.44	67.30	67.16
88,000 LB	MACH/IAS	0.583/273	0.583/273	0.583/273	0.583/273	0.583/273	0.583/273	0.583/273	0.583/273	0.583/273
	EPR A/L	1.48/1.98	1.48/1.95	1.48/1.91	1.48/1.87	1.48/1.83	1.48/1.79	1.48/1.75	1.48/1.70	1.48/1.66
	N2/N1	81.3/75.5	82.2/76.3	83.0/77.0	83.8/77.8	84.7/78.6	85.5/79.3	86.3/80.1	87.1/80.8	87.9/81.6
	FF/EGT	2507/307	2538/319	2569/331	2600/343	2630/356	2661/386	2692/380	2723/392	2754/405
	RAT/TAS	-20.8/349	-15.5/353	-10.2/356	-4.9/360	0.4/364	5.7/367	11.0/371	16.3/374	21.6/378
	NAM/1,000	69.62	60.50	69.37	69.24	69.11	68.98	68.84	68.69	68.55

LONG RANGE CRUISE – 19,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-37.6	-32.6	-27.6	-22.6	-17.6	-12.6	-7.6	-2.6	2.4
84,000 LB	MACH/IAS	0.583/273	0.583/273	0.583/273	0.583/273	0.583/273	0.583/273	0.583/273	0.583/273	0.583/273
	EPR A/L	1.47/1.98	1.47/1.95	1.47/1.91	1.47/1.87	1.47/1.83	1.47/1.79	1.47/1.75	1.47/1.70	1.47/1.66
	N2/N1	81.1/75.1	82.0/75.9	82.8/76.7	83.6/77.4	84.5/78.2	85.3/79.0	86.1/79.7	86.9/80.4	87.7/81.2
	FF/EGT	2465/304	2495/316	2525/328	2556/341	2586/353	2616/365	2646/377	2677/389	2707/402
	RAT/TAS	-20.8/349	-15.5/353	-10.2/356	-4.9/360	0.4/364	5.7/367	11.0/371	16.3/374	21.6/378
	NAM/1,000	70.82	70.70	70.57	70.44	70.31	70.17	70.03	69.88	69.73
80,000 LB	MACH/IAS	0.567/265	0.567/265	0.567/265	0.567/265	0.567/265	0.567/265	0.567/265	0.567/265	0.567/265
	EPR A/L	1.45/1.99	1.45/1.95	1.44/1.92	1.44/1.88	1.44/1.84	1.44/1.80	1.44/1.75	1.44/1.71	1.44/1.67
	N2/N1	80.5/74.1	81.4/74.9	82.2/75.7	83.0/76.4	83.8/77.2	84.6/77.9	85.5/78.6	86.2/79.4	87.0/80.1
	FF/EGT	2339/296	2368/309	2396/321	2425/333	2454/345	2482/357	2511/369	2540/381	2569/393
	RAT/TAS	-21.5/340	-16.2/343	-11.0/347	-5.7/350	-0.4/354	4.8/357	10.1/360	15.4/364	20.7/367
	NAM/1,000	72.58	72.46	72.33	72.19	72.06	71.92	71.77	71.63	71.48
76,000 LB	MACH/IAS	0.554/259	0.554/259	0.554/259	0.554/259	0.554/259	0.554/259	0.554/259	0.554/259	0.554/259
	EPR A/L	1.42/1.99	1.42/1.96	1.42/1.92	1.42/1.89	1.42/1.85	1.42/1.80	1.42/1.76	1.42/1.72	1.42/1.67
	N2/N1	80.0/73.2	80.8/74.0	81.6/74.7	82.5/75.5	83.3/76.2	84.1/76.9	84.9/77.7	85.7/78.4	86.4/79.1
	FF/EGT	2230/290	2257/302	2285/313	2312/325	2339/337	2367/349	2394/361	2421/373	2449/385
	RAT/TAS	-22.1/331	-16.9/335	-11.6/338	-6.4/342	-1.1/345	4.1/349	9.4/352	14.7/355	19.9/358
	NAM/1,000	74.32	74.19	74.06	73.92	73.79	73.64	73.50	73.35	73.20
72,000 LB	MACH/IAS	0.554/259	0.554/259	0.554/259	0.554/259	0.554/259	0.554/259	0.554/259	0.554/259	0.554/259
	EPR A/L	1.41/1.99	1.41/1.96	1.41/1.92	1.41/1.89	1.41/1.85	1.41/1.80	1.41/1.76	1.41/1.72	1.41/1.67
	N2/N1	79.8/72.8	80.6/73.6	81.4/74.3	82.2/75.1	83.0/75.8	83.9/76.5	84.6/77.3	85.4/78.0	86.2/78.7
	FF/EGT	2190/287	2217/299	2244/311	2271/323	2290/334	2325/346	2352/358	2379/370	2405/382
	RAT/TAS	-22.1/331	-16.9/335	-11.6/338	-6.4/342	-1.1/345	4.1/349	9.4/352	14.7/355	19.9/358
	NAM/1,000	75.65	75.52	75.39	75.25	75.11	74.97	74.82	74.67	74.51

LONG RANGE CRUISE – 21,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-41.6	-36.6	-31.6	-26.6	-21.6	-16.6	-11.6	-6.6	-1.6
104,000 LB	MACH/IAS	0.648/293	0.648/293	0.648/293	0.648/293	0.648/293	0.648/293	0.648/293	0.648/293	0.648/293
	EPR A/L	1.61/1.99	1.61/1.95	1.61/1.92	1.61/1.88	1.61/1.83	1.61/1.79	1.61/1.75	1.61/1.70	1.61/1.66
	N2/N1	83.2/78.9	84.1/79.8	85.0/80.6	85.9/81.4	86.7/82.2	87.6/83.0	88.4/83.8	89.3/84.6	90.1/85.4
	FF/EGT	2888/333	2925/346	2959/359	2995/372	3032/385	3069/398	3105/411	3142/424	3178/437
	RAT/TAS	-21.7/385	-16.3/389	-11.0/393	-5.6/397	-0.2/401	5.1/405	10.5/409	15.8/413	21.2/417
	NAM/1,000	66.59	66.47	66.40	66.26	66.12	65.98	65.83	65.83	65.54
100,000 LB	MACH/IAS	0.634/286	0.634/286	0.634/286	0.634/286	0.634/286	0.634/286	0.634/286	0.634/286	0.634/286
	EPR A/L	1.59/1.99	1.59/1.96	1.59/1.92	1.59/1.88	1.59/1.84	1.59/1.80	1.59/1.75	1.59/1.71	1.59/1.67
	N2/N1	82.7/78.3	83.6/79.1	84.5/79.9	85.4/80.7	86.2/81.5	87.1/82.3	87.9/83.1	88.7/83.9	89.6/84.7
	FF/EGT	2762/326	2797/339	2831/352	2865/364	2900/377	2934/390	2969/403	3005/416	3039/429
	RAT/TAS	-22.4/376	-17.1/380	-11.7/384	-6.4/388	-1.0/392	4.3/396	9.6/400	15.0/404	20.3/408
	NAM/1,000	68.14	68.02	67.89	67.77	67.64	67.51	67.37	67.18	67.06
96,000 LB	MACH/IAS	0.634/286	0.634/286	0.634/286	0.634/286	0.634/286	0.634/286	0.634/286	0.634/286	0.634/286
	EPR A/L	1.58/1.99	1.58/1.96	1.58/1.92	1.58/1.88	1.57/1.84	1.57/1.80	1.57/1.75	1.57/1.71	1.57/1.67
	N2/N1	82.5/77.9	83.4/78.7	84.3/79.6	85.2/80.4	86.0/81.2	86.9/82.0	87.7/82.8	88.5/83.5	89.3/84.3
	FF/EGT	2715/323	2749/336	2783/349	2817/362	2850/374	2884/387	2918/400	2952/413	2988/426
	RAT/TAS	-22.4/376	-17.1/380	-11.7/384	-6.4/388	-1.0/392	4.3/396	9.6/400	15.0/404	20.3/408
	NAM/1,000	69.32	69.19	69.07	68.94	68.81	68.68	68.40	68.40	68.21
92,000 LB	MACH/IAS	0.619/279	0.619/279	0.619/279	0.619/279	0.619/279	0.619/279	0.619/279	0.619/279	0.619/279
	EPR A/L	1.55/2.00	1.55/1.96	1.55/1.93	1.55/1.89	1.55/1.85	1.55/1.80	1.55/1.76	1.55/1.72	1.55/1.67
	N2/N1	82.0/77.1	82.9/77.9	83.7/78.7	84.6/79.5	85.5/80.3	86.3/81.1	87.1/81.9	87.9/82.6	88.8/83.4
	FF/EGT	2587/316	2619/329	2652/341	2684/354	2716/366	2748/379	2780/392	2812/404	2845/417
	RAT/TAS	-23.2/367	-17.8/371	-12.5/375	-7.2/379	-1.9/383	3.5/387	8.8/391	14.1/394	19.4/398
	NAM/1,000	71.03	70.90	70.78	70.65	70.52	70.38	70.24	70.10	69.95
88,000 LB	MACH/IAS	0.602/271	0.602/271	0.602/271	0.602/271	0.602/271	0.602/271	0.602/271	0.602/271	0.602/271
	EPR A/L	1.53/2.00	1.52/1.97	1.52/1.93	1.52/1.90	1.52/1.86	1.52/1.81	1.52/1.77	1.52/1.73	1.52/1.68
	N2/N1	81.4/76.2	82.3/77.0	83.2/77.8	84.0/78.6	84.9/79.4	85.7/80.2	86.5/80.9	87.3/81.7	88.1/82.4
	FF/EGT	2457/308	2488/321	2518/333	2549/346	2579/358	2610/371	2640/383	2671/396	2701/408
	RAT/TAS	-24.0/357	-18.7/361	-13.4/365	-8.1/369	-2.8/373	2.5/376	7.8/380		18.4/387
	NAM/1,000	72.73	72.61	72.48	72.35	72.21	72.08	71.93	71.79	71.64

LONG RANGE CRUISE – 21,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-41.6	-36.6	-31.6	-26.6	-21.6	-16.6	-11.6	-6.6	-1.6
84,000 LB	MACH/IAS	0.602/271	0.602/271	0.602/271	0.602/271	0.602/271	0.602/271	0.602/271	0.602/271	0.602/271
	EPR A/L	1.51/2.00	1.51/1.97	1.51/1.93	1.51/1.90	1.51/1.86	1.51/1.81	1.51/1.77	1.51/1.73	1.51/1.68
	N2/N1	81.2/75.8	82.1/76.6	83.0/77.4	83.8/78.2	84.6/79.0	85.5/79.8	86.3/80.5	87.1/81.3	87.9/82.0
	FF/EGT	2412/305	2442/318	2572/330	2502/343	2532/355	2562/368	2592/380	2622/392	2652/405
	RAT/TAS	-24.0/357	-18.7/361	-13.4/365	-8.1/369	-2.8/373	2.5/376	7.8/380	13.1/383	18.4/387
	NAM/1,000	74.08	73.95	73.82	73.69	73.55	73.41	73.27	73.12	72.97
80,000 LB	MACH/IAS	0.586/264	0.586/264	0.586/264	0.586/264	0.586/264	0.586/264	0.586/264	0.586/264	0.586/264
	EPR A/L	1.48/2.01	1.48/1.97	1.48/1.94	1.48/1.90	1.48/1.86	1.48/1.82	1.48/1.78	1.48/1.73	1.48/1.69
	N2/N1	80.7/74.9	81.5/75.7	82.4/76.5	83.2/77.2	84.1/78.0	84.9/78.8	85.7/79.5	86.5/80.3	87.3/81.0
	FF/EGT	2289/297	2318/310	2346/322	2375/334	2403/346	2432/359	2460/371	2488/383	2517/395
	RAT/TAS	-24.8/348	-19.5/352	-14.2/355	-8.9/359	-3.6/363	1.7/366	6.9/370	12.2/373	17.5/377
	NAM/1,000	75.99	75.86	75.72	75.58	75.44	75.30	75.15	75.00	74.85
76,000 LB	MACH/IAS	0.574/258	0.574/258	0.574/258	0.574/258	0.574/258	0.574/258	0.574/258	0.574/258	0.574/258
	EPR A/L	1.46/2.01	1.46/1.98	1.46/1.94	1.46/1.91	1.46/1.87	1.46/1.83	1.46/1.78	1.46/1.74	1.46/1.70
	N2/N1	80.2/74.0	81.0/74.8	81.9/75.6	82.7/76.4	83.5/77.1	84.4/77.9	85.2/78.6	86.0/79.3	86.8/80.1
	FF/EGT	2189/291	2217/303	2244/315	2271/327	2298/339	2325/352	2352/364	2380/376	2407/388
	RAT/TAS	-25.4/341	-20.1/344	-14.8/348	-9.5/352	-4.3/355	1.0/359	6.3/362	11.6/366	16.9/369
	NAM/1,000	77.83	77.70	77.56	77.42	77.28	77.13	76.98	76.83	76.67
72,000 LB	MACH/IAS	0.574/258	0.574/258	0.574/258	0.574/258	0.574/258	0.574/258	0.574/258	0.574/258	0.574/258
	EPR A/L	1.45/2.01	1.45/1.98	1.45/1.94	1.45/1.91	1.45/1.87	1.45/1.83	1.45/1.78	1.44/1.74	1.44/1.70
	N2/N1	79.9/73.6	80.8/74.4	81.6/75.2	82.5/76.0	83.3/76.7	84.1/77.5	84.9/78.2	85.7/78.9	86.5/79.7
	FF/EGT	2149/288	2176/300	2203/312	2229/324	2256/336	2283/348	2309/361	2336/373	2362/385
	RAT/TAS	-25.4/341	-20.1/344	-14.8/348	-9.5/352	-4.3/355	1.0/359	6.3/362	11.6/366	16.9/369
	NAM/1,000	79.28	79.15	79.01	78.87	78.72	78.58	78.42	78.27	78.11

LONG RANGE CRUISE – 23,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-45.6	-40.6	-35.6	-30.6	-25.6	-20.6	-15.6	-10.6	-5.6
104,000 LB	MACH/IAS	0.664/289	0.664/289	0.664/289	0.664/289	0.664/289	0.664/289	0.664/289	0.664/289	0.664/289
	EPR A/L	1.65/2.01	1.65/1.97	1.65/1.94	1.65/1.90	1.65/1.86	1.65/1.82	1.65/1.77	1.65/1.73	1.65/1.68
	N2/N1	83.3/79.3	84.2/80.2	85.1/81.0	86.0/81.8	86.8/82.7	87.7/83.5	88.6/84.3	89.4/85.1	90.3/85.9
	FF/EGT	2813/334	2849/347	2884/360	2920/373	2956/387	2992/400	3027/413	3063/426	3099/440
	RAT/TAS	-25.1/391	-19.7/395	-14.3/399	-8.9/403	-3.6/408	1.8/412	7.2/416	12.6/420	17.9/424
	NAM/1,000	69.46	69.34	69.22	69.09	68.95	68.81	68.66	68.52	68.37
100,000 LB	MACH/IAS	0.654/284	0.654/284	0.654/284	0.654/284	0.654/284	0.654/284	0.654/284	0.654/284	0.654/284
	EPR A/L	1.63/2.01	1.63/1.98	1.63/1.94	1.63/1.90	1.63/1.86	1.63/1.82	1.63/1.78	1.63/1.73	1.63/1.69
	N2/N1	82.9/78.7	83.8/79.6	84.7/80.4	85.5/81.2	86.4/82.1	87.3/82.9	88.1/83.7	89.0/84.5	89.8/85.3
	FF/EGT	2708/327	2742/341	2776/354	2811/367	2846/380	2880/393	2915/406	2950/419	2984/433
	RAT/TAS	-25.6/385	-20.3/389	-14.9/393	-9.5/397	-4.2/401	1.2/405	6.6/409	11.9/413	17.3/417
	NAM/1,000	71.02	70.90	70.77	70.63	70.49	70.34	70.19	70.03	69.88
96,000 LB	MACH/IAS	0.654/284	0.654/284	0.654/284	0.654/284	0.654/284	0.654/284	0.654/284	0.654/284	0.654/284
	EPR A/L	1.62/2.01	1.62/1.98	1.62/1.94	1.62/1.90	1.62/1.86	1.62/1.82	1.62/1.78	1.62/1.73	1.62/1.69
	N2/N1	82.7/78.4	83.6/79.3	84.5/80.1	85.3/80.9	86.2/81.8	87.1/82.6	87.9/83.4	88.8/84.2	89.6/85.0
	FF/EGT	2662/325	2696/338	2729/351	2761/364	2795/377	2829/390	2863/403	2898/416	2931/429
	RAT/TAS	-25.6/385	-20.3/389	-14.9/393	-9.5/397	-4.2/401	1.2/405	6.6/409	11.9/413	17.3/417
	NAM/1,000	72.24	72.12	71.99	71.91	71.76	71.61	71.45	71.29	71.13
92,000 LB	MACH/IAS	0.639/277	0.639/277	0.639/277	0.639/277	0.639/277	0.639/277	0.639/277	0.639/277	0.639/277
	EPR A/L	1.59/2.01	1.59/1.98	1.59/1.95	1.59/1.91	1.59/1.87	1.59/1.83	1.59/1.79	1.59/1.74	1.59/1.70
	N2/N1	82.2/77.8	83.1/78.6	84.0/79.4	84.8/80.3	85.7/81.1	86.5/81.9	87.4/82.7	88.2/83.5	89.1/84.3
	FF/EGT	2542/318	2574/331	2606/343	2639/356	2669/369	2701/382	2733/395	2765/408	2799/421
	RAT/TAS	-26.4/376	-21.0/380	-15.7/384	-10.3/388	-5.0/392	0.4/396	5.7/400	11.1/404	16.4/408
	NAM/1,000	73.98	73.85	73.71	73.57	73.48	73.34	73.20	73.06	72.85
88,000 LB	MACH/IAS	0.623/270	0.623/270	0.623/270	0.623/270	0.623/270	0.623/270	0.623/270	0.623/270	0.623/270
	EPR A/L	1.57/2.02	1.57/1.99	1.57/1.95	1.57/1.92	1.57/1.88	1.57/1.84	1.57/1.79	1.57/1.75	1.57/1.71
	N2/N1	81.6/76.9	82.5/77.7	83.4/78.5	84.2/79.3	85.1/80.1	85.9/80.9	86.8/81.7	87.6/82.5	88.4/83.3
	FF/EGT	2410/310	2440/322	2474/335	2504/348	2534/360	2565/373	2595/386	2625/399	2655/411
	RAT/TAS	-27.2/366	-21.9/370	-16.6/374	-11.2/378	-5.9/382	-0.6/386	4.8/390	10.1/394	15.4/397
	NAM/1,000	76.02	75.89	75.66	75.53	75.39	75.25	75.11	74.96	74.81

LONG RANGE CRUISE – 23,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-45.6	-40.6	-35.6	-30.6	-25.6	-20.6	-15.6	-10.6	-5.6
84,000 LB	MACH/IAS	0.623/270	0.623/270	0.623/270	0.623/270	0.623/270	0.623/270	0.623/270	0.623/270	0.623/270
	EPR A/L	1.55/2.02	1.55/1.99	1.55/1.95	1.55/1.92	1.55/1.88	1.55/1.84	1.55/1.79	1.55/1.75	1.55/1.71
	N2/N1	81.4/76.5	82.3/77.3	83.1/78.2	84.0/79.0	84.9/79.8	85.7/80.6	86.6/81.3	87.4/82.1	88.2/82.9
	FF/EGT	2366/307	2396/320	2426/332	2456/345	2486/357	2515/370	2545/383	2575/395	2604/408
	RAT/TAS	-27.2/366	-21.9/370	-16.6/374	-11.2/378	-5.9/382	-0.6/386	4.8/390	10.1/394	15.4/397
	NAM/1,000	77.41	77.28	77.15	77.01	76.87	76.73	76.58	76.43	76.27
80,000 LB	MACH/IAS	0.606/262	0.606/262	0.606/262	0.606/262	0.606/262	0.606/262	0.606/262	0.606/262	0.606/262
	EPR A/L	1.53/2.02	1.53/1.99	1.53/1.96	1.53/1.92	1.53/1.89	1.53/1.85	1.53/1.80	1.53/1.76	1.53/1.71
	N2/N1	80.8/75.6	81.7/76.4	82.6/77.2	83.4/78.0	84.3/78.8	85.1/79.6	85.9/80.4	86.8/81.1	87.6/81.9
	FF/EGT	2246/299	2274/312	2302/324	2330/337	2359/349	2387/362	2415/374	2443/387	2471/399
	RAT/TAS	-28.0/357	-22.7/361	-17.4/364	-12.1/368	-6.8/372	-1.5/376	3.8/379	9.2/383	14.5/387
	NAM/1,000	79.42	79.28	79.13	79.01	78.87	78.72	78.42	78.42	78.26
76,000 LB	MACH/IAS	0.594/257	0.594/257	0.594/257	0.594/257	0.594/257	0.594/257	0.594/257	0.594/257	0.594/257
	EPR A/L	1.50/2.03	1.50/2.00	1.50/1.96	1.50/1.93	1.50/1.89	1.50/1.85	1.50/1.81	1.50/1.77	1.50/1.72
	N2/N1	80.3/74.8	81.2/75.6	82.1/76.4	82.9/77.2	83.8/77.9	84.6/78.7	85.4/79.5	86.2/80.2	87.1/81.0
	FF/EGT	2143/292	2170/304	2197/317	2224/329	2251/341	2278/354	2304/366	2332/378	2358/391
	RAT/TAS	-28.6/349	-23.3/353	-18.0/357	-12.7/361	-7.4/364	-2.1/368	3.2/372	8.5/375	13.8/379
	NAM/1,000	81.51	81.38	81.24	81.09	80.94	80.79	80.64	80.47	80.30
72,000 LB	MACH/IAS	0.594/257	0.594/257	0.594/257	0.594/257	0.594/257	0.594/257	0.594/257	0.594/257	0.594/257
	EPR A/L	1.48/2.03	1.48/2.00	1.48/1.96	1.48/1.93	1.48/1.89	1.48/1.85	1.48/1.81	1.48/1.77	1.48/1.72
	N2/N1	80.1/74.4	81.0/75.2	81.8/76.0	82.7/76.8	83.5/77.5	84.3/78.3	85.2/79.1	86.0/79.8	86.8/80.6
	FF/EGT	2103/289	2129/302	2156/314	2182/326	2209/338	2235/351	2262/363	2288/375	2313/387
	RAT/TAS	-28.6/349	-23.3/353	-18.0/357	-12.7/361	-7.4/364	-2.1/368	3.2/372	8.5/375	13.8/379
	NAM/1,000	83.06	82.92	82.77	82.63	82.47	82.32	82.16	81.99	81.87

LONG RANGE CRUISE – 25,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-49.5	-44.5	-39.5	-34.5	-29.5	-24.5	-19.5	-14.5	-9.5
	MACH/IAS	0.678/283	0.678/283	0.678/283	0.678/283	0.678/283	0.678/283	0.678/283	0.678/283	0.678/283
	EPR A/L	1.70/2.03	1.70/1.99	1.70/1.96	1.70/1.92	1.70/1.88	1.70/1.84	1.70/1.80	1.70/1.75	1.70/1.71
104,000	N2/N1	83.4/79.8	84.3/80.7	85.2/81.6	86.1/82.4	87.0/83.3	87.9/84.1	88.8/84.9	89.6/85.8	90.6/86.6
LB	FF/EGT	2746/335	2781/348	2816/362	2851/375	2886/389	2921/402	2956/416	2991/429	3026/443
	RAT/TAS	-28.6/396	-23.2/400	-17.8/404	-12.4/409	-7.0/413	-1.6/417	3.8/421	9.2/425	14.5/429
	NAM/1,000	72.02	71.90	71.78	71.65	71.52	71.39	71.24	71.10	70.95
	MACH/IAS	0.671/280	0.671/280	0.671/280	0.671/280	0.671/280	0.671/280	0.671/280	0.671/280	0.671/280
	EPR A/L	1.68/2.03	1.68/2.00	1.68/1.96	1.68/1.93	1.68/1.89	1.68/1.85	1.68/1.80	1.67/1.76	1.67/1.71
100,000	N2/N1	83.0/79.2	83.9/80.1	84.8/81.0	85.7/81.8	86.6/82.6	87.5/83.5	88.3/84.3	89.2/85.1	90.1/85.9
LB	FF/EGT	2651/329	2684/343	2718/356	2752/369	2786/383	2820/396	2854/409	2888/423	2922/436
	RAT/TAS	-29.0/391	-23.6/396	-18.2/400	-12.8/404	-7.4/409	-2.0/413	3.3/417	8.7/421	14.1/425
	NAM/1,000	73.84	73.72	73.60	73.47	73.33	73.19	73.04	72.89	72.74
	MACH/IAS	0.671/280	0.671/280	0.671/280	0.671/280	0.671/280	0.671/280	0.671/280	0.671/280	0.671/280
	EPR A/L	1.66/2.03	1.66/2.00	1.66/1.96	1.66/1.93	1.66/1.89	1.66/1.85	1.66/1.80	1.66/1.76	1.66/1.71
96,000	N2/N1	82.8/78.9	83.7/79.7	84.6/80.6	85.5/81.4	86.4/82.3	87.2/83.1	88.1/83.9	89.0/84.7	89.8/85.5
LB	FF/EGT	2598/326	2632/339	2665/352	2698/366	2731/379	2764/392	2798/406	2831/419	2864/432
	RAT/TAS	-29.0/391	-23.6/396	-18.2/400	-12.8/404	-7.4/409	-2.0/413	3.3/417	8.7/421	14.1/425
	NAM/1,000	75.33	75.20	75.08	74.95	74.80	74.66	74.50	74.35	74.19
	MACH/IAS	0.659/275	0.659/275	0.659/275	0.659/275	0.659/275	0.659/275	0.659/275	0.659/275	0.659/275
	EPR A/L	1.64/2.03	1.64/2.00	1.64/1.97	1.64/1.93	1.64/1.89	1.64/1.85	1.64/1.81	1.63/1.77	1.63/1.72
92,000	N2/N1	82.3/78.2	83.2/79.1	84.1/79.9	85.0/80.7	85.9/81.6	86.7/82.4	87.6/83.2	88.5/84.0	89.3/84.8
LB	FF/EGT	2488/319	2520/332	2551/345	2583/359	2615/372	2647/385	2679/398	2711/411	2743/424
	RAT/TAS	-29.6/384	-24.3/388	-18.9/393	-13.5/397	-8.1/401	-2.8/405	2.6/409	8.0/413	13.3/417
	NAM/1,000	77.22	77.08	76.95	76.82	76.67	76.52	76.36	76.19	76.02
	MACH/IAS	0.644/268	0.644/268	0.644/268	0.644/268	0.644/268	0.644/268	0.644/268	0.644/268	0.644/268
	EPR A/L	1.61/2.04	1.61/2.01	1.61/1.97	1.61/1.94	1.61/1.90	1.61/1.86	1.61/1.82	1.61/1.77	1.61/1.73
88,000	N2/N1	81.8/77.5	82.7/78.4	83.6/79.2	84.5/80.0	85.3/80.8	86.2/81.7	87.1/82.5	87.9/83.3	88.8/84.1
LB	FF/EGT	2372/312	2402/325	2433/338	2463/351	2492/364	2522/377	2553/390	2584/403	2614/416
	RAT/TAS	-30.4/375	-25.0/380	-19.7/380	-14.3/388	-9.0/392	-3.6/396	1.7/400	7.1/404	12.4/408
	NAM/1,000	79.13	79.00	78.87	78.73	78.64	78.47	78.30	78.13	77.96

LONG RANGE CRUISE – 25,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-49.5	-44.5	-39.5	-34.5	-29.5	-24.5	-19.5	-14.5	-9.5
84,000 LB	MACH/IAS	0.644/268	0.644/268	0.644/268	0.644/268	0.644/268	0.644/268	0.644/268	0.644/268	0.644/268
	EPR A/L	1.60/2.04	1.60/2.01	1.60/1.97	1.60/1.94	1.60/1.90	1.60/1.86	1.59/1.82	1.59/1.77	1.59/1.73
	N2/N1	81.6/77.2	82.5/78.0	83.4/78.9	84.3/79.7	85.1/80.5	86.0/81.4	86.8/82.2	87.7/82.9	88.5/83.7
	FF/EGT	2326/309	2356/322	2385/355	2415/347	2445/360	2475/373	2503/386	2533/399	2562/412
	RAT/TAS	-30.4/375	-25.0/380	-19.7/384	-14.3/388	-9.0/392	-3.6/396	1.7/400	7.1/404	12.4/408
	NAM/1,000	80.72	80.57	80.43	80.29	80.12	79.96	79.86	79.70	79.54
80,000 LB	MACH/IAS	0.627/261	0.627/261	0.627/261	0.627/261	0.627/261	0.627/261	0.627/261	0.627/261	0.627/261
	EPR A/L	1.57/2.04	1.57/2.01	1.57/1.98	1.57/1.95	1.57/1.91	1.57/1.87	1.57/1.83	1.56/1.78	1.56/1.74
	N2/N1	81.0/76.3	81.9/77.1	82.8/78.0	83.6/78.8	84.5/79.6	85.4/80.4	86.2/81.2	87.0/82.0	87.9/82.7
	FF/EGT	2203/301	2231/313	2259/326	2287/339	2315/352	2343/364	2371/377	2398/390	2430/403
	RAT/TAS	-31.2/366	-25.9/370	-20.6/374	-15.2/378	-9.9/382	-4.5/386	0.8/390	6.1/393	11.5/397
	NAM/1,000	83.04	82.90	82.77	82.62	82.47	82.32	82.17	82.01	81.72
76,000 LB	MACH/IAS	0.616/256	0.616/256	0.616/256	0.616/256	0.616/256	0.616/256	0.616/256	0.616/256	0.616/256
	EPR A/L	1.54/2.05	1.54/2.02	1.54/1.98	1.54/1.95	1.54/1.91	1.54/1.87	1.54/1.83	1.54/1.79	1.54/1.74
	N2/N1	80.5/75.5	81.4/76.3	82.2/77.2	83.1/78.0	84.0/78.8	84.8/79.6	85.7/80.4	86.5/81.1	87.4/81.9
	FF/EGT	2112/295	2139/307	2165/320	2192/333	2219/345	2246/358	2273/370	2299/383	2323/395
	RAT/TAS	-31.8/359	-26.5/363	-21.1/367	-15.8/371	-10.5/375	-5.2/379	0.1/382	5.5/386	10.8/390
	NAM/1,000	85.03	84.89	84.75	84.60	84.45	84.30	84.14	83.97	83.92
72,000 LB	MACH/IAS	0.616/256	0.616/256	0.616/256	0.616/256	0.616/256	0.616/256	0.616/256	0.616/256	0.616/256
	EPR A/L	1.53/2.05	1.53/2.02	1.53/1.98	1.53/1.95	1.53/1.91	1.53/1.87	1.53/1.83	1.53/1.79	1.53/1.74
	N2/N1	80.2/75.1	81.1/75.9	82.0/76.8	82.9/77.6	83.7/78.4	84.6/79.2	85.4/79.9	86.2/80.7	87.1/81.5
	FF/EGT	2072/292	2099/305	2125/317	2151/330	2177/342	2204/355	2230/367	2256/380	2277/392
	RAT/TAS	-31.8/359	-26.5/363	-21.1/367	-15.8/371	-10.5/375	-5.2/379	0.1/382	5.5/386	10.8/390
	NAM/1,000	86.65	86.51	86.37	86.22	86.06	85.91	85.75	85.58	85.60

LONG RANGE CRUISE – 27,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT -53.5	-48.5	-43.5	-38.5	-33.5	-28.5	-23.5	-18.5	-13.5
104,000 LB	MACH/IAS	0.692/278	0.692/278	0.692/278	0.692/278	0.692/278	0.692/278	0.692/278	0.692/278	0.692/278
	EPR A/L	1.75/2.04	1.75/2.01	1.75/1.98	1.75/1.95	1.75/1.91	1.75/1.87	1.75/1.83	1.75/1.78	1.74/1.74
	N2/N1	83.6/80.6	84.5/81.5	85.4/82.3	86.4/83.2	87.3/84.1	88.2/85.0	89.1/85.8	89.9/86.7	90.6/87.2
	FF/EGT	2718/338	2738/352	2773/365	2807/379	2842/393	2877/407	2912/421	2946/434	2926/444
	RAT/TAS	-32.1/400	-26.7/405	-21.3/409	-15.9/414	-10.5/418	-5.1/422	0.3/427	5.7/431	10.5/428
	NAM/1,000	73.60	73.89	73.77	73.65	73.52	73.52	73.25	73.11	73.17
100,000 LB	MACH/IAS	0.681/273	0.681/273	0.681/273	0.681/273	0.681/273	0.681/273	0.681/273	0.681/273	0.681/273
	EPR A/L	1.73/2.05	1.73/2.02	1.73/1.99	1.73/1.95	1.73/1.91	1.73/1.87	1.73/1.83	1.72/1.79	1.72/1.74
	N2/N1	83.1/79.8	84.0/80.7	85.0/81.6	85.9/82.4	86.8/83.3	87.7/84.2	88.5/85.0	89.4/85.8	90.3/86.7
	FF/EGT	2593/331	2626/344	2659/358	2693/372	2726/385	2759/399	2793/412	2826/426	2860/440
	RAT/TAS	-32.7/394	-27.3/398	-21.9/403	-16.5/407	-11.1/411	-5.7/416	-0.3/420	5.1/424	10.5/428
	NAM/1,000	75.94	75.82	75.69	75.57	75.44	75.30	75.15	75.01	74.85
96,000 LB	MACH/IAS	0.681/273	0.681/273	0.681/273	0.681/273	0.681/273	0.681/273	0.681/273	0.681/273	0.681/273
	EPR A/L	1.71/2.05	1.71/2.02	1.71/1.99	1.71/1.95	1.71/1.91	1.70/1.87	1.70/1.83	1.70/1.79	1.70/1.74
	N2/N1	82.8/79.3	83.7/80.2	84.7/81.1	85.6/81.9	86.5/82.8	87.4/83.6	88.2/84.5	89.1/85.3	90.0/86.1
	FF/EGT	2529/326	2561/340	2594/353	2626/367	2659/380	2691/394	2724/408	2757/421	2789/435
	RAT/TAS	-32.7/394	-27.3/398	-21.9/403	-16.5/407	-11.1/411	-5.7/416	-0.3/420	5.1/424	10.5/428
	NAM/1,000	77.86	77.74	77.61	77.48	77.35	77.20	77.05	76.90	76.74
92,000 LB	MACH/IAS	0.675/270	0.675/270	0.675/270	0.675/270	0.675/270	0.675/270	0.675/270	0.675/270	0.675/270
	EPR A/L	1.68/2.05	1.68/2.02	1.68/1.99	1.68/1.95	1.68/1.92	1.68/1.88	1.68/1.84	1.68/1.79	1.68/1.75
	N2/N1	82.4/78.7	83.3/79.5	84.2/80.4	85.1/81.3	86.0/82.1	86.9/83.0	87.8/83.8	88.7/84.6	89.5/85.4
	FF/EGT	2437/320	2468/334	2500/347	2531/360	2562/374	2594/387	2626/401	2657/414	2689/428
	RAT/TAS	-33.1/390	-27.7/394	-22.3/399	-16.9/404	-11.5/407	-6.1/412	-0.7/416	4.7/420	10.1/424
	NAM/1,000	80.02	79.89	79.76	79.63	79.49	79.34	79.18	79.02	78.86
88,000 LB	MACH/IAS	0.664/266	0.664/266	0.664/266	0.664/266	0.664/266	0.664/266	0.664/266	0.664/266	0.664/266
	EPR A/L	1.66/2.05	1.66/2.02	1.66/1.99	1.66/1.96	1.66/1.92	1.65/1.88	1.65/1.84	1.65/1.80	1.65/1.75
	N2/N1	81.9/78.0	82.9/78.9	83.8/79.7	84.7/80.6	85.6/81.4	86.4/82.3	87.3/83.1	88.2/83.9	89.0/84.7
	FF/EGT	2337/314	2367/327	2397/340	2428/353	2458/367	2488/380	2518/393	2549/407	2579/420
	RAT/TAS	-33.6/384	-28.2/388	-22.8/393	-17.5/397	-12.1/401	-6.7/405	-1.3/409	4.0/413	9.4/417
	NAM/1,000	82.14	82.01	81.87	81.73	81.43	81.43	81.27	81.10	80.93

LONG RANGE CRUISE – 27,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT -53.5	-48.5	-43.5	-38.5	-33.5	-28.5	-23.5	-18.5	-13.5
84,000 LB	MACH/IAS	0.664/266	0.664/266	0.664/266	0.664/266	0.664/266	0.664/266	0.664/266	0.664/266	0.664/266
	EPR A/L	1.64/2.05	1.64/2.02	1.64/1.99	1.64/1.96	1.64/1.92	1.64/1.88	1.64/1.84	1.64/1.80	1.64/1.75
	N2/N1	81.7/77.6	82.6/78.5	83.5/79.4	84.4/80.2	85.3/81.0	86.2/81.9	87.1/82.7	87.9/83.5	88.8/84.3
	FF/EGT	2288/310	2318/323	2348/337	2377/350	2407/363	2436/376	2466/389	2496/403	2525/416
	RAT/TAS	-33.6/384	-28.2/388	-22.8/393	-17.5/397	-12.1/401	-6.7/405	-1.3/409	4.0/413	9.4/417
	NAM/1,000	83.89	83.75	83.61	83.31	83.31	83.16	82.99	82.82	82.64
80,000 LB	MACH/IAS	0.650/259	0.650/259	0.650/259	0.650/259	0.650/259	0.650/259	0.650/259	0.650/259	0.650/259
	EPR A/L	1.61/2.06	1.61/2.03	1.61/2.00	1.61/1.96	1.61/1.93	1.61/1.89	1.61/1.85	1.61/1.81	1.61/1.76
	N2/N1	81.2/76.9	82.1/77.8	83.0/78.6	83.9/79.5	84.8/80.3	85.6/81.1	86.5/81.9	87.3/82.7	88.2/83.6
	FF/EGT	2182/303	2210/316	2238/329	2267/342	2295/356	2323/369	2351/382	2377/394	2404/407
	RAT/TAS	-34.3/376	-29.0/380	-23.6/384	-18.3/388	-12.9/392	-7.5/396	-2.2/400	3.2/404	8.5/408
	NAM/1,000	86.06	85.92	85.77	85.62	85.47	85.31	85.15	85.04	84.91
76,000 LB	MACH/IAS	0.639/255	0.639/255	0.639/255	0.639/255	0.639/255	0.639/255	0.639/255	0.639/255	0.639/255
	EPR A/L	1.59/2.06	1.59/2.03	1.59/2.00	1.59/1.97	1.59/1.93	1.59/1.89	1.59/1.85	1.59/1.81	1.59/1.77
	N2/N1	80.7/76.3	81.6/77.1	82.5/78.0	83.3/78.8	84.2/79.6	85.1/80.5	85.9/81.2	86.8/82.0	87.7/82.9
	FF/EGT	2095/298	2123/311	2150/324	2177/336	2205/349	2232/362	2257/375	2284/388	2304/400
	RAT/TAS	-34.9/369	-29.5/374	-24.2/378	-18.8/382	-13.5/386	-8.1/390	-2.8/394	2.6/398	7.9/402
	NAM/1,000	88.16	88.01	87.85	87.69	87.53	87.24	87.24	87.08	87.19
72,000 LB	MACH/IAS	0.639/255	0.639/255	0.639/255	0.639/255	0.639/255	0.639/255	0.639/255	0.639/255	0.639/255
	EPR A/L	1.57/2.06	1.57/2.03	1.57/2.00	1.57/1.97	1.57/1.93	1.57/1.89	1.57/1.85	1.57/1.81	1.57/1.77
	N2/N1	80.4/75.8	81.3/76.7	82.2/77.5	83.1/78.4	84.0/79.2	84.8/80.0	85.7/80.8	86.5/81.6	87.5/82.4
	FF/EGT	2054/295	2080/308	2107/321	2133/333	2161/346	2186/359	2212/372	2238/385	2255/396
	RAT/TAS	-34.9/369	-29.5/374	-24.2/378	-18.8/382	-13.5/386	-8.1/390	-2.8/394	2.6/398	7.9/402
	NAM/1,000	89.96	89.82	89.67	89.52	89.28	89.20	89.03	88.86	89.06

LONG RANGE CRUISE – 29,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-57.5	-52.5	-47.5	-42.5	-37.5	-32.5	-27.5	-22.5	-17.5
104,000 LB	MACH/IAS	0.731/282	0.731/282	0.731/282	0.731/282	0.731/282	0.731/282	0.731/282	0.731/282	
	EPR A/L	1.82/2.06	1.82/2.02	1.82/1.99	1.82/1.96	1.82/1.92	1.82/1.88	1.82/1.84	1.81/1.81	
	N2/N1	84.2/82.0	85.2/82.9	86.1/83.8	87.0/84.7	88.0/85.6	88.9/86.5	89.8/87.4	90.3/87.7	
	FF/EGT	2767/348	2803/362	2839/376	2876/390	2912/405	2948/419	2984/433	2911/440	
	RAT/TAS	-34.4/419	-28.9/423	-23.4/428	-18.0/433	-12.5/437	-7.1/442	-1.6/447	2.5/438	
	NAM/1,000	75.63	75.51	75.39	75.26	75.12	74.99	74.85	75.19	
100,000 LB	MACH/IAS	0.696/267	0.696/267	0.696/267	0.696/267	0.696/267	0.696/267	0.696/267	0.696/267	
	EPR A/L	1.78/2.07	1.78/2.04	1.78/2.01	1.78/1.97	1.78/1.94	1.78/1.90	1.78/1.86	1.78/1.82	
	N2/N1	83.3/80.6	84.2/81.5	85.2/82.4	86.1/83.3	87.0/84.2	87.8/85.0	88.8/85.9	89.7/86.8	
	FF/EGT	2549/334	2582/347	2616/361	2649/375	2682/389	2715/403	2748/417	2781/431	
	RAT/TAS	-36.2/398	-30.8/403	-25.4/408	-20.0/412	-14.6/417	-9.2/421	-3.8/425	1.7/430	
	NAM/1,000	78.16	78.04	77.91	77.79	77.66	77.52	77.38	77.23	
96,000 LB	MACH/IAS	0.696/267	0.696/267	0.696/267	0.696/267	0.696/267	0.696/267	0.696/267	0.696/267	0.696/267
	EPR A/L	1.76/2.07	1.76/2.04	1.76/2.01	1.76/1.97	1.76/1.94	1.76/1.90	1.76/1.86	1.76/1.82	1.76/1.77
	N2/N1	83.0/80.0	83.9/81.0	84.9/81.9	85.8/82.7	86.7/83.6	87.6/84.5	88.5/85.4	89.4/86.2	90.3/87.1
	FF/EGT	2489/329	2522/343	2554/357	2587/371	2619/385	2551/398	2684/412	2716/426	2748/440
	RAT/TAS	-36.2/398	-30.8/403	-25.4/408	-20.0/412	-14.6/417	-9.2/421	-3.8/425	1.7/430	7.1/434
	NAM/1,000	80.04	79.92	79.79	79.66	79.53	79.38	79.24	79.09	78.93
92,000 LB	MACH/IAS	0.684/262	0.684/262	0.684/262	0.684/262	0.684/262	0.684/262	0.684/262	0.684/262	0.684/262
	EPR A/L	1.73/2.07	1.73/2.04	1.73/2.01	1.73/1.98	1.73/1.94	1.73/1.91	1.73/1.86	1.73/1.82	1.73/1.78
	N2/N1	82.5/79.2	83.4/80.1	84.4/81.0	85.3/81.9	86.2/82.8	87.1/83.6	88.0/84.5	88.9/85.3	89.7/86.2
	FF/EGT	2379/321	2410/335	2410/335	2472/363	2503/376	2534/390	2565/404	2595/417	2626/431
	RAT/TAS	-36.9/392	-31.5/396	-31.5/396	-20.7/405	-15.3/409	-9.9/414	-4.5/418	0.9/422	6.3/426
	NAM/1,000	82.31	82.18	82.18	81.92	81.78	81.64	81.49	81.33	81.17
88,000 LB	MACH/IAS	0.679/261	0.679/261	0.679/261	0.679/261	0.679/261	0.679/261	0.679/261	0.679/261	0.679/261
	EPR A/L	1.71/2.07	1.71/2.04	1.71/2.01	1.71/1.98	1.70/1.94	1.70/1.91	1.70/1.87	1.70/1.82	1.70/1.78
	N2/N1	82.1/78.6	83.0/79.5	83.9/80.3	84.8/81.2	85.8/82.1	86.7/82.9	87.5/83.8	88.4/84.6	89.3/85.5
	FF/EGT	2296/316	2326/329	2356/343	2386/356	2415/370	2445/383	2475/397	2505/410	2535/424
	RAT/TAS	-37.1/389	-31.7/394	-26.3/398	-20.9/402	-15.5/407	-10.1/411	-4.7/415	0.7/419	6.1/424
	NAM/1,000	84.74	84.61	84.47	84.32	84.18	84.03	83.87	83.72	83.56

LONG RANGE CRUISE – 29,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-57.5	-52.5	-47.5	-42.5	-37.5	-32.5	-27.5	-22.5	-17.5
84,000 LB	MACH/IAS	0.679/261	0.679/261	0.679/261	0.679/261	0.679/261	0.679/261	0.679/261	0.679/261	0.679/261
	EPR A/L	1.68/2.07	1.68/2.04	1.68/2.01	1.68/1.98	1.68/1.94	1.68/1.91	1.68/1.87	1.68/1.82	1.68/1.78
	N2/N1	81.7/78.0	82.7/78.9	83.6/79.8	84.5/80.7	85.4/81.5	86.3/82.4	87.2/83.2	88.1/84.1	89.0/84.9
	FF/EGT	2236/311	2266/325	2295/338	2324/352	2353/365	2383/379	2412/392	2439/405	2468/419
	RAT/TAS	-37.1/389	-31.7/394	-26.3/398	-20.9/402	-15.5/407	-10.1/411	-4.7/415	0.7/419	6.1/424
	NAM/1,000	86.98	86.84	86.70	86.55	86.40	86.24	86.07	85.99	85.82
80,000 LB	MACH/IAS	0.675/259	0.675/259	0.675/259	0.675/259	0.675/259	0.675/259	0.675/259	0.675/259	0.675/259
	EPR A/L	1.66/2.08	1.66/2.04	1.66/2.01	1.66/1.98	1.66/1.95	1.66/1.91	1.66/1.87	1.66/1.83	1.66/1.78
	N2/N1	81.3/77.5	82.3/78.4	83.2/79.2	84.1/80.1	85.0/81.0	85.9/81.8	86.8/82.6	87.6/83.5	88.6/84.3
	FF/EGT	2171/307	2197/320	2226/334	2254/347	2282/360	2311/374	2339/387	2369/400	2390/413
	RAT/TAS	-37.3/386	-31.9/391	-26.6/395	-21.2/400	-15.8/404	-10.4/408	-5.0/412	0.4/417	5.8/421
	NAM/1,000	89.02	88.96	88.81	88.66	88.50	88.34	88.16	87.94	88.01
76,000 LB	MACH/IAS	0.666/255	0.666/255	0.666/255	0.666/255	0.666/255	0.666/255	0.666/255	0.666/255	0.666/255
	EPR A/L	1.64/2.08	1.64/2.05	1.64/2.02	1.64/1.98	1.64/1.95	1.64/1.91	1.64/1.87	1.64/1.83	1.64/1.79
	N2/N1	80.9/76.9	81.8/77.7	82.7/78.6	83.6/79.5	84.5/80.3	85.4/81.2	86.3/82.0	87.1/82.8	88.1/83.7
	FF/EGT	2090/301	2117/315	2144/328	2172/341	2199/354	2226/368	2253/381	2279/394	2296/405
	RAT/TAS	-37.8/381	-32.4/366	-27.0/390	-21.7/394	-16.3/399	-10.9/403	-5.5/407	-0.1/411	5.2/415
	NAM/1,000	91.24	91.10	90.95	90.79	90.63	90.47	90.30	90.19	90.39
72,000 LB	MACH/IAS	0.666/255	0.666/255	0.666/255	0.666/255	0.666/255	0.666/255	0.666/255	0.666/255	0.666/255
	EPR A/L	1.62/2.08	1.62/2.05	1.62/2.02	1.62/1.98	1.62/1.95	1.62/1.91	1.62/1.87	1.62/1.83	1.62/1.79
	N2/N1	80.6/76.5	81.5/77.4	82.4/78.2	83.4/79.1	84.2/79.9	85.1/80.8	86.0/81.6	86.9/82.4	87.9/83.3
	FF/EGT	2046/298	2072/312	2099/325	2126/338	2153/351	2179/364	2206/377	2233/391	2246/401
	RAT/TAS	-37.8/381	-32.4/386	-27.0/390	-21.7/394	-16.3/399	-10.9/403	-5.5/407	-0.1/411	5.2/415
	NAM/1,000	93.20	93.06	92.90	92.58	92.58	92.41	92.24	92.06	92.42

LONG RANGE CRUISE – 31,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-61.4	-56.4	-51.4	-46.4	-41.4	-36.4	-31.4	-26.4	-21.4
	MACH/IAS	0.751/278	0.751/278	0.751/278	0.751/278	0.751/278	0.751/278			
	EPR A/L	1.89/2.07	1.89/2.04	1.89/2.01	1.89/1.98	1.89/1.94	1.89/1.90			
104,000	N2/N1	84.6/83.3	85.6/84.2	86.5/85.2	87.5/86.1	88.4/87.0	89.4/88.0			
LB	FF/EGT	2758/354	2795/369	2832/384	2868/384	2905/413	2941/428			
	RAT/TAS	-37.6/426	-32.1/431	-26.6/436	-26.6/436	-15.6/446	-10.2/450			
	NAM/1,000	77.22	77.10	76.98	76.98	76.72	76.59			
	MACH/IAS	0.740/273	0.740/273	0.740/273	0.740/273	0.740/273	0.740/273	0.740/273		
	EPR A/L	1.86/2.08	1.86/2.05	1.86/2.01	1.86/1.98	1.86/1.95	1.86/1.91	1.86/1.87		
100,000	N2/N1	84.0/82.2	85.0/83.2	85.9/84.1	86.9/85.0	87.8/86.0	88.8/86.9	89.7/87.8		
LB	FF/EGT	2630/345	2665/360	2700/374	2735/388	2769/403	2804/417	2839/432		
	RAT/TAS	-38.2/420	-32.7/425	-27.2/430	-21.8/434	-16.3/439	-10.8/444	-5.4/449		
	NAM/1,000	79.80	79.68	79.55	79.42	79.29	79.15	79.00		
	MACH/IAS	0.740/273	0.740/273	0.740/273	0.740/273	0.740/273	0.740/273	0.740/273	0.740/273	
	EPR A/L	1.84/2.08	1.84/2.05	1.84/2.01	1.83/1.98	1.83/1.95	1.83/1.91	1.83/1.87	1.83/1.83	
96,000	N2/N1	83.7/81.6	84.7/82.6	85.6/83.5	86.6/84.4	87.5/85.3	88.5/86.2	89.4/87.1	90.2/87.8	
LB	FF/EGT	2569/340	2603/355	2637/369	2671/383	2705/398	2739/412	2773/427	2779/439	
	RAT/TAS	-38.2/420	-32.7/425	-27.2/430	-21.8/434	-16.3/439	-10.8/444	-5.4/449	-0.2/450	
	NAM/1,000	81.71	81.58	81.45	81.32	81.18	81.04	80.88	80.96	
	MACH/IAS	0.718/265	0.718/265	0.718/265	0.718/265	0.718/265	0.718/265	0.718/265	0.718/265	0.718/265
	EPR A/L	1.80/2.09	1.80/2.05	1.80/2.02	1.80/1.99	1.80/1.96	1.80/1.92	1.80/1.88	1.80/1.84	1.79/1.79
92,000	N2/N1	83.0/80.5	84.0/81.5	85.0/82.4	85.9/83.3	86.9/84.2	87.8/85.1	88.7/86.0	89.6/86.8	90.4/87.6
LB	FF/EGT	2421/330	2453/344	2485/358	2517/372	2549/387	2581/401	2613/415	2645/429	2661/442
	RAT/TAS	-39.3/408	-33.9/412	-28.5/417	-23.0/422	-17.6/426	-12.1/431	-6.7/435	-1.2/440	4.0/442
	NAM/1,000	84.17	84.04	83.91	83.77	83.64	83.50	83.34	83.18	83.13
	MACH/IAS	0.695/255	0.695/255	0.695/255	0.695/255	0.695/255	0.695/255	0.695/255	0.695/255	0.695/255
	EPR A/L	1.76/2.09	1.76/2.06	1.76/2.03	1.76/2.00	1.76/1.97	1.76/1.93	1.76/1.89	1.76/1.85	1.76/1.81
88,000	N2/N1	82.2/79.3	83.1/80.2	84.1/81.1	85.0/82.0	86.0/82.9	86.9/83.8	87.8/84.7	88.8/85.6	89.7/86.4
LB	FF/EGT	2269/319	2299/333	2329/347	2359/361	2389/375	2419/389	2449/403	2471/416	2501/430
	RAT/TAS	-40.6/394	-35.2/399	-29.8/403	-24.3/408	-18.9/412	-13.5/417	-8.1/421	-2.7/426	2.7/430
	NAM/1,000	86.87	86.74	86.60	86.46	86.32	86.17	86.00	86.11	85.95

LONG RANGE CRUISE – 31,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-61.4	-56.4	-51.4	-46.4	-41.4	-36.4	-31.4	-26.4	-21.4
84,000 LB	MACH/IAS	0.695/255	0.695/255	0.695/255	0.695/255	0.695/255	0.695/255	0.695/255	0.695/255	0.695/255
	EPR A/L	1.74/2.09	1.74/2.06	1.74/2.03	1.74/2.00	1.74/1.97	1.74/1.93	1.74/1.89	1.74/1.85	1.74/1.81
	N2/N1	81.9/78.8	82.8/79.7	83.8/80.6	84.7/81.5	85.6/82.4	86.5/83.2	87.4/84.1	88.4/85.0	89.3/85.8
	FF/EGT	2215/315	2244/329	2273/343	2303/357	2332/370	2361/384	2390/398	2410/410	2439/424
	RAT/TAS	-40.6/394	-35.2/399	-29.8/403	-24.3/408	-18.9/412	-13.5/417	-8.1/421	-2.7/426	2.7/430
	NAM/1,000	89.00	88.88	88.73	88.59	88.44	88.29	88.12	88.30	88.13
80,000 LB	MACH/IAS	0.691/254	0.691/254	0.691/254	0.691/254	0.691/254	0.691/254	0.691/254	0.691/254	0.691/254
	EPR A/L	1.71/2.09	1.71/2.06	1.71/2.03	1.71/2.00	1.71/1.97	1.71/1.93	1.71/1.89	1.71/1.85	1.71/1.81
	N2/N1	81.4/78.1	82.4/79.0	83.3/79.9	84.2/80.8	85.1/81.6	86.0/82.5	86.9/83.4	87.8/84.2	88.9/85.1
	FF/EGT	2137/310	2165/323	2194/337	2222/351	2250/364	2278/378	2307/392	2335/405	2351/417
	RAT/TAS	-40.8/392	-35.4/397	-30.0/401	-24.6/406	-19.2/410	-13.7/414	-8.3/419	-2.9/423	2.5/427
	NAM/1,000	91.70	91.57	91.42	91.27	91.12	90.96	90.79	90.60	90.91
76,000 LB	MACH/IAS	0.686/252	0.686/252	0.686/252	0.686/252	0.686/252	0.686/252	0.686/252	0.686/252	0.686/252
	EPR A/L	1.69/2.10	1.68/2.07	1.68/2.03	1.68/2.00	1.68/1.97	1.68/1.93	1.68/1.90	1.68/1.85	1.68/1.81
	N2/N1	80.9/77.4	81.9/78.3	82.8/79.2	83.7/80.0	84.6/80.9	85.5/81.8	86.4/82.6	87.3/83.5	88.4/84.4
	FF/EGT	2062/304	2088/318	2115/331	2143/345	2170/358	2197/372	2224/385	2252/399	2263/410
	RAT/TAS	-41.0/389	-35.6/394	-30.2/398	-24.8/403	-19.4/407	-14.0/411	-8.6/416	-3.2/420	2.2/424
	NAM/1,000	94.34	94.27	94.12	93.96	93.80	93.64	93.46	93.26	93.74
72,000 LB	MACH/IAS	0.686/252	0.686/252	0.686/252	0.686/252	0.686/252	0.686/252	0.686/252	0.686/252	0.686/252
	EPR A/L	1.67/2.10	1.67/2.07	1.67/2.03	1.66/2.00	1.66/1.97	1.66/1.93	1.66/1.90	1.66/1.85	1.66/1.81
	N2/N1	80.6/76.9	81.6/77.8	82.5/78.7	83.4/79.6	84.3/80.5	85.2/81.3	86.1/82.2	87.0/83.0	88.1/83.9
	FF/EGT	2016/301	2043/314	2069/328	2096/341	2123/355	2149/368	2176/382	2201/395	2209/405
	RAT/TAS	-41.0/389	-35.6/394	-30.2/398	-24.8/403	-19.4/407	-14.0/411	-8.6/416	-3.2/420	2.2/424
	NAM/1,000	96.51	96.37	96.06	96.06	95.89	95.72	95.43	95.43	96.02

DC-9 Classic – Aircraft Operating Manual

LONG RANGE CRUISE – 33,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-65.4	-60.4	-55.4	-50.4	-45.4	-40.4	-35.4	-30.4	-21.4
104,000 LB	MACH/IAS EPR A/L N2/N1 FF/EGT RAT/TAS NAM/1,000									
100,000 LB	MACH/IAS EPR A/L N2/N1 FF/EGT RAT/TAS NAM/1,000									
96,000 LB	MACH/IAS EPR A/L N2/N1 FF/EGT RAT/TAS NAM/1,000	0.755/267 1.91/2.10 84.0/82.9 2545/346 -41.7/424 83.36	0.755/267 1.90/2.07 85.0/83.9 2579/361 -36.2/429 83.24	0.755/267 1.90/2.03 86.0/84.8 2613/376 -30.7/434 83.11	0.755/267 1.90/2.00 87.0/85.8 2647/391 -25.3/439 82.98	0.755/267 1.90/1.97 88.0/86.7 2681/405 -19.7/444 82.85	0.755/267 1.90/1.93 88.9/87.6 2715/420 -14.3/449 82.71	0.755/267 1.90/1.90 89.7/88.3 2714/432 -9.2/450 82.87		
92,000 LB	MACH/IAS EPR A/L N2/N1 FF/EGT RAT/TAS NAM/1,000	0.745/263 1.87/2.10 83.4/81.8 2426/337 -42.2/419 86.32	0.745/263 1.87/2.07 84.4/82.7 2459/352 -36.7/424 86.19	0.745/263 1.87/2.04 85.4/83.7 2492/366 -31.3/429 86.06	0.745/263 1.87/2.01 86.4/84.6 2524/381 -25.8/434 85.92	0.745/263 1.87/1.97 87.3/85.6 2557/395 -20.3/439 85.77	0.745/263 1.87/1.94 88.3/86.5 2589/410 -14.8/443 85.62	0.745/263 1.87/1.90 89.2/87.4 2619/424 -9.4/448 85.55	0.745/263 1.87/1.86 90.0/88.1 2619/436 -4.3/449 85.67	
88,000 LB	MACH/IAS EPR A/L N2/N1 FF/EGT RAT/TAS NAM/1,000	0.732/258 1.83/2.11 82.7/80.7 2315/329 -42.9/412 88.91	0.732/258 1.83/2.07 83.7/81.7 2346/343 -37.5/417 88.79	0.732/258 1.83/2.04 84.7/82.6 2377/357 -32.0/421 88.65	0.732/258 1.83/2.01 85.7/83.5 2408/372 -26.5/426 88.50	0.732/258 1.83/1.98 86.6/84.4 2439/386 -21.1/431 88.35	0.732/258 1.83/1.94 87.5/85.4 2470/400 -15.6/436 88.19	0.732/258 1.83/1.90 88.5/86.3 2501/415 -10.2/440 88.03	0.732/258 1.83/1.86 89.5/87.2 2522/428 -4.7/445 88.21	0.732/258 1.82/1.82 90.3/87.8 2519/440 0.3/445 88.29

LONG RANGE CRUISE – 33,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT -65.4	-60.4	-55.4	-50.4	-45.4	-40.4	-35.4	-30.4	-21.4
84,000 LB	MACH/IAS	0.732/258	0.732/258	0.732/258	0.732/258	0.732/258	0.732/258	0.732/258	0.732/258	0.732/258
	EPR A/L	1.81/2.11	1.81/2.07	1.81/2.04	1.81/2.01	1.81/1.98	1.81/1.94	1.81/1.90	1.81/1.86	1.81/1.82
	N2/N1	82.5/80.2	83.4/81.1	84.4/82.0	85.4/83.0	86.3/83.9	87.2/84.8	88.2/85.7	89.2/86.6	90.1/87.5
	FF/EGT	2265/325	2295/339	2326/353	2356/367	2387/382	2417/396	2447/410	2466/423	2496/437
	RAT/TAS	-42.9/412	-37.5/417	-32.0/421	-26.5/426	-21.1/431	-15.6/436	-10.2/440	-4.7/445	0.8/449
	NAM/1,000	90.87	90.74	90.59	90.44	90.28	90.13	89.96	90.22	90.05
80,000 LB	MACH/IAS	0.718/252	0.718/252	0.718/252	0.718/252	0.718/252	0.718/252	0.718/252	0.718/252	0.718/252
	EPR A/L	1.78/2.11	1.78/2.08	1.78/2.05	1.78/2.02	1.77/1.98	1.77/1.95	1.77/1.91	1.77/1.87	1.77/1.83
	N2/N1	81.8/79.1	82.7/80.1	83.7/81.0	84.7/81.9	85.6/82.8	86.5/83.7	87.4/84.6	88.6/85.5	89.5/86.4
	FF/EGT	2155/316	2184/331	2213/345	2242/359	2270/373	2299/387	2328/401	2339/413	2367/427
	RAT/TAS	-43.7/403	-38.2/408	-32.8/413	-27.4/418	-21.9/422	-16.5/427	-11.0/432	-5.6/436	-0.2/441
	NAM/1,000	93.61	93.48	93.34	93.18	93.03	92.71	92.71	93.24	93.07
76,000 LB	MACH/IAS	0.697/244	0.697/244	0.697/244	0.697/244	0.697/244	0.697/244	0.697/244	0.697/244	0.697/244
	EPR A/L	1.74/2.12	1.74/2.09	1.74/2.06	1.74/2.02	1.74/1.99	1.74/1.96	1.74/1.92	1.74/1.88	1.74/1.84
	N2/N1	80.9/77.9	81.9/78.9	82.8/79.8	83.8/80.7	84.7/81.6	85.6/82.4	86.5/83.3	87.4/84.2	88.7/85.2
	FF/EGT	2025/307	2052/321	2080/335	2107/349	2134/362	2161/376	2188/390	2215/404	2216/414
	RAT/TAS	-44.7/392	-39.3/397	-33.9/401	-28.5/406	-23.1/410	-17.7/415	-12.2/419	-6.8/424	-1.4/428
	NAM/1,000	96.76	96.63	96.48	96.32	96.15	95.99	95.80	95.64	96.58
72,000 LB	MACH/IAS	0.697/244	0.697/244	0.697/244	0.697/244	0.697/244	0.697/244	0.697/244	0.697/244	0.697/244
	EPR A/L	1.71/2.12	1.71/2.09	1.71/2.06	1.71/2.02	1.71/1.99	1.71/1.96	1.71/1.92	1.71/1.88	1.71/1.84
	N2/N1	80.5/77.3	81.4/78.2	82.4/79.1	83.3/80.0	84.2/80.9	85.1/81.8	86.0/82.6	86.9/83.5	88.3/84.5
	FF/EGT	1965/302	1992/316	2018/330	2044/344	2071/357	2097/371	2123/385	2150/399	2146/407
	RAT/TAS	-44.7/392	-39.3/397	-33.9/401	-28.5/406	-23.1/410	-17.7/415	-12.2/419	-6.8/424	-1.4/428
	NAM/1,000	99.71	99.57	99.42	99.25	99.08	98.72	98.72	98.54	99.70

LONG RANGE CRUISE – 35,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-69.3	-64.3	-59.3	-54.3	-49.3	-44.3	-39.3	-34.3	-29.3
104,000 LB	MACH/IAS EPR A/L N2/N1 FF/EGT RAT/TAS NAM/1,000									
100,000 LB	MACH/IAS EPR A/L N2/N1 FF/EGT RAT/TAS NAM/1,000									
96,000 LB	MACH/IAS EPR A/L N2/N1 FF/EGT RAT/TAS NAM/1,000									
92,000 LB	MACH/IAS EPR A/L N2/N1 FF/EGT RAT/TAS NAM/1,000									
88,000 LB	MACH/IAS EPR A/L N2/N1 FF/EGT RAT/TAS NAM/1,000	0.759/256 1.91/2.12 83.3/82.3 2343/338 -45.8/422 90.14	0.759/256 1.91/2.09 84.3/83.3 2377/353 -40.3/428 89.94	0.759/256 1.91/2.06 85.3/84.3 2410/368 -34.9/433 89.76	0.759/256 1.91/2.03 86.3/85.3 2442/383 -29.4/438 89.61	0.759/256 1.91/1.99 87.3/86.2 2474/398 -23.9/443 89.46	0.759/256 1.91/1.96 88.2/87.2 2505/413 -18.4/448 89.32	0.759/256 1.91/1.92 89.3/88.1 2525/427 -12.9/452 89.57		

LONG RANGE CRUISE – 35,000 FEET

GROSS WEIGHT	OPERATING PARAMETERS	OAT °C AMBIENT								
		-69.3	-64.3	-59.3	-54.3	-49.3	-44.3	-39.3	-34.3	-29.3
84,000 LB	MACH/IAS	0.759/256	0.759/256	0.759/256	0.759/256	0.759/256	0.759/256	0.759/256	0.759/256	
	EPR A/L	1.88/2.12	1.88/2.09	1.88/2.06	1.88/2.03	1.88/1.99	1.88/1.96	1.88/1.92	1.88/1.88	
	N2/N1	82.8/81.4	83.8/82.4	84.8/83.4	85.8/84.3	86.8/85.3	87.7/86.2	88.7/87.1	89.8/88.1	
	FF/EGT	2271/332	2302/347	2333/361	2364/376	2395/391	2426/405	2456/420	2473/433	
	RAT/TAS	-45.8/422	-40.3/428	-34.9/433	-29.4/438	-23.9/443	-18.4/448	-12.9/452	-7.4/457	
	NAM/1,000	92.99	92.85	92.71	92.57	92.42	92.26	92.10	92.46	
80,000 LB	MACH/IAS	0.755/255	0.755/255	0.755/255	0.755/255	0.755/255	0.755/255	0.755/255	0.755/255	0.755/255
	EPR A/L	1.85/2.12	1.85/2.09	1.85/2.06	1.85/2.03	1.85/2.00	1.85/1.96	1.85/1.92	1.85/1.88	1.84/1.84
	N2/N1	82.3/80.6	83.3/81.5	84.3/82.5	85.3/83.4	86.2/84.4	87.2/85.3	88.1/86.2	89.3/87.2	90.2/88.0
	FF/EGT	2196/325	2226/340	2256/355	2286/369	2316/384	2346/398	2375/413	2384/425	2399/438
	RAT/TAS	-46.0/420	-40.5/426	-35.1/431	-29.6/436	-24.1/441	-18.6/445	-13.1/450	-7.6/455	-2.3/458
	NAM/1,000	95.73	95.59	95.44	95.29	94.13	94.96	94.80	95.44	95.44
76,000 LB	MACH/IAS	0.720/241	0.720/241	0.720/241	0.720/241	0.720/241	0.720/241	0.720/241	0.720/241	0.720/241
	EPR A/L	1.80/2.13	1.80/2.10	1.80/2.07	1.80/2.04	1.80/2.01	1.80/1.98	1.80/1.94	1.80/1.90	1.80/1.86
	N2/N1	81.1/78.9	82.1/79.8	83.0/80.8	84.0/81.7	84.9/82.6	85.9/83.5	86.8/84.4	87.7/85.3	89.2/86.3
	FF/EGT	2024/313	2051/327	2079/341	2107/355	2134/370	2161/384	2189/398	2216/412	2208/422
	RAT/TAS	-47.9/401	-42.4/406	-37.0/411	-31.5/415	-26.1/420	-20.6/425	-15.2/429	-9.8/434	-4.3/439
	NAM/1,000	99.06	98.92	98.77	98.62	98.45	98.28	98.11	97.93	
72,000 LB	MACH/IAS	0.720/241	0.720/241	0.720/241	0.720/241	0.720/241	0.720/241	0.720/241	0.720/241	0.720/241
	EPR A/L	1.77/2.13	1.77/2.10	1.77/2.07	1.77/2.04	1.77/2.01	1.77/1.98	1.77/1.94	1.77/1.90	1.77/1.86
	N2/N1	80.6/78.2	81.6/79.2	82.5/80.1	83.5/81.0	84.4/81.9	85.4/82.8	86.3/83.7	87.9/84.8	88.8/85.7
	FF/EGT	1977/309	2004/323	2031/337	2057/351	2085/366	2111/380	2136/394	2119/402	2145/416
	RAT/TAS	-47.9/401	-42.4/406	-37.0/411	-31.5/415	-26.1/420	-20.6/425	-15.2/429	-9.8/434	-4.3/439
	NAM/1,000	101.40	101.26	101.12	100.97	100.79	100.62	100.55	100.44	100.23

GO-AROUND

Go-Around EPR Bleed Corrections

Engine bleeds for A/C OFF	+0.02
Engine anti-ice ON *	-
Airfoil anti-ice ON * (two engines)	-0.03
Airfoil anti-ice ON * (one engine)	-0.06

* Do not use engine and airfoil anti-ice if RAT is above 14°C (57°F).

Go-Around EPR

EPR				
PRESS ALT (FT) LIMIT EPR	**TEMP LIMIT EPR**	**AIRPORT TEMP (°F)**	**AIRPORT TEMP (°C)**	**RAT °C**
	1.76	117	47	50
	1.81	107	42	45
	1.86	99	37	40
Sea Level 1.93	1.90	90	32	35
	1.93	80	27	30
	1.93	71	22	25
	1.93	62	17	20
1,000 1.97	1.94	53	12	15
	1.97	44	7	10
2,000 2.02	2.00	36	2	5
	2.02	26	-3	0
3,000 2.07	2.06	17	-8	-5
	2.07	8	-13	-10
4,000 2.12	2.11	0	-18	-15
	2.12	-10	-23	-20
5,000 2.18	2.16	-19	-28	-25
	2.18	-27	-33	-30
	2.21	-36	-38	-35

ENGINE OUT

Net Driftdown – Anti-ice Corrections

This table provides the maximum aircraft weight vs. terrain elevation at which one engine inoperative enroute performance requirements are met. Weights are based on maximum continuous thrust and have been adjusted to include the required 2,000 feet terrain clearance, i.e. the aircraft's actual altitude capability is 2,000 feet above the terrain elevation.

Engine anti-ice ON *	Reduce table weights by 7,500 lbs.
Engine and airfoil anti-ice ON	Reduce table weights by 13,000 lbs.

Net Driftdown – Engine-Out

TERRAIN ELEVATION (FT)	TEMPERATURE			
	ISA – 10°C	ISA	ISA + 10°C	ISA + 20°C
15,000	90,500	86,400	82,700	78,300
14,000	93,500	89,400	85,400	80,700
13,000	96,500	92,300	88,200	83,100
12,000	99,500	95,300	90,900	85,400
11,000	102,500	98,200	93,600	87,800
10,000	105,000	101,200	96,400	90,100
9,000	108,500	104,100	99,100	92,500
8,000		107,000	101,800	94,800
7,000		110,000	104,500	97,200
6,000			107,300	99,500
5,000			110,000	101,900
4,000				104,300
3,000				106,600
2,000				109,900

Engine Ice Protection: Reduce table weights by 7,500 lbs.

Engine % Aircraft Ice Protection: Reduce table weights by 13,000 lbs.

Gliding Distance (All Weights)

INITIAL DRIFTDOWN ALTITUDE (1,000')	HORIZONTAL GLIDING DISTANCE (NM)
35	80.6
30	69.1
25	57.6
20	46.1
15	34.6
10	23.0
5	11.5

Maintain 225 KIAS during driftdown.

The data presented in this table is based on a glide ratio of 14:1.

FUEL CONSERVATION PROCEDURES

At the ramp, taxi-out and takeoff

- Take a known ATC delay at the gate.
- If the gate is needed by an inbound flight, take the ATC delay in a delay-absorbing area.
- Delay starting the engines until the aircraft is loaded and the doors are closed.
- During pushback, start the engines late in the operation rather than early.
- Restrict use of the APU to essential operations only.
- Use 5° flaps during takeoff whenever conditions make it practicable.
- Balanced thrust takeoffs can save some fuel, however the principle advantage is longer engine life.

Climb and cruise

- If climbing to FL250 or below; climb at 250 to 10,000 feet, then continue climb at 290 knots.
- If climbing to above FL250; climb at published climb schedule:
  - Under 90,000lbs: 290/.72M
  - 90,000-95,000lbs: 300/.72M
  - Over 95,000lbs: 310/.74M
- Cruise at optimum altitude whenever feasible. Operate flight with minimum fuel usages as a goal, but also consider minimum schedule disruption.
- Normally, cruise at a constant .76 Mach or 320 knots at lower altitudes.

Descent, Landing and Taxi-in

- Plan descent at 330 knots.
- Avoid fuel consuming level flight at low altitudes.
- Idle thrust can be used down to 1,500 feet above the surface when operating in a traffic pattern area, or down to minimum approach altitude when operating IFR. Stay "spooled up" below these altitudes. 55% N1 is a good value for spool up.
- Flaps 40/50 extension can be delayed until no later than 1,000 feet AGL, if weather conditions are VFR or better (1,000 + 3) with no tailwind. However, the aircraft must still be stabilized on profile 800-500 AGL straight in.
- Do not start the APU for landing unless needed (slush, standing water, etc., or for electrical requirements). Don't start the APU too soon with long taxi-in, but note one minute of operation is recommended before imposing load on the APU.

CRUISE PROCEDURES

General

The operation of the DC-9 in a cruise configuration is somewhat unique when compared to previous jet aircraft. Previously, the term "jet service" has been synonymous with long range. The DC-9 offers passengers the benefits of jet flight for short and medium trips as well. On short flights, the cruise regime is virtually nonexistent. The profile could, and will in some cases, consist of takeoff, climb, descent and landing.

Two cruise procedures are available:
1. High speed cruise, essentially 320 KIAS/.76M
2. Long range cruise varying IAS/Mach in relation to gross weight and latitudes to obtain maximum miles per pound of fuel.

Fuel Consumption of Pounds per Mile

The fuel consumption of turbojet engines cannot be easily generalized. Fuel consumption is a function of temperature, EPR, altitude and Mach number. The pounds of fuel per nautical mile however, is a function of weight, altitude, and speed and is essentially independent of temperature.

The speed of sound increases with an increase in temperature. The engine specific fuel consumption (SFC) for given values of thrust, altitude, and Mach number increases with temperature at approximately the same rate as the speed of sound. Therefore, the pounds of fuel per mile is practically independent of temperature and the range constant (pounds/mile) times the range in miles is equal to fuel required.

The less the range constant, the farther the aircraft can fly with a given amount of fuel.

Cruise Control Procedures

The DC-9 normally flies at high speed cruise, which is 320 KIAS or .76 Mach. These are not structurally limited speeds, but are arbitrary speeds for fuel conservation.

Long Range Cruise (LRC) is used when fuel economy is the prime consideration. The long range speed is defined as the greater of the two speeds at which one percent (1%) in range is sacrificed (99% of maximum nautical miles/pounds of fuel) and will vary with the gross weight and flight altitude. Charts are provided for the LRC regime.

When setting cruise power, leave climb power on after leveling off at altitude until cruise airspeed has been reached. Then reduce power to target EPR as indicated on the cruise chart for the appropriate gross weight.

FLIGHT PLANNING

Flight Planning Factors

When calculating the dispatch fuel quantity for the DC-9, take into account the following factors:

1. Determine the enroute flight plan fuel required from the applicable flight time and fuel planning chart.

2. Determine fuel required to divert to the alternate destination.

3. Add 650 pounds of fuel for each planned instrument approach.

4. Add 300 pounds of fuel for taxi-out at each station.

5. Add 4,000 pounds for FAA required 45 minute reserve.

Note: The minimum fuel quantity for dispatch is 8,040 pounds.

FLIGHT TIME AND FUEL PLANNING CHART: 35,000 – 33,000 FEET

The flight time and fuel burn listed in this table are based on the following speed schedule:

CLIMB:	CRUISE:	DESCENT:
250 KIAS to 10,000’ 290/.72M to 25,000’ 290/.72M to 310/.74M (variable with weight) above 25,000’	250 KIAS to 10,000’ 320 KIAS to 25,000’ .76M above 25,000’	.80M to 25,000’ 330 KIAS to 25,000’ to 10,000’ 250 KIAS below 10,000’

SEGMENT DIST (NM)		35,000 FEET/438 KTAS					33,000 FEET/441 KTAS				
		TAILWIND		0	HEADWIND		TAILWIND		0	HEADWIND	
		100KT	50KT	WIND	50KT	100KT	100K	50K	WIND	50K	100K
1400	Time	2:44	3:00	3:22	3:46	4:21	2:43	2:59	3:20	3:45	4:19
	Fuel	15.6	17.0	18.9	21.0	24.0	15.7	17.2	19.1	21.3	24.3
1300	Time	2:33	2:48	3:08	3:31	4:03	2:32	2:47	3:07	3:30	4:02
	Fuel	14.6	15.9	17.7	19.7	22.5	14.8	16.1	17.9	20.0	22.8
1200	Time	2:21	2:35	2:54	3:16	3:46	2:21	2:34	2:53	3:15	3:45
	Fuel	13.6	14.8	16.5	18.4	21.0	13.7	14.9	16.7	18.6	21.3
1100	Time	2:10	2:23	2:40	3:00	3:28	2:10	2:22	2:40	2:59	3:26
	Fuel	12.6	13.8	15.3	16.9	19.4	12.7	13.9	15.4	17.2	19.7
1000	Time	1:59	2:11	2:27	2:45	3:09	1:59	2:10	2:26	2:44	3:08
	Fuel	11.7	12.7	14.1	15.6	17.8	11.8	12.8	14.2	15.8	18.0
900	Time	1:48	1:59	2:13	2:29	2:51	1:47	1:58	2:12	2:28	2:50
	Fuel	10.7	11.6	12.9	14.3	16.2	10.7	11.7	13.0	14.4	16.4
800	Time	1:36	1:46	1:59	2:13	2:34	1:36	1:45	1:59	2:12	2:33
	Fuel	9.6	10.4	11.6	12.8	14.5	9.6	10.5	11.7	12.9	14.7
700	Time	1:25	1:30	1:45	1:57	2:15	1:25	1:33	1:45	1:57	2:14
	Fuel	8.6	9.0	10.3	11.3	12.8	8.6	9.4	10.4	11.4	13.0
600	Time	1:14	1:22	1:32	1:41	1:56	1:14	1:21	1:31	1:41	1:56
	Fuel	7.6	8.2	9.1	9.9	11.2	7.5	8.2	9.1	9.9	11.2
500	Time	1:03	1:10	1:18	1:26	1:39	1:03	1:10	1:18	1:25	1:38
	Fuel	6.6	7.2	7.9	8.5	9.6	6.5	7.1	7.8	8.5	9.6
400	Time		:57	1:04	1:10	1:21	:52	:57	1:04	1:10	1:20
	Fuel		6.0	6.6	7.1	8.0	5.5	6.0	6.6	7.1	8.0
300	Time				:55	1:02			:50	:55	1:02
	Fuel				5.8	6.4			5.3	5.7	6.3
200	Time										
	Fuel										
100	Time										
	Fuel										
50	Time										
	Fuel										

1. Interpolate wind effect when large deviations exist between actual wind and wind increments shown on the chart.
2. The chart is based on a landing weight of 85,000 lbs or below. If actual landing weight is expected to be above 85,000 lbs, add a fuel burn correction of 150 lbs per hour of flight time for each 5,000 lbs increment of additional landing weight.

FLIGHT TIME AND FUEL PLANNING CHART: 31,000 – 29,000 FEET

The flight time and fuel burn listed in this table are based on the following speed schedule:

CLIMB:	CRUISE:	DESCENT:
250 KIAS to 10,000' 290/.72M to 25,000' 290/.72M to 310/.74M (variable with weight) above 25,000'	250 KIAS to 10,000' 320 KIAS to 25,000' .76M above 25,000'	.80M to 25,000' 330 KIAS to 25,000' to 10,000' 250 KIAS below 10,000'

SEGMENT DIST (NM)		31,000 FEET/445 KTAS					29,000 FEET/449 KTAS				
		TAILWIND		0	HEADWIND		TAILWIND		0	HEADWIND	
		100KT	50KT	WIND	50KT	100KT	100K	50K	WIND	50K	100K
1400	Time	2:42	2:58	3:19	3:44	4:17					
	Fuel	16.0	17.5	19.4	21.7	24.8					
1300	Time	2:31	2:46	3:06	3:29	4:00					
	Fuel	15.0	16.4	18.2	20.3	23.3					
1200	Time	2:20	2:33	2:52	3:14	3:44	2:19	2:33	2:51	3:13	3:42
	Fuel	13.9	15.2	16.9	18.9	21.7	14.3	15.6	17.4	19.5	22.4
1100	Time	2:09	2:22	2:39	2:58	3:25	2:08	2:21	2:38	2:57	3:24
	Fuel	12.9	14.1	15.7	17.4	20.0	13.2	14.5	16.1	18.0	20.6
1000	Time	1:58	2:10	2:25	2:43	3:07	1:58	2:09	2:24	2:42	3:06
	Fuel	11.9	13.0	14.4	16.1	18.3	12.2	13.3	14.8	16.5	18.9
900	Time	1:47	1:58	2:12	2:27	2:50	1:46	1:57	2:11	2:27	2:49
	Fuel	10.8	11.8	13.2	14.6	16.7	11.1	12.1	13.5	15.0	17.2
800	Time	1:35	1:45	1:58	2:12	2:32	1:35	1:44	1:58	2:11	2:31
	Fuel	9.7	10.6	11.8	13.1	14.9	9.9	10.8	12.1	13.4	15.4
700	Time	1:24	1:33	1:45	1:56	2:14	1:24	1:33	1:44	1:56	2:13
	Fuel	8.7	9.5	10.5	11.6	13.2	8.8	9.7	10.8	11.9	13.6
600	Time	1:14	1:21	1:31	1:41	1:55	1:13	1:21	1:31	1:40	1:55
	Fuel	7.6	8.3	9.2	10.0	11.4	7.7	8.4	9.4	10.3	11.7
500	Time	1:03	1:10	1:18	1:25	1:38	1:03	1:09	1:17	1:25	1:37
	Fuel	6.6	7.2	7.9	8.6	9.8	6.6	7.3	8.0	8.7	10.0
400	Time	:52	:57	1:04	1:10	1:20	:52	:57	1:04	1:10	1:20
	Fuel	5.5	6.0	6.6	7.1	8.1	5.5	6.0	6.7	7.2	8.2
300	Time		:45	:50	:55	1:02	:41	:45	:50	:55	1:02
	Fuel		4.8	5.3	5.7	6.4	4.4	4.8	5.3	5.8	6.4
200	Time					:44				:40	:44
	Fuel					4.7				4.3	4.7
100	Time										
	Fuel										
50	Time										
	Fuel										

1. Interpolate wind effect when large deviations exist between actual wind and wind increments shown on the chart.
2. The chart is based on a landing weight of 85,000 lbs or below. If actual landing weight is expected to be above 85,000 lbs, add a fuel burn correction of 150 lbs per hour of flight time for each 5,000 lbs increment of additional landing weight.

FLIGHT TIME AND FUEL PLANNING CHART: 27,000 – 25,000 FEET

The flight time and fuel burn listed in this table are based on the following speed schedule:

CLIMB:	CRUISE:	DESCENT:
250 KIAS to 10,000’ 290/.72M to 25,000’ 290/.72M to 310/.74M (variable with weight) above 25,000’	250 KIAS to 10,000’ 320 KIAS to 25,000’ .76M above 25,000’	.80M to 25,000’ 330 KIAS to 25,000’ to 10,000’ 250 KIAS below 10,000’

SEGMENT DIST (NM)		27,000 FEET/453 KTAS					25,000 FEET/457 KTAS				
		TAILWIND		0	HEADWIND		TAILWIND		0	HEADWIND	
		100KT	50KT	WIND	50KT	100KT	100K	50K	WIND	50K	100K
1400	Time Fuel										
1300	Time Fuel										
1200	Time Fuel										
1100	Time Fuel										
1000	Time Fuel	1:59 12.5	2:08 13.7	2:23 15.3	2:40 17.1	3:04 19.5					
900	Time Fuel	1:46 11.4	1:56 12.5	2:10 13.9	2:25 15.5	2:47 17.7					
800	Time Fuel	1:34 10.1	1:44 11.1	1:57 12.4	2:10 13.8	2:30 15.8	1:34 10.4	1:43 11.4	1:56 12.9	2:09 14.3	2:29 16.5
700	Time Fuel	1:24 9.0	1:32 9.9	1:43 11.0	1:55 12.2	2:12 14.0	1:23 9.2	1:32 10.2	1:43 11.4	1:54 12.6	2:11 14.5
600	Time Fuel	1:13 7.8	1:20 8.6	1:30 9.6	1:39 10.5	1:54 12.0	1:13 8.0	1:20 8.8	1:30 9.9	1:39 10.9	1:53 12.4
500	Time Fuel	1:02 6.7	1:09 7.4	1:17 8.2	1:24 8.9	1:37 10.2	1:02 6.9	1:09 7.6	1:17 8.4	1:24 9.2	1:36 10.6
400	Time Fuel	:52 5.6	:57 6.1	1:04 6.8	1:10 7.4	1:20 8.4	:52 5.7	:57 6.2	1:03 6.9	1:09 7.6	1:19 8.6
300	Time Fuel	:41 4.4	:45 4.8	:50 5.4	:55 5.9	1:02 6.5	:41 4.5	:45 4.9	:49 5.4	:55 6.0	1:01 6.7
200	Time Fuel			:37 4.0	:40 4.3	:44 4.7	:30 3.3	:33 3.6	:37 4.0	:39 4.3	:44 4.8
100	Time Fuel										
50	Time Fuel										

1. Interpolate wind effect when large deviations exist between actual wind and wind increments shown on the chart.
2. The chart is based on a landing weight of 85,000 lbs or below. If actual landing weight is expected to be above 85,000 lbs, add a fuel burn correction of 150 lbs per hour of flight time for each 5,000 lbs increment of additional landing weight.

FLIGHT TIME AND FUEL PLANNING CHART: 23,000 – 21,000 FEET

The flight time and fuel burn listed in this table are based on the following speed schedule:

CLIMB:	CRUISE:	DESCENT:
250 KIAS to 10,000’ 290/.72M to 25,000’ 290/.72M to 310/.74M (variable with weight) above 25,000’	250 KIAS to 10,000’ 320 KIAS to 25,000’ .76M above 25,000’	.80M to 25,000’ 330 KIAS to 25,000’ to 10,000’ 250 KIAS below 10,000’

SEGMENT DIST (NM)		23,000 FEET/445 KTAS					21,000 FEET/432 KTAS				
		TAILWIND		0	HEADWIND		TAILWIND		0	HEADWIND	
		100KT	50KT	WIND	50KT	100KT	100K	50K	WIND	50K	100K
1400	Time Fuel										
1300	Time Fuel										
1200	Time Fuel										
1100	Time Fuel										
1000	Time Fuel										
900	Time Fuel										
800	Time Fuel										
700	Time Fuel	1:25 9.4	1:33 10.3	1:45 11.6	1:56 12.8	2:14 14.7					
600	Time Fuel	1:14 8.2	1:21 9.0	1:31 10.1	1:41 11.1	1:56 12.7	1:15 8.3	1:23 9.1	1:34 10.3	1:43 11.3	1:58 13.0
500	Time Fuel	1:03 7.0	1:10 7.7	1:18 8.6	1:25 9.4	1:38 10.8	1:04 7.1	1:11 7.8	1:19 8.8	1:27 9.6	1:40 11.0
400	Time Fuel	:52 5.7	:57 6.3	1:04 7.1	1:10 7.7	1:20 8.8	:53 5.8	:58 6.4	1:05 7.2	1:12 7.9	1:22 9.0
300	Time Fuel	:41 4.5	:45 5.0	:51 5.6	:55 6.1	1:02 6.8	:41 4.6	:46 5.0	:51 5.6	:56 6.2	1:04 6.9
200	Time Fuel	:30 3.3	:33 3.6	:37 4.0	:40 4.3	:44 4.8	:30 3.3	:33 3.6	:37 4.1	:40 4.4	:45 4.9
100	Time Fuel					:27 3.0				:25 2.7	:28 3.0
50	Time Fuel										

1. Interpolate wind effect when large deviations exist between actual wind and wind increments shown on the chart.
2. The chart is based on a landing weight of 85,000 lbs or below. If actual landing weight is expected to be above 85,000 lbs, add a fuel burn correction of 150 lbs per hour of flight time for each 5,000 lbs increment of additional landing weight.

FLIGHT TIME AND FUEL PLANNING CHART: 19,000 – 17,000 FEET

The flight time and fuel burn listed in this table are based on the following speed schedule:

CLIMB:	CRUISE:	DESCENT:
250 KIAS to 10,000’ 290/.72M to 25,000’ 290/.72M to 310/.74M (variable with weight) above 25,000’	250 KIAS to 10,000’ 320 KIAS to 25,000’ .76M above 25,000’	.80M to 25,000’ 330 KIAS to 25,000’ to 10,000’ 250 KIAS below 10,000’

SEGMENT DIST (NM)		19,000 FEET/420 KTAS					17,000 FEET/408 KTAS				
		TAILWIND		0	HEADWIND		TAILWIND		0	HEADWIND	
		100KT	50KT	WIND	50KT	100KT	100K	50K	WIND	50K	100K
1400	Time										
	Fuel										
1300	Time										
	Fuel										
1200	Time										
	Fuel										
1100	Time										
	Fuel										
1000	Time										
	Fuel										
900	Time										
	Fuel										
800	Time										
	Fuel										
700	Time										
	Fuel										
600	Time	1:16	1:24	1:35	1:45	2:01					
	Fuel	8.5	9.4	10.6	11.7	13.4					
500	Time	1:05	1:12	1:21	1:29	1:42	1:06	1:13	1:22	1:30	1:44
	Fuel	7.2	8.0	9.0	9.8	11.3	7.4	8.2	9.2	10.1	11.6
400	Time	:53	:59	1:06	1:13	1:23	:54	1:00	1:07	1:14	1:25
	Fuel	5.9	6.6	7.3	8.0	9.2	6.0	6.7	7.5	8.2	9.4
300	Time	:42	:46	:52	:57	1:04	:30	:33	:38	:41	:46
	Fuel	4.6	5.1	5.7	6.3	7.1	3.4	3.7	4.2	4.5	5.1
200	Time	:30	:33	:38	:40	:45	:30	:33	:38	:41	:46
	Fuel	3.4	3.7	4.1	4.4	5.0	3.4	3.7	4.2	4.5	5.1
100	Time			:23	:25	:27			:23	:24	:27
	Fuel			2.5	2.7	3.0			2.5	2.7	3.0
50	Time										
	Fuel										

1. Interpolate wind effect when large deviations exist between actual wind and wind increments shown on the chart.
2. The chart is based on a landing weight of 85,000 lbs or below. If actual landing weight is expected to be above 85,000 lbs, add a fuel burn correction of 150 lbs per hour of flight time for each 5,000 lbs increment of additional landing weight.

FLIGHT TIME AND FUEL PLANNING CHART: 15,000 – 13,000 FEET

The flight time and fuel burn listed in this table are based on the following speed schedule:

CLIMB:	CRUISE:	DESCENT:
250 KIAS to 10,000’ 290/.72M to 25,000’ 290/.72M to 310/.74M (variable with weight) above 25,000’	250 KIAS to 10,000’ 320 KIAS to 25,000’ .76M above 25,000’	.80M to 25,000’ 330 KIAS to 25,000’ to 10,000’ 250 KIAS below 10,000’

SEGMENT DIST (NM)		15,000 FEET/396 KTAS					13,000 FEET/386 KTAS				
		TAILWIND		0	HEADWIND		TAILWIND		0	HEADWIND	
		100KT	50KT	WIND	50KT	100KT	100K	50K	WIND	50K	100K
1400	Time Fuel										
1300	Time Fuel										
1200	Time Fuel										
1100	Time Fuel										
1000	Time Fuel										
900	Time Fuel										
800	Time Fuel										
700	Time Fuel										
600	Time Fuel										
500	Time Fuel	1:08 7.6	1:15 8.4	1:24 9.5	1:33 10.4	1:47 12.0					
400	Time Fuel	:55 6.2	1:01 6.9	1:09 7.7	1:16 8.5	1:27 9.7	:56 6.4	1:02 7.1	1:10 7.9	1:17 8.7	1:29 10.1
300	Time Fuel	:43 4.8	:48 5.3	:54 6.0	:59 6.6	1:07 7.4	:43 4.9	:48 5.4	:54 6.1	1:00 6.8	1:08 7.6
200	Time Fuel	:31 3.4	:34 3.7	:38 4.3	:41 4.6	:47 5.2	:31 3.5	:34 3.8	:39 4.3	:42 4.7	:47 5.3
100	Time Fuel	:20 2.2	:21 2.3	:23 2.5	:25 2.7	:28 3.0	:20 2.2	:21 2.3	:23 2.6	:25 2.7	:28 3.1
50	Time Fuel										

1. Interpolate wind effect when large deviations exist between actual wind and wind increments shown on the chart.
2. The chart is based on a landing weight of 85,000 lbs or below. If actual landing weight is expected to be above 85,000 lbs, add a fuel burn correction of 150 lbs per hour of flight time for each 5,000 lbs increment of additional landing weight.

FLIGHT TIME AND FUEL PLANNING CHART: 7,000 FEET

The flight time and fuel burn listed in this table are based on the following speed schedule:

CLIMB:	CRUISE:	DESCENT:
250 KIAS to 10,000’ 290/.72M to 25,000’ 290/.72M to 310/.74M (variable with weight) above 25,000’	250 KIAS to 10,000’ 320 KIAS to 25,000’ .76M above 25,000’	.80M to 25,000’ 330 KIAS to 25,000’ to 10,000’ 250 KIAS below 10,000’

SEGMENT DIST (NM)		7,000 FEET/270 KTAS				
		TAILWIND		0	HEADWIND	
		100KT	50KT	WIND	50KT	100KT
1400	Time Fuel					
1300	Time Fuel					
1200	Time Fuel					
1100	Time Fuel					
1000	Time Fuel					
900	Time Fuel					
800	Time Fuel					
700	Time Fuel					
600	Time Fuel					
500	Time Fuel					
400	Time Fuel	1:13 7.1	1:22 8.0	1:33 9.0	1:43 9.9	2:00 11.5
300	Time Fuel	:55 5.5	1:02 6.1	1:11 6.9	1:18 7.6	1:30 8.7
200	Time Fuel	:37 3.8	:42 4.2	:48 4.8	:53 5.2	1:01 6.0
100	Time Fuel	:22 2.3	:23 2.4	:26 2.7	:29 2.9	:33 3.4
50	Time Fuel	:13 1.5	:14 1.6	:15 1.7	:16 1.8	:17 1.9

1. Interpolate wind effect when large deviations exist between actual wind and wind increments shown on the chart.
2. The chart is based on a landing weight of 85,000 lbs or below. If actual landing weight is expected to be above 85,000 lbs, add a fuel burn correction of 150 lbs per hour of flight time for each 5,000 lbs increment of additional landing weight.

ALTERNATE PLANNING

DIST	20	40	60	80	100	120	140	160	180	200
OPTIMAL FL	050	080	110	140	170	200	230	250	260	270
TIME	.13	.17	.19	.21	.28	.28	.31	.34	.36	.40
FUEL	2400	2500	2600	2700	3300	3300	3800	3800	4000	4400
TAS	268	280	340	348	358	374	390	399	406	409

DIST	220	240	260	280	300	320	340	360	380	400
OPTIMAL FL	290	300	310	320	330	330	340	340	350	350
TIME	.42	.46	.48	.50	.53	.55	.59	1.02	1.05	1.07
FUEL	4700	4900	5100	5300	5700	5900	6200	6400	6600	6900
TAS	417	423	430	433	437	436	438	437	439	439

DIST	420	440	460	480	500	520	540	560	580	600
OPTIMAL FL	350	350	350	350	350	350	350	350	350	350
TIME	1.10	1.13	1.15	1.18	1.21	1.24	1.26	1.29	1.32	1.35
FUEL	7100	7400	7600	7800	8100	8300	8500	8800	9000	9200
TAS	439	439	439	439	439	439	439	439	439	439

DIST	620	640	660	680	700	720	740	760	780	800
OPTIMAL FL	350	350	350	350	350	350	350	350	350	350
TIME	1.37	1.40	1.43	1.45	1.48	1.51	1.54	1.56	1.59	2.02
FUEL	9500	9700	9900	10200	10400	10600	10900	11100	11300	11600
TAS	439	439	439	439	439	439	439	439	439	439

The time and fuel numbers includes en route trip requirement at LRC (long range cruise) from destination to alternate with additional fuel for approach and landing at alternate airport.

CRUISE ALTITUDE SELECTION

GROSS WEIGHT	TARGET ALT	WIND IMPROVEMENT ALTITUDE								
		350	**330**	**310**	**290**	**270**	**250**	**230**	**210**	**190**
65,000	350	0	9	19	32	47	61	78	95	112
70,000	350	0	10	19	31	44	59	76	93	111
75,000	350	0	9	19	31	43	57	74	91	109
80,000	350	0	8	18	29	41	55	71	88	106
85,000	350	0	7	16	27	39	52	67	85	103
90,000	350	0	7	15	25	37	50	64	81	100
95,000	350	0	6	14	23	34	47	61	77	95
100,000	350	0	3	11	19	29	42	56	71	89
105,000	350	0	2	9	17	27	38	52	67	83
110,000	350	0	3	6	14	23	34	47	62	77

The target weight is the most efficient altitude for the aircraft weight if wind is not considered.

The table numbers indicate the increase in tailwind or decrease in headwind necessary to fly an altitude other than the target altitude at the same cost.

Example; Target altitude for an aircraft weight of 90,000 pounds is flight level 350. However, if flight level 290 has a wind improvement of 25 knots, both flight levels are equally efficient and can be flown at the same cost. If flight level 290 has a wind improvement of more than 25 knots, it is the more efficient altitude.

CLIMB CAPABILITY

FLIGHT LEVEL	350	330	310	290
STANDARD TEMP	-54	-50	-46	-42
STANDARD +10	108	108	108	108
STANDARD +20	98	101	105	108
STANDARD +30	91	93	95	98

The table numbers indicate the maximum weight in thousands of pounds the aircraft can arrive at the selected flight level.

Rate of climb will be approximately 300 fpm for the last 300 feet of the climb based on M.75 and climb thrust.

Step climbs, depending on weight, will require approximately 200 to 600 pounds of fuel burn for a 2,000 foot step and 300 to 900 pounds of fuel burn for a 4,000 foot step.

CRUISE SPEED ADJUSTMENT FOR WIND

ALTITUDE	WIND COMPONENT						
	20	40	60	80	100	120	140
35,000	1	2	3	4	5	6	7
33,000	1	3	4	6	7	8	10
31,000	2	4	5	7	9	10	13
29,000	2	4	7	9	11	14	15
27,000	3	5	8	10	13	16	18
25,000	3	6	9	12	15	18	21
23,000	3	7	10	14	17	20	24
21,000	4	8	11	15	19	22	27

This chart indicates the normal cruise speed adjustment for a given altitude and headwind or tailwind component. When flying against headwind, add the adjustment to the normal cruise speed. When flying with a tailwind, subtract the adjustment to the normal cruise speed.

For example, the target altitude for the DC-9-31 is FL350. However, the aircraft is being flown at FL310 due to more favorable winds. The flight is experiencing a 40 knot headwind component at FL310. The long range cruise table indicates the aircraft should be flown at 273 IAS for the current weight (96,000 lbs) and temperature (-41C). The speed adjustment for a 40 knot headwind component at FL310 is +4. The aircraft should be flown at 273 + 4 = 277 knots.

DESCENT DISTANCE

CRUISE MACH/290 KTS to 10,000 FT	
INITIAL ALTITUDE	**DISTANCE NM**
370	71
350	66
330	61
310	56
290	51
270	46
250	42
220	34
200	28
150	11

Decrease distance 10% for each 50 knots of headwind.

Increase distance 10% for each 50 knots of tailwind.

Note: Descent distances are to 10,000 feet and 290 knots.

HOLDING – FLAPS UP

ALTITUDE STD TEMP	GROSS WEIGHT - LBS										
	106000	102000	98000	94000	90000	86000	82000	78000	74000	70000	66000
35,000 -54	**IAS** **FF** **EPR**	231 2603 2.04	225 2474 2.00	218 2341 1.96	212 2209 1.91	206 2080 1.86	199 1968 1.82	193 1851 1.78	186 1749 1.74	179 1651 1.71	171 1555 1.67
31,000 -46	229 2531 1.89	223 2410 1.85	217 2296 1.82	211 2186 1.78	205 2089 1.75	198 1997 1.72	192 1906 1.69	185 1818 1.65	178 1730 1.62	171 1635 1.59	164 1547 1.55
27,000 -38	221 2431 1.74	215 2336 1.71	209 2244 1.69	203 2155 1.66	197 2069 1.63	191 1977 1.60	184 1887 1.57	178 1803 1.55	171 1722 1.52	165 1641 1.49	160 1559 1.46
23,000 -31	213 2419 1.63	207 2327 1.60	201 2237 1.58	195 2152 1.55	189 2070 1.53	183 1988 1.51	177 1909 1.48	172 1828 1.46	168 1745 1.43	163 1662 1.40	158 1582 1.38
21,000 -27	209 2433 1.57	203 2346 1.55	197 2260 1.53	192 2177 1.51	186 2097 1.49	181 2015 1.46	176 1934 1.44	172 1850 1.42	168 1770 1.39	163 1692 1.37	159 1612 1.34
19,000 -23	205 2459 1.53	199 2375 1.51	194 2293 1.49	188 2210 1.47	184 2127 1.45	180 2043 1.42	176 1960 1.40	172 1880 1.38	167 1802 1.36	163 1724 1.33	159 1645 1.31
17,000 -19	201 2492 1.49	196 2407 1.47	191 2321 1.45	187 2234 1.43	183 2147 1.41	179 2066 1.39	175 1986 1.36	171 1907 1.34	168 1829 1.32	164 1750 1.30	160 1673 1.28
15,000 -15	198 2523 1.45	194 2432 1.43	190 2344 1.41	186 2259 1.39	182 2178 1.37	179 2099 1.35	175 2018 1.33	171 1940 1.31	167 1863 1.30	163 1788 1.28	160 1713 1.26
13,000 -11	198 2557 1.41	195 2470 1.39	191 2386 1.37	187 2303 1.35	184 2220 1.34	180 2138 1.32	176 2056 1.30	172 1980 1.29	169 1905 1.27	165 1831 1.25	161 1758 1.23
11,000 -7	199 2599 1.37	196 2513 1.36	192 2426 1.34	188 2342 1.32	185 2256 1.31	181 2176 1.29	177 2101 1.28	174 2026 1.26	170 1952 1.25	166 1879 1.23	162 1807 1.21
9,000 -3	200 2641 1.34	197 2554 1.32	193 2467 1.31	190 2384 1.30	186 2306 1.28	182 2229 1.27	179 2154 1.25	175 2079 1.24	172 2006 1.22	168 1933 1.21	164 1862 1.20
7,000 1	202 2690 1.31	198 2604 1.30	195 2524 1.28	191 2445 1.27	188 2366 1.26	184 2288 1.24	181 2212 1.23	177 2135 1.22	174 2059 1.20	170 1986 1.19	167 1913 1.18
5,000 5	203 2748 1.28	199 2666 1.27	196 2586 1.26	193 2504 1.25	189 2424 1.23	186 2344 1.22	183 2265 1.21	179 2187 1.20	176 2110 1.19	172 2035 1.17	169 1962 1.16
3,000 9	204 2797 1.26	200 2714 1.25	197 2631 1.24	194 2548 1.23	191 2465 1.22	187 2384 1.20	184 2304 1.19	181 2224 1.18	178 2146 1.17	174 2071 1.16	171 1996 1.15

SECTION 5

AIRCRAFT GENERAL

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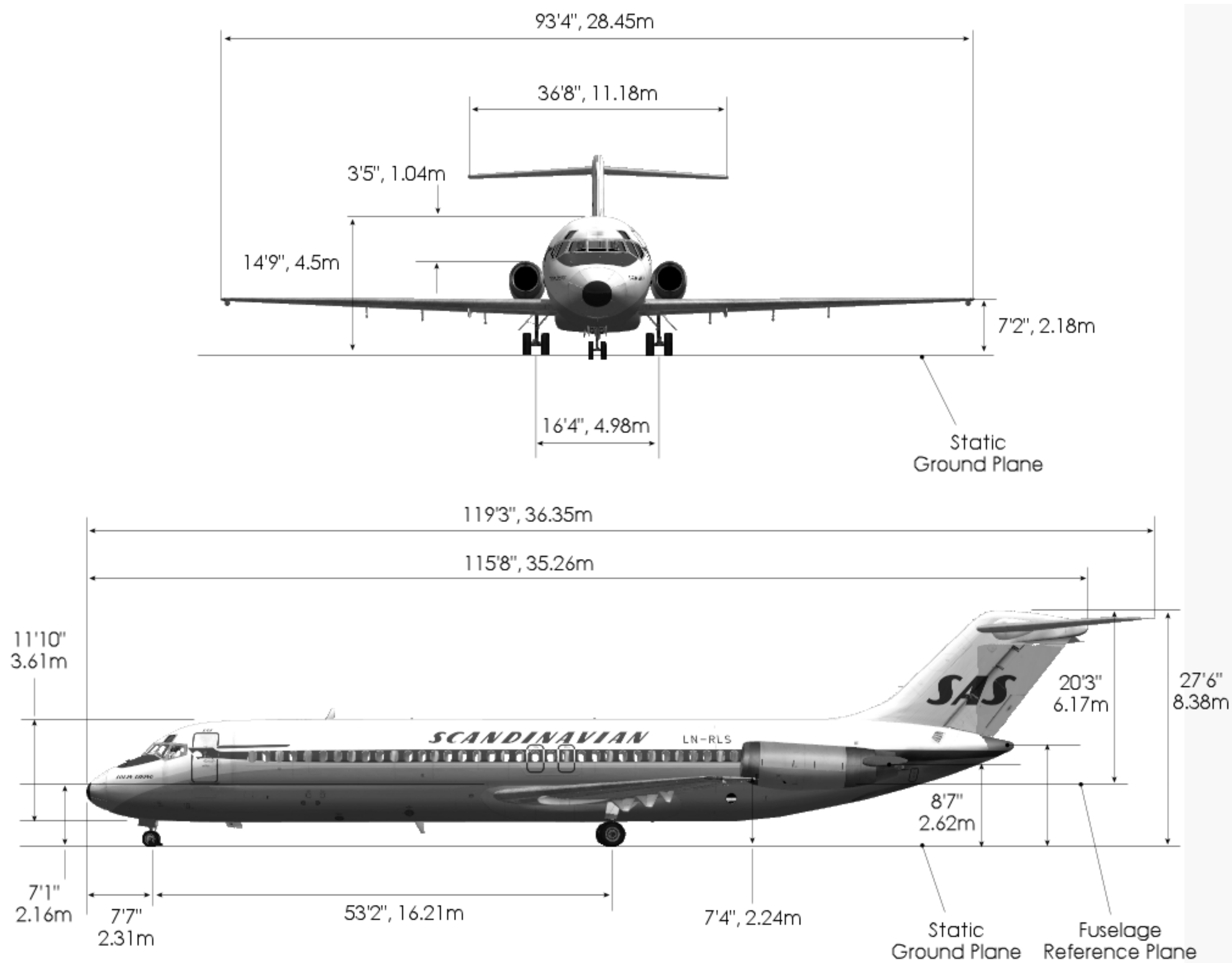
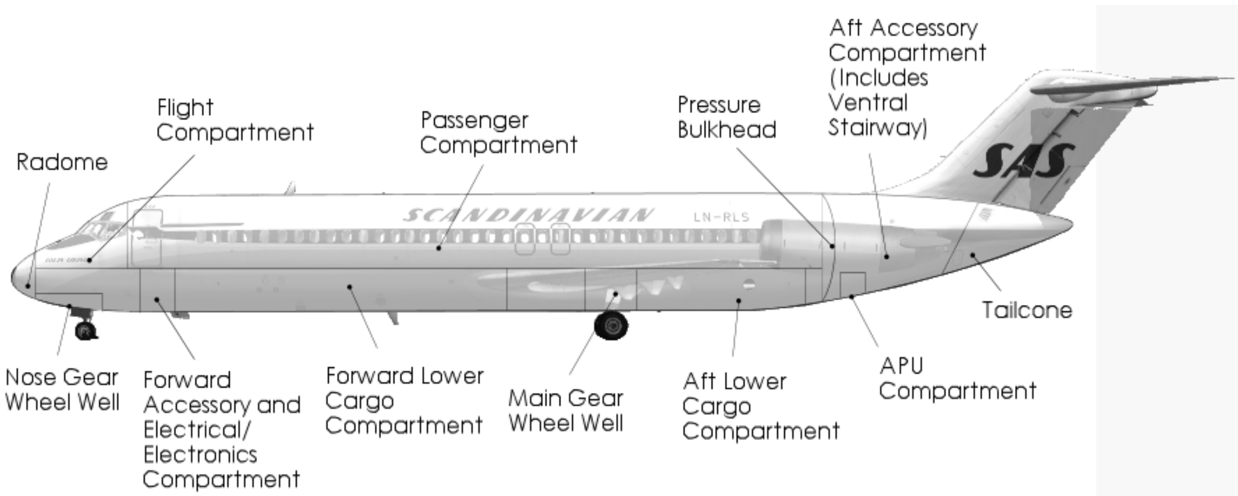
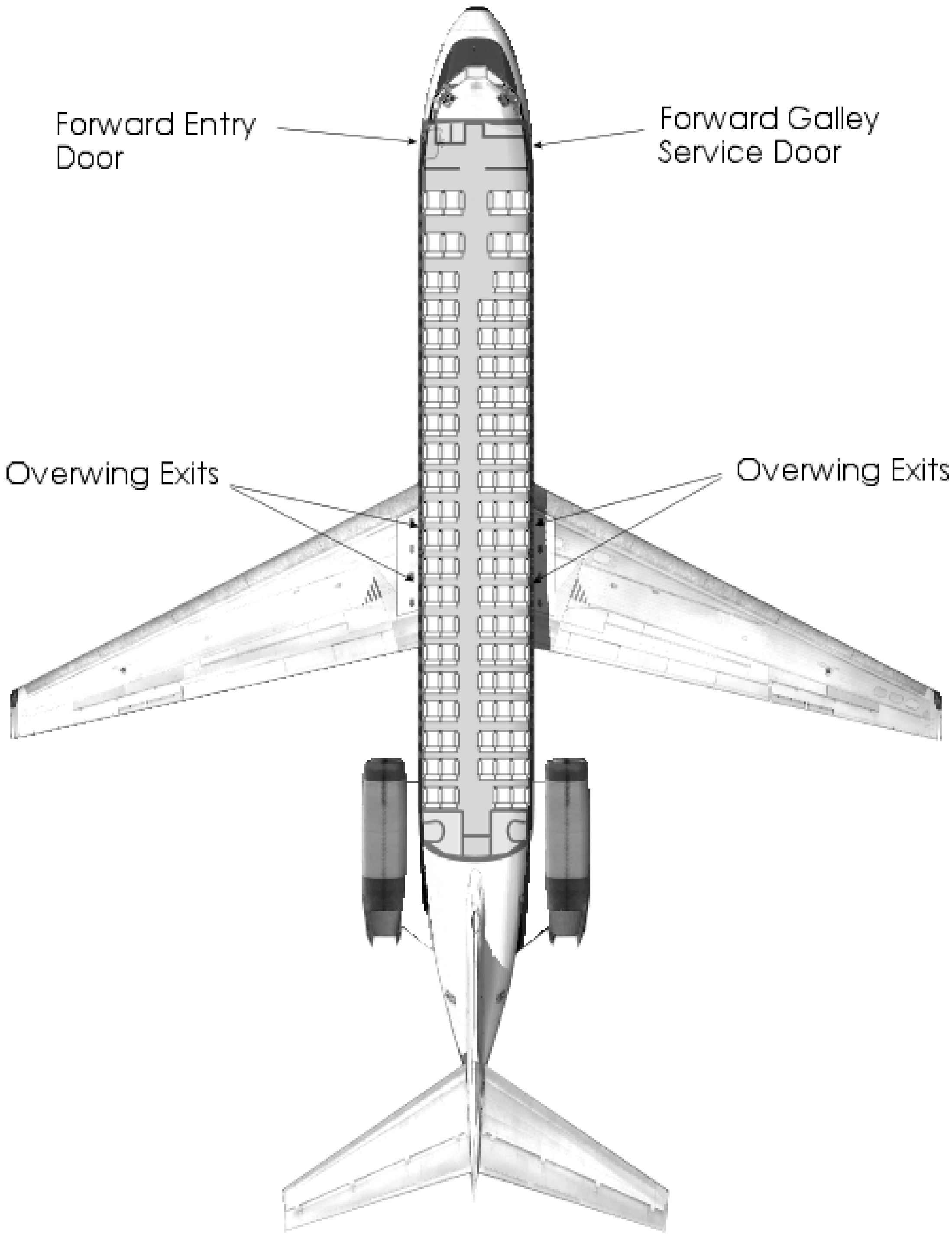
DIMENSIONS



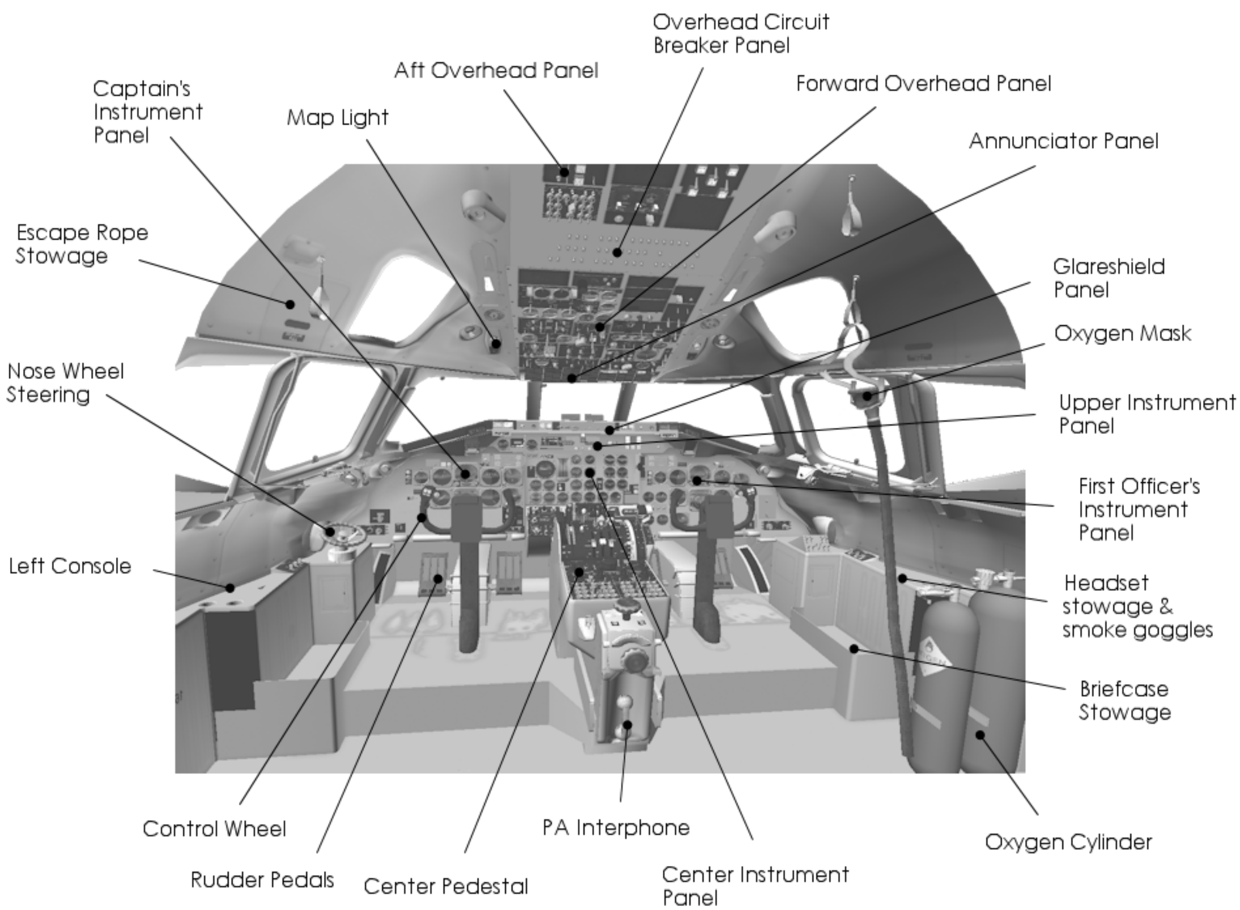
COMPARTMENTS



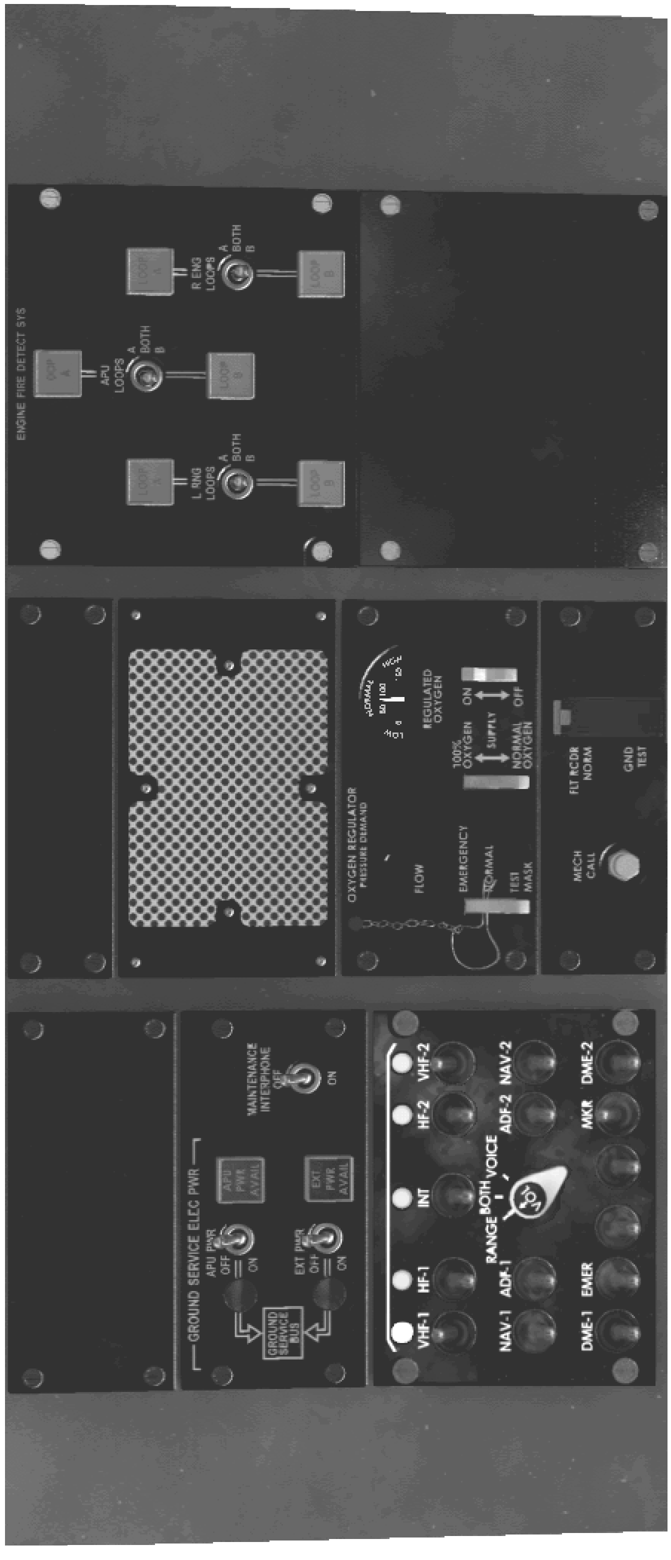
INTERIOR ARRANGEMENT



COCKPIT ARRANGEMENT

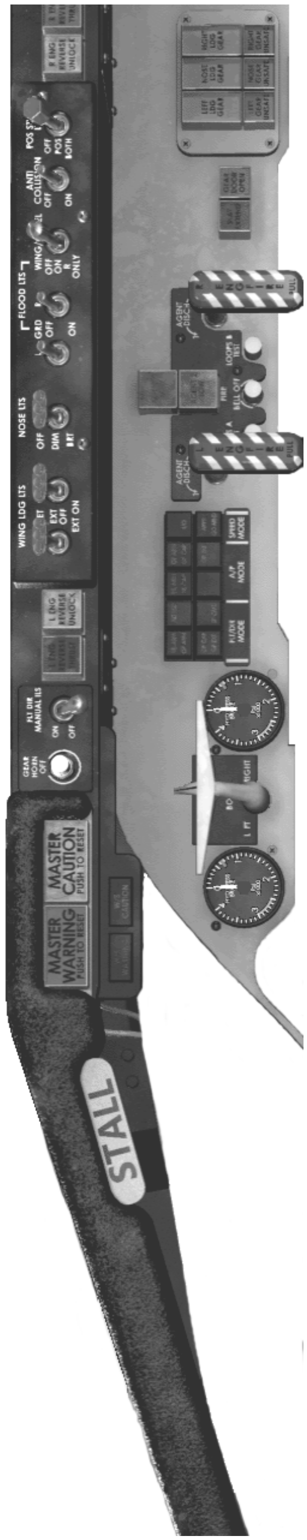


AFT OVERHEAD SWITCH PANEL

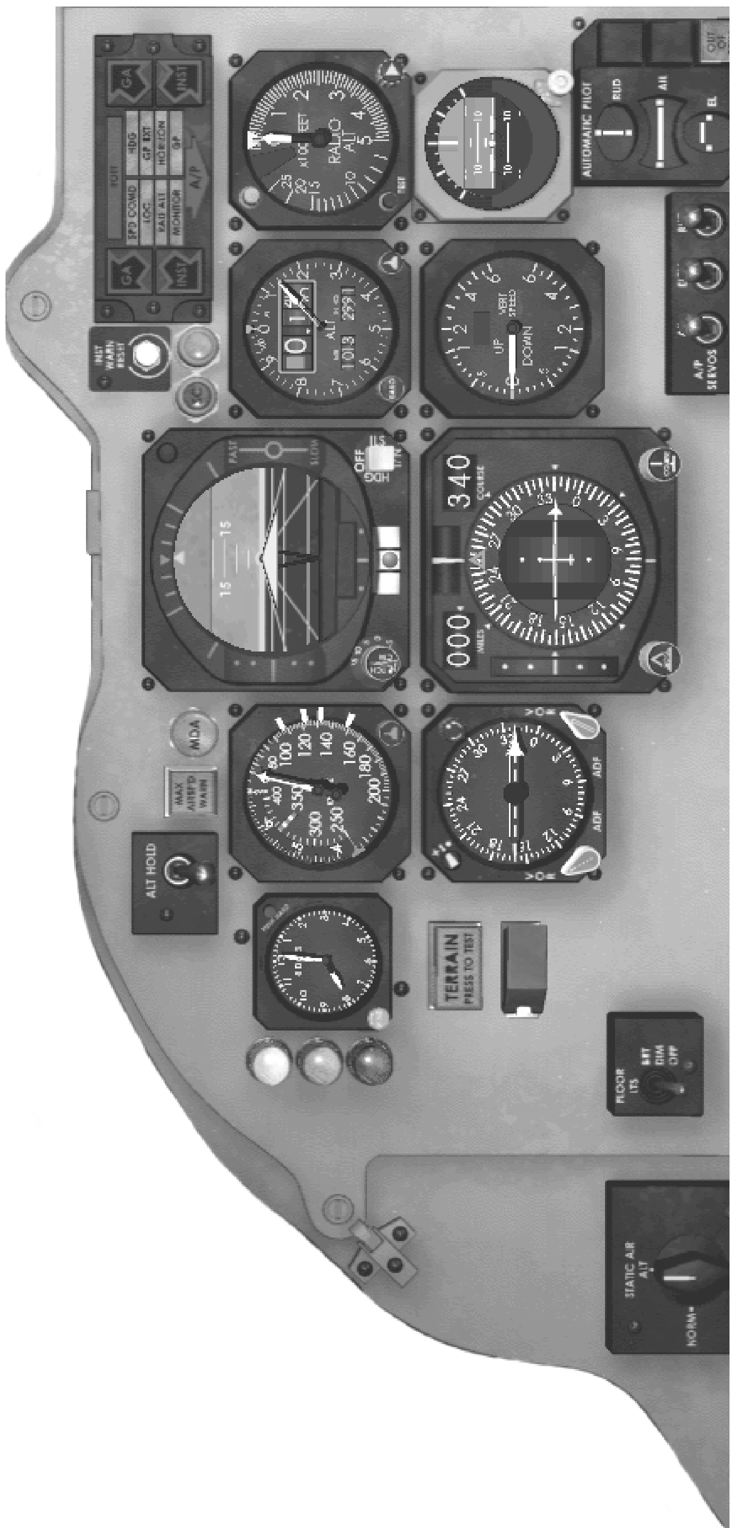


FORWARD OVERHEAD SWITCH PANEL

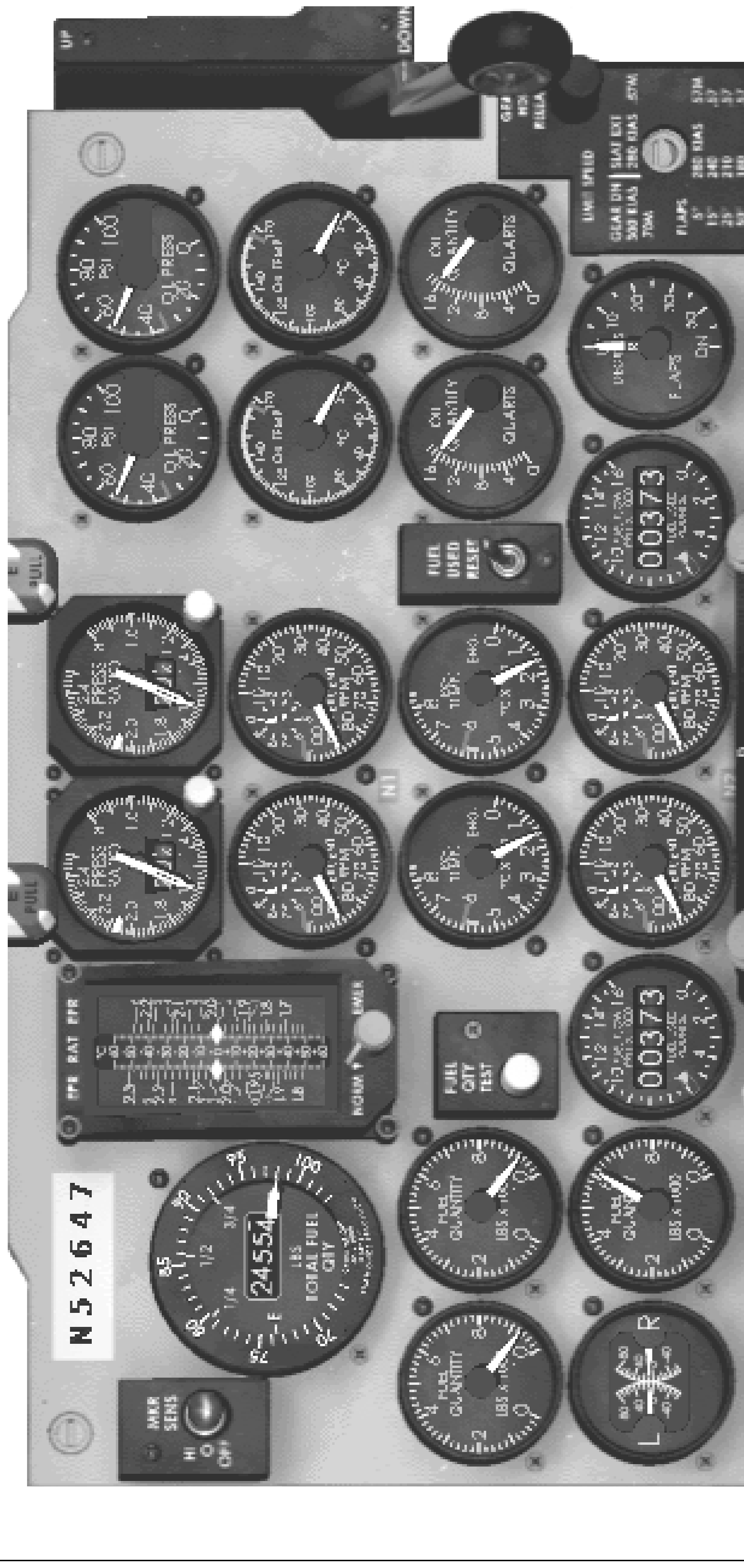
GLARESHIELD AND UPPER INSTRUMENT PANEL



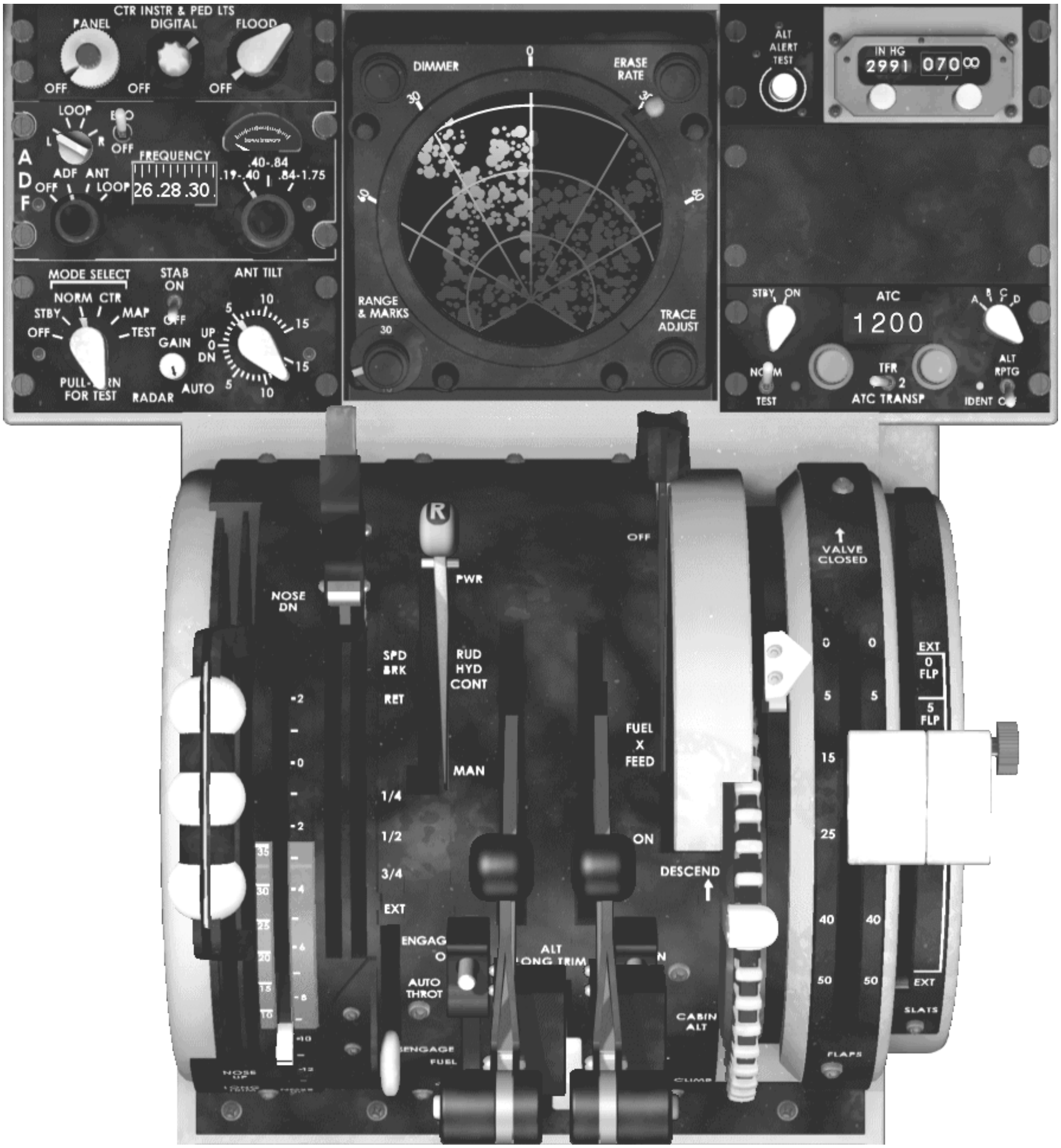
CAPTAIN'S INSTRUMENT PANEL



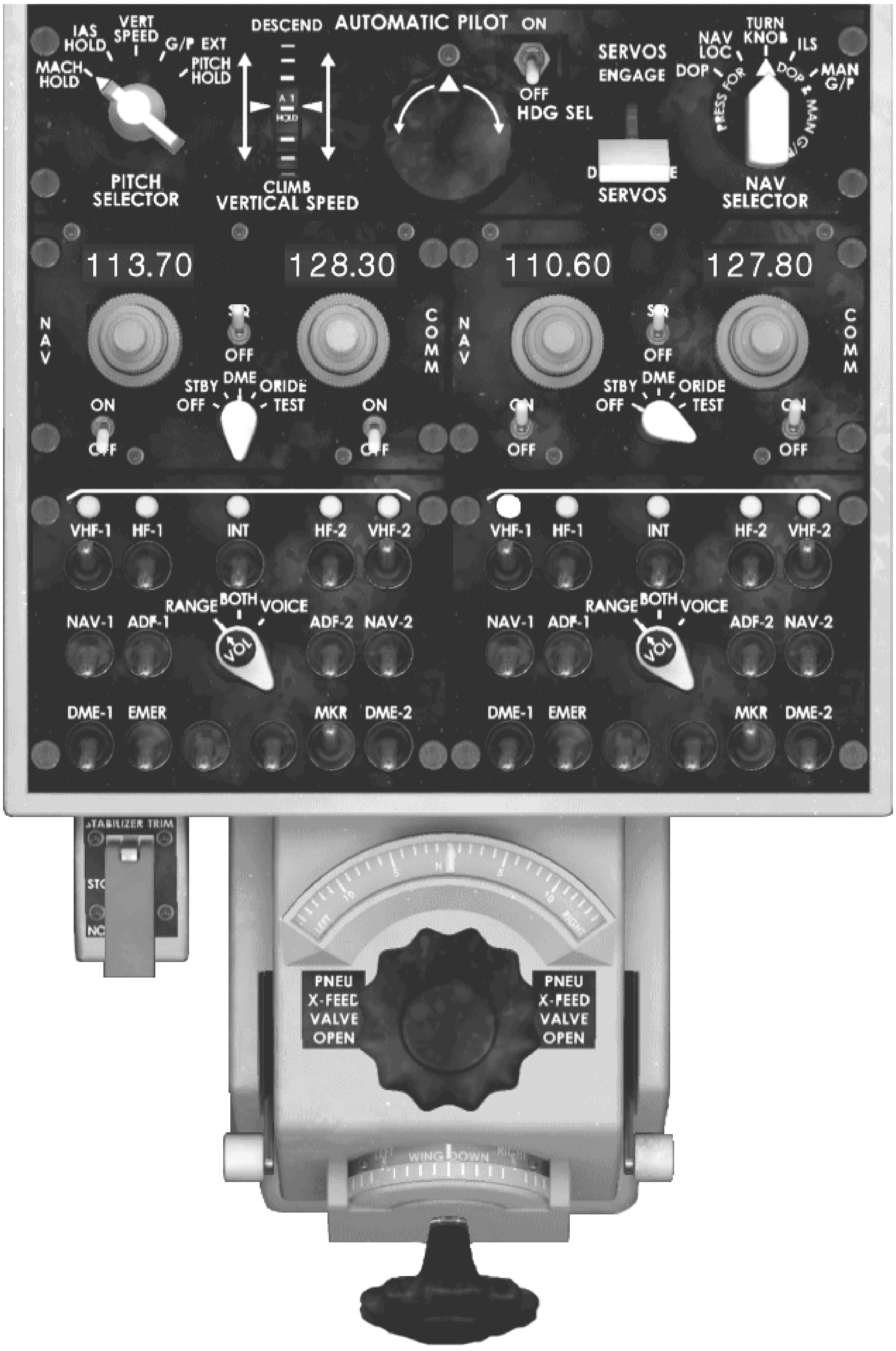
CENTER INSTRUMENT PANEL



FORWARD CONTROL PEDESTAL



AFT CONTROL PEDESTAL



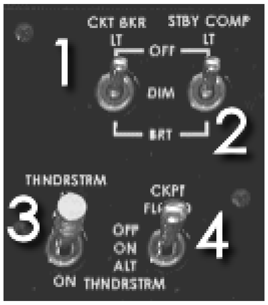
FLIGHT COMPARTMENT LIGHTING

(Overhead Panel)

1. PANEL LIGHT SWITCH
Toggles integral overhead panel lights on/off.

2. RED FILL LIGHTS SWITCH
Toggles red fill lights to light overhead panel. (not simulated)

3. OVERHEAD FLOODLIGHT SWITCH
Toggles overhead floodlights to light overhead panel.



(Overhead Panel)

1. CKT BKR PANEL SWITCH
On/dim/off switch for circuit breaker panel floodlights.

2. STBY COMP LIGHT SWITCH
On/dim/off switch for standby compass floodlights.

3. THNDRSTRM LIGHT SWITCH
OFF Lighting is controlled individually by the FO and captain.
ON Overrides individual light settings and turns on all cockpit floodlights to full intensity.

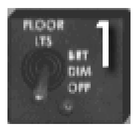
4. CKPT FLOOD SWITCH
OFF Turns off cockpit overhead flood lights
ON Turns on one light in both cockpit overhead floodlights.
ALT THNDRSTRM Turns on both lights in both cockpit overhead floodlights and increases overall lighting intensity.

(Captain's Side Panel)

1. PANEL AND INSTRUMENT LIGHTS SWITCH
On/off switch for Captain's instrument panel and console integral lights.

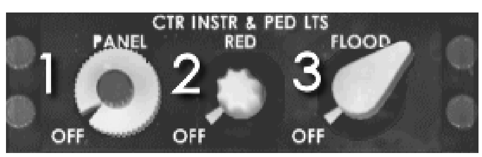
2. RED FILL LIGHTS SWITCH
On/off switch for the red fill lights for the Captain's instrument panel. (not simulated)

3. WHITE LIGHTS SWITCH
On/off switch for the flood lights for the Captain's instrument panel.



(Control Pedestal)

1. FLOOR LIGHTS SWITCH
Three position switch which operates the cockpit floor lights. (not simulated)



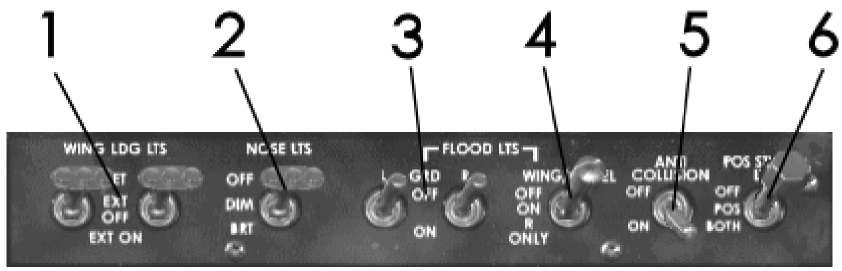
(Center Pedestal)

1. INTEGRAL LIGHTS SWITCH
On/off switch for center instrument panel and control pedestal integral lights.

2. RED FILL LIGHTS SWITCH
On/off switch for the red fill lights for the center instrument panel and control pedestal. (not simulated)

2. WHITE LIGHTS SWITCH
On/off switch for the flood lights for the center instrument panel and control pedestal.

EXTERNAL LIGHTING



(Glareshield)

1. WING LANDING LIGHTS SWITCHES (L & R)

RET	Wing landing lights are retracted and extinguished.
EXT OFF	Wing landing lights are fully extended and extinguished.
EXT ON	Wing landing lights are fully extended and illuminated.

2. NOSE LANDING AND TAXI LIGHT SWITCH

OFF	Nose landing light and taxi lights are extinguished.
DIM	Nose landing light and taxi lights are illuminated dim.
BRT	Nose landing light and taxi lights are illuminated bright.

Note: The nose landing lights and taxi lights will automatically extinguish when the landing gear handle is moved out of the DOWN position.

3. GROUND FLOOD LIGHTS SWITCHES (L & R)

Toggles on/off the fixed position flood lights on each side of the fuselage.

4. WING/NACELLE FLOOD LIGHTS SWITCH

OFF	Extinguishes both wing leading edge lights and both engine nacelle flood lights.
ON	Illuminates both wing leading edge lights and both engine nacelle flood lights.
R ONLY	Illuminates right wing leading edge light and right engine nacelle flood light.

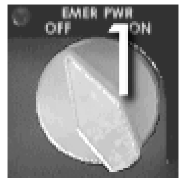
5. ANTI-COLLISION LIGHTS SWITCH

Toggles on/off the anti-collision lights on top and bottom of the fuselage.

6. POS/STROBE LIGHTS SWITCH

OFF	Both position and strobe lights are extinguished.
POS	Position lights are illuminated.
BOTH	Position lights are illuminated at all times, and strobe lights are illuminated when the airplane is in flight mode (airborne).

CABIN STANDBY LIGHTING



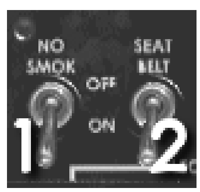
(Glareshield)

1. EMER PWR SWITCH

ON Energizes the cabin standby lights

The cabin standby lights are located in the ceiling and are distributed throughout the entire length of the cabin. The lights will stay illuminated until the aircraft batteries are completely discharged (minimum 45 minutes).

PASSENGER INFORMATION SIGNS



1. NO SMOK SWITCH

OFF Turns off the No Smoking signs in the cabin.
ON Turns on the No Smoking signs in the cabin.

2. SEAT BELT SWITCH

OFF Turns off the Fasten Seat Belt signs in the cabin.
ON Turns on the Fasten Seat Belt signs in the cabin.

ANNUNCIATOR PANEL, MASTER CAUTION & MASTER WARNING LIGHTS

Description

One set of MASTER WARNING and MASTER CAUTION lights are installed on both the Captain's and FO's side of the glareshield. The master lights can be turned off by pressing the light. However, the lights on the annunciator panel will remain illuminated until the indicated malfunction or condition is corrected.

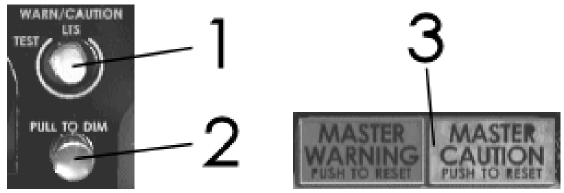
The annunciator panel, located on the overhead panel, contains color coded indicator lights to advise the flight crew of certain malfunctions and conditions with the airplane systems. Legends on top the color coded lights lenses pinpoint the nature and location of the malfunction or condition (e.g. ELECTRIC, ICE PROTECT, etc.).

All red (warning) lights cause the MASTER WARNING light to illuminate.

Most amber (caution) lights cause the MASTER CAUTION light to illuminate. The exceptions are:

EMER LIGHT NOT ARMED
AC CROSSTIE LOCKOUT
DC TRANSFER BUS OFF
L/R ICE PROTECT TEMP LOW
L/R ENGINE VALVE
L/R START VALVE OPEN
FLAP/RUDDER STOP INOP
STALL INDICATION FAILURE
SPOILER DEPLOYED
MACH TRIM INOP
RADIO FAN OFF
AUTO SPOILER DO NOT USE
SLAT DISAGREEMENT
FLT RECORDER OF
L/R REVERSER ACCUMULATOR LOW
L/R OUTBD ANTI-SKID
L/R INBD ANTI-SKID
All door lights under the "DOOR" legend.

The blue (advisory) lights will not cause either the MASTER WARNING or the MASTER CAUTION lights to illuminate.



(Overhead Panel)

1. WARNING/CAUTION LIGHTS TEST SWITCH
Press to test the integrity of all the annunciator panel lights, MASTER WARNING light and MASTER CAUTION light.

2. WARNING/CAUTION LIGHTS PULL TO DIM SWITCH
Not simulated.

3. MASTER WARNING AND MASTER CAUTION LIGHTS
Illuminates in conjunction with certain annunciator panel light to alert the flight crew of a malfunction or condition requiring immediate action (warning) or corrective action (caution).

DC-9-30 ANNUNCIATOR PANEL

ELECTRIC

	AC CROSSTIE LOCKOUT
APU GEN OFF	DC TRANSFER BUS OFF
L AC BUS OFF	R AC BUS OFF
L GEN OFF	R GEN OFF
L CSD OIL PRESS LOW	R CSD OIL PRESS LOW
EMER LIGHT NOT ARMED	DC BUS OFF

ICE PROTECT

L ENG ANTI-ICE ON	R ENG ANTI-ICE ON
WING ANTI-ICE ON	TAIL DE-ICE ON
GROUND ANTI-ICE DISAGREEMENT	PITOT/STALL HEATER OFF
L ICE PROTECT TEMP HIGH	R ICE PROTECT TEMP HIGH
AIRFOIL ICE PROT PRESS ABNORMAL	ICE PROTECT SUPPLY PRESS HI
L ICE PROTECT TEMP LOW	R ICE PROTECT TEMP LOW
L ENG VALVE	R ENG VALVE

ENGINE

L FUEL HEAT ON	R FUEL HEAT ON
L START VALVE OPEN	R START VALVE OPEN
L OIL STRAINER CLOGGING	R OIL STRAINER CLOGGING
L OIL PRESS LOW	R OIL PRESS LOW
L INLET FUEL PRESS LOW	R INLET FUEL PRESS LOW
L FUEL FILTER PRESS INOP	R FUEL FILTER PRESS INOP

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AUX FUEL PUMP PRESS LOW	FLAP/RUDDER STOP INOP
	STALL INDICATION FAILURE
GPWS INOP	SPOILER DEPLOYED
	TAIL COMPT TEMP HIGH
CABIN PRESS	APU FIRE
AC EMER BUS OFF	DC EMER BUS OFF

RUDDER TRAVEL UNRESTRICTED	AUTO SPOILER DO NOT USE
RAIN REPELLENT RESERVE IN USE	SLAT DISAGREEMENT
CABIN OXYGEN ON	WINDSHEAR INOP
MACH TRIM INOP	APU OIL TEMP HIGH
FIRE DETECTOR LOOP	APU OIL PRESS LOW
L AIR COND SUPPLY TEMP HI	R AIR COND SUPPLY TEMP HI
RADIO FAN OFF	FLT RECORDER OFF

HYD & ANTI-SKID

ELEVATOR PWR ON	SPOILER/FLAP EXTENDED
	RUDDER CONTROL MANUAL
L REVERSER ACCUMULATOR LOW	R REVERSER ACCUMULATOR LOW
L HYD TEMP HI	R HYD TEMP HI
L HYD PRESS LOW	R HYD PRESS LOW
L OUTBD ANTI-SKID	R OUTBD ANTI-SKID
L INBD ANTI-SKID	R INBD ANTI-SKID

DOORS

TAILCONE	
	AFT STAIRWAY DOOR
	AFT CABIN DOOR
	AFT CARGO DOOR
STAIRWAY DOOR	FWD CARGO DOOR
MAIN CABIN DOOR	GALLEY DOOR
FWD ACCESSORY COMPT DOOR	ELEC COMPT DOOR

RED LIGHT (WARNING) – Indicates a condition requiring immediate action. Light remains illuminated until the condition is corrected.

AMBER LIGHT (CAUTION) – Indicates a condition requiring corrective action. Light remains illuminated until the condition is corrected.

BLUE LIGHT (ADVISORY) – Indicates a system is ON and operating. Light remains illuminated until the corresponding system is OFF or ceases to operate.

BLANKS – Not in use. Does not illuminate.

SECTION 6

ICE & RAIN PROTECTION

TABLE OF CONTENTS

GENERAL

General

The airplane ice protection systems employ hot air and electrical heating for anti-icing and anti-fogging functions. Rain removal is accomplished by chemical repellent and electrically operated windshield wipers.

Window Heat

Electrical heating provides heat for anti-icing and anti-fogging of the pilot's three windshields, and anti-fogging for the clearview and eyebrow windows.

Probe Heat

Electrical heating is used for anti-icing the pitot tubes, static port areas, stall angle of attack vanes, and ram air temperature probe.

Airfoil Ice Protection

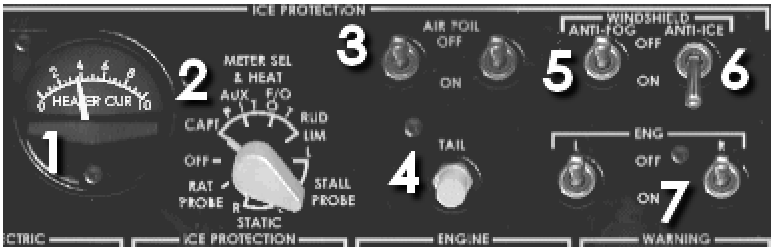
The airfoil ice protection system provides anti-icing heat to the wing leading edge slats and to the air conditioning ram air-scoop inlet in flight, when the air foil switch and associated pneumatic crossfeed valves are actuated.

De-icing is available for the horizontal stabilizer leading edge by the tail de-ice pushbutton. Heat is then diverted from the wing leading edge slats and strakes to the horizontal stabilizer. Tail de-icing is provided for 2.5 minutes, and then flow is reverted back to the wing slats and strakes again. When air foil anti-icing is selected, tail de-icing will automatically be selected every 15 minutes.

Engine Anti-Ice

Engine anti-icing is provided by independent system, controlled by individual switches located on the overhead ice protection panel. Each engine provides ice protection for the respective engine, nose cowl, inlet bullet, and compressor inlet guide vanes.

CONTROLS AND INDICATORS



1. HEATER CUR METER
Displays current flow to each position as selected by the METER SEL & HEAT switch.

2. METER SEL & HEAT SELECTOR
When the selector is moved from the OFF position, all pitot tubes, rudder limiter, stall probes and static ports are heated.

3. AIR FOIL ANTI-ICE SWITCHES (L, R)

OFF Stops the flow of heated air to the wing leading edge slats, strakes, and horizontal stabilizer.

ON Opens up the pressure regulator valve to allow heated air to flow to the wing leading edge slats, strakes, and horizontal stabilizer.

4. TAIL DE-ICE PUSHBUTTON
Closes shutoff valve to the wings and strakes, and opens up the shutoff valve to de-ice the tail. After a timed period, 2.5 minutes, the system automatically reverts back to anti-icing the wings and strakes.

5. WINDSHIELD ANTI-FOG SWITCH

OFF Deactivates the anti-fog system.

ON Prevents and/or removes condensation on the inside surface of the windshields, clearview, and overhead windows.

6. WINDSHIELD ANTI-ICE SWITCH

OFF Deactivates the window anti-ice system.

ON Provides anti-ice heat to three windshields.

7. ENG ANTI-ICE SWITCHES (L, R)

OFF Closes valves to shut off air to engine anti-ice system.

ON Opens valves to provide heater air to anti-ice engine nose cowl, bullet, and inlet compressor guide vanes.

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1. RAIN REPELLENT SELECTOR SWITCH

RES (Momentary) Positions selector valve from primary to reserve fluid container. Selector valve cannot be reset to primary until serviced by maintenance.

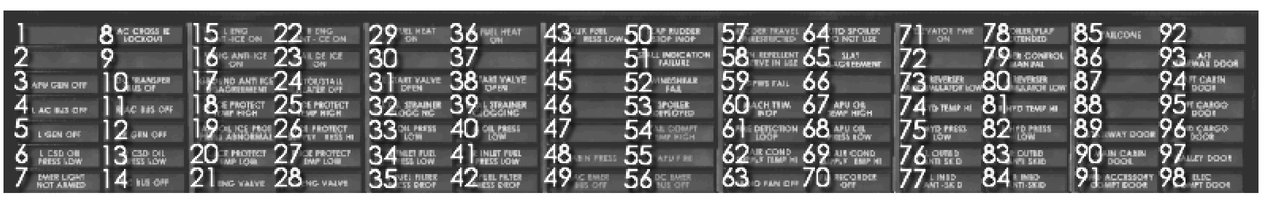
2. RAIN REPELLENT PUSHBUTTONS (L, R)

Discharges a metered quantity of fluid from spray nozzles onto the windshield.

3. WINDSHIELD WIPER SWITCH

Controls variable speed, electrically operated windshield wipers. Wipers should be used in conjunction with rain repellent.

WARNING AND CAUTION INDICATORS



15 & 22. ENG ANTI-ICE ON LIGHTS (L, R)(Blue)

Indicates engine anti-ice system is on.

16. WING ANTI-ICE ON LIGHT (Blue)

Indicates anti-ice heat has been selected for wing leading edge and strakes.

23. TAIL DE-ICE ON LIGHT (Blue)

Indicates de-ice heat has been selected for the leading edge of the horizontal stabilizer.

24. PITOT/STALL HEATER OFF LIGHT

Comes on to indicate METER SEL & HEATER selector in OFF position. MASTER CAUTION light also comes on.

58. RAIN REPELLENT RESERVE IN USE LIGHT (Blue)

Indicates reserve fluid container has been selected.

SECTION 7

ELECTRICAL

TABLE OF CONTENTS

GENERAL

General

The airplane electrical system is designed for simple and automatic operation. When a problem occurs, the system automatically takes the best course of action to maintain electrical power to the system.

The airplane electrical power system consists of a 115/200 volt, 400 Hz AC power generating and distribution system. For control circuits, lighting and other load devices requiring DC power, 28 volt DC power is supplied by transformer-rectifiers (TR).

Power for the DC system is supplied from two batteries when the main power distribution system is de-energized.

Power for APU starting is supplied by the batteries.

A battery charger, powered from an AC bus, maintains the batteries in a charged condition.

The controls and indicators for the electrical system are located on the left side of the overhead panel.

AC power generating system

AC power is normally supplied by any two of three AC generators, one on each engine and one on the auxiliary power unit (APU). Each generator is rated at 40 KVA maximum continuous output and is capable of supplying sufficient power for operation of essential electric systems in the event of loss of the other two generators.

For ground operations, an external power source may be connected to the airplane. The external power receptacle is located on the lower fuselage, left side.

The APU generator is mounted directly on the APU, and driven at a constant speed by the APU governing system.

Each engine-driven generator is driven through a constant-speed drive (CSD), which converts the variable speed output of the engine to a constant speed.

Each CSD is provided with a disconnect switch in case of malfunction of the generator or the CSD. Once disconnected, the CSD must be manually reconnected at the engine after engine shutdown.

AC power distribution system

The electrical system is comprised of independent left and right systems which are normally powered by the respective engine driven generator. APU power and external power may be selected to power either or both generator buses.

The Ground Service Bus provides power to those circuits necessary for ground servicing operations.

An automatic priority system is installed to determine which power source is used. Power is automatically applied from the highest available priority source.

Electrical system priority:

1. Engine generator
2. APU generator
3. External power
4. AC crosstie relay

Example: If the APU is supplying power to the bus, and an engine driven generator is placed on the bus, the APU generator will automatically be taken off the bus.

The shutdown of a generator will automatically transfer the load from that generator to the remaining operating generator, through the AC crosstie relay.

DC power distribution system

The function of the DC power distribution system is similar to the AC system in that the right and left system function separately. The DC system has a manual crosstie in the event of a failure of either side. In addition to the left and right systems, DC power is supplied from two batteries.

The left DC system is powered by two transformer-rectifiers (T/R), both of which receive power from the left AC bus. The right DC system is also powered by two T/Rs, one powered by the right AC bus and one powered by the ground service bus.

Batteries

Two 14 volt batteries are connected in series to supply 28 volt DC power. The battery is automatically being charged when electrical power is on the aircraft and the battery switch is ON.

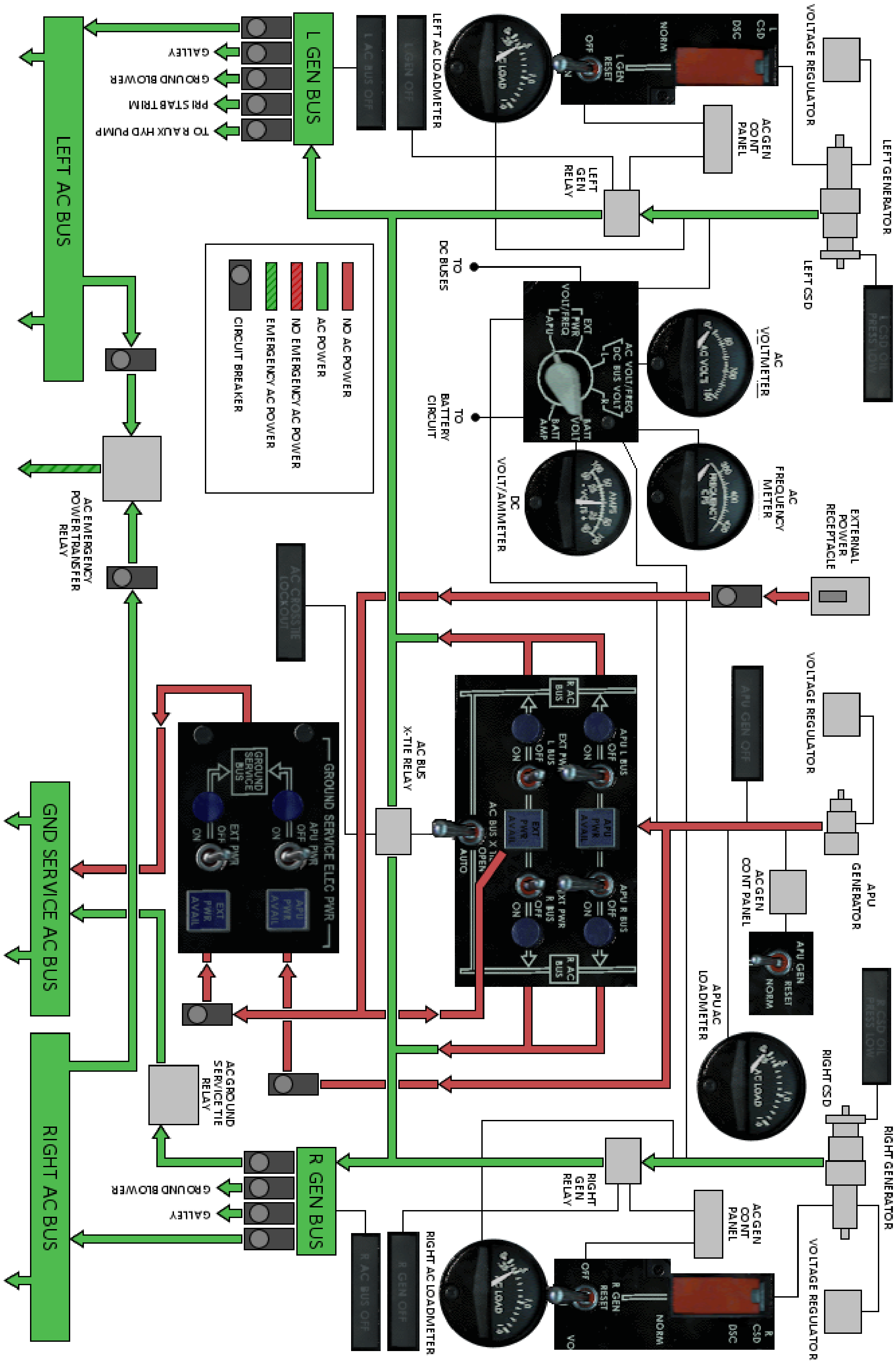
Battery charger

The battery charger is operative when the aircraft power is on, and the battery switch is in the ON position. When the battery is fully charged, the battery charger will be in a pulsating mode. If the battery is in a low state of charge, the ammeter will indicate a continuous current of approximately 65 amperes, and then switch into a pulsating mode as the battery becomes fully charged.

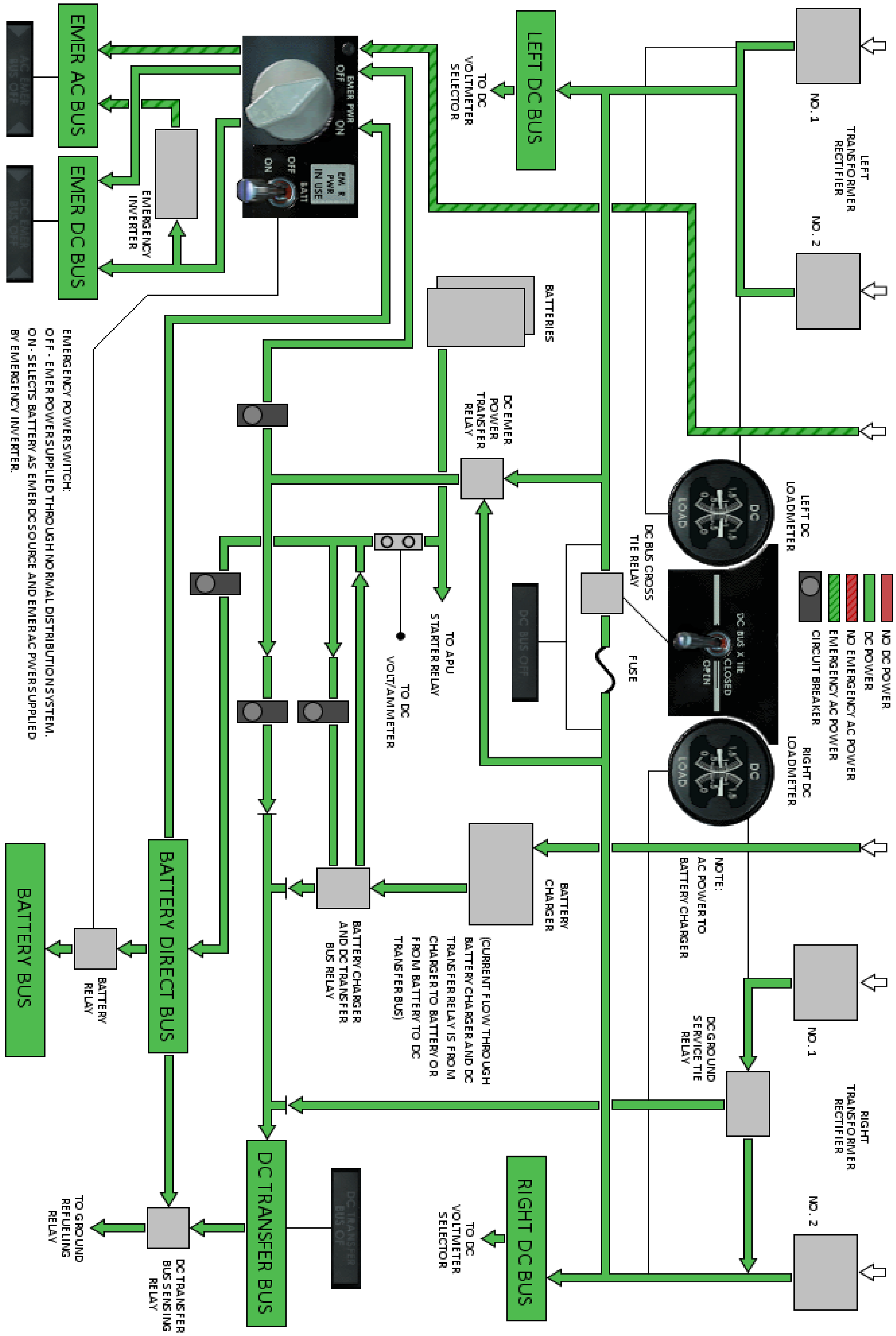
Emergency AC and DC Power Supply

During normal operations, the emergency AC bus receives power from the left AC bus and the emergency DC bus receives power from the left DC bus. If power is lost, the emergency AC and DC buses will receive power from the remaining AC or DC bus. In the event of a complete loss of power, the batteries will provide power to the AC and DC emergency buses. When operating on emergency power, the batteries should power essential instruments for about 45 minutes.

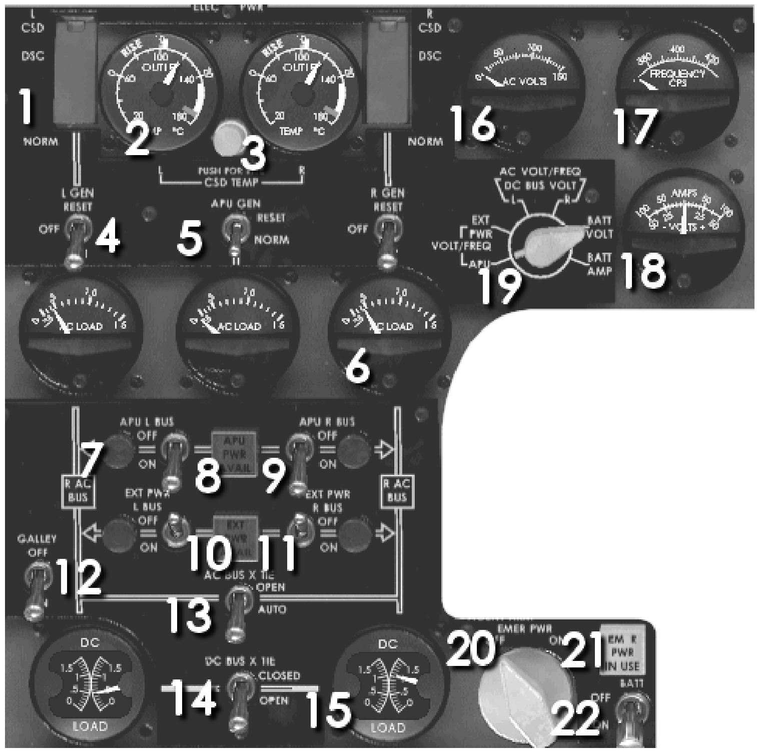
FUNCTIONAL SCHEMATIC – AC SYSTEM



FUNCTIONAL SCHEMATIC – DC SYSTEM



CONTROLS AND INDICATORS



1. CSD DISCONNECT SWITCH (L, R)

NORM Guarded switch normally in this position.

DISC (Momentary) Disconnects CSD from engine drive.

Note: Once disconnected, the CSD cannot be reconnected. This must be done by maintenance personnel on the ground. In the simulator, you can click a hotspot between the CSD Oil Temperature gauges to reconnect the CSD when on the ground.

2. CSD OIL TEMPERATURE GAUGE (L, R)

Indicates CSD oil outlet temperature or oil temperature rise across the drive.

3. CSD TEMP PUSH FOR RISE BUTTON

When actuated, temperature rise (outlet temperature minus inlet temperature) is displayed on outer scale of indicator.

4. GEN SWITCH (L, R)

RESET (Momentary) Resets generator control circuit.

OFF Disconnects generator from AC power distribution system.

ON Connects generator to AC power distribution system.

5. APU GEN SWITCH

RESET (Momentary) Resets generator control circuit.

NORM For normal operation.

6. AC LOAD METER (3)

Indicates the load each AC generator is delivering to the distribution system. Indicates from 0 to 1.5 with 1.0 indicating 100% of generator rated capacity.

7. POWER IN USE LIGHT (4)
Indicates selected power source is connected to respective bus.

8. APU PWR AVAIL LIGHT
Indicates APU power is available.

9. APU BUS SWITCH (L, R)
OFF Removes APU power from respective buses.
ON Selects APU power to respective buses.

10. EXT PWR AVAIL LIGHT
Indicates external power is available.

11. EXT PWR BUS SWITCH (L, R)
OFF Removes external power from selected bus.
ON Selects external power to respective bus.

12. GALLEY SWITCH
OFF De-energizes galley power relays removing power from all galleys.
ON Energizes galley power relays which supply power to all galleys.

13. AC BUS X TIE SWITCH
OPEN Opens AC crosstie relay, isolating left and right AC distribution systems. Prevents automatic closing of relay with loss of left or right AC bus power.
AUTO Normally operated in this position. With loss of left or right AC bus power, relay closes automatically, connecting the two buses together.

14. DC BUS X TIE SWITCH
CLOSE Connects left and right DC buses, allowing any combination of T/R's to power both DC buses.
OPEN Normal position. Isolates left and right DC distribution systems.

15. DC LOAD METER (L, R)
Indicates load the respective T/R is delivering to the distribution system. Reading of 1 indicates 100% of T/R rated capacity.

16. AC VOLTS METER
Indicates voltage output of generators or external power.

17. FREQUENCY METER
Indicates frequency control of generator or external power in cycles per second (Hz).

18. DC VOLTS/AMPS METER
Indicates charge or discharge current of battery, battery voltage, or DC bus voltage.

19. INDICATOR SELECTOR SWITCH
When moved to either L or R positions, AC voltage and frequency for selected sources are read on respective meters. All other positions select only a single source as indicated on switch placard.

20. EMER PWR SWITCH
OFF Removes battery as source of emergency power.
ON Connects battery as source of emergency AC and DC power.

21. EMER PWR IN USE LIGHT
Indicates emergency power is on.

22. BATT SWITCH
OFF Removes battery from battery bus, battery charger and DC transfer bus.
ON Connects battery to battery bus. Selects battery to battery charger, and DC transfer bus.

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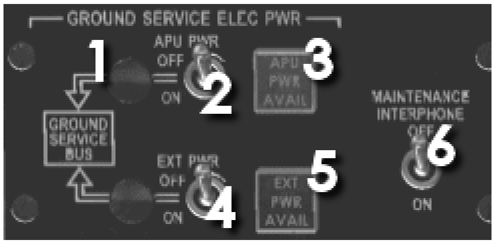

1. GROUND SERVICE BUS POWER IN USE LIGHT (2) (Blue)

The light indicates that the selected power source is connected to the Ground Service Bus and supplying power.

2. APU PWR SWITCH

OFF Removes APU generator power from the Ground Service Bus

ON Connects APU generator power to the Ground Service Bus.

3. APU PWR AVAIL LIGHT (Blue)

Indicates APU generator power is available.

4. EXT PWR SWITCH

OFF Removes external power from the Ground Service Bus

ON Connects external power to the Ground Service Bus. Note: External power will be selected to power the Ground Service Bus if both APU generator and external power switches are selected ON.

5. EXT PWR AVAIL LIGHT (Blue)

Indicates external power is available.

6. MAINTENANCE INTERPHONE

OFF Disconnects all maintenance interphone jacks from the service interphone.

ON Connects all maintenance interphone jacks from the service interphone.

WARNING AND CAUTION INDICATORS

3. APU GEN OFF LIGHT
Comes on to indicate APU is operating but APU generator is not in use. MASTER CAUTION lights also come on.

4 & 11. AC BUS OFF LIGHT (L, R)
Comes on to indicate generator bus is not powered. MASTER CAUTION lights also come on.

5 & 12. GEN OFF LIGHT (L, R)
Comes on to indicate generator relay is open, disconnecting generator from its bus. MASTER CAUTION lights also come on.

6 & 13. CSD OIL PRESS LOW LIGHT (L, R)
Comes on to indicate oil pressure in the CSD is below operating limits. MASTER CAUTION lights also come on.

8. AC CROSSTIE LOCKOUT LIGHT
Comes on to indicate AC crosstie relay is locked open and automatic AC crosstie is inoperative.

10. DC TRANSFER BUS OFF LIGHT
Not in use.

49. DC EMER BUS OFF LIGHT
Indicates the emergency DC bus is not powered.

56. DC EMER BUS OFF LIGHT
Indicates the emergency DC bus is not powered.

OPERATING RANGES

CONDITION OR ITEM		NORMAL MINIMUM	NORMAL MAXIMUM	ALLOWABLE MINIMUM	ALLOWABLE MAXIMUM
L & R DC LOADMETERS		The maximum indicated difference should not exceed 0.3 and both loadmeters should indicate some load.		0	1.0
L & R DC BUS		24V	28V	22V	30V
GENERATORS	VOLTAGE	Voltage: 112V	118V	107V	123V
	ENGINE FREQUENCY	Frequency: 396Hz	404Hz	380Hz	420Hz
	APU FREQUENCY	Ground: 390Hz	410Hz	380Hz	420Hz
		Flight: 395Hz	420Hz	380Hz	420Hz
EXTERNAL POWER		Voltage: 112V	118V	107V	123V
		Frequency: 396Hz	404Hz	380Hz	420Hz
AC LOADMETERS OF OPERATING GENERATORS		ENGINE GENERATORS			
		OVER 0	UNDER 1.0	0	1.0
		APU GENERATOR			
	GND	OVER 0	UNDER 1.25	0	1.25
	FLT	OVER 0	UNDER 1.0 BELOW 25,000 FT	0	UNDER 1.0 BELOW 25,000 FT
			UNDER 0.7 ABOVE 25,000 FT		UNDER 0.7 ABOVE 25,000 FT
GENERATORS DRIVE TRANSMISSION OIL TEMPERATURESRISE		The yellow radial line on the rise temperature scale (11.2°C) indicates an operating point, when exceeded, where there may be a malfunction. Make an entry in the flight log.			
GENERATOR DRIVE TRANSMISSION OUTLET OIL TEMPERATURE		ABOVE 0	146°C		Red Radial 163°C

CONDITION OR ITEM	NORMAL		ALLOWABLE	
	MINIMUM	**MAXIMUM**	**MINIMUM**	**MAXIMUM**
BATTERY VOLTAGE a. No other power on airplane, no load on battery	NOT LESS THAN 25V		NOT LESS THAN 25V	
b. Battery charging	29V to 34V (See * NOTE below)		25V at 165°C 37.5V at 0°C	
NOTE: The battery voltage may be steady or be fluctuating, depending on the battery charger's mode of operation.	*NOTE: Battery charging voltages at ambient temperature of 21°C*			
c. Emergency Power switch in the ON position.	NOT LESS THAN 25V		NOT LESS THAN 25V	
BATTERY AMPERES	0	65A TO THE LEFT		
a. Battery charging	** NOTE: Battery ampere reading may be steady at 65A reducing to 45A, or pulsing at intervals of 5 seconds to 30 minutes.*			
b. Emergency Power switch in the ON position	10A TO THE RIGHT	30A TO THE RIGHT		
c. No power on aircraft	20A TO THE RIGHT	50A TO THE RIGHT		
BATTERY CHARGER	*NOTE: Do not attempt to reset a tripped battery charger circuit breaker.*			

CIRCUIT BREAKER LISTING – ALPHABETICALLY BY CIRCUIT BREAKER

Name	Power Source(s)	Location
115 VAC UTILITY E/E COMPT	Right AC Bus	L9
400 CYCLE UTILITY FLIGHT COMPT	Right AC Bus	L10
ACARS MU	Battery Bus	OH A18
ADF 1	Left Radio Bus	C13
ADF 1	Left Radio Bus (Essential)	E16
ADF 2	Right Radio Bus	C4
ADF 2	Right Radio Bus (Normal)	E6
AIR COND AUTOMATIC SHUT-OFF & PURGING RELAY	Left DC Bus	M24
AIR CONDITION FLOW CONTROL VALVE LEFT	Emergency DC Bus	OH C12
AIR CONDITION FLOW CONTROL VALVE RIGHT	Emergency DC Bus	OH C13
AIR CONDITION REGULATOR VALVE LEFT	Emergency DC Bus	OH B12
AIR CONDITION REGULATOR VALVE RIGHT	Emergency DC Bus	OH B13
AIRFOIL ADVISORY & PRESSURE ABNORMAL CAUTION	Left DC Bus	M27
ALTERNATE EMER AC BUS FEED	Right AC Bus	L11
ALTERNATE GEAR POWER CONTROL	Right DC Bus	R29
ALTERNATE THUNDER STORM	Right DC Bus	R40
ALTITUDE COMPARATOR	Left Radio Bus	F24
ANTI COLLISION - LOWER	Left AC Bus	K13
ANTI COLLISION - UPPER	Right AC Bus	L13
ANTI SKID TEST	Left Radio Bus	A11
ANTI-ICE VALVE - LEFT ENGINE - COWL	Left AC Bus	K26
ANTI-ICE VALVE - LEFT ENGINE - LEFT	Left AC Bus	K27
ANTI-ICE VALVE - LEFT ENGINE - RIGHT	Left AC Bus	K28
ANTI-ICE VALVE - RIGHT ENGINE - COWL	Right AC Bus	L26
ANTI-ICE VALVE - RIGHT ENGINE - LEFT	Right AC Bus	L27
ANTI-ICE VALVE - RIGHT ENGINE - RIGHT	Right AC Bus	L28
ANTI-ICE VALVE CAUTION - LEFT	Left DC Bus	S38
ANTI-ICE VALVE CAUTION - RIGHT	Right DC Bus	T38
ANTI-SKID - INBOARD POWER	Left DC Bus	P36
ANTI-SKID - OUTBOARD POWER	Right DC Bus	R36
ANTI-SKID - PARKING BRAKE CONTROL	Left DC Bus	P37
ANTI-SKID - TEST	Right DC Bus	R37
APU CONTROL	Battery Bus	OH B20
APU DOOR CONTROL	DC Transfer Bus	U39
APU FIRE WARNING HORN	DC Transfer Bus	W34
APU OIL PRESSURE & TEMP CAUTION	DC Transfer Bus	X35
ATC 1	Left Radio Bus (Essential)	D12
ATC 1	Left Radio Bus (Essential)	E12
ATC 2	Right Radio Bus (Normal)	D2
ATC 2	Right Radio Bus (Normal)	E2
AUTO DATA ANALYSIS	Left Radio Bus	G16
AUTO DATA ANALYSIS DEF VOLTS - ØA LEFT	Left AC Bus	K22
AUTO DATA ANALYSIS DEF VOLTS - ØA RIGHT	Right AC Bus	L22
AUTO DATA ANALYSIS DEF VOLTS - ØC LEFT	Left AC Bus	K23
AUTO DATA ANALYSIS DEF VOLTS - ØC RIGHT	Right AC Bus	L23
AUTO DATA ANALYSIS REF VOLTS - ØB LEFT	Left Radio Bus	F16
AUTO DATA ANALYSIS REF VOLTS - ØB RIGHT	Left Radio Bus	F15

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AUTO THROTTLE CMPTR AMPLIFIER	Right Radio Bus	F5
AUTO THROTTLE OFF LIGHT	Emergency DC Bus	OH C7
AUTOPILOT & ALTERNATE LONGITUDE TRIM - ØA	Right Radio Bus	F12
AUTOPILOT & ALTERNATE LONGITUDE TRIM - ØB	Right Radio Bus	F13
AUTOPILOT & ALTERNATE LONGITUDE TRIM - ØC	Right Radio Bus	F14
AUTOPILOT 1	Left Radio Bus	F18
AUTOPILOT 1	Left Radio Bus	G18
AUTOPILOT AIR DATA CMPTR 1	Left Radio Bus	F17
AUTOPILOT AIR DATA CMPTR 1	Left Radio Bus	G17
AUTOPILOT AIR DATA CMPTR 2	Right Radio Bus	F1
AUTOPILOT AIR DATA CMPTR 2	Right Radio Bus	G1
AUTOPILOT OFF LIGHT	Emergency DC Bus	OH C8
AUX PITOT HEATER	Left DC Bus	P34
BATTERY CHARGER - ØA	Ground Service Bus	U21
BATTERY CHARGER - ØB	Ground Service Bus	W21
BATTERY CHARGER - ØC	Ground Service Bus	X21
BATTERY CHARGER & TRANSFER RELAY - ØA	Left AC Bus	K7
BATTERY CHARGER & TRANSFER RELAY - ØB	Left AC Bus	K8
BATTERY CHARGER & TRANSFER RELAY - ØC	Left AC Bus	K9
BATTERY RELAY	Battery Direct Bus	OH C16
BRAKE OVERHEAT DETECTOR	Left DC Bus	P38
BUS OUT LIGHTS - DC TRANSFER	Battery Bus	OH C19
BUS OUT LIGHTS - EMERGENCY AC	Battery Bus	OH C20
BUS OUT LIGHTS - EMERGENCY DC	Battery Bus	OH C18
CABIN LOW PRESSURE WARNING	Right DC Bus	N23
CABIN OVERHEAD LIGHTS - LEFT	Ground Service Bus	U27
CABIN OVERHEAD LIGHTS - RIGHT	Ground Service Bus	U26
CABIN OXYGEN ADVISORY	Right DC Bus	R38
CABIN PRESSURE CONTROL	Right AC Bus	J4
CABIN PRESSURE MAN AUTO CONTROL	Right DC Bus	N22
CABIN PRESSURE MAN/AUTO CONTROL	Ground Service Bus	Z30
CABIN SIDEWALL	Right AC Bus	L21
CABIN STANDBY LIGHTS	Emergency DC Bus	OH A12
CABIN TEMP	Right DC Bus	N21
CALL SYSTEM	Left DC Bus	P39
CAPT & FO FLOOD LIGHTS	Emergency DC Bus	OH A14
CAPTAIN'S ALTIMETER	Right Radio Bus	C3
CAPTAIN'S COMPASS	Emergency AC Bus	OH B4
CAPTAIN'S COURSE HEADING DISPLAY	Emergency AC Bus	OH B3
CAPTAIN'S HEADING OUTPUT 2	Left Radio Bus	C10
CAPTAIN'S HEADING OUTPUT 3	Left Radio Bus	C11
CAPTAIN'S HORIZON DISPLAY	Emergency AC Bus	OH C2
CAPTAIN'S PITOT HEATER	Emergency DC Bus	OH C11
CAPTAIN'S RMI SERVO	Right Radio Bus	G6
CARGO & TAIL COMPT & WATER SERV PNL LIGHTS	Ground Service Bus	X24
CENTER FUEL TANK BOOST PUMP - AFT - ØA	Right AC Bus	J9
CENTER FUEL TANK BOOST PUMP - AFT - ØB	Right AC Bus	J10
CENTER FUEL TANK BOOST PUMP - AFT - ØC	Right AC Bus	J11
CENTER FUEL TANK BOOST PUMP - FWD - ØA	Left AC Bus	H9
CENTER FUEL TANK BOOST PUMP - FWD - ØB	Left AC Bus	H10
CENTER FUEL TANK BOOST PUMP - FWD - ØC	Left AC Bus	H11
CHARGER & TRANSFER BUS GND SERV INTLK	Ground Service Bus	U23
CHARGER & TRANSFER RELAY	Battery Direct Bus	OH C15

CHARGER & TRANSFER RELAY CONTROL	Left DC Bus	M36
COCKPIT DOOR UNLOCK	Left DC Bus	P24
COCKPIT OVERHEAD WHITE FLOOD	Left DC Bus	P40
COCKPIT VOICE RECORDER	Right Radio Bus (Normal)	D4
COCKPIT WHITE FLOOD LIGHTS	Ground Service Bus	Z39
COCKPIT WINDOW ANTI-FOG - CAPTAIN'S FIRST OFFICER'S & CENTER	Left AC Bus	H27
COCKPIT WINDOW ANTI-FOG - CLEARVIEW & EYEBROW	Right AC Bus	J27
COCKPIT WINDOW ANTI-FOG - CONTROL	Right AC Bus	J26
COMPASS SINGLE POINTER 28 VAC	Emergency AC Bus	OH A4
CONTROL	Battery Direct Bus	OH A15
CSD DISC - LEFT	Left DC Bus	S27
CSD DISC - RIGHT	Right DC Bus	T27
CSD OIL PRESSURE LOW CAUTION - LEFT	Left DC Bus	S25
CSD OIL PRESSURE LOW CAUTION - RIGHT	Right DC Bus	T25
CSD OIL TEMP - LEFT	Left DC Bus	S26
CSD OIL TEMP - RIGHT	Right DC Bus	T26
DC BUS CROSS TIE CONTROL	Emergency DC Bus	OH B10
DC BUS OFF SENSING	Right DC Bus	R24
DC BUS OUT CAUTION	DC Transfer Bus	X36
DC TRANSFER BUS FEED	Left DC Bus	M34
DC TRANSFER BUS SENSING	DC Transfer Bus	X37
DC VOLTMETER - LEFT	Left DC Bus	P23
DC VOLTMETER - RIGHT	Right DC Bus	R23
DEAD BUS SLAVE RELAYS & AC BUS WARNING LIGHTS - LEFT	DC Transfer Bus	X40
DEAD BUS SLAVE RELAYS & AC BUS WARNING LIGHTS - RIGHT	DC Transfer Bus	X39
DME 1	Left Radio Bus (Essential)	D11
DME 1	Left Radio Bus (Essential)	E11
DME 2	Right Radio Bus (Normal)	D1
DME 2	Right Radio Bus (Normal)	E1
DOOR WARNING	Right DC Bus	R26
ELEVATOR POWER ADVISORY	Left DC Bus	P29
EMER AC BUS FEED	Left AC Bus	K10
EMER BUS WARNING LIGHTS PROTECT RELAY	Ground Service Bus	Z40
EMERGENCY AC BUS SENSING	Emergency AC Bus	OH B5
EMERGENCY DC BUS FEED	Left DC Bus	M35
EMERGENCY DC BUS SENSING	Emergency DC Bus	OH B11
EMERGENCY INVERTER	Battery Direct Bus	OH C17
EMERGENCY LIGHTS ARM & CHARGE	Emergency DC Bus	OH A13
EMERGENCY LIGHTS ARM & CHARGE	Left DC Bus	M33
EMERGENCY LIGHTS CHARGING	Ground Service Bus	Z32
EMERGENCY NAV XFMR	Emergency AC Bus	OH B2
EMERGENCY POWER IN USE LIGHT	Emergency DC Bus	OH A11
ENGINE IGNITION - LEFT	DC Transfer Bus	U42
ENGINE IGNITION - RIGHT	DC Transfer Bus	U41
ENGINE START PUMP	DC Transfer Bus	U40
EXTERNAL POWER RELAYS	DC Transfer Bus	X38
FIRE DETECTORS - APU - LOOP A	DC Transfer Bus	W35
FIRE DETECTORS - APU - LOOP B	DC Transfer Bus	W36
FIRE DETECTORS - LEFT ENGINE - LOOP A	DC Transfer Bus	W39
FIRE DETECTORS - LEFT ENGINE - LOOP B	DC Transfer Bus	W40
FIRE DETECTORS - RIGHT ENGINE - LOOP A	DC Transfer Bus	W37
FIRE DETECTORS - RIGHT ENGINE - LOOP B	DC Transfer Bus	W38
FIRE EXTINGUISHING CONTROL - BOTTLE 1	DC Transfer Bus	X41

FIRE EXTINGUISHING CONTROL - BOTTLE 2	DC Transfer Bus	X42
FIRE WARNING - BELL	DC Transfer Bus	W41
FIRE WARNING - LIGHTS	DC Transfer Bus	W42
FIRE X AGENT LOW PRESSURE CAUTION	Right DC Bus	R28
FIRST OFFICER'S ALTIMETER	Left Radio Bus	C12
FIRST OFFICER'S COMPASS	Right Radio Bus	F6
FIRST OFFICER'S COURSE AND HEADING DISPLAY	Right Radio Bus	F7
FIRST OFFICER'S HEADING OUTPUT 1	Right Radio Bus	C1
FIRST OFFICER'S HEADING OUTPUT 2	Right Radio Bus	C2
FIRST OFFICER'S HEADING OUTPUT 3	Left Radio Bus	C9
FIRST OFFICER'S HORIZON DISPLAY	Right Radio Bus	F10
FIRST OFFICER'S PITOT HEATER	Right DC Bus	R34
FIRST OFFICER'S TURN & SLIP	Right Radio Bus	F11
FLIGHT DIRECTOR 1 - CMPTR	Right Radio Bus	F3
FLIGHT DIRECTOR 1 - CMPTR	Left Radio Bus	F20
FLIGHT DIRECTOR 1 - CONTROL	Left Radio Bus	G20
FLIGHT DIRECTOR 2 - CMPTR	Right Radio Bus	F2
FLIGHT DIRECTOR 2 - CONTROL	Right Radio Bus	G2
FLIGHT DIRECTOR INDICATION - PITCH	Left Radio Bus	C14
FLIGHT DIRECTOR INDICATION - ROLL	Left Radio Bus	C15
FLIGHT INTERPHONE	Right Radio Bus (Normal)	E8
FLIGHT INTERPHONE 1	Emergency DC Bus	OH A8
FLIGHT INTERPHONE 2	Emergency DC Bus	OH A9
FLIGHT RECORDER	Left Radio Bus	F21
FLIGHT RECORDER	Left Radio Bus	G21
FUEL FILTER PRESSURE DROP CAUTION - LEFT	Left DC Bus	S36
FUEL FILTER PRESSURE DROP CAUTION - RIGHT	Right DC Bus	T36
FUEL FLOW - LEFT	Left AC Bus	K24
FUEL FLOW - RIGHT	Right AC Bus	L24
FUEL HEAT - LEFT - CONTROL	Left AC Bus	K29
FUEL HEAT - LEFT - TIMER	Left AC Bus	K30
FUEL HEAT - RIGHT - CONTROL	Right AC Bus	L29
FUEL HEAT - RIGHT - TIMER	Right AC Bus	L30
FUEL HEAT ON ADVISORY - LEFT	Left DC Bus	S37
FUEL HEAT ON ADVISORY - RIGHT	Right DC Bus	T37
FUEL PUMP PRESSURE CAUTION - LEFT	Left DC Bus	S34
FUEL PUMP PRESSURE CAUTION - RIGHT	Right DC Bus	T34
FUEL QUANTITY - CENTER	Left AC Bus	H16
FUEL QUANTITY - LEFT	Left AC Bus	H15
FUEL QUANTITY - RIGHT	Right AC Bus	J15
FUEL QUANTITY - TRANSFER RELAY	Right AC Bus	J16
FUEL QUANTITY TOTALIZER	Right AC Bus	J17
FUEL TEMP - LEFT	Left DC Bus	S35
FUEL TEMP - RIGHT	Right DC Bus	T35
FWD PASSENGER ENTRANCE STAIR - ACTUATORS AFT	Ground Service Bus	Z37
FWD PASSENGER ENTRANCE STAIR - CARRIAGE MOTORS - 1	Ground Service Bus	Z34
FWD PASSENGER ENTRANCE STAIR - CARRIAGE MOTORS - 2	Ground Service Bus	Z35
FWD PASSENGER ENTRANCE STAIR - CONTROL	Ground Service Bus	Z38
FWD PASSENGER ENTRANCE STAIR - HANDRAIL FWD	Ground Service Bus	Z36
FWD PASSENGER ENTRANCE STAIR CARRIAGE MOTORS 1	Battery Direct Bus	OH A16
FWD PASSENGER ENTRANCE STAIR CARRIAGE MOTORS 2	Battery Direct Bus	OH A17
FWD PASSENGER ENTRANCE STAIR LIGHTS	Ground Service Bus	X31
GALLEY AREA WORK LIGHTS	Ground Service Bus	X30

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GALLEY CONTROL	Right AC Bus	L6
GALLEY DRAIN MAST HEATER	Right AC Bus	J28
GALLEY DRAIN MAST HEATER & CONTROL	Right DC Bus	N33
GALLEY POWER - 1 & 2	Right DC Bus	R25
GALLEY POWER - 3	Left DC Bus	P25
GENERATOR CONTROL - APU	DC Transfer Bus	U36
GENERATOR CONTROL - LEFT	DC Transfer Bus	U38
GENERATOR CONTROL - RIGHT	DC Transfer Bus	U37
GLIDE SLOPE 1	Emergency DC Bus	OH B9
GLIDE SLOPE 2	Right Radio Bus (Normal)	E5
GLIDESLOPE 2	Right Radio Bus	C6
GPWS 1	Right Radio Bus	F8
GPWS 2	Right Radio Bus	G8
GROUND CONTROL RELAY	Left AC Bus	H18
GROUND CONTROL RELAY	Right AC Bus	J18
GROUND FLOOD LIGHTS - LEFT	Ground Service Bus	U25
GROUND FLOOD LIGHTS - RIGHT	Ground Service Bus	U24
GROUND REFUELING	Ground Service Bus	Z33
GROUND REFUELING	Battery Direct Bus	OH B15
GROUND SERVICE BUS CONTROL	Right AC Bus	L7
HYD PRESSURE LOW CAUTION - LEFT	Left DC Bus	P30
HYD PRESSURE LOW CAUTION - RIGHT	Right DC Bus	R30
HYD PUMP CONTROL - LEFT	Left DC Bus	S28
HYD PUMP CONTROL - RIGHT	Right DC Bus	T28
HYD TEMP HIGH CAUTION - LEFT	Left DC Bus	P31
HYD TEMP HIGH CAUTION - RIGHT	Right DC Bus	R31
ICE PROTECT AUGMENT VALVE - LEFT	Left DC Bus	M29
ICE PROTECT AUGMENT VALVE - RIGHT	Right DC Bus	N29
INST PANEL FLUORESCENT	Right AC Bus	L20
INST VIBRATION	Left DC Bus	P28
INST XFMR - LEFT	Left AC Bus	K12
INST XFMR - RIGHT	Right AC Bus	L12
INTEGRAL LIGHTS - CAPTAIN'S INST PANEL	Left AC Bus	K17
INTEGRAL LIGHTS - CENTER INST PANEL	Right AC Bus	L18
INTEGRAL LIGHTS - FIRST OFFICER'S INST PANEL	Right AC Bus	L17
INTEGRAL LIGHTS - OVERHEAD PANEL AFT	Left AC Bus	K19
INTEGRAL LIGHTS - OVERHEAD PANEL FWD	Left AC Bus	K18
INTEGRAL LIGHTS - PEDESTAL	Right AC Bus	L19
INVERTER POWER	Left DC Bus	M37
LANDING GEAR INDICATOR AND WARNING	DC Transfer Bus	X34
LAVATORY MIRROR LIGHTS 1	Ground Service Bus	W30
LAVATORY MIRROR LIGHTS 2	Ground Service Bus	W31
LAVATORY WATER HEATER 1	Left AC Bus	H29
LAVATORY WATER HEATER 2	Right AC Bus	J29
LEFT ENGINE OIL PRESSURE	Left Radio Bus	A9
LEFT FLAP POSITION	Left Radio Bus	A10
LEFT FUEL TANK BOOST PUMP - AFT - ØA	Right AC Bus	J12
LEFT FUEL TANK BOOST PUMP - AFT - ØB	Right AC Bus	J13
LEFT FUEL TANK BOOST PUMP - AFT - ØC	Right AC Bus	J14
LEFT FUEL TANK BOOST PUMP - FWD - ØA	Left AC Bus	H12
LEFT FUEL TANK BOOST PUMP - FWD - ØB	Left AC Bus	H13
LEFT FUEL TANK BOOST PUMP - FWD - ØC	Left AC Bus	H14
LEFT HYDRAULIC - BRAKE PRESSURE	Left Radio Bus	B10

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LEFT HYDRAULIC - OIL QUANTITY	Left Radio Bus	B11
LEFT HYDRAULIC - SYSTEM PRESSURE	Left Radio Bus	B9
LEFT SUPPLY AIR PRESSURE	Left Radio Bus	B13
LEFT TEMP CONTROL VALVE POSITION	Left Radio Bus	B12
LEFT TRANSFORMER RECTIFIER - 1 - ØA	Left AC Bus	K1
LEFT TRANSFORMER RECTIFIER - 1 - ØB	Left AC Bus	K2
LEFT TRANSFORMER RECTIFIER - 1 - ØC	Left AC Bus	K3
LEFT TRANSFORMER RECTIFIER - 2 - ØA	Left AC Bus	K4
LEFT TRANSFORMER RECTIFIER - 2 - ØB	Left AC Bus	K5
LEFT TRANSFORMER RECTIFIER - 2 - ØC	Left AC Bus	K6
MACH TRIM OVERRIDE	Emergency DC Bus	OH C9
MANUAL TEMPERATURE CONTROL CABIN	Emergency AC Bus	OH C5
MANUAL TEMPERATURE CONTROL COCKPIT	Emergency AC Bus	OH C4
MAP & BRIEFCASE	Right DC Bus	R41
MARKER BEACON	Left Radio Bus (Essential)	D14
MARKER BEACON	Left Radio Bus (Essential)	E14
MASTER CAUTION	Ground Service Bus	Z42
MASTER WARNING	Ground Service Bus	Z41
MAXIMUM AIRSPEED WARNING	Left DC Bus	P27
MISC CABIN & LAVATORY OCCUPIED LIGHTS	Ground Service Bus	X27
NAV COMPARATOR	Left Radio Bus	F25
NAV INST XFMR 1	Left Radio Bus	F26
NOSE GEAR LANDING & TAXI - LEFT	Left AC Bus	K16
NOSE GEAR LANDING & TAXI - RIGHT	Right AC Bus	L16
OIL PRESSURE LOW CAUTION - LEFT	DC Transfer Bus	U35
OIL PRESSURE LOW CAUTION - RIGHT	DC Transfer Bus	U34
OIL QUANTITY - LEFT	Left DC Bus	S21
OIL QUANTITY - RIGHT	Right DC Bus	T21
OIL STRAINER CLOGGING - LEFT	Left DC Bus	S24
OIL STRAINER CLOGGING - RIGHT	Right DC Bus	T24
OIL TEMP - LEFT	Left DC Bus	S22
OIL TEMP - RIGHT	Right DC Bus	T22
OVERHEAD SWITCH PANEL LIGHTS AFT XFMR SECONDARY		D21
OVERHEAD SWITCH PANEL LIGHTS AFT XFMR SECONDARY		E21
OVERHEAD SWITCH PANEL LIGHTS FORWARD XFMR SECONDARY		E22
OVERHEAD SWITCH PANEL LIGHTS FORWARD XFMR SECONDARY		E23
OVERHEAT WHEEL WELL SENSOR	Left DC Bus	M22
PASS WARN SIGNS ELECTROLUMINESCENCE	Left AC Bus	H28
PASSENGER ADDRESS	Emergency DC Bus	OH A7
PASSENGER ADDRESS	Left Radio Bus	F23
PASSENGER ADDRESS	Left AC Bus	K21
PASSENGER MUSIC	Left Radio Bus	F22
PASSENGER MUSIC	Left Radio Bus	G22
PASSENGER WARNING SIGNS	Right DC Bus	R39
PITOT HEATER ADVISORY	Left DC Bus	P33
PNEU PRESSURE	Emergency AC Bus	OH A5
PRESSURE RATIO - LEFT	Left AC Bus	K25
PRESSURE RATIO - RIGHT	Right AC Bus	L25
PRIMARY LONGITUDE TRIM - BRAKE	Left Radio Bus	G25
PRIMARY LONGITUDE TRIM - CONTROL	Left Radio Bus	G24
PRIMARY LONGITUDE TRIM - STAB MOTION INDICATOR	Left Radio Bus	G23
PROBE HEATER	Right AC Bus	J22
PURGING EIGHTH STAGE BLEED VALVE	Right DC Bus	N24

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RADIO ALTIMETER 2	Right Radio Bus (Normal)	D5
RADIO DC BUS FEED - ESSENTIAL	Left DC Bus	P22
RADIO DC BUS FEED - LEFT	Left DC Bus	P21
RADIO DC BUS FEED - NORMAL	Right DC Bus	R22
RADIO DC BUS FEED - RIGHT	Right DC Bus	R21
RADIO INST MONITOR	Left AC Bus	K11
RADIO LOAD MONITOR CONTROL	Ground Service Bus	Z31
RADIO RACK FAN - ØA	Left AC Bus	H2
RADIO RACK FAN - ØB	Left AC Bus	H3
RADIO RACK FAN - ØC	Left AC Bus	H4
RADIO RACK FAN CAUTION	Left DC Bus	M23
RADIO RACK VENTURI	Left AC Bus	H5
RAIN REPELLENT - LEFT	Left DC Bus	M32
RAIN REPELLENT - RIGHT	Right DC Bus	N32
RAM AIR VALVE	Right AC Bus	J5
RAZOR OUTLETS	Right AC Bus	L8
REVERSER ACCUM LOW CAUTION - LEFT	Left DC Bus	S30
REVERSER ACCUM LOW CAUTION - RIGHT	Right DC Bus	T30
REVERSER ACCUM SHUT-OFF - LEFT	Left DC Bus	S29
REVERSER ACCUM SHUT-OFF - RIGHT	Right DC Bus	T29
REVERSER THRUST ADVISORY - LEFT	Left DC Bus	S32
REVERSER THRUST ADVISORY - RIGHT	Right DC Bus	T32
RIGHT ENGINE OIL PRESSURE	Right Radio Bus	A1
RIGHT FLAP POSITION	Right Radio Bus	A2
RIGHT FUEL TANK BOOST PUMP - AFT - ØA	Right AC Bus	J6
RIGHT FUEL TANK BOOST PUMP - AFT - ØB	Right AC Bus	J7
RIGHT FUEL TANK BOOST PUMP - AFT - ØC	Right AC Bus	J8
RIGHT FUEL TANK BOOST PUMP - FWD - ØA	Left AC Bus	H6
RIGHT FUEL TANK BOOST PUMP - FWD - ØB	Left AC Bus	H7
RIGHT FUEL TANK BOOST PUMP - FWD - ØC	Left AC Bus	H8
RIGHT HYDRAULIC - BRAKE PRESSURE	Right Radio Bus	B2
RIGHT HYDRAULIC - OIL QUANTITY	Right Radio Bus	B3
RIGHT HYDRAULIC - SYSTEM PRESSURE	Right Radio Bus	B1
RIGHT SUPPLY AIR PRESSURE	Right Radio Bus	B6
RIGHT TEMP CONTROL VALVE POSITION	Right Radio Bus	B5
RIGHT TRANSFORMER RECTIFIER - 1 - ØA	Right AC Bus	L1
RIGHT TRANSFORMER RECTIFIER - 1 - ØB	Right AC Bus	L2
RIGHT TRANSFORMER RECTIFIER - 1 - ØC	Right AC Bus	L3
RUDDER & LIMITER HEATER	Right AC Bus	J30
RUDDER CONTROL MANUAL ADVISORY	Right DC Bus	R33
RUDDER TRAVEL	Right DC Bus	R32
SELCAL 1	Left Radio Bus (Essential)	D13
SELCAL 1	Left Radio Bus (Essential)	E13
SELCAL 2	Right Radio Bus (Normal)	D3
SELCAL 2	Right Radio Bus (Normal)	E3
SPEED COMMAND CMPTR 1	Right Radio Bus	F4
SPEED COMMAND CMPTR 1	Right Radio Bus	G4
SPOILER CONTROL	Left AC Bus	H19
SPOILER CONTROL	Left DC Bus	P32
STAB AUG CMPTR 1	Left Radio Bus	F19
STAB AUG CMPTR 1	Left Radio Bus	G19
STALL WARNING & VANE HEATER - LEFT	Left AC Bus	H24
STALL WARNING & VANE HEATER - RIGHT	Right AC Bus	J24

STALL WARNING STICK SHAKER - CAPTAIN'S	Left DC Bus	P35
STALL WARNING STICK SHAKER - FIRST OFFICER'S	Right DC Bus	R35
START VALVE OPEN ADVISORY - LEFT	Left DC Bus	S33
START VALVE OPEN ADVISORY - RIGHT	Right DC Bus	T33
STATIC AIR TEMP	Right AC Bus	J20
STATIC PORT HEATER - LEFT	Left AC Bus	H23
STATIC PORT HEATER - RIGHT	Right AC Bus	J23
SUPPLY AIR HIGH PRESSURE AUG VALVE - LEFT	Left DC Bus	M26
SUPPLY AIR HIGH PRESSURE AUG VALVE - RIGHT	Right DC Bus	N26
SUPPLY AIR PRESSURE REGULATOR VALVE	Right DC Bus	N27
SUPPLY AIR TEMP CAUTION - LEFT	Left DC Bus	M28
SUPPLY AIR TEMP CAUTION - RIGHT	Right DC Bus	N28
SUPPLY AIR TEMP HIGH CAUTION - LEFT	Left DC Bus	M25
SUPPLY AIR TEMP HIGH CAUTION - RIGHT	Right DC Bus	N25
TAIL COMPT TEMP HIGH CAUTION	Right DC Bus	N30
TAKE-OFF WARNING	Left DC Bus	P26
TEMP CONTROL - CABIN	Right AC Bus	J1
TEMP CONTROL - COCKPIT	Left AC Bus	H1
TOILET FLUSHING - LEFT - ØA	Ground Service Bus	U29
TOILET FLUSHING - LEFT - ØB	Ground Service Bus	W29
TOILET FLUSHING - LEFT - ØC	Ground Service Bus	X29
TOILET FLUSHING - RIGHT - ØA	Ground Service Bus	U28
TOILET FLUSHING - RIGHT - ØB	Ground Service Bus	W28
TOILET FLUSHING - RIGHT - ØC	Ground Service Bus	X28
TOTAL AIR TEMP	Right AC Bus	J21
TRUE AIR SPEED	Right AC Bus	J19
VERTICAL GYRO 1	Emergency AC Bus	OH C1
VERTICAL GYRO 2	Right Radio Bus	F9
VHF COMM 1	Emergency DC Bus	OH B7
VHF COMM 2	Right Radio Bus (Normal)	E7
VHF NAV 1	Emergency DC Bus	OH B8
VHF NAV 1 28 VAC	Emergency AC Bus	OH A3
VHF NAV 2	Right Radio Bus	C5
VHF NAV 2	Right Radio Bus (Normal)	E4
WARNING LIGHT DIMMING	Right DC Bus	R27
WATER QUANTITY	Ground Service Bus	U30
WATER SERVICE PANEL HEATER	Ground Service Bus	U31
WEATHER RADAR - ØA	Left Radio Bus (Essential)	D15
WEATHER RADAR - ØA	Left Radio Bus (Essential)	E15
WEATHER RADAR - ØB	Left Radio Bus (Essential)	D16
WEATHER RADAR - ØC	Left Radio Bus (Essential)	D17
WHEEL WELL SERV LTS & 28VAC UTILITY OUTLET	Ground Service Bus	X23
WING LANDING - LEFT	Left AC Bus	K14
WING LANDING - RIGHT	Right AC Bus	L14
WING LANDING LIGHT CONTROL - LEFT	Left AC Bus	K15
WING LANDING LIGHT CONTROL - RIGHT	Right AC Bus	L15
WIND SHIELD WIPER - LEFT	Left DC Bus	M31
WIND SHIELD WIPER - RIGHT	Right DC Bus	N31
WINDSHIELD ANTI-ICE - CENTER	Left AC Bus	H26
WINDSHIELD ANTI-ICE - LEFT	Left AC Bus	H25
WINDSHIELD ANTI-ICE - RIGHT	Right AC Bus	J25
WING & TAIL VALVES	Left DC Bus	M30
WING NACELLE FLOOD LIGHTS	Ground Service Bus	X25

WING POSITION LIGHTS - INBOARD	Ground Service Bus	W24
WING POSITION LIGHTS - OUTBOARD	Ground Service Bus	W25
XFMR RECTIFIER POWER - ØA	Ground Service Bus	U22
XFMR RECTIFIER POWER - ØB	Ground Service Bus	W22
XFMR RECTIFIER POWER - ØC	Ground Service Bus	X22

CIRCUIT BREAKER LISTING – ALPHABETICALLY BY POWER SOURCE(S)

Name	Power Source(s)	Location
ACARS MU	Battery Bus	OH A18
APU CONTROL	Battery Bus	OH B20
BUS OUT LIGHTS - DC TRANSFER	Battery Bus	OH C19
BUS OUT LIGHTS - EMERGENCY AC	Battery Bus	OH C20
BUS OUT LIGHTS - EMERGENCY DC	Battery Bus	OH C18
BATTERY RELAY	Battery Direct Bus	OH C16
CHARGER & TRANSFER RELAY	Battery Direct Bus	OH C15
CONTROL	Battery Direct Bus	OH A15
EMERGENCY INVERTER	Battery Direct Bus	OH C17
FWD PASSENGER ENTRANCE STAIR CARRIAGE MOTORS 1	Battery Direct Bus	OH A16
FWD PASSENGER ENTRANCE STAIR CARRIAGE MOTORS 2	Battery Direct Bus	OH A17
GROUND REFUELING	Battery Direct Bus	OH B15
APU DOOR CONTROL	DC Transfer Bus	U39
APU FIRE WARNING HORN	DC Transfer Bus	W34
APU OIL PRESSURE & TEMP CAUTION	DC Transfer Bus	X35
DC BUS OUT CAUTION	DC Transfer Bus	X36
DC TRANSFER BUS SENSING	DC Transfer Bus	X37
DEAD BUS SLAVE RELAYS & AC BUS WARNING LIGHTS - LEFT	DC Transfer Bus	X40
DEAD BUS SLAVE RELAYS & AC BUS WARNING LIGHTS - RIGHT	DC Transfer Bus	X39
ENGINE IGNITION - LEFT	DC Transfer Bus	U42
ENGINE IGNITION - RIGHT	DC Transfer Bus	U41
ENGINE START PUMP	DC Transfer Bus	U40
EXTERNAL POWER RELAYS	DC Transfer Bus	X38
FIRE DETECTORS - APU - LOOP A	DC Transfer Bus	W35
FIRE DETECTORS - APU - LOOP B	DC Transfer Bus	W36
FIRE DETECTORS - LEFT ENGINE - LOOP A	DC Transfer Bus	W39
FIRE DETECTORS - LEFT ENGINE - LOOP B	DC Transfer Bus	W40
FIRE DETECTORS - RIGHT ENGINE - LOOP A	DC Transfer Bus	W37
FIRE DETECTORS - RIGHT ENGINE - LOOP B	DC Transfer Bus	W38
FIRE EXTINGUISHING CONTROL - BOTTLE 1	DC Transfer Bus	X41
FIRE EXTINGUISHING CONTROL - BOTTLE 2	DC Transfer Bus	X42
FIRE WARNING - BELL	DC Transfer Bus	W41
FIRE WARNING - LIGHTS	DC Transfer Bus	W42
GENERATOR CONTROL - APU	DC Transfer Bus	U36
GENERATOR CONTROL - LEFT	DC Transfer Bus	U38
GENERATOR CONTROL - RIGHT	DC Transfer Bus	U37
LANDING GEAR INDICATOR AND WARNING	DC Transfer Bus	X34
OIL PRESSURE LOW CAUTION - LEFT	DC Transfer Bus	U35
OIL PRESSURE LOW CAUTION - RIGHT	DC Transfer Bus	U34
CAPTAIN'S COMPASS	Emergency AC Bus	OH B4
CAPTAIN'S COURSE HEADING DISPLAY	Emergency AC Bus	OH B3
CAPTAIN'S HORIZON DISPLAY	Emergency AC Bus	OH C2
COMPASS SINGLE POINTER 28 VAC	Emergency AC Bus	OH A4
EMERGENCY AC BUS SENSING	Emergency AC Bus	OH B5
EMERGENCY NAV XFMR	Emergency AC Bus	OH B2
MANUAL TEMPERATURE CONTROL CABIN	Emergency AC Bus	OH C5
MANUAL TEMPERATURE CONTROL COCKPIT	Emergency AC Bus	OH C4

PNEU PRESSURE	Emergency AC Bus	OH A5
VERTICAL GYRO 1	Emergency AC Bus	OH C1
VHF NAV 1 28 VAC	Emergency AC Bus	OH A3
AIR CONDITION FLOW CONTROL VALVE LEFT	Emergency DC Bus	OH C12
AIR CONDITION FLOW CONTROL VALVE RIGHT	Emergency DC Bus	OH C13
AIR CONDITION REGULATOR VALVE LEFT	Emergency DC Bus	OH B12
AIR CONDITION REGULATOR VALVE RIGHT	Emergency DC Bus	OH B13
AUTO THROTTLE OFF LIGHT	Emergency DC Bus	OH C7
AUTOPILOT OFF LIGHT	Emergency DC Bus	OH C8
CABIN STANDBY LIGHTS	Emergency DC Bus	OH A12
CAPT & FO FLOOD LIGHTS	Emergency DC Bus	OH A14
CAPTAIN'S PITOT HEATER	Emergency DC Bus	OH C11
DC BUS CROSS TIE CONTROL	Emergency DC Bus	OH B10
EMERGENCY DC BUS SENSING	Emergency DC Bus	OH B11
EMERGENCY LIGHTS ARM & CHARGE	Emergency DC Bus	OH A13
EMERGENCY POWER IN USE LIGHT	Emergency DC Bus	OH A11
FLIGHT INTERPHONE 1	Emergency DC Bus	OH A8
FLIGHT INTERPHONE 2	Emergency DC Bus	OH A9
GLIDE SLOPE 1	Emergency DC Bus	OH B9
MACH TRIM OVERRIDE	Emergency DC Bus	OH C9
PASSENGER ADDRESS	Emergency DC Bus	OH A7
VHF COMM 1	Emergency DC Bus	OH B7
VHF NAV 1	Emergency DC Bus	OH B8
BATTERY CHARGER - ØA	Ground Service Bus	U21
BATTERY CHARGER - ØB	Ground Service Bus	W21
BATTERY CHARGER - ØC	Ground Service Bus	X21
CABIN OVERHEAD LIGHTS - LEFT	Ground Service Bus	U27
CABIN OVERHEAD LIGHTS - RIGHT	Ground Service Bus	U26
CABIN PRESSURE MAN/AUTO CONTROL	Ground Service Bus	Z30
CARGO & TAIL COMPT & WATER SERV PNL LIGHTS	Ground Service Bus	X24
CHARGER & TRANSFER BUS GND SERV INTLK	Ground Service Bus	U23
COCKPIT WHITE FLOOD LIGHTS	Ground Service Bus	Z39
EMER BUS WARNING LIGHTS PROTECT RELAY	Ground Service Bus	Z40
EMERGENCY LIGHTS CHARGING	Ground Service Bus	Z32
FWD PASSENGER ENTRANCE STAIR - ACTUATORS AFT	Ground Service Bus	Z37
FWD PASSENGER ENTRANCE STAIR - CARRIAGE MOTORS - 1	Ground Service Bus	Z34
FWD PASSENGER ENTRANCE STAIR - CARRIAGE MOTORS - 2	Ground Service Bus	Z35
FWD PASSENGER ENTRANCE STAIR - CONTROL	Ground Service Bus	Z38
FWD PASSENGER ENTRANCE STAIR - HANDRAIL FWD	Ground Service Bus	Z36
FWD PASSENGER ENTRANCE STAIR LIGHTS	Ground Service Bus	X31
GALLEY AREA WORK LIGHTS	Ground Service Bus	X30
GROUND FLOOD LIGHTS - LEFT	Ground Service Bus	U25
GROUND FLOOD LIGHTS - RIGHT	Ground Service Bus	U24
GROUND REFUELING	Ground Service Bus	Z33
LAVATORY MIRROR LIGHTS 1	Ground Service Bus	W30
LAVATORY MIRROR LIGHTS 2	Ground Service Bus	W31
MASTER CAUTION	Ground Service Bus	Z42
MASTER WARNING	Ground Service Bus	Z41
MISC CABIN & LAVATORY OCCUPIED LIGHTS	Ground Service Bus	X27
RADIO LOAD MONITOR CONTROL	Ground Service Bus	Z31
TOILET FLUSHING - LEFT - ØA	Ground Service Bus	U29
TOILET FLUSHING - LEFT - ØB	Ground Service Bus	W29
TOILET FLUSHING - LEFT - ØC	Ground Service Bus	X29

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TOILET FLUSHING - RIGHT - ØA	Ground Service Bus	U28
TOILET FLUSHING - RIGHT - ØB	Ground Service Bus	W28
TOILET FLUSHING - RIGHT - ØC	Ground Service Bus	X28
WATER QUANTITY	Ground Service Bus	U30
WATER SERVICE PANEL HEATER	Ground Service Bus	U31
WHEEL WELL SERV LTS & 28VAC UTILITY OUTLET	Ground Service Bus	X23
WING NACELLE FLOOD LIGHTS	Ground Service Bus	X25
WING POSITION LIGHTS - INBOARD	Ground Service Bus	W24
WING POSITION LIGHTS - OUTBOARD	Ground Service Bus	W25
XFMR RECTIFIER POWER - ØA	Ground Service Bus	U22
XFMR RECTIFIER POWER - ØB	Ground Service Bus	W22
XFMR RECTIFIER POWER - ØC	Ground Service Bus	X22
ANTI COLLISION - LOWER	Left AC Bus	K13
ANTI-ICE VALVE - LEFT ENGINE - COWL	Left AC Bus	K26
ANTI-ICE VALVE - LEFT ENGINE - LEFT	Left AC Bus	K27
ANTI-ICE VALVE - LEFT ENGINE - RIGHT	Left AC Bus	K28
AUTO DATA ANALYSIS DEF VOLTS - ØA LEFT	Left AC Bus	K22
AUTO DATA ANALYSIS DEF VOLTS - ØC LEFT	Left AC Bus	K23
BATTERY CHARGER & TRANSFER RELAY - ØA	Left AC Bus	K7
BATTERY CHARGER & TRANSFER RELAY - ØB	Left AC Bus	K8
BATTERY CHARGER & TRANSFER RELAY - ØC	Left AC Bus	K9
CENTER FUEL TANK BOOST PUMP - FWD - ØA	Left AC Bus	H9
CENTER FUEL TANK BOOST PUMP - FWD - ØB	Left AC Bus	H10
CENTER FUEL TANK BOOST PUMP - FWD - ØC	Left AC Bus	H11
COCKPIT WINDOW ANTI-FOG - CAPTAIN'S FIRST OFFICER'S & CENTER	Left AC Bus	H27
EMER AC BUS FEED	Left AC Bus	K10
FUEL FLOW - LEFT	Left AC Bus	K24
FUEL HEAT - LEFT - CONTROL	Left AC Bus	K29
FUEL HEAT - LEFT - TIMER	Left AC Bus	K30
FUEL QUANTITY - CENTER	Left AC Bus	H16
FUEL QUANTITY - LEFT	Left AC Bus	H15
GROUND CONTROL RELAY	Left AC Bus	H18
INST XFMR - LEFT	Left AC Bus	K12
INTEGRAL LIGHTS - CAPTAIN'S INST PANEL	Left AC Bus	K17
INTEGRAL LIGHTS - OVERHEAD PANEL AFT	Left AC Bus	K19
INTEGRAL LIGHTS - OVERHEAD PANEL FWD	Left AC Bus	K18
LAVATORY WATER HEATER 1	Left AC Bus	H29
LEFT FUEL TANK BOOST PUMP - FWD - ØA	Left AC Bus	H12
LEFT FUEL TANK BOOST PUMP - FWD - ØB	Left AC Bus	H13
LEFT FUEL TANK BOOST PUMP - FWD - ØC	Left AC Bus	H14
LEFT TRANSFORMER RECTIFIER - 1 - ØA	Left AC Bus	K1
LEFT TRANSFORMER RECTIFIER - 1 - ØB	Left AC Bus	K2
LEFT TRANSFORMER RECTIFIER - 1 - ØC	Left AC Bus	K3
LEFT TRANSFORMER RECTIFIER - 2 - ØA	Left AC Bus	K4
LEFT TRANSFORMER RECTIFIER - 2 - ØB	Left AC Bus	K5
LEFT TRANSFORMER RECTIFIER - 2 - ØC	Left AC Bus	K6
NOSE GEAR LANDING & TAXI - LEFT	Left AC Bus	K16
PASS WARN SIGNS ELECTROLUMINESCENCE	Left AC Bus	H28
PASSENGER ADDRESS	Left AC Bus	K21
PRESSURE RATIO - LEFT	Left AC Bus	K25
RADIO INST MONITOR	Left AC Bus	K11
RADIO RACK FAN - ØA	Left AC Bus	H2
RADIO RACK FAN - ØB	Left AC Bus	H3

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RADIO RACK FAN - ØC	Left AC Bus	H4
RADIO RACK VENTURI	Left AC Bus	H5
RIGHT FUEL TANK BOOST PUMP - FWD - ØA	Left AC Bus	H6
RIGHT FUEL TANK BOOST PUMP - FWD - ØB	Left AC Bus	H7
RIGHT FUEL TANK BOOST PUMP - FWD - ØC	Left AC Bus	H8
SPOILER CONTROL	Left AC Bus	H19
STALL WARNING & VANE HEATER - LEFT	Left AC Bus	H24
STATIC PORT HEATER - LEFT	Left AC Bus	H23
TEMP CONTROL - COCKPIT	Left AC Bus	H1
WING LANDING - LEFT	Left AC Bus	K14
WING LANDING LIGHT CONTROL - LEFT	Left AC Bus	K15
WINDSHIELD ANTI-ICE - CENTER	Left AC Bus	H26
WINDSHIELD ANTI-ICE - LEFT	Left AC Bus	H25
AIR COND AUTOMATIC SHUT-OFF & PURGING RELAY	Left DC Bus	M24
AIRFOIL ADVISORY & PRESSURE ABNORMAL CAUTION	Left DC Bus	M27
ANTI-ICE VALVE CAUTION - LEFT	Left DC Bus	S38
ANTI-SKID - INBOARD POWER	Left DC Bus	P36
ANTI-SKID - PARKING BRAKE CONTROL	Left DC Bus	P37
AUX PITOT HEATER	Left DC Bus	P34
BRAKE OVERHEAT DETECTOR	Left DC Bus	P38
CALL SYSTEM	Left DC Bus	P39
CHARGER & TRANSFER RELAY CONTROL	Left DC Bus	M36
COCKPIT DOOR UNLOCK	Left DC Bus	P24
COCKPIT OVERHEAD WHITE FLOOD	Left DC Bus	P40
CSD DISC - LEFT	Left DC Bus	S27
CSD OIL PRESSURE LOW CAUTION - LEFT	Left DC Bus	S25
CSD OIL TEMP - LEFT	Left DC Bus	S26
DC TRANSFER BUS FEED	Left DC Bus	M34
DC VOLTMETER - LEFT	Left DC Bus	P23
ELEVATOR POWER ADVISORY	Left DC Bus	P29
EMERGENCY DC BUS FEED	Left DC Bus	M35
EMERGENCY LIGHTS ARM & CHARGE	Left DC Bus	M33
FUEL FILTER PRESSURE DROP CAUTION - LEFT	Left DC Bus	S36
FUEL HEAT ON ADVISORY - LEFT	Left DC Bus	S37
FUEL PUMP PRESSURE CAUTION - LEFT	Left DC Bus	S34
FUEL TEMP - LEFT	Left DC Bus	S35
GALLEY POWER - 3	Left DC Bus	P25
HYD PRESSURE LOW CAUTION - LEFT	Left DC Bus	P30
HYD PUMP CONTROL - LEFT	Left DC Bus	S28
HYD TEMP HIGH CAUTION - LEFT	Left DC Bus	P31
ICE PROTECT AUGMENT VALVE - LEFT	Left DC Bus	M29
INST VIBRATION	Left DC Bus	P28
INVERTER POWER	Left DC Bus	M37
MAXIMUM AIRSPEED WARNING	Left DC Bus	P27
OIL QUANTITY - LEFT	Left DC Bus	S21
OIL STRAINER CLOGGING - LEFT	Left DC Bus	S24
OIL TEMP - LEFT	Left DC Bus	S22
OVERHEAT WHEEL WELL SENSOR	Left DC Bus	M22
PITOT HEATER ADVISORY	Left DC Bus	P33
RADIO DC BUS FEED - ESSENTIAL	Left DC Bus	P22
RADIO DC BUS FEED - LEFT	Left DC Bus	P21
RADIO RACK FAN CAUTION	Left DC Bus	M23
RAIN REPELLENT - LEFT	Left DC Bus	M32

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REVERSER ACCUM LOW CAUTION - LEFT	Left DC Bus	S30
REVERSER ACCUM SHUT-OFF - LEFT	Left DC Bus	S29
REVERSER THRUST ADVISORY - LEFT	Left DC Bus	S32
SPOILER CONTROL	Left DC Bus	P32
STALL WARNING STICK SHAKER - CAPTAIN'S	Left DC Bus	P35
START VALVE OPEN ADVISORY - LEFT	Left DC Bus	S33
SUPPLY AIR HIGH PRESSURE AUG VALVE - LEFT	Left DC Bus	M26
SUPPLY AIR TEMP CAUTION - LEFT	Left DC Bus	M28
SUPPLY AIR TEMP HIGH CAUTION - LEFT	Left DC Bus	M25
TAKE-OFF WARNING	Left DC Bus	P26
WIND SHIELD WIPER - LEFT	Left DC Bus	M31
WING & TAIL VALVES	Left DC Bus	M30
ADF 1	Left Radio Bus	C13
ALTITUDE COMPARATOR	Left Radio Bus	F24
ANTI SKID TEST	Left Radio Bus	A11
AUTO DATA ANALYSIS	Left Radio Bus	G16
AUTO DATA ANALYSIS REF VOLTS - ØB LEFT	Left Radio Bus	F16
AUTO DATA ANALYSIS REF VOLTS - ØB RIGHT	Left Radio Bus	F15
AUTOPILOT 1	Left Radio Bus	F18
AUTOPILOT 1	Left Radio Bus	G18
AUTOPILOT AIR DATA CMPTR 1	Left Radio Bus	F17
AUTOPILOT AIR DATA CMPTR 1	Left Radio Bus	G17
CAPTAIN'S HEADING OUTPUT 2	Left Radio Bus	C10
CAPTAIN'S HEADING OUTPUT 3	Left Radio Bus	C11
FIRST OFFICER'S ALTIMETER	Left Radio Bus	C12
FIRST OFFICER'S HEADING OUTPUT 3	Left Radio Bus	C9
FLIGHT DIRECTOR 1 - CMPTR	Left Radio Bus	F20
FLIGHT DIRECTOR 1 - CONTROL	Left Radio Bus	G20
FLIGHT DIRECTOR INDICATION - PITCH	Left Radio Bus	C14
FLIGHT DIRECTOR INDICATION - ROLL	Left Radio Bus	C15
FLIGHT RECORDER	Left Radio Bus	F21
FLIGHT RECORDER	Left Radio Bus	G21
LEFT ENGINE OIL PRESSURE	Left Radio Bus	A9
LEFT FLAP POSITION	Left Radio Bus	A10
LEFT HYDRAULIC - BRAKE PRESSURE	Left Radio Bus	B10
LEFT HYDRAULIC - OIL QUANTITY	Left Radio Bus	B11
LEFT HYDRAULIC - SYSTEM PRESSURE	Left Radio Bus	B9
LEFT SUPPLY AIR PRESSURE	Left Radio Bus	B13
LEFT TEMP CONTROL VALVE POSITION	Left Radio Bus	B12
NAV COMPARATOR	Left Radio Bus	F25
NAV INST XFMR 1	Left Radio Bus	F26
PASSENGER ADDRESS	Left Radio Bus	F23
PASSENGER MUSIC	Left Radio Bus	F22
PASSENGER MUSIC	Left Radio Bus	G22
PRIMARY LONGITUDE TRIM - BRAKE	Left Radio Bus	G25
PRIMARY LONGITUDE TRIM - CONTROL	Left Radio Bus	G24
PRIMARY LONGITUDE TRIM - STAB MOTION INDICATOR	Left Radio Bus	G23
STAB AUG CMPTR 1	Left Radio Bus	F19
STAB AUG CMPTR 1	Left Radio Bus	G19
ADF 1	Left Radio Bus (Essential)	E16
ATC 1	Left Radio Bus (Essential)	D12
ATC 1	Left Radio Bus (Essential)	E12
DME 1	Left Radio Bus (Essential)	D11

DME 1	Left Radio Bus (Essential)	E11
MARKER BEACON	Left Radio Bus (Essential)	D14
MARKER BEACON	Left Radio Bus (Essential)	E14
SELCAL 1	Left Radio Bus (Essential)	D13
SELCAL 1	Left Radio Bus (Essential)	E13
WEATHER RADAR - ØA	Left Radio Bus (Essential)	D15
WEATHER RADAR - ØA	Left Radio Bus (Essential)	E15
WEATHER RADAR - ØB	Left Radio Bus (Essential)	D16
WEATHER RADAR - ØC	Left Radio Bus (Essential)	D17
115 VAC UTILITY E/E COMPT	Right AC Bus	L9
400 CYCLE UTILITY FLIGHT COMPT	Right AC Bus	L10
ALTERNATE EMER AC BUS FEED	Right AC Bus	L11
ANTI COLLISION - UPPER	Right AC Bus	L13
ANTI-ICE VALVE - RIGHT ENGINE - COWL	Right AC Bus	L26
ANTI-ICE VALVE - RIGHT ENGINE - LEFT	Right AC Bus	L27
ANTI-ICE VALVE - RIGHT ENGINE - RIGHT	Right AC Bus	L28
AUTO DATA ANALYSIS DEF VOLTS - ØA RIGHT	Right AC Bus	L22
AUTO DATA ANALYSIS DEF VOLTS - ØC RIGHT	Right AC Bus	L23
CABIN PRESSURE CONTROL	Right AC Bus	J4
CABIN SIDEWALL	Right AC Bus	L21
CENTER FUEL TANK BOOST PUMP - AFT - ØA	Right AC Bus	J9
CENTER FUEL TANK BOOST PUMP - AFT - ØB	Right AC Bus	J10
CENTER FUEL TANK BOOST PUMP - AFT - ØC	Right AC Bus	J11
COCKPIT WINDOW ANTI-FOG - CLEARVIEW & EYEBROW	Right AC Bus	J27
COCKPIT WINDOW ANTI-FOG - CONTROL	Right AC Bus	J26
FUEL FLOW - RIGHT	Right AC Bus	L24
FUEL HEAT - RIGHT - CONTROL	Right AC Bus	L29
FUEL HEAT - RIGHT - TIMER	Right AC Bus	L30
FUEL QUANTITY - RIGHT	Right AC Bus	J15
FUEL QUANTITY - TRANSFER RELAY	Right AC Bus	J16
FUEL QUANTITY TOTALIZER	Right AC Bus	J17
GALLEY CONTROL	Right AC Bus	L6
GALLEY DRAIN MAST HEATER	Right AC Bus	J28
GROUND CONTROL RELAY	Right AC Bus	J18
GROUND SERVICE BUS CONTROL	Right AC Bus	L7
INST PANEL FLUORESCENT	Right AC Bus	L20
INST XFMR - RIGHT	Right AC Bus	L12
INTEGRAL LIGHTS - CENTER INST PANEL	Right AC Bus	L18
INTEGRAL LIGHTS - FIRST OFFICER'S INST PANEL	Right AC Bus	L17
INTEGRAL LIGHTS - PEDESTAL	Right AC Bus	L19
LAVATORY WATER HEATER 2	Right AC Bus	J29
LEFT FUEL TANK BOOST PUMP - AFT - ØA	Right AC Bus	J12
LEFT FUEL TANK BOOST PUMP - AFT - ØB	Right AC Bus	J13
LEFT FUEL TANK BOOST PUMP - AFT - ØC	Right AC Bus	J14
NOSE GEAR LANDING & TAXI - RIGHT	Right AC Bus	L16
PRESSURE RATIO - RIGHT	Right AC Bus	L25
PROBE HEATER	Right AC Bus	J22
RAM AIR VALVE	Right AC Bus	J5
RAZOR OUTLETS	Right AC Bus	L8
RIGHT FUEL TANK BOOST PUMP - AFT - ØA	Right AC Bus	J6
RIGHT FUEL TANK BOOST PUMP - AFT - ØB	Right AC Bus	J7
RIGHT FUEL TANK BOOST PUMP - AFT - ØC	Right AC Bus	J8
RIGHT TRANSFORMER RECTIFIER - 1 - ØA	Right AC Bus	L1

RIGHT TRANSFORMER RECTIFIER - 1 - ØB	Right AC Bus	L2
RIGHT TRANSFORMER RECTIFIER - 1 - ØC	Right AC Bus	L3
RUDDER & LIMITER HEATER	Right AC Bus	J30
STALL WARNING & VANE HEATER - RIGHT	Right AC Bus	J24
STATIC AIR TEMP	Right AC Bus	J20
STATIC PORT HEATER - RIGHT	Right AC Bus	J23
TEMP CONTROL - CABIN	Right AC Bus	J1
TOTAL AIR TEMP	Right AC Bus	J21
TRUE AIR SPEED	Right AC Bus	J19
WING LANDING - RIGHT	Right AC Bus	L14
WING LANDING LIGHT CONTROL - RIGHT	Right AC Bus	L15
WINDSHIELD ANTI-ICE - RIGHT	Right AC Bus	J25
ALTERNATE GEAR POWER CONTROL	Right DC Bus	R29
ALTERNATE THUNDER STORM	Right DC Bus	R40
ANTI-ICE VALVE CAUTION - RIGHT	Right DC Bus	T38
ANTI-SKID - OUTBOARD POWER	Right DC Bus	R36
ANTI-SKID - TEST	Right DC Bus	R37
CABIN LOW PRESSURE WARNING	Right DC Bus	N23
CABIN OXYGEN ADVISORY	Right DC Bus	R38
CABIN PRESSURE MAN AUTO CONTROL	Right DC Bus	N22
CABIN TEMP	Right DC Bus	N21
CSD DISC - RIGHT	Right DC Bus	T27
CSD OIL PRESSURE LOW CAUTION - RIGHT	Right DC Bus	T25
CSD OIL TEMP - RIGHT	Right DC Bus	T26
DC BUS OFF SENSING	Right DC Bus	R24
DC VOLTMETER - RIGHT	Right DC Bus	R23
DOOR WARNING	Right DC Bus	R26
FIRE X AGENT LOW PRESSURE CAUTION	Right DC Bus	R28
FIRST OFFICER'S PITOT HEATER	Right DC Bus	R34
FUEL FILTER PRESSURE DROP CAUTION - RIGHT	Right DC Bus	T36
FUEL HEAT ON ADVISORY - RIGHT	Right DC Bus	T37
FUEL PUMP PRESSURE CAUTION - RIGHT	Right DC Bus	T34
FUEL TEMP - RIGHT	Right DC Bus	T35
GALLEY DRAIN MAST HEATER & CONTROL	Right DC Bus	N33
GALLEY POWER - 1 & 2	Right DC Bus	R25
HYD PRESSURE LOW CAUTION - RIGHT	Right DC Bus	R30
HYD PUMP CONTROL - RIGHT	Right DC Bus	T28
HYD TEMP HIGH CAUTION - RIGHT	Right DC Bus	R31
ICE PROTECT AUGMENT VALVE - RIGHT	Right DC Bus	N29
MAP & BRIEFCASE	Right DC Bus	R41
OIL QUANTITY - RIGHT	Right DC Bus	T21
OIL STRAINER CLOGGING - RIGHT	Right DC Bus	T24
OIL TEMP - RIGHT	Right DC Bus	T22
PASSENGER WARNING SIGNS	Right DC Bus	R39
PURGING EIGHTH STAGE BLEED VALVE	Right DC Bus	N24
RADIO DC BUS FEED - NORMAL	Right DC Bus	R22
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SECTION 8

FIRE PROTECTION

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GENERAL

General

A fire detection system is provided for each engine and the APU. Each detection system consists of two detector loops mounted parallel to each other.

With the loop switch set to BOTH, only one loop needs to detect a fire or overheat condition to activate the fire warning system.

Fire Warning System

The fire warning for an engine fire consists of the following lights and warning sounds:

- A red ENG FIRE light located in the fire handle on the upper main instrument panel.
- The MASTER WARNING light on the glareshield.
- Aural warnings (fire bell and vocal) from the central aural warning system.

Engine Fire Detection System Panel

The panel consists of three switches and six amber lights. The lights and switches are arranged in three groups consisting of one switch and two lights. Each group represents a fire detector circuit, left engine loops, right engine loops and APU loops.

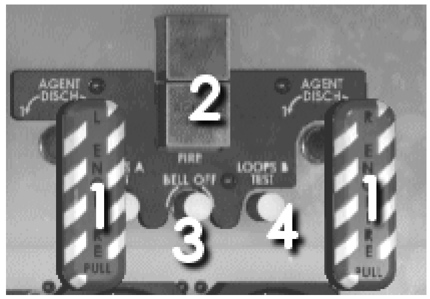
Fire Test Switches

The fire test switches are located on the engine fire panel. Only the loop B test switch is simulated in the panel. This test switch will test both loops. When the test switch is depressed, the fire handles will illuminate, the fire bell will sound and the loop lights on the Engine Fire Detection System panel will illuminate.

Fire Extinguishing System

The fire extinguishing system consists of a fixed system and portable fire extinguishers. The fixed system consists of two extinguishing agent containers, distribution lights, a control unit, and agent low indicating lights. Hand operated extinguishers are available in the cockpit and in the passenger compartment.

CONTROLS AND INDICATORS



1. ENG FIRE Handle (L and R)
Provides fire warning indication and protection for the applicable engine. Lights within the handle are turned on by the engine fire detection system or test circuit. Pulling the handle will silence the aural warnings and shut off engine fuel.

Click the right mouse button on the fire handles to pull them out. Click the left mouse button on the applicable left/right click area to rotate the fire handle left/right to discharge the fire extinguishing agent into the engine.

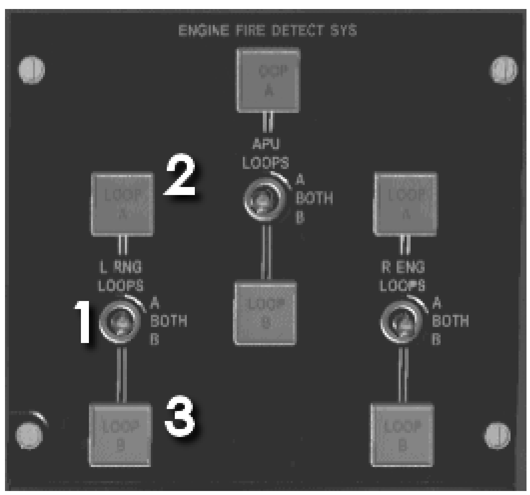
2. AGENT LOW Light (1 and 2) (Amber)
Comes on to indicate fire extinguishing agent has been discharged (pressure below required minimum).

3. FIRE BELL OFF Switch
Push to turn off aural warnings for engine fire.

4. LOOPS TEST Button (A and B)
Push to test the fire detection system loops circuits.

1. APU FIRE AGENT SWITCH
(No. 1 and No. 2)
(Momentary) Moving switch to DISCH with FIRE CONT switch in OFF & AGENT ARM discharges respective fire extinguishing agent into the APU compartment.

2. APU FIRE CONT SWITCH
NORM Provides control power to APU MASTER switch for normal operation.
OFF & AGENT ARM Shuts down APU and arms APU FIRE AGENT switches for subsequent discharge of fire extinguishing agent.



1. LOOPS Selector Switch (L Eng, R Eng, APU)
The Loops Selector switch connects the applicable engine or APU to the selected fire detection loop(s). The switch is normally set to BOTH, except when isolating and testing for malfunctioning and/or inoperative loop(s).

2. LOOP A Light (L Eng, R Eng, APU) (Amber)
The light comes when activated by associated fire detection loop or when the LOOPS Test switch is pressed. Note: Pressing LOOPS Test switch B will test both LOOP A and LOOP B. (LOOPS Test switch A is currently not simulated)

3. LOOP B Light (L Eng, R Eng, APU) (Amber)
Same as LOOP A light.

WARNING AND CAUTION INDICATORS

55. APU FIRE LIGHT
Indicates APU fire detection circuit has detected a fire in the APU compartment.

61. FIRE DETECTION LOOP LIGHT
Illuminates when any single LOOP light on the engine fire detection system panel illuminates.

SECTION 9

AIRCRAFT FUEL

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GENERAL

General

The airplane fuel system is designed to provide an uninterrupted fuel flow, under all conditions and attitudes encountered during normal commercial service.

Fuel Tanks

The aircraft is equipped with three fuel tanks. The total fuel capacity is 24,649 lbs. The main wing tanks each have a capacity of 9,286 lbs. The center wing tank has a capacity of 6,077 lbs.

Fuel Feed

Each fuel tank has two AC boost pumps installed. Each main boost pump can supply both engines at take-off power.

Fuel is normally provided to each engine from the respective main wing tank. Crossfeed from either main tank to either engine is available, but fuel transfer is not. The purpose of crossfeed operation is to correct a main tank imbalance. The Fuel Crossfeed Valve Lever is located on the pedestal.

Fuel loaded in the center tank should be used before the main wing tank fuel. The two center tanks pumps are connected in series to provide higher pressure than that of the wing tank pumps, connected in parallel, and ensure usage of the center tank fuel even with both main tank pumps operating.

A 28 volt DC start pump, operated by a switch on the overhead panel, is installed in the right main tank and is used for APU or engine starting when AC power is not available.

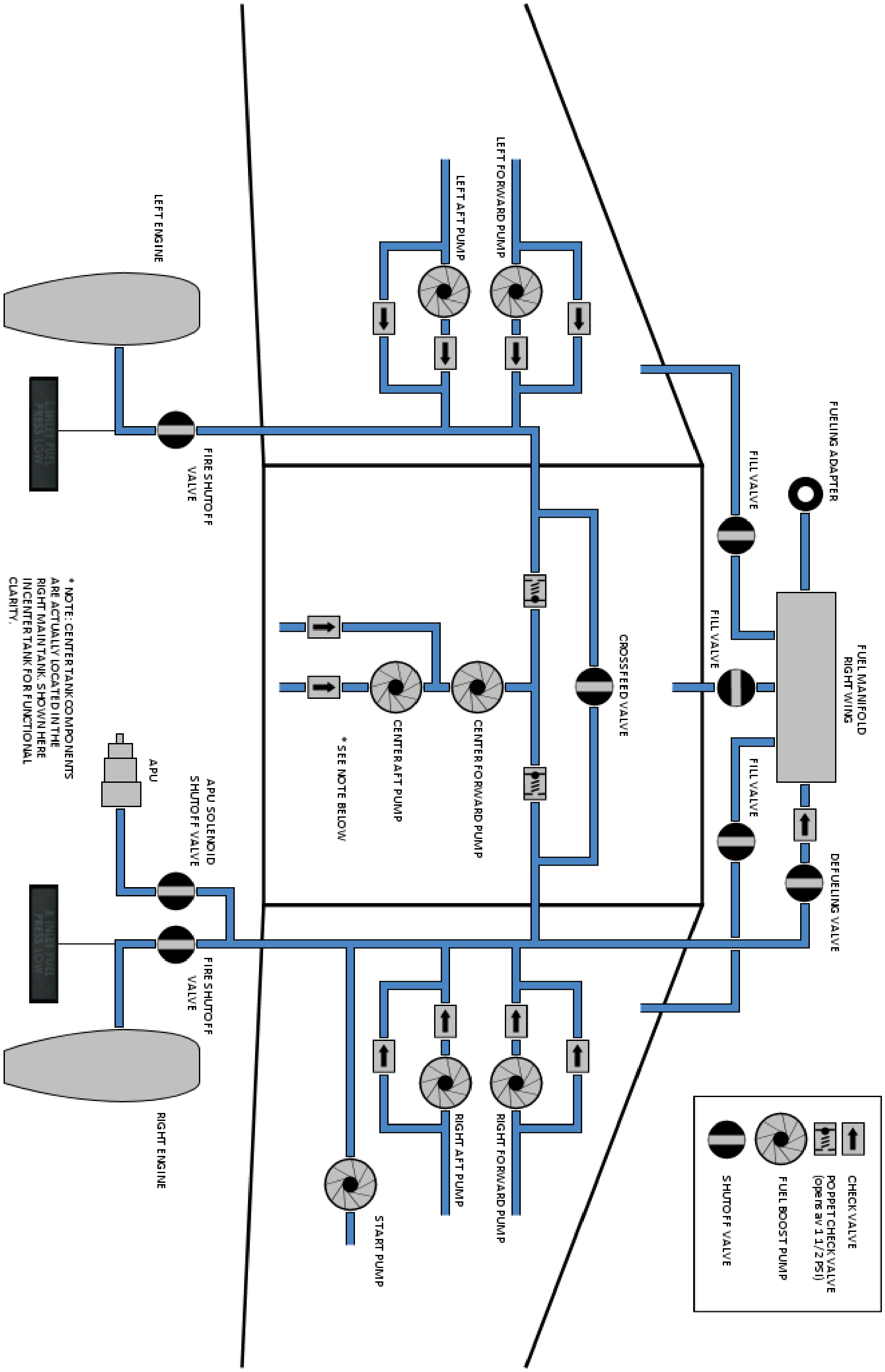
Low fuel pressure at the engine inlet is indicated by a light on the annunciator panel. Each engine can suction feed from the respective main tank. The APU can suction feed from the right main tank. Neither engine nor the APU can suction feed from the center tank.

The Fuel Control Panel is located on the overhead panel.

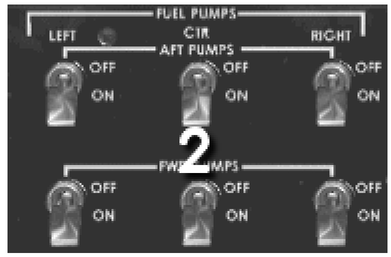
Fuel Tank Quantity Indicating

The fuel quantity gauges are located on the left side of the center instrument panel. They display the fuel quantity of each main tank, the center tank, total fuel quantity and aircraft gross weight.

FUNCTIONAL SCHEMATIC



CONTROLS AND INDICATORS



1. START PUMP SWITCH

OFF Pump is off.

ON Pump is on supplying fuel pressure to the right engine and APU.

2. FUEL BOOST PUMP SWITCHES (left, center, right) (aft and forward)

OFF Turns off applicable fuel boost pumps.

ON Turns on applicable fuel boost pumps.

3. FUEL HEAT SWITCHES (left and right)

OFF Normal Position

ON Momentary. Turns on fuel heater for left or right engine. The fuel heater is automatically switched off when the fuel heater cycle is complete.

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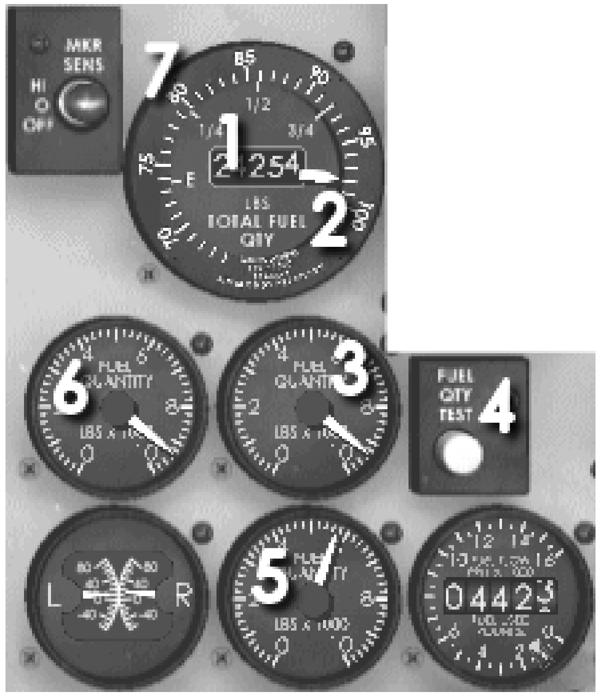

1. TOTAL FUEL QTY INDICATOR
Provides a digital summation of the fuel quantities indicated by the individual tank quantity indicators.

2. FUEL QTY INDICATOR
An analog pointer provides a summation of the fuel quantities indicated by the individual tank quantity indicators.

3. RIGHT MAIN TANK FUEL QTY INDICATOR
Indicates the fuel quantity in the right main tank.

4. FUEL QTY TEST SWITCH
This switch sends a false fuel used signal to the fuel quantity gauges as a means to test the system.

Pressed: All fuel quantity gauges should show decreasing fuel quantity indications.

Released: All fuel quantity gauges should return to their previous quantity indications.

5. CENTER TANK FUEL QTY INDICATOR
Indicates the fuel quantity in the center tank.

6. LEFT MAIN TANK FUEL QTY INDICATOR
Indicates the fuel quantity in the left main tank.

7. GROSS WEIGHT SCALE
The adjustable dial indicates aircraft total weight in thousand pound increments. When rotated to set total gross weight opposite the fuel quantity indicator, this scale will provide a continuous indication of aircraft gross weight as fuel decreases.

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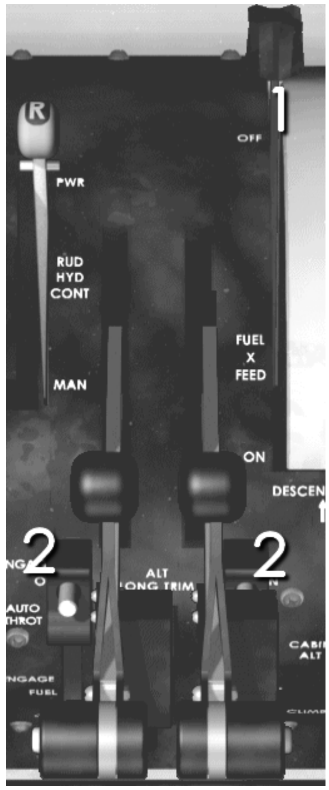


1. FUEL X-FEED LEVER

OFF Fuel crossfeed valve is closed, allowing left main fuel tank to feed left engine and right main fuel tank to feed right engine and APU.

ON Opens fuel cross feed valve, allowing either or both main tanks to feed both engines and APU.

2. FUEL CONTROL LEVERS (L, R)

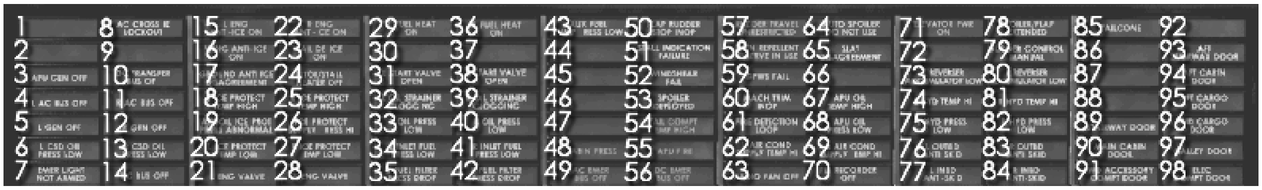
Fuel lever lock/release button must be depressed to unlock lever prior to actuation to ON or OFF.

OFF Shuts off fuel to applicable engine, and then turns off ignition.

ON Turns on ignition to the applicable engine, and then turns on fuel.

Note: When a fuel lever is set to ON, ignition is turned on for the applicable engine regardless of ignition switch position.

WARNING AND CAUTION INDICATORS



<u>34 & 41. INLET FUEL PRESS LO LIGHT (L, R)</u>

Comes on to indicate low fuel supply pressure at the engine. Light also comes on when engine is operating on suction feed. MASTER CAUTION Lights also come on.

SECTION 10

PNEUMATICS, AIR CONDITIONING & PRESSURIZATION

TABLE OF CONTENTS

GENERAL

Pneumatics

The pneumatic system provides pressurized air for cabin pressurization, air conditioning, ice protection, engine starting, and potable water tank pressurization. For ground operation and engine starting, pneumatic pressure is supplied by the APU, by ground power equipment, or by an operating engine.

In flight pneumatic pressure is supplied by the 8th and 13th compressor stages of both engines. Normally, bleed air from the left and right engines is supplied to the respective air conditioning units. Bleed air from both engines is supplied to the ice protection systems simultaneously. Pneumatic crossfeed valves permit operation of the air conditioning system and ice protection systems from either engine.

APU bleed air is normally used only for engine starting and for ground air conditioning when the engines are not operating.

Air Conditioning

Pressurized air from the pneumatic system is used for air conditioning and for pressurizing the airplane. During ground operation, pneumatic air to operate the air conditioning systems can be obtained from a ground source connected to the airplane, by the auxiliary power unit (APU), or by the engines. During flight, only the engines supply bleed air for operating the air conditioning.

The airplane has two identical air conditioning systems, designed for independent or parallel operation.

Normally the right system operates from the right engine bleed air and supplies the passenger compartment temperature requirements. The left system operates from the left engine bleed air and supplies the flight compartment temperature requirements.

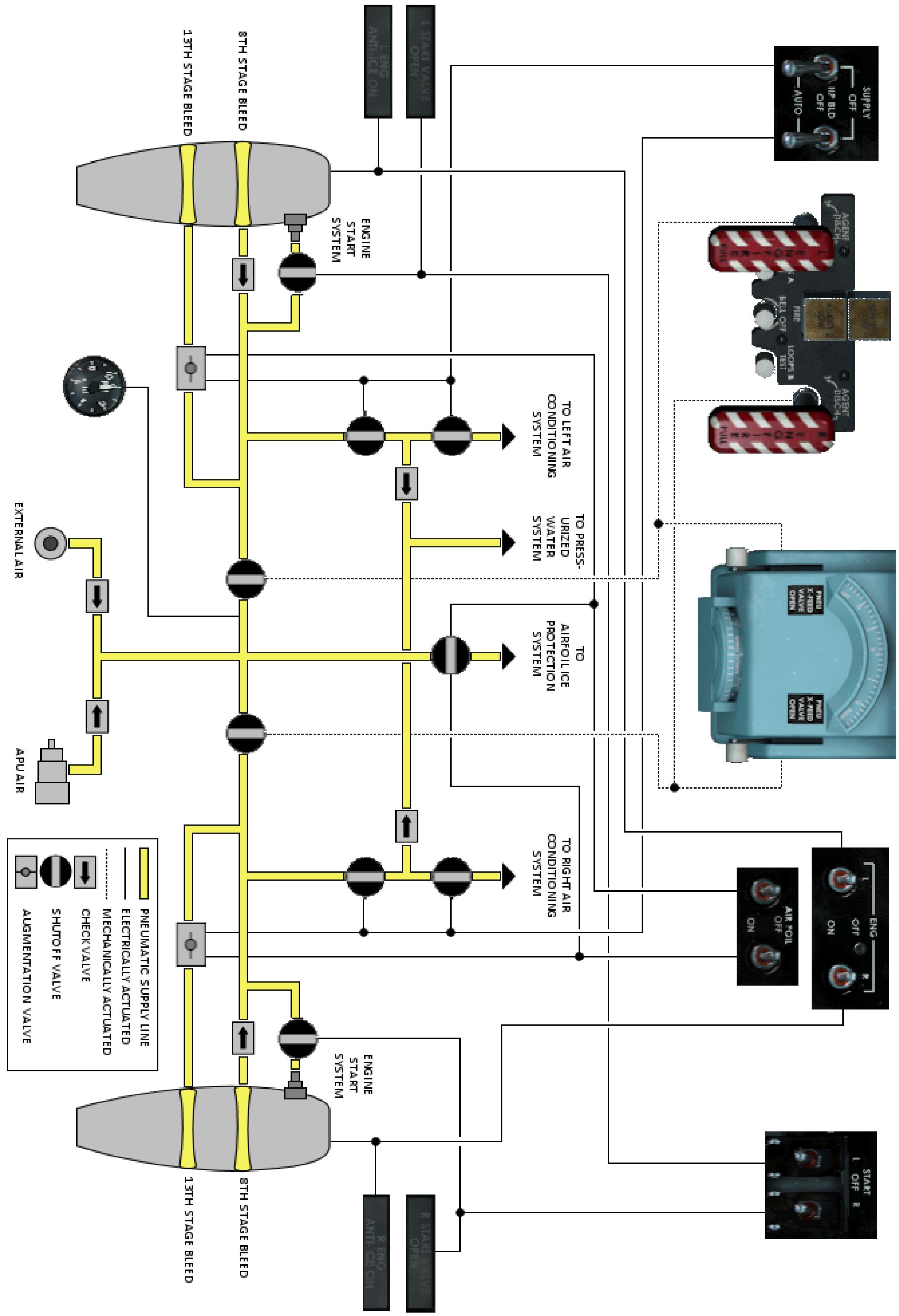
Pressurization

Pressurization is provided by a controlled flow of bleed air from the pneumatic supply, which passes through the air conditioning systems and is then ducted to the pressurized areas. Desired pressurization levels are maintained by regulating escape of the compressed air through the cabin air outflow valve. The butterfly outflow valve is normally fully closed during flight. The automatic controller modulates the nozzle outflow valve during flight to maintain the desired pressurization level.

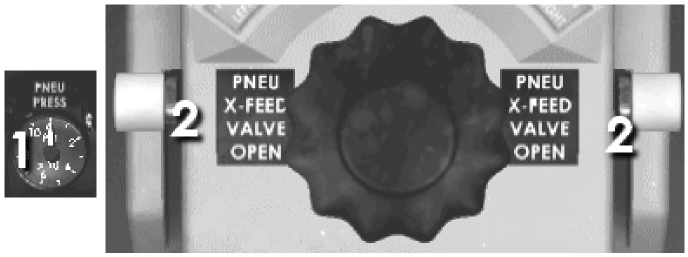
Dual pressure relief valves are installed to protect the airplane structure from maximum input pressure. Dual pressure relief valves prevent the cabin differential pressure from exceeding the maximum limit of 8.06 PSI. Negative pressure is relieved by the inward movement of the galley service and passenger entrance door seals, and one negative pressure relief valve installed in the lower aft pressure bulkhead.

When operating on the pressure schedule, the cabin rate of climb will be proportional to the airplane rate of climb, with maximum limits as set by the rate limit knob. When climbing or descending toward a selected altitude above schedule, the cabin rate of change will be as selected on the rate limit knob. With the knob at the index mark, the rate limit is normally 700 fpm climb and 300 fpm descent.

FUNCTIONAL SCHEMATIC



CONTROLS AND INDICATORS



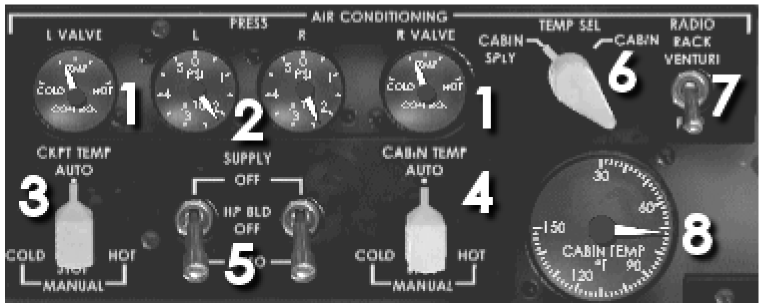
1. PNEUMATIC PRESSURE GAUGE
Indicates the pneumatic pressure in the crossfeed manifold.

2. PNEUMATIC X-FEED VALVE LEVER

Open (Up) Supplies bleed air for air foil ice protection (in flight only), for operating both air conditioning packs from one operating engine, and for making pneumatic crossfeed starts from opposite operating engine. Also, on the ground, supplies APU bleed air or air from pneumatic ground source for operating one or both air conditioning packs or for engine starting.

Closed (Down) Shuts off engine bleed air for air foil ice protection and pneumatic crossfeed starts, and each air conditioning pack is supplied engine bleed air from its respective engine only. On the ground, APU bleed air or air from pneumatic ground source is shutoff and not available for air conditioning packs or engine starts.

AIR CONDITIONING



1. TEMP CONTROL VALVE INDICATOR (L, R)
Indicates position of air conditioning system control valve.

COLD	Indicates temperature control valve is closed and blocking hot air supply.
HOT	Indicates temperature control valve is fully open to allow maximum hot air supply.

2. PRESSURE GAUGE
Indicates pneumatic supply pressure available for operation of each air conditioning pack.

3. COCKPIT TEMPERATURE SELECTOR

AUTO	Temperature is automatically adjusted.
MANUAL COLD	(Momentary) Moves TEMP CONTROL VALVE towards cold.
MANUAL HOT	(Momentary) Moves TEMP CONTROL VALVE towards hot.
STOP	(Momentary) Stops movement of TEMP CONTROL VALVE in manual mode.

4. CABIN TEMPERATURE SELECTOR
See Cockpit Temperature Selector.

5. SUPPLY SWITCH (L, R)

OFF	Closes off all pneumatic valves for the air conditioning system.
HP BLD OFF	Opens up the regulator valve but keeps the high press augmentation valve closed.
AUTO	Opens up the regulator valve and adjusts the augmentation valve as necessary.

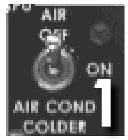
6. TEMPERATURE SELECT SWITCH

CABIN SPLY	Selects cabin supply duct temperature for display on the Cabin Temperature Gauge.
CABIN	Selects cabin supply duct temperature for display on the Cabin Temperature Gauge.

7. RADIO RACK VENTURI SWITCH

VENTURI	In flight, opens venture valve and turns off radio rack fan.
FAN	In flight, turns on primary radio rack fan and closes venture valve for radio rack cooling.

8. CABIN TEMPERATURE GAUGE
Indicates cabin temperature or cabin supply duct temperature as selected by Cabin Temperature Select switch.



1. APU AIR SWITCH

ON APU bleed control valve opens to provide APU bleed air to the airplane pneumatic system.

OFF Closes the APU bleed control valve.

AIR COND COLDER Closes turbine bypass valve and increases differential pressure across air conditioning turbine, thus lowering temperature of conditioned air during ground operation. Use of this switch position significantly reduces airflow in the cockpit and cabin.

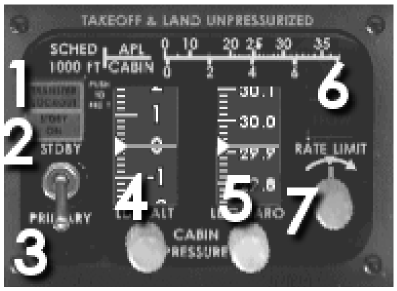
2. AIR CONDITIONING SHUTOFF SWITCH

Disables automatic shutoff of the air conditioning system.

3. RAM AIR SWITCH

Controls the ram air valve in the right air conditioning system.

PRESSURIZATION



1. TRANSFER LOCKOUT LIGHT (Blue)
Indicates automatic transfer of pressurization control system is prohibited.

2. STDBY ON LIGHT (Blue)
Indicates pressurization control is transferred to the standby system.

3. SYSTEM SELECTOR SWITCH
Used to manually transfer system from primary to standby or return the system from standby to primary.

4. LDG ALT SELECTOR KNOB
Used to set departure/destination airport altitude in the landing altitude window. The scale is numbered in 100 ft increments.

5. LDG BARO SELECTOR KNOB
Used to set departure/destination barometric pressure in Mb/In Hg window.

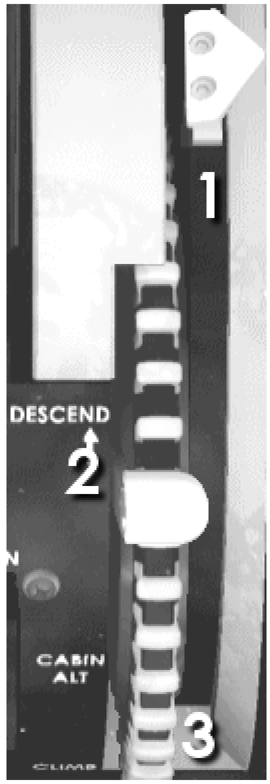
6. FLOW LIGHT
Indicates current air flow is insufficient to maintain cabin pressure. The cause may be insufficient air conditioning inflow or excessive fuselage leakage. Press to test light.

Note: It is normal for the FLOW light to be illuminated on the ground when the engines are at idle power.

7. RATE LIMIT CONTROL KNOB
Normally set at index mark and does not require adjustment unless a rapid climb or descent is anticipated.

8. CAB ALT AND DIFF PRESS GAUGE
Outer CAB ALT dial indicates existing cabin altitude in thousands of feet. Inner DIFF PRESS dial shows difference in pressure between cabin and ambient in PSI.

9. CABIN CLIMB GAUGE
Standard rate instrument, indicates rate of change in feet per minute in cabin altitude during automatic or manual control.



1. OUTFLOW VALVE POSITION INDICATOR
Indicates position of cabin air outflow valve. Fully forward – open, fully aft – closed.

2. CABIN ALT CONTROL LEVER

Auto	(Up) Cabin altitude is controlled automatically.
Manual	(Down) Cabin altitude is manually controlled by adjusting the Cabin Altitude Control Wheel.

3. CABIN ALT CONTROL WHEEL
With the Cabin Altitude Control lever in the auto (up) position, the control wheel rotates as cabin air outflow valve automatically adjusts to maintain cabin altitude.

With the Cabin Altitude Control lever in the manual (down) position, manually rotate the control wheel in the desired direction to adjust cabin air outflow valve.

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WARNING AND CAUTION INDICATORS

48. CABIN PRESS (Red)

Comes on when cabin altitude exceeds 9,500 ft. The CABIN PRESS light is accompanied by the MASTER WARNING light. The NO SMOKING and FASTEN SEAT BELTS signs in the cabin also come on.

54. TAIL COMPT TEMP HIGH (Red)

Not in use.

62. L AIR COND SUPPLY TEMP HI (Amber)

Not in use.

63. RADIO FAN OFF (Amber)

Not in use.

69. R AIR COND SUPPLY TEMP HI (Amber)

Not in use.

SECTION 11

HYDRAULICS, BRAKES & LANDING GEAR

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HYDRAULICS

The DC-9 hydraulic system consists of two completely independent left and right systems. There are no provisions for routing hydraulic fluid or pressure from one system to the other.

In some cases, pressure from each hydraulic system supplies the same service. For example, some of the flaps actuating cylinders receive pressure from the left system, and some receive pressure from the right system. Services normally receiving pressure from both hydraulic systems will operate safely but at a reduced efficiency when one system is inoperative.

Each system has a reservoir and is pressurized by an engine-driven hydraulic pump.

Hydraulic Supply

The left and right hydraulics reservoirs are located in the left and right main gear wheel wells. Each reservoir supplies fluid to its own system respectively.

Hydraulic Pumps

The left hydraulic system is pressurized by a pump mounted on the left engine and the right hydraulic system is pressurized by a pump mounted on the right engine. Each of the engine-driven pumps can operate in a high pressure or low pressure mode. The high pressure mode provides 3,000 PSI and is used for taxi, take-off and landing. The low pressure mode provides 1,500 PSI and is selected during normal flight when system demands are low to reduce wear on the system.

An auxiliary electrical pump is installed in the right hydraulic system and is designed for continuous operation at 3,000 PSI.

An alternate hydraulic motor/pump is installed to mechanically transfer pressure between the left and right hydraulic system. Note that there is no transfer of fluid between the left and right hydraulic system. For the alternate pump to operate, either the left or right system must be pressurized to provide energy to drive the alternate pump. The alternate pump is normally used during taxi, take-off and landing as a backup source of pressure.

Left Hydraulic System

The left hydraulic system supplies pressure and pressure distribution for operation of the following:

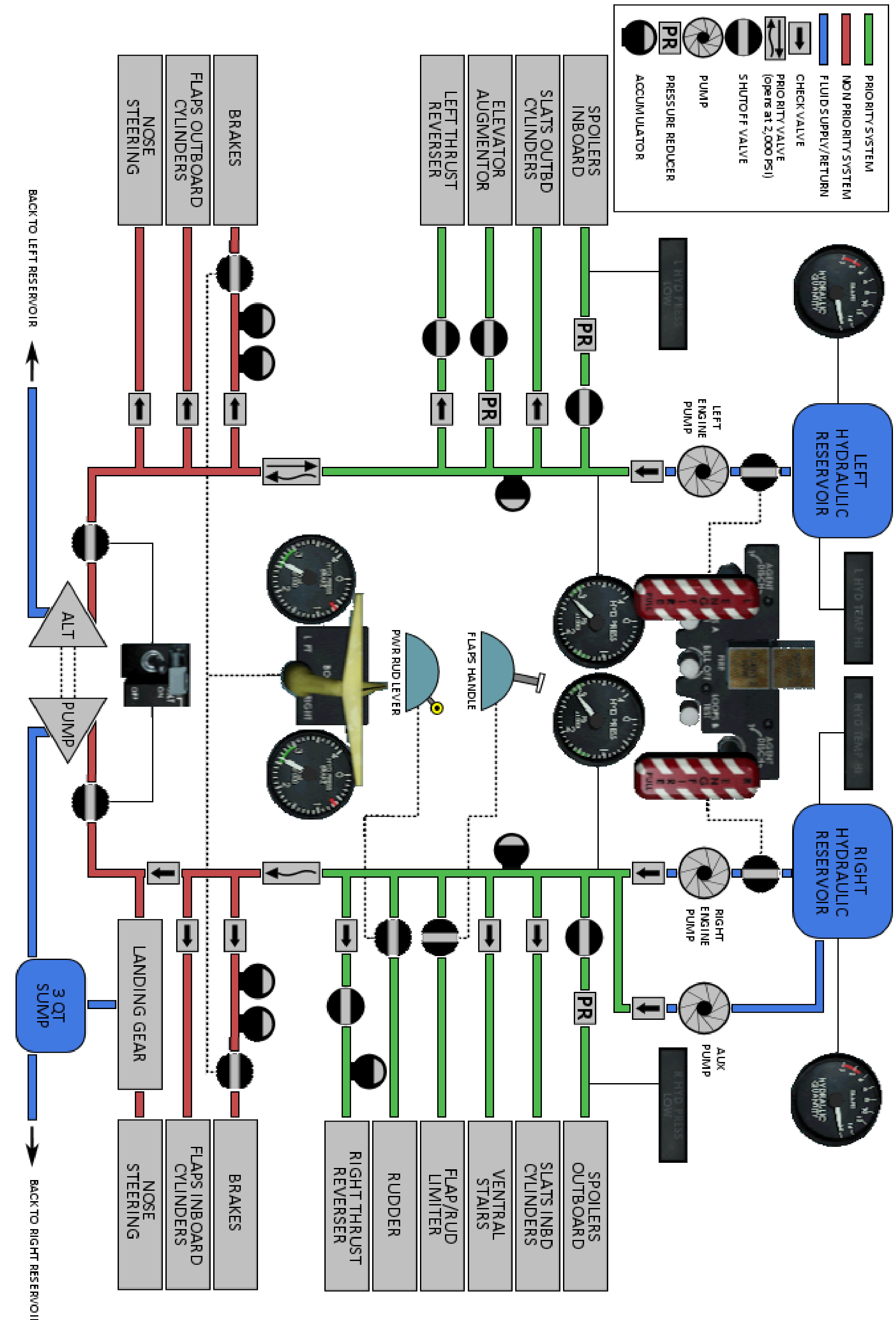
1. Inboard flight spoilers
2. Left engine thrust reversers
3. Left and right wheel brakes
4. Wing flap outboard actuators
5. Nose wheel steering system – left cylinder
6. Elevator augmenter power
7. Outboard slat cylinders
8. Alternate hydraulic pump

Right Hydraulic System

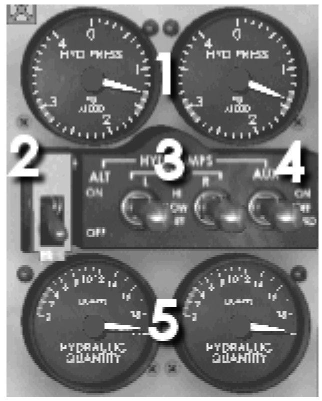
The right hydraulic system supplies pressure and pressure distribution for operation of the following:

1. Outboard flight spoilers
2. Right engine thrust reversers
3. Rudder power
4. Left and right wheel brakes
5. Wing flap inboard actuators
6. Nose wheel steering system – right cylinder
7. Landing gear
8. Inboard slat cylinders
9. Alternate hydraulic pump
10. Rudder throw limiter
11. Ventral stairway

FUNCTIONAL SCHEMATIC



HYDRAULICS CONTROLS AND INDICATORS



1. HYD PRESSURE INDICATOR (2)
Indicates system hydraulic pressure existing in the hydraulic lines between the pump and reservoir.

2. ALT HYD PUMP SWITCH

ON	Mechanically connects left and right hydraulic systems.
OFF	Mechanically separates left and right hydraulic systems.

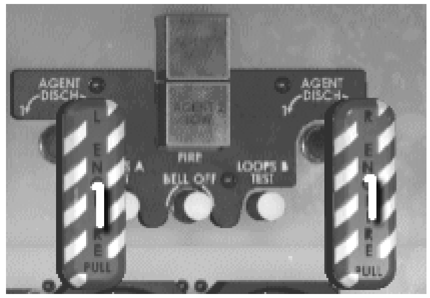
3. ENG HYD PUMPS SWITCHES (L, R)

HI	Engine-driven pump operate at 3,000 PSI (upper green band).
LOW	Engine-driven pump operate at 1,500 PSI (lower green band).
OFF	No pressure output for system circulation other than pump lubrication and cooling.

4. AUX HYD PUMP SWITCH

ON	Turns on electrically drive hydraulic pump. Operates at 3,000 PSI.
OFF	Pump inoperative.
OVRD	Auxiliary pump turned on. Overrides the thermal protective circuit and permits pump operation if no other source of needed pressure is available, even if the pump is overheating.

5. HYD FLUID QUANTITY INDICATORS (2)
Indicates quantity of hydraulic fluid in reservoir.



1. L & R ENG FIRE SHUTOFF HANDLES (2)
When the handles are pulled, all hydraulic fluid to the engine-driven hydraulic pumps will stop.

LANDING GEAR

Introduction

The airplane is equipped with a fully retractable tricycle landing gear consisting of nose gear and main gear assemblies. The landing gear is actuated by the landing gear handle.

When retracted, the landing gear is fully enclosed by doors. In case of a hydraulics failure, the landing gear may be mechanically released to freefall to the extended locked position. When freefall is used, the main gear hydraulically operated doors will not close.

An electrically monitored, visual and aural indicating and warning system provides indication of gear and brake system status.

Spray deflectors are installed on both main gear and nose gear assemblies to minimize water and slush ingestion on take-off and landing.

A tail bumper assembly, mounted on the bottom of the aft fuselage, prevents structural damage if the aft fuselage should make contact with the ground.

Nose Gear

The nose gear assembly is steerable, has dual wheels, and is mounted in a wheel well in the forward lower section of the nose of the airplane.

The nose gear is locked in both the extended and retracted positions by overcenter linkage actuated by hydraulic bungee cylinders and bungee springs.

A ground shift mechanism, mounted on the nose gear strut, is operated by compression and extension of the nose gear strut. This mechanism is used to establish ground or flight modes of operation.

Nose Gear Doors

The nose gear wheel well doors consist of two forward doors and two aft doors. The forward doors are closed when the gear is extended.

Nose Wheel Steering

The nose wheel steering system is hydraulically controlled through a full range of 164°, 82° to either side of center, by a steering wheel located on the captain's left console. The pedal steering mechanism permits approximately 17° of steering control in either direction through the use of the rudder pedals. Flap position affects the amount of nose wheel steering available from the rudder pedals.

When the steering cylinders are in the neutral position, they act as shimmy dampers.

Turning the nose gear more than 45° either side of center causes the nose gear tire on the outboard side of the turn to lift off the pavement because the nose gear strut is not completely vertical.

Main Gear

The airplane is equipped with two main landing gear and one nose gear, all with dual wheels and locks mounted on a shock strut.

When extended, each main landing gear is locked down by overcenter linkage actuated by hydraulic bungee cylinders and bungee springs. When retracted, the main landing gear assemblies are held up by hydraulic pressure, providing the engine driven pumps are selected to supply 3,000 PSI. If the pumps are selected to supply 1,500 PSI, the main gear will rest upon the doors. If hydraulic power is unavailable for gear extension, the main gear doors latches may be released by the emergency gear extension lever.

Main Gear Doors

The main gear doors consist of a hydraulically operated main door and a mechanically operated outboard door. The main gear doors are mechanically latched when closed. The main gear doors cycle to the closed position when the gear is approaching the extended position.

Alternate Hydraulic Motor/Pump System

The alternate hydraulic motor/pump system will provide pressure for gear operation in the event of a pressure loss in the right hydraulic system. With the ALT HYD PUMP switch in the ON position, the left hydraulic system will drive the motor/pump to provide pressure specifically for gear operation.

Ground Shift Mechanism

The ground shift mechanism is operated by the compression and extension of the nose shock strut. When the nose shock strut is not compressed, the ground shift mechanism disengages the rudder pedal nosewheel steering mechanism, centers the nose gear for retraction, and retracts the landing gear control handle anti-retract stop. The ground shift mechanism also establishes ground or flight mode for various systems.

Visual/Aural Indicating and Warning System

Three green landing gear position lights illuminate to indicate the landing gear is down and locked. Three red GEAR UNSAFE lights illuminate when the landing gear is in any intermediate position. The GEAR DOOR OPEN annunciator will come one anytime either of the main landing gear doors are not closed and latched.

The landing gear warning horn and vocal warning will sound when the throttles are at IDLE and the landing gear handle is not in the down position. The horn may be silenced by pressing the GEAR HORN OFF button on the glareshield. When flaps are selected to 18° or greater, the only way to silence the gear horn is by selecting gear down.

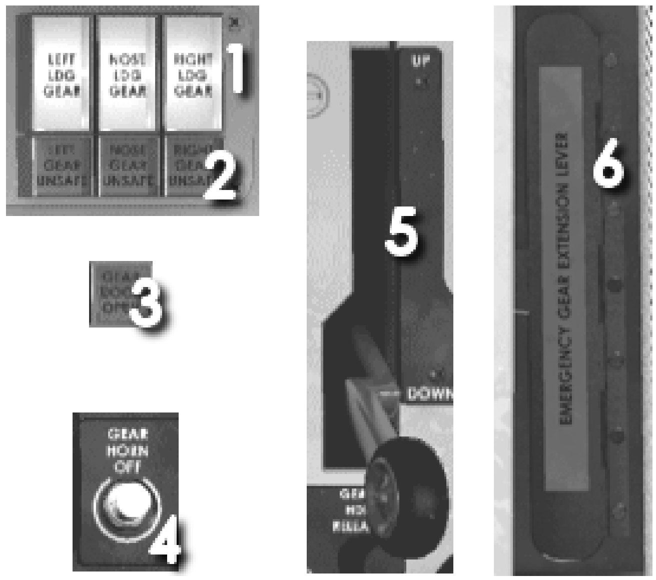
Reference markings on each main gear landing gear over-center linkage provide visual confirmation that the landing gear is down and locked. A periscope is located in the cabin floor for visual inspection of the main landing gear overcenter linkage.

The nose gear also has visual markings on the overcenter linkage and may be inspected through a peephole in the cockpit.

Tail Bumper and Strike Indicator

During normal operations, the tail of the aircraft should not make contact with the ground. In case of early rotation or other abnormal operation causing the tail to contact the surface, a tail bumper is installed to prevent or limit structural damage. The bumper extends beyond the fuselage skin and is linked to a shock absorber. The strike indicator is wired in the horizontal position.

CONTROLS AND INDICATORS



1. LDG GEAR LIGHTS (Green)
Indicates landing gear is fully extended and locked and the control lever is in the DOWN notch.

2. GEAR UNSAFE LIGHTS (Red)
Indicates an unsafe gear condition. Will remain illuminated unless the gear condition (fully down and locked or fully retracted) matches the control lever position selected. Push to test.

3. GEAR DOOR OPEN LIGHT
Indicates either one or both main gear doors are not fully closed and locked. Push to test.

4. GEAR HORN OFF Button
Pushing the Gear Horn Off button will silence the landing gear warning horn and vocal warning if flaps are set to 17° or less. If the flaps are set to more than 17°, the landing gear warning horn and vocal warning cannot be silenced unless the landing gear is down and locked.

5. LANDING GEAR CONTROL HANDLE

UP	Positions control valve to hydraulically retract the landing gear.
DOWN	Positions control valve to hydraulically unlock, fully extend, and lock the landing gear.

6. EMERGENCY GEAR EXTENSION LEVER

UP	Mechanically releases main gear door latches, nose gear overcenter locks, and places gear hydraulic system in bypass condition, allowing gear to free-fall and lock into position.
DOWN	Restores normal landing gear operation.

BRAKES

Introduction

Each main gear wheel is fitted with a disc-type power brake. Each brake is actuated by either of two completely separate sets of cylinders (7 in each set). Each set of cylinders is powered by a separate hydraulic system.

The wheel brakes are controlled by two completely independent hydraulic brake systems. Each system is capable of supplying reserve brake pressure in the event of a hydraulic pressure failure in the other system. Either or both systems may be selected for brake operation by the HYD BRAKE SYS selector handle. Normally, both systems are in operation at the same time.

Each main gear wheel is equipped with a brake wear indicator for visual inspection. Each main gear wheel has three fuse plugs which will yield and deflate the tire to prevent dangerous pressure buildup from excessive heat transfer from an overheated brake. The fuse plugs yield from heat and will not prevent over-inflation.

The airplane wheel brakes may be mechanically applied by depressing the brake pedals.

A gauge and annunciator light provide visual indication of brake temperature.

Parking Brake

The parking brake is a mechanical means of holding the wheel brake manual brake control valves in the pressure applied position. The parking brakes are held by accumulator pressure when the hydraulic systems are not operating.

The parking brakes are set by depressing the brake pedals, pulling up the park brake control knob (located on the captain's left console) and releasing the brake pedals.

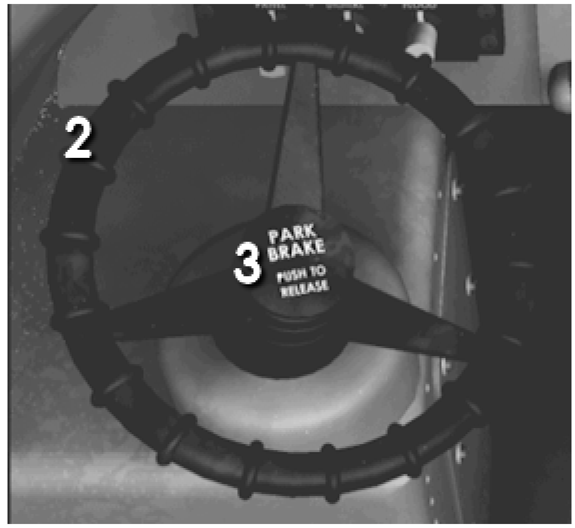
If the throttles are advanced to a take-off setting with the parking brake set, the aural/vocal warning system will be activated.

Anti-Skid System

A fully automatic anti-skid system is installed to obtain a more effective braking application, through control of wheel rotation at the point of maximum braking efficiency. The system is deactivated whenever the landing gear handle is not in the down detent or the parking brakes are set.

Both main landing gear wheels and nose gear wheel are fitted with spin brakes. The purpose of the spin brake is to stop the tire rotation after take-off.

CONTROLS AND INDICATORS



1. RUDDER/BRAKE PEDALS
Provides control of nosewheel steering through an arc approximately 17° left or right, during ground operation. If desired, the rudder pedal steering can be blocked or overpowered with the nosewheel steering wheel.

Depress top of pedal to apply power brake pressure.

2. NOSE GEAR STEERING WHEEL
The Nose Gear Steering Wheel provides control of the nose gear steering through an arc of approximately 82° left or right, during ground operations.

3. PARK BRAKE CONTROL
To set parking brake, lift the park brake control in the center of the Nose Gear Steering Wheel. Release the park brake by depressing the Park Brake Control or by depressing the brake pedals.

If the park brake is set and the throttles advanced for take-off, the take-off warning will sound.

The parking brake operates by locking hydraulic pressure in the brake lines. If there is no hydraulic pressure available, the parking brake cannot be set.

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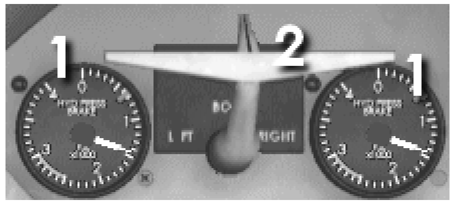


1. L & R BRAKES HYD PRESSURE GAUGES
Provides indication of pressure available in either hydraulic system for brake application.

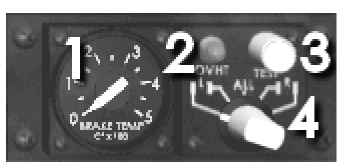
2. HYD BRAKE SYS SELECTOR HANDLE
Provides for selection of either LEFT, BOTH, or RIGHT hydraulic system pressure for brake operation.

1. ANTI-SKID SWITCH

OFF	Anti-skid system is inoperative.
ARM	Activates the anti-skid system. The anti-skid system will monitor the wheel speed to provide maximum braking without skidding the wheels.

2. TEST CHK SWITCH

OFF	Test circuit inoperative.
A or B	(Momentary) Activates anti-skid test circuit. Anti-skid lights on overhead annunciator panel will illuminate.



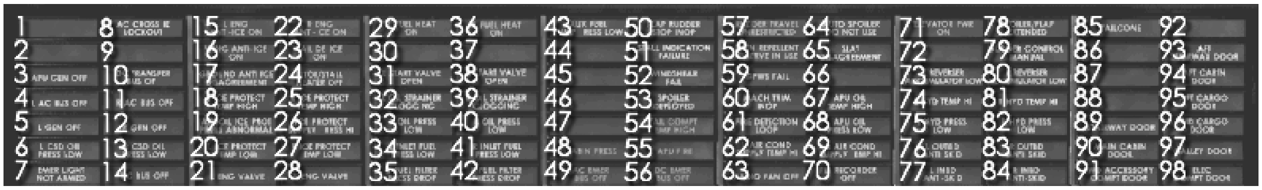
1. BRAKE TEMP GAUGE
Indicates selected or hottest brake temperature.
Hot brakes: 200°C - 400°C
Overheated: Over 400°C

2. OVHT LIGHT
Comes on when the brake temperature exceeds 305°C and goes off when the temperature has cooled to 260 °C.

3. BRAKE TEMP TEST BUTTON
Tests the brake temperature circuit and overheat light. Temperature gauge will indicate 450°C and overheat light will come on.

4. BRAKE TEMP SELECTOR SWITCH
Selects which brake temperature to display on the Brake Temp gauge. When set to ALL, the gauge will display the temperature of the hottest brake.

WARNING AND CAUTION INDICATORS



74 & 81. L & R HYD TEMP HI CAUTION LIGHTS
Indicates hydraulic reservoir fluid temperature has reached approximately 105° (221°F). The MASTER CAUTION light will also come on.

75 & 82. L & R HYD PRESS LOW LIGHTS
Indicates hydraulic pressure for lateral control spoiler has dropped below normal levels. The light illuminates when hydraulic pressure decreases and remains below 900 PSI. The light extinguishes when hydraulic pressure increases above 1,200 PSI. The MASTER CAUTION light will also come on.

76, 77, 83 & 84. L OUTBD ANTI-SKID, L INBD ANTI-SKID, R OUTBD ANTI-SKID, R INBD ANTI-SKID
Illuminates to indicate a malfunction in the anti-skid system. All these lights will also come on when testing the anti-skid system with the ANTI-SKID TEST CKT switch.

SECTION 12

FLIGHT CONTROLS

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GENERAL

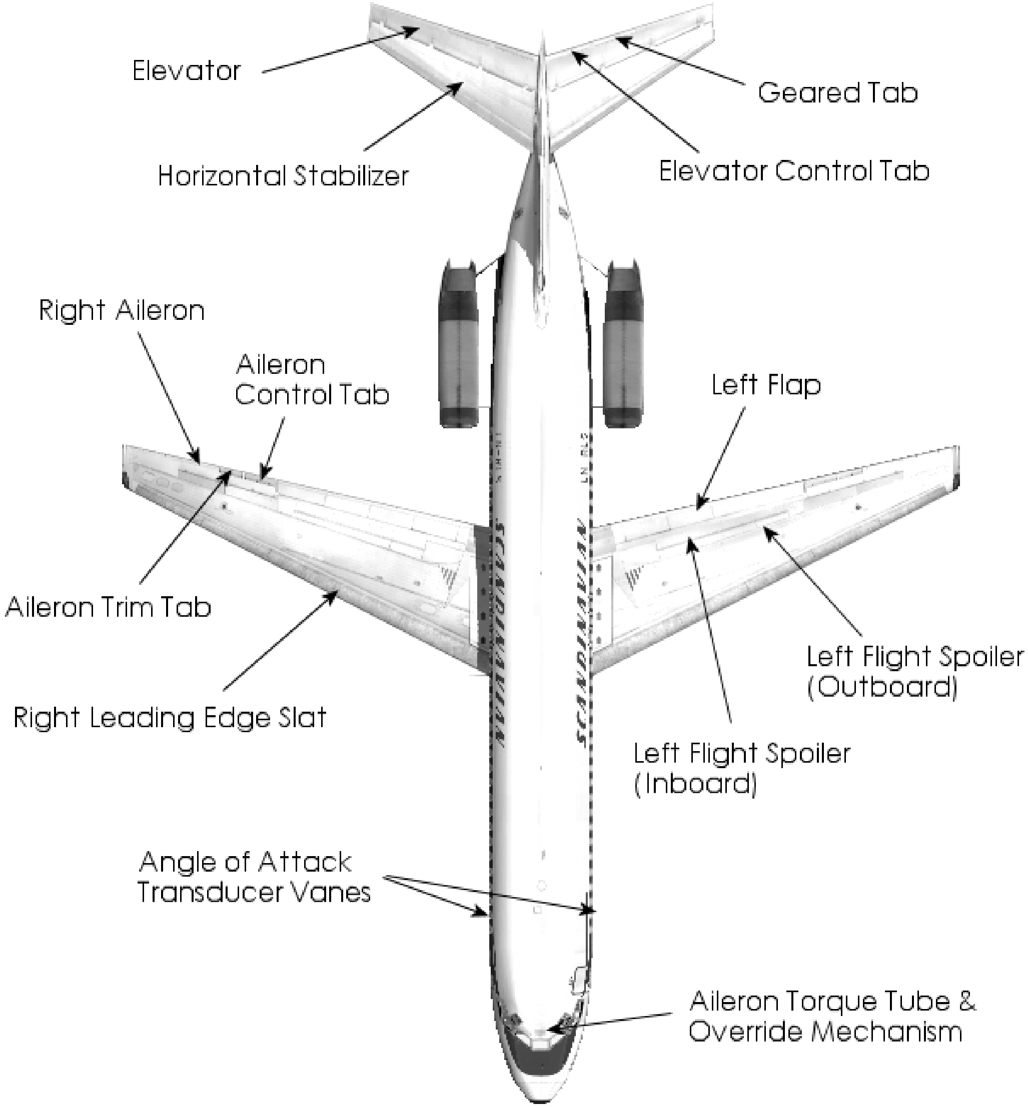
The DC-9 has conventional aileron, rudder, and elevator control systems. Control surfaces are protected against ground gust forces by viscous dampers and hydraulic cylinders.

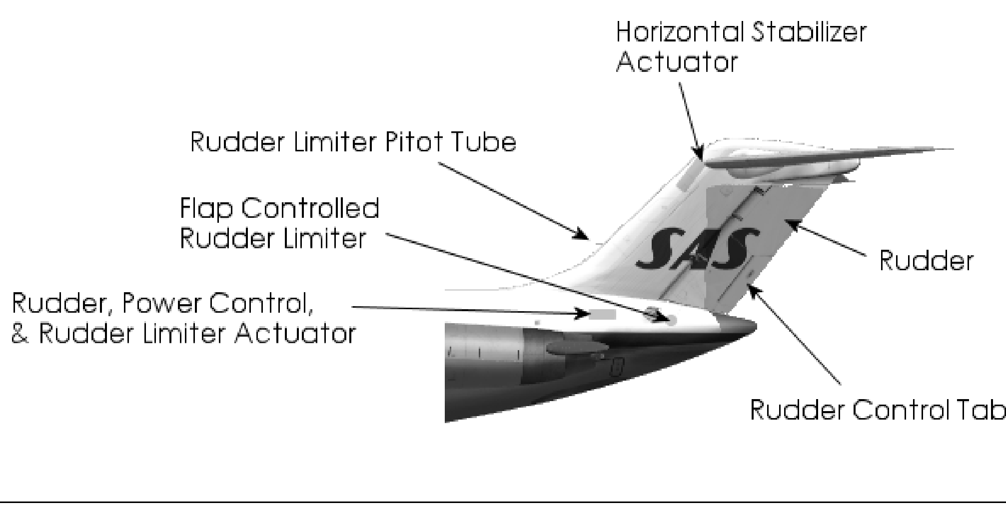
The horizontal stabilizer is adjustable for longitudinal trim. Lateral control is aided by hydraulically operated flight spoilers. The flight spoilers also operate to serve as ground spoilers.

The rudder is normally hydraulically powered, but will automatically revert to aerodynamic tab control when hydraulic power is lost. A yaw damper system aids directional stability and a Mach trim system aids longitudinal stability in the high-Mach range.

Conventional hydraulically operated slotted slats and wing leading edge slats are installed for lift augmentation.

MAJOR COMPONENT LOCATION





PRIMARY FLIGHT CONTROLS

Lateral Control System

The ailerons provide the primary roll control and are augmented by the flight spoilers when increased roll control is required.

The control column in the cockpit is cable connected to an aileron control tab which controls aileron movement. In flight, the deflecting control tab will cause the aileron to move aerodynamically.

Aileron trim is provided by a separate tab on each aileron. The trim tab is cable controlled by the Aileron Trim knob on the aft pedestal.

Longitudinal Control System

Each elevator operates independently. Each elevator is controlled by a single control tab located inboard on the elevator. The control tabs are cable connected to the control column.

A gear tab is installed outboard of the control tab on the elevator. The gear tab is linked to move in the opposite direction of the elevator. Thus, the gear tab always assists the operation of the control tab.

The elevators normally operate aerodynamically. However, for extreme high angle of attack flight conditions, a 975 PSI hydraulic power augmentation system is installed for additional nose down capability. The main purpose for the elevator augmentation system is to allow the airplane to recover from a deep stall when natural airflow across the tail is insufficient to "fly" the elevators.

A Mach Trim Compensator is installed on the First Officer's control column. The Mach Trim Compensator provides a force to move the columns slightly aft when the airspeed is above M.80. This action offsets the effects of Mach Tuck that occurs at high speeds.

A movable horizontal stabilizer provides longitudinal trim. The stabilizer is moved by a jackscrew driven by an electric motor. The stabilizer trim is operated by moving the trim control handle on the pedestal. Operation of the trim control handle will cause the autopilot to disengage.

A cable operated indicator moves fore and aft along a track on the pedestal to indicate the current nose up or nose down trim setting.

When the horizontal stabilizer is moved, an audio signal will sound for every 2° of stabilizer movement. A vocal warning will be sounded whenever the stabilizer is moved by the autopilot at a rate greater than 20° in 30 seconds. A switch on the aft pedestal is used to stop a primary-trim runaway stabilizer condition.

Note: In the real airplane the warning sounds are for every 1° of stabilizer movement and rate greater that 2° in 30 seconds. These values have been increased as the MSFS autopilot is very active on the stabilizer trim. This would have generated quite a bit of noise in the cockpit if the real values had been used.

The stabilizer trim is electrically operated, thus stabilizer trim will be unavailable if a total loss of electric power occurs. The stabilizer will then be locked in the position it had at the time the electrical power was lost.

When the airplane is parked, it is possible for the elevators to split due to tail winds. When this occurs, the flight crew may notice the control columns feel locked in position. The condition is removed as soon as the airplane is taxied and the natural airflow of the tail “flies” the elevator toward the neutral position.

Rudder System

The rudder normally operates in the powered mode and is actuated by hydraulic pressure. In the event of a system failure or by pilot selection, the rudder may operate in manual mode actuated by a control tab.

Powered Rudder Operation

During powered rudder operation, the control tab is locked and the rudder is actuated by hydraulic pressure from the right system based on rudder pedal input. Hydraulic power to the rudder may be shut off by placing the rudder power control handle in the manual position. When hydraulic pressure drops below 950 PSI, the rudder automatically reverts to manual operation. Trim is accomplished by turning a trim knob on the pedestal.

Manual Rudder Operation

During manual rudder operation, rudder pedal movement operates a control tab on the rudder. Trim is accomplished by turning the trim knob on the pedestal.

Rudder Throw Limiter

A Rudder Throw Limiter is installed to protect the empennage from overload in case of inadvertent application of excessive rudder control. The limiter operates by ram air pressure from the pitot tube on the leading edge of the vertical stabilizer. As speed increases, rudder movement will become more and more restricted.

A RUDDER TRAVEL UNRESTRICTED light on the overhead annunciator panel illuminates whenever full rudder throw is available.

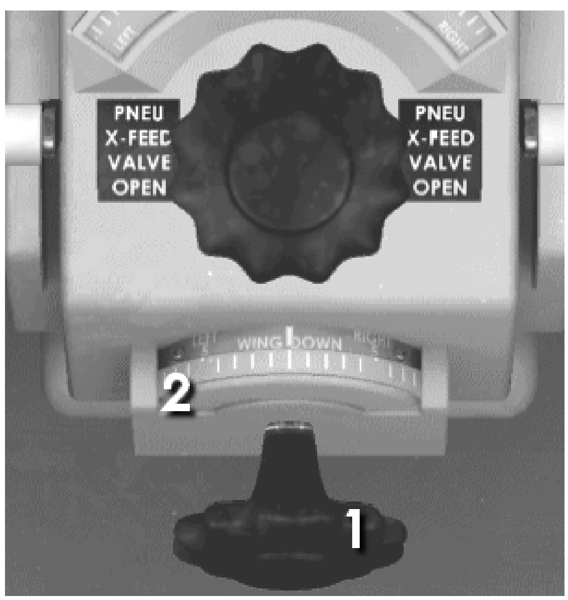
The rudder pitot tube is electrically heated whenever probe heat is on.

Yaw Damper

A yaw damper is installed to provide damping of any lateral directional oscillation. The yaw damper can produce a maximum of 2.5 degrees of rudder travel in either direction to provide stability augmentation.

LONGITUDINAL CONTROL AND TRIM

1. CONTROL COLUMN (2)
Movement of the control wheel deflects an aileron control tab. Aerodynamic forces on the control tab moves the aileron.



1. AILERON TRIM Control
Rotate the trim control knob left or right to deflect an aerodynamic trim tab on each aileron.

2. AILERON TRIM Indicator
Indicates the amount of left or right wing down aileron trim setting.

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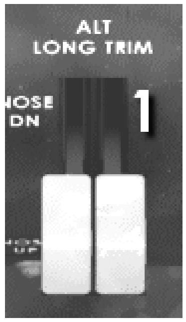

1. ALT LONG TRIM CONTROL

Alternate longitude trim control.

Currently not simulated.

2. STABILIZER TRIM PRIMARY MOTOR BRAKE SWITCH

This switch is only used to stop a runaway stabilizer condition.

NORM	Normal stabilizer trim operation.
STOP	Brake applied to prevent stabilizer movement.

Currently not simulated.

3. MACH TRIM COMP SWITCH

TEST	Introduces a signal in the Mach trim system as a means of functionally checking the computer and indicator.
NORM	The system will automatically provide Mach trim when needed.
OVRD	Deactivates the Mach trim system. The MACH TRIM INOP light will illuminate.

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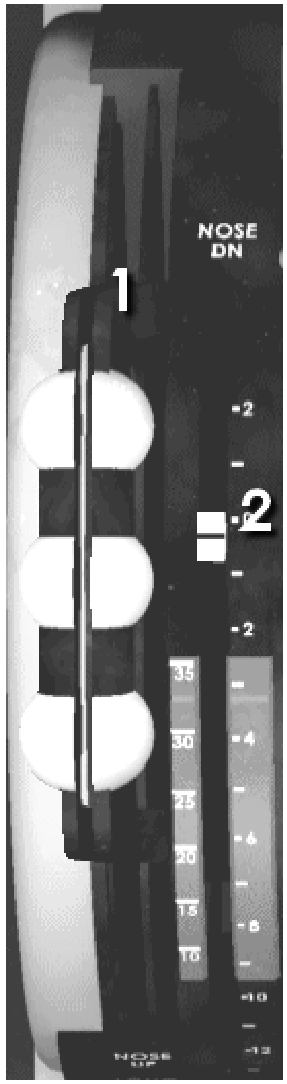
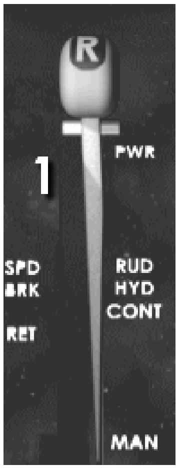
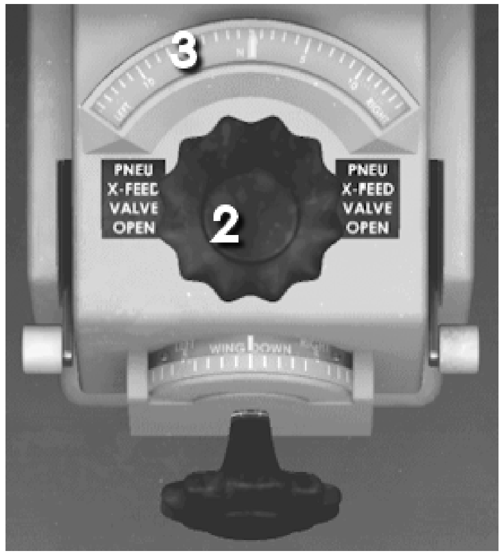


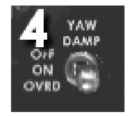
1. LONG TRIM Handles
Move both handles simultaneously in the same direction to trim the stabilizer. The trim handles override both the electric control wheel trim switch and the alternate longitudinal trim controls.

2. LONG TRIM Indicator
The LONG TRIM indicator is mechanically connected to the stabilizer. It indicates position and movement of the stabilizer. The green band indicates the takeoff trim range.

RUDDER CONTROL AND TRIM







1. RUDDER HYDRAULIC CONTROL LEVER

PWR Locks rudder control tab in faired position. Rudder movement is hydraulically assisted.

MAN Rudder control tab is unlocked. Hydraulic power to the rudder is removed.

2. RUDDER TRIM CONTROL

Rotate trim knob left or right to trim rudder during power operation and trim rudder control tab during manual operation.

3. RUDDER TRIM INDICATOR

Indicates the amount of left or right rudder trim setting.

4. YAW DAMP SWITCH

OFF Yaw damper operation is disabled if the autopilot is disengaged. If the autopilot is engage, yaw damper operation is automatically provided.

ON Yaw damper operation is provided regardless of autopilot status.

OVRD Stops all yaw damper operation.

Rudder Pedals

Push left or right pedal to yaw the airplane left or right.

SECONDARY FLIGHT CONTROLS

Spoiler System

Each wing has inboard and outboard flight spoilers that are operational during all phases of flight.

Flight Spoilers

There are two Flight Spoiler panel on each wing. These panels have a threefold purpose:

- They are used as roll augmentation devices.
- They are used as speed brakes when the aircraft is in-flight.
- They are used on the ground to act as ground spoilers.

Speed Brakes

In flight, manually moving the spoiler lever aft will extend the four flight spoilers to serve as speed brakes. When used as speed brakes, the spoiler panels will extend symmetrically up to a maximum of 35 degrees.

In flight, if the speedbrakes are extended with the flaps extended 6 degrees or more, the Spoiler/Flap Extended light on the overhead annunciator panel and the Master Caution light will illuminate, and a warning horn will sound.

On the ground, if either throttle is advanced with the spoiler lever not fully forward, the take-off warning horn will sound.

Ground Spoilers

All four spoiler surfaces may be extended to a maximum of 60 degrees to serve as ground spoilers.

Spoiler Operation – Take-Off

The spoilers are armed for take-off by squeezing the spoiler handle and raising it to the armed position. Arming the spoilers for take-off without positioning the AUTO BRAKE selector to TO will cause the take-off warning horn to sound (when the throttles are advanced). Likewise, positioning the AUTO BRAKE switch to TO without arming the spoilers will cause the take-off warning horn to sound.

When the throttles are retarded to idle and reverse thrust selected during a rejected take-off, the spoilers will automatically deploy and initiate automatic braking. Auto spoilers are applied until pilot takeover, by stowing the spoilers, or the airplane comes to a full stop.

Spoiler Operation – Landing

At main gear wheel spin up or nose strut compression, the spoilers are automatically deployed and extended to 60 degrees.

In the event of a go-around, the spoilers will automatically retract upon advancing the left throttle lever.

Trailing Edge Flap System

The flaps are double slotted and move aft and down. Two hydraulic cylinders actuate each flap. The inboard cylinders are powered by the right hydraulic system and the outboard cylinders are powered by the left hydraulic system. Normally, the flaps are operated by both hydraulic systems, but they will continue to operate at a reduced rate with only a single hydraulic system available.

Flaps may be positioned with the flaps handle in any of six permanent detents in a 0 to 50 degree range by movement of the flap/slat handle. Available flaps detents are: 0, 5, 15, 25, 40 and 50 degrees.

If the aircraft is on the ground, the throttles are advanced for takeoff and the flaps are set to more than 15 degrees, the takeoff warning horn will sound.

Leading Edge Slat System

The leading edge slat system provides wing lift augmentation. The slats are hydraulically operated. Two hydraulic cylinders actuate each slat. The inboard cylinders are powered by the right hydraulic system and the outboard cylinders are powered by the left hydraulic system. Normally, the slats are operated by both hydraulic systems, but they will continue to operate at a reduced rate with only a single hydraulic system available.

The slats are actuated by the flap/slat handle. The slats should be either fully retracted or fully extended. The flap/slat handles are locked together. Moving the flap/slat handle out of the 0/UP position will extend the slats.

The takeoff warning horn will sound if the throttles are advanced for take-off and the slats are not extended.

Take-off Warning

A take-off audible warning signal will sound if the throttles are advanced for take-off together with at least one of the following conditions:

- the stabilizer trim is not set within the takeoff range
- the flap/slat handle is set to more than 15 degrees
- the slats are not extended
- the spoiler lever is not fully forward
- the parking brakes are on.

Stall Protection System

The DC-9 does not provide adequate natural indications of stall under certain conditions.

Prior to the onset of a stall, the stall protection system will be activated. The airplane is equipped with two stall detection systems, each receiving input from an angle-of-attack vane, the horizontal stabilizer and the slat/flap position transmitters.

When approaching a stalled condition the following will be activated:

- Stick Shaker will be activated.
- At stall the claxon aural warning and vocal “Stall” will sound.
- Stall warning light will come one.
- Stick Pusher will be activated.

Post Stall Pusher System

Whenever a stall is detected, the control column will be abruptly moved forward, the STICK PUSHER PUSH TO INHIBIT glareshield light will come on, and the autopilot, if engaged, will be disconnected. The Post Stall Pusher System will keep forward pressure on the control column until the airplane has come out of the stalled condition or the STICK PUSHER PUSH TO INHIBIT glareshield light is pushed in.

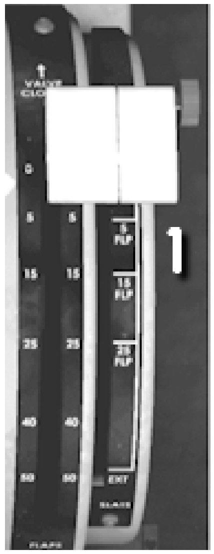
SPEEDBRAKE/SPOILER

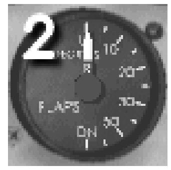
1. SPEEDBRAKE/SPOILER LEVER

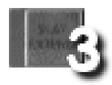
MANUAL MODE: In-flight, the speedbrake/spoiler lever is used to control the flight spoilers to act as speedbrakes by pulling the lever aft to the EXT position. On the ground, the lever is used deploy all spoiler panels, flight spoilers and ground spoilers.

AUTOMATIC MODE: When the speedbrakes are armed prior to landing, all spoiler panels will deploy upon main wheel spin up at touchdown and the lever will move to the EXT position. If the speedbrakes are armed prior to take-off, the spoiler panels will deploy when reverse thrust is selected for a rejected take-off. The speedbrakes are armed by pulling the lever up in the RET position.

FLAP/SLAT SYSTEM







1. FLAP/SLAT LEVER
Move the FLAP/SLAT lever to any of the six permanent detents to set flap and slat as required by the current flight conditions.

2. FLAP POSITION INDICATOR
Indicates the position of the left and right outboard flaps.

3. SLAT ADVISORY LIGHTS
When illuminated, the light indicates slats are extended.

STALL WARNING SYSTEM

1. STALL TEST SWITCH

SYS1 Tests right stall system. The system will operate the stick shaker on the control column, turn on the STALL and test the stall recognition speakers.

OFF Turns the test off, normal operating mode.

SYS2 Tests the left stall system. Same tests performed as with SYS1.

2. STALL LIGHT (Red)
A flashing STALL light indicates the airplane is in a stalled condition, or a test of the stall warning system.

WARNING AND CAUTION INDICATORS

51. STALL INDICATION FAILURE (Amber)
Currently not simulated.

53. SPOILER DEPLOYED (Amber)
Comes on to indicate Ground Spoiler is extended in flight, or any spoiler is deployed on the ground with the spoiler lever in the stowed position.

57. RUDDER TRAVEL UNRESTRICTED (Blue)
Comes on to indicate full rudder travel is available (22 degrees).

60. MACH TRIM INOP (Amber)
Comes on when the MACH TRIM COMP switch is placed to OVRD.

64. AUTO SPOILER DO NOT USE (Amber)
Currently not simulated.

65. SLAT DISAGREEMENT (Amber)
Currently not simulated.

71. ELEVATOR PWR ON (Blue)
Illuminates to indicate that the hydraulic elevator augmentation system is activated.

78. SPOILER/FLAP EXTENDED (Amber)
Comes on to indicate speedbrakes are extended with flaps extended beyond 5 degrees. The MASTER CAUTION light will also illuminate. The light will not come on when on the ground.

79. RUDDER CONTROL MANUAL (Amber)
Illuminates to indicate there is no hydraulic power to the rudder power cylinders.

SECTION 13

INST/NAV/COMM

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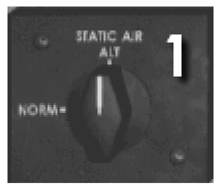
PITOT/STATIC SYSTEM

The pitot/static system provides air data sensing and inputs to various computers and indicators for computation and display of airplane airspeed, Mach number, altitude, vertical speed and overspeed warning.

The pitot tubes are mounted on top of the nose radome. The static ports are installed on both sides of the fuselage.

STATIC AIR SELECTOR VALVE

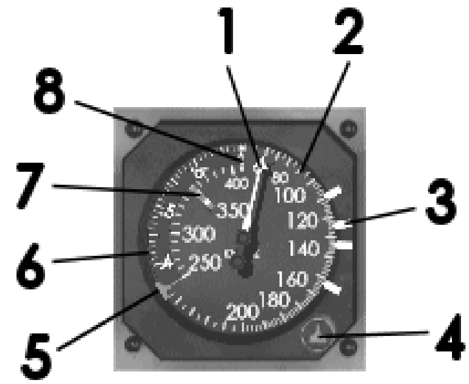


1. STATIC AIR SELECTOR VALVE

NORM Altimeter is servoed by input from the air data computer.
ALT Altimeter will function as barometric altimeter.

AIRSPEED/MACH INDICATOR

The airspeed/Mach indicator is a differential-pressure measuring instrument that continuously senses total and static pressures from the pitot and static systems and presents the results simultaneously as Mach number information and indicated airspeed.



1. MOVING POINTER
Indicates both airspeed and Mach number.

2. FIXED AIRSPEED DIAL
Range from 60 to 400 knots.

3. SPEED BUGS
Manually adjustable bugs.

4. SET INDEX KNOB
Used to set airspeed set index marker.

5. AIRSPEED SET INDEX MARKER
Indicates selected airspeed.

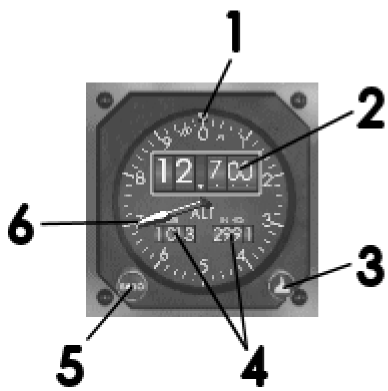
6. MOVING MACH SCALE
Range from 0.4 to 1.0.

7. AIRSPEED BARBER POLE
Red and yellow radial at 350 knots.

8. MACH BARBER POLE
Red and yellow radial at Mach 0.84. Red and yellow arc from Mach 0.84 to 1.0.

ALTIMETER

The altimeter indicator can function as an absolute-pressure measuring instrument that continuously senses static air pressure from the static pressure system, or as a servoed indicator displaying altitude information from the air data computer.



1. ALTITUDE REFERENCE INDEX (Amber)
The index is set with the Reference Index knob.

2. DIGITAL READOUT
The Digital Readout is made with a continuously rotating drum which indicates barometric altitude from -1,000 to 50,000 feet. The leftmost number on the drum counter is marked green in the "0" position to alert of altitudes of less than 10,000 feet.

3. REFERENCE INDEX KNOB
Used to set altitude reference index.

4. MB/IN HG READOUT
Digital readout of the current barometric pressure setting expressed in millibars and inches of mercury.

5. BARO SET KNOB
Used to change the barometric pressure setting.

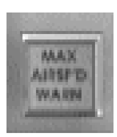
6. 100 FOOT POINTER
The pointer will make a full circle for each 1,000 feet of altitude gained or lost.

VERTICAL SPEED INDICATOR

The vertical speed indicator operates from the airplane static pressure system and provides instantaneous display of airplane vertical speed in the range of 0 to 6,000 FPM, up or down. Pneumatic accelerometers within the indicator eliminates lag by providing instantaneous response without overshoot.

OVERSPEED WARNING

The overspeed sensor provides warning when indicated airspeed exceeds 350 knots (for altitudes from sea level to 25,850 feet) and when Mach number exceeds 0.84 (for altitudes above 25,850 feet). When the maximum airspeed or Mach number has been exceeded, a warning light in the cockpit is illuminated and an aural warning clacker sounds.



MAX AIRSP'D WARN LIGHT

ILLUMINATED	Maximum operating airspeed or Mach number is exceeded, accompanied by clacker warning.

SAT/TAS INDICATOR

1. STATIC AIR TEMPERATURE POINTER
Provides reading of static air temperature. (deactivated on the ground).

2. OFF FLAG
Appears when power is removed from the instrument or a failure situation has been detected.

3. TRUE AIRSPEED READOUT
Provides readout of true airspeed corrected for air density and compressibility (operative on the ground).

FLIGHT RECORDER SYSTEM

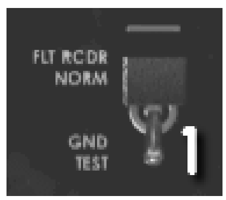
General

The flight recorder system is an airborne recorder that provides a record of pressure altitude, indicated airspeed, heading, radio transmission time correlation, and vertical acceleration with respect to time. The data is recorded on a 25-hour continuous tape similar to the voice recorder. The tape is never exhausted as it re-records after 25 hours.

The flight recorder system is turned off when the parking brakes are set or the both fuel shutoff levers are placed in the OFF position. The flight recorder system is turned on when both fuel shutoff levers are placed in the ON position and the parking brake is released.

The flight recorder itself is not fireproof, but it is mounted in a fireproof box. The tape and box are waterproof and are able to withstand unusual shock and vibration.

CONTROLS AND INDICATORS



1. FLIGHT RECORDER TEST SWITCH

GND TEST	Power is applied to the flight recorder and the FLT RECORDER OFF light should extinguish.
NORM	Recorder operates when parking brake is off and either fuel lever is on.

CLOCK

An 8-day, stem-wound clock with sweep second hand is installed on the main panel.

1. WINDING KNOB
Not simulated.

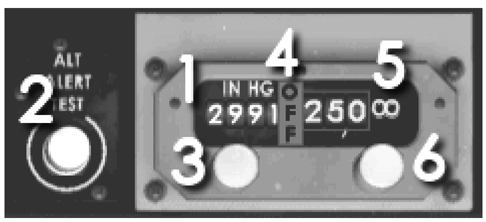
AUTOMATIC ALTITUDE ALERTING SYSTEM

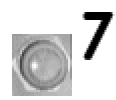
General

The automatic altitude alerting system is designed to alert the flight crew upon approaching a preselected altitude in either ascent or descent by aural and visual signals in sufficient time to establish level flight at that preselected altitude.

Set the desired altitude into the digital window of the alert controller. Within 900 feet of the preselected altitude, the amber ALT ALERT WARNG light will illuminate and a one-second beep tone sounds. Upon reaching 300 feet of the preselected altitude, the ALT ALERT WARNG light will extinguish. If the airplane deviates more than 300 feet from the captured altitude, the ALT ALERT WARNG light will illuminate again and the beep tone will sound.

CONTROLS AND INDICATORS





1. BAROMETRIC PRESSURE READOUT
Indicates selected reference barometric pressure in inches of mercury.

2. ALTITUDE ALERT LIGHTS TEST SWITCH
Depressing the button causes the ALT ALERT light to illuminate.

3. BAROMETRIC PRESSURE SELECTOR KNOB
Sets the reference barometric pressure in inches of mercury.

4. OFF FLAG
Visible with loss of input signal or electrical power.

5. DIGITAL ALTITUDE READOUT
Indicates selected altitude from 0 to 50,000 feet.

6. ALTITUDE SELECTOR & SYSTEM TEST KNOB
Rotate to set preselect altitude.

7. ALTITUDE ALERT LIGHT (Amber)
The light illuminates and the altitude alert tone sounds at approximately 900 feet prior to intercepting the selected altitude. The light extinguishes at approximately 300 from the selected altitude. Push the light to reset it.

GROUND PROXIMITY WARNING SYSTEM

General

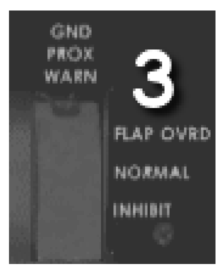
A Ground Proximity Warning System is installed to provide the flight crew with a warning if the aircraft flight path would imminently result in hazardous proximity to the ground.

The system provides 5 warning modes for the following situations:

MODE 1 Excessive rate of descent
MODE 2 Excessive terrain closure rate
MODE 3 Altitude loss after take-off
MODE 4 Descent in wrong configuration
MODE 5 Descent below the glideslope

Warning for modes 1-4 consist of an aural WHOOP, WHOOP, TERRAIN and a visual red TERRAIN light on the pilot's instrument panel. The warning for mode 5 is the aural GLIDESLOPE. There is no way to cancel a warning once it has been activated except by taking corrective actions such as adding power and executing a positive pull up. The warning will cease once the dangerous situation no longer exists.

CONTROLS AND INDICATORS



<u>1. TERRAIN WARNING LIGHT/GPWS TEST SWITCH</u>
Indicates corrective action is required due to airplane proximity to the ground of unsafe flight path.

<u>2. GLIDESLOPE INHIBIT SWITCH</u>
Deactivates the glideslope aural warning (Mode 5) portion of the GPWS without affecting the basic four modes.

<u>3. GND PROX WARN SWITCH</u>

FLAP OVRD	Bypasses the 35° flap position switch, simulating a flap configuration if flaps cannot be extended.
NORMAL	Normal mode. The system remains silent during all normal flight conditions, and annunciates dangerous flight conditions.
INHIBIT	Prevents the GPWS from functioning in any mode.

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WARNING AND CAUTION INDICATORS

<u>59. GPWS FAIL</u>

Illuminates to indicate that the Ground Proximity Warning System is inoperative. The light will also illuminate when testing the GPWS.

COMPASS INDICATOR/RADIO MAGNETIC INDICATOR (RMI)

1. NO 2 ADF/VOR POINTER

2. NO 1 ADF/VOR POINTER

3. ROTATING HEADING CARD

4. NO 2 ADF/VOR SELECTOR KNOB

5. NO 1 ADF/VOR SELECTOR KNOB

6. WARNING FLAG
Indicates all compass card information displayed on the indicator is unusable.

FLIGHT DIRECTOR SYSTEM

General

The flight director system provides visual displays to assist the flight crew in navigation and control of the aircraft. The flight director system includes an ADI, RMI, speed command switch/light, manual ILS switch, ALT HOLD (altitude hold) switch, and mode annunciator lights.

The flight director modes of operation are:

- OFF
- HDG (heading)
- N/L (navigation/localizer)
- ILS (instrument landing system) automatic and manual capture operation
- ALT HOLD (altitude hold)
- SC (speed command)

The OFF, HDG, N/L and ILS mode are selected at flight director indicator. Manual ILS operation is selected with the FLT DIR MANUAL ILS switch. Altitude hold mode is selected with the ALT HOLD switch. The speed command mode is selected with the SC switch/light.

The flight director section of the mode annunciator display will indicate the following flight director conditions:

- N-L ARM
- G-P ARM
- G-P CAP or G-P EXT for the N/L or ILS modes of operation
- ALT HLD for altitude hold
- SP CMD for the speed command mode

Attitude Director Indicator

The Attitude Director Indicator provides attitude information as the relationship between a fixed airplane symbol at the center of the indicator and a movable-horizon background.

Computed pitch and roll command information is displayed by a V-command bar. The mode selector knob controls the inputs to the V-command bar and a PITCH CMD knob permits selection of pitch attitude references in the HDG and N/L modes and in the ILS mode before glideslope capture.

Command information for capturing and maintaining the preselected desired flight path is displayed by the V-command bar position relative to the fixed airplane symbol. The flight crew should maneuver the airplane symbol to the V-command bar.

The HDG mode of operation normally precedes either N/L or ILS modes. With the FLT/DIR MANUAL ILS switch in the OFF position, the aircraft will approach the edge of the beam on the selected heading. At the edge of the beam, the flight director provides V-bar commands to gradually capture the selected radial or localizer.

If N/L or ILS modes are used for beam intercept without first selecting or switching through the HDG position of the mode selector switch, the flight director will immediately display roll commands for beam capture outside the beam edge. In N/L or ILS mode, when tuned to a localizer frequency, placing the FLT DIR MANUAL ILS switch in the ON position will force immediate capture of localizer course and glideslope.

The flight director V-command bar will display roll commands to intercept and fly the localizer course and pitch commands to fly the glideslope. The ADI will also display glideslope and localizer deviations.

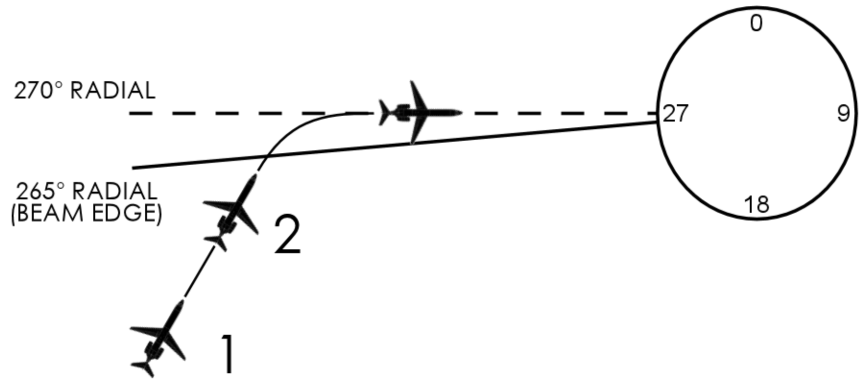
The ALTITUDE HOLD switch may be engaged when operating in the HDG, N/L, or ILS mode prior to glideslope capture. The V-command bars will indicate pitch attitude necessary to maintain the altitude established at the time of engagement, when the ALTITUDE HOLD switch is in the ON position. The ALTITUDE HOLD switch will automatically return to the OFF position when the glideslope is automatically or manually captured.

Horizontal Situation Indicator

The HSI provides display of selected navigational aids and associated information, with respect to airplane position. The relative position and course of a beam is displayed by a movable segment (lateral deviation bar) of the course arrow. After capture, the relative distance from the centerline of the beam is indicated by the displacement of this segment.

Direction indications are display with reference to the magnetic heading of the aircraft. The HDG control is set for the desired course. The COURSE control is set for the desired VOR radial or localizer magnetic course.

VOR CAPTURE

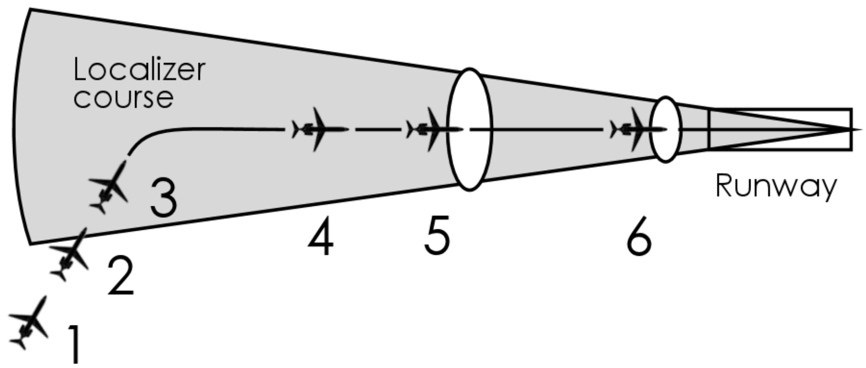


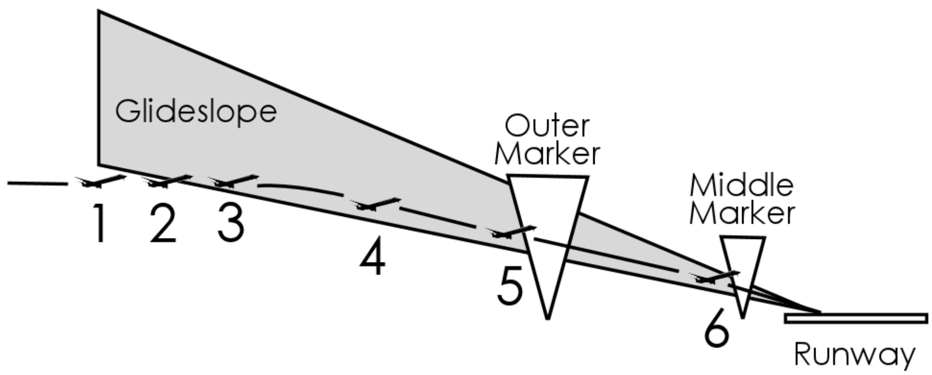
1. Tune the NAV radio to the desired VOR station. Rotate the course arrow to the desired radial. The deviation bar now indicates the relative position between the aircraft and the radial. Set the heading marker to the desired intercept heading, and rotate the mode selector to N/L. The mode annunciator N-L ARM light illuminates, indicating that steering commands are still referenced to the heading marker and the computer is armed for VOR capture. With the ALT HOLD switch ON, V-bar pitch commands are referenced to the existing altitude, and the annunciator will display ALT HLD.

   When capturing a radial, airspeed, altitude, distance from station, and prevailing winds combine to influence the amount of overshoot that could be encountered. To optimize beam capture, a convergence angle should be selected that considers the effect of altitude and airspeed on rate of turn, and the fact that the maneuvering area in 5° of omni deviation is proportional to the distance from the station. As distance from the station increases, the convergence angle may also be increased. As a guide, use approximately a 30° convergence angle at 10 miles from the station.

2. As the aircraft approaches the desired radial the lateral deviation bar moves toward the center of the lateral deviation scale. The computer senses “beam edge” at approximately 5° from the radial and automatically switches to capture operation and the N-L ARM light extinguishes. The flight director is now in full N/L mode and the V-command bar directs the aircraft to roll out on and track the radial, automatically compensating for crosswind.

ILS APPROACH





1. Tune the NAV radio to the desired localizer frequency and set the course arrow to the published inbound front course. Rotate the mode selector to N/L. If the aircraft is more than approximately 2 dots from the localizer centerline, the mode annunciator N-L ARM light will illuminate. Steering commands are still referenced to the heading marker which is set to the desired intercept heading.

   Assuming the aircraft has leveled out at the published minimum approach altitude, engage altitude hold by placing the ALT HOLD switch in the ON position. The mode annunciator will display ALT HOLD. The V-command bar now displays roll and pitch commands to maintain altitude and capture the localizer course.

   If altitude hold is not desired, use the PITCH CMD knob to set the nose down angle that gives the desired rate of descent.

2. When the aircraft reaches the beam edge, the mode annunciator N-L ARM extinguishes. The V-command bar will now present commands to capture and track the localizer centerline and maintain existing altitude.

3. The aircraft is flown to center the miniature aircraft in the V-command bar.

4. When the aircraft has been established on the inbound front course to the outer marker, the mode selector should be rotated clockwise to ILS to arm the system for automatic glideslope capture. The G-P ARM mode annunciator light illuminates. As the aircraft approaches the outer marker, the glideslope pointer will move toward center scale.

5. Upon glideslope capture, the G-P CAP mode annunciator light illuminates and the localizer deviation pointer at the bottom of the Attitude Director Indicator comes into view. The ALT HOLD switch, if on, will automatically disengage. This indicates to the pilot that glideslope capture has been accomplished and pitch commands are now included in the V-command bar display to track the glidepath. The PITCH CMD knob is now inoperative. If automatic glideslope capture does not occur, the FLT DIR MANUAL ILS switch may be placed in the ON position.

6. At the middle marker the G-P EXT mode is automatically activated and the G-P EXT mode annunciator light illuminates.

HEADING (HDG) MODE

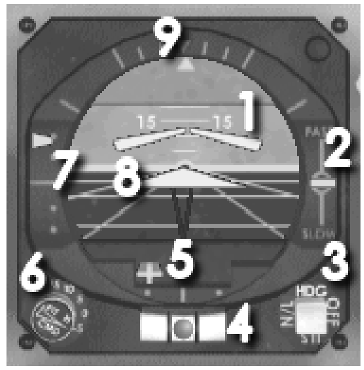
1. To display heading information on the V-command bar set the desired heading on the course indicator and select the HDG mode on the mode selector knob.

   When altitude hold is not engaged the PITCH CMD knob controls the pitch command signal to the V-command bars. To engage altitude hold set the ALT HOLD switch to ON. The mode annunciator will display ALT HLD and the V-command bar now displays commands to maintain the existing altitude at the time of engagement.

2. Control the aircraft to align the delta-shaped aircraft symbol with the V-command bar.

   Correct the heading as required with the HDG control knob, and control the aircraft to re-align the delta-shaped aircraft symbol with the V-command bar.

ATTITUDE DIRECTOR INDICATOR



1. V-COMMAND BAR
Displays computed pitch and roll commands required to intercept and track selected headings, radio course, or glideslope. The V-command bar is aligned with the delta aircraft symbol when pitch and roll commands are satisfied.

Pitch commands are displayed by vertical displacement of the V-command bar relative to the delta-shaped aircraft symbol. Roll commands are displayed by rotation of the V-command bar relative to the delta-shaped aircraft symbol.

2. SLOW-FAST POINTER
Indicates deviation from the reference speed as computed by the speed command system.

3. MODE SELECTOR KNOB
Sets the flight director mode. Available modes are:

- OFF
- ILS – instrument landing system mode
- N/L – navigation and localizer mode
- HDG – heading mode

4. SLIP INDICATOR
Indicates aircraft slip.

5. HORIZONTAL DEVIATION SCALE & POINTER
Indicates lateral deviation from the localizer beam. The indicator is removed from view when no localizer signal is available.

6. PITCH COMMAND KNOB
May be used to set a desired fixed pitch attitude command for the V-command bar.

7. GLIDESLOPE SCALE & POINTER
Indicates vertical position of the aircraft relative to the glideslope. The aircraft is on the centerline of the glideslope beam when the pointer is aligned with the center mark.

8. AIRCRAFT SYMBOL
The peak of the stationary delta-shaped aircraft symbol represents the actual aircraft pitch attitude on the pitch scale.

9. BANK INDICATOR & HORIZON BAR
Aircraft bank angle is displayed by an indicator read against a fixed scale at the top of the instrument case. Roll attitude is shown by the horizon bar rotation relative to the aircraft symbol. The horizon bar also moves vertically to display pitch attitude.

1. SPEED COMMAND FLAG
Monitors reliability of the speed command indication. When in view, the speed command indications are not usable.

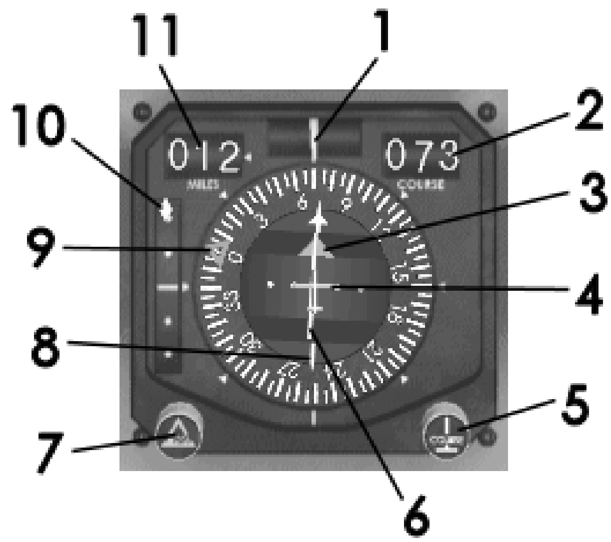
2. COMPUTER FLAG
Monitors active input signals to the computer for selected modes of operation. When in view, command information for the selected mode is not usable.

3. LOCALIZER SHUTTER
Monitors localizer reception for unreliable localizer signal. The shutter is retracted after glideslope capture during ILS mode of operation.

4. GYRO FLAG
Monitors power or signal failure of the vertical gyro and malfunction of the primary attitude display servo system. When in view, attitude information is not usable.

5. GS FLAG
Monitors glideslope receiver and reliability of radio signal input. When in view, glideslope indications are not usable.

HORIZONTAL SITUATION INDICATOR



1. LUBBER LINE
Indicates gyro-stabilized magnetic heading of airplane on compass card.

2. COURSE READOUT
Digital readout of VOR radial or localizer course selected with the course control knob.

3. TO-FROM POINTER
Indicates whether the selected course will lead the aircraft to or from the tuned station.

4. AIRCRAFT SYMBOL
Stationary aircraft symbol represents aircraft position, with respect to movable portions of the indicator display.

5. COURSE CONTROL KNOB
Used to set the desired VOR radial or localizer course.

6. LATERAL DEVIATION BAR
A segment of the course arrow is displaced left or right to represent deviation from the selected VOR radial or localizer course.

7. HDG CONTROL KNOB
Used to set the heading marker to the desired heading.

8. COURSE ARROW
The arrow is rotated with the course control knob to the VOR radial or localizer course to be flown.

9. HEADING MARKER
Rotated by the HDG knob and sets the selected heading on the azimuth ring.

10. GLIDESLOPE SCALE AND POINTER
In view when tuned to and receiving a glideslope signal. Displays airplane vertical deviation from the glideslope centerline.

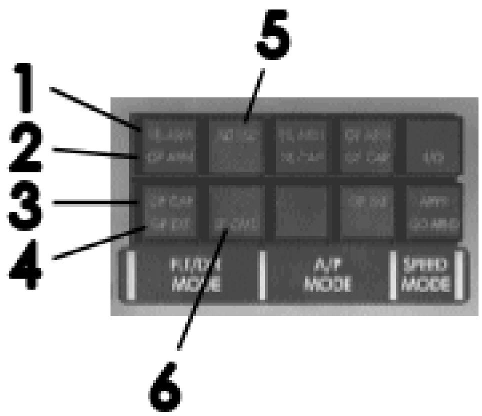
11. DME READOUT
Digital readout of DME slant-range distance in nautical miles.

1. COMPASS FLAG
When in view, indicates compass card information is not usable.

2. VOR LOC FLAG
Monitors VOR/localizer receiver for unreliable VOR or LOC radio signal. When in view, VOR and localizer information is not usable.

3. GS FLAG
Monitors glideslope receiver and reliability of radio signal input. When in view, glideslope information is not usable.

MODE ANNUNCIATOR



1. N-L ARM LIGHT
Indicates flight director mode selector is in NAV-LOC or ILS position, and flight director is armed for automatic capture of VOR or localizer beam, but beam has not been intercepted.

2. G-P ARM LIGHT
Indicates flight director mode selector is in ILS position and has captured localizer, but has not intercepted glideslope.

3. G-P CAP LIGHT
Indicates flight director mode selector is in ILS position and has captured glideslope.

4. G-P EXT LIGHT
Indicates flight director mode selector is in ILS position and glidepath extension has been automatically initiated by a middle marker beacon signal.

5. ALT HLD LIGHT
Illuminates when the altitude hold switch is engaged.

6. SPD CMD LIGHT
Illuminates when speed command mode selector switch is actuated or when a remote signal is received from the associated speed command system.

CONTROLS AND INDICATORS

1. SC LIGHT & SWITCH

Speed command mode may be selected by pressing SC light and switch, while mode selector knob is in ILS, N/L, or HDG position. The SPD CMD light illuminates when the SC mode is active.

Note: The speed command mode is cancelled when mode selector knob is momentarily rotate.

2. ALT HOLD SWITCH

ON – When operating in HDG or N/L mode or in ILS mode prior to glideslope capture, the V-command bar will indicate pitch attitude necessary to maintain altitude established at time of engagement. The switch will automatically return to the OFF position when automatic or manual glideslope capture occurs.

3. FLT DIR MANUAL ILS SWITCH

ON – Capture of localizer course and glideslope occurs immediately. The V-command bar displays roll commands to intercept and track the localizer course, and pitch commands to fly the glideslope. The switch will return to the OFF position when the mode selector switch is placed in any position from N/L or ILS.

1. COMPASS SELECTOR SWITCH

Selects the compass heading source for the course indicators.

2. VOR/ILS TRANSFER SWITCH

NORM	VOR, localizer and glideslope deviation signals are supplied to the Captain's system from NAV1 and the First Officer's system from NAV2.
F/O	Deviation signals are supplied to both the Captain's and First Officer's system from NAV2.

MODE SELECTOR FUNCTIONS

MODE	SUBMODE OR CONDITION		FLT DIR MODE ANNUNCIA-TION	FLIGHT DIRECTOR V-BAR COMMAND DISPLAY		FLIGHT DIRECTOR HORIZONTAL DEVIATION INDICATION	FLIGHT DIRECTOR AND COURSE INDICATOR GS DEVIATION POINTER	COURSE INDICATOR LATERAL DEVIATION BAR
				PITCH	ROLL			
OFF	NONE		NONE	OUT OF VIEW				
SC	Mode selected by pressing light and switch. Mode selector knob must be in HDG, N/L, or ILS position.		SPD CMD and SC LIGHT	Pitch attitude to maintain reference speed	Wings level	Out of view	Out of view unless radio is tuned to localizer frequency – then glideslope deviation	Displays VOR or localizer deviation
HDG	PITCH COMMAND (selected with PITCH CMD knob on flight dir. ind.)		NONE	Selected pitch attitude	Selected heading (selected with course indicator HDG control)			
	ALTITUDE HOLD (ALT HOLD switch ON)		ALT HOLD	Pitch attitude to maintain altitude				
N/L (note 1)	Switch to N/L from HDG prior to VOR or localizer capture. Radio tuned to VOR or localizer frequency	PITCH COMMAND	N-L ARM	Selected pitch attitude	Selected heading until VOR or localizer capture			
		ALTITUDE HOLD	N-L ARM ALT HLD	Pitch attitude to maintain altitude				
	After VOR or localizer capture. Radio tuned to VOR or localizer frequency.	PITCH COMMAND	NONE	Selected pitch attitude	At capture, command to turn to VOR or localizer course, then commands to maintain VOR or localizer course.			
		ALTITUDE HOLD	ALT HLD	Pitch attitude to maintain altitude				

MODE SELECTOR FUNCTIONS

<table>
<tr><th rowspan="2">MODE</th><th colspan="2" rowspan="2">SUBMODE OR CONDITION</th><th rowspan="2">FLT DIR MODE ANNUNCIA-TION</th><th colspan="2">FLIGHT DIRECTOR V-BAR COMMAND DISPLAY</th><th rowspan="2">FLIGHT DIRECTOR HORIZONTAL DEVIATION INDICATION</th><th rowspan="2">FLIGHT DIRECTOR AND COURSE INDICATOR GS DEVIATION POINTER</th><th rowspan="2">COURSE INDICATOR LATERAL DEVIATION BAR</th></tr>
<tr><th>PITCH</th><th>ROLL</th></tr>
<tr><td rowspan="4">ILS (note 2)</td><td rowspan="2">After localizer capture and prior to glideslope capture. Radio tuned to localizer frequency.</td><td>PITCH COMMAND</td><td>G-P ARM</td><td>Selected pitch attitude</td><td rowspan="2">Command to maintain selected localizer course</td><td rowspan="2">Out of view</td><td rowspan="5">Displays glideslope deviation</td><td rowspan="5">Displays VOR or localizer deviation</td></tr>
<tr><td>ALTITUDE HOLD</td><td>G-P ARM ALT HLD</td><td>Pitch attitude to maintain altitude</td></tr>
<tr><td rowspan="2">After glideslope capture (ALT HOLD switch automatically goes to OFF position at glideslope capture)</td><td>NONE (PITCH CMD knob function inoperative after GS capture)</td><td>G-P CAP</td><td rowspan="2">Pitch attitude to fly glideslope</td><td rowspan="2">Same as above</td><td rowspan="3">Displays localizer deviation</td></tr>
<tr><td>GS EXT (actuated by middle marker)</td><td>G-P EXT</td></tr>
<tr><td>N/L or ILS</td><td colspan="2">MANUAL CAPTURE AND FIXED ANGLE INTERCEPT – FLIGHT DIRECTOR MANUAL ILS switch ON and radio tuned to localizer frequency. (ALT HOLD switch automatically goes to OFF position)</td><td>G-P CAP (immediately) then G-P EXT (when glideslope extension is reached)</td><td>Same as above (PITCH CMD knob function inoperative)</td><td>Immediate command for fixed angle intercept (45°) and when course edge is reached command for turn to fly course.</td></tr>
</table>

Note:

1. If N/L mode is selected without first going through HDG mode, a fixed intercept angle of 45° will be commanded and no annunciation will be displayed. When the selected course has been intercepted, command displays are as shown in N/L mode.

2. If ILS mode is selected without first going through HDG mode, a fixed intercept angle of 45° will be commanded and no annunciation will be displayed. When the selected course has been intercepted, command displays are as shown in ILS mode.

STANDBY ATTITUDE INDICATOR

A gyroscopic standby attitude indicator is provided on the Captain's instrument panel.

The gyro receives its power from the battery direct bus and is powered whenever both fuel shutoff levers are placed in the ON position or the aircraft is in flight as sensed by the ground shift mechanism.

The OFF flag indicates a power failure when in view.

SPEED COMMAND SYSTEM

General

The Speed Command System is an automatic computing system that provides speed-deviation indications with regards to the computed reference speed. The system is designed for low-speed operations such as takeoff, approach and go-around. SLOW-FAST indication is provided on the ADI. The ADI also displays V-command bar pitch commands when the speed command system is activated.

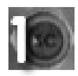
The Speed Command System's primary function is to aid the pilot in rapidly acquiring and maintaining the computed reference speed for takeoff, approach and go-around. The speed command system is especially useful during maneuvers such as a go-around when the aircraft angle of attack, attitude, airspeed and thrust are rapidly changing. In order to minimize altitude loss and maintain a safe margin above stalling speed, the pilot must precisely control attitude and airspeed and predict aircraft response.

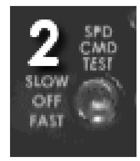
The speed command mode is selected by pressing the SC light and switch.

SPEED COMMAND MODES AND CONDITIONS

Airplane	With throttles	Speed reference mode will be	Flight Director
On the ground longer than 3 seconds	In any position	T/O (Takeoff) V_2 + 10	Pilots can select speed command flight director mode by pressing SC light and switch. NOTE: Mode selector must not be in OFF position.
During lift-off, after takeoff, or in climb conditions	In takeoff thrust position	T/O (Takeoff) V_2 + 10	
In flight	Less than TO thrust setting	APPR (Approach) V_{APP}	Not in speed command mode
	TO thrust setting	GO ARND (go-around) V_2 + 10	In speed command mode

CONTROLS AND INDICATORS





1. SC LIGHT & SWITCH

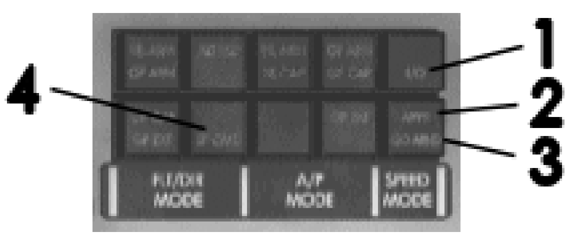
Speed command mode may be selected by pressing SC light and switch, while mode selector knob is in ILS, N/L, or HDG position. The SPD CMD light illuminates when the SC mode is active.

Note: The speed command mode is cancelled when the mode selector knob is momentarily rotate.

2. SPD COMM TEST SWITCH

Simulates a SLOW-FAST signal in the system for test purposes.

To test the system, place the speed command in the TO mode. Set the flight director mode selector to any position other than OFF, flaps 0° and retracted slats, then press the SC switch and light. Place the test switch in either SLOW or FAST position. The FAST/SLOW pointer on the ADI should deflect towards the respective end of scale and the Flight Director should indicate 2° nose up or nose down.



1. T/O LIGHT

Speed command system is in takeoff mode.

2. APPR LIGHT

Speed command system is in approach mode.

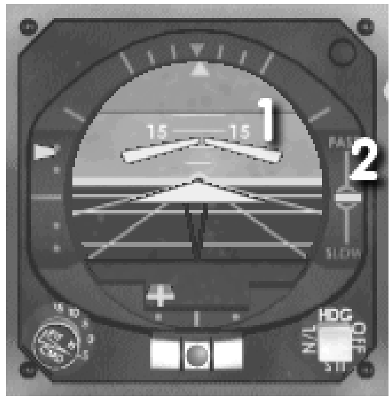
3. GO ARND LIGHT

Speed command system is in go-around mode.

4. SPD CMD LIGHT

Indicates Flight Director is in speed command mode.

CONTROLS AND INDICATORS



1. V-COMMAND BAR
When the flight director is in speed command mode, the V-command bar will display pitch commands to maintain the computed reference speed. The V-command bar will display roll commands to maintain a wings level attitude.

2. SLOW-FAST INDICATOR
Indicates deviation from the reference speed as computed by the speed command system.

VHF NAVIGATION SYSTEMS

General

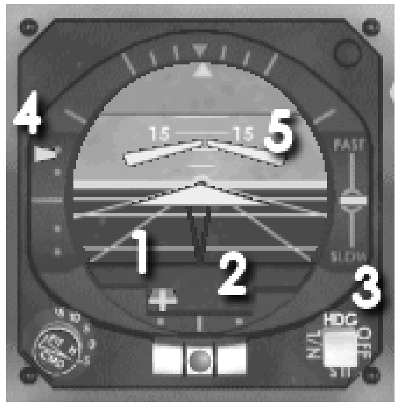
The very-high-frequency navigation system includes a VHF navigation receiver and a VHF NAV/COMM control panel with associated antennas.

System indications are provided by the ADI, HSI and compass indicator. Directional indications are displayed by pointers on the compass indicator. VOR/LOC warning flags, to-from arrow, VOR localizer shutter and V-bar commands are displayed by the ADI.

The VHF NAV/COMM control panel provides controls to energize the system, select the operating frequency, and adjust the audio volume.

Audio outputs can be selected on the audio control panel.

CONTROLS AND INDICATORS



1. HORIZONTAL DEVIATION SCALE & POINTER
Indicates lateral deviation from the localizer beam. The indicator is removed from view when no localizer signal is available.

2. LOCALIZER SHUTTER
Covers the localizer pointer and scale until glidepath has been captured.

3. MODE SELECTOR KNOB
ILS – Localizer and glideslope information is displayed by the V-command bar.

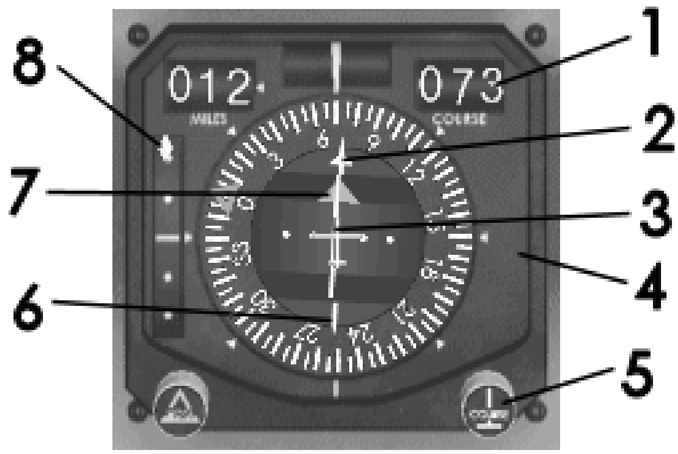
N/L – VOR and localizer information is displayed by the V-command bar.

4. GLIDESLOPE SCALE & POINTER
Indicates vertical position of the aircraft relative to the glideslope. The aircraft is on the centerline of the glideslope beam when the pointer is aligned with the center mark.

5. V-COMMAND BAR
Displays computed pitch and roll commands required to intercept and track selected headings, radio course, or glideslope. The V-command bar is aligned with the delta aircraft symbol when pitch and roll commands are satisfied.

Pitch commands are displayed by vertical displacement of the V-command bar relative to the delta-shaped aircraft symbol. Roll commands are displayed by rotation of the V-command bar relative to the delta-shaped aircraft symbol.

CONTROLS AND INDICATORS



1. COURSE READOUT
Digital readout of VOR radial or localizer course selected with the course control knob.

2. COURSE ARROW
Rotate the arrow with the course control knob to the VOR or localizer magnetic course to be flown.

3. LATERAL DEVIATION BAR
A segment of the course arrow is displaced left or right to represent deviation from the selected VOR radial or localizer course.

4. VOR LOC FLAG
Monitors VOR/localizer receiver for unreliable VOR or LOC radio signal.

5. COURSE CONTROL KNOB
Used to set the desired VOR radial or localizer course.

6. RECIPROCAL COURSE ARROW
Indicates reciprocal of selected course.

7. TO-FROM POINTER
Indicates whether the selected course will lead the aircraft to or from the tuned station.

8. GLIDESLOPE SCALE AND POINTER
In view when tuned to and receiving a glideslope signal. Displays airplane vertical deviation from the glideslope centerline.

CONTROLS AND INDICATORS

1. NO 2 ADF/VOR POINTER

2. NO 1 ADF/VOR POINTER

3. ROTATING HEADING CARD

4. NO 2 ADF/VOR SELECTOR KNOB

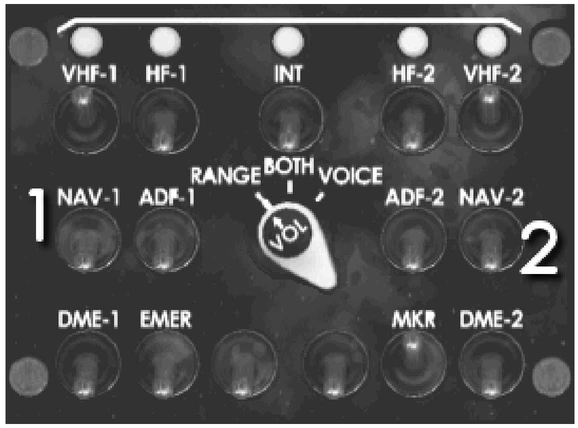
5. NO 1 ADF/VOR SELECTOR KNOB

6. WARNING FLAG
Indicates all compass card information displayed on the indicator is unusable.

1. FREQUENCY WINDOW
Displays the selected VOR or localizer frequency.

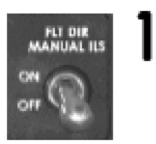
2. FREQUENCY SELECTOR KNOB
Selects the frequency for the desired VOR or localizer.

CONTROLS AND INDICATORS



1. NAV 1 AUDIO SELECTOR SWITCH
Up – Selects audio output of the NAV-1 receiver.

2. NAV 2 AUDIO SELECTOR SWITCH
Up – Selects audio output of the NAV-2 receiver.



1. FLT DIR MANUAL ILS SWITCH
ON – Captures localizer course and glideslope immediately. The V-command bar will display roll commands to intercept and track the localizer course, and pitch commands to follow the glideslope. The switch will automatically return to OFF when the mode selector is placed in any position other than N/L and ILS.

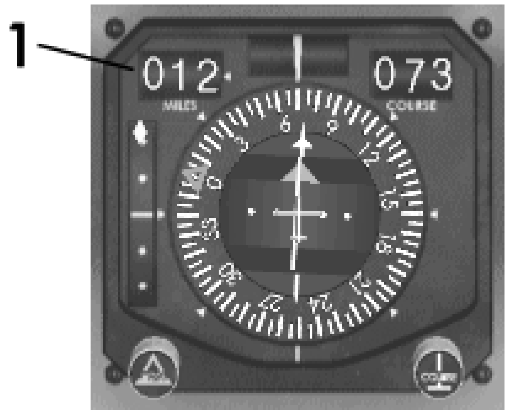
DISTANCE MEASURING EQUIPMENT (DME)

General

The DME system components are located on the HSI and the VHF NAV/COMM control panel. A distance indicator is located on the upper left corner of the HSI. A DME function switch is located on the VHF NAV/COMM control panel. Switches on the audio control panel permit monitoring of the DME ground station identification signal.

The system can track a VORTAC station up to a maximum of 200 miles or a DME at an ILS station up to a maximum of 50 miles.

CONTROLS AND INDICATORS



<u>1. DISTANCE INDICATOR</u>
Indicates distance in nautical miles between DME ground station and the aircraft. The measured distance is slant range (line of sight) distance to the station. A flag covers the distance readout when distance information is unusable.

<u>1. FREQUENCY WINDOW</u>
Displays the selected VOR or localizer frequency.

<u>2. FREQUENCY SELECTOR KNOB</u>
Selects the frequency for the desired VOR or localizer.

<u>3. DME FUNCTION SWITCH</u>

OFF	DME system unpowered.
STBY	DME system powered, but distance information is not available.
DME	DME system in normal operating mode.
ORIDE	Override mode provides for increased range (50 to 200 NM) when a DME station at an ILS is tuned.
TEST	Causes the distance readout to slowly roll back to 0 NM.

AUTOMATIC DIRECTION FINDING SYSTEM (ADF)

CONTROLS AND INDICATORS

1. DOUBLE BAR POINTER
Indicates bearing information from either ADF-1 or VOR-1. Points right if no signal is received.

2. SINGLE BAR POINTER
Indicates bearing information from VOR-2. Points to the right if no signal is received.

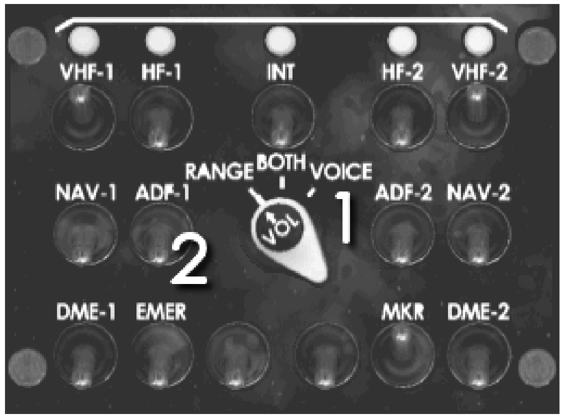
3. ROTATING HEADING CARD
Indicates aircraft magnetic heading.

4. RIGHT ADF-VOR SWITCH
Selects VOR-2 bearing information displayed by double bar pointer.

5. LEFT ADF-VOR SWITCH
Selects ADF-1 or VOR-1 bearing information displayed by single bar pointer.

6. WARNING FLAG
OFF - Indicates all compass card information displayed on the indicator is unusable.

CONTROLS AND INDICATORS



1. ADF AUDIO SWITCH

The audio signal selected by the ADF-1 switch is fed through a filter selection network. ADF-1 audio signals are mixed at this switch.

RANGE	Filters voice audio and passes range audio.
VOICE	Filters range audio and passes voice audio.
BOTH	Passes both voice and range audio.

2. ADF SELECTION SWITCH

Toggles ADF-1 audio signal on or off.

CONTROLS AND INDICATORS

1. LOOP SWITCH
Used to electronically position the loop antenna to determine bearing quality when using aural null for homing or position fixing. Speed and direction of antenna rotation is controlled by this switch.

2. BFO (BEAT FREQUENCY OSCILLATOR) SWITCH
Allows "zero beat" tuning to carrier frequency of weak voice or range signals.

3. TUNING METER
Displays signal strength. With the function selector switch in ADF or ANT position, adjust the Tune Control for maximum meter indication.

4. BAND SWITCH
Selects one of the three available frequency ranges. Only the selected frequency range is visible in the frequency dial window.

5. TUNE CONTROL
Selects and adjusts receiver frequency within the range selected by the band switch. In the simulator, click the frequency dial window to select the frequency.

For ease of use, a pop-up frequency window will appear when hovering the mouse cursor over the frequency dial window which allows for conventional MSFS frequency change.

6. FREQUENCY DIAL WINDOW
Displays selected frequency in megacycles.

7. FUNCTION SWITCH
Selects mode of operation:

OFF	System powered down.
ADF	Automatic Direction Finding.
ANT	Antenna mode. Range navigation, maximum tuning indication, or broadcast monitor.
LOOP	Aural null operation.

8. GAIN CONTROL
Adjusts the volume to headsets or speakers.

MARKER BEACON SYSTEM

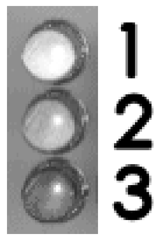
General

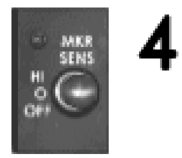
The pre-tuned marker beacon system provides visual and aural signals to the flight crew when passing over an outer, middle, inner or airway marker.

The visual signals are provided by three lights (blue, amber and white) on the main instrument panel. Each light has a push-to-test feature.

Sensitivity of the marker beacon system can be adjusted by setting the marker sense switch to LO, HI or OFF.

CONTROLS AND INDICATORS





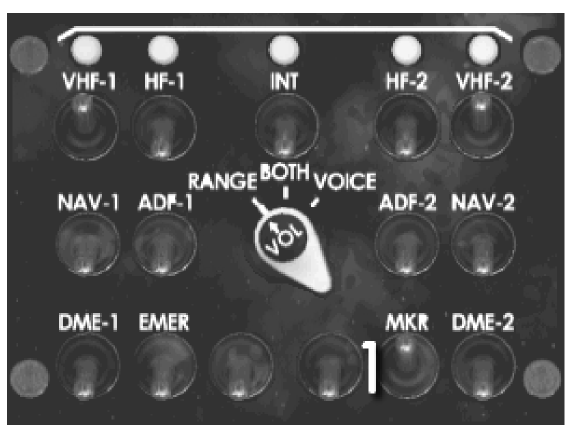
1. WHITE INDICATOR LIGHT
Light starts flashing when passing over an inner or airway marker beacon. The light is accompanied by a 3000 Hz tone signal.

2. AMBER INDICATOR LIGHT
Light starts flashing when passing over the middle marker beacon. The light is accompanied by a 1300 Hz tone signal.

3. BLUE INDICATOR LIGHT
Light starts flashing when passing over the outer marker beacon. The light is accompanied by a 400 Hz tone signal.

4. MKR SENS SWITCH
This switch controls the sensitivity of the marker beacon signal.

OFF	Shuts off the marker beacon receiver.
LO/HI	Controls the sensitivity of the marker beacon receiver.



1. MKR SELECTOR SWITCH
UP - Selects marker beacon audio to headphones and/or speakers.

INSTRUMENT FAILURE WARNING SYSTEM

General

The instrument failure warning system is designed to assist the pilots in early recognition and evaluation of instrument system failures detected by the instrument comparator or instrument system differences.

The instrument failure warning system operates continuously, but is designed for optimum warning during the approach phase.

Malfunctions detected by the instrument failure warning system are displayed on two navigation instrument failure warning annunciators, one for the captain and one for the first officer.

Warnings are annunciated by two GA (go-around) warning light arrows, two INST (instrument) warning light arrows, and one A/P (autopilot) warning light. The GA and INST warning light arrows indicate which system has failed. The arrows on the left indicate a failure in the captain's instruments and the arrows on the right indicate a failure in the first officer's instruments.

The INST arrow indicates a failure which will affect instrument flight and the GA arrow indicates a failure that affects operations during a go-around. Certain failures will also cause the flight director V-command to be removed from view. The A/P light provides indications for the autopilot system.

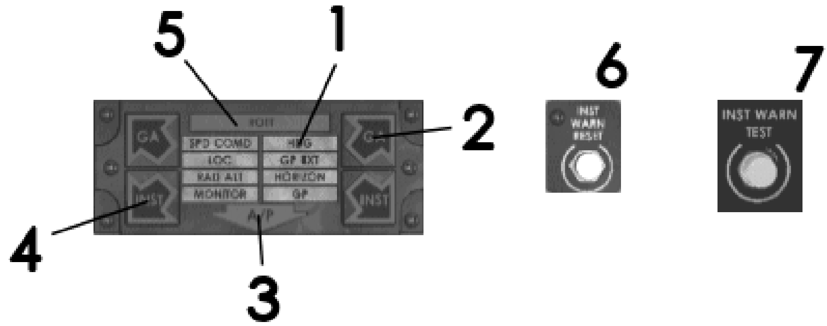
Systems and functions monitored by the instrument failure monitor are:

- Vertical gyro ADI
- HSI and related displays
- VHF NAV and glideslope receivers
- Flight director computers
- Flight director command servo loops
- Autopilot
- Radio Altimeters

The center of the instrument failure warning annunciator displays amber legends when a difference is detected between the captain's and first officer's systems. Functions monitored by the comparator and the associated light legends are:

- HORIZON: Attitude, flight director indicator
- HDG : Compass, pictorial deviation indicators
- LOC : Localizer signal, VHF NAV receivers
- RAD ALT: Glideslope signal, glideslope receivers
- GP: Radio altimeters
- MONITOR: Comparator failure

CONTROLS AND INDICATORS



1. COMPARATOR LIGHTS
When a difference between two identical systems is detected and a failure is not detected by failure monitoring (instrument warning flag circuits), a signal is sent to the appropriate comparator legend and the light illuminates.

2. GA ARROWS (2)
RED – Indicates that an instrument or equipment failure has occurred and the instrument or equipment is not to be used in a go-around.

GREEN – Indicates that an instrument or equipment in the parallel system (on the side pointed to by the green arrow) is still operating and may be used in a go-around.

3. A/P ARROW
RED – If the automatic pilot has been disengaged by any other means than by the autopilot release button on one of the pilots' control wheels, the A/P arrow illuminates red.

The light is turned off by clicking on it. In the real aircraft you have to press the autopilot release button on the control wheel to extinguish the light.

GREEN – If a failure has been detected which does not affect autopilot operation, the A/P arrow illuminates green.

Note: The autopilot must be engaged for the green light to illuminate.

4. INST ARROWS (2)
RED – Indicates that an instrument or equipment failure has occurred and the arrow points to the affected instrument panel.

GREEN – Indicates that an instrument or equipment in the parallel system (on the side pointed to by the green arrow) is still operating and may be used in a go-around.

5. THROTTLE LIGHT
The auto throttle system is deactivated.

6. INST WARN RESET
Resets all annunciator light, except the autopilot light when on red, and rearms system for another discrepancy display. Reset the autopilot light by clicking the red light.

7. INST WARN TEST SWITCH
When pressed, INST and GA arrows (both red and green) lights, A/P (green only) light, throttle (red) light, and comparator lights should illuminate.

Note: SPD CMD, RAD ALT and GP EXT comparator lights will not illuminate.

ANNUNCIATOR INDICATIONS

Speed Command Mode:

Speed Command mode is active when the flight director is in SC mode and the speed command system is in T/O mode for takeoff or GO-ARND mode for go-around.

COMPARATOR LIGHTS	FAILURES		FAILURE WARNING LIGHTS						V-COMMAND BAR OUT OF VIEW	
Indicate difference between No.1 and No. 2 system which does not involve a failure.	No. 1 indicates failure in Captain's system, No.2 indicates failure in FO's system.		INST ARROWS		GA ARROWS		A/P ARROWS	THROTTLE		
			CAPT.	F/O	CAPT.	F/O			CAPT	F/O
HORIZON	VERTICAL GYRO	No. 1	RED	GREEN	RED	GREEN	GREEN		X	
		No. 2	GREEN	RED	GREEN	RED	RED			X
HORIZON	ATTITUDE DISPLAY	No. 1	RED	GREEN	RED	GREEN	GREEN		X	
		No. 2	GREEN	RED	GREEN	RED	GREEN			X
HDG	COMPASS SYSTEM	No. 1								
		No. 2					RED			
	FLIGHT DIRECTOR COMPUTER	No. 1	RED	GREEN	RED	GREEN	GREEN			
		No. 2	GREEN	RED	GREEN	RED	GREEN			
	FLIGHT DIRECTOR COMMAND	No. 1	RED	GREEN	RED	GREEN	GREEN			
		No. 2	GREEN	RED	GREEN	RED	GREEN			
	SPEED COMMAND COMPUTER		RED	RED	RED	RED			X	X
	AUTOPILOT						RED			

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Cruise Mode:

Cruise mode is active at all times when not in approach or speed command mode.

COMPARATOR LIGHTS	FAILURES		FAILURE WARNING LIGHTS					
Indicate difference between No.1 and No. 2 system which does not involve a failure.	No. 1 indicates failure in Captain's system, No.2 indicates failure in FO's system.		INST ARROWS		GA ARROWS		A/P ARROWS	THROTTLE
			CAPT.	F/O	CAPT.	F/O		
HORIZON	VERTICAL GYRO	No. 1	RED	GREEN	RED	GREEN	GREEN	
		No. 2	GREEN	RED	GREEN	RED	RED	
HORIZON	ATTITUDE DISPLAY	No. 1	RED	GREEN	RED	GREEN	GREEN	
		No. 2	GREEN	RED	GREEN	RED	GREEN	
HDG	COMPASS SYSTEM	No. 1	RED	GREEN	GREEN	GREEN	GREEN	
		No. 2	GREEN	RED	GREEN	GREEN	RED	
HDG	COURSE INDICATOR HEADING	No. 1	RED	GREEN	GREEN	GREEN	GREEN	
		No. 2	GREEN	RED	GREEN	GREEN		
	AUTOPILOT						RED	

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Approach Mode:

Approach mode is active at when the flight directors or autopilot have captured the glideslope and the flaps are set to 25° or more.

COMPARATOR LIGHTS	FAILURES		FAILURE WARNING LIGHTS						V-COMMAND BAR OUT OF VIEW	
Indicate difference between No.1 and No. 2 system which does not involve a failure.	No. 1 indicates failure in Captain's system, No.2 indicates failure in FO's system.		INST ARROWS		GA ARROWS		A/P ARROWS	THROTTLE		
			CAPT.	F/O	CAPT.	F/O			CAPT	F/O
HORIZON	VERTICAL GYRO	No. 1	RED	GREEN	RED	GREEN	GREEN	RED	X	
		No. 2	GREEN	RED	GREEN	RED	RED			X
HORIZON	ATTITUDE DISPLAY	No. 1	RED	GREEN	RED	GREEN	GREEN		X	
		No. 2	GREEN	RED	GREEN	RED	GREEN			X
HDG	COMPASS SYSTEM	No. 1	RED	GREEN	RED	GREEN	GREEN		X	
		No. 2	GREEN	RED	GREEN	GREEN	RED			X
HDG	COURSE INDICATOR HEADING	No. 1	RED	GREEN	RED	GREEN	GREEN			
		No. 2	GREEN	RED	GREEN	GREEN				
	FLIGHT DIRECTOR COMPUTER	No. 1	RED	GREEN	RED	GREEN	GREEN			
		No. 2	GREEN	RED	GREEN	RED	GREEN			
	FLIGHT DIRECTOR COMMAND	No. 1	RED	GREEN	RED	GREEN	GREEN			
		No. 2	GREEN	RED	GREEN	RED	GREEN			
LOC	VHF NAV RECEIVER	No. 1	RED	GREEN	GREEN	GREEN			X	
		No. 2	GREEN	RED	GREEN	GREEN	GREEN			X
GP	GS RECEIVER	No. 1	RED	GREEN	GREEN	GREEN			X	
		No. 2	GREEN	RED	GREEN	GREEN	GREEN			X
RAD ALT	RADIO ALTIMETER	No. 1	RED	GREEN	GREEN	GREEN	GREEN			
		No. 2	GREEN	RED	GREEN	GREEN	GREEN			
	SPEED COMMAND COMPUTER							RED		
	AUTOPILOT						RED			
	AUTO THROTTLE							RED		

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Go-Around Mode:

Go-Around mode is active when the flight director is in SC mode and the speed command system is in GO-ARND mode.

COMPARATOR LIGHTS	FAILURES		FAILURE WARNING LIGHTS						V-COMMAND BAR OUT OF VIEW	
Indicate difference between No.1 and No. 2 system which does not involve a failure.	No. 1 indicates failure in Captain's system, No.2 indicates failure in FO's system.		INST ARROWS		GA ARROWS		A/P ARROWS	THROTTLE		
			CAPT.	F/O	CAPT.	F/O			CAPT	F/O
HORIZON	VERTICAL GYRO	No. 1	RED	GREEN	RED	GREEN			X	
		No. 2	GREEN	RED	GREEN	RED				X
HORIZON	ATTITUDE DISPLAY	No. 1	RED	GREEN	RED	GREEN			X	
		No. 2	GREEN	RED	GREEN	RED				X
HDG	COMPASS SYSTEM	No. 1								
		No. 2								
	FLIGHT DIRECTOR COMPUTER	No. 1	RED	GREEN	RED	GREEN				
		No. 2	GREEN	RED	GREEN	RED				
	FLIGHT DIRECTOR COMMAND	No. 1	RED	GREEN	RED	GREEN				
		No. 2	GREEN	RED	GREEN	RED				
	AUTOPILOT						RED			

RADIO ALTIMETER

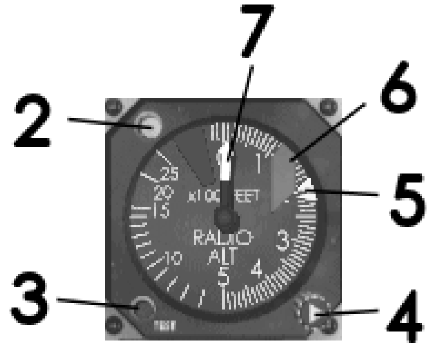
General

The radio altimeter provides the pilots with a precise measurement of the aircraft's altitude above the ground.

The altitude is measured by radiating energy from the transmitting antenna on the belly of the aircraft down toward the ground, where it is reflected back up towards the receiving antenna. The delay measured between the transmitting antenna and receiving antenna is proportional to the aircraft height above the ground.

The radio altimeter is not operational above 2,500 feet above the ground. For this reason, a test feature on the indicator provides an in-flight check at any altitude.

CONTROLS AND INDICATORS



1. MDA LIGHT (amber)
ILLUMINATED – Radio altitude is at or less than setting on the decision height cursor. Illuminates together with the decision height light on the radio altimeter indicator.

2. INDICATOR DECISION HEIGHT (DH) LIGHT (amber)
ILLUMINATED – Radio altitude is at or less than setting on the decision height cursor.

3. TEST BUTTON
When pressed, the pointer will move to indicate 250 feet radio altitude and the warning flag will show.

4. DECISION HEIGHT (DH) SET KNOB
Moves the decision height cursor allowing the desired decision height to be set.

5. DECISION HEIGHT (DH) CURSOR
Indicates the decision height currently set with the decision height set knob.

6. WARNING FLAG
Appears when the test button is pressed, and in the event of a failure or power loss.

7. RADIO ALTITUDE POINTER
Indicates the aircraft's current altitude above the ground.

VOICE RECORDER SYSTEM

General

The voice recorder system records and preserves all sounds and voice conversations audible on the flight deck, communications heard on either the Captain's or First Officer's headsets, the public address system and the service interphone.

The recorder uses a looping tape to preserve the last 30 minutes of sound and communications. The tape's previous contents are continually overwritten by more recent recordings.

The voice recorder unit is contained in an impact and fire resistant box located in the aft cargo compartment right hand tunnel.

There is no on/off switch for the voice recorder system. The system is continuously operating when electric power is on.

CONTROLS AND INDICATORS

1. COCKPIT MONITOR MICROPHONE
Records all audible sounds on the flight deck.

2. ERASE BUTTON
Press and hold the erase button for 7 seconds to erase the tape. The aircraft must be on the ground with the parking brake set.

3. TEST BUTTON
Introduces a test signal into the voice recorder system. The needle on the monitor meter should deflect.

4. MONITOR METER
Indicates recording level on flight deck.

VHF COMMUNICATION SYSTEM

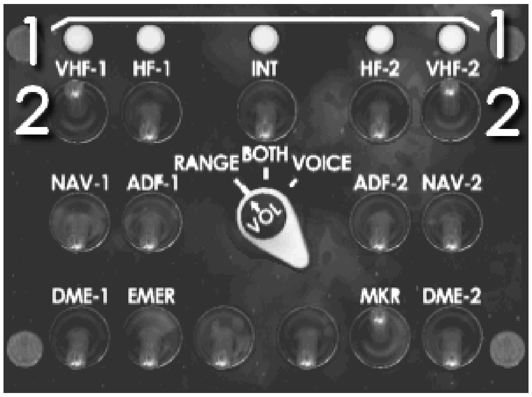
General

The VHF (Very High Frequency) system consists of two separate identical systems designated VHF-1 and VHF-2. These systems can be operated separately or simultaneously. The VHF system provides for communication between the airplane and ground and/or other airplanes. The system operates in the 118.00 to 135.95 megacycles range. Transmitting and receiving frequency is selected on the VHF NAV/COMM control panel.

Power is supplied to the VHF system when the aircraft is powered.

Selection of the desired VHF system is made by depressing the applicable MICR SEL pushbutton and placing the corresponding reception toggle switch in the ON position. This connects the microphone and the headset of the flight interphone system to the desired VHF system transmitter section. Depressing the push-to-talk buttons on the pilot's control wheel activates the transmitter for communications broadcast.

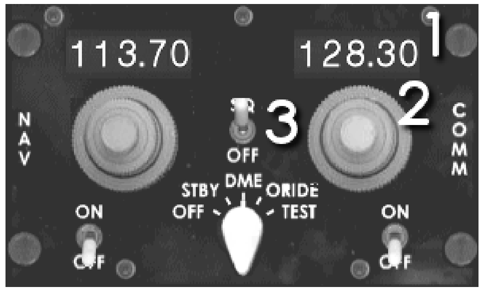
CONTROLS AND INDICATORS



1. MICR SEL BUTTONS
Push to connect the microphones to the applicable VHF system.

2. VHF SELECTION SWITCHES
Up - VHF-1, VHF-2 or both systems may be selected.

CONTROLS AND INDICATORS



1. FREQUENCY INDICATOR
Indicates the currently selected radio frequency for communications.

2. FREQUENCY SELECTOR KNOB
Sets the radio frequency for communications. In the sim, click directly on the frequency numbers to change the set frequency.

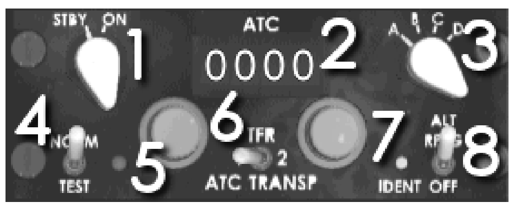
3. SQUELCH SWITCH
Squelches background noise while awaiting the frequency selected signal.

TRANSPONDER

General

A Mode C transponder is installed in the aircraft. When interrogated, the transponder will send back the selected squawk code and altitude if the mode selector has been set to mode C. The transponder is located on the forward part of the pedestal.

CONTROLS AND INDICATORS



1. FUNCTION SELECTOR KNOB

STBY The system is powered, but no response is sent out to interrogations.

ON The system is powered and actively responding to interrogations.

2. CODE READOUT

Displays the selected four-digit transponder octal code.

3. MODE SELECTOR

Allows the selection of discrete transponder codes.

Mode A Transponder replies to ATC interrogations sending octal code, but without altitude data.
Mode B Similar to mode A.
Mode C - Transponder replies to ATC interrogations sending octal code and altitude data.
Mode D – Not in use.

The mode selector is normally left in the C position.

4. NORMAL TEST

NORM The reply light illuminates when the transponder is interrogated by a ground station.

TEST Simulates a transponder ground signal and illuminates the light.

5. REPLY LIGHT
Illuminates when the transponder is interrogated by a ground station or when the test switch is placed in the TEST position.

6. TFR SWITCH
Connects the transponder controller head to either the number one or number two transponder.

7. IDENT BUTTON
Transmits an identification pulse to the ground station. This helps ATC to easily identify the aircraft on their radar scope.

8. ALT RPTG (Altitude Reporting)

ON	The transponder transmits an altitude code when interrogated.
OFF	The altitude reporting function of the transponder is disabled.

WEATHER RADAR

General

The weather radar is installed to provide the flight crew with a visible display of precipitation and terrain ahead of the aircraft.

The weather radar system is composed of:

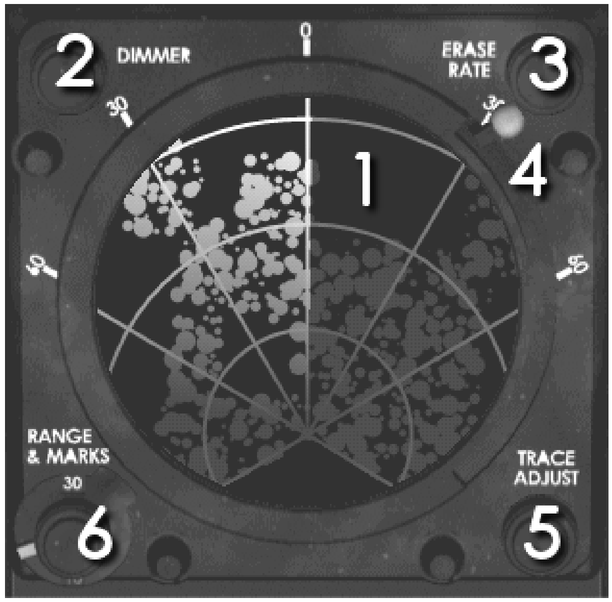
- Antenna
- Transceiver
- Control panel
- Radar display

The radar antenna focuses transmitted energy into a narrow penetrating beam. The return signal (echo) is then detected by the antenna and sent to the transceiver unit which processes the signal for presentation on the radar display.

Antenna stabilization is provided in pitch and roll azimuth. Stabilization attempts to keep the antenna sweeping parallel to the horizon at the tilt angle selected with the ANT TILT control. If gyro stabilization is selected OFF, the antenna will maintain a plane of sweep parallel to the aircraft's pitch and roll axes.

The radar display presents target data from the transceiver unit on a time (range) and azimuth (relative bearing) basis. The resultant display represents a topographic picture of the area under surveillance.

CONTROLS AND INDICATORS



1. DISPLAY SCREEN
The radar display screen is a monochromatic indicator display that is capable of displaying radar returns through an arc of 120 degrees either side of the nose. Azimuth lines are marked at 0, 30 and 60 degrees either side of the nose.

2. DIMMER KNOB
Rotating the control adjusts the overall intensity of the radar display.

3. ERASE RATE
Rotating the control varies the retention time of illuminated targets on the indicator screen.

4. VARIABLE BRIGHTNESS CONTROL
Rotating the control adjusts the Polaroid filter from neutral to red for optimum viewing under ambient light conditions.

5. TRACE ADJUST
Rotating the control changes the sweep trace brilliance and cutoff level.

6. RANGE & MARKS KNOB
Rotating the control selects the desired range of 30, 80, or 180 NM and associated range marks of 10, 20, or 30 NM respectively.

CONTROLS AND INDICATORS

1. MODE SELECTOR KNOB

OFF Cuts power to the radar system.

STBY Applies power to selected circuits of the radar system to warm up the system and maintain the radar in a state of readiness.

NORM Normal precipitation scanning mode.

CTR (Contour) Enables identification of an area of heavy precipitation within a larger area of precipitation (not simulated).

MAP Ground mapping mode is used when the primary interest is ground returns rather than precipitation returns (not simulated).

TEST Tests the radar system. The radar screen displays a test pattern.

2. STAB (STABILIZATION)

ON Turns on gyro stabilization of the radar antenna. Stabilization of the antenna is provided in both pitch and roll.

OFF Maintains antenna alignment parallel to the aircraft’s pitch and roll axes.

3. ANT (ANTENNA) TILT

With stabilization ON, the rotary ANT TILT knob and fixed tilt angle scale are referenced to the horizon. With stabilization OFF, the knob and scale are referenced to the centerline of the aircraft.

4. GAIN KNOB

Adjusts the receiver sensitivity to increase or decrease the threshold level of target reception on the radar display. In the AUTO (fully clockwise) position receiver sensitivity is preset at a fixed value for optimum precipitation return.

WINDSHEAR DETECTION SYSTEM

General

The windshear system provides warning to the flight crew in the event of a detected and potentially hazardous windshear condition. A hazardous windshear condition is defined as a windshear of such intensity and duration that it would exceed the aircraft performance capability and likely cause inadvertent loss of control or ground contact.

The windshear system monitors the aircraft's longitudinal and vertical acceleration, both relative to the air mass and its inertial acceleration. A windshear is indicated when a significant difference between the two accelerations exceeds a computed threshold. The windshear system also measures temperature changes to enhance the windshear detection.

The windshear system operates in three different modes:

TAKEOFF MODE – From takeoff up to 1,500 feet AGL or 3 minutes after liftoff.

APPROACH MODE – From when airspeed is less than 175 knots, landing gear extended or flaps set for approach, until touchdown or a go-around is initiated.

GO-AROUND MODE – The aircraft is in G/A mode when any engine N1 is greater than 90% while in the APPR mode or the designated go-around switch is pressed, until the aircraft has climbed above 1,500 feet.

There are two types of visual windshear annunciations: flashing red W/S WARNING light and flashing amber W/S CAUTION light. The red W/S WARNING light illuminates when a performance decreasing windshear has been detected, for example tailwind. The W/S CAUTION light illuminates when a performance increasing windshear has been detected, for example headwind.

A dedicated loudspeaker in the cockpit broadcasts an aural windshear warning together with the flashing red and amber warning lamps on the glareshield when a hazardous windshear has been detected by the system. The aural warning "WINDSHEAR" is heard three times per windshear occurrence.

CONTROLS AND INDICATORS

1. W/S WARNING LIGHT (Red)
Illuminates and flashes when a decreasing performance windshear is detected. Accompanied by the aural warning "WINDSHEAR".

2. W/S CAUTION LIGHT (Amber)
Illuminates and flashes when an increasing performance windshear is detected. Steady in-flight illumination means a thermally unstable air mass typical of dry adiabatic conditions conductive to microburst windshear has been detected.

3. W/S FAIL LIGHT (Amber)
During testing of the windshear warning system the light illuminates until the 8-second test cycle is complete. Testing requires that the aircraft be on the ground, airspeed less than 60 knots, and longitudinal acceleration is less than 0.073G.

In-flight, the light illuminates steady when a failure has been detected in the windshear warning system.

WARNING AND CAUTION INDICATORS

52. WINDSHEAR INOP ANNUNCIATOR LIGHT
Illuminates during windshear system test and stays on until the test is complete. If the light is illuminated in flight, this indicates a failure has been detected in the windshear warning system.

59. GPWS FAIL
Indicates a failure has been detected in the ground proximity warning system.

70. FLT RECORDER OFF
Illuminates to indicate recorder is de-energized or that the tape is broken or not winding properly. When the light is extinguished, it indicates the recorder is operating properly.

SECTION 14

AUTO FLIGHT SYSTEM

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GENERAL

General

The Sperry SP-50 Automatic Flight Control System (AFCS) is a gyroscopically controlled electromechanical system which maintains the aircraft on any desired heading or in coordinated turn maneuvers in a normal stabilized attitude.

The AFCS consists of two separate sub-systems that function independently or together as part of an integrated system. The sub-systems are the stability augmentation system, which incorporates yaw damper and Mach trim compensator, and the autopilot, which incorporates roll axis and pitch axis controls.

Engagement of the autopilot with the automatic pilot controller servos switch will automatically engage the yaw damper, together with the autopilot roll and pitch axes, to provide fully automatic control of the aircraft.

Stability Augmentation Sub-System

Mach Trim Compensator

The purpose of the Mach trim compensator is to compensate for the nose-down pitching moment generated during operation at high Mach numbers.

The Mach trim compensator is active when the aircraft is powered and the MACH TRIM COMP switch is in the NORM position.

Yaw Damper System

The yaw damper system is installed to reduce the rolling and yawing oscillation tendencies (Dutch roll) of the aircraft.

The yaw damper function is activated at any time the automatic pilot is engaged. When the automatic pilot is disengaged, the yaw damper is activated by placing the YAW DAMP switch in the ON position.

Automatic Pilot Sub-System

An automatic pilot is installed in the aircraft to reduce the workload on the flight crew and to provide improved flight comfort and stability. The automatic pilot controls the aircraft in vertical speed attitude and heading.

The automatic pilot stabilizes the aircraft in both the pitch and roll axes and steers it to headings entered manually by the pilot or fed in from the compass system or from navigational radio beams.

Pitch attitude may be automatically controlled to maintain a precise barometric altitude, a fixed pitch angle or a fixed vertical speed.

Automatic Pilot Controller

Vertical Speed Wheel

The VERT SPEED wheel is the primary pitch control and will maintain the vertical speed of the aircraft when the autopilot is engaged. Put the wheel in the detent (ALT HLD) to engage altitude hold function. In the detent position the autopilot will maintain the barometric altitude existing upon engagement. Moving the wheel out of the detent position will return control to the vertical speed mode.

Pitch Selector knob

The pitch selector knob sets the pitch axis control mode.

MACH HOLD – Maintains the existing Mach number during climb or descent. The autopilot will pitch the aircraft up or down to decrease or increase the aircraft's speed as required to maintain the Mach number.

IAS HOLD – Maintains the existing indicated airspeed during climb or descent. The autopilot will pitch the aircraft up or down to decrease or increase the aircraft's speed as required to maintain the airspeed.

PITCH HOLD – Maintains the aircraft's current pitch attitude.

Note: The MACH HOLD, IAS HOLD, and PITCH HOLD may be engaged any time the autopilot is not under glidepath control. If any of these modes are selected and the autopilot then automatically engages the glidepath, the pitch selector will automatically return to the VERT SPEED position. The pitch selector will also return to the VERT SPEED position if the vertical speed wheel is moved.

G/P EXT – Enables manual selection of the glidepath extension mode. This mode reduces glidepath sensitivity to provide necessary performance for low approaches. This mode is normally automatically engaged when the aircraft passes over the middle marker.

Turn Knob

The turn knob establishes the basic directional command mode and has priority over all other directional modes. Rotating the turn knob will establish the aircraft in a coordinated turn. The aircraft will turn in the direction of knob rotation and bank proportional to the degree of knob rotation. When the turn knob is returned to the center detent position, the aircraft will maintain the heading existing at the time the bank angle has decreased to less than 6°.

HDG SEL Switch

The HDG SEL switch engages the heading select mode. The automatic pilot will maneuver the aircraft along a path defined by the selected heading on the HSI. The aircraft will turn through the smallest angle between the present heading and the selected heading. The turn knob must be placed in the center detent.

Heading hold may be used during the armed phase of a directional radio beam capture. However, it will yield control to the radio mode at the beam edge, and may not be reengaged during lateral radio beam control.

Servos Engaged/Disengaged Switch

The automatic pilot SERVOS ENGAGED/DISENGAGED switch, located on the automatic pilot controller panel, serves as a master autopilot switch. It permits engagement or disengagement of the aileron and elevator axes. If the yaw axis is not already engaged, if will be by setting the switch to SERVOS ENGAGED.

Disengagement of the automatic pilot as a result of any abnormal procedure or condition will cause the red A/P arrow on the failure warning annunciator to illuminate.

NAV Selector Switch

The NAV SELECTOR switch provides selection of the radio control modes.

NAV LOC – The autopilot will automatically capture and maneuver the aircraft along paths defined by the localizer and VOR systems. When this mode is armed, sensors will automatically switch to capture mode at the beam edge. The NAV LOC may be armed with the heading mode engaged or disengaged, or the turn knob out of the center detent position. However, the NAV LOC mode will not automatically capture the beam until the turn knob has been returned to the center detent position.

ILS – Arms the ILS control mode which will automatically capture and maneuver the aircraft along paths defined by the localizer and glideslope systems. The turn knob can be in or out of the center detent, and the HDG SEL switch can be engaged or disengaged.

MAN G/P – Manually bypasses the automatic beam capture sequence and forces beam capture (not simulated).

Mode Annunciation

The mode annunciator continuously indicates the mode of operation when the automatic pilot is operating in a radio beam function. The annunciated modes are: N-L ARM, N-L CAP, G-P ARM, G-P CAP, and G-P EXT.

Pitch Maneuvers

To Establish Rate Of Climb Or Descent

Move the VERT SPEED wheel towards the CLIMB or DESCEND position to establish the desired pitch up or pitch down attitude. The rate of climb or descent is proportional to the amount the wheel is moved out of the ALT HOLD detent position.

To Level Off And Hold Altitude

When reaching the desired altitude, move the VERT SPEED wheel to the ALT HOLD detent position.

Turn Maneuvers

To Turn To Preselected Heading

Rotate the HDG knob on the HSI to align the bug with the desired heading. Place the HDG SEL switch in the ON position. The automatic pilot will turn the aircraft in a smooth coordinated turn and roll out wings level on the selected heading.

To change the heading at any time, rotate the HDG knob on the HSI to the new desired heading. The automatic pilot will automatically and immediately turn the aircraft to the new selected heading.

If the turn knob is rotated out of the center detent position, the HDG SEL knob will automatically return to the OFF position.

To Turn Manually

Rotate the turn knob out of the center detent position in the direction of the desired turn. This will automatically return the NAV Selector switch to the TURN KNOB position and turn knob mode.

The bank angle established by the automatic pilot will be proportional to the degree of turn knob rotation. When the aircraft approaches the desired heading, slowly rotate the turn knob back to the center detent position. When the desired heading has been desired, place the turn knob in the center detent position.

When the turn knob is placed in the center detent position, the automatic pilot will maintain the heading that exists when the aircraft bank angle has decreased to less than 6°.

Auto Throttle

The auto throttle system has been designed to aid the pilots with speed control during the approach to landing phase of flight.

When engaged, the auto throttle system will maintain the computed approach reference speed (V_{REF}), which is based on aircraft weight and flap setting. The approach reference speed is computed by the Speed Command Computer. In order to activate the auto throttle system, the Speed Command mode must be activated first.

When the auto throttle system is active, the red speed bug on the Airspeed indicator is automatically positioned to indicate the computed approach reference speed (V_{REF}).

Note that the auto throttle system has been designed for use during the approach to landing phase only. Do not use the auto throttle system for climbout, cruise or any other phase of flight.

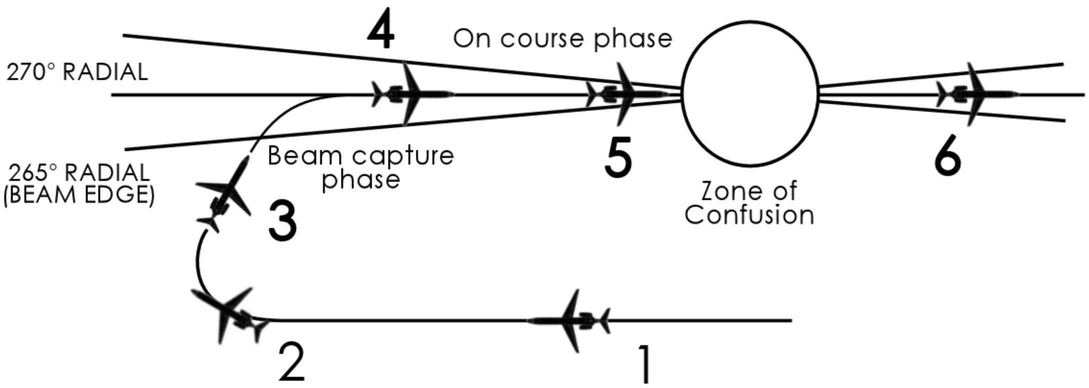
The auto throttle system will automatically disengage on touchdown. However, the flight crew has to manually retard the throttles.

FSX GPS

The built in GPS in FSX can be enabled and used with the autopilot to guide the aircraft. Enable the FSX GPS in the Options section of the Flight Center.

Once enabled, two buttons will appear over the Flight Mode Annunciator just under the glareshield. The left button opens and closes the GPS window. The right button enables/disables GPS navigation using the autopilot.

Automatic VOR Capture



1. Tune the navigation radio to the desired VOR station frequency. Set the desired course on the HSI. The deviation bar on the HSI indicates your position relative to the desired VOR radial. Turn the NAV SELECTOR switch to the NAV LOC position. The mode annunciator displays N-L ARM to indicate the automatic pilot is armed for automatic beam capture.

2. To maneuver the aircraft to approach the selected radial at the desired intercept angle, the pilot may choose to fly with the automatic pilot in the heading select mode or turn knob mode. Note that the turn knob must be in the center detent position for automatic capture of the VOR beam.

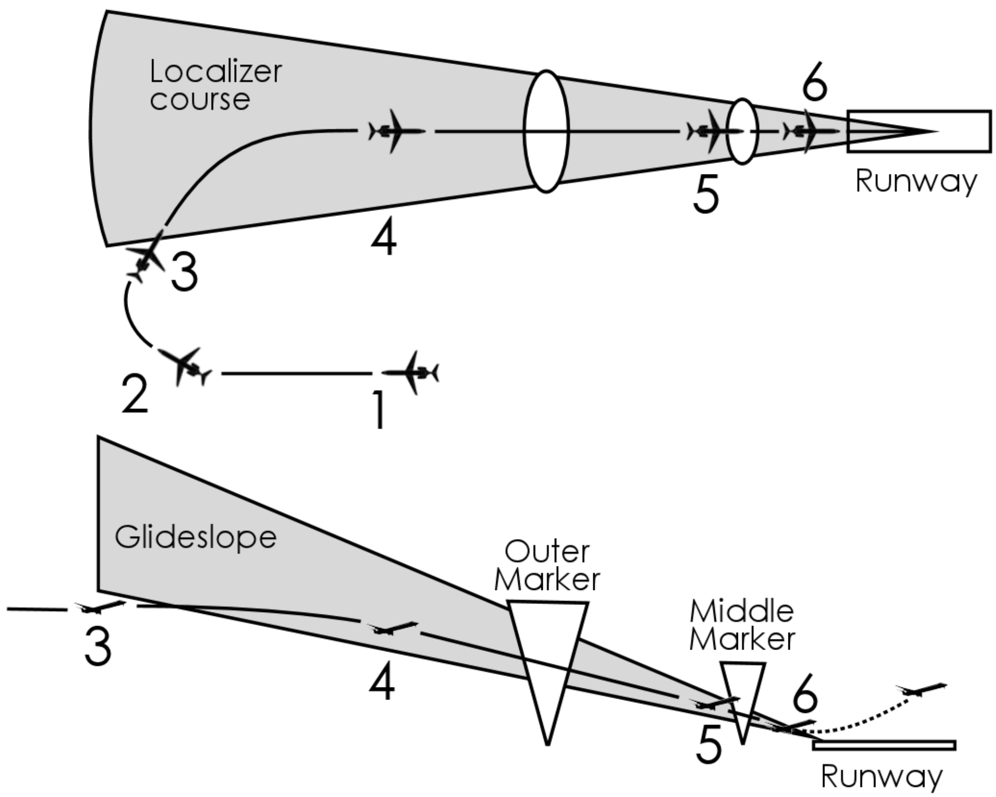
3. At the beam edge, the automatic pilot automatically captures and tracks the selected course. The mode annunciator indicates N-L CAP to indicate the VOR has been captured. If the heading select mode was used to establish the intercept angle, the HDG SEL switch automatically returns to the OFF position.

4. The automatic pilot automatically compensates for crosswinds and continues to track the VOR beam.

5. When the aircraft approaches the Zone of Confusion right above the VOR station transmitter, the automatic pilot will automatically decouple the beam signal and fly a drift corrected radial heading.

6. After the VOR station has been passed and the beam signal has become usable again, the automatic pilot recouples to the beam signal and continues to track the outbound radial.

Automatic ILS Capture



1. Tune the navigation radio to the desired ILS frequency. Set the inbound localizer course on the HSI. Turn the NAV SELECTOR switch to the ILS position. The mode annunciator displays N-L ARM and G-P ARM indicating the automatic pilot is armed for automatic beam capture.

2. To maneuver the aircraft to approach the localizer inbound course at the desired intercept angle, the pilot may choose to fly with the automatic pilot in the heading select mode or turn knob mode. Note that the turn knob must be in the center detent position for automatic capture of the VOR beam. Establish a 20° to 60° intercept angle at least 12 to 15 miles from the transmitter.

3. At the beam edge, the automatic pilot automatically captures and tracks the localizer beam. The mode annunciator indicates N-L CAP and G-P ARM indicating the automatic pilot has captured the localizer beam and is still armed for glideslope capture. If the heading select mode was used to establish the intercept angle, the HDG SEL switch automatically returns to the OFF position.

4. At glideslope intercept, the automatic pilot automatically captures and tracks the glidepath. The mode annunciator displays N-L CAP and G-P CAP indicating the automatic pilot has captured both the localizer beam and the glidepath. If automatic glidepath capture did not occur, rotate the NAV SELECTOR switch to MAN G/P to manually force glideslope capture.

5. Glidepath extension (reduced pitch sensitivity) is initiated when the aircraft passes over the middle marker beacon or when radio altitude is less than 300 feet. G-P EXT is displayed on the mode annunciator to indicate that glidepath extension has been activated. If automatic glidepath extension did not occur or no middle marker is installed or the radio altimeter is inoperative, rotate the PITCH SELECTOR switch to G/P EXT to manually initiate glidepath extension.

6. Disengage the automatic pilot at the automatic approach minimums. Land the aircraft manually.

7. On a missed approach, disengage the automatic pilot and perform missed approach procedures manually.

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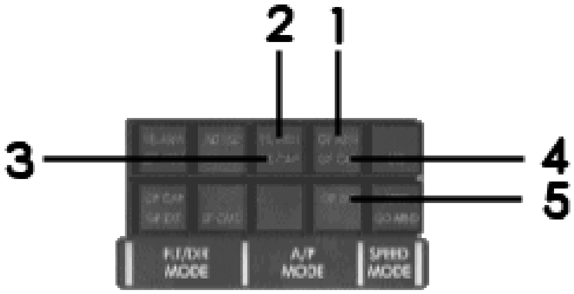
CONTROLS AND INDICATORS



1. G-P ARM ANNUNCIATOR LIGHT
Illuminated when the autopilot is armed for automatic capture of the glidepath beam.

2. N-L ARM ANNUNCIATOR LIGHT
Illuminated when the autopilot is armed for automatic capture of VOR or LOC beam.

3. N-L CAP ANNUNCIATOR LIGHT
Illuminated when the autopilot has captured VOR or LOC beam.

4. G-P CAP ANNUNCIATOR LIGHT
Illuminated when the autopilot has captured the glidepath beam.

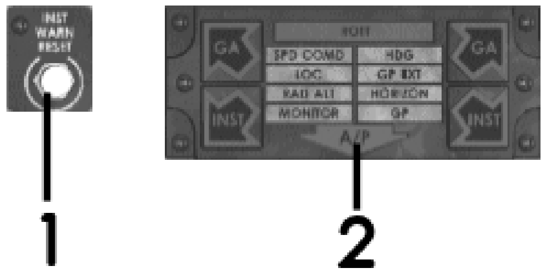
5. G-P EXT ANNUNCIATOR LIGHT
Illuminated when the autopilot is in glidepath extension mode.

1. YAW DAMPER SWITCH

ON	Activates the yaw damper
OFF	Deactivates the yaw damper. Note that the yaw damper will automatically engage when the automatic pilot is engaged, regardless of the yaw damper switch position.

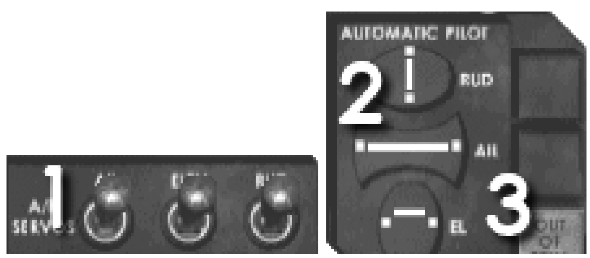
2. MACH TRIM COMP SWITCH

TEST	Tests integrity of system. The MACH TRIM INOP light will illuminate during the test.
NORM	Mach trim compensator system automatically scheduled as a function of aircraft Mach number.
OVRD	Utilizes emergency DC bus power to retract Mach pitch trim compensator.



1. INST WARN RESET
Push the reset button to return the warning system red/green A/P arrow to the armed condition after the abnormal condition is corrected.

2. A/P ARROW
A/P arrow illuminates red when any abnormal condition causes autopilot disengagement. A/P arrow illuminates green when to indicate satisfactory condition when an abnormal condition detected by the failure monitor system does not affect autopilot function.



1. AP SERVOS SWITCHES
Provides for individual engagement/ disengagement of the aileron and elevator servo drives and the rudder actuator. The aileron and elevator servos will be disengaged simultaneously when the autopilot SERVOS ENGAGED/DISENGAGED switch is placed in the DISENGAGED position.

2. AUTOPILOT INDICATOR
The autopilot trim indices, one each for the elevator, aileron and rudder, indicate trim condition (the amount of force applied by the servos to maintain the existing attitude).

3. OUT OF TRIM ANNUNCIATOR LIGHT(amber)
Illuminates to indicate failure of the horizontal stabilizer to trim out sustained elevator deflection.

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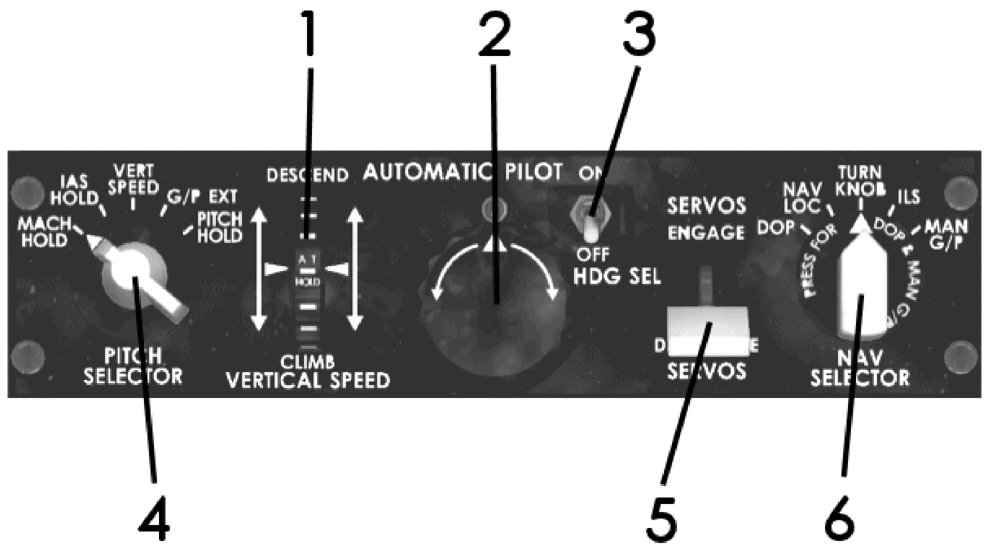


1. VERT SPEED CONTROL WHEEL
Allows for the selection of vertical speed commands into the automatic pilot. ALT HOLD (center detent position) maintains existing altitude.

2. TURN KNOB
This is the primary control of the AFCS; it permits manual changes in aircraft heading. All other lateral control modes are automatically disengaged when the turn knob is moved out of the center detent position.

3. HDG SEL ON/OFF SWITCH
Locks the directional control to the HSI heading bug as selected when the turn knob is in the detent position. The switch will automatically return to the OFF position when the turn knob is moved out of the center detent position.

4. PITCH SELECTOR SWITCH
MACH HOLD – Adjusts pitch to maintain a constant Mach number.

IAS HOLD – Adjusts pitch to maintain a constant airspeed.

VERT SPEED – Permits vertical speed commands to be inserted into the automatic pilot with the VERT SPEED wheel or glideslope deviation signal. This switch position will be automatically selected when the VERT SPEED wheel is moved out of the center detent position, or when glidepath capture occurs.

G/P EXT – Provides manual selection of glidepath extension mode.

PITCH HOLD – Maintains airplane pitch attitude existing at time of engagement.

5. SERVOS ENGAGE/DISENGAGE SWITCH
Provides for simultaneous engagement/ disengagement of the aileron and elevator servo drives and the rudder actuator. The AP servo switches must be ON for the servos to be engaged. The yaw damper function will be activated even if the yaw damper switch is in the OFF position. When positioned to DISENGAGED, the yaw damper function will be disengaged, unless the yaw damper switch is set to ON. When the switch is placed in the DISENGAGED position, the PITCH SELECTOR will return to VERT SPEED and the NAV SELECTOR will return to TURN KNOB.

6. NAV SELECTOR SWITCH
DOP – Not in use.

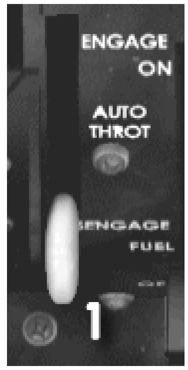
NAV LOC – Provides automatic capture and tracking along a localizer beam and/or VOR radial.

Note: When the FSX GPS option is enabled in the Options section of the Flight Center, setting the NAV selector switch to NAV LOC will make the autopilot follow the flight plan loaded into the FSX GPS.

TURN KNOB – Permits manual changes in aircraft heading by means of the turn knob. The switch will return to TURN KNOB when the turn knob is moved out of the center detent position.

ILS – Arms the automatic pilot for automatic capture of the instrument landing system beams. This mode may be selected with the turn knob in or out of the center detent position and with or without the heading selector engaged.

MAN G/P – Basically the same as ILS mode except the pilot initiates glidepath capture manually by selecting the MAP G/P position. The MAN G/P mode is not simulated.



1. AUTO THROTTLE ENGAGE HANDLE

ENGAGE	Activates the auto-throttle servo to position the throttle handles through the Speed Command system.
DISENGAGE	Deactivates the auto-throttle servo.

SECTION 15

OXYGEN

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GENERAL

General

The aircraft is equipped with two independent gaseous oxygen systems. One oxygen system is installed in the cockpit for the Flight Crew, and the other oxygen system is installed in the passenger compartment for the passengers and Flight Attendants.

Flight Crew Oxygen System

Oxygen to the Flight Crew is supplied from a high-pressure gaseous oxygen supply cylinder.

For normal operation of the system the supply toggle switch must be set to ON, the diluter control switch to NORMAL OXYGEN and the TEST MASK/NORMAL/EMERGENCY switch to NORMAL. This setup will supply oxygen to the masks upon demand.

In the event of a cabin decompression at altitudes above 28,000 feet, the system will automatically sense the change in cabin pressure and supply the masks with 100% pure oxygen under pressure.

In the event of an emergency where protective breathing is required (such as smoke in the cabin, etc.) the diluter control switch must be set to the 100% OXYGEN position.

If an oxygen regulator failure occurs, the diluter control switch must be set to 100% OXYGEN and the TEST MASK/NORMAL/EMERGENCY switch must be set to EMERGENCY. (The TEST MASK/NORMAL/EMERGENCY switch is currently not simulated)

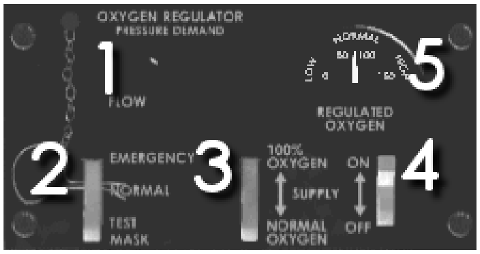
Passenger Oxygen System

Oxygen for the passenger cabin is supplied from a 111 cubic feet high pressure cylinder located in the flight compartment.

An oxygen mask stowage box is located above each set row on both sides of the aisle in the overhead stowage rack utility panel, in each lavatory, and at the forward and aft flight attendant’s station.

If cabin decompression occurs, emergency oxygen is automatically made available to the cabin occupants.

CONTROLS AND INDICATORS



1. FLOW INDICATOR
Provides a visual indication of oxygen flow from the regulator to the masks.

2. TEST MASK/NORMAL/EMERGENCY CONTROL

EMERGENCY	The regulator supplies oxygen under pressure to the masks. Note that the safety pin must be pulled to place the lever in the EMERGENCY position.
NORMAL	This is the normal operating position.
TEST MASK	(Momentary) The regulator supplies oxygen under pressure to the masks for testing purposes.

3. DILUTER DEMAND CONTROL

100% OXYGEN	The regulator supplies 100% pure oxygen at all altitudes.
NORMAL OXYGEN	The regulator supplies oxygen mixed with cabin ambient air at a ratio varying with altitude to the masks. Above 28,000 feet, oxygen under pressure is supplied to the masks.

4. SUPPLY TOGGLE

ON	Oxygen is supplied to the regulator.
OFF	Oxygen to the regulator is shut off.

5. REGULATED OXYGEN PRESSURE GAUGE
The meter indicates the oxygen pressure in the supply line to the regulator.

SECTION 16

POWERPLANT & AUXILIARY POWER

TABLE OF CONTENTS

POWER PLANT

The airplane is equipped with two axial-flow, bypass, turbofan, Pratt and Whitney JT8D-7 engines, which have a normal static take-off thrust rating of 14,000 pounds.

The engine nacelles are supported from horizontal pylons by vibration-isolating side mount systems. The nacelles are isolated from the fuselage by a firewall within the pylon and by a secondary fire seal at the pylon fuselage interface. The nacelle's ventilation system is designed to provide adequate cooling of the engine and accessories and to prevent accumulation of combustible gases.

For engine monitoring, the following instruments are provided for each engine:

- Engine Pressure Ratio (EPR)
- N1 and N2 tachometers
- Exhaust Gas Temperature (EGT)
- Fuel Flow with Fuel Used readout
- Oil Pressure
- Oil Temperature
- Fuel Temperature

Engine Starting

Either engine may be started by using a pneumatic ground supply or by pneumatic supply from the auxiliary power unit. When one engine is operating, the opposite engine may be started by using the pneumatic crossfeed system. An electrically controlled, pneumatically actuated starter air shutoff valve on each engine controls the starter of the respective engine.

Left and right start switches, with a 5-position ignition switch, are provided on the engine starting panel on the overhead panel. For starting, select SYS A, SYS B or BOTH. The left or right START VALVE OPEN light on the annunciator panel illuminates to indicate the selected engine starter air shutoff valve is open. To extend starter life and reduce the chance of failure of the starter shear section, do not engage the starter, except for an abnormal or emergency condition, when the compressors are rotating.

Ignition Systems

Two independent 20-Joule ignition systems (A and B) are provided for each engine. An IGN (ignition) switch is provided on the ENG panel for ignition system selection.

For starting on the ground, the applicable start switch is placed in the ON position to open the respective engine starter air shutoff valve.

When the ignition switch is placed in the BOTH, SYS A or SYS B position, and the fuel shutoff lever is moved to the ON position, the ignition circuit is completed to the selected engine.

Placing the ignition switch in the OVRD position bypasses the fuel shutoff system. When the ignition switch is in the OFF position, ignition functions are inhibited.

Engine Oil System

Oil is pumped from the oil tank by the main oil pump and delivered to the system through an oil filter. Oil quantity is sensed in the oil tank and displayed on the System Display Panel. A differential pressure transmitter senses pressure on both sides of the filter. The STRAINER CLOGGING annunciator light illuminates together with the MASTER CAUTION light if the differential pressure becomes excessive. A pressure regulating valve maintains the oil pressure at about 45 PSI.

The oil is cooled as it flows through the fuel/oil heat exchanger. Temperature and pressure is sensed and displayed in the cockpit. The OIL PRESS LOW annunciator light and the MASTER CAUTION light illuminate to indicate a low oil pressure condition.

Engine Fuel System

Fuel delivered by the fuel supply system passes through the engine-driven first stage centrifugal pump. From the pump, the fuel flows through the air/fuel heat exchanger. The fuel is then filtered before entering the fuel control valve. The fuel may bypass the filter if it becomes clogged. Fuel pressure into the engine is monitored by an inlet pressure switch. If the pressure becomes too low, the INLET FUEL PRESS LOW annunciator light and the MASTER CAUTION light will illuminate. A fuel flow transmitter measures fuel delivered from the fuel control to the engine. Fuel heat is used to prevent and remove ice at the fuel filter. When the FUEL HEAT switch is placed in the ON position, bleed air is supplied to the air/fuel heat exchanger for one minute. The FUEL HEAT ON annunciator light illuminates to indicate the bleed air valve is open.

Thrust Reversers

Two hydraulically powered thrust reverser doors on each engine provide the means for directing fan air and exhaust gases forward to achieve aircraft ground deceleration. The thrust reversers are to be used on the ground only and actuation time is approximately 2 seconds.

When the thrust reverser unlatches, an amber ENG REVERSE UNLOCK light on the center instrument panel illuminates. When the reverser is fully extended, a blue ENG REVERSE THRUST light on the same panel illuminates.

CONTROLS AND INDICATORS

1. ENG IGN SWITCH

Controls a battery-powered fuel boost pump used for engine starting when no external power or APU electrical power is available.

2. ENG IGN SWITCH

OFF — System is de-energized.

SYS A — Provides 20-Joule AC ignition from exciter A when the fuel control shutoff lever is in the ON position.

SYS B — Provides 20-Joule AC ignition from exciter B when the fuel control shutoff lever is in the ON position.

BOTH — Provides 20-Joule AC ignition from exciter A and B when the fuel control shutoff lever is in the ON position.

OVRD — Provides power to high energy igniters in both engines, bypassing start switches and fuel levers.

3. ENGINE START SWITCH (L, R)

Opens the pneumatically-activated starter valve. When the starter valve butterfly opens 5° the STARTER VALVE OPEN annunciator light will illuminate. The starter valve routes pneumatic pressure to the engine starter turbine.

4. FUEL HEAT SWITCH (L, R)

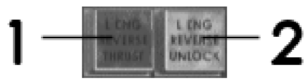
ON — Opens shutoff valve to supply hot air to air/fuel heat exchanger for 1 minute. FUEL HEAT ON annunciator light illuminates.

OFF — Removes power from fuel heat circuit.

5. PNEU PRESS INDICATOR

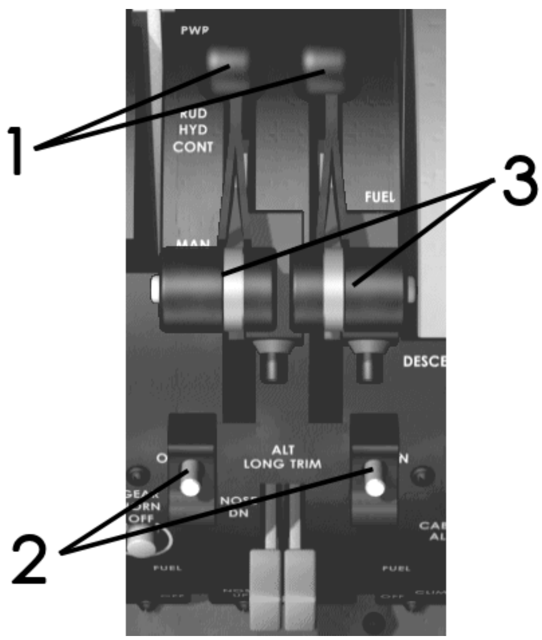
Indicates the pneumatic pressure available for engine starting in PSI. The indicator should show a drop in pressure as the starter valve is opened, and a rise when the valve is closed.

DC-9 Classic – Aircraft Operating Manual



1. L & R ENG REVERSE THRUST LIGHTS (Blue)
Illuminates to indicate the thrust reversers are fully deployed.

2. L & R ENG REVERSE UNLOCK LIGHTS (Amber)
Illuminates to indicate the thrust reversers are unlatched and extended.

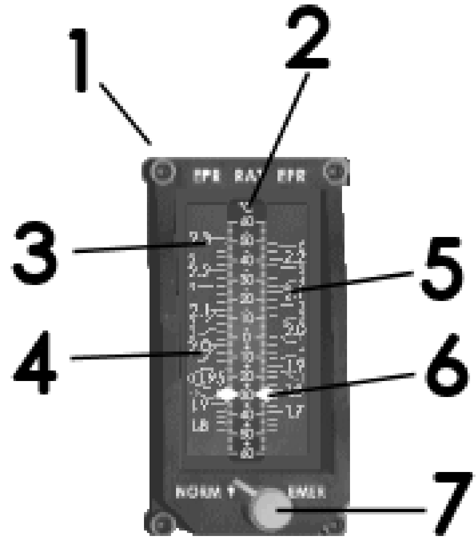


1. THRUST REVERSER LEVER (L, R)
Moving thrust reverser lever aft actuates thrust reverser.

2. FUEL LEVER

ON	Completes ignition circuit first, then turns on fuel.
OFF	Shuts off fuel, then shuts off ignition.

3. THROTTLE (L, R)
Each throttle is cable connected to its respective engine fuel control unit to regulate engine thrust.



1. RAM AIR TEMPERATURE/ENGINE PRESSURE RATIO (EPR) INDICATOR
Indicates the Ram Air Temperature (RAT) and provides the means to determine the maximum EPR for various modes of engine operation, temperatures and/or pressure altitudes.

The scales indicate the fixed relationship between maximum EPR and pressure altitude. The temperature pointer, when referenced against the scales, indicate the maximum EPR as limited by temperature.

The maximum EPR is determined by reading up from the bottom of the scale until the first of the two limiting values (temperature or pressure altitude) is reached.

Note: Engine Pressure Ratio (EPR) is the pressure differential as measured between the low pressure spool at the front of the engine and the high pressure spool at the back of the engine.

2. RAM AIR TEMPERATURE FIXED SCALE
Ram Air Temperature scale calibrated in fixed two degrees increments from +60°C to -60°C.

3. LEFT AND RIGHT INDICATOR WINDOWS
Displays the static takeoff (STA-TO) or in-flight (FLT-TO) (go-around) EPR scales.

4. EPR AND PRESSURE ALTITUDE LIMITATION NUMBERS (White and yellow numbers)
The white EPR and yellow pressure altitude numbers indicate the fixed relationship between maximum EPR and pressure altitude.

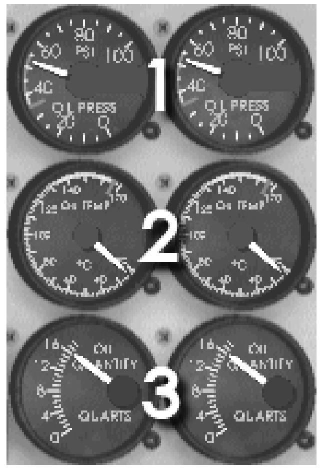
5. RIGHT INDICATOR WINDOW
Displays maximum climb (MCL) or maximum continuous thrust (MCT) EPR scales.

6. RAM AIR TEMPERATURE (RAT) POINTERS
Moves up and down the temperature scale indicating Ram Air Temperature as sensed by the RAT probe.

7. SELECTOR KNOB

NORM-7	Displays JT8D-7 engine static takeoff (STA-TO) thrust and maximum climb (MCL) thrust EPR scales.
EMER	Displays JT8D-7 engine in-flight (FLT-TO) thrust (for go-around) and maximum continuous (MCT) thrust EPR scales.

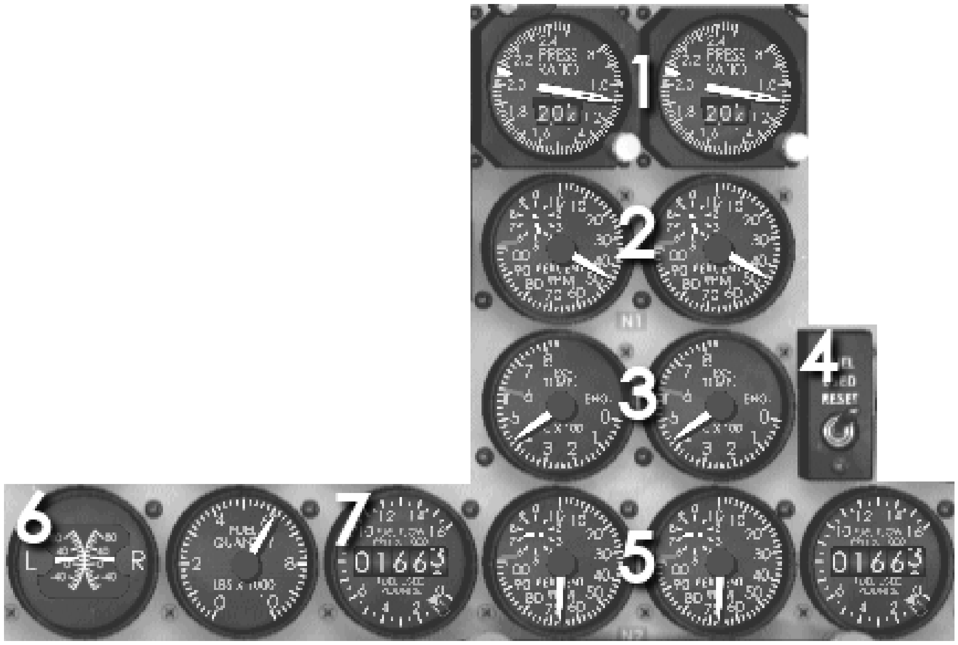
DC-9 Classic – Aircraft Operating Manual



1. OIL PRESS (L, R)
Indicates oil pressure in distribution lines on engine side of main oil filter (PSI).

2. OIL TEMP (L, R)
Indicates temperature of the oil that has passed through fuel/oil cooler (PSI).

3. OIL QUANTITY (L, R)
Indicates usable oil in tank (quarts).



1. L & R PRESSURE RATIO INDICATORS
Indicates ratio of turbine discharge pressure (PT7) to compressor inlet pressure (PT2). Set knob moves EPR reference bug.

2. L & R N_1 TACHOMETER
Indicates RPM of N_1 compressor. The small dial is graduated in 1% increments. The large dial is graduated in 2% increments. Tachometer systems are self-generating (no power required).

3. L & R EGT GAUGE
Indicates exhaust gas temperature in °C.

4. FUEL USED RESET SWITCH
Resets the fuel used readout on each fuel flow/fuel used indicator to 00000.

5. L & R N_2 TACHOMETER
Indicates RPM of N_2 compressor. The small dial is graduated in 1% increments. The large dial is graduated in 2% increments. Tachometer systems are self-generating (no power required).

6. FUEL TEMP GAUGE
Indicates temperature of fuel after fuel has flowed through the air/fuel heat exchanger.

7. L & R FUEL FLOW GAUGE/FUEL USED GAUGE
The dial indicates fuel flow rate delivered to the engine. The digital readout indicates total fuel used by the engine.

WARNING AND CAUTION INDICATORS

29 & 36. FUEL HEAT ON (L, R) (Blue)
Indicates bleed air supply to air/fuel heat exchanger is open.

31 & 38. L/R START VALVE OPEN (Amber)
Indicates the engine starter butterfly valve is open, allowing bleed air to flow into the compressor stage of the turbine.

33 & 40. L/R OIL PRESS LOW (Amber)
Indicates low engine oil pressure. The MASTER CAUTION light will also illuminate.

34 & 41. INLET FUEL PRESS LOW (L, R)
Indicates low fuel pressure at engine. The MASTER CAUTION light will also illuminate.

AUXILIARY POWER UNIT

The Auxiliary Power Unit (APU) is a gas turbine engine installed to supply pneumatic requirements for cabin air conditioning and engine starting as well as electrical power for normal airplane systems operation while on the ground. The APU is operable in flight to supply an alternate source of electrical power.

The APU is installed aft of the rear pressure bulkhead in the unpressurized area of the lower fuselage.

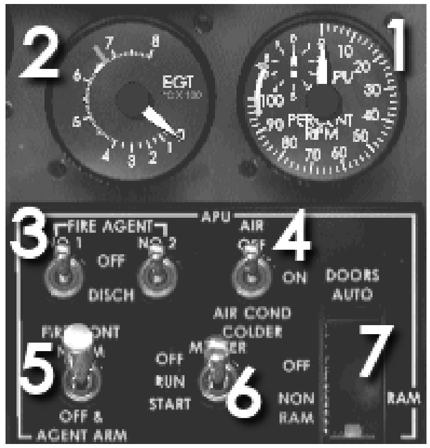
Fuel is normally supplied to the APU from the right main tank. The DC start pump or any right main or center fuel boost pump will supply fuel to the APU.

All APU controls and indicators are located on the overhead panel.

The APU can be started on the ground or in-flight. Maximum operating altitude for the APU is FL350. Maximum starting altitude for the APU is FL240. APU bleed air is only available on the ground.

A 40 KVA power AC generator is mounted on the APU to provide electrical power to either or both electrical systems.

CONTROLS AND INDICATORS



1. APU PERCENT RPM GAUGE
Indicates APU RPM as a percentage of an established normal operating RPM. The small dial makes one full revolution for each 10% RPM. Normal operating range is indicated by a green arc between 95 and 105 percent RPM.

2. APU EGT GAUGE
Indicates APU exhaust gas temperature in °C.

3. NO 1 AND 2 APU FIRE AGENT SWITCH
DISCH (Momentarily) Moving the switch to DISCH with the APU FIRE CONT switch in the OFF & AGENT ARM will discharge respective fire extinguishing agent into the APU compartment.

4. APU AIR SWITCH
ON APU load control valve opens to provide APU bleed air to the airplane pneumatic system.
AIR COND COLDER Closes turbine bypass valve and increases differential pressure across air conditioning turbine lowering temperature of conditioned air during ground operation. Use of this switch position, although providing cooler air, significantly reduces cockpit / cabin airflow.
OFF Removes electrical power from APU load control valve and turbine bypass valve circuits.

5. APU FIRE CONT SWITCH
NORM Provides control power to the APU master switch for normal operation.
OFF & AGENT ARM Shuts down the APU and arms the APU fire agent switches for subsequent discharge of the fire extinguishing agent.

6. APU MASTER SWITCH

START (Momentary) Initiates APU start. Release to RUN after observing initial rise in RPM.
RUN Normal APU operating mode.
OFF Automatically shuts off bleed air regardless of AIR switch position and shuts down APU. Note: The APU is also shut down if the battery switch is set to OFF.

7. APU DOORS CONTROL SWITCH

AUTO Automatically selects ram door position for starting and non-ram door position for ground and flight operation.
RAM (Momentary) Provides manual override to open ram door.

Note: The click area to open/close the guard is located just to the right of the switch.

WARNING AND CAUTION INDICATORS

55. APU FIRE LIGHT
Indicates the APU fire detection system has been activated. The MASTER WARNING light will also illuminate.

SECTION 17

WEIGHT & BALANCE

TABLE OF CONTENTS

INTRODUCTION

This section presents the basic weight and balance data necessary to complete the Weight and Balance Control portion of the official aircraft paperwork required before each flight when computerized data is unavailable.

When completing a manual weight and balance calculation, the following minimum data must be used:

- Aircraft Standard Operating Weight (SOW) List.
- Passenger Adjusted Weight Tables
  - Summer Weights (May 1 thru October 31)
  - Winter Weights (November 1 thru April 30)
- Cargo Adjusted Weight Tables
  - Forward Bin
  - Aft Bin
- Fuel Adjusted Weight Table
- Balance Graph
- Stabilizer Trim and Takeoff Table

When it is necessary to complete manual weight and balance calculations for a ferry flight or test hop, the following additional data must be used:

- Standard Operating Weights (SOW) Adjustments (Ferry Flights, Test Hops, Flight Training Only)

When performing a weight and balance calculation in the index system, the following rules should be followed at all times.

- Verify the W&B subtype for the aircraft and take extra care to assure that only the data tables and balance graph applicable to that sub type are used. Note: In this simulation, only subtype F has been used.
- Use the numbers printed exactly as they appear. Do not round off, drop digits, or interpolate between the tables.
- When reading the cargo and fuel tables, use the printed value closest to the actual cargo or fuel weight. For weights that fall exactly midway between two values, use the next higher table value.
- For special weight passenger groups, determine the total weight of the group prior to entering Non-Standard Passenger Adjusted Weights tables. Use the weight closest to the total passenger weight. For weights that fall exactly midway between two values, use the next higher table value.
- When determining the stabilizer trim units for takeoff, use the takeoff weight column and balance unit row closest to the actual takeoff gross weight and final balance units.
- For dispatch of a revenue flight, the aircraft balance units at both Gross Weight Without Fuel and Takeoff Gross Weight must be inside the unshaded “A” region.
- For dispatch of a test hop, ferry flight or flight training with less than full standard operating items (no flight attendants, partial galley items, etc), the aircraft balance units at both Gross Weight Without Fuel and Takeoff Gross Weight must be inside the shaded “B” region.

WEIGHT & BALANCE CONTROL FORM

AIRCRAFT	LOADING SUPERVISOR	FORM PREPARED BY

WEIGHT & BALANCE CONTROL

BALANCE UNIT COLUMNS

A/C TYPE ______	W&B SUBTYPE ______	S.O.W.
ACM(S) WEIGHT 1 ☐ 2 ☐		+
NBR F/As 1 2 3 4 5	XFA WEIGHT / F/A LESS SKED	+1 / -1 (+ / -)
FWD BIN CARGO WT	LBS	MD80 ONLY
MID BIN CARGO WT	LBS	
REAR BIN CARGO WT	LBS	
TRAPPED AUX TANK FUEL WT.	LBS	+
TOTAL PSGRS (F+Y+M+S) ______	PASSENGERS (F/Y COUNTS & WTS. DO NOT INCLUDE MILITARY/SPORTS/SPECIAL GROUP COUNTS & WT., IF APPLICABLE)	F / Y
MILITARY/SPORT/SPECIAL PASSENGER GROUP COUNT & WTS.	M ____ S ____ SW ____	
GROSS WEIGHT WITHOUT FUEL (BALANCE UNIT AND WEIGHT PLOTTED ON GRAPH)	☐	
SEE BACK FOR ADJUSTMENT		DO NOT EXCEED MAX ZERO FUEL WT.
	-	ZERO FUEL WEIGHT ADJUSTED
		DO NOT EXCEED ADJUSTED MAX ZFW
CORRECTION FWD CARGO	+ - ☐ LBS	MD80 ONLY
CORRECTION MID CARGO	+ - ☐ LBS	
CORRECTION AFT CARGO	+ - ☐ LBS	
CORRECTION PASSENGERS F	+ - ☐	
CORRECTION PASSENGERS Y	+ - ☐	
CHILD WEIGHT SAVINGS C	(-) ☐	-
SEAT ROW BLOCKING ☐ ROWS	FWD / AFT	COACH CABIN ONLY
CORRECTED GROSS WT. WITHOUT FUEL (BALANCE UNIT AND WEIGHT PLOTTED GRAPH)	☐	
FUEL ON BOARD WT. ______	LBS	
CORRECTED F.O.B. ☐	LBS	
TAKEOFF GROSS WEIGHT (BALANCE UNIT AND WEIGHT PLOTTED GRAPH)	☐	
CORRECTED TAKEOFF GROSS WEIGHT (BALANCE UNIT AND WEIGHT PLOTTED GRAPH)	☐	
➡ **MAXIMUM TAKEOFF GROSS WEIGHT** (ENTER FIGURE FROM BLOCK 15 OR FROM JT MESSAGE)		TRIM
RAMP WT. ABOVE MTOW (BLOCK 16) N/A FOR F28 A/C	ACM(S) WT / RAMP WEIGHT = MAX TOGW + ACM WT	+ / CORR. TRIM

STANDARD OPERATING WEIGHTS (SOW)

(All weights given in pounds)

REGISTRATION NUMBER	SOW	W&B SUBTYPE	MTOW	MLW	MZFW	MAX FUEL	ENGINE TYPE
SUBTYPE F							
N52647	61252.75	F	105000	95300	87000	24600	JT8D-7
N912VJ	60752.73	F	105000	95300	87000	24600	JT8D-7

(Insert your own AC registrations and new data for your favorite DC-9 aircraft)

CARGO ADJUSTED WEIGHTS

Weight & Balance Data – Subtype F

FORWARD (F) CARGO BIN	
99.98	4399.10
199.96	4499.08
299.94	4599.06
399.92	4699.04
499.90	4799.02
599.88	4899.00
699.86	4998.98
799.84	5098.96
899.82	5198.94
999.80	5298.92
1099.77	5398.90
1199.75	5498.87
1299.73	5598.85
1399.71	5698.83
1499.69	5798.81
1599.67	5898.79
1699.65	5998.77
1799.63	6098.75
1899.61	6198.73
1999.59	6298.71
2099.57	6398.69
2199.55	6498.67
2299.53	6598.65
2399.51	6698.63
2499.49	6798.61
2599.47	6898.59
2699.45	6998.57
2799.43	7098.55
2899.41	7198.53
2999.39	7298.51
3099.37	7398.49
3199.35	7498.47
3299.32	7598.45
3399.30	7698.43
3499.28	7798.40
3599.26	7898.38
3599.26	7998.36
3699.24	8098.34
3799.22	8198.32
3899.20	8298.30
3999.18	8398.28
4099.16	8428.28
4199.14	
4299.12	

REAR (R) CARGO BIN	
100.01	2600.32
200.03	2700.33
300.04	2800.35
400.05	2900.36
500.06	3000.37
600.07	3100.38
700.09	3200.40
800.10	3300.41
900.11	3400.42
1000.12	3500.43
1100.14	3600.44
1200.15	3700.46
1300.16	3800.47
1400.17	3900.48
1500.19	4000.49
1600.20	4100.51
1700.21	4200.52
1800.22	4300.53
1900.23	4400.54
2000.25	4500.56
2100.26	4600.57
2200.27	4700.58
2300.28	4800.59
2400.30	4900.61
2500.31	4990.62

PASSENGER ADJUSTED WEIGHTS - SUMMER

(May 1 – October 31)
W&B Subtype F
8F/93Y

180 LBS/PAX

First Class (F) (Rows 1-2)		Coach Class (Y) (Rows 3-21)					
PAX	ADJ WT	PAX	ADJ WT	PAX	ADJ WT	PAX	ADJ WT
1	179.95	1	180.00	33	5939.89	65	11699.78
2	359.90	2	359.99	34	6119.88	66	11879.77
3	539.85	3	539.99	35	6299.88	67	12059.77
4	719.80	4	719.99	36	6479.88	68	12239.76
5	899.75	5	899.98	37	6659.87	69	12419.76
6	1079.69	6	1079.98	38	6839.87	70	12599.76
7	1259.64	7	1259.98	39	7019.86	71	12779.75
8	1439.59	8	1439.97	40	7199.86	72	12959.75
		9	1619.97	41	7379.86	73	13139.75
		10	1799.97	42	7559.85	74	13319.74
		11	1979.96	43	7739.85	75	13499.74
		12	2159.96	44	7919.85	76	13679.74
		13	2339.96	45	8099.84	77	13859.73
		14	2519.95	46	8279.84	78	14039.73
		15	2699.95	47	8459.83	79	14219.73
		16	2879.94	48	8639.83	80	14399.72
		17	3059.94	49	8819.83	81	14579.72
		18	3239.94	50	8999.83	82	14759.72
		19	3419.93	51	9179.82	83	14939.71
		20	3599.93	52	9359.82	84	15119.71
		21	3779.93	53	9539.92	85	15299.71
		22	3959.92	54	9719.81	86	15479.70
		23	4139.92	55	9899.81	87	15659.70
		24	4319.92	56	10079.81	88	15839.70
		25	4499.91	57	10259.80	89	16019.69
		26	4679.91	58	10439.80	90	16199.69
		27	4859.91	59	10619.80	91	16379.68
		28	5039.90	60	10799.79	92	16559.68
		29	5219.90	61	10979.79	93	16739.68
		30	5399.90	62	11159.79		
		31	5579.89	63	11339.78		
		32	5759.89	64	11519.78		

PASSENGER ADJUSTED WEIGHTS - WINTER

(November 1 – April 30)
W&B Subtype F
8F/93Y

							185 LBS/PAX
First Class (F) (Rows 1-2)		**Coach Class (Y) (Rows 3-21)**					
PAX	**ADJ WT**	**PAX**	**ADJ WT**	**PAX**	**ADJ WT**	**PAX**	**ADJ WT**
1	189.95	1	190.00	33	6109.88	65	12029.77
2	369.90	2	369.99	34	6289.88	66	12209.76
3	559.84	3	559.99	35	6479.88	67	12399.76
4	739.79	4	739.99	36	6659.87	68	12579.76
5	929.74	5	929.98	37	6849.87	69	12769.75
6	1109.69	6	1109.98	38	7029.86	70	12949.75
7	1299.63	7	1299.98	39	7219.86	71	13139.75
8	1479.58	8	1479.97	40	7399.86	72	13319.74
		9	1669.97	41	7589.85	73	13509.74
		10	1849.96	42	7769.85	74	13689.74
		11	2039.96	43	7959.85	75	13879.73
		12	2219.96	44	8139.84	76	14059.73
		13	2409.95	45	8329.84	77	14249.73
		14	2589.95	46	8509.84	78	14429.72
		15	2779.95	47	8699.83	79	14619.72
		16	2959.94	48	8879.83	80	14799.71
		17	3149.94	49	9069.83	81	14989.71
		18	3329.94	50	9249.82	82	15169.71
		19	3519.93	51	9439.82	83	15359.71
		20	3699.93	52	9619.81	84	15539.70
		21	3889.93	53	9809.81	85	15729.70
		22	4069.92	54	9989.81	86	15909.69
		23	4259.92	55	10179.80	87	16099.69
		24	4439.91	56	10359.80	88	16279.69
		25	4629.91	57	10549.80	89	16469.68
		26	4809.91	58	10729.79	90	16649.68
		27	4999.90	59	10919.79	91	16839.68
		28	5179.90	60	11099.79	92	17019.67
		29	5369.90	61	11289.78	93	17209.67
		30	5549.89	62	11469.78		
		31	5739.89	63	11659.78		
		32	5919.89	64	11839.77		

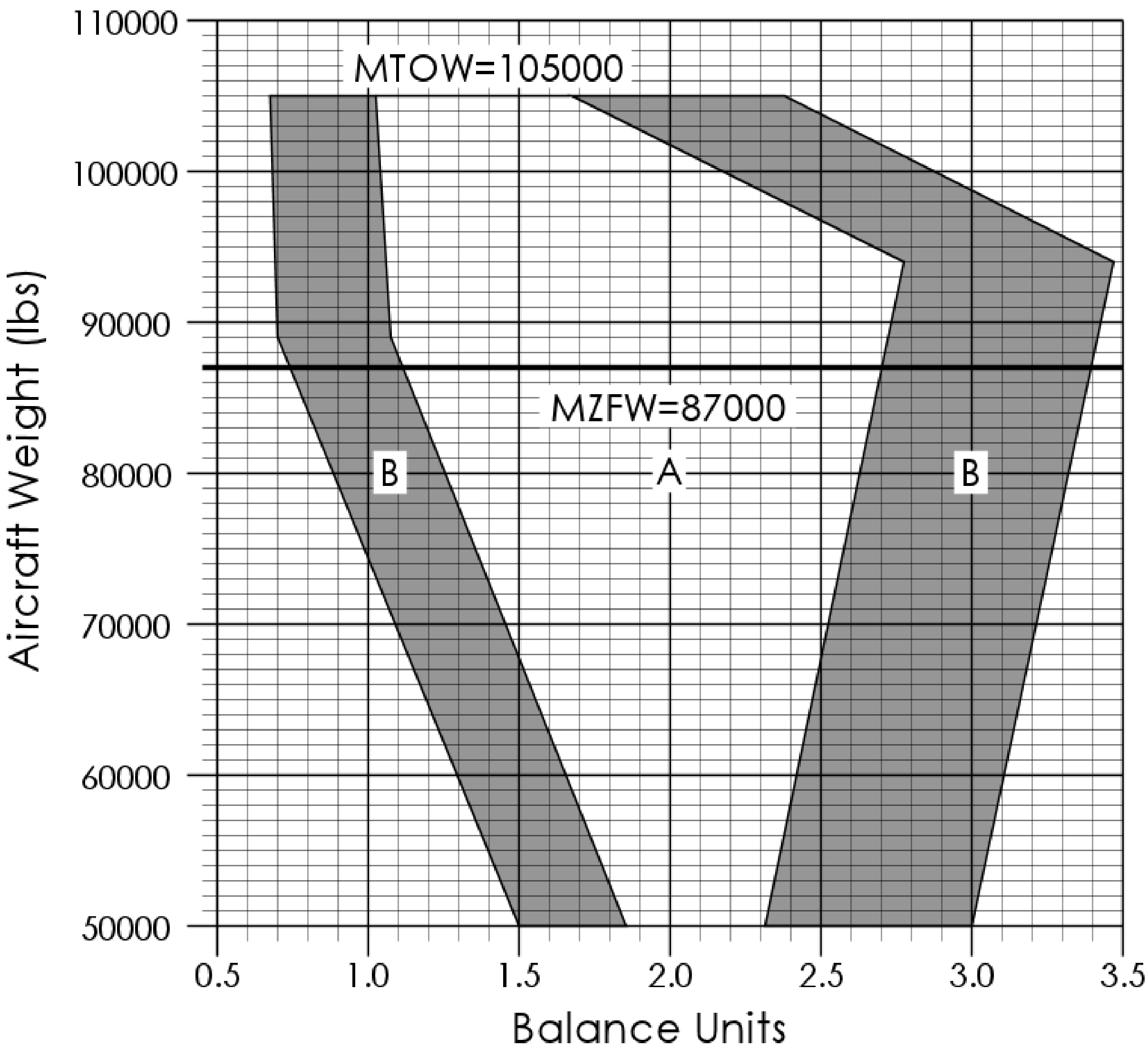
FUEL ADJUSTED WEIGHTS

W&B Subtype F
8F/93Y

100.00	5099.92	10099.93	15099.98	20100.01
200.00	5199.92	10199.93	15199.98	20200.01
299.99	5299.92	10299.93	15299.98	20300.00
399.99	5399.92	10399.93	15399.98	20400.00
499.99	5499.92	10499.93	15499.98	20500.00
599.99	5599.92	10599.93	15599.99	20599.99
699.98	5699.92	10699.93	15699.99	20699.99
799.98	5799.92	10799.93	15799.99	20799.99
899.98	5899.92	10899.93	15899.99	20899.98
999.98	5999.92	10999.93	15999.99	20999.98
1099.98	6099.92	11099.93	16099.99	21099.98
1199.97	6199.92	11199.93	16200.00	21199.97
1299.97	6299.92	11299.93	16300.00	21299.97
1399.97	6399.92	11399.93	16400.00	21399.97
1499.97	6499.92	11499.93	16500.00	21499.96
1599.97	6599.92	11599.94	16600.00	21599.96
1699.96	6699.92	11699.94	16700.01	21699.96
1799.96	6799.92	11799.94	16800.01	21799.95
1899.96	6899.92	11899.94	16900.01	21899.95
1999.96	6999.92	11999.94	17000.01	21999.95
2099.96	7099.92	12099.94	17100.01	22099.94
2199.96	7199.92	12199.94	17200.02	22199.94
2299.95	7299.92	12299.94	17300.02	22299.94
2399.95	7399.92	12399.94	17400.02	22399.93
2499.95	7499.92	12499.94	17500.02	22499.93
2599.95	7599.92	12599.95	17600.03	22599.93
2699.95	7699.92	12699.95	17700.03	22699.92
2799.95	7799.92	12799.95	17800.03	22799.92
2899.95	7899.92	12899.95	17900.03	22899.92
2999.94	7999.92	12999.95	18000.04	22999.91
3099.94	8099.92	13099.95	18100.04	23099.91
3199.94	8199.92	13199.95	18200.04	23199.91
3299.94	8299.92	13299.95	18300.05	23299.90
3399.94	8399.92	13399.95	18400.05	23399.90
3499.94	8499.92	13499.96	18500.05	23499.90
3599.94	8599.92	13599.96	18600.05	23599.89
3699.94	8699.92	13699.96	18700.05	23699.89
3799.93	8799.92	13799.96	18800.05	23799.89
3899.93	8899.92	13899.96	18900.05	23899.88
3999.93	8999.92	13999.96	19000.05	23999.88
4099.93	9099.92	14099.96	19100.04	24099.88
4199.93	9199.92	14199.96	19200.04	24199.87
4299.93	9299.92	14299.97	19300.04	24299.87
4399.93	9399.92	14399.97	19400.03	24399.87
4499.93	9499.92	14499.97	19500.03	24499.86
4599.93	9599.92	14599.97	19600.03	24599.86
4699.93	9699.92	14699.97	19700.02	
4799.93	9799.92	14799.97	19800.02	
4899.93	9899.92	14899.98	19900.02	
4999.93	9999.93	14999.98	20000.01	

BALANCE GRAPH

W&B Subtype F
8F/93Y



A	Dispatch in this region for revenue flights, test hops, ferry flights and training.
B	Dispatch in this region for test hops, ferry flights and training only. (Use passenger weights from test hops, ferry flights correction page.)

STABILIZER TRIM SETTING FOR TAKEOFF

W&B Subtype F
8F/93Y

	FLAPS 5 & 15						
BALANCE UNITS	TAKOFF WEIGHT (LBS)						
	50000	60000	70000	80000	90000	100000	110000
0.6	NA	NA	NA	NA	NA	9.3	9.1
0.7	NA	NA	NA	NA	9.5	9.0	8.8
0.8	NA	NA	NA	NA	9.2	8.8	8.6
0.9	NA	NA	NA	NA	9.0	8.5	8.4
1.0	NA	NA	NA	9.2	8.7	8.3	8.1
1.1	NA	NA	NA	8.9	8.4	8.1	7.9
1.2	NA	NA	9.2	8.6	8.2	7.8	7.7
1.3	NA	9.5	8.8	8.3	7.9	7.6	7.4
1.4	NA	9.1	8.5	8.0	7.6	7.3	7.2
1.5	9.5	8.7	8.1	7.7	7.4	7.1	7.0
1.6	9.0	8.3	7.8	7.4	7.1	6.9	6.8
1.7	8.5	7.9	7.4	7.1	6.8	6.6	6.5
1.8	8.1	7.5	7.1	6.8	6.6	6.4	6.3
1.9	7.6	7.1	6.8	6.5	6.3	6.2	6.1
2.0	7.1	6.7	6.4	6.2	6.1	5.9	5.9
2.1	6.7	6.3	6.1	5.9	5.8	5.7	5.7
2.2	6.2	5.9	5.8	5.6	5.5	5.5	5.5
2.3	5.7	5.5	5.4	5.3	5.3	5.2	5.2
2.4	5.3	5.1	5.1	5.0	5.0	5.0	5.0
2.5	4.8	4.8	4.8	4.8	4.8	4.8	4.8
2.6	4.3	4.4	4.4	4.5	4.5	4.5	4.6
2.7	3.9	4.0	4.1	4.2	4.2	4.3	NA
2.8	3.4	3.6	3.8	3.9	4.0	4.1	NA
2.9	2.9	3.2	3.4	3.6	3.7	3.9	NA
3.0	2.5	2.8	3.1	3.3	3.5	3.6	NA
3.1	NA	2.4	2.8	3.0	3.2	3.4	NA
3.2	NA	NA	2.4	2.7	3.0	3.1	NA
3.3	NA	NA	NA	2.4	2.7	NA	NA
3.4	NA	NA	NA	NA	2.4	NA	NA

USE OF THIS CHART

To determine the takeoff stabilizer trim using this chart, enter at the CLOSEST weight to the actual takeoff weight and read down to the balance unit value CLOSEST to the actual balance units. No interpolation is required.

Example: *Actual Takeoff Weight (GTOW) = 85,000 lbs*
Actual Balance Units = 2.73
Table Takeoff Weight = 90,000 lbs
Table Balance Units = 2.7
Stabilizer Trim Setting = 4.2

NON-STANDARD PASSENGER ADJUSTED WEIGHTS (FIRST CLASS CABIN ONLY)

Summer or Winter (180 & 185 LBS/PAX)
W&B Subtype F
8F/93Y

CHILD SAVINGS	
PAX	**ADJ WT**
1	-99.97
2	-199.94
3	-299.92
4	-399.89
5	-499.86
6	-599.83
7	-699.80
8	-799.77

*SPECIAL PASSENGER WEIGHT GROUPS
199.94
399.89
599.83
799.77
999.72
1199.66
1399.60
1599.55
1799.49
1999.43

*NOTE: Table should be entered with TOTAL WEIGHT of special passenger groups.

NON-STANDARD PASSENGER ADJUSTED WEIGHTS (COACH CLASS CABIN ONLY)

Summer or Winter (180 & 185 LBS/PAX)
W&B Subtype F
8F/93Y

CHILD SAVINGS	
PAX	**ADJ WT**
1	-100.00
2	-200.00
3	-299.99
4	-399.99
5	-499.99
6	-599.99
7	-699.99
8	-799.98
9	-899.98
10	-999.98

*SPECIAL PASSENGER WEIGHT GROUPS				
200.00	4199.92	8199.84	12199.77	16199.69
399.99	4399.92	8399.84	12399.76	16399.68
599.99	4599.91	8599.83	12599.76	16599.68
799.99	4799.91	8799.83	12799.75	16799.68
999.98	4999.90	8999.83	12999.75	16999.67
1199.98	5199.90	9199.82	13199.75	17199.67
1399.97	5399.90	9399.82	13399.74	17399.67
1599.97	5599.89	9599.82	13599.74	17599.66
1799.97	5799.89	9799.81	13799.73	17799.66
1999.96	5999.88	9999.81	13999.73	17999.65
2199.96	6199.88	10199.80	14199.73	18199.65
2399.95	6399.88	10399.80	14399.72	18399.65
2599.95	6599.87	10599.80	14599.72	18599.64
2799.95	6799.87	10799.79	14799.72	18799.64
2999.94	6999.87	10999.79	14999.72	18999.63
3199.94	7199.86	11199.78	15199.71	19199.63
3399.93	7399.86	11399.78	15399.70	19399.63
3599.93	7599.85	11599.78	15599.70	19599.62
3799.93	7799.85	11799.77	15799.70	19799.62
3999.92	7999.85	11999.77	15999.69	19999.62

*NOTE: Table should be entered with TOTAL WEIGHT of special passenger groups.

WEIGHT AND BALANCE CORRECTIONS

W&B Subtype F
8F/93Y

ADDITIONAL CREWMEMBERS (ACM)	
One (1) ACM	169.93

FLIGHT ATTENDANTS	
Standard F/A number	3
One (1) XFA	140.03
F/A Less Scheduled	NA

COACH CABIN AFT ROW BLOCKING CORRECTIONS

Rows Blocked	Passenger Range				
	0-19	20-38	39-57	58-76	77-83
1	+9.98	+9.94	+9.91	+9.87	+9.83
2	+9.96	+9.89	+9.81	+9.74	+9.56
3	+9.94	+9.83	+9.72	+9.61	+9.50
4	+9.92	+9.77	+9.62	+9.48	NA
5	+9.90	+9.72	+9.53	+9.34	NA

CORRECTIONS FOR USE DURING TEST HOPS, FERRY FLIGHTS AND FLIGHT TRAINING.

W&B Subtype F
8F/93Y

STANDARD OPERATING WEIGHT (SOW)		
STANDARD OPERATING ITEM (SOI) PACKAGE	PARTIAL	FEW
ONBOARD ITEMS	Pilots & Manuals Lavatory Chemicals Lavatory Supplies Cabin Supplies ½ Galley Supplies ½ Potable Water NO FLIGHT ATTENDANTS	Pilots & Manuals Lavatory Chemicals Lavatory Supplies NO FLIGHT ATTENDANTS
SOW ADJUSTMENT	-999.70	-1749.52

ADJUSTED PASSENGER WEIGHTS (PASSENGERS SEATED IN ROWS 1-3 ONLY)	
PAX	**ADJ WT**
1	169.96
2	339.91
3	509.87
4	679.82
5	849.78
6	1019.73
7	1189.69
8	1359.64
9	1529.60
10	1699.56
11	1869.51
12	2039.47
13	2209.42

EXAMPLE W&B PROBLEM

Type of flight:	Revenue
Date of flight:	May 18
A/C Number:	N52647
Passengers:	3F/65Y
Forward Cargo:	1,120 lbs
Rear Cargo:	450 lbs
FOB:	17,500 lbs

AIRCRAFT N52647 | LOADING SUPERVISOR R. Øijordsbakken | FORM PREPARED BY E. Øijordsbakken

WEIGHT & BALANCE CONTROL

BALANCE UNIT COLUMNS

A/C TYPE DC-9 · W&B SUBTYPE F · W&B SEASON S	S.O.W.	61,252.75
ACM(S) WEIGHT 1 ☐ 2 ☐		+
NBR F/As 1 2 3 4 5	XFA WEIGHT +1 / F/A LESS SKED -1	
FWD BIN CARGO WT	1,120 LBS	1,099.77
MID BIN CARGO WT	LBS (MD80 ONLY)	
REAR BIN CARGO WT	450 LBS	500.06
TRAPPED AUX TANK FUEL WT.	LBS	+
TOTAL PSGRS (F+Y+M+S) 68 · PASSENGERS (F/Y COUNTS & WTS. DO NOT INCLUDE MILITARY/SPORTS/SPECIAL GROUP COUNTS & WT., IF APPLICABLE)	3 F	539.85
	65 Y	11,699.78
MILITARY/SPORT/SPECIAL PASSENGER GROUP COUNT & WTS.	M ____ S ____ SW ____	
GROSS WEIGHT WITHOUT FUEL (BALANCE UNIT AND WEIGHT PLOTTED ON GRAPH) ☐		75,092.21
SEE BACK FOR ADJUSTMENT	87000	DO NOT EXCEED MAX ZERO FUEL WT.
	-	ZERO FUEL WEIGHT ADJUSTED
		DO NOT EXCEED ADJUSTED MAX ZFW
CORRECTION FWD CARGO	+/- ☐ LBS (MD80 ONLY)	
CORRECTION MID CARGO	+/- ☐ LBS	
CORRECTION AFT CARGO	+/- ☐ LBS	
CORRECTION PASSENGERS F	+/- ☐	
CORRECTION PASSENGERS Y	+/- ☐	
CHILD WEIGHT SAVINGS C	(-) ☐	-
SEAT ROW BLOCKING ☐ ROWS	FWD / AFT	COACH CABIN ONLY
CORRECTED GROSS WT. WITHOUT FUEL (BALANCE UNIT AND WEIGHT PLOTTED GRAPH) ☐		
FUEL ON BOARD WT.	17,500 LBS	17,500.02
CORRECTED F.O.B.	☐ LBS	
TAKEOFF GROSS WEIGHT (BALANCE UNIT AND WEIGHT PLOTTED GRAPH) ☐		92,592.23
CORRECTED TAKEOFF GROSS WEIGHT (BALANCE UNIT AND WEIGHT PLOTTED GRAPH) ☐		
MAXIMUM TAKEOFF GROSS WEIGHT (ENTER FIGURE FROM BLOCK 15 OR FROM JT MESSAGE)		105,000 · TRIM 5.5
RAMP WT. ABOVE MTOW (BLOCK 16) N/A FOR F28 A/C	ACM(S) WT	+ · CORR. TRIM
	RAMP WEIGHT = MAX TOGW + ACM WT	

COMPLETING THE WEIGHT AND BALANCE CONTROL FORM

Here are the steps involved in completing the example W&B problem on the previous page.

1. If they haven't already been entered, we'll start by inserting two critical maximum values.
   - Near the center of the form is a line that says **DO NOT EXCEED MAX ZERO FUEL WT**. In the boxes to the left of that label, insert **87,000**.
   - Toward the bottom of the form there is a large black arrow and the label **MAXIMUM TAKEOFF GROSS WEIGHT**. In the boxes to the right of that label, insert **105,000**.

2. The aircraft's Standard Operating Weight can be found on page 17-4 (Section 17 Page 4). Each aircraft in the fleet has its own unique value. Copy the number from the **SOW** column into the boxes on the right side of the **S.O.W.** line on the form. Enter it exactly as shown – the last 3 digits are especially important, as you will see.

   For the sample aircraft, the value is **61,252.75**.

3. Skip down to the **FWD BIN CARGO WT** line. Enter the actual weight of the cargo in the forward bin in the space to the left of **LBS**. Then go to page 17-5, and scan through the **FORWARD (F) CARGO BIN** table until you find the value closest to that weight. Copy the table value into the boxes on the right side of the line. If a weight is exactly midway between two values in the table (e.g. 750 lbs), use the larger of the two values from the table.

   For our example, the **1120 lbs** of cargo led to a value of **1,099.77** being entered.

4. Skip the **MID BIN CARGO WT** line since our aircraft doesn't have a middle cargo bin.

5. On the **REAR BIN CARGO WT** line, enter the actual weight of cargo in the rear bin to the left of **LBS**. Then use the **REAR (R) CARGO BIN** table on page 17-5 to find the nearest value to enter in the boxes on the right side of the line.

   In our example, the **450 lbs** of cargo led to an entry of **500.06** in those boxes.

6. Enter the total number of passengers in the **TOTAL PSGRS** box.

   Our sample flight has 68 passengers, so enter that value in the box.

7. Enter the number of F (First) Class passengers in the box to the left of **F.** The **PASSENGER ADJUSTED WEIGHTS** tables are on pages 17-6 and 17-7. The table on 17-6 is for use during the summer months, with an average of 180 lbs per passenger. The table on 17-7 increases that average to 185 lbs per passenger during the winter months, due to the additional clothing that is usually worn in colder weather.

- Our sample form is for a flight on May 18th, so the **Summer** table on page 17-6 would be used.

8. In the table's **First Class (F)** section, find the number of F-Class passengers and the Adjusted Weight for that number.

   - Our flight has **3** First Class passengers, so **539.85** is entered in the boxes.

9. Enter the number of Y (Coach) Class passengers in the box to the left of Y. Then scan through the **Coach Class (Y)** section of the table for the Adjusted Weight value to enter.

   - Our sample flight has **65** Coach Class passengers, so we enter **11,699.78** in the boxes.

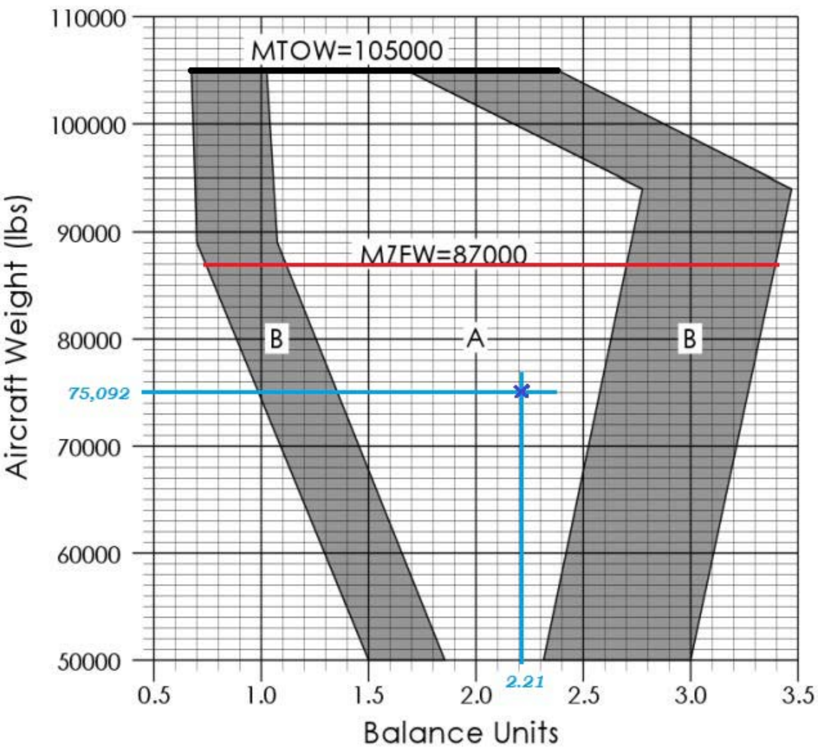
10. If children are known to be among the passengers, or if some of the passengers have additional equipment (e.g. military personnel or athletes), then corrections would be made to the weights that have been entered. Pages 17-11 through 17-14 contain the tables for those, and other, weight corrections.

    - Since there is no mention of special passengers, we can skip the next line.

11. Total all of the entries made so far to find a very important value known as the Zero Fuel Weight (ZFW). Additionally, the last 3 digits give us the Balance Unit.

    - The total of all the entries so far is **75,092.21**. So our ZFW is 75,092 lbs, and the Balance Unit is 2.21.

12. The ZFW and Balance Unit are plotted on the Balance Graph, shown on page 17-9 and reproduced here. Note that an "X" has been placed where 75,092 lbs and 2.21 Balance Units intersect. For a revenue flight (i.e. one that carries passengers and/or cargo) to be legal, that X must fall in the central area marked **A**. (The restrictions for non-revenue flights — test flights, ferry flights, and training flights —are less demanding since the X only needs to fall within the **A** or **B** areas.) The X must also fall below the Maximum ZFW limit, which is 87,000 lbs for this aircraft and has been shown in red.



Once the values have been plotted on the Balance Graph and have been found to be legal, then a checkmark is placed in the box to the left of the ZFW value.

13. There are no corrections for this flight, nor are any rows blocked in the cabin. So the lines devoted to those calculations can be skipped.

14. Next is the fuel load for the flight. Write the weight of the fuel (in pounds) in the space to the right of **FUEL ON BOARD WT**.

    ▢ In our example, we start with **17,500 lbs** of fuel.

15. In the **FUEL ADJUSTED WEIGHT** table on page 17-8, find the value that is closest to the fuel weight. Enter that adjusted weight value in the boxes on the right side of the line. As before, if the actual weight is midway between two table values, use the larger value.

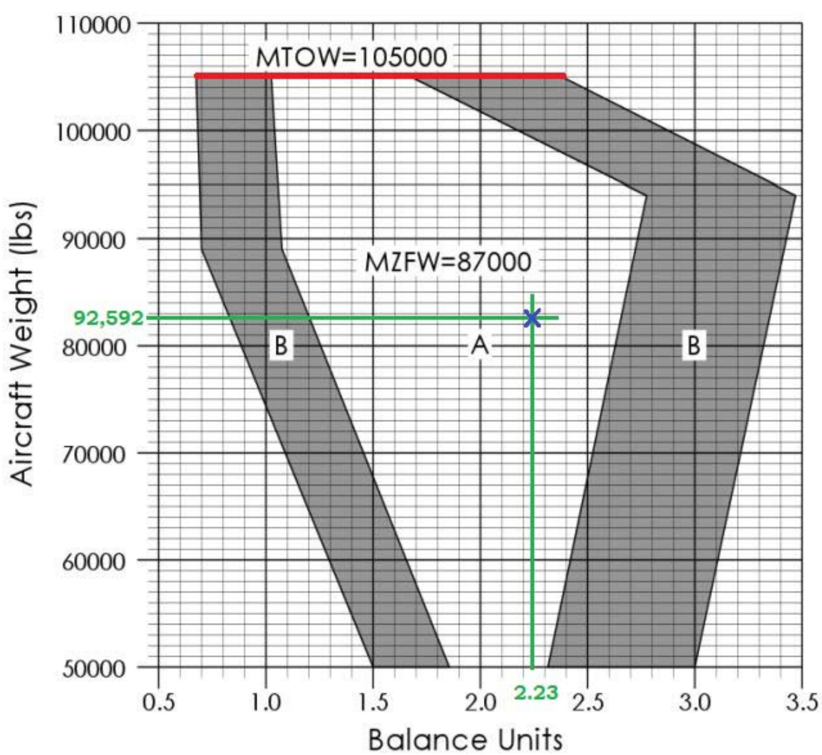
    ▢ The table value closest to 17,500 is **17500.02**, so that is what is entered in the boxes.

16. Add the Fuel Adjusted Weight to the Zero Fuel Weight to find the aircraft's Takeoff Gross Weight, as well as an updated Balance Unit.

    ▢ In the example, 75,092.21 + 17,500.02 = 92,592.23. So our Takeoff Gross Weight will be **92,592 lbs**. The last 3 digits give another Balance Unit, which is **2.23** in this case.

DC-9 Classic – Aircraft Operating Manual

17. Once again, we must plot the weight and balance units on a Balance Graph to make sure they fall within the legal envelope.



Again, the point clearly falls within area **A**. And it is well below the Maximum Takeoff Weight of 105,000 lbs. (A value which is so important that we wrote it earlier on the Weight and Balance Control form to make sure it would not be exceeded.) Once this has been verified on the graph, you should put a checkmark in the box on the **TAKEOFF GROSS WEIGHT** line.

18. Finally, we must refer to the **STABILIZER TRIM SETTING FOR TAKEOFF** table on page 17-10. To use that table, you will use the Takeoff Gross Weight (rounded to the nearest 10,000 lbs), as well as the final Balance Unit value (rounded to the nearest 0.1 unit). The intersection of those two values in the table gives the trim setting.

❒ As was summarized in step 16, our Takeoff Gross Weight will be **92,592 lbs**, so we use the 100,000 lb column. The Balance Unit value for that weight is **2.23**, so we use the 2.2 row. That column and row intersect at 5.5, so that will be the trim setting for takeoff. Write that value in the **TRIM** box in the lower right corner of the form.

19. That's how the Weight and Balance Control form is completed. Of course, there are several parts that were omitted. But only those values that are absolutely required for the DC-9 simulator were discussed, so don't be concerned about any of the other items.

SECTION 18

MANEUVERS & PROCEDURES

DC-9 Classic – Aircraft Operating Manual

TABLE OF CONTENTS

OPERATING TECHNIQUES

A procedure may be described as an orderly plan for accomplishing a specific task, and usually involves several steps. Technique may be described as the expert manner of performing these steps.

Proper operating technique results in a higher degree of safety, better passenger comfort, less wear and tear on equipment, and increased fuel economy.

At all times, the pilot should perform his/her duties with awareness, intelligence and in anticipation of what will happen next, to ensure the safety and success of the flight.

POWER BACK FROM GATE

POWER BACK FROM GATE (Procedure)

1. Power back gate departure is only authorized when both crew members have received proper training. A minimum of two ground crew are required, one Guideman and one Wingwalker. The Guideman should be position in front of the aircraft, in clear view of both pilots. The Wingwalker should be positioned aft of the right wing. Depending on the situation and gate location, a second Wingwalker for the left wing might be required.
2. Both engines should be running before commencing with the procedure. See the Engine Start procedure on how to start the engines.
3. Complete the AFTER START checklist.
4. Flash nose wheel landing and taxi light once to indicate to the Guideman that you are ready to begin power back. To re-establish cockpit to ground communication, flash the nose light three times (not simulated).
5. At the direction of the Guideman (come forward signal), taxi the aircraft two or three feet forward. This is done as a safety precaution against blocked wheels before going into reverse thrust.
6. Once the Guideman sees the aircraft moving forward, he will give the power back signal by rotating the wands horizontally in a circular motion.
7. Apply and hold the brakes to stop the forward motion and simultaneously set both engines to reverse idle thrust.
8. When both blue ENG REVERSE THRUST lights come on, release the brakes and drop both feet to the floor.
9. Monitor Guideman and establish reverse thrust for rearward movement. In the real aircraft you should not exceed 1.3 EPR. In the simulator, slowly increase the EPR until you find the minimum value that moves the aircraft. Rearward speed should not exceed that of a normal walk.
10. If rearward speed is excessive, place one engine in forward thrust.
11. Turns during power back must be commanded by the Guideman. Upon the Guideman’s signal, turn the steering wheel tiller in the direction of the Guideman’s lowered wand. Turns are made with reference to the Guideman’s left or right.
12. When the aircraft has reached the desired position, the Guideman will give the come forward signal.
13. Sharply come out of reverse, and apply forward thrust.
14. CAUTION: DO NOT USE BRAKES TO STOP REARWARD MOVEMENT.
15. Check that all reverse lights are out.
16. On the Guideman’s signal, establish forward movement or come to a full stop.
17. Flash nose wheel landing and taxi light once, to signal to the Guideman that you are ready to taxi.
18. When the area is clear, the Guideman will give the standard departure salute.

SPECIAL CAUTIONS:

- The Guideman should never give the stop signal when the aircraft is in rearward movement. The come forward signal should be used to stop the aircraft.
- Do not use the brakes when the airplane is in rearward movement.
- If the brakes are inadvertently applied during rearward movement and the aircraft starts to tail tip, immediately move both throttles into forward thrust.

TAXI

Taxi Thrust

To begin the taxi roll and break away from the ramp, release the brakes and smoothly increase thrust. On the ramp area, limit thrust to 1.2 EPR to minimize jet blast and avoid damaging equipment on the ramp area.

When adding power to break away, set the power and wait for the engines and aircraft to respond. Do not continually increase thrust until the aircraft starts moving. Roll straight forward at first before turning to avoid the need for excessive thrust and possible damage to the nosewheel steering mechanism.

Note: In FSX, the actual EPR required to start taxiing may be higher than the real world value of 1.2 EPR. This is due to how FSX simulates ground operations.

Taxiing

Set the flaps to the takeoff setting after the "all clear" salute has been received.

The limit deflection angle for the nose wheel is 82 degrees left and right.

The main gear is approximately 54ft behind the pilots. When entering turns, the pilot should therefore overshoot the centerline to compensate for the aft position of the main gear. A turning radius of 72' is required. Only the wingtip is visible to the pilot. The horizontal stabilizer may not clear an obstacle cleared by the wingtip.

Avoid riding the brakes. Intermittent, positive application of the brakes will ensure cool brakes and less wear.

The DC-9 has a very responsive nose wheel steering and light nose wheel footprint. Special caution is therefore required when taxiing on wet or slippery surfaces. Turning too rapidly at a high taxi speed may cause the nose wheel to lose traction and skid. Heading control will not be regained until the speed has been reduced and the nose wheel deflection is reduced.

Normal Idle Thrust

With idle thrust and a loaded aircraft, greater use of the brakes may be required. Note that reverse thrust to assist slowing the aircraft during normal taxiing is not authorized. However, during conditions of reduced brake effect, reverse thrust may be used in an emergency to assist slowing the aircraft. Do not use asymmetrical thrust for directional control.

Anti-Skid

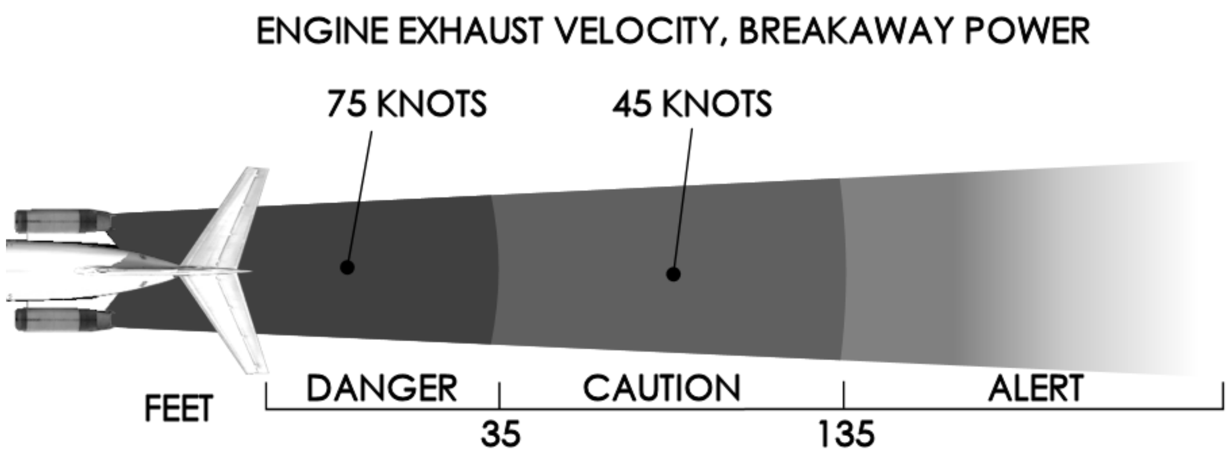
The anti-skid system should not be used while taxiing on the ramp area. Turn the anti-skid system on after leaving the ramp area, and off before entering the ramp area.

JET BLAST

When maneuvering on the ramp area special caution must be taken to avoid jet blast damage.

Use the following technique when maneuvering on the ramp area:

- Apply thrust to a maximum of 1.2 EPR.
- Retard both throttles as soon as the aircraft starts rolling.
- If a tight turn is required, leave the power on at 1.2 EPR until the point where jet blast could cause damage, then close both throttles. This should give the aircraft sufficient momentum to sustain taxi out of the congested area.
- If 1.2 EPR is not sufficient to move the aircraft out of a gate area where there is danger of jet blast damage to ground equipment, the Captain should request a tow out.



DANGER:

During breakaway power, the jet blast in this zone is powerful enough to uproot trees, cause structural damage to other aircraft, tip over and move heavy objects and break windows.

CAUTION:

During breakaway power, the jet blast in this zone is strong enough to weathercock unbraked aircraft, sway lift trucks, damage roofing and move unsecured objects.

ALERT:

During breakaway power, the jet blast in this zone can move unbraked carts and small objects.

DELAYED ENGINE START/SINGLE ENGINE TAXI

In order to save fuel, the Captain may elect to delay the start of the right engine. However, before taxiing single-engine, consideration should be given to the following:

- Location of gate in relation to runway
- Aircraft weight
- Ramp gradient
- Degree of the initial turn off of the gate
- Operational status of the APU
- Known or suspected ground delays
- Contamination of airport surfaces

During lengthy single-engine taxi, maintain fuel balance by crossfeeding as necessary. Do not use center tank fuel during ground operations. This is due to the environmental impact of fuel spillage which could result from a failed main tank check valve.

On the first flight of the day, there is an AC crosstie check requirement which means a delayed engine start is not an option. At the Captain's discretion though, if a long taxi route or delay is anticipated, the right engine may be shut down after the AC crosstie check has been accomplished.

After a delayed engine start, if the Captain elects to start the right engine her/himself, stop the aircraft and set the brakes. If starting the engine while taxiing is preferred, the Captain will direct the First Officer to start the right engine. This leaves the Captain free to taxi and monitor communications.

Note: Delayed engine starts may only be accomplished when the APU is supplying AC power to the right electrical system. The left and right APU bus switches must be ON during single engine taxi as the APU will not automatically crosstie on the ground.

Delayed engine start procedure:

1. Accomplish the entire Before Start checklist.
2. Start the left engine.
3. Accomplish the entire After Start checklist.

A minimum of 5 minutes prior to the application of takeoff power:

4. Accomplish the Before Start checklist (D) items only.
5. Start the right engine.
6. Accomplish the After Start checklist (D) items only.
7. After both engines are started, accomplish the Before Takeoff checklist.

TAKE-OFF

Before Take-off

Normally, the Before Take-off checklist is performed while taxiing out to the take-off position. This checklist must be completed before commencing the take-off roll.

Runway Alignment

On the runway, line up slightly left or right of the center line to avoid the centerline lights. These lights, which are embedded into the runway surface, can cause nose wheel thump during the take-off roll.

When the aircraft is lined up with the runway, check heading indication is about the same as the runway number.

If a braked take-off is being made, make sure the nose wheel is aligned with the runway prior to releasing the brakes.

Rotation and Initial Climb

The take-off and initial climb performance depends on executing the rotation at the correct speed and proper rate. Rotation at V_R should be smooth and continuous. Rotating late, slow or under rotating causes the take-off ground run to increase.

Advance the throttles to 1.4 EPR or 80% N2. Monitor the engine instruments. Engine acceleration from idle to 1.4 EPR shall not vary more than 3 seconds between engines.

Continue advancing the throttles smoothly to takeoff power. Ensure takeoff power is set by 60 knots. Crosscheck all engine instruments for reasonableness during the take-off roll. This is especially important in icing conditions. All needles should be within normal range. Crosscheck N1 against EPR to verify thrust.

Callouts for “80 knots”, “V_1”, “rotate”, “V_2” and “V_2 + 10” should be made.

At V_R, smoothly rotate into the command bars to takeoff attitude. Do not exceed 20° aircraft nose up (ANU). During normal rotation it will take about 2-3 seconds from start of rotation to liftoff, and approximately the same amount of time from liftoff to takeoff attitude. With proper rotation, liftoff should occur at 8° ANU. Note that with the main gear on the ground, the tail cone will strike the runway at a body angle of 11.5° ANU.

This procedure will result in a smooth liftoff using minimum runway and acceleration to V_2 prior to reaching 35’ AGL. Wings level should be maintained all the way through rotation and initial climb.

Crosswind Takeoff

Use normal takeoff procedures, applying aileron deflection into the wind to maintain wings level. Use rudder to maintain runway centerline. Hold a light forward pressure on the control column for better nosewheel rudder steering.

Takeoff Actions and Callouts:

	PF	PNF
Commencing the takeoff roll	Advance throttles smoothly to takeoff power setting and command “SET POWER”.	Trim throttles to takeoff power setting and call “POWER SET”.
Prior to 80 knots	Check required thrust obtained. Captain takes control of throttles.	
80 knots	Verify airspeed and call “CHECKED”.	Scan engine instruments. Call “80 KNOTS”.
V_1 -5 knots	Captain removes hand from throttles.	Call “V_1”.
V_R	Rotate to takeoff attitude.	Call “ROTATE”.
Positive rate of climb	Command “GEAR UP”.	Call “POSITIVE RATE”. Select gear up.
After liftoff	Establish initial climb speed V_2 + 10 to 20 knots.	Monitor speed and attitude.
500’ AFE	May engage autopilot.	Verify autopilot engagement.
Climbing through 1,000’ AFE	Cancel command bars. Reduce pitch and acceleration. Command “FLAPS UP” at flap retraction speed. Command “SLATS RETRACT” at slat retraction speed. Command “SET CLIMB POWER”. Maintain clean maneuver speed. Call for the After Takeoff Checklist.	Retract flaps. Retract slats. Set climb power and call “POWER SET”. Call the clean maneuver speed. Accomplish After Takeoff checklist.
Acceleration altitude (not lower than 3,000’ AFE).	Accelerate to 250 KIAS.	

Takeoff Procedure:

1. Align the airplane with the runway and check compass heading against the published runway heading.
2. Advance the throttles to 1.4 EPR or 80% N_2.
3. Monitor the engine instruments. Engine acceleration from idle to 1.4 EPR shall not vary more than 3 seconds between engines.
4. Continue advancing the throttles smoothly to takeoff power.
5. Ensure takeoff power is set by 60 knots.
6. Crosscheck all engine instruments for reasonableness during the take-off roll. This is especially important in icing conditions. All needles should be within normal range.
7. Crosscheck N_1 against EPR to verify thrust.
8. Callouts for “80 knots”, “V_1”, “rotate”, “V_2” and “V_2 + 10” should be made.
9. At V_R, smoothly rotate into the command bars to takeoff attitude. Do not exceed 20° ANU (Aircraft Nose Up).
10. During normal rotation it will take about 2-3 seconds from start of rotation to liftoff, and approximately the same amount of time from liftoff to takeoff attitude.
11. With proper rotation, liftoff should occur at 8° ANU. Tail strike may occur at 11.5° ANU.
12. This procedure will result in a smooth liftoff using minimum runway and acceleration to V_2 prior to reaching 35’ AGL.
13. When the aircraft has reached a positive rate of climb…
14. …select gear up and verify that the gear has been properly retracted by observing that all three gear lights are out.
15. Disarm the spoilers.

BELOW 1000 FEET

16. Maintain take-off power.
17. Airspeed V_2 + 10 to 20 knots.
18. Max pitch up angle 20 degrees.
19. Autopilot may be engaged at 500’ AFE.

1000 – 3000 FEET

20. Cancel the command bars
21. Reduce the pitch angle to achieve approximately one half existing rate of climb.
22. Retract flaps on schedule.
23. Retract slats on schedule.
24. When flaps and slats are retracted, set climb power.
25. Airspeed V_{CLEAN} to 3000 feet.

ABOVE 3000 FEET

26. Accelerate to 250 knots by reducing pitch angle a bit more.
27. Maintain a rate of climb of approximately 500 – 1000 FPM during acceleration.
28. Procedure complete.

Rejected Take-off

Due to the critical nature of the rejected takeoff, an immediate and coordinated effort is required by the flight crew. The Captain must be prepared to reject the takeoff: feet in position to apply the brakes and hand ready to retard the throttles.

Any decision to reject the takeoff must be made prior to V_1. If a takeoff is rejected above V_1, there is a high risk that a runway overrun will occur. Rejecting the takeoff prior to V_1 should not be considered unless the aircraft is unflyable.

The decision to reject the takeoff will always be made by the Captain. The Captain calls "REJECT" and thus alerts the First Officer that the Captain is taking over the controls.

Rejected Takeoff Duties – Captain:

- Call "REJECT".
- Simultaneously apply maximum braking and retard the throttles to IDLE.
- Rapidly pull the spoiler handle up, aft and up to latch.
- Apply maximum reverse thrust.
- Maintain maximum reverse thrust and maximum braking until the aircraft comes to a complete stop.

Rejected Takeoff Duties – First Officer:

- If the First Officer is PF, assure positive transfer of aircraft control to the Captain.
- Note the speed at which the takeoff was rejected.
- Apply light forward pressure on the control column.
- Callout indicated airspeeds as the aircraft decelerates.
- Advise ATC of the rejected takeoff.

CLIMB

General

On the climbout, make shallow turns and smooth changes in attitude for passenger comfort.

The initial power reduction from takeoff power to climb power will be called for by the PF and set by the PNF. Subsequent power changes will be set by the PF. The PNF will establish climb EPR with reference to the RAT/EPR gauge.

Altitude	Climb Speed	Max Turbulence Climb Speed
Below 3,000' AFE	Clean Maneuver	Clean Maneuver
3,000' AFE to 10,000' MSL	250 KIAS	250 KIAS
At or Above 10,000' MSL	320 KIAS/M.76	285 KIAS/M.74

Climb/Descent Actions and Callouts:

	PF	PNF
1,000' above or below assigned altitude	Call altitude vacating and assigned altitude. (e.g., "seven for eight")	Verify altitude.
Climbing or descending through 18,000' MSL or transition altitude/level.	Call "18,000, __ __" or "Transition altitude/level, ____", and set altimeter.	Respond "__ __". Verify altitude and set altimeter.
Climbing or descending through 10,000' MSL.	Call "10,000".	Verify altitude.

CRUISE

General

Normally, cruise power and speed is uniquely calculated for each flight according to the aircraft weight, cruise altitude, ISA deviation and cost index data.

In the absence of automated cruise data, refer to the Cruise chart in the Performance section.

When reaching the cruising altitude, level off and maintain climb power until the aircraft has accelerated to the desired cruise airspeed or Mach.

DESCENT

Descent Power and Speed

Descents should be planned and conducted at idle power. Above the Mach crossover altitude, descend at the cruise Mach speed. Below the Mach crossover altitude, descend at 290KIAS. Note that at idle power, there will be a reduction in available bleed air for pressurization and anti-icing. Anticipate potential rough air and the need for anti-ice.

Standard Descent Procedure

The standard procedure for descent is to descend with a clean aircraft at idle power. If the pilot needs to expedite the descent for traffic reasons, speedbrakes should be used to increase the rate of descent.

Descents with flaps/slats extended and/or gear down should be avoided as they are airspeed limited, noisy and expensive.

Suppose we are cruising at 22,000 ft with a 30 knot tailwind and need to descend to the airport, which is at sea level. To manually calculate the Top of Descent point, use the following method:

- Determine the altitude difference (total altitude you need to descend)
- 22,000ft
- Drop the last three digits
- 22,000 → 22
- Multiply by three
- 22 x 3 = 66
- For an unrestricted descent to a landing, add 10 NM.
- 66 + 10 = 76
- For a descent to an intermediate lower altitude, no additive is required.
- Add 2 NM for every 10 knots of tailwind and subtract 2 NM for every 10 knots of headwind.
- 30 knots tailwind
- 76 + (3 x 2) = 82
- Our TOD is approximately 82NM away from our landing destination.

Speedbrake Usage

If needed, the speedbrakes can be used to lose a significant amount of altitude in a relatively short period of time. Due to the high rate of descent resulting from the use of speedbrakes, they should be used with discretion within the airport area and never below initial approach altitude.

The use of speedbrakes reduces passenger comfort as well as reduces fuel efficiency and should be avoided if possible.

Observe the following when operating the speedbrakes:

- Flaps must be up when extending the speedbrakes.
- Operate the speedbrake handle slowly.
- Avoid aileron input during speedbrake extension and retraction.
- Do not extend the landing gear with speedbrakes extended or spoilers armed.
- Retract the speedbrakes prior to reaching clean maneuvering speed.

Cabin Pressurization During Descent

A 3° descent profile will help maintain a 300fpm cabin rate of descent. Multiply the ground speed by six to find the required vertical speed required to maintain a 3° descent profile.

Suppose our groundspeed during descent is 315 KIAS. To maintain a 3° descent profile, we should descend at (6 x 315) = 1890 fpm.

HOLDING

Fuel Economy

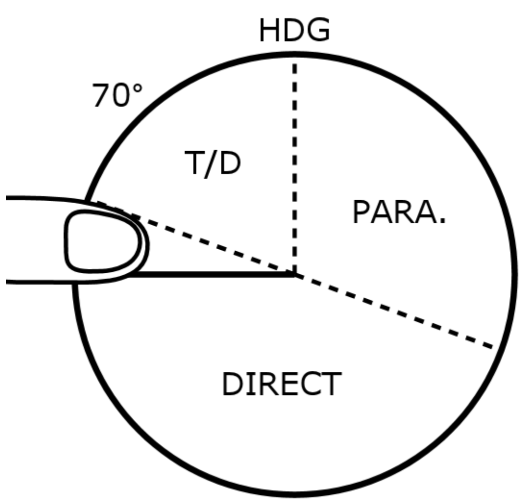
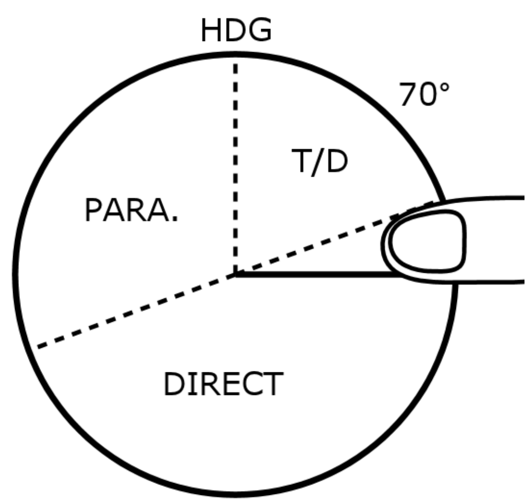
When ordered to enter a holding pattern by ATC, maintain the highest possible altitude to lower fuel consumption.

If prolonged holding is expected, request ATC to increase the size of the holding pattern. This will reduce the number of turns required. Turns require increased power and increased fuel burn.

All holding should be flown with a clean configuration. At or above 14,000ft hold at 220 KIAS. Below 14,000ft hold at 190 KIAS. If fuel is an issue or for best fuel economy, use the speeds in the cruise chart in the Performance section. However, the pilot should always comply with the ATC minimum and maximum holding speeds.

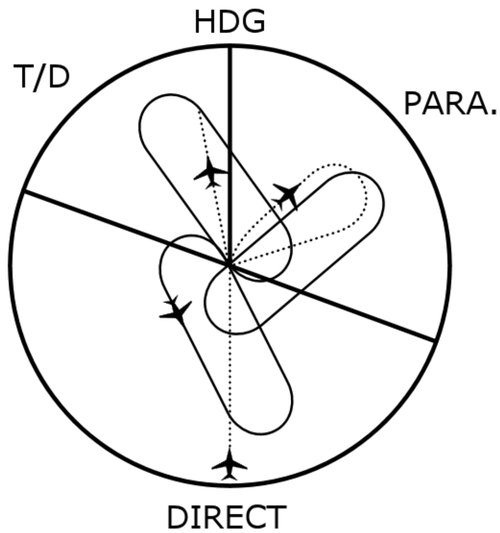
Determining Holding Pattern Entries

As visualized from your RMI (top index being your heading), this thumb type entry will work only with radials. If using NDB, convert bearings to radials.

 	
NON-STANDARD PATTERN For left turns, visualize your left thumb at the 9 o'clock position on the RMI. Any radial between your thumb and heading is teardrop. Opposite segment is parallel; 6 o'clock segment is direct entry.	**STANDARD PATTERN** For right turns, visualize your right thumb at the 9 o'clock position on the RMI. Any radial between your thumb and heading is teardrop. Opposite segment is parallel; 6 o'clock segment is direct entry.

DC-9 Classic – Aircraft Operating Manual

Executing the Entry

<table>
<tr>
<td>


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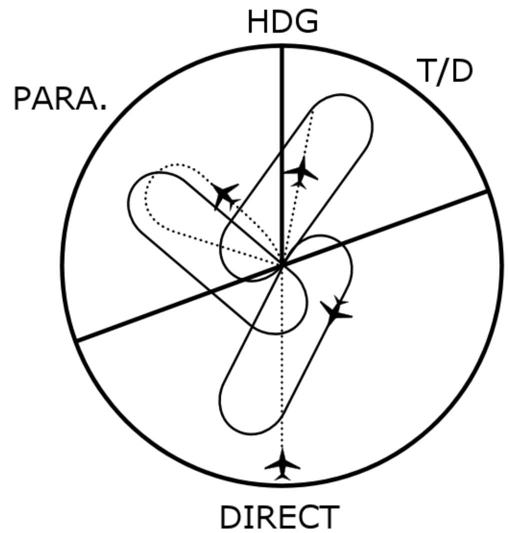

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<tr>
<td>NON-STANDARD</td>
<td>STANDARD</td>
</tr>
<tr>
<td>Teardrop procedure: Proceed outbound on track of 30° to holding course, turn left to intercept holding course.
Parallel procedure: Parallel holding course, turn right and return to holding fix, or intercept holding course.
Direct Entry procedure: Turn left and fly the pattern.</td>
<td>Teardrop procedure: Proceed outbound on track of 30° to holding course, turn right to intercept holding course.
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Direct Entry procedure: Turn right and fly the pattern.</td>
</tr>
</table>

APPROACH SPEED COMPONENTS

When strong and gusty winds are present an approach speed additive is necessary. The minimum additive to V_{REF} (1.3 x V_S) is +5 knots. The maximum additive is +20 knots.

The additive is computed by adding ½ of any steady state wind, and all of the gust.

Conditions:

- Landing Weight: 90,000 lbs.
- Flaps: 40
- Runway: 28

From the speed cards we read V_{A40} = 132. This speed already has 5 knots added. Subtract 5 knots and get V_{REF} = 127 knots, which we will use in the calculations below.

<u>Example #1 – Wind calm:</u>
V_{REF} .... 127 knots
Wind calculations ....0 knots
Gust calculations ....0 knots
Calculated additive...............................0 knots
Additive .... +5 knots minimum
Final Approach Speed ..... 127 + 5 = 132 knots

<u>Example #2 – Wind 280 at 44 knots:</u>
V_{REF} .... 127 knots
Wind calculations ....44 x ½ = 22 knots
Gust calculations ....0 knots
Calculated additive............................ 22 knots
Additive ....+20 knots maximum
Final Approach Speed ...127 + 20 = 147 knots

<u>Example #3 – Wind 260 at 14 knots with gusts to 24 knots:</u>
V_{REF} .... 127 knots
Wind calculations ....14 x ½ = 7 knots
Gust calculations ....24 – 14 = 10 knots
Calculated additive............. 7 + 10 = 17 knots
Additive ....+17 knots maximum
Final Approach Speed ...127 + 17 = 144 knots

ILS APPROACH

Category I ILS Approaches

Complete the ILS approach briefing prior to commencing the approach. If the approach or runway of intended landing is changed, a complete briefing must be accomplished prior to commencing the new approach.

The flight director must be used for all ILS approaches for which an ILS clearance has been received.

Configure the aircraft so as to arrive approximately 5 NM from the final approach fix with flaps extended to 15. When the aircraft is 1 ½ dots below the glideslope, extend the landing gear and call "LANDING CHECKLIST". At ½ dots below the glideslope, extend flaps to 25. When intercepting the glideslope, extend flaps to 40/50 and establish V_{REF} plus additive. Complete the Landing checklist.

CAT I ILS Approach Actions and Callouts

The PNF may have his radio tuned to a station other than the ILS for orientation prior to the FAF. From the FAF, both pilots must have the ILS tuned and both flight directors selected for ILS.

	PF	PNF
Initial approach	Command "FLAPS 15".	Selects flaps to 15°.
When cleared for the approach (and within 90° of intercepting the final approach course).	Select flight director to ILS and altitude hold ON. Check FMA for N/L ARM and ALT HLD.	
LOC alive	Check CDI.	Call "LOCALIZER ALIVE".
LOC capture	Check FMA for G/P ARM and ALT HLD.	
G/S alive	Check G/S.	Call "GLIDESLOPE ALIVE".
1 ½ dots	Command "GEAR DOWN. LANDING CHECKLIST".	Select gear down. Read Landing checklist.
½ dot	Command "FLAPS 25".	Select flaps to 25°.

G/S intercept	Command "FLAPS 40/50". Check FMA for G/P CAP. Reduce to VREF + additive. Command "SET MISSED APPROACH ALTITUDE".	Select flaps to 40/50°. Complete Landing checklist and call "LANDING CHECKLIST COMPLETE. Set missed approach altitude.
1,000' AFE	Verify altitude.	Call "1,000 FEET".
500' AFE	Verify altitude, speed and sink rate.	Call "500 FEET, REF PLUS ___, SINK ___".
DA + 100'	Verify altitude.	Call "100 ABOVE". Divide time between monitoring instruments and scanning outside for runway environment.
DA	Call "LANDING" and land the aircraft, or "GO AROUND" and execute the missed approach.	Call "MINIMUMS" and either "RUNWAY IN SIGHT" or "NO CONTACT".

Category II ILS Monitored Approach

> Pilots must use the “monitored” approach procedure on all Category II approaches.
> The Captain will always brief all Category II approaches.

Upon completion of the approach briefing, the Captain will fly the aircraft to the “1,000 FEET” callout.

At the “1,000 FEET” callout, the First Officer will assume control of the throttles. From this point and continuing through the approach, the First Officer will have his left hand on the throttle, right hand on the control column with his/her thumb next to the autopilot disconnect button. The Captain will have his right hand at the base of the throttles, left hand on the control column with his/her thumb next to the autopilot disconnect button.

At the “100 ABOVE” call, the Captain will respond “OUTSIDE” and start scanning the outside for airport environment. The First Officers continues to scan the instruments and FMA.

When the First Officer calls “MINIMUMS”, one of three things will occur:

1. If the Captain has the runway environment in sight, he/she will call “LANDING”. The Captain will disengage the autopilot, lift the First Officers hand off of the throttles and land the aircraft. The First Officer continues to monitor the instruments until touchdown.
2. If the Captain does not see the runway environment, he/she will call “GO AROUND”. The First Officer will push the TOGA button and execute a go-around.
3. If the Captain does not respond to the “MINIMUMS” call at all, the First Officer will immediately push the TOGA button and execute a go-around.

CAT II ILS Monitored Approach Actions and Callouts

<table>
<tr><th></th><th>CAPTAIN</th><th>FIRST OFFICER</th></tr>
<tr><td>Initial approach</td><td>Command “FLAPS 15”.</td><td>Selects flaps to 15°.</td></tr>
<tr><td rowspan="3">When cleared for the approach (and within 90° of intercepting the final approach course)</td><td colspan="2">Select flight director and autopilot to ILS, and altitude hold ON.</td></tr>
<tr><td colspan="2">Check FMA for N/L ARM and ALT HLD.</td></tr>
<tr><td>Check FMA for N/L ARM and G/P ARM.</td><td></td></tr>
<tr><td>LOC alive</td><td>Check CDI.</td><td>Call “LOCALIZER ALIVE”.</td></tr>
<tr><td rowspan="2">LOC capture</td><td colspan="2">Check FMA for G/P ARM and ALT HLD.</td></tr>
<tr><td>Check FMA for N/L CAP and G/P ARM.</td><td></td></tr>
<tr><td>G/S alive</td><td>Check G/S.</td><td>Call “GLIDESLOPE ALIVE”.</td></tr>
</table>

1 ½ dots	Command “GEAR DOWN, LANDING CHECKLIST”.	Select gear down, read landing checklist.
½ dot	Command “FLAPS 25”.	Select flaps to 25°.
G/S intercept	Command “FLAPS 40/50”. Check FMA for G/P CAP. Reduce to V_{REF} + additive. Command “SET MISSED APPROACH ALTITUDE”.	Select flaps to 40°/50°. Complete Landing checklist and call “LANDING CHECKLIST COMPLETE”. Set missed approach altitude.
1,000’ AFE	Verify altitude. Guard throttles. Guard autopilot disconnect button Monitor approach.	Call “1,000 FEET”. Take control of throttles.
500’ AFE	Verify altitude, speed and sink rate.	Call “500 FEET, REF PLUS ___, SINK ___”.
DH + 100’	Call “OUTSIDE” and divert scan outside of cockpit.	Call “100 ABOVE”.
DH	Call “LANDING”, lift FOs hand from throttles, disconnect autopilot, and land the aircraft, *OR* Call “GO-AROUND” and perform PNF go-around duties.	Call “MINIMUMS”. Monitor transfer of throttles and disengagement of autopilot. Monitor LOC and G/S for deviations. Execute the missed approach. *Note: If the Captain fails to respond, execute the missed approach.*

NON-PRECISION APPROACH

General

Non-precision approaches such as VOR, LOC, NDB, LDA, ASR and LOC (BACK CRS) may be flown manually or using the autopilot.

On a LOC (BACK CRS) approach, insert the front course in the course window of the HSI. Silence the aural glideslope warning by activating the G/S INHIBIT switch.

Descend to the MDA using non-precision approach procedures, or using the glideslope, if available.

If flying the approach with the autopilot engaged, use the TURN KNOB or place the heading select switch to ON for steering, or select NAV/LOC to maintain the localizer course. Use the vertical speed control wheel to maintain the glideslope.

The aircraft should be configured and on speed for landing by the FAF. Start your timer when passing the FAF whenever this is to be used as the primary or secondary means of determining the MAP.

Carefully monitor speed and altitude and leave specified step-down altitudes promptly after crossing appropriate fixes.

Set the altitude alerter to the published MDA. Round up to the nearest 100' (e.g. if the MDA is 810', set the altitude alerter to 900'). When an intermediate step-down altitude is designated, set the altitude alerter to the step-down altitude, then to the MDA.

Non-Precision Approach Actions and Callouts

	PF	PNF
Initial approach	Command “FLAPS 15”.	Select flaps to 15°.
Approximately 5 NM from the FAF	Command “GEAR DOWN, LANDING CHECKLIST”.	Select gear down. Read the Landing checklist.
Prior to FAF	Command “FLAPS 25”. Command “FLAPS 40/50”. Reduce to V_{REF} + additive.	Select flaps to 25°. Select flaps to 40/50°. Complete the Landing checklist. Call “LANDING CHECKLIST COMPLETE”.
FAF or leaving last intermediate step-down altitude	Initiate descent to MDA Command “SET MDA”.	Start timing, if applicable. Notify ATC. Set MDA (round up to the next 100’).
1,000’ AFE	Verify altitude.	Call “1,000 FEET”.
MDA + 100’	Verify altitude.	Call “100 ABOVE”.
MDA	Command “SET MISSED APPROACH ALTITUDE”.	Call “MINIMUMS”. Set missed approach altitude.
MAP	Call “LANDING” and land the aircraft, or “GO AROUND” and execute the missed approach procedure.	Call “MISSED APPROACH POINT”, and “RUNWAY IN SIGHT” or “NO CONTACT”.

VISUAL APPROACH

General

Maintain a minimum altitude of 1,500' AFE until on the base leg. Turn base abeam the intended rollout point on final.

When cleared for a visual approach, set the altitude alerter to the backup instrument approach. If no backup instrument approach is available, set the altitude alerter to 1,500' above field elevation.

Turning base:

- Gear down
- Landing checklist
- Flaps 25°

Turning final, roll out on:

- a 3-mile final (minimum)
- extended runway centerline
- electronic glideslope or VASI/PAPI

At 1,000' AFE:

- Engines spooled
- Select landing flaps
- Complete Landing checklist

At 500' AFE:

- Landing configuration
- Airspeed: VREF + additive
- Sink rate: 500 to 800 FPM

A good rule of thumb on final approach to give a 3° glide path: One-half the ground speed (knots) times ten will give the required rate of descent.

For example GS= 100, (100 / 2) x 10 = 500fpm

Another good rule of thumb: For a 3° glide path maintain 300 feet of altitude for each mile from the touchdown.

For example: If you are 5 miles from touchdown, 5 x 300 = 1500 feet. You should be at 1500 feet altitude when 5 miles from touchdown.

Visual Illusions

Be alert for the following visual illusions when executing a visual approach:

Runway Slope
An up-sloping runway creates an illusion of being high on the approach. A down-sloping runway creates the illusion of being low on the approach.

Visibility
Rain, haze, dust, smoke, glare or darkness may cause the illusion of being too high on the approach.

Runway Lighting
Strong, bright runway lights appear to be closer while dim runway lights appear to be farther away.

Runway Dimensions
The width versus length ratio of the runway will also affect visual perspective.

	PF	PNF
1,000' AFE	Verify altitude.	Call "1,000 FEET".
500' AFE	Verify altitude, speed and sink rate.	Call "500 FEET, REF ___, SINK ___".

GO-AROUND/MISSED APPROACH

A go-around is the actual flying of the aircraft when an approach cannot be completed to a landing.

A missed approach is the route of flight and altitude (published or instructed) to be flown when an approach cannot be completed to a landing.

Advance the throttles to go-around power, and rotate towards 15° ANU (with V_2 as the target speed). Retract flaps to 15°. With a positive rate of climb, raise the landing gear. Spoilers should be disarmed, time permitting. Proceed as with a normal takeoff.

To quickly determine V_2 in the event of a go-around, use V_{REF} 40/50 + 10 knots for a two engine go-around, and V_{REF} 25 for a single-engine go-around.

Go-Around Actions and Callouts

	PF	PNF
Go-around	Command “GO AROUND”. Disconnect the autopilot (if engaged) and depress the TOGA switch (precision approaches only) while simultaneously advancing the throttles to go-around EPR. Command “MAX POWER”. Rotate into command bars (20° ANU maximum). Command “FLAPS 15”. **Single engine:** Maintain V_2.	Check FMA for SPD CMD (if applicable). Monitor GA EPR. Adjust if necessary and call “POWER SET”. Monitor pitch attitude. Retract flaps to 15°.
Positive rate of climb	Command “GEAR UP”. Command “ADVISE ATC” and “DISARM SPOILERS”.	Call “POSITIVE RATE”. Select gear up. Advise ATC and disarm the spoilers.
1,000’ AFE or OCA	Proceed with normal takeoff profile. **Single-engine:** Proceed with Engine Failure on Takeoff procedure.	

LANDING

General

The engines must be spooled by 1,000' AFE. In VMC only, final flap selection can be delayed until no later than 1,000' AFE.

By 500' AFE the aircraft must be stabilized in landing profile: airspeed V_{REF} + additive, sink rate 500 to 800 FPM. Glideslope or VASI/PAPI must be used, if available. The 1,000' runway marking is the aiming point.

On final approach, sink rates in excess of 800 FPM should be called out. When sink rates exceed 1,000 FPM, a go-around should be considered (depending upon altitude above the ground) rather than continue with a poor approach.

Cross the runway threshold at 50' at an airspeed of V_{REF} + additive. Touchdown should occur at V_{REF} to V_{REF} minus 5 knots. A prolonged flare and hold-off is not desirable, as excessive runway is consumed or a tail strike is possible.

If the spoilers are armed, the ground spoilers will actuate to 60° at aircraft touchdown. The spoilers will actuate with main wheel spin-up or actuation of the ground switch mechanism on the nose gear leg. On a wet runway, hydroplaning may prevent wheel spin-up sufficient to automatically deploy the spoilers. If the ground spoilers do not extend, pull the spoiler handle up, aft, and up to latch.

If the aircraft bounces or balloons, avoid extreme attitude changes and use the following steps to recover:

- Hold or re-establish a normal landing attitude.
- If the bounce is high and likely to cause excessive runway use for the recovery, initiate a go-around. As the aircraft may touch down a second time on a go-around, do not retract the landing gear until a positive rate of climb has been established.
- Do not push the nose over as this will most likely cause another bounce and possible damage the nose gear.
- Do not increase pitch above normal as this will only increase the height of the bounce and could cause the tail to strike the runway.

The landing distance is affected by the glide path as well as the height above the runway threshold. For example, crossing the threshold at 100 feet instead of 50 feet can increase the landing distance by up to 950 feet on a 3° glide slope. A glide slope of 1° can increase the landing distance by up to 1,500 feet.

Crosswind Landing

On final approach, establish a crab angle to fly the aircraft on the extended runway centerline. Maintain the crab until just before the flare. In the flare, apply rudder to align the aircraft with the runway, and apply aileron input to bank the aircraft into the wind to maintain zero drift. Note that the wingtip will make ground contact at an 8° bank angle).

Do not attempt to hold off the downwind wheels by aileron deflection. Prompt and firm runway contact with the main landing gear will greatly assist in rollout stabilization. Proper aileron input is necessary to keep the wings level and assist in directional control during the rollout.

Reverse Thrust

Upon touchdown, position the reverse levers into the REVERSE IDLE detent. The PNF will call the number of illuminated amber reverser lights. As the PF applies reverse thrust, the PNF will call out the number of illuminated reverser lights and the applied EPR.

When the PNF call "80 KNOTS", the PF will begin reducing reverse thrust. When the PNF calls "60 KNOTS", the reversers will normally be retracted. However, subject to the Captains discretion, the reversers may remain extended until the landing roll is completed.

Normal reverse thrust to be used is 1.6 EPR. Under adverse conditions, such as the aircraft approaching the end of the runway with excessive speed, use as much reverse thrust as necessary.

When landing on wet or slippery runways or single-engine operation, initiate reverse thrust after nose wheel contact.

When reverse thrust is used, the exhaust gases from the engines are deflected by the thrust reverse buckets disrupting the airflow over the vertical stabilizer and rudder, thereby reducing rudder authority. In the event of directional control problems during rollout, reduce reverse thrust or select forward idle if necessary to maintain or regain directional control.

ENGINE THRUST SETTING	MAXIMUM RUDDER EFFECTIVENESS
Forward idle	100%
Reverse idle	65%
1.3 EPR	45%
1.6 EPR	15%

The above table is based on a speed of 100 KIAS. Rudder effectiveness decreases with decreasing airspeed.

Reverse thrust in excess of 1.6 EPR may cause compressor stall. If compressor stalls are encountered (backfiring sounds, EPR fluctuations), reduce reverse thrust.

When landing on a wet or slippery runway, do NOT attempt to steer using asymmetrical reverse thrust. Use of asymmetrical forward thrust to regain directional control is allowed.

Brakes

Brake effectiveness increases dramatically above 80 knots. Normally, brakes are not applied until the aircraft decelerates close to or below 80 knots. This technique will prevent excessive wear and prevent overheating. However, when conditions warrant, brakes should be applied as needed.

Landing Actions and Callouts

	PF	PNF
Touchdown	Select reverse thrust.	Call "___ LIGHTS".
Rollout	After nose wheel touchdown, apply brakes as required.	Call "___ LIGHTS" and "___EPR". Monitor deceleration.
80 knots	Select idle reverse.	Call "80 KNOTS".
60 knots	Stow reverse levers.	Call "60 KNOTS".

TAXI-IN

General

When workload permits, accomplish the After Landing checklist.

At the Captain's discretion, the right engine may be shut down prior to arriving at the gate. If desired, shut down the right engine no sooner than 5 minutes after landing, or upon arrival at the gate, whichever occurs first.

To reduce the risk of FOD, set the flaps to 15° for taxi to the gate. Retract the flaps and slats when approaching the gate area/ramp.