

Preface

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MD-88/90
Operations Manual Volume 1
Delta Air Lines, Inc.

Revision Number: 16
Revision Date: February 26, 2016
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Preface

Model Identification

Chapter P1

Section 1

General

The aircraft listed in the table below are covered in this manual. The numbers are used to distinguish data peculiar to one or more, but not all of the aircraft. Where data applies to all aircraft listed, no reference is made to individual ship numbers.

Ship number is supplied by the operator. Registry number is supplied by the national regulatory agency. Serial number is supplied by Boeing.

The procedures and information contained in this manual also apply to aircraft acquired by Delta Air Lines subsequent to the current revision; however, this document may not address all pertinent information for these aircraft. In such instances, specific operating procedures and systems information can be found in appropriate Differences Chapter(s) and/or Fleet Bulletin(s) prior to their incorporation in the next scheduled revision.

Ship Number	Registry Number	Serial Number	Model
0904	N904DL	49535	MD-88
0905	N905DL	49536	MD-88
0906	N906DL	49537	MD-88
0907	N907DL	49538	MD-88
0908	N908DL	49539	MD-88
0910	N910DL	49541	MD-88
0911	N911DL	49542	MD-88
0912	N912DL	49543	MD-88
0913	N913DL	49544	MD-88
0914	N914DL	49545	MD-88
0915	N915DL	49546	MD-88
0916	N916DL	49591	MD-88
0917	N917DL	49573	MD-88
0918	N918DL	49583	MD-88
0919	N919DL	49584	MD-88
0920	N920DL	49644	MD-88

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Ship Number	Registry Number	Serial Number	Model
0921	N921DL	49645	MD-88
0922	N922DL	49646	MD-88
0923	N923DL	49705	MD-88
0924	N924DL	49711	MD-88
0925	N925DL	49712	MD-88
0926	N926DL	49713	MD-88
0927	N927DA	49714	MD-88
0928	N928DL	49715	MD-88
0929	N929DL	49716	MD-88
0930	N930DL	49717	MD-88
0931	N931DL	49718	MD-88
0932	N932DL	49719	MD-88
0933	N933DL	49720	MD-88
0934	N934DL	49721	MD-88
0935	N935DL	49722	MD-88
0936	N936DL	49723	MD-88
0937	N937DL	49810	MD-88
0938	N938DL	49811	MD-88
0939	N939DL	49812	MD-88
0940	N940DL	49813	MD-88
0941	N941DL	49814	MD-88
0942	N942DL	49815	MD-88
0943	N943DL	49816	MD-88
0944	N944DL	49817	MD-88
0945	N945DL	49818	MD-88
0946	N946DL	49819	MD-88
0947	N947DL	49878	MD-88



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Ship Number	Registry Number	Serial Number	Model
0948	N948DL	49879	MD-88
0949	N949DL	49880	MD-88
0950	N950DL	49881	MD-88
0951	N951DL	49882	MD-88
0952	N952DL	49883	MD-88
0953	N953DL	49884	MD-88
0954	N954DL	49885	MD-88
0955	N955DL	49886	MD-88
0956	N956DL	49887	MD-88
0957	N957DL	49976	MD-88
0958	N958DL	49977	MD-88
0959	N959DL	49978	MD-88
0960	N960DL	49979	MD-88
0961	N961DL	49980	MD-88
0962	N962DL	49981	MD-88
0963	N963DL	49982	MD-88
0964	N964DL	49983	MD-88
0965	N965DL	49984	MD-88
0966	N966DL	53115	MD-88
0967	N967DL	53116	MD-88
0968	N968DL	53161	MD-88
0969	N969DL	53172	MD-88
0970	N970DL	53173	MD-88
0971	N971DL	53214	MD-88
0972	N972DL	53215	MD-88
0973	N973DL	53241	MD-88
0974	N974DL	53242	MD-88

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Ship Number	Registry Number	Serial Number	Model
0975	N975DL	53243	MD-88
0976	N976DL	53257	MD-88
0977	N977DL	53258	MD-88
0978	N978DL	53259	MD-88
0979	N979DL	53266	MD-88
0980	N980DL	53267	MD-88
0981	N981DL	53268	MD-88
0982	N982DL	53273	MD-88
0983	N983DL	53274	MD-88
0984	N984DL	53311	MD-88
0985	N985DL	53312	MD-88
0986	N986DL	53313	MD-88
0987	N987DL	53338	MD-88
0988	N988DL	53339	MD-88
0989	N989DL	53341	MD-88
0990	N990DL	53342	MD-88
0991	N991DL	53343	MD-88
0992	N992DL	53344	MD-88
0993	N993DL	53345	MD-88
0994	N994DL	53346	MD-88
0995	N995DL	53362	MD-88
0996	N996DL	53363	MD-88
0997	N997DL	53364	MD-88
0998	N998DL	53370	MD-88
0999	N999DN	53371	MD-88
9000	N900DE	53372	MD-88
9001	N901DE	53378	MD-88



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Ship Number	Registry Number	Serial Number	Model
9002	N902DE	53379	MD-88
9003	N903DE	53380	MD-88
9004	N904DE	53409	MD-88
9005	N905DE	53410	MD-88
9006	N906DE	53415	MD-88
9007	N907DE	53416	MD-88
9008	N908DE	53417	MD-88
9009	N909DE	53418	MD-88
9010	N910DE	53419	MD-88
9011	N911DE	49967	MD-88
9012	N912DE	49997	MD-88
9013	N913DE	49956	MD-88
9014	N914DE	49957	MD-88
9015	N915DE	53420	MD-88
9016	N916DE	53421	MD-88
9017	N917DE	49958	MD-88
9018	N918DE	49959	MD-88
9019	N919DE	53422	MD-88
9020	N920DE	53423	MD-88
9201	N901DA	53381	MD-90-30
9202	N902DA	53382	MD-90-30
9203	N903DA	53383	MD-90-30
9204	N904DA	53384	MD-90-30
9205	N905DA	53385	MD-90-30
9206	N906DA	53386	MD-90-30
9207	N907DA	53387	MD-90-30
9208	N908DA	53388	MD-90-30

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Ship Number	Registry Number	Serial Number	Model
9209	N909DA	53389	MD-90-30
9210	N910DN	53390	MD-90-30
9211	N911DA	53391	MD-90-30
9212	N912DN	53392	MD-90-30
9213	N913DN	53393	MD-90-30
9214	N914DN	53394	MD-90-30
9215	N915DN	53395	MD-90-30
9216	N916DN	53396	MD-90-30
9217	N917DN	53552	MD-90-30
9218	N918DH	53553	MD-90-30
9219	N919DN	53576	MD-90-30
9220	N920DN	53582	MD-90-30
9221	N921DN	53583	MD-90-30
9222	N922DX	53584	MD-90-30
9223	N923DN	53585	MD-90-30
9224	N924DN	53586	MD-90-30
9225	N925DN	53587	MD-90-30
9226	N926DH	53588	MD-90-30
9227	N927DN	53589	MD-90-30
9228	N928DN	53590	MD-90-30
9229	N929DN	53459	MD-90-30
9230	N930DN	53458	MD-90-30
9231	N931DN	53544	MD-90-30
9232	N932DN	53457	MD-90-30
9233	N933DN	53543	MD-90-30
9234	N934DN	53462	MD-90-30
9235	N935DN	53460	MD-90-30



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Ship Number	Registry Number	Serial Number	Model
9236	N936DN	53461	MD-90-30
9237	N937DN	53352	MD-90-30
9238	N938DN	53353	MD-90-30
9239	N939DN	53356	MD-90-30
9240	N940DN	53359	MD-90-30
9241	N941DN	53555	MD-90-30
9242	N942DN	53556	MD-90-30
9243	N943DN	53557	MD-90-30
9244	N944DN	53558	MD-90-30
9245	N945DN	53559	MD-90-30
9246	N946DN	53354	MD-90-30
9247	N947DN	53355	MD-90-30
9248	N948DN	53357	MD-90-30
9249	N949DN	53358	MD-90-30
9250	N950DN	53360	MD-90-30
9251	N951DN	53361	MD-90-30
9252	N952DN	53560	MD-90-30
9253	N953DN	53523	MD-90-30
9254	N954DN	53524	MD-90-30
9255	N955DN	53525	MD-90-30
9256	N956DN	53526	MD-90-30
9257	N957DN	53527	MD-90-30
9258	N958DN	53528	MD-90-30
9259	N959DN	53529	MD-90-30
9260	N960DN	53530	MD-90-30
9261	N961DN	53531	MD-90-30
9262	N962DN	53532	MD-90-30

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Ship Number	Registry Number	Serial Number	Model
9263	N963DN	53533	MD-90-30
9264	N964DN	60001	MD-90-30
9265	N965DN	60002	MD-90-30



General

The manufacturer has developed normal and non-normal procedures for the MD-88/90 aircraft. Delta Air Lines, Inc. has modified some of these procedures for simplification and standardization, when appropriate, with other aircraft operated by Delta Air Lines, Inc. Finally, the FAA has approved the procedures presented in this Operations Manual.

These procedures are intended to be followed during normal ground operations and in flight. Deviations from these procedures should be made only with good cause and based on the safest course of action. The captain's best judgment must be applied if an abnormality occurs that is not covered by these procedures.

Manual Rights

The MD-88/90 Operations Manual has been prepared for the exclusive use of Delta Air Lines, Inc., Flight Operations personnel under the direction and authority of Delta and shall, at all times, remain the property of Delta. The holder hereof acknowledges and agrees that this manual contains or may contain trade secrets, copyrighted material and commercial and proprietary information, privileged and confidential, to the interest of Delta, and the holder hereof further agrees that this manual may not be reproduced, distributed or copied, in whole or in part, without the express prior written consent of Delta.

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Corrections to the Manual

Log on to the Delta Flight Operations Portal, <http://dlnet.delta.com> and submit a Publications Change Request (PCR) to correct any errors or discrepancies discovered in this manual, or to submit a suggested change to any Aircraft Operating Manual, Volume 1, Volume 2, Quick Reference Handbook (QRH), Flight Crew Training Manual (FCTM), Normal Checklist, Airway Manual (AM), Flight Operations Manual (FOM), Operating Experience (OE/TOE) Guide, Fleet Bulletin (FB), or All Pilots Bulletin (APB).

There are links to the PCR form on each fleet page and also on the Flight Ops Manuals/Library Services page. Once submitted, the PCR is automatically routed to the applicable Fleet Technical Manager and Technical Writer for that manual.

Organization

The operations manual is organized in the following manner.

Volume 1

- Preface - Contains general information regarding the manual's purpose, structure, and content. It also contains lists of abbreviations, a record of revisions and a list of effective pages.
- Limitations - Covers operational limitations.
- Normal Procedures - Covers all amplified normal operating procedures and are based on a thorough analysis of crew activity required to operate the aircraft, and reflect the latest knowledge and experience available.
- Normal Operational Information - Contains reference material used to support normal procedures.
- Supplementary Procedures is organized by system and covers:
 - any procedure that is non-routine in nature,
 - any first-flight-of-the-day test or other systems test,
 - guidance on lengthy operating procedures, and
 - adverse weather procedures and guidance.
- Differences - Notes differences between aircraft models and variants.

Volume 2

- Preface - Contains general information regarding the manual's purpose, structure, and content. It also contains lists of abbreviations, a record of revisions and a list of effective pages.
- Contains general aircraft and systems information. These chapters are generally subdivided into sections covering controls and indicators and systems descriptions.

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- Non-normal checklists - Contains checklists used to manage non-normal situations.
- Non-Normal Operational Information - Contains reference material used to support non-normal procedures.
- Non-Normal Checklist Instructions - Contains non-normal checklist instructions and evacuation flow/philosophy.
- Revision Record - Contains general information regarding the manual's purpose, structure, and content. It also contains lists of abbreviations, a record of revisions and a list of effective pages.

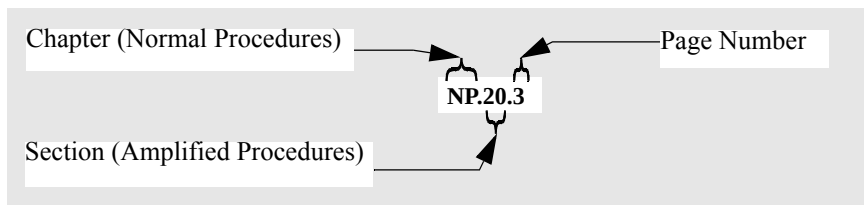
FCTM

- Preface - Contains general information regarding the manual's purpose, structure, and content. It also contains lists of abbreviations, a record of revisions and a list of effective pages.
- Provides information and recommendations on aircraft operations, maneuvers, and techniques.

Page Numbering

This manual uses a decimal page numbering system. The page number is divided into three fields; chapter, section, and page. An example of a page number for the Normal Procedures chapter follows:

Example Page Number



Warnings, Cautions, and Notes

The following levels of written advisories are used throughout the manual.

Warning - A warning is an instruction about a hazard that if ignored could result in injury, loss of aircraft control, or loss of life. A warning will appear prior to the applicable step or item.

WARNING: Do not pressurize any hydraulic or pneumatic system until clearance is obtained from Maintenance.

Caution - A caution is an instruction concerning a hazard that if ignored could result in damage to equipment. A caution will appear prior to the applicable step or item.

CAUTION: Do not set takeoff thrust until oil temperature is above 50°C.

Note - A note provides amplified information, instruction, or emphasis. A note will appear after the applicable step or item.

Note: The checklist must not be modified in any way.

Aircraft Effectivities

Differences in aircraft configuration are shown by use of aircraft effectivities throughout Volumes 1 and 2, QRH, and the FCTM. The following rules are used to express aircraft effectivities:

- Aircraft effectivities are listed by model and/or ship number. A range of aircraft is defined by a dash, e.g. 9901 - 9910. A comma in the effectivity range indicates a break in the range, e.g. 9901 - 9910, 9912 - 9925; aircraft 9911 is excluded from the range. Aircraft introduced to the fleet following manual publication are effective as subsequent ships, e.g. 9901 & Subsequent.
- Aircraft effectivities are listed in bold text throughout the manual, except in the Limitations chapter. In the Limitations chapter, aircraft effectivities are listed in bold when the effectivity applies to the entire section or subsection. When the effectivity applies only to a step within a section, it is listed in normal text.
- Aircraft effectivities apply only to the paragraph, illustration, operational note, procedural step, etc. and to subordinate items (if any). Refer to the examples below.

Example (with subordinate items):

9951 – 9961	
CTR TK PUMP (affected).....	OFF
Do not open the WING X FEED valve.	
OUTR TK XFR.....	ON

In this example, the effectivity 9951 - 9961 applies to the first procedural step (CTR TK PUMP.....) and the further indented/subordinate step (Do not...). The effectivity does not apply to the next equivalently indented step (OUTR TK XFR.....).

Example (without subordinate items):

Using ship number:

9951 – 9961	
CTR TK PUMP (affected).....	ON
OUTR TK XFR.....	OFF

In this example, the effectivity 9951 - 9961 applies to the first procedural step (CTR TK PUMP) only. The effectivity does not apply to the next procedural step (OUTR TK XFR).

Using model number:

767-300	
EQUIPMENT COOLING mode selector.....	AUTO

In this example, the 767-300 will have the selector in the AUTO position.

When airplane effectivities are centered immediately below a checklist title, the entire checklist applies to the listed airplanes. In the following example, the FUEL L + R CTR PUMPS LO PR checklist is applicable to 9951-9961 only:

FUEL L + R CTR PUMPS LO PR
9951-9961

Preface

Abbreviations

Chapter P1

Section 3

General

The following abbreviations may be found throughout the manual. Some abbreviations may also appear in lowercase letters. Abbreviations having very limited use are explained in the chapter where they are used. Since this list is compiled across several fleets, there may be some abbreviations that do not apply to this specific fleet.

A	
ABV	Above
AC	Alternating Current or Aircraft
ACARS	Aircraft Communications Addressing and Reporting System
ACB	Automatic Thrust Cutback
ACE	Actuator Control Electronics
ACP	Audio Control Panel
ACT	Active
ADC	Air Data Computer
ADF	Automatic Direction Finder
ADI	Attitude Director Indicator
ADIRS	Air Data Inertial Reference System
ADIRU	Air Data Inertial Reference Unit
ADM	Air Data Module
AED	Automated External Defibrillator
AFB	Alternate Fuel Burn

AFDC	Autopilot Flight Director Computer
AFDS	Autopilot Flight Director System
AFE	Above Field Elevation
AFM	Airplane Flight Manual (FAA approved)
AFM - DPI	Airplane Flight Manual - Digital Performance Information
AFS	Automatic Flight System (Autopilot or Autothrottle)
A/G	Air/Ground
AGL	Above Ground Level
AH	Alert Height
AHRS	Attitude Heading Reference System
AI	Anti-Ice
AIL	Aileron
AIMS	Airplane Information Management System
ALFA	Safe Stall Margin Speed
ATL	Altitude
ALT ACQ	Altitude Acquire
ALT HOLD	Altitude Hold

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ALTN	Alternate
AM	Amplitude Modulation
AMI	Airline Modifiable Information
AMM	Aircraft Maintenance Manual
ANP	Actual Navigational Performance
ANT	Antenna
ANU	Aircraft Nose Up
AOA	Angle of Attack
AOC	Airline Operational Communication Data Link
A/P	Autopilot
APB	All Pilots Bulletin
APL	Airplane
APP	Approach
APU	Auxiliary Power Unit
AR	Authorization Required
ARINC	Aeronautical Radio, Incorporated
ARM	Aircraft Restrictions Manual
ARPT	Airport
ARR	Arrival
ART	Automatic Reserve Thrust
ASA	Autoland Status Annunciator
ASI	Airspeed Indicator
ASR	Airport Surveillance Radar
ASYM	Asymmetry

A/T	Autothrottle
ATA	Actual Time of Arrival
ATC	Air Traffic Control
ATIS	Automated Terminal Information Service
ATM	Assumed Temperature Method
ATT	Attitude
AUTO	Automatic
AUTO-THROT	Autothrottle
AUX	Auxiliary
AVAIL	Available
AWABS	Automated Weight and Balance System
B	
BARO	Barometric
BAT	Battery
B/C or B/CRS or BAC or BCS	Back Course
BFO	Beat Frequency Oscillator
BITE	Built-In Test Equipment
BKR	Breaker
BLD	Bleed
BLW	Below
BRG	Bearing
BRT	Bright
BTL	Bottle
BTL DISCH	Bottle Discharge (fire extinguisher)

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BTMS	Brake Temperature Monitoring System
C	
C	Captain or Celsius or Center or Cool
CAA	Civil Aviation Authority
CADC	Central Air Data Computer
CALSEL	Call Select
CANC/RCL	Cancel/Recall
CANPA	Constant Angle Non-Precision Approach
CAP	Capture
CAPT	Captain
CAWS	Central Aural Warning System
CB	Circuit Breaker
CCD	Cursor Control Device
CDS	Common Display System
CDU	Control Display Unit
CFIT	Controlled Flight Into Terrain
CG	Center of Gravity
CHKL	Checklist
CHR	Chronograph
CKD	Checked
CKT	Circuit
CL	Close
CLB	Climb
CLMP	Computer Lockout Manual Power

CLR	Clear
CMD	Command
CO	Company
COMM	Communication
COMP	Comparator
COMPT	Compartment
CON	Continuous
CONFIG	Configuration
CONT	Control
COOL	Cooling
CRM	Crew Resource Management
CRS	Course
CRT	Cathode Ray Tube
CRZ	Cruise
CTL	Control
CTR	Center
CWS	Control Wheel Steering
D	
DA	Decision Altitude
DA(H)	Decision Altitude (Height)
DC	Direct Current
DCU	Display Concentrator Unit
D/D	Direct Descent
DDA	Derived Decision Altitude (MDA +50 feet)
DDG	Dispatch Deviations Guide
DEL	Delete
DEP	Departure

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DEP ARR	Departure Arrival
DEPR	Depressurize
DES	Descent
DEU	Display Electronic Unit
DFCS	Digital Flight Control System
DFGC	Digital Flight Guidance Computer
DFGS	Digital Flight Guidance System
DH	Decision Height
DIFF	Differential
DIR	Direct
DISC	Disconnect
DISCH	Discharge
DK	Deck
DME	Distance Measuring Equipment
DN	Down
DPC	Display Processing Computer
DSP	Display Select Panel
DSPL	Display
DTG	Distance to Go
DTW	Distance to Waypoint
DU	Display Unit
E	
EADI	Electronic Attitude Director Indicator
ECON	Economy
E/D	End of Descent
E/E	Electrical/Electronic

EEC	Electronic Engine Control
EFI	Electronic Flight Instruments
EFIS	Electronic Flight Instrument System
EGPWS	Enhanced Ground Proximity Warning System
EGT	Exhaust Gas Temperature
EHSI	Electronic Horizontal Situation Indicator
EICAS	Engine Indication and Crew Alerting System
EIS	Electronic Instrument System
ELEC	Electrical
ELEV	Elevator
EMER	Emergency
ENG	Engine
ENG OUT	Engine Out
ENT	Entry
EO or E/O	Engine Out
EOAP	Electronic Overhead Annunciation Panel
EPC	Electrical Power Center
EPR	Engine Pressure Ratio
EQPT or EQUIP	Equipment
ETOPS	Extended Range Operation with Twin Engine Airplanes
ETP	Equal Time Point
EVAC	Evacuation

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EXEC	Execute
EXT	Extend or External
F	
F	Fahrenheit
FAC	Final Approach Course
FAA	Federal Aviation Administration
FADEC	Full Authority Digital Engine Control
FAF	Final Approach Fix
FAR	Federal Aviation Regulation
FB	Fleet Bulletin
FCC	Flight Control Computer
FCTL	Flight Control
FCTM	Flight Crew Training Manual
FD, F/D or FLT DIR	Flight Director
FF	Fuel Flow
FFM	Force Fight Monitor
FGCP	Flight Guidance Control Panel
FGS	Flight Guidance System
FILT	Filter
FIR	Flight Information Region
FL CH or FLCH	Flight Level Change
FLT	Flight
FLT CTRL	Flight Control
FLPRN	Flaperon
FMA	Flight Mode Annunciator

FMC	Flight Management Computer
FMS	Flight Management System
F/O or FO	First Officer
FOM	Flight Operations Manual
FPA	Flight Path Angle
FPM	Feet Per Minute
FPV	Flight Path Vector
FREQ	Frequency
F/S	Fast/Slow
FT	Feet
FWD	Forward
FWSOV	Fire Wall Shut Off Valve
FX	Fix
G	
GA	Go-Around
GEN	Generator
GLS	GNSS Landing System
GMT	Greenwich Mean Time
GND	Ground
GNSS	Global Navigation Satellite System
GP or G/P	Glide Path
GPS	Global Positioning System
GPWS	Ground Proximity Warning System
GS	Ground Speed
G/S	Glide Slope
GW	Gross Weight

H	
HAA	Height Above Airport
HAT	Height Above Touchdown
HDG	Heading or Hydraulic Driven Generator
HDG REF	Heading Reference
HDG SEL	Heading Select
HF	High Frequency
HGS	Head-Up Guidance System (HGS® is a registered trademark of Flight Dynamics)
HI	High
HLD	Hold
HPA	Hectopascals
HPSOV	High Pressure Shut Off Valve
HSI	Horizontal Situation Indicator
HUD	Head-Up Display
HYD	Hydraulic
I	
IAF	Initial Approach Fix
IAN	Integrated Approach Navigation
IAS	Indicated Airspeed
ICAO	International Civil Aviation Organization
IDENT	Identification
IFE	In-Flight Entertainment System
IFR	Instrument Flight Rules

IGN	Ignition
IGS	Instrument Guidance System
ILS	Instrument Landing System
IM	Inner Marker
IMC	Instrument Meteorological Conditions
IN	Inches
INBD	Inboard
IND	Indicator
IND LTS	Indicator Lights
INOP	Inoperative
INIT	Initialization
INSTR	Instrument
INT or INTPH	Interphone
INTC	Intercept
INTC CRS	Intercept Course
IP	Instructor Pilot
IRS	Inertial Reference System
IRU	Inertial Reference Unit
ISA	International Standard Atmosphere
ISDU	Inertial System Display Unit
ISFD	Integrated Standby Flight Display
ISLN	Isolation
J	
JAA	Joint Aviation Authority

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K	
K or KTS	Knots
KCAS	Knots Calibrated Airspeed
KGS	Kilograms
KIAS	Knots Indicated Airspeed
L	
L	Left
LAT	Latitude
LBS	Pounds
LD	Load
LDA	Localizer-type Directional Aid
LDG	Landing
LDG ALT	Landing Altitude
LE	Leading Edge
LIM	Limit
LIM SPD	Limit Speed
LKD	Locked
L NAV or LNAV	Lateral Navigation
LOC	Localizer
LOC-BC	Localizer Back Course
LOM	Locator Outer Marker
LON	Longitude
LRC	Long Range Cruise
LRU	Line Replaceable Unit
LSK	Line Select Key
LT	Light
LWR CTR	Lower Center

LWR DSPLY or LWR DSPL	Lower Display
M	
M	Mach
MAG	Magnetic
MAHP	Missed Approach Holding Point
MAN	Manual
MAP	Missed Approach Point
MASI	Mach/Airspeed Indicator
MAX	Maximum
MCC	Maintenance Control Center
MCDU	Multi-function Control and Display Unit
MCO	Maintenance Carry Over
MCP	Mode Control Panel
MCT	Maximum Continuous Thrust
MDA	Minimum Descent Altitude
MDA(H)	Minimum Descent Altitude (Height)
MDM	Mechanical Dispatch Manual
MEA	Minimum Enroute Altitude
MEL	Minimum Equipment List
MFD	Multifunction Display
MHZ	Megahertz
MIC	Microphone
MIN	Minimum

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MKR	Marker
MLS	Microwave Landing System
MM	Middle Marker
MMO	Maximum Mach Operating Speed
MNPS	Minimum Navigation Performance Specification
MOCA	Minimum Obstruction Clearance Altitude
MOD	Modify
MORA	Minimum Off Route Altitude
MSA	Minimum Safe Altitude
MSG	Message
MSGS RCVD	Messages Received
MSL	Mean Sea Level
MTRS	Meters
MUH	Minimum Use Height
N	
N	Normal
NADP	Noise Abatement Departure Procedures
NAR	North American Route
NAV	Navigation
NAV RAD	Navigation Radio
ND	Navigation Display
NGS	Nitrogen Generation System
NLT	No Later Than
NM	Nautical Mile(s)

NNC	Non-Normal Checklists
NNM	Non-Normal Maneuvers
NPS	Navigation Performance Scales
NORM	Normal
N1	Low Pressure Rotor Speed
N2	High Pressure Rotor Speed (Pratt & Whitney and GE engines) or Intermediate Pressure Rotor Speed (Rolls Royce Engines)
N3	High Pressure Rotor Speed (Rolls Royce Engines)
O	
OAP	Overhead Annunciator Panel (a.k.a. EOAP)
OAT	Outside Air Temperature
OCC	Operations Control Center
ODM	Operational Data Manual
OFST	Offset
OHU	Overhead Unit
OM	Outer Marker
OP	Open
OUTBD DSPL	Outboard Display
OVHD	Overhead
OVHT	Overheat
OVRD	Override
OVSPD	Overspeed
OXY or O2	Oxygen

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P	
PA	Passenger Address
PAPI	Precision Approach Path Indicator
PAR	Precision Approach Radar
PASS	Passenger
PBE	Protective Breathing Equipment
PCP	Pilot Call Panel
PDC	Pitch Data Computer or Performance Data Computer or Pre-Departure Clearance or Pre-Departure Check
PERF	Performance
PERF INIT	Performance Initialization
PES	Pitch Enhancement System
PF	Pilot Flying
PFAF	Precision Final Approach Fix
PFC	Primary Flight Computer
PFD	Primary Flight Display
PI	Performance Inflight
PIP	Product Improvement Package
PLI	Pitch Limit Indicator
PM	Pilot Monitoring
PMC	Power Management Control

PNL	Panel
POS	Position
POS INIT	Position Initialization
POS REF	Position Reference
PPI	Planned Position Indicator
PPOS	Present Position
PRES or PRESS	Pressure
PREV	Previous
PRI	Primary
PRAIM	Predictive Receiver Autonomous Integrity Monitoring
PROG	Progress
PROX	Proximity
P/RST	Push To Reset
PRV	Pressure Regulating Valve
PSI	Pounds Per Square Inch
PTH	Path
PTT	Push To Talk
PTU	Power Transfer Unit
PWR	Power
PWS	Predictive Windshear System
Q	
Q	Quantity
QFE	Local Station Pressure
QNH	Altimeter Setting
QRH	Quick Reference Handbook
QTY	Quantity

R	
R	Right
RA	Radio Altitude or Resolution Advisory
RAD	Radio
RAS	Remote Access System
RAT	Ram Air Temperature or Ram Air Turbine
RCL	Request for Clearance
RDMI	Radio Distance Magnetic Indicator
REC	Recorder
RECIR or RECIRC	Recirculation
REF	Reference
RET	Retract
REV	Reverse
RF	Radius-to-Fix (RF) Legs or Refill
RMI	Radio Magnetic Indicator
RON	Remain Overnight
RNAV or RNV	Area Navigation
RNP	Required Navigational Performance
RPL	Rudder Pressure Limiter
RPM	Revolutions Per Minute
RPR	Rudder Pressure Reducer
RSEP	Rudder System Enhancement Program
RST	Reset
RSVR	Reservoir

R/T	Radio Transmit
RTE	Route
RTO	Rejected Takeoff
RTP	Radio Tuning Panel
RUD	Rudder
RVR	Runway Visual Range
RVSM	Reduced Vertical Separation Minimum
S	
SAAAR	Special Aircraft and Aircrew Authorization Required
SAARU	Secondary Attitude Air Data Reference Unit
SAT	Static Air Temperature or Satellite
SB	Service Bulletin
S/B	Speedbrake
S/C	Step Climb
SDF	Simplified Directional Facility
SEI	Standby Engine Indicator
SEL	Select
SELCAL	Selective Calling
SENS	Sensitivity
SERV	Service
SG	Symbol Generator
SMGCS	Surface Movement and Guidance Control System
SPD	Speed
SPDBRK	Speedbrake
STA	Station

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STAB	Stabilizer
STAT	Status
STBY	Standby
STD	Standard
SYS	System
T	
T or TRU	True
T or TK or TRK	Track (to a Navaid)
TA	Traffic Advisory
TAA	Terminal Arrival Area
TACAN	Tactical Air Navigation
TAC	Thrust Asymmetry Compensation
TAI	Thermal Anti-Ice
TAS	True Airspeed
TAT	Total Air Temperature
T/C	Top of Climb
TCA	Terminal Control Area
TCAS	Traffic Alert and Collision Avoidance System
T/D	Top of Descent
TDZ	Touch Down Zone
TDZE	Touch Down Zone Elevation
TE	Trailing Edge
TEMP	Temperature
TERR	Terrain
TFC	Traffic
TFR	Transfer

THR	Throttle or Thrust
THR HOLD	Throttle Hold
TMC	Thrust Management Computer
TMI	Track Message Identifier
TMSP	Thrust Mode Select Panel
TO or T/O	Takeoff
TOC	Top of Climb
TOD	Top of Descent
TO/GA	Takeoff/Go-Around
TR	Traffic Resolution
TRK	Track
TRP	Thrust Rating Panel
TRU	Transformer Rectifier Unit
TURB	Turbine or Turbulence
U	
UNLKD	Unlocked
UNSCHD or UNSCHED	Unscheduled
UPR DSPL	Upper Display
U.S.	United States
USB	Upper Side Band
UTC	Universal Time Coordinated
UTIL	Utility

V	
VA	Design maneuvering speed
VAL	Valve
VANP	Vertical Actual Navigational Performance
VASI	Visual Approach Slope Indicator
VDP	Visual Descent Point
VEF	Speed at Engine Failure
VERT	Vertical
VFR	Visual Flight Rules
VG	Vertical Gyro
VHF	Very High Frequency
VIB	Vibration
VLV	Valve
VMC	Visual Meteorological Conditions
VMCA	Minimum Control Airspeed or Single Engine Minimum Control Airspeed
VMCG	Minimum Control Speed Ground
VMO	Maximum Operating Speed
V NAV or VNAV	Vertical Navigation
VOR	VHF Omnidirectional Range
VR	Rotation Speed
VREF	Reference Speed
VRNP	Vertical Required Navigation Performance

V/S	Vertical Speed
VSCF	Variable Speed Constant Frequency
VSD	Vertical Situation Display
VSI	Vertical Speed Indicator
VTK	Vertical Track
V1	Takeoff Decision Speed
V1 (MCG)	Minimum V1 for Control on the Ground
V2	Scheduled Takeoff Target Speed
W	
W	Warm
WATRS	Western Atlantic Route System
WDR	Weight Data Record
WGS-84	World Geodetic System of 1984
WHL	Wheel
WPT	Waypoint
WT	Weight
WXR	Weather Radar
X	
X-FEED	Crossfeed
XPDR or XPNDR	Transponder
XTK	Cross Track

Preface

Revision Record

Chapter P1

Section 4

Revision Notification Transmittal Letter

To: All holders of Delta Air Lines, Inc. Operations Manuals.

Subject: Operations Manual Revision.

This revision reflects the most current information available to Delta Air Lines, Inc. through the subject revision date. The following revision highlights explain changes in this revision. General information below explains the use of revision bars to identify new or revised information.

Revision Record

No.	Revision Date	Date Filed
0	June 21, 2010	
2	August 4, 2011	
4	January 19, 2012	
6	November 7, 2012	
8	April 11, 2013	
10	January 16, 2014	
12	October 23, 2014	
14	April 9, 2015	
16	February 26, 2016	

No.	Revision Date	Date Filed
1	March 01, 2011	
3	November 10, 2011	
5	August 30, 2012	
7	February 14, 2013	
9	November 21, 2013	
11	May 8, 2014	
13	February 12, 2015	
15	September 24, 2015	

General

Delta Air Lines, Inc. issues operations manual revisions to provide new or revised procedures and information. Formal revisions also incorporate appropriate information from previously issued Fleet Bulletins.

The revision date is the approximate date the revision material is distributed and considered current. The revision should be incorporated on the revision date, but may be incorporated as much as 21 days after the revision date.

Formal revisions include a Transmittal Letter, a new Revision Record, Revision Highlights, and a current List of Effective Pages. Use the information on the new Revision Record and List of Effective Pages to verify the operations manual content.

The Revision Record should be completed by the person incorporating the revision into the manual.

Filing Instructions

Consult the List of Effective Pages (P1.5). Pages identified with an asterisk (*) are either replacement pages, new (original) issue pages, or deleted pages. Remove corresponding old pages and replace or add new pages. Remove pages marked DELETED; there are no replacement pages for deleted pages.

Be careful when inserting changes not to throw away pages from the manual that are not replaced. The List of Effective Pages determines the correct content of the manual.

Revision Highlights

This section (P1.4) replaces the existing section P1.4 in your manual.

Pages containing revised technical and non-technical material have revision bars associated with the changed text or illustration.

Repaginated material not containing technical revisions are identified only by a new page date.

Chapter P1 - Preface

Section 1 - Model Identification

P1.1.1 - Removed ship 0909 as it is no longer being flown.

Section 3 - Abbreviations

P1.3.10 - Added abbreviation for RAS - Remote Access System.

Chapter L - Limitations

Section 10 - Operating Limitations

Operational Limitations

L.10.1 - Removed references to "Green Pages" as we now only refer to the "Delta Special Pages."

L.10.3 - Revised Max Taxi Weight to 150,500 lbs.

L.10.3 - Revised MTOW to 149,500 lbs.

Chapter NP - Normal Procedures

Section 11 - Normal Checklist Instructions

Normal Checklist Instructions

NP.11.1 - Added "Normal Checklist Instructions" in case all engines have been shut down while off the gate.

Section 12 - Operational Procedures

Automation Guidelines

NP.12.1 - Revised guideline to, "All pilot-induced lateral, vertical, and speed mode changes should be verbalized by the PF and, after referencing the FMA, the PM should verbally confirm the appropriate FMA status."

NP.12.1 - Changed "verify" to "verbalize" in two steps.

Standard Callouts

NP.12.4 - Added statement for crews to focus on aircraft state after level off.

NP.12.4 - Revised statement to, "Approximately 1,000 feet below each assigned altitude."

NP.12.5 - Revised statement to, "Approximately 1,000 feet above each assigned altitude."

NP.12.5 - Removed "ALL APPROACHES (ILS and Non-ILS)" Callout Tables, as they are no longer needed with new automation guidelines.

NP.12.7 - Added Go-Around Callouts for cross fleet standardization initiative and to enhance flight path management.

Clearance Verification Procedures

NP.12.9 - Updated reference to Airway Manual.

Section 20 - Amplified Procedures

Interior Inspection - First Officer

NP.20.2 - Removed Vol. 1, Vol. 2, ODM, and FCTM, from the list of required documents.

NP.20.2 - Added steps to verify EFB mounts are on board.

Exterior Inspection - Captain or First Officer

NP.20.8 - Removed statement about checking ailerons by manually moving them.

NP.20.12 - Removed statement "After verifying left aileron position is opposite right aileron, move aileron to faired position."

Preflight Procedure - Pilot Monitoring

NP.20.18 - Revised "(88) IGNITION selector.....as reqd" and under "(90) IGNITION switch.....AUTO" added statement to ensure switch is in AUTO.

NP.20.18 - Updated cross reference to Fuel System Test.

Preflight Procedure - First Officer

NP.20.35 - Added step "Ignition.....as reqd C&F."

Engine Start Procedure

NP.20.39 - Removed steps for ignition to simplify management of engine ignition.

NP.20.44 - Removed "Start checklist" to simplify management of engine ignition.

After Start Procedure

NP.20.45,47-48 - Removed step "(88) ENG IGN selector - OFF", to simplify management of engine ignition.

Taxi Procedure

NP.20.52 - Revised to "EPR T/O."

NP.20.52 - Revised effectivities for all 90's. Removed note.

NP.20.52 - Removed references to "Green Pages" as we now only refer to the "Delta Special Pages."

Delayed Start Procedure

NP.20.56 - Removed steps to simplify management of engine ignition.

NP.20.57-58 - Removed step "(88) ENG IGN selector - OFF", to simplify management of engine ignition.

NP.20.58 - Removed "Delayed Start Checklist", to simplify management of engine ignition.

Before Takeoff Procedure

NP.20.60 - Revised checklist to verify runway position to help correct a discrepancy between the actual aircraft position and the required runway position, per FB 16-01.

NP.20.62 - Added steps and revised order of steps to align with Normal Checklist to enhance identifying correct runway.

Cruise Procedure

NP.20.69 - Added bullet "Fuel remaining should be recorded on the flight plan and compared against planned fuel remaining."

NP.20.69 - Re-ordered information for TCI, sending reports, and fuel. The intent is for crews to continually monitor fuel.

NP.20.70 - Updated reference to Airway Manual.

Landing Procedure

NP.20.76 - Revised statement and removed callouts, as they are no longer used with new automation guidelines.

Go-Around Procedure

NP.20.79-80 - Updated "Go-Around" procedure, (Incorporation of FB 15-08).

Shutdown Procedure

NP.20.86 - Added instruction, "(9220-9265) Flight Deck Access System switch - Guard extended, switch OFF."

Chapter NOI - Normal Operational Information

Section 3 - Approach Guidance

NOI.3.3-4,7-10,12,14 - Updated reference to Airway Manual.

NOI.3.3 - Revised statement to, "Approach may continue to DA(H) if established on the final segment and the controlling visibility decreases below the authorized minimums."

NOI.3.15 - Removed references to "Green Pages" as we now only refer to the "Delta Special Pages."

Chapter SP - Supplementary Procedures

Section 1 - Airplane General, Emer. Equip., Doors, Windows

Oxygen Mask, Regulator, Interphone, and Smoke Goggles Test

SP.1.7 - Revised effectivities.

Oxygen Mask Test

SP.1.8 - Added new procedure "Oxygen Mask Test."

SP.1.8 - Revised effectivities.

Oxygen Mask Stowage Procedure

SP.1.9 - Added new procedure "Oxygen Mask Stowage Procedure."

SP.1.9 - Revised effectivities.

Section 3 - Anti-Ice, Rain

Engine Anti-Ice Operation

SP.3.1 - Removed "Engine Ignition Operation" as it is in SP.16, and we no longer need to alternate IGN and in certain circumstances keep it on.

Section 5 - Communications

ACARS-601

SP.5.10 - Added section "ACARS Landing Performance Request."

SP.5.21 - Revised title to "Turbulence."

SP.5.39 - Changed to "Select 28k."

Section 6 - Electrical

Emergency Power Check

SP.6.2 - Added note for the 90, to only perform the Emergency Power Check when there is no N2 rotation.

Section 7 - Engines, APU

Crossbleed Start

SP.7.8 - Removed steps for Engine ignition.

Section 11 - Flight Management, Navigation

IRS Operation

SP.11.1 - Revised step to clarify how to accomplish a IRU FULL ALIGNMENT.

FMS Initialization

SP.11.6 - Update effectivities to MD-90 and removed DL1 database.

Section 12 - Fuel

Fuel System Test

SP.12.6 - Added statement, "Do not perform Center Fuel Tank Pumps Check unless there is at least 500 lbs of fuel in the center tank."

SP.12.6 - Added "Verify that the L and R INLET FUEL PRESS LO lights both extinguish."

Section 16 - Adverse Weather

Cold Weather Operation

SP.16.1 - Revised statement for clarity and to align with other fleets for standardization.

SP.16.9 - Updated reference to Airway Manual.

Guidelines for Takeoff on Contaminated Runways or Landing with Braking Action Less than Good

SP.16.17 - Added A321 to list of fleets.

Ground De/Anti-Icing Procedure

SP.16.19 - Revised captain's response on the pre-gate departure communication to include the ship number.

Remote (Engine(s) Running)

SP.16.29 - Removed references to "Green Pages" as we now only refer to the "Delta Special Pages."

SP.16.29 - Revised the pre-de/anti-icing (to include forced air) communication to include the deicer asking and the captain confirming that engines are at idle.

Chapter DF - Differences

Section 10 - MD-88/90 Differences

Flight Management, Navigation

DF.10.14 - Updated effectivities for 90 to "Single FMC installed."

DF.10.14 - Updated effectivities for 90 to "Pegasus system installed."

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Preface

Chapter P1

List of Effective Pages - FAA Approved

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* P1.2.1-6	February 26, 2016
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Limitations
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Limitations

Operating Limitations

Chapter L

Section 10

General

The MD-88/90 aircraft must be operated in compliance with Certificate Limitations of the applicable FAA Approved Airplane Flight Manual (AFM). This chapter contains Airplane Flight Manual (AFM) limitations and manufacturer recommended non-AFM operating limitations.

Limitations that are obvious, shown on displays or placards, or incorporated within an operating procedure or flight plan/performance documents are not published in this chapter.

Those AFM limitations that are incorporated into other chapters of this manual, into the Vol. 2, or into the QRH are identified with an [AFM] tag.

Note: The symbol (#) indicates recall limitations. Recall limitations are those operationally significant limitations that must be committed to memory. Memorization is necessary because there are no placards, display indications, or markings indicating a limitation exists.

Note: A logbook entry is required any time an aircraft limitation is exceeded, e.g., overweight landing, engine exceedance, etc.

Airplane General, Emergency Equipment, Doors, Windows

Operational Limitations

General Operating Limits

# Maximum Takeoff and Landing Tailwind Component	10 knots, or as permitted by Delta Special Page
# Maximum Operating Altitude	37,000 feet
Maximum Takeoff and Landing Pressure Altitude	8,500 feet

Door Mounted Slides

Evacuation slide girt bars at forward entry and service door and aft left hand door must be engaged prior to departure until arrival at unloading ramp at destination.

Flight Deck Security Door

An operational check of the Flight Deck Access System will be accomplished according to approved procedures once each flight day.

Rear Passenger Entrance

Emergency operating handle must be exposed and normal operating handle covered prior to departure until arrival at unloading ramp at destination.

Crosswind

The Delta MD-88/90 crosswind limit is 30 knots for takeoff or landing, including gusts.

Note: The crosswind component may be further limited by low visibility approaches, contamination, or runway width.

Note: Refer to SP.16, Guidelines for Contaminated Runways.

Maximum Speeds

Observe VMO pointer and aural warning. Observe gear and flap placard speeds.

Turbulent air penetration speed is 280 ± 5 KIAS/ $.77 \pm .02$ M (whichever is lower).

Landing Lights

Wing landing light motors should be allowed to cool for 1 1/2 minutes after initial extension or retraction and 3 1/2 minutes after each subsequent extension or retraction. Lamps should not be operated in still air for periods of over 10 minutes.

Maximum Weight Limitations

The weights below may be further restricted by Operating Limitations, Center of Gravity Envelope, Operating Envelope, Fuel Loading/Management Data, and other data in the ODM and MDM.

Weights	Pounds		
	88	90	
Ship Numbers	All	9201-9218 9220-9265	9219
Maximum Taxi Weight (MTW)	150,500	166,500	168,500
Maximum Takeoff Weight (MTOW)	149,500	166,000	168,000
Maximum Landing Weight (MLW)	139,500	142,000	142,000
Maximum Zero Fuel Weight (MZFW)	122,000	132,000	132,000

Air Systems

Pressurization

Maximum relief valve pressure is 8.32 psi.

Maximum cabin differential pressure is 8.07 psi.

Anti-Ice, Rain

Engines

Use engine anti-ice during all ground and flight operations whenever icing conditions exist or are anticipated.

Wings

Use airfoil anti-ice in flight whenever icing conditions exist.

Windshields

The windshield anti-ice must be on for all flight operations except as follows:

- Outer Windshield ply cracked or Windshield heat inoperative - the maximum speed is 315 KIAS below 10,000 feet.
- Inner Windshield ply cracked - respective windshield heat must be turned off and the maximum speed for a cracked inner pane is 235 KIAS below 10,000 feet.

Note: These restrictions do not apply to clear view or eyebrow windows.

Automatic Flight

Autopilot

Do not engage autopilot for takeoff below 500 feet AGL.

On non-ILS approaches, disconnect the autopilot no later than 50 feet below MDA.

For autopilot coupled CAT I approaches not requiring the use of autoland, the autopilot must be disconnected and the approach flown manually if the AP TRIM light is illuminated in excess of three seconds after the airplane is stabilized and tracking the glideslope.

FMS Vertical and Lateral Engagement Limits

- NAV must not be engaged to the Flight Director and/or autopilot in climb until the aircraft is above 400 feet AGL.
- VNAV must not be engaged to the Flight Director and/or autopilot in climb until the aircraft is above 1,000 feet AGL.
- NAV and VNAV must be manually disengaged for landing approach when below 400 feet AGL.

One Engine Inoperative Limits

Engine out coupled ILS approaches are not permitted. Disconnect the autopilot prior to glideslope capture.

Use of windshear guidance (flight director or coupled) with one engine inoperative is prohibited.

Autoland

The autoland capability may only be used with flaps 28 or 40.

A successful autoland preflight test is required on the DFGC to be used for an autoland.

For approaches requiring the use of autoland, a missed approach must be executed if the AP TRIM light is illuminated in excess of three seconds after the airplane is stabilized and tracking the glideslope.

Do not conduct autoland operations if:

- ALIGN (ALN) mode is not annunciated on an FMA by 100 feet radio altitude.
- Either engine becomes inoperative greater than 50 feet AFE.
- Any unusual control position or other abnormal conditions exist in the manual flight control system.
- Autospoilers are inoperative.
- Both buses are powered by a single generator.

Wind Speeds

Maximum allowable wind speeds for autoland operations:

# Headwind	25 knots
# Crosswind	15 knots
# Tailwind	10 knots

Electrical

AC Power

AC voltage range is 115 ± 3 volts.

AC Frequency

- External power and engine generator range is 400 ± 4 Hz
- APU generator (on ground) range is 396 ± 8 Hz
- APU generator (in flight) range is 400 ± 10 Hz

AC Generator Loads

- Continuous generator load range is 0 to 1.0
- 5 minute maximum when overload is greater than 1.0 to 1.5
- 5 second maximum when overload is greater than 1.5.

DC Power

Maximum difference between same side DC loadmeters is 0.3.

88

DC load range is 0 to 1.0

90

DC load range is 0 to 1.5

Engines, APU

Engines

Engine Limitations - Emergency Conditions

The published operating limits for engines relate to predefined normal and abnormal operations. If, however, any crew finds itself in a life-threatening situation which requires an application of thrust beyond the certified takeoff limits, they can feel confident that the engine(s) will operate satisfactorily for whatever reasonable time is required to maintain safe control of the aircraft.

Automatic Reserve Thrust (ART)

88

Automatic reserve thrust system (ART) must be off when using the takeoff flex mode of the thrust rating system.

Engine Ignition

88

On for takeoff, landing, turning engine anti-ice on/off, severe turbulence, and heavy rain.

90

Auto for takeoff and landing. On for severe turbulence and heavy rain.

Engine Limit Display Markings

Maximum and minimum limits are displayed as a red radial or light.

Outside of limits is marked with a red arc.

Normal engine takeoff range is marked by an orange radial.

Cautionary range is marked by a yellow arc.

Normal operating range is marked by a green arc.

Engine Starter Limitations

88

Ninety cumulative seconds of starting and/or motoring. This may consist of 3 normal start cycles of 30 seconds each with engine allowed to stop turning between starts.

Five minutes off for cooling. Subsequent start attempts: 30 seconds on and 5 minutes off.

90

Three start attempts of 2 minutes each with 15 seconds between each attempt, or 4 minutes continuous cranking. 30 minutes off for cooling.

Engine Synchronization

Engine synchronizer selector must be off below 1,500 feet AFE.

Reverse Thrust

Ground use only.

EGT Limits

Condition	88		90	
	Duration	EGT Limit (°C)	Duration	EGT Limit (°C)
Starting				
# Ground	Momentary	500	Momentary	635
Flight	Momentary	625	Momentary	635
Takeoff				
Normal	*5 minutes	590	10 minutes	635
	*2 minutes	595		
Maximum	5 minutes	625	10 minutes	635
Continuous		580		610
*The sum of time at both EGT limits must not exceed five minutes.				

APU

Starter Limits

Three consecutive start attempts with five (5) minutes cooling between starts. After the third attempt, one hour off before any further attempts.

Generator Load

Condition	88	90
Ground	1.25	1.0
Below 25,000 feet	1.0	0.6
25,000 feet and above	0.6	0.6
Maximum Operating Altitude	37,000 feet	37,000 feet

Flight Controls

Full application of pitch, roll, or yaw controls should be confined to speeds below the maneuvering speed.

Rapid and large alternating control inputs, especially in combination with large changes in pitch, roll, or yaw, and full control inputs in more than one axis at the same time, should be avoided as they may result in structural failures at any speed, including below the maneuvering speed.

Speedbrakes

Speedbrakes may not be used with flaps extended.

Do not extend gear with speedbrakes extended.

Rudder

Rudder must be powered and unrestricted for takeoff.

Spoilers

Do not arm ground spoilers prior to gear extension.

Slat/Flap Limit Speeds (KIAS)

Placarded Slat/Flap Limit Speeds (KIAS)		
Configuration	88	90
Mid position / Flaps 11	280/.57 Mach	280/.57 Mach
Full extend / Flaps 15	240/.57 Mach	240/.57 Mach
Flaps 23	220/.57 Mach	220/.57 Mach
Flaps 28	200/.57 Mach	205/.57 Mach
Flaps 40	200/.57 Mach	200/.57 Mach

Flaps/Slats Extension Speed (DELTA)	
Configuration	88 / 90
# Mid position / Flaps 11	280/.57 Mach
# Full extend / Flaps 15	240/.57 Mach
# Flaps 23	220/.57 Mach
# Flaps 28/40	200/.57 Mach

Note: Do not exceed Delta limit speeds for flap extension.

Flight Instruments, Displays

Altimeters

Reduced Vertical Separation Minimums (RVSM)

Manual switching to the alternate static system is prohibited for RVSM operations.

Altimeter Crosscheck Limits for RVSM Operations

The maximum allowable on-the-ground altimeter reading differences at a known field elevation for RVSM operations are:

Max Difference Between Captain & F/O	Max Difference Between Captain or F/O & Field Elevation
60 feet	75 feet

The maximum allowable in-flight difference between captain and first officer altimeter readings for RVSM operations is 200 feet.

Standby altimeters do not meet altimeter accuracy requirements of RVSM airspace.

Displays

Do not select compact mode in flight except for a display failure.

When using FMS NAV mode, the pilot flying the aircraft must select the MAP mode on his ND.

The flight director must be operative on the PFD of each pilot who has MAP or PLAN mode selected on his ND during takeoff or approach.

During terminal area and approach operation, one EFIS NAV display must be in the ARC or ROSE mode during localizer capture in order to crosscheck FMS operation with navigation radio data.

Flight Management, Navigation

Inertial Reference System (IRS)

A minimum of one multifunction control display unit (MCDU) is required for ground alignment of the IRS.

Autoland is inhibited when either IRU is in the attitude mode or off mode.

Enhanced GPWS must be in OVRD when operating in ATT mode.

Weather Radar

Do not operate weather radar in a hangar or within 50 feet of fueling operations or fuel spills. Do not operate weather radar within 15 feet of personnel.

Note: The hangar and personnel restrictions do not apply to the weather radar test mode.

Fuel

Center Tank Fuel

If each main tank is not full but has at least 3800 pounds, the maximum zero fuel weight

88

- 122,000 pounds.

90

- 132,000 pounds.

must be reduced by the amount of center tank fuel in excess of

88

- 11,000 pounds.

90

- 3,000 pounds.

If either main tank has less than 3800 pounds, subtract any center tank fuel weight from the maximum zero fuel weight.

Lateral Imbalance

Main tanks must not differ by more than 1500 pounds.

Fuel Heat

88

Fuel heat must be OFF during takeoff, landing and go-around.

Fuel Circuit Breaker

Do not reset any fuel pump circuit breakers.

Hydraulics

Do not reset any hydraulic auxiliary pump circuit breakers.

Landing Gear

Maximum landing gear retraction speed is 250 KIAS

Maximum landing gear extension speed is 300 KIAS/0.70 MACH

Warning Systems

Enhanced Ground Proximity Warning System (EGPWS)

Terrain Display

Do not use the terrain display for navigation.

Terrain Awareness Alerting

The use of terrain awareness alerting and terrain display functions is prohibited within 15NM of takeoff, approach or landing at an airport or runway not contained in the EGPWS airport/runway database. Crews will normally be notified of new runways not included in the database via EFB or flight plan remarks.

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Normal Procedures

Chapter NP

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Normal Procedures

Philosophy and Assumptions

Chapter NP

Section 10

General

A procedure, as used in this manual, is a series of tasks that are required during a particular phase of flight. Normal procedures are routinely performed on most flights and are outlined in Section 20 of this chapter. The procedures are arranged in chronological order.

Normal procedures assume:

- All aircraft systems are operating normally.
- The flight deck configuration is correct before the procedure commences.
- The pilot is employing the use of autoflight systems.
- The pilot has knowledge and understanding of aircraft systems and limitations.

The above assumptions allow normal procedures to be written to the appropriate level of detail. For additional details including recommendations and techniques, refer to the Flight Crew Training Manual (FCTM).

Philosophy and Compliance with Normal Procedures

Normal procedures provide Delta pilots with the fundamental guidance to operate a flight safely and efficiently. As such, pilots are expected to:

- have a sound knowledge and understanding of normal procedures, and
- routinely use and comply with the procedures on every flight.

Procedures are written considering a normal operating environment. The captain may authorize a deviation from normal procedures when considered in the best interest of safety and/or in the event of a non-normal operating environment.

Normal Procedures and CRM/TEM

Normal procedures are designed to embrace the principles of Delta Air Lines' Crew Resource Management (CRM) and Threat and Error Management (TEM) strategies. For example, embedded in normal procedures are the requirements to provide briefings at key times during the flight. It is not practical, however, to include all aspects of CRM/TEM into normal procedures. Pilots must have a comprehensive understanding of Delta's CRM/TEM philosophy and use it in conjunction with normal procedures.

Terminology

May - The word "may" is used in a permissive sense to state authority or permission. Compliance is not mandatory.

Should - The word "should" is used to indicate that compliance is expected. Deviations are permitted only where an operational requirement exists.

Will, Shall, and Must - The words "will", "shall", and "must" are used in an imperative sense to state the requirement to accomplish the act prescribed. Compliance is mandatory unless an emergency situation exists where compliance would not be in the interest of safety.

Guide - A "guide" is a document that assists the pilot in conducting a normal procedure. The use of a guide is not mandatory.

Crew Duties and Responsibilities

The captain retains final authority for all actions directed and performed.

Crew duties are divided between the pilot flying (PF), pilot monitoring (PM), captain (C), and first officer (F).

The captain's general responsibilities during ground operations include:

- calling for checklists, and
- taxiing.

The first officer's general responsibilities during ground operations include:

- monitoring taxi,
- checklist reading,

- communications, and
- tasks requested by the captain.

The captain is responsible for assigning the PF role. Normally the PF/PM roles remain unchanged throughout the flight but the captain may change the assignments at any time due to operational needs.

The PF's general responsibilities during flight are:

- flight path management and airspeed control,
- aircraft configuration,
- navigation, and
- calling for checklists.

The PM's general responsibilities during flight are:

- monitoring flight path, airspeed, aircraft configuration, and navigation;
- checklist reading;
- communications; and
- tasks requested by the PF.

Tasks Excluded from Normal Procedures

The following procedures are not addressed in NP.20:

- flight deck lighting,
- crew comfort tasks,
- exterior lighting (Refer to NP.12, Exterior Lights Usage), and
- communication procedures.

Aircraft Configuration Changes During Normal Procedures

Prior to taxi, the flaps will be selected to the takeoff or default position.

During flight, the PF will call for any gear or flap change; the PM will verify that the airspeed is appropriate before accomplishing the change. If operational necessity requires an immediate configuration change and the PM is occupied with other duties, the PF may announce the change and move the appropriate control. This should be understood as the exception and not the rule.

After landing, no configuration changes shall be made until clear of the active runway, or until the aircraft has reached taxi speed when a 180° turn is required.

Sequence, Flow and Responsibility for Tasks

The specific tasks within a procedure are arranged in a logical order. The sequence of the tasks within a procedure may be changed as necessary.

Tasks are accomplished from memory (with the exception of the Secure procedure). This sequence is referred to as a flow pattern. Flow pattern guides assist in learning the sequence and are located in the Flight Crew Training Manual (FCTM).

Tasks are assigned to and normally performed by a specific pilot. The other pilot may perform the task.

Use of Triggers

A “trigger,” is an event that initiates a procedure or task. Procedures start with a trigger statement. For example, the trigger used to commence the Pushback procedure is:

When all exterior doors are closed and the cabin is ready for pushback:

Triggers are also used within a procedure to define when a task or a series of tasks are normally accomplished.

Operational flexibility may dictate adjusting a particular trigger.

Aircraft Limitations in Normal Procedures

Aircraft limitations are generally found in the Limitations chapter of this manual and are not normally repeated in normal procedures. There are procedures, however, that are defined ideally when in context with a limitation. In these cases, the limitation will be referred to or embedded in the normal procedure. Pilots need to be aware that normal procedures do not always refer to limitations when they are applicable. Pilots must have a fundamental knowledge and understanding of aircraft limitations.

AFM limitations incorporated into a normal or supplementary procedure in the Volume 1, any section of the Volume 2, or any section of the QRH are identified with an [AFM] tag.

Relationship Between Procedures and Checklists

A normal checklist usually follows the completion of a normal procedure. The name of the checklist is either identical to the procedure that precedes it or is preceded with “After.” For example:

- After completing the Taxi procedure, the captain calls for the Taxi checklist.
- After completing the Takeoff procedure, the PF calls for the After Takeoff checklist.

Not all tasks within a procedure appear on the checklist that follows. Delta uses criteria that include input from human factor experts, FAA requirements, and fleet standardization to determine what tasks rise to the level that requires inclusion on a normal checklist.

Normal Procedures Construction

Table Header

Except for inspections and preflight procedures that are assigned to one crewmember, normal procedures are shown in a two-column table format. The column header indicates the crewmember responsible for each task. The pilot normally assigned the task is identified in the table header as follows:

- Pilot Flying,
- Pilot Monitoring,
- Captain,
- First Officer, or
- Any Crewmember (Secure procedure only).

Table Cells

Each cell represents either:

- a single task;
- multiple related tasks;
- a warning, caution, or note;
- clarifying information; or
- a trigger.

When the cell only appears in one column, the task is assigned to that pilot. When the table cell spans both columns, the task is applicable to both pilots. Due to space limitations and/or complexity, a task can span both columns but will be assigned to one pilot.

The following conventions are used to assign a task within a cell:

- (C) - captain,
- (F) - first officer,
- (PF) - pilot flying, or
- (PM) - pilot monitoring.

Cell Content

Triggers appear across both columns in bold text and do not have a bullet.

A task is identified with a bullet (●). When the task requires a control to be positioned, the name of the control device appears followed by the position in which it is to be placed. When either the control or position is labeled on the flight deck, the terms are capitalized. For example:

- EMERGENCY LIGHTS switch - OFF

Warnings and cautions appear before the task they affect. Notes will appear after the task they affect.

References

When it is deemed to be beneficial to refer the reader to another informational source, the notation “Refer to ____” is used.

Separate Tables within a Procedure

On some procedures a separate shaded table is used. The separate table contains tasks that are not part of the associated procedure and have one of the following characteristics:

- The tasks do not fit within the time-ordered flow of the procedure (e.g., transition altitude).
- The tasks are not required on every flight (e.g., runway change procedure).

System Discrepancies during Ground Operations

It is the crewmember's responsibility to verify correct system response.

Before engine start, if there is a discrepancy noted:

- Verify that the system controls are set correctly.
- Check the respective circuit breaker as required.
- Test the respective system light as required.

-
- Check the Mechanical Dispatch Manual (MDM) to decide if the condition has a dispatch effect.
 - Decide if maintenance is needed.

During or after engine start, if there is a discrepancy noted:

- Complete the respective non-normal checklist (NNC).
- On the ground, check the MDM.

After engine start, the MASTER CAUTION system, annunciator lights and alerts are the primary means of alerting the flight crew to non-normal conditions or incorrect configurations.

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Normal Procedures

Chapter NP

Normal Checklist Instructions

Section 11

General

The primary purpose of the normal checklists is to ensure that the crew has properly configured the aircraft and to verify essential and critical items have been accomplished.

The explanation of each checklist is found in NP.20, Amplified Procedures section of this chapter.

Checklist Content

The checklist has the minimum items needed to operate the airplane safely.

Normal checklist items meet one or more of the following criteria:

- items essential to safety of flight that are not monitored by an alerting system;
- items essential to safety of flight that are monitored by an alerting system but if not accomplished, would likely result in a catastrophic event;
- items needed to meet regulatory requirements;
- items needed to maintain fleet commonality;
- items that enhance safety of flight and are not monitored by an alerting system;
- items that could result in injury to personnel or damage to equipment if not accomplished.

Normal Checklist Use Policy

The crew will use the checklist on every flight and for every phase of flight for which a checklist has been established.

Normal Checklist Instructions

In the event such as taxi delays where all engines are shut down while off the gate, all procedures and checklists will be performed again starting with the Pushback checklist.

Procedure versus Checklist

Before accomplishing the checklist, each crewmember will configure all controls and systems in accordance with the associated normal procedure.

The checklist is then used to verify essential procedural tasks.

Additionally, when a checklist includes a challenge and response for a briefing, the associated briefing should be completed prior to calling for the checklist that contains the briefing. The checklist functions as a “check” list, not a “do” list.

The Secure checklist is the only exception to this verification philosophy. Since these items are not performed on every flight, the Secure checklist may be accomplished as a “read and do” checklist.

Procedural Errors or Omissions

If during the execution of a checklist the airplane configuration does not agree with the needed configuration:

- Stop the checklist.
- Complete the respective procedural steps.
- Continue the checklist.

If it becomes apparent that an entire procedure was not accomplished:

- Stop the checklist.
- Complete the entire procedure.
- Accomplish the entire checklist from the start.

Checklist Initiation and Completion

On the ground, the captain calls for the checklists and the first officer reads the checklists. In flight, the PF calls for the checklists and the PM reads the checklists. If a checklist is required but has not been called for, the other pilot should query the pilot responsible for calling for the checklist.

Whenever possible, accomplish checklists before or after high workload times.

Normally checklists are not called for until all associated procedural items are complete and there is an expectation that the checklist can be completed without interruption. The Preflight checklist, however, may be initiated before the completion of the logbook and/or fuel required tasks. If either or both of these tasks are not complete, the checklist will be read up to the last completed task. When the remaining task(s) has been completed, the checklist will be continued. Additionally, when the transition level is below 10,000 feet, the Approach checklist should be started, but will not be considered complete until the local altimeter is read.

Crewmembers may need to suspend a checklist for a short time to accomplish other tasks. The checklist should not be stowed prior to completion. If the interruption is short, continue the checklist with the next step. If a crewmember is not sure where the checklist was interrupted or the interruption is for an extended period of time, re-accomplish the checklist from the beginning.

After resuming the checklist, all checklist challenges and responses must be made by the designated pilot(s) before calling the checklist complete and stowing the checklist.

When all items of the checklist have been completed satisfactorily, the pilot reading the checklist shall announce “___ CHECKLIST COMPLETE” and may stow the checklist.

If all pilots vacate the flight deck after accomplishing the Preflight checklist, the checklist must be re-accomplished.

First-Flight-of-the-Day and After Shutdown Reminders

The Normal Checklist (hardcard) includes first-flight-of-the-day and after shutdown reminders. They are on the hardcard as a convenient means to recall tasks that may have to be performed.

Checklist Response Designators

Located on the right side of specific checklist response items are designators indicating which crewmembers must verbalize a response. Items that do not have designators are to be accomplished silently.

The following designators are used:

- C - captain,
- F - first officer,
- C&F - captain and first officer,
- PM - pilot monitoring, and
- All - All flight deck crewmembers.

If a checklist item is identified with a C&F, a dual response is required. The first response will be made by the pilot being challenged, the challenger will then respond.

Checklist Challenges

Checklist challenges identify the control or task to be checked. The pilot reading the checklist shall read the specific challenge as written.

When a checklist challenge does not end with “switch” or “lever”, the challenge refers to system status. For example, “Landing Gear...”, refers to the status of the landing gear, not just the position of the lever.

When a checklist challenge ends with “switch” or “lever”, the challenge refers to the position of the switch or lever. For example, “Engine start levers...” refers to the position of the levers.

Checklist Responses

Checklist responses are spoken as written although some items may use abbreviations due to hardcard space limitations.

When a checklist response is shown in all capital letters it refers to switch or lever position. For example, “Engine start levers...CUTOFF.”

When a checklist response is written in lower case it refers to the status of the associated system. For example, “Landing gear...down.”

When a checklist response does not allow the use of a specific switch position, the following terms are used as a response:

- A blank line “_____” requires a unique response and is used when the response is a variable value; such as takeoff thrust, altimeters, bugs, flaps, slats, or stabilizer trim settings.
- **as reqd** means alternatives are available. Respond with the actual position of the control. For example, “Autobrakes.....3”.
- **ckd** means that controls or other systems have been evaluated/tested for proper system operation.
- **complete** indicates the associated procedure and/or procedural task in its entirety has been completed.
- **entered** indicates information, values or selections associated with the procedure have been correctly loaded in the appropriate location.
- **set** indicates panel switches, knobs, or bugs are verified to be in the correct position or the correct value has been entered.
- **verified** indicates the challenged items are correctly entered, annunciated, or have otherwise been confirmed to be correctly displayed.
- **xckd** indicates the associated value or setting has been confirmed to have been entered correctly at all locations, as specified.

An explanation of the checklist response appears in the Amplified Procedures section of this chapter when the response:

- is not obvious on how the procedure is verified and/or what needs to be verbalized,
- is not addressed at all in the procedure, or
- has a blank line “ ____.”

Verification of Checklist Items

When performing a checklist requiring verbalization, the crew will progress to the next item only after the response is confirmed by the crewmember being challenged.

The crewmember responding to a checklist challenge must confirm the task or procedure was completed by:

- visually verifying the checklist item, or
- observing the item was completed, or
- confirming completion with the crewmember who accomplished the procedure.

When responding to a checklist item, a visual verification must be accomplished, when possible.

Runway, Intersection, Departure, Performance Data, or Approach Changes, or Go-Around

A ■ indicates items that should be considered for re-accomplishment in the event of a runway, intersection, departure, performance data, or approach change, or go-around.

Takeoff

In the event a runway, intersection, departure, or performance data change occurs after completing a checklist the captain should call for the runway/departure change items. After the necessary procedural steps are accomplished, the first officer will verbalize each change item by stating the challenge to the item. The designated crewmember(s) will respond with either:

- “NO CHANGE” for an item, or
- the appropriate checklist response for the item that changed.

Landing

In the event a runway or approach change occurs after completing a checklist the pilot flying (PF) should call for the runway/approach change items. After the necessary procedural steps are accomplished, the pilot monitoring (PM) will verbalize each change item (if not previously briefed) by stating the challenge to the item. The designated crewmember(s) will respond with either:

- “NO CHANGE” for an item, or
- the appropriate checklist response for the item that changed.

Note: If the landing runway assignment is changed and the captain determines the runway change can be accomplished visually, the captain may choose to waive the runway change items.

Normal Procedures
Operational Procedures**Chapter NP**
Section 12

Multi-purpose Control Display Unit (MCDU)

Before taxi, the captain or first officer may make MCDU entries. The other pilot must verify the entries.

Make MCDU entries before taxi or when stopped, when possible. If MCDU entries must be made during taxi, the first officer makes the entries. The captain must verify the entries.

In flight, MCDU entries will normally be made by the PF. When the autopilot is off, or when operating in a high workload environment, the PF should direct the PM to make MCDU entries. Both pilots should verify MCDU entries affecting lateral or vertical flight path.

Automation Guidelines

The automation policy is described in the FOM. The following guidelines are used to achieve these policies:

- Briefing should include any uncommon levels of automation and related monitoring expectations.
- VNAV should be used when available and appropriate during climb, cruise, and initial descent.
- Both pilots are responsible for comparing the performance of the autoflight system with the desired flight path of the aircraft.
- All pilot-induced lateral, vertical, and speed mode changes should be verbalized by the PF and, after referencing the FMA, the PM should verbally confirm the appropriate FMA status.
- Both pilots are responsible for monitoring the FMA and/or MCP whenever any component of the autoflight system is engaged and a flight mode change occurs.

Autopilot Guidelines

The PF will verbalize when the autopilot is engaged or disengaged.

When an autopilot is engaged:

- the PF should operate the MCP and
- the PM should verbalize that the proper selections have been set.

When an autopilot is not engaged:

- the PM should operate the MCP as directed by the PF and
- the PF should verbalize that the proper selections have been set.

Normal VHF Radio Management

VHF radios should normally be operated as follows:

- VHF 1 should be used for communications with ATC.
- VHF 2 should be used for communications with ramp control, station operations, and other company communications. When VHF 2 is not used for ramp or company communications, a listening watch on 121.5 should be maintained as conditions permit.
- VHF 3 should be used for ACARS datalink.

The first officer should clearly communicate to the captain the radio being used to receive taxi instructions.

Stabilized Approach

Delta defines a stabilized approach as maintaining a stable speed, descent rate, and lateral flight path while in the landing configuration.

WARNING: At any altitude, if the following stabilized approach criteria cannot be established and maintained, initiate a go-around. Do not attempt to land from an unstable approach.

No lower than 1000 feet AFE:

- Be fully configured for landing (gear and landing flaps extended).
- Maintain a stabilized descent rate not to exceed 1,000 fpm.
- Be aligned with the intended landing runway.

No lower than 500 feet AFE:

- Be on target airspeed.
- The engines are stabilized at the thrust setting required to maintain the desired airspeed and rate of descent.

Crossing the Runway Threshold:

- Positioned to make a normal landing in the touchdown zone.

Planned Deviations

- A circling maneuver and some published approaches (such as the River Visual at DCA) may require a planned deviation to the lateral stabilized approach criteria. Some published approaches require higher than standard descent rates. Verbalize all planned deviations during the approach briefing.

Unplanned Descent Rate Exceedance

- In the event of a momentary descent rate exceedance, crews may proceed as long as the descent rate exceedance is verbally acknowledged and corrective action is immediately initiated.

Standard Callouts

The following callouts will be verbalized by the appropriate crewmember.

Crews should focus on the aircraft state during the level-off period.

Some callouts are made automatically by aircraft aural systems. When a required callout is made automatically, it may be omitted by the appropriate crewmember.

On any approach, when the pilot flying (PF) can maintain visual contact with the runway, the “APPROACHING MINIMUMS”, “MINIMUMS” and “MISSED APPROACH POINT” callouts are not required.

Note: If the Radio Altimeter is inoperative, reference the barometric altimeter for the “1,000” and “500” callouts.

TAKEOFF		
Condition	Crew Member	Callout
At autothrottles ON	PM	“EPR ____”
At approximately 60 KIAS	PM	“CLAMP”
At 80 KIAS	PM	“80 KNOTS, THRUST NORMAL”
At V1	PM	“V1”
At VR	PM	“ROTATE”
At positive rate of climb	PM	“POSITIVE RATE”

CLIMB		
Condition	Crew Member	Callout
Approximately 1,000 feet below each assigned altitude	PM	“OUT OF ____ FOR ____” “ALTITUDE ARMED” or “OUT OF ____ FOR ____,” ALTITUDE/ VNAV CAPTURE”
Approaching transition altitude (if other than 18,000 feet)	PM	“TRANSITION ALTITUDE”

DESCENT		
Condition	Crew Member	Callout
Approximately 1,000 feet above each assigned altitude	PM	“OUT OF ____ FOR ____” “ALTITUDE ARMED” or “OUT OF ____ FOR ____, ALTITUDE/ VNAV ____ CAPTURE”
Approaching transition level (if other than FL 180)	PM	“TRANSITION LEVEL”

ALL APPROACHES		
Condition	Crew Member	Callout
Any significant deviation from planned flight path, airspeed or descent rate	PM	“SPEED +/- ____” or “SINK ____”, etc.
At approximately 1,000 AGL	PM	“1,000, CLEARED TO LAND” or “1,000, NO LANDING CLEARANCE”
Below 1,000 AGL: Any descent exceeding 1,000 feet per minute	PM	“SINK ____”
At approximately 500 AGL	PM	“500”
Prior to descending below 100 feet above TDZE/Rwy Threshold Elevation: • With runway in sight (if not already called) • With runway not in sight	C	“RUNWAY IN SIGHT” (F must acknowledge) Note: This call not required on CAT III and visual approaches. “GO AROUND” (F must acknowledge)

CAT I, CAT II, & CAT III APPROACHES		
Condition	Crew Member	Callout
Autoland approaches. When annunciated (approximately 150 feet RA, 100 feet minimum)	PM	“ALIGN”
Approximately 80 feet above minimums	PM	“APPROACHING MINIMUMS”
At or before minimums	C	“APPROACH LIGHTS IN SIGHT”, or “RUNWAY IN SIGHT” or “GO AROUND” (FO must acknowledge)
At minimums	PM	“MINIMUMS”

NON-ILS APPROACHES		
Condition	Crew Member	Callout
Approximately 80 feet above minimums	PM	“APPROACHING MINIMUMS”
At or before minimums	C	“APPROACH LIGHTS IN SIGHT”, or “RUNWAY IN SIGHT” or “GO AROUND” (FO must acknowledge)
At minimums	PM	“MINIMUMS”
At missed approach point	PM	“MISSED APPROACH POINT”

GO-AROUND ALL APPROACHES		
Condition	Crew Member	Callout
When a Go-Around is warranted	PF/PM	“GO AROUND”
	PF	“TO/GA POWER”, and either “AUTOTHROTTLES ON” (if operable) or “SET GO-AROUND THRUST” (if autothrottles are inop)
After proper FMA mode annunciation	PM	“GO AROUND VERIFIED”
	PF	“FLAPS ____”
At positive rate of climb	PM	“POSITIVE RATE”
	PF	“GEAR UP”

AFTER ALL LANDINGS		
Condition	Crew Member	Callout
Verify spoilers are up	PM	“SPOILERS UP”
If spoilers are not up	PM	“NO SPOILERS”
At 80 knots	PM	“80 KNOTS”

Clearance Verification Procedures

The pilot flying (PF) and pilot monitoring (PM) should monitor and confirm all issued ATC clearances, unless operational constraints (e.g., PAs, PM leaves flight deck) prohibit. If any pilot is unsure of the stated clearance, contact ATC to verify.

Note: If a clearance, departure procedure, or route is changed, reaccomplish the clearance verification procedure.

Clearance Type	Action	
	PF	PM
Pre-Departure Clearance (PDC)/Departure Clearance (DCL) via ACARS, or voice On voice clearances, both pilots should monitor and at least one pilot must write down the ATC clearance.		Referencing the departure clearance, verbalize the departure, route of flight, altitude, and any speed restriction to the PF.
	Referencing the FMS and MCP, verbalize the departure, route of flight, altitude, and any speed restriction to the PM.	
Taxi	The captain should repeat the taxi clearance after the first officer has read the clearance back to ATC. When issued complex and/or extensive taxi instructions, at least one pilot should write down, or enter into the FMS scratchpad, the taxi clearance.	
Takeoff	Acknowledge clearance items different than previously briefed.	

Clearance Type	Action	
	PF	PM
Altitude	The PF (or PM if the autopilot is off) will set the altitude specified by the ATC clearance or a procedure and pull the altitude set knob. Both pilots should verify the altitude specified by either an ATC clearance or a procedure has been set correctly by stating the altitude and pointing at the altitude display window. Verify the altitude ARM annunciation appears in the FMA along with the appropriate pitch mode. Ensure the proper altimeter reference - QNH, QNE, or QFE - is set.	
Crossing Restrictions, Headings, and Airspeeds	Acknowledge the clearance received by repeating the new clearance.	
Class I or II Airspace	Refer to Airway Manual, Airspace & Enroute Navigation, CDRC.	

Lights Usage

Exterior Lights Usage

Exterior lights should be used in accordance with the following:

Phase of Flight	Lights Usage
Aircraft is powered	Navigation/Position lights illuminated continuously. • POS/STROBE lights - BOTH 9219 - 9265 • LOGO lights - ON
Engines running/aircraft moving	Anti-collision lights (beacons) illuminated immediately prior to aircraft movement or engine start, whichever occurs first. • ANTI-COLLISION lights - ON
Taxiing	Taxi light illuminated when moving or intending to move. • NOSE light - TAXI DIM/BRT
Crossing a runway	All exterior lights illuminated. Note: Avoid using WING LDG lights if they will adversely affect the vision of other pilots. • NOSE lights - BRT • WING LDG lights - EXT ON • FLOOD lights - ON • WING/NACL lights - ON
Line up and wait	All exterior lights illuminated, except the landing lights. • NOSE lights - DIM • FLOOD lights - ON • WING/NACL lights - ON
Takeoff	All exterior lights illuminated. • NOSE lights - BRT • WING LDG lights - EXT ON
In flight (at 10,000 feet)	Consider retracting the WING LDG lights as the aircraft accelerates above 250 knots, due to vibration.

Phase of Flight	Lights Usage
In flight (above 18,000 feet)	Exterior lights extinguished, except the anti-collision (beacon), navigation/position, and strobe lights. • NOSE lights - OFF • WING LDG lights - RET • FLOOD lights - OFF • WING/NACL lights - OFF
In flight (below 18,000 feet)	All exterior lights illuminated. Note: Consider delaying extension of the WING LDG lights until the aircraft slows through 250 knots, due to vibration. Note: The NOSE lights may remain OFF until landing clearance has been received. • NOSE lights - BRT • WING LDG lights - EXT ON • FLOOD lights - ON • WING/NACL lights - ON

Emergency Lights Usage

Emergency lights must be armed for taxi, takeoff, and landing. They are not required to be armed during either the boarding or deplaning process.

Intentionally
Blank

Normal Procedures
Amplified Procedures

Chapter NP
Section 20

Interior Inspection - First Officer

Normally the first officer accomplishes this procedure. However, it does not preclude the captain from completing all or part of the procedure if time and conditions dictate.

It is the responsibility of the flight leader/purser to verify the cabin emergency equipment inspection is completed. For flights without flight attendants on board, refer to SP.1, Cabin Inspection-Flights without Flight Attendants.

The Interior Inspection procedure assumes that the Electrical Power Up procedure is complete. Refer to SP.6, Electrical Power Up, if required.

WARNING: If a red A/C OUT-OF-SERVICE tag is installed, personnel are not to activate any system, control, switch, or circuit breaker without obtaining verbal approval of maintenance personnel (preferably the mechanic performing the repairs).

Flight deck security search Complete
Refer to FOM, chapter 4, Sensitive Security Information, for information and timing requirements.

Logbook Check

All crewmembers must review the logbook to become familiar with the history and maintenance status of the aircraft.

If there is doubt concerning the status of the logbook, contact MCC via the dispatcher.

- Ensure the logbook matches the aircraft ship number.
- Ensure the Airworthiness Release has been signed by maintenance.

Note: Airworthiness Release sign-off is not required at a Delta non-maintenance station when aircraft airworthiness discrepancies do not exist.

- Review any EP-19s for special equipment and/or operating instructions.
- Consult the MDM for any operating limitations or crew operating procedures as a result of existing MELs/CDLs.

Waste tanks Check

- Ensure lavatories have been serviced, if required.

Quantities Check

Check the following are sufficient for flight:

- minimum oxygen pressure 1,000 psi;
- hydraulic quantities:
 - (88) Left: 8 quarts; Right: 9 quarts;
 - (90) Left: 9 quarts; Right: 10 quarts;
- engine oil:
 - Maintenance stations: (88) 12 quarts; (90) 16 quarts;
 - Non-maintenance stations: (88) 8 quarts; (90) 12 quarts;

Required documents Check

- Aircraft Logbook;
- Normal Checklists (2);
- Jeppesen Airside Flight Kits, refer to FOM, chapter 11.2, Jeppesen Airside Flight Kits;
- Quick Reference Handbook (QRH) (2);
- Mechanical Dispatch Manual (MDM);
- Engine Performance Logbook;
- Speed Booklet; and
- Quick Reference Card.

EFB mounts Check

Verify 3 EFB mounts on board.

Circuit breakers Check

Verify circuit breakers are in or collared in compliance with dispatch requirements.

Flight deck emergency equipment Check

- Fire extinguisher - Check and stowed;
 - trigger safety pin in place,
 - seal intact,
 - pressure in green band, and
 - properly stowed.
- Crash ax - stowed;
- PASS OXY MASK release switch - guard closed;
- PBE - check;
 - Verify the PBE is in its stowage bracket and both plastic seals are intact.

- Escape ropes - stowed;
- Life vests - stowed;
- Gear pins - stowed;
- ELT - ARMED;
 - Verify properly stowed and the mode switch is in the ARMED position.

Jumpseat Secure

Crew luggage Secure

Printer paper Check

Flight deck door Check

88 & 9201 - 9219

Verify the decompression latch indicator for each panel is aligned with the green band.

9220 and subsequent

Verify the decompression latches are secure and that the quick release handles are stowed with their retaining levers horizontal.

Exterior Inspection - Captain or First Officer

Before each flight the captain must verify the airplane is in satisfactory condition for flight. Make a complete exterior inspection, and report any discrepancies to the captain and to maintenance as soon as possible. Emphasis should be placed on tire wear, airframe or control damage, and leaking fluids.

Be aware of security issues. Refer to FOM, chapter 4, Sensitive Security Information.

Following the route below, complete the preflight at the point where the inspection began, ensuring a complete circuit around the aircraft.

Items at each location may be checked in any sequence.

Ensure that:

- surfaces and structures are clear, undamaged, not missing parts, and there are no fluid leaks;

Note: Assessing the condition of the upper wing surfaces may require viewing from inside the aircraft.

- hydraulic lines and electrical wires are secure and undamaged.
- installed placards are readable;
- gear struts are not fully compressed;
- gear pins have been removed;
- engine inlets and tailpipes are clear, cowlings are secured and undamaged, and the reversers are stowed;
- doors and access panels that are not in use are latched;
- probes, sensors, ports, vents, and drains are unobstructed, clear, and undamaged;
- skin area adjacent to the pitot probes and static ports is not wrinkled;
- antennas are not damaged;
- light lenses are clean and not damaged;
- exterior lights are illuminated in accordance with NP.12, Lights Usage.

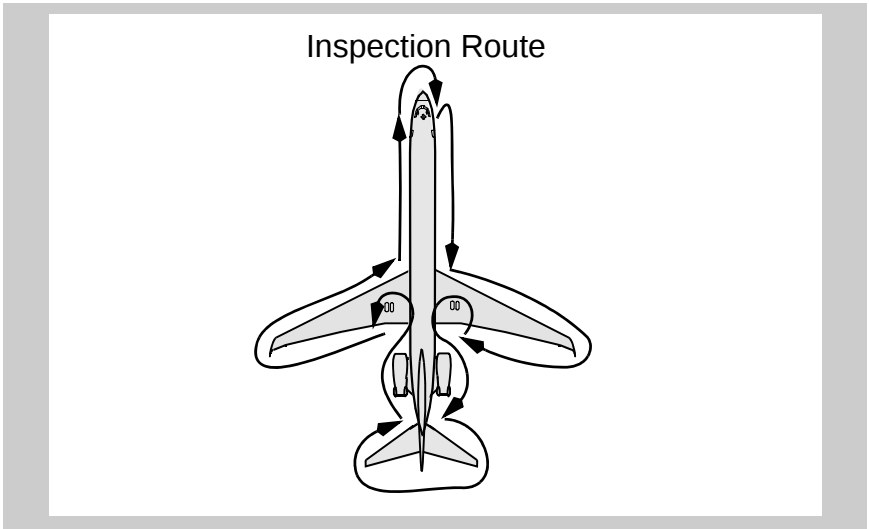
Notify maintenance if any:

- tread groove is worn completely around the tire;
- tires are worn beyond limits, damaged, or tread is separating;
- layer of cord is showing;
- questionable cut exists;

- tire shows appearance of improper inflation;
- wheel through-bolt or nut is missing or damaged.

CAUTION: Airplanes that are exposed to high-sustained winds, or wind gusts, greater than 75 mph (approximately 65 knots) are susceptible to elevator damage and/or jamming. In accordance with the Aircraft Maintenance Manual, airplanes suspected to have been subjected to these conditions must have visual and physical inspections (moving the surfaces by hand) of all flight controls and an operational check of these systems.

For cold weather operation, refer to SP.16, Cold Weather Operation.



Left Forward Fuselage

- Probes, sensors, ports, vents and drains (as applicable) Check
- Doors and access panels (not in use) Latched
- Strake Check
- Electrical ground service panel..... Check
- Place LIGHTS switch to ON.
- Stall warning vane Check
- Ensure vane is approximately parallel with the ground.

Nose

Radome	Check
Diverter strips - Secure	
Doors and access panels (not in use)	Latched
Probes, sensors, ports, vents and drains (as applicable)	Check
Wipers and windshield	Check

Nose Landing Gear and Wheel Well

Tires and wheels	Check
Gear doors	Check
Gear strut and nose wheel steering assembly	Check
Ground Shift Linkage mechanism	Check
Hydraulic lines and electrical wires	Check
Exterior lights	Check
Gear pin	Removed
Spray deflector	Check
Approximately 2 inches above the ground.	
Steering bypass lever	As required
If towbar is attached, towing lever set to bypass, pin installed.	

Right Forward Fuselage

Probes, sensors, ports, vents, and drains (as applicable)	Check
Strake	Check
Doors and access panels (not in use)	Latched
Exterior lights	Check
Oxygen pressure relief green disc	In place
Stall warning vane	Check
Ensure vane is approximately parallel with the ground.	

-
- (90) Right VSCF inlets Check
- E & E door Check
- Ensure door is closed and secure.
- Potable water (if applicable) Check
- Confirm the potable water supply is sufficient.

Right Inboard Wing and Lower Fuselage

- Probes, sensors, ports, vents, and drains (as applicable) Check
- Doors and access panels (not in use) Latched
- Exterior lights Check
- (90) Left VSCF inlets Check
- Main landing gear bypass lever Check
- Ensure lever is flush with fuselage and securely latched.

Right Wing and Leading Edge

- Doors and access panels (not in use) Latched
- Probes, sensors, ports, vents, and drains (as applicable) Check
- Leading edge slats Check
- Vortilon Check
- Fuel sticks Check
- Lower wing surface Check
- Check for ice formation due to cold soaked fuel (1/8 inch max).

Right Wing Tip and Trailing Edge

Exterior lights	Check
Static discharge wicks	Check
Control surfaces	Check
Check all spoilers are flush.	
Flaps and fairings	Check
Wing surface	Check
Check for ice formation due to cold soaked fuel and evidence of runback icing.	

Right Landing Gear and Wheel Well

Tires, brakes and wheels	Check
Gear strut, actuators, and doors	Check
Verify that the shimmy damper is serviced above the refill line.	
Hydraulic lines and electrical wires	Check
Check to ensure that the brake hydraulic line quick disconnect fittings are safety-wired.	
Spray deflector	Check
Down lock indicator	Check
Lights	Check
SPOILER lever	ON
Gear pin	Removed

Right Aft Fuselage and Upper Wing Surface

Doors and access panels (not in use)	Latched
Probes, sensors, ports, vents, and drains (as applicable)	Check
Exterior lights	Check
Overwing emergency exits	Check
Upper wing surface condition.....	Check

Right Engine

Probes, sensors, ports, vents, and drains (as applicable)	Check
Engine inlet	Check
(90) Rubber-tipped bullet nose	Check
Nacelle	Check
Doors and access panels (not in use)	Latched
Exhaust area	Check
Thrust reverser	Check
Check that reverser is stowed and undamaged.	
(88) Reverser leading edge	Check
(90) C-Duct grabber pin	Retracted
(90) Pylon flap	Check faired

Tail

Right tail area Check

Check the following are clear of obstruction and have no damage.

- Tail compartment louvers
- (88) APU Shroud Cooling Inlet
- APU exhaust outlet
- Heat exchanger outlet
- APU Ventilation Compartment Exhaust outlet

Doors and access panels (not in use) Latched

Probes, sensors, ports, vents, and drains (as applicable) Check

(90) Check silver tape in place over nitrogen bottle discharge port.

Rudder limiter pitot Check

Vertical stabilizer and rudder Check

Horizontal stabilizer and elevator Check

Static discharge wicks Check

Exterior lights Check

Lower aft fuselage surface Check

Check for evidence of tail strike damage.

Tail skid Check

Indicator horizontal and safety wired.

APU intake doors (RAM and non-RAM) Check

Tailcone assembly Check

Tailcone jettison panel - ensure closed and flush.

Left tail area Check

Check the following are clear of obstruction and have no damage.

- Tail compartment louvers
- Heat exchanger outlet

Left Engine

Probes, sensors, ports, vents, and drains (as applicable)	Check
Engine inlet	Check
(90) Rubber-tipped bullet nose	Check
Nacelle	Check
Doors and access panels (not in use)	Latched
Exhaust area	Check
Thrust reverser	Check
Check that reverser is stowed and undamaged.	
(88) Reverser leading edge	Check
(90) C-Duct grabber pin	Retracted
(90) Pylon flap	Check faired

Left Aft Fuselage and Upper Wing Surface

Doors and access panels (not in use)	Latched
Aft lavatory service panel	Check
Ensure latched, no leaks.	
Probes, sensors, ports, vents, and drains (as applicable)	Check
Outflow valves	Check
Exterior lights	Check
Overwing emergency exits	Check
Upper wing surface condition	Check

Left Landing Gear and Wheel Well

- Gear strut, actuators, and doors Check
Verify that the shimmy damper is serviced above the refill line.
- Hydraulic lines and electrical wires Check
Check to ensure that the brake hydraulic line quick disconnect fittings are safety-wired.
- Tires, brakes and wheels Check
- Spray deflector Check
- Down lock indicator Check
- Lights Check
- SPOILER lever ON
- Gear pin Removed

Left Wing Tip and Trailing Edge

- Exterior lights Check
- Static discharge wicks Check
- Flaps and fairings Check
- Control surfaces Check
- Check all spoilers are flush.
- Wing surface Check
Check for ice formation due to cold soaked fuel and evidence of runback icing.

Left Wing and Leading Edge

Probes, sensors, ports, vents, and drains (as applicable)	Check
Doors and access panels (not in use)	Latched
Leading edge slats	Check
Fuel sticks	Check
Vortilon	Check
Lower wing surface	Check
Check for ice formation due to cold soaked fuel (1/8 inch max.)	

Left Inboard Wing and Lower Fuselage

Doors and access panels (not in use)	Latched
Probes, sensors, ports, vents, and drains (as applicable)	Check
Exterior lights	Check

Left Forward Fuselage

Doors and access panels (not in use)	Latched
Probes, sensors, ports, vents, and drains (as applicable)	Check
Positive pressure relief valves	Check
(88) Forward lavatory service panel	Check
Ensure latched, no leaks.	
Radio rack venturi outlet	Check
Electrical ground service panel.....	Check
Place LIGHTS switch to OFF.	
Potable water (if applicable)	Check
Confirm the potable water supply is sufficient.	

Preflight Procedure - Pilot Flying

Normally the pilot flying (PF) accomplishes this procedure. However, it does not preclude another crewmember from completing all or part of the procedure if time and conditions dictate. In all cases both the pilot flying (PF) and pilot monitoring (PM) must confirm the FMS preflight entries.

After completing this procedure, the pilot flying (PF) should accomplish a visual scan to ensure the pilot monitoring (PM) has accomplished the flight deck set-up.

WARNING: If a red A/C OUT-OF-SERVICE tag is installed, personnel are not to activate any system, control, switch, or circuit breaker without obtaining verbal approval of maintenance personnel (preferably the mechanic performing the repairs).

IRS Panel Set

IRS MODE SELECT selectors - NAV

ON BAT lights illuminate during self-test, then ALIGN lights illuminate steady.

ALIGN lights extinguish after present position has been entered and full alignment is complete.

FMS Set

IDENT page - Select

Airplane MODEL and ENGINES - Verify

NAV DATA database - Verify

Refer to SP.11, FMS Initialization, Configuration Identification.

NAV DATA ACTIVE date - Verify

Verify that the current database is active based upon the local date of departure.

POS INIT page - Select

Present position - Enter

GMT/UTC - Verify

ROUTE page - Select

Enter ORIGIN, DEST, RUNWAY, and route.

DEP ARR key - Push

Enter or confirm departure runway and departure procedure or
SID. If known, enter arrival approach and STAR.

ROUTE page - Select

Verify selected departure and route. Correct route discontinuities.

ACTIVATE prompt - Select

EXEC key - Push

(90) DOC DATA page - Select

Enter month and day (if required), ship number, and flight number.

PERF INIT page - Select

Enter FUEL (if required), ZFW, RESERVES, COST INDEX,
CRZ ALT, CRZ WIND (if required), ISA DEV (if required), and
STEP SIZE (if required).

TAKEOFF page - Select

Verify PRE FLT COMPLETE

Departure briefing..... Complete

Refer to FOM, chapter 3, Briefings.

Preflight Procedure - Pilot Monitoring

Normally the pilot monitoring (PM) accomplishes this procedure. However, this does not preclude another crewmember from completing all or part of the procedure if time and conditions dictate. In all cases the pilot monitoring (PM) must confirm that the Preflight Procedure – Pilot Monitoring, has been completed.

WARNING: If a red A/C OUT-OF-SERVICE tag is installed, personnel are not to activate any system, control, switch, or circuit breaker without obtaining verbal approval of maintenance personnel (preferably the mechanic performing the repairs).

First-flight-of-the-day items (if required) Check

These checks or tests need only be accomplished prior to the first departure of the calendar day as noted in the aircraft logbook. These system tests are covered in the Supplementary Procedures chapter of this manual.

• FLIGHT RECORDER	SP.10
• GPWS	SP.15
• WINDSHEAR	SP.15
• Max Speed Warning	SP.15
• Emergency Power	SP.6
• Gear Lights/Horn	SP.14
• Hydraulic Systems	SP.13
• Transponder/TCAS	SP.15
• FLIGHT DECK ACCESS SYSTEM	SP.1
• Observer Oxygen Mask	SP.1
88 • Thrust Rating Panel (TRP)	SP.7
90 • Ice FOD Alert	SP.3

Aft overhead panel	Check
GROUND SERVICE ELEC PWR and MAINTENANCE INTERPHONE switches - OFF	
ENG FIRE DETECT SYS APU and ENG LOOPS switches – BOTH	
OXY LINE PRESS - green band	
FLT RCDR – NORM, red guard down	
CADC, FD CMD, EFIS, (90) FMS (if installed) selector switches	NORM
COCKPIT VOICE RECORDER	Check
Refer to SP.5, Cockpit Voice Recorder Test.	
ELECTRICAL POWER panel	Set

88

L and R CSD DISC switches - NORM,
red guards down and safety wired

L and R GEN switches - ON

APU GEN switch - NORM

APU L and R switches - OFF, unless APU is powering the aircraft

EXT PWR L and R BUS switches – ON if external power is in use
and OFF if external power is not in use

GALLEY power switch - ON

AC BUS X TIE switch - AUTO

DC BUS X TIE switch - OPEN

EMER PWR switch - OFF

90

L, APU, and R GEN switches - ON

L and R BUS TIE switches - AUTO

GALLEY power switch - ON

External power switch - ON

DC BUS X TIE switch - OPEN

EMER PWR switch - ARM

BATTERY switch ON and locked

Turn switch ON and rotate clockwise to lock.

BATT VOLT -Check for 25 volts minimum.

Note: With battery voltage less than 25 volts with no load, the battery must be recharged or replaced.

(88) IGNITION selectoras reqd

Select SYS A for captain's leg and SYS B for first officer's leg.

(90) IGNITION switch AUTO

Ensure switch in AUTO.

FUEL TANK PUMPS Checked

Refer to Chapter SP 12, [Fuel System Test](#).

RIGHT AFT PUMP switch - ON, if APU operating.

(90) N1 MODE LEFT-ENGINE and RIGHT-ENGINE

switch lights Extinguished

EMERGENCY LIGHTS switch ARM

EMER LIGHT NOT ARMED (ELEC) message extinguished.

Flight deck emergency lights extinguished.

Passenger signs ON

NO SMOK/CHIME switch - ON

SEAT BELTS switch - ON

ICE PROTECTION panel Set

Refer to SP.3, Meter Selector and Heat System Test.

METER SEL & HEAT selector - CAPT

PITOT/STALL HEAT OFF (ICE) message extinguished.

AIR FOIL switch - OFF

WINDSHIELD ANTI-FOG switch - As required

WINDSHIELD ANTI-ICE - ON

ENG L and R anti-ice switches - OFF

(90) HYDRAULIC CONTROL ELEVATOR OFF

switch light Extinguished

Cargo fire warning Check

Refer to SP.8, Cargo Fire Warning Test.

ENGINE SYNC selector	OFF
GROUND PROXIMITY WARNING SYSTEM switch	NORM
WINDSHEAR TEST switch	NORM
IRS MODE SELECT selectors	NAV
Flight Deck Door Panel	Check
AUTO UNLOCK and LOCK FAIL lights - Extinguished	
ANTI-SKID switch	ARM
Verify L and R INBD and L and R OUTBD ANTI-SKID (HYD) messages extinguished.	
STALL TEST switch	OFF
Refer to SP.15, Stall Warning System Test.	
MAX SPEED WARNING TEST switch	OFF
Full functional check required on first flight of the day.	
YAW DAMPER switch	ON
Verify YAW DAMP OFF (CONT) message extinguished.	
MACH TRIM COMPENSATOR switch	NORM
Verify:	
(88) Mach trim indicator on first officer's control column is fully retracted.	
(88) MACH TRIM INOP (CONT) message extinguished.	
(90) MACH TRIM FAULT (CONT) message extinguished.	
(90) ICE FOD switch	Check

AIR CONDITIONING panel Set

If APU air is required for cooling or heating, refer to SP.2,
APU Ground Air Conditioning

Instrument cooling air FLOW indicator - ON

Check flow indicator under first officer's glareshield with
both air conditioning supply switches off

CKPT TEMP selector - AUTO and 12 o'clock position

CABIN TEMP selector - AUTO and 2 o'clock position

SUPPLY switches - OFF

TEMP SEL - as desired

RADIO RACK switch - FAN

CABIN PRESSURE control panel Set

System selection switch - AUTO 1

LDG ALT knob - Rotate to set destination
airport elevation

LDG BARO knob - Rotate to set destination altimeter setting, if
known

FLOW light - Press and verify AUTO INOP, AUTO 1 INOP, AUTO
2 INOP, and FLOW lights illuminate.

RATE LIMIT control knob - Set to index (12 o'clock)

AIR COND SHUTOFF switch AUTO

RAM AIR switch OFF

Do not use the ON position of the RAM AIR switch to ventilate the
aircraft on the ground.

Annunciator panel and digital lights Check

EOAP cue buttons - Push

Verify no abnormal system messages are illuminated.

(90) Hydraulic system pressure may be required to extinguish CTRL messages.

(90) Certain advisory messages will only be displayed when the blue STATUS cue button is illuminated and depressed.

Notify MCC of the message. No further crew action is required.

ANNUN/DIGITAL LTS TEST button - Push and hold.

Verify EOAP and engine indication panel test patterns, MASTER CAUTION and MASTER WARNING lights on the captain and first officer's glareshields, all digital lights, and the AGENT LOW lights on the engine fire extinguishing control panel.

Standby compass Check

Standby compass light switch - DIM/BRT

Mirror - set

Compare standby compass heading approximately agrees with aircraft heading.

Exterior lightsSet

See NP.12, Lights Usage.

WING LDG LTS - RET

FLOOD LTS - OFF

NOSE LTS - OFF

WING/NACL - OFF

ANTI-COLLISION - OFF

POS/STROBE - BOTH

Mode control panel Check and set

VHF NAV radios – Set frequency and course

Perform autoland availability test on both DFGCs prior to any leg in which an autoland may be required.

Refer to SP.4, Autoland Availability Test.

FD switches – FD

Verify HDG HLD and ALT HLD in both the captain and first officer's FMA. Captain and first officer pitch and roll command bars should center on their respective PFDs.

SPD MACH knob – Set

Push in SPD MACH knob to set desired cruise mach.

Push in again to set desired speed.

AUTO THROT switch – OFF

HEADING select knob – Rotate to desired heading

Bank angle select knob – Rotate to the 15° position

AP ON switch – Off

AP ON 1/2 selector switch – Select 1 for captain's leg or 2 for first officer's leg.

ALT set knob – Rotate knob to initial clearance altitude, if available, and pull to arm.



(88) WARM light As required

If the aircraft will be deiced:

OVERWING HEATER switch – OFF

Switch must remain OFF until directed to be placed to
ARM on the deicing checklist.

If the aircraft will not be deiced:

OVERWING HEATER switch – ARM

WARM light – Illuminated

L and R FAIL lights - Extinguished

If the WARM light is not illuminated, press the switchlight
to initiate a reset of the overwing heater system and begin
timing for 12 minutes.

If the WARM light illuminates within 12 minutes,
confirm the absence of ice by visually inspecting the heater
blanket surface.

If the WARM light does not illuminate after 12 minutes a
tactile wing inspection is required.

Note: In the absence of trained ground personnel, flight crews are
qualified to perform a tactile wing inspection. Refer to SP.3,
Tactile Wing Inspection.

Fire warning Check

Refer to SP.8, Fire Warning System Test.

(88) ART switch AUTO

READY and ART lights – Extinguished

Verify ART INOP (MISC) message extinguished

Engine instruments Check

Engine and system display panels – Check all gauges display a
numeric value

Confirm minimum required oil and hydraulic quantities

FUEL USED RESET button – Push and hold momentarily

Verify FUEL FLOW USED readout is 0

Fuel quantity panel Check

Refer to SP.12, Fuel Quantity Panel Test.

Thrust rating panel Set
(88) T.O. - Push
(90) TOGA - Push
NO MODE light - Extinguished

Landing gear Check
Refer to SP.14, Landing Gear Lights/Horn Check.
Full functional check required on first flight of the day.
Landing gear lever – DOWN
GEAR DOOR OPEN light – Extinguished
LEFT, NOSE, and RIGHT gear green lights – Illuminated

WARNING: Do not establish hydraulic power which will result in flap movement unless the wing/flap area has been cleared of personnel and equipment. Use an outside observer.

Hydraulic panel Set
Refer to SP.13, Hydraulic System Check.
L and R ENG HYD PUMPS – ON
TRANS HYD PUMP – OFF
AUX HYD PUMP – OFF

Brake temperature Check and ALL
Refer to SP.14, Brake Temperature Test.
Brake temperature selector - ALL
OVHT light – Extinguished

WARNING: Do not place radar in an operating mode during ground operations unless aircraft is headed away from people, large metal objects, any refueling operation, flammable containers, or explosive liquids.

Radar Check
Refer to SP.15, Warning Systems for ship specific Radar System Tests.

Stabilizer trim Check

Operate the LONG TRIM (suitcase) handles, and ALT LONG TRIM levers in the nose up and nose down direction.

Verify LONG TRIM indicator moves the proper rate and direction.

Spoiler/ SPEED BRAKE lever RET

Spoiler/ SPEED BRAKE lever – Retracted and disarmed.

Verify the lever is full forward and the top of the red arming band is visible on the lever

RUDDER HYDRAULIC CONTROL lever PWR

Takeoff warning, throttles Check, idle

Throttles – Advance to takeoff position.

Verify takeoff warning (CAWS) sounds.

Throttles – Idle

Thrust reverser levers – Down

Throttle TOGA button – Push

TAK OFF and TAK OFF in both the captain and first officer's FMA

(90) Overrated thrust gate - Reset (aft) position

FUEL CROSSFEED lever OFF

CABIN ALTITUDE control lever Auto

Place the CABIN ALT control lever in the up (auto) position.

Verify the outflow valve position indicator is in or moves to the VALVE OPEN (full aft) position.

WARNING: Do not establish hydraulic power which will result in flap movement unless the wing/flap area has been cleared of personnel and equipment. Use an outside observer.

FLAP/SLAT handle UP/RET

FLAP/SLAT handle – UP/RET detent

FLAPS position indicator – UP

SLATS advisory lights – Extinguished

Note: A single hydraulic system may not fully retract the flaps and slats.

(88) FUEL levers	OFF
(90) FUEL switches	OFF
Radios and transponder	Check and set
COMM radios – Set	
Recommend COMM radio #1 for ATC and #2 for other (Company, ramp, ATIS, guard, etc.)	
ADF – Set frequency, as desired, NORM and ADF	
Transponder – Set	
Selector – STBY	
ATC code – Enter, if available	
1 or 2 selector switch – 1 for captain’s leg or 2 for first officer’s leg	
STABILIZER TRIM brake switch	NORM
RUDDER and AILERON TRIM	0,0
Left and Right PNEUMATIC CROSS-FEED VALVE levers	OPEN
AUTO BRAKE selector	OFF
AUTO BRAKE switch	DISARM
Flight Interphone handset	Check
Cabin interphone communication - Check	
PA system communication – Check	
Press and release button on overhead panel to connect to PA system	
FMS entries	Verify

Preflight Procedure - Captain

Logbook Check

All crewmembers must review the logbook to become familiar with the history and maintenance status of the aircraft.

If there is doubt concerning the status of the logbook, contact MCC via the dispatcher.

- Ensure the logbook matches the aircraft ship number.
- Ensure the Airworthiness Release has been signed by Maintenance.

Note: Airworthiness Release sign-off is not required at a Delta non-maintenance station when airworthiness discrepancies do not exist.

- Review any EP-19s for special equipment and/or operating instructions.
- Consult the MDM for any operating limitations or crew operating procedures as a result of existing MELs/CDLs.

Electronic Flight BagSet

Prior to the Pushback checklist, turn Airplane mode ON to ensure WiFi and Bluetooth® are turned off. The EFB must be operated in Airplane mode with WiFi disabled from the start of the Preflight checklist through the completion of the Shutdown checklist. Enabling Airplane mode with Bluetooth® off will also conserve battery life.

To turn Airplane mode ON, accomplish the following steps:

- Select SETTINGS
- Select Network icon
- Slide the Airplane mode ON/OFF switch to ON.

JEPPESEN application - Configure

The following steps are mandatory:

- Select the Jepp FliteDeck PRO tile
- Select the route icon.
- Select the down arrow to expand the route drawer
- Select New Flight, if necessary
 - In pop-up window, select OK
- Enter ORIGIN and DESTINATION airports

The following steps are optional:

- Enter ALTERNATE airport as desired
- Enter Nav aids, Airways, and/or Waypoints, as desired
- Select SID
 - Select applicable departure procedure
- Select STAR
 - Select applicable arrival procedure
- Select Terminal Charts View (airplane) icon
- Select REF
 - Select applicable reference documents, e.g., local ramp procedures
- Select CO
 - Select applicable Delta Special Pages, e.g., Engine Out Departure Procedure
- Select TAXI
 - Select applicable taxi charts
- Select enroute icon
 - Select appropriate HIGH/LOW portion of enroute charts and set an appropriate chart scale

Airwatch Secure Content Locker (SCL) - Configure

- Select the DELTA CONTENT LOCKER (Airwatch SCL) tile
- Open the appropriate documents/operating manuals as desired

Seat Adjust

Adjust the seat for optimum eye reference.

Whenever the seat is adjusted, verify a positive horizontal (fore and aft) seat lock by pushing against the seat.

Rudder pedals	Adjust
Adjust the rudder pedals to allow for full rudder pedal and brake pedal movement.	
Oxygen mask	Check
Refer to SP.1, Oxygen Mask, Regulator, Interphone, and Smoke Goggles Test.	
Audio control panel	Set
MIC selector - As desired	
Audio control knobs - As desired	
MASKS/BOOM switch - BOOM	
Window	Close and lock
Parking brake	as reqd
Set Parking Brake if brake temperature allows, if unable, set Parking Brake prior to all doors closed to ensure proper sequencing of the ACARS -601.	
• Verify minimum pressure to set PARK BRAKE is:	
• (88) 1400 psi	
• (90) 1700 psi	
• Verify maximum brake temperature to set PARK BRAKE is less than:	
• (88) 300°C	
• (90) 500°C	
EFIS control panel	Set
DH, PFD, ND, and WX knobs - As desired	
MODE, RANGE, and ADF selectors - As desired	
MAP declutter buttons - As desired	
Clock	Set

Flight and nav instruments Check

Compare captain's and first officer's instruments for approximate agreement

STATIC AIR selector - NORM

MACH/Airspeed indicator - Airspeed pointer 0, VMO pointer approximately 340, MACH approximately 150, no flags

RDMI – VOR/ADF selector knobs to VOR, no flags

PFD - no flags

ND - no flags

FMA - no amber lights

TS/VSI - 0, no failure messages

Standby horizon indicator - Pull to cage, no off flag

Standby altitude/airspeed indicator - altitude approximately field elevation and IAS approximately 0, no flags

Altimeters Set

Set the local altimeter setting in the primary and standby altimeters.

Verify no flag displayed.

Verify RVSM and altimeter crosscheck are within limits. Refer to L.10, Flight Management, Navigation.

Fuel required Verify

Compare flight plan block fuel and actual fuel on board.

If actual fuel onboard is less than flight plan block fuel, ensure MIN FUEL FOR T/O plus flight plan TAXI FUEL is on board. Refer to FOM, chapter 5.

Stabilizer trim Check

Operate the control wheel trim switch in the nose up and nose down direction.

Verify LONG TRIM indicator moves the proper rate and direction.

Flight attendant briefing Complete

Accomplish a flight attendant briefing. Refer to FOM, chapter 3, Communications.

ATC clearance Verify

Refer to NP.12, Clearance Verification procedures.

Call for the Preflight checklist.

Preflight Procedure - First Officer

Logbook Check

Refer to Interior Inspection - First Officer.

Electronic Flight BagSet

Prior to the Pushback checklist, turn Airplane mode ON to ensure WiFi and Bluetooth® are turned off. The EFB must be operated in Airplane mode with WiFi disabled from the start of the Preflight checklist through the completion of the Shutdown checklist.

Enabling Airplane mode with Bluetooth® off will also conserve battery life.

To turn Airplane mode ON, accomplish the following steps:

- Select SETTINGS
- Select Network icon
- Slide the Airplane mode ON/OFF switch to ON.

JEPPESEN application - Configure

The following steps are mandatory:

- Select the Jepp FliteDeck PRO tile
- Select the route icon.
- Select the down arrow to expand the route drawer
- Select New Flight, if necessary
 - In pop-up window, select OK
- Enter ORIGIN and DESTINATION airports

The following steps are optional:

- Enter ALTERNATE airport as desired
- Enter Nav aids, Airways, and/or Waypoints, as desired
- Select SID
 - Select applicable departure procedure
- Select STAR
 - Select applicable arrival procedure
- Select Terminal Charts View (airplane) icon
- Select REF
 - Select applicable reference documents, e.g., local ramp procedures
- Select CO
 - Select applicable Delta Special Pages, e.g., Engine Out Departure Procedure
- Select TAXI
 - Select applicable taxi charts
- Select enroute icon
 - Select appropriate HIGH/LOW portion of enroute charts and set an appropriate chart scale

Airwatch Secure Content Locker (SCL) - Configure

- Select the DELTA CONTENT LOCKER (Airwatch SCL) tile
- Open the appropriate documents/operating manuals as desired

Seat Adjust

Adjust the seat for optimum eye reference.

Whenever the seat is adjusted, verify a positive horizontal (fore and aft) seat lock by pushing against the seat.

Rudder pedals	Adjust
Adjust the rudder pedals to allow for full rudder pedal and brake pedal movement.	
Oxygen mask	Check
Refer to SP.1, Oxygen Mask, Regulator, Interphone, and Smoke Goggles Test.	
Audio control panel	Set
MIC selector - As desired	
Audio control knobs - As desired	
MASKS/BOOM switch - BOOM	
Window	Close and lock
EFIS control panel	Set
DH, PFD, ND, and WX knobs - As desired	
MODE, RANGE, and ADF selectors - As desired	
MAP declutter buttons - As desired	
Clock	Set
Flight and nav instruments	Check
Compare captain's and first officer's instruments for approximate agreement	
STATIC AIR selector - NORM	
MACH/Airspeed indicator - Airspeed pointer 0, VMO pointer approximately 340, MACH approximately 150, no flags	
RDMI – VOR/ADF selector knobs to VOR, no flags	
PFD - no flags	
ND - no flags	
FMA - no amber lights	
TS/VSI - 0, no failure messages	
TAS/SAT indicator - TAS approximately 130, SAT approximately outside air temperature	

Altimeter	Set
Set the local altimeter setting.	
Verify no flag displayed.	
Verify RVSM and altimeter crosscheck are within limits. Refer to L.10, Flight Management, Navigation.	
Fuel required	Verify
Compare flight plan block fuel and actual fuel on board.	
If actual fuel onboard is less than flight plan block fuel, ensure MIN FUEL FOR T/O plus flight plan TAXI FUEL is on board. Refer to FOM, chapter 5.	
Stabilizer trim	Check
Operate the control wheel trim switch in the nose up and nose down direction.	
Verify LONG TRIM indicator moves the proper rate and direction.	
ACARS	Set
Complete ACARS initialization. Refer to SP.5, Aircraft Communications Addressing and Reporting for details.	
ATIS	Obtain
ATC clearance	Obtain
After receiving the clearance:	
• Set the MCP as required. • Set the transponder code. • Verify ATC clearance. Refer to NP.12, Clearance Verification procedures.	
Read the Preflight checklist when requested.	

Preflight Checklist

Interior & exterior inspection	complete	C
Captain ensures the interior and exterior inspections are complete.		
Circuit breakers	ckd	C
Oxygen mask	ckd	All
Refer to SP.1, Oxygen Mask, Regulator, Interphone, and Smoke Goggles Test.		
Voice recorder	ckd	C
Electrical panel	set	C
Battery switch	ON & locked	C
Ignition	as reqd	C&F
Fuel tank pumps, crossfeed	ckd, OFF	C
Passenger signs	ON	C
Ice protection panel	set	C
Cargo fire warning	ckd	C
Air conditioning panel	set	C
Pressurization panel	set	C
Air conditioning shutoff switch	AUTO	C
Annun panel & digital lights	ckd	C
Windows	closed & locked	C&F
Parking brake	as reqd	C
■ Mode control panel	ckd & set	C
Altimeters	__, xckd	C&F
Confirm the captain's, first officer's, and standby altimeter settings are correctly set.		
Verbalize the altimeter setting.		
Flight & nav instruments	ckd	C&F

(88) WARM light	as reqd	C
Confirm overwing heater system status.		
Verbalize “WARM” if the WARM light is illuminated or “OFF” if the WARM light is extinguished.		
Fire warning	ckd	C
Engine instruments	ckd	C
Brake temp	ckd & ALL	C
Radar	off	C
Takeoff warning, throttles	ckd, idle	C
Outflow valve	AUTO	C
(88) Fuel levers/ (90) Fuel switches	OFF	C
■ Radios & transponder	set	C
Ensure the communication radios are set as appropriate.		
Ensure the transponder code is set as appropriate and the Transponder mode select switch is set to STBY.		
Stab trim brake switch	NORM	C
Rudder & aileron trim	0, 0	C
Flight attendant briefing	complete	C
■ Departure briefing	complete	C
Logbook & QRHs	onboard	C
Ensure the logbook is onboard and the logbook review is complete.		
Ensure that each QRH is on board.		
Fuel required	___ onboard ___	C&F
Compare and verbalize flight plan block fuel and actual fuel on board.		
If actual fuel onboard is less than flight plan block fuel, ensure MIN FUEL FOR T/O plus flight plan TAXI FUEL is on board. Refer to FOM, chapter 5.		

Pushback Procedure

Captain	First Officer
Operate the APU in accordance with FOM chapter 3, Aircraft Operational Policy.	
When all exterior doors are closed and the cabin is ready for pushback:	
• Verify “CABIN IS READY FOR PUSHBACK” advisory has been received	• Exterior doors - Verify closed
• Fuel Qty Panel - Checked • FUEL TANK PUMPS panel - Set • All FUEL TANK PUMP switches ON for all tanks containing fuel.	
	• Flight deck door - Closed and locked • Transponder - ALT ON/XPNDR/XPDR, or as required by local airport operating procedures.
Call “PUSHBACK CHECKLIST.”	Accomplish the Pushback checklist.
Note: The Pushback checklist must be completed prior to aircraft movement.	
When advised the ground crew is ready for pushback:	
Direct the first officer to call for pushback or engine start clearance as appropriate.	When requested by the captain, call for pushback or engine start clearance.
When pushback clearance has been received:	
• Parking Brake - OFF	• ANTI-COLLISION - ON
Note: Do not turn the beacon on or release brakes until cleared for pushback or engine start.	
Call "BEACON ON, BRAKES RELEASED, CLEARED TO PUSH."	
CAUTION: Do not use the brakes to stop the airplane during pushback or towing. This can damage the nose gear or the tow bar.	
With initial aircraft movement:	
If not immediately cleared for engine start, ask: "ARE WE CLEAR TO START ENGINE(S)?"	Plan engine start to be prepared to taxi upon ground crew salute.

Pushback Checklist

Doors	closed	F
Ensure all exterior door annunciator lights extinguished.		
Fuel tank pumps	ckd & set	C&F
Flight deck door	closed & locked	F
Ensure the LOCK FAIL light is extinguished.		
Transponder	ALT ON/XPNDR/XPDR	F

Engine Start Procedure

Captain	First Officer
Single engine taxi unless an operational necessity dictates otherwise. The captain should determine engine taxi configuration after considering aircraft weight, ramp conditions, taxiway, and maneuvering requirements. Single engine taxi out using the left engine is the normal procedure, conditions permitting. Single engine taxi out using the right engine is permitted. The tug driver will advise the captain when it is clear to start engine(s).	
Note: One pilot will accomplish the engine start procedure while the other will monitor the pushback. Normally the first officer accomplishes the engine start procedure.	
When cleared and ready to start:	
Announce the engine(s) to be started.	
	• L and R PNEU X-FEED VALVE levers - OPEN • L and R AIR CONDITIONING SUPPLY switches - OFF • Pneumatic pressure - Check 88 • Check PNEU PRESS gauge for positive pressure. 90 • PNEU PRESS gauge indication may only be observed after START switch is pulled.
For cold weather refer to SP.16, Cold Weather Operation. 88 CAUTION: Do not reengage the starter while the engine is accelerating or decelerating except for a tailpipe fire.	

Captain	First Officer
	88 • START switch - Hold ON • Observe: • START VALVE OPEN message • N2 • HYDRAULIC PRESS • OIL PRESS • N1. At approximately 22-24% N2 (minimum 20% N2) with EGT below 100C: • FUEL lever - ON • Observe: • FUEL FLOW (800-1100 PPH) Note: 1100 PPH or greater and/or flashing FUEL FLOW may be an indication of an impending hot start • EGT within 20 seconds of placing lever ON
	At 40% N2: • START switch - Release • Observe: • START VALVE OPEN message extinguished • N2 stabilized at or above 50%.
Note: If N2 is greater than 42% but below 50%, with captain's concurrence advance the throttle to increase N2 to 65% momentarily while monitoring EGT. This should close the surge valve and result in increased idle RPM and decreased EGT.	

Captain	First Officer
Standard day, sea level, approximate stabilized idle indications are: 88 • N2 - 50-60% • EGT - 300-480°C • OIL PRESS - 40 psi minimum • FUEL FLOW - 800-1100 pph. Note: Bleed extractions should only be made once the engine has stabilized at idle RPM. A 4-5% decrease in N2 due to bleed extraction is considered normal. This reduction in engine idle speed may result in an N2 RPM less than 50% and is acceptable provided other engine indications are stable. 88 Accomplish the Aborted Start - Manual, QRH, NNC.7 for any of the following: • no N2 • no OIL PRESS prior to 20% N2 • no N1 prior to 20% N2 • no FUEL FLOW within 20 seconds of FUEL lever ON • no EGT within 20 seconds of FUEL lever ON • rapid EGT rise • N2 fails to increase above 42% • FUEL FLOW flashing combined with one or more of the abnormal indications above.	



Captain	First Officer
90 CAUTION: Do not reengage the starter while the engine is accelerating or decelerating except for a tailpipe fire.	
	90 • ENG START switch - Pull Note: If ENG START switch will not remain latched, pull and hold. • Observe: • START VALVE OPEN message • N2 • VIB below 4.0 • HYDRAULIC PRESS • OIL PRESS • May not indicate until 20% N2 • N1 • With 20-26% N2, N1 could just be indicating 0-1% • Not required until 33% N2.

Captain	First Officer
	At 25-26% N2 (minimum 15% N2) with EGT below 250°C: CAUTION: After moving the fuel switch to ON, jiggle the switch to ensure it is seated properly in the detent. • FUEL switch - ON • Observe: • FUEL FLOW indication (800-1100 PPH) 30 seconds after START VALVE OPEN message • EGT rise 20 seconds after FUEL FLOW. Note: If flashing FUEL FLOW is observed, monitor the EGT and other engine indications. Allow the EEC to activate fuel de-pulse logic prior to manually aborting the start for rising EGT. At 45% N2: • ENG START switch - unlatched and light out Note: If ENG START switch remains latched or was held in position, push in switch between 43-45% N2. • Observe: • START VALVE OPEN message extinguished • N2 stabilized at or above 55%.

Captain	First Officer
Standard day, sea level, approximate stabilized idle indications are: 90 • N2 - 55-60% • EGT - 300-530°C Note: With high ambient conditions, idle EGT may exceed 530°C, but may not exceed 610°C. • OIL PRESS - 80 psi minimum • FUEL FLOW - 800-1100 pph. 90 Accomplish the ENG START ABORTED - Auto, QRH, NNC.7 for: • L or R ENG START ABORTED message Accomplish the Aborted Start - Manual, QRH, NNC.7 for: • no OIL PRESS by 20% N2 • VIB above 4.0.	

After Start Procedure

Captain	First Officer
After starting engine(s):	
In preparation for single-engine taxi:	
	• L ENG anti-ice switch - As required • Refer to SP.16, Adverse Weather. 88 • L and R EXT PWR BUS switches – OFF • L GEN - check • L GEN OFF message extinguished • Check AC VOLTS and FREQUENCY • AIR CONDITIONING panel - Set • L and R AIR CONDITIONING SUPPLY switches - AUTO • Left engine instruments - check for normal idle indications
CAUTION: Do not begin taxi until all hydraulic pumps are on.	
	• Hydraulic panel - Check and set • All HYD PUMPS - ON • Check L and R HYDRAULIC PRESS and L and R HYD QTY normal • Check L and R BRAKE PRESS in green band • L PNEU X-FEED VALVE lever - As required • CLOSED unless required to be OPEN for cooling.

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Captain	First Officer
In preparation for two-engine taxi:	
	• L ENG anti-ice - As required • Refer to SP.16, Ground De/Anti-Icing. • L GEN - check • L GEN OFF message extinguished • Check AC VOLTS and FREQUENCY • L AIR CONDITIONING SUPPLY switch - AUTO • Left engine instruments - Check • L PNEU X-FEED VALVE lever - CLOSED
	• Engine start procedure - Accomplish

Captain	First Officer
	• R ENG anti-ice switch - As required • Refer to SP.16, Ground De/Anti-Icing. 88 • L and R EXT PWR BUS switches – OFF • L and R GEN - Check • L and R GEN OFF messages extinguished • Check AC VOLTS and FREQUENCY • APU AIR switch - As required • OFF unless required to be ON for cooling • APU MASTER switch - As required • OFF unless required to be ON for cooling. • AIR CONDITIONING panel - Set • L and R AIR CONDITIONING SUPPLY switches - AUTO • Engine instruments - Check for normal idle indications
CAUTION: Do not begin taxi until all hydraulic pumps are on.	
	• Hydraulic panel - Check and set • All HYD PUMPS - ON • Check L and R HYDRAULIC PRESS and L and R HYD QTY normal • Check L and R BRAKE PRESS in green band • PNEU X-FEED VALVE levers - as required • CLOSED unless required to be OPEN for cooling.
Call "AFTER START CHECKLIST"	Accomplish the After Start checklist.

Captain	First Officer
Receive and return the marshalling agent's taxi salute.	

Captain	First Officer
Prior to aircraft movement:	
Call "SALUTE RECEIVED, FLAPS ____."	Select flaps as directed, and arm the autobrakes and spoilers.
Note: If the WDR is not available, select flaps to the default setting of flaps 11.	

After Start Checklist

Engine anti-ice	as reqd	C
Ensure the anti-ice switches are in the correct position for the current environmental conditions.		
Generator(s)	ckd	F
Air conditioning panel	set	F
Hydraulic panel	ckd & set	F

Taxi Procedure

Captain	First Officer
After WDR has been received:	
Performance data may be entered and verbalized at any point after receipt of the WDR but should not interfere with other critical crew duties and responsibilities. The captain's analysis of the WDR shall not be completed while the captain is taxiing the aircraft. The balance of the Taxi procedure and the reading of the Taxi checklist should be completed during low workload times.	
• Verify the header block for the correct: • flight number, • ship number, • date, and • release number. • Verify the performance data is available for the FMS entered takeoff runway/position. • Perform a complete analysis of the following WDR blocks: • FMS, • weather, • performance, and • notes. Refer to FOM, chapter 5, Weight Data Record (WDR).	
For PACKS OFF takeoff, refer to SP.2, Takeoff with Air Conditioning Packs Off.	
Referencing the WDR data:	
• PERF INIT page - Enter ZFWT into ZFW • reconcile differences between flight plan ramp weight and actual gross weight before entering final ZFW. Note: The WDR delivered to the crew does not include unusable/ballast fuel in ZFWT. No manual corrections need to be made.	• FUEL QTY panel - Enter ZFW 88 • Push and rotate ZFW knob 90 • Push up or down ZFW buttons
	• Verify runway on RTE page - Note: If not displayed, verify on ND prior to takeoff.

Captain	First Officer
Verify and verbalize the set zero fuel weight.	
• TAKE-OFF CONDTN and LONG TRIM - Set • rotate CG thumbwheel until TOCG value is displayed in CG readout • rotate FLAP thumbwheel until takeoff flap setting is displayed in FLAP readout • verify LONG TRIM readout with WDR STAB value	
Verify and verbalize the set takeoff condition computer settings.	
• set LONG TRIM indicator to WDR STAB value and verify position is aligned with LONG TRIM takeoff position indicator (green band).	
Verify and verbalize the set stabilizer value.	
	• FLAP TO SEL – rotate thumbwheel to 23° for flaps 11°. For other than flaps 11°, rotate thumbwheel to desired flap setting.
• Takeoff speeds - Set	• TAKEOFF REF Page - Enter V1, VR, and V2
• MCP - Set • set SPD/MACH Readout to V2 • external airspeed reference bugs - Set • position bugs at V1, V2+20, SLAT RET and CLEAN referencing the WDR and Speed Booklet	• Takeoff speeds - Set • external airspeed reference bugs - Set • position bugs at V1, V2+20, SLAT RET and CLEAN referencing the WDR and Speed Booklet

Captain	First Officer
88 • (F) TRP - Set Alternate Power: • T.O. FLX - Push • ART switch - OFF • Assumed Temp selector - rotate until desired value is displayed in FMA Thrust Window as EPR __ (where __ is desired temperature) • ART INOP message - Verify displayed. Normal Power: • T.O. - Push • ART switch - AUTO. Note: The ART INOP message will extinguish and the READY light will illuminate with two engines operating and the slats extended. Maximum Power: CAUTION: Do not use maximum power unless directed by MEL and Performance Data precludes use of alternate power or performance limited at normal thrust with a field elevation of greater than 5,000 MSL. • T.O. - Push • ART switch - OFF • ART INOP message - Verify displayed Note: Logbook entry required.	

Captain	First Officer
90 • (F) TRP - Set Alternate Power: • TO FLX - Push • Assumed Temp selector - Rotate until desired value is displayed in FMA Thrust Window as EPR __ (where __ is desired temperature) • FLX __ (where __ is temperature) - Verify in Thrust Rating Mode Annunciator. Normal Power: • Not applicable. Takeoff power settings are either maximum power or derated from 28K. Maximum Power (28K): • TO/GA - Push • EPR T/O - Verify in Thrust Rating Mode Annunciator. Note: Maximum power may only be used when approved by WDR or Airway Manual Special Pages. Logbook entry not required. 90 Note: If directed by Delta Special Pages, verify ACB is displayed in FMA throttle window. Refer to SP.7, Automatic Thrust Cutback.	
	• Engine Display Panel - Check • EPR LIMIT Readout - verify allowable limit for takeoff • EPR indicators - EPR limit reference bugs should match the EPR LIMIT readout. If not, set MAN EPR SET knobs.
	• AUTO BRAKE selector - T.O. • AUTO BRAKE switch - ARM • Spoiler/SPEED BRAKE lever - ARM • squeeze and pull up so red placard and ARM are visible.

Captain	First Officer
When workload and conditions permit:	
• Rudder - Check • hold the nose wheel steering wheel during the rudder check to prevent nose wheel movement. • Move the rudder pedals to full travel in both directions and verify: • freedom of movement • rudder pedals return to center.	• Ailerons and spoilers - Check • check for freedom of movement and full travel turning the control wheel full deflection to each side, and center. SPOILER DEPLOYED message should illuminate and extinguish as appropriate with throttles at idle.
• (F) Elevators - Check Note: Avoid hitting stops with excessive force. 88 • Move control column full aft then full forward and hold. The ELEVATOR POWER ON light should illuminate. Release the control column and observe that the light extinguishes. 90 WARNING: If the opposite control column seems to lag behind or not move to the aft or forward stop completely or simultaneously, the control columns may be disconnected. Contact maintenance if this is suspected. Do not takeoff in this condition. • Move control column full aft then full forward. Observe ELEVATOR AT LIMIT light is illuminated at both aft and forward limits. Observe that light extinguishes when not at either limit.	
EFBs - Set • Display applicable REF, CO, and Taxi page(s), as needed. • Select the planned assigned SID prior to Departure, as desired.	
Call "TAXI CHECKLIST."	Accomplish the Taxi checklist.

For extended ground time:

Consider shutting down one or more engines. When departing from ramp areas where taxiing is restricted to both engines, consider shutdown of one engine after exiting the restricted area.

Taxi Checklist

- Flaps & slats ____, ____, ____, T/O C&F
 - Ensure:
 - flap value on the WDR,
 - FLAP/SLAT handle position,
 - FLAPS position indicator value, and
 - SLATS T/O advisory light illuminated and all other SLATS advisory lights extinguished.
 - Verbalize:
 - flap value on the WDR,
 - FLAP/SLAT handle position,
 - FLAPS position indicator value, and
 - TAKEOFF.

- Autobrakes & spoilers T.O., ARM & ARM F

- Takeoff condition computer verified C&F
 - Confirm the following values have been verified and verbalized:
 - CG value
 - FLAP value

- Takeoff speeds ____, xckd C&F
 - Confirm:
 - V2 in MCP SPD/MACH window
 - V1, VR, and V2 on FMS TAKEOFF REF page
 - captain's and first officer's airspeed reference bugs on V1, V2+20, SLAT RET, and CLEAN
 - airspeed command bug at V2.
 - Verbalize V1, VR, V2, V2+20, SLAT RET, and CLEAN speeds.

-
- Thrust C&F
- Confirm
- TRP selection
 - (88) ART switch position
 - EPR LIMIT readout(s) match EPR LIMIT reference bugs.
- Verbalize
- TRP selection
 - FMA throttle window readout
 - (88) ART switch position
 - EPR LIMIT readout(s)
- Stab Trim set C&F
- Confirm LONG TRIM indicator aligned with LONG TRIM takeoff position indicator (green band).
- Flight controlsckd C&F

Delayed Start Procedure

Captain	First Officer
Initiate the Delayed Start procedure to ensure proper engine warm up. If performing a crossbleed start, (Refer to Chapter SP.7, Crossbleed Start for additional information).	
When ready to start:	
Announce engine start.	
	• L PNEU X-FEED VALVE lever - CLOSED • R AIR CONDITIONING SUPPLY switch - OFF • Pneumatic pressure - Check 88 • check PNEU PRESS gauge for positive pressure. 90 • PNEU PRESS indication may only be observed after START switch is pulled.

Captain	First Officer
After engine start:	
	• R ENG anti-ice switch - As required • refer to SP.16, Ground De/Anti-Icing. • R GEN - Check • R GEN OFF message extinguished • APU GEN OFF message illuminated • check AC VOLTS and FREQUENCY • APU AIR switch - As required. • OFF unless required to be ON for cooling • APU MASTER switch - As required • OFF unless required to be ON for cooling. • AIR CONDITIONING panel - Set • R AIR CONDITIONING SUPPLY switch - AUTO • Engine instruments - Check

Captain	First Officer
	- Hydraulic panel - Check and set - AUX and TRANS HYD PUMPS - OFF - check HYDRAULIC PRESS - after 5 seconds, observe no significant pressure loss. - All HYD PUMPS - ON - check L and R HYDRAULIC PRESS and L and R HYD QTY normal - check L and R BRAKE PRESS in green band - L and R PNEU X-FEED VALVE levers - As required - CLOSED unless required to be OPEN for cooling.
Call “DELAYED AFTER START CHECKLIST.”	Accomplish the Delayed After Start checklist.

| Delayed After Start Checklist

Engine anti-iceas reqd C
Ensure the anti-ice selectors switches are in the correct position for the current environmental conditions.

Generator ckd F
Air conditioning panelset F
Hydraulic panelckd & set F

Before Takeoff Procedure

Captain	First Officer
When a runway, intersection, departure, or performance change occurs prior to takeoff:	
- FMS data must be modified using the most recent WDR information. Refer to the Taxi Procedure for specifics. - After updating/verifying any changed items, complete the runway change boxed items and any associated procedural steps for all previously completed checklists. Note: Performance data for an intersection departure is also valid for all other takeoff positions on that runway that afford additional runway length.	

Captain	First Officer
Operate the engines for a minimum of 2 minutes (5 minutes minimum if possible if engine has been shut down more than two hours). 90 Operate the engines until the oil temperature is at least 50°C before applying takeoff thrust.	
88 Prior to takeoff momentarily advance throttles, one at a time, to approximately 65% N2 to close the surge valves and improve engine acceleration.	
When in proximity to the departure runway:	
	Notify the flight attendants to finalize preparations for takeoff with the following PA, “FLIGHT ATTENDANTS, PLEASE PREPARE THE CABIN FOR DEPARTURE.”
	Receive “THE CABIN IS READY FOR TAKEOFF” report from the flight leader/purser via the interphone. Refer to FOM chapter 3.

Captain	First Officer
Takeoff briefing - Complete The Pilot Flying (PF) will verify and verbalize: • runway - outside reference and ND/FMS runway • departure • first fix • H: heading mode • A: altitude constraints • A: airspeed constraints	
• Takeoff configuration warning - Check • cycle both throttles past 3 units and back within 2 seconds. CAWS takeoff warning should not occur.	
	• APU AIR switch - OFF • APU MASTER switch - As required • L and R PNEU X FEED VALVE levers - CLOSED if left OPEN for cooling • ENG IGN selector - As required • Annunciator panel and warning lights - Check

Captain	First Officer
• (F) Brake Temperature - Check • Verify: • OVHT light extinguished. 88 • BRAKE TEMP gauge does not exceed 205°C 90 • BRAKE TEMP gauge does not exceed: • 250 °C for airport elevations up to 2200' MSL • 210 °C for airport elevations 2201' - 3000' MSL • 160 °C for airport elevations 3001' - 4500' MSL • 105 °C for airport elevations 4501' - 5500' MSL • 40 °C for airport elevations 5501' - 6500' MSL • Corrections to brake temperature limit: • When OAT exceeds 32°C, subtract 5°C for each 1°C above 32°C. • For each 1 knot of tail wind, subtract 15°C Note: For temperatures greater than those listed above, reference ODM, chapter 7, Maximum Takeoff Brake Temperature charts. Brake temperature limits ensure sufficient brake energy available in the event that an ensuing takeoff is rejected. Temperature limits are based on a 165,000 pound aircraft and a V1 of 160 knots.	
• Check aircraft versus runway position on ND (10 nm scale)	
• Fuel - Check • Fuel quantity is equal to or greater than MIN FUEL FOR T/O	
	• Transponder - TA/RA
Call "BEFORE TAKEOFF CHECKLIST."	Accomplish the Before Takeoff checklist.
Manage the radar and terrain display as required.	
WARNING: Prior to crossing a runway hold short line to either take off from or cross a runway, both crewmembers should confirm their position by comparing taxiway and runway identification signs to the taxi chart.	

Before Takeoff Checklist

- Runway position ____, ____, ____ C&F
 Verify and verbalize:
 - the runway/intersection displayed on the WDR, and
 - the actual runway takeoff position observed.

- Flaps & slats ____, ____ T/O C&F
 - Ensure:
 - WDR agrees with FLAPS position indicator, and
 - SLATS T/O advisory light illuminated and all other SLATS advisory lights extinguished.
 - Verbalize:
 - WDR FLAP position agrees with indicated flap position
 - TAKEOFF.

- Takeoff briefing complete C
 Ensure the takeoff briefing has been completed by the PF.

- Takeoff warning ckd C

- APU air switch OFF F

- Brake temp ckd F

- Transponder TA/RA F

- Annunciator panel & warning lights ckd F
 Ensure:
 - 88/90**
 - EOAP APU GEN OFF message with APU operating
 - L and R ENG ANTI-ICE ON lights illuminated, if required

 - 88 only**
 - EOAP ART INOP message with ART switch OFF for AT or MX takeoff thrust selections
 - RUDDER TRAVEL UNRESTRICTED advisory light illuminated
 - Ignition system light(s) illuminated
 - L and R FUEL HEAT ON lights extinguished

88/90

- all other EOAP messages extinguished
- all other warning and advisory lights extinguished.

Flight attendantsnotified & acknowledge

F

Takeoff Procedure

Pilot Flying	Pilot Monitoring												
When cleared for takeoff:													
Confirm alignment with the intended departure runway by reference to the ND.													
Verify brakes are released. Advance throttles to approximately: 88 • 1.4EPR 90 • 1.2EPR Allow the engines to stabilize.													
Call “AUTOTHROTTLES.”	Select the AUTO THROT switch to AUTO THROT.												
	Announce “EPR ____” after verifying FMA throttle window indication.												
	Announce “CLAMP” when CLMP is annunciated.												
Verify takeoff thrust is set by approximately 60 knots. Adjust as necessary.													
	Monitor engine instruments throughout the takeoff. Crosscheck EPR and ensure N1 approximately: <table><tr><td>T/O Power</td><td>88</td><td>90</td></tr><tr><td>ALTERNATE</td><td>88% N1</td><td>78% N1</td></tr><tr><td>NORMAL</td><td>92% N1</td><td>82% N1</td></tr><tr><td>MAXIMUM</td><td>95% N1</td><td>85% N1</td></tr></table> to ensure the required takeoff thrust has been obtained.	T/O Power	88	90	ALTERNATE	88% N1	78% N1	NORMAL	92% N1	82% N1	MAXIMUM	95% N1	85% N1
T/O Power	88	90											
ALTERNATE	88% N1	78% N1											
NORMAL	92% N1	82% N1											
MAXIMUM	95% N1	85% N1											
After takeoff thrust is set, the captain's hand must be on the throttles until V1.													
Monitor airspeed.													
At 80 knots:													
	Verify 80 knots Announce “80 KNOTS, THRUST NORMAL.”												

Pilot Flying	Pilot Monitoring
At V1:	
	Verify V1 speed Announce "V1"
At VR:	
Rotate to the takeoff pitch attitude.	Announce "ROTATE."
	Monitor airspeed and vertical speed. Verify a positive rate of climb and announce "POSITIVE RATE."
Verify a positive rate of climb on the altimeter. Call "GEAR UP."	Position the landing gear handle to UP.
Above 400 feet AGL:	
Call for the appropriate roll mode	Select the commanded roll mode
At thrust reduction height:	
Call for "CLIMB POWER."	Select CL power on the TRP, and adjust throttles, as required
At the acceleration height:	
Reduce pitch attitude to 10° and begin acceleration. Verify acceleration.	
At the flap retraction speed:	
Call "FLAPS UP."	Move FLAP/SLAT handle to 0.
Call "VNAV."	Select VNAV.
At the slat retraction speed:	
Call "SLATS RETRACT."	Move FLAP/SLAT handle to UP/RET.

Pilot Flying	Pilot Monitoring
After reaching clean speed:	
	• APU MASTER switch - OFF. 88 • ENG IGN selector - OFF. • FUEL TANK PUMPS panel - Set • All FUEL TANK PUMP switches ON for all tank containing fuel. • Ice protection panel - set • AIR FOIL ICE - As required. • ENG ICE - As required. • Annunciator panel and warning lights - Check. • Spoiler/SPEED BRAKE lever - Down with red placard out of view. • AUTO BRAKE selector - OFF. • AUTO BRAKE switch - OFF. • FLAP T.O. SEL - 23°. • AUX and TRANS PUMP switches - OFF. 88 • ART switch - AUTO. • Pressurization panel - Check.
CAUTION: Use of TEMP selectors in MANUAL can cause one or both packs to trip due to high temperature and loss of cabin pressure.	
	• AIR CONDITIONING panel - Set. • CKPT and CABIN TEMP selectors - AUTO. • ENG SYNC - N1.
Call "AFTER TAKEOFF CHECKLIST."	Accomplish the After Takeoff checklist.

After Takeoff Checklist

APU off

(88) Ignition OFF

Fuel tank pumps set

Spoilers disarmed

Autobrakes OFF

Flap takeoff selector 23

Flaps & slats up & retracted

 Ensure:

- FLAP/SLAT handle in UP/RET position,
- FLAPS position indicator UP, and
- SLATS advisory lights extinguished.

Aux & trans hyd pumps OFF

Landing gear up

 Ensure landing gear handle UP and gear light indications normal.

(88) ART switch AUTO

Pressurization panel ckd

 Ensure the cabin is pressurizing.

Air conditioning panel set

 Ensure the temperature selectors are in AUTO.

Engine sync N1

Climb Procedure

Pilot Flying	Pilot Monitoring
Approaching transition altitude:	
	If other than 18,000 feet, call “TRANSITION ALTITUDE.”
• Altimeters - Set	

Pilot Flying	Pilot Monitoring
• Anti-Ice - As required	
After climbing through approximately 10,000 feet AFE:	
• (C) NO SMOKE/CHIME switch - Cycle to sound cabin chime twice.	
When conditions permit:	
• (C) SEAT BELTS sign - OFF • (C) Ensure PA is made advising passengers to keep seat belts fastened while seated.	
	Aircraft performance - Check • Verify FMS PERF INIT FUEL matches FUEL QTY and update as necessary. • Verify FMS OPT cruise altitude. Note: The FMS does not consider use of engine or airfoil anti-ice. Refer to ODM, chapter 4, for Maximum Recommended Initial Cruise Altitude.
After passing 18,000 feet:	
Call “CLIMB CHECKLIST.”	Accomplish the Climb checklist.

Climb Checklist

Altimeters 29.92, xckd C&F

Ensure the captain, first officer, and standby altimeters are correctly set.

Cruise Procedure

Pilot Flying	Pilot Monitoring
88 CAUTION: Undetected PT2 probe icing can cause erroneous EPR indications and the possibility of a slow decay in airspeed. • Anti-ice - As required	
After reaching top of climb: • Apply Tactical Cost Index procedures as necessary per FOM. • Monitor fuel trend. • Fuel remaining should be recorded on the flight plan and compared against planned fuel remaining.	
Enroute: • Monitor fuel trend. • Send turbulence reports as necessary • Send position reports as necessary. • Fuel remaining should be recorded on the flight plan and compared against planned fuel remaining.	
Fuel - Check • Update fuel in FMS as required. • Check that fuel distribution is correct. Note: If center tank fuel is present, verify center tank pump switches are ON. • Crosscheck flight plan fuel remaining versus actual fuel on board: • At all flight plan reporting points. For flight plans with no reporting points, once prior to top of descent. • If possible, at all flight plan waypoints.	
Engines - Check N1 indication • (88) 76-84% • (90) 72-82%	
CAUTION: Do not operate below minimum cruise speed for any reason, including holding.	
	Minimum cruise speed - Check • Add 10 knots to SPEED BOOKLET CLEAN speed. VHF NAV radios - Tune • Tune radios to a valid VOR station.

Pilot Flying	Pilot Monitoring
• EFB - Manage: • Select enroute icon. • Select appropriate HIGH/LOW portion of enroute charts and set an appropriate chart scale. • Monitor the battery power indicator and connect the powered keyboard when necessary. Note: An electrical outlet in the flight deck is not an approved power source. • Connect the powered keyboard when the EFB battery power indicator displays 20% or less. • Conserve battery power as much as possible. During extended cruise, consider shutting down an EFB to preserve battery life. Note: All EFBs may not be off simultaneously. Maintain at least one EFB in sleep or ON mode to provide ready access to data when operational needs dictate.	
When approach procedure is known:	
• FMS DEP/ARR INDEX page - Select ARR • Select/modify APPROACH, STAR, and TRANSITIONS as necessary.	
• Compute landing weight. • Determine flap setting. • Refer to SPEED BOOKLET and set airspeed reference bugs to: • CLEAN, • 0/EXT, • FLAPS 15, and • GO-AROUND. • Verbalize and crosscheck the set airspeed reference bugs. • Note Vref and airspeed command bug setting for landing. • Set RADIO and/or BARO minimums, as appropriate. Note: Refer to NOI.3, Approach Selection Table.	
To ensure adequate obstacle clearance in conditions of extreme cold weather (-10°C or lower, or as specified in the Delta Special Page), refer to Airway Manual, Weather, Altimeter Corrections.	

Pilot Flying	Pilot Monitoring
EFB - Configure: • JEPPESEN application - Configure • Select the Jepp FliteDeck PRO tile. • Select the airport (airplane) icon. • Select DESTINATION airport. • Select REF. • Select applicable reference documents, e.g., local ramp procedures. • Select CO. • Select applicable Delta Special Pages, e.g., Critical Performance procedures. • Select TAXI. • Select applicable taxi chart(s). • Select APP. • Select applicable approach chart(s). • Select STAR. • Select applicable arrival procedure charts. • Airwatch Secure Content Locker (SCL) - Configure • Select the DELTA CONTENT LOCKER (Airwatch SCL) tile. • Open the appropriate document/operating manual as desired. • Check the EFB mount for security.	
After FMS data has been entered:	
	• FMS data - Verify
• Approach briefing - Accomplish. Refer to FOM, chapter 3.	

Descent Procedure

Pilot Flying	Pilot Monitoring
• Anti-Ice - As required	
At top of descent or approximately 20 minutes prior to landing:	
Notify the flight attendants with a PA that includes “FLIGHT ATTENDANTS PLEASE PREPARE THE CABIN FOR ARRIVAL.”	
• (C) SEAT BELTS sign - ON	
• (F) ENG SYNC - OFF • (F) Pressurization panel - Set • Set LDG ALT • Set LDG BARO • Check CABIN CLIMB gauge for proper descent rate. • (F) WINDSHIELD ANTI-FOG switch - As required. • On for descent into high humidity conditions when flight has been conducted above FL250	
CAUTION: Failure to select the auxiliary and transfer pumps ON prior to inducing a hydraulic demand may result in hydraulic pump cavitation and/or pressure fluctuations.	
• (F) AUX PUMP - ON • Verify normal right HYDRAULIC PRESS and QTY. • (F) TRANS PUMP - ON • (F) BRAKE PRESS - Check. • Verify pressure is equal to or greater than left and right system pressure.	

Pilot Flying	Pilot Monitoring
Approaching transition level:	
	If other than FL 180, Call “TRANSITION LEVEL.”
• Altimeters - Set local altimeter setting	

Pilot Flying	Pilot Monitoring
At FL180 or reaching top-of-descent, whichever occurs later:	
Call “DESCENT CHECKLIST.”	Accomplish the Descent checklist.

Descent Checklist

- Altimeters ____, xckd C&F
Ensure the captain, first officer, and standby altimeters are correctly set.
Verbalize the altimeter setting (local or 29.92).
- Minimums ____, xckd C&F
Ensure the captain's and first officer's radio and/or baro minimums are set to the approach chart value.
Verbalize "RADIO" and the numeric value, if required. Verbalize "BARO" and the numeric value.
- Landing data ____, ____, xckd C&F
Referencing the SPEED BOOKLET:
Verbalize the landing flaps and Vref speed.
Confirm the captain's and first officer's airspeed reference bugs are correctly set.
- Approach briefing complete PM
Ensure the Approach Briefing has been completed by the PF.
- Seat belt signs ON PM
- Engine sync OFF PM
- Pressurization panel set PM
- Hydraulic panel set PM
Ensure AUX and TRANS HYD PUMPS switches ON.

Approach Procedure

Pilot Flying	Pilot Monitoring
Approaching transition level:	
	If other than FL 180, call “TRANSITION LEVEL.”
Altimeters - Set local altimeter setting	

Pilot Flying	Pilot Monitoring
When arrival, approach, or runway changes prior to landing:	
- FMS data must be modified. - After updating/verifying any changed items, complete the Runway Change boxed items for the Descent and Approach checklists and their associated procedures. Note: If the landing runway assignment is changed and the captain determines the runway change can be accomplished visually, the captain may choose to waive the “runway change” items.	

Pilot Flying	Pilot Monitoring
Anti-Ice - As required	
Before descending through approximately 10,000 feet AFE:	
- Flight and navigation instruments - Set - Verify correct arrival and approach selected in FMS. - VHF NAV frequency and course set.	
	- FUEL TANK PUMPS panel - Set - Verify all FUEL TANK PUMP switches ON for all tanks containing fuel. - Verify FUEL X FEED lever OFF.
WARNING: Spoilers must be fully retracted prior to flap extension to provide a safe stall margin. Spoilers must be disarmed prior to landing gear extension.	
	- Spoiler/SPEED BRAKE lever- RET - Lever full forward and disarmed with red placard out of view.

Pilot Flying	Pilot Monitoring
At approximately 10,000 feet AFE:	
(C) NO SMOKE/CHIME switch - Cycle to sound cabin chime twice.	
Call "APPROACH CHECKLIST."	Accomplish the Approach checklist.

Approach Checklist

- Flight & nav instruments verified C&F
 Ensure correct arrival and approach procedures are entered.
 Ensure the proper frequency and course/radial are set as appropriate.
- Spoilers RET & disarmed PM
- Cabin notification complete C
 Ensure that the cabin chime signal has been sounded twice.
- Altimeters ___, xckd C&F
 Ensure the captain, first officer, and standby altimeters are correctly set.
 Verbalize the altimeter setting.

Landing Procedure

Pilot Flying	Pilot Monitoring
When ready to configure the aircraft for landing:	
Call “FLAPS ____” according to the flap extension schedule.	Set the FLAP/SLAT handle as directed.
When cleared for the approach:	
Manage the approach in accordance with the appropriate Approach Guide and Automation Guidelines.	
Call “GEAR DOWN”	Set the landing gear handle DOWN. Check - Gear handle - DOWN detent - LEFT, NOSE, and RIGHT gear lights - Illuminated green - GEAR DOOR OPEN light - Extinguished. - HYDRAULIC PRESS and QTY - Normal - BRAKE PRESS - Normal
At vertical path capture:	
Call “FLAPS ____” as needed for landing.	Set the FLAP/SLAT handle as directed.
CAUTION: Do not arm spoilers until the landing gear indicates down and locked. CAUTION: Do not arm spoilers with AUTO SPOILER FAIL message.	
	Spoiler/SPEED BRAKE lever - ARM Pull lever straight up until red placard is visible.
	88 ENG IGN selector - As required Select SYS A for captain leg; SYS B for F/O leg.

Pilot Flying	Pilot Monitoring
	Annunciator panel - Check 88 • RUDDER TRAVEL UNRESTRICTED light - On by 165 KIAS. • Other lights/messages - Extinguished except those of an advisory nature.
	Autobrakes - As required. Note: If autobrakes are used, place AUTO BRAKE selector to MED or MAX (MIN not recommended) and the switch to ARM.
Call "LANDING CHECKLIST."	Accomplish the Landing checklist.

Pilot Flying	Pilot Monitoring
No later than 1,000 feet AFE:	
Verify: • Bank angle select knob 15, • Missed approach heading, and • Missed approach altitude.	
Note: Provided stabilized approach criteria are observed, the timing of the configuration may be modified as necessary for a more fuel-efficient operation.	

Landing Checklist

Landing gear	down, 3 green	C&F
Flaps & slats	____, _____, LAND	C&F
• Ensure: • FLAP/SLAT handle position, • FLAPS position indicator, and • SLATS LAND advisory light illuminated and all other SLATS advisory lights extinguished. • Verbalize: • FLAP/SLAT handle position, • FLAPS position indicator, and • LAND.		
Spoilers	ARM	C&F
Ensure the spoiler/SPEED BRAKE lever is locked in the ARM position.		
(88) Ignition	as reqd	PM
Autobrakes	as reqd	PM
Annunciator panel	ckd	PM

Go-Around Procedure

Pilot Flying	Pilot Monitoring
When a go-around is warranted:	
Advance throttles, push either TO/GA button and announce: • “TO/GA POWER”, and either • “AUTOTHROTTLES ON” (if operable) or • “SET GO AROUND THRUST” (if A/Ts inop).	Select or verify AUTO THROT Switch on, - or - Adjust throttles to the EPR GA bugs. Verify FMA pitch and roll display GO RND, GO RND. Announce, “GO AROUND VERIFIED”.
Verify: • Rotation to go-around pitch attitude, • Thrust setting is sufficient for the go-around, and • Proper FMA mode annunciation(s).	
Call “FLAPS 15”.	Set flap lever as directed.
	Monitor airspeed and vertical speed. Verify a positive rate of climb and announce “POSITIVE RATE”.
Confirm a positive rate of climb on the altimeter.	
Call “GEAR UP.”	Position the landing gear handle to UP.
	Verify missed approach altitude is set.
Above 400 feet RA:	
Verify or call for the appropriate roll mode.	Select or verify roll mode.
At 1,000 feet AFE:	
Call “CLIMB POWER.”	Select CL power on TRP and adjust throttles, if required.
Call “SPEED COMMAND BUG 180.”	Set speed command bug to 180.
If another approach is warranted at the destination airport:	
Consider leaving flaps at 15 and maintain appropriate maneuvering speed.	Verify flaps 15 and appropriate maneuvering speed as directed.

Pilot Flying		Pilot Monitoring	
If a diversion is required:			
Select Speed Command 250 and call for IAS 250.		Verify Speed Command 250 and set IAS 250.	
Retract flaps and slats on schedule.		Retract flaps and slats on schedule.	
At level off altitude and above maneuvering speed:			
Call “AFTER TAKEOFF CHECKLIST.”		Accomplish After Takeoff checklist.	

Landing Roll Procedure

Pilot Flying	Pilot Monitoring
At main gear touchdown:	
Verify throttles at idle.	
	Verify the spoiler/SPD BRK lever is UP. Call "SPOILERS UP"
WARNING: After reverse thrust is initiated, a full stop must be made. CAUTION: If difficulty in maintaining directional control is experienced during reverse thrust operation, reduce reverse thrust to reverse idle (or forward idle thrust if required), regain directional control, and reapply reverse thrust as necessary. Do not attempt to maintain directional control by using asymmetric reverse thrust.	
88 CAUTION: Do not aerobrake; lower thrust reverser buckets may contact runway if pitch attitude is in excess of 8 degrees.	
90 CAUTION: Do not move reverse throttles through reverse thrust detent unless emergency reverse thrust is required.	
After main gear touchdown and once nose lowering has commenced thrust reversers may be deployed to reverse idle detent. Upon nosewheel touchdown, normal reverse should be used.	Verify normal reverse thrust operation.
By 80 KIAS initiate movement of reverse thrust levers to reach reverse idle detent prior to taxi speed.	At 80 KIAS call "80 KNOTS."
Prior to taxi speed: • Autobrakes - Disarm	

After Landing Procedure

Captain	First Officer
When clear of the active runway and workload permits:	
Note: Engine may be shutdown after cool down requirements have been met.	
• Spoiler/SPEED BRAKE lever - RET	• FLAP/SLAT handle - 0 88 • ENG IGN selector - OFF • Anti-Ice - As required (refer to SP.16, Ground De/Anti-Icing) • APU - As required (refer to FOM 3.4, APU Policy) 88 • OVERWING HEATER switch - As required • If the aircraft will be deiced, OVERWING HEATER switch OFF • Radar - OFF
CAUTION: Do not retract slats until flaps are fully up. If the flap/slat handle is out of sequence with the flap/slat position, the slat follow up mechanism can be damaged.	
	• FLAP/SLAT handle - UP/RET • Transponder - ALT ON/XPDR/XPDR • AUTO BRAKE selector - OFF • L and R PNEU X-FEED VALVE levers - OPEN
Call "AFTER LANDING CHECKLIST."	Accomplish the After Landing checklist.

After Landing Checklist

(88) Ignition OFF
(88) Overwing heater as reqd
Radar OFF
Spoilersretracted
Flaps & slatsup & retracted
Verify FLAP/SLAT handle UP/RET, FLAPS position indicator UP,
and SLATS advisory lights extinguished

Shutdown Procedure

Captain	First Officer
Engines require a 3-minute cool down prior to shutdown.	
After engine cool down requirements have been met and single engine taxi is desired:	
Call for engine shutdown. Note: Normally the right engine is shut down.	88 • FUEL lever - OFF 90 • FUEL switch - OFF
After stopping at the gate:	
• PARK BRAKE - Set • SEAT BELTS switch - OFF • Call for engine shutdown.	• AUX and TRANS HYD PUMP switches - OFF • AIR CONDITIONING SUPPLY switches - As required 88 • FUEL lever(s) - OFF 90 • FUEL switch(es) - OFF • ANTI-COLLISION switch - OFF • FUEL TANK PUMP switches - As required • RIGHT AFT PUMP switch - ON, if APU operating • ICE PROTECT panel - Set • METER SEL and HEAT switch - OFF • AIRFOIL switch - OFF • WINDSHIELD ANTI-FOG switch - OFF • WINDSHIELD ANTI-ICE switch - OFF unless OAT less than 0°C • ENG anti-ice switches - OFF • FD switches - OFF • Transponder - STBY

Captain	First Officer
When engines are shut down:	
• PARK BRAKE - As required After the chocks are inserted, the brakes should be released for cooling. Refer to FOM, 6.1, Parking, Brake Release. Refer to SP.16, Cold Weather Operations.	
Call "SHUTDOWN CHECKLIST."	Accomplish the Shutdown checklist.

Shutdown Checklist

Seat belt signs	OFF	C
Ice protection panel	set	C
Fuel tank pumps	set	C
Air conditioning panel	set	C
Anti-collision light	OFF	C
Aux & trans hyd pumps	OFF	C
(88) Fuel levers/ (90) Fuel switches	OFF	C
Transponder	STBY	C
Parking brake	as reqd	C

Captain	First Officer
After the Shutdown Checklist is complete:	
When external power is available:	
88 - EXT PWR AC VOLTS and FREQUENCY - Check 88 - EXT PWR BUS switches - ON - APU AIR switch - OFF - APU MASTER switch - OFF	
- ACARS information - Enter - Complete ACARS Postflight procedures. Refer to SP.5, Aircraft Communications Addressing and Reporting System (ACARS). Do not send FLT SUMMARY report, the report will auto-send after five minutes. - EOAP Messages - Check - Depress each system cue button. - Record abnormal messages in the aircraft logbook. - Engine oil, oxygen, and hydraulic quantities - Check - If quantities are less than the following values, make a logbook entry and notify maintenance as soon as possible. - Engine oil: - Maintenance stations: (88) 12 quarts; (90) 16 quarts. - Non-maintenance stations: (88) 8 quarts; (90) 12 quarts. - Oxygen: 1,000 psi. - Hydraulic fluid: (88) Left: 8 quarts; Right: 9 quarts. (90) Left: 9 quarts; Right: 10 quarts. - Logbook - Make required entries for maintenance discrepancies. - Flight deck lights and electronic displays - Set as required. - Red color-coded circuit breakers - Pull as required. - Pull red color-coded circuit breakers based on estimated ground time. Refer to placard instructions on panel. (9220-9265) Flight Deck Access System switch - Guard extended, switch OFF.	

After shutdown reminders:

- Enter appropriate ACARS information.
- Check oxygen, engine oil, and hydraulic quantities.
- Check EOAP messages.
- Make appropriate logbook entries.
- Shutdown the APU, unless required for environmental reasons.
- Pull red color-coded circuit breakers as required.

Secure Procedure

Captain	Any Crewmember
After coordination with local maintenance or operations:	
Accomplish the Secure checklist only when the aircraft is to remain for two hours or more. The captain will designate a crewmember to accomplish the Secure checklist. When operating the last flight of any day into a limited or non-maintenance station, accomplish the following: • If a maintenance discrepancy is noted and entered in the logbook, the MCC must be contacted through the dispatcher as soon as possible to facilitate corrective action and avoid delays. If a flight crew placard is applicable, it should be installed prior to departing the aircraft. • Perform a complete exterior inspection, in accordance with the Exterior Inspection - Captain or First Officer. If the aircraft will layover in cold weather, ensure it is configured as described in SP.16, Cold Weather Operation.	
When ready to secure the aircraft:	
Call "SECURE CHECKLIST."	Accomplish the Secure Checklist as a "read and do" checklist.
• APU AIR and AIR CONDITIONING SUPPLY switches - OFF • GALLEY switch - OFF • EMER LTS switch - OFF • IRS MODE selectors - OFF • (88) OVERWING HEATER switch - OFF • Outflow valve - Set • CABIN ALT control lever - Manual • CABIN ALT control wheel - Rotate position indicator to abeam the 15° flap position • PNEU X-FEED VALVE levers - Closed • FUEL TANK PUMP switches - OFF • Emergency power - Check (Refer to SP.6, Emergency Power Check). • EMER PWR switch - OFF	

Captain	Any Crewmember
• APU and External power - Set as required Note: Allow the APU automatic cool down cycle to complete prior to removing battery power. This process takes one minute. • If only ground service power is required: • GROUND SERVICE ELEC PWR EXT PWR AVAIL light - Verify illuminated • (88) GROUND SERVICE ELEC PWR EXT PWR switch - ON • (88) L and R APU and EXT BUS switches - OFF • (90) GROUND SERVICE ELEC PWR switch - ON • (90) L and R BUS TIE switches - OPEN • APU MASTER switch - OFF • BATT switch - OFF • If electrical power is not required: • (88) L and R APU and EXT BUS switches - OFF • (90) External power switch - OFF • APU MASTER switch - OFF • BATT switch - OFF Note: At some stations, external power may not be available. After confirming with station personnel, leave APU MASTER switch ON and BATTERY switch ON and rotate battery switch from lock to unlock.	

Secure Checklist

APU air and air cond supply switches OFF

Galley power OFF

Emergency lights OFF

IRS mode selectors OFF

(88) Overwing heater OFF

Outflow valve set

Pneumatic crossfeed valves closed

Fuel tank pumps OFF

Emergency power ckd

Emergency power switch OFF

APU & external power as reqd

Battery switch OFF

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Normal Operational Information

Normal Ops Info

Chapter NOI

Section 1

Normal Ops Info

The Normal Ops Info section includes the Approach Guidance. This section provides quick reference tools for the experienced crew member. For more detailed information, refer to the Airway Manual, the FCTM, the ODM, and the FOM.

Approach Guidance

The approach guidance section begins with the Approach Selection Table. The table lists the approach type, any qualifiers for the approach, and the MCP selection(s). A page number will then direct the pilot to the recommended approach guide to be used.

Following the Approach Selection Table are the Approach Guides. The guides have been developed for each type of authorized approach and are intended to help the pilot prepare for, brief, and conduct the approach procedure. The use of an approach guide is recommended, but not required.

Following the Approach Guides is the RADIO/BARO Minimums Chart. The chart contains the landing minimum settings for all approaches.

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Normal Operational Information
Reserved

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Section 2

Reserved for future use.

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Normal Operational Information

Approach Guidance

Chapter NOI

Section 3

Approach Selection Table

Approach Type	Qualifier	MCP Selection(s) Page
VNAV Prior to the FAF		VOR/LOC/NAV/HDG SEL pg NOI.3.2
ILS	For PRM considerations also see NOI.3.5	ILS CAT I pg NOI.3.3
		AUTO LAND CAT II pg NOI.3.7 SA CAT II pg NOI.3.7 CAT III pg NOI.3.9
LDA with GS	For PRM considerations also see NOI.3.5	ILS pg NOI.3.3
RNAV (RNP)	GPS Required	NOT AUTHORIZED
RNAV (GPS) RNAV (GNSS) GPS	GPS Required	NOT AUTHORIZED
ILS (GS out) LOC LDA (without GS) VOR		VOR/LOC VERT SPD pg NOI.3.11
LOC (BACK CRS) NDB		HDG SEL VERT SPD pg NOI.3.13
Charted Visual Flight Procedures	Procedure in FMS Database	NAV VNAV pg NOI.3.15
	NO Procedure in FMS Database	Fly using visual references
Circling Maneuver		pg NOI.3.17

VNAV to Meet Altitude Constraints Prior to the Published FAF

If using VNAV to comply with published constraints located outside the FAF:

When cleared for the approach:

If above the published FAF altitude and unable to determine if all altitude constraints outside the FAF will be complied with:

When:

- established on a published segment of the approach, or
- vectored to a final approach course intercept heading and level at the active way point altitude, or
- cleared direct to an approach waypoint and level at that waypoint altitude:

Appropriate roll mode VOR/LOC/NAV/HDG SEL Select

MCP altitude Set

Set FAF altitude.

VNAVSelect or verify

FMA indicates VNAV LVL/DES.

FMS OVRD Select

When the altitude of the last way point prior to the FAF is assured, then:

Note: The Approach Mode is active after passing the point prior to the FAF.

At this point using VNAV with FMS OVRD selected, the aircraft will attempt to maintain the FMS generated path for the remainder of the approach. It may be necessary to select IAS or VERT SPD to capture the ILS Glide Slope.

ILS/AUTO LAND Mode Select

NAV and VNAV must not be used from the FAF inbound. Ensure appropriate roll and pitch modes are selected prior to the final approach fix.

Refer to the Approach Guide for the specific approach to be flown.

ILS CAT I, LDA with GS - Approach Guide ILS or AUTO LAND

For inoperative equipment, refer to the QRH, Non-Normal Ops Info tab, ILS Approach Equipment Requirements.

For any inoperative ground based equipment, refer to the Airway Manual, Ops Specs, Takeoff Minima.

For ILS Precision Runway Monitor (PRM) Approach, refer to the ILS Precision Runway Monitor (PRM) Approach Breakout Procedures Approach Guide.

Note: Approach may continue to DA(H) if established on the final segment and the controlling visibility decreases below the authorized minimums. Specific foreign country exceptions may apply. For further information, refer to the Airway Manual, Ops Specs, Takeoff Minima

Airport diagram Review

Autopilot As required

If operable, both the Autopilot and Flight Director will be utilized for all ILS approaches when the reported weather is below 4,000 feet RVR or 3/4 mile.

FMS approach procedure Select and verify

Flight and nav instruments Set

Minimums Set DA

When cleared for the approach:

ILS Mode Select

Select when established on a published inbound segment of the approach or when on a final approach course intercept heading. Adhere to all published step down fix altitudes located outside the final approach segment.

No later than 1,000 feet AGL:

Missed approach altitude Set

Set lowest initial level off altitude on missed approach procedure.



No later than DA (unless autoland):

Autopilot Disconnect

Execute a Missed Approach for any of the following:

- Criteria listed in Airway Manual, Ops Specs, Takeoff Minima. or
- In IMC, a navigation radio or flight instrument failure occurs which affects the ability to safely complete the approach, or
- In IMC, full scale deflection of the localizer or glide slope, or
- In IMC, when the navigation instruments show significant disagreement.

ILS Precision Runway Monitor (PRM) Considerations

PRM procedure Brief Jeppesen 11-XX Pages

Primary and Monitor Frequencies - Brief

Breakout procedure Brief

“Breakout” Procedure

Note: All "Breakouts" must be hand flown.

Pilot Flying	Pilot Monitoring
If ATC call “Traffic Alert” during the PRM approach:	
A/P - Disengage	F/D (both) - OFF
Maneuver as directed by ATC Note: If ATC "breakout" instructions coincide with a TCAS RA, follow the vertical guidance of the RA and the lateral guidance directed by ATC. Note: If descending, vertical speed should not exceed 1,000 FPM.	Communicate with ATC as required.
	When established on the “breakout” heading: • F/D (both) - ON
When "breakout" is complete, reset automation to appropriate level.	



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ILS CAT II or SA ILS CAT II - Approach Guide

AUTO LAND

For inoperative equipment, refer to the QRH, Non-Normal Ops Info tab, ILS Approach Equipment Requirements.

For any inoperative ground based equipment, refer to the Airway Manual, Ops Specs, Takeoff Minima.

Note: Approach may continue to DA(H) if established on the final segment and the controlling RVR goes below minimums. Specific foreign country exceptions may apply. For further information, refer to the Airway Manual, Ops Specs, Takeoff Minima.

Approaches must be flown using autoland procedures.

Maximum reported wind component to initiate approach and land:

25 knots headwind, 15 knots crosswind, 10 knots tailwind

Airport diagram and SMGCS chart Review

FMS approach procedureSelect and verify

Flight and nav instrumentsSet

MinimumsSet

Note: Minimums for RVR 1600 approaches may be set to the lowest charted minimums, but no lower than 100 feet DA(H).

RA Authorized:

- Set radio altimeter bug to published RA
- Set baro altimeter bug to airport elevation

RA Not Authorized:

- Set radio altimeter to OFF
- Set baro altimeter bug to published DA
- IM required
- DA is determined by the IM or the first officer's baro altimeter, whichever occurs first.

Marker beacon audio (RA Not Authorized)ON

AutobrakesRecommended



Callouts Review

Call "ALIGN" when ALN appears in the FMA roll window.

FMA Review

See FCTM, Flight Pattern Profiles, ILS Auto land for FMA progression.

When cleared for the approach:

AUTO LAND Select

Select when established on a published inbound segment of the approach or when on a final approach course intercept heading. Adhere to all published step down fix altitudes located outside the final approach segment.

No later than 1000 feet AGL:

Missed approach altitude Set

Set lowest initial level off altitude on missed approach procedure.

Execute a Missed Approach for any of the following:

- criteria listed in the Airway Manual, Ops Specs, Takeoff Minima, or
- In IMC, a navigation radio or flight instrument failure occurs which affects the ability to safely complete the approach, or
- In IMC, full scale deflection of the localizer or glide slope, or
- In IMC, when the navigation instruments show significant disagreement.

ILS CAT III - Approach Guide

AUTO LAND

For inoperative equipment, refer to the QRH, Non-Normal Ops Info tab, ILS Approach Equipment Requirements.

For any inoperative ground based equipment, refer to the Airway Manual, Ops Specs, Takeoff Minima.

Note: If the aircraft is established on the final approach segment and the controlling RVR decreases below the authorized minima, the approach may not continue to DA(H).

Approaches must be flown using autoland procedures.

Maximum reported wind component to initiate approach and land:

25 knots headwind, 15 knots crosswind, 10 knots tailwind

Airport diagram and SMGCS chart Review

FMS approach procedureSelect and verify

Flight and nav instrumentsSet

MinimumsSet

Set radio altimeter bug to 50 feet.

Set baro altimeter bug to airport elevation.

Autobrakes Required, if operable

Callouts Review

Call "ALIGN" when ALN appears in the FMA roll window.

FMA Review

See FCTM, Flight Pattern Profiles, ILS Auto land for FMA progression.

When cleared for the approach:

AUTO LAND Select

Select when established on a published inbound segment of the approach or when on a final approach course intercept heading. Adhere to all published step down fix altitudes located outside the final approach segment.



No later than 1000 feet AGL:

Missed approach altitude Set
Set lowest initial level off altitude on missed approach
procedure.

Execute a Missed Approach for any of the following:

- criteria listed in the Airway Manual, Ops Specs, Takeoff Minima, or
- any controlling RVR goes below minimums, or
- In IMC, a navigation radio or flight instrument failure occurs which affects the ability to safely complete the approach, or
- In IMC, full scale deflection of the localizer or glide slope, or
- In IMC, when the navigation instruments show significant disagreement.

ILS (GS Out) or LDA (without GS) or LOC or VOR - Approach Guide VOR/LOC & VERT SPD

Autopilot Required in IMC
FMS approach procedure Select and verify
Flight and Nav instruments Set
Minimums Set DDA
Set MDA + 50 feet

Raw data and VTK ERROR Monitor

- ILS (GS Out) or LDA (without GS) or LOC - one pilot in ARC or ROSE during LOC capture
- VOR - one pilot in ARC or ROSE
- FMS - PROGRESS page 2/2

When cleared for the approach:

VOR/LOC or NAV Select
VOR/LOC required from the FAF inbound.

When:

- established on a published segment of the approach and level at FAF altitude, or
- vectored to a final approach course intercept heading and level at FAF altitude:

MCP altitudeSet
Set DDA rounded up to the next highest 100 feet.

When at descent point:

VERT SPD Select
Set published descent rate or 800 fpm if not published.

No later than 1,000 feet AGL:

Missed approach altitudeSet
Set lowest initial level off altitude on missed approach procedure.



No later than 100 feet below DDA:

Autopilot Disconnect

Execute a Missed Approach for any of the following:

- Criteria listed in Airway Manual, Ops Specs, Takeoff Minima, or
- In IMC, a navigation radio or flight instrument failure occurs which affects the ability to safely complete the approach, or
- In IMC, full scale deflection of the localizer during an ILS (GS Out) or LDA (without GS) or LOC approach, or
- In IMC, actual course deviates from published inbound course by more than 10 degrees during a VOR approach, or
- In IMC, when the navigation instruments show significant disagreement.

LOC (BACK CRS) or NDB - Approach Guide

HDG SEL & VERT SPD

Autopilot Required in IMC

FMS approach procedure Select and verify
NDB - select an underlying straight in approach or runway for
situational awareness.

Flight and Nav instruments Set

- LOC (BACK CRS) - set frequency and front course
- NDB - set frequency

Minimums Set DDA
Set MDA + 50 feet.

Raw data and VTK ERROR Monitor

- LOC (BACK CRS) - one pilot in ARC or ROSE
- NDB - EFIS control panel ADF ON and RDMI #1 to ADF
- FMS - PROGRESS page 2/2

When cleared for the approach:

HDG SEL or NAV Select

- If using NAV, the PF will have MAP selected on his ND.
- HDG SEL is required from the FAF inbound.

When:

- Established on a published segment of the approach and level at FAF altitude, or
- Vectored to a final approach course intercept heading and level at FAF altitude:

MCP altitudeSet
Set DDA rounded up to the next highest 100 feet.

VERT SPD Select
Set published descent rate or 800 fpm if not published.

No later than 1,000 feet AGL:

Missed approach altitudeSet
Set lowest initial level off altitude on missed approach
procedure.

No later than 100 feet below DDA:

Autopilot Disconnect

Execute a Missed Approach for any of the following:

- criteria listed in the Airway Manual, Ops Specs, Takeoff Minima, or
- In IMC, a navigation radio or flight instrument failure occurs which affects the ability to safely complete the approach, or
- In IMC, full scale deflection of the localizer for a LOC (BACK CRS) approach, or
- In IMC, actual course deviates from published inbound course by more than 10 degrees during an NDB approach, or
- In IMC, when the navigation instruments show significant disagreement.

Charted Visual Approach Guide (Procedure in FMS Database) NAV & VNAV Modes

The following guidance supplements visual approach preparations. FMS guidance is an aid to promote more precise ground track and altitude control. Do not sacrifice outside visual vigilance while using FMS capabilities.

Note: All aircraft are equipped with DME/DME/IRU navigation. GPS receivers may be installed.

Delta Special Pages
and Attention All Users page Reference as applicable

Autopilot As desired

FMS approach procedure Select and verify

RNAV Visuals are normally coded in the FMS database as RNV.

Charted Visual Approaches may include waypoints or reference points which differ by name from FMS coded waypoints.

When cleared for the approach:

NAV Select

TDZE/Rwy Threshold Elevation or
RWY rounded up to the nearest 100 feet Set

VNAV Select

No later than 1,000 feet AGL:

Missed approach altitude Set as desired

Set lowest initial level off altitude on missed approach procedure.



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Circling Maneuver

Note: Do not use ILS mode.

The following guidance supplements normal approach preparations and procedures for the type of approach to be flown.

Weather requirements Check

- Visibility - 3 miles (4800m) or published visibility for the highest circling speed category, whichever is higher.
- Ceiling - 1000 feet (300m) or the published HAA (height above airport) for the highest circling speed category, whichever is higher.

Autopilot Required in IMC

Minimums Set MDA

Set published MDA or airport elevation plus 1000 feet (300m), whichever is higher.

When cleared for the approach:

VOR/LOC or HDG SEL or NAV Select

VOR/LOC or HDG SEL required from the FAF inbound.

AltitudeSet

Set published MDA or airport elevation plus 1000 feet (300m), rounded up to the next higher 100 feet.

At configuration point:

Landing gear and landing flapsSet

Aircraft should be fully configured for landing prior to FAF.

At FAF or descent point:

VERT SPD Select

When level at the MDA (ALT HLD):

Missed approach altitudeSet

Set lowest initial level off altitude on missed approach procedure.

When needed to execute circling maneuver:

HDG SEL Select



No later than 50 feet below MDA:

Autopilot Disengage

Execute a missed approach if visual contact with the airport is lost.

Conducting a missed approach:

Use normal missed approach procedures except:

- Make the initial climbing turn towards the landing runway to reach the missed approach heading. Turn may be more than 180 degrees and not in the shortest direction.
- Fly the published missed approach corresponding to the instrument approach procedure just flown until alternate instructions are received.

RADIO/BARO Minimums Chart

APPROACH TYPE	BARO	RADIO
ILS TO CAT I	PUBLISHED DA	OFF
CAT II (1)	AIRPORT ELEVATION	PUBLISHED RA
CAT II - RA NOT AUTH	PUBLISHED DA	OFF
CAT III (1)	AIRPORT ELEVATION	50'
STRAIGHT IN (NON-ILS)	DA/DDA(2)	OFF
CIRCLE TO LAND (NON-ILS)	HIGHER OF: PUBLISHED MDA OR AIRPORT ELEVATION +1000'	OFF
VISUAL	APPROACH MINIMUMS(3)	OFF

Notes:

- (1) CAT II and CAT III DH will be made by reference to the radio altimeter (RA) only.
- (2) The DDA is the published MDA + 50'.
- (3) Set the approach minimums for the instrument approach used to back up the visual approach. If no instrument approach is available, any number may be set to aid in the approach. Both altimeter bugs should agree.



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Crosswind Guidance	SP.16.13
AWABS Determinations	SP.16.14
Category Definitions	SP.16.15
Takeoff Runway Contaminant Decision Tree	SP.16.16
Contaminant Millimeters to Inches Conversion	SP.16.18
Ground De/Anti-Icing Procedure	SP.16.19
Pre-Gate Departure Communication	SP.16.19
Aircraft Configuration and Communication	SP.16.20
At Gate or Off Gate (Prior to Engine Start)	SP.16.21
Remote (Engines Not Running)	SP.16.25
Remote (Engine(s) Running)	SP.16.29
Hot Weather Operation	SP.16.33
Turbulence	SP.16.34
Severe Turbulence	SP.16.34
Volcanic Ash Encounter	SP.16.35
Ground Operations	SP.16.35
In Flight	SP.16.35

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Supplementary Procedures

Introduction

Chapter SP

Section 05

General

This chapter contains procedures that are organized by system and covers:

- Procedures (adverse weather operation, etc.) that are accomplished as required rather than routinely performed on each flight,
- Any first-flight-of-the-day test or other systems test,
- Guidance on lengthy operating procedures, and
- Adverse weather procedures and guidance.

At the discretion of the Captain, procedures may be performed by recall, by reviewing the procedure prior to accomplishment, or by reference to the procedure during its accomplishment.

Supplementary procedures are provided by section. Section titles correspond to the respective system titles, except for the adverse weather section.

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Supplementary Procedures	Chapter SP
Airplane General, Emer. Equip., Doors, Windows	Section 1

Aft Passenger Stairway Manual Operation

WARNING: Ensure area is clear in the vicinity of the stairs.

Note: Pressurizing the right hydraulic system may aid in lowering the aft stairs, but is not necessary.

Aft pressure bulkhead door Open

Service light switch ON

To lower stairs if catwalk is not down from ceiling:

Catwalk Lower

Latch mechanism Operate

Proceed to aft end of catwalk. Latch is at aft end of catwalk on Captain's side of aircraft. Latch can be identified by reflective tape.

CAUTION: Do not confuse with the red exit handle that releases the tailcone.

Cable guide might need to be moved aside.

Push latch mechanism forward. Hold until stairs are fully extended.

Catwalk Raise

To raise stairs if catwalk is not down from ceiling:

Catwalk Lower

Right hydraulic system Pressurize

Latch mechanism Operate

Latch is at aft end of catwalk on Captain's side of aircraft, marked with reflective tape.

Cable guide might need to be moved aside.

Push latch mechanism aft. Hold until stairs are fully retracted.

Cabin Inspection

For a flight without a flight attendant staff (ferry flight, test flight, delivery flight, training flight, etc.) the pilots verify the following:

- Doors - Secured and at least the Forward entry door armed
- Beverage cart - Stowed and locked in position
- Galley (coffee pots, doors, and drawers, etc.) - Secured
- Overhead bins - Closed
- Closets - Closed and locked
- Lavatories - Inspect for general security; doors closed.

After block-in, pilots must disarm all doors and partially open the main entry door, to be fully opened by the gate agent.

Electronic Flight Bag (EFB) Mount

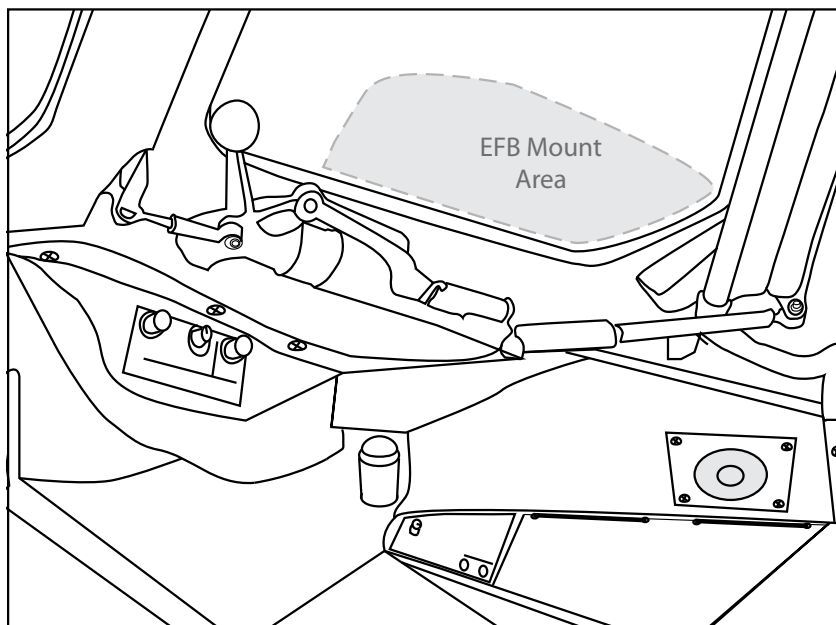
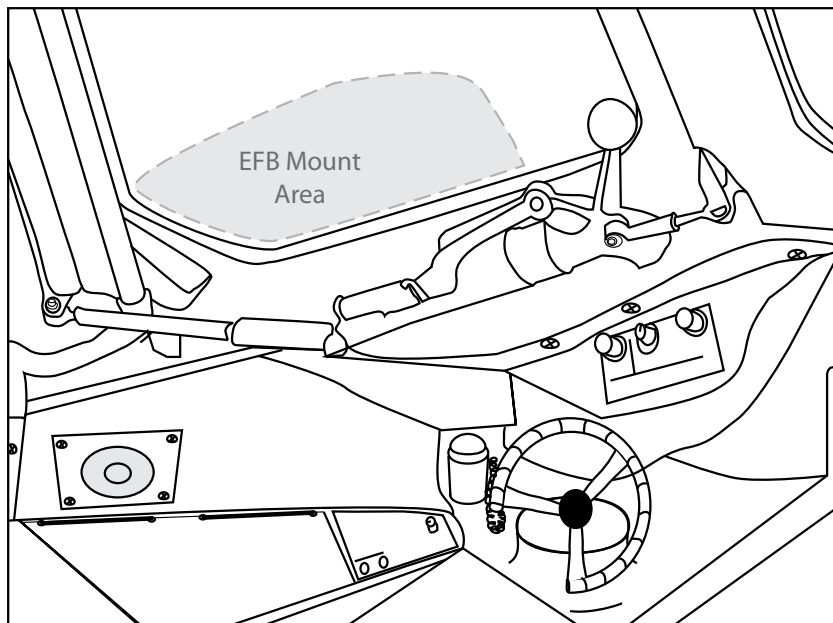
Note: Prior to the first flight of the day, the EFB mounting system must be installed/reinstalled to ensure the mount attachment is secure. During subsequent flights, mount security may be verified with a gentle tug. Reinstall the mount as required.

CAUTION: Do not place the EFB in direct sunlight on the glareshield.

Do not use any other mounting or securing system other than the provided approved system.

To secure the EFB mount in the aircraft:

- Ensure the side window and suction cups are clean. If necessary, wipe with pretreated lens/screen cloth or moist cloth.
- Sunshades (as installed) should be stowed prior to securing the mount.
- Ensure the locking levers are in the OFF position.
- Position the suction cups in the mounting zone indicated in the following diagrams.
- To remove trapped air, press each cup against the window until completely compressed.
- Move the locking levers to the ON position.
- Ensure the EFB and mount are free and clear of all flight controls, and do not restrict access to egress, tiller, oxygen mask, or line of sight.
- Squeeze the gray tabs together to expand the mounting tabs and insert the EFB into the mount.
 - If the EFB is in the portrait mode, the fixed tabs should be positioned at the bottom of the mount to prevent the EFB from slipping.
- Use caution when deploying sunshades with the EFB mount installed to avoid damage.



Flight Deck Access System Test (9204-9020) (9201-9219)

(0904-9020)

(9201-9219)

Full functional check required on first flight of the day.

Note: Test not required if the Remote Access System is inoperative.

FLIGHT DECK DOOR rotary switchAUTO

Access code Enter

key Push

Verify alert sounds.

Verify amber keypad LED illuminates.

Verify AUTO UNLK light illuminates.

FLIGHT DECK DOOR rotary switchDENY

Verify AUTO UNLK light extinguishes.

Verify no alert sounds after approximately 30 seconds following the keypad entry.

Verify red keypad LED illuminates.

FLIGHT DECK DOOR rotary switchUNLK

Push, turn and hold the FLT DK DOOR rotary switch to UNLK position.

Verify alert sounds continuously.

Verify the LOCK FAIL light illuminates.

Verify green keypad LED illuminates.

FLIGHT DECK DOOR rotary switch Release

Verify switch returns to AUTO position.

Verify alert ceases.

Verify the LOCK FAIL light extinguishes.

If any part of the test fails:

Contact maintenance.

Flight Deck Access System Test (9220-9265)

(9220-9265)

Full functional check required on first flight of the day.

KILL switch on Door Control Module NORM (guard closed)

Door Control Panel rotary switch AUTO

Access codeEnter

Enter key Push

Verify alert sounds continuously (2 beeps followed by 2 beeps followed by a continuous tone).

Verify the AUTO UNLK annunciator is flashing.

Verify amber keypad LED illuminates.

Door Control Panel rotary switchDENY & release

Verify AUTO UNLK annunciator light extinguishes.

Verify the alert sound ceases.

Verify red keypad LED illuminates.

Door Control Panel rotary switch Hold in UNLKD

Verify the door electronic lock disengages (audible click).

Verify green keypad LED illuminates.

Door Control Panel rotary switchRelease

Verify switch returns to AUTO position.

KILL switch on Door Control Module OFF (up - guard extended)

Verify the LOCK FAIL annunciator light is illuminated.

KILL switch on Door Control Module NORM (down - guard closed)

Verify the LOCK FAIL annunciator light extinguishes.

Door Close & locked

Close door from flight deck side.

Verify it is locked by pushing on the door and ensuring it does not move.

Oxygen Mask, Regulator, Interphone, and Smoke Goggles Test

88 (as installed)

90

Oxygen mask and regulator Check

Oxygen mask - Stowed and doors closed

NORMAL/100% regulator selector - 100%

Push down to lock in position.

RESET TEST lever - TEST (down in direction of arrow) and hold

Flow indicator displays yellow cross momentarily, then turns black.

EMERGENCY PRESS TO TEST knob - Push and hold while continuing to hold RESET lever

Flow indicator displays yellow cross and oxygen flow is audible

EMERGENCY PRESS TO TEST knob - Release

Flow indicator displays black

Right OXYGEN MASK release lever (red) - Squeeze and hold while continuing to hold RESET lever

Flow indicator momentarily displays yellow cross and mask harness inflates

Flow indicator displays black to indicate no leaks in the harness

Right OXYGEN MASK release lever - Release

Flow indicator displays black

RESET TEST lever - Release

Interphone system Check

Oxygen mask - Stowed and doors closed

MIC SELECTOR and receiver control - INT

MASKS/BOOM switch - MASKS

Overhead speaker - Adjust

Control wheel microphone switch - Push forward and hold.

Tap on oxygen mask box cover and listen for tapping sound through speaker.

MASKS/BOOM switch - BOOM

Smoke goggles Check
Verify condition and proper adjustment

Oxygen Mask Test

88 (as installed)

Oxygen mask and regulator Check

Oxygen mask - Stowed and doors closed

Regulator control knob 100% or NORM

TEST/RESET button Push and hold

Verify white OXY ON flag in view.

Verify oxygen flow indicator light blinks or comes on steady until the mask is fully pressurized. The light will then go out.

Verify regulator operation is audible during pressurization.

Note: If the oxygen flow indicator light remains on, a system leak is indicated.

TEST/RESET button Release

Verify white OXY ON flag is removed from view.

Regulator control knob EMER

TEST/RESET button Push and hold

Verify white OXY ON flag in view.

Verify oxygen flow indicator light comes on steady and remains on until the TEST/RESET button is released.

Verify regulator operation is audible during pressurization.

TEST/RESET button Release

Verify white OXY ON flag is removed from view.

Regulator control knob 100%

Interphone system Check

MIC SELECTOR and receiver control - INT

MASKS/BOOM switch - MASKS

Overhead speaker - Adjust

Control wheel microphone switch - Push forward and hold

Tap on oxygen mask box cover and listen for tapping sound
through speaker.

MASKS/BOOM switch - BOOM

Oxygen Mask Stowage Procedure

88 (as installed)

With oxygen mask doors open, shift the white oxygen shutoff lever to "OFF."

Grasp the regulator with one hand and extend your arm away from your body.

Rotate the "X" shaped inflation harness cross piece 90 degrees and insert into face shield.

Note: Do not insert inflation harness cross piece into the nose cone.

Tightly roll mask sides inward around harness. Grasp the mask sides and squeeze the package inward.

Rotate the oxygen hose swivel, positioning the hose along one corner of the box.

While coiling hose into lowest area of box, stow box liner.

Insert mask into the box with the regulator up.

Press the regulator firmly into the mask box.

Close the doors.

TEST/RESET button Push and hold

Verify white OXY ON flag in view.

Potable Water Quantity Check

To check the level of the potable water in the tank:

Potable water system service doorOpen

Service light On

Observe which water level indicator lights are illuminated. (The lights are labeled "Low", "1/2", "3/4", and "Full").

The illuminated light corresponding to the highest level indicates the level of water in the tank.

Service lightOff

Potable water system service door Close

Supplementary Procedures

Introduction

Chapter SP

Section 2

APU Ground Air Conditioning

CABIN ALT control lever Auto (Up)

PNEU X-FEED VALVE levers Open

Set APU AIR switch.

If cabin is above 75°F:

Select AIR COND COLDER.

If cabin is below 75°F:

Select ON.

AIR CONDITIONING SUPPLY switches AUTO

88/90

- AIR CONDITIONING SUPPLY switches are normally in the AUTO position.

88

- If pack pressure is <12 psi with both packs on, selecting AIR COND COLDER may increase cooling.
- With both packs on, if left or right air conditioning pressure remains or is <12 psi; operate only one pack.
- When using the APU for electrical power, the APU ground limit should not be exceeded: 1.25 [AFM]

90

- If cabin temperature is 75° or greater, with both packs on, selecting AIR COND COLDER may increase cooling.
- With both packs on, if left or right air conditioning FLOW indicator is less than 12:00 position, operate only one pack.
- Turn packs to AUTO one at a time to minimize heat exchanger fan (electrical) starting loads.
- When using the APU for electrical power, the APU ground limit should not be exceeded: 1.0 [AFM]

88

Note: The right pack should be operated during hot ramp conditions. The right pack heat exchanger draws air from the tail compartment. This reduces the likelihood of a TAIL COMP TEMP HIGH light.

90

Note: The right pack should be operated during hot ramp conditions. The right pack heat exchanger draws air from the tail compartment. This reduces the likelihood of a TAIL TEMP HIGH light.

CKPT TEMP/CABIN TEMP selectors AUTO

Takeoff with Air Conditioning Packs Off

Prior to takeoff:

Check EPR.

Thrust rating computer should increase T/O EPR setting by .02 when packs are turned off.

AIR CONDITIONING SUPPLY switches OFF

After takeoff (not below 400 feet AFE):

AIR CONDITIONING SUPPLY switches (one at a time) AUTO

AIR CONDITIONING SUPPLY switches must be in AUTO prior to selecting climb power to prevent NO MODE light from illuminating.

Supplementary Procedures

Anti-Ice, Rain

Chapter SP

Section 3

Engine Anti-Ice Operation

88

ENG IGN selector ON

ENG anti-ice switches ON (one at a time)

Turn ENG anti-ice switches ON one at a time. Wait until engine is stabilized before turning on opposite engine anti-ice.

ENG ANTI-ICE ON lights ON

ENG VALVE messages OFF

Message illumination indicates one or more engine anti-ice valves has malfunctioned. Depart icing area as soon as possible.

88

ENG IGN selector OFF

Ignition may be turned OFF after engines have stabilized.

When engine anti-ice is no longer required:

88

ENG IGN selector ON

ENG anti-ice switches OFF

Autothrottles may disconnect if ENGINE ANTI-ICE switches are moved to OFF while wing anti-ice or tail de-ice is on. Thrust rating panel NO MODE light will illuminate.

ENG ANTI-ICE ON lights OFF

ENG VALVE messages OFF

88

ENG IGN selector OFF

Airfoil Ice Protection

PNEU X-FEED VALVE leversOpen

AIR FOIL anti-ice switch..... ON

Note: Do not use wing anti-ice prior to 400 feet AGL.

WING ANTI-ICE ON lightIlluminated

Check PNEU PRESS gage.

- L and R ICE PROT TEMP LOW and WING ICE PRESS ABNML Messages should be extinguished within one minute.
- Pneumatic pressure should be above yellow arc on pneumatic pressure gauge.
 - If necessary, increase engine power.
- Every 15 minutes of operation, tail de-ice system will automatically be operated for 2 1/2 minutes.
 - Wing will not be anti-iced during that time.
 - At completion of tail de-ice cycle, system will revert to wing anti-ice and start a new 15 minute cycle.

88

- Manual tail de-ice should be initiated 1 minute prior to extension of landing flaps (normally just prior to landing gear extension).

90

- Moving the flaps to 40 will activate both wing and tail anti-ice simultaneously, and the WING ANTI-ICE ON and TAIL DE-ICE ON will illuminate until the aircraft is on the ground or flaps are repositioned to less than 40.

When icing conditions no longer exist:

AIR FOIL anti-ice switchOFF

Tail de-ice will be provided for 2 1/2 minutes after AIR FOIL anti-ice switch is moved to OFF.

After completion of tail de-ice cycle:

PNEU X-FEED VALVE leversClose

Primary Ice Detection Test

90

Full functional check required on first flight of the day.

ICE FOD switch TEST

- Hold switch in TEST position and observe that the following four messages are displayed on the EOAP:
 - L/R ICE FOD ALERT and L/R ICE FOD SYS INOP.
- Release switch. Observe that all messages extinguish. [AFM]

Tactile Wing Inspection

If a tactile wing inspection is necessary at a station where personnel have not been trained in Delta procedures (e.g. provisional airports), flight crews are qualified to perform these inspections.

Note: The tactile wing inspection if required, should be accomplished as close to departure as practical.

LadderPosition

Place ladder approximately 8 feet outboard of the wing root along the leading edge.

Upper Wing Surface Inspect

Use inspection pole to verify no ice or frost is present.

The wing surface should be rough where there are black stripes and smooth between the black stripes. Only the rough - smooth - rough contrast felt with the inspection pole indicates no ice is present.

If the surface has a constant texture, either rough or smooth, ice may be present and further check of the wing surface is required.

Meter Selector and Heat System Test

METER SEL & HEAT selectorRotate

Move the selector to each position and observe a HEATER CUR gauge indication.

Note: The RAT PROBE position will indicate a HEATER CUR gauge indication of 0 with the aircraft on the ground.

Supplementary Procedures

Automatic Flight

Chapter SP

Section 4

Autoland Availability Test

Note: Test must be performed while aircraft is on ground.

Set VHF NAV radios.

- Set both VHF NAV radios to same ILS frequency.
- Use an inoperative ILS frequency (an example is 108.1).

Push AUTOLAND button.

- Observe the following:
 - Autothrottle, arm, roll and pitch mode annunciators display AUTO LND/PRE/FLT/TEST light during autoland test for selected DFGC FMAs.
 - R/A's, PFD's and ILS indications display test functions.
 - After approximately 55 seconds, flight mode annunciator goes blank or reverts to previous display.
 - The NO AUTOLAND light extinguishes indicating a valid test.
- If test is invalid, NO AUTOLAND light remains illuminated until the FMA RESET button is pushed.
- DO NOT initiate test on other side until entire test is complete.
- Move DFGC 1-2 switch to opposite position and repeat test.

Set VHF NAV radios.

Captain and First Officer set desired departure VHF NAV frequency and course.

Autothrottle Advance

88

Observe the following caution when operating the autothrottles during takeoff.

CAUTION: During takeoff, the DFGC engine failure logic is armed if:

- The flight director pitch axis is in takeoff mode.
- The aircraft is above 400 feet radio altitude and
- Both engine EPR's are below the go-around EPR limit.

If the DFGC detects an EPR drop greater than or equal to 0.25 EPR and 7% N1 from the same engine, as compared to the other engine, the engine failure logic is satisfied and the DFCG will change the thrust rating panel (TRP) to go-around (GA). This will cause the autothrottle system to unclamp and enter normal EPR limit (EPR LIM) mode where the throttles will maintain the higher engine EPR at the selected go-around thrust limit. Such an EPR and N1 drop may also result from an engine surge (stall). Advancing thrust levers on a surging engine will hinder surge recovery and may result in eventual engine failure.

Autoland Documentation

When an autoland has not been recorded within a thirty-day period, the MEL ITEMS FOR SHIP NUMBER section of the flight release will contain an “S” item as follows:

- S22-00-00A ACCOMPLISH LLM AUTO LANDING

If the autoland was attempted and unsuccessful, make a logbook write-up. Include as much pertinent information as possible.

Accomplish an autoland and document in ACARS via the following procedures.

Guidance for Satisfactory/Unsatisfactory Autoland

Guidance for identifying and documenting autolands is found in the MDM, TOPP Dispatch Documents Section 50-10-05, Aircraft Log System, Log Sheet.

Procedures

From the ACARS MENU:

SUMMARY ARR DATA Select

On the ARRIVAL page:

AUTOLAND Select

On the AUTOLAND page:

CATEGORY Toggle

Toggle 1, 2 or 3 (the actual weather conditions) into field.

SUCCESSFUL Toggle

Toggle YES or NO into the field. Yes is default.

RUNWAY Enter

Enter landing runway into field.

REMARKS Enter

Note: EDIT TEXT entry/edit available if autoland was not successful.

The data on the ARRIVAL page must be entered within seven minutes of the “IN” time or the data will be lost.

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Aircraft Communication Addressing and Reporting System (ACARS)

Pre-Departure Clearance

The flight crew shall compare the filed flight plan versus the digital pre-departure clearance and shall initiate voice contact with Air Traffic Control if any question/confusion exists between the filed flight plan and the digital pre-departure clearance.

Digital-Automatic Information Service

The flight crew shall verify that the D-ATIS altimeter setting numeric value and alpha value are identical. The alpha value is the numeric altimeter setting spelled out (i.e., two niner niner two). This will be depicted on the ACARS ATIS message. If the D-ATIS altimeter setting altimeter numeric value and alpha values are different, the flight crew must not accept the D-ATIS altimeter setting.

Company Communications Sequence

The COMMUNICATIONS SEQUENCE chart depicts DATA LINK functions that are currently in effect for Delta Air Lines. The chronological sequence in which DATA LINK messages should be sent is shown as a function of flight phase. The messages that appear above the profile are ROUTINE and should be sent whenever appropriate on every flight. The messages below the profile are NON ROUTINE and should be sent as needed.

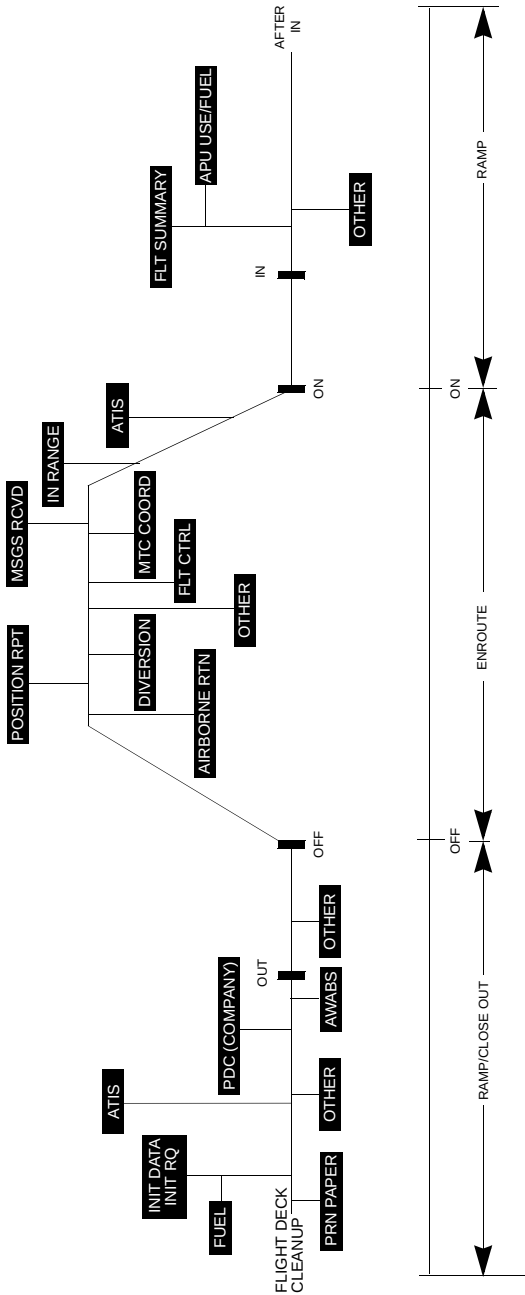
Messages are delivered to the Flight Control dispatcher's queue and are also directly processed by Flight Following. This direct processing of DATA LINK messages results in system wide updates.

Communications Sequence Chart

COMPANY COMMUNICATIONS

ABOVE PROFILE LINE – ROUTINE
BELOW PROFILE LINE – NON ROUTINE

NOTE: All items shown on MISC MENU
and DOWNLINKS MENU (except CAL-
SEL) are operative at any time.



ACARS-601

Introduction

ACARS-601 software standardizes message format, time logic, and other metrics across all fleets. Some functions are provisioned for future use.

The most important change from earlier versions for a user to understand is that downlinks are no longer organized by phase of flight. Instead, links are divided into three general categories: “DATA”, “REPORTS”, and “REQUESTS.”

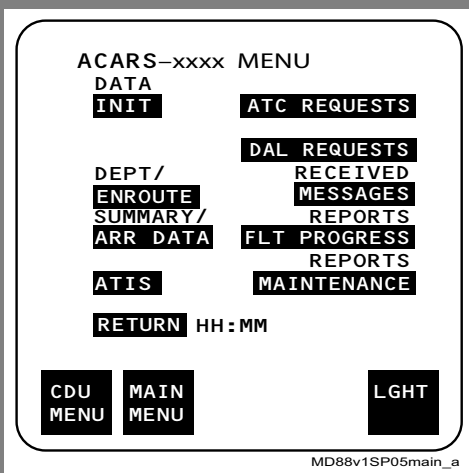
Out-Off-On-In (OOOI) logic depends on aircraft wiring of parking brake cabin and cargo door sensors. If all sensors are wired, the Out event time is the first parking brake release after all cabin and cargo doors are closed. In addition, the In event time is the last time the parking brake is set before the forward cabin door is opened.

Menu Navigation

Main Menu

The prompts on the main MENU are divided into three general categories: DATA, REQUESTS, and REPORTS.

- DATA includes:
 - DATA INIT
 - ATIS
 - DEPT / ENROUTE
 - SUMMARY / ARR DATA
 - RECEIVED MESSAGES
- REQUESTS include:
 - ATC REQUESTS
 - DAL REQUESTS
- REPORTS include:
 - REPORTS FLT PROGRESS
 - REPORTS MAINTENANCE



Preflight

Access from MAIN MENU page. Select DATA INIT, then select INIT RQST.

The INIT DATA required fields are defined to be FLIGHT NO., FLT RLS #, DEPT STN, DEST STN, ETE, FOD, CAPT ID, and F/O ID

INIT DATA 1/2

The screenshot shows the 'ACARS-xxxx INIT DATA 1/2' screen. It contains several input fields and buttons, numbered 1 through 9 for identification:

- 1** points to the 'FLIGHT NO.' field (four digits).
- 2** points to the 'FLT RLS DATE' field (two digits).
- 3** points to the 'DEPT STN' field (four digits).
- 4** points to the 'DEST STN' field (four digits).
- 5** points to the 'ETE' field (two digits).
- 6** points to the 'UTC' field (two digits).
- 7** points to the 'FMC RESET' button.
- 8** points to the 'FOD' field (two digits).
- 9** points to the 'NEXT PAGE' button.

Other visible elements include 'ID/RLS DATA', 'INIT RQST', 'RETURN', and 'HH:MM' at the bottom. At the very bottom are buttons for 'CDU MENU', 'MAIN MENU', 'PREV', 'NEXT', and 'LGHT'. The text 'MD89v1SP05inid_a' is visible in the bottom right corner of the screen area.

1 FLIGHT NO.

Automatically updates when INIT RQST selected, or may be manually entered.

2 FLT RLS DATE

Automatically updates when INIT RQST selected, or may be manually entered.

3 DEPT STN

Automatically updates when INIT RQST selected, or may be manually entered.

4 DEST STN

Automatically updates when INIT RQST selected, or may be manually entered.

5 ETE

Must be manually entered.

6 UTC

Confirm correct.

7 FMC RESET

Not functional.

8 FOD (Fuel On Departure)

Verify correct or enter manually. Will be downlinked with the OUT event.

9 ID / RLS DATA NEXT PAGE

Displays INIT DATA 2/2.

INIT DATA 2/2

The diagram shows the INIT DATA 2/2 screen with the following fields and buttons:

- ACARS-xxxx** (Label)
- CAPT ID** (Field 10)
- F/O ID** (Field 11)
- F/A ID** (Field 12)
- HELP** (Field 13)
- SEND** (Button)
- RETURN HH:MM** (Button)
- CDU MENU** (Button)
- MAIN MENU** (Button)
- PREV** (Button)
- NEXT** (Button)
- LGHT** (Button)
- INIT DATA 2/2** (Title)
- CAPT 2 ID** (Field 14)
- F/O 2 ID** (Field 15)
- FLT RLS #** (Field 16)
- RLS AMEND** (Field 17)

MD88v1SP05ini2_a

10 CAPT ID

Must be populated.

11 F/O ID

Must be populated.

12 F/A ID

Not functional.

13 HELP

Not functional.

14 CAPT 2 ID

Not functional.

15 F/O 2 ID

Not functional.

16 FLT RLS

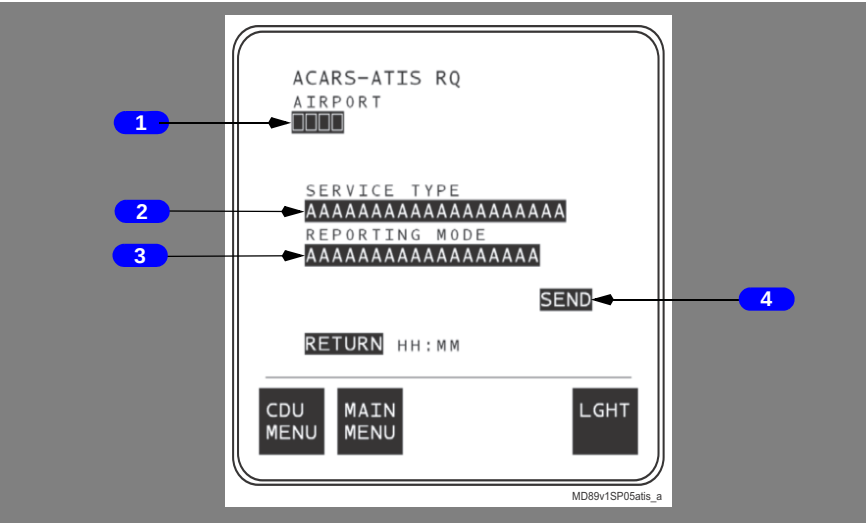
Not functional.

17 RLS AMEND

Not functional.

ATIS Page

Access from prompt on MAIN MENU page, or select ATC REQUESTS, then ATIS. This page allows requests of digital ATIS information when provided by airport.



1 AIRPORT

Defaults to the departure station before OFF event and to the destination station after OFF event.

2 SERVICE TYPE

Allows selection of Departure ATIS, Enroute Info Service, or Arrival ATIS.

3 REPORTING MODE

Allows selection of Single Report (default), Start Auto-Updates, or Stop Auto-Updates.

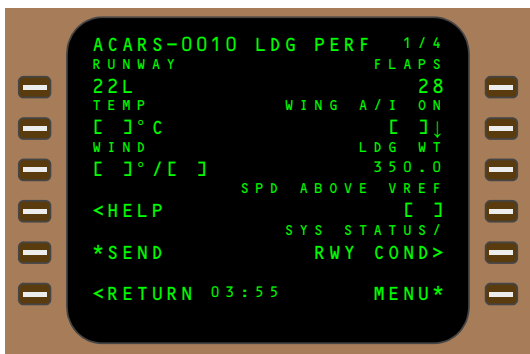
4 SEND

Queues message for downlink.

ACARS Landing Performance Request

Note: LPR is intended for normal landing distances. For non-normal landing configurations, use the ODM charts.

From the ACARS main menu page, line select DAL REQUESTS, then PERF LANDING.



The image shows a simulated ACARS Landing Performance Request (LPR) screen. The screen is a dark rectangular display with green text, set against a light brown background that includes several push-button icons. The text on the screen is as follows:

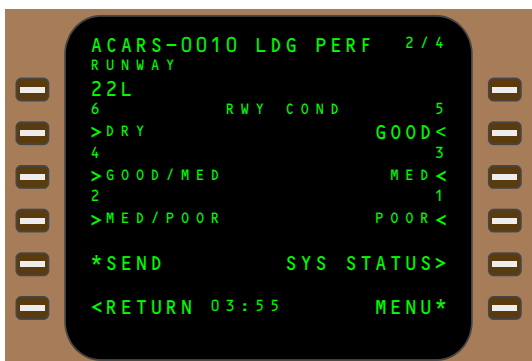
```
ACARS-0010 LDG PERF 1 / 4
RUNWAY                FLAPS
22L                    28
TEMP                  WING A/I ON
[ ]°C                 [ ]
WIND                  LDG WT
[ ]°/[ ]              350.0
                      SPD ABOVE VREF
<HELP                 [ ]
                      SYS STATUS/
*SEND                 RWY COND>
<RETURN 03:55        MENU*
```

Desired runway must be entered. (If you would like to get an LPR for an alternate airport, enter the airport code prior to the runway, e.g. DTW4R.) If flap and landing weight are not entered, they will default to Flaps 28 and estimated or max landing weight. Temperature and wind are automatically captured but may be entered manually if desired. Wing A/I can be toggled on if necessary.

Calculations assume the aircraft will decelerate during the flare and touchdown at VREF minus 5 knots. Speed above VREF is not entered for headwinds; however, additives for gusts are carried through to touchdown and should be entered.

Entering a value in the SPD ABOVE VREF block increases the touchdown speed by the same amount and landing distance will increase.

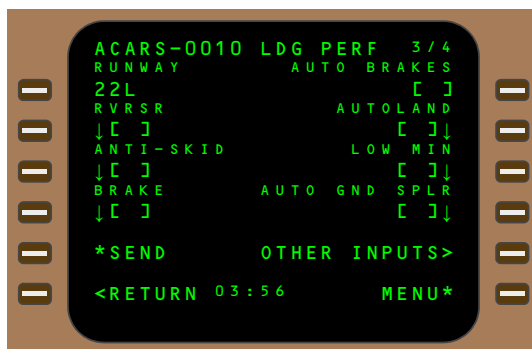
Select the RWY COND prompt, then line select the desired Runway Condition Code (e.g. 5) or Braking Action Report (e.g. GOOD).



Select SYS STATUS to display page 3.

Enter desired autobrake selection.

- 0 = Max manual
- 2 = MED autobrakes
- 5 = Max autobrakes



Page 3 also allows calculation adjustments for inoperative braking systems. MIN autobrakes are not used.

Defaults: If the blocks for flaps, autobrakes, and landing weight are left blank, the system will default to Flaps 28, MED autobrakes, and estimated or max landing weight. Crews must always enter weight when landing above the aircraft max landing weight.

ACARS Landing Performance Request Uplink

'*' Indicates fields selected or default.

LDIST = Calculated Landing Distance includes a 1500' air run from threshold to touchdown, plus stopping distance, plus a 15% safety margin. LDIST will never be greater than the available runway length.

LTP = Latest Touchdown Point to protect the LDIST on the available runway (default is 1500'). LTP varies between 1000' to 3000'. A landing beyond the LTP reduces the 15% safety margin included in the LDIST.

'()' = The LDIST and LTP are in parentheses when LTP is less than 1500'.

'- - - -' = Dashes appear when the 15% safety margin cannot be met or data is not available for requested conditions.

Page 1: Provides station, runway and available runway landing distance.

Fields 28, MED Autobrakes and GOOD braking action were requested (*).

JFK 22L		8400
5*GOOD	LDIST	LTP
F28*B-MED	8100	1800
F28 B-MAX	6000	2800
F40 B-MED	7700	2200
F40 B-MAX	5800	2800
W 318/14	TW01	XW14
*PRINT		

The LDIST for the requested conditions is 8100'. The actual stopping distance is less since LDIST includes a 15% safety margin. LDIST is 300' shorter than the available runway length; therefore LTP can increase from 1500' to 1800'. As autobrake and flap selections increase, LDIST decreases and LTP increases. LTP will never be greater than 1/3rd of the runway length up to 3000'.

Page 2: Provides additional data for requested conditions as well as other Runway Condition Codes or Braking Actions Reports.

F28 B-MED	LDIST	LTP
6 DRY	7500	2400
5*GOOD	8100	1800
4 G/M	8300	1600
3 MED	(8400)	(1400)
2 M/P	----	----
1 POOR	----	----
*PRINT		

Page 3: System status page. Includes ship number, flight number/date, and landing weight, as well as braking system status and production time stamp.

SHIP 0922	FLT 1956/17
WT 125.8	VREF PLUS 00
TEMP 4	A30.03
REVSER OK	WING AI OFF
ANTSKD OK	ASPOIL OK
LDIST INCL 15	PCT MARGIN
END ACARS	LPR 2012Z
*PRINT	

ACARS Misc Report LPR Request

An ACARS MISC RPT message may be used to obtain landing data for airports other than the current destination, however only default flap/autobrake and max landing weight are available.

To obtain an LPR for an airport other than the current destination, go to the main menu and select DAL REQUEST followed by MISC RPT. In the boxes under "Code," two characters may be required depending on the ACARS software level.

ACARS-xxxx MISC RPT

CODE

REMARKS

EDIT TEXT

[LPR4ATL27L]

[]

[]

[]

[]

SEND

RETURN HH:MM

CDU MENU

MAIN MENU

LGHT

For the message body, an example is "LPR4ATL27L," where:

LPR = Landing Performance Request

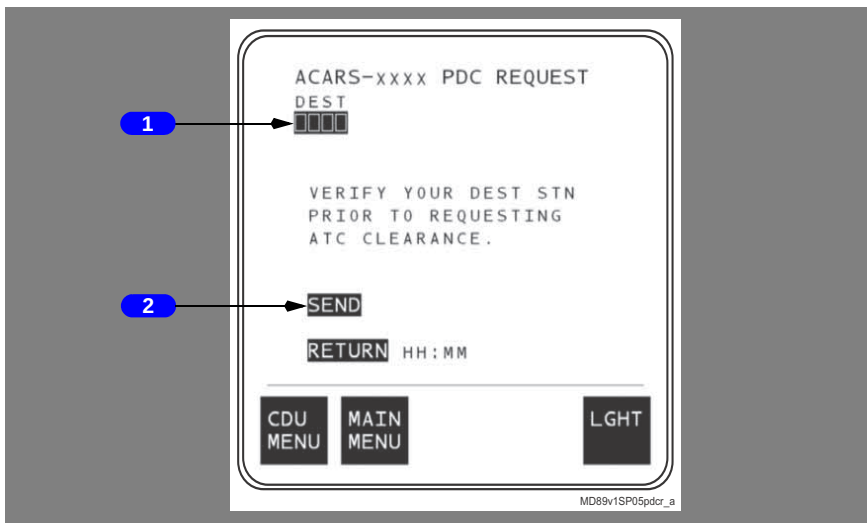
4 = Runway Condition Code

ATL = Airport for which you are requesting LPR

27L = Runway for which you are requesting LPR

PDC RQST Page

Access from MAIN MENU page. Select ATC REQUESTS, then PDC RQST. This page requests delivery of a Pre-Departure Clearance.



1 DEST

Destination station.

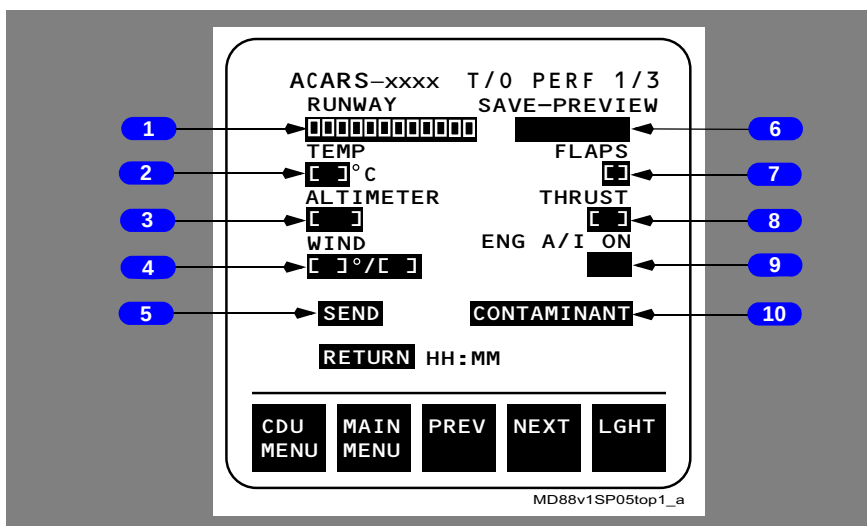
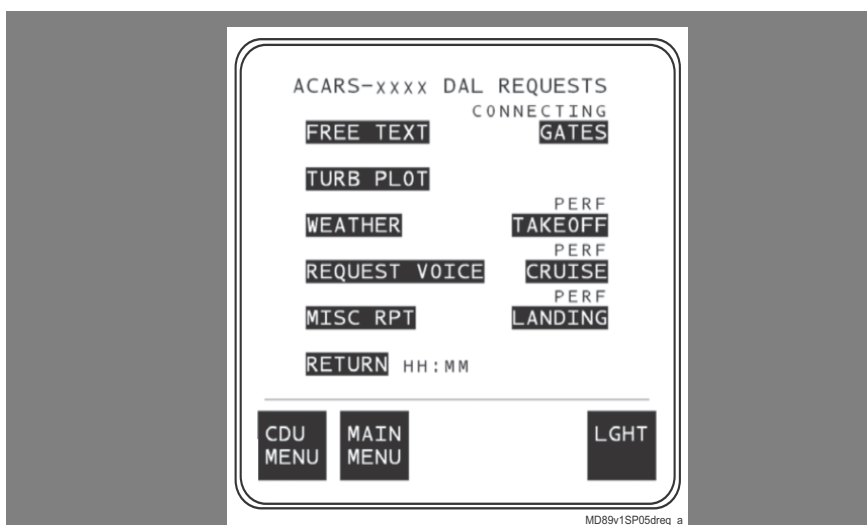
2 SEND

Queues message for downlink.

T/O PERF Pages (WDR Requests)

INIT DATA

Access from MAIN MENU page. Select DAL REQUESTS, then select PERF TAKEOFF.



Page 1 of 3

1 RUNWAY

Enter runway designation or runway and intersection designation (may include dash, e.g. 27R-M18). Do not precede with 88.

2 TEMP (Optional)

Enter temperature (degrees C).

3 ALTIMETER (Optional)

Enter altimeter.

4 WIND (Optional)

Enter wind direction (3 numbers) and wind speed (1-3 numbers).

5 SEND

Queues request for downlink and returns to MENU.

6 SAVE-PREVIEW

Not functional.

7 FLAPS

Not functional.

8 THRUST

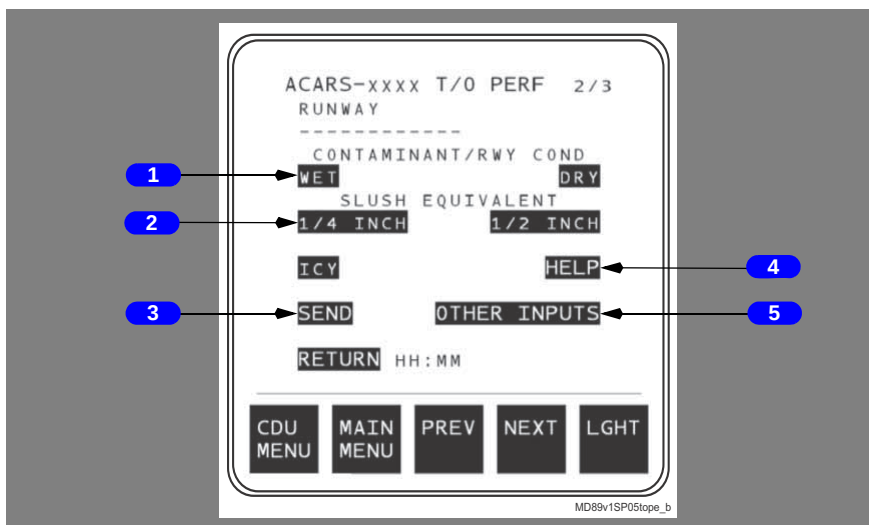
Not functional.

9 ENG A/I ON

Not functional.

10 CONTAMINANT

Show T/O PERF 2/3.



Page 2 of 3

1 CONTAMINANT/RWY COND

Defaults to Dry. Select Wet if desired.

2 SLUSH EQUIVALENT

Select either ¼ INCH, ½ INCH or ICY if desired.

3 SEND

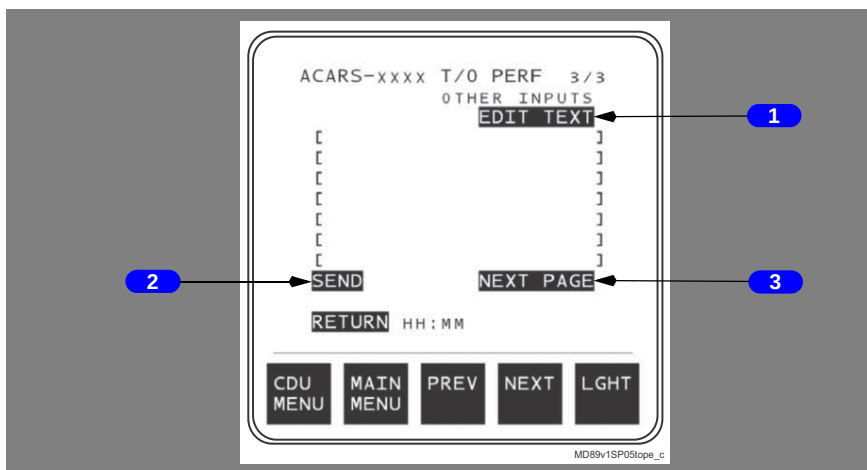
Queues request for downlink and returns to MENU.

4 HELP

Not functional.

5 OTHER INPUTS

Show T/O PERF 3/3.



Page 3 of 3

1 EDIT TEXT

Text entry/edit (0-23 characters/line, 7 lines). Provisioned for future use.

2 SEND

Queues request for downlink and returns to MENU.

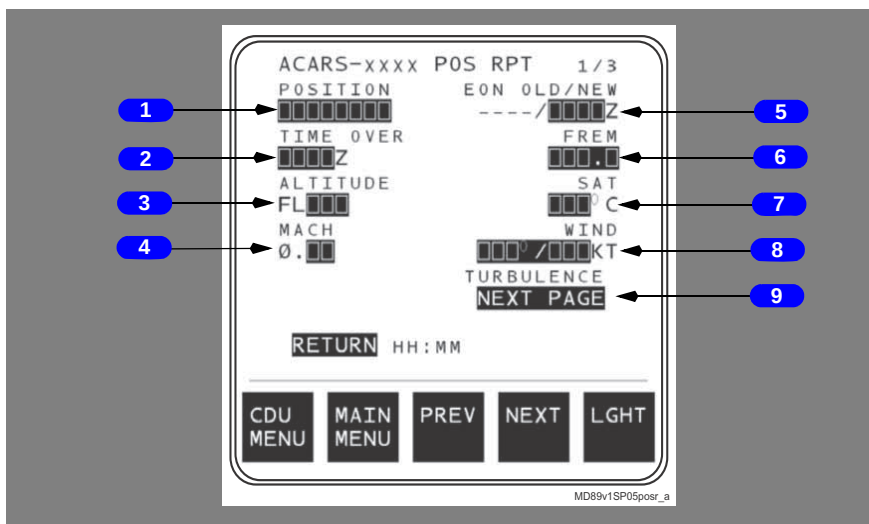
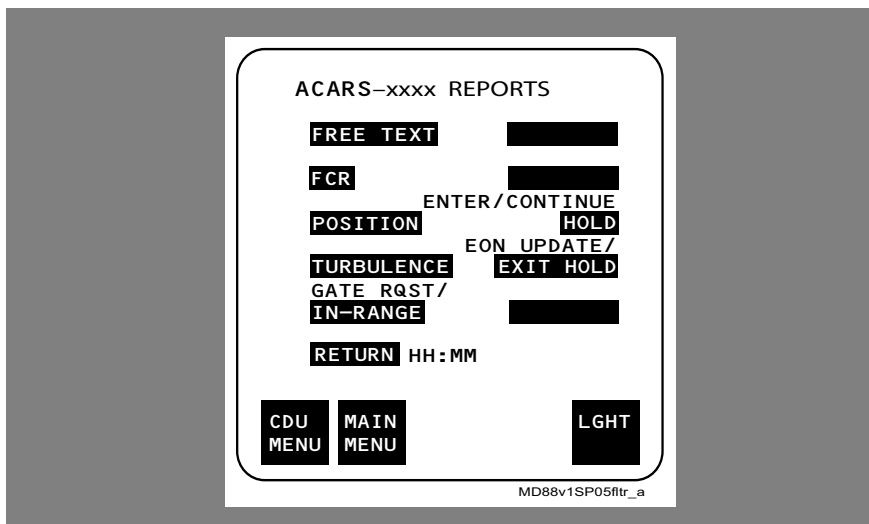
3 NEXT PAGE

Show T/O PERF 1/3.

EN ROUTE

Position Report

Select from MAIN MENU page. Select REPORTS FLT PROGRESS, then POSITION.



Page 1 of 3

1 POSITION

Enter reporting point identifier from the flight plan.

2 TIME OVER

Enter current time (Z).

3 ALTITUDE

Enter current aircraft flight level.

4 MACH

Enter current airspeed in Mach (2 digit format).

5 EON OLD/NEW

Enter new estimated ON time.

6 FREM

Enter current fuel on board.

7 SAT

Enter static air temperature.

8 WIND

Enter wind direction / speed.

9 TURBULENCE NEXT PAGE

Show POS RPT page 2/3.

ACARS-xxxx POS RPT 2/3

0 SMOOTH 4 MOD TURB

1 OCCL LIGHT 5 SEV TURB

2 LT TURB 6 EXT TURB

3 LIGHT/MOD

SEND REMARKS

RETURN HH:MM

CDU MENU MAIN MENU PREV NEXT LGHT

MD89v1SP05posr_b

Page 2 of 3

1 Turbulence

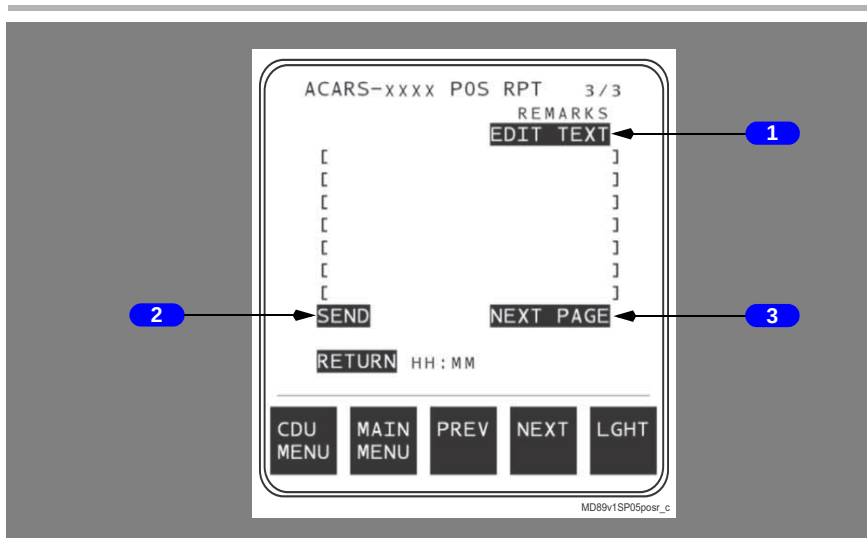
Touch to select level of turbulence: 2 LT TURB, 4 MOD TURB, 5 SEV TURB and 6 EXT TURB are for reporting continuous turbulence. 1 OCCL LIGHT and 3 LIGHT / MOD are for reporting occasional turbulence.

2 SEND

Queue message for downlink.

3 REMARKS

Show POS RPT page 3/3.



Page 3 of 3

1 REMARKS EDIT TEXT

Text entry/edit.

2 SEND

Queues messages for downlink.

3 NEXT PAGE

Show POS RPT 1/3.

IN-RANGE

From REPORTS FLT PROGRESS select GATE RQST / IN-RANGE.

ACARS-xxxx REPORTS

FREE TEXT [REDACTED]

FCR [REDACTED]

ENTER/CONTINUE

POSITION [REDACTED] HOLD

EON UPDATE/

TURBULENCE [REDACTED] EXIT HOLD

GATE RQST/

IN-RANGE [REDACTED]

RETURN HH:MM

CDU MENU MAIN MENU LGHT

MD88v1SP05fltr_a

ACARS-xxxx IN-RANGE 1/3

EON OLD/NEW LDG RWY

1 ----/ [REDACTED]Z 3 [REDACTED]

CONNECTING

2 GATE RQSTS: [REDACTED]

FLT NO [REDACTED]

FLT NO [REDACTED]

FLT NO [REDACTED]

4 SEND 5 GND SVC RQSTS

NEXT PAGE

RETURN HH:MM

CDU MENU MAIN MENU PREV NEXT LGHT

MD89v1SP05inra_a

Page 1 of 3

1 EON OLD / NEW

Enter estimated on time.

2 CONNECTING GATE RQSTS

Not functional.

3 LDG RWY

Not functional.

4 SEND

Queue message for downlink.

5 GND SVC RQSTS NEXT PAGE

Show IN-RANGE 2/3.

ACARS-XXXX IN-RANGE 2/3

APU INOP WHEELCHAIRS

AISLE CHAIRS

UNACCOMP MINORS

REMARKS

SEND NEXT PAGE

RETURN HH:MM

CDU MENU MAIN MENU PREV NEXT LGHT

MD89v1SP05inra_b

Page 2 of 3

1 APU INOP

Default is blank. May enter YES or NO.

2 WHEELCHAIRS

Enter total number of wheelchairs requested at destination.

3 AISLE CHAIRS

Enter number of passengers requiring carry-off assistance.

4 UNACCOMP MINORS

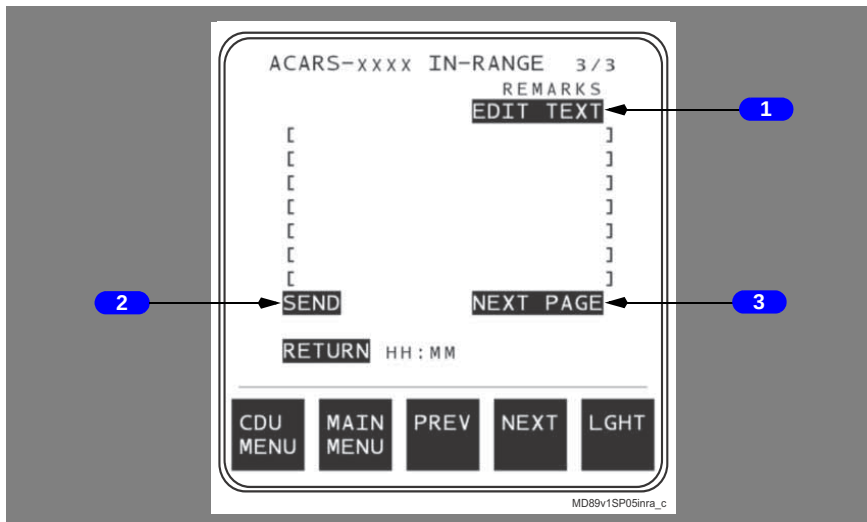
Enter total number of unaccompanied minors.

5 SEND

Queue message for downlink.

6 REMARKS

Show IN-RANGE 3/3.



Page 3 of 3

1 REMARKS EDIT TEXT

Text entry/edit.

2 SEND

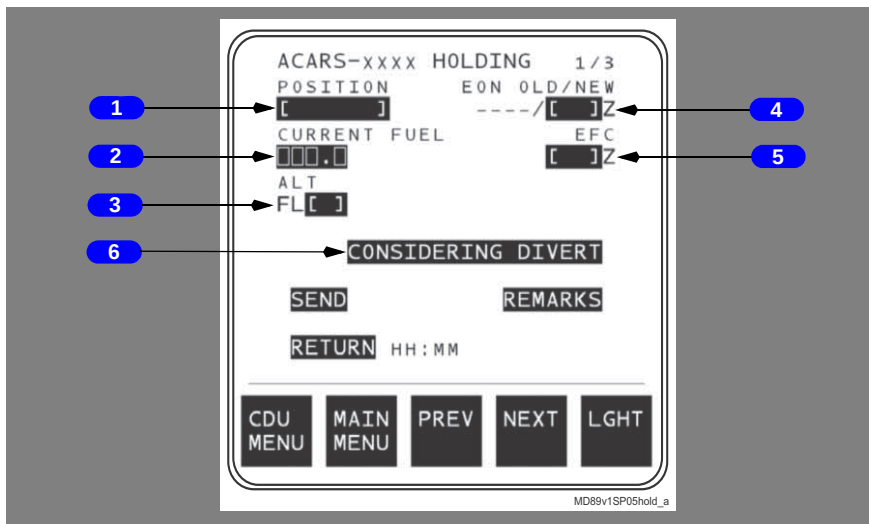
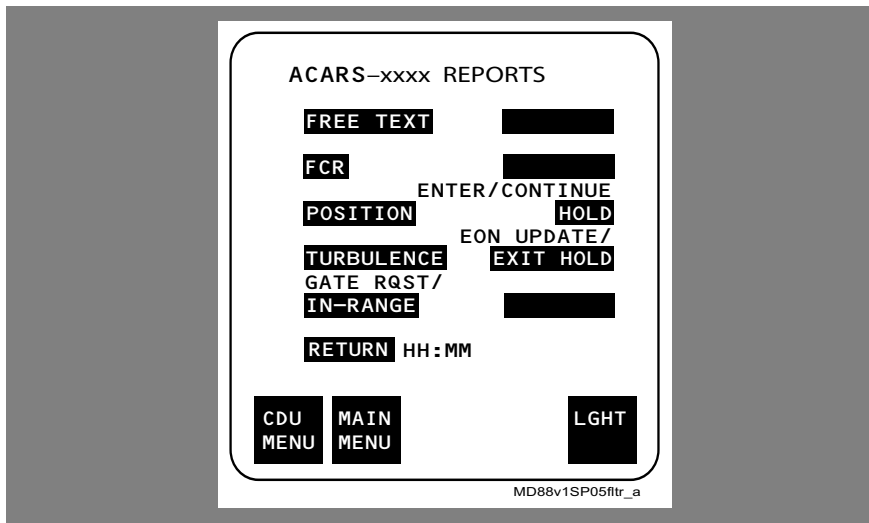
Queues messages for downlink.

3 NEXT PAGE

Show IN-RANGE 1/3.

HOLDING

From REPORTS FLT PROGRESS select ENTER / CONTINUE HOLD.



Page 1 of 3

1 POSITION

Enter current position.

2 CURRENT FUEL

Enter actual fuel on board.

3 ALT

Enter current altitude (3 digits).

4 EON OLD / NEW

May show previous estimate. Enter new estimated ON time.

5 EFC

Enter estimated further clearance time.

6 CONSIDERING DIVERT

Shows HOLDING page 2 of 3.

The screenshot shows the ACARS-HOLDING 2/3 screen. At the top, it displays "ACARS-xxxx HOLDING 2/3" and "CONSIDERING DIVERT". Below this, there are two input fields: "TO STATION" with a bracketed box [] and "AT FUEL" with a bracketed box [.]. To the left of the "TO STATION" field is a blue circle with the number 1, and to the right of the "AT FUEL" field is a blue circle with the number 2. Below these fields are two buttons: "SEND" and "REMARKS". To the left of the "SEND" button is a blue circle with the number 3, and to the right of the "REMARKS" button is a blue circle with the number 4. Below the "SEND" button is a "RETURN" button followed by "HH : MM". At the bottom of the screen are five buttons: "CDU MENU", "MAIN MENU", "PREV", "NEXT", and "LGHT". The text "MD89v1SP05hold_b" is visible in the bottom right corner of the screen.

Page 2 of 3

1 TO STATION

Enter station identifier.

2 AT FUEL

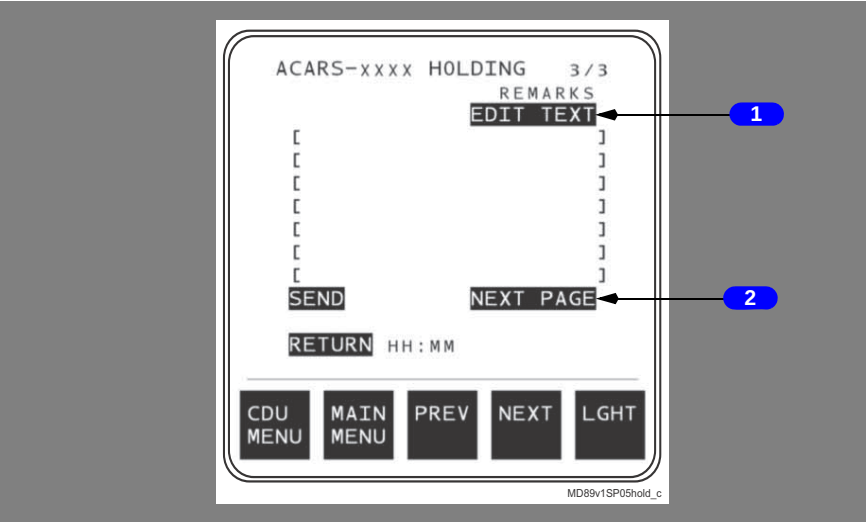
Enter proposed divert (bingo) fuel level.

3 SEND

Queue message for downlink. Set new ETA with EON time. Return to MAIN MENU.

4 REMARKS

Show HOLDING page 3 of 3.



Page 3 of 3

1 EDIT TEXT

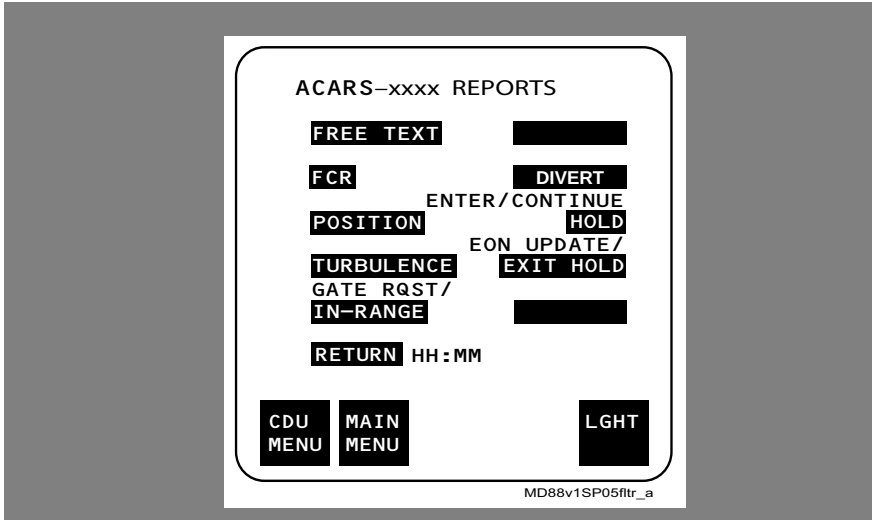
Text entry/edit.

2 NEXT PAGE

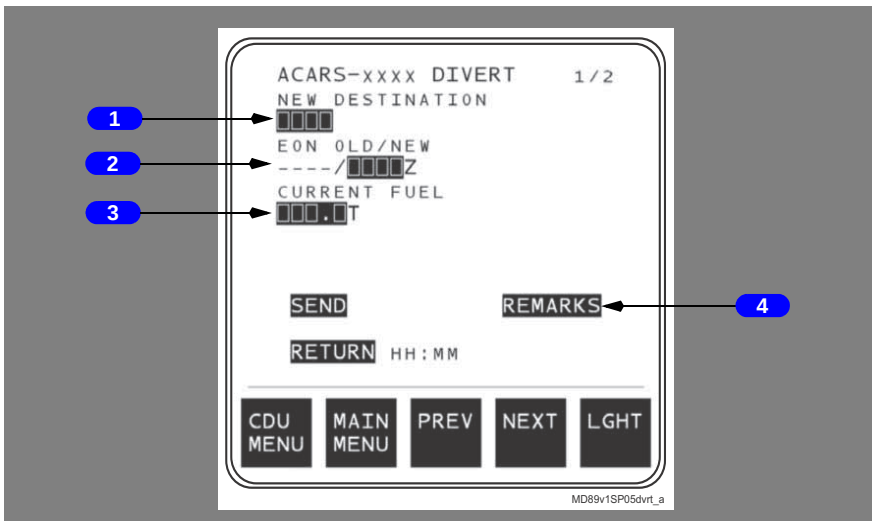
Show HOLDING 1/3.

DIVERT

From the MAIN MENU select REPORTS FLT PROGRESS, then select DIVERT.



Page 1 of 2



1 NEW DESTINATION

Enter new destination station.

2 EON OLD / NEW

May show previous estimate. Enter new estimated ON time.

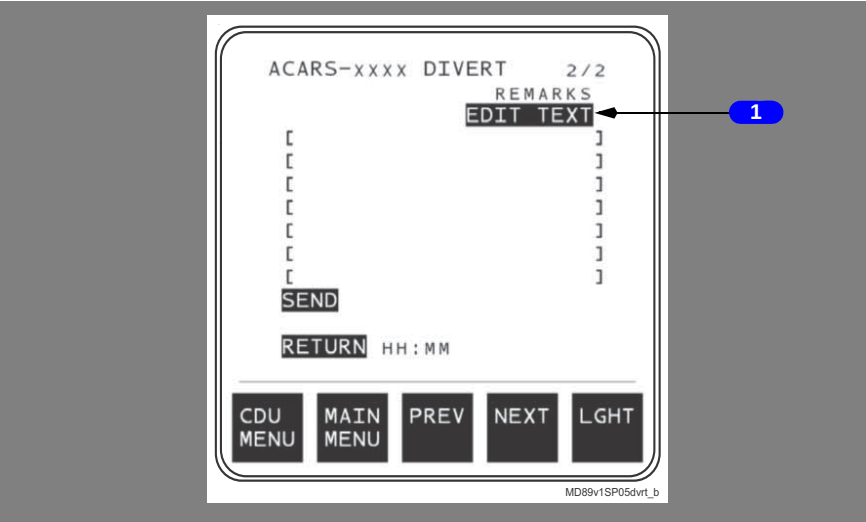
3 CURRENT FUEL

Enter actual fuel on board.

4 REMARKS

Displays DIVERT page 2 of 2.

Page 2 of 2.



1 EDIT TEXTS

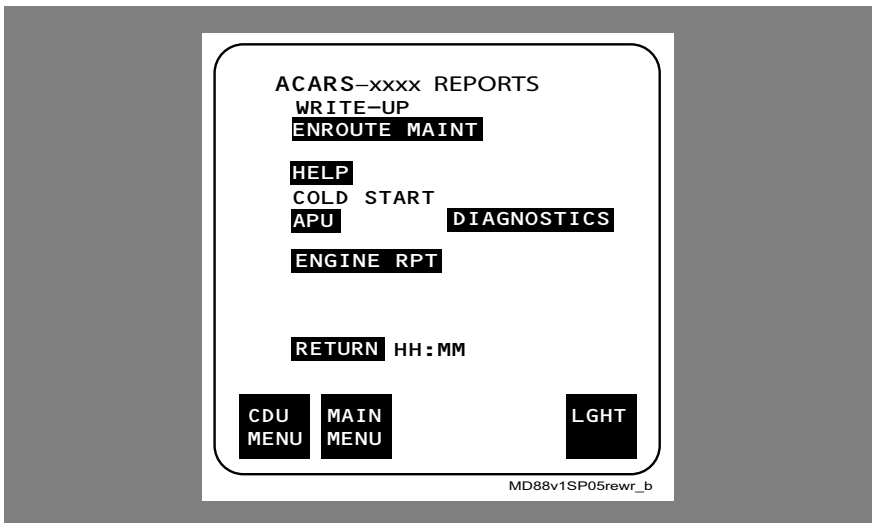
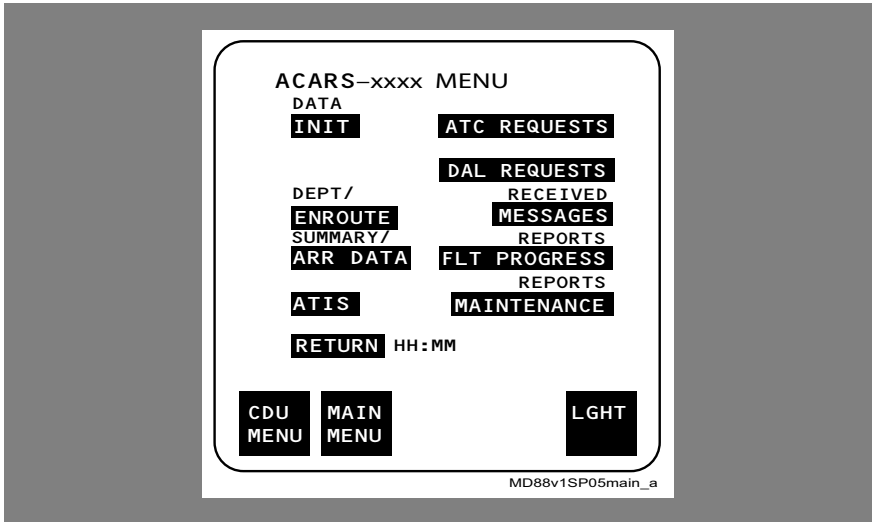
Text entry/edit.

DELTA
MD-88/90 Operations Manual

Maintenance Write-Up and Engine Reports

From MAIN MENU select REPORTS MAINTENANCE.

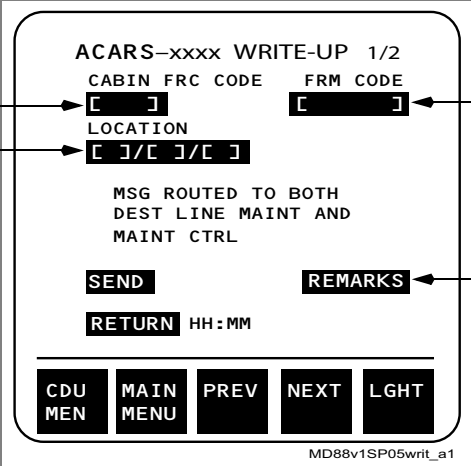
Note: Report discrepancies with the write-up enroute screen rather than sending a Free Text Message.



Note: HELP, COLD START APU, and DIAGNOSTICS are provisioned for future use.

Write-Ups Page

When WRITE-UP ENROUTE MAINT is selected, complete the WRITE-UP page.



ACARS-xxxx WRITE-UP 1/2

CABIN FRC CODE FRM CODE

1 → [] ← 3 []

2 → [][][][][]

LOCATION

MSG ROUTED TO BOTH
DEST LINE MAINT AND
MAINT CTRL

SEND REMARKS ← 4

RETURN HH:MM

CDU MEN MAIN MENU PREV NEXT LGHT

MD88v1SP05writ_a1

Note: “MSG ROUTED TO BOTH DEST LINE MAINT AND MAINT CTRL” is provisioned for future use. Crews should verbally notify local Line Maintenance (if available) of open logbook items.

Page 1 of 2

1 CABIN FRC CODE

Enter numeric code (e.g. 253-12).

2 LOCATION

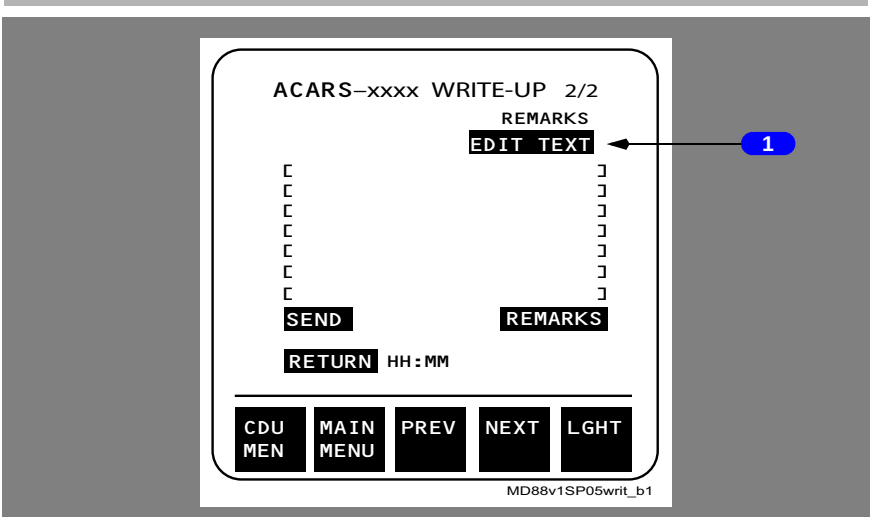
Enter three-character location (e.g. 401 or 01A).

3 FRM CODE

N/A.

4 REMARKS

Displays WRITE UP page 2/2.



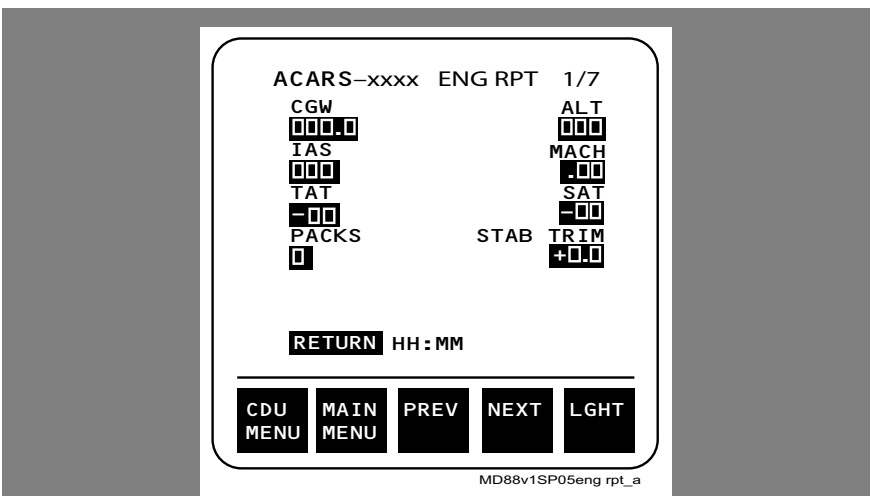
1 EDIT TEXT

Text entry / edit. Submit discrepancies to MCC (future programming will allow message routing to destination as well).

Engine Report Page

When ENGINE RPT is selected, complete the Engine Report page.

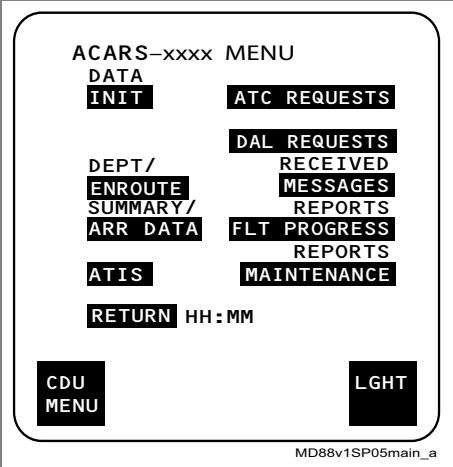
Note: When all 7 pages of the report are completed, the SEND prompt will display.

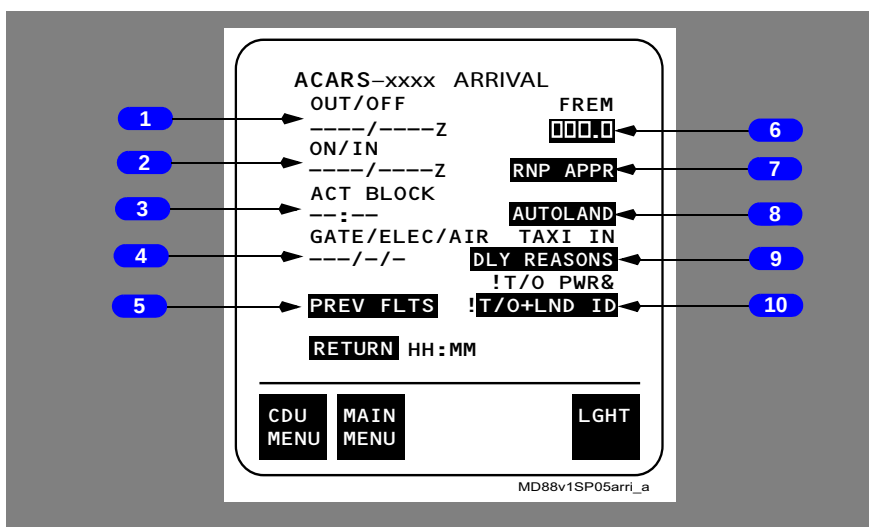


Postflight

Flight Summary and Arrival Data

From the MAIN MENU select SUMMARY / ARR DATA.





ARRIVAL

1 OUT / OFF

Out / Off event times.

Note: On aircraft with the appropriate wiring modifications, the Out event time is the first parking brake release after all cabin and cargo doors are closed.

2 ON / IN

On / In event times.

Note: On aircraft with the appropriate wiring modifications, the In event time is the last time the parking brake is set before the forward cabin door is opened.

3 ACT BLOCK

Actual block time.

4 GATE / ELEC / AIR

When functional will provide gate number and Y or N indicator for gate electrical power and conditioned air.

5 PREV FLTS

Show page PREV FLTS, then view and/or print flight times for current or previous flights.

6 FREM

Fuel remaining must be manually entered.

7 RNP APPR

Not functional.

8 AUTOLAND

Show page AUTOLAND.

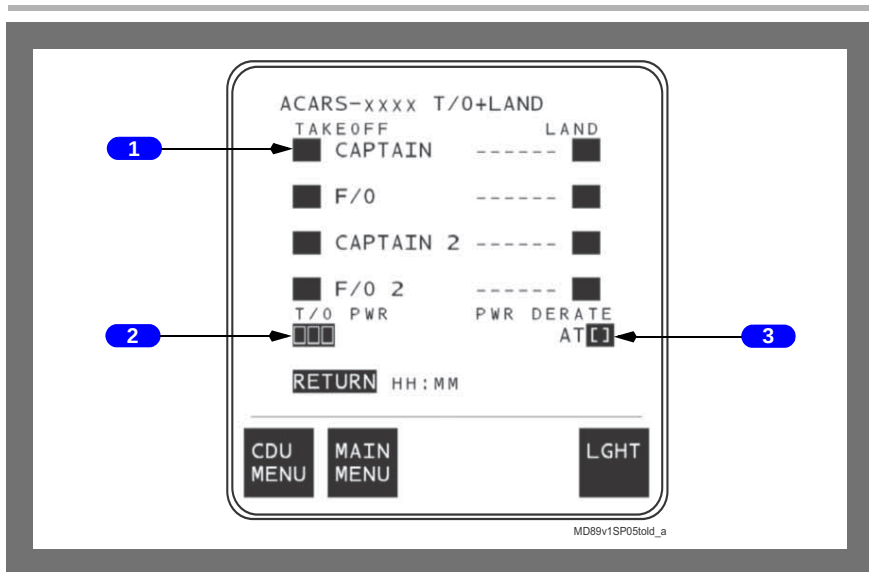
9 TAXI IN DLY REASON

Automatically displayed after landing. Delay times should be entered for all categories that apply and will be automatically sent with the arrival data.

10 !T/O PWR & T/O+LND ID

Show T/O+LAND page.

Note: The “!” symbol indicates required data has not been entered.



T/O+LAND

1 TAKEOFF / LAND

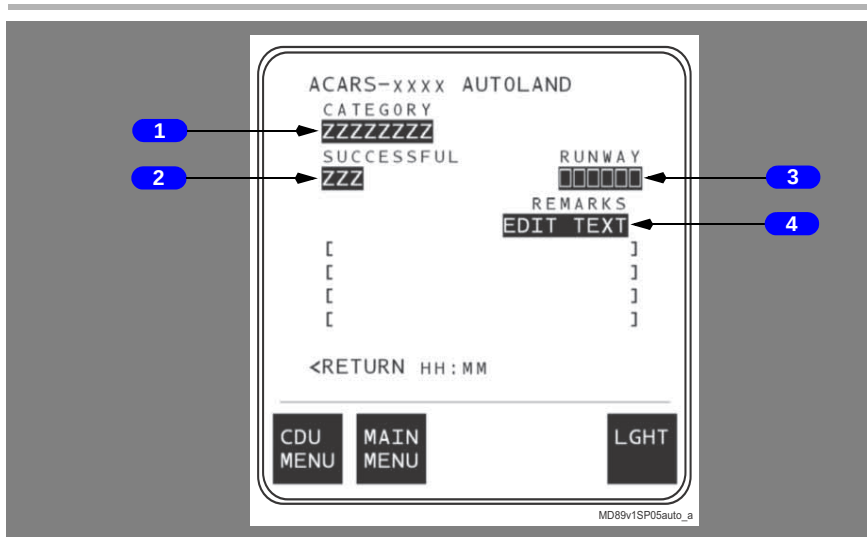
Touch to indicate which pilot performed the takeoff and the landing.

2 T/O PWR

MD-88: Select T/O or MAX, MD-90: Select 28K.

3 PWR DERATE AT

Enter actual Assumed Temperature, if used.



ACARS-XXXX AUTOLAND

CATEGORY
ZZZZZZZZ

SUCCESSFUL
ZZZ

RUNWAY
[][][][][][]

REMARKS
EDIT TEXT

[]
[]
[]
[]

<RETURN HH:MM

CDU MENU MAIN MENU LGHT

MD89v1SP05auto_a

AUTOLAND

1 CATEGORY

Select appropriate approach category.

2 SUCCESSFUL

Select Y or N (Default is Y).

3 RUNWAY

Enter approach runway.

4 EDIT TEXT

Text entry/edit available if autoland not successful.

Note: Aircraft logbook entry required.

Other

Free Text

From the MAIN MENU select DAL REQUESTS then FREE TEXT.

ACARS-xxxx DAL REQUEST

CONNECTING

FREE TEXT GATES

TURB PLOT

PERF

WEATHER TAKEOFF

PERF

REQUEST VOICE CRUISE

PERF

MISC RPT LANDING

RETURN HH:MM

CDU MENU MAIN MENU LGHT

MD88v1SP05dalr_a

ACARS-xxxx FREE TEXT 1/2

ENTER ADDRESS(ES)

1 -/-/-

A-FLT CONTROL

B-DEST STN

C-DEPT STN

D-MAINT CONTROL

G-CREW TRACKER

Z-SCORES/ALT RADIO

TTY ADDR OTHER STN

2 [] []

RETURN HH:MM

CDU MENU MAIN MENU PREV NEXT LGHT

MD89v1SP05fxt_a

Page 1 of 2

1 ENTER ADDRESS(ES)

Designate address(es) for message routing by entering the corresponding code letter(s).

Note: “B – DEST STN” is provisioned for future use. Crews should verbally notify the MCC/Line maintenance of open log book items.

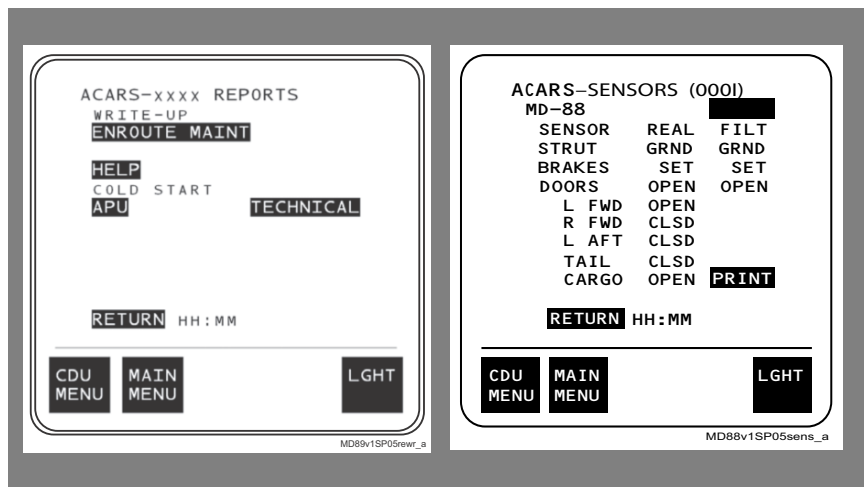
Note: Refer to FOM, Ch 3, ACARS Departure Delay Reports.

2 TTY ADDR and OTHER STN

Use only as directed.

Sensors

From the MAIN MENU select REPORTS MAINTENANCE, then TECHNICAL, then SENSORS.



Out-Off-On-In (OOOI) logic depends on aircraft wiring of parking brake, cabin door, and cargo door sensors.

To determine aircraft Out-Off-On-In (OOOI) logic, check the status of the CARGO sensor.

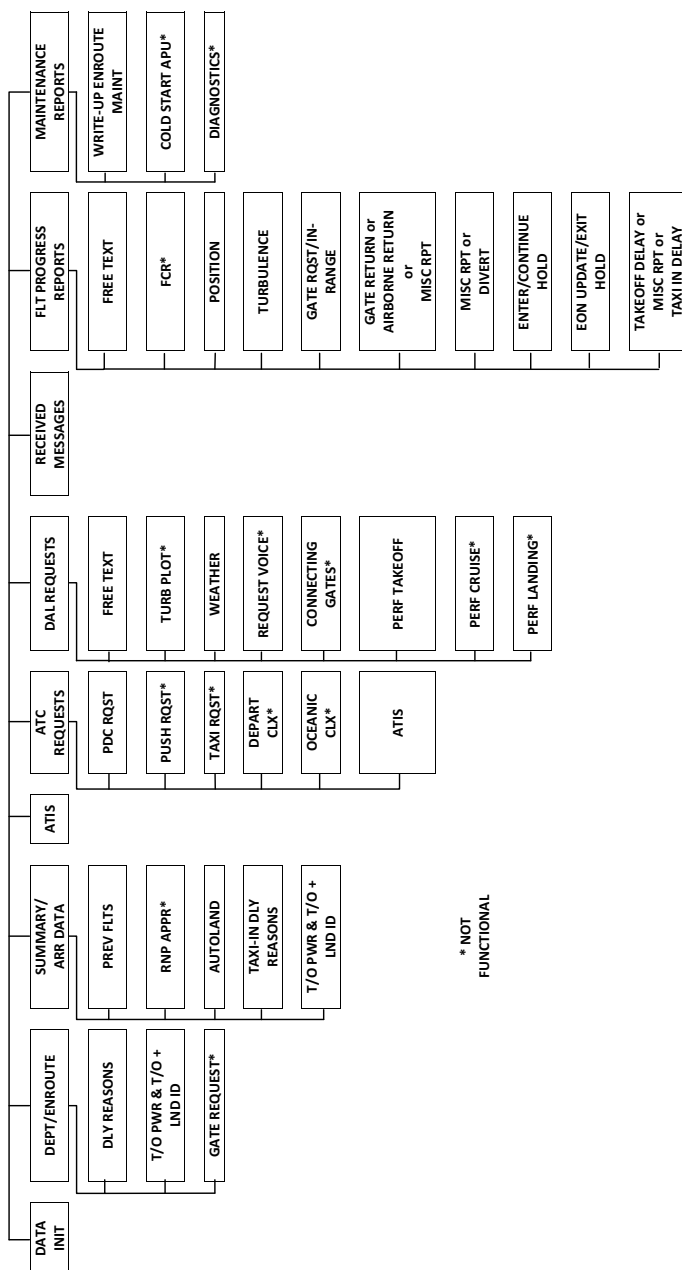
If a cargo door is open and CARGO SENSOR is CLOSED (no signal), forward cabin door position and Anti-Collision lights determine the Out event and the In event times.

If a cargo door is open and CARGO SENSOR is OPEN, the Out event and the In event times are determined as follows:

- Out event time is the first parking brake release after all cabin and cargo doors are closed.
- In event time is the last time the parking brake is set before the forward cabin door is opened.

Menu Layout Chart

ACARS -601 DATA LINK INDEX



Cockpit Voice Recorder Test

TEST switch Push and hold for a minimum of 5 seconds.

After a slight delay:

Monitor indicator Green band
A tone may be heard through a headset plugged into the headset jack.

TEST switch Release

Flight Deck Interphone Operation with Oxygen Masks

MASKS/BOOM switch MASKS

Select when intra-flight deck communications is desired.

To activate flight deck speakers:

Intercom (I/C) switch Select

Depress the switch on the captain's and first officer's audio control panels and rotate to adjust volume.

Microphone switch Push

Momentarily push the Control Wheel Push-to-Talk (INT) switch forward or push the Audio Control Panel Push-to-Talk (R/T-I/C) switch.

Intentionally
Blank

Supplementary Procedures

Electrical

Chapter SP

Section 6

Electrical Power Up

The following procedure is accomplished to permit safe application of electrical power.

Circuit breakers Check
 Verify circuit breakers are in or collared in compliance with dispatch requirements.

Throttles Idle

Fuel (88) Levers / (90) Switches OFF

Aux and Trans Hydraulic switches OFF

Landing Gear Handle DOWN

Air Conditioning Supply switches OFF

Battery switch ON, Locked

90

Note: Wait 90 seconds before starting the APU. This will allow the EPCU built-in-test to finish and prevent an ELEC SYS BIT FAIL message.

88

Emergency Power switch OFF

90

Emergency Power switch ARM

Electrical Power Establish

88

AC Bus X Tie switch AUTO

90

L/R Bus Tie switches AUTO

DC Bus X Tie switch OPEN

If external power is desired:

Note: If external power is to be used, external power BUS CONTROL switches should be OFF and remain OFF until the unit being connected has been checked for the correct volts and frequency.

88
External Power Avail light Illuminated

88
L/R External Power Bus switches ON

90
External Power switch ON

If APU power is desired:

APU Start

APU Power Avail light Illuminated

88
L/R APU Bus switches ON

Emergency Power Check

90

Note: This check should only be performed when both engines are shutdown and there is no N2 rotation on either engine.

EMER PWR switch ON

- Captain's flight instruments - No flags.
- AC EMER BUS OFF and DC EMER BUS OFF lights - extinguished.
- EMER PWR IN USE light - illuminated.

VOLT/FREQ selector BATT VOLT

Observe minimum battery voltage of 25 volts.

VOLT/FREQ selector BATT AMP

88
Observe amps discharge rate on ammeter (to the right): 10-50

90
Observe amps discharge rate on ammeter (to the right): 10-70

88

EMER PWR switch OFF

- Observe charge (to the left) on ammeter and return to zero.
- #1 VOR course select readout may be erratic during check.

Note: Some aircraft have pulse chargers which cycle the ammeter to the left and back to zero until the battery is fully charged. Others have constant current chargers which show a steady charge until the battery is fully charged. An indication of no charge could result from a faulty charger or a battery being fully charged. To determine if the system is operational, turn the EMER PWR switch to ON to deplete the battery enough to trigger charging.

90

EMER PWR switch ARM

Battery charger has three different charging modes:

- Main mode - initial mode after power up or APU start. Up to 75 amps DC deflection to the left until battery is 90 - 95% charged.
- Topping mode - the ammeter will indicate a pulsed, two second ON and eight second OFF, 26 amp DC deflection to the left for 30 minutes.
- TR mode - a continuous 0-5 amp DC deflection to the left.

AC CROSSTIE LOCKOUT RESET/AC CROSSTIE LOCKOUT on the Ground

88

This procedure will be utilized on the ground when Maintenance personnel are not readily available.

AC CROSSTIE LOCKOUT RESET switch Reset

Reset switch located on CB panel behind Captain.

Note: If reset attempt is not successful, a complete shutdown of aircraft electrical power is required to reset the crosstie lockout protective circuitry.

If AC CROSSTIE LOCKOUT message remains illuminated after reset attempt:

APU Shut down

Engines. Shut down

Battery switch. OFF

After engines come to a complete stop:

Battery switch. ON/Lock

Check AC CROSSTIE LOCKOUT message.

If AC CROSSTIE LOCKOUT message is extinguished:

APU/Engines Restart

If AC CROSSTIE LOCKOUT message is illuminated:

Consult MEL.

AC Crosstie Relay Operation Verification

88

APU BUS switches OFF

LEFT and RIGHT GEN switches ON

Each engine driven generator should be powering its own bus.

AC X TIE switch AUTO

LEFT GEN switch OFF

- L GEN OFF message should illuminate
- Right generator is powering all buses

LEFT GEN switch ON

- L GEN OFF message should extinguish

RIGHT GEN switch OFF

- R GEN OFF message should illuminate
- Left generator is powering all buses

RIGHT GEN switch ON

- R GEN OFF message should extinguish

Emergency Power Summary of Operative Equipment

Air Conditioning/Pressurization

- Manual pressurization
- Manual temperature control

APU

88

- Windmill start.

90

- Battery start (in flight, one attempt only)
- APU OIL PRESS LOW and APU OIL TEMP HIGH messages.

Communications/Navigation

- Captain's VHF and flight deck speaker.
- Captain's ND and VHF NAV (no marker beacons). No DME.
- PA and flight interphone.
- Flight guidance panel- Captain's nav frequency only.

Electrical

- Captain's pitot heater.
- Captain's and first officer's white instrument flood lights (incandescent).
- Cabin standby lighting.
- MASTER WARNING and MASTER CAUTION lights.
- Annunciator lights/messages (left screen of EOAP is operative).

88

- AC CROSSTIE LOCKOUT
- L and R GEN OFF
- L and R AC BUS OFF
- DC BUS OFF
- Buses
 - Emergency AC and DC
 - DC transfer
 - Battery direct
 - Battery

Flight Controls

- All except automatic ground spoilers and stabilizer trim, slat extension beyond mid sealed, and auto slat extension
- Continuous "SLAT OVERSPEED" warning, if IAS is greater than 280/.57 M.

Flight Instruments

- Captain's flight instruments (no RDMI or marker beacon indications in PFD)
- F/O's RDMI (No DME)
- STANDBY HORIZON indicator

Fire Protection

- APU and engine fire detection and protection (no AGENT LOW lights and no cargo fire protection or detection)

Fuel

- DC start pump

Hydraulics

- Both engine driven hydraulic pumps, (No pressure indication)

Ice Protection

- Engine anti-ice if operating at time of power failure
- WINDSHIELD OVERHEAT message but no anti-icing

Landing Gear

- Extension and retraction (no position indicating lights, no horn)
- Alternate gear extension (no wheel well inspection lights)
- Manual brakes (no anti-skid)
- Nose wheel steering

Oxygen

- All oxygen equipment (if O2 required, all passenger oxygen modules must be manually opened)

Pneumatics

- Only low stage air available
- Pneumatic pressure indicator

Power Plant

- OIL PRESS LOW messages, EGT, N1, and N2
- Thrust Reversing (no indicator lights)
- Ignition
- Left EPR gauge

Intentionally
Blank

Supplementary Procedures

Engines, APU

Chapter SP

Section 7

APU Start (Ground and In Flight)

88

Note: For in flight starts, refer to APU START ENVELOPE.

90

Note: APU IN FLIGHT START ENVELOPE is the same as the aircraft flight envelope, but is currently limited to FL 350 and below. Normal deterioration and wear of the APU may adversely affect APU starting capability at the FL350 maximum start altitude. If time and conditions permit, crews should consider descending below FL330. All starts are electric. Only three attempts should be made.

BATT switch ON/LOCK

Check battery voltage.

If battery voltage is less than 25 with no load, battery must be replaced/allowed to recharge.

During APU start, battery voltage must be at least 22 volts.

Fire warning Test

Not necessary if previously tested.

APU FIRE CONT switch NORM

88

APU DOORS switch AUTO

APU AIR switch OFF

Fuel pump ON

If AC power is available from aircraft or external source, turn on one fuel tank boost pump.

If AC power is not available, move DC start pump switch to ON.

Note: Use right fuel pump (or left with crossfeed open) at all times. Do not operate APU from center tank to prevent possible cavitation and APU flameout at low fuel quantities.

APU MASTER switch START/RUN

Note: Momentary off-scale deflections of EGT and rpm indications may occur during normal start.

APU OIL PRESS LOW message Check OFF

Message normally extinguishes by 35%, but no later than 95% rpm.

APU EGT and RPM Check

Note limits on gauges are not exceeded.

Unusual starting trends should be noted in the aircraft log book, as they may indicate an impending APU malfunction.

Voltage and Frequency Check

If no voltage or frequency is indicated, reset the APU GEN switch.

If needed, refer to QRH, NNC.6, Electrical for APU GEN OFF message.

Fuel pump As required

After start turn on AC boost pump, if needed, and turn off DC start pump, if required, to supply fuel pressure for APU.

Note: Use right fuel pump (or left with crossfeed open) at all times.

Do not operate APU from center tank to prevent possible cavitation and APU flameout at low fuel quantities.

APU AIR switch As required

PNEU PRESS GAUGE indication Check

Air pressures up to 61 psi from the APU are normal.

Air conditioning system As required

Accomplish APU Ground Air Conditioning System Operation, in SP.2, Supplementary Procedures, Air Systems, if necessary.

APU Shutdown

APU AIR switch OFF

APU MASTER switch OFF

The OFF position of the APU MASTER switch automatically shuts bleed air off regardless of the APU AIR switch position and activates a timer to provide a cool-down period of 60 seconds before automatic shutdown.

If APU does not shut down when APU MASTER switch is moved to OFF (after 60 second cool-down), move APU FIRE CONT switch to OFF AND AGENT ARM. After APU shuts down, return switch to NORM.

88

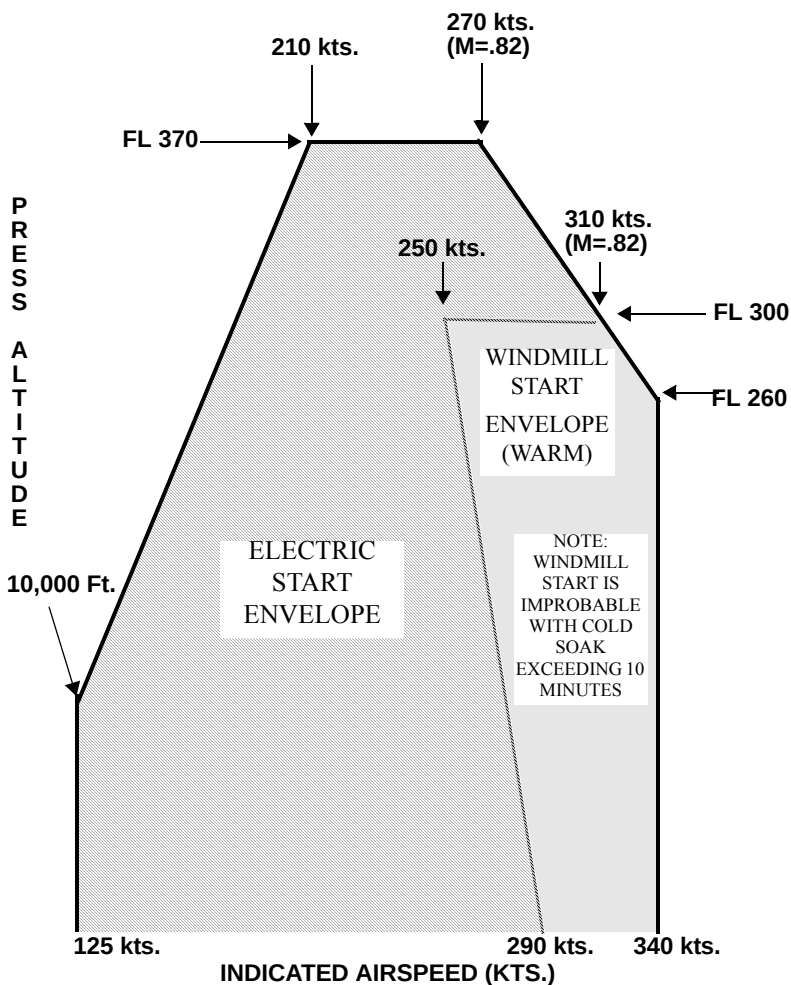
Note: The APU BUS switches are normally left in the ON position for flight unless a non-normal checklist places them OFF.

90

Note: The APU GEN switch is always left in the ON position.

APU In Flight Start Envelope

88



Note: For the APU, there may be no rpm Indications for over one minute and a completed start may take in excess of two minutes. If the OAT is below 0°F, an off-scale EGT indication can be seen during start; however, as the EGT increases (10 - 20 seconds), the flight deck EGT gauge should display normal indications.

Battery Start

This procedure is to be utilized when APU generator and ground electrical power are unavailable. Both engines should be started prior to taxi.

Aircraft Chock

Exterior/Interior Preflight Complete

Complete the following Preflight and Engine Start checklist items:

CBs Check

Throttles IDLE

FUEL (88) levers / (90) switches OFF

Battery ON/Lock

Fire Warning Check

Agent low lights are not powered.

EMER PWR switch ON

PNEU X FEED valves OPEN

AIR CONDITIONING SUPPLY switches OFF

88

AC X TIE switch OPEN

DC X TIE switch OPEN

88

ENG IGN selector SYS A or SYS B

90

IGNITION switch ON

Pneumatic pressure Check

If using ground air supply:

88
36 psi minimum at sea level less 1 psi per 1000 feet pressure
altitude above sea level.

90
25 psi minimum

If using APU air supply:

88
Positive pressure indication.

90
Pressure indication may only be observed after START switch is
pulled.

DC START PUMP ON

ANTI-COLLISION light ON

Right Engine Start

Start valve closing can be verified by observing an increase in
pneumatic pressure as start switch is released.

Verify START VALVE OPEN message is no longer displayed after
generator comes on line.

System Status: Only the following engine instruments/warning lights
will be operative during start:

OIL PRESS LOW message

EGT

N1

N2

Right Generator Volts/Frequencies Check

88
AC X TIE switch AUTO

Engine Instruments Check

Main Tank Fuel Pumps ON

DC Start Pump OFF

90	IGNITION switch	AUTO
88	EMER PWR switch	OFF
90	EMER PWR switch	Check armed
	Do not move switch through OFF position.	
	Preflight checklist	Complete
	Preflight checklist must be completed after starting engine since electrical power was not available prior to start.	
	Left Engine	Start
	After Start checklist	Complete

Crossbleed Start

Note: Cross-bleed starts are not permitted during pushback or when an aircraft is under tow.

Note: Cross-bleed starts are permitted when attached to a pushback tug provided the parking brake is set.

Accomplish the following delayed start procedure with the aircraft stopped:

Parking Brake Set
L and R PNEU X FEED VALVE levers OPEN
L and R AIR CONDITIONING SUPPLY switches OFF
Ramp Area/Taxiway Check
 Ensure ramp area/taxiway is clear of personnel, baggage carts, etc.
Pneumatic pressure Check

Advance throttle of operating engine to obtain:

88

36 psi minimum at sea level less 1 psi per 1000 feet pressure altitude above sea level.

90

25 psi minimum.

Note: Nominal recommended operating pressure range is 25 to 45 psi. Pressure above 25 psi may be required based on existing conditions, i.e., crosswinds, tailwinds.

Pressure in excess of 45 psi may cause starter damage on both 88 and 90 aircraft.

▪ Engine Start Procedure Accomplish
Delayed After Start Procedure Accomplish
The Captain calls “DELAYED AFTER START CHECKLIST.”
The First Officer reads the DELAYED AFTER START checklist.

Report information to MCC.

Thrust Rating Panel Check

88

Full functional check required on first flight of the day.

TRP Test button Push
Observe + 12° (±1) in RAT readout and 2.08 (±.01) in EPR limit readout. All lights should be extinguished.

TRP Test button Release
Observe ambient temperature in RAT readout. EPR readout will display dashes. NO MODE light should be illuminated.
Select T/O on TRP.
RAT and SAT gauges should be approximately equal.

Automatic Thrust Cutback (9201-9216) (9237-9252)

90
(9201-9216)
(9237-9252)

FMS Initialization:

Cutback EPR/AltitudeEnter
On the FMS takeoff page set MD-90 ACB EPR and altitude from the Delta Special Pages.

CONFIRM* 6R promptPress
Verify ACB displayed in FMA throttle window and 1L prompt displays DISARM.

After takeoff:

Cutback AltitudeMonitor ACB
Verify throttles retard to ACB EPR at ACB altitude.
If ACB disarms after takeoff is initiated, manually reduce thrust to ACB EPR setting at ACB altitude.

Semi-Automatic Thrust Cutback (9217-9236) (9253-9265)

(9217-9236)

(9253-9265)

Prior to takeoff:

EPR SEL button Press

Observe EPR SEL and NO MODE lights illuminate on the TRP and
EPR SEL appears on the engine display panel.

ASSUMED TEMP/EPR knob Rotate

Rotate knob to set MD-90 ACB EPR from Delta Special Pages.
Ensure EPR is displayed in FMA throttle window. EPR SEL and
NO MODE lights will extinguish after 10 seconds if no changes are
made to the cutback EPR or the TRP.

TOGA or TO FLX Press

With TOGA selected the FMA throttle window displays cutback
EPR. With TO FLX selected the FMA throttle window displays
cutback EPR and assumed temperature.

After takeoff:

EPR SEL Press

Press EPR SEL button on TRP at or above minimum cutback
altitude from Delta Special Pages. Autothrottles will unclamp and
thrust will reduce to cutback EPR. FMA throttle window will
display cutback EPR. EPR SEL will annunciate on engine display
panel.

Air Bottle Start Procedure

Note: An air bottle start is accomplished without regard to pneumatic pressure buildup in the duct system. Continuous positive N2 rotation to 20% is indicative of a good start regardless of reading on pneumatic pressure gauge. Start left engine with the bottle, then start right engine using Crossbleed Start procedure.

PUSHBACK checklist Complete

Complete applicable items for left engine start. Pneumatic pressure will not be indicated until air bottle is turned on.

Right PNEU X FEED valve Close

This allows air only to left engine pneumatic duct for start.

Left GEN CONTROL switch OFF

Left ENGINE HYDRAULIC pump OFF

Engine bottle start Complete

Engage left START switch.

Advise ground crew to open the air bottle.

Check L START VALVE OPEN message on EOAP.

Observe positive N2 rotation.

At 20% N2:

Fuel ON

During hot summertime conditions, rotation increase may slow above 15% N2.

Do not discontinue the start unless engine fails to reach 20% N2.

88

Release START switch at 40% N2 and command air off.

90

Ensure START switch releases by 45% N2.

CAUTION: Monitor EGT until idle is stabilized at normal N2 idle. A hotter than normal start generally occurs when using an air bottle. Abort start prior to reaching EGT ground start limit.

AFTER START checklist Complete

Manual Start Procedure (90)

90

Note: This procedure is to be used when directed by MEL if the automatic start system or any of the ignition systems are inoperative.

PUSHBACK checklist..... Complete

ENG IGN switch ON

Note: With ENG IGN switch ON, auto-abort is not available.

ENG START switch Pull

Note: If ENG START switch will not remain latched, pull and hold ENG START switch.

Observe:

START VALVE OPEN message

N2

VIB below 4.0

HYDRAULIC PRESS

OIL PRESS

- May not indicate until 20% N2

N1

- With 20-26% N2, N1 could just be indicating 0-1%
- Not required until 33% N2

At 25-26% N2 (minimum 15% N2) with EGT below 250°C:

FUEL switch ON

Observe:

FUEL FLOW indication (800-1100 PPH)

EGT rise within 20 seconds after FUEL FLOW

ENG START switch Unlatched and light out by 45% N2

Note: If ENG START switch remains latched or was manually held in position, push in ENG START switch between 43% and 45% N2.

Observe:

START VALVE OPEN message extinguished

N2 stabilized at or above 55% and EGT stable

Standard day, sea level, approximate stabilized idle indications are:

- N2 - 55-60%
- EGT - 300-530°C

Note: With high ambient conditions, idle EGT may exceed 530°C, but may not exceed 610°C.

- OIL PRESS - 80 psi minimum
- FUEL FLOW - 800-1100 pph.

After engine is stabilized:

ENG IGN switch AUTO

Accomplish Aborted Start - Manual, QRH, NNC.7 Engines, APU section for:

- No N2 rotation
- No OIL PRESS prior to 20% N2
- No N1 prior to 33% N2
- No EGT rise within 20 seconds after FUEL FLOW
- Rapid EGT rise
- Hung start (EGT does not accelerate to idle and other indications are in normal range)
- VIB above 4.0

Continue with normal after start procedure.

Supplementary Procedures

Fire Protection

Chapter SP

Section 8

Fire Warning System Test

Check MASTER WARNING and MASTER CAUTION lights OFF.

LOOP switches Both

88

Depress TEST buttons.

90

Test FIRE TEST switch.

Check fire bell/vocal warning.

Fire bell should sound followed by vocal warning of “FIRE LEFT (RIGHT) ENGINE.” Fire bell then sounds followed by vocal warning of “FIRE RIGHT (LEFT) ENGINE.”

Depress FIRE BELL OFF button.

Aural warning should stop.

FIRE warning lights (2) Illuminated

Lights in ENGINE FIRE SHUTOFF handles should be illuminated.

MASTER WARNING lights (2) Illuminated

88

MASTER CAUTION lights (2) Illuminated

APU FIRE warning light (1) Illuminated

88

Fire detector loop message (1) Illuminated

88

LOOP lights (6) Illuminated

Release TEST buttons/switch.

All above warning lights should extinguish.

88

Note: The DIGITAL LIGHTS TEST button must be pressed to test the fire agent low lights.

Note: The DIGITAL LIGHTS TEST button must be pressed to test the fire agent low lights and fuel switches.

Cargo Fire Warning Test (9904-9020) (9201-9217)

(0904-9020)

(9201-9217)

All cargo compartment loop selectors BOTH

Cargo fire SYSTEM TEST switch. Press and hold

Ensure the following indications are observed:

Glareshield

- MASTER WARNING and MASTER CAUTION lights illuminate.

Overhead panel

- CARGO FIRE light illuminates.
- Fire warning will sound.
 - Cancel by pressing fire bell cut out.

Fire Control Panel

- All cargo compartment FIRE/ARMED lights illuminate.
- All cargo compartment FAULT lights remain extinguished.
- Both BTL DISCH/AGT LOW lights remain extinguished.

Note: Breakaway lockwire is not authorized on BTL DISCH/AGT LOW switch guards.

- All SQUIB lights (6) illuminate.

Cargo fire SYSTEM TEST switch. Release

All lights extinguish.

Perform a detector loop test.

Note: The detector loop test ensures that a detector is not stuck in an alarm condition after a system test. The selector must remain in every position for approximately 2 seconds, otherwise a faulty condition may not be detected. At the pilot's discretion, the loop selectors may either all be placed in A, then B, then returned to BOTH or each selector may be cycled through all positions one at a time.

FORWARD, MID, and AFT cargo compartment loop selectors (2 seconds)	A
FORWARD, MID, and AFT cargo compartment loop selectors (2 seconds)	B
FORWARD, MID, and AFT cargo compartment loop selectors	BOTH

Cargo Fire Warning Test (9218-9265)

(9218-9265)

Perform the following prior to each flight as part of Preflight - Pilot Monitoring.

CARGO DETECTION SUPPRESSION CONTROL PANEL

(CDSCP) CHECKED

Verify the MASTER CAUTION and MASTER WARNING lights on the glare shield are off, the SMOKE DET LOOP/CARGO FIRE annunciator on the Captain's Instrument Panel is off. Verify the CDSCP's ARM switch is set to AUTO, and that all CDSCP lights and LED's are out. (If 'PUSH' DSCH light is on, BTL 1 is empty. If the 'AUTO/MAN' DSCH light is on, BTL 2 is empty.)

CDSCP PANEL TEST SWITCH Press and hold

Depress TEST switch until AURAL WARNING sounds and the test sequence is complete, then release. Observe the following:

- The PUSH & AUTO/MAN DSCH lights are ON.
- ALL FAIL 'A' and 'B' LED's ON at first, then OFF as DET LED's come ON.
- ALL DET 'A' and 'B' LED's are ON.
- "DET LED "ON" means that loop is operational.
- "DET LED "OFF" means that loop is inoperative.
- The FWD, MID and AFT Squib LED's for the Diverter Valve illuminate.
- BTL ARMED 1 Squib LED illuminates.
- BTL ARMED 2 Squib LED illuminates.
- The FIRE LED on the CDSCP is ON and flashing indicating the timer is operating.
- The SMOKE DET LOOP/CARGO FIRE annunciator ON (captain's instrument panel).
- CARGO SMOKE annunciator ON (EOAP).
- MASTER CAUTION and MASTER WARNING lights ON.
- All other CDSCP LED's are ON, except FAIL LED's are OFF after DET LED's are ON.

Note: The aural warning can be silenced during the test by pressing the CDSCP's HORN RESET button.

Note: Pressing the ANNUN/DIGITAL LTS TEST switch on the Annunciator Panel performs a lamp test of all the CDSCP's lights and LED's.

Release the TEST switch and verify all lights and LED's are out.

Note: If a test is required in flight accomplish the above procedure.

Lavatory Smoke Alarms

88

Location

Located in undersink compartment above waste receptacle (see illustration below).

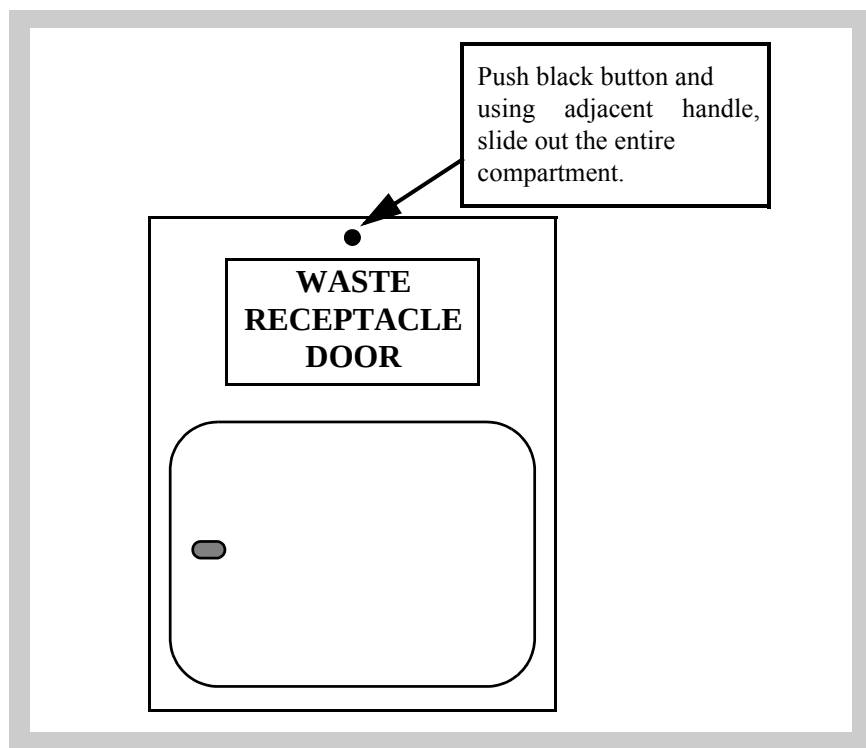
Operation

Will be activated by smoke in the lavatory.

- May be deactivated by opening cover and removing the battery.

Note: Battery is normally safetied in with wire. If needed, cutting pliers located in cabin in security kit.

- To test unit (if desired), press red TEST button on unit and release.



Flaps 13 Selection

Perform the following procedure for a Flaps 13 takeoff when required by AWABS.

- FLAP TO SEL thumbwheel 11
 - FLAP/SLAT handle 11
 - Left FLAP handle detent lever Lift & Hold
 - FLAP TO SEL thumbwheel 13
- Verify flap setting by observing flap handle movement and flap position indicator.
- Accomplish normal Takeoff Warning Check.

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Supplementary Procedures
Flight Instruments, Displays

Chapter SP
Section 10

Flight Recorder Test

Full functional check required on first flight of the day.

FLT RECORDER switch GND TEST
Observe FLT RECORDER OFF message extinguishes.

FLT RECORDER switch NORM
Verify guard is closed.

Maintenance Check Message

The MAINT CHECK message appears on the ND for two reasons:

- The symbol generator has not been programmed to Delta specifications prior to installation.
- The computer fault buffer has filled with messages.

Intentionally
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IRS Operation

True/Magnetic Heading Selection

The TRUE/MAG push-button on each pilot's instrument panel has been deactivated to the MAG operation only for all Delta Operations.

Ground Alignment

An operative MCDU is required for alignment.

Aircraft must remain stationary during ground alignment.

- Failure to do so will result in a flashing ALIGN light and an illuminated FAULT light. [AFM]

Full alignment is required for the first flight of the day and any flight with planned routing into Class II airspace; all other flights only require fast realignment.

Initial Alignment (Full Alignment)

IRS ALIGN lights must be extinguished prior to moving aircraft.

Primary Method

IRS Mode selectorsOFF, then NAV |

Observe ON BAT annunciators illuminate during self test, extinguish, then the ALIGN annunciators illuminate and extinguish after alignment is complete.

FMS POS/INIT page Select

Enter present position on the SET IRS POS line.

Acceptable sources include:

- (9237-9252)
- GPS position
 - Gate position
 - Reference Gate LAT LON (using the following format:
N3310.0W08130.6)

- Reference airport (using 4 letter ICAO Code)
- Reference airport LAT LON

Note: At least one IRU ALIGN light must be on for the IRS to accept new present position.

Note: Disagreement of IRU stored position and the manually-entered position will generate a RE-ENTER IRS POSITION scratchpad message. Two consecutive identical latitude entries which disagree with IRS computed latitude will generate steady ALIGN and FAULT annunciations.

To reset:

Cycle the IRS selector switch to OFF until ALIGN light extinguishes, then to NAV.

After present position has been accepted and IRUs have completed alignment:

Observe ALIGN mode annunciators extinguish.

- Normal PFD attitude will be restored.
- Full alignment requires from 2.5 to 10 minutes.

Alternate Method (may be used when FMS is inoperative)

IRS MODE selectors NAV

MCDU MENU key Push

IRS INIT/REF (5L) Select

Enter present position in scratch pad.

Line select present position to DATA FIELD (5R).

Note: Disagreement of IRU stored position and the manually entered position will generate a RE-ENTER IRS POSITION scratchpad message. Two consecutive identical latitude entries which disagree with IRS computed latitude will generate steady ALIGN and FAULT annunciations. To reset cycle the IRS selector switch to OFF until ALIGN light extinguishes, then to NAV.

After present position has been accepted and IRUs have completed alignment:

Observe ALIGN mode annunciators extinguish.

- Normal PFD attitude will be restored.
- Full alignment requires from 2.5 to 10 minutes.

Realign at Intermediate Stops (Quick or Down Mode Alignment)

IRS ALIGN lights must be extinguished prior to moving aircraft.

IRS MODE selectorsALIGN

Rotate IRS MODE selectors to ALIGN from NAV, and observe
ALIGN lights illuminated.

POS INT page Select

Enter present position on the SET IRS POS line.

Acceptable sources include:

(9237-9252)

- GPS position
- Gate position
- Reference Gate LAT LON (using the following format:
N3310.0W08130.6)
- Reference airport (using 4 letter ICAO Code)
- Reference airport LAT LON

IRS mode selector NAV

Observe ALIGN lights extinguish within 30 seconds.

90

Note: If downmode alignment causes a nuisance anti-skid fault
message, it may be reset by turning the ANTI-SKID switch
OFF then back to ARM.

Shutdown

IRS MODE selectors OFF

Selectors should be placed to OFF for securing the aircraft or if power
is to be removed from aircraft.

- Failure to do so will cause internal IRS batteries to discharge.
- Mechanics' call horn in nose wheel well will sound if power is
removed from aircraft with IRS mode select switches in other
than the OFF position.

IRS ALIGN HOLD TEMP LOW

Message appears on FMS IRS INIT/REF page of the MCDU when internal temperature of unit is too cold or all sensors are not within temperature tolerance. The position can be entered and alignment will begin as soon as all parameters are satisfied.

IRS ALIGN Light(s) Flashing

POS INIT page Select

Present Position Enter

Reenter the correct present position on SET IRS POS line with mode selectors in NAV.

Box prompts need not be displayed if present position has been previously entered.

Existing position may be overwritten.

If ALIGN light continues to flash:

IRS MODE Selector(s) OFF

Wait until ALIGN light extinguishes.

After ALIGN light extinguishes:

IRS MODE selectors NAV

Verify light illuminated steady.

Enter present position using the alternative method via the MCDU menu page as described in SYSTEM OPERATION.

If ALIGN light continues to flash:

Maintenance action is required.

FMS Initialization

Configuration Identification

IDENT page Select

Verify the following:

- Correct MODEL (MD-88 or MD-90).
- Correct ENGINES (JT8D-219 or V2528-D5).
- Correct NAV DATA database.
 - DL9 (MD-88)
 - DL5 (MD-90)
- Correct NAV DATA ACTIVE Date. If non current, update.
Verify that the current database is active based upon the local date of departure.
If current data base is not available, contact maintenance and refer to the MDM.

Position Initialization

POS INIT page Select

Using coordinates at least as accurate as the airport reference point, enter present position on the SET POS line. Confirm the box prompts are replaced by the entered present position.

Acceptable sources include:

(9237-9252)

- GPS Position
- Gate position
- Reference Gate LAT LON
- Reference airport (using 4 letter ICAO Code)
- Reference airport LAT LON

Verify GMT is correct.

(9237-9252)

Verify UTC is correct.

FMS Preflight for Origins/Destinations not contained in FMS Database

Certain Offline Airports may not be in the FMS Database. If necessary use the following procedures when FMS database support is unavailable:

Conduct a full alignment of the IRS using the most accurate information available.

Enter the closest online airport to your Offline Airport in origin on the FMS RTE page. Do not enter/select a runway.

Create a waypoint for the actual Offline Airport using Lat/Long or an available navaid collocated on the field. Load this waypoint in the appropriate sequence on the RTE LEGS page.

Display and use raw data as applicable for all departures/arrivals/approaches/missed approaches at airports not supported by the FMS database.

Route Initialization

RTE page Select

Note: The FMS data base contains all those victor airways within 75 nm of a Delta on-line airport, as well as those beyond 75 nm necessary to provide coverage of our route structure.

Previous route Clear

Entry or re-entry of origin clears previous route.

If EXEC light illuminates, execute. If this step is not performed, the RUNWAY prompt may not appear.

(9237-9252)

Note: No RUNWAY box prompts will appear.

Runway and route information Enter

If runway and/or SID is not known, it may be entered later.

(9237-9252)

Note: After ORIGIN and DEST are entered, the NEXT PAGE key must be pushed in order to begin entering route information.

To enter a SID

DEP ARR key Push

DEP page Select

SID and RUNWAY Select

When the departure SID is runway dependent, a runway must be selected before the SID can be selected.

Note: Initial SID departures may show unconnected lines on the ND from the end of the runway to the departure route and from the departure route to the first fix. This is not a problem as long a discontinuity is not shown on the MCDU.

To enter an airway

First waypoint of airway segmentEnter

The beginning waypoint of the segment of interest must be entered before the airway entry will be accepted.

Entering an airway will provide boxes in the adjacent TO column for the entry of the airway endpoint.

Both the beginning and ending waypoints must be entered before the airway can be displayed on the ND.

To enter an NDB

Three letter code followed by NBEnter

To enter route termination

After receipt of ATIS or ATC clearance:

DEP ARR key Push

ARR page Select

STAR and APPROACH Select

When the approach STAR is runway dependent, a runway must be selected before the STAR can be selected.

Verify that the waypoints and any associated altitude and airspeed restrictions match the charted procedure prior to selecting the EXEC key. Ensure FMS programming will comply with the ATC clearance.

One technique for selecting an ARRIVAL STAR is:

DEP ARR key Push
ARR page Select
APPROACH Select
APPROACH TRANS Select (if required)
STAR Select
STAR TRANS Select (if required)
LEGS key Push

Clean up any route discontinuities to the clearance limit.

Verify that all FMS waypoints, altitudes and airspeeds match the charted procedure and will comply with the ATC clearance.

EXEC key Push

For routes ending with an airway designator and then airport code:

Terminate the airway with the charted waypoint nearest the airport.

- As determined from the airway chart
- May be the same as the airport code

Note: Entry of an excessive number of waypoints is indicated by the message, ROUTE FULL.

If the ROUTE FULL message occurs while entering a departure or arrival procedure:

Do not enter the procedure into the route, even though the DEP/ARR page shows SEL or ACTIVATE.

Verify route is correct.

ACTIVATE prompt Push

EXEC key Push

With ND in PLAN mode:

LEGS page Select

Verify each route leg is correct.

Use MAP CTR STEP prompt.

Note: A route must contain at least one waypoint, other than the departure runway before it can be executed.

Documentary Data

90

Enter month and day (if required).

Enter ship number, then flight number.

Example: Ship 9201 Flight Number 355 entered as 92010355.

Performance initialization

PERF INIT page Select

GROSS WT Enter

Enter flight plan RAMP WT and compare with WDR RMWT when received.

88

FUEL Enter

Enter TOTAL FUEL from the FUEL QTY panel followed by /A for alternate fuel burn or /N for normal fuel burn.

Enter flight plan BLOCK FUEL if fueling is not complete.

ZFW Enter

Enter flight plan ZERO FUEL WT.

RESERVES Enter

Enter flight plan FMS RESERVE FUEL.

Note: Unusable/ballast fuel is included in Flight Plan FMS Reserve Fuel for accountability purposes. It is not to be used for reserve fuel planning.

COST INDEX Enter

Enter flight plan INITIAL COST INDEX.

- Speed is controlled in VNAV by the cost index
- A zero COST INDEX yields minimum fuel burn
- Advise ATC if cruise TAS is different from filed, or anytime TAS changes by 5% or 10 knots (whichever is greater)

CRZ ALT Enter

CRZ WIND Enter

Enter flight plan T-O-C WINDS.

ISA DEV Enter

Enter flight plan ISA.

(9237-9252)

Note: There are no data fields for cruise winds and ISA deviation. The entries will be made on the RTE DATA page.

(9237-9252)

STEP SIZEEnter

Enter zero (0) if there are no planned step climbs.

CAUTION: Leaving step size at ICAO results in the FMS assuming step climbs were accomplished at the optimum points and at the optimum altitude. Predicted fuel at destination may be higher than actual fuel.

(9237-9252)

No other PERF INIT entries are required.

TAKEOFF REF page Select

CAUTION: Changing the departure runway on the TAKEOFF REF page does not change it on the DEPARTURE page. This could result in flying the wrong departure procedure (a runway dependent SID), resulting in a possible loss of separation.

(9201-9216)

(9237-9252)

ACB EPR/ALTEnter

(9237-9252)

Note: ACB entries need to be made on TAKEOFF REF page 2.

If directed by Delta Special Pages, refer to Supplementary Procedures, Engines, APU, Automatic Thrust Cutback.

(9237-9252)

No other preflight entries are required.

PRE-FLT COMPLETE Verify

FMS Lateral Navigation

Proceeding Direct to a Waypoint

DIR INTC key (for active route) Push

Enter desired waypoint in the DIRECT TO boxes.

(9237-9252)

Enter desired waypoint in the DIR/INTC boxes.

Observe ND for modified route.

(9237-9252)

ABEAM POINTS (if desired) Select

Note: This will create abeam points for all waypoints on the routing prior to executing the routing change.

RTE COPY (if desired) Select

Note: This will copy the active RTE to RTE 2 prior to executing the routing change.

EXEC key Push

NAV ARM

Intercepting a Leg to a Waypoint

DIR INTC key (for active route)..... Push

Enter the waypoint to which the intercept course will be flown in the INTC LEG TO boxes.

If required, enter leg's inbound course in INTC CRS boxes.

(9237-9252)

Enter the waypoint to which the intercept course will be flown in the DIR/INTC boxes.

(9237-9252)

If required, enter the legs inbound course under INTC CRS TO (6R prompt). The course will change from small font to large font.

Observe ND for modified route.

EXEC key Push

To establish an appropriate intercept track:

Use the HDG SEL mode and MAP display.

NAV ARM

Note: If the airplane heading will not intercept the selected leg, a NOT ON INTERCEPT HEADING message will appear on the scratch pad line.

Intercepting an Airway

Note: Use HDG HLD to deselect NAV if armed, then use HDG SEL to establish an intercept track.

DIR INTC key (for active route) Push

Enter into DIRECT TO boxes the VOR or waypoint that identifies airway behind where the aircraft will intercept airway.

(9237-9252)

Enter into DIRECT/INTC boxes the VOR or waypoint that identifies airway behind where the aircraft will intercept airway.

EXEC key Push

RTE key Push

Enter airway number in dashes on left side of route page.

Enter airway end point specified in ATC Clearance in boxes on right side or route page.

EXEC key Push

DIR INTC key Push

Enter next waypoint downstream of intercept point into INTC LEG TO boxes.

(9237-9252)

Enter the course under INTC CRS TO (6R prompt). Observe the entered course is depicted in large font.

Observe NAV display to ensure dashed magenta and white lines overlay each other.

EXEC key Push

NAV ARM

Note: Resolve any route discontinuities and delete all waypoints not in ATC clearance.

Route Discontinuity/Modification

LEGS or RTE page Select

Line select waypoints in the desired sequence.

Observe ND for modified route.

- The autopilot NAV mode will track the waypoint sequence shown on the active LEGS page.
- After any route modification, always return to the LEGS page to close the discontinuity and to ensure the waypoint sequence is consistent with the clearance.
- Until this action is complete, the original and modified track will appear on the MAP display.

EXEC key Push

NAV Arm (if required)

Confirm NAVTRK in FMA

Deleting Waypoint

LEGS page Select

Note: The delete function cannot be used to erase the active waypoint or active holding pattern.

Remove waypoint(s) using delete key.

Link any discontinuity that exists.

EXEC key Push

Entering a Crossing Radial from a Fix as a Waypoint

FIX page Select

Enter desired fix identifier.

Enter desired radial from fix on the DNTKFX (Downtrack Fix) line or select ABEAM line if desired radial is perpendicular to course.

Line select DNTKFX or ABEAM line to scratch pad.

(9237-9252)

Enter desired radial from fix on the BRG/DIST line or select ABEAM line if desired radial is perpendicular to course.

Line select BRG/DIST or ABEAM line to scratch pad.

LEGS key Push

Push DIR INTC key if fix is prior to active waypoint.

Line select FIX/RADIAL/DISTANCE to desired waypoint sequence.

Observe ND for modified route.

EXEC key Push

Entering An Along Track Speed/Altitude Crossing Waypoint

LEGS key Push

Line select reference waypoint to scratch pad.

Enter slash mark (/) then a minus sign (-) if before the reference waypoint, followed by distance.

Line select scratch pad entry to reference waypoint.

Enter desired speed/altitude for crossing waypoint.

To Enter a Waypoint Not in the Database

LEGS, DIR INTC or RTE key Push

Construct the point by:

- Specified waypoint - radial - DME
- Specified VOR radial/VOR radial crossing
- Latitude and longitude

Line select waypoint in the desired sequence.

Observe ND for proper sequence.

EXEC key Push

Contingency Routing

Note: Used when an alternate route may be needed/required but not definite.

RTE key Push

Line select RTE 2 page.

(9237-9252)

Note: NEXT PAGE must be selected in order to begin route information.

Enter desired route information.

Note: A departure airfield must be entered as well as destination airfield on the RTE 2 page in order to receive descent path information once RTE 2 is activated.

Observe ND RTE 2 information is correct.

Activate when desired.

Observe DIRECT TO and INTC LEG TO prompts appear.

Use appropriate prompt to link present position with new route.

(9237-9252)

Observe DIR/INTC boxes appear.

EXEC key Push

Destination Change

RTE page Select

Enter new destination on DEST line.

Modify route as necessary using RTE or LEGS page.

EXEC key Push

Offset

RTE page Select

Enter desired offset direction (L or R) then distance (up to 20 NM) over prompt dashes (6R).

(9237-9252)

Distances up to 99 NM may be entered.

EXEC key Push

- FMS computes 45° intercept from original to offset path if outside 2 1/2 nm, 10° intercept within 2 1/2 nm.
- Offset automatically terminates at last waypoint, approach procedure, route discontinuity, or use of DIR INTC key, and FMA goes to HDG HLD.

Navaid Inhibit

NAV DATA page Select

Enter NAVAID identifier below INHIBIT prompt.

- Two navaids can be entered.
- Overwriting or use of DELETE key clears previous entry.

System Status:

- A navaid remains inhibited until deleted or a new nav database is loaded.
- Manual tuning is not inhibited.

Holding

Note: When flying an offset, holding is in relation to the offset.

HOLD key Push

Observe HOLD AT and PPOS (Present Position) or NEXT HOLD prompt displayed.

If NEXT HOLD prompt displayed:

Line select NEXT HOLD (6L).

Observe HOLD AT and PPOS displayed.

Desired holding fix Enter

If holding at present position:

Line select PPOS (6R) to scratch pad, then to prompt boxes (6L).

Note: The INBD CRS/DIR for a Present Position hold cannot be changed.

If holding at waypoint:

Enter waypoint in scratch pad.

Line select to prompt boxes (6L).

Observe modified route correctly displayed on ND.

If holding details displayed are incorrect or inadequate:

Enter correct information on appropriate line.

EXEC key Push

Note: Prior to entering the holding pattern, the HOLD may be deleted on the LEGS page.

To assure remaining within protected airspace:

Plan holding speed to be no more than the maximum holding speed (airplane configuration permitting).

Advise air traffic control if unable to comply with FAA/ICAO maximum holding speeds.

Reduce to holding airspeed prior to initial arrival at the holding fix.

If the winds are less than 50 knots when at or below 14,000 feet or less than 75 knots when above 14,000 feet:

NAV may be used to track the holding pattern.

If the winds are greater when arriving at the holding fix:

Accomplish a minimum turn radius holding pattern.

Disengage NAV.

Use heading select mode with maximum bank angle selected.

To assure remaining within protected airspace:

Plan holding speed to be no more than the maximum holding speed (airplane configuration permitting).

Advise air traffic control if unable to comply with FAA/ICAO maximum holding speeds.

Reduce to holding airspeed prior to initial arrival at the holding fix.

To Exit HOLD:

HOLD key Push

Line select EXIT HOLD.

Observe EXIT HOLD prompt changes to EXIT ARMED.

EXEC key PUSH

Note: When flying an offset path holding pattern, cancelling the offset deletes the holding pattern.

Navigation Accuracy Check

While still within VOR reception range, the FMS position and aircraft position are compared. The check is performed as follows:

Manually tune a VOR that is between 30-130 nm from the known aircraft position.

Select ARC mode on EFIS Control Panel.

Enter the VOR on an FMS FIX page.

Center the VOR deviation indicator on the Navigation Display.

Compare VOR radial and RDMI distance with the FIX page bearing and distance.

The acceptable tolerances are ± 4 degrees and ± 4 nm respectively.

(9237-9252)

POS Page 2 Select

Verify RNP/Actual (RNP) values are displayed and that actual is less than RNP.

FMS Vertical Navigation

Temporary Speed Restriction

If in VNAV:

FMS OVRD Push

To set desired speed in speed select readout:

Use SPD/MACH button.

To deselect:

FMS OVRD Push

FMS target speed will again be displayed.

Note: Using FMS OVRD will not update the descent profile. An entry on the DES page on the MCDU is required.

If speed change becomes permanent:

Make change on appropriate pages (CRZ, DES, CLB, etc.).

Re-select VNAV on MCP.

Temporary Altitude Restriction

Set level off altitude on MCP.

In VNAV:

Observe VNAV CAP, then VNAV LVL when altitude is reached.

When Resumption of Climb or Descent Desired

Set new altitude on MCP.

VNAV Engage

Speed/Altitude Constraint at Waypoint

LEGS key Push

Enter speed/altitude.

If constraint is to cross the waypoint at a specific altitude:

Enter the altitude only.

If constraint is to cross at or above altitude:

Enter A after altitude.

If constraint is to cross at or below altitude:

Enter B after altitude.

If constraint is to cross between two altitudes:

Enter lower altitude followed by A.

Then enter upper altitude followed by B.

Note: Speed entry must be followed by a slash (/) mark and altitude.

EXEC key Push

To Delete Constraint

Use DEL key and line select to desired line.

Observe FMC computed values appear.

EXEC key Push

Speed/Altitude Transition and Restriction

CLB/DES key Push

Enter speed/altitude.

EXEC key Push

To Delete Transition or Restriction

Use DEL key and line select to desired line.

EXEC key Push

Climb/Cruise/Descent Speed Change

CLB/CRZ/DES key Push

Select desired schedule or enter desired speed on ECON SPD
line (2L).

EXEC key Push

Climb or Descent Direct

To delete all altitude constraints at waypoints between current altitude
and MCP altitude:

CLB/DES key Push

CLB/DES DIR Select

CLB DIR or DES DIR prompt will only be displayed when
climb/descent is active and an altitude constraint exists at a
waypoint between current altitude and either cruise or end of
descent altitude.

EXEC key Push

Cruise Altitude Change

Set new altitude on MCP.

CRZ key Push

Enter new cruise altitude on CRZ ALT line.

EXEC key Push

VNAV (if not already) Engage

Note: Use of Cruise altitude change procedure will delete altitude
constraint at waypoint if cruise altitude entered is equal to or
below existing constraint altitude.

Descent

Prior to top of descent, after receiving ATIS or ATC clearance:

DEP ARR key Push

ARR page Select/Confirm

STAR and APPROACH Select/Confirm

When the approach STAR is runway dependent, a runway must be selected before the STAR can be selected.

Verify that the waypoints and any associated altitude and airspeed restrictions match the charted procedure prior to selecting the EXEC key. Ensure FMS programing will comply with the ATC clearance.

DES key Push

Fly either ECON SPD or POLICY as determined by the flight plan COST INDEX. (POLICY equates to approximately .75/300).

FORCAST Select

If required:

Enter expected icing altitude under TAI/ON prompt.

If only the destination has been entered, and no defined altitude/speed restriction below cruise altitude is entered:

System Status:

- No T/D calculation is displayed.
- A blank descent page will appear.

If only a runway is entered to define the end of descent (E/D) point:

System Status:

- A descent page is created to an E/D of 2,000 feet AGL with a target speed of 170 knots 8 nm from the runway.

When cleared to descend:

Set altitude on MCP.

VNAV descent should occur at FMS computed T/D point.

System Status:

- DES NOW prompt will only be displayed prior to reaching programmed T/D.

If earlier than FMS computed T/D is desired:

DES NOW Select

EXEC key Push

Verify VNAV is engaged on FMA.

System Status:

- Throttles will retard to idle.
- Descent will begin at 1,000-1,500 feet per minute until intercepting the ECON descent profile.

FMS Progress Functions

Flight Progress Data Check

PROG page Select

Check distance to go (DTG) and estimated time of arrival (ETA) for next two waypoints and destination.

Determining Distance to Cross Radial from a Fix:

FIX page Select

Enter desired fix identifier on FIX line.

Enter desired radial from fix on DNTKFX or select ABEAM line if desired radial from fix is perpendicular to course.

(9237-9252)

Enter desired radial from fix on BRG/DIST or select ABEAM line if desired radial from fix is perpendicular to course.

Observe distance to go.

DTG and ETA to Downpath Waypoint or Alternate

PROG page 1 Select

Enter downpath waypoint or alternate airport waypoint by overwriting the displayed destination waypoint (4L).

System Status:

DTG and ETA to waypoint (identified as ENROUTE WPT or DIR TO FIX for ships 9237-9252) will be displayed.

Leaving and returning to page returns original destination.

FMS Performance Data Entry

Step Climb Evaluation

- CRZ key Push
- STEP TO altitudeEnter
- ACTUAL WINDEnter
Enter wind at STEP TO altitude. ACTUAL will change to EST.
- SAVINGS Check

Descent Forecasts

- DES key Push
- FORECAST page Select
- TRANS LVL Check
- TAI/ON (if required)Enter
- WIND SPDEnter
Enter flight plan DESCENT FORECAST WINDS altitudes
(up to four).
- WIND DIR/SPDEnter
Enter flight plan DESCENT FORECAST WINDS.

Waypoint Winds

- LEGS key Push
- RTE DATA page Select
- CRZ WINDEnter
Enter flight plan COMPUTED ENROUTE WINDS.
- (9237-9252)
- WIND prompt Select
- ALTEnter
Enter flight plan computed enroute winds (1L).

ALT/OAT Enter

Enter flight plan altitude and OAT.

Note: For more entries, select NEXT PAGE key.

EXEC key Push

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Supplementary Procedures

Fuel

Chapter SP

Section 12

Fuel Management Procedure

WARNING: It is not recommended that a takeoff be initiated with less than 2400 pounds in each main tank.

Engine start, taxi, and takeoff,

FUEL X FEED lever OFF

LEFT and RIGHT FUEL TANKS, AFT
and FWD PUMP switches ON

CTR FUEL TANKS, AFT and FWD PUMP switches. As reqd
AFT and FWD PUMP switches - ON if CTR tank FUEL QTY
contains usable fuel
AFT and FWD PUMP switches - OFF if CTR tank FUEL QTY
indicates zero

After takeoff:

When CTR tank FUEL QTY indicates zero:

CTR FUEL TANKS, AFT and FWD PUMP switches OFF

Approach, and landing,

FUEL X FEED lever OFF

LEFT, CTR (if required), and RIGHT FUEL TANKS,
AFT and FWD PUMP switches. ON

After engine shutdown,

LEFT, CTR, and RIGHT FUEL TANKS,
AFT and FWD PUMP switches OFF
RIGHT AFT PUMP switch - ON, if APU operating

Alternate Fuel Burn Procedure

Note: Alternate Fuel Burn Procedure (Automatic or Manual) is required for:

88

Aircraft with inoperative overwing heaters.

90

Aircraft with inoperative return-to-tank system.

Alternate Fuel Burn Procedure - Automatic

Note: Use the automatic fuel burn procedure when the auto position of the center tank pump switches are operative.

After takeoff, if CTR tank FUEL QTY contains usable fuel:

CTR FUEL TANKS, AFT and FWD PUMP switches AUTO

Note: When operating both CTR PUMP switches in AUTO, if any off schedule fuel usage is observed, move both CTR PUMP switches to ON and resume normal fuel management schedule.

Monitor the automatic fuel burn schedule.

CTR tank FUEL QTY will burn to approximately:

88

- 10,000 pounds

90

- 3,000 pounds

L and R MAIN tank FUEL QTY will burn to approximately 4,000 pounds

CTR tank FUEL QTY will burn to zero.

When CTR tank FUEL QTY indicates zero:

CTR FUEL TANKS, AFT and FWD PUMP switches OFF

Alternate Fuel Burn Procedure - Manual

Note: Use the manual fuel burn procedure when the auto position of the center tank pump switches are inoperative.

After takeoff:

When center tank fuel quantity is greater than (88) 10,000 pounds or (90) 3,000 pounds:

CTR FUEL TANKS, AFT and FWD PUMP switches ON

Burn CTR tank FUEL QTY down to approximately:

88

- 10,000 pounds

90

- 3,000 pounds

When CTR tank FUEL QTY is less than (88) 10,000 pounds or (90) 3,000 pounds:

CTR FUEL TANKS, AFT and FWD PUMP switches OFF

Burn L and R MAIN tank FUEL QTY down to approximately 4,000 pounds.

When L and R MAIN tank FUEL QTY reach 4,000 pounds:

CTR FUEL TANKS, AFT and FWD PUMP switches ON

Burn CTR tank FUEL QTY to zero.

CTR FUEL TANKS, AFT and FWD PUMP switches OFF

Crossfeed Operation

Note: Use this procedure to correct main tank fuel imbalance. If imbalance is accompanied by an INLET FUEL PRES LO annunciation, refer to appropriate procedure.

Note: This condition may be due to a fuel leak, an uneven engine fuel burn condition, or APU fuel consumption.

Note: An unexplained lateral fuel imbalance (500 pounds or more in 30 minutes) may indicate a fuel leak. If a fuel leak is suspected, accomplish the QRH Fuel Leak checklist.

Main Tank Pump switches (All) ON

FUEL X FEED lever ON

CTR Tank Pump switches Verify OFF

Main Tank Pump switches
(Tank With Lesser Quantity) OFF

Main Fuel Tank Quantity Indicators Observe

Crew should observe the main tank fuel quantities to confirm that the imbalance between tanks is being corrected.

Note: Tank with greater quantity should decrease consistent with engine (and APU, if applicable) consumption. Tank with lesser quantity should not decrease.

When main tanks are at desired level and prior to approach and landing,

Main Tank Pump switches (All) ON

CTR Tank Pump switches As required

FUEL X FEED lever As required

Ground Fuel Transfer

Interphone Contact With Ground Crew Establish

Fuel Pump switches (Supplying Tank) ON

All other fuel Pump switches. OFF

If left main is the supplying tank:

FUEL X FEED lever. ON

Request ground crew to open defueling valve and fill valve (for tank to be filled).

FUEL QTY Indications Monitor

When tanks are on schedule,

Fuel Pump switches OFF

FUEL X FEED lever. OFF

Request ground crew to close defueling and fill valves.

Fuel System Test

Fuel tank pumps and fuel crossfeed valve Check

All FUEL TANK PUMP switches - OFF

DC start pump - Check

START PUMP switch - ON

R INLET FUEL PRESS LO message extinguishes.

START PUMP switch - OFF

R INLET FUEL PRESS LO message illuminates.

Main fuel tank pumps and crossfeed - Check

One at a time, turn each main FUEL TANK PUMP switch ON, then OFF. Check that the associated (L or R) INLET FUEL PRESS LO message extinguishes when the switch is ON and illuminates when the switch is OFF. While checking one of the main tank boost pumps, move FUEL X FEED lever to ON and observe INLET FUEL PRES LO annunciation in opposite systems extinguishes. Move FUEL X FEED lever to OFF and observe light in opposite systems illuminates again.

Note: Leave the RIGHT FUEL TANK, AFT PUMP switch ON if APU is operating.

Center fuel tank pumps - Check

Note: Flap position must be less than six degrees to perform the test.

Note: If the Center fuel tank does not contain flight planned fuel intended for consumption on the flight, it is not necessary to check the Center tank pumps, as they will not be used. Do not perform Center Fuel Tank Pumps Check unless there is at least 500 lbs of fuel in the center tank.

Verify both CTR fuel boost pump switches are in OFF, then move the CTR FWD fuel boost pump to ON. Verify that the L and R INLET FUEL PRESS LO lights both extinguish. Observe the CENTER FUEL PRESS LO annunciation illuminates and MASTER CAUTION light illuminates after approximately 22 seconds. Move the CTR FWD fuel boost pump switch to OFF and observe CENTER FUEL PRESS LO annunciation extinguishes and MASTER CAUTION light extinguishes.

Repeat the above procedure for the CTR AFT fuel boost pump.

Fuel Quantity Panel Test Procedure

Fuel quantity panel Check

FUEL QTY ZFW button - push and hold

Note number currently set for zero fuel weight, then release.

FUEL QTY TEST button - push and hold

Observe left, right, and center readouts change to 3,000 pounds (+/-100). TOTAL FUEL should indicate 9,000 pounds (+/-300). GROSS WT should indicate the currently set zero fuel weight plus 9,000 pounds (+/-300).

Release TEST button and quantities should return to current fuel on board.

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Supplementary Procedures

Hydraulics

Chapter SP

Section 13

Hydraulic System Check

Note: Full functional check required on first flight of the day.

The hydraulic pumps may be turned on with clearance from ground personnel, or without clearance, when the following three conditions are satisfied.

- GEAR DOOR OPEN light extinguished.
- Slat DISAGREE light extinguished.
- Flap position indicator agrees with flap handle position.

ENG HYD PUMPS switch ON

AUX HYD PUMP switch OVRD/ON

- Place AUX HYD PUMP switch to OVRD and observe right system pressure rise.
- Move AUX HYD PUMP switch to ON and observe right system pressure approximately 3000 psi (± 200) and R HYD PRESS LOW message extinguished.
- GEAR DOOR OPEN light - extinguished.

TRANS HYD PUMP switch ON

Observe left system pressure rise above 2,000 psi and L HYD PRESS LOW message extinguished.

CAUTION: Illumination of HYD PRESS LOW message with normal pressure may indicate spoiler on/off/ system bypass valve in the OFF position or system malfunction. It must be investigated prior to dispatch.

Check brake pressure.

Hydraulic Quantities	Normal
• Check low quantity warning lights extinguished. • On the ground, a single hydraulic system may not fully retract the flaps. • Quantity minimums are: 88 • Left: 8 quarts, Right: 9 quarts 90 • Left: 9 quarts, Right: 10 quarts	
AUX/TRANS HYD PUMP switches	OFF

Supplementary Procedures

Landing Gear

Chapter SP

Section 14

Landing Gear Lights/Horn Check

Full functional check required on first flight of the day.

Note: When performing a functional check of the landing gear lights, ensure both lamps within the individual indicators illuminate.

Pull landing gear handle out, down, and hold.

- Landing gear green lights should extinguish.
- Landing gear red lights should illuminate.
- Aural warning should sound.
- Depress gear horn OFF button to silence warning horn.
- Advance and retard both throttles to reset aural warning.

Release landing gear handle.

- Landing gear green lights should illuminate.
- Landing gear red lights should extinguish.

Nose gear downlock indicator pin.

On the ground, must be extended approximately 1/4 inch with hydraulic pressure normal. May be less than 1/4 inch with right hydraulic pressure off due to weight of aircraft on gear.

Operating Over a Raised Arresting Cable

On approach, fly vertical path to minimums. Performance permitting, attempt to avoid landing prior to or on an arresting cable.

On departure, begin takeoff roll just past the cable (if installed). At the pilot's discretion, complete a back taxi, or taxi to the approach end on the parallel taxiway, onto the runway, then slowly past the cable to takeoff position.

Note: Operate over a raised cable only at a slow taxi speed. Avoid "donuts" used to elevate the cable.

If during landing, takeoff, or taxi the aircraft comes in contact with the cable, regardless of speed, the nose gear spray deflector must be inspected at the next aircraft block-in as follows:

- The aft center deflector should be checked for visible damage.

- The flexible deflector side plate should be checked for attachment/separation from deflector.
- A logbook entry is required if damage is found. Notify maintenance if a logbook entry is made.

Main Landing Gear Periscope Operation

Aircraft Depressurize
Differential pressure must be less than 2 psi.

Periscope Locate
Periscope is located between three and four windows aft of the aft overwing emergency exit. Raise the carpet, floor cover plate and periscope dust cap.

Downlock indicator light switch Hold on
Switch is located adjacent to periscope assembly.

Index marks Align to view desired landing gear downlock indicator
Rotate periscope 180 degrees to view opposite landing gear downlock indicator.

Note: Periscope can be removed by pulling straight up in order to clean the lens surface.

Landing gear downlock indicator View
Gear is down and locked when orange stripe on overcenter brace is in a straight line.

After inspection is complete:

Replace periscope dust cap, floor cover and carpet.

Brake Temperature Test

Brake temperature Test

BRAKE TEMPERATURE selector - ALL

TEST button - Push

BRAKE TEMP gauge - Pointer moves into the test band

OVHT light - illuminates

Note: A flashing OVHT light indicates a faulty temperature sensor.

TEST button - Release

BRAKE TEMP gauge - Pointer returns to normal

OVHT light - Extinguishes

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Supplementary Procedures

Warning Systems

Chapter SP

Section 15

GPWS Test

Full functional check required on first flight of the day.

GND PROX WARN switch Test

Hold in TEST position momentarily and release.

Note: ND WX display knob must be out of OFF for Terrain test pattern to appear.

Observe the following:

GPWS and BELOW G/S lights illuminate

GPWS FAIL message on EOAP

Aural warning

Aircraft with enhanced GPWS installed will also test:

GPWS and BELOW G/S lights illuminate

“GLIDESLOPE” aural warning

“WHOOOP-WHOOP PULL-UP” and “TERRAIN, TERRAIN PULL-UP” aural warnings

TERR lights illuminate

Terrain test pattern on both NDs and blue TERR message appear

FAIL light illuminates on center instrument panel.

GND PROX WARN switch NORM

MAX Speed Warning Test

Full functional check required on first flight of the day.

- MAX SPD WARN TEST switchSYS 1
 Observe clacker and vocal “OVERSPEED” warning.
- MAX SPD WARN TEST switchSYS 2
 Observe clacker and vocal “OVERSPEED” warning.
- MAX SPD WARN TEST switchOFF

Radar/(88) PWS System Test (0904-9020, 9201-9219, 9237-9252)

Set range selector in any position except 5 NM.

Gain ControlAUTO

Mode Selector TEST

Observe the following during an approximate 8 second test:

- WXR ON appears on PFD.
- WXR TEST appears on ND.
- Proper test pattern (Only item that will be applicable to test if PWS is not installed).

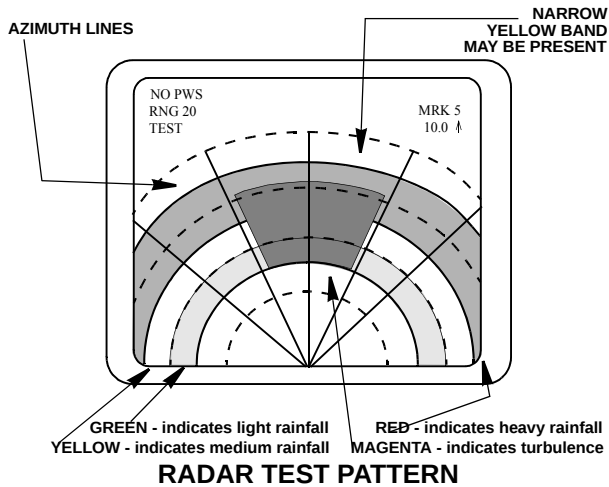
88

- Amber NO PWS message is displayed in upper left corner of radar display.
- Amber PWS INOP light is illuminated on the center instrument panel.
- Amber W/S AHEAD light is illuminated and vocal “MONITOR RADAR DISPLAY” is heard.
- Red W/S AHEAD light is illuminated and vocal “GO AROUND WINDSHEAR AHEAD, WINDSHEAR AHEAD” is heard.

Verify PWS INOP, amber W/S AHEAD and red W/S AHEAD lights are no longer illuminated.

Verify that the NO PWS message is no longer displayed in the upper left corner of radar display.

Mode Selector TCAS



Weather Radar System Test (9220-9236) (9253-9265)

(9220-9236)

(9253-9265)

Weather radar Test Procedure

Mode Selector TEST

GAIN Control AUTO

STAB Switch ON

Mode Selector ARC or MAP

Range Selector As Desired

WX Contrast ON, adjusted as desired

Rotate WX contrast control knob until indicator brightness is at a comfortable level.

Observe indicator sweep trace is scanning smoothly from 90 degrees one side of center to 90 degrees the other side of center in approximately 4 seconds.

Observe test pattern for the following display:

Range and azimuth marks.

Green, amber, and red test bands.

WXR ON appears on PFD.

WXR TEST appears on ND.

Digital range (RNG) readout should read one-half the range selector position (e.g., with range selector set at 80, 20-NM intervals will appear on indicator and digital readout will be 40).

Mode Selector OFF

WX Contrast OFF

Note: The weather radar test can be accomplished both on the ground with the parking brakes set, and in flight above 2,300 feet AGL with results identical to those described.

Radar Operation

Note: The recommended tilt and range settings are guidelines for good radar operation. The flight crew is not limited to these settings. Operational needs often dictate flexibility in tilt and range selections.

Before Takeoff

To confirm radar operation with a confidence check:

Set tilt 15° up, select WX/TCAS, and short range.

Slowly lower tilt until weather or ground returns are displayed.

If no returns can be detected:

Suspect an inoperative radar.

To evaluate terminal area weather before takeoff:

Set Tilt at 15° UP, Range at 40 NM or less.

- The radar height of weather targets displayed is at least (tilt X range X 100).
- Weather targets displayed at:

10 nm are at least	15,000 feet
15 nm	22,500 feet
20 nm	30,000 feet

While evaluating weather returns in the area:

Slowly lower tilt from 15° up to 4° up.

Takeoff

Tilt is initially set at 4° up.

Range at shortest appropriate for terminal area conditions.

During initial climb (below 10,000 feet AGL):

Gradually lower tilt to 1° - 2° up.

While displaying weather returns:

Maintain the radar display clear of ground returns.

CAUTION: Failing to lower tilt from initial takeoff setting will cause overscanning of weather areas enroute.

Climb

As climb continues above 10,000 feet AGL:

Lower tilt as necessary to maintain ground returns at the outer edge of the display.

Note: A range selection of 80 nm or less is optimal during climb, unless a longer range setting is needed for deviation planning.

Cruise

To establish enroute park:

Set Range at 80 NM or less.

Adjust Tilt to produce ground returns at the outer edge of radar display.

This tilt setting guards against overscanning nearby weather areas and provides continuous confirmation that the radar is working. Weather targets will separate from ground returns and move towards the bottom of the display.

Range settings above 100 NM should be selected occasionally for long range planning.

Storms detected at long range will increase in displayed intensity as they are approached. Plan early deviations accordingly.

Set tilt to produce a scattering of ground returns beyond 100 nm.

Note: Nearby weather areas may not be detected due to overscanning. When returning to a shorter range, lower tilt to enroute park position.

At cruise altitudes above 30,000 feet:

Use sufficient DOWN tilt to direct the beam into unfrozen areas of nearby storms.

Confidence check:

To check enroute radar performance:

Adjust tilt to display farthest possible ground returns.

In WX and with GAIN control in AUTO:

A properly functioning radar should detect ground returns to the following distances:

10,000 feet AGL	100 nm
20,000 feet AGL	140 nm
30,000 feet AGL	175 nm
40,000 feet AGL	200 nm

Descent

On descent from cruise altitude:

Raise tilt as necessary to maintain ground returns at the outer edge of the display.

Low altitude park:

Generally used at altitudes below 10,000 feet AGL.

To observe weather:

Set Tilt 1 1/2° to 2° UP, range at shortest appropriate distance.

Note: If ground returns flood display, raise tilt until ground returns are removed, and weather can be displayed.

Approach

Approach park:

On final approach:

Set Tilt at 10° UP, Range at 20 NM.

- At 10° up tilt, the radar height of weather returns displayed will be above aircraft altitude by at least (tilt X distance X 100).
- Weather areas will be developed above aircraft altitude by at least:

10,000 feet if displayed at 10 nm

15,000 feet 15 nm

20,000 feet 20 nm

Strong returns at mid to upper levels indicates hazardous convective activity.

In a thunderstorm environment:

Occasionally lower tilt to produce ground returns and detect radar shadows, then return tilt to approach park.

Radar Guidelines

Tilt formula:

Note: Using ground returns as a reference provides quick and effective tilt management.

When more precise tilt management is desired:

The tilt formula can be used:

- Tilt x distance x 100 = feet (above or below) aircraft altitude.
- Example: With 5° down tilt, the radar beam would be centered approximately 20,000 feet below aircraft altitude 40 nm ahead. $5 \times 40 \times 100 = 20,000$ feet (below aircraft altitude).

Tilt accuracy check:

Optimal conditions for this check are:

- Straight and level flight.
- Altitude 10,000 feet AGL or higher.
- Level terrain.
- No intervening weather.

To check the accuracy of tilt control:

Adjust tilt until the yellow ground return arc starts at a distance equal to $(2 \times \text{AGL altitude}/1000)$.

- Example: if at 34,000 feet AGL, yellow ground returns start at 68 nm on the display (2×34) .

Check tilt setting.

Tilt should be at $3 \frac{1}{2}^\circ$ down $\pm 1 \frac{1}{2}^\circ$ (acceptable limits 2° - 5° down).

If tilt is not within 2° - 5° down:

Note difference between tilt setting and $3 \frac{1}{2}^\circ$ down.

This is the amount of tilt error present and should be applied to all tilt settings.

Gain Control

For proper calibration of the receiver:

GAIN control must be in AUTO.

Manual GAIN can be used to evaluate the relative strength of surrounding weather areas.

While slowly reducing the GAIN:

Observe weather target.

- The GAIN knob will provide variable GAIN control for weather returns when out of the AUTO position.
- A blue CAL appears in the upper right area of the indicator whenever variable GAIN control is active.
- Rotating the GAIN knob counter clockwise decreases gain from MAX to MIN.
- The level of selected gain is indicated by a blue readout MAX, 9 . . . 1 or MIN below CAL.
- Weaker targets will shrink and disappear while stronger targets persist. At minimum GAIN any weather targets still displayed contain extremely heavy rain.

If display becomes filled with red returns:

Check tilt, raise if necessary to remove ground returns from the display.

Weather area being scanned may be Level 3 in strength.

Reduce GAIN level until only heavier areas display as red, to differentiate rain intensity within the weather area.

WARNING: At reduced levels of GAIN, some weather targets will disappear from the indicator. Targets which are displayed will understate the true strength of the weather. Return GAIN to AUTO, immediately after using manual GAIN.

Attenuation

Note: Expect attenuation any time weather targets reach Level 3 when the radome is wet or ice covered, or when operating within precipitation.

To locate intense rain areas that may be totally attenuated:

Watch for crescent shaped returns, concave on the back side.

Note an absence of returns or shadow beyond the target.

Use ground returns to confirm radar penetration, and locate radar shadows.

When flying through areas of moderate to heavy rain:

System Status:

Radar range may become limited by attenuation.

Set tilt to attempt to produce ground returns beyond the weather returns.

If attenuation is confirmed:

Monitor the outer edge of the weather returns.

Turn away from shadows that dip towards the bottom of the display.

Fly towards the area of farthest returns (this is the area of lightest precipitation).

Advise ATC that your radar range is limited and request vectors away from known thunderstorm areas.

WARNING: Radar shadows are areas of unknown weather intensity. Never penetrate a storm that produces a radar shadow.

Turbulence Avoidance

When using radar to avoid turbulence enroute:

Deviate upwind of storms when possible.

Expect turbulence to be present in any convective activity regardless of intensity level displayed on radar.

When convective storms reach Level 3 (red):

Expect moderate to severe turbulence in all areas of the storm, including the Level 1 and 2 areas.

Note: TURB mode can be used to detect areas of horizontal rain movement within 40 nm.

Set tilt to ensure beam is sweeping at flight altitude.

WARNING: An absence of indicated turbulence in TURB mode does not mean it is safe to penetrate a weather area that by other indications is hazardous.

TCAS/Transponder System Test (0904-9020) (0904-9020) (0904-9020) (0904-9020)

(0904-9020)
(9201-9219)
(9237-9265)

Full functional test required on first flight of the day.

CAUTION: Do not test in flight. This will cause a momentary loss of transponder and TCAS systems.

TCAS/TRANSPONDER FUNCTION selectorTEST

The TCAS/TRANSPONDER FUNCTION selector is used to test TCAS and the aircraft transponders.

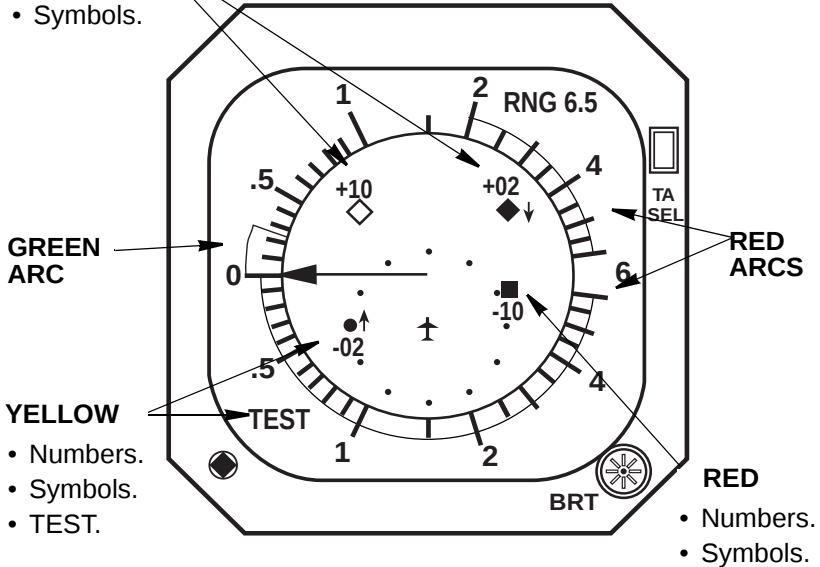
Moving the spring-loaded knob momentarily to the TEST position initiates a transponder self test and a TCAS processor self test.

Transponder Test Indications

- Transponder - The code display window of the transponder control panel will display all eights (8888).
- The ATC FAIL light will be illuminated during the test. This display will be indicated for approximately three seconds.
- If a transponder problem exists, the ATC FAIL light on the transponder control panel will remain illuminated

WHITE

- Number.
- Symbols.



TA/VSI Test Indications

- TA/VSI - Each of the TCAS traffic symbols, along with portions of the green and red arcs will be displayed on the TA/VSI.
- This display will be indicated for approximately 12 seconds.
- After the self test is completed a voice message indicates system status as appropriate.
 - “TCAS SYSTEM TEST OK”
 - “TCAS SYSTEM TEST FAIL”

TCAS/Transponder System Test (9220-9228)

(9220-9228)

Full functional test required on first flight of the day.

CAUTION: Do not test in flight. This will cause a momentary loss of transponder and TCAS systems.

TCAS Mode select switch Press

Press test button located on top of mode select switch.

Observe PASS appears on ATC code display.

Aural “TCAS TEST” and “TCAS TEST PASS” or “TCAS TEST FAIL.”

TCAS/Transponder System Test (9229-9236)

(9229-9236)

Full functional test required on first flight of the day.

CAUTION: Do not test in flight. This will cause a momentary loss of transponder and TCAS systems.

TCAS Mode select switch Press

Press test button located on top of mode select switch.

Aural “TCAS SYSTEM TEST OK” or “TCAS SYSTEM TEST FAIL.”

Windshear Test

Full functional test required on first flight of the day.

WINDSHEAR TEST switch TEST

Hold test switch in position momentarily and release.

Observe the following during an approximate 8 second test.

- PFD displays WIND SHR in upper left corner and flashes amber 4 times followed by red 4 times.
- Amber light on glareshield (if installed), illuminates 3 times followed by red light which illuminates 3 times.
- WINDSHEAR INOP EOAP message is annunciated for 2 seconds then extinguishes.
- Aural warning should sound.
- FD pitch bars center then indicate pitch up followed by pitch down then are biased from view.
- Fast/slow indicator is centered, then indicates one bar up followed by one bar down, then is biased from view. Sometimes the F/S is biased from view.
- PLI is centered, then indicates 10° pitch up followed by 10° pitch down, then is biased from view.
- STALL IND FAILURE and GPWS FAIL EOAP messages illuminate for 6 seconds then extinguish.
- FMA displays WIND SHR, AUT W/S, HDG HLD, WIND SHR.

Note: Windshear test may fail if the flaps and slats have drooped sufficiently. In this case, fully retract the flaps and slats, then repeat the test.

Stall Warning System Test

STALL TESTSYS 1 then SYS 2

Verify the same indications for both positions:

- Vibration of both control columns
- STALL and STICK PUSHER PUSH TO INHIBIT lights illuminate on the captain and first officer's glareshields
- Stall warning horn
- STALL vocal alert

Supplementary Procedures
Adverse Weather**Chapter SP**
Section 16

Introduction

Airplane operation in adverse weather conditions may require additional considerations due to the effects of extreme temperatures, precipitation, turbulence, and windshear. Procedures in this section supplement normal procedures and should be observed when applicable.

Cold Weather Operation

Considerations associated with cold weather operation are primarily concerned with low temperatures and with ice, snow, slush, and standing water on the airplane, ramps, taxiways, and runways.

Icing conditions can exist when OAT (on the ground) is 6°C or below or TAT/RAT is 10°C or below (in flight) and any one of the following exist:

- visible moisture (clouds, fog with visibility of one statute mile (1600m) or less, rain, snow, sleet, ice crystals, etc.) is present; or
- 3°C or less temperature/dewpoint spread; or
- ice, snow, slush or standing water is present on the ramps, taxiways, or runways.

Preflight Procedure

Although removal of surface snow, ice or frost is normally an ACS function, the flight crew should carefully inspect areas where surface snow, ice or frost could change or affect normal system operations.

Exterior Inspection

Do the normal Exterior Inspection with the following additional steps:

Surfaces Check

Ensure all leading edge devices, tab surfaces, all control surfaces, and the upper wing are free of snow, ice, and frost. The upper wing surfaces should be confirmed free of frozen contamination by inspection from the best vantage points.

Note: After inspection, monitor environmental conditions and ensure control surfaces remain free of contamination.

Note: Takeoff with light coatings of frost, up to 1/8 inch (3mm) in thickness on lower wing surfaces due to cold fuel is allowable.

Thin hoarfrost is acceptable on the upper surface of the fuselage provided all vents and ports are clear. Thin hoarfrost is a uniform white deposit of fine crystalline texture, which usually occurs on exposed surfaces on a cold and cloudless night, and which is thin enough to distinguish surface features underneath, such as paint lines, markings or lettering.

Probes, sensors, ports, vents, and drains (as applicable) Check

Check all probes, sensors, ports, vents, and drains are free of ice and snow. Water rundown after snow removal may refreeze immediately forward of static ports and cause an ice buildup which disturbs airflow over the static ports resulting in erroneous static readings even when static ports themselves are clear.

VSCF inlets Check

Verify inlets are clear of snow and ice.

Pack inlets and outlets Check

Verify the air inlets and outlets, including the outflow valve, are free of snow and ice.

CAUTION: During or following an environmental icing event, ice or snow can accumulate inside the engine inlet which cannot be seen from the ground or from inside the cabin. If this potential exists, have the engine inlet inspected by the appropriate ground personnel prior to engine start.

Engine inlets Check

Verify the inlet cowling is free of snow and ice.

Landing gear Check

Gear strut, actuators, doors, tires, brakes, and wheels should be free of snow or ice.

APU air inlets Check

The APU inlet doors must be free of snow or ice prior to APU start.

Engine Start Procedure

Note: When anticipating taxiing on a slippery or contaminated surface, consider starting both engines.

Do the normal Engine Start procedure with the following modifications:

A cold engine may exhibit abnormal oil pressure and temperature indications during start. Observe appropriate engine limitations and do not increase thrust above idle until all engine parameters are in the normal range.

Illumination of the L or R OIL STRAINER CLOGGING annunciator light(s) may occur during a cold engine start. Refer to QRH for the appropriate abnormal procedure.

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For first flight of the day engine starts, when the OAT is at or below -6°C (20°F), accomplish the following steps:

- Start both engines to allow for full 5 minute warm-up.
- Engine anti-ice on (regardless of environmental conditions).
- After warm-up is complete, advance both throttles to 1.2 EPR and check for normal EPR increase.
- If EPR indications are not approximately equal for both engines, allow engines to warm-up for 2 additional minutes.
- Advance throttles again to check for normal EPR increase and if still abnormal, contact MCC.

Note: Failure to comply with the above procedure may result in erroneous EPR indications on takeoff roll.

If OAT is -35°C (-30°F) or colder:

- operate the engine(s) at idle for two minutes before advancing throttle

90

Minimum oil temperature before advancing throttle above idle is -10°C.

Oil temperature must reach 50°C before takeoff.

Engine Anti-ice Operation - On the Ground

Engine anti-ice must be selected ON immediately after engine start and remain on during all ground operations when icing conditions exist or are anticipated.

WARNING: Do not rely on airframe visual icing cues before activating engine anti-ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

When engine anti-ice is needed:

ENG anti-ice switches ON

When engine anti-ice is no longer needed:

ENG anti-ice switches OFF

Taxi Procedure

Do the normal Taxi procedure with the following modifications:

CAUTION: Avoid taxiing in deep snow or slush since steering will be more difficult. Brakes, landing gear and flaps may also freeze after takeoff if contaminated with snow or slush.

CAUTION: Taxi at a reduced speed. Use smaller nose wheel steering and rudder inputs and apply minimum thrust evenly and smoothly. Taxiing on slippery taxiways or runways at excessive speed or with high crosswinds may start a skid.

CAUTION: The flap position indicator and leading edge devices annunciator panel should be closely observed for positive movement. If the flaps should stop, the flap lever should be placed immediately in the same position as indicated.

Flaps & slats Extend

Set the flaps to the applicable WDR takeoff setting.

88
FUEL HEAT switch(es) ON

MD-88/90 Operations Manual

Place fuel heat switch ON after engine start when fuel temperature is 0°C or below.

Fuel heat switches may be operated simultaneously.

Observe oil temperature rise.

During icing conditions, do an engine run up, as needed, to minimize ice build-up. Use the following procedure:

- Check that the area behind the airplane is clear.

88

- Run the engines up to a minimum of 70% N1 for approximately 15 seconds or 60% N1 for 40 seconds duration at intervals no greater than 10 minutes.

90

- Run the engines up to a minimum of 50% N1 for approximately 1 second duration at intervals no greater than 10 minutes.

Before Takeoff Procedure

Note: Do not use alternate power for moderate/heavy rain, slush, snow, or standing water.

Refer to the Takeoff Runway Contaminant Decision Tree in this section. For performance corrections, refer to the WDR.

Do the normal Before Takeoff procedure with the following modifications:

Left and right pneumatic crossfeed valve levers As required
Pneumatic crossfeed valve levers may be open if airfoil anti-ice will be required after takeoff.

Note: Do not use wing anti-ice prior to 400 feet AGL.

Annunciator panel and warning lights Check

88

L and R FUEL HEAT ON lights extinguished prior to takeoff.

If contamination is present:

APU As required

The APU may be used as a backup source of electrical power until completion of the After Takeoff checklist when any of the following conditions exist:

- moderate or heavy rain,
- standing water, snow, or slush on the runway.

88

ENG IGN OVRD

Takeoff Procedure

Refer to the Takeoff Runway Contaminant Decision Tree in this section, if applicable.

Do the normal Takeoff Procedure with the following modifications:

During icing conditions, the takeoff must be preceded by a standing takeoff.

A standing takeoff is accomplished by holding the brakes while in position on the assigned runway until the engines are stabilized at or above:

88

- 70% N1

90

- 50% N1

before the start of the takeoff roll.

If the aircraft starts to move due to poor braking conditions, release the brakes and continue the takeoff.

During takeoff in icing conditions, a partially blocked PT-2 probe may cause erroneous EPR indications resulting in less than desired thrust. Crosscheck EPR and ensure N1 is approximately:

T/O POWER	88	90
ALTERNATE	88% N1	78% N1
NORMAL	92% N1	82% N1
MAXIMUM	95% N1	85% N1

to ensure the required takeoff thrust has been obtained.

After 70 knots during takeoff roll, reduce forward pressure on control column to reduce spray from the nosewheel.

If icing conditions exist or are anticipated immediately after takeoff, the engine anti-ice system should be on. EPR loss due to use of engine anti-ice is automatically recovered during takeoff by the thrust rating computer.

Climb, Cruise, and Descent Procedures

Engine Anti-Ice Operation – In Flight

Engine anti-ice must be ON during all flight operations when icing conditions exist or are anticipated.

When operating in areas of possible icing, activate engine anti-ice before entering icing conditions.

WARNING: Do not rely on airframe visual icing cues before activating engine anti-ice. Use the temperature and visible moisture criteria because late activation of engine anti-ice may allow excessive ingestion of ice and result in engine damage or failure.

When engine anti-ice is needed:

88
ENG IGN selector ON
ENG anti-ice switches ON (one at a time)
Turn ENG anti-ice switches ON one at a time. Wait until engine is stabilized before turning on opposite engine anti-ice.
ENG ANTI-ICE ON lights ON
ENG VALVE messages OFF
Message illumination indicates one or more engine anti-ice valves has malfunctioned. Depart icing area as soon as possible.

88
ENG IGN selector OFF
Ignition may be turned OFF after engines have stabilized.

When engine anti-ice is no longer needed:

88
ENG IGN selector ON

ENG anti-ice switches OFF

Autothrottles may disconnect if ENGINE ANTI-ICE switches are moved to OFF while wing anti-ice or tail de-ice is on. Thrust rating panel NO MODE light will illuminate.

ENG ANTI-ICE ON lights OFF

ENG VALVE messages OFF

88

ENG IGN selector OFF

Wing Anti-Ice Operation – In Flight

Note: Do not use wing anti-ice prior to 400 feet AGL.

Ice accumulation on the flight deck window frames, windshield center post, side windows, or windshield wiper arm may be used as an indication of structural icing conditions and the need to turn on wing anti-ice.

When wing anti-ice is needed:

PNEU X-FEED VALVE levers Open

AIR FOIL anti-ice switch ON

WING ANTI-ICE ON light Illuminated

Check PNEU PRESS gage.

- L and R ICE PROT TEMP LOW and WING ICE PRESS ABNML Messages should be extinguished within one minute.
- Pneumatic pressure should be above yellow arc on pneumatic pressure gauge.
 - If necessary, increase engine power.
- Every 15 minutes of operation, tail de-ice system will automatically be operated for 2 1/2 minutes.
 - Wing will not be anti-iced during that time.
 - At completion of tail de-ice cycle, system will revert to wing anti-ice and start a new 15 minute cycle.

When wing anti-ice is no longer needed:

AIR FOIL anti-ice switch OFF

Tail de-ice will be provided for 2 1/2 minutes after AIR FOIL anti-ice switch is moved to OFF.

After completion of tail de-ice cycle:

PNEU X-FEED VALVE leversClose

Cruise Procedure

Cold Temperature Altitude Corrections

Extremely low temperatures create significant altimeter errors and greater potential for reduced terrain clearance. When the temperature is colder than ISA, true altitude will be lower than indicated altitude.

To ensure adequate obstacle clearance in conditions of extreme cold weather (-10°C or lower, or as specified in the Delta Special Page), refer to Airway Manual, Weather, Altimeter Corrections.

Descent Procedure

FMS Descent Page TAI/ON ALT

Provides for a more accurate descent profile.

Engines should be operated at the highest practical RPM to furnish adequate bleed air for airfoil and engine ice protection during descent.

Approach and Landing Procedures

Refer to the Guidelines for Contaminated Runways procedure in this section, if applicable.

Do the normal Approach and Landing procedures with the following modifications:

88

Manual tail de-ice should be initiated 1 minute prior to extension of landing flaps (normally just prior to landing gear extension).

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Moving the flaps to 40 will activate both wing and tail anti-ice simultaneously, and the WING ANTI-ICE ON and TAIL DE-ICE ON will illuminate until the aircraft is on the ground or flaps are repositioned to less than 40.

90

For flaps 28 landings, press tail de-ice button 1 minute prior to extension of landing flaps (normally just prior to gear extension).

88

FUEL HEAT ON

- Place fuel heat switches ON when fuel temperature is 0° C or below.
- Observe oil temperature rise.
- Do not operate fuel heat switches simultaneously.
- Complete prior to final approach.
- Ensure FUEL HEAT ON lights extinguished prior to landing.

If the runway is contaminated:

APU As required

- The APU may be used as a backup source of electrical power when any of the following conditions exist:
- moderate or heavy rain,
 - standing water, snow, or slush on the runway.

88

ENG IGN OVRD

CAUTION: Reverse thrust above 1.3 EPR may blank the rudder and degrade directional control effectiveness. However, as long as the aircraft is aligned with runway track, reverse thrust may be used as necessary (up to maximum), to stop the aircraft.

After Landing Procedure

Do the normal After Landing procedure with the following modifications:

- After prolonged operation in icing conditions with the flaps extended, or when an accumulation of airframe ice is observed, or when landing on a runway contaminated with ice, snow, or slush:
- Prior to retracting the flaps/slats, a visual inspection is required.
- Refer to Taxi procedure in this section for engine anti-ice, engine run up, and taxi guidance.

Secure Procedure

Complete the Secure Checklist at all stations for aircraft remaining overnight unless maintenance specifically requests for the aircraft to remain powered.

Do the normal Secure procedure with the following modifications whenever the temperature falls below 0°C (32°F) or the aircraft may be de/anti-iced during overnight parking:

Parking brake As required

If the ramp is contaminated with ice or snow, parking brake should remain set.

Stabilizer trim 0 (cruise neutral)

In addition, when temperatures are (or are forecasted to be) below 32° F, ACS may ask crews to perform the following actions:

- Leave the APU running, and
- Leave one (preferably the right) pack running to provide heated air for the cabin.

ACS will be making these requests to prevent the potable water system from freezing. In order to accomplish that goal, the Secure Checklist will be modified in the following manner:

APU air & R air cond supply switches ON

Galley power OFF

Emergency lights OFF

IRS mode selectors OFF

(88) Overwing heater OFF

Outflow valve Set

Pneumatic crossfeed valves Open

Fuel tank pumps As required

Emergency power Ckd

Emergency power switch OFF

APU & external power As required

Battery switch ON

Note: Additional cold weather securing procedures are required to be accomplished by maintenance and/or ACS personnel. Stations have the responsibility for draining the water system.

Guidelines for Takeoff on Contaminated Runways or Landing with Braking Action Less than Good

When there is contamination on the runway or the braking action is less than good, captains must evaluate crew, aircraft, and environmental conditions in determining the safety of operating their flight.

Procedure Guidance

General

- Consider crew capability.
- Consider current Maintenance Carry Overs (MCOs) - reversers, antiskid, etc.
- Consider type and amount of contaminant.
- Consider source and age of reported braking action.
- Consider usable runways and taxiways (NOTAMS, ATIS, etc.).

Taxi

- Be aware that ramps and taxiways may be very slippery.
- Be cautious of jet blast effect on ground personnel and equipment.
- Taxi onto and off runways at an extremely slow speed. Nose wheel slippage may occur causing the aircraft to continue straight ahead and possibly off the paved surface.

Crosswind Guidance

- On slippery runways, crosswind guidelines are a function of runway surface condition, airplane loading, and proper pilot technique.
- The following crosswind guidelines are applicable for takeoff and landing:

Braking Action	Runway Condition	ICAO	MU	RCR	Takeoff and Landing Crosswind Component	Tailwind
---	Dry	6	≥ 40	≥ 19	30	10*
Good	Damp Frost (<1/8")	5				
Good/ Medium	Wet	4		39-36		
Medium/ Fair	Dry Snow**	3	35-30	13-18	20	5
Medium/ Poor	Wet Snow/ Standing Water/ Slush	2	29-26	-	10	0
Poor	Ice - No Melting**	1	25-21	6-12		
Nil	Do Not Operate					

* Unless the aircraft and airport are authorized for 15 knots.

** Takeoff on untreated ice or snow should only be attempted when no melting is present.

Note: Crosswind guidelines are not considered limitations. Refer to the Limitations chapter for crosswind limits.

Note: Reduce crosswind guidelines by 5 knots on wet or contaminated runways whenever asymmetric reverse thrust is used.

Note: When multiple reports are present, e.g. "Braking Action Fair to Good", use the lower crosswind value.

Takeoff

- Refer to the Takeoff Runway Contaminant Decision Tree, this section.
- Do not take off with braking action report of NIL by any air carrier aircraft or airport operator.
- A rolling takeoff is strongly advised when the crosswind exceeds 20 knots.
- Do not take off with standing water, slush, or wet snow in excess of 1/2 inch (1.2 cm) depth.
- Do not take off in dry snow in excess of four inches (10 cm) depth.

AWABS Determinations

Airport Customer Service (ACS) maintains a template in AWABS which describes conditions on each runway. ACS will enter the runway contaminant type and depth when more than 25% of the runway is affected. AWABS interprets this information according to rules established by Flight Operations to automatically select the contaminant type.

Note: For the A319, A320, 717, B737NG, B757-300, B767-400, A330, and 777-200LR, W (WET) is automatically selected by AWABS when the runway is reported wet. For other aircraft types, the captain must notify the gate agent or Operations if he wants Load Control Center (LCC) to load plan for W (WET) numbers.

AWABS limits the takeoff weight, as appropriate, based upon the selected contaminant type.

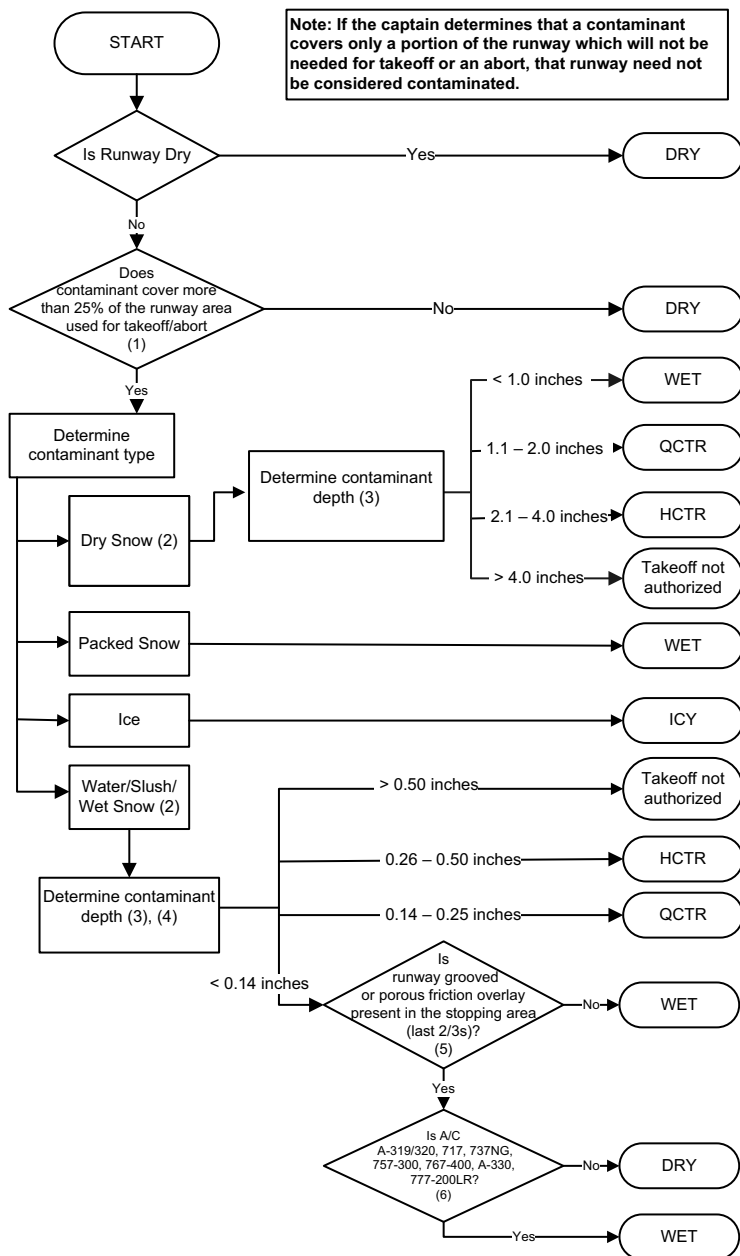
If the captain determines that a contaminant covers only a portion of the runway which will not be needed for takeoff or an abort, that runway need not be considered contaminated. The captain's determination affects his flight only and should be communicated to the dispatcher so AWABS can be updated appropriately, via LCC.

Category Definitions

- **DRY** - A runway is dry, or can be considered dry, based upon the considerations discussed in the Takeoff Runway Contaminant Decision Tree.
- **Slippery** - Under slippery conditions it is assumed that only the aircraft's braking capability is degraded; the aircraft's ability to accelerate is assumed to be unaffected.
 - **W (WET)** - A runway which is wet and on which the Captain considers the aircraft's braking capability to be degraded, or a runway covered with packed snow.
 - **I (ICY)** - A runway whose surface is covered by ice.
- **Cluttered** - Under cluttered conditions it is assumed that there is sufficient depth of contaminant that both the aircraft's acceleration and braking capability are degraded.
 - **QCTR** (1/4 inch clutter) - A runway whose surface is covered by an equivalent standing water depth of between 0.14 and 0.25 inches.
 - **HCTR** (1/2 inch clutter) - A runway whose surface is covered by an equivalent standing water depth of between 0.26 and 0.50 inches. Refer to the Takeoff Runway Contaminant Decision Tree, this section, for dry snow equivalent depths.

Takeoff Runway Contaminant Decision Tree

Use the following decision tree to determine runway condition for takeoff.



Takeoff Runway Contaminant Decision Tree Notes		
1		If the captain determines that a contaminant covers only a portion of the runway which will not be needed for takeoff or an abort, that runway need not be considered contaminated. Note: There are circumstances that permit the Airport Authority to clear only the center 100 feet of the runway. In those circumstances, only the contaminant coverage within the cleared area is used to establish the percentage coverage.
2	Snow	AWABS determines if snow is dry or wet on the basis of temperature. Snow is considered: • Wet when the temperature is 30° F (-1.1°C) or above • Dry when the temperature is below 30° F (-1.1°C) Note: A good operational test is: If a well compacted snowball can be made, the snow is wet; if the snowball falls apart, then the snow is dry.
3		A runway can be covered at varying depths over its length/width. When contaminant depths vary along the runway, a weighted average may be required. The contaminant depth along the runway where the aircraft will be at higher speeds should be weighed more heavily than at other points.
4		A weighted average depth: • Less than or equal to 1/4 inch equates to QCTR, • Over 1/4 inch and up to 1/2 inch equates to HCTR Note: When the average depth exceeds 1/2 inch, takeoff will not be attempted.
5		Grooved runways and runways with special porous overlays are designed to drain water from the runway surface in order to reduce the possibility of hydroplaning and increase the effective friction coefficient. Properly maintained runways with grooves or porous pavement have been shown to provide braking action approximately equivalent to a dry runway.
6		A319, A320, A321, A330, 717, B737NG, B757-300, B767-400, and B777-200LR aircraft cannot consider a wet runway dry even if it is grooved or has a porous friction course overlay.

Contaminant Millimeters to Inches Conversion

Use the following table for foreign stations that report runway clutter depth in millimeters (mm).

mm	0	6.35	12.7	25.4	50.8	101.6	152.4
Inches	0	1/4	1/2	1	2	4	6

Landing

- If FCTM, Quick Reference Landing Length chart does not apply, determine braking action. If braking action is less than good, accomplish an ACARS Landing Performance Request or refer to the ODM, Quick Reference Tab, Operational Landing Distance table.
- Do not land with a braking action report of NIL by any air carrier aircraft or airport operator in the landing or rollout portion of the runway.
- Do not land with standing water, slush, or wet snow in excess of one inch (2.5 cm) depth.
- Do not land in dry snow in excess of four inches (10 cm) depth.
- Use maximum landing flap configuration when landing on a contaminated runway.
- Consider using MAX autobrakes for maximum stopping effectiveness.
- Land as early in the touchdown zone as possible.
- Do not assume the last 2,000 feet of the runway will have braking action as good as the touchdown zone.
- Avoid abrupt steering inputs.
- Use maximum allowable symmetrical reverse thrust.
- If side slipping off the runway, select reverse idle and release brakes to return to centerline.
- Aircraft will tend to drift off the runway nose first with forward thrust and tail first with reverse thrust.
- Be aware of the possibility of white out effect from reverse thrust use in dry snow.

Ground De/Anti-Icing Procedure

Pre-Gate Departure Communication

The captain can expect to talk to several different people during the deicing process, however, only two call signs are used.

- “Iceman” is a person who communicates with the captain via the VHF radio from a position within operations, the control center or the deice pad tower. This person will refer to the aircraft’s “Ship Number” in all communications.
- “Deicer/Coordinator” is the person who will be in direct control of the actual deicing operation on the aircraft. He/she will be plugged into the aircraft interphone system or on VHF radio and must be in direct communication with the captain at all times. This person will not know the flight number and will refer to the aircraft’s “Ship Number” in all communications.

The following communication procedures will be used:

PRE-GATE DEPARTURE COMMUNICATION	
CAPTAIN:	“This is ship #_____, we will require deicing.”
ICEMAN:	“Ship #_____, your aircraft will be deiced with the engine(s) running. OR “Ship #_____, your aircraft will be deiced_____ (at the gate, off the gate, or at the remote) with the engines shut down.”
CAPTAIN:	“Roger, ship #_____.”

Use the appropriate procedure for deicing at the gate or at the remote site with engines running or shut down.

Note: Advise deicer/coordinator if the APU will be running during de/anti-icing.

Note: Ensure engine inlets have been inspected and are clear prior to engine start.

Aircraft Configuration and Communication

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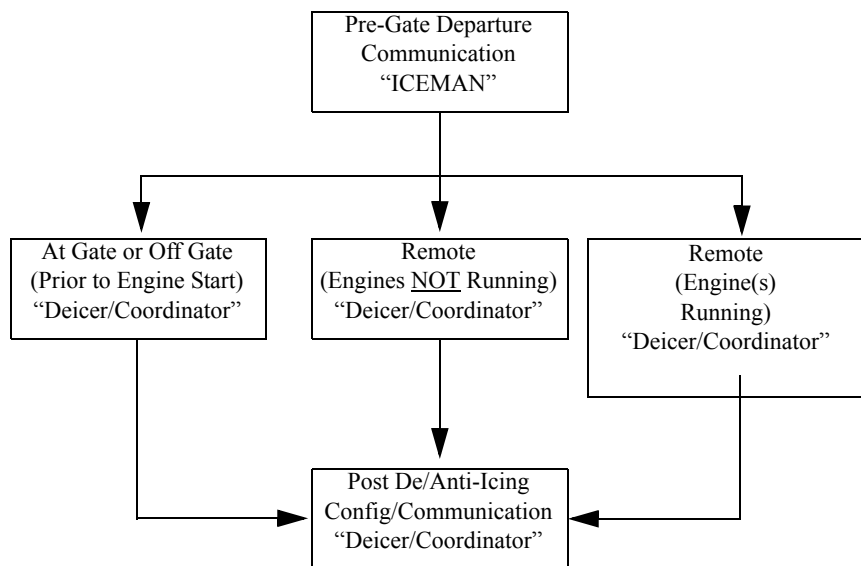
Note: OVERWING HEATER switch must remain OFF until aircraft is configured for de/anti-icing.

Prior to departure from the gate, when conditions warrant, the captain will contact “Iceman” and follow the Pre-Gate Departure Communication. The Iceman will describe one of three de/anti-icing scenarios:

- At Gate or Off Gate (Prior to Engine Start)
- Remote (Engines Not Running)
- Remote (Engine(s) Running)

Follow the communication and configurations described in the appropriate procedure. Once complete, follow the Post De/Anti-Icing configuration and communication.

Note: If the APU is inoperative, advise Iceman.



At Gate or Off Gate (Prior to Engine Start)

Make a PA to the passengers regarding the deicing process.

Approximately one minute prior to deicing:

PRE-DEICING COMMUNICATION	
DEICER/COORD:	"Ship # ____, brakes set?"
CAPTAIN:	"Roger, ship # ____, brakes set."
DEICER/COORD:	"Ship # ____ Type II / IV with (fluid brand name) will be used for anti-icing (if anti-icing required)."
CAPTAIN:	"Roger, ship # ____."
DEICER/COORD:	"Ship # ____, ready for deicing?"
CAPTAIN:	"Stand by." (Follow procedure below).

OR

PRE-DEICING COMMUNICATION USING FORCED AIR	
DEICER/COORD:	"Ship # ____, brakes set?"
CAPTAIN:	"Roger, ship # ____, brakes set."
DEICER/COORD:	"Ship # ____, the final process used will be forced air with Type I fluid (or forced air only) with no holdover time."
CAPTAIN:	"Roger, ship # ____." OR "Negative, ship # ____, holdover time required."
DEICER/COORD:	"Ship # ____, ready for deicing?" OR "Ship # ____, Type II / IV with (fluid brand name) will be used for anti-icing (if anti-icing required). Ready for deicing?"
CAPTAIN:	"Stand by." (Follow procedure below).

Prior to de/anti-icing:

Aircraft configuration for de/anti-icing:

CAUTION: Snow, slush, or ice ingestion in the APU inlet duct while the APU is running can cause serious damage. Coordinate with ground personnel to ensure that APU inlet area is clear before starting APU. Ingestion of deicing fluid causes objectionable fumes and odors to enter the airplane.

APU or external power As required

Aux and trans hyd pumps ON

Hydraulic system pressure Verify

Flaps & slats Extend

Extend the flaps and slats to the anticipated takeoff position.

AIR COND SUPPLY switches OFF

Outflow valve Close

Manually position the outflow valve position indicator to abeam the 15 flap position.

APU bleed air switch OFF

Reduces the possibility of fumes entering the air conditioning system.

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OVERWING HEATER switch ARM

Note: The WARM light may not illuminate due to cold outside air temperatures. This is not an indication of an inoperative overwing heater system. The WARM light is not required prior to takeoff.

WARNING: Once the deicing operation begins, any aircraft movement or changes in configuration must be coordinated with the ground crew.

CAPTAIN:	“Ship # ____, aircraft ready for deicing.”
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POST DE/ANTI-ICING COMMUNICATION	
DEICER/COORD:	“Ship # ___ de/anti-icing, tactile inspection, and aircraft inspection complete.” OR “Ship # ___ de/anti-icing, tactile inspection, and aircraft inspection complete. The final process used was forced air with Type I fluid (or forced air only) with no holdover time.”
CAPTAIN:	“Roger, ship # ____.”
DEICER/COORD:	“Ship # ___ Type I fluid application started ___ minutes ago. The freeze point is ___ °C. No Type II or IV was used.” OR “Ship # ___ Type II/IV fluid application with (fluid brand name) started ___ minutes ago.” OR (Non-US locations): “Ship # ___ Type II/IV fluid application (fluid brand name) started ___ minutes ago using a fluid mixture of ___ (% concentrate).”
CAPTAIN:	“Roger, ship # ___ Type I started ___ minutes ago. The freeze point is ___ °C. No Type II or IV was used.” OR “Roger, ship # ___ Type II/IV (fluid brand name) started ___ minutes ago.” OR (Non-US locations): “Roger, ship # ___ Type II/IV (fluid brand name) started ___ minutes ago using a fluid mixture of ___ (% concentrate).”
DEICER/COORD:	“Ship # ____, clear to start engines (when applicable). Do not move the aircraft under power until you have been given the all clear salute.”
CAPTAIN:	“Roger, ship # ____.”

Post de/anti-icing:

WARNING: An All Clear salute is required to verify de/anti-icing procedures are complete.

Aircraft configuration post de/anti-icing:

Complete the Pushback procedure, if not already accomplished.

APU As required

Outflow valve AUTO

Wait approximately 1 minute after deicing is complete to restore bleed air for pack operation to ensure deicing fluid has been cleared from the engines and APU.

Engine(s) Start

Accomplish the After Start procedure.

AIR COND SUPPLY switches As required

Accomplish the Taxi procedure.

Remote (Engines Not Running)

If remote deicing with engines not running is anticipated, the APU should be left operating. If the APU or a portion of the APU is inoperative, confirm that electric and/or air carts are available at the remote location before departing the gate.

CAUTION: Snow, slush, or ice ingestion in the APU inlet duct while the APU is running can cause serious damage. Coordinate with ground personnel to ensure that APU inlet area is clear before starting APU. Ingestion of deicing fluid causes objectionable fumes and odors to enter the airplane.

Approaching the icepad:

- Contact “Iceman”.
- Start the APU if it is not already operating.
- Make a PA to the passengers regarding the deicing process.

Just prior to entering the deicing area:

- Verify slats and flaps are in the intended takeoff position.

When the aircraft is in position for deicing:

PRE-DEICING COMMUNICATION	
DEICER/COORD:	“Ship # ____, brakes set?”
CAPTAIN:	“Roger, ship # ____, brakes set.”
DEICER/COORD:	“Ship # ____ Type II / IV with (fluid brand name) will be used for anti-icing (if anti-icing required).”
CAPTAIN:	“Roger, ship # ____.”
DEICER/COORD:	“Ship # ____, ready for deicing?”
CAPTAIN:	“Stand by.” (Follow procedure below).

OR

PRE-DEICING COMMUNICATION USING FORCED AIR	
DEICER/COORD:	“Ship # ____, brakes set?”
CAPTAIN:	“Roger, ship # ____, brakes set.”
DEICER/COORD:	“Ship # ____, the final process used will be forced air with Type I fluid (or forced air only) with no holdover time.”

CAPTAIN:	“Roger, ship # ____.” OR “Negative, ship # ____, holdover time required.”
DEICER/COORD:	“Ship # ____, ready for deicing?” OR “Ship # ____, Type II / IV with (fluid brand name) will be used for anti-icing (if anti-icing required). Ready for deicing?”
CAPTAIN:	“Stand by.” (Follow procedure below).

Prior to de/anti-icing:

Aircraft configuration for de/anti-icing.

APU or external power As required

AIR COND SUPPLY switches OFF

Outflow valve Close

Manually position the outflow valve position indicator to abeam the 15 flap position.

APU bleed air switch OFF

Reduces the possibility of fumes entering the air conditioning system.

Engines Shut down

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OVERWING HEATER switch ARM

Note: The WARM light may not illuminate due to cold outside air temperatures. This is not an indication of an inoperative overwing heater system. The WARM light is not required prior to takeoff.

WARNING: Once the deicing operation begins, any aircraft movement or changes in configuration must be coordinated with the ground crew.

CAPTAIN:	“Ship # ____, aircraft ready for deicing.”
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POST DE/ANTI-ICING COMMUNICATION	
DEICER/COORD:	“Ship # ___ de/anti-icing, tactile inspection, and aircraft inspection complete.” OR “Ship # ___ de/anti-icing, tactile inspection, and aircraft inspection complete. The final process used was forced air with Type I fluid (or forced air only) with no holdover time.”
CAPTAIN:	“Roger, ship # ____.”
DEICER/COORD:	“Ship # ___ Type I fluid application started ___ minutes ago. The freeze point is ___ °C. No Type II or IV was used.” OR “Ship # ___ Type II/IV fluid application with (fluid brand name) started ___ minutes ago.” OR (Non-US locations): “Ship # ___ Type II/IV fluid application (fluid brand name) started ___ minutes ago using a fluid mixture of ___ (% concentrate).”
CAPTAIN:	“Roger, ship # ___ Type I started ___ minutes ago. The freeze point is ___ °C. No Type II or IV was used.” OR “Roger, ship # ___ Type II/IV (fluid brand name) started ___ minutes ago.” OR (Non-US locations): “Roger, ship # ___ Type II/IV (fluid brand name) started ___ minutes ago using a fluid mixture of ___ (% concentrate).”
DEICER/COORD:	“Ship # ____, clear to start engines (when applicable). Do not move the aircraft under power until you have been given the all clear salute.”
CAPTAIN:	“Roger, ship # ____.”

Post de/anti-icing:

WARNING: Do not move aircraft until ATC taxi clearance and the All Clear Salute have been received.

Aircraft configuration post de/anti-icing:

APU As required

Outflow valve AUTO

Wait approximately 1 minute after deicing is complete to restore bleed air for pack operation to ensure deicing fluid has been cleared from the engines and APU.

Engine(s) Start

Accomplish the After Start procedure.

AIR COND SUPPLY switches As required

Accomplish the Taxi procedure.

Remote (Engine(s) Running)

CAUTION: Engines running deicing is not allowed during freezing drizzle, light freezing rain, sleet, or rime ice. Also, engines running deicing is not allowed during rain or high humidity with a cold soaked wing. The engines are susceptible to ice ingestion when ice or slush is removed from the wings or fuselage.

Note: Deicing with the engines running is authorized only at stations identified in the Delta Special Pages.

Approaching the icepad:

- Contact “Iceman”
- Make a PA to the passengers regarding the deicing process.

Just prior to entering the deicing area:

- Verify slats and flaps are in the intended takeoff position.

When the aircraft is in position for deicing:

PRE-DEICING COMMUNICATION	
DEICER/COORD:	“Ship # ____, brakes set, engines at idle?”
CAPTAIN:	“Roger, ship # ____, brakes set, engine at idle.”
DEICER/COORD:	“Ship # ____ Type II / IV with (fluid brand name) will be used for anti-icing (if anti-icing required).”
CAPTAIN:	“Roger, ship # ____.”
DEICER/COORD:	“Ship # ____, ready for deicing?”
CAPTAIN:	“Stand by.” (Follow procedure below).

OR

PRE-DEICING COMMUNICATION USING FORCED AIR	
DEICER/COORD:	“Ship # ____, brakes set, engines at idle?”
CAPTAIN:	“Roger, ship # ____, brakes set, engine at idle.”
DEICER/COORD:	“Ship # ____, the final process used will be forced air with Type I fluid (or forced air only) with no holdover time.”
CAPTAIN:	OR “Negative, ship # ____, holdover time required.”

DEICER/COORD:	“Ship # ____, ready for deicing?” OR “Ship # ____, Type II / IV with (fluid brand name) will be used for anti-icing (if anti-icing required). Ready for deicing?”
CAPTAIN:	“Stand by.” (Follow procedure below).

Prior to de/anti-icing:

Aircraft configuration for de/anti-icing:

Throttles IDLE

APU OFF

AIR COND SUPPLY switches OFF

Outflow valve Close

Manually position the outflow valve position indicator to abeam
the 15 flap position.

APU bleed air switch OFF

Reduces the possibility of fumes entering the air conditioning
system.

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OVERWING HEATER switch ARM

Note: The WARM light may not illuminate due to cold outside air
temperatures. This is not an indication of an inoperative
overwing heater system. The WARM light is not required
prior to takeoff.

**WARNING: Once the deicing operation begins, any aircraft
movement or changes in configuration must be
coordinated with the ground crew.**

CAPTAIN:	“Ship # ____, aircraft ready for deicing.”
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POST DE/ANTI-ICING COMMUNICATION	
DEICER/COORD:	“Ship # ___ de/anti-icing, tactile inspection, and aircraft inspection complete.” OR “Ship # ___ de/anti-icing, tactile inspection, and aircraft inspection complete. The final process used was forced air with Type I fluid (or forced air only) with no holdover time.”
CAPTAIN:	“Roger, ship # ___.”
DEICER/COORD:	“Ship # ___ Type I fluid application started ___ minutes ago. The freeze point is ___ °C. No Type II or IV was used.” OR “Ship # ___ Type II/IV fluid application with (fluid brand name) started ___ minutes ago.” OR (Non-US locations): “Ship # ___ Type II/IV fluid application (fluid brand name) started ___ minutes ago using a fluid mixture of ___ (% concentrate).”
CAPTAIN:	“Roger, ship # ___ Type I started ___ minutes ago. The freeze point is ___ °C. No Type II or IV was used.” OR “Roger, ship # ___ Type II/IV (fluid brand name) started ___ minutes ago.” OR (Non-US locations): “Roger, ship # ___ Type II/IV (fluid brand name) started ___ minutes ago using a fluid mixture of ___ (% concentrate).”
DEICER/COORD:	“Ship # ___, clear to start engines (when applicable). Do not move the aircraft under power until you have been given the all clear salute.”
CAPTAIN:	“Roger, ship # ___.”

Post de/anti-icing:

WARNING: Do not move aircraft until ATC taxi clearance and the All Clear Salute have been received.

Taxi may be commenced prior to restoring bleed air and pack operation.

Aircraft configuration post de/anti-icing:

APU As required

Outflow valve AUTO

Wait approximately 1 minute after deicing is complete to restore bleed air for pack operation to ensure deicing fluid has been cleared from the engines and APU.

AIR COND SUPPLY switches As required

Accomplish the Taxi procedure.

Hot Weather Operation

During ground operation the following considerations will help keep the airplane as cool as possible:

- If a ground source of conditioned air is available, the supply should be plugged in immediately after engine shutdown and should not be removed until just prior to engine start.
- If a ground source of conditioned air is not available, both packs should be used (when possible) for maximum cooling.
- All doors, including cargo doors, and windows should be closed as much as possible.
- Electronic components which contribute to a high temperature level in the flight deck should be turned off while not needed.
- All flight deck air outlets should be opened.
- All passenger cabin gasper outlets should be opened and all window shades on the sun-exposed side of the passenger cabin should be closed.

During takeoff performance evaluation consider the following:

- High temperatures inflict performance penalties which must be taken into account on the ground before takeoff.
- Alternate takeoff procedures (Packs Off Takeoff, etc.)

Turbulence

During flight in light to moderate turbulence, the autopilot and/or autothrottle may remain engaged unless airspeed, altitude or attitude deviations require use of manual control. Avoid making large pitch, roll, thrust or trim changes.

The turbulent air penetration speed provides ample protection from stall and high speed buffet, while also providing protection from exceeding the structural limit. Refer to the Limitations section for the turbulent air penetration speed. At 10,000 feet and below, minimum recommended speed is 250 KIAS or minimum maneuvering speed (whichever is greater). Do not fly less than minimum maneuvering speed for existing configuration.

- Passenger signs ON
- Advise passengers to fasten seat belts prior to entering areas of reported or anticipated turbulence. Instruct flight attendants to check that all passengers' seat belts are fastened.

Severe Turbulence

Severe turbulence should be avoided if at all possible. If severe turbulence cannot be avoided, an increased buffet margin is recommended. This can be obtained by descending approximately 4,000 feet below optimum altitude. The autothrottle should be off in severe turbulence.

- 88
- ENG IGN selector ON
- 90
- IGNITION switch ON

Note: Refer to QRH, section 3, Severe Rain/Ice/Turbulence.

Note: If an approach must be made into an area of severe turbulence, delay flap extension as long as possible. The airplane can withstand higher gust loads in the clean configuration. Diversion to another airfield is the best policy if severe turbulence persists in the area.

Volcanic Ash Encounter

Ground Operations

Aircraft should not operate into or out of airports where there is falling ash and/or ash-covered runways/taxiways. If an airport's operational surfaces are contaminated with ash, the taxiways and runways to be used must be swept prior to use, and if possible, sprayed with water to minimize aircraft contamination from any remaining ash.

Restrict ground use of the APU to engine starts. Use ground starting air and electrical power, if available.

Do not use windshield wipers for dust removal. Coordinate with Maintenance to hose off ash deposits with water and wipe residue away with a soft cloth.

Avoid the use of air conditioning packs on the ground as long as recirculation fans will maintain adequate cabin comfort. If air conditioning is required, operate at full cold setting. Use preconditioned air at the terminal from a filtered ground cart, if available. If possible, keep engine bleeds off.

Avoid static operations of engines above idle power.

To prevent contamination of air conditioning system, consider a takeoff with packs off.

Use rolling takeoff procedures to minimize engine dust ingestion.

During landing, limit reverse thrust to avoid impairing visibility and minimize ingesting dust into the engines. Exercise caution as braking may be less effective than normal due to contamination on the runway.

In Flight

CAUTION: If volcanic ash is encountered in flight, refer to the QRH, section 0, Volcanic Ash.

Intentionally
Blank

Differences

Chapter DF

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Differences

MD-88/90 Differences

Chapter DF

Section 10

Introduction

Review of this section is one method of maintaining recency on both aircraft types if you have only flown one type during the past 90 days.

Aircraft General, Emergency Equipment, Doors, Windows

Item	88	90
Logo Lights	Not installed.	9219 - 9265 only.

Air Systems

Item	88	90
Cabin Air Recirculation Fan	Operates in flight only.	Operates on ground under certain circumstances to help maintain cabin ventilation. Operates automatically in flight.
Air Conditioning Indicators	<u>Pressure</u> gauges indicate supply pressure for each air conditioning pack.	<u>Flow</u> gauges indicate air conditioning pack discharge flow.
Pneumatic Indication System	TAIL COMP TEMP HIGH warning light indicates excessive tail compartment temperature, but does not differentiate between left and right sides.	L TAIL TEMP HIGH / R TAIL TEMP HIGH warning light indicates which side has excessive tail compartment or pylon temperature.

Anti-Ice, Rain

Item	88	90
Engine Anti-Ice	Engine anti-ice provides heat to cowling, bullet nose, inlet guide vanes, and EPR probe.	Engine anti-ice is cowling only (7th stage bleed air). No bleed air provided to the bullet nose, but bullet nose is rubber coated and vibration eliminates ice buildup.
Airfoil Ice Protection	With airfoil ice selected, wing/tail anti-icing alternates every 15/2.5 minutes regardless of flap setting.	With airfoil ice selected, wing/tail anti-icing alternates every 15/2.5 minutes. Moving flaps to 40° will cause both the wing and tail to be anti-iced until on the ground or flaps are repositioned to less than 40°.
Forward Strakes	Forward strakes are anti-iced with pneumatic air.	Electrical heating elements are installed in the forward strakes.

Electrical

Item	88	90
System Operation	Engine driven generators are driven through constant-speed drives which convert the variable speed output of the engine to a constant speed. The CSDs maintain a constant voltage and frequency output regardless of varying engine speed and electrical loads.	Engine driven generators are variable speed constant frequency (VSCF). Converters maintain constant voltage output.
Controls and Indicators	APU bus switches, external power switches, and an AC crosstie relay are used to connect the right and left AC buses to an appropriate electrical power source.	Two bus tie relays perform function of APU bus switches, external power switches and AC crosstie relay (automatic operation).
Battery	Will power all equipment listed on emergency circuit breaker panel and DC transfer bus for approximately 30 minutes.	Will power all equipment listed on overhead emergency circuit breaker panel and DC transfer bus for approximately 45 minutes.

Engines, APU

APU

Item	88	90
APU Duct Pressurization	No automatic duct depressurization during a TAIL COMP TEMP HIGH condition.	Automatic APU pneumatic duct depressurization during a L/R TAIL TEMP HIGH condition.
APU Warm-Up	60-second warm-up required prior to using pneumatic air.	No warm-up needed prior to using pneumatic air.
APU as Pneumatic Air Supply	Cannot be used for pneumatic supply in flight.	Can be used for pneumatic air supply up to 20,000 feet.
APU Maximum Altitude	Maximum altitude for start: FL 370.	Maximum altitude for start: FL 350.
APU Air Switch ON	Opens APU load control valve to provide APU air to aircraft pneumatic system.	Provides pneumatic air and opens ram inlet door to maximize APU performance.
APU Air Switch OFF	Turns off pneumatic air by closing APU load control valve.	Turns off pneumatic air and closes ram inlet door to prevent runway contact on takeoff and landing.
APU DOORS Switch	APU DOORS switch used to control APU doors automatically or manually.	Not installed. APU doors operated automatically.

APU

Item	88	90
APU Ram Air Door	In AUTO position, APU ram air door opens automatically at the beginning of the start cycle and closes when the APU reaches 95%.	During ground operation, moving the APU AIR Switch to ON will open the ram door. When open, the ram door extends even with the tail skid. Moving the APU AIR Switch to OFF will retract the ram door, thus eliminating the possibility of ram door damage in the event of a tail skid strike during takeoff rotation or landing flare.

Engines

Thrust Rating Panel	
90 Thrust Rating Panel	Derate from 28K thrust rating. TO/FLX • Selects the flexible takeoff rating mode. ASSUMED/EPR • Used in conjunction with the TO FLX or EPR SEL mode buttons. TO/GA - Selects takeoff and go around thrust. 9237 - 9252 Note: EPR SEL button is inoperative.
88 Thrust Rating Panel	Only derate is flex power with assumed temperature. TO selects normal takeoff power. TO FLEX selects alternate takeoff power (must also turn ART switch OFF and set assumed temperature).

Engines

Item	88	90
Engine Type	Pratt & Whitney JT8D-219 engines.	International Aero V2500 engines.
Static Thrust	21,700 pounds.	28,000 pounds.
N1 Mode	No N1 mode.	N1 mode is an EEC mode initiated automatically when EEC can no longer calculate a valid EPR (DEFAULT light on overhead panel illuminates). Also initiated when throttle advanced beyond the frangible gate.
N2 Indication	N2 displayed in both analog and digital forms.	N2 displayed in digital form only.
N2 Idle RPM	50 to 60%	55 to 60%
Thrust Rating Window	EPR limit readout is installed instead of thrust rating window. Individual CMD EPR readout windows are installed.	Thrust rating window (formerly EPR Limit Readout on MD-88) is blank.
Thrust Mode Window	Not installed.	Displays current thrust mode selected with TRP.
Engine Vibration Display	Not installed.	Shows vibration level from 0 to 9.9. (Normal range is approximately 0.0 to 4.0).
Flashing EGT	Also indicates impending hot start, but not as accurate.	Indicates impending hot start.

Engines

Item	88	90
Ignition (IGN) Switch/Selector	Five-position selector: • SYS A • OFF • SYS B • BOTH • OVRD	Two-position switch: • AUTO • ON
Ignition System	Ignition is provided when selector is in the A, B, or BOTH position if the FUEL lever is ON. Ignition is provided continuously when the selector is in OVRD regardless of the fuel lever position.	Both ignitors are powered continuously when IGN and FUEL switches are both ON.
Automatic Ignition	Not installed.	Automatically alternates between the A & B systems for normal engine starts. Provides dual ignition for T/O, approach, engine anti-ice ON, sub-idle (N2) conditions, engine surge, & throttle past frangible gate.
Engine Starting Modes	All engine starts are manual.	Normal and manual engine starting modes are available.
Engine Starting (Normal Mode)	N/A (All engine starts are manual.)	Normal mode uses ignition in AUTO. Normal mode controls start valve, fuel metering and ignitors.

Engines

Item	88	90
Engine Starting (Manual Mode)	All engine starts are manual.	Manual mode uses ignition switch ON. AUTO ABORT is not available for manual starts.
Engine Starting (AUTO ABORT)	No AUTO ABORT capability.	In normal mode, AUTO ABORT performed for hot start, hung start, locked N1 rotor, ignition failure, electronic control lost, engine surge, and EGT failure. Once N2 reaches 50%, the AUTO ABORT feature is inhibited. AUTO ABORT is not available for manual starts.
Engine START Switch	START switch must be held in the ON position from start initiation until N2 reaches 40%.	START switch automatically retracts by 43% N2 (or should be manually pushed in by 45% N2).
Engine Starting (Stabilized Idle)	Stabilized idle N2 is 50 - 60%.	Stabilized idle N2 is 55 - 60%.
Synchronizer System	Three position switch. Synchronizes N1, N2, or EPR (OFF position).	Two position switch. Synchronizes N1 or EPR (OFF position) only.
Engine Oil System	Only fuel-cooled oil cooler is installed. Regulated oil pressures are lower.	Both air-cooled and fuel-cooled oil coolers installed. Unregulated oil pressures are higher.

Engines

Item	88	90
Oil Pressure		
Minimum for Engine Start	Positive indication	Must be indicated by 20% N2
Amber light ON	40 psi	80 psi
Red light ON	35 psi	60 psi
Oil Temperature		
Min before advancing throttle above idle	N/A	-10°C
Min for Takeoff	N/A	50°C
Amber light ON	135°C	155°C
Red light ON	165°C	165°C
Oil Quantity		
Max Capacity	16 qts	30 qts
Min dispatch from maintenance station	12 qts	16 qts
Min dispatch from non-maintenance station	8 qts	12 qts
Min after start	N/A	8 qts
Thrust Reversers	Clamshell-type reversers are installed.	Cascade-type reversers are installed. Activation below 60 knots allows a maximum EPR of 1.07. Activation above 60 knots allows a maximum EPR of 1.30. In extreme circumstances, pulling through the emergency reverse thrust detent allows a maximum EPR of 1.4. CAUTION: Activation of emergency reverse thrust results in an ENG SYS FAIL message and requires an extensive thrust reverser maintenance inspection.

Fire Protection

Item	88	90
FIRE TEST	Two fire test LOOP buttons are installed. FIRE TEST is accomplished by pressing LOOP A and LOOP B buttons simultaneously. Test indications are: • 2 engine fire handles illuminate, • 2 aural warnings, • 2 fire bells, • 2 master warning lights • 2 master caution lights, • 1 APU fire light • a fire detector loop message, & • 6 loop lights.	Single FIRE TEST switch tests both A and B systems on left and right engines and APU. Test indications are: • 2 engine fire handles illuminate, • 2 aural warnings, • 2 fire bells, • 2 master warning lights, and • 1 APU fire light. Single FAULT TEST switch tests both loop systems and fire detection components for faults.
Test Indications (Not Illuminated)	Agent low lights do not illuminate during test.	Agent low lights and fuel switch lights do not illuminate during test.
FAULT TEST	Not installed.	For maintenance use only.
Loop Operation	Loop operation is same, only management is different.	Loop operation is same, only management is different.
Automatic Loop Test	Automatic loop tests are not installed.	Automatic loop test for short circuits or if falsely energized.

Item	88	90
Fuel Switch	Fuel switch lights are not installed.	Fuel switch, if ON, illuminates with respective fire warning handle.
Engine Fire Handle	Pulling L/R engine fire handle shuts off fuel only at the wing.	Pulling L/R engine fire handle will shut off fuel at the fuel metering unit and at the wing.

Flight Controls

Item	88	90
Elevator	Not normally hydraulically powered.	Normally hydraulically powered.
Flight Control Check	Produces ELEVATOR POWER ON light when the elevator power augmentor system activates. Occurs when the elevator control tabs have been displaced approximately 10° nose down with respect to the elevator surface.	Includes an up and down limit check of the elevator via illumination of the blue ELEVATOR AT LIMIT light on the annunciator panel.
HYD CONT ELEV Switch	Not installed.	Used to bypass powered elevator (OFF light illuminates).
Loss of Hydraulic Pressure	N/A	If hydraulic pressure is lost, reverts to manual elevator (ELEVATOR CONTROLS MANUAL message illuminates).

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Item	88	90
Control Columns	Ailerons are cable connected and respond to movement of the opposite aileron. Should any part of the system become jammed, either control wheel will drive the unjammed tab cable system by application of approximately 50 lbs of pressure to the control wheel.	The left and right control columns are connected by means of a split torque tube. Should any part of the system become jammed between the control columns and control tabs, a pre-locked detent-type mechanism will allow the pilots to override the jam by using approximately 150 lbs of force.
Rudder Throw Limiter	Rudder throw is 2.5° (restricted) to 22° (unrestricted).	Rudder throw is 3° (restricted) to 23° (unrestricted).
Unrestricted Rudder	Blue RUDDER TRAVEL UNRESTRICTED light advises of unrestricted rudder.	Rudder Throw is constantly monitored by the Rudder Hook Monitor (RHM) System. No annunciation for unrestricted rudder.
Backup Rudder Limiter	There is no backup rudder limiter.	A backup rudder limiter limits rudder deflection to 10°. If both hydraulic systems fail, the backup rudder limiter is inoperative.

Flight Instruments, Displays

Item	88	90
System Display Panel	Indicates RAT.	Indicates TAT.
EVENT Pushbutton	Not installed.	Marks an event on the flight data recorder.

Flight Management, Navigation

Item	88	90
Flight Management Computers	Single FMC installed.	Single FMC installed.
Flight Management System	-901 FMC installed.	Pegasus system installed.
GPS	Not installed.	Installed on 9237-9252 only.

Fuel

Item	88	90
Alternate Fuel Burn	Center tank to approximately 10,000 pounds, then main tanks to approximately 4,000 pounds, then center tank to empty, then back to main tanks.	Center tank to approximately 3,000 pounds, then main tanks to approximately 4,000 pounds, then center tank to empty, then back to main tanks.
Return to Tank System	Not installed.	Recycles fuel heated by the fuel-oil heat exchanger to the main fuel tanks.
Fuel Tank Vent System	Fuel tank vent system does not permit overflow into the center tank.	Fuel tank vent system permits overflow into the center tank so that heated, recycled fuel can return to the main tanks even when center tank is feeding and main tanks are full.
Fuel Heat	Manual fuel heat installed.	Fuel heat is not installed.

Hydraulics

Item	88	90
Hydraulic Quantity Minimums (Preflight)	Left - 8 qts Right - 9 qts	Left - 9 qts Right - 10 qts
Hydraulic Quantity Minimums (After Engine Start)	Left - 4 qts Right - 4 qts	Left - 6 qts Right - 6 qts

Landing Gear

Item	88	90
Brakes	Brakes are conventional steel brakes with different temperature limits.	Brakes are carbon brakes with different temperature limits.
Autobrakes	Autobrakes are disarmed at any speed by depressing brake pedals beyond 25% travel.	Below 90 knots: • 25% pedal deflection is required to disengage autobrakes. Above 90 knots: • 90% pedal deflection is required to disengage autobrakes.
Autobrakes (TO)	Autobrakes in TO mode use only the right hydraulic system at speeds less than 70 knots; at speeds greater than 70 knots, both hydraulic systems are used.	Autobrakes in TO mode use both hydraulic systems at all speeds.

Item	88	90
Autobrakes (Delay)	Max brakes apply with one (1) second time delay. Min. & Med. autobrakes apply with three (3) second time delay.	All autobrake modes apply with one (1) second time delay.
Brake Temperatures		
OVHT Light ON	305°C	540°C
OVHT Light OFF	260°C	425°C
Set brakes	300°C max	500°C max
▪	▪	▪

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Item	88	90
Takeoff	205°C max	Ensure BRAKE TEMP gauge does not exceed: • 250 °C for airport elevations up to 2200' MSL • 210 °C for airport elevations 2201' - 3000' MSL • 160 °C for airport elevations 3001' - 4500' MSL • 105 °C for airport elevations 4501' - 5500' MSL • 40 °C for airport elevations 5501' - 6500' MSL Corrections to brake temperature limit: • When OAT exceeds 32°C, subtract 5°C for each 1°C above 32°C. • For each 1 knot of tail wind, subtract 15°C. Note: For temperatures greater than those listed above, reference the ODM, chapter 7, Maximum Takeoff Brake Temperature charts. Brake temperature limits ensure sufficient brake energy available in the event that an ensuing takeoff is rejected. Temperature limits are based on a 165,000 pound aircraft and a V1 of 160 knots.

Warning Systems

Item	88	90
EOAP	Monitor light advises of fault in EOAP.	Status light below EOAP screens. Replaces MONITOR light. Advises 2nd level discrepancies or system information requiring no procedural action by the flight crew.
Landing Gear Horn	Will sound when altitude less than 1,500 feet RA.	Will sound when altitude less than 1,500 feet RA (less than 1,200 feet RA on some aircraft.)

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