TRANS WORLD AIRLINES

LOCKHEED 1011

FLIGHT HANDBOOK

FLIGHT OPERATIONS TRAINING DEPARTMENT

KANSAS CITY, MISSOURI

1011 FLIGHT HANDBOOK
TRANS WORLD AIRLINES

TRANSMITTAL RECORD PAGE

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TWA Flight Operations Training BULLETIN 78-11

To: All Flight Crew Members

File: Bulletin Section
Flight Handbooks

MINIMUM COST ALTITUDE SELECTION

A series of charts has been developed to replace the present minimum cost altitude/wind trade charts. The data on these Minimum Cost Altitude Selection charts is displayed in a simplified, tabular format. At the same time, the Minimum Cost Cruise Thrust Setting charts have been revised to provide altitude capability and standard atmosphere temperature for all fleets. The new charts will be available in the field on or about November 1, 1978.

MINIMUM COST ALTITUDE SELECTION CHARTS

These charts are being issued in two slightly different variations of the same format. The charts for aircraft which are flown on both domestic and international include information for all available altitudes in the cruise spectrum without regard for directional restrictions. Those issued for domestic have been split into eastbound and westbound sections to further simplify their use.

It is expected that the Minimum Cost Altitude Selection chart will most frequently be used enroute for altitude change based on finding conditions different than forecast. Most initial altitude selection in today's operation is done on the basis of forecast winds by the flight planning computer which is programed with minimum cost altitude information identical to that shown on the new charts. The chart can also be used for manual flight planning when it is required.

As illustrated on the accompanying examples, the chart employs some new terms which may need definition. The term "reference altitude" is the minimum cost altitude for the adjacent weight and assumes the wind to be the same at all altitudes. Since winds are not always the same, a series of altitudes is shown at the top of the chart as "wind improvement altitudes". They head columns of wind values representing knots of increased tailwind or decreased headwind required at that altitude to achieve the same cost as the reference altitude. There is a zero in the column representing the altitude that is the reference altitude for the weight. The remaining figures along that weight line show the wind improvement required to fly other than the reference altitude.

The wind improvement concept is not complex. If the reported wind for an altitude other than reference is better by the number of knots shown, the altitude can be flown for the same cost. If the wind is better by more than the number of knots shown, the wind improvement altitude becomes the minimum cost altitude for that set of wind conditions.

When forecast temperature shows that a hotter than standard atmosphere is present, climb capability of the aircraft must be checked to ensure that it can reach the reference altitude while still maintaining an acceptable rate of climb. Climb rates of 300 feet/minute for wide body and 500 feet/minute for narrow body aircraft have been used as the cutoff point and both the altitude selection and cruise thrust setting charts discussed below are based on these climb rate figures. The premise here is that when average climb performance deteriorates below these figures, the increase in engine overhaul cost due to the longer period of exposure to climb thrust offsets the fuel savings that might have been gained by going to a higher altitude, even though the minimum cost speed schedule was attainable upon reaching that altitude. Since such cost factors as engine overhaul expense are not observable by the crew, it is important that the computer flight plan or altitude selection chart altitude be recognized as the true minimum cost altitude. The fact that a particular aircraft could

October 16, 1978

slowly climb to some higher altitude at less than the acceptable average rate of climb does not mean that lower cost has been achieved, even though the observed fuel flow at altitude would seem to indicate this.

CRUISE THRUST SETTING CHARTS

The previous chart concept and, in most cases, the same format remain in the Minimum Cost Cruise Thrust Setting charts. Any block on these charts showing information indicates the capability of maintaining the appropriate cruise mach for the aircraft concerned.

Most of our aircraft do not have climb thrust capability to maintain the acceptable rate of climb discussed previously to altitudes as high as those at which they might otherwise be able to cruise. Climb capability is further restricted when a temperature hotter than the one for which the engine was rated exists. The cruise thrust setting charts for the wide body aircraft were recently revised to show the acceptable climb performance limit in the form of coded lines representing the performance limit for the temperature at which the engine is rated and for hotter temperature(s). The charts for the narrow body fleets will now show the same information as appropriate.

The altitude selection charts are based on the standard climb performance rating and will never show a reference altitude for a given weight that is higher than the top coded line on the cruise thrust setting chart. However, the cruise thrust chart will frequently show data in blocks above the coded line indicating that cruise speed is available at that weight/altitude combination but that climb rate to get there is less than the established acceptable minimum.

An example of the preceding is provided on the attached 1011 chart. The example also shows a change to 5,000 pound weight increments being introduced to the wide body charts at this time.

All charts now have the standard ISA atmosphere temperature shown in the block with the altitude. Since the altitude selection chart shows the reference altitude in terms of rated climb capability, the forecast temperature must be compared to standard to determine whether the reference altitude can be used or if a lower cruise altitude must be used due to limited climb capability.

The thrust setting charts for the 747 and 1011 no longer show the 1.3G maneuver capability line since neither aircraft can climb to or maintain minimum cost cruise at the 1.3G altitude limit. A new note at the bottom of these charts serves as a reminder that better than 1.3G protection is available at all altitudes for which data is shown.

The charts for the 707, 727, and DC-9 continue to indicate the altitude limit for 1.3G maneuver capability. When smooth air is forecast, it is permissible to use an altitude higher than the 1.3G limit provided your aircraft has the climb and cruise capability. It should be emphasized, however, that the 1.3G line represents the ability of the aircraft to withstand the vertical gusts associated with moderate turbulence or to maneuver up to approximately a 40 degree bank in still air without encountering stall buffet. Combinations of turbulence and maneuvering could cause the onset of buffet with lesser values. If light to moderate turbulence associated with thunderstorm activity or clear air turbulence is forecast or encountered after reaching altitude, the flight should be flown at an altitude below the 1.3G line to provide sufficient maneuver margin.

R. J. Kenny

R. J. Kenny
Staff Vice President
Flight Operations Training

MINIMUM COST ALTITUDE SELECTION - DOMESTIC EXAMPLE (727-31/C)

EASTBOUND

REFERENCE		WIND IMPROVEMENT ALTITUDE					
WEIGHT	ALT	410	370	330	290	270	250
115	410	0	3	10	37	52	
120	370	2	0	13	34	47	
125	370		0	10	30	42	
130	370		0	7	26	38	52
135	370		0	4	22	34	48
140	370		0	2	18	30	44
145	330		2	0	14	26	40
150	330			0	10	20	32
155	330			0	7	14	25

WESTBOUND

REFERENCE		WIND IMPROVEMENT ALTITUDE					
WEIGHT	ALT	390	350	310	280	260	240
115	390	0	8	26	40		
120	390	0	6	22	34		
125	390	0	4	18	29	47	
130	390	0	2	14	24	41	
135	350		0	13	29	43	
140	350		0	10	25	39	55
145	350		0	8	22	35	52
150	350		0	6	19	31	45
155	350		0	4	16	27	40

For an aircraft weighing 135,000 pounds, the minimum cost altitude is FL 370 if the wind is the same at all altitudes. It would require 4 knots more tailwind or less headwind to justify flying at FL 330. If more than 4 knots wind improvement existed, FL 330 would become the preferred altitude.

INTERNATIONAL EXAMPLE (747)

REFERENCE		WIND IMPROVEMENT ALTITUDE													
WEIGHT	ALT	380	370	360	350	340	330	320	310	300	290	280	270	260	250
500	380	0	3	7	12	17	23	31							
520	370		0	3	7	12	17	23	31						
540	360		1	0	2	6	11	17	23	30					
560	360			0	2	5	10	16	22	28	36				
580	350				0	2	5	10	16	21	27				
600	340					0	2	6	10	16	22				
620	340					0	2	5	9	15	21				
640	330						0	2	4	8	14	22			
660	320							0	2	4	7	14	21		
680	320							0	1	3	6	11	18		
700	310								0	2	4	7	13	20	
720	310								0	1	3	6	11	17	23

MINIMUM COST CRUISE THRUST SETTING CHART EXAMPLE (1011)

HIGH ALTITUDE
HEAVY WEIGHT

ALTITUDE STD TEMP	GROSS WEIGHT - LBS 450000	445000	440000	435000	430000	425000	420000	415000	410000	405000	400000	395000	390000	385000	380000	375000
36000 -56.													281 .585	281 .575	281 .567	281 .559
35000 -54.										288 .577	288 .569	288 .561	288 .555	288 .549	288 .543	288 .536
34000 -52.							295 .570	295 .563	295 .556	295 .551	[illegible] .545	295 .539	295 .532	295 .526	295 .521	295 .515
33000 -50.				301 .563	301 .557	301 .551	301 .546	301 .540	301 .534	301 .528	301 .523	301 .517	301 .513	301 .508	301 .503	301 .499
32000 -48.		308 .551	308 .547	308 .540	308 .535	308 .529	308 .524	308 .519	308 .514	308 .509	308 .505	308 .501	308 .496	308 .492	308 .488	308 .484
31000 -46.	315 .534	315 .529	315 .524	315 .519	315 .515	315 .510	315 .506	315 .502	315 .498	315 .494	315 .489	315 .485	315 .481	315 .478	315 .474	315 .470
30000 -44.	320 .513	320 .509	320 .505	320 .501	320 .497	320 .493	320 .489	320 .485	320 .481	320 .477	320 .474	320 .470	320 .467	320 .463	320 .460	320 .456
29000 -42.	320 .490	320 .486	320 .482	320 .478	320 .475	320 .471	320 .467	320 .464	320 .460	320 .457	320 .453	320 .450	320 .446	320 .443	320 .439	320 .436
28000 -40.	320 .470	320 .466	320 .463	320 .459	320 .456	320 .452	320 .448	320 .445	320 .441	320 .438	320 .435	320 .431	320 .428	320 .425	320 .422	320 .418
27000 -38.	320 .452	320 .448	320 .445	320 .441	320 .438	320 .434	320 .431	320 .427	320 .424	320 .421	320 .418	320 .415	320 .411	320 .408	320 .405	320 .402
26000 -37.	320 .435	320 .431	320 .427	320 .424	320 .421	320 .417	320 .414	320 .411	320 .408	320 .405	320 .402	320 .399	320 .396	320 .393	320 .390	320 .387

1. CHART EPR IS THAT REQUIRED FOR MACH 0.84 OR 320 KNOTS IAS.
2. IF SAT IS HOTTER THAN STD + 15 DEGREES C OR ANTI ICE IS ON, CHECK CRUISE MODE OF TAT/EPR INDICATOR FOR EPR LIMIT.
3. ALL WEIGHT-ALTITUDE COMBINATIONS SHOWN HAVE AT LEAST 1.35G MANEUVER MARGIN.
4. ACCEPTABLE CLIMB PERFORMANCE LIMITS:
   15 DEGREE C HOTTER THAN STANDARD
   20 DEGREE C HOTTER THAN STANDARD

DATA PRESENTED IS: | IAS
EPR |

The circled box above shows that a 400,000 pound aircraft could climb to flight level 350 when temperature was as much as 15° hotter than standard (-54). It could not climb at an acceptable rate, however, to that same flight level if the temperature were 20° hotter than standard.

TWA Flight Operations Training BULLETIN 78-8

TO: All 1011 Flight Crew Members and Flight Dispatch Officers

FILE: Bulletin Section 1011 Flight Handbook

1011-100 DIFFERENCES BULLETIN REVISION

This bulletin contains revisions to Flight Operations Training Bulletin 78-7 1011-100 Differences, Chapter 4 Performance Considerations. The following pages should be inserted in subject bulletin.

Page 4.04 2 - Engine Inoperative Drift Down procedure introduced.

Page 4.05 Additional performance notes added to instructions.

Richard J. Kenny
Staff Vice President
Flight Operations Training

April 26, 1978

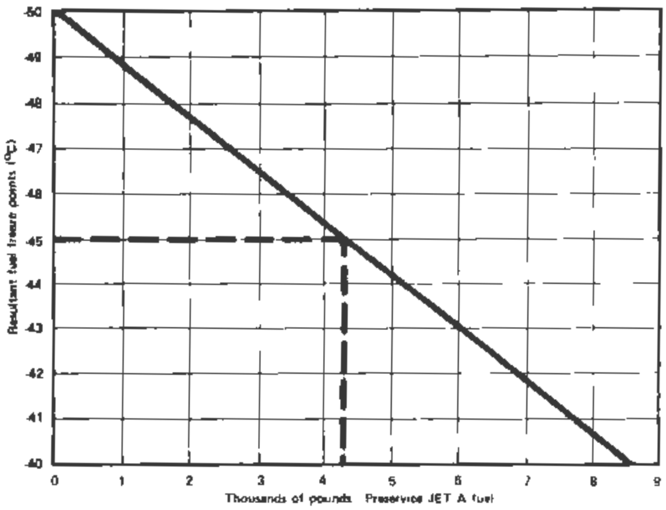
Fuel tank temperatures must be maintained at $3^{\circ}C$ warmer than calculated freeze points. Any action taken to maintain this temperature should be noted in the log along with OAT and fuel tank temperature before and after such action.

RANGE CAPABILITY

Range Capability charts for representative altitudes are based on Long Range Cruise speed. Charts follow for 25,000 and 20,000 feet should the loss of an engine necessitate flight at these levels and for 14,000 and 10,000 feet in the event of a depressurization or loss of oxygen.

Enter the appropriate chart with present gross weight and fuel remaining to determine nautical air mile range capability.

FUEL FREEZE POINT CHART



EXAMPLE SHOWN: 4,200 pounds of Jet A remains

Enter chart at 4.2 on the horizontal line, proceed vertically to freeze point curve. Proceed horizontally, read resultant freeze point on vertical line. When filled with Jet A-1 resultant freeze point is 45°C

1-ENGINE INOPERATIVE (25,000 FEET/20,000 FEET)

FUEL REMAINING	GROSS WEIGHT 390,000	380,000	370,000	360,000	350,000	340,000	330,000	320,000
70,000	/1690	1890/1725	1910/1760					
60,000	/1440	1580/1470	1600/1500	1625/1525	1650/1550			
50,000	/1190	1300/1215	1320/1240	1340/1265	1360/1290	1385/1305	1410/1320	1440/1335
40,000	/ 940	1020/ 965	1050/ 990	1070/1005	1090/1020	1110/1035	1130/1050	1150/1065
30,000	/ 700	760/ 715	775/ 730	790/ 745	810/ 760	825/ 770	840/ 780	855/ 790

3-ENGINE (14,000 FEET/10,000 FEET)

FUEL REMAINING	GROSS WEIGHT 390,000	380,000	370,000	360,000	350,000	340,000
70,000		1570/1500				
60,000		1330/1225	1360/1255	1390/1285		
50,000		1100/1020	1120/1040	1140/1060	1165/1080	
40,000			890/ 825	910/ 840	925/ 855	940/ 875
30,000				695/ 625	705/ 635	715/ 650

2-ENGINE INOPERATIVE (MAX CONTINUOUS) DRIFT DOWN/TOTAL RANGE CAPABILITY — INTERNATIONAL OPERATION

The instructions on page 4.05 should be referenced in conjunction with the following information.

In the unlikely event of the loss of two engines, prompt implementation of drift down procedures will maximize range capability and minimize descent rates. Decelerate to drift down speed and use max continuous thrust throughout the descent. Maximum range is achieved by attaining a Drift Down chart gross weight/altitude combination at the highest possible altitude and by maintaining Drift Down chart EPR and IAS.

If aircraft weight exceeds a chart weight/altitude combination, fuel must be immediately jettisoned until a chart weight/altitude combination is met. Achieving a chart weight/altitude combination as high as possible ensures level off by 4,000 feet. Maintain EPR and IAS to chart values throughout the descent.

The Drift Down chart includes nautical air mile and time information for each weight/altitude combination. These values are for information purposes and simply indicate the distance and time from a particular altitude to the 4,000 foot level off altitude. Note that these NAM range figures are a part of and not in addition to the range values listed in the Total Range Capability chart.

Once a charted weight/altitude combination is achieved, refer to the Total Range Capability chart to determine fuel requirements for diversion. If fuel remaining is in excess of diversion requirements, consideration should be given to additional fuel jettisoning to improve single engine altitude capability. Fuel remaining values in the Total Range Capability chart include an extra 4,000 pounds for 15 minutes of holding over the diversion airport in addition to range capability.

When altitude is stabilized (about 4,000 feet), maintain Drift Down chart EPR and accelerate to a 2-Engine Inoperative Long Range Cruise chart IAS appropriate to altitude and weight. Thereafter, use 2-Engine Inoperative LRC thrust setting chart (page 4.06), maintain chart speed, and accept a gradual increase in altitude as weight decreases.

↓PROCEDURES

1. Set Drift Down chart EPR.
2. Jettison fuel if necessary.
   Refer to Drift Down chart Instruction 1.
3. Adjust Drift Down chart EPR & IAS.
   Refer to Instruction 2.
4. Advise ATC nature of problem.
5. Select desired airport for diversion.
6. Determine range capability.
   Refer to Instruction 3.
7. Start APU at 14,000 feet if operative.
8. When VSI is zero, accelerate to 2-Engine Inoperative LRC speed.
   Refer to Instruction 4. ↑

2-ENGINE INOPERATIVE (MAX CONTINUOUS) DRIFT DOWN / TOTAL RANGE CAPABILITY

INSTRUCTIONS

The data presented is valid for temperatures as hot as ISA + 9°C. Anti-ice EPR reduction is unnecessary for this procedure.

1. If aircraft weight exceeds Drift Down gross weight/ altitude combination, fuel must be immediately jettisoned (jettison rate 4500 lbs/min) until a chart gross weight/altitude combination has been achieved. To maximize range, this should be accomplished at the highest possible altitude.

2. Decelerate at altitude to drift down speed and use max continuous thrust throughout the descent. Adjust Drift Down EPR and IAS as altitude is lost during drift down. After jettison completed, read distance and time to level off altitude.

3. After achieving a chart gross weight/altitude combination, refer to Total Range Capability chart to determine fuel requirements for diversion. If fuel is in excess of diversion requirements, consideration should be given to additional fuel jettisoning to improve single engine altitude capability.

   Nautical air mile range and fuel remaining includes credit for drift down from cruise altitude. Do not add Drift Down distance to these values. Fuel remaining also includes an allowance for an additional 15 minutes holding over destination at max cruise thrust (4000 lbs).

   If operative, start the APU at 14,000 feet.

4. When altitude is stabilized (about 4,000 feet), use 2-Engine Inoperative Long Range Cruise thrust setting chart, maintain chart speed, and accept a gradual increase in altitude as weight decreases.

DRIFT DOWN

GROSS WEIGHT	ALTITUDE	EPR	IAS	NAM	TIME (MIN)
372,000	35,000	.605	245	440	96
371,800	33,000			432	95
371,600	31,000			425	94
371,300	29,000			415	92
371,000	27,000			405	90
370,700	25,000			395	88
370,400	23,000			385	86
370,100	21,000	.601	240	371	84
369,800	19,000	.594		357	82
369,400	17,000	.585		342	79
368,800	15,000	.574		323	75
368,200	13,000	.560		300	72
367,400	11,000	.546	235	275	66
366,000	9,000	.532		245	59
364,000	7,000	.518		205	50
360,000	5,000	.505		125	32
353,000	4,000	.491		0	0

TOTAL RANGE CAPABILITY

NAUTICAL AIR MILE RANGE	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
FUEL REMAINING (X 100#)	206	230	255	277	300	324	348	373	395	418	441	466	490	512

2-ENGINE INOPERATIVE LRC

ALTITUDE STD TEMP	GROSS WEIGHT - LBS 360000.	350000.	340000.	330000.	320000.	310000.	300000.	290000.
15000 -15.								
14000 -13.								
13000 -11.								
12000 -9.								234/.440 .546/+13
11000 -7.							238/.438 .543/+14	234/.431 .525/+18
10000 -5.							238/.430 .522/+18	234/.423 .505/+22
9000 -3.						241/.429 .519/+19	237/.422 .502/+23	233/.415 .486/+26
8000 -1.					245/.427 .516/+20	241/.421 .500/+24	237/.414 .483/+27	233/.407 .467/+31
7000 1.				249/.426 .512/+21	245/.419 .496/+24	241/.413 .481/+28	237/.406 .465/+31	233/.399 .449/+35
6000 3.				248/.418 .493/+25	245/.412 .478/+28	241/.405 .463/+32	237/.398 .447/+35	233/.392 .432/+39
5000 5.			252/.416 .489/+26	248/.410 .475/+29	244/.404 .460/+32	241/.398 .445/+36	237/.391 .430/+39	233/.384 .416/+43
4000 7.		256/.415 .485/+27	252/.409 .471/+30	248/.403 .457/+33	244/.396 .443/+36	240/.390 .429/+40	236/.384 .414/+43	232/.377 .400/*
3000 9.	259/.413 .481/+17	255/.407 .467/+31	252/.401 .454/+34	248/.395 .440/+37	244/.389 .426/+41	240/.383 .412/+44	236/.376 .398/+48	232/.370 .384/*
2000 11.	259/.405 .463/+32	255/.400 .450/+35	251/.394 .437/+38	248/.388 .424/+41	244/.382 .410/+45	240/.376 .397/+49	236/.369 .383/*	232/.363 .370/*
1000 13.	259/.398 .446/+36	255/.392 .433/+39	251/.387 .421/+42	247/.381 .408/+46	244/.375 .395/+49	240/.369 .382/*	236/.363 .369/*	232/.356 .356/*
0 15.	258/.391 .430/+40	255/.385 .418/+43	251/.379 .405/+47	247/.374 .392/+50	243/.368 .380/+53	239/.362 .367/*	235/.356 .355/*	231/.350 .342/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN BEST 2 ENGINE OUT SPEED.
2. TAT IS THE LIMITING TEMPERATURE OF MAX CONTINUOUS THRUST FOR EPR SHOWN.
3. ANTI-ICE CORRECTION:
   WHEN TAT IS SHOWN REDUCE CHART EPR .008 FOR ENGINE, .014 FOR ENGINE AND WING
   WHERE TAT IS REPLACED BY AN ASTERISK (*) USE CHART EPR.

DATA PRESENTED IS: IAS/MACH
EPR/TAT

TWA Flight Operations Training BULLETIN 78-7

TO: All 1011 Flight Crew Members and Flight Dispatch Officers

FILE: Bulletin Section 1011 Flight Handbook

1011 - 100 DIFFERENCES

CHAPTER 4 - PERFORMANCE CONSIDERATIONS

Attached is Chapter 4 of "Lockheed 1011-100 Differences" which details planning and performance considerations and procedures. As explained in Flight Operations Training Bulletin 78-1, this is the fourth of a series of bulletins on the subject of 1011-100 Differences.

Information that is especially pertinent to the transoceanic operation is identified as "-International Operation". Accordingly, domestic qualified crew members do not need to refer to the information so identified.

This material should be studied and then retained in the bulletin section of your flight handbook until it is incorporated permanently in the handbook.

Flight Operations Training Bulletins 78-1, 78-2, 78-3, 78-5, and 78-7 introduced information concerning system differences between the standard 1011 aircraft and the 1011-100 model. These bulletins also provide international operational data for ditching and sea survival, inertial navigation and communication, and long range performance.

All 1011 crew members and flight dispatch officers are to review these bulletins and return the attached certification sheet to their General Manager of Flying or Area Manager of Flight Dispatch prior to April 30, 1978.

Richard J. Kenny
Staff Vice President
Flight Operations Training

April 10, 1978

1011 - 100
DIFFERENCES TRAINING

Flight Operations Training Bulletins 78-1, 78-2, 78-3, 78-5, 78-7, and 78-8 provide information concerning system differences between the standard 1011 aircraft and the 1011-100 model. These bulletins also provide international operational data for ditching and sea survival, inertial navigation and communication, and long range performance.

All 1011 crew members and flight dispatch officers are to review these bulletins and return this certification sheet to their General Manager of Flying or Area Manager of Flight Dispatch, as appropriate, prior to performing 1011-100 duties.

Print or type your name, PRN, domicile, date, and place your signature in the spaces provided. This will confirm that you have read and are familiar with the contents of these bulletins as they pertain to your bid operation, Domestic or International.

____________________ ____________________

NAME (print) SIGNATURE

________ ____________ ____________________

PRN DOMICILE DATE

CHAPTER 4

PERFORMANCE CONSIDERATIONS

Six 1011 aircraft (11025, 11026, 11028, 11029, 11030 and 11031) are being converted to a 1011-100 international configuration. 11028 and 11029 have been leased to Delta and will not be used in the initial 1011 international service.

AIRCRAFT IDENTIFICATION NUMBERS

When an aircraft's modifications are complete, the aircraft identification number will be changed from the current 11000 series to the 31000 series (11025 to 31025, etc.). The identification number change will permit all computer and maintenance programs to track these aircraft as a separate fleet.

DISPATCH CODE

The dispatch code for the 1011-100 aircraft is "I".

FLIGHT PLANNING - INTERNATIONAL OPERATION

Additional considerations for transatlantic flight planning are:

> Trip fuel is normally calculated on the next lower directional altitude (2,000 feet lower up to and including FL290 and 4,000 feet lower above FL290) to provide for en route contingencies such as restricted altitude, alternate track, etc. However, if payload cannot be accomodated, trip fuel may be calculated at optimum altitude.

Additional capability is provided for en route contingencies by the required fuel reserves.

RESERVE FUEL

International reserve fuel will be 8,000 pounds plus 25 pounds per minute of planned flight time but never less than 11,000 pounds. For example, for a planned flight time of 7:00, the required fuel reserve would be:

	8,000#
420 minutes x 25# =	10,500#
Total fuel reserve	18,500#

The 8,000 pounds represents a 30 minute hold at 1,500 feet. This same reserve fuel formula must be used when operating under a re-release. Re-release dispatch procedures may be used whenever necessary to extend a flight to non-stop operation.

For dispatch to those stations for which there is no approved alternate, such as Santa Maria and Keflavik, the required reserve is 30,000 pounds.

ALTERNATE PLANNING CHART

The information in the Alternate Planning chart assumes an en route climb to optimum altitude, cruise at LRC, and a normal descent and approach to the alternate airport. This applies to both domestic and international. Time and fuel figures are based on the above assumptions except for altitudes 10,000 feet and below which are based on 250 knots IAS.

TAKEOFF

WEIGHTS

Maximum taxi weight is 468,000 pounds and maximum takeoff weight is 466,000 pounds. Takeoff Performance Data worksheets now include the -100 weights.

SPEEDS

A placard incorporating V_2 speeds for weights up to 466,000 pounds is being installed. The new takeoff worksheets also incorporate lower Vmcg and V_2min speeds that came about as a result of a recent re-certification of the 1011 by Lockheed.

WEIGHT AND BALANCE

Weight and balance information will continue to be computer generated. A new stabilizer trim computer is being developed to handle the heavier - 100 weights. Any changes to operating weights and basic reference numbers will be published by message.

CLIMB

SPEEDS

There is no change from the present climb speeds.

THRUST - INTERNATIONAL OPERATION

Climb thrust setting procedure is changed slightly to permit the -100 more flexibility in adjusting to the North Atlantic track structure. Select cruise mode of the EPR computer and subtract .01 EPR for climb thrust setting until rate of climb falls to 500 feet per minute. At this point, select climb mode of the EPR computer, increase thrust to climb rating, and continue climb. When rate of climb again falls to 500 feet per minute, and if additional climb capability is required, add .01 EPR to climb mode EPR.

If the EPR computer is inoperative, determine climb thrust from the Normal Climb/Maximum Cruise chart and subtract .01 EPR. When climb rate falls to 500 feet per minute, determine climb thrust from the Maximum Climb chart. When climb rate again falls to 500 feet per minute, and if additional climb capability is required, add .01 EPR to the EPR listed on the Maximum Climb chart.

CRUISE

SPEED

Fuel price increases now optimize minimum cost cruise at approximately M.84. Accordingly, cruise speed for all 1011 operations, both domestic and international, will be at M.84 effective April 30. This lower cruise speed also lends itself to improved range capability.

STEP CLIMB

Step climbs of 4,000 feet or less will be flown at M.84. Thrust up to the Maximum Climb rating plus .01 EPR may be used to achieve M.84 step climb capability.

LANDING

Weight

Maximum landing weight for the -100 is 368,000 pounds. All landing charts now incorporate -100 information.

SPEEDS

A Vref placard for speeds up to 466,000 pounds will be installed. The re-certification of the 1011 also resulted in slightly lower Vref speeds at some gross weights.

GO-AROUND CAPABILITY

The Engine Out Maximum Landing Gross Weight chart gives go-around capability temperatures for weights up to 466,000 pounds. The airport critical temperatures listed on the landing charts reflects go-around capability at the -100 maximum landing weight of 368,000 pounds.

FUEL FREEZE CONSIDERATIONS - INTERNATIONAL OPERATION

The following considerations are necessary to maintain fuel tank temperatures 3°C above the fuel freeze point.

The type of fuel added will be noted on the M-180J as JET A or JET A-1. JET A fuel has a freeze point of -40°C and JET A-1 has a freeze point of -50°C.

When adding fuel, consider all pre-service fuel aboard the aircraft as JET A. If JET A-1 fuel is added, refer to freeze point JET A/JET A-1 fuel mixture chart to establixh mixed fuel freeze points. The Fuel Freeze Point chart is located on page 4.03.

TWA Flight Operations Training BULLETIN 78-5

TO: All 1011 Flight Crew Members and Flight Dispatch Officers

FILE: Bulletin Section
1011 Flight Handbook

1011-100 DIFFERENCES

CHAPTER 3 - NAVIGATION AND COMMUNICATIONS SYSTEMS

Attached is Chapter 3 of "Lockheed 1011-100 Differences" which provides information on inertial navigation and communications modifications. As explained in Flight Operations Training Bulletin #78-1, this is the third of four chapters.

The inertial navigation equipment installed on the 1011-100 aircraft will normally be used for navigational purposes on international flights only. This supplemental information is provided in addition to the inertial navigation portion of the International Procedures training course.

Domestic flights will use the INS for attitude information. Consequently, domestic crews should refrain from attempting to use the INS equipment in the NAV mode to preclude possible damage to the equipment. Domestic qualified crew members should study the information in the Domestic INS Operation section on page 3.01 and Controls and Indicators page 3.02. The remainder of the chapter provides supplementary background information that may be of interest to domestic 1011 flight crews.

This material should be retained in the bulletin section of your flight handbook for ready reference until it is incorporated permanently in the handbook.

Richard J. Kenny

Richard J. Kenny
Staff Vice President
Flight Operations Training

CHAPTER 3

NAVIGATION AND COMMUNICATIONS SYSTEMS

Three vertical gyros and two compass directional gyros are removed and replaced with three Delco Carousel IV Inertial Navigation systems. The DIR GYRO breakers located at 1G5 and 1G23 are deactivated.

Two HF radios and a second ADF are provided in addition to the presently installed ADF and three VHF COMM radios.

An INS cooling system is installed to provide additional cooling for inertial navigation system units.

The 1011 check lists are being revised to include INS related items for the 1011-100 aircraft.

DOMESTIC INS OPERATION

When the 1011-100 is operated on domestic routes the three INS Mode Selector Units (MSU) will be placed in the ATT position. This will permit the INS vertical gyros to provide the necessary attitude data to their respective ADI and electronic units within approximately five minutes after ATT is selected. At flight termination leave all MSUs in OFF position.

The RADIO/INS switches are to be selected to the RADIO position. This will permit the HSIs to display normal magnetic heading and radio data.

INERTIAL NAVIGATION SYSTEM (INS)

Each INS consists of a Mode Selector Unit (MSU), Control Display Unit (CDU), Navigation Unit (NU), and battery.

Each NU has a computer and platform. The computer provides INS navigation data to the CDU, HSI, and autopilot/flight director. The platform contains accelerometers, vertical gyros, and a directional gyro. The vertical gyros provide attitude data to the respective ADI, radar, speed command, AIDS, and autopilot/flight director. The directional gyro provides compass stabilization.

INS accelerometers sense aircraft movement which is used to compute navigation data. Each INS provides its own display of navigation data and indications of its own operating status. The HSI also displays INS data such as aircraft ground speed, distance, course, and time to next waypoint.

Air data computers provide altitude and true airspeed data. However, if the air data computers fail, INS will not be seriously affected. If TAS is not provided, the wind display will show zeros.

CONTROL DISPLAY UNIT (CDU)

Each CDU has a keyboard to insert data into the INS computer and a data selector to display the data.

MODE SELECTOR UNIT (MSU)

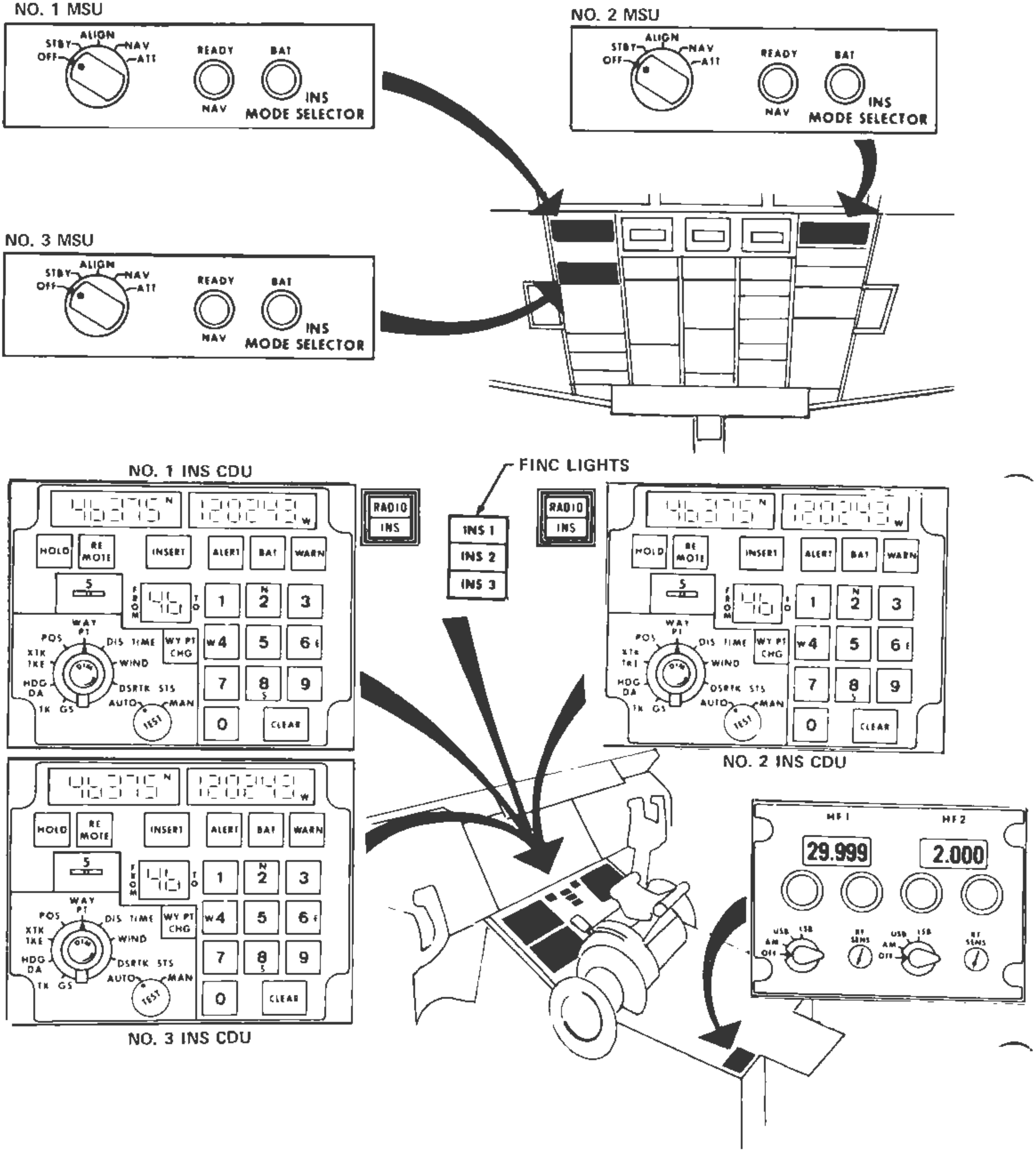
Each MSU controls its respective INS. The NAV mode is the normal international operating mode. NAV provides system alignment, navigation and attitude data. If ATT is selected, only attitude data is provided without navigation capability. The platform vertical gyros provide attitude data within approximately five minutes after ATT is initially selected.

BATTERY

Each INS has its own standby battery to provide INS power when normal aircraft power fails. The standby batteries are located in the forward avionics compartment with the NUs. Each can power its INS for approximately fifteen minutes. INS cannot be started if its battery is not in good condition.

The amber CDU BAT light will appear when INS is operating on battery power. The CDU WARN and MSU red BAT light will appear

INS AND HF RADIO
CONTROLS AND INDICATORS



if battery voltage is too low to continue operating and INS will automatically shut down.

RNAV ANNUNCIATORS

RNAV will appear on the HSI when its RADIO/INS switch is selected to INS. RNAV will appear on the AFCS Mode panels when an autopilot/flight director is coupled to INS. The annunciators are a result of area navigation installation provisions and will function in lieu of INS annunciators.

HORIZONTAL SITUATION INDICATOR (HSI)

All HSI perimeter windows are active when RNAV appears on the HSI. RNAV will appear when its RADIO/INS switch is selected to INS, indicating INS navigation data is being displayed on the HSI.

It is possible for the HSIs to use the No. 1 or No. 2 INS by alternate RNAV switching; however, the No. 3 INS cannot be selected.

Ground speed is displayed when RADIO or INS is selected, providing the MSU is in the NAV mode.

The glide slope scale, bar, and flag cannot appear when RNAV is displayed on the HSI.

The glareshield heading selector data and HSI heading cursor will not agree on the HSI card with RNAV displayed because the heading cursor displays magnetic heading and the card displays true heading.

RADIO/INS SWITCHES

These two switches control the HSI displays. When INS is selected, RNAV and TRUE appear on the HSI, indicating INS navigation and true heading are displayed on the HSI. When RADIO is selected, VOR or ILS and MAG appear, indicating normal radio and magnetic heading data are displayed on the HSI.

ALTERNATE SWITCHING

The alternate switches perform their normal functions when VOR or ILS is displayed on the HSI. The following switching differences apply when RNAV is displayed on the HSI:

- HDG - No switching capability provided when HDG flag appears.
- DEV - No switching capability provided when NAV flag appears.
- RNAV - Switching capability provided when HDG/NAV flag(s) appear. When selected, HSI is switched to other (1 or 2) INS.

VERTICAL GYRO 3 LIGHT

Indicates No. 3 INS failed or its attitude data not valid.

INSTRUMENT COMPARATOR ANNUNICATORS

Annunciators will continue to function as on aircraft without INS. The HEADING annunciators may appear if TRUE is displayed on one HSI and MAG is displayed on the other, depending on local magnetic variation.

INS ATTITUDE SYSTEM

An ATT flag will appear on the ADI to indicate the INS has failed or that its attitude data is not valid. Alternate ATT can be selected to use the No. 3 INS for attitude data.

INS COMPASS SYSTEM

Magnetic or true heading data can be displayed on the HSI cards depending on the position of the RADIO/INS switches. True heading is displayed when INS is selected and magnetic heading is displayed when RADIO is selected.

The RMI cards always display magnetic heading data and cannot be switched to an INS.

AUTOPILOT/FLIGHT DIRECTOR INS OPERATION

Each autopilot/flight director uses its respective INS for INS navigation guidance. No. 3 INS cannot be used.

To couple an autopilot/flight director to INS, select both VHF NAV panels to any VOR FREQUENCY, select either RADIO/INS switch to INS, turn autopilot/flight director on and select the NAV mode. RNAV annunciators will appear on the AFCS Mode panels to indicate the autopilot/flight director is coupled to INS. Any pitch mode can be selected to perform its normal function.

The aircraft will fly any change in desired track after passing a waypoint if the respective CDU AUTO/MAN switch is in the AUTO position. The course change is made just prior to reaching the waypoint.

The following action is required when changing autopilot/flight director operation from VOR to INS and from INS to VOR:

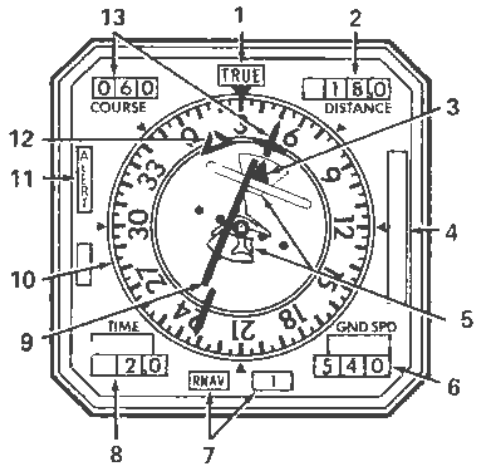
> To begin INS operation after tracking VOR, release the NAV mode, select either RADIO/INS switch to INS and re-engage NAV mode. The APFD selected will determine which INS is used.
>
> To resume VOR operation after tracking INS, release the NAV mode, select both RADIO/INS switches to RADIO, then re-engage NAV mode.
>
> After an autopilot/flight director has been coupled to INS, either or both HSIs can be switched to RADIO, if it becomes necessary to monitor magnetic heading, or VOR display. The APFD will remain coupled to INS as long as NAV mode remains engaged.

INERTIAL NAVIGATION SYSTEM COOLING

INS computers and batteries are located in the forward avionics compartment. An INS cooling fan and sensor have been installed which will provide backup cooling when normal compartment cooling is not adequate.

An INS Cooling switch is added to the engineer's ECS Monitor panel which provides control and indication of INS cooling.

HORIZONTAL SITUATION INDICATOR (HSI)



CIRCUIT BREAKERS

1F3-CAPT HSI
1F21-F/O HSI
1E8-AREA NAV
1E26-AREA NAV

1. TRUE/MAG DISPLAY

   TRUE - Appears when its RADIO/INS switch is selected to INS. HSI displays true heading.
   MAG - Appears when its RADIO/INS switch is selected to RADIO. HSI displays magnetic heading.
   HDG - Red flag appears when magnetic or INS true heading failed or is not valid.

2. DISTANCE DISPLAY

   NM distance to next waypoint. Appears when RNAV displayed, and MSU in NAV position.

3. TO-FROM POINTER

Indicates to/from VOR station. Indicates to next INS waypoint when RNAV displayed if CDU selector is in AUTO, and MSU in NAV position.

4. GLIDE SLOPE DISPLAY

Scale and bar appear with ILS frequency tuned. Blanked when RNAV displayed. Red GS flag appears if glide slope data fails or is not valid when ILS is displayed. One dot = $\frac{1}{4}^{\circ}$.

5. Red flag appears if localizer/VOR/INS fails or is not valid.

6. GROUND SPEED DISPLAY

Indicates aircraft ground speed and appears when RNAV displayed, if MSU is in NAV position.

7. RNAV/VOR/ILS DISPLAY

RNAV appears when its RADIO/INS switch is selected to INS. VOR/ILS appears when its RADIO/INS switch is selected to RADIO. 1 or 2 indicates VOR/ILS/INS system selected.

8. TIME DISPLAY

Indicates time in minutes to next waypoint when RNAV displayed and MSU in NAV position.

9. DEVIATION BAR

Indicates LOC/VOR deviation or INS crosstrack deviation. One dot =

VOR - 5°
LOC - $1\frac{1}{4}^{\circ}$
INS - 3 3/4 NM

10. COMPASS CARD

Indicates magnetic or true heading when MAG or TRUE displayed.

11. ALERT LIGHT

Appears when within 2 miles of next waypoint when RNAV displayed, and MSU in NAV position.

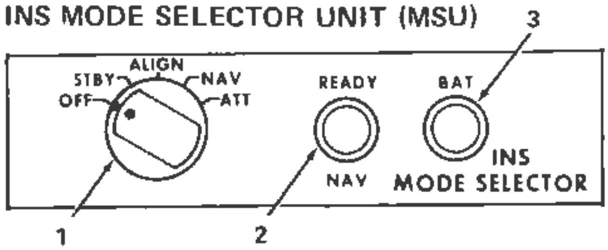
12. HEADING CURSOR

Both HSI cursors controlled by glareshield heading selector. Indicate magnetic heading, agreeing with heading window selector when MAG displayed.

13. COURSE CURSOR AND DISPLAY

Indicates selected LOC/VOR course or INS desired track. HSI course cursor is controlled by its glareshield course selector.

INS MODE SELECTOR UNIT (MSU)



1. MODE SELECTOR

OFF	- INS off.
STBY	- Warmup power applied to INS.
ALIGN	- INS alignment and battery check provided. (Not TWA procedure.)
NAV	- INS alignment attitude and navigation data provided.
ATT	- INS attitude data provided without navigation data.

2. READY NAV LIGHT

Green light indicates INS navigation data available.

3. BAT FAIL LIGHT

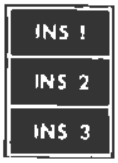
Red light indicates battery voltage too low while INS is operating on battery and INS will shut down.

RADIO/INS SELECTOR SWITCH

RADIO - HSI displays MAG and VOR or ILS data.

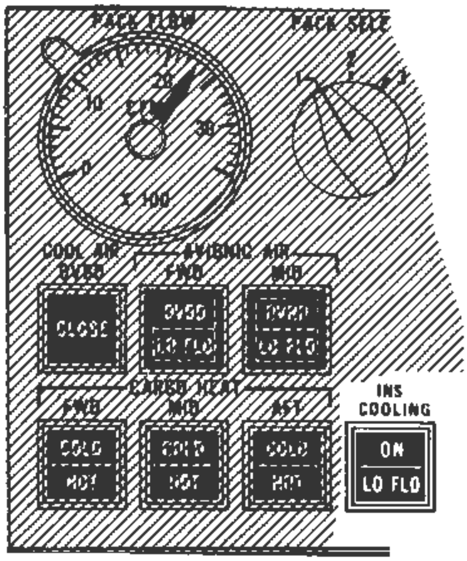
INS - HSI displays TRUE and RNAV. INS data provided to HSI if MSU in NAV position.

FAILED INERTIAL NAVIGATION COMPARISON LIGHT (FINC)



Red light indicates INS computed present position out of tolerance for navigation purposes.

INS COOLING



CIRCUIT BREAKERS

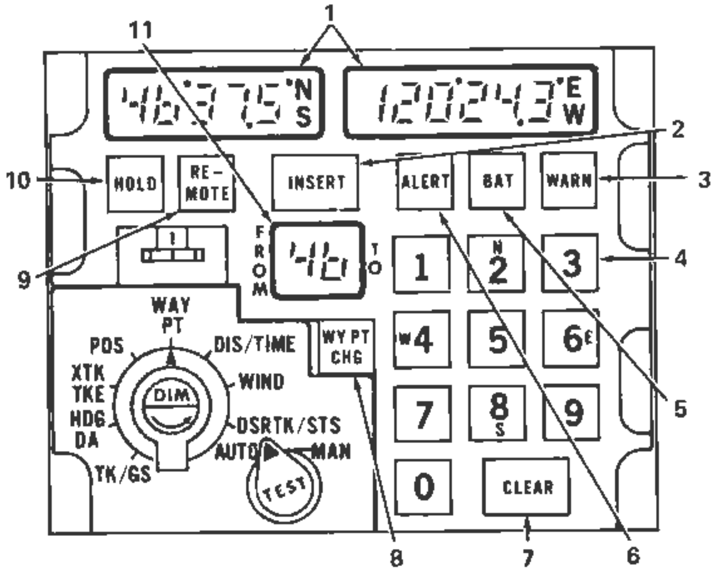
2C19, 21-INS CONT FAN

INS COOLING SWITCH

Provides control and indication of INS cooling fan in forward avionics compartment.

- OUT - Normal switch position. Automatic INS cooling provided.
- IN - Alternate switch position. Starts INS fan.
- LO FLO - Airflow in ventilation duct too low for normal cooling. Extinguished when duct airflow returns to normal.
- ON - INS fan automatically operating.

INS CONTROL DISPLAY UNIT (CDU)



CIRCUIT BREAKERS

1G6 - VG/INS-1 1E6 - INS PWR 1E7 - INS HTR	NO. 1 INS
1G24 - INS/VERT GYRO 1G25 - INS HTR	NO. 2 INS
1E24 - INS - 3/GYRO - 3 1E25 - INS - 3 HTR	NO. 3 INS

1. DATA WINDOWS

LEFT - Displays numerical data and latitude to 1/10 of a minute. Comprised of a five digit display plus symbols for decimal, left/right displacement and north/south latitude.

RIGHT - Displays numerical data and longitude to 1/10 of a minute. Comprised of a six digit display plus symbols for decimal, degrees, left/right displacement and east/west longitude.

2. INSERT SWITCH

When illuminated, indicates computer ready to accept data. Light will go out when data inserted in computer. Light stays on if data rejected.

3. WARN LIGHT

Red light will come on if out of tolerance condition exists in INS. If data selector is placed to STS (status), Action code display appears in right data window. Pressing TEST switch will reset WARN light if malfunction has cleared.

4. KEYBOARD SWITCHES

Switches insert numerical and directional data into computer. Type of data being loaded depends on position of data selector.

5. BATTERY LIGHT

Amber light indicates INS is using battery power.

6. ALERT LIGHT

Amber light indicates aircraft is within two minutes of waypoint. Goes out when INS switches to next navigation leg. If AUTO/MANUAL switch in MAN, light will flash indicating leg switching did not occur.

7. CLEAR SWITCH

Provides clearing of data which is typed on keyboard and appears in data windows or From/To window but has not been inserted.

8. WAYPOINT SEQUENCE CHANGE SWITCH

When pushed, illuminates to indicate system is ready to accept a waypoint sequence change in From/To window. Light will go out when a sequence change is inserted or when CLEAR is pressed.

9. REMOTE SWITCH

Amber light illuminates to indicate system ready to accept remotely loaded waypoint data. Also used with HOLD switch to freeze present position display. REMOTE must be selected on each INS to be loaded. Pressing REMOTE a second time will release remote function.

10. HOLD SWITCH

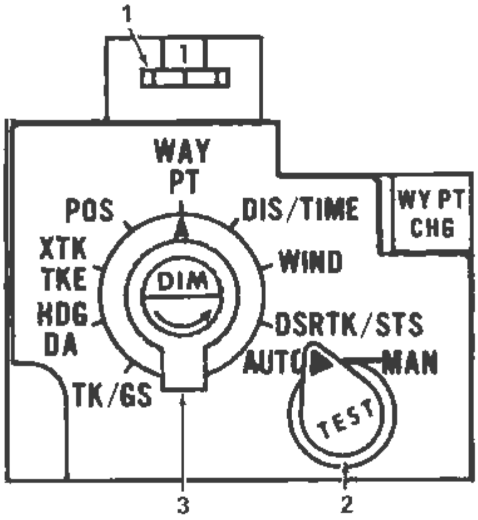
Freeze position display in data windows.

If REMOTE switch is engaged on all three INS, pressing HOLD will freeze present position display on all INS.

11. FROM/TO WINDOW

Displays waypoint sequence on which the navigation information is being computed.

INS DATA, WAYPOINT AND AUTO/MAN SELECTORS



1. WAYPOINT SELECTOR

Assigns a sequence number (1 to 9) to waypoints as they are loaded. Number indicates which waypoint will be displayed in data window if data selector is in WAYPT position.

2. AUTO/MANUAL SELECTOR

AUTO	- System will automatically sequence WAYPOINTS in numerical order: 1-2, 2-3, 8-9, 9-1, 1-2.
MAN	- Automatic leg switching won't occur. System continues to fly extension of leg shown in FROM-TO window.
TEST (WARN light off)	- Tests lights in mode selector and control display units. If NAV READY light is on, also tests HSI display and INS comparison lights.
TEST (WARN light on)	- Causes malfunction code to appear in right data window. If malfunction was transient, pressing TEST also resets WARN light.

3. DATA SELECTOR

Dim

Controls lights for data windows, annunciators and FROM/TO display.

Track/Ground Speed (TK/GS)

True track in tenths of degrees. Ground speed in knots.

Heading/Drift Angle (HDG-DA)

Heading - True heading in tenths of degrees.
Drift Angle - Angular difference between true heading and track in degrees left or right of heading.

Cross Track Distance/Track Angle Error (XTK-TKE)

Cross Track Distance - Lateral distance from desired track to present position in tenths of miles left or right of desired track.
Track Angle Error - Angular difference between desired track and actual track in degrees left or right of desired track.

Position (POS)

Displays present position of aircraft in latitude and longitude to tenths of minutes. Also used to load gate position for alignment.

Waypoint (WAYPT)

Displays coordinates of waypoint selected by waypoint selector.

Distance/Time (DIS/TIME)

Nautical miles from present position to next waypoint shown in FROM/TO window. Minutes from present position to next waypoint shown in FROM/TO window.

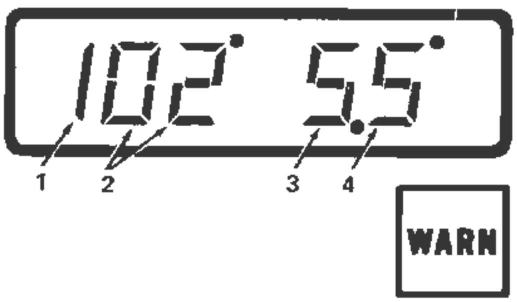
Wind (WIND)

True wind direction (in degrees) and velocity (in knots). Not valid if air data computer or TAS fails.

Desired Track/Status (DSRTK/STS)

Desired track from last waypoint to next waypoint inserted in FROM/TO window. System status and action codes displayed in right data window.

INS STATUS CODES



When the data selector switch is in DSTRK/STS position, the right data window will display codes to identify operational status, malfunctions and performance index.

1. Operating Mode

Code 0 = Computer not in NAV mode.
Code 1 = Computer in NAV mode.

2. Action and Malfunction Codes

When INS WARN light is on, these codes will indicate action to be taken. Pressing TEST switch will cause malfunction codes to be displayed. When all malfunction codes have been displayed, the second and third digits will again indicate an action code or go blank.

01 - INS failure that may damage equipment.
02 - Failure of NAV mode.
03 - INS NAV data to HSI and AP/FD system unreliable. CDU display is still valid, (does not illuminate WARN light).
04 - (Ground only) INS alignment unsatisfactory.
05 - (Ground only) INS alignment unsatisfactory.

3. ACTUAL PERFORMANCE INDEX

9 - Standby mode, INS warmup.
8 - Platform leveling, Attitude mode available.
7 - Coarse azimuth, Gate position must be inserted before fine alignment will start.
6 - Fine alignment.
5 - INS ready to navigate using stored correction factors from previous flight.
4 to 0 - INS starts recalibrating correction factors. As actual performance index gets lower, the system operates more on recalibrated correction factors and less on stored correction factors from previous flights.

4. DESIRED PERFORMANCE INDEX

5 - INS uses stored correction factors from previous flight.
4 to 0 - Correction factors are recalibrated during alignment. At turn on, INS will display 5. Lower index may be loaded if desired.

INS TEST AND ALIGNMENT

The aircraft must not be moved during INS alignment.

INS shall be realigned at flight origination and crew change stations.

The flight engineer will accomplish the following on all three INS sets after normal electrical bus power is available and master radio switches are pushed in:

Place INS mode selector to NAV.

Adjust CDU lights to desired brillance.

Rotate CDU data selector to POS.

Press test switch on CDU and observe the following: 8s appear in both data windows, all condition lights at CDU and INS mode selectors are illuminated and INS comparator (FINC) light comes on for the set being tested. Release test switch and observe that INSERT light only remains on.

Check data selector in POS and load gate latitude. Check left data window for correct latitude and INSERT.

Load gate longitude and check right data window for correct longitude and INSERT. Ensure that INSERT light goes out after latitude and longitude have both been loaded.

Place data selector to DSTRK/STS. Check that desired performance index 5 appears in right end of right data window; if not, press 5 key and INSERT. Index cannot be changed after alignment is complete.

INS ALIGNMENT COMPARISON AND INTERNAL CHECK

During INS alignment, the gate coordinates inserted into the three INS units are compared. A difference of more than .7 NM will cause a CDU WARN and FINC light to appear. This comparison will aid in detecting the insertion of the wrong present position coordinates.

Once aligned, INS compares the inserted alignment position with its memory of present position at shut down for the previous flight. If the difference between inserted position and memory position is less than 30 miles, INS computes corrections to reduce errors on the next flight. If the difference exceeds 30 miles, the INS WARN light appears.

INS CHECK AND WAYPOINT LOADING

The first officer will accomplish the following INS check and loading procedure after the MSU green READY NAV lights appear:

Check the INS mode selectors are in the NAV position with READY NAV lights on.

At each CDU check for correct alignment status and confirm correct geographic gate position has been loaded.

Place both RADIO/INS switches to INS.

Press test switch on CDU and observe the following: 8s appear in both data windows, all condition lights at CDU and INS mode selectors are illuminated and INS comparator (FINC) light comes on for the set being tested. Check the appropriate HSI for TRUE heading, course cursor and course window display for agreement. ALERT light on, 8s displayed on all HSI windows, and RNAV displayed. Release test switch.

Return both RADIO/INS switches to RADIO and check that MAG and VOR or ILS appears in HSI window.

Following receipt and confirmation of ATC clearance, and when appropriate, waypoints may be loaded using the following procedure

Press the remote switch on each CDU. Remote lights should be on.

On one CDU, rotate data selector switch to WAYPT.

Rotate waypoint selector wheel to first waypoint number.

Load latitude. Check left data display window to confirm that latitude is correct, then press INSERT.

Load longitude. Check right data display window to confirm that longitude is correct, then press INSERT

Move waypoint selector wheel to next number in sequence and repeat loading procedure for each waypoint in the flight plan.

All waypoints must be checked on a CDU other than the one on which they were loaded. This check is to be made by a crew member other than the one who loaded the waypoints.

When loading is complete, release the remote function by pressing the remote switch once again and note remote lights go out.

HSI DISPLAY - BEFORE TAKEOFF AND LANDING

It is necessary to have both RADIO/INS switches selected to RADIO. Check that MAG and VOR or ILS appear on HSIs.

INS INFLIGHT PROCEDURES

Prior to establishing INS navigation, an effort should be made to determine the most accurate INS system, preferably No. 1 or No. 2. Should a system be found to be considerably more accurate, that system should be selected as primary for navigation and used to navigate the aircraft utilizing the appropriate autopilot. The No. 3 INS cannot be coupled for autopilot operation, therefore, it should not be selected as primary except for MEL limitations.

INS navigation data and cross track error should be monitored by selecting both HSIs to INS using the RADIO/INS switch. Note that zero XTK error by itself is not a valid check of navigational accuracy since an error in waypoint loading will cause the aircraft to fly on course to the wrong coordinates.

The primary INS should routinely be selected to POS as a continuous check of present position versus flight plan. A periodic check of XTK/TKE and DIS/TIME should be made to confirm navigational accuracy.

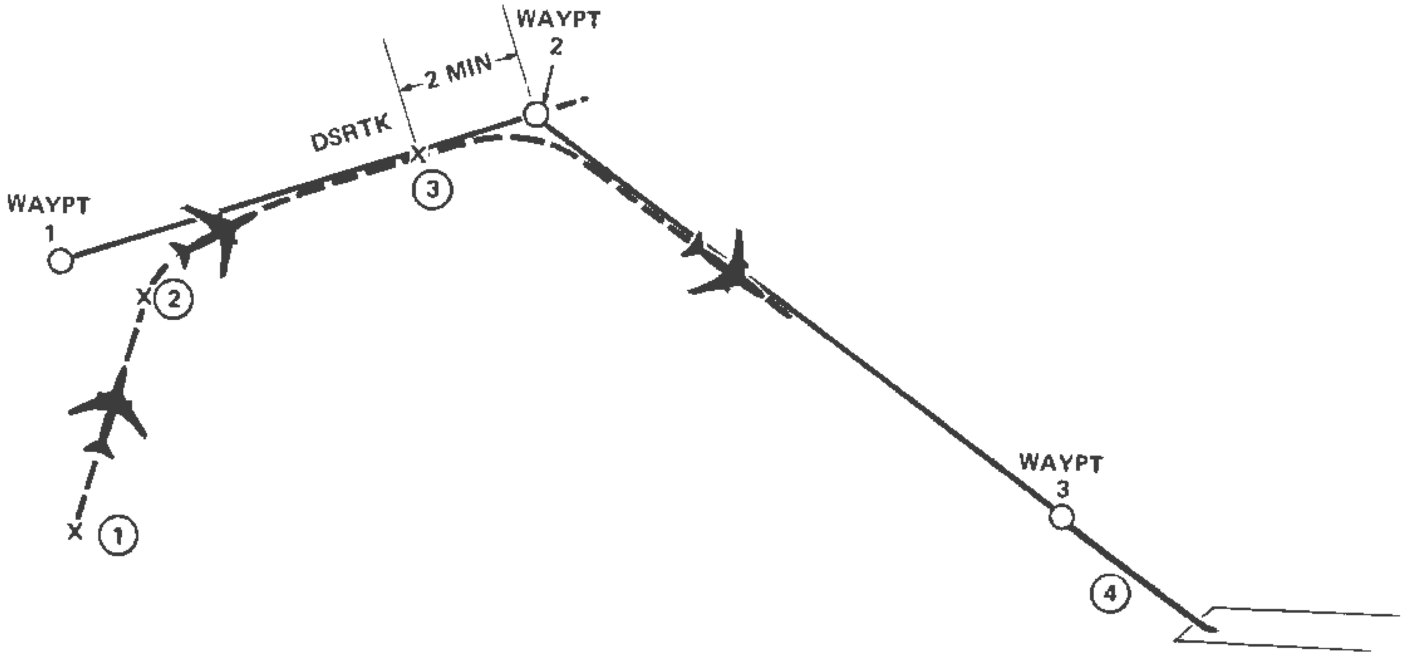
The secondary INS should routinely be selected to DIS/TIME. TIME can be used to monitor the ETA for the next waypoint and a discrepancy between current ETA and flight plan ETA would point out a possible error in the loaded waypoint or in the flight plan. A periodic comparison of XTK/TKE will provide a gross error check of the primary INS.

The No. 3 INS should routinely be selected to WIND. Wind along with temperature can be helpful in anticipating possible turbulence. Wind should be logged at the intermediate 5° meridian for inclusion in the next position report. A periodic comparison of DIS/TIME will provide a gross error check of the secondary INS.

Approaching a waypoint change, it is essential that both pilots recheck the coordinates for the next waypoint to be used. This confirmation of correct coordinates will be made at or just prior to the alert light coming on. It will be made in both the primary and secondary INS to preclude a navigational error induced by incorrect waypoint loading.

A continuous cross check between INSs to compare XTK/TKE, POS, WAYPT and DIS/TIME will further insure navigational accuracy and prevent undetected navigational excursions.

AUTOPILOT/FLIGHT DIRECTOR INS PROCEDURES



① VECTORING

- .Select A or B AP to CMD, turn FD on.
- .Select HDG mode with desired heading set in window or use control wheel steering.
- .Select any pitch mode, or use control wheel steering.

② INS APFD ENGAGEMENT

- .Select either or both RADIO/INS switch(es) to INS. TRUE and RNAV will appear on HSI.
- .Select any VOR frequency in both VHF NAV control panels.
- .Check for proper INS desired track in HSI course window.
- .Select NAV mode. RNAV annunciators appear on AFCS Mode panels. HDG mode will disengage if selected. If NAV mode was engaged for VOR tracking, it must be released and selected again.

③ ALERT LIGHT

- .Appears on HSI when within 2 minutes of next waypoint if RNAV displayed. If course change required, it will take place prior to reaching waypoint with CDU switch in AUTO.

④ APFD VOR/ILS AT DESTINATION

- .Release NAV mode.
- .Select both RADIO/INS switches to RADIO.
- .Tune radio(s) to desired ILS or VOR frequency.
- .Reengage NAV or desired navigation or approach mode (A/L, APR, LOC) and resume normal APFD operation.

AIRWAYS OPERATION

These procedures may also be used when operating on airways with the following exceptions:

Radio is the primary navigation reference and the RADIO/INS switches must be selected to RADIO. Both HSIs will display MAG heading and provide radio navigation information to monitor airway operation.

The INSs should be selected to XTK/TKE, DIST/TIME, and WIND.

The autopilot/flight directors may be operated coupled to INS or VOR.

TRANSITIONING TO INS NAVIGATION

Approaching the radio aid that defines the beginning of inertial navigation:

Accomplish a gross error check by comparing present position and crosscheck data on each INS with the radio navigation data. REMOTE and HOLD can be used to compare all three INSs.

Recheck the coordinates of the two waypoints that define the first leg.

RADIO/INS switch to INS. The HSI will now display INS data and TRUE heading.

TO CHANGE SEQUENCE OF WAYPOINTS OR BYPASS A WAYPOINT

Example: Bypass waypoint 3, go direct from waypoint 2 to waypoint 4.

Recheck waypoint 4 coordinates.

When ALERT light illuminates prior to reaching waypoint 2, press WYPT CHG switch.

Type desired waypoints on key board (2-4).

Check that FROM-TO window shows desired sequence (2-4) then INSERT. The INS will automatically switch to leg 2-4.

COURSE CHANGE BETWEEN WAYPOINTS

Example: While on leg 2-3, proceed from present position direct to waypoint 4.

Recheck waypoint 4 coordinates.

Press WYPT CHG switch.

Type new sequence in FROM-TO window (0-4) and INSERT.

The INS will display navigation information from present position direct to waypoint 4.

DISTANCE/TIME CHECK TO OUT-OF-SEQUENCE WAYPOINT

Example: While flying leg 2-3, check distance and time from waypoint 3 to waypoint 7.

Data selector to DIS/TIME.

Press WYPT CHG switch and load 3-7 in FROM-TO window. Do not insert.

The left data window will display total distance from waypoint 3 to waypoint 7, the right data window will display time from waypoint 3 to waypoint 7 based on present ground speed.

To return to normal operation, press CLEAR switch and FROM-TO window will return to leg 2-3.

The INS will navigate on the inserted leg (2-3), while displaying distance and time for another leg (3-7) as long as the INSERT is not pressed.

DISTANCE ABEAM CHECK

Example: While flying airways you are cleared direct present position to a distant VOR (waypoint 6) and all three inertials have 0-6 inserted in their INS have 0-6 inserted in their FROM-TO windows. Later ATC asks "How far abeam an intermediate VOR the aircraft will pass."

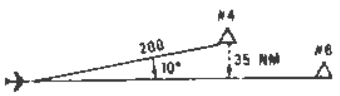
Use No. 3 INS to solve the problem.

Enter the intermediate VOR as a waypoint. (waypoint 4).

Press WYPT CHG and load present position to waypoint 4 (0-4) in the FROM-TO window then INSERT.

Select DIS/TIME and note the distance. (200 nm).

Using the wind side of the Jeppesen computer, put distance over TAS index and read over TKE to find distance abeam the VOR.



INS DIVERSION PROCEDURE

If an inflight diversion, other than the normal flight plan change, becomes necessary:

Data select switch to WAYPT.

Waypoint selector to a number following the one shown in the FROM-TO window.

Load and INSERT the coordinates of the diversion point.

Using the WYPT CHG switch, load and insert the new leg (waypt "0" to the diversion waypoint) in the FROM-TO window.

The autopilot will immediately capture the new desired track to the diversion point.

TO RETURN TO RADIO NAVIGATION

Tune the VOR to the arriving landfall radio aid.

Select the inbound course with the course select knob.

Once positive identification of the radio aid is established, place the RADIO/INS switch to RADIO.

Corrective action should be taken immediately to establish the aircraft on the proper inbound radial so as to arrive directly over the fix and on the proper course.

RESTARTING INS IN FLIGHT

If an INS is turned off in flight, the navigation function is lost until realigned back on the ground.

INS can be restarted in flight however, to supply attitude data. To do this, place the mode selector to ATT. The INS platform will cage to the air frame, temperature will be brought to the proper level, and gyros will spin up to proper speed. When attitude data is available, the ATT flag will go out of view on the ADI.

INS OPERATION AFTER LANDING

When parked, place all CDU selectors to POS and record the existing latitude and longitude in the aircraft log.

If an action code was displayed during the previous flight, make the appropriate writeup in the aircraft log.

At intermediate stations where no crew change occurs, leave all mode selectors in NAV.

At flight termination or off line stations where no TWA maintenance is available, leave all mode selectors in OFF.

If necessary to shut down INS electrical power for any reason, place INS mode selectors to OFF to prevent unnecessary INS battery depletion.

1011-100 INS LOGBOOK DATA

The engineer will enter INS departure turn on time and arrival present position in the MALFUNCTION section of the logbook. Previous INS malfunctions, including Action and Malfunction code numbers will also be entered.

The following example illustrates how to enter INS position and on time data:

ITEM	MALFUNCTION			WORK PERFORMED, STATION, DATE MECHANIC MAKING CORRECTION
	FIRM CODE:	1	Note:	COR
	INS No. 1 -N51°28.2' W 27.6'			
	INS No. 2 -N51°28.8' W 27.1'			
	INS No. 3 -N51°28.4' W 27.9'			
	On time-1630Z			
				MOC-T TAG F/I USED ☐ YES ☐ N

INS ADDITIONAL PROCEDURES

CDU WARN LIGHT ON

1. Select DSRTK/STS. Action and malfunction codes will appear in second and third digits of right hand CDU window.

2. Press and release TEST switch to cause all malfunction codes to appear.

3. If WARN light goes out, leave affected INS in NAV mode but select another INS for primary navigation reference.

4. If warn light remains on and action code reappears enter action and malfunction codes in the logbook and refer to the following for corrective action:

   Code 01 - Turn INS off.
   Code 02 - If INS FINC light on, select ATT. Select APFD-B with No. 1 FINC light. Select APFD-A with No. 2 FINC light.
   If INS FINC light not on, leave affected INS in NAV mode, but select another INS for primary navigation. Since the WARN light cannot be cleared, STS position must be monitored. If another problem develops that could damage INS, 02 will change to 01.
   Code 03 - Check for unreliable signals to HSI and APFD. Select HSI and APFD to unaffected INS.
   Code 04 - (Ground only) Select STBY, then NAV to re-align INS. After inserting present position, select STS. Press and release TEST until all codes clear and WARN light goes out.
   Code 05 - (Ground only) Select OFF, then NAV to realign INS.

5. If an INS is selected to ATT or OFF because of an inflight malfunction:

   Compare present position readout on remaining INS CDUs. If they agree, select either INS as primary navigation reference.

   If any significant difference exists between the remaining INS units: Use other APFD. Place data selectors to XTK/TKE. Maintain equal cross track distance between the remaining two sets. This will average out the difference between the INS units.

HSI HDG/NAV FLAG(S) WITH RNAV DISPLAYED

1. Select alternate RNAV switch.

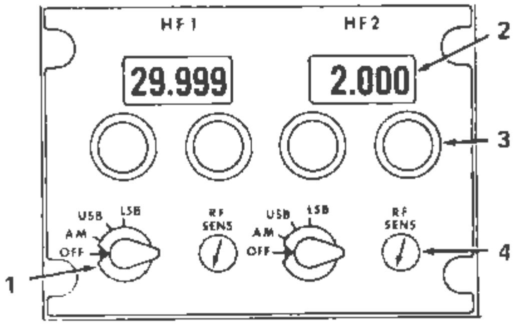
2. Engage unaffected autopilot/flight director as required.

INS LO FLO LIGHT

1. Check that ON light also appears on INS cooling switch.

2. If ON light does not appear, press switch in to manually operate INS cooling fan.

HF COMM RADIOS



CIRCUIT BREAKERS

1C1, 3-HF No. 1 DC, AC
1C19, 21-HF No. 2 DC, AC

1 MODE SELECTOR

OFF - HF off.
AM - Amplitude modulation in 2 to 30 MHz frequency range.
USB - Upper side band. Normally used because it is more effective for long range communication. Transmitting and receiving station must be in same mode.
LSB - Lower side band.

2 FREQUENCY WINDOW

3 FREQUENCY SELECTORS

May be selected from 2,000 to 29.999 MHz in one KHz steps. Transceiver capability 2.800 to 26.999 MHz.

4 RF SENS CONTROL

Controls squelch or receiver sensitivity for best signal noise level.

HF RADIO ADDITIONAL PROCEDURES

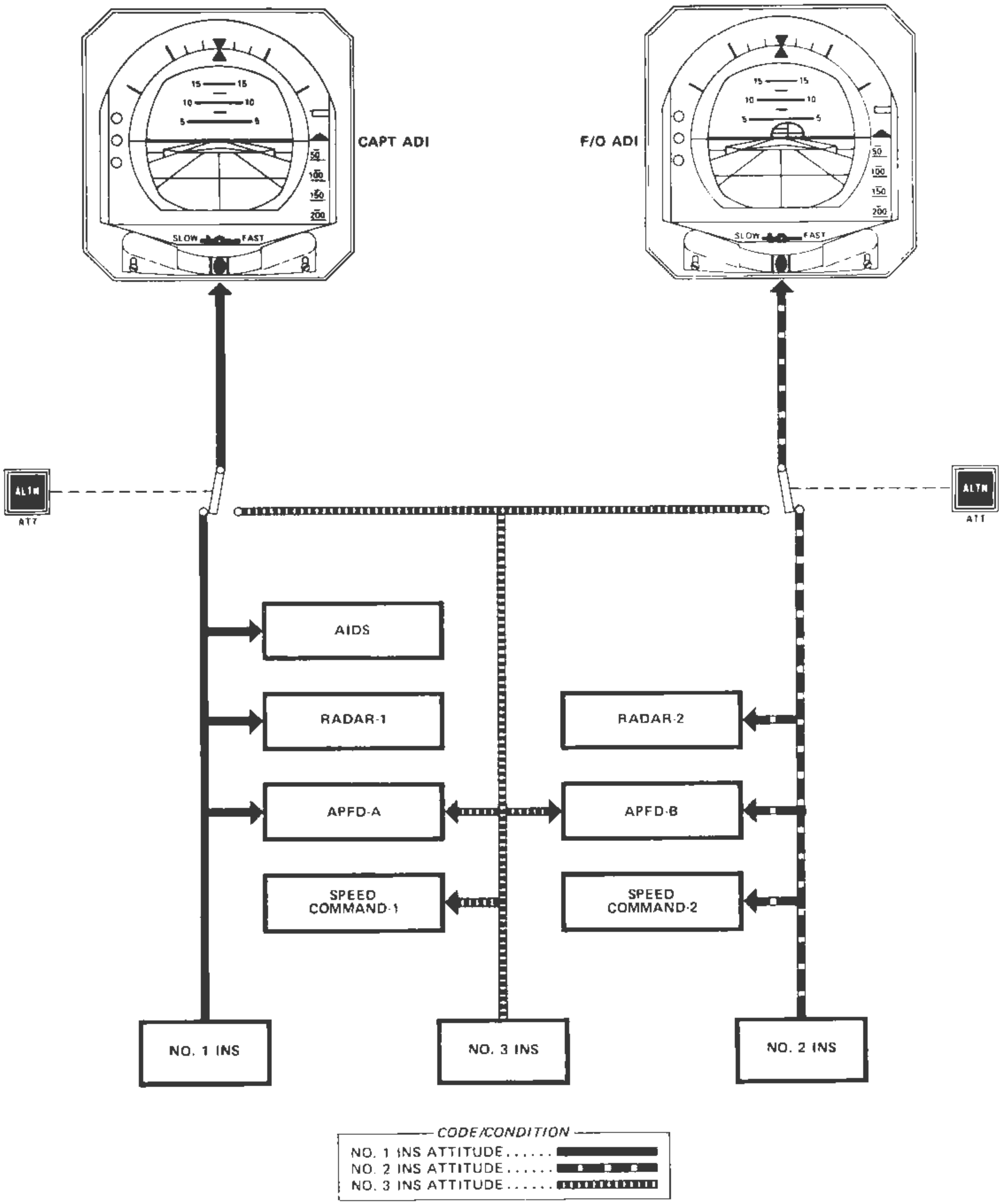
HF TRANSMITTING/RECEIVING DIFFICULTY

If difficulties are encountered either in transmitting or receiving HF communications, it may be the result of the HF coupler interlock malfunctioning. Pull and reset DC and AC circuit breakers, 1C1, 3 and 1C19, 21.

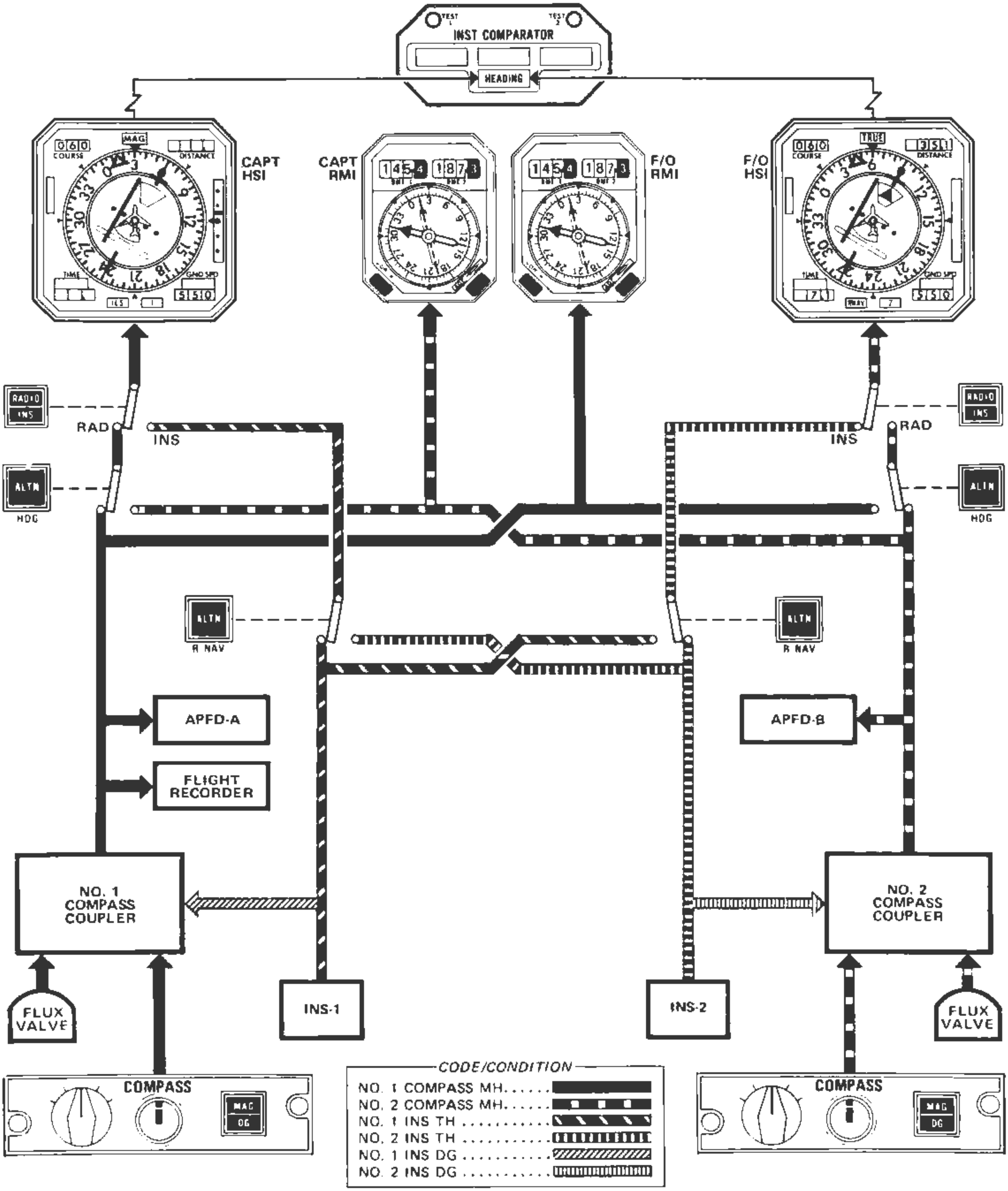
GEOGRAPHIC GATE POSITIONS FOR INS ALIGNMENT

AIRPORT	ICAO IDENT	IATA IDENT	GATES	LATITUDE	LONGITUDE
Bangor	KBGR	BGR		N44°48.0'	W 68°49.0'
Boston	KBOS	BOS	DOM	N42°22.4'	W 71°01.3'
Boston	KBOS	BOS	INTL	N42°22.1'	W 71°00.9'
Dublin	EIDW	DUB		N53°25.7'	W 6°14.8'
Frankfurt	EDDF	FRA	TWA	N50°02.9'	E 8°35.1'
Frankfurt	EDDF	FRA	NEW	N50°02.9'	E 8°34.5'
Gander	CYQX	YQX		N48°56.8'	W 54°34.5'
Gatwick	EGKK	GWK		N51°09.3'	W 0°09.8'
Goose Bay	CYYR	YYR		N53°19.3'	W 60°24.8'
Halifax	CYHZ	YHZ		N44°53.2'	W 63°30.9'
Keflavik	BIKF	KEF	5	N63°58.2'	W 22°35.8'
London	EGLL	LHR		N51°28.2'	W 27.6'
Manchester	EGCC	MAN		N53°21.5'	W 2°16.3'
Montreal	CYUL	YUL		N45°27.3'	W 73°45.1'
Newark	KEWR	EWR	TWA	N40°42.3'	W 74°09.9'
New York	KJFK	JFK	TWA	N40°38.7'	W 73°46.6'
New York	KJFK	JFK	Hgr 12	N40°38.9'	W 73°48.5'
Paris	LFPG	CDG		N49°00.9'	E 2°32.7'
Paris	LFPO	ORY		N48°43.6'	E 2°21.8'
Paris	LFPB	LBG		N48°57.0'	E 2°26.0'
Philadelphia	KPHL	PHL	TWA	N39°52.5'	W 75°14.6'
Prestwick	EGPK	PWK	1-8	N55°30.7'	W 4°36.4'
Shannon	EINN	SNN	TWA	N52°41.6'	W 8°55.2'
Toronto	CYYZ	YYZ		N43°41.0'	W 79°37.3'
Windsor Locks	KBDL	BDL	TWA	N41°56.1'	W 72°41.1'

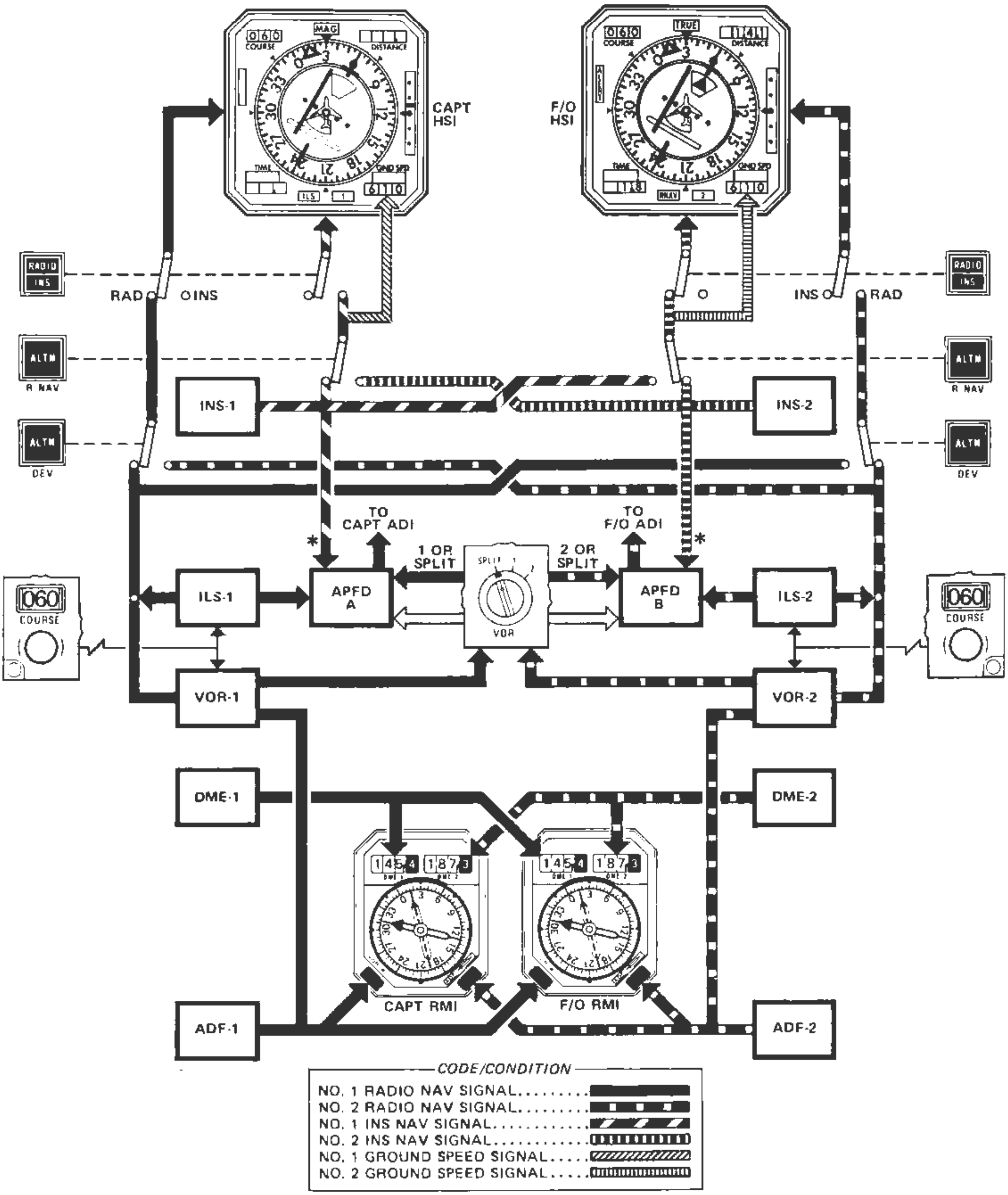
INS ATTITUDE SYSTEM



INS/COMPASS SIGNALS



INS/RADIO NAVIGATION SIGNALS



* IF APFD IN NAV MODE AND HSI INITIALLY SELECTED TO INS.

TO: All 1011 Flight Crew Members

FILE: Bulletin Section
1011 Flight Handbook

1011 TAIL STRIKES

We have recently experienced several incidents of tail strikes occurring during takeoff or landing. Since most occurrences of this type are avoidable through the use of good operating technique and knowledge of the relation between aircraft body attitude and tail or fuselage contact, we have prepared a review of these factors. Although the cost of repairing aircraft damage following a strike is important, the need to operate our flights with a greater margin of safety is of primary concern. This bulletin will review takeoff and landing techniques relative to their effect on tail strike potential and will show the relationship between pitch attitude and possible runway contact upon landing.

Takeoff

Start a smooth rotation at V_r and continue this action through liftoff until the airspeed stabilizes at V_2 + 10 knots or a maximum pitch angle of 17 degrees is attained. Early or abnormally fast rotation can cause the tail skid to strike the runway before liftoff, as well as adversely affect takeoff performance.

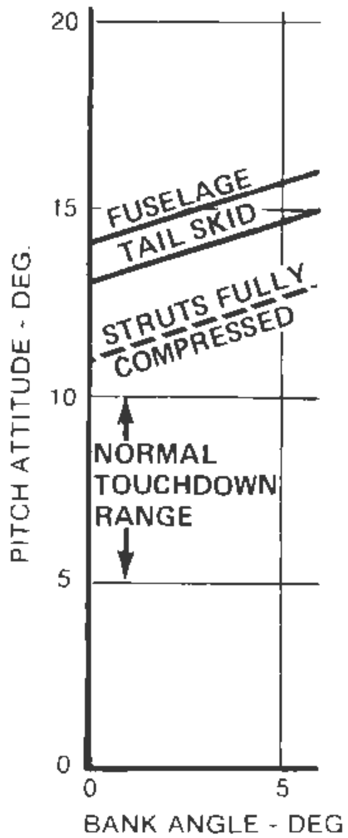
Landing

Proper airspeed and approach path control are essential to a successful approach and landing. If any significant departure from the normal approach path occurs below 500 feet and corrective action is not immediately successful, go around.

Pitch Attitude For Landing

The normal pitch attitude on final approach in landing configuration is approximately 7 degrees, based on a 3 degree glide path. The landing flare requires only a slight pitch change from normal approach attitude. Initiate flare and start closing the throttles at approximately 30 feet. By holding back pressure to maintain flare attitude, touchdown should occur just as the throttles reach the closed position.

The following illustration shows pitch attitude at touchdown relative to tail skid and fuselage ground contact. Notice that bank angle improves the tail strike margin slightly. An approach in a 30 knot crosswind, however, only requires approximately 4½ degrees of bank so the improvement is not of major significance.



The preceding illustration shows that the tail skid will strike the runway at approximately 12-13 degrees of pitch with the struts fully extended. However, with the struts fully compressed this pitch attitude is decreased to 11 degrees or less. If the flare is accomplished too high and the aircraft is held off in an effort to achieve a smoother landing, the increased pitch attitude may cause the tail skid to contact the runway. If holding off results in dropping onto the runway, the combination of fully compressed struts and high pitch attitude may cause both the tail skid and the fuselage to strike the runway.

Richard J. Kenny

Richard J. Kenny
Staff Vice President
Flight Operations Training

TWA Flight Operations Training BULLETIN 78-3

TO: All 1011 Flight Crew Members and Flight Dispatch Officers

FILE: Bulletin Section 1011 Flight Handbook

1011-100 DIFFERENCES

CHAPTER 2 - DITCHING PROCEDURES AND SLIDE/RAFT INFORMATION

Attached is Chapter 2 of "Lockheed 1011-100 Differences" which introduces safety equipment changes and details 1011 ditching procedures. As explained in Flight Operations Training Bulletin 78-1, this is the second of four bulletins on the subject of 1011-100 Differences.

This material should be studied and then retained in the bulletin section of your flight handbook until it is incorporated permanently in the handbook. An updated cover sheet is provided with this bulletin which replaces the one issued with Bulletin 78-2 dated January 16, 1978.

Richard J. Kenny

Richard J. Kenny
Staff Vice President
Flight Operations Training

March 1, 1978

LOCKHEED 1011 - 100 DIFFERENCES

This document has been developed for use by 1011 flight crew members and flight dispatch officers and provides specific information on aircraft system modifications and procedures for 1011 - 100 operations.

CONTENTS

* * *

CHAPTER 2

DITCHING PROCEDURES AND SLIDE/RAFT INFORMATION

The 1011 international configured aircraft features two major differences in safety equipment; life vests are provided for all passengers and the evacuation slide converts into a life raft. Thus, it is referred to as a slide/raft which is deployed and available immediately upon door opening as either a slide or a raft.

This bulletin will review:

- Ditching area evaluation.
- Ditching techniques.
- Flotation characteristics.
- Slide/raft description, deployment, sea worthiness, sea survival, and signaling.
- Crew ditching duties.

DITCHING AREA EVALUATION

EVALUATING THE DITCHING HEADING

In order to select a proper ditching heading, a basic knowledge of sea evaluation and other factors involved is required. The problems during ditching are rapid deceleration, potential hull damage, and injury to passengers and crew. These can be minimized by selecting the optimum ditching heading.

When unable to obtain sufficient information in determining a ditching heading, best observation of the surface conditions can be made at an altitude of 2,000 feet. Lower altitude observations appear quite different and should be disregarded.

SWELLS

Generally speaking, the ditch heading will be parallel to the swell. The individual swells appear to be regular and smooth, with considerable distance between the rounded crests. Local winds have little effect on the system. Therefore, do not use swell direction to determine surface wind direction.

WAVES (OR CHOP)

This condition of the surface is caused by local winds and is characterized by surface irregularity, short distance between crests and whitecaps.

WIND CONSIDERATIONS

Wind, unless of high velocity, is a secondary consideration in establishing the run-out heading. Some crosswind will usually exist and must be accepted in order to parallel the major swell.

These general rules will serve to guide the heading selection:

Wind 0-20 knots.
Ignore the wind and parallel the major swell. Of the two possible headings select the one which has the greatest headwind component.

Wind 20-45 knots.
Angle into the wind but avoid a heading that is more than 45° to the swell.

Wind 45 knots and above.
Wind of this force makes it necessary to consider a direct heading into the wind. The swell direction will usually be the same as the wind direction. Extreme surface turbulence and spray tend to obscure the surface and swell. Even in this situation, if swell configurations can be established, it is usually better to approach at an angle to the swell face and accept crosswind wind effect.

ESTIMATING WIND VELOCITY AND DIRECTION

Wind direction and velocity can be estimated with reasonable accuracy by observing the breaking action of wave crests. Breaking mist will fall downward in the same direction as the wave movement. The wave will overrun the spindrift streaks and produce the illusion that the streaks are sliding upwind. This apparent movement will always point, like a weather vane, to the direction from which the wind is blowing.

The appearance of whitecap and streak activity permits velocity estimates:

Calm to 10 knots.
Scattered ripples and wavelets. Whitecaps few and scattered.

10-20 knots.
Many small waves with frequent whitecaps. Extensive white foam.

20-45 knots.
Moderate high waves. Dense white water. Well defined streaks.

45 knots and above.
High rolling waves of obviously violent nature. Surface covered by dense streaks of spindrift.

DITCHING TECHNIQUES

APPROACH AND TOUCHDOWN

If possible, obtain area altimeter setting, surface conditions, and recommended ditch heading from AMVER (Automated Mutual Assistance Vessel Rescue System) via ATC.

Dump fuel to minimum.

Descend to 2,000 feet, observe swell and wind conditions. Make final confirmation of ditch heading and start descent.

Water landings require substantially different techniques than runway landings for the following reasons:

Depth perception over water is very unreliable.

Undulating water surface makes low altitude judgment difficult.

High nose attitude in stall causes low tail position which drags first and throws center section downward with great vertical force.

Therefore, the following procedures must be strictly adhered to during a water landing. When an altitude of 1000 feet is reached:

Pull aural warning CB (IL8) and ground proximity computer AC CB (1B20). Leave gear up. Lower flaps to 33°. Trim to the touchdown attitude, and maintain a speed of bug + 5 knots and a sink rate of 200 FPM or less.

Proper sink rate and attitude are critical to the ditching result. Make every effort to maintain the sink rate of 200 feet per minute or less to the point of touchdown. With this fly-on method, a flare is neither necessary nor desirable.

With one or more engines inoperative, it may be necessary to use partial flaps in order to maintain a sink rate no greater than 200 feet per minute. This would be accomplished by using a flap versus speed ratio that would provide the maximum flap extension permitted by the available power. Speed should be maintained to at least minimum for the degree of flap used.

The proper touchdown spot is on the face of the swell, just downslope of the crest. The tendency to make a spot landing may induce a desire to flare and reduce power. This type of landing would be very difficult to achieve due to the unreliable depth perception and constantly changing surface height. It is most important to maintain this attitude until touchdown.

FLOTATION ATTITUDE

Tests show that when ditching the 1011, the wing engines, flaps, and horizontal stabilizer will be severely damaged and could separate during touchdown. With only this damage, all door sills will be above water. Doors number one will be a maximum of six feet above the waterline and doors number four will be approximately one and one half feet above the waterline.

Additional impact damage could change the floating attitude. Center engine separation is possible and, if it occurs, will raise the number four doors approximately one half foot. A CG aft of 26% MAC and combined with flooding of the lower compartments could place the number four doors below the water level.

LIFE VESTS

Crew life vests remain in their present position near the crew seats.

An adult life vest is located in a pouch under each passenger seat. The pouch can be opened by pulling on the red tab which releases a snap fastener.

Eighteen children life vests and five spare adult life vests are also provided. They are located as follows:

First class coat compartment - Six children and two adults.
R-2 door flight attendant seat - Six children.
R-3 door flight attendant seat - Six children and three adults.

SLIDE/RAFT DEPLOYMENT

The slide/raft is deployed in the same manner as the slide on the domestic aircraft. To operate the slide/raft in the water:

1 Check that the water level is below the door sill.

2. Check that the evacuation slide lever is in the ENGAGE position.

3. Remove plastic cover, stand back from door, and pull down on the red emergency door "T" handle.

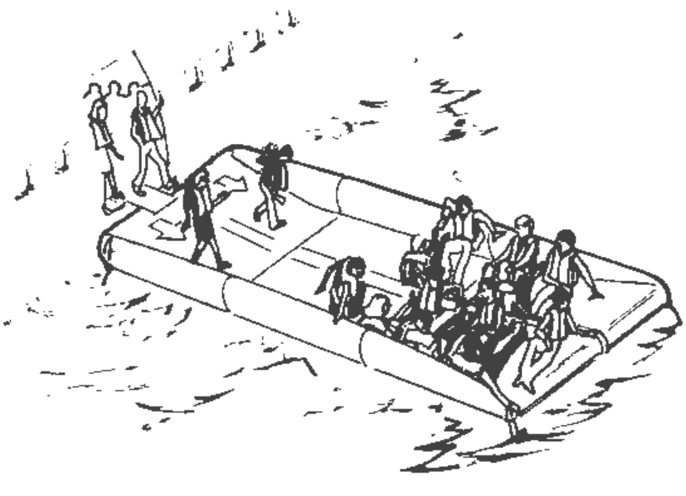
   If the slide/raft fails to inflate automatically, pull the red manual inflation handle located on the slide girt.

Shoes and sharp objects should be removed prior to boarding the slide/raft.

If practical, remove first aid kits and blankets from the aircraft and take them into the raft.

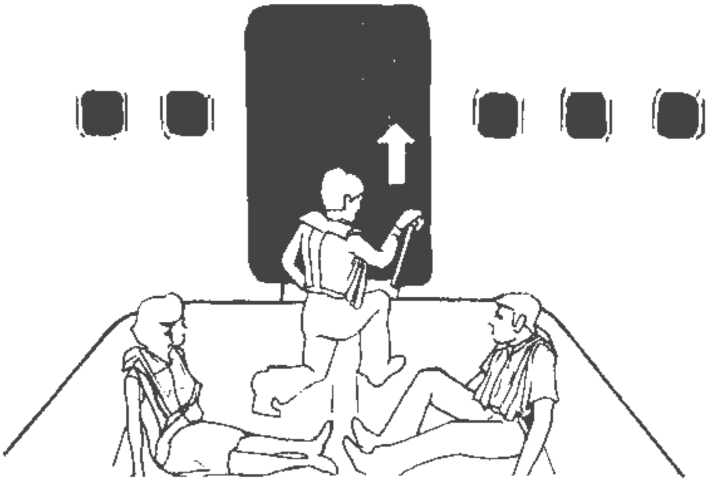
Life vests should be inflated just before leaving the aircraft.

Load passengers directly into the slide/raft. Direct them to move left and right alternately and towards the end of the slide/raft.



It is standard practice to board one crew member in each raft to take command and activate the raft emergency equipment.

Once loaded, disconnect the slide/raft from the door sill by pulling the separation handle located under the Velcro flap on top of the girt.



A mooring line will keep the slide/raft within 25 feet of the aircraft. It is the same type mooring line that is on 25-man rafts and aircraft slides that have mooring lines. The mooring line may be released by pulling the pin on the quick disconnect located on the mooring line approximately one foot from the raft. The mooring line will also separate automatically when a stress is placed on the frangible disconnect, should the aircraft start to sink before it is disconnected.

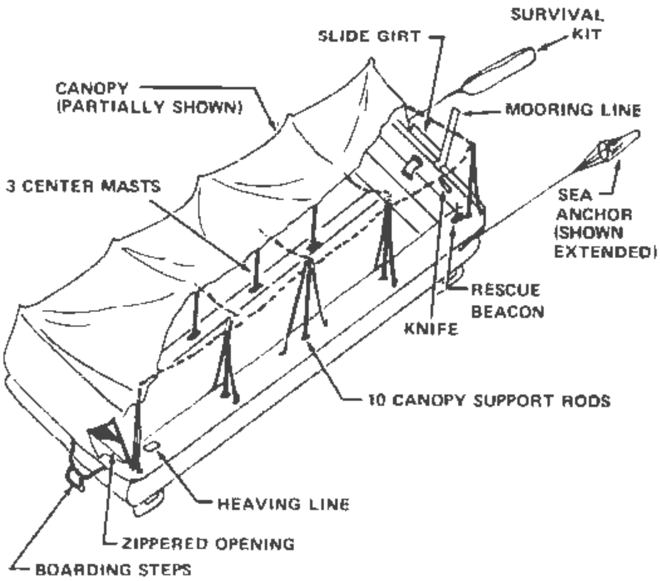
SLIDE/RAFT DESCRIPTION

Slide/rafts at doors one, two and three each have a normal capacity of 51 people. Number four door slide/rafts have a normal capacity of 30. All the slide/rafts are designed to accomodate a 25% overload.

Slide/rafts are equipped with a boarding ladder, heaving line, canopy, rescue beacon, sea anchor, and survival kit.

The survival kit is packed with the raft and attached by a line at the girt end of the raft. After raft deployment it must be retrieved from the water. The kit contains a raft instruction book, first aid kit, bailing bucket, sponge, hand pump, de-salting kit, whistle, flashlight, flare, sea dye marker, VHF transceiver, canopy, ten canopy support rods, three canopy center support masts, three center mast pads, and the standard raft repair clamp.

SLIDE/RAFT



A knife is stowed in a pocket on top of the raft tube near the mooring line attachment.

A slide/raft that is upside down is extremely difficult to turn right side up. It is usable upside down but the canopy cannot be installed. However, the canopy could be used by spreading it across the top like a blanket and held by the occupants.

SLIDE/RAFT SEAWORTHINESS

To make the raft seaworthy:

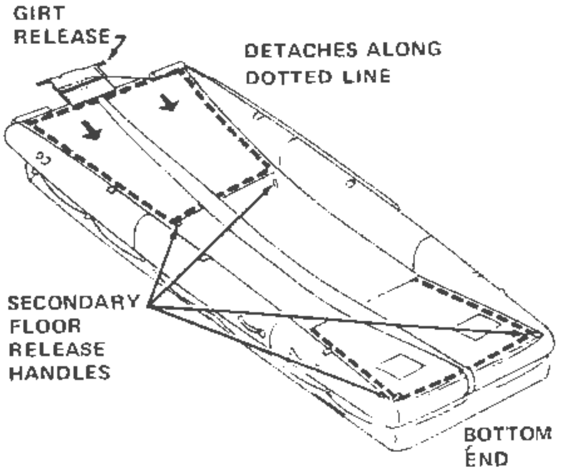
1. Lower secondary floor.

2. Check distribution of passengers.

3. Deploy sea anchor.

4. Check inflation.

Slide/rafts have a secondary floor on each end, which is used in the evacuation slide mode. This secondary floor must be lowered to provide full seating capacity and to permit secure seating down inside the raft. Passengers do not have to be moved to lower the floor. It may be lowered either with or without people sitting on the floor.



To lower the secondary floor, pull the four red release handles which remove the release pins. Lift the edges of the secondary floor that are secured with Velcro tape, and the secondary floor will drop into the bottom of the raft.

Check distribution of passengers by having them evenly spaced about the raft. Occupants should sit double-rowed with their backs to the outer raft tube and in the center of the raft with their backs to the center and their legs extended toward the outer raft tube. Keep low and move about only on hands and knees. The raft commander should sit at the sea anchor corner of the raft.

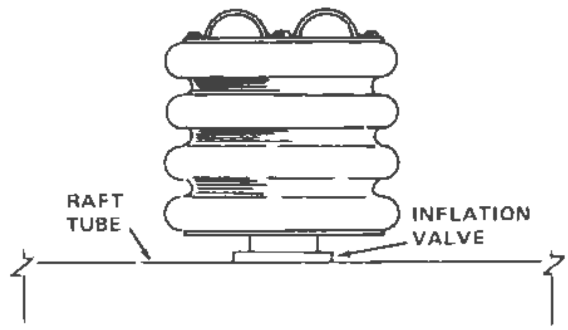
The sea anchor must be manually deployed. It is released from a snap pocket located between the outer two raft tubes at the girt corner of the raft.

Raft inflation should be checked periodically. The raft tubes should be firm, but not drum tight. If more air is needed, two inflation valves (one for each upper and lower tube) are located at the sea anchor corner of the raft. A bellows-type hand pump is provided in the survival kit.

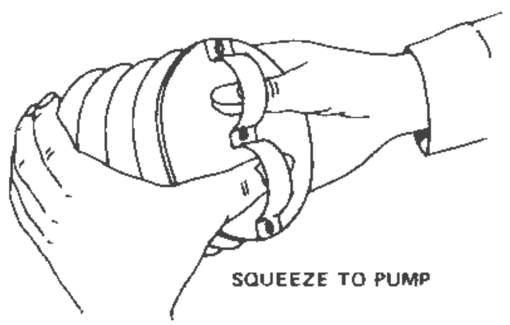
To use the bellows type hand pump:

1. Screw the pump fitting clockwise, in the direction of the arrow, into the inflation valve until the valve comes to a stop. At this point, the hand pump is attached and the inflation valve is automatically opened

HAND OPERATED AIR PUMP



2. Operate the pump by squeezing the bellows until the desired pressure has been added.



3. Close the valve by unscrewing the pump fitting until it disengages. Ensure the inflation valve is closed finger tight.

SLIDE/RAFT SURVIVAL

A most important aspect in survival is mental attitude; the will to live. Next is your equipment and how to use it.

You should keep all unused equipment in the survival kit. Inventory and be able to obtain required items immediately.

One of the greatest survival problems is exposure to the elements.

The basic procedural steps for raft survival are:

Reduce exposure from the elements.
- Retrieve passengers from the water.
- Erect the canopy.
- Bail out the raft.
- Wring out wet clothing.
- Huddle together for warmth.

Provide water to drink.
- Use the de-salting kit.
- Catch rain water.

To aid in getting people from the water and into the raft, the heaving line and boarding steps are located at the opposite end from the sea anchor. The heaving line can also be used to tie the rafts together. A tie point is located at the girt end of the slide/raft.

THE CANOPY

The canopy, ten side support rods, three center support masts, and three center mast pads are located in the survival kit. Slide/rafts at doors one, two, and four are rectangular in shape. The canopies are also rectangular in shape and either end of the canopy will fit at either end of the slide/raft.

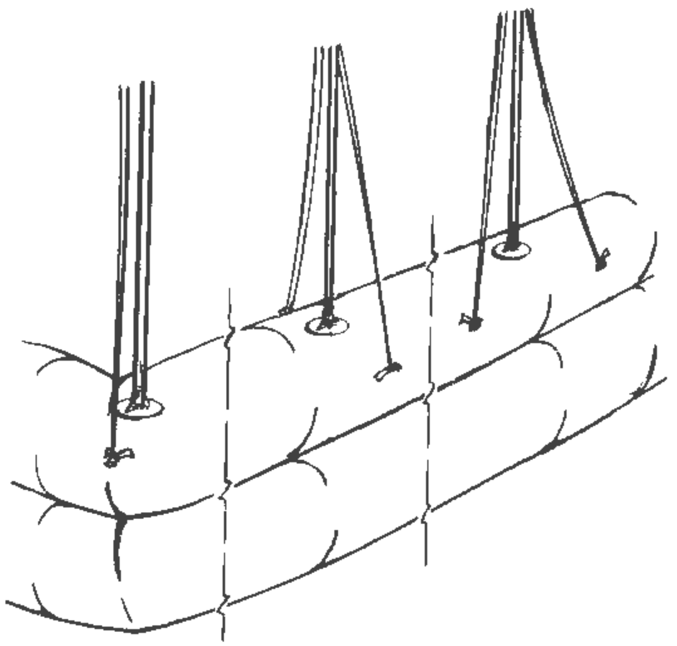
Door three slide/rafts and their canopies are angled at the girt end. This requires that the angled end of the canopy be installed at the angled end of the slide/raft. A wide white stripe is painted on both the raft tube and the canopy at the girt end near the sea anchor. When beginning the canopy installation on these rafts, first align the two white stripes to ensure correct positioning.

To install the canopy:

1. Insert and tie the ten canopy support rods into the sockets provided around the outer raft tube. Tie the string attached to the lower part of the rods into the holes provided in the raft sockets.

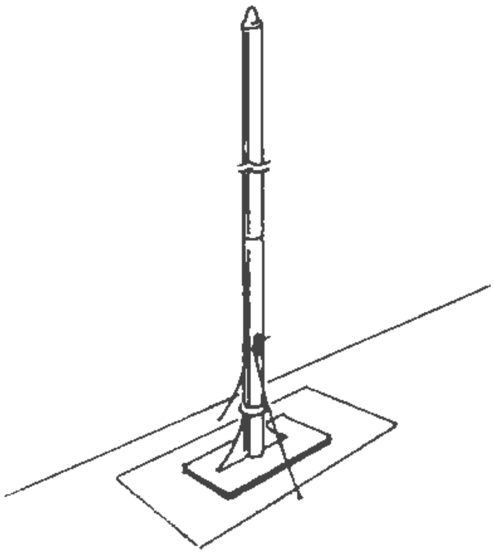
2. Attach the canopy to the upwind end (sea anchor end) first. On number three door slide/rafts, first align the white stripes. Attach the canopy to the rods by aligning the canopy grommets (metal openings) with the side support rods and insert the rod tips into the canopy grommets until they snap into place. If a rod needs to be removed from the canopy grommet, push down on the rod tip to unlock. Guy lines are attached to the canopy near each rod attachment. Tie these lines to the loops provided on the raft tube.

   After the upwind side of the canopy is secured, attach the other rods and guy lines.



SIDE RODS ATTACHED TO TUBES

3. The three center support masts are each in three sections that screw together. They are designed so they can not be assembled incorrectly. Each mast has a mast pad which attaches to Velcro material located on the center portion of the raft. Tie the strings, which are attached to the slide near the Velcro material, through the holes of the lower mast section. Push the mast bottoms into the position mast pads and snap the mast tips into the canopy grommets.



CENTER MAST IN MAST PAD

When sun shade only is desired and ventilation is needed, the canopy sides can be rolled up and tied to the canopy top with straps provided at intervals around the canopy.

When cold weather protection is needed, pull the sides down over the top raft tube. When outside access is needed, zippered openings are available at both ends.

A bailing bucket and sponge are located in the survival kit. These should be used to bail and dry out the raft.

WATER

Gathering of rain water is essential. During a rain storm, raise the center canopy poles for a short interval to get a steep slope on the canopy top. This will allow salt deposits to wash off. Then remove the canopy center poles and allow the canopy to sag in the middle. Drain water through the grommet holes into any containers you can improvise.

A water de-salting kit is packed in the survival kit. It consists of a one pint plastic bag and eight chemical briquets. Each of the briquets is capable of neutralizing one pint of sea water suitable for drinking.

It is operated by filling the plastic container with sea water up to the line marked on the plastic bag, removing the waterproof cover from the briquet and placing it in the plastic bag. Then, secure the plastic bag top with the strap and buckle assembly, and gently massage the briquet until it is completely dissolved.

To consume the water, unscrew the plug from the drain in the bottom of the bag. The plastic bag is graduated in two-ounce increments, which would be useful where necessary to practice rationing.

Do not drink unconditioned sea water. Thirst will only be increased and violent sickness follows. Continued consumption will probably result in death.

FOOD

Food is the least important of survival requirements. A person in normal health can survive 2 to 3 weeks without food, providing water is available. Without water, life expectancy is reduced to between 4 and 8 days.

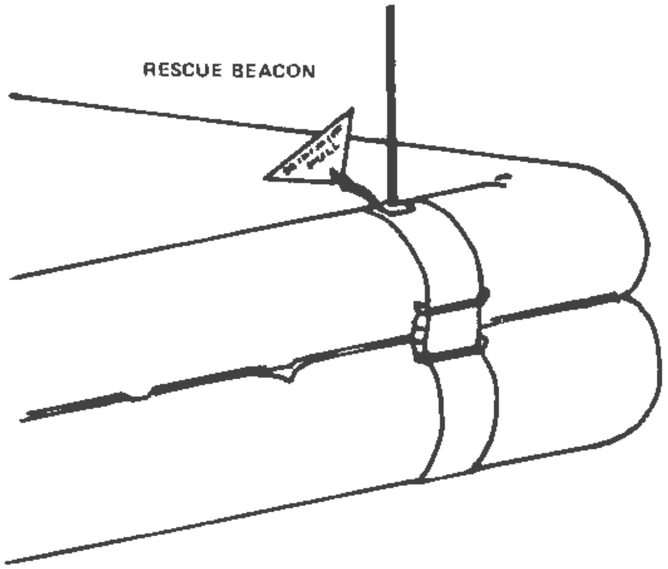
It takes water to digest food, so a cardinal rule of survival is that no food should be eaten unless a pint or more of water per day is available.

SLIDE/RAFT SIGNALLING

The survival kit contains a VHF transceiver, flare, sea dye marker, mirror, and flashlight that are the same type as on a 25-man raft. It also has a miniature sized whistle.

RESCUE BEACON

A new type rescue beacon is attached to the slide/rafts at doors one, two, and three. Door number four slide/rafts do not have rescue beacons. The beacon transmits on the emergency frequencies of 121.5 and 243 MHz. The beacon is mounted on the outer raft tube near the sea anchor.



The beacon is activated automatically when the slide/raft is inflated in the water. Antennas are mounted on both the upper and lower raft tubes. The lower antenna provided is in the event the slide/raft must be used upside down. An indicator light located at the base of the antenna will illuminate when the unit is operating.

The raft tube must be firm to provide proper antenna support. If the upper raft tube fails, hold the antenna vertical and touch only the base of the antenna.

The beacon can also be activated on land by first inflating the slide/raft and then pulling the "Manual Activation Pull" tab located at the base of the antenna. To silence the beacon if it is interfering with transceiver radio operation, unsnap the antenna from the pocket and place the antenna in the water.

VHF TRANSCEIVER

A VHF transceiver is located in each survival kit. It operates on 121.5 or 123.1 MHz. To operate the transceiver, extend the antenna to turn it on. Depress the transmit button to talk and release it to listen. Collapse the antenna to turn it off.

Operate the VHF transceiver at least twice hourly and whenever a ship or aircraft is seen or heard. When using the VHF transceiver on 121.5, unsnap the rescue beacon antenna and submerge it in water to prevent radio interference.

FLARE

One end of the flare produces a dense cloud of orange smoke for day use and the other end a brilliant red light for night use.

The night end can be identified by a raised white cross. The flare is ignited by removing the cap and scratching the now exposed igniter button with the friction coated surface of the cap. Hold it at arm's length on the downwind side of the raft.

Each end will burn 45 seconds. After one end of the flare has been used, it may be cooled by immersing in water and retained until the opposite end is needed.

SEA DYE MARKER

The dye marker is contained in a gauze bag which is inside a protective fabric container. The dye is capable of coloring the sea water to a brilliant green color. This provides a prominent contrast against the sea water, visible up to 10 miles from search altitudes. The time it remains effective is dependent upon wind and sea conditions.

The fabric dye container has a pair of tie straps which are used for securing it to the raft. It is used by stripping the pull tab and agitating the dye container in the water.

Use the flares and sea dye marker only when an aircraft or ship is seen or heard.

SIGNAL MIRROR

A signal mirror provides a signal that can be seen for many miles, even in hazy weather. It is used by holding the mirror close to eye level, reflecting sunlight onto the back of the other extended hand, and slowly raising the hand and mirror until the sun is reflected on the target.

FLIGHT ATTENDANT EVACUATION STATIONS

Depending upon the number of flight attendants assigned, seat assignments will be filled in the following order:

	F/A	Seat Assignment
1	L1	L1 door F/A seat
2	L2	L2 door F/A seat
3	R2	R2 door F/A seat
4	L3	L3 door F/A seat
5	R3	R3 door F/A seat
6	L4	L4 door F/A seat
7	R4	R4 door F/A seat
8	R1	R1 door F/A seat
9	L2B	Service center 2, left F/A seat
10	R2B	Service center 2, right F/A seat
11	L3B	Aisle seat L3 door area, load permitting
12	R3B	Aisle seat at R3 door area, load permitting

Minimum number of flight attendants required on the 1011-100 is six. Assigned flight attendants, including additional flight attendants, must be 1011 safety qualified and in uniform.

DITCHING CREW DUTIES

CAPTAIN

Transmit emergency message.
Instruct flight attendants, first officer, engineer, and ACM.
Brief passengers.
Have cabin alerted 30 seconds before splash down.
Direct evacuation.
Check life vest inflation.

FIRST OFFICER

As directed by captain.
Check R1 door activated.
Check life vest inflation.
Expedite evacuation in forward cabin.

FLIGHT ENGINEER

Subject to captain's discretion:

Secure cockpit station.
Take aisle seat R4 door area.

Check R4 door activated.
Check life vest inflation.
Expedite evacuation in aft cabin.

FLIGHT ATTENDANT L1

Go to cockpit for captain's instructions.
Brief other attendants and passengers.
Coordinate all cabin preparation.
Advise captain when completed.

Open adjacent door.

Expedite evacuation.

OTHER FLIGHT ATTENDANTS

Assist in cabin preparation.
Open adjacent door.
Expedite evacuation.

Flight attendants not seated adjacent to a door:

Move into aisles.
Expedite passenger movement to usable exits.

SLIDE/RAFT SUMMARY

The slide/raft deployment, manual inflation, and girt separation are the same as for the present evacuation slide operation both on land and in the water. There are few differences in the slide/raft feature from the 25 man raft.

The slide/raft seaworthiness phase has just three differences - a secondary floor to lower, a manually deployed sea anchor, and a different type hand pump.

The slide/raft survival phase has just one difference - the method of the canopy installation.

The slide/raft signalling phase has just one difference - an automatic rescue beacon.

TWA Flight Operations Training **BULLETIN** 78-2

TO: All 1011 Flight Crew Members and Flight Dispatch Officers

FILE: Bulletin Section 1011 Flight Handbook

1011-100 DIFFERENCES

CHAPTER 1 - STRUCTURAL MODIFICATIONS

Attached is Chapter 1 of "Lockheed 1011-100 Differences" which provides specific information on structural modifications to these aircraft. As explained in Flight Operations Training Bulletin #78-1, this is the first of four bulletins on this subject.

This material should be studied and then retained in the bulletin section of your flight handbook so that all 1011 - 100 information can be easily located. A cover sheet is provided with this bulletin to identify the contents of the completed document.

Richard J. Kenny

Richard J. Kenny
Staff Vice President
Flight Operations Training

January 16, 1978

LOCKHEED 1011 - 100 DIFFERENCES

This document has been developed for use by 1011 flight crew members and flight dispatch officers and provides specific information on aircraft system modifications and procedures for 1011 - 100 operations.

CONTENTS

*   *   *

CHAPTER 1

1011-100 STRUCTURAL MODIFICATIONS

Four 1011 airplanes (11028, 11029, 11030, and 11031) are being converted to a 1011-100 configuration for use on international routes. Modifications to these four airplanes increase maximum takeoff gross weight to 466,000 pounds and maximum certificated landing weight to 368,000 pounds.

FUSELAGE

The fuselage is strengthened to accomodate the increased weight by reinforced stringers and longerons. Additionally, the forward and aft portions of the fuselage below the main deck are reinforced.

WING

The wing structural changes include increased thickness at the front and rear spar web and cap. Wing skin thickness is also increased.

LANDING GEAR

The landing gear is modified by installing heavy duty wheels on both the nose and main gear assemblies, larger nose and main wheel tires, stronger main gear axles, and heavier stators in the main wheel brake assemblies. The main landing gear trunnion pins, supports, and side brace fittings are strengthened.

OUTBOARD AILERONS

The outboard ailerons have been rerigged to a new neutral position of approximately 2 degrees up. This is done to compensate for the added weight in the center section resulting from the new fuel cell installation.

RUDDER HYDRAULIC LIMITER

The higher takeoff gross weight also requires a change in the rudder hydraulic limiter schedule. System A will automatically shut down and system C will reduce to 2000 PSI when the indicated airspeed goes above 164 knots. When the airspeed is greater than 260 knots, system B pressure will be shut down. Therefore, in cruise above 260 knots, system C at 2000 PSI is the only hydraulic power available to the rudder. If system C fails, system A will be automatically restored at 3000 PSI. As airspeed decreases, the hydraulic systems will be restored to the rudder on the same speed schedule. Cockpit indications for rudder hydraulic limiting will not change.

PERFORMANCE IMPROVEMENTS

Airflow paths in the area of the main landing gear doors, ECS ducts, leading edge slats, and horizontal stabilizer have better seals installed to reduce drag which improves the performance of the airplane and reduces cabin noise.

WEIGHT CHANGES

Modifications to the structure, center tank fuel system, and the performance improvements add approximately 1800 pounds to the empty weight. There are no changes to the existing flight crew procedures for obtaining takeoff stabilizer trim setting. The Basic Reference Number (BRN) continues to be 795. The Load and Balance Record will be used as in the past for weight and balance calculations.

CENTER TANK FUEL SYSTEM

Fuel capacity is increased by the addition of two 9,500 pound capacity tanks. The additional tanks, designated 1A and 3A, are situated side by side in the wing center section just forward of the main gear wheel wells.

Tank transfer and gravity transfer switches are installed on the fuel panel to open and close their respective valves. The fuel quantity test switch is relocated just to the left of the fuel used reset switch. New switchlights on the fuel panel permit reading tank 1A or 3A quantities on tank 1 or 3 quantity indicators. These switchlights also incorporate a low quantity indication when fuel in 1A or 3A drops below 150 pounds.

Fuel Servicing

Whenever the required fuel load for tanks 1 and 3 is in excess of 54,000 pounds, tanks 1A and 3A are fueled through separate fueling valves simultaneously with tanks 1 and 3. Dripless sticks, reading from 790 to 9,560 pounds, are provided for tanks 1A and 3A.

Fuel Distribution For Total Fuel Load Above 154,000 Pounds.

TOTAL FUEL LOAD (LBS)	TANK 1 & 3 EACH	TANK 1A & 3A EACH	TANK 2L & 2R EACH
155,000	51,900		25,700
156,000	52,400		
158,000	53,400		
159,400	54,000		
160,000	54,400	400	
162,000	55,400	1,400	
164,000	56,400	2,400	
166,000	57,400	3,400	
168,000	58,400	4,400	
170,000	59,400	5,400	
172,000	60,400	6,400	
174,000	61,400	7,400	
176,000	62,400	8,400	
178,000	63,400	9,400	
178,400	63,500	9,500	25,700

Fuel Use

Fuel from tanks 1A and 3A cannot be fed directly to the engines. 1A fuel must be transferred to tank 1 and 3A fuel to tank 3. Fuel is normally transferred by jet pumps using pressure supplied by the tank pumps in tanks 1 or 3. Fuel can also be transferred by gravity. The fuel tank scavenge system for tanks 1A and 3A is similar in operation to the other tanks.

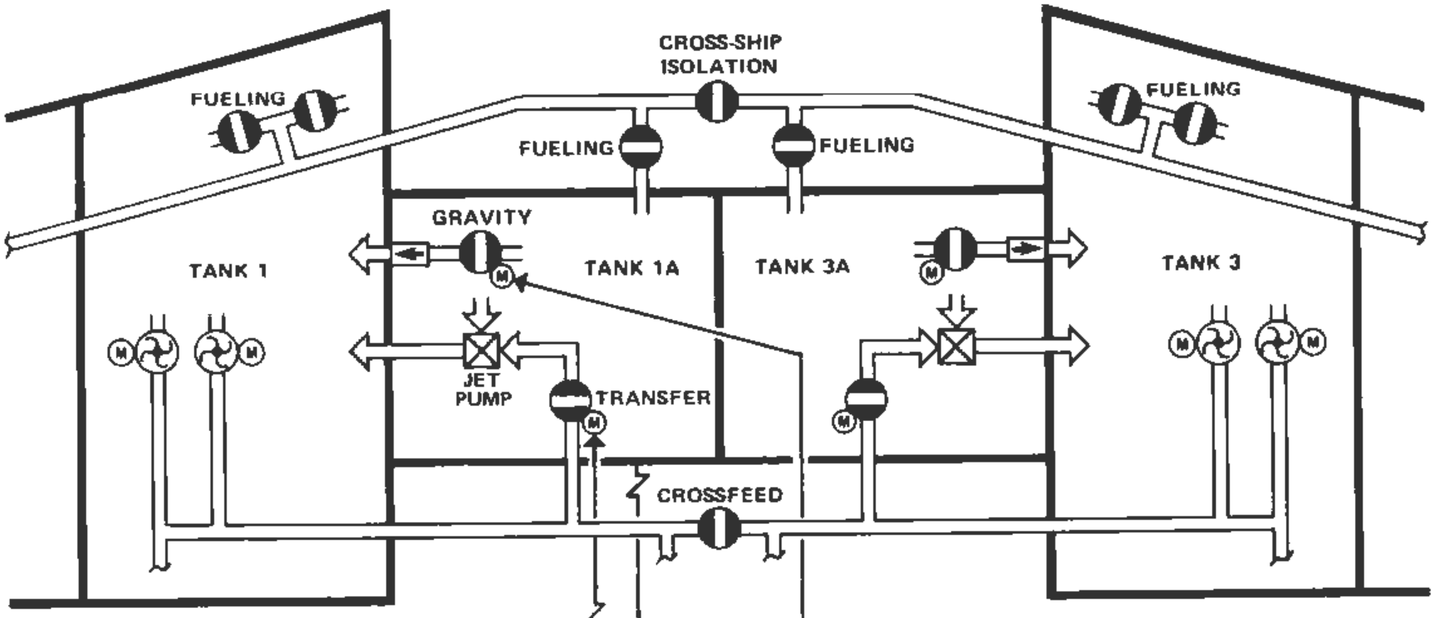
Fuel burn procedures are based on structural requirements to eliminate weight in the center of the airplane. Accordingly, the engines will be fed from their respective tanks for takeoff. When practical, and before 14,000 pounds of fuel is used, start crossfeeding all engines from tanks 1 and 3. When tank 1A and 3A low lights come on, close the transfer valves. When quantities in tanks 1, 3, and 2L plus 2R are equal, use tank-to-engine for the remainder of the flight.

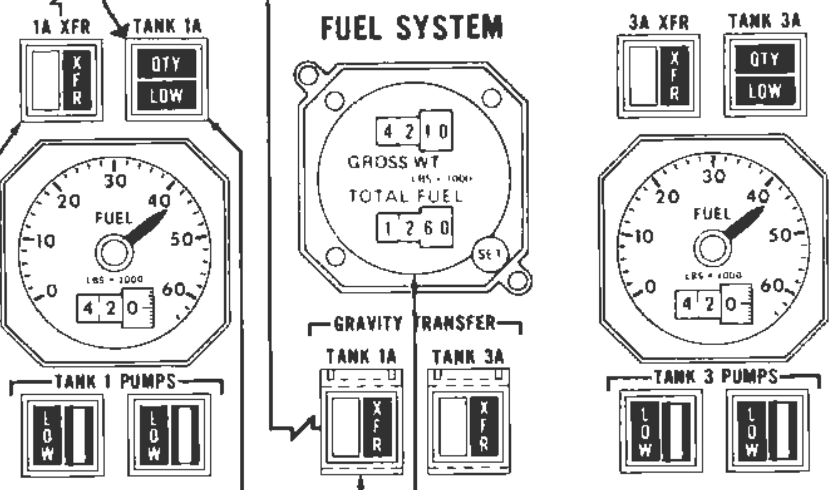
When fuel is carried in the center tanks, the 1A and 3A tank transfer switches should be latched in during preflight. When approximately 7,000 pounds have been used from tanks 1 and 3 each and the aircraft is in flight, fuel transfer automatically commences through the tank transfer valves and the legend "XFR" illuminates on the tank transfer switches. When tanks 1A and 3A are empty, the tank transfer switches must be released to activate the tank 1 and 3 scavenge system.

Should automatic transfer fail, manual transfer can take place through the backup gravity transfer system. With the gravity transfer switch latched in, the legend "XFR" illuminates on the gravity transfer switch. The gravity method leaves about 800 pounds in each tank which will ultimately be transferred by the scavenge system.

Fuel Jettison

Fuel must be jettisoned from tanks 1A and 3A through tanks 1 and 3. The master jettison switch automatically sends an open signal to tank 1A and 3A gravity transfer valves.





CENTER TANK TRANSFER SWITCH

In-transit light indicates power to valve motor.

IN - Arms valve to open when tank 1 or 3 can accept fuel. Arms the LOW light. XFR illuminates whenever fuel is transferring.

OUT - Closes valve and disarms the LOW light.

3U5, 6 - SCAVENGE VALVE TANK 1 & 1A, 3 & 3A.

3U16 - SCAVENGE VALVE TANK 1A & 3A.

CENTER TANK LOW/QUANTITY SWITCH

IN - QTY illuminates and indicator shows tank 1A (3A) quantity only.

OUT - QTY is extinguished and indicator shows tank 1(1A)/3(3A) quantity.

LOW - 1A/3A quantity is below 150 pounds if tank transfer switch is in.

TOTAL FUEL QUANTITY INDICATOR

3U1 - INBD PUMP IND.

CENTER TANK GRAVITY TRANSFER SWITCH

In-transit light indicates power to valve motor.

IN - Opens valve. XFR illuminatas to indicate switch position. Fuel transfers when level in main tank permits. All but 800 pounds can be gravity transferred.

OUT - Closes valve.

Gravity transfer valve opens automatically when the Master Jettison switch is latched in.

1H14, 15 - GRAVITY FEED VALVE TANK 1A, 3A.

(7009)

Modification Of Circuit Breaker Panels

Circuit breaker panel No. 1.
Two new circuit breakers labeled GRAVITY FEED VALVE TANK 1A and 3A are installed in positions H14 and H15.

Circuit breaker panel No. 3.
Present circuit breakers in positions U2, 3, 5, and 6 are moved to positions U1, 2, 3, and 4 respectively. New circuit breakers labeled SCAVENGE VALVE TANK 1&1A and 3&3A are installed in positions U5 and U6. New circuit breaker SCAVENGE VALVE TANK 1A&3A is installed in position U16.

Galley circuit breaker panels.
On the left panel, position B21, present breaker is replaced by one of larger capacity to accomodate the power required for fueling tanks 1A and 3A. On the right panel, position H18, present breaker is replaced by one of larger capacity to accomodate fueling valves 1A and 3A.

SPEED PLACARD

The V_2/V_{ref} placard is revised because the 1011 - 100 has been recertificated resulting in changes to V_{ref} speeds.

V_2 SPEEDS 10^o FLAPS		V_{REF} SPEED 33^o FLAPS
IAS KNOTS	WEIGHT	IAS KNOTS
169	466,000	166
168	460,000	164
166	450,000	162
165	440,000	160
163	430,000	158
162	420,000	156
160	410,000	154
159	400,000	151
157	390,000	149
156	380,000	147
154	370,000	145
153	360,000	142
151	350,000	140
149	340,000	138
147	330,000	136
146	320,000	133
144	310,000	131
142	300,000	129
140	290,000	127
139	280,000	124
137	270,000	122
135	260,000	120
STD. DAY SEA LEVEL CONDITION		

TWA Flight Operations Training **BULLETIN** 78-1

TO: All 1011 Flight Crew Members and Flight Dispatch Officers

FILE: Bulletin Section 1011 Flight Handbook

LOCKHEED 1011-100 OIFFERENCES

Four 1011 aircraft are being converted to a 1011-100 configuration for use on international flights beginning in the spring. The conversion is being performed in two stages.

Lockheed is performing the following first stage structural modifications. Fuel capacity is increased 19,000 pounds with the addition of center section fuel tanks. The fuselage and wing structure are strengthened to maintain the same structural integrity at the heavier weight as in the present aircraft. A heavier main landing gear and larger nose and main gear tires are installed. The first airplane will be available for domestic service following completion of the first stage modifications.

Second stage modifications will be performed at MCI before the aircraft enter international service. TWA will install door mounted slide/rafts, triple Carousel IV inertial navigation systems, a second ADF, and two HF communications systems.

Modifications to these aircraft will increase their maximum takeoff gross weight to 466,000 pounds and maximum certificated landing weight to 368,000 pounds. Until the aircraft enter international service, they will be operated at 430,000 pounds maximum takeoff gross weight and 358,000 pounds maximum landing weight and all present procedures will be followed.

1011-100 differences will be detailed in a series of bulletins which will be issued during the next several months. This material should be studied and then retained in the bulletin section of your flight handbook so that all 1011-100 information can be easily located. After the modification program is completed, the information will be integrated into the flight handbook.

The content of the four bulletins will be as follows:

Bulletin 1 will provide specific information on modifications to the fuel system, heavy gear, fuselage and wing strengthening, and performance improvements.

Bulletin 2 will cover the safety related changes including slide/raft information and ditching procedures.

Bulletin 3 will be concerned with inertial navigation, ADF, HF communications systems and procedures.

Bulletin 4 will cover performance changes, weight differences, climb and cruise thrust setting changes, and international flight planning requirements.

Richard J. Kenny

Richard J. Kenny
Staff Vice President
Flight Operations Training

January 9, 1978

INTRODUCTION

This flight handbook contains information, limitations, and procedures to be followed for safe and efficient operation of the subject aircraft. Good judgment is expected in instances where the recommended procedure does not cover the situation.

The handbook is the property of TWA and is not to be made available to persons or agencies not affiliated with TWA unless authorized. Refer to the TWA Management Policy and Procedure Manual for information regarding control of this publication.

ASSIGNMENT

Copies of this handbook will be assigned during initial training. Assignment of additional or replacement copies and policy regarding crew member responsibilities relative to availability in flight are outlined in the TWA Flight Operations Policy Manual.

REVISIONS

Revisions are numbered and issued in consecutive order. Each revision includes a transmittal page. The page includes a resume of major changes to aid in determining the extent or significance of the revised material. Transmittal pages are also used to control the deletion of teletype messages and operational bulletins obsoleted by inclusion of their subject material into the main body of this handbook.

Yellow pages are used to describe system modifications or procedural changes planned for, but not yet applicable to, an entire fleet. When the change becomes standard, the appropriate white page is revised and the yellow page deleted.

The person to whom this handbook is assigned is responsible for keeping it current. Revised pages are to be inserted as soon as possible after they are received. A transmittal record page is provided and must be maintained.

REVISION SYMBOLS

↓ Indicates beginning of more than one line of revised or new material.

↑ Indicates end of more than one line of revised or new material.

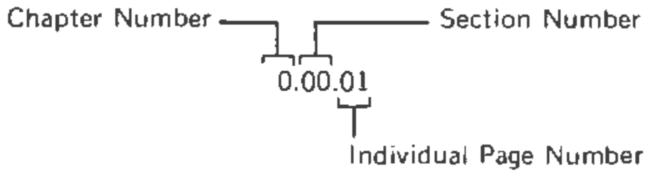
→ Indicates only one line, or portion therof, of revised or new material.

← Indicates deletion of material.

* * * Indicates end of section.

PAGE NUMBERING

Each page number is composed of three segments as described below:



Each page is also dated; the date is changed each time the content of the page is revised or altered.

INDEXING

Each chapter index shows all section and paragraph titles in the order they appear. New index pages are provided in revision transmittals when revised pages require subject titles to be rearranged. Special check-off pages are issued quarterly to up-date page dates for purposes of checking content. Requests for missing pages should be directed to Publications, 1307 Baltimore, Kansas City, Missouri 64105

Current Flight Operations Training Bulletins should be filed behind the index tab. A bulletin index is provided and will be revised as bulletins are issued or deleted.

FORMAT

This handbook is designed to meet the needs of the operating crew relative to preflight, inflight and postflight operations. Format and content are arranged so that each crew member can easily and quickly locate specific procedural coverage or necessary system information.

FORMAT (Cont'd.)

Material that is basic theory or of an initial training nature is omitted so that the operational portions of the aircraft systems can be more easily referenced.

Chapters 1, 2, 3, and 4 contain the operating limitations, normal, emergency, and abnormal procedures. These chapters cover pertinent FAA Approved Flight Manual Limitations, general and specific normal operating procedures, normal, emergency, and abnormal check lists together with their amplifications, and a listing of system specifications in quick reference form.

Chapter 6 is utilized for general information of an operational nature. Instructions for use of the aircraft logbook or requirements when operating a test flight are representative items found in this chapter.

Chapter 21 contains the Minimum Equipment and Configuration Deviation Lists plus the normal en route operational performance charts together with instructions for their use. Performance capability curves for engine out configurations are also provided.

Chapters 5 through 20 cover operational information about the aircraft systems. Each of these chapters is arranged identically to aid in quickly locating needed data. The chapter index lists each separate procedure or illustration. The type of information found in each section of a chapter is outlined below:

Section .01 - Additional Procedures

Contains additional normal operating procedures for use when operating a system where the usual complement of components is not available. These procedures are designed for specific inflight malfunctions or to provide alternate operating instructions when dispatched with a unit inoperative. The aircraft is able to safely continue operation and may or may not have to observe a performance restriction. This section also includes instrument correction data when required to operate in an alternate mode.

Section .02 - Controls and Indicators

Provides illustrations of each general type of controls and indicator related to systems covered in the chapter. Includes brief description of normal function of control. Shows specific nomenclature and location of the controlling electrical circuit protection.

Section .03 - Schematics

Contains one or more simplified schematics designed to support the System Description section.
The same basic style, showing primary system flow from left to right or top to bottom, is employed for all schematics. Unless mentioned in procedures, electrical power sources are normally not specifically labelled. A code/condition block states the condition shown in the schematic; most schematics are designed to show the system in its normal configuration with electrical power supplied and switches or controls in their usual position.

Section .04 - System Description

Provides a brief description of a system and its operation. This ties the information provided in the Controls and Indicator section into a full picture of the system. Where additional information is needed to complete a system coverage, it is provided by including a simplified schematic in section 03.

Additional Sections

In some chapters additional sections may be used to show information which does not fit the above categories. Titles of these sections are descriptive of their contents.

GRAPHIC STANDARDS AND SYMBOLS

The primary flow of any schematic is shown by the widest solid line. If more than one primary system is shown, such as left and right system, coded patterns of the same width are used.

Where the primary system is being controlled, the control function is represented by a line one-half the width of the primary line. If more than one control system is shown, coded patterns are used.

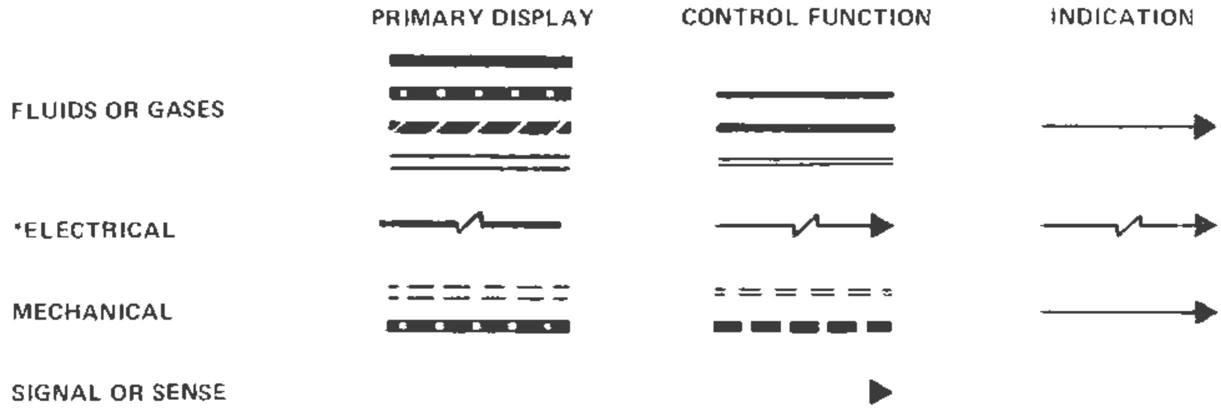
The line representing the flow or connection from a system to an indicator is a single-width line.

To differentiate between electrical, mechanical, and fluid lines representative lines are used.

Standard symbols for system units are used where possible. The symbol also indicates the method used to actuate as: M for motor, S for solenoid or a handle for manual.

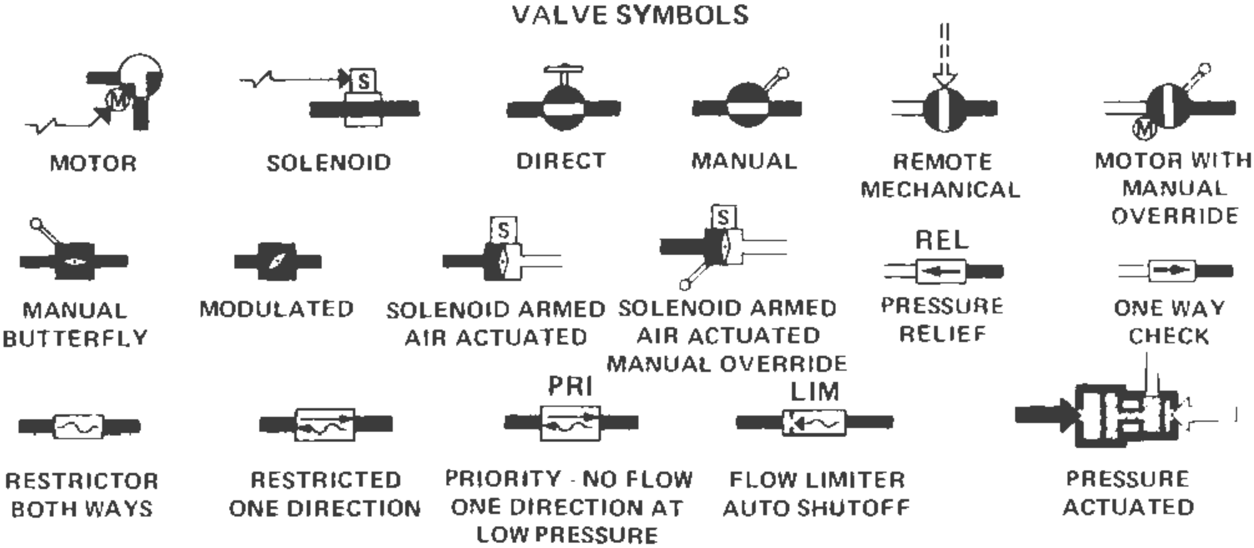
(SEE FOLLOWING PAGE FOR SOME TYPICAL SYMBOL ILLUSTRATIONS.)

SYMBOLS

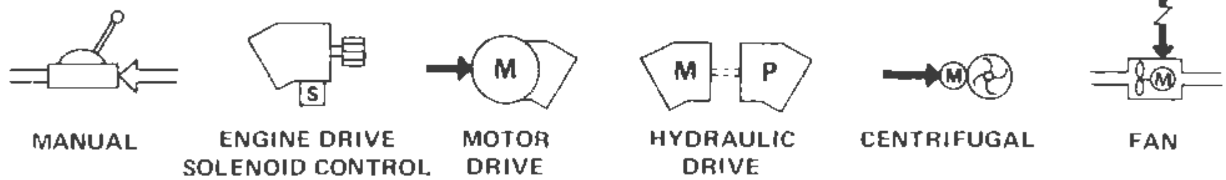


*The electrical symbol is not used where electrical flow is self evident such as a line originating at a circuit breaker.

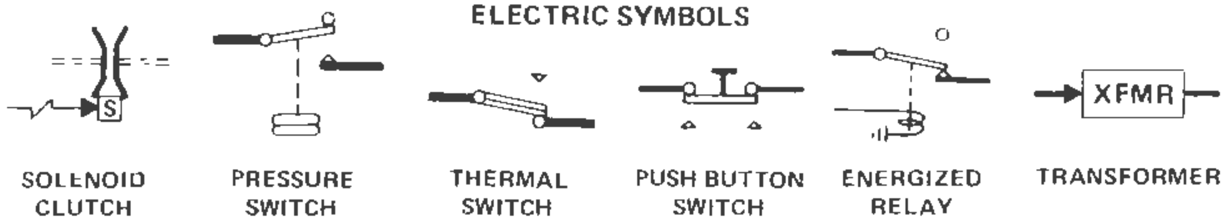
VALVE SYMBOLS



PUMP SYMBOLS



ELECTRIC SYMBOLS



The " " point of a switch indicates either its momentary or relay energized position.

* * *

ADC - Air Data Computer
ADI - Attitude Director Indicator
AFCS - Avionic Flight Control Systems
AIDS - Airborne Integrated Data System
A/L - Autoland
ALPHA - Angle of Attack
ALTN - Alternate
ANNUN - Annunciator
AP - Autopilot
APFDS - Autopilot Flight Director System
APR - Approach
APU - Auxiliary Power Unit
AS/M - Airspeed Mach
ATM - Air Turbine Motor
ATS - Autothrust System
ATT - Attitude
AUTO/SPLR - Autospoiler

BRG - Bearing

C/W - Caution and Warning
CDU - Control Display Unit
CMD - Command
CRZ - Cruise
CWS - Control Wheel Steering

DA - Drift Angle
DANA - Dual Auto Land Not Available
DEV - Deviation
DH - Decision Height
DIFF - Differential
DIS - Distance
DLC - Direct Lift Control
DSRTK - Desired Track

ECS - Environmental Control System

FCES - Flight Control Electronic Systems
FD - Flight Director
FIRM - Fault Isolation Reporting Method
FLR - Flare

GA - Go-Around
GCU - Generator Control Unit
GS - Ground Speed

HDG - Heading
HSI - Horizontal Situation Indicator

IDG - Integrated Drive Generator
INS - Inertial Navigation System
INV - Inverter
ISLN - Isolation

KVAR - Kilo Volt Amperes Reactive
KW - Kilo Watts

LAT - Latitude
LONG - Longitude
LRS - Load Relief System
LSB - Lower Side Band

MON - Monitor
MAN - Manual
MSU - Mode Selector Unit
MTG - Miles To Go

OVHT - Overheat
OVRD - Override

PFCS - Primary Flight Control Systems
PMG - Permanent Magnet Generator
POS - Position
PTU - Power Transfer Unit

RAT - Ram Air Turbine
RCCB - Remote Control Circuit Breaker
R NAV - Area Navigation

SAS - Stability Augmentation System
SCS - Speed Command System
S/O - Shut Off
SSC - Static System Correction
STBY - Standby
SYNCH - Synchronize

TGT - Turbine Gas Temperature
TK - Track
TKE - Track Angle Error
TURB - Turbulence - Turbine

USB - Upper Side Band

VS - Vertical Speed

WD - Wind Direction
WS - Wind Speed
WYPT - Waypoint

XTK - Cross Track Oistance

* * *

POLICY

PROFICIENCY REQUIREMENTS

PILOTS

FLIGHT ENGINEERS

MANEUVERS

* * *

Recurrent training and proficiency checks shall normally be conducted at the Kansas City Training Center. Aircraft proficiency checks may be conducted at crew domiciles as necessary.

All flight crew members reporting for a proficiency check must bring a complete nav kit and, in addition, those reporting for recurrent training must bring a current flight handbook.

Pilots reporting for a proficiency check will normally be scheduled for a full simulator check. In the event that a combination simulator/aircraft proficiency check is scheduled, the simulator check shall be completed prior to being scheduled for the aircraft check. The aircraft check must be given no later than the end of the month following the month in which the simulator check was completed, provided that the pilot's proficiency check qualification does not expire in the interim.

Current regulations permit four types of recurrent training and proficiency checks.

Simulator Recurrent Training
Simulator Proficiency Check
Simulator/Aircraft Proficiency Check
Aircraft Proficiency Check

Generally, any one may substitute for another, as requirements dictate.

* * *

GENERAL REQUIREMENTS

Flight deck crew members participate in a continuous training program consisting of quarterly recurrent training bulletins, operations and special training bulletins, equipment ground school, flight simulator training, and proficiency checks.

Pilots and flight engineers attend annual recurrent ground school on each type of aircraft on which they are qualified. In addition, they complete flight simulator recurrent training consisting of two hours briefing and de-briefing and a minimum of four hours simulator time with at least two hours at the controls for each pilot. In the event the simulator is not available, the crew member will receive a proficiency check in the aircraft with no minimum time required.

CAPTAIN

Captains will receive recurrent simulator training annually in their base month and six months later will receive a simulator proficiency check or a simulator/aircraft proficiency check.

Two satisfactory landings must be observed in conjunction with a simulator proficiency check. This will normally be done during the captain's annual line check, but may be done on a local training flight.

FIRST OFFICER

Every other year a simulator proficiency check or a simulator/aircraft proficiency check will be given in conjunction with annual recurrent simulator training.

Two satisfactory landings must be observed in conjunction with a simulator proficiency check. This may be done on a local training flight or by a line captain on a line flight.

FLIGHT ENGINEER

All operations will be conducted in accordance with the procedures outlined in the Flight Engineer Simulator Recurrent Training/Proficiency Check guide.

PROFICIENCY REPORT FORM

A proficiency report will be completed by the instructor conducting the simulator or aircraft period. If any maneuver or procedure cannot be completed satisfactorily, the crew member's General Manager - Flying will be notified of the unsatisfactory performance on a proficiency check or the failure to complete simulator recurrent training.

* * *

PILOT SIMULATOR RECURRENT TRAINING/ PROFICIENCY CHECK MANEUVERS

The following items and maneuvers encompass those required for completion of the simulator recurrent training course, simulator and/or aircraft proficiency checks. Also incorporated are all of the requirements to maintain Category II and Category IIIA qualifications for captains.

BRIEFING AND EQUIPMENT EXAMINATION

A briefing session shall be conducted prior to each period. The current recurrent training bulletin shall be reviewed and discussed. Prior to each period the applicable maneuvers shall be discussed and sufficient knowledge of systems and equipment shall be demonstrated. Also, weather data and airport conditions for a particular airport will be reviewed so that takeoff data may be computed.

PREFLIGHT INSPECTION

Includes all cockpit preparation prior to flight, all cockpit checks, Before Starting Engines check list, engine starting, and the After Starting Engines check list.

TAXI PROCEDURES

Includes radio and navigation instrument selection for the area departure, taxi procedures, the Taxi check list, and the Before Takeoff check list. Specific attention should be given to the use of steering and brakes.

TAKEOFF - REJECTED

At maximum takeoff weight, an outboard engine shall be failed prior to V_1. The pilot shall demonstrate proper directional control and stopping technique.

NORMAL TAKEOFF

During takeoff, special attention shall be given to tracking on or near the runway center line, engine thrust management, V_1, V_r, V_2, initial climb attitude, flap retraction, and the normal takeoff profile.

INSTRUMENT TAKEOFF

A takeoff shall be given with visibility conditions simulating 700 RVR. The pilot will demonstrate normal takeoff technique and proper instrument procedures while flying IFR

ENGINE FAILURE AFTER V_1

At maximum takeoff weight, an outboard engine failure shall be given after V_1. Proper adherence to the climbout profile and proper use of the Emergency check list shall be stressed.

The climb should be continued following the completion of the profile. Returning to the airport of departure or proceeding to another airport should be considered. Major items to be observed in this maneuver are:

Maintain control by applying rudder and aileron as necessary.

Close adherence to speeds on flap retraction, control of altitude, and climb procedures.

AREA DEPARTURE AND AREA ARRIVAL

On area departure/arrival, proper tuning and identification of radios, strict compliance with ATC clearance, and speed and altitude control are items of importance. Speed shall be either that dictated by the phase of flight, i.e., whether holding is expected, etc., or as directed by ATC.

HOLDING

Holding instructions shall be given at a high or low altitude. The pilot will be expected to comply with proper holding procedures, including proper pattern entry.

STEEP TURNS (CAPTAIN ONLY)

At 250 knots indicated airspeed, 45° bank turns should be completed in both directions. The turns will be at least 180° in duration. Smooth control application and ability to maintain altitude, airspeed, and constant bank angle shall be the primary basis for judging performance.

APPROACHES TO STALLS

The pilot shall be required to demonstrate proficiency in recognition of stick shaker or initial stall buffet and effect recovery of the aircraft from this condition with proper use of thrust, pitch, and lateral control.

POWERPLANT FAILURES

The pilot will be required to demonstrate proficiency in managing the aircraft during engine failure. Emphasis shall be placed on aircraft control, proper immediate action items, and check list usage.

PILOT SIMULATOR RECURRENT TRAINING/ PROFICIENCY CHECK MANEUVERS (Cont'd)

PRECISION APPROACHES

The following approaches will be conducted:

ILS Flight Director

ILS Autopilot, Autoland, To Landing

ILS Autopilot, Auto Go-Around

One will be made with one engine inoperative.

In the case of the flight director approach, the DH for captains and first officers will be Category II minimums.

Performance shall be judged on use of the equipment, tuning and identification of radios, crew coordination procedures, ability to maintain headings and rates of descent, alignment with the localizer course and glide path, and recognition of DH.

LANDING FROM ILS APPROACH

An ILS Autopilot, Autoland approach shall be conducted to start of flare at which time visual conditions will be given. At this time, the pilot will evaluate the position of his aircraft in relation to the runway and demonstrate good judgment in determining whether a safe landing can be made or a missed approach is required.

ONE ENGINE INOPERATIVE - MISSED APPROACH FROM ILS APPROACH

A missed approach from the landing configuration shall be completed with a wing engine shut down. The missed approach shall be executed at DH.

Attention shall be directed to the ability of the pilot to control heading on the missed approach, to rotate the aircraft and apply thrust properly, to control airspeed, and to use proper gear and flap retraction procedures.

NON-PRECISION APPROACHES

Any two of the following approaches shall be conducted: ADF, ASR, LOC, or VOR.

Performance shall be judged on proper use of equipment, tuning and identification of radios, crew coordination procedures, ability to maintain headings, rates of descent, and proper tracking and recognition of MDA.

OTHER MISSED APPROACH

A missed approach will be conducted from an approach other than an ILS.

Attention shall be directed to the ability of the pilot to control heading on the missed approach, to rotate the aircraft and apply thrust properly, to control airspeed, and to use proper gear and flap retraction procedures.

LANDING - NORMAL

At least one full stop landing will be made from an instrument or visual approach.

During final approach, proper slot, runway alignment, airspeed control, and normal sink rates shall be maintrained. The pilot shall demonstrate normal landing technique and proper procedures in the use of spoilers, brakes, and reverse thrust.

LANDING - REJECTED

Under visual conditions, with all engines operating and the aircraft in the landing configuration, the pilot shall demonstrate the go-around capability of the aircraft at the start of flare.

The pilot shall advance the throttles while rotating to check the sink rate and commanding the wing flaps to the go-around configuration. The rotation shall be continued to a climbout attitude while advancing the throttles to go-around thrust and commanding, "Trim thottles." From this point the maneuver shall be conducted using normal missed approach procedures.

LANDING - TWO ENGINE INOPERATIVE (F/O ONE ENGINE INOPERATIVE)

The approach shall be made in accordance with the two engine inoperative procedure (one engine inoperative procedure for F/O).

Performance shall be judged on aircraft systems management, approach procedure, slot recognition, runway alignment, and airspeed control.

NORMAL AND ABNORMAL PROCEDURES

The pilot shall be required to demonstrate the proper use of as many of the systems and devices as necessary to determine that he has a practical knowledge of the normal and abnormal procedures appropriate to the aircraft type.

EMERGENCY PROCEDURES

The pilot shall be required to demonstrate his knowledge of emergency procedures either as they are simulated or discussed in the equipment examination This will include:

Emergency Procedures section of the Flight Handbook.

Emergency check list.

* * *

FLIGHT ENGINEER SIMULATOR RECURRENT TRAINING/PROFICIENCY CHECK GUIDE

BRIEFING AND EQUIPMENT

The engineer will review 35mm preflight slides that will cover an interior and exterior preflight. Emphasis will be given to model differences, if applicable, procedure changes and recent aircraft modifications.

The engineer will complete the top portion of the fuel and data log and the appropriate portion of the takeoff data sheet.

A procedures review will cover normal, emergency, abnormal, and additional procedures with emphasis on the following: cabin pressure loss, rapid descent, electrical fire and smoke removal, emergency landing/evacuation, engine fires and failures, fuel jettison, and hydraulic emergencies. Emergency equipment location, function, and operation will also be covered during the briefing.

The flight will be crew coordinated as amplified in chapter 2 of the flight handbook and emphasis will be placed on the proper use of the check lists and the flight handbook.

During the briefing, the engineer's knowledge of the latest recurrent training bulletin will be determined.

PREFLIGHT

The engineer will perform a normal cockpit preflight and exterior preflight, if applicable.

Prior to starting engines, the Before Starting Engines check list will be read in its entirety. During engine start, the engineer's scan pattern and his ability to handle normal and abnormal procedures will be monitored. After engine start, the engineer should use the appropriate procedures for electrical changeover and cross check controls and instruments while reading the After Engines Starting check list.

TAXI

The engineer will be required to make appropriate fuel and data log entries, compute stabilizer trim, and comply with air conditioning and pressurization procedures. He should cross check controls and instruments while reading the Taxi check list.

TAKEOFF

The engineer will read the Before Takeoff check list, scan the flight engineer panel, trim takeoff thrust and monitor engine instruments.

CLIMB

The engineer will be responsible for setting climb power, scanning the engine and flight instruments and the engineer's panel, and the proper operation and monitoring of aircraft systems.

CRUISE

Cruise power will be set in accordance with the flight handbook. The engineer shall use proper procedures in operation and monitoring of aircraft systems at cruise altitude.

AIR CONDITIONING AND PRESSURIZATION

The engineer will be responsible for various phases of operation of the air conditioning system to include duct overheats, pack trips, and temperature control malfunctions.

Operation of the pressurization system will include normal procedures, pack malfunctions, cabin pressure loss and related systems, rapid descent, and smoke removal.

ELECTRICAL

The engineer will be responsible for knowledge and procedural operation in the following areas: electrical limits, electrical trips and malfunctions and their singular or combined effect on aircraft operation, and electrical emergencies as covered on the check lists.

POWERPLANT

There will be engine failures and fires during various phases of flight. The engineer shall know the effect of these failures on system operation and aircraft performance and manage the systems in accordance with procedures in the flight handbook. The engines will be operated within the limits prescribed in chapter 2.75 of the flight handbook.

ANTI-ICING SYSTEMS

The engineer shall have an understanding of the normal and abnormal operation, limits, malfunctions, and operational effects of the anti-icing systems.

FUEL SYSTEM

The engineer will be checked for system knowledge to include normal operation and limitations, and abnormal and additional procedures.

FLIGHT ENGINEER SIMULATOR RECURRENT TRAINING/PROFICIENCY CHECK GUIDE (Cont'd)

HYDRAULIC SYSTEMS

The engineer will be checked on system operation including backup systems and procedures to continue aircraft operation. Specific emphasis will be placed on hydraulic fluid/system pressure loss.

FLIGHT CONTROLS

The engineer will be checked on his knowledge of normal operation and abnormal procedures to include flap, stabilizer, and spoiler malfunctions.

COMMUNICATIONS - NAVIGATION

The engineer will be responsible for cross checking flight and navigation instruments during various phases of flight and have an understanding of power sources and signal flow.

DESCENT

The engineer will read the Landing Preliminary check list and be responsible for system operation of air conditioning and pressurization under normal and abnormal situations. The engineer will maintain a traffic watch, if applicable, and comply with crew coordination procedures.

APPROACH AND LANDING

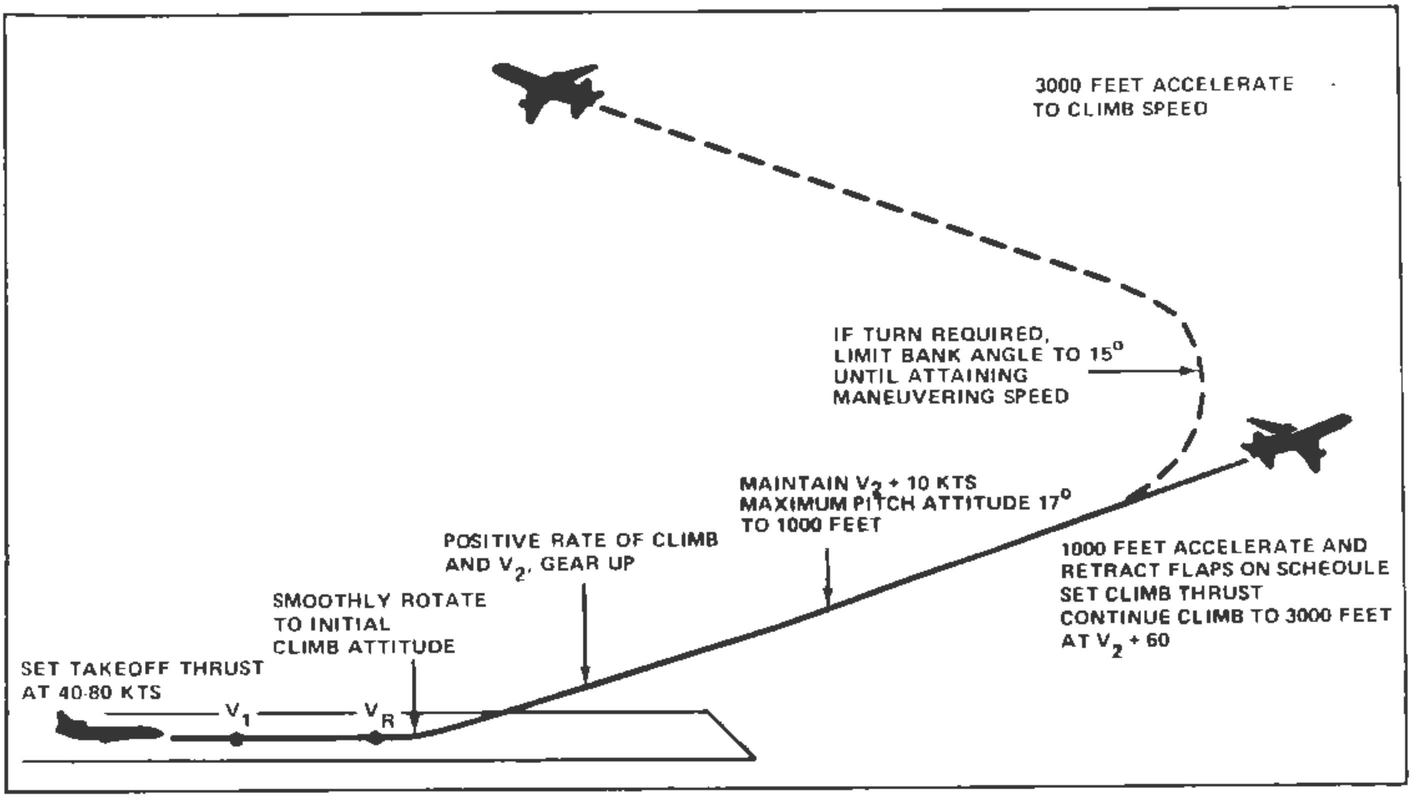
The engineer will read the Landing Final check list and back the pilots up on crew coordination to include required callouts during the approach.

POST LANDING DUTIES

These duties include reading the After Landing check list and electrical changeover. This may include the engineer's duties during Emergency Landing/Evacuation procedures.

*　　*　　*

NORMAL TAKEOFF



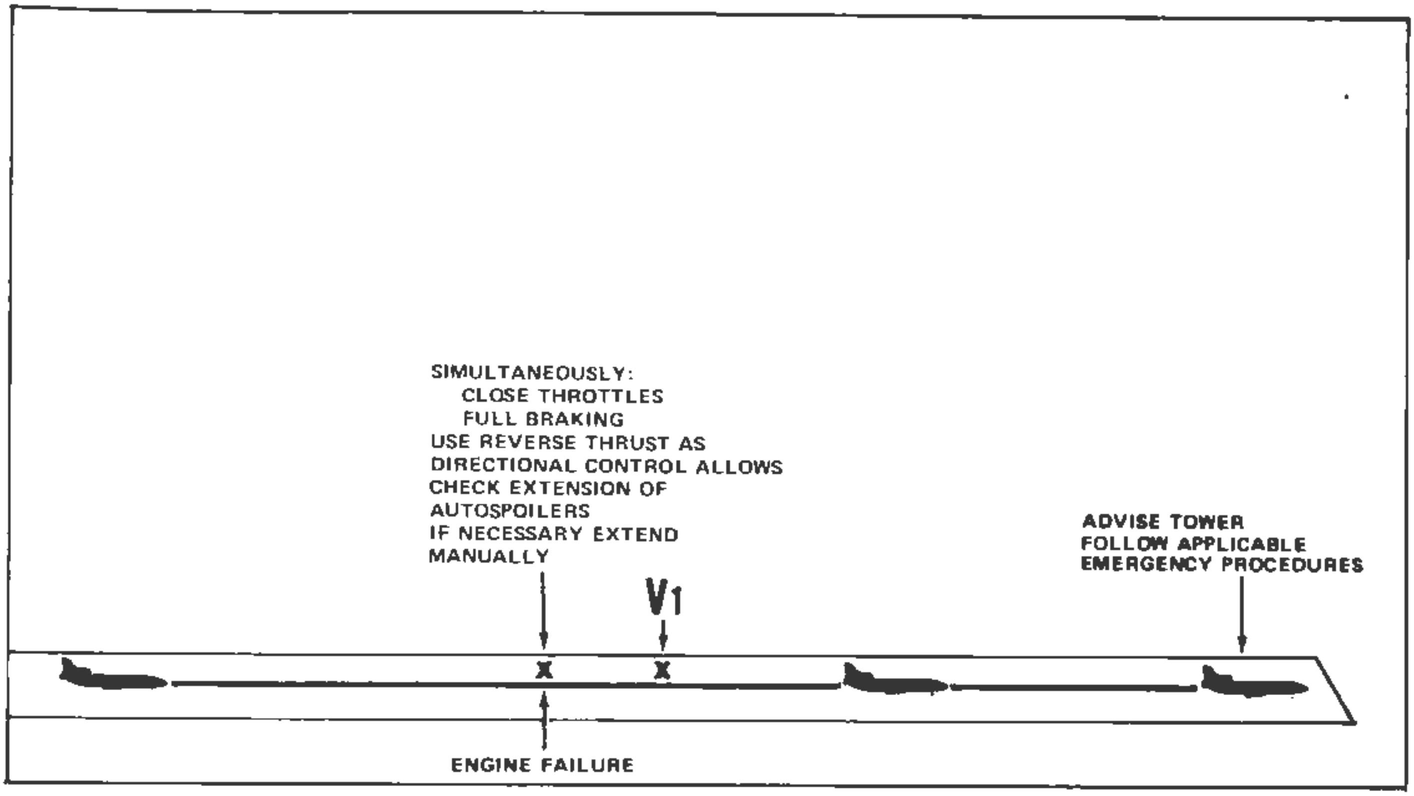
FLAP RETRACTION SCHEDULE	
FLAPS	SPEED
10 TO 4	$V_2 + 30$
4 TO 0	$V_2 + 60$

At 1,000 feet above field elevation, lower nose to approximately 8 to 10 degrees to establish a suitable climb gradient while accelerating for flap retraction. During clean up, it is desirable to continue climb at no less than 500 feet per minute.

REFERENCES:

1011 Flight Handbook - Chapter 2
→ Flight Operation Policy Manual - Chapter 6.

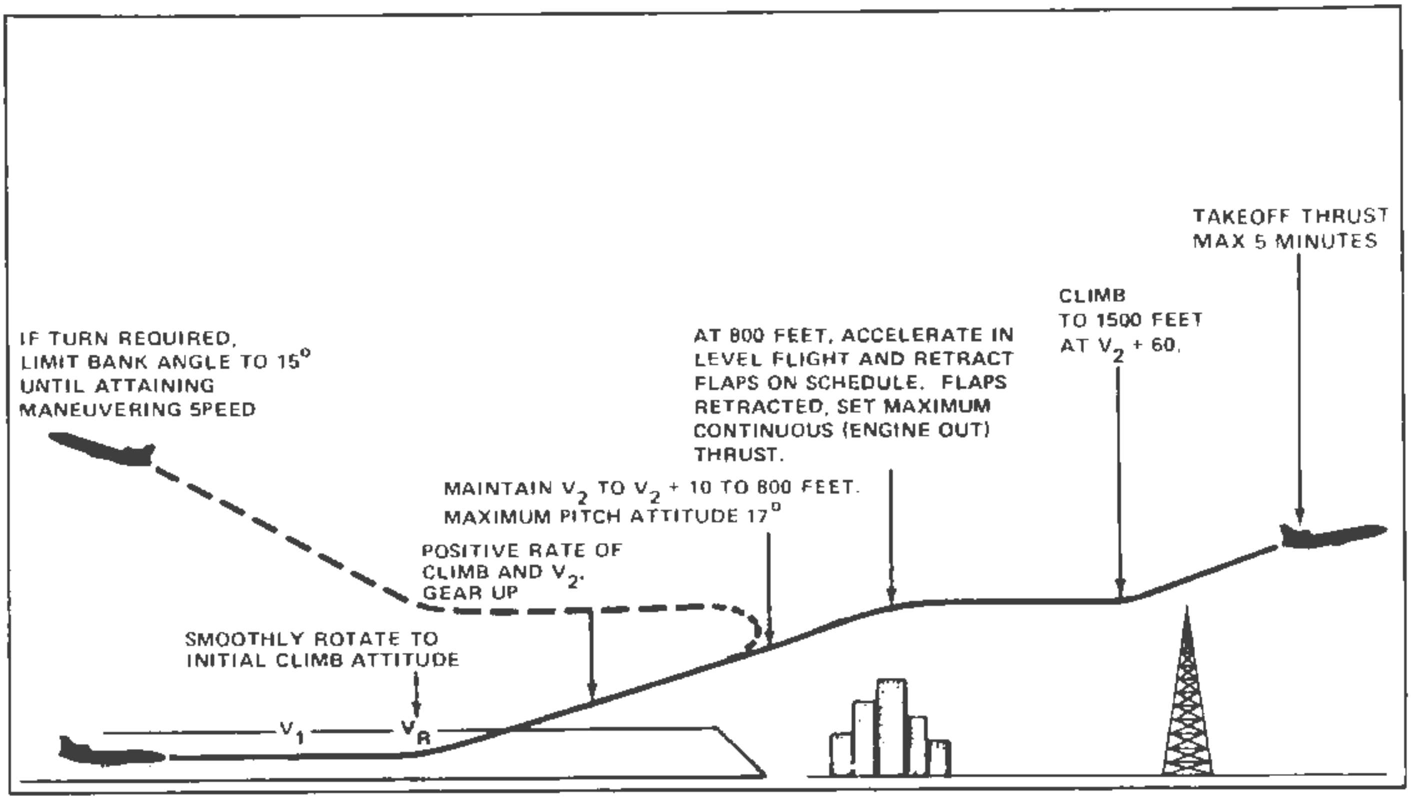
REJECTED TAKEOFF



The decision to reject a takeoff is solely the responsibility of the captain. Maximum effort stopping technique shall be initiated.

REFERENCES: 1011 Flight Handbook, Chapters 2 and 3.
→ Flight Operations Policy Manual, Chapters 6 and 10.

TAKEOFF - ENGINE FAILURE AFTER V_1



FLAP RETRACTION SCHEDULE	
FLAPS	SPEED
10 TO 4	$V_2 + 30$
4 TO 0	$V_2 + 60$

Close engine instrument monitoring on takeoff by all crew members is essential, to detect possible engine failure or malfunction. Except for engine 2 fail lights, failure of the number 2 engine may be difficult to recognize because of lack of yaw.

Use a normal rate of rotation at V_r.

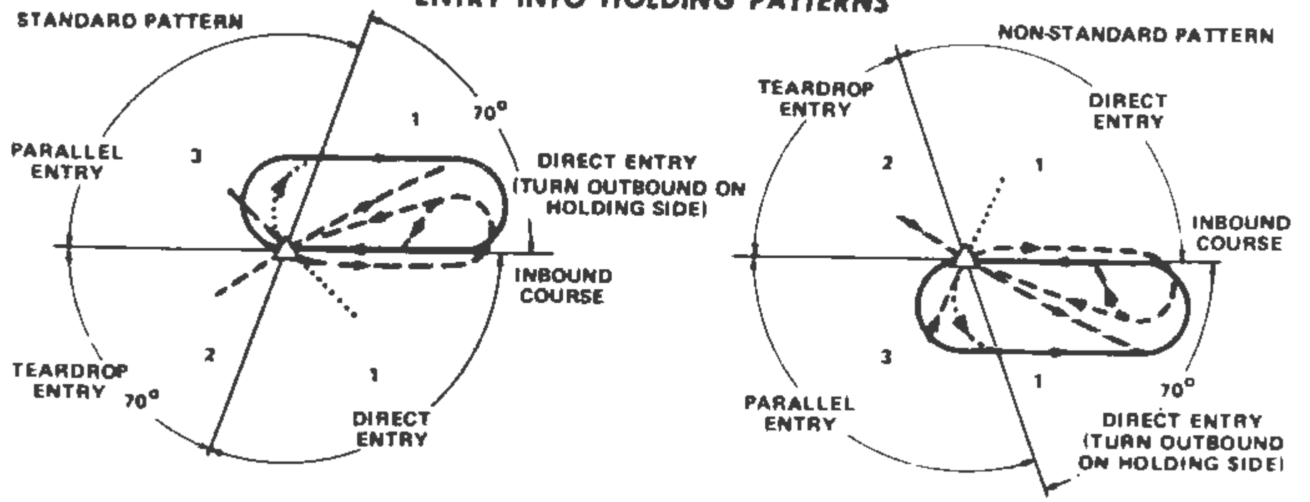
Best angle of climb speed must be maintained to 1500 feet, thus providing optimum obstacle clearance along the takeoff flight path. The "final takeoff climb segment" terminates upon reaching 1500 feet. Any further extension of the climb-out profile would be classified as "enroute climb".

If an engine fire warning occurs on takeoff, fly the engine failure profile as depicted above, whether the engine is producing significant thrust or not.

Use good judgment and ensure the correct controls are operated when shutting down an engine. This is more important than quick action. Conditions such as aircraft buffeting or vibration and/or reported visible fire may require earlier or immediate compliance with the engine fire or failure procedure. Circumstances must dictate the action taken.

HOLDING PATTERNS AND PROCEDURES

ENTRY INTO HOLDING PATTERNS



1. DIRECT ENTRY:
   TURN RIGHT AND FLY THE PATTERN.
2. TEARDROP ENTRY:
   PROCEED ON OUTBOUND TRACK OF 30° (OR LESS) TO HOLDING COURSE, TURN RIGHT TO INTERCEPT HOLDING COURSE
3. PARALLEL ENTRY:
   PARALLEL HOLDING COURSE, TURN LEFT, AND RETURN TO HOLDING FIX OR INTERCEPT HOLDING COURSE.

1. DIRECT ENTRY:
   TURN LEFT AND FLY THE PATTERN.
2. TEARDROP ENTRY:
   PROCEED ON OUTBOUND TRACK OF 30° (OR LESS) TO HOLDING COURSE, TURN LEFT TO INTERCEPT HOLDING COURSE.
3. PARALLEL ENTRY:
   PARALLEL HOLDING COURSE, TURN RIGHT AND RETURN TO HOLDING FIX OR INTERCEPT HOLDING COURSE.

Enroute to a holding fix the appropriate radios should be properly tuned and identified.

Reduce speed to the appropriate maximum holding speed or less within 3 minutes prior to ETA at the holding fix. Make all turns during entry and while holding with:

30° bank angle or at flight director computed bank angle.

14,000 feet and below:	Use holding charts, hold clean, flaps 4 or 10 as speed restrictions permit, one minute pattern.
Above 14,000 feet:	Hold clean and use chart speed but not above FAA maximum speed without ATC approval, one and a half minute pattern.

FAA Maximum airspeeds:

Thru 6,000 feet MSL	- 200 knots
Above 6,000 thru 14,000 feet MSL	- 210 knots
Above 14,000 feet MSL	- 230 knots

Climbing in Holding Pattern:

Below 10,000 feet	- 250 knots
10,000 feet and above	- 310 knots

Some chart holding speeds exceed the FAA maximum airspeed. In such cases, request to hold at the chart speed. Chart holding speeds are 10% above minimum drag which make it unnecessary to increase thrust in the turns.

Compensate for known effect of wind, except when turning. Once established in the holding pattern, the drift correction angle can be determined along the inbound course. On the outbound leg of one minute patterns, the inbound drift correction should be tripled and applied to the outbound course. In one and a half minute patterns, the inbound drift correction should be multiplied by 2½ and applied to the outbound course. The size of the pattern is governed by inbound times.

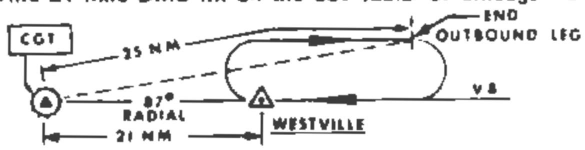
Outbound timing begins over or abeam the fix, whichever is later. If the abeam position cannot be determined start timing when the turn to the outbound heading is completed.

HOLDING PATTERNS AND PROCEDURES (Cont'd)

DME holding is subject to the same entry and holding procedures, except that distances (nautical miles) are used instead of time values. You may be instructed to hold on an airway or a specified radial.

Example 1:

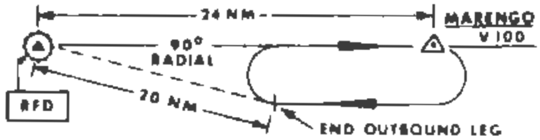
Clearance: Hold East of the Westville 21 mile DME fix on the 087 radial of Chicago Heights, 4 mile legs, right turns.



Where the DME holding pattern is on the side of the fix away from the VORTAC, the end of the outbound leg is the DME fix plus the leg length (21 + 4 = 25). This would also be true if the clearance specified left turns. Mileage shown in the pattern indicates leg length is added to fix mileage.

Example 2:

Clearance: Hold West of the Marengo 24 mile DME fix on the 090 radial of Rockford, 4 mile legs, right turns.



Where the DME holding pattern is on the side of the fix toward the VORTAC, (between the fix and the VORTAC), the end of the outbound leg is the DME fix minus the leg length (24 - 4 = 20). This would also be true if the clearance specified left turns. Mileage shown in the pattern indicates leg length is subtracted from fix mileage.

If the Autopilot and/or Flight Director are used when holding on a localizer front course, airway, or VOR radial the following guide lines apply:

AUTOPILOT

Ensure that the inbound course is set on the HSI. Use CWS mode and maneuver with the control wheel.

Use altitude hold, as appropriate.

If cleared for an ILS approach from the holding pattern:

When turning inbound use an intercept heading of 45° or less.
When within 90° of the inbound course select CMD and A/L.
If above the glide slope use control wheel steering or select VS to fly the aircraft down to the glide slope.

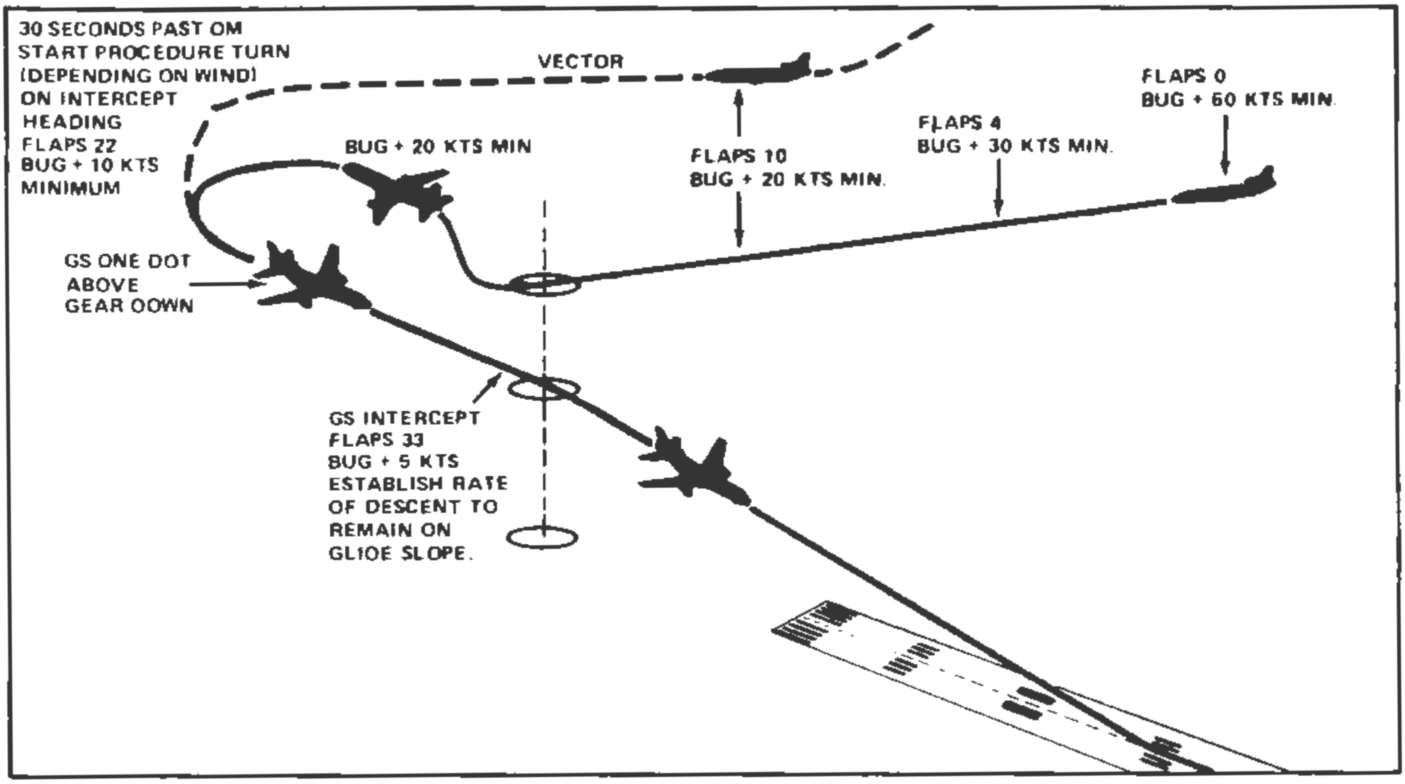
FLIGHT DIRECTOR

Ensure that the inbound course is set on the HSI. When turning inbound and within 90° of the inbound VOR course, select the NAV mode. Normally, a 45° intercept will be programmed. When turning outbound set the heading cursor to the outbound heading and select the HDG mode. Use altitude hold as appropriate. If cleared for an ILS approach from the holding pattern:

When turning inbound within 90° of the inbound course select A/L. Cross check other instruments closely if a significant pitch down command is indicated.

REFERENCE: 1011 Flight Handbook, Chapter 2.

BASIC ILS



Crew coordination and approach plate review should be completed as soon as approach information is available. Position awareness during any approach is important to aid in anticipating speed and configuration changes. Radios should be tuned to facilitate position awareness during initial vectoring in the terminal area.

After initial flap extension, the landing final check list should normally be completed to the boxed items.

When on the localizer intercept heading, all radios should be tuned for the approach. Proper RMI needle selection should be made.

After seeing three green lights, complete the landing final check list.

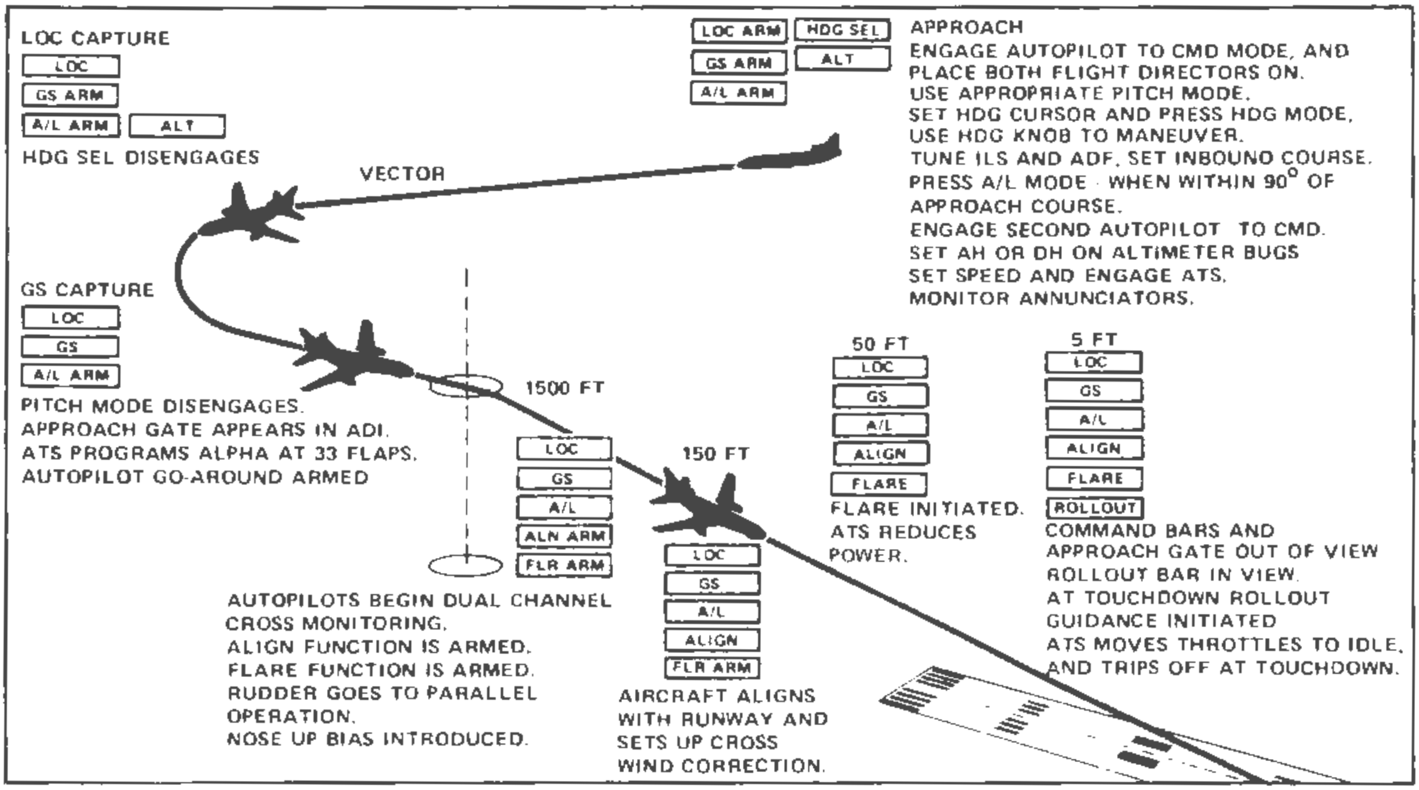
See the "Flight Director Approach" or "Autopilot Approach" diagrams for pertinent details.

No later than the final fix inbound, all radios should be tuned and identified on the ILS facilities.

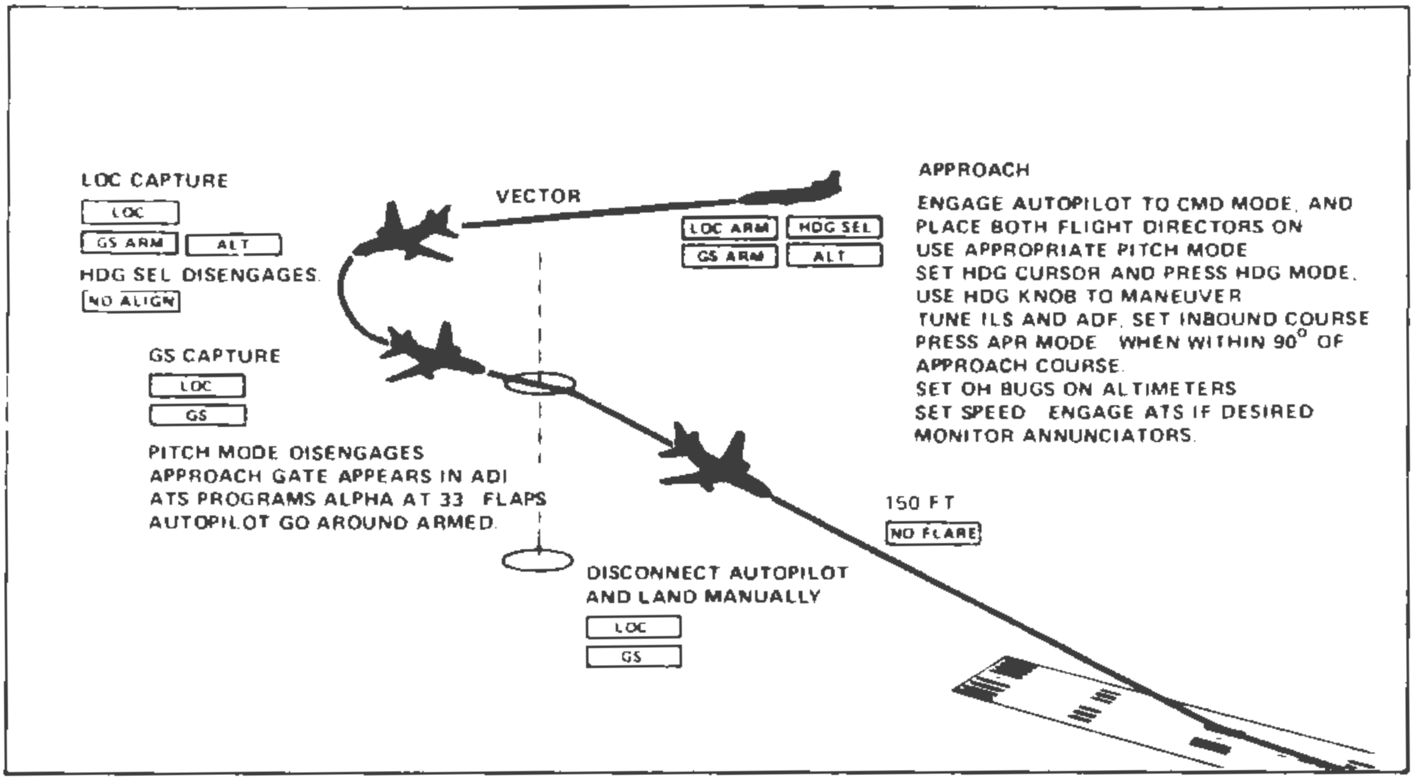
REFERENCES:

1011 Flight Handbook, Chapter 2.
Flight Operations Policy Manual, Chapter 3.

AUTO PILOT/FLIGHT DIRECTOR-ILS APPROACH (A/L MODE)



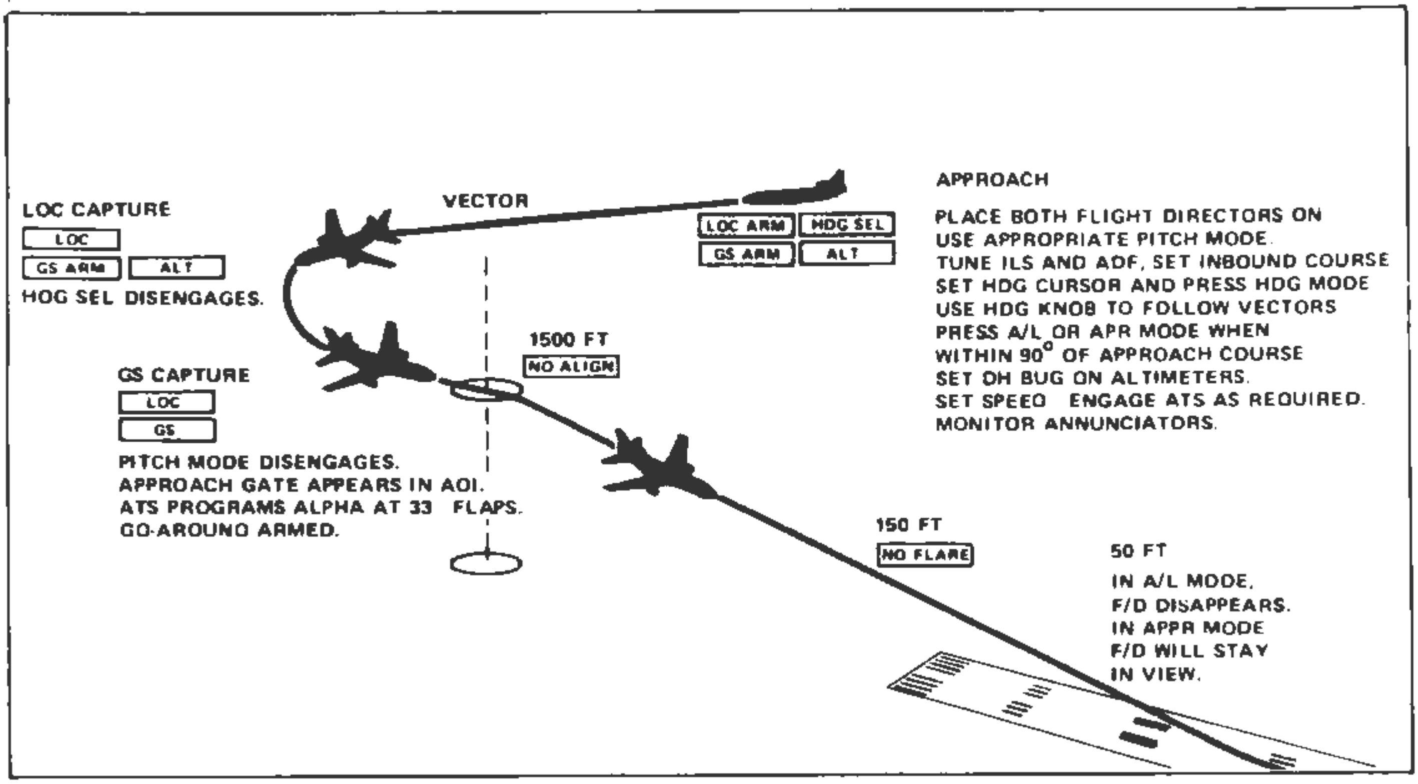
AUTO PILOT/FLIGHT DIRECTOR-ILS APPROACH (APR MODE)



REFERENCES:

1011 Flight Handbook, Chapter 2.
Flight Operations Policy Manual, Chapter 2.

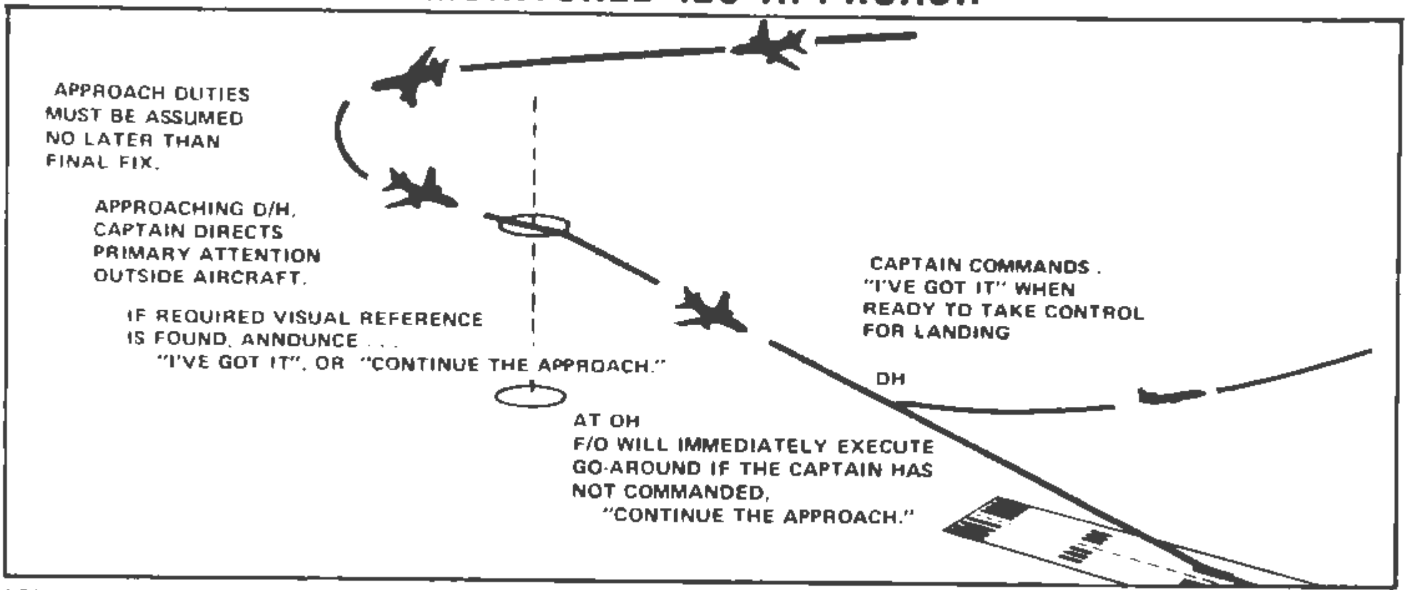
FLIGHT DIRECTOR ILS APPROACH



REFERENCES:

1011 Flight Handbook, Chapter 2
Flight Operations Policy Manual, Chapter 6.

MONITORED ILS APPROACH

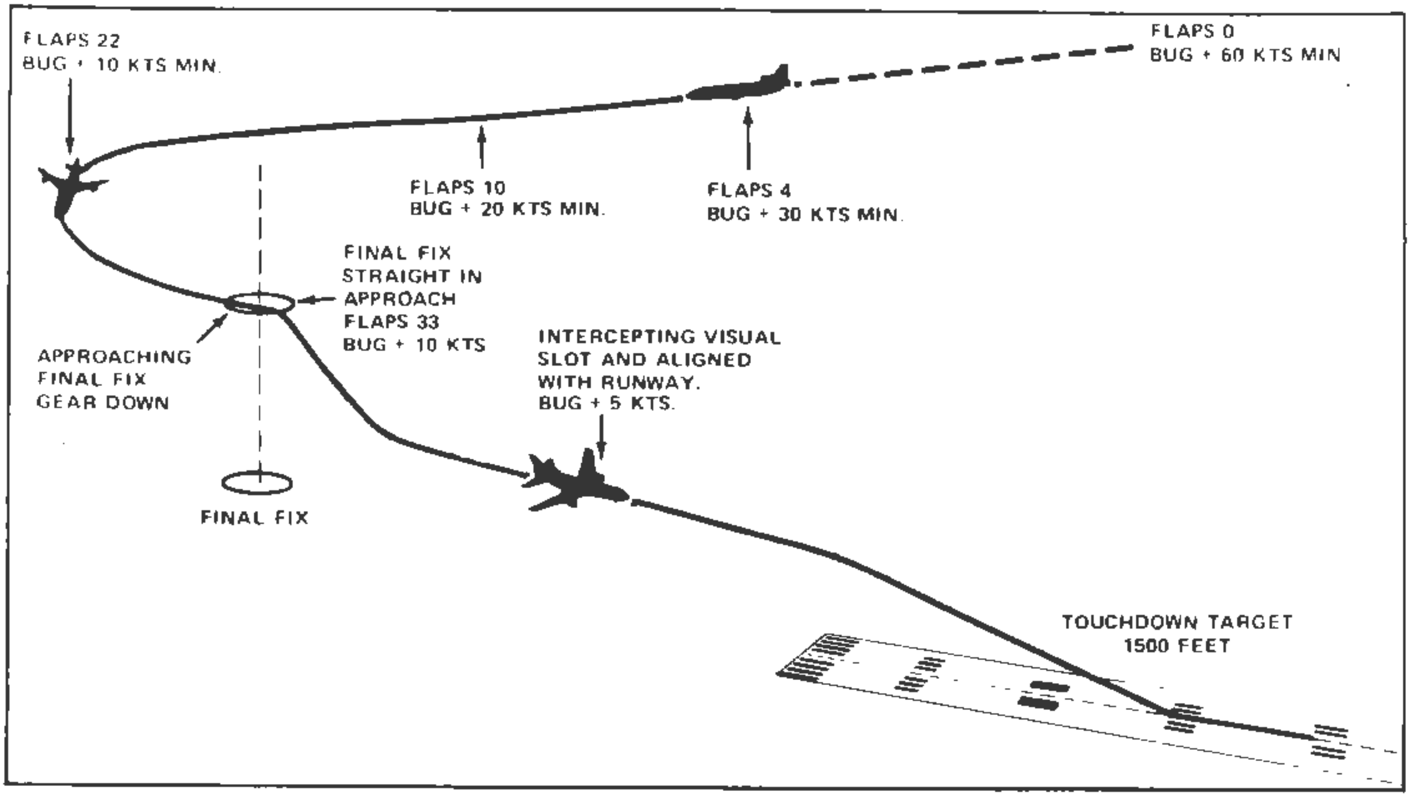


CONCEPT - First officer will fly approach head down and make all call outs below 500 feet. Captain will monitor approach primarily head up and assume control and land aircraft following visual transition. The minimum required airborne equipment must be used for the approach flown.

1. The captain is in command and must assume control any time the situation requires such action.
2. This approach is recommended any time the RVR is less than 4000 feet or ceiling below 400 feet with the first officer assuming the operational role, and the captain the monitor role, no later than the final approach fix.
3. CAT II requires use of autopilot in A/L mode in accordance with Ops. Specs. However, F/D approaches with or without autothrust may be utilized to CAT I minima, SCD.
4. Below 400 feet or 100 feet above DH, the captain's primary attention becomes "head up" for visual cues.
5. When adequate visual reference is obtained, at DH, the captain will announce "continue the approach" or "I've got it." If no visual reference, the first officer makes the go-around.
6. Continue coupled to maintain stable flight path - autopilot may remain engaged to touchdown if in A/L mode.
7. After the captain assumes control, the first officer's primary attention continues to be head down, to monitor instruments and callout deviations.
8. Flight engineer additional duties: Backs up captain and first officer on all callouts, assists and monitors all position indicators, fail flags, altimeter settings, airspeed and altimeter bug settings, notes field elevation and DH during crew coordination review and cross checks altimeter bugs, maintains traffic watch.
9. CREW COORDINATION CALLOUTS

POSITION	FIRST OFFICER CALLS	CAPTAIN CALLS
OM	"Outer marker"	"Flags checked"
500 feet	. . . .	"135K/sink 700 feet"
100 feet above minimums	"100 to go"	. . . .
DH (at or no later than)	"Minimums". If captain gives no command, execute a go around	"Continue approach" or "I've got it" or "Go around"
100 feet (Captain normally assumes control)	"100 feet"	. . . .
After captain takes over and through rollout	Any deviations observed affecting stabilized flight. (Airspeed - Sink - Glide Slope - Localizer)	. . . .
50 feet (Captain must take over no later than 50 feet)	"Sink 700 feet"	. . . .

VOR - LOC - ADF - ASR



Crew coordination and approach plate review should be completed prior to arrival in the terminal area. Position awareness during any approach is important to aid in anticipating speed and configuration changes. Radios should be tuned to facilitate position awareness during initial vectoring in the terminal area.

After initial flap extension, the landing final check list should be completed to the boxed items.

When on the final approach course intercept heading, all radios should be tuned for the approach. Proper RMI needle selection should be made.

After seeing three green lights, complete the landing final check list.

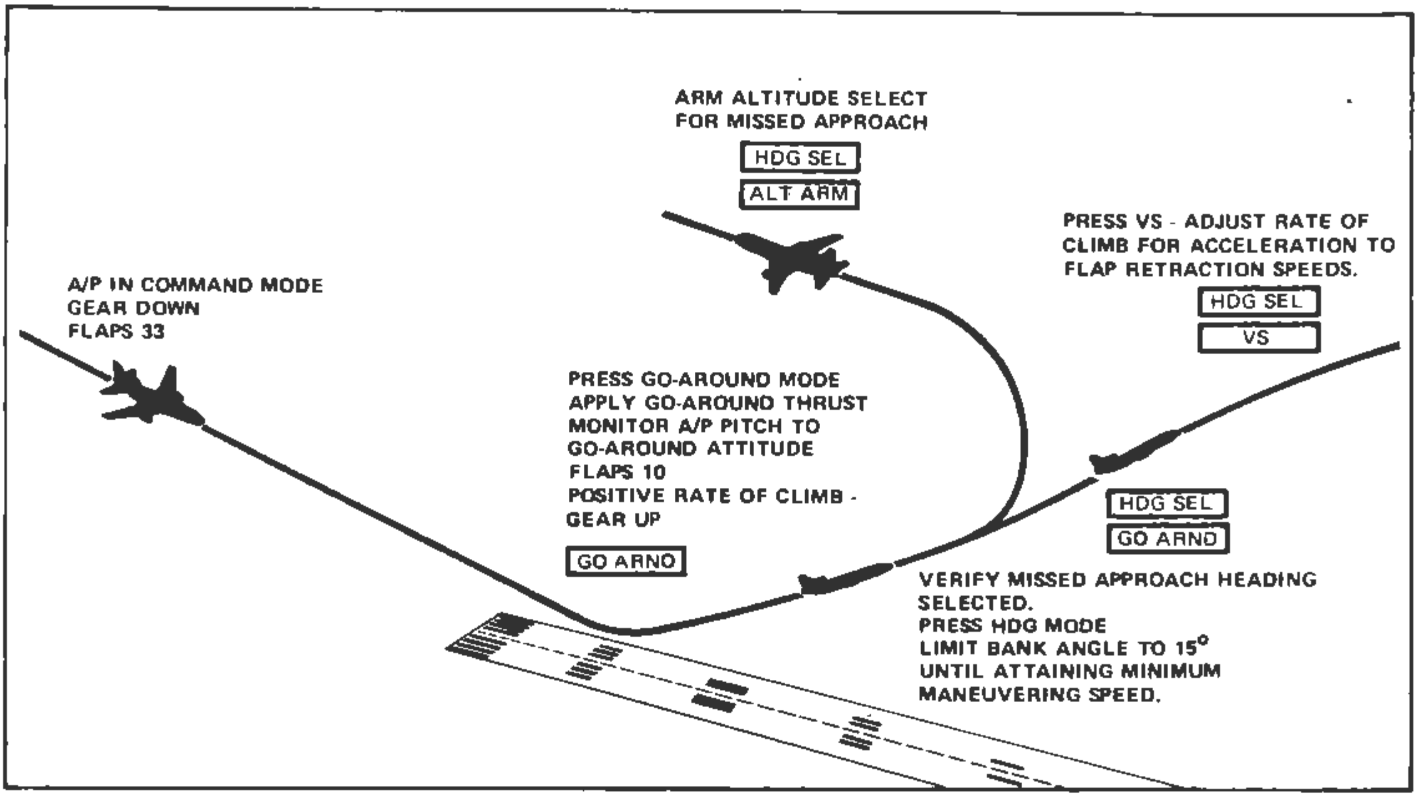
No later than the final fix inbound, all radios should be tuned and identified on the appropriate facilities.

Sink rate from the final approach fix to "MDA" will depend on ground speed, altitude change and "Missed Approach Point".

REFERENCES:

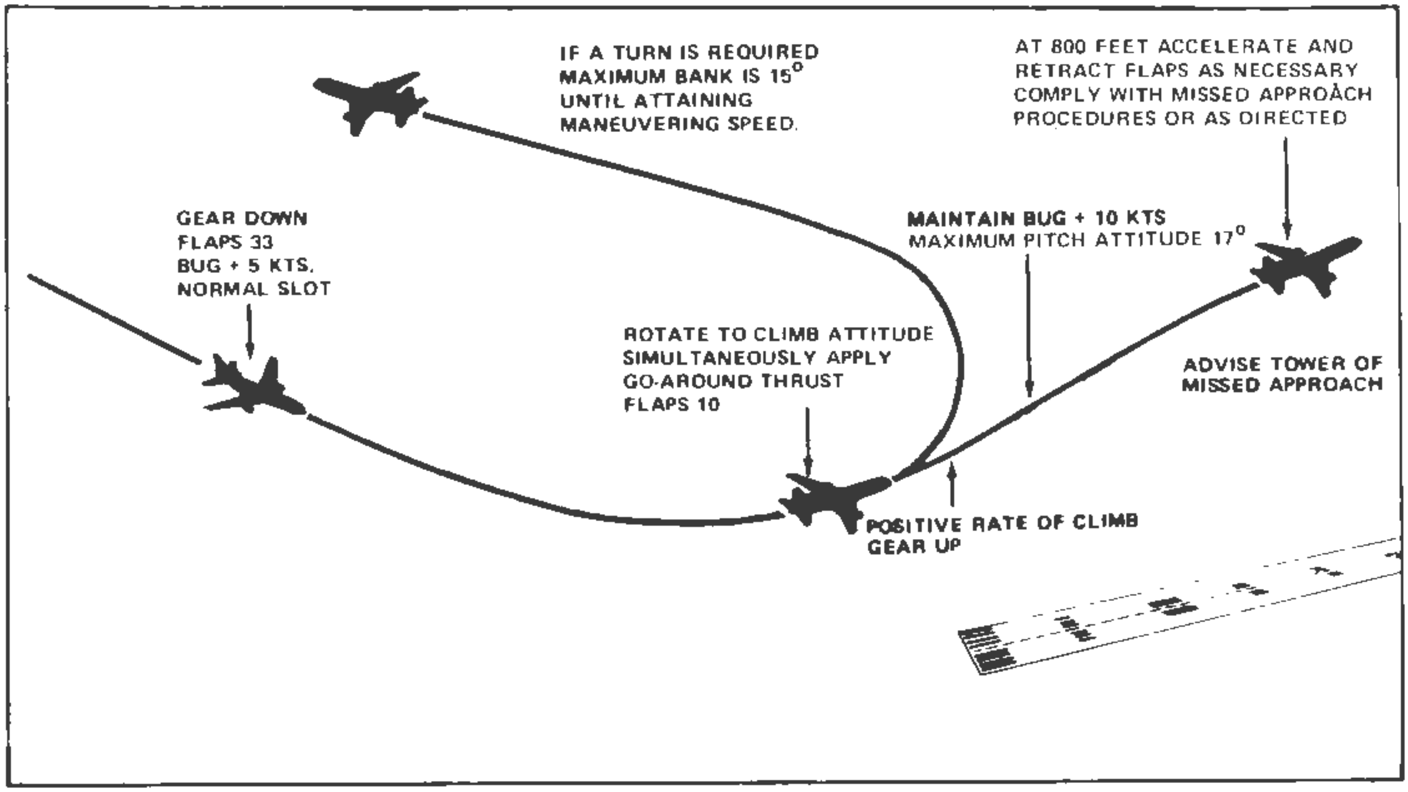
1011 Flight Handbook, Chapter 2.
Flight Operations Policy Manual, Chapter 6.

AUTO GO-AROUND MISSED APPROACH



FLAP RETRACTION SCHEDULE
10 TO 4 BUG + 30 KNOTS
4 TO 0 BUG + 60 KNOTS

MISSED APPROACH



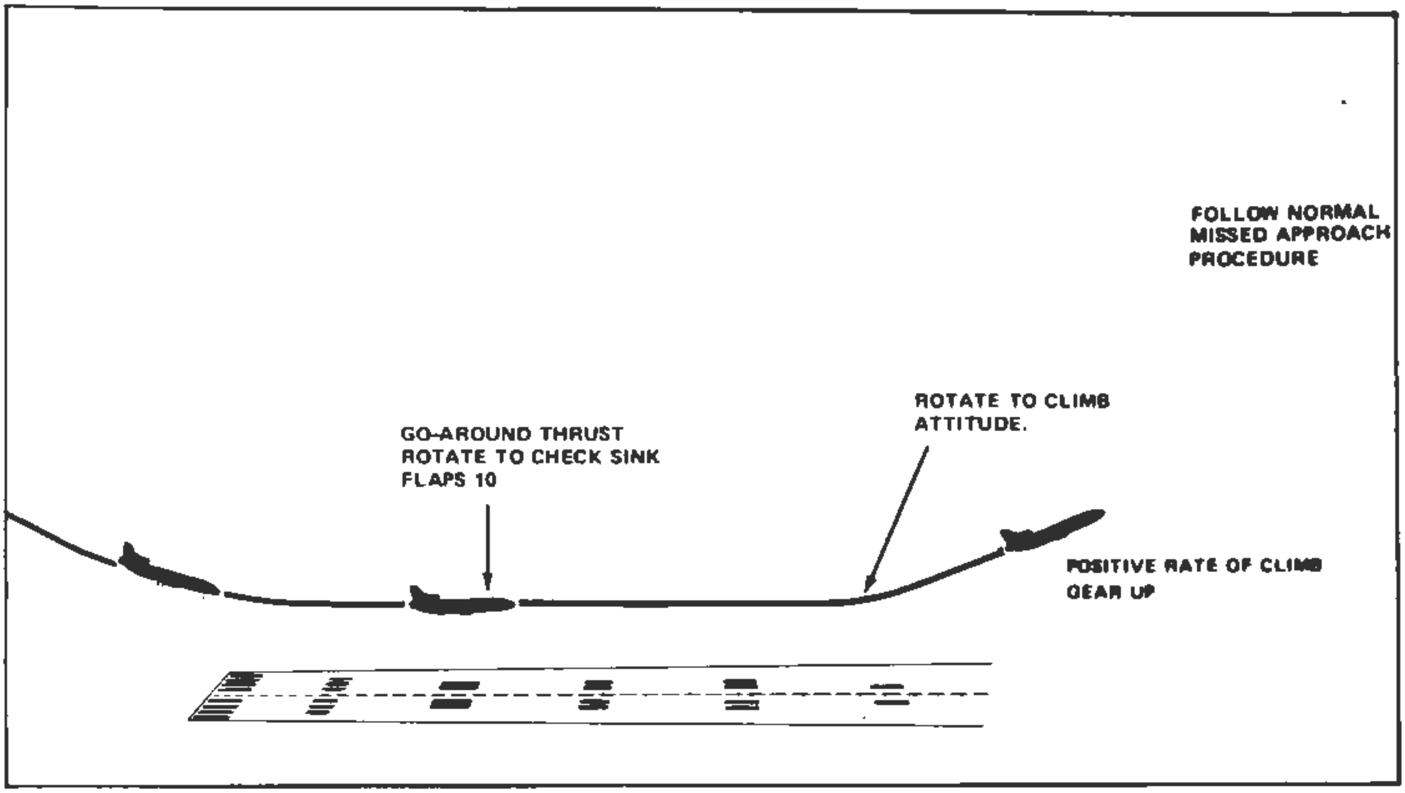
FLAP RETRACTION SCHEDULE	
FLAPS	SPEED
10 TO 4	BUG + 30
4 TO 0	BUG + 60

If missed approach is initiated with an engine inoperative, coordinate rudder with thrust application. At 800 feet shallow climb and retract flaps as necessary while accelerating to appropriate speed.

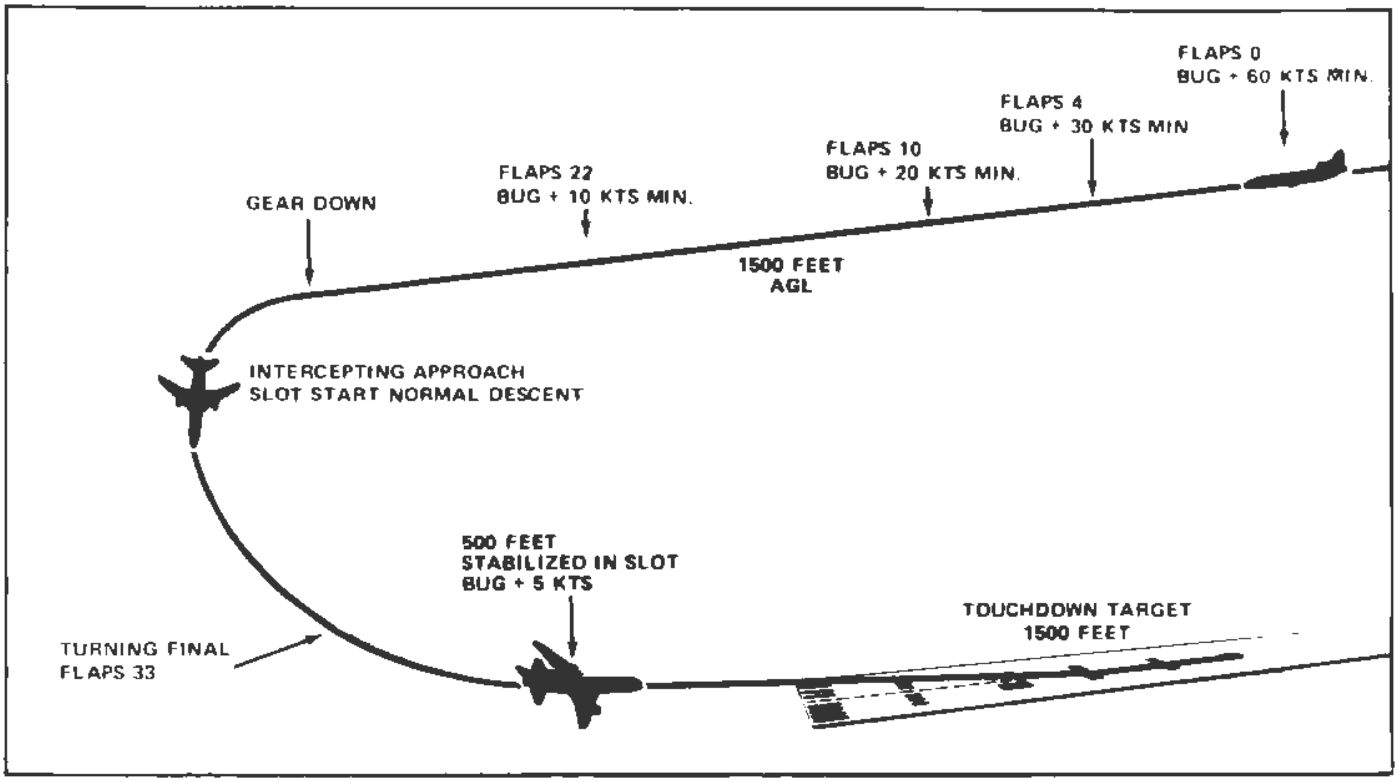
REFERENCES:

1011 Flight Handbook, Chapter 2.
→ Flight Operations Policy Manual, Chapter 6.

REJECTED LANDING



NORMAL LANDING



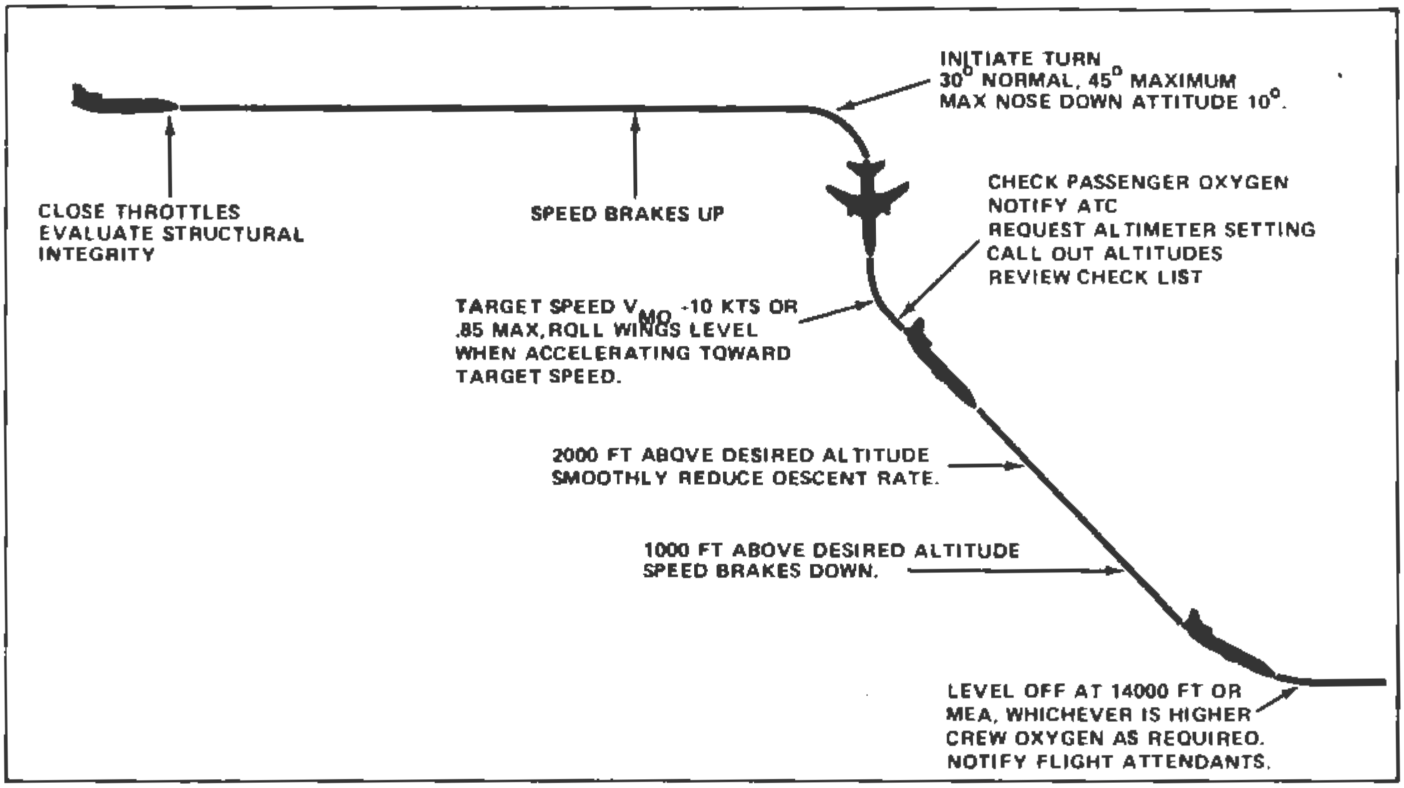
Below 500 feet, if any significant departure from the normal approach path occurs, and corrective action is not immediately effective, a missed approach should be executed.

REFERENCES:

1011 Flight Handbook, Chapter 2.

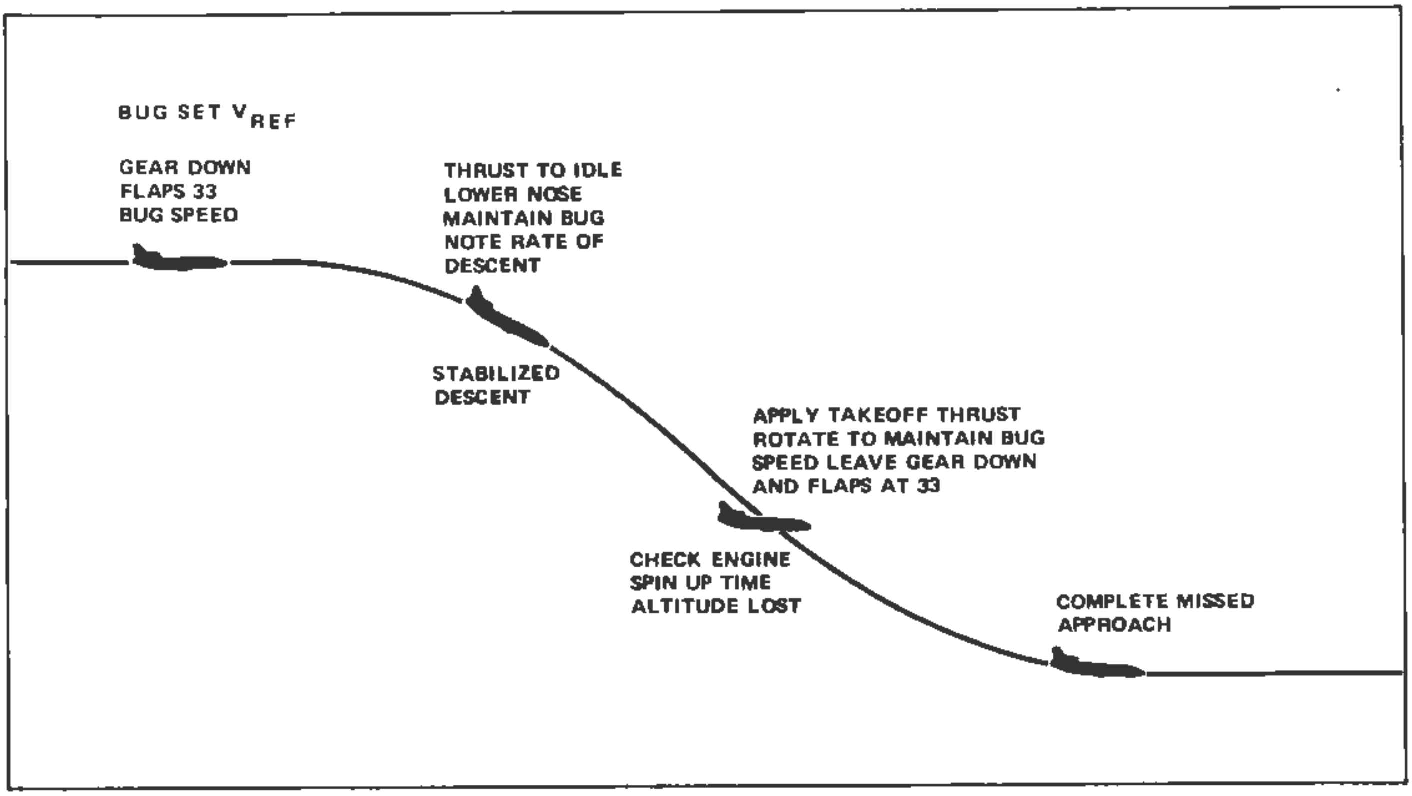
→ Flight Operations Policy Manual, Chapters 6 and 10.

RAPID DESCENT

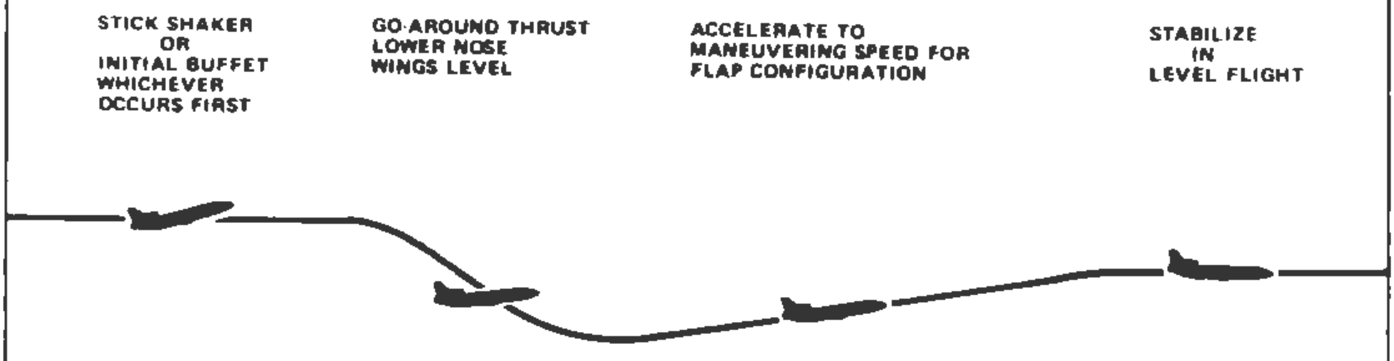


REFERENCE: 1011 Flight Handbook, Chapter 3.

HIGH SINK RATE MANEUVER



STALL RECOVERY



MANEUVERING SPEEDS	
FLAPS	V_{REF} +
0	60
4	30
10	20
22	10
33	5

Configurations:	Thrust Target	Trim Speed	Recovery Flaps
Clean	55% N_1	Bug + 60	0
10 Flaps, 20° bank	55% N_1	Bug + 20	10
33 flaps, gear down	55% N_1	Bug + 5	33

ENTRY

Determine weight and set airspeed bug. Initially decelerate to approximately 200 knots and set thrust. Establish gear/flap configuration, and while decelerating, trim stabilizer until manuvering speed for flap configuration is reached.

During approaches to stall, the speed bleed may be made with a shallow rate of climb. Avoid any rate of sink.

RECOVERY

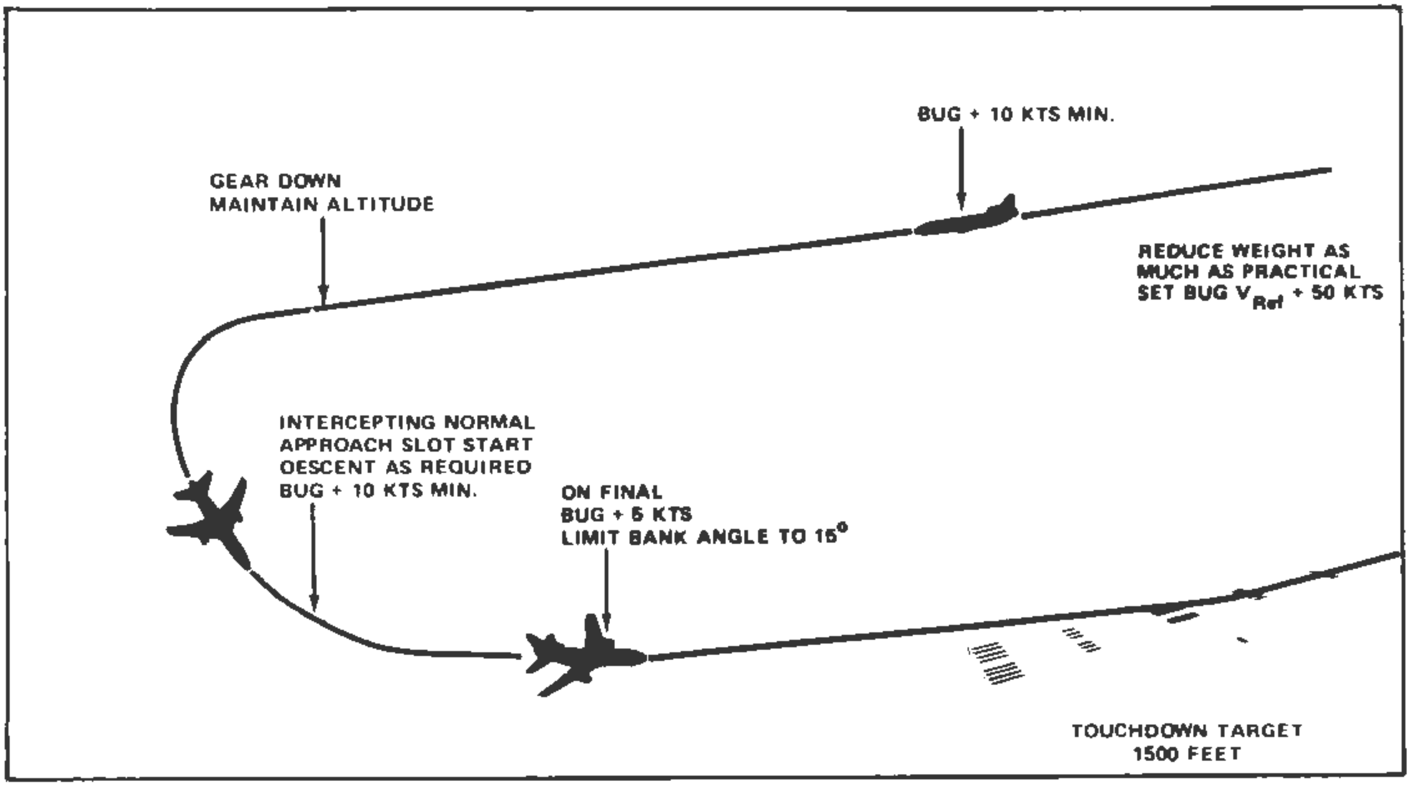
At the first indication of stall (buffet or stick shaker), apply go-around thrust while lowering the nose to approximately 7 1/2° nose up pitch attitude and leveling the wings. At higher altitudes, it will be necessary to establish a lower pitch attitude to obtain desired acceleration. Maintain the flap and gear configuration. Accelerate to maneuvering speed with a minimum loss of altitude. Take care to avoid secondary buffet.

Stall warning is considered to be any warning, readily identifiable by the pilot, whether stick shaker or initial buffet caused by airflow separation.

Recovery from an approach to a stall should be initiated at the earliest recognizable stall warning, stick shaker or initial buffet.

Less altitude is lost and the recovery is simplified by not changing flap position. When the flaps are up, the stall recovery is usually accomplished before the flaps can be extended. Retracting the flaps from the landing position is not recommended, especially when near the ground as a greater altitude loss will result during the recovery.

NO FLAP LANDING



In the event the flaps cannot be extended, or if one or more leading-edge device did not extend, a partial flap landing would be made.

Consideration should be given to dumping fuel to reduce approach and landing speeds to a minimum.

Extend the landing gear before turning base leg. However, if hydraulic problems affect gear extension, the gear should be extended sooner.

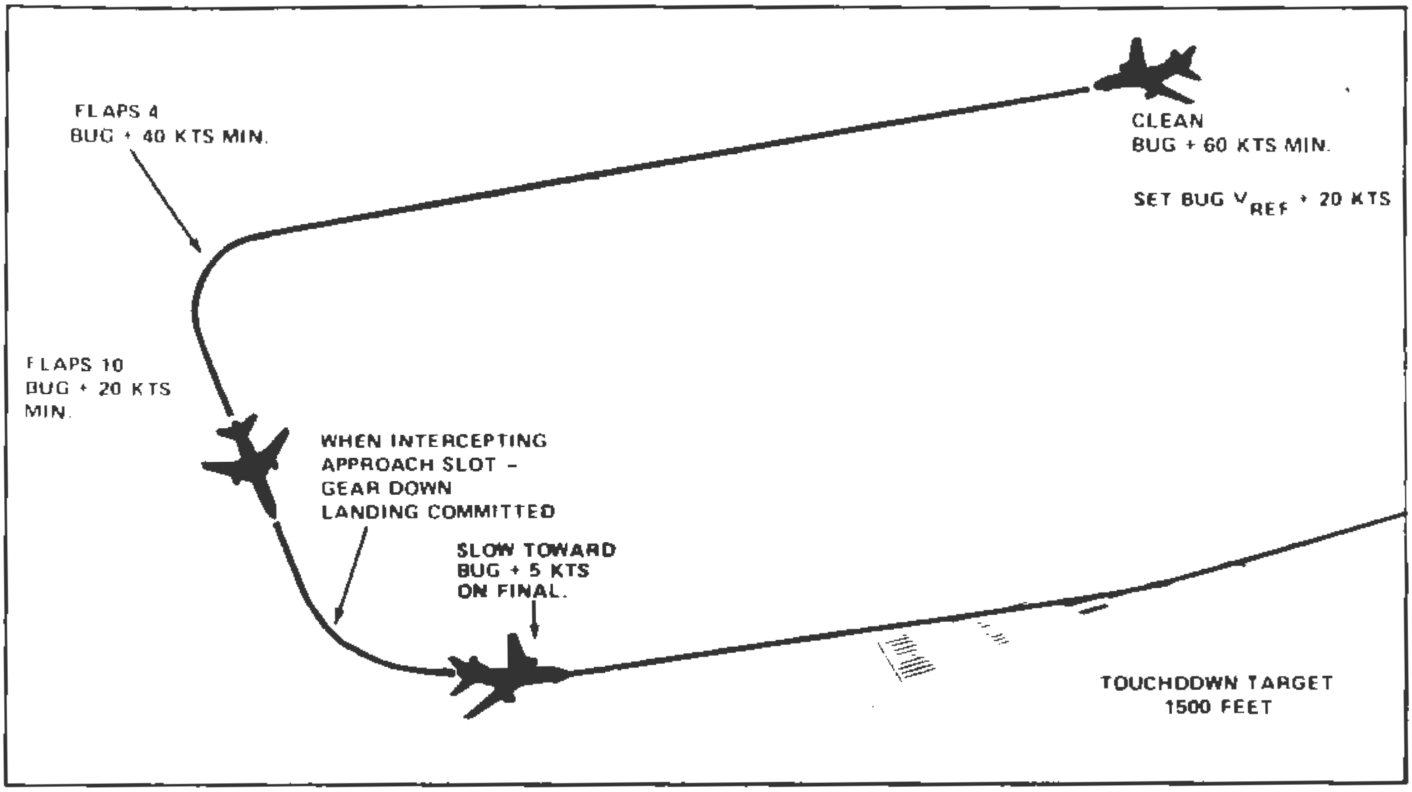
Close adherence to proper airspeed is imperative. With the low drag situation of no flaps, speed control is more difficult.

If the approach is discontinued, apply go-around thrust and rotate smoothly. With a positive rate of climb, retract the gear, if able, and accelerate to minimum speed or greater.

REFERENCE:

1011 Flight Handbook, Chapter 4.

TWO ENGINES INOPERATIVE LANDING



Give consideration to dumping fuel to reduce approach and landing speeds and to increase reserve thrust available for slot or glide slope correction.

Initiate the Two Engine Inoperative check list. Evaluate hydraulic capability and determine how the systems can best be utilized.

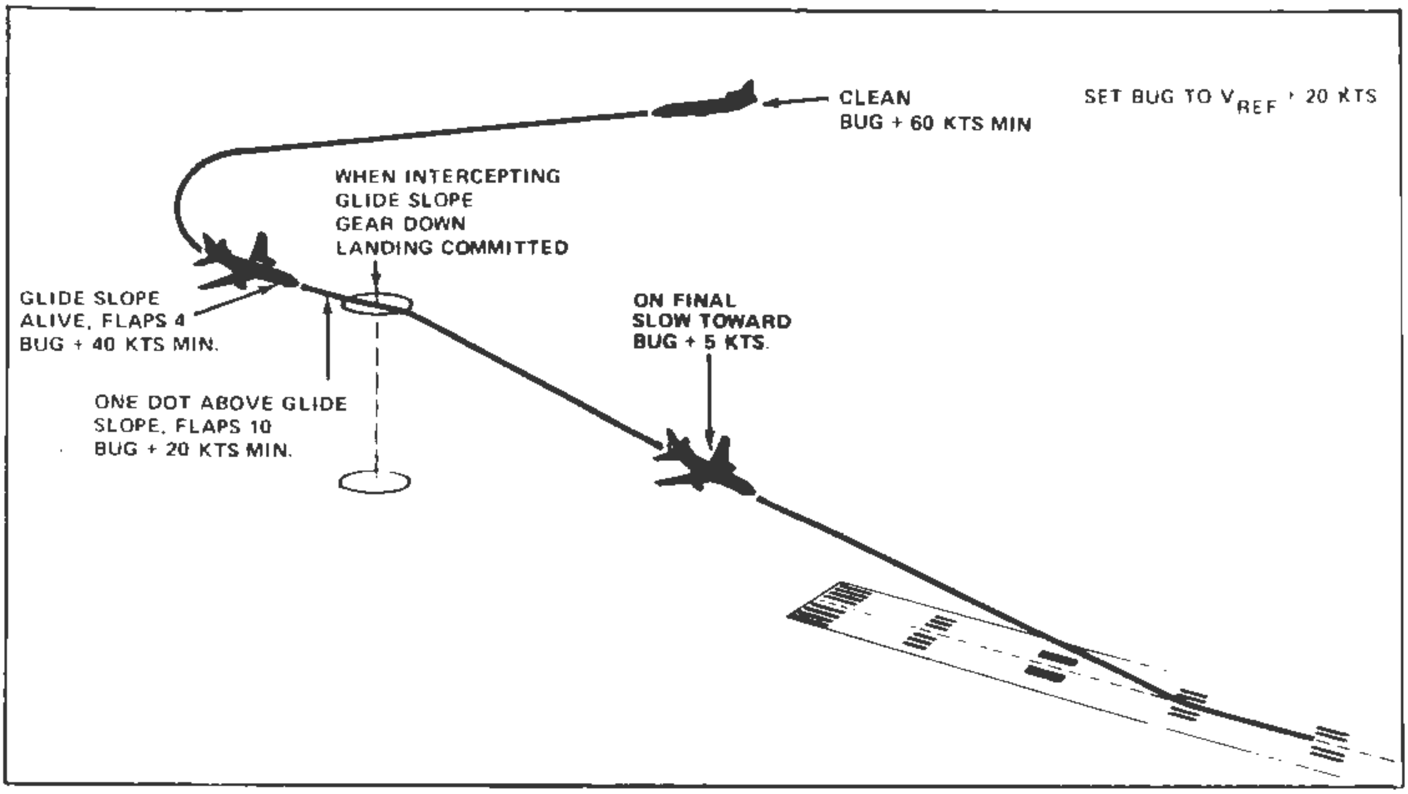
If a visual approach is to be made, fly a wider pattern, if practical. Plan the approach so that the turn onto final can be made at least 1000 feet above the airport and use an ILS glide slope if available.

After gear extension and verification of green lights, complete the landing final check list.

REFERENCE.

1011 Flight Handbook, Chapter 4.

ILS - TWO ENGINES INOPERATIVE



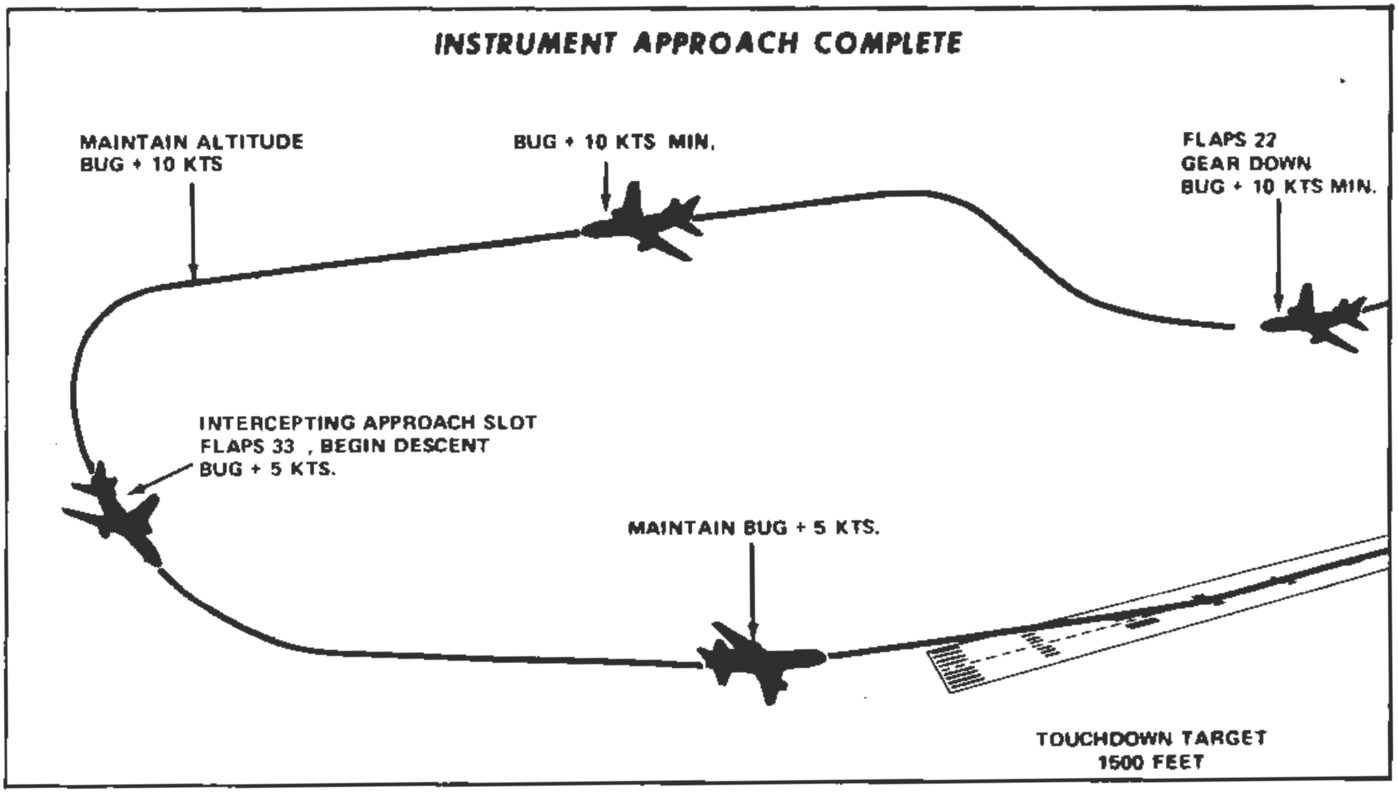
Give consideration to dumping fuel to reduce approach and landing speeds and to increase reserve thrust available for glide slope correction.

Initiate the Two Engine Inoperative check list. Evaluate hydraulic capability and determine how the systems can best be utilized.

Advise ATC of your higher airspeed and specify the size pattern and localizer intercept that you desire.

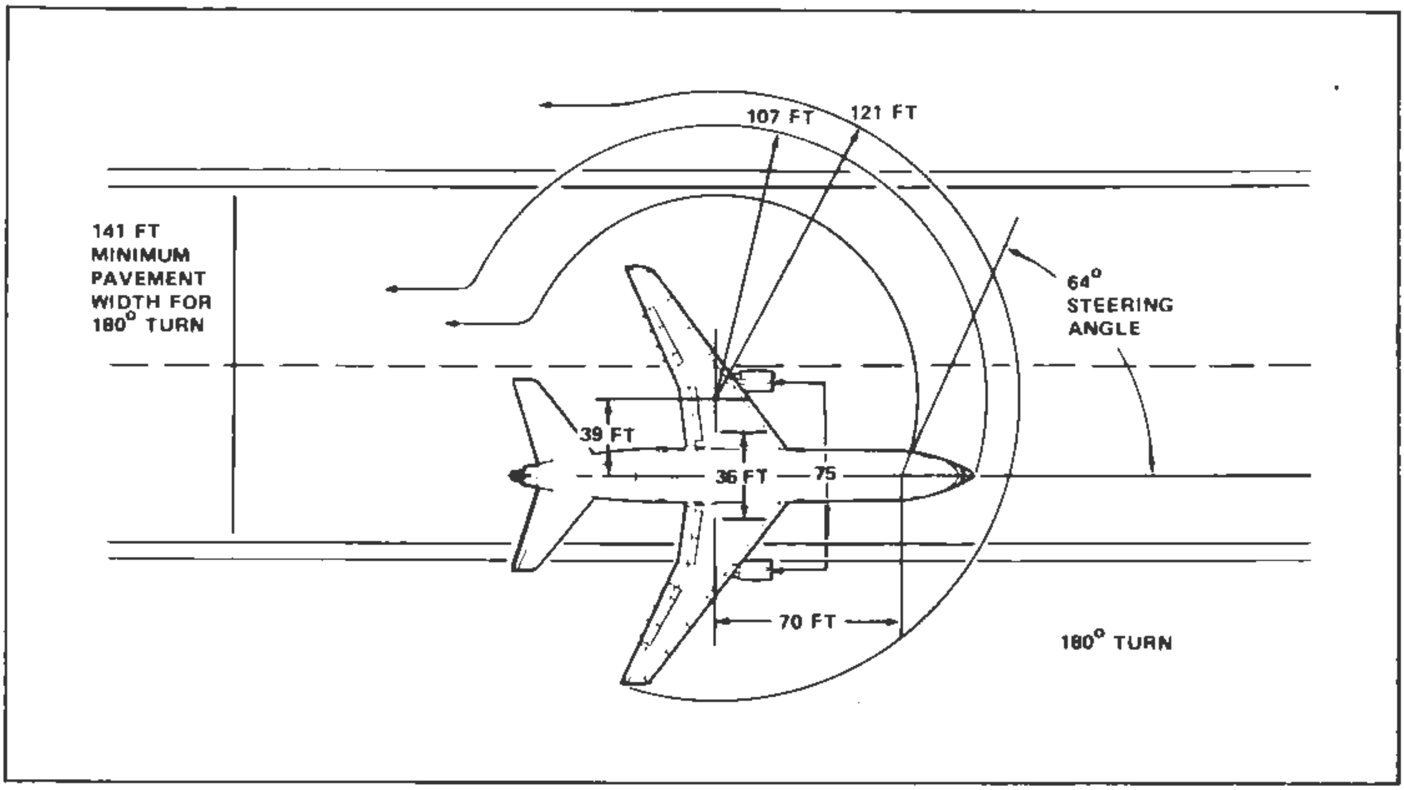
REFERENCE: 1011 Flight Handbook, Chapter 4.

CLOSE-IN CIRCLE



Minimums for close-in circle approach are 1000-3.

MINIMUM TURNING CIRCLE

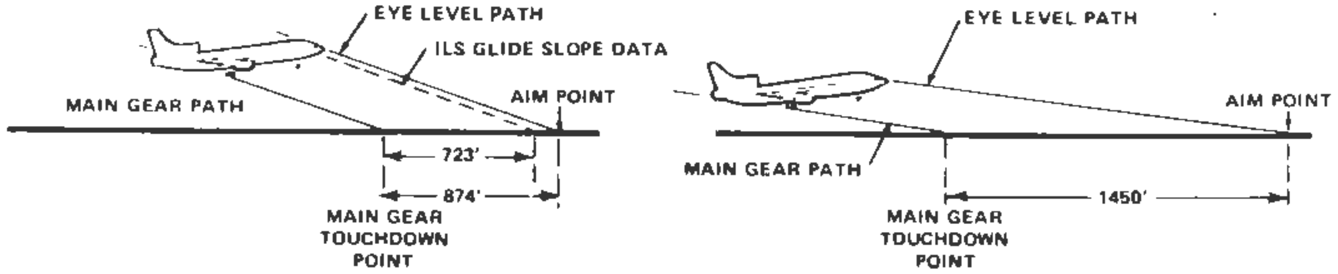


APPROACH AND LANDING GEOMETRY

GROSS WEIGHT 358,000 LBS.
FLAPS 33 (DLC OPERATIVE)

2.5° GLIDE PATH
(MINIMUM GLIDE PATH ANGLE)

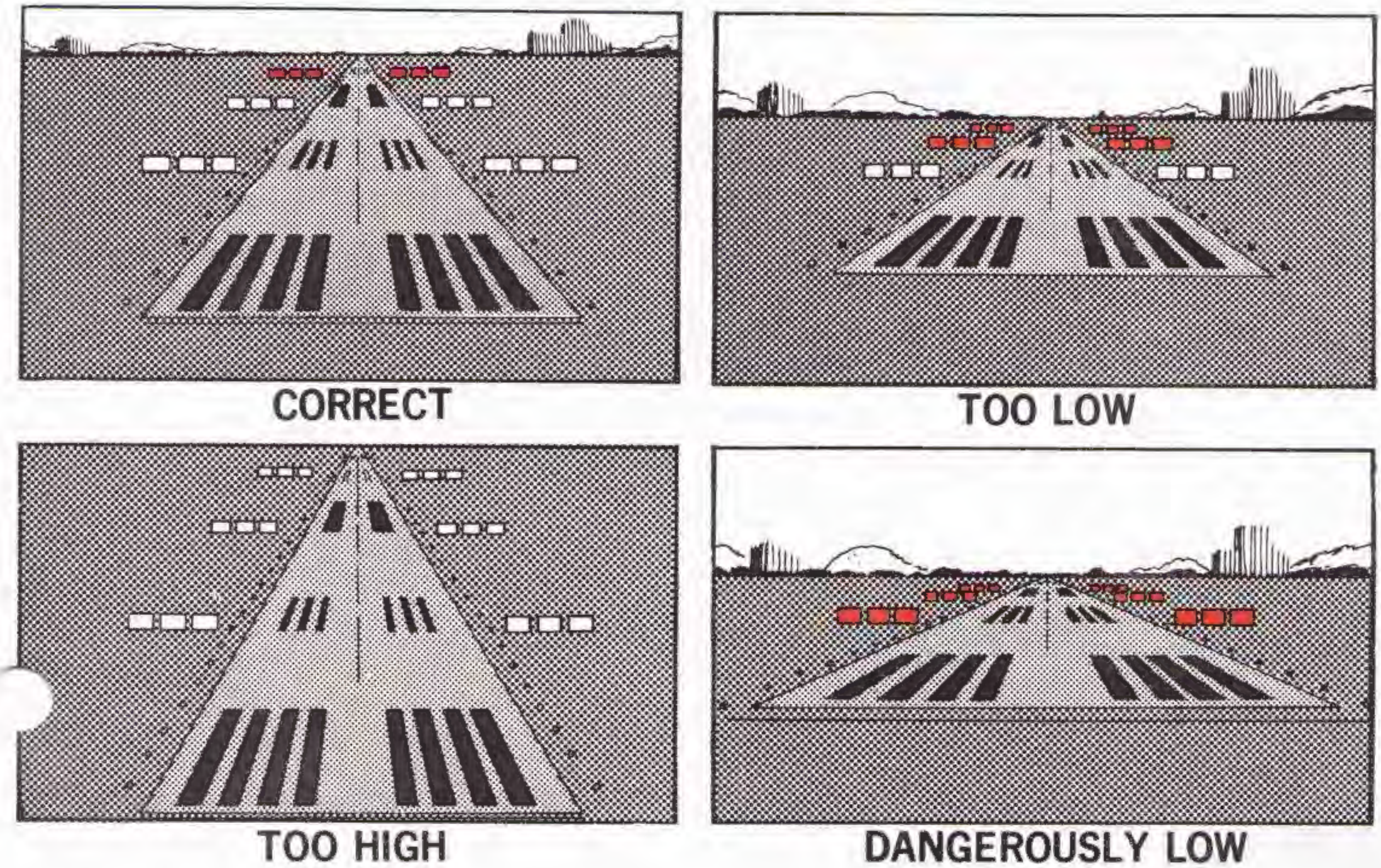
1.5° GLIDE PATH
(NOT RECOMMENDED)



RUNWAY THRESHOLD HEIGHT DATA

GLIDE PATH DEGREES	BODY ATTITUDE DEGREES	THRESHOLD CLEARANCE-FEET EYE LEVEL AIM POINT					
		1000 FT		1500 FT		2000 FT	
		EYE LEVEL	GEAR	EYE LEVEL	GEAR	EYE LEVEL	GEAR
1.5	8.8	26.4	(-) 11.8	39.5	1.3	52.6	14.4
2.5	7.8	43.5	5.4	65.3	27.2	87.1	48.9
3.5	6.8	61.2	23.1	91.7	53.7	122.2	84.2

WIDE-BODY JETS VASI



Glide path 2½ to 3½$^{\circ}$ usually aligned with other approach aid VASI does not provide center line alignment.

GENERAL

ILLUSTRATIONS

* * *

CERTIFICATE LIMITATIONS

Observance of the limitations contained in section 1 of the FAA Approved Airplane Flight Manual is required by law.

The contents of this chapter are reproduced from section 1 of the FAA Approved Airplane Flight Manual. Whenever there is a difference between the limitations contained in this chapter and those in the remaining chapter of this handbook, the most conservative limitation is to be observed

WEIGHT LIMITATIONS

Maximum taxi weight is 432,000 pounds, this weight must be adjusted by accounting for fuel burnoff, so that the maximum in-flight weight limitations are not exceeded.

Maximum brake release weight with flaps 10 is 430,000 pounds or less as limited by the TWA takeoff gross weight charts.

Maximum landing weight is 358,000 pounds or less as limited by the TWA landing gross weight charts in chapter 21.

Maximum zero fuel weight is 325,000 pounds The maximum taxi weight, maximum brake release weight or maximum in-flight weight may be less than the values listed above as limited by the center of gravity, fuel density and fuel loading limits this chapter.

OPERATIONAL LIMITS

Operational temperature limits are shown on the graph in section 1 02.

Runway slope limits are $\pm$ 2%.

Limiting tailwind component is 10 knots.

Maximum operating altitude is 42,000 feet pressure altitude.

Takeoff, landing and en route operational limits are shown on the chart in section 1.02.

PERFORMANCE LIMITATIONS

TAKEOFF WEIGHT LIMITATIONS

Aircraft takeoff performance weight limits derived from the TWA takeoff gross weight charts, are quoted in compliance with the climb gradient requirements specified in FAR Part 25.

The takeoff performance weight limits for conditions on the TWA takeoff gross weight data charts are weights at brake release.

The TWA takeoff gross weight data charts are based on second segment climb performance requirements. No other segment of the takeoff flight path is more limiting within the approved operational range.

Maximum permissible takeoff weight may be less than the structural limiting weight. These weight limits may be caused by some other criteria such as: available runway length, maximum V_1 brake energy limits, obstacle clearance, etc.

KIND OF AIRPLANE OPERATION

This airplane is certificated in the Transport Category, FAR 25.

The airplane is approved for the following kinds of flight and operation, both day and night; when the required equipment is installed and approved in accordance with the applicable Federal Aviation Regulations:

- Visual (VFR)
- Instrument (IFR)
- Icing Conditions
- Extended Overwater

FLIGHT MANEUVERING LOAD ACCELERATION LIMITS

Flaps Retracted	+ 2.5g - 1.0g
Flaps Extended	+ 2.0g to 0.0g

MINIMUM FLIGHT CREW

Three crew members - captain, first officer, engineer.

MAXIMUM OPERATING LIMIT SPEED

The maximum operating limit speed shall not be deliberately exceeded in any regime of flight (climb, cruise, or descent).

AIRSPEED LIMITATIONS

V_{mo}/M_{mo} as indicated by the maximum speed pointer on airspeed indicator.

See Maximum Airspeed Limits chart this chapter for:

- V_{fe} - Flap Extension Speeds.
- V_a - Design Maneuvering Speed.
- Landing gear speeds, V_{lo} and V_{le}.

AIRSPEED LIMITATIONS (Cont'd.)

FLAP MALFUNCTION

In the event that the trailing edge flaps fail to extend, the slats may still be operable. The maximum airspeed limit for the leading edge slats in any position other than up and locked is 250 knots/0.6 mach.

SLAT MALFUNCTION

Do not exceed 22 degrees of flap if the leading edge slats are locked in any position other than fully extended.

CONFIGURATION DEVIATION LIST

When the airplane is to be operated with a configuration deviation, it must be operated in accord with the certificate limitations as amended by the Configuration Deviation List, chapter 21.

POWERPLANT LIMITATIONS

(RR RB.211-22B Engine.)

Engine thrust EPR values for takeoff and maximum continuous thrust limits are contained in appropriate charts in chapter 21.

ENGINE PRESSURE RATIO COMPUTER

The Engine Pressure Ratio Computer System can be used to determine engine rating for all modes of operation. Crosschecks with the appropriate power setting charts in chapter 21 are required for takeoff modes. If values differ, the chart must be used.

ENGINE INSTRUMENT MARKINGS

Red radial line . . . . . . Maximum or minimum limit

Yellow arc . . . . Precautionary range

Green arc . . . . Normal operating range

OPERATING LIMITATIONS RR RB211-22B ENGINES

CONDITION	N_1 %	N_2 %	N_3 %	TGT Deg.C	TIME LIMIT
DURING START OR RELIGHT	—	—	—	550	Momentary (not exceeding 2 Seconds)
MAXIMUM FOR ACCELERATION	—	—	—	738	2 Minutes *
MAXIMUM TAKEOFF ***	99.5	101.5	95.0	728	5 Minutes *
MAXIMUM CONTINUOUS ***	101.0	101.5	93.7	700	Unrestricted
GROUND IDLE **	$21.0^{+2.3}_{-0}$	—	—	460	Unrestricted
MAXIMUM OVERSPEED	103.0	106.0	96.2	—	20 Seconds
MAXIMUM REVERSE THRUST	90.0	—	—	685	30 Seconds
MAXIMUM OVER TEMPERATURE	—	—	—	750	20 Seconds

* It is permitted to use 738 degrees C TGT for 2 minutes during takeoff but the total time at takeoff conditions must not exceed 5 minutes.

** The ground idle N_1 relates to an ambient temperature of 15 degrees C. The N_1 limit varies by 0.5% for each 15 degrees C change of ambient temperature; N_1 increasing above 15 degrees C and decreasing below 15 degrees C ambient temperature.

*** The N_1 limit for takeoff of 99.5% is designated by a red horizontal line on the outer portion of the scale plate of the vertical indicators. The N_1 limit for maximum continuous of 101% is designated by a red vertical on the vertical indicator scale plate That portion of the N_1 speed range between 99.5 and 101% is designated by yellow marking.

POWERPLANT LIMITATIONS (Cont'd.)

ENGINE OIL SYSTEM

Minimum oil pressure for dispatch:

Below 70% N_3	35 PSI
Above 70% N_3	40 PSI

Minimum oil pressure in-flight	35 PSI
Minimum during large reductions in RPM (each occasion)	18 PSI for 5 minutes

Oil Temperature

Minimum for Starting and Relighting	Minus 30°C
Minimum before Advancing Throttle	Minus 10°C
Maximum	Plus 100°C

Stabilized oil inlet temperature in excess of 90°C must be reported and the duration recorded for required maintenance procedures.

Maximum during tansient overshoot on reducing RPM	Plus 100°C to Plus 135°C for 15 minutes

ENGINE FUEL SYSTEM

Fuel Temperature

Maximum	Plus 95°C
Maximum during transient overshoot on reducing RPM	Plus 115°C for 15 minutes

Approved Fuels and Oils

Approved fuels, additives and oils are listed in rolls Royce, Operating Instructions, F-RB-211-T.

Reverse Thrust System

Takeoff shall not be initiated with any reverser lights on.

Movement and use of reverse thrust levers to the reverse thrust position in-flight is prohibited.

FUEL SYSTEM LIMITATIONS

The maximum allowable fuel quantity in each tank 2 left or tank 2 right is 27,179 pounds (structural limit).

MINIMUM FUEL REQUIRED

For takeoff, flight , and landing, the minimum fuel in each tank 2 compartment must not be less than the quantities shown on the Tank 2 Minimum Fuel Required for Flight charts in this section. (There is no minimum requirement for tanks 1 and 3.) Fuel loading and usage procedures described in chapter 2 assure compliance with the Minimum Fuel Required for Flight charts. Therefore, the primary utilization of this chart is for circumstances which lead to deviations from the standard or alternate fuel management described in chapter 2. For such circumstances, such as fuel migration from one tank compartment to another, use the following procedure:

Enter the chart with the actual airplane gross weight and read the required fuel load in the inboard and outboard sections.

If Minimum Fuel Requirements are not met, fuel must be ground transferred.

If Minimum Fuel Required is within limits check lateral imbalance using the following chart. If lateral limits are exceeded, fuel must be ground transferred.

Check to ensure that the longitudinal CG is within limits and will remain within limits during flight. Two CG limit diagrams are shown in this chapter. The choice of the appropriate CG diagram is subject to takeoff and zero fuel weight considerations as described in chapter 2.

The Minimum Fuel for Flight chart is based on a fuel density of 6.5 pounds per U.S. gallon, which is in the lower range of the average fuel density expected to be utilized for the 1011-1 (i.e., JP4 fuel). Normal tolerance excursions below this density are permissible.

With a normal operative quantity indicator system, fuel remaining in fuel tanks when the quantity indicator reaches zero is not considered useable in-flight.

LATERAL IMBALANCE OF FUEL LOAD

For takeoff, flight, and landing, the maximum allowable variation of fuel loads between paired tanks shall not exceed those shown below at the corresponding airplane gross weight. If maximum allowable imbalance exists in one pair of tanks, the other 2 pair must be equal.

FUEL SYSTEM LIMITATIONS (Cont'd.)

AIRPLANE GROSS WEIGHT	TANK PAIRS*		
	TANKS 1+1A AND 3+3A	TANKS 2L & 2R INBOARD	TANKS 2L & 2R OUTBOARD
355,000 lb or less	24,300 lb	12,400 lb	8,500 lb
370,000 lb	20,200 lb	10,300 lb	6,900 lb
380,000 lb	17,200 lb	8,600 lb	5,900 lb
390,000 lb	13,900 lb	7,000 lb	4,700 lb
400,000 lb	10,600 lb	5,200 lb	3,600 lb
410,000 lb	7,100 lb	3,400 lb	2,400 lb
420,000 lb	3,500 lb	1,700 lb	1,200 lb
430,000 lb or more	0 lb	0 lb	0 lb

* Linear variation between weights.

FUEL JETTISON

Flaps Up

Fuel may be jettisoned only between 180 and 300 knots with the flaps up and gear up or down.

Flaps Down

Fuel may be jettisoned with flaps extended from 4 to 22 degrees at speeds not to exceed $V_2 + 20$ with gear up or down. (TWA does not use 4 flaps.)

ELECTRICAL SYSTEM

Takeoff with a generator breaker failed in the closed position is prohibited.

WEIGHT AND BALANCE

When installed, the Weight and Balance System does not adversely affect any other aircraft system but function and performance characteristics have not been determined. Therefore, flight operations must not be predicated on its use.

The airplane must be loaded in accordance with a loading schedule compatible with the information on the 1011 Load Balance Record.

CENTER OF GRAVITY

Refer to the Design Center of Gravity Envelope in this chapter.

At takeoff weights less than 293,000 pounds, use rolling takeoff procedure.

CABIN PRESSURIZATION

Maximum Relief Valve Differential Pressure 8.83 PSI

Maximum Differential Pressure at Takeoff and Landing 0.15 PSI

OPERATION WITH ALL ECS PACKS OFF

Takeoff with all ECS packs off is permitted only when the airport ambient temperature is 120° F or less.

To assure adequate pre-cooling, operate 2 or more ECS packs prior to and during taxi.

If takeoff is made with ECS packs off, ECS must remain off until at least 400 feet above ground level. Pack flow may be re-established at 400 feet above ground level or when obstacle clearance is assured, whichever is higher. In no case should all packs be off more than 5 minutes.

UNPRESSURIZED FLIGHT

Unpressurized flight is to be made with one pack operating and an outflow valve open.

RAM AIR TURBINE

Do not takeoff with RAT deployed.

AUXILIARY POWER UNIT (APU) LIMITS

N_G RPM - 101.5% Steady State
102.5% Transient

TGT - 1066°C (Maximum)
760°C (Start)

Altitude Operating Limit - 31,000 feet.

APU generator load must be limited to 54 KW above 14,000 feet.

Approved Oil - PWA Spec, No. 521.

It is prohibited to supply both APU load compressor air and engine bleed air simultaneously to a common manifold.

ENGINE ANTI-ICE SYSTEM

Engine anti-icing system must be on when icing conditions exist.

DOOR-MOUNTED ESCAPE SLIDES

Each door select lever on the door control panel must be in the engage position prior to departure from the passenger ramp and remain in position until arrival at the unloading ramp. After the door is closed in engage it must be verified that the girt bar is locked in place.

INTERIOR DOORS

All interior doors shall be closed and latched for taxi, takeoff, landing, and turbulence.

GALLEY OCCUPANCY

Do not occupy during taxi, takeoff, or landing.

OVERHEAD STOWAGE COMPARTMENTS

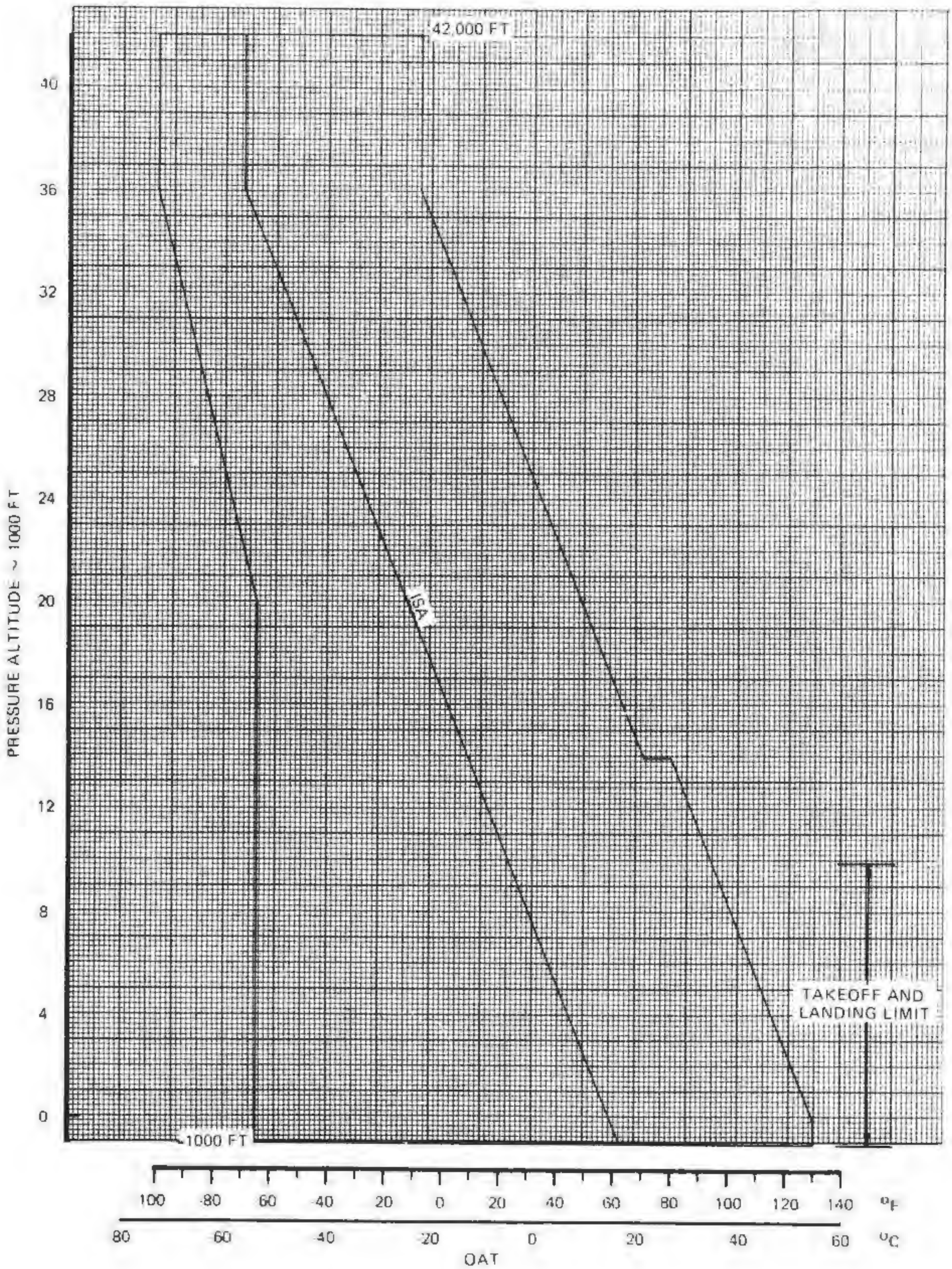
The overhead stowage compartments shall be closed except for compartment loading or unloading.

GALLEY SMOKE DETECTOR

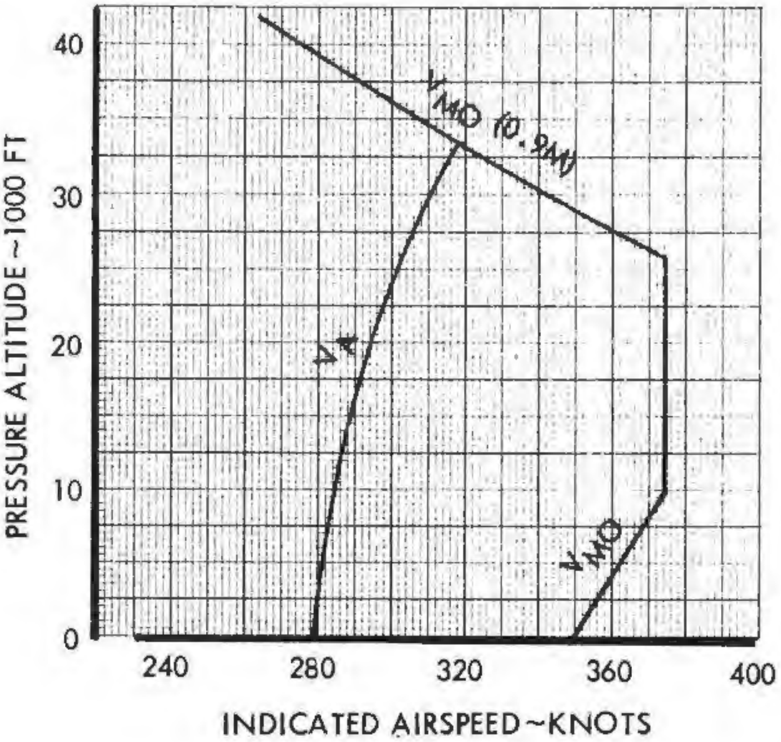
No flight may be dispatched with an inoperative galley smoke detector system.

* * *

ENVIRONMENTAL ENVELOPE



MAXIMUM AIRSPEED LIMITS



V_{FE} FLAPS EXTENSION SPEEDS

FLAP ANGLE SELECTED (DEGREES)	KNOTS IAS/MACH
4	250/0.6
10	230/0.5
22	205/0.5
33	170/0.4

If the landing flap extension speeds are inadvertently exceeded the LRS will limit flap angle to 28° at airspeeds above 164 knots. When airspeed decreases to 164 knots, flaps will extend, as selected, to 33°. Limit speed with flaps at LRS position (28°) is 195 KIAS/0.4 Mach.

LANDING GEAR OPERATING SPEEDS, V_{LO}:

RETRACTION, 230 KIAS

→ EXTENSION, 250 KIAS/0.73M* (NORMAL OPERATIONS)

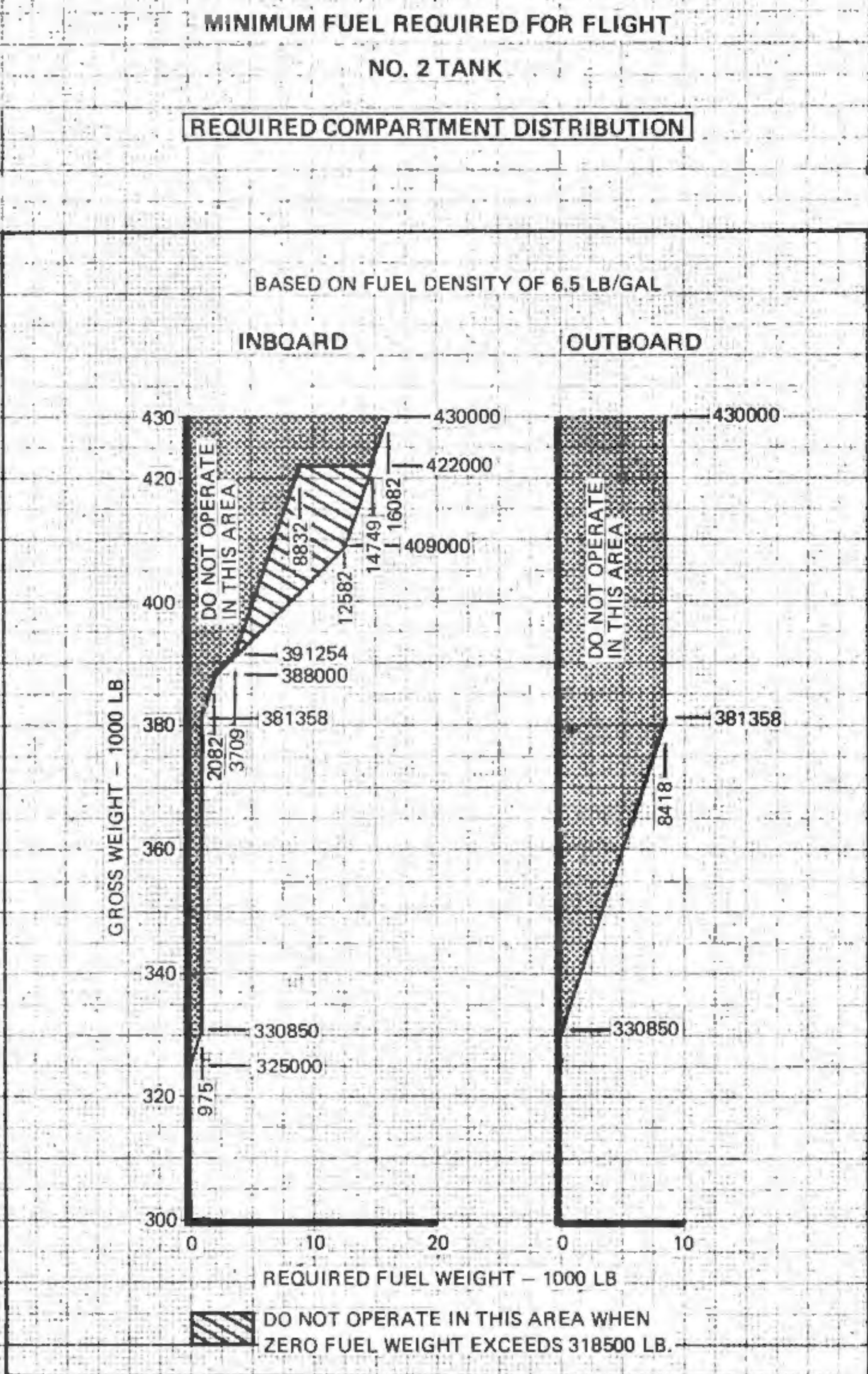
LANDING GEAR EXTENDED SPEEDS, V_{LE}:

→ 250 KIAS/0.73M* (NORMAL OPERATIONS)

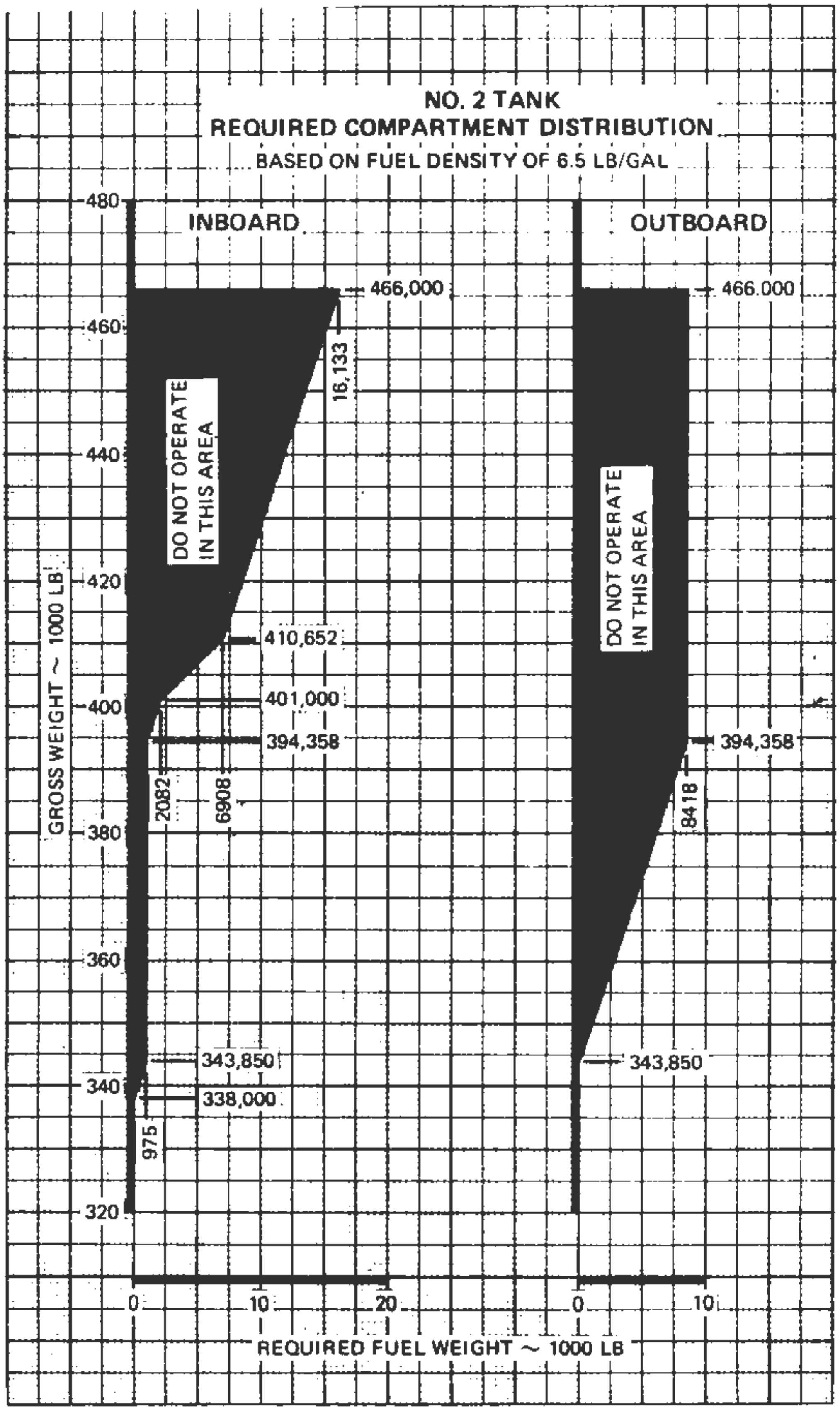
The above placard speeds shall not be deliberately exceeded in any regime of flight.

* The Landing Gear Operating speed, V_{LO}, and Landing Gear Extended Speed, V_{LE}, is 300 KIAS/0.85M when FAA - approved Lockheed Service Bulletins 093-52-010, -050, -051, -074 and -078 are accomplished, as applicable.

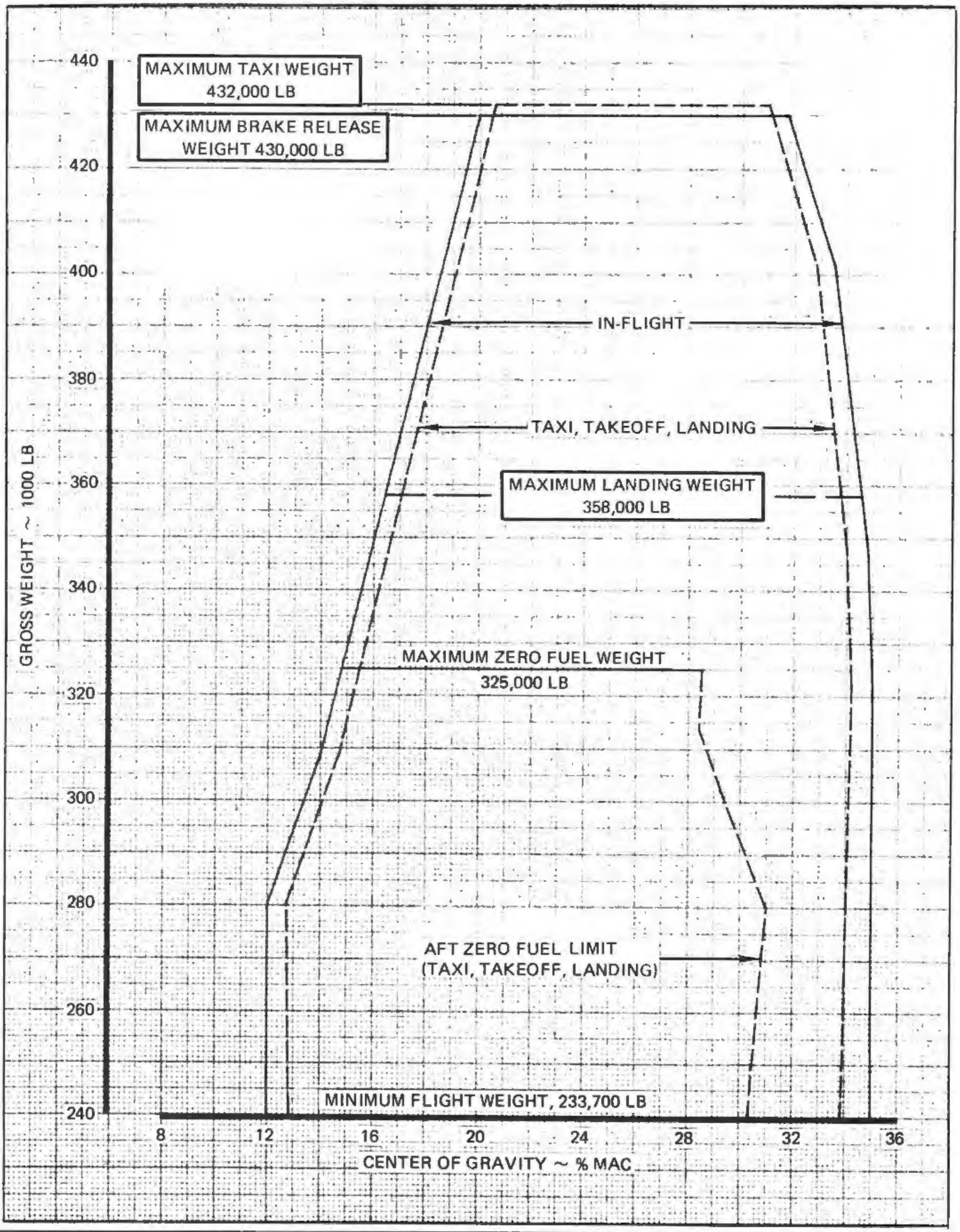
MINIMUM FUEL FOR FLIGHT



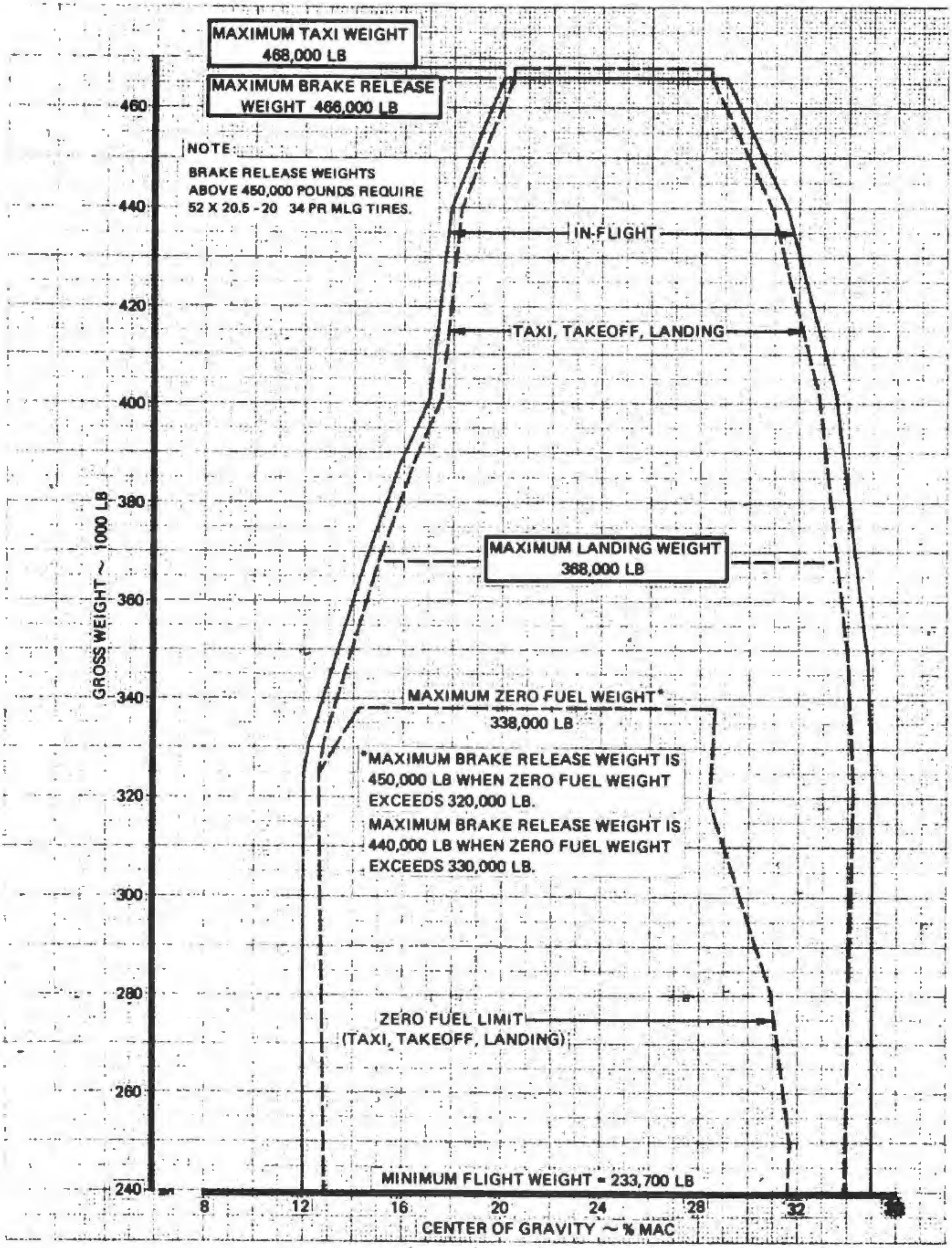
MINIMUM FUEL FOR FLIGHT -*100*



DESIGN CENTER OF GRAVITY ENVELOPE, FUEL MANAGEMENT



DESIGN CENTER OF GRAVITY ENVELOPE, FUEL MANAGEMENT *-100*



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MODIFICATION SUMMARY

CHECK LIST AND CREW COORDINATION

CHECK LIST

PREFLIGHT GUIDE

FUELING AND FUEL MANAGEMENT

APPROACH AND LANDING (Cont'd)

RAMP

SYSTEM SPECIFICATIONS

* * *

FLAP LOAD RELIEF SYSTEM DEACTIVATION

The flap load relief system is being deactivated.

This modification consists of removing the wires between the LRS computer and the LRS actuator. The FLAP LRS INOP and FLAP LRS LIMITING lights will be removed from the pilot's annunciator panel. The flap LRS override switch will be removed from the first officer's side of the pedestal.

The aural warning for the LRS system is being deactivated. However, the LRS aural warning test function is still active.

15 DEGREE ENGINE AFTERBODY

Engines are being modified with a 15 degree afterbody. The purpose of the modification is to reduce weight and drag. The new afterbody is substantially shorter than existing engines and there is a marked difference in engine appearance.

The present engine and the 15 degree afterbody engine are interchangeable and can be installed on aircraft in any combination. There are no changes in operational procedures associated with the new afterbody.

FLIGHT DIRECTOR WARNING ANNUNCIATOR

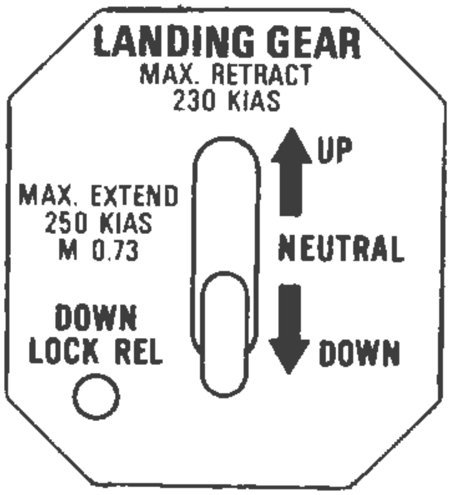
The autopilot/flight director computers are being modified to delete the NO FLARE annunicator and flashing alert light for flight director only ILS approaches. These normally appear at 150 feet with flight director only approaches if the autoland mode is selected. The NO ALIGN annunicator will still appear at 1,500 feet after the modification is completed.

ADDITIONAL ADI PITCH MARKINGS

Additional pitch markings on ADIs will be provided for 17½, 20, 22½, and 25 degree pitch up reference.

LANDING GEAR SPEED RESTRICTION

A modification is in process to strengthen the landing gear doors. A speed restriction of 250 knots and M.73 will be in effect for all operations until the modification is completed. A placard is installed to the left of the gear lever. When the modification is completed, the placard will be removed, and speed will be increased to 300 knots and M.85.



BUS TRANSFER RELAY CONTACT WELDING

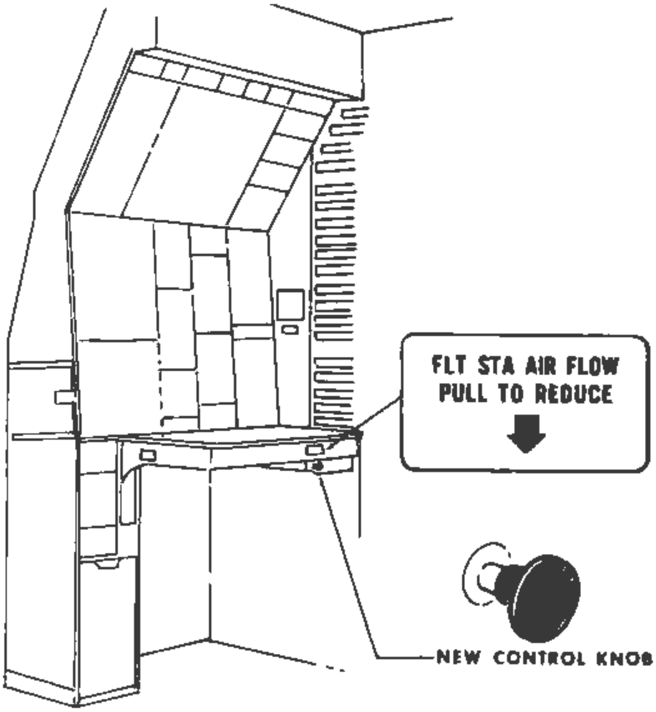
Welding of the main electrical contacts of the DC Standby bus and engine start bus transfer relays has been reported. The problem is most likely to occur when the standby power preflight check is being performed or during engine start. If the welding occurs, the battery continuously powers the subject bus resulting in a discharge of the battery. The only indication of the malfunction is on the battery ammeter and voltmeter.

Until a modification is completed, the engineer should check that the battery is charging normally after the standby power check and after the engines are started. With the DC meter selector in the battery position, normal battery charging is indicated by cycling between zero and -40 amps.

An indication of engine start bus contacts welding to the battery is the DC ammeter cycling between +20 and -20 amps. If the DC Standby bus welds to the battery, the ammeter shows zero or positive amps and the battery charger turns off. In either case, the battery depletes and all loads on the affected busses are unpowered. This includes the battery bus which powers the engine fire extinguishers and the evacuation alarm.

TWO-POSITION COCKPIT FLOW CONTROL VALVE

A two-position, cockpit flow control valve knob is being installed under the right side of the engineer's table. The purpose of this push-pull control is to reduce cockpit noise when all three packs are operating. Pulling the control will select low flow; pushing the control will select normal flow. Selecting reduced flow will lower cockpit air noise to an acceptable level for communications. This is also the recommended way to reduce cockpit drafts instead of closing the side window vents, the overhead air vents, and turning off one pack.



EVACUATION SLIDE MOORING LINE

A mooring line assembly has been approved for installation on all evacuation slides. The mooring line provides an easily released tethering capability that will keep the slide in the vicinity of an aircraft in the water. The line is 25 feet long and has an automatic and manual release. The manual release is located within reach of the slide and is worked by unsnapping the tab, pulling the tab until a cotter pin comes free, and then pulling line loose if necessary.

* * *

GENERAL

The procedures to follow when operating the aircraft under normal conditions are described in this chapter. Instructions about these phases of operation are listed, together with Normal check list amplification. All operating procedures and limitations set forth in this handbook shall be adhered to unless deviation is necessary for safety.

Operating procedures that are not considered part of a normal operation, such as anti-icing, manual pressurization, etc., are in the appropriate system chapter. This is done to reduce the volume of the normal procedure sections and, where there are two ways of accomplishing a job, to define which is the normal method.

USE OF THE NORMAL CHECK LIST

The normal check list is not intended to provide a double check of every normal procedure. It covers important items to be checked prior to the more critical phases of operation. The crew should accomplish procedures in an orderly manner at the appropriate time, then confirm their accomplishment by reading and answering for the check list when specified. For example, the operational checks which require a significant length of time should be done prior to reading the Before Starting Engines check list.

Turn on the essential radio switch prior to reading the Before Starting Engines check list and leave it on until completion of the Secure Cockpit check list. The cockpit voice recorder operates through the essential radio power switch.

The captain will normally respond to all pilot items on the check lists except as noted.

The Before Starting Engines and the Secure Cockpit check lists will be read by the first officer. The engineer will read the remaining sections. The first officer will answer for all the pilot items on the After Takeoff, Landing Final (except boxed items), and After Landing sections of the check list.

The engineer will silently perform his own challenges and responses.

The crew member reading the check list will advise the captain when the check list called for is accomplished, stating "__________ check list complete."

When a check list answer is "Check", this indicates the position of the control is in the desired position, but not necessarily operationally checked. For example, "EXTERIOR LIGHTS . . . CK" indicates the position of the various exterior light controls have been visually checked for proper position, not that all the lights will operate. When an operational check of a system is required, the answer to the check list challenge will be two-fold, such as "RADIOS . . ON & CK."

There are items on the check list that will be accomplished before reading the check list. When the captain calls for the check list, this is his command for the check list to be read and complied with.

The following outlines when the various check list sections are to be completed. It is recognized, however, that conditions can dictate some deviation.

Before Starting Engines - When the operating cockpit crew is in the cockpit and after the time consuming checks have been completed.

After Starting Engines - When all engines have stabilized at idle RPM and prior to brake release for pushout or taxi from the station. Additionally, when restarting an engine intentionally shut down due to anticipated departure delay.

Taxi - After the wing flaps have reached the takeoff position prior to reaching the runway. When an engine must be restarted, delay reading until all engines are running and the After Starting Engines list has been read.

Before Takeoff - After receiving takeoff clearance and approaching the takeoff end of the runway, or when in position and holding when takeoff clearance is imminent.

After Takeoff - Any time after flap retraction has been completed and climb power has been set.

Landing Preliminary - Normally when leaving flight level 180. On low level flights, ten to fifteen minutes before estimated time of arrival or before beginning descent.

Landing Final - Normally after initial flap extension and prior to final fix and/or gear extension. Prior to gear extension, this section will be accomplished down to the boxed items.

USE OF THE NORMAL CHECK LIST (Cont'd.)

After seeing three green lights, the captain will command "Complete the check list." The engineer will then read and answer aloud for the boxed items. After these responses, the engineer will announce "Final check list complete."

After Landing - When the landing roll phase is completed and starting to taxi.

Secure Cockpit - After all fuel and ignition switches are off.

WARNING LIGHT CHECKS

During preflight checks of warning or annunciator lights, all bulbs in each light fixture must be operative. Before replacing bulbs in push button switches, it is advisable to pull related circuit breakers to avoid inadvertent operation of affected equipment.

CREW COORDINATION - GENERAL

Crew duties, as set forth in this handbook, are generally common to all TWA aircraft.

Crew members will normally adhere to their specific duties, as outlined herein. They should not assume the duties assigned to another crew member unless directed to do so by the captain. Each subordinate crew member is responsible to the captain for the proper handling of his station functions. The greatest safety and proper crew coordination can only be achieved when each crew member performs the duties and functions for which he is responsible.

When the first officer is flying the aircraft, the captain will maintain his feet in a normal position on the rudder pedals and closely monitor all controls during the critical stages of takeoff, climb, approach, and landing. The captain will also perform those en route procedural duties normally assigned to the first officer. The exception would be items that can only be accomplished by the first officer due to physical location of controls and switches. Any time the captain desires to take over the controls, he will call out "I've got it" when he has the controls for all three axes. The first officer will then relinquish the controls and assume his normal duties.

Crew members will repeat the captain's commands to indicate they understand and are complying with the command.

After receipt and confirmation of any ATC clearance, the pilot flying will repeat aloud his understanding of the clearance to assure that all crew members are aware of the altitude and clearance limit to which the flight is cleared.

The first officer or engineer will assist the captain by silencing the gear warning horn when the throttles are retarded.

All cockpit crew members shall assist the captain in monitoring and cross-checking instruments, bug settings, assigned altitudes and headings, control positions including flaps, spoilers, landing gear, stabilizer position, etc. A crew member shall immediately call to the captain's attention any discrepancy noticed.

More specific assignment of duties for the approach phase of flight are outlined in the Approach and Landing section of this chapter.

COCKPIT/CABIN CHIME SIGNALS

Hi-lo chime:

> Interphone call originating from the cockpit or cabin.

Three chimes:

> Flight attendant reports to cockpit.

Four chimes:

> Severe turbulence is imminent. Flight attendants will take the nearest seat.

Six chimes from the cockpit:

> An emergency exists. Flight attendant in charge reports to cockpit immediately.

Six hi-lo chimes from cabin:

> An emergency interphone call is being made. The flight attendant will transmit without waiting for a reply at the completion of six hi-lo chimes.

* * *

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NORMAL 1011 CHECK LIST

BEFORE STARTING ENGINES

AT THRU STATIONS (NO MECH. DELAY OR CREW CHANGE) NECESSARY TO READ ONLY BOXED ITEMS

PILOTS

1. GEAR LEVER & LIGHTS .... DOWN & CK
2. PARKING BRAKE .... ON
3. 100 DOM INS MODE SELECTORS .... ATT
   INTL INS MODE SELECTORS .... NAV
4. COMPASSES .... MAG
5. RADIOS .... ON & CK
6. OVERHEAD PANEL .... CK
7. EXTERIOR LIGHTS .... CK
8. STBY PWR & EMERG LTS .... ARMED
9. SEAT BELT & NO SMOKE .... ON
10. FLIGHT INSTRUMENTS .... CK
11. ALTIMETERS & CLOCKS .... SET & CROSSCK
12. -100 RADIO/INS SWITCHES .... RADIO
13. RADAR & TRANSPONDER .... STBY

14. WARNING LIGHTS .... CK
15. STALL WARNING .... CK
16. ANTI-SKID .... CK & ON
17. INSTRUMENT COMPARATOR .... CK
18. AFCS WARNING & MODE ANN .... CK
19. GROUND PROXIMITY WARNING .... CK
20. INSTRUMENT SOURCE SELECTORS .... NORMAL
21. BRAKE SELECTOR .... SYS B
22. PITCH & ROLL DISCONNECTS .... NORMAL
23. SPEED BRAKES .... DOWN
24. FUEL & IGNITION SWITCHES .... OFF
25. RUDDER & AILERON TRIM .... CK
26. OXY MASK & REGULATOR .... CK & EMERG OFF

ENGINEER

1. FUEL PANEL .... CK & SET
2. FUEL QUANTITY .... ________
3. BATTERY SWITCH .... ON
4. HYDRAULIC QUANTITY .... CK
5. PRESSURIZATION CONTROLS .... CK & SET
6. ENGINE OIL QUANTITY .... CK
7. APU PANEL .... CK
8. FLIGHT RECORDER .... ON & CK
9. EPR COMPUTER .... T.O.
10. CIRCUIT BREAKERS .... CK

11. ELECTRICAL PANEL .... CK & SET
12. HYDRAULIC PANEL .... CK & SET
13. FIRE CONTROL PANELS .... CK & SET
14. BLEED CONTROLS .... CK & SET
15. AIR CONDITIONING CONTROLS .... CK & SET
16. FUEL AMPLIFIER & JETTISON PANELS .... NORMAL
17. WEIGHT & BALANCE .... ON & CK
18. SLAT MONITOR .... ON & CK
19. AURAL WARNING & GALLEY SMOKE .... CK
20. WARNING LIGHTS .... CK
21. CREW OXYGEN .... ON
22. OXY MASK & REGULATOR .... CK & EMERG OFF

WHEN GEAR DOORS & FLAPS CLEAR

Pilots

27. BRAKE PRESSURE .... CK

28. AUTOPILOT & FLIGHT DIRECTOR .... CK & OFF
29. STABILIZER TRIM .... CK

Engineer

23. HYDRAULIC PUMPS .... CK & OFF

AFTER STARTING ENGINES

Pilots

1. START SWITCHES .... OFF
2. ANTI-COLLISION LIGHTS .... ON
3. BRAKE PRESSURE .... CK
4. FLIGHT CONTROLS .... CK

Engineer

1. FUEL TANK PUMPS .... ON
2. ELECTRICAL PANEL .... CK
3. HYDRAULIC PANEL .... CK
4. PACK VALVES .... OPEN
5. DOOR WARNING LIGHTS .... CK
6. APU .... CK

TAXI

Pilots

1. ENGINE ANTI-ICE .... ________
2. FLAPS .... 10 & GREEN LIGHT
3. AILERONS .... CK
4. STABILIZER TRIM .... CK & SET
5. T/O DATA, EPR & A/S BUGS .... SET & CROSSCK
6. PITOT, ALPHA & WINDSHIELD HEAT .... ON

Engineer

1. AIDS GROSS WEIGHT .... SET
2. ANNUNCIATORS .... CK

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NORMAL 1011 CHECK LIST

PILOTS — ENGINEER

BEFORE TAKEOFF

	Pilots			Engineer	
1	CABIN ALERT	CK	1.	PACK VALVES	CK
2	TRANSPONDER	CK			
3	STROBE LIGHTS	ON			
4	IGNITION	ON			
5	TEMP PROBES HEAT	ON			

AFTER TAKEOFF

	Pilots			Engineer	
1	GEAR LEVER	NEUTRAL	1	PACK VALVES	CK
2	LANDING & LOGO LIGHTS	OFF			
3.	IGNITION	OFF			
4	SEAT BELT & NO SMOKE	CK			

LANDING PRELIMINARY

	Pilots			Engineer	
1	ANNUNCIATOR RECALL	CK	1.	CABIN ALTITUDE	CK
2	ANTI-ICE	CK	2.	CIRCUIT BREAKERS	CK
3	SEAT BELT SIGN	ON			
4	LOGO LIGHT	CK			
5.	ALTIMETERS	SET & CROSSCK			
6	GW & AIRSPEED BUGS	SET & CROSSCK			

LANDING FINAL

	Pilots			Engineer	
1	EPR COMPUTER	GO AROUND	1.	FUEL PANEL	CK
2	IGNITION	ON	2.	SLAT MONITOR	CK
3	NO SMOKING SIGN	ON			
4	ALTIMETERS	SET & CROSSCK			
5	BRAKE PRESSURE	CK			

WHEN GEAR EXTENDED

6.	GEAR & ANTI-SKID	DOWN & CK
7	FLAPS	____ & GREEN LIGHT
8	1011 ALTIMETERS	CK-INCH HG/MILLIBARS

AFTER LANDING

	Pilots			Engineer	
1	BRAKE PRESSURE	CK	1.	APU	CK
2.	IGNITION	OFF			
3.	RADAR, TRANSPONDER & DME	STANDBY			
4	FLAPS	UP			
5.	SPOILERS	DOWN			
6	STABILIZER TRIM	ZERO			
7	STROBE LIGHTS	OFF			

SECURE COCKPIT

	Pilots			Engineer	
1	PARKING BRAKE	ON	1.	FUEL TANK PUMPS	OFF
2.	AIR DATA HEAT	OFF	2.	HYDRAULIC PANEL	CK
3	WINDSHIELD HEAT	IDLE & OFF	3.	PACK VALVES	CK
4.	ANTI-COLLISION LIGHTS	OFF	4.	FLIGHT RECORDER	OFF
5.	STBY PWR & EMERG LTS	OFF		*FLIGHT TERMINATION*	
	FLIGHT TERMINATION		5.	BATTERY SWITCH	OFF
6.	RADAR	OFF	6.	CREW OXYGEN	OFF
7	-100 INS MODE SELECTORS	OFF			

RADIOS . . . . OFF

* * *

EXTERIOR

Perform a check of the general condition of the aircraft exterior for obvious damage, excessive fluid leakage, and the following:

Fixed masts, such as pitot heads, TAT probes, radio antennas, and angle-of-attack sensors.

Engine cowling, pylons, inlet and exhaust areas.

Wing leading edges, tips, and trailing edges.

Flight control surfaces.

Landing gear and tires.

COCKPIT

SAFETY CHECK

Before connecting electric power to the busses or pressurizing pneumatic manifold, check the following:

Ignition and start switches off

Gear lever in down detent.

Flap handle agrees with flap/slat position.

Fuel and ignition switches off.

Radar off.

Fuel jettison switches off.

Tank pump switches off.

Battery switch on.

AC hydraulic pump switches off.

ATM switches off.

FIRE CONTROL TEST

Fire Extinguisher

DC bus 1 must be powered to make extinguisher check.

Press the fire extinguisher test switch and check that all main and alternate lights illuminate. While holding the test switch, press the short switch and check all lights go out.

Release test switch.

Fire Detection Loop.

Set all engine and APU fire detector selectors to BOTH and press A and B test switches simultaneously. Silence fire bell and check the following:

All A and B loop lights illuminated.

Master fire warning lights illuminated.

Fire detector loop light flashes.

Fire control lights illuminated.

Release test switch and check all lights extinguished.

APU START

Select DC meter to BAT and AC meter to APU.

Check battery condition light out.

Place APU master power switch on and check:

Primary fuel emergency shutoff valve in-transit light.

APU low oil quantity light out.

Auto fire shutdown switch in and armed light on. This is an inflight requirement.

APU bleed air shutoff switch off.

Mode selector switch in minimum mode.

Push APU generator breaker trip switch.

Push APU start switch and check the following.

Doors in-transit light illuminated for about 10 seconds while doors open.

Don't load light illuminates after doors in-transit light goes out.

RPM and TGT increasing.

Battery voltage and amperage during start.

If RPM does not increase beyond 56% or TGT does not further increase after 40 seconds, push the stop switch.

When RPM has stabilized with don't load light out and TGT stabilized in the green band, check APU generator:

Field relay closed.

Voltage and frequency normal.

Low oil pressure light out.

Push generator breaker close switch and observe APU generator breaker and AC tie breakers close, APU KW load, and battery charging.

If external power in use, push generator breaker close switch, turn off external power switch, and observe APU generator breaker closes.

COCKPIT (Cont'd)

APU NOT AVAILABLE

Observe that external power available light is on.

Select external power with AC meter selector and check voltage and frequency.

Place external power switch to ON.

Observe that the AC tie breakers are closed.

Check battery charger operation.

AIR CONDITIONING START

Close all pack valves, both cross bleed valves, and ATM isolation valve.

Open APU bleed air shutoff valve and check open light illuminated.

Observe bleed air pressure indication on No. 2 pressure gauge.

Open ATM isolation valve and both cross bleed valves.

Observe bleed air pressure indication on No. 1 and No. 3 pressure gauges.

The following items should be checked before operating an air conditioning pack:

Pack auto/manual control switch in auto.

Ground control switch in and ram auto light out

Zone trim switches in. Closed light off.

Zone temperature selectors in mid position.

When OAT greater than 32°F, press humidity control to ON. Do not operate humidity control with temperature less than 32°F.

During warm weather, it may be necessary to operate APU in normal mode to provide proper ventilation and cooling.

Floor heat switch in and off light out.

When the manifold is pressurized, open pack valves one at a time. Monitor each pack for normal operation prior to opening the next pack valve.

GENERAL

During the pre-flight at each station, check the following:

Oxygen regulator emergency lever NORMAL, oxygen diluter lever 100%. Oxygen supply lever at observer position off.

Oxygen mask.

Smoke goggles (except second ACM).

Seat belt and shoulder harness.

Microphone and headset.

Life vest.

CIRCUIT BREAKERS

Check that all circuit breakers on panels No. 1, No. 2, and No. 3 are in unless banded open.

ENGINEER'S AREA

Check the following:

Engineer desk equipment including the pilots' Abnormal Procedures Guide check list.

Normal, Emergency and Abnormal Procedures Guide check lists in holder.

Spare bulb supply.

OBSERVER'S STATION

Check the following:

Fire extinguisher seal.

Portable oxygen bottle pressure above minimum and mask hose attached.

Hand axe.

Flight Crew Information Bulletin, if aboard.

Rain repellent pressure and quantity normal.

Escape hatch closed and locked.

Inertia reel handles secured.

First aid kit seal.

FIRM manual.

Performance manual.

PILOT'S STATION

NORMAL AND EMERGENCY CHECK LISTS

Check that a Normal and an Emergency check list are in the glare shield holder.

MASTER RADIO SWITCHES

Essential and No. 2 switches on.

WINDSHIELD HEAT

Captain's and first officer's heaters in idle and side window switches on.

Press test switch and note all six fault lights flash.

AIR DATA SENSOR HEAT

Place all switches on and note off lights extinguished. Return switches to OFF position.

FIRE CONTROLS AND DISCHARGE LIGHTS

Controls in and discharge lights out.

MACH FEEL

Both system 1 and 2 fail and off lights out.

Mach indicator minimum.

RUDDER LIMITER

Mechanical limiter ± 30° lights on.

Hydraulic limiter push light on.

VOICE RECORDER

Hold the cockpit voice recorder test switch in for at least five seconds. The test meter should indicate in the good range. A malfunction is indicated if the test meter drops to zero any time during the test.

PASSENGER ADDRESS

Check first class and coach area separately using cockpit speaker volume control with PA mike. Leave both switches on and volume off.

ANTI-SKID

Place anti-skid on. Off light will be illuminated with parking brake on.

Press the normal and the alternate test switches. Observe that all wheel lights are illuminated on both tests.

Off light goes out and on light illuminates during test.

INS MODE SELECTORS - *100:*

DOM Select ATT on each MSU.

INTL Select NAV on each MSU.

INS TEST AND ALIGNMENT - *100 INTL*

Realign INS at flight origination and crew change stations. The aircraft must not be moved until INS alignment is completed.

Perform the following on each CDU:

Adjust CDU lights to desired brilliance.

Rotate CDU data selector to POS.

Press CDU test switch and observe that 8s appear in both data windows, CDU and MSU lights appear, and FINC light appears for set being tested. Release test switch and observe that insert light remains on.

Check data selector in POS and load gate latitude. Check for accuracy and insert. Load gate longitude, check for accuracy, and insert. Check insert light goes out after latitude and longitude have been loaded.

Place data selector to DSTRK/STS and check that desired performance index 5 appears in right data window; if not, press 5 switch and insert Index cannot be changed after alignment is completed.

When alignment is completed, code 1 will appear as first digit in right data window and green ready NAV light will appear on MSU.

If INS electrical power fails, turn its mode selector off to prevent INS battery depletion.

PILOT'S INSTRUMENT PANELS

Check all instruments for fail flags and general condition.

Press to test marker beacon lights.

PILOT'S STATION (Cont'd)

MAX INDICATOR RESET

Press reset switch to reset any maximum indicator lights that are on.

STABILIZER TRIM ZERO

This will ensure stabilizer and stabilizer trim position are together when hydraulic systems are pressurized and thus avoid rapid stabilizer movement.

LANDING GEAR UPLOCK MECHANICAL RELEASES

Check all controls in normal position.

GUARDED SWITCHES

Check that reverser ground check, alternate hydraulic gear extension, and fuel control amplifier test switches are under guard.

ENGINEER'S STATION

OXYGEN

Open crew oxygen supply valve and check pressure normal.

Check oxygen mask and regulator as outlined in Pilot's Before Starting Engines amplification.

SERVICE INTERPHONE

Check service interphone switch off.

INDICATOR LIGHTS

Press warning caution advisory test switch and observe that indicator and annunicator lights illuminate.

Reset APU fail flags.

ENGINEER'S INSTRUMENT PANELS

Check all indicators and instruments for general condition.

FUEL PANEL

Turn on each tank pump and observe respective low pressure light is out. Turn off all pumps and check that their low pressure lights stay out.

Open all tank valves and check flowbars on and in-transit lights out.

Open all crossfeed valves. Check flowbars on and in-transit lights out.

Check fuel temperature indication at tank and each engine. Return selector to tank.

Press 2L and 2R inboard tank switches to QTY and check for proper distribution between inboard and outboard sections of each tank. If excess fuel has transferred into either inboard section, turn on both its tank pumps. When the fuel has been returned to the outboard section, turn off both tank pumps. Return both inboard tank switches to normal position.

Press fuel quantity test switch. Check that quantity indicators and numerical readouts drive toward full and that 2L and 2R inboard low lights come on. Release switch and check that all indicators return to previous indication. Gross weight and total fuel indicators will be affected during check.

Press fuel used reset switch until all fuel used indicators read zero.

-100

If fuel in tanks, press 1A and 3A XFR switches on.

If fuel in tanks, check gravity transfer valves will open then close.

Press tank 1A and 3A switches to QTY and check for proper distribution between tanks 1/1A and 3/3A. Return switches to normal position. Check low lights on when pressing fuel quantity test switch.

GENERATOR CONTROLS

Check that AC bus tie breaker flowbar, engine generator field relay, and generator breaker open lights are on.

Press each engine generator breaker trip switch to prevent the generator from autoparalleling during engine start.

Check galley power bus 1, 2, and 3 switches on.

Check IDG low pressure lights on.

ESSENTIAL POWER

Select AC essential selector to NORM B3 (G1) position. Check essential fail lights extinguished.

ENGINEER'S STATION (Cont'd)

DC AND STANDBY POWER CHECK

Check DC bus isolation open light out.

Check all TR positions for normal volts and positive amperage.

Place standby power switch to ON and check:

Standby DC bus for normal volts.

Inverter for normal volts and frequency.

Standby power flowbar light on.

Standby bus fail lights out.

Place standby power switch to ARM and check:

Unarm light is out.

Standby power flowbar light is out.

All bus fail lights out.

Select DC meter to BAT position.

Check battery for normal volts and charging indication.

HYDRAULIC PANEL

Check the following:

Suction shutoff flowbars on.

Pump shutoff flowbars on.

Reservoir low quantity lights out and fluid quantity above minimum.

Reservoir high temperature lights out.

Case drain high temperature lights out.

Pump output low pressure lights on.

Both ATM switches off.

Ram air turbine switch unlocked light out.

Both AC pumps off and on light out.

Both PTUs off and flowbars out.

BLEED AIR AND AIR CONDITIONING PANEL

Check that the engine high pressure and isolation valve switches are in and off lights out.

Place area overheat selector to A, press test switch and check:

All seven area overheat lights on.

Both wing anti-ice duct fail lights on.

Area/duct overheat light flashes.

Place selector to B and repeat test.

Place selector to BOTH and repeat test.

ENGINE INSTRUMENTS

Test each instrument.

FUEL CONTROL AMPLIFIER

Override lights out.

JETTISON PANEL

Check all lights out.

WEIGHT AND BALANCE

Press power switch and observe on light.

Press test switch and note all panel lights illuminate and gross weight lights show all 8s. Release switch and note lights show 100 $\pm$ 1.0.

Press gross weight switch.

Press hard landing reset switch to reset any hard landing indicator light.

AIDS

Encode month, day, flight number and leg. Day is date of flight origination, Greenwich Mean time. Place all zeros in pilot indentification windows.

Encode AIDS leg number. Number of leg is number since initial flight origination.

ECS MONITOR PANEL

Check that cool air overboard close light is out. Check avionics air forward and mid overboard lights are on and low flow lights out.

ENGINEER'S STATION (Cont'd)

-100: Press INS cooling switch and check on light illuminates. Press INS cooling switch and check the on light goes out.

Check that cargo heat forward, mid, and aft switches are in. Cold and hot lights will be off during normal operating conditions if air conditioning packs are in operation.

Place temperature selector to MID CAB and select switch to DUCT position.

Check that ECS temperature selector is in ACM discharge position.

CABIN PRESSURE CONTROL PANEL

Set baro set window and cabin altimeter to local altimeter setting.

Set mode selector to normal.

Set normal rate selector to index mark.

Set the standby rate selector to hold.

Press the forward and aft manual switches and observe manual lights on.

Drive both outflow valves partially closed with manual control switches.

Drive both outflow valves partially open with manual control switches.

Press both manual switches and check manual lights out

Observe that both outflow valves go full open.

Set cabin altitude to planned cruise altitude but not less than 1000 feet above field elevation.

NACELLE/PYLON OVERHEAT TEST

Set all nacelle and pylon overheat selectors to the both position and press the test switch.

Observe that:

All A and B loop lights illuminate.

Nacelle No. 1, 2, and 3 overheat lights flash.

ENGINE TURB COOLING AIR OVERHEAT TEST

Press both engine turbine cooling air overheat A and B test buttons simultaneously and observe:

Three engine overheat lights illuminated.

Turbine air overheat for engines 1, 2, and 3 lights flash.

Press A test button and observe:

Overheat and turbine air overheat (annunciator) lights not illuminated.

Press B test button and observe:

Overheat and turbine air overheat (annunciator) lights not illuminated.

WHEEL WELL FIRE TEST

Set the wheel well fire selector to both. Press A and B test buttons simultaneously, silence the fire bell, and check:

Both A and B loop lights illuminated.

Master fire warning lights illuminated.

Wheel well fire light flashes.

BRAKE TEMPERATURE MONITOR

Place left gear 1F/2F switch on and depress test switch. Observe that both temperature indicators increase. Either high temperature or overheat light may come on depending on brake temperature.

Release test switch and place 1F/2F switch off.

Repeat test for remaining switches and check that same indications occur as above.

SLAT MONITOR PANEL

Check slat monitor light switch on. With flaps up, check slat left and right wing lights out and indicators at zero, no fail flag, and lock lights out.

AURAL WARNING TEST PANEL

Hold test switch and check aural signal at each position of aural warning test selector. On unsafe takeoff test, all cargo door annunciator lights also illuminate.

ENGINEER'S STATION (Cont'd)

GALLEY SMOKE PANEL

Place switch to test position, check light and aural signal. Place switch to horn cutout to silence horn.

ANNUNCIATOR LIGHT PANEL

Check for normal indications.

PASSENGER OXYGEN PANEL

Check oxygen flow light extinguished.

WASTE WATER PANEL

Check all pump and drain mast heater lights out.

Select No. 1 drain mast heaters.

FLIGHT RECORDER

Turn on recorder.

Wait 15 seconds, then press recorder test switch and hold for at least 5 seconds. Observe test light remains on during test.

RATED EPR MODE

Select takeoff mode.

LOWER GALLEY

CIRCUIT BREAKER PANELS

Check that all circuit breakers on left and right panels are in unless banded open.

* * *

FUEL LOADING

Fuel must be distributed as shown on fuel distribution tables in this section.

Fuel tank capacities and minimum fuel for takeoff shall be as outlined in section 2.75.

Aircraft weight at brake release for takeoff minus fuel on board shall not exceed the zero fuel weight.

The M-180J is used as the record of fuel and oil serviced to each aircraft and the total fuel and oil load at each flight departure. This form should indicate that no fuel was added when fueling through. In the event of a fuel topoff, a new form should be issued by the control agent. The M-180J(s) should be retained until flight termination for handling in the same manner as other documentation.

The dispatch release messages will give the fuel load in pounds and this information will be entered on the M-180J by the control agent.

The fuel load will include taxi fuel. Additional taxi fuel as specified in section 2.75 will be required when operating from JFK or ORD to provide for increased taxi time.

The cockpit fuel gauges, or measuring sticks if fuel gauges are inoperative, are used by the engineer to confirm the fuel load.

The engineer signs the M-180J to certify that the proper fuel load is on board and the calculated add is within limits.

Servicing personnel will compute the calculated add in pounds. To convert the calculated add fuel figure to gallons, divide by fuel density (pounds per gallon). Density can be measured with a hydrometer if available at the station. If actual density is not available, a list of fuel weights for regular stations is included. If density information is not available from either actual measurement or from the list, a weight of 6.7 pounds per gallon of JET A or JET A-1 (kerosene) or 6.4 pounds per gallon of JET B (JP-4) may be assumed. Regardless of the source of fuel density information, the value used should be written in the "S.G." space provided in the "calculated add gallons" block.

The gallons added is recorded in the "amount fuel add by truck meter" block.

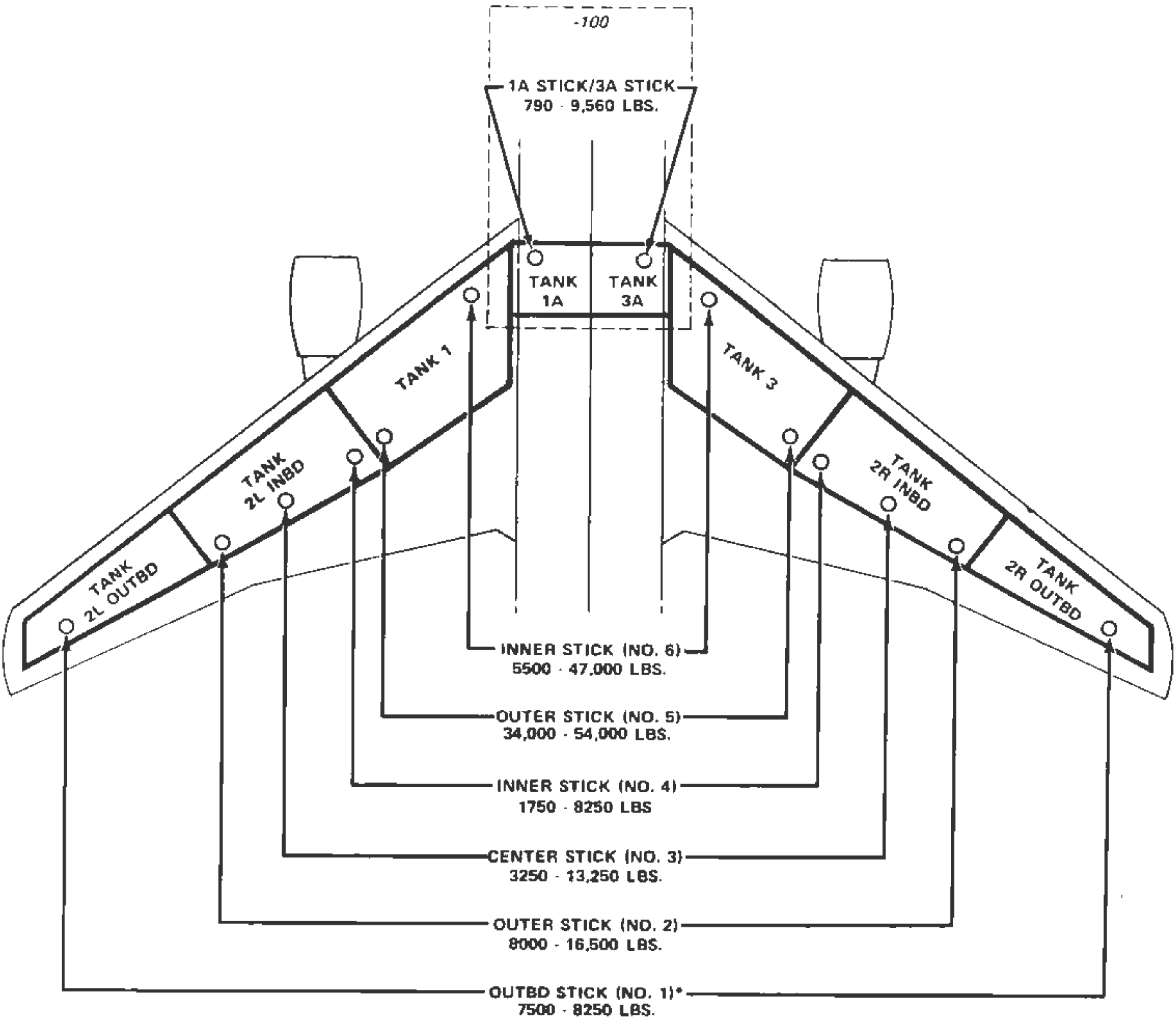
The total amount of fuel added (in gallons) must agree within a tolerance of three percent (3%) of the calculated add plus 100 gallons.

For example, if the calculated add is 5,000 gallons, 3% of 5,000 gallons is 150 gallons plus 100 gallons equals a total tolerance of 250 gallons. Therefore, the actual add should be within ± 250 gallons of the calculated add of 5,000 gallons.

If not within tolerance, first try to determine the reason for the discrepancy. Comparison of the pre-service quantities shown for individual tanks may be of value in determining whether an indicator error exists. If the reason for the discrepancy can be determined and there is sufficient fuel on board for the trip, no measuring stick check is required. If, however, the reason for the discrepancy cannot be determined and the fuel load is marginal, the measuring sticks must be pulled to verify the amount of fuel on board.

Servicing personnel are responsible for the securing of servicing panels, caps, and measuring sticks and the draining of fuel tank sumps.

DRIPLESS STICKS



* NOTE: IF OUTBD (NO. 1) STICK READING IS ABOVE 8250 LBS. CONSIDER FUEL LEVEL TO BE 8670 LBS.

USE MAINTENANCE MANUAL CORRECTION TABLES WHEN AIRCRAFT IS NOT LEVEL.

FUEL DISTRIBUTION/USAGE

All values rounded to nearest 100 pounds.

ALL AIRCRAFT FUEL LOAD LESS THAN 63,000 POUNDS

Feed from tank to respective engine for entire flight.

TOTAL FUEL LOAD (LBS)	TANK 1 & 3 EACH	TANK 2L & 2R EACH	TANK 2L & 2R INBOARD
21,000	7,000	3,500	1,000
22,000	7,300	3,700	1,000
24,000	8,000	4,000	1,000
26,000	8,700	4,300	1,000
28,000	9,300	4,700	1,000
30,000	10,000	5,000	1,000
32,000	10,700	5,300	1,000
34,000	11,300	5,700	1,000
36,000	12,000	6,000	1,000
38,000	12,700	6,300	1,000
40,000	13,300	6,700	1,000
42,000	14,000	7,000	1,000
44,000	14,700	7,300	1,000
46,000	15,300	7,700	1,000
48,000	16,000	8,000	1,000
50,000	16,700	8,300	1,000
52,000	17,300	8,700	1,000
54,000	18,000	9,000	1,000
56,000	18,700	9,300	1,000
58,000	19,300	9,700	1,000
60,000	20,000	10,000	1,300
62,000	20,700	10,300	1,600

ALL AIRCRAFT FUEL LOAD 63,000 TO 84,000 POUNDS

Feed from tank to respective engine for takeoff. When practical, start crossfeeding all engines from tank 2 after enroute climb is established. When quantities in tanks 1, 3, and 2L plus 2R are equal, use tank to engine to end of flight.

TOTAL FUEL LOAD (LBS)	TANK 1 & 3 EACH	TANK 2L & 2R EACH	TANK 2L & 2R INBOARD
64,000	21,000	11,000	2,300
66,000	21,000	12,000	3,300
68,000	21,000	13,000	4,300
70,000	21,000	14,000	5,300
72,000	21,000	15,000	6,300
74,000	21,000	16,000	7,300
76,000	21,000	17,000	8,300
78,000	21,000	18,000	9,300
80,000	21,000	19,000	10,300
82,000	21,000	20,000	11,300
84,000	21,000	21,000	12,300

ALL AIRCRAFT FUEL LOAD 84,000 POUNDS TO 154,000 POUNDS

Feed from tank to respective engine until total fuel quantity is 84,000 pounds. Crossfeed all engines from tank 2 until quantities are equal. When quantities in tanks 1, 3, and 2L plus 2R are equal, use tank to engine to end of flight.

TOTAL FUEL LOAD (LBS)	TANK 1 & 3 EACH	TANK 2L & 2R EACH	TANK 2L & 2R INBOARD
86,000	21,700	21,300	12,600
88,000	22,300	21,700	13,000
90,000	23,000	22,000	13,300
92,000	23,700	22,300	13,600
94,000	24,300	22,700	14,000
96,000	25,000	23,000	14,300
98,000	25,700	23,300	14,600
100,000	26,300	23,700	15,000
102,000	27,000	24,000	15,300
104,000	27,700	24,300	15,600
106,000	28,300	24,700	16,000
108,000	29,000	25,000	16,300
110,000	29,700	25,300	16,600
112,000	30,400	25,700	17,000
114,000	31,400	FULL	FULL
116,000	32,400		
118,000	33,400		
120,000	34,400		
122,000	35,400		
124,000	36,400		
126,000	37,400		
128,000	38,400		
130,000	39,400		
132,000	40,400		
134,000	41,400		
136,000	42,400		
138,000	43,400		
140,000	44,400		
142,000	45,400		
144,000	46,400		
146,000	47,400		
148,000	48,400		
150,000	49,400		
152,000	50,400		
154,000	51,400	25,700	17,000

FUEL DISTRIBUTION/USAGE (Cont'd)

FUEL LOAD ABOVE 154,000 POUNDS

Feed from tank to respective engine until total fuel quantity is 84,000 pounds. Crossfeed all engines from tanks 1 and 3 until quantities are equal. When quantities in tanks 1, 3, and 2L plus 2R are equal, use tank to engine to end of flight.

-100: Feed from tank to respective engine for takeoff. When practical and before 14,000 pounds of fuel is used, start crossfeeding all engines from tanks 1 and 3. If applicable, when tank 1A and 3A low lights come on, close transfer valves. When quantities in tanks 1, 3, and 2L plus 2R are equal, use tank to engine to end of flight.

TOTAL FUEL LOAD (LBS)	TANK 1 & 3 EACH	TANK 1A & 3A EACH	TANK 2L & 2R EACH
155,000	51,900		25,700
156,000	52,400		
158,000	53,400		
159,400	54,000		
160,000	54,400	400	
162,000	55,400	1,400	
164,000	56,400	2,400	
166,000	57,400	3,400	
168,000	58,400	4,400	
170,000	59,400	5,400	
172,000	60,400	6,400	
174,000	61,400	7,400	
176,000	62,400	8,400	
178,000	63,400	9,400	
178,400	63,500	9,500	25,700

FUEL FREEZE CONSIDERATIONS

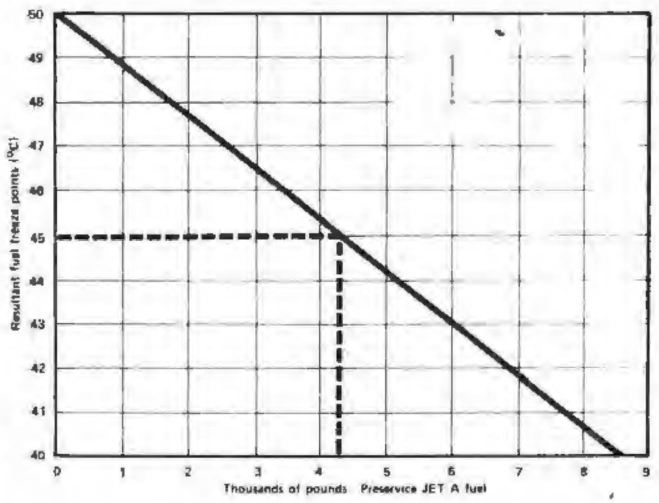
The following considerations are necessary to maintain fuel tank temperatures 3°C above the fuel freeze point.

The type of fuel added will be noted on the M-180J as JET A or JET A-1. JET A fuel has a freeze point of -40°C and JET A-1 has a freeze point of -50°C.

When adding fuel, consider all pre-service fuel aboard the aircraft as JET A. If JET A-1 fuel is added, refer to freeze point JET A/JET A-1 fuel mixture chart to establish mixed fuel freeze points.

Fuel tank temperature must be maintained at 3°C warmer than calculated freeze points. If diversionary action is required to maintain this temperature, note in the log action taken, OAT, and fuel tank temperature before and after such action.

FREEZE POINT OF JET A/JET A-1 FUEL MIXES



EXAMPLE SHOWN: 4,200 pounds of Jet A remains.

Enter chart at 4.2 on the horizontal line, proceed vertically to freeze point curve. Proceed horizontally, read resultant freeze point on vertical line. When Jet A-1 fuel added, resultant freeze point is -45°C.

AVERAGE FUEL DENSITY (LBS/GAL)

DOMESTIC STATIONS

MONTHS

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
ABQ	6.86	6.84	6.82	6.79	6.76	6.73	6.71	6.72	6.74	6.78	6.83	6.86
BAL	6.82	6.82	6.79	6.76	6.73	6.70	6.68	6.69	6.71	6.75	6.78	6.81
BOS	6.93	6.93	6.90	6.87	6.84	6.81	6.79	6.79	6.82	6.85	6.88	6.92
CMH	6.83	6.83	6.80	6.77	6.73	6.70	6.69	6.69	6.71	6.75	6.79	6.83
CVG	6.79	6.78	6.76	6.72	6.69	6.66	6.64	6.65	6.67	6.71	6.75	6.78
DAY	6.83	6.83	6.80	6.77	6.73	6.70	6.69	6.69	6.71	6.75	6.79	6.83
DEN	6.82	6.81	6.79	6.76	6.73	6.69	6.67	6.68	6.70	6.74	6.78	6.81
EWR	6.83	6.83	6.81	6.78	6.74	6.71	6.69	6.70	6.72	6.75	6.79	6.82
IAD	6.84	6.83	6.81	6.78	6.74	6.71	6.70	6.71	6.72	6.76	6.80	6.83
IND	6.81	6.80	6.76	6.72	6.69	6.65	6.64	6.64	6.67	6.71	6.76	6.80
JFK	6.83	6.83	6.81	6.78	6.74	6.71	6.69	6.70	6.72	6.75	6.79	6.82
LAS	6.82	6.80	6.78	6.75	6.72	6.69	6.67	6.67	6.70	6.74	6.79	6.81
LAX	6.89	6.88	6.88	6.87	6.86	6.85	6.84	6.84	6.84	6.85	6.87	6.88
MCI	6.84	6.83	6.80	6.76	6.72	6.69	6.67	6.68	6.70	6.74	6.80	6.83
ORO	6.87	6.87	6.83	6.80	6.76	6.73	6.71	6.71	6.74	6.78	6.82	6.86
PHL	6.74	6.74	6.71	6.68	6.64	6.61	6.60	6.60	6.63	6.66	6.70	6.74
PHX	6.85	6.84	6.82	6.79	6.76	6.73	6.71	6.72	6.74	6.78	6.82	6.84
PIT	6.85	6.85	6.82	6.78	6.75	6.72	6.71	6.73	6.77	6.77	6.81	6.84
SFO	6.86	6.85	6.84	6.84	6.83	6.82	6.82	6.81	6.81	6.82	6.84	6.85
STL	6.84	6.82	6.80	6.76	6.73	6.69	6.68	6.68	6.71	6.74	6.80	6.83

NOTE: If hydrometer is not available, use fuel density listed above for station and month. If station is not listed, use average density of 6.7 lbs/gal for Jet A, and 6.4 lbs/gal for Jet B (JP-4).

INTERNATIONAL STATIONS

JET A-1

MONTHS

STATION	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
BOS	6.87	6.87	6.83	6.80	6.77	6.74	6.72	6.72	6.75	6.78	6.81	6.85
CDG	6.67	6.66	6.64	6.62	6.60	6.58	6.57	6.57	6.59	6.62	6.64	6.66
DUB	6.61	6.61	6.60	6.59	6.57	6.55	6.55	6.55	6.56	6.58	6.60	6.61
FRA	6.73	6.72	6.70	6.68	6.65	6.64	6.62	6.63	6.65	6.68	6.71	6.72
JFK	6.77	6.78	6.72	6.72	6.68	6.65	6.64	6.65	6.65	6.68	6.71	6.75
LHR	6.63	6.63	6.61	6.60	6.58	6.56	6.55	6.55	6.57	6.59	6.61	6.63
ORY	6.67	6.66	6.64	6.62	6.60	6.58	6.57	6.57	6.59	6.62	6.64	6.66
SNN	6.63	6.63	6.61	6.60	6.59	6.57	6.56	6.56	6.57	6.59	6.61	6.63

JET B or JP-4

JFK	6.45	6.44	6.43	6.40	6.36	6.33	6.30	6.31	6.33	6.37	6.41	6.44

NOTE: If hydrometer is not available, use fuel density listed above for station and month. If station is not listed, use average density of 6.7 lbs/gal for kerosene (Jet A-1) and 6.4 lbs/gal for Jet B (JP-4).

* * *

CREW BRIEFING

The captain will brief the designated flight attendant on expected flight time, altitude, etc. The attendant should advise the captain of any specific problems concerning passenger service.

The captain and engineer will review status of the aircraft condition, particularly about inoperative items and modifications.

GENERAL

All time-consuming checks should be accomplished before reading the check list.

If interphone contact is desired before starting engines, turn the anti-collision lights on. Ground crew man will answer this signal, "Ground to cockpit, anti-collision lights off, go ahead." The anti-collision lights should then be turned off if not ready to start engines.

BEFORE STARTING ENGINES CHECK LIST AMPLIFICATION

For all items marked with a symbol †, detailed preflight procedures are printed in section 2.05.

PILOTS

1. GEAR LEVER & LIGHTS . . . . . DOWN & CK

   Check landing gear lever down and three green gear lights on. The red gear door and in-transit lights may also be on if any gear door is open.

2. PARKING BRAKE . . . . ON

   The red parking brake lights should be on. If parking brake lights are not on, check that parking brake handle is set and brake accumulator pressure is available.

   If accumulator pressure is low, pressurize hydraulic system B with AC hydraulic pump after obtaining ground clearance that flaps and gear doors are clear.

3. *-100 DOM:* INS MODE SELECTORS . . . ATT

   Select ATT on the three INS MSUs.

   -100 INTL: INS MODE SELECTORS . . . NAV

   Check all three INS mode selectors are in the NAV position and READY NAV lights on.

   Check all three CDUs for correct alignment status and that station gate position has been loaded.

   Select INS on both RADIO/INS switches, and perform the following test:

   Press each CDU test switch and check that CDU lights appear and 8s display in data windows; MSU lights appear; FINC light appears for INS being tested; TRUE and RNAV appear on HSI with 8s displayed in windows. Release test switch.

   Select RADIO on both RADIO/INS switches and check that MAG and VOR or ILS appear on HSI.

   Route waypoints may be loaded using the following procedure:

   Press REMOTE switch on each CDU and check remote lights appear.

   Select CDU data selector to WAYPT and waypoint selector to 1 on any CDU.

   Load latitude of first waypoint. Check left data window for accuracy, then press INSERT.

   Load longitude of first waypoint. Check right data window for accuracy, then press INSERT.

   Select waypoint selector to next waypoint and repeat loading procedure for the first nine waypoints in the flight plan.

   All waypoints are to be checked on a CDU, other than the one on which they were loaded, by a crew member who did not load the waypoints.

   When loading is complete, press the REMOTE switch and check remote lights go out.

4. COMPASSES . . . . MAG

   Set compass controller mode switches to MAG position. Verify that No. 1 and No. 2 compass sync index indicator needles are centered, indicating the directional gyro is at the magnetic heading. Verify that all compass cards are in agreement.

BEFORE STARTING ENGINES CHECK LIST AMPLIFICATION (Cont'd)

When jetway ramps or servicing equipment are parked in the vicinity of the wing tips there may be significant errors in compass card indications. Recheck compass indications after taxiing away from ramp area.

5. RADIOS . . . . ON & CK

Do not operate radio transmitters while fueling.

Place master radio switches on. Check that the audio selector switches are selected for ground service calls.

Select proper frequencies in all communication and navigation equipment. Identify selected stations.

CHECK EQUIPMENT AS OUTLINED BELOW PRIOR TO EACH ORIGINATING FLIGHT.

ADF

Select ADF mode and tune to desired frequency.

Set RMI selector switches to ADF position. Check that the RMI pointer indicates the approximate relative bearing to the selected station.

VOR

Accomplish the following check at stations where a VOR omni-test (VOT) is available. See Jeppesen manual for frequency.

Select the VOR frequency on both VOR receivers. Set RMI selector switches to VOR position. Check that the VOR pointers point to 180°. Set 000° or 180° in each HSI course window. Check that the TO-FROM flag points to 180°.

If necessary, rotate the appropriate course knob until the needle centers. Check that deviation does not exceed ± 3° and that the spread between the captain's and first officer's deviation needles does not exceed 4°.

At stations where a VOT is not available, the following VOR self-test must be accomplished.

Select any VOR frequency on both VOR receivers. Set RMI selector switches to VOR position. Set 000° or 180° in each HSI course window. Press each test switch. The test warning light should come on, and a VOR flag in the RMI and the NAV flag in the HSI should appear for several seconds, then go out of view. Check that the RMI pointers point to 180°. Check that the TO-FROM flag points to 180°. If necessary, rotate the course knob until the needle centers. Check that deviation does not exceed ± 3° and that the spread between the captain's and first officer's needles does not exceed 4°.

Release the test switch and check that the warning light goes out.

DME

Select DME to test. DME flag followed by four dashes followed by four zeros appear in distance windows.

6. OVERHEAD PANEL . . . . CK

Only the following overhead lights should be illuminated:

Anti-skid switch in. Off light illuminated.

Passenger address first class and coach area lights.

Both magnetic compass lights.

Yaw SAS fail lights may be on.

PFCS stabilizer switch inoperative lights.

Rudder hydraulic limiter push light.

Rudder mechanical limiter ± 30° light.

Air data sensor heat switch off lights.

Bright or dim legend for warning, caution, and advisory lights.

Captain's and first officer's windshield heat idle lights.

7. EXTERIOR LIGHTS . . . . CK

During daytime, navigation lights should be on if visibility conditions warrant their use. At night, navigation light should be on at all times. Anti-collision lights are to be turned on just before starting engines and are to remain on while any engine is running.

Turn logo lights on only during hours of darkness before midnight. Do not turn on for any operation after midnight.

BEFORE STARTING ENGINES CHECK LIST AMPLIFICATION (Cont'd)

8. STBY PWR & EMERG LTS .... ARMED

   Both switches in ARM position and unarm lights off.

9. SEAT BELT & NO SMOKE .... ON

10. FLIGHT INSTRUMENTS .... CK

    IAS/MACH – Check that the maximum speed pointer is at approximately sea level V_{mo}, the airspeed needle is at 60, and the mach and IAS flags are out of view.

    ADI – Check horizon erect, and ATT and FD flags out of view.

    HSI – Check setting of course and heading cursors, and HDG flag out of view.

    RMI – Check heading flags out of view and ADF/VOR selector in desired position.

    VERTICAL SPEED – Check needle on zero and flag out of view.

    STANDBY HORIZON – Check horizon erect and off flag out of view. If necessary, pull cage knob to erect position, then allow knob to gently return to case.

11. ALTIMETERS & CLOCKS ... SET & CROSSCK

    Check that the altimeter flags are out of view. Set altimeters to the local altimeter setting.

    Cross check altitude indications and compare both altimeter indications with the published ramp elevation.

    See the General Information section of the Operations manual (Jeppesen) for published ramp elevations and altimeter tolerances.

12. *-100:* RADIO/INS SWITCHES ...... RADIO

    Check both RADIO/INS switches selected to RADIO and MAG, VOR, or ILS appear on both HSIs.

13. RADAR & TRANSPONDER .... STBY

    Do not use any position other than standby, test, or off when being fueled or within fifty yards of an aircraft being fueled.

    Prepare for operation by placing the gain switch to AUTO, the tilt control to zero, and checking that the ANT and RT fault lights are out.

    Select standby: Use No. 2 system eastbound No. 1 system westbound.

    If it is desirable to have both sets warmed up because of thunderstorm conditions, use test position.

14. WARNING LIGHTS .... CK

    Place the warning caution advisory test switch to ON. Observe that all indicator and annunciator lights on the overhead panel, pilot's instrument panel, and pedestal illuminate except for fire controls, marker beacons, slat LE TRANS, CDU, MSU, HSI, and FINC lights.

    Press maximum indicator reset switch to extinguish engine TGT warning lights.

15. STALL WARNING .... CK

    Test each system separately and return both switches to ON.

16. ANTI-SKID .... CK & ON

    Check that switch is in, verify all monitor lights out, and off light illuminated. On light will illuminate when parking brake released.

17. INSTRUMENT COMPARATOR .... CK

    Press TEST 1 switch to display all comparison flags on both instrument comparator panels and the ATT flag in the ADI on the side that is activated. Press TEST 1 switches on both panels at the same time and observe the VERTICAL GYRO 3 annunciator light illuminates.

    Press TEST 2 switch to display all monitor flags.

18. AFCS WARNING & MODE ANN .... CK

    Press No. 1 and then No. 2 AFCS warning and AFCS mode test switches and check for proper annunciator indications.

19. GROUND PROXIMITY WARNING ...... CK

    Press either pull-up light. Check that both pull-up lights and the ground proximity light illuminate, and that the aural warning is heard from the cockpit speaker.

BEFORE STARTING ENGINES CHECK LIST AMPLIFICATION (Cont'd)

20. INSTRUMENT SOURCE SELECTORS . . . . NORMAL

    Check all switch lights out.

21. BRAKE SELECTOR . . . . SYS B

    Check brake selector switch in normal system B position.

    Check hrake accumulator pressure for system B and C.

22. PITCH & ROLL DISCONNECTS . . . NORMAL

    Check handle lights out.

23. SPEED BRAKES . . . . DOWN

    Check lever manual override lights out.

24. FUEL & IGNITION SWITCHES . . . . OFF

25. RUDDER & AILERON TRIM . . . . CK

    Check rudder and aileron trim for freedom and align both trim indices to flight trim position.

26. OXY MASK & REGULATOR . . . . CK & EMERG OFF

    Check connection of oxygen hose and mike cord. Clean mask.

    Check emergency oxygen:

    > Hold mask away from face. Place all regulator levers to the up position. Check flow indicator for continuous oxygen flow.
    >
    > Place emergency lever to NORMAL. Oxygen flow should stop.

    Check mask:

    > Don mask and adjust for leakproof fit. Be certain mask will not pull away from face when performing cockpit duties.

    Check regulator:

    > Place supply lever to OFF. No flow (oxygen or ambient air) should be available when inhaling.
    >
    > Place oxygen lever to NORMAL. Ambient air should be available but no oxygen flow should be indicated when inhaling.
    >
    > Place supply lever to ON. Oxygen flow should be indicated when inhaling.
    >
    > Place oxygen lever to 100%. Oxygen flow should be indicated when inhaling.

    Check mask microphone:

    > Place mike selector to interphone. Press mask mike switch. Check output with headset or speaker.

    Place both masks in stowage compartment with face down, hose free and toward pilot.

    Ensure smoke goggles are available.

    At the time the check list is read, reconfirm that emergency levers are normal including those at both ACM stations.

WHEN GEAR DOORS AND FLAPS CLEAR

27. BRAKE PRESSURE . . . . CK

    If accumulator pressure is low (2500 pounds or less), pressurize hydraulic system B with AC hydraulic pump after obtaining ground clearance that flaps and gear doors are clear.

28. AUTOPILOT & FLIGHT DIRECTOR . . . . CK & OFF

    When clearance is received from ground crew, advise engineer to pressurize all hydraulic systems, and check all stabilizer inoperative lights go out. If spoiler check required, request ground crew proceed to tail of aircraft and observe all spoilers faired. As a secondary method, command flight engineer to observe spoilers from the cabin.

    With the captain's and first officer's flight director source selectors in normal position and alternate lights out, place both flight director switches on and engage autopilot A to command.

    Select heading and altitude hold modes. AFCS mode annunciator will show HDG SEL and ALT. Rotate the heading knob, left, right, and center. Command bars and control wheel will follow the heading knob.

BEFORE STARTING ENGINES CHECK LIST AMPLIFICATION (Cont'd)

Operate the captain's wheel in the pitch axis. The altitude hold mode selector light will extinguish and the AFCS modes annunciator ALT flag will go out of view. The autopilot will stay in command.

Operate the captain's wheel in the roll axis. The autopilot will trip to CWS.

Press the captain's control wheel autopilot disconnect switch. The autopilot will trip off. The alert light will flash, the aural warning will sound, and the autopilot disconnect message will appear. Press the disconnect switch a second time to reset the warning panel.

Use first officer's control wheel and repeat procedure to check autopilot B.

Turn off both flight directors.

29. STABILIZER TRIM . . . . CK

Check that the stabilizer trim switches on the captain's and first officer's control wheels trim the stabilizer correctly by observing mechanical trim wheel, stabilizer position, and control movement.

Return stabilizer to the zero position.

Advise the engineer to turn off the AC hydraulic pumps and the PTUs.

ENGINEER

1 FUEL PANEL . . . . † CK & SET

Turn on one tank pump in tank No. 1. Check its low pressure light out.

If fueling is completed, check refuel power light out.

2. FUEL QUANTITY . . . . ________

Respond by giving total pounds of fuel aboard for takeoff. Write quantity on fuel log.

3. BATTERY SWITCH . . . . ON

4 HYDRAULIC QUANTITY . . . . CK

Check that all quantity indicators are above minimum level. Write quantity on fuel log.

5. PRESSURIZATION CONTROLS . . † CK & SET

6. ENGINE OIL QUANTITY . . . . CK

Check for minimum oil quantity. Write quantity on fuel log.

7. APU PANEL . . . . † CK

Check that RPM and TGT are within limits and warning lights are out. When APU is not running, check that master power switch is off.

8. FLIGHT RECORDER . . . . † ON & CK

Check the off light is out.

9. EPR COMPUTER . . . . T.O.

10. CIRCUIT BREAKERS . . . . CK

Check that all cockpit circuit breakers are in unless banded out or placarded. At intermediate stops, review any additional changes to inoperative equipment.

11. ELECTRICAL PANEL . . . . † CK & SET

12. HYDRAULIC PANEL . . . . † CK & SET

13. FIRE CONTROL PANELS . . . . . † CK & SET

14. BLEED CONTROLS . . . . † CK & SET

15. AIR CONDITIONING CONTROLS . . . . † CK & SET

16. FUEL AMPLIFIER & JETTISON PANELS . . . . † NORMAL

17. WEIGHT & BALANCE . . . . † ON & CK

18. SLAT MONITOR . . . . † ON & CK

19. AURAL WARNING & GALLEY SMOKE . . † CK

20. WARNING LIGHTS . . . . † CK

21. CREW OXYGEN . . . . ON

Check crew oxygen pressure gauge for minimum pressure after oxygen mask and regulator check.

BEFORE STARTING ENGINES CHECK LIST AMPLIFICATION (Cont'd)

22. OXY MASK & REGULATOR . . . . † CK & EMERG OFF

Reconfirm that emergency lever is off when the check list is read.

WHEN GEAR DOORS & FLAPS CLEAR

23. HYDRAULIC PUMPS . . . . CK & OFF

On captain's command, close 1 and 3 pack flow control valves, select APU to normal mode. Turn B ATM to AUTO and check RPM and pressure increase. Turn off B ATM. Turn on B AC pump and B-A PTU. Turn C ATM to AUTO and check RPM and pressure increase. Turn off C ATM and turn on C AC pump and C-D PTU.

If any spoiler panel was observed up during external preflight, a spoiler check is required.

When captain advises stabilizer trim check completed, turn off both AC hydraulic pumps and both PTUs.

* * *

ENGINE STARTING - NORMAL

Do not start the engines until the pilots and engineer are at their stations and the Before Starting Engines check list is read.

When ready, the captain will contact the ground crew and advise, "Ready to start engines."

When start clearance is received, the engineer will turn off packs one and three and note the start time. The normal start sequence is one, two, and three.

The captain will turn on the anti-collision light and command the first officer, "Turn ______".

The first officer will push the appropriate ground start switch, note the valve open light is on, and check for N_3 rotation within ten seconds.

The engineer will check the engine isolation and high pressure flowbars on, duct pressure normal, APU max mode light on (if starting from the APU), oil pressure increasing, and N_2 turning.

STARTING DUCT PRESSURE PSI		
	ALTITUDE	
TEMP °F	SEA LEVEL	5000 FT
-20	33	28
20	29	25
60	27	22
100	24	19

Starts may be made at slightly lower pressure but start may be prolonged.

When N_3 is 20% and TGT is below 100°, the captain will place the fuel and ignition switch to ON. Observe fuel flow, TGT, N_1 increasing, and low oil pressure light goes out.

If enrich is used, hold the switch in enrich until ground idle is reached or TGT approaches 550°. Do not cycle the fuel and ignition switch between enrich and on.

The captain will keep his hand on the fuel and ignition switch until the engine is at ground idle.

The engineer should close the APU bleed air shutoff valve when the start valve closes (approximately 45% N_3). When the engine is at idle and TGT starts to decrease, the engineer should check the IDG low pressure light is out.

Start the remaining engines using the same procedure, but with engine bleed air. After the first engine started reaches idle and while starting the second engine, observe that the APU generator voltage and frequency are stabilized and within limits. Select the operating engine generator position, compare the voltage and frequency with the APU, and allow the IDG to autoparallel when within limits by tripping the field, closing the generator breaker, and then closing the field relay. Compare the voltage and frequency of the remaining IDGs with the other generators and allow them to autoparallel when within limits.

After the second engine generator is powering the busses, push the APU stop switch and observe that the APU field relay and generator breaker trip

Pack three may be turned on after two engines are at idle, and pack one after all engines are at idle.

If external power is used during starting, monitor IDG voltage and frequency. When within limits, connect each IDG to its bus. The AC tie breaker will open as each generator breaker closes.

Turn off the external power switch and all tie breakers should close.

If external air or electrical is used for starting, the captain will advise the ground crew when it is no longer required.

COLD WEATHER STARTING

On cold-soaked engines when outside temperature is 14°F (-10°C) and colder, place the fuel and ignition switch to ENRICH when N_3 is 17%. Allow 60 seconds for lightoff before abandoning the start.

ENGINE STARTING - ABNORMAL

The following are the more likely abnormal situations which could occur. See chapter 20.01 for additional starting procedures not covered in this section.

NO ROTATION WITHIN TEN SECONDS OF PRESSING START SWITCH.

Push the ground start release switch and check circuit breakers 1-E-13, 14, 15, and 3-N-3, 9, and 15.

ENGINE STARTING - ABNORMAL (Cont'd)

NO LIGHT OFF INDICATIONS WITHIN 30 SECONDS OF PLACING THE FUEL AND IGNITION SWITCH TO ON.

Place the fuel and ignition switch off. After thirty seconds, push the ground start release switch. Check fuel supply and circuit breakers 3-N-6, 12, 18, and 1-F-13, 14, 15.

NO OIL PRESSURE INDICATIONS WITHIN 30 SECONDS OF START OF ROTATION.

Place fuel and ignition switch off.

Push the ground start release switch.

HOT START IS OBSERVED OR ANTICIPATED.

If TGT rapidly approaches 550°C, place the fuel and ignition switch off and continue to rotate the engine until TGT is below 200°C. A second attempt is permissible if the hot start TGT limit was not exceeded. If a second attempt is not desired, push the ground start release switch after rotating the engine for thirty seconds.

An early indication of a possible hot start is if TGT overtakes N_3. For example, if 350° TGT is reached before 35% N_3. Be prepared to shut off fuel and ignition if TGT approaches 550°C.

ENGINE DOES NOT CONTINUE TO ACCELERATE AFTER STARTER CUTOUT.

Push the ground start release switch and command the engineer to close the affected engine high pressure bleed valve.

START VALVE OPEN LIGHT OR GROUND START RELEASE SWITCH ILLUMINATED AFTER 55% N_3.

Push the ground start release switch. If either light is still on, place the fuel and ignition switch off, and close affected engine isolation valve.

Any time a start is aborted after starter cutout, push the ground start release switch immediately after the fuel and ignition switch is off to prevent possible starter crash re-engagement, unless TGT has exceeded 550°C or an engine fire exists. If another start attempt is desired, ensure N_3 is zero before pushing the ground start switch.

ENGINE DECELERATES FROM GROUND IDLE

If N_3 is higher than 45%, use enrich to accelerate the engine to ground idle.

If N_3 is less than 45%, place the fuel and ignition switch off and monitor TGT. If TGT increases to 550°C, press the ground start switch and rotate the engine until TGT is less than 200°C.

GATE PUSHBACK

The engines may be started before, during or after gate pushback.

BEFORE MOVING

The captain must be in interphone contact with ground personnel.

Complete the Before Starting Engines check list.

WHEN READY TO MOVE

Ground personnel will advise the captain "Ready for pushback, release the brakes."

The captain will assure that the ground signal man is in sight, brake pressure is normal, ground control clearance has been received if required, then release the brakes. The captain will then reply "Brakes released".

TOWING

Should the captain desire to stop the aircraft, he should advise the interphone man to "Stop the aircraft." Avoid using the aircraft brakes without first advising the ground personnel.

When towing is completed, ground personnel will advise, "Park the brakes." After the brakes are parked, advise the ground personnel, "Brakes parked."

AFTER PUSHBACK COMPLETED

Ground personnel will assure that all items associated with the pushback are secured or returned to normal. They will then advise "Nose gear steering connected and all gear pins removed."

WHEN READY TO TAXI

The captain will advise "Disconnect interphone, standing by for hand signals." The interphone man will acknowledge and advise the captain if he will be in any location other than the 9 to 12 o'clock position. The salute from the signalman indicates that all ground equipment is clear. The captain must acknowledge the salute by momentarily flashing the appropriate inboard landing light.

AFTER STARTING ENGINES CHECK LIST AMPLIFICATION

PILOTS

1. START SWITCHES . . . . OFF

   Check that push light is off and that ground start switches are released.

2. ANTI-COLLISION LIGHTS . . . . ON

   Anti-collision lights should remain on while any engine is running.

3. BRAKE PRESSURE . . . . CK

   Both hydraulic brake pressure gauges indicate normal.

4. FLIGHT CONTROLS . . . . CK

   Observe the surface position indicator for proper travel while making the following checks:

   Ensure tow bar has been removed.

   Hold the nose steering wheel and move the rudder pedals full travel.

   Move the control column nose up and nose down.

   Move the control wheel left and right and check both inboard and outboard ailerons.

   Pull speed brake lever half way aft to determine that the lever's hydraulic assist is operative and then return lever to the full down position.

ENGINEER

1. FUEL TANK PUMPS . . . . ON

   Turn all fuel tank pumps on and check that their low pressure lights are out. Close all cross-feed valves and check in-transit lights.

2. ELECTRICAL PANEL . . . . CK

   Check that the galley busses are powered.

   Check that all field, generator, and tie breakers are closed and power meters indicate each generator is sharing the load. Check that the battery is charging.

3. HYDRAULIC PANEL . . . . CK

   Place the ATMs to AUTO.

   Check that all high temperature, low pressure, and low quantity lights are out, system pressure gauges indicate normal system pressure, and hydraulic quantity is above minimum.

4. PACK VALVES . . . . OPEN

   Note that all pack flow control switches have flowbars on and verify flow. Use three packs normally and monitor for proper operation.

   If high pressure valve was closed during engine start, check switch is positioned so valve is armed to open.

5. DOOR WARNING LIGHTS . . . . CK

   Check door warning annunciator panel. All lights should be out.

6. APU . . . . CK

   → Check NG is zero. Turn off master power switch after door in-transit light goes out. Checl all APU lights are out.

* * *

LEAVING RAMP

Acknowledge the clearance salute and release brakes. If possible, keep nose wheel centered until aircraft starts rolling. Normally, gate departure can be accomplished by initially rolling straight forward and then initiating turn out.

Use equal thrust on all three engines to start aircraft rolling. Keep engine thrust as low as possible when maneuvering in the ramp area.

FLAPS

After leaving the ramp, place flap handle to required takeoff setting.

ENGINE ANTI-ICING

Anti-ice must be on for taxi and takeoff when the following conditions occur simultaneously:

> Temperature below 46°F and OAT plus dew point is 78 or less.
>
> Visible moisture (fog of 1 mile visibility or less, rain, drizzle or wet snow) is present.

Low bleed pressures at ground idle thrust may not illuminate the heat light.

TAXIING

Make large radius turns whenever possible. Be aware of wing tips when near other aircraft or ramp equipment.

Do not make rapid or abrupt movements of the steering wheel. If the wheel is released while in a turn, the nose wheel will rapidly return to the rudder pedal steering position.

Do not use reverse thrust for backing or taxiing the aircraft.

TAKEOFF PERFORMANCE

Record V_1, V_r, and V_2 on the takeoff data worksheet for the actual takeoff gross weight under the existing runway conditions.

Prior to turning on temperature probe heat, check TAT/EPR indicator for existing runway temperature and rated EPR. Crosscheck TAT against SAT and rated EPR indication against Takeoff Thrust chart for accuracy.

If a pack is operating, rated EPR will indicate .008 low. Therefore, add .008 to indicated EPR to determine allowable EPR.

Complete the takeoff data worksheet A reduced thrust takeoff should be made whenever conditions permit.

STABILIZER TRIM SETTING

The engineer will check takeoff gross weight, center-of-gravity (CG) location, and stabilizer trim setting as shown on the Load and Balance Record. He will record the trim setting on the takeoff data worksheet.

If the stabilizer trim computer has to be used, the engineer will determine CG and use the panel placard for the trim setting.

TAXI CHECK LIST AMPLIFICATION

PILOTS

1. ENGINE ANTI-ICE . . . . ________

   Respond "ON" or "OFF" as appropriate. If engine anti-ice is on, check that heat lights are on and high pressure lights are out.

2. FLAPS . . . . 10 & GREEN LIGHT

   Both indicator tapes should align at the 10 degree flap position and the green leading edge slat indicator light should be on. Engineer check the slat monitor panel and confirm all slats extended.

3. AILERONS . . . . CK

   After flaps are extended to the takeoff position, rotate control wheel both directions while observing surface position indicator for travel of all spoilers and for rudder movement which is provided by the turn coordination feature of YAW SAS.

4. STABILIZER TRIM . . . . CK & SET

   Set stabilizer to the takeoff trim position reported by the engineer.

5. T/O DATA, EPR & AIRSPEED BUGS . . . . SET & CROSSCK

   Confirm that correct V_1, V_r, and V_2 are entered on the takeoff data card. Set the bug on each airspeed indicator to V_2 and crosscheck the settings.

TAXI CHECK LIST AMPLIFICATION (Cont'd)

Set takeoff EPR in the command window and check that all bugs are aligned. Set assumed thrust EPR when making a reduced thrust takeoff.

If any water or slush is standing on runway, observe appropriate restrictions.

6. PITOT, ALPHA, & WINDSHIELD HEAT . . .ON

On cold days turn on alpha heat as soon as practical; it may take as much as 5 minutes to reach operating temperature and put out off lights.

Select normal position on windshield heat (idle and off lights out).

ENGINEER

1 AIDS GROSS WEIGHT . . . . SET

Upon receipt of Load and Balance Record, encode the takeoff gross weight to nearest hundred pounds:

Also, set gross weight in total fuel quantity indicator.

2. ANNUNCIATORS . . . . CK

Scan pilot's instrument panels, overhead switch panel, and engineer's panel for annunciator and indicator lights. If any abnormal indications are observed, notify the captain immediately.

BEFORE TAKEOFF CHECK LIST AMPLIFICATION

PILOTS

1. CABIN ALERT . . . . .CK

Make a brief PA announcement. "All flight attendants please be seated."

2. TRANSPONDER . . . . CK

Position the function selector as required.

3. STROBE LIGHTS . . . . ON

4. IGNITION . . . . ON

After takeoff clearance is received, turn on continuous ignition.

If engine anti-ice was used during taxi, but is not required for takeoff, turn it off at this time.

5. TEMP PROBES HEAT . . . . ON

A fail flag may show in the TAT/EPR instrument and indications may not be valid until airborne.

ENGINEER

1. PACK VALVES . . . . CK

Turn off humidity control if on.

For no pack takeoff:

Close all pack flow control valves.

Check flowbars go out.

Verify flow decreasing.

Leave engine isolation, ATM isolation, and crossbleeds open.

For one pack takeoff using engine bleed air:

Normally pack 2 is used.

Close 1 and 3 pack flow control valves.

Check flowbars go out.

Verify flow decreasing.

Leave engine isolation, ATM isolation, and crossbleeds open.

Reduce rated EPR .005. Reduce runway zero wind and climb limit weight 4,000 pounds.

* * *

TAKEOFF PROCEDURES

Each pilot shall have his chair locked in position and his rudder pedals adjusted to allow full rudder travel. The engineer shall position and lock his chair within 45 degrees of facing forward. Do not move any chair during the critical phases of takeoff and initial climb.

The flight directors should normally be turned on, the runway heading selected in the heading display, with TAKEOFF and HDG modes selected.

As the throttles are advanced for takeoff the first officer and engineer will check engine instruments for abnormal indications. At slightly less than takeoff EPR command engineer to "trim throttles". The engineer will set takeoff EPR between 40 and 80 knots. If an EPR gauge is malfunctioning or is in error, use chart N_1. Check the engine 2 fail arm light is on.

If any engine limit is exceeded, conditions permitting, retard throttle until below limit. If any shutdown limit is exceed, when conditions permit, use engine failure procedure.

If the takeoff warning horn sounds as the throttles are advanced and the cause cannot be immediately corrected, discontinue the takeoff.

Maintain forward pressure on the yoke and use rudder pedal steering for directional control. If rudder pedal steering is inoperative use the nose steering wheel until the rudder becomes effective. (Normally 80 knots).

The engineer will monitor engine performance and call "Engine failure" should engine parameters indicate an abnormal condition significantly affecting thrust output.

If an engine fails, or if other abnormal conditions require a rejected takeoff prior to reaching V_1 speed, the rejected takeoff procedure must be initiated without delay.

(Technical information regarding a rejected takeoff may be found in chapter 10 of the Flight Operations Policy Manual.)

The captain shall keep his hand on the throttles until the aircraft reaches V_1.

The first officer shall call out V_1 and V_r as they are reached. At V_r rotate through liftoff attitude and stabilizer airspeed at V_2 + 10 knots but do not exceed 17 degrees nose up attitude.

NORMAL TAKEOFF

Use normal takeoff procedure for all runways except when specific noise abatement procedure is listed in the approach chart section of the Operations (Jeppesen) Manual.

Maintain takeoff flaps and V_2 + 10 knots until reaching 1,000 feet above the airport. Limit pitch attitude to a maximum of 17 degrees and accept any resulting speed increase.

If a turn is required, limit bank angle to 15 degrees until attaining maneuvering speed. Begin turn as soon as practicable consistent with safety.

At 1,000 feet above field elevation, lower the nose to approximately 8 to 10 degrees to establish a suitable climb gradient while accelerating for flap retraction. During clean up, it is desirable to continue to climb at no less than 500 feet per minute. Retract flaps on schedule. Set climb thrust when flaps are fully retracted and continue climb to 3,000 feet above field elevation at V_2 + 60 knots.

At 3,000 feet, expedite acceleration to climb speed using moderate climb attitude.

Manage thrust as necessary to stay within maximum speed restrictions. Command engineer to set climb thrust when appropriate.

FIRST OFFICER TAKEOFF

If the conditions outlined in chapter 6 of the Flight Operations Policy Manual are met, the captain may allow the first officer to make the takeoff. When the first officer makes the takeoff, normal takeoff procedures will be followed except as modified below

The captain will maintain directional control during engine acceleration toward takeoff thrust. The first officer will assume directional control with rudder pedal steering as the aircraft becomes aligned with the runway. If rudder pedal steering is inoperative the captain will use the nose steering wheel until the rudder becomes effective.

The captain will advance the throttles to slightly less than takeoff EPR and command the engineer to trim throttles. The captain will call V_1 and V_r as they are reached on the takeoff roll. He will keep his hand on the throttles until the aircraft is airborne and a positive rate of climb and normal climb-out attitude have been established. At this point he will indicate that the first officer is to assume control of the throttles by commanding, "Your throttles."

GROUND PROXIMITY WARNING

If a ground proximity warning is observed or heard, immediately pull up and maintain takeoff or maximum continuous thrust, as applicable. Maintain V_2 (maximum rate of climb) until the warning ceases.

REJECTED TAKEOFF

The decision to discontinue a takeoff is solely the responsibility of the captain. Regardless of which pilot is making the takeoff, the captain will stop the aircraft using the following procedure:

1. Apply full brakes while closing the throttles.

   If anti-skid inoperative, apply brakes in a gradually increasing manner to prevent locking wheels.

2. Apply reverse thrust. Maintain directional control with rudder and brakes.

3. Check extension of auto-ground spoilers. If they do not extend, manually extend spoilers.

4. Perform Engine Failure or Engine Fire check list, if appropriate.

When aircraft is stopped or clear of the runway, check brake temperature indications. If all temperatures remain in the green band, a subsequent takeoff may be commenced without further consideration of brake cooling. If brake temperatures indicate in the red bands, maintenance must perform an inspection prior to the next takeoff. (See Brake Energy, 21.60.)

ENGINE FAILURE AFTER V_1

If an engine fails after V_1, continue the takeoff and follow the engine failure procedure. Command "Gear up" when airborne with a positive rate of climb and at V_2. A positive rate of climb must be verified by a sustained climb indication and a continuing increase in altitude.

After flap retraction, command "Climb thrust". The engineer will set climb thrust using the Maximum Continuous (Engine Out) thrust setting chart.

* * *

CLIMB THRUST

The engineer should select the EPR mode selector to the mode to be used for climb and note the annunciator shows the selected mode.

Select cruise mode on the EPR computer and subtract .01 EPR for climb thrust setting until rate of climb reaches 500 feet per minute. At this point, select climb mode on the EPR computer, increase thrust to climb rating, and continue climb to cruise altitude.

If the EPR computer is inoperative, determine climb thrust from the Normal Climb/Maximum Cruise chart and subtract .01 EPR. When climb rate reaches 500 feet per minute, determine climb thrust from the Maximum Climb chart.

Check and reset climb EPR as necessary. Check climb EPR just prior to level-off at cruise altitude.

When EPR indicator is in error, set thrust by aligning N_1 tachometer to the average of the other N_1 tachometers.

AFTER TAKEOFF CHECK LIST AMPLIFICATION

PILOTS

1. GEAR LEVER . . . . NEUTRAL

   After the landing gear and door lights go out, return the gear lever to the neutral detent. The engineer should monitor fluid quantity in hydraulic systems and ATM operation during gear retraction.

2. LANDING & LOGO LIGHTS . . . . OFF

3. IGNITION . . . . OFF

   Press continuous ignition switch and check that the ON light goes off.

4. SEAT BELT & NO SMOKE . . . . CK

ENGINEER

1. PACK VALVES . . . . CK

   When 400 feet above field elevation, open one pack flow control valve. At approximately 600 feet above field elevation, open the second pack flow control valve. The third pack may remain shut down SCD; if used, it should not be started until 800 feet above field elevation.

ANTI-ICING

When engine anti-ice is used during takeoff, delay turning on wing anti-ice until reaching 800 feet above field.

Use engine anti-ice in flight when TAT is between +5°C and -15°C with visible moisture present. Use wing anti-ice if airframe icing is anticipated or encountered.

Turn on continuous ignition before turning on engine anti-ice. Leave ignition on until engine anti-ice is turned off.

ALTIMETER

The first officer will advise the captain:

> When climbing through 1,000 feet below the last assigned altitude.
>
> When reaching the altimeter transition altitude.

Set both pilots' altimeters to 29.92 in. Hg. when passing through the altimeter transition altitude (17,500).

ALTITUDE ALERT

Set altitude alert to each altitude assigned by ATC.

Set only those altitudes requiring a level-off when departing via a SID.

Crossing altitudes may be set when this action does not interfere with outside traffic watch.

TURBULENCE PENETRATION

When turbulence is anticipated, use weather radar to locate storm cells and to determine best penetration heading.

Before entering areas of known turbulence:

> Determine best penetration altitude, if possible below the 1.3G aerodynamic ceiling.
>
> When above 30,000 feet, do not climb to higher altitude to avoid turbulence unless the storm can definitely be topped.

TURBULENCE PENETRATION (Cont'd)

Adjust thrust, if necessary, to maintain the applicable target penetration speed range of 280-290 knots or mach .82-.85. If airspeed is greater than 290, reduce to 290 regardless of mach. If airspeed is below 280, do not further reduce speed if mach is within target range. If both mach and airspeed are less than minimum target values, increase speed until the first target is attained.

Turn on continuous ignition.

Engage autopilot in any mode, except altitude hold. If moderate to severe turbulence is encountered, use turbulence mode to reduce autopilot response rate.

Make thrust changes only if necessary to maintain target airspeed.

Monitor autopilot response, but avoid overriding the controls when the autopilot is applying corrections. If autopilot overridden the aircraft will remain in attitude existing when controls were released.

CLIMB PERFORMANCE RECORDS

The engineer will monitor the engine instruments and maintain a record of fuel consumption during climb. Fuel flow readings should be noted at a point two thirds of the way to cruising altitude from altitude where stabilized climb thrust was set. Fuel flow readings should be taken as required when variable thrust settings are used for step climb conditions.

The engineer, at the time of recording climb fuel figures, shall check fixed oxygen supply to detect any trend toward depletion.

Whenever specific climb performance data is recorded, use first officer's instruments where possible.

CREW OXYGEN USE PRECAUTIONS

When the requirement for use of oxygen no longer exists, the crew member who was using his mask must check the controls on his regulator to assure that the remaining oxygen supply is not accidentally depleted.

WEATHER RADAR

Initial tuning:

Mode - NORM. Radar will be operational after 3½ minute warm up period in either STBY or TEST.

Gain - AUTO. Receiver sensitivity is optimized for detection of long range targets. If manual gain is used, increase from MIN position until noise (snow) just barely appears.

Indicator - AHEAD. If IND was off, a 60 seconds warm up is required. LEFT or RIGHT may be selected after initial tuning.

Range - 300.

Polaroid Filter - Full left until radar is tuned; then adjust as desired.

Range marks - Adjust until visible. Avoid setting too bright so as not to obscure returns.

Intensity - Adjust until sweep line is visible, but trailing no luminesecence.

Tilt - Adjust as necessary for best identification of storm cells during climb. When reaching cruise altitude, tilt antenna down until ground clutter appears; then tilt upward about 2 degrees beyond where ground clutter disappears. Tilt should be slightly down allowing the antenna to scan the lower part of the storm cells because the radar is designed to detect large water droplets and these are found at the lower levels. Snow and ice at the higher levels yield little or no radar return.

Contour - If a bright return is received select contour mode. Area of black hole in return is the area of heaviest rainfall and turbulence. Avoid areas of steep rainfall gradients and unusual shapes such as hooks, fingers, or scalloped edges. These are areas of maximum turbulence and possible hail.

Changing ranges - When changing ranges INTENSITY and TILT may need readjustment, but GAIN should normally be left in its original position.

* * *

CRUISE THRUST

As cruise altitude is reached, gradually level the aircraft while continuing to use climb EPR for acceleration to cruise speed. Program the ADI slow-fast pointer for cruise speed by using the IAS control knob to dial in cruise chart indicated airspeed. When cruise chart speed is attained, smoothly retard throttles to cruise chart EPR. Allow aircraft to stabilize while monitoring the slow-fast pointer. If pointer indicates a trend toward speed change (pointer out of bullseye), adjust thrust with number two throttle. Use number two throttle to trim thrust until a .03 EPR difference from chart is required, then adjust number one and three throttles .01 EPR and realign number two. Monitor slow-fast pointer to maintain cruise chart speed.

If speed deteriorates in turbulence, use climb thrust to regain cruise speed.

When step climbing 4,000 feet or less, mach .84 speed may be used.

CRUISE PERFORMANCE RECORDS

During the stabilized cruise portion of flight, the engineer shall record aircraft and engine performance data in the logbook, time permitting. When recording logbook data, also record crew oxygen pressure and compare with that observed in climb.

INS INTERNATIONAL OPERATION - *100*

Prior to establishing INS navigation, an effort should be made to determine the most accurate INS system, preferably No. 1 or No. 2. Should a system be found to be considerably more accurate, that system should be selected as primary for navigation and used to navigate the aircraft utilizing the appropriate autopilot. The No. 3 INS cannot be coupled for autopilot operation. Therefore, it should not be selected as primary except for MEL limitations

INS navigation data and cross track error should be monitored by selecting both HSIs to INS using the RADIO/INS switch. Note that zero XTK error by itself is not a valid check of navigational accuracy since an error in waypoint loading will cause the aircraft to fly on course to the wrong coordinates.

The primary INS should routinely be selected to POS as a continuous check of present position versus flight plan. A periodic check of XTK/TKE and DIS/TIME should be made to confirm navigational accuracy.

The secondary INS should routinely be selected to DIS/TIME. TIME can be used to monitor the ETA for the next waypoint and a discrepancy between current ETA and flight plan ETA would point out a possible error in the loaded waypoint or in the flight plan. A periodic comparison of XTK/TKE will provide a gross error check of the primary INS.

The No. 3 INS should routinely be selected to WIND. Wind along with temperature can be helpful in anticipating possible turbulence. Wind should be logged at the intermediate 5° meridian for inclusion in the next position report. A periodic comparison of DIS/TIME will provide a gross error check of the secondary INS.

Approaching a waypoint change, it is essential that both pilots recheck the coordinates for the next waypoint to be used. This confirmation of correct coordinates will be made at or just prior to the alert light coming on. It will be made in both the primary and secondary INS to preclude a navigational error induced by incorrect waypoint loading.

A continuous cross check between INSs to compare XTK/TKE, POS, WAYPT, and DIS/TIME will further insure navigational accuracy and prevent undetected navigational excursions.

AIRWAYS OPERATION

These procedures may also be used when operating on airways with the following exceptions:

> Radio is the primary navigation reference and the RADIO/INS switches must be selected to RADIO. Both HSIs will display MAG heading and provide radio navigation information to monitor airway operation.
>
> The INSs should be selected to XTK/TKE, DIST/TIME, and WIND

TRANSITIONING TO INS NAVIGATION

Approaching the radio aid that defines the beginning of inertial navigation:

> Accomplish a gross error check by comparing present position and crosscheck data on each INS with the radio navigation data. REMOTE and HOLD can be used to compare all three INSs.
>
> Recheck the coordinates of the two waypoints that define the first leg.
>
> RADIO/INS switch to INS. The HSI will now display INS data and TRUE heading.

INS INTERNATIONAL OPERATION – *100* (Cont'd)

CHANGE SEQUENCE OF WAYPOINTS OR BY-PASS A WAYPOINT

Example: Bypass waypoint 3, go direct from waypoint 2 to waypoint 4.

Recheck waypoint 4 coordinates.

When ALERT light illuminates prior to reaching waypoint 2, press WYPT CHG switch.

Type desired waypoints on key board (2-4).

Check that FROM-TO window shows desired sequence (2-4) then INSERT. The INS will automatically switch to leg 2-4.

COURSE CHANGE BETWEEN WAYPOINTS

Example: While on leg 2-3, proceed from present position direct to waypoint 4.

Recheck waypoint 4 coordinates.

Press WYPT CHG switch.

Type new sequence in FROM-TO window (0-4) and INSERT.

The INS will display navigation information from present position direct to waypoint 4.

DISTANCE/TIME CHECK TO OUT-OF-SEQUENCE WAYPOINT

Example: While flying leg 2-3, check distance and time from waypoint 3 to waypoint 7.

Data selector to DIS/TIME.

Press WYPT CHG switch and load 3-7 in FROM-TO window. <u>Do not insert</u>.

The left data window will display total distance from waypoint 3 to waypoint 7, the right data window will display time from waypoint 3 to waypoint 7 based on present ground speed.

To return to normal operation, press CLEAR switch and FROM-TO window will return to leg 2-3.

The INS will navigate on the inserted leg (2-3), while displaying distance and time for another leg (3-7) as long as the INSERT is not pressed.

AUTOPILOT/FLIGHT DIRECTOR INS

1. VECTORING

- Select A or B AP to CMD, turn FD on.
- Select HDG mode with desired heading set in window or use control wheel steering.
- Select any pitch mode, or use control wheel steering.

2. INS APFD ENGAGEMENT

- Select either or both RADIO/INS switch(es) to INS. TRUE and RNAV will appear on HSI.
- Select any VOR frequency in both VHF NAV control panels.
- Check for proper INS desired track in HSI course window.
- Select NAV mode. RNAV annunciators appear on AFCS mode panels. HDG mode will disengage if selected. If NAV mode was engaged for VOR tracking, it must be re-leased and selected again.

3. ALERT LIGHT

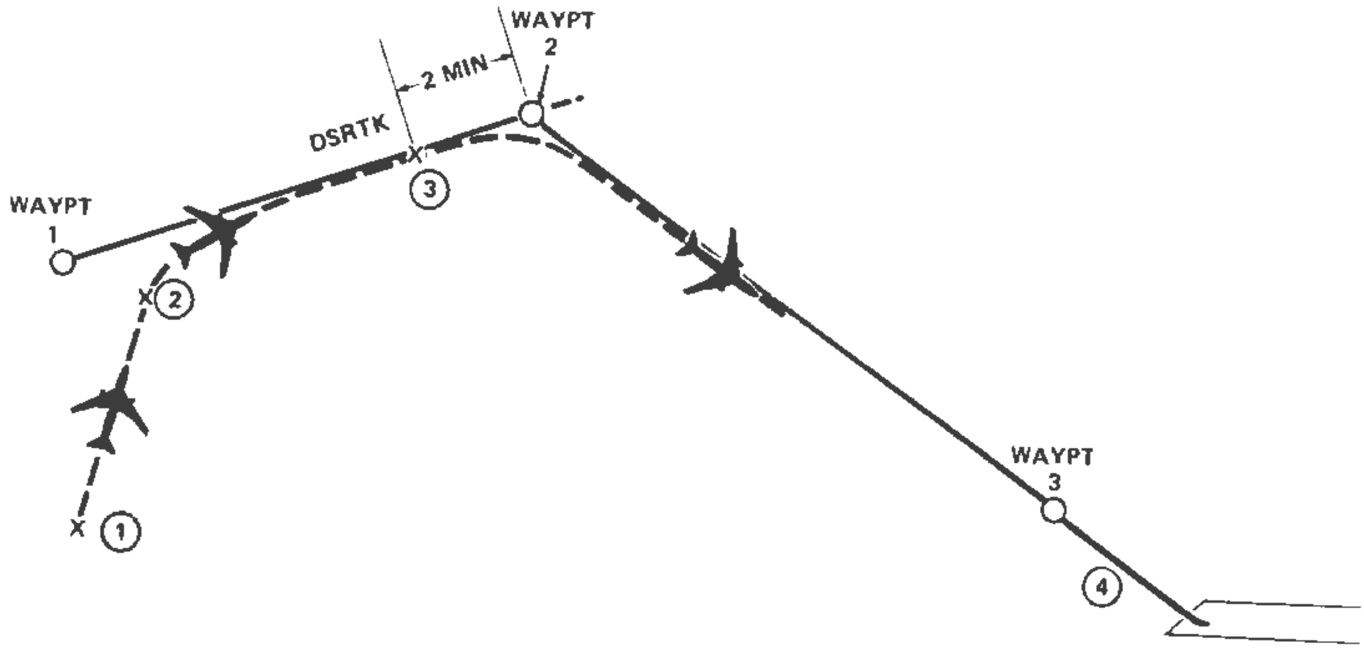
- Appears on HSI when within 2 minutes of next waypoint if RNAV displayed. If course change required, it will take place prior to reaching waypoint with CDU switch in AUTO.

4. APFD VOR/ILS AT DESTINATION

- Release NAV mode.
- Select both RADIO/INS switches to RADIO.
- Tune radio(s) to desired ILS or VOR frequency.
- Re-engage NAV or desired navigation or ap-proach mode (A/L, APR, LOC) and resume normal APFD operation.

INS INTERNATIONAL OPERATION – *100* (Cont'd)

AUTOPILOT/FLIGHT DIRECTOR INS



DISTANCE ABEAM CHECK

Example: While flying airways you are cleared direct present position to a distant VOR (waypoint 6) and all three INS have 0-6 inserted in their FROM–TO windows. Later ATC asks "How far abeam an intermediate VOR the aircraft will pass."

Use No. 3 INS to solve the problem.

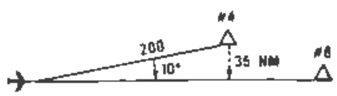
Enter the intermediate VOR as a waypoint. (waypoint 4).

Press WYPT CHG and load present position to waypoint 4 (0-4) in the FROM–TO window then INSERT.

Select DIS/TIME and note the distance. (200 nm).

Select XTK/TKE and note the track angle error (10R).

Using the wind side of the Jeppesen computer, put distance over TAS index and read over TKE to find distance abeam the VOR.



INS DIVERSION

If an inflight diversion, other than the normal flight plan change, becomes necessary:

Data select switch to WAYPT.

Waypoint selector to a number following the one shown in the FROM–TO window.

Load and INSERT the coordinates of the diversion point.

Using the WYPT CHG switch, load and insert the new leg (waypt "0" to the diversion waypoint) in the FROM–TO window.

The autopilot will immediately capture the new desired track to the diversion point.

RETURN TO RADIO NAVIGATION

Tune the VOR to the arriving landfall radio aid.

Select the inbound course with the course select knob.

Once positive identification of the radio aid is established, place the RADIO/INS switch to RADIO.

INS INTERNATIONAL OPERATION – *100* (Cont'd)

Corrective action should be taken immediately to establish the aircraft on the proper inbound radial so as to arrive directly over the fix and on the proper course.

DESCENT

Remain at cruise altitude as long as possible so that thrust may be reduced to the minimum practical level consistent with operational requirements during descent.

To begin descent, smoothly close the throttles and descend in the clean configuration at cruise mach until intersecting 350 knots IAS. Maintain 350 knots IAS to 10,000 feet or lower as local ATC regulations and speed limits permit.

PRESSURIZATION SYSTEM

Set rate knob to index then select cabin altitude to landing airport elevation.

Set landing airport altimeter setting in barometer set window.

Monitor cabin vs aircraft descent rates and advise the captain if it appears that the cabin will not reach the selected altitude prior to landing using descent rate of 300 feet/minute.

ANTI-ICING SYSTEMS

Use wing anti-ice to remove any accumulated ice prior to extending flaps.

During use of engine anti-ice, turn on continuous ignition before turning on anti-ice. Maintain enough throttle on all engines to keep heat light on and leave ignition on until anti-ice is turned off.

ALTIMETER

The first officer will advise the captain:

When descending through 1,000 feet above the last assigned altitude.

When reaching the altimeter transition level.

When leaving 11,000 feet for descent to or below 10,000 feet.

Domestic - Set both pilots' altimeters to local altimeter setting when descending through FL 180 or the lowest usable flight level.

International - After leaving the transition level both pilots' shall set their altimeters to the local altimeter setting. If the altimeter setting given by the ground station does not clearly state millibars or inches, the station shall be questioned to eliminate any possible misunderstanding.

ALTITUDE ALERT

During the descent phase of flight, the altitude alert system is to provide altitude alert protection for each succeeding descent restriction appropriate to the approach being flown.

If on a published segment when approach clearance is received, set the published minimum altitude for that segment unless assigned an altitude that is higher.

If not on a published segment when approach clearance is received, set the last assigned altitude until established on a track which has a charted altitude, then set the appropriate altitude for that charted segment unless assigned a higher altitude.

Set each assigned or charted altitude, as applicable, down to and including the final approach fix (FAF) crossing altitude. After passing FAF, position the altitude alert control to cancel further warnings.

* * *

CREW COORDINATION - INSTRUMENT AND VISUAL APPROACHES

These procedures designate specific callouts and tasks to the pilots and engineer in the conduct of either instrument or visual approaches. To clearly establish which pilot should accomplish a particular task, the terms "pilot flying" and "pilot not flying" are used. For crew coordination purposes, the pilot handling the flight controls is considered the "pilot flying" regardless of whether he is the captain or first officer.

Nothing in this procedure alters or diminishes the basic responsibility of the captain for the safe conduct of the flight.

ALTIMETER SETTING

Set all barometric and radio altimeter bugs as follows:

> Category II or IIIA approaches - Set both barometric altimeter bugs to 20 feet above the published DH MSL figure or alert height. Set both radio altimeter bugs to the applicable DH RA or RA figure.
>
> Instrument approaches other than Category II or IIIA – set both barometric altimeter bugs to the published DH or MDA. Set both radio altimeter bugs to 100 feet.
>
> Visual approaches – With electronic guidance, set barometric and radio altimeter bugs as appropriate for the electronic guidance minimums being utilized. Without electronic guidance, set both barometric altimeter bugs to 500 feet above runway touchdown zone elevation or field elevation. Set both radio altimeter bugs to 100 feet.

APPROACH CALLOUTS – IN NORMAL APPROACH SEQUENCE

"Localizer alive" and Glide slope alive" when needle starts moving in from full deflection.

Name of final fix ("Romeo" or "Outer marker" for example) and "Flags checked" when over final fix.

"Localizer" or "Glide slope" if more than one dot deviation throughout the approach. "Localizer" if outside the bullseye below 300 feet on a Category II or Category IIIA approach.

Actual airspeed and sink rate at 500 feet.

"Airspeed" or "Sink rate", after leaving 500 feet, if any sustained deviation from target airspeed or any sink rate in excess of 1,000 feet per minute observed

"One hundred to go" or "One hundred to alert" at 100 feet above minimums.

Visual cues, such as "Sequence flashers", "Approach lights", "Runway", etc., as they appear.

"Minimums, no runway" when required visual cues do not exist at decision height or missed approach point.

"One hundred feet" at 100 feet above runway touchdown zone elevation or field elevation, as appropriate.

"PILOT FLYING" CREW COORDINATION DUTIES

Review the approach plate as soon as approach information is available.

Confirm whether the barometric or radio altimeters will be used to determine minimums and that altimeter bugs are set as appropriate.

Call out final fix.

Call out "One hundred to go" at 100 feet above minimums. Call "One hundred to alert" for Category IIIA.

Do not descend below DH or MDA unless required visual cues are clearly visible and the aircraft is in a position to effect a normal landing.

Execute a missed approach at DH or when reaching MAP if required visual cues are not visibile and/or "Minimums, no runway" is called out.

"PILOT NOT FLYING" CREW COORDINATION DUTIES.

Assist in traffic watch.

Review the approach plate as soon as approach information is available. Call out the following for the pilot flying and the engineer:

> Runway touchdown zone elevation (TDZE) or field elevation as appropriate.
>
> Decision height (RA or MSL) or alert height for a precision approach.
>
> Minimum descent altitude (MDA) and missed approach point (MAP) for a non-precision approach.

CREW COORDINATION - INSTRUMENT AND VISUAL APPROACHES (Cont'd)

Monitor flight and engine instruments throughout the approach. Promptly inform the pilot flying of any observed malfunctions or irregularities. Focus specific attention on altimeter accuracy and setting, airspeed and altimeter bug settings, flap position, and all fail warnings associated with flight instruments.

Call out "Localizer alive" or "Glide slope alive", as appropriate, when the localizer or glide slope needle starts moving in from full deflection.

Check flag status on each pilot's panel and answer "Flags checked" when pilot flying announces the final fix. Call any instrument showing a flag to the attention of the pilot flying.

Monitor AFCS mode annunciators, ADI, HSI, and altimeters for warning flags during the remainder of the approach after leaving the final fix.

Call out "Localizer" or "Glide slope" if more than one dot deviation throughout the approach. Call out any localizer deviation outside the bullseye below 300 feet on a Category II or Category IIIA approach.

At 500 feet on all approaches (visual or instrument), call out the actual airspeed and sink rate as "______ knots, sink ________."

After leaving 500 feet, call out any sustained deviation from target airspeed and any sink rate in excess of 1000 feet per minute as "Airspeed" or "Sink rate."

When approaching minimums, advise the pilot flying as visual cues associated with the approach appear, such as sequence flashers, approach lights, threshold lights, touchdown zone and runway lights, or similar cues.

Call out "Minimums, no runway" when required visual cues do not exist at DH or MAP as appropriate.

Call out "One hundred feet" above the runway touchdown zone elevation (TDZE) or field elevation, as appropriate, on all approaches (visual or instrument).

FLIGHT ENGINEER CREW COORDINATION DUTIES

Monitor flight engineer station throughout the approach.

Assist in maintaining traffic watch.

Participate in reviewing the approach plate by noting the information called out by the pilot not flying.

Monitor ADI, HSI, and altimeters for warning flags and correct bug settings.

Monitor all instruments and promptly call any discrepancy to the attention of both pilots.

Back up both pilots for all required callouts. If a callout is omitted, make the callout in a timely manner.

CATEGORY IIIA APPROACH

For Category IIIA approaches, the RVR information in Operations Specifications will be strictly adhered to.

For Category IIIA approaches, an AH (alert height) of 100 feet radio altitude is established above which a CAT IIIA approach will be discontinued and a missed approach executed if a failure occurs in one of the required aircraft redundant operation systems or in the ground equipment.

For CAT IIIA approaches, visual reference must be established with the touchdown zone at the time of flare initiation or "No runway" shall be called and a missed approach executed.

Missed approach guidance shall be achieved using:

> Autopilot automatic go-around mode with flight director computed pitch command, or
>
> Computed flight director pitch command display in go-around mode, or
>
> Direct reference to attitude director indicators.

The normal missed approach procedures shall apply for thrust, flap and gear retraction, and minimum maneuvering speeds.

GROUND PROXIMITY WARNING

If a ground proximity warning is observed or heard, immediately pull up and apply go-around thrust. Maintain maximum rate of climb consistent with speed and configuration until warning ceases.

If the "glide slope" warning is heard during an ILS approach, take immediate action to return the aircraft to the center of the glide slope beam.

HSI DISPLAY - *100*

Both RADIO/INS switches are to be selected to RADIO. This displays magnetic heading and VOR or ILS data on each HSI. With MSU in NAV mode, ground speed, time, and distance data will also be displayed.

APPROACH DESCENT

When cleared to descend prior to final approach, descend to 1,000 feet above the assigned altitude using minimum thrust for existing conditions. When a significant altitude change is required at a high rate of descent, speed brakes may be used. Do not use speed brakes with any flaps extended or when below initial approach altitude. When reaching 1,000 feet above the assigned altitude, adjust rate of descent to prevent going below assigned altitude.

LANDING PERFORMANCE RESTRICTIONS

When landing conditions involve tailwinds, runway not clean and dry, or anti-skid system inoperative, a reduction in landing gross weight may be required. Refer to Landing Gross Weight Data section, chapter 21, for maximum landing weight.

FINAL APPROACH SPEED

Final approach speed for all approaches is bug + 5 knots plus 50% of any gust value.

LANDING PRELIMINARY CHECK LIST AMPLIFICATION

PILOTS

1. ANNUNCIATOR RECALL . . . . CK

   Press and release pilot's master test switch to recall all uncorrected conditions annunciators on the caution and warning panel.

2. ANTI-ICE . . . . CK

   Check status of all anti-ice systems and turn on those which may be needed for descent and landing.

   If heavy to moderate icing conditions have been encountered in flight and the airport temperature is 46°F or below, approach and landing speeds should be increased by 5 knots to compensate for ice buildup on the unheated surfaces of the aircraft.

3. SEAT BELT SIGN . . . . ON

   The seat belt sign may be turned on before reading this portion of the check list since it is the signal for flight attendants to distribute the personal effects of the passengers.

4. LOGO LIGHT . . . . CK

   Turn lights on only during the hours of darkness before midnight.

5. ALTIMETERS . . . . SET & CROSSCK

   Check altimeters for the current local altimeter setting and indicated altitude. See the general information section of the operations manual (Jeppesen) for altimeter tolerances. Set all barometric and radio altimeter bugs to appropriate minimums.

6. GW & AIRSPEED BUGS . . . SET & CROSSCK

   The engineer will supply the estimated landing gross weight and check the boundary speed placard for V_{ref}. For normal approach, set bugs to boundary speed.

ENGINEER

1. CABIN ALTITUDE . . . . CK

   Advise the captain if it appears that the cabin will not reach the selected altitude before landing using a maximum descent rate of 300 feet per minute.

2. CIRCUIT BREAKERS . . . . CK

   Check for tripped circuit breakers in the cockpit.

AUTOPILOT/FLIGHT DIRECTOR APPROACH

Engage an autopilot in CMD and place both flight directors on. Use an approprate pitch mode.

Align HSI heading cursor and press HDG mode and use HDG knob to maneuver.

Tune ILS on both receivers and select inbound front course with course knobs.

Check ADF and RMI pointers, and DME distance display, if available.

Press A/L mode, LOC ARM, GS ARM and, A/L ARM appear on annunciator.

AUTOPILOT/FLIGHT DIRECTOR APPROACH (Cont'd)

Engage second autopilot in CMD.

On CAT II ILS approaches set the barometric altimeter bug to 20 feet above the published DH MSL figure. Set the radio altimeter bug to the applicable DH RA figure as shown on the approach chart.

On CAT IIIA approaches set the radio altimeter bug to the lowest radio altitude shown on the profile of the approach being flown. Set the barometric altimeter bug to 20 feet higher than the MSL altitude shown for the same position.

Set speed and engage autothrust.

LOCALIZER CAPTURE

At capture point, LOC ARM changes to LOC and HDG SEL disappears.

GLIDE SLOPE CAPTURE

GS ARM changes to GS on annunciator, pitch mode trips off, and approach gate comes into view in ADIs.

Autopilot/flight directors pitch to 750 feet per minute rate of sink initially, then start tracking the glide slope. Outer marker lights will flash.

Go-around mode is armed at 33 flaps.

The pilot must continuously guard all flight controls throughout approach, auto flare, and landing rollout. Be prepared to disconnect the autopilot any time autopilot responds excessively to a deflected LOC or GS signal.

AT 1,500 FEET RADIO ALTITUDE OR 30 SECONDS AFTER GLIDE SLOPE CAPTURE, WHICHEVER OCCURS LAST

Autopilot/flight director dual channel initiates cross monitoring and A/L, ALN ARM, and FLR ARM appears in annunciators.

Rudder shifts to parallel operation.

At 500 feet radio altitude tone sounds and middle marker lights flash when over the LMM.

At 150 feet radio altitude, align appears in annunciator as aircraft is aligned with the runway. Nose of ADI aircraft symbol should be within the approach gate.

Tone sounds from fifty feet above DH/AH down to bug setting where DH lights flash. At fifty feet radio altitude flare appears in annunciator as autopilot initiates flare and autothrust starts to retard throttles.

At five feet radio altitude approach gate and command bars go out of view in ADI and rollout pointer appears. Rollout appears in annunciator.

AT TOUCHDOWN AND ROLLOUT

Autopilot maintains runway center line. Autothrottle trips off when throttles reach idle.

MONITORED ILS APPROACH

The captain will brief that a monitored approach will be made and determine that each crew member is aware of his duties. Approach duties must be assumed no later than the final fix.

The first officer will assume the operational role for the approach.

Category II requires use of autopilot in A/L mode in accordance with Operations Specifications. However, flight director approaches with or without autothrust may be utilized to Category I minima, SCD. See Autopilot/Flight Director Approach procedures, this section.

Crew coordination callouts will be made as stated in the FPS 20 section

During the approach, the captain will monitor approach progress and look for visual cues. Approaching decision height (D/H), the captain's primary attention will be directed outside the aircraft. If the required visual reference exists at or approaching D/H, the captain may command the first officer to "Continue the approach" or he may command, "I've got it". If required visual reference does not exist at D/H, the captain will command "Go-around" or "I've got it" and execute a go-around. An immediate go-around will be executed by the first officer upon reaching D/H if the captain has not commanded "Continue the approach" or "I've got it". If the command is "Continue the approach", the captain should normally assume control at the 100 foot call, however, he must assume control of the aircraft no later than 50 feet.

MONITORED ILS APPROACH (Cont'd)

When the captain commands "I've got it" and assumes control of the aircraft for landing, the first officer will remain head down and call out any deviations affecting stabilized flight.

NORMAL APPROACH AND LANDING

When approaching the traffic pattern, select flaps 4 and check that the LE flap green light is on. Slow to a minimum of bug + 30 knots.

On downwind leg, select flaps 10 and slow to a minimum of bug + 20 knots.

When opposite the approach end of the runway, select flaps 22 and slow to a minimum of bug + 10 knots.

Turning base leg, extend the gear.

When intercepting the approach slot, start a normal descent. Turning final select flaps 33 and slow to a minimum of bug + 5 knots + 50% of the gust value.

Adjust sink rate so as to be stabilized in the slot as soon as practicable but no later than 500 feet above the field elevation.

Use stabilizer trim to keep elevator column forces near zero throughout the approach. Frequently cross-check sink rate, pitch attitude, and the visual position of the 1,500 foot touchdown target to maintain aircraft in the approach slot.

When approaching the touchdown point, initiate the flare and smoothly reduce thrust to idle. Normal touchdown should occur at a pitch attitude of 9 to 10 degrees as the throttles are closed. Do not try to hold the aircraft off, as floating will result causing an excessive amount of runway to be used. Also, flaring to a pitch attitude above 12½ degrees will cause the tail skid to contact the runway.

Immediately after the main gear touches down, observe autospoiler operation and raise the reverse levers to the interlock position while lowering the nose wheel onto the runway. As soon as the nose wheel touches down, apply full reverse thrust. Ease off from the full reverse stops to the eleven o'clock position so as not to exceed reverse thrust limitations.

Braking effectiveness is reduced when landing on a wet or slippery runway if brakes are applied before wheel spin-up. Therefore, delaying application of brakes until at or below 100 knots improves stopping capability. Spoilers and reverse thrust provide the most effective deceleration forces in the higher speed regime.

If directional control becomes a problem while in reverse thrust, reduce thrust on all engines. If necessary, return to forward thrust. Use rudder, differential braking, and nose wheel steering to return the aircraft to the center line. Do not use nose wheel steering above 80 knots.

When the runway is wet or slippery, a silky smooth touchdown may contribute to hydroplaning; therefore, a positive touchdown is desirable.

The first officer will call out a speed of 80 knots during the landing roll.

At this time gradually reduce reverse thrust so as to approach reverse idle by 60 knots.

Hold steady brake pressure as required until the airplane has slowed to a safe taxi speed.

When landing roll is completed or when turning off the runway, return engines to forward thrust, retract flaps and spoilers, and check brake pressure.

Do not cycle reverse levers if engine does not return to forward thrust.

Engineer should closely monitor all engine parameters on center instrument panel until reverse thrust has been terminated, engines have stabilized in forward thrust, and aircraft is on taxiway.

CROSSWIND LANDING TECHNIQUE

Establish a track on the extended runway centerline and maintain the crab angle until approximately 150' above the touchdown zone. At this time, apply rudder to align the aircraft with the runway and lower the upwind wing as necessary to maintain centerline. Throughout flare and touchdown, aircraft should be aligned with the runway centerline with no crosstracking. As the upwind gear touches down, maintain aileron deflection until both the downwind and nose gear are on the runway. Anticipate the change in apparent rudder effectiveness as the nose gear touches down.

LANDING FINAL CHECK LIST AMPLIFICATION

PILOTS

1. EPR COMPUTER .... GO-AROUND

   Check go-around mode on EPR computer.

2. IGNITION .... ON

3. NO SMOKING SIGN .... ON

4. ALTIMETERS .... SET & CROSSCK

   Set field barometric pressure.

5. BRAKE PRESSURE .... CK

   Check normal and alternate brake pressure.

WHEN GEAR EXTENDED

6. GEAR & ANTI-SKID .. ..DOWN & CK

   Do not place gear lever up before placing gear lever down.

   Check that green gear lights are on and red gear and door lights are out.

   Check anti-skid control switch on and anti-skid annunciator lights out.

   If one or more anti-skid annunciators do not give a proper indication, refer to Braking With Anti-Skid Inoperative in chapter 17.

7. FLAPS ....______& GREEN LIGHT

   Call out the degree of flap extension.

   Check LE slats green light on.

   Check to ensure the flaps are fully extended prior to landing.

   When flaps are extended to 33 degrees, monitor the speed brake lever to determine proper DLC operation.

8. INTL: ALTIMETERS ....
   ....CK–INCH HG/MILLIBARS

   Set altimeters to local altimeter setting, (inches of mercury or millibars as applicable) and cross-check pressure settings.

ENGINEER

1. FUEL PANEL .... CK

   Normally, all main tank pumps should be on and crossfeed valves closed.

2. SLAT MONITOR .... CK

   Check all green lights are on and confirm all leading edge slats are extended.

AFTER LANDING CHECK LIST AMPLIFICATION

PILOTS

1. BRAKE PRESSURE .... CK

   Check normal and alternate brake pressure indicator for approximately 3,000 PSI. If normal brakes or anti-skid becomes inoperative or ineffective, place selector to ALT SYS C.

2. IGNITION ....OFF

3. RADAR, TRANSPONDER, & DME...STANDBY

4. FLAPS .... UP

5. SPOILERS .... DOWN

   Check lever in the full forward position.

6. STABILIZER TRIM ....ZERO

   The stabilizer will drift to a zero position without hydraulic pressure. This will ensure stabilizer and control trim position are together when system is pressurized and thus avoid rapid stabilizer movement.

7. STROBE LIGHTS .... OFF

ENGINEER

1. APU .... CK

   Do not start APU if advised by ramp control that external power will be available.

   Delay starting the APU when a significant taxi or gate delay is anticipated.

   When the aircraft is clear of the runway:

   Place the APU master switch to ON.

AFTER LANDING CHECK LIST AMPLIFICATION (Cont'd)

Place mode selector to minimum.

Press APU generator breaker trip switch.

Start APU using normal procedures.

After APU don't load light goes out, close both crossbleed valves and No. 2 engine isolation valve. Open APU bleed air shut-off valve.

Place mode selector to normal.

With volts and frequency stabilized and within limits, press the field relay trip switch.

Press the generator breaker close switch and field relay close switch to provide autoparalleling of the generator.

If the total generator load exceeds APU generator limit, reduce electrical load as necessary.

If the APU is not used reduce electrical load as necessary and leave one engine generator operative for electrical power until external power is available.

TAXI IN WITH NO. 2 ENGINE SHUT DOWN

When conditions after landing indicate it is practical, taxiing to the station may be accomplished on two engines.

For taxi with No. 1 and No. 3 engines, No. 2 engine will be shut down provided:

Clear of runway.

Flaps and slats are retracted.

Engine at idle for at least one minute.

Both ATMs and AC pumps are operating normally. Place both ATMs and AC pumps to ON.

Reduce electrical load, one tank pump off in each tank.

Trip the No 2 engine generator breaker and advise captain "Ready for shutdown".

* * *

FLAPS

The flaps should be up for parking.

PARKING

Use gradual pressure on nose steering wheel to start turns. If the wheel is released during a turn, the nosewheel will rapidly return to the pedal steering position.

INTERNATIONAL – *100*

When parked, place all CDU selectors to POS and enter existing latitude, longitude, INS departure turn on time, and any INS malfunctions in aircraft log.

ENGINE SHUTDOWN

→Open generator breakers, place fuel and ignition switches off, and observe fuel flow and TGT for indications of shutdown. Pull fire control if engine does not shut down.

GATE ARRIVAL SIGNAL

When the parking brakes are set, turn off the seat belt sign to signal the flight attendants and passengers that it is safe for them to get out of their seats and move about.

SECURE COCKPIT CHECK LIST AMPLIFICATION

PILOTS

1. PARKING BRAKE . . . . ON

   When in position, park the brakes and check that the red parking brake lights come on.

2. AIR DATA HEAT . . . . OFF

3 WINDSHIELD HEAT . . . . IDLE & OFF

4 ANTI-COLLISION LIGHTS . . . . OFF

   After the last engine is shut down, turn off the anti-collision lights.

5. STBY PWR & EMERG LIGHT . . . . OFF

FLIGHT TERMINATION

6. RADAR . . . . OFF

7. *-100:* INS MODE SELECTORS . . . . OFF

   Select OFF on the three INS MSUs.

ENGINEER

1. FUEL TANK PUMPS . . . . OFF

2. HYDRAULIC PANEL . . . . CK

   Turn off the ATMs and AC pumps.

3. PACK VALVES . . . . CK

   Open both cross bleed valves. Three packs will normally be operated to maintain cabin air conditioning during ground operation.

4. FLIGHT RECORDER . . . . OFF

FLIGHT TERMINATION

5. BATTERY SWITCH . . . . OFF

6. CREW OXYGEN . . . . OFF

   Close the crew oxygen shutoff valve.

   RADIOS . . . . OFF

   Turn the master radio switches off when it is determined there is no need for cabin communication.

EXTERIOR LIGHTS

At night, turn the wing flood and wheel well lights on to provide light for servicing. Leave the logo light on.

ELECTRICAL POWER

Normally, leave the aircraft with electrical power on all busses. Close the APU bleed valve before shutting down APU.

COCKPIT LIGHTS

Turn off all unnecessary cockpit lights at flight termination.

* * *

AIRCRAFT PERFORMANCE

Maximum Weights (pounds)

		-100
Taxi	432,000	468,000
Brake Release	430,000	466,000
Landing	358,000	368,000
Zero Fuel	325,000	320,000

Fleet Average Operating – See Weight and Balance Data chapter 21.

Maximum Airspeeds and Mach Numbers

	IAS - KTS	Mach
V_{mo}/M_{mo}		
Sea Level	350	—
10,000 feet to 26,000 feet	375	—
26,000 feet to 42,000 feet	—	.90
Landing Gear		
Extending/Extended	250	.73
Retracting	230	
Flap Extension		
4	250	
10	230	
22	205	
33	170	
Slat Extended	250	

Limiting Tailwind Component	KTS
Takeoff or Landing	10

Crosswind Component (peak gusts)

Takeoff and Landing	35

Minimum Airspeeds — IAS - KTS

V_1 and V_r	See G.W. Data Chapter 21
V_2	See V_2 Placard

Boundary Speed — See Boundary Speed Placard

Stall Speeds (IAS – KTS)

		-100
Max T.O. Weight		
No Flaps	166	176
4 Flaps	133	144
10 Flaps	128	138
Max Landing Weight		
No Flaps	150	155
4 Flaps	123	125
10 Flaps	119	121
22 Flaps	114	116
33 Flaps	112	115

Bug Speeds (V_{ref} + ______________)

	IAS - KTS
No Flap Landing	50
One or more LE Slats not extended	20
Trailing Edge Flap Asymmetry (Full slats)	1 KT/each degree flap not available
Normal Approach Speed	5 + ½ gust

Climb Speed	IAS - KTS	Mach
Normal		
Below 10,000 MSL	250	—
Above 10,000 MSL	320	.82
Turbulence Target Speed	280 - 290	.82-.85

Max Certificate Operating Altitude — 42,000 feet

Max Temperature T.O. and Land — 130°F sea level; 84°F - 10,000 feet

Slush or Standing Water Limits - inches

Takeoff	½
Landing	1

ENGINE LIMITATIONS

Takeoff Thrust - pounds — 42,000

Engine Shutdown Limits

If any of these engine parameters reaches the following limits, use the engine failure procedure when conditions permit:

- N_1 - - 103%
- N_2 - - 106%
- N_3 - - 96%
- TGT - - 750°C for 20 sec.
  775°C for 5 sec. (Red light on steady).

Takeoff Thrust

Use of takeoff thrust - 5 minutes.

During takeoff the engines should be operated so that the following parameters remain below these indicator markings:

- N_1 - - Red horizontal line
- N_2 - - Red radial line
- N_3 - - Red band
- TGT - - Red band

ENGINE LIMITATIONS (Cont'd)

When using any of the following thrust settings, these engine parameters should be maintained below the following markings.

Normal Climb/Maximum Cruise, Maximum Climb, or Maximum Continuous used for Climb.

- N_1 - - Red band
- N_2 - - Red radial line
- N_3 - - Amber band
- TGT
  - Normal Climb/Max Cruise — 685°C
  - Max Climb or Max Continuous — Amber band

Cruise Thrust

- N_1 - - Red band
- N_2 - - Red radial line
- N_3 - - Amber band
- TGT - - 685°C

Reverse Thrust

- N_1 - - 90%
- TGT - - 685°C for 30 seconds

Ground Idle

- N_1 - - 23.3% max 21.0% min
- TGT - - 460°C

During Start or Relight

- TGT - - 550°C for 2 seconds

Oil System Limits

Minimum Quantity before Engine Start - qts	10
Normal Minimum Pressure - PSI	40
Minimum Oil Pressure - PSI	35
Transient on RPM Reduction - PSI (5 minutes maximum each time)	18
Low Oil Pressure Light On - PSI	18
Oil Temperature - °C	
Steady State - (log if exceeded)	90
Maximum	100
Transient	135-15 minutes

Maximum time with ground start switch in and no engine rotation - seconds	10
Maximum time with fuel and ignition switch on and no light off - seconds	30
Minimum clearing time after unsuccessful start - seconds	30
Maximum time for indication of oil pressure after rotation - seconds	30

FUEL

Fuel Tank Capacities - usable fuel

6.7 lbs per gal (actual capacity) - pounds

		-100
1 & 3, each	54,130	53,970
1A & 3A, each		9,560
2L & 2R, each		
Inboard	16,980	16,980
Outboard	8,670	8,670
Total	25,650	25,650
Total - (all tanks)	159,560	178,360

Tank Maximum Capacities (structural limits) - pounds	
2L & 2R, each	27,100
Fuel Reserve - pounds	
FAA	11,000
TWA (INT - 8,000 + 25#/ Flt Plan minute)	4,000
Taxi Fuel, Normal - pounds	1,500
Additional Taxi Fuel, at JFK, LHR, and between 1600 - 1800 hrs local time at ORD - pounds	500
Fuel Jettison Rate - pounds/minute	4,500
Total Residual - Fuel, after complete Jettisoning - pounds	24,000
Fuel Temperature Limit - °C	
Tank Minimum	-40
Engine Maximum	95
Minimum for Takeoff - pounds	21,000

Minimum Fuel procedure required if tank quantity is less than:

- Tank 1 or 3 - 2000 pounds
- Tank 2L or 2R - 1000 pounds

HYDRAULIC

Pressure Values - PSI	
Normal	3,000
Engine Pump Low Pressure Light On	700
Minimum Fluid Level for Departure	¼ full
Stabilizer Travel	+2 to -14
Stabilizer White Band	-2.5 to -8

AIR CONDITIONING

Pack Trip - Off - °C

Compressor Discharge	215
ACM Discharge	98
Hot Air Manifold Trip	150

PRESSURIZATION

Cabin Differential Pressure Limits - PSI

Cabin Pressure Control Maximum	8.6
Maximum Pressure Relief	8.8
Takeoff and Landing Maximum	0.15
Cabin Altitude Warning Horn	10,000 Feet

ELECTRICAL

AC Generator	
Voltage	115 ± 5
Frequency (H_z)	400 ± 5
PMG Voltage	125 ± 5
Power Rating (KW)	81 Max Cont.
5 minutes	120
APU (above 14,000 ft)	54
External Power	
Voltage	115 ± 10
Frequency (H_z)	400 ± 10
TR Unit	
Voltage	28 ± 2
Amperes Maximum Cont	75
Battery	
Voltage	22 to 38
Inverter	
Voltage	115 ± 5
Frequency (Hz)	400 ± 10
IDG	
Maximum oil out temperature - °C	180
Maximum oil rise - °C	40

AUXILIARY POWER UNIT

N_G RPM - Steady State		101 %
Transient		102 %
TGT		
Maximum Start	Limit - °C	760
Maximum Continuous	Limit - °C	1066
Altitude Operating Limit	- 31,000 feet	
Altitude Start Limit	- 25,000 feet	

DE-ICING AND ANTI-ICING

Temperature range for nacelle anti-ice with visible moisture

Ground - Temp below 46°F & OAT + Dew Point is equal to 78 or less.

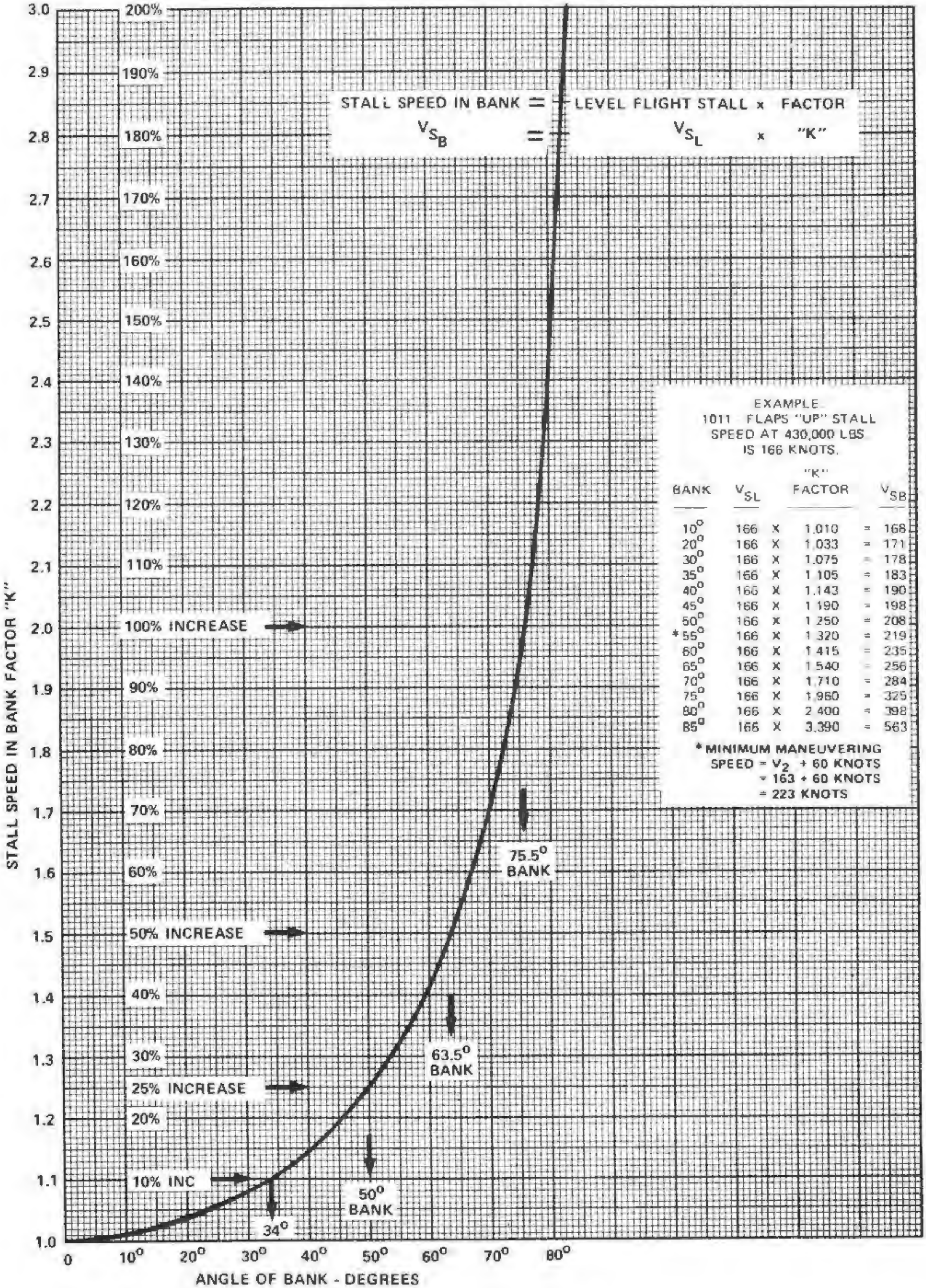
Flight - -15°C to +5°C

EMERGENCY EQUIPMENT

Escape Slide Air Bottle Pressure at 70°F Minimum PSI Doors 1, 2, 3, & 4	2850
Oxygen Bottles - Minimum PSI at 70°F	
Portable	1750
Crew Fixed System	
Domestic	950
International	1300

Oxygen Duration In Minutes	DOM	INTL
5 Cockpit Crew on Normal	143	204
5 Cockpit Crew on 100%	15	21
5 Cockpit Crew on Emergency	12	16
Cockpit Walk-Around Bottle	14	14
Cabin Walk-Around Bottle		
LO - Outlet	146	146
HI - Outlet	73	73
Cabin Crew Plus 100% Passengers	15	15

STALL SPEED VS. BANK ANGLE



EXAMPLE
1011 FLAPS "UP" STALL
SPEED AT 430,000 LBS
IS 166 KNOTS.

BANK	V_{SL}		"K" FACTOR		V_{SB}
10°	166	X	1.010	=	168
20°	166	X	1,033	=	171
30°	166	X	1.075	=	178
35°	166	X	1 105	=	183
40°	166	X	1.143	=	190
45°	166	X	1 190	=	198
50°	166	X	1 250	=	208
*55°	166	X	1 320	=	219
60°	166	X	1 415	=	235
65°	166	X	1 540	=	256
70°	166	X	1,710	=	284
75°	166	X	1,960	=	325
80°	166	X	2 400	=	398
85°	166	X	3,390	=	563

* MINIMUM MANEUVERING SPEED = V_2 + 60 KNOTS
= 163 + 60 KNOTS
= 223 KNOTS

GENERAL

CHECK LIST

CHECK LIST AMPLIFICATION

* * *

GENERAL

The Emergency Procedures set up in this handbook represent the best known available facts about the subjects. Flight crews should follow these procedures as long as they fit the emergency. At any time they are not adequate or do not apply, the crew's best judgment should prevail. Safe altitude and airspeed should always be of primary concern.

Emergency Procedures are covered by an Emergency check list, a copy of which is in the check list pouch on the glare shield in the cockpit. Where deemed necessary, the items on this check list are amplified in section 3.10. This section must be checked, following accomplishment of the check list, for secondary procedures and information relative to the emergency.

USE OF EMERGENCY CHECK LIST

After the initial steps toward combating the emergency have been completed, i.e., memory items, the captain shall call for and designate who is to read the Emergency check list. It is imperative that the entire check list for the particular emergency be completed without delay since failure to do so may reduce capability to handle the emergency or may even compound it.

The challenge contains the control and its correct position. The crew members reading the check list shall read only the challenge. The crew member responsible for positioning the pertinent control shall answer with the response after making certain that it is properly positioned. For example, the challenge, "Throttle Close," will be answered, "Close."

The person reading the check list will advise the captain when the check list is complete.

ALL EMERGENCIES

Report position and nature of emergency. The decision as to best descent procedure or whether descent is necessary or not, will depend upon the nature of the emergency, weather conditions, terrain and any possible structural weakness in the aircraft caused by the emergency. Only the crew can evaluate the emergency sufficiently to make the proper decisions.

Time permitting, the captain should secure such technical information and assistance as may be available, via radio, from maintenance and engineering personnel.

In an emergency, which involves smoke, fumes, rapid loss of cabin pressure, etc., oxygen must be used and interphone communications set up immediately. When the degree of emergency has been determined, the continued use of oxygen will be dictated by the existing circumstances.

Prepare for emergency descent and landing by determining the position of the nearest landing field and the best method of descent, dependent upon the circumstances of the emergency.

Fires are the most urgent emergencies and require immediate action in the earliest stages for proper control. Whenever fire or smoke is reported or suspected, thorough investigation must be made. In all cases of fire warnings, it must be assumed that a fire exists until proven otherwise.

Experience shows that serious damage to the aircraft can be incurred (on the ground) with very little indication to the cockpit crew. Be suspicious of any indication, and if there is any question as to aircraft damage:

1. Stop the aircraft.
2. Move fuel and ignition switches to OFF.
3. Pull all engine fire controls.
4. Discharge one fire extinguisher bottle to each engine.
5. Immediately determine the need for passenger evacuation.

SILENCING AURAL WARNINGS

During emergency conditions, silence the aural warning(s) promptly to improve crew coordination.

FIRE WARNING BELL

The captain or first officer will silence any fire bell after noting fire warning light indication. If warning is from an APU fire, the engineer will report, "APU Fire." When first officer silences the bell he will advise the captain, "Bell Off."

CABIN PRESSURE WARNING

When an intermittent horn sounds in flight, the engineer shall check the cabin altitude while silencing the horn. He will then advise the captain, "Cabin Altitude Horn Off."

* * *

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EMERGENCY 1011 CHECK LIST

REPORT POSITION AND NATURE OF EMERGENCY AS SOON AS PRACTICAL. CONSIDER REQUIREMENTS FOR DESCENT AND LANDING. AFTER COMPLETION OF CHECK LIST, REFER TO 3.10 OF THE FLIGHT HANDBOOK.

ENGINE FAILURE/TURBINE AIR OVERHEAT — 3.10.01

1. THROTTLE, CLOSE .... CLOSE
2. FUEL & IGNITION SWITCH OFF .... OFF
3. FUEL PANEL, CK .... CK
4. ELECTRICAL POWER, CK .... CK
5. HYDRAULIC POWER, CK .... CK
6. PNEUMATICS, CK .... CK
7. -100 ENGINE 1 OR 3, PULL CIRCUIT BREAKERS 2K1, 3J15 & 3J16.

ENGINE FIRE — 3.10.01

1. THROTTLE, CLOSE .... CLOSE
2. FUEL & IGNITION SWITCH, OFF .... OFF
3. FIRE CONTROL, PULL .... PULL
4. FIRE BOTTLE, DISCHARGE ...... DISCHARGE
5. IF WARNING PERSISTS AFTER 30 SECONDS, DISCHARGE OTHER BOTTLE.
6. IF WARNING PERSISTS, CLEAN UP AIRCRAFT & ACCELERATE TO 300 KTS MINIMUM.
7. IF WARNING PERSISTS, PROCEED TO NEAREST SUITABLE AIRPORT.
8. FUEL PANEL, CK .... CK
9. ELECTRICAL POWER, CK .... CK
10. IDG, DISCONNECT .... DISCONNECT
11. HYDRAULIC POWER, CK .... CK
12. PNEUMATICS, CK .... CK
13. -100 ENGINE 1 OR 3, PULL CIRCUIT BREAKERS 2K1, 3J15, & 3J16.

APU FIRE — 3.10.02

1. IF APU DOES NOT AUTO SHUTDOWN, PULL APU FIRE CONTROL AND DISCHARGE A BOTTLE.
2. IF WARNING PERSISTS, DISCHARGE OTHER BOTTLE.

WHEEL WELL FIRE — 3.10.02

1. DLC/AUTO SPOILERS, OFF .... OFF
2. GEAR LEVER, NEUTRAL .... NEUTRAL
3. LEFT & RIGHT LANDING GEAR UPLOCK RELEASE HANDLES, PULL (300 KNOTS/M.85 MAX) .... PULL
4. BRAKE TEMPERATURES, MONITOR ... MONITOR
5. AFTER FIRE OR BRAKE OVERHEAT CONDITION HAS CEASED, LEFT & RIGHT LANDING GEAR UPLOCK RELEASE HANDLES, STOW ..... STOW
6. GEAR LEVER, DOWN .... DOWN
7. DLC/AUTO SPOILERS, ON .... ON
8. AS APPROPRIATE, LANDING GEAR, UP OR DOWN .... UP OR DOWN

GALLEY FIRE/SMOKE — 3.10.03

1. GALLEY POWER BUSSES OFF .... OFF
2. CHECK COOL AIR OVERBOARD VALVE OPEN.
3. AFT OUTFLOW VALVE MANUALLY CLOSE .... CLOSE
4. ESTABLISH COMMUNICATION WITH GALLEY & DETERMINE CAUSE.
5. IF UNOCCUPIED, DON SMOKE MASK BEFORE ENTERING.

ELECTRICAL FIRE/SMOKE — 3.10.03

1. OXY MASK, SMOKE GOGGLES & INTERPHONE, ON .... ON
2. OXYGEN REGULATORS, ALL LEVERS, UP .... UP
3. DC BUS ISOLATION, OPEN .... OPEN
4. SELECT ESS AC TO A GEN POSITION.
5. GENERATOR BREAKERS, OPEN .... OPEN
6. IF CONDITION PERSISTS:
   a. AC TIE BREAKERS, OPEN .... OPEN
   b. GENERATOR BREAKERS, CLOSE ...... CLOSE
   c. BATTERY SWITCH, OFF .... OFF
   d. ESSENTIAL SELECTOR, OFF .... OFF

BRAKE FIRE/SMOKE — 3.10.04

1. STOP AIRCRAFT.
2. ALERT EMERGENCY EQUIPMENT.
3. CONFIRM NATURE OF REPORTED BRAKE PROBLEM.
4. IF FIRE VISIBLE:
   a. PARK BRAKES.
   b. SHUT DOWN ENGINES.
   c. EVALUATE NEED TO EVACUATE.
5. IF EXCESSIVE SMOKE APPARENT:
   a. TURN NOSE WHEEL FULL TRAVEL TO PREVENT AIRCRAFT ROLLING.
   b. LEAVE BRAKES OFF.
   c. MONITOR GEAR FOR INDICATION OF FIRE.

AIR CONDITIONING SMOKE — 3.10.05

1. OXY MASK, SMOKE GOGGLES & INTERPHONE, ON .... ON
2. OXYGEN REGULATORS, ALL LEVERS, UP ..... UP
3. CROSS BLEED VALVES, CLOSE .... CLOSE
4. ENG 1 ISLN VALVE, CLOSE .... CLOSE
5. IF SMOKE CONTINUES:
   a. ENG 1 ISLN VALVE, OPEN .... OPEN
   b. ENG 2 ISLN VALVE, CLOSE .... CLOSE
6. IF SMOKE CONTINUES:
   a. ENG 2 ISLN VALVE, OPEN .... OPEN
   b. ENG 3 ISLN VALVE, CLOSE .... CLOSE

SMOKE REMOVAL — 3.10.06

1. HIGH PRESSURE & ENGINE ISLN VALVE, OPEN .. .. OPEN
2. PACK FLOW CONTROL VALVES, OPEN ... OPEN
3. CHECK COOL AIR OVERBOARD VALVE OPEN.
4. CABIN ALTITUDE SELECTOR, 10,000 FT .... 10,000 FT
5. CABIN PRESSURE RATE SELECTOR, MAXIMUM .... MAXIMUM
6. FRESH AIR VALVES, OPEN .... OPEN

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EMERGENCY 1011 CHECK LIST

LOSS OF ALL GENERATORS —— 3.10.06

1. STANDBY POWER SWITCH, ON .... ON
2. AC TIE BREAKERS, OPEN .... OPEN
3. GALLEY POWER BUSSES, OFF .... DFF
4. DC BUS ISOLATION, OPEN .... OPEN
5. GEN FIELD RELAYS, CLOSE .... CLOSE
6. IF ANY GENERATOR FIELD RELAY CLOSES:
   a. FOR GENERATOR NO. 3, CHECK GENERATOR BREAKER CLOSED.
   b. AC ESSENTIAL BUS, SELECT .... SELECT
   c. STANDBY POWER, ARM .... ARM
7. IF NO GENERATOR FIELD RELAYS CLOSE, CONSIOER STARTING APU.
8. REDUCE ALL UNNECESSARY ELECTRICAL LOADS.

RAPID DEPRESSURIZATION —— 3.10.07

1. OXYGEN MASK & INTERPHDNE, ON .... ON
2. IF AIRCRAFT IS ABOVE 14,000 FEET, INITIATE RAPID DESCENT, IF PRACTICAL.
3. IF CABIN ALTITUDE ABOVE 14,000 FEET, PASSENGER OXYGEN ON .... ON
4. IF CABIN ALTITUDE ABOVE 30,000 FEET, OXYGEN REGULATORS, ALL LEVERS UP ... UP
5. MAKE CABIN ANNOUNCEMENTS WHEN PRACTICAL.

RAPID DESCENT —— 03.10.07

1. THROTTLES, CLOSE .... CLOSE
2. WITH STRUCTURAL OAMAGE SUSPECTED, AVOID HIGH IAS & ABRUPT MANEUVERING
3. SPEED BRAKES, MAXIMUM ... . MAXIMUM
4. DESCENT TARGETS:
   a. 10° NOSE DOWN.
   b. V_{mo} MINUS 10 KTS, MACH .85 MAX.

EMERGENCY LANDING/DITCHING —— 3.10.08

NOTIFY ATC, COMPANY, FLIGHT ATTENDANTS AND PASSENGERS

PRIDR TD LANDING/DITCHING

1. SHOULDER & SEAT BELTS SECURE .... SECURE
2. LANDING GEAR.
   LANDING - GEAR DOWN .... DOWN
   DITCHING - GEAR UP .. .. UP
   PULL AURAL WARN PWR CB (1L8) & GND PROXIMITY CMPTR AC CB (1B20).
3. PACK VALVES CLOSE .... CLOSE
4. COOL AIR OVERBOARD VALVE CLOSE .. CLOSE
5. OUTFLOW VALVES CLOSE .... CLOSE
6. FLAPS 33 33
7. EMERGENCY EXIT LIGHTS ON .... ON

LANDING/DITCHING

1. WHEN READY TO SECURE ENGINES, FUEL & IGNITION SWITCHES OFF ....OFF
2. PULL FIRE CONTROLS & DISCHARGE BOTH EXTINGUISHERS TO EACH ENGINE.

EVACUATION —— 3.10.09

1. PARKING BRAKE ON ....ON
2. FUEL & IGNITION SWITCHES OFF .... OFF
3. EMERGENCY EXIT LIGHTS ON .... ON
4. EVACUATION ALARM ON .... ON
5. APU & ENGINE FIRE CONTROLS PULL ... PULL
6. AS APPROPRIATE, FIRE EXTINGUISHERS DISCHARGED .... DISCHARGED
7. DIRECT EVACUATION.

* * *

GENERAL

When emergency procedures are accomplished, use deliberate actions to ensure that the correct controls are actuated.

For all fire warnings, the captain or first officer will silence the warning bell and announce, "Bell off". The engineer will scan the overhead switch panel and the engineer's panel for indication of the fire location and inform the captain.

ENGINE FAILURE/TURBINE AIR OVERHEAT

1. THROTTLE, CLOSE .... CLOSE

   Smoothly close the throttle, allow the engine to run down to idle speed, and silence the gear horn. During the rundown, the engineer should scan the hydraulic panel to check all systems are pressurized.

2. FUEL & IGNITION SWITCH, OFF .... OFF

   Place fuel and ignition switch to OFF and observe fuel flow and TGT for indications of shutdown.

3. FUEL PANEL, CK ....CK

   For engine 1 or 3, close the respective tank valve. For engine 2, close its tank valve if the APU is not to be used.

   Turn off the fuel tank pumps in any tank from which fuel is not being used. Monitor fuel distribution.

4. ELECTRICAL POWER, CK ....CK

   Check that all busses are powered, active generators are operating within normal KW limits, and the generator field and generator breaker for the inoperative generator is open.

   Check essential power has auto backup.

5. HYDRAULIC POWER, CK .... CK

   Check that the related hydraulic quantity is normal and then restore the system.

   For engine 1 or 3, turn on PTU. For engine 2, place both ATMs to ON and, during the approach, turn on both AC pumps.

6. PNEUMATICS, CK .... CK

   If all three packs are operating, close number 1 pack flow control valve and refer to Loss Of One Bleed Source procedure in 19.01.

7. -100: ENGINE 1 OR 3, PULL CIRCUIT BREAKERS 2K1, 3J15, & 3J16.

   This removes power from the wheel well lights and lower anti-collision lights. The electrical wiring for these lights runs through the center section near the additional fuel tanks and could be a fire hazard if debris from an engine should puncture a fuel tank.

ENGINE FIRE

A fire is indicated by the fire bell, illumination of the fire control and master fire warning lights. The C/W fire detect loop light and both A and B loop test lights will also illuminate.

Although an engine fire is serious, it does not require immediate shutdown. This is particularly true when the engine is producing usable thrust during the critical phases of takeoff. Under these conditions it is usually best to delay shutting the engine down until the gear is up and speed is V_2 plus 50 knots minimum.

1. THROTTLE, CLOSE .... CLOSE

   Close the throttle and silence the gear horn.

2. FUEL & IGNITION SWITCH, OFF .. .OFF

   Place fuel and ignition switch to OFF and observe fuel flow and TGT for indications of shutdown. If fuel flow does not decrease, pull fire pull handle immediately.

3. FIRE CONTROL, PULL .... PULL

   The engineer should check the following:

   For engine 1 or 3, fuel tank and emergency valves close. For engine 2, only primary and secondary emergency valves close.

   Generator field relay and generator breaker open.

   High pressure and engine isolation valves close.

ENGINE FIRE (Cont'd)

4. FIRE BOTTLE, DISCHARGE . . . DISCHARGE

   Place the fire bottle discharge switch either right or left to discharge a fire bottle and verify the discharge indicator light comes on.

5. IF WARNING PERSISTS AFTER 30 SECONDS, DISCHARGE OTHER BOTTLE.

   If the fire warning light stays on, or goes out and comes on again, discharge the other bottle and verify that discharge indicator light comes on.

6. IF WARNING PERSISTS, CLEAN UP AIRCRAFT AND ACCELERATE TO 300 KTS MINIMUM.

   If the warning persists after both fire extinguisher bottles have been discharged, the fire may be extinguished or confined by accelerating to the highest practical airspeed for existing conditions. Do not extend speed brakes or flaps until landing is imminent.

7. IF WARNING PERSISTS, PROCEED TO NEAREST SUITABLE AIRPORT.

8. FUEL PANEL, CK . . . . CK

   For engine 1 or 3, close the respective tank valve. For engine 2, close its tank valve if the APU is not to be used.

   Turn off the fuel tank pumps in any tank from which fuel is not being used. Monitor fuel distribution.

9. ELECTRICAL POWER, CK . . . . CK

   Check that all busses are powered, active generators are operating within normal KW limits, and the generator field and generator breaker for the inoperative generator is open.

   Check essential power has auto backup.

10. IDG, DISCONNECT . . . . DISCONNECT

11. HYDRAULIC POWER, CK . . . . CK

    Check that the related hydraulic quantity is normal and then restore the system.

    For engine 1 or 3, turn on PTU. For engine 2, place both ATMs to ON and, during the approach, turn on both AC pumps.

12. PNEUMATICS, CK . . . . CK

    If all three packs are operating, close number 1 pack flow control valve and refer to Loss Of One Bleed Source procedure in 19.01.

13. -100: ENGINE 1 OR 3, PULL CIRCUIT BREAKERS 2K1, 3J15, & 3J16.

    This removes power from the wheel well lights and lower anti-collision lights. The electrical wiring for these lights runs through the center section near the additional fuel tanks and could be a fire hazard if debris from an engine should puncture a fuel tank.

APU FIRE

1. IF APU DOES NOT AUTO SHUTDOWN, PULL APU FIRE CONTROL AND DISCHARGE A BOTTLE.

   Check TGT and N_G decreasing, vent closed light on, and fire extinguisher discharge light on.

   If the APU did not shut down or warning persists after shutdown, pull fire control and discharge a bottle.

2. IF WARNING PERSISTS, DISCHARGE OTHER BOTTLE.

   With auto shutdown and manual discharge, both bottles would have been used at this time. With a manual shutdown, one bottle would still be available.

WHEEL WELL FIRE

A fire is indicated by the fire bell, illumination of the C/W wheel well fire light, and the master fire warning lights. Both A and B test lights will also illuminate.

1. DLC/AUTO SPOILERS, OFF . . . . OFF

   Turning off both channels of DLC/Auto spoilers eliminates the possibility of auto spoiler deployment in flight with main gear down and the gear lever neutral.

2. GEAR LEVER, NEUTRAL . . . . NEUTRAL

   This removes all hydraulic pressure from the landing gear system.

WHEEL WELL FIRE (Cont'd)

3. LEFT & RIGHT LANDING GEAR UPLOCK RELEASE HANDLES, PULL (300 KNOTS/ M.85 MAX) . . . . PULL

   This will unlock the left and right main gear uplocks and the respective gear free falls into the down and locked position. The main gear doors will remain open to allow the slipstream to blow out the fire or cool the overheated brakes.

4. BRAKE TEMPERATURES, MONITOR . . . . MONITOR

   Monitor the brake temperatures until all eight temperatures are in the green band.

5. AFTER FIRE OR BRAKE OVERHEAT CONDITION HAS CEASED, LEFT & RIGHT LANDING GEAR UPLOCK RELEASE HANDLES, STOW . . . . STOW

   Return the left and right main gear uplock release handles to the stowed position to restore normal gear operation.

6. GEAR LEVER, DOWN . . . . DOWN

   The nose gear will extend and the main gear doors will close at this time.

7. DLC/AUTO SPOILERS, ON . . . . ON

   This restores normal direct lift control and autospoiler operation.

8. AS APPROPRIATE, LANDING GEAR, UP OR DOWN . . . . UP OR DOWN

   Landing gear up or down depends on continuation of flight or immediate landing.

GALLEY FIRE/SMOKE

Smoke in galley causes warning horn and light to flash. Overheat in oven exhaust duct causes light to come on steady.

1. GALLEY POWER BUSSES, OFF . . . . . . OFF

   Press all three galley power bus switches to OFF. This removes all electrical power from the ovens and refrigerators.

2. CHECK COOL AIR OVERBOARD VALVE OPEN.

   Verify close is not annunciated on cool air overboard switch. Normally, the galley cool air overboard valve is open. If it has been closed for any reason, open it to improve galley ventilation.

3. AFT OUTFOW VALVE MANUALLY CLOSE . . . . CLOSE

   Flow through forward valve will increase to help remove smoke from galley.

4. ESTABLISH COMMUNICATION WITH GALLEY AND DETERMINE CAUSE.

   Determine situation and action required.

   With fire in oven duct have attendant close all oven vents and then discharge CO_2 fire extinguisher into exhaust duct port.

5. IF UNOCCUPIED, DON SMOKE MASK BEFORE ENTERING.

   If possible, use lift to check galley

ELECTRICAL FIRE/SMOKE

This procedure is based on the assumption that an electrical fire is suspected but there is no indication of which bus or component is at fault. Unless there is reliable evidence to indicate what is causing the smoke or fire, the check list procedure is to be followed until the problem is identified and isolated.

If an electrical component can definitely be identified as the source of smoke, deactivate the component in lieu of accomplishing the check list procedure.

1. OXY MASK, SMOKE GOGGLES & INTERPHONE, ON . . . . ON

   Put on oxygen mask and smoke goggles. Check that the smoke goggles defogging tubes are positioned under the mask.

   Captain and first officer should have cockpit speakers on or put on headsets.

   Engineer and observers should put on headsets.

   Check that flight interphone is on and microphone selector interphone switch is on.

ELECTRICAL FIRE/SMOKE (Cont'd)

2. OXYGEN REGULATORS, ALL LEVERS, UP . . . . UP

   This will provide one hundred percent oxygen under pressure to keep goggles free of smoke. When smoke density or goggle fogging is no longer a problem, return the emergency lever to normal to conserve crew oxygen.

3. DC BUS ISOLATION, OPEN . . . . OPEN

   This separates the DC busses from the Essential bus in preparation for further isolation steps.

4. SELECT ESS AC TO A GEN POSITION.

   Rotate the essential power selector to any active generator position and confirm that the Essential AC bus is powered. This will ensure continued operation of the Essential and Standby busses when generator breakers are tripped.

5. GENERATOR BREAKERS, OPEN . . . . OPEN

   This action removes all power from the normal AC and DC busses and leaves only the Essential, Standby, and Battery busses powered. With the captain's instrument selectors in their normal positions, all of the captain's instruments except the RMI are powered. Power is also available to the A flight director and autopilot.

   Fail flags will appear on the first officer's vertical speed, IAS/MACH, HSI, and ADI. Alternate switching will not remove flags. Fail flags will also appear on SAT and TAS.

   The ground proximity fail light will appear on caution and warning panel. Aural and visual warnings will be inoperative.

   Cabin pressurization must be controlled manually.

   Manual gear extension procedure must be used to extend gear.

   Check electrical distribution diagrams for other inoperative systems.

6. IF CONDITION PERSISTS:

   Problem could be associated with Essential or Standby busses.

   a. AC TIE BREAKERS, OPEN . . . . . OPEN

      This isolates the three AC busses before restoring power.

   b. GENERATOR BREAKERS, CLOSE . . . . CLOSE

      This restores power to AC and DC busses. Check first officer's instruments (except RMI) powered.

   c. BATTERY SWITCH, OFF . . . . .OFF

      This prevents Standby bus autotransfer from taking place after next step.

   d. ESSENTIAL SELECTOR, OFF . . . . .OFF

      This removes power from Essential and Standby busses. Battery bus, AC and DC busses remain powered. Turn off emergency lights if not needed.

      Reverse operating and slat lock light will be on when essential power is off and normal bus power available.

BRAKE FIRE/SMOKE

1. STOP AIRCRAFT.

2. ALERT EMERGENCY EQUIPMENT.

   Request the control tower operator to alert the emergency equipment to stand by until after the brakes, wheels, and tires have cooled.

3. CONFIRM NATURE OF REPORTED BRAKE PROBLEM.

   This procedure assumes the tower or another aircraft reports the aircraft wheel(s) are smoking or on fire. To confirm reported problem, investigate as follows:

      If report states the gear is smoking, direct a crew member to check for possibility of fire from the left or right forward cabin door.

4. IF FIRE VISIBLE:

   a. PARK BRAKES.

      Parking the brakes will prevent the aircraft from moving during evacuation.

BRAKE FIRE/SMOKE (Cont'd)

b. SHUT DOWN ENGINES.

c. EVALUATE NEED TO EVACUATE.

If emergency equipment is on the scene and has the fire under control, consider remaining on board until steps are brought to the aircraft. If emergency equipment is not immediately available and fire persists, evacuate via the most practical means available (jetway, boarding steps, evacuation slides). Use the PA and/or voice commands to keep the evacuation calm and orderly.

5. IF EXCESSIVE SMOKE APPARENT:

a. TURN NOSE WHEEL FULL TRAVEL TO PREVENT AIRCRAFT ROLLING.

If the aircraft continues to move with all engines at idle thrust, turning the nose wheel full travel in either direction may be effective in maintaining position.

b. LEAVE BRAKES OFF.

If the brakes are overheated with no visible fire, the pilot should release the brakes and stand by at the controls until the wheels are chocked.

c. MONITOR GEAR FOR INDICATION OF FIRE.

Maintain a watch on the wheels and brakes until the emergency equipment arrives.

When inspecting overheated tires and wheels, approach them from the front or rear only.

AIR CONDITIONING SMOKE

Smoke appearing at the gasper vents and air conditioning outlets can be either from the air cycle packs or an engine bleed source. Complete the steps of this procedures until the smoke is shut off. Once the smoke has been controlled, do not reopen bleed or isolation valves provided cabin pressurization and ventilation can be maintained with the remaining packs.

1. OXY MASK, SMOKE GOGGLES & INTERPHONE, ON . . . . ON

Put on oxygen mask and smoke goggles. Check that the smoke goggles defogging tubes are positioned under the mask.

Captain and first officer should have cockpit speakers on or put on headsets.

Engineer and observers should put on headsets.

Check the flight interphone is on and microphone selector interphone switch is on.

2. OXYGEN REGULATOR, ALL LEVERS, UP . . . . UP

This will provide one hundred percent oxygen under pressure to keep goggles free of smoke. When smoke density or goggle fogging is no longer a problem, return the emergency lever to normal to conserve crew oxygen.

3. CROSSBLEED VALVES, CLOSE . . . . CLOSE

4. ENG 1 ISLN VALVE, CLOSE . . . . . . CLOSE

This isolates the three systems and eliminates one bleed and one pack as a source of smoke. Check that the engine isolation valve, high pressure valve, and both crossbleed valves flowbars go out and that the No. 1 duct pressure drops to near zero. Wait for several seconds to see if this step has the desired effect.

5. IF SMOKE CONTINUES.

a. ENG 1 ISLN VALVE, OPEN . . . . . OPEN

Continued smoke inflow indicates that the No. 1 bleed source is not at fault. Check that the engine isolation valve flowbar illuminates and duct pressure returns to normal.

b. ENG 2 ISLN VALVE, CLOSE . . . CLOSE

Place the No. 2 isolation valve switch off and check that the flowbar goes out and duct pressure drops to near zero. If APU is operating, close the APU bleed valve.

AIR CONDITIONING SMOKE (Cont'd)

6. IF SMOKE CONTINUES:

   a. ENG 2 ISLN VALVE, OPEN . . . . . OPEN

      Check that the No. 2 pressure has returned to normal.

   b. ENG 3 ISLN VALVE, CLOSE . . . CLOSE

      If smoke stops, it identifies the No. 3 system as the source of smoke. Check that the No. 3 pressure has dropped to near zero.

SMOKE REMOVAL

This procedure is based on the assumption that the source of smoke has been identified, and isolated or corrected. If smoke source was the bleed air or air conditioning system, do not reopen bleed, isolation or pack valves which remained closed as a result of completing the Air Conditioning Smoke check list.

1. HIGH PRESSURE & ENGINE ISOLATION VALVE, OPEN . . . . OPEN

2. PACK FLOW CONTROL VALVES, OPEN . . . . OPEN

   These steps ensure maximum airflow to the cabin to help exhaust the smoke.

3. CHECK COOL AIR OVERBOARD VALVE OPEN.

   Verify close is not annunciated on cool air overboard switch. Normally, the galley cool air overboard valve is open. If it has been closed for any reason, open it to improve galley ventilation.

4. CABIN ALTITUDE SELECTOR, 10,000 FT . . . . 10,000 FT

   Verify that both outflow valves move toward open.

5. CABIN PRESSURE RATE SELECTOR, MAXIMUM . . . . .MAXIMUM

   These two steps initiate a cabin altitude increase at the maximum rate to provide the highest possible air outflow rate, under automatic control.

6. FRESH AIR VALVES, OPEN . . . . OPEN

   Open all cockpit air controls including gasper outlets to achieve the maximum cockpit ventilation rate.

LOSS OF ALL GENERATORS

Use the following procedure if all AC generators are made inoperative by electrical faults, by multiple engine flameout or for any reason other than turning the generators off for the Electrical Fire/Smoke procedure.

1. STANDBY POWER SWITCH, ON . . . . . . ON

   This will lock in standby power and provide a steady power source until generator operation is restored. The battery provides forty minutes of operating time.

2. AC TIE BREAKERS, OPEN . . . . OPEN

   This manually isolates all generators; otherwise one generator may be allowed to power the entire electrical system.

3. GALLEY POWER BUSSES, OFF . . . . . . OFF

4. DC BUS ISOLATION, OPEN . . . . OPEN

   This manually isolates the DC Essential bus which otherwise may allow one TR to power the entire DC system.

5. GEN FIELD RELAYS, CLOSE . . . . . .CLOSE

   Place all generator field relays to CLOSE and attempt to activate any operative generator.

6. IF ANY GENERATOR FIELD RELAY CLOSES:

   a. FOR GENERATOR NO. 3, CHECK GENERATOR BREAKER CLOSED.

   b. AC ESSENTIAL BUS, SELECT . . SELECT

      Place the essential power selector to any generator whose field relay has been closed. If successful in restoring power to the Essential AC bus, check that the captain's instruments and the EPR and N_3 indicators confirm the presence of essential power.

   c. STANDBY POWER, ARM . . . . ARM

      This will conserve battery power.

LOSS OF ALL GENERATORS (Cont'd)

7. IF NO GENERATOR FIELD RELAYS CLOSE, CONSIDER STARTING APU.

   An APU start should not be attempted above 25,000 feet. Maximum APU load above 14,000 feet is 54 KW.

   With no engine generator power a fully charged battery will provide Standby and Battery bus power for a maximum of forty minutes. Attempting an APU start will significantly reduce battery operating time.

8. REDUCE ALL UNNECESSARY ELECTRICAL LOADS.

   With DC busses not powered the landing gear must be extended using manual procedures.

RAPID DEPRESSURIZATION

Rapid depressurization will be indicated by a sudden increase in cabin altitude and warning horn. If pressure loss is accompanied by fogging it is usually uncontrollable.

Flight deck crew must be on oxygen above 12,000 feet cabin altitude. Flight deck crew must be on oxygen above 10,000 up to and including 12,000 feet if duration of flight at these cabin altitudes exceeds 30 minutes.

1. OXYGEN MASK & INTERPHONE, ON . . . ON

   The captain will command crew to go on oxygen. Put on masks and recheck that the regulator supply lever is on, diluter lever one hundred percent, and emergency lever is normal.

2. IF AIRCRAFT IS ABOVE 14,000 FEET, INITIATE RAPID DESCENT, IF PRACTICAL.

   Close throttles and evaluate the type of descent required. When structural damage is suspected, avoid high IAS and abrupt maneuvering.

3. IF CABIN ALTITUDE ABOVE 14,000 FEET, PASSENGER OXYGEN ON . . . . ON

   Press the passenger oxygen manual switch and hold for fifteen seconds. This step should still be performed if the passenger oxygen flow light is on.

4. IF CABIN ALTITUDE ABOVE 30,000 FEET, OXYGEN REGULATORS, ALL LEVERS UP . . . . UP

   If cabin altitude is above 30,000 feet, place emergency lever on oxygen regulator to emergency after putting on mask. If cabin altitude is below 30,000 feet, leave emergency lever in normal to conserve oxygen.

5. MAKE CABIN ANNOUNCEMENTS WHEN PRACTICAL.

   Make a PA announcement as soon as practical informing the passengers and flight attendants to use oxygen masks.

   When cabin altitude is below 14,000 feet, make a PA announcement that oxygen is no longer required in the cabin.

RAPID DESCENT

1. THROTTLES, CLOSE . . . . CLOSE

   Smoothly close throttles and evaluate type of descent required.

2. WITH STRUCTURAL DAMAGE SUSPECTED, AVOID HIGH IAS & ABRUPT MANEUVERING.

   When indications such as severe depressurization, loud noises, or abnormal flight control positions indicate structural damage to the aircraft, allow gradual deceleration to slowest practical speed and avoid steep bank angles or abrupt pitch changes during entry into descent attitude.

3. SPEED BRAKES, MAXIMUM . . . . MAXIMUM

   Extend speed brakes while maintaining wings level. Be alert for roll or pitch changes caused by asymmetric spoiler extension.

4. DESCENT TARGETS:

   a. 10° NOSE DOWN.

   b. V_{mo} MINUS 10 KTS, MACH 0.85 MAX.

   Roll aircraft into thirty degree bank and allow nose to drop to approximately ten degrees nose down. As aircraft accelerates, level wings and adjust pitch attitude to hold V_{mo} - 10 knots IAS maximum.

   The autopilot control wheel steering function may be used throughout the descent.

EMERGENCY LANDING/DITCHING

GENERAL

This procedure is applicable to an anticipated or unanticipated landing/water landing. Crew duty charts are also located in this section.

The variable nature of each emergency landing/ditching makes it impossible to set down definite procedures. Therefore, the procedures in this section are guidelines only. Proper evaluation of the situation will dictate the course of action to be followed.

If the emergency landing is made at an airport, a landing on a runway is preferred. This minimizes the aircraft damage and allows maximum directional control.

A landing in open terrain is a matter of selecting the best approach and runout condition consistent with time and maneuvering ability.

NOTIFY ATC, COMPANY, FLIGHT ATTENDANTS, AND PASSENGERS.

Transmit the emergency message and any additional information or request on the tower or ATC frequency in use at that time. The emergency message should include:

> Flight number and position, a description of the emergency, your intended action and kind of assistance desired.

Similar information should also be forwarded to company via appropriate communication means available.

In the event of a ditching, Oceanic Traffic Control will alert the automated mutual assistance vessel rescue system (AMVER). AMVER is capable of plotting vessel positions anywhere in the world and will provide information relative to vessels known to be in your vicinity. Communications with most surface vessels can be established on 2182 KHz. Vessels in your vicinity are capable of supplying information relative to sea conditions, swell movement, wind condition, and possible ditch heading.

If unable to establish communications, set the transponder to code 7700 and broadcast the following message as often as possible:

> "Mayday, Mayday, Mayday.
> This is TWA Flight ______ .
>
> Depress the microphone button for two ten second intervals.
>
> "This is TWA Flight ____________ , over."

Flight attendant L1 should be summoned to the cockpit with a PA announcement or the six bell signal.

Explain the nature of the emergency and approximately how much time is available. Review what sort of cabin preparations should be made and any expected adverse evacuation conditions: wind, terrain, structural damage.

Specific instructions for cabin preparation are in the flight attendants' Emergency Procedures Handbook.

It is desirable for the captain to brief the passengers. If the situation makes this impossible, the first attendant will brief them using the passenger address system. If the PA is inoperative, the flight attendant will use the megaphone.

Approximately thirty seconds before landing, instruct the passengers to assume the emergency landing position and to remain in that position until the aircraft comes to a stop.

If an additional crew member is in the cockpit, direct him to be seated in the cabin in a location where he can assist the flight attendants. If no seats are available in the cabin, the additional crew member should be assigned a duty station and told to get to it immediately after the aircraft stops.

PRIOR TO LANDING/DITCHING

Before landing, time permitting, dump fuel which will allow a slower approach speed and in the case of ditching, increase overall aircraft buoyancy. Depressurize early which eliminates one procedural step immediately before landing. Remove all loose items (flight kits, clipboards, etc.) from the cockpit and store in the lavatories.

Depressurize early by shutting down the packs and closing the cool air overboard valves.

Do not open exits prior to the aircraft coming to a full stop. An exit that is opened can let fire enter the cabin immediately and drastically reduce the time available for evacuation.

The PA system or megaphones may be used as necessary to direct passenger movement.

EMERGENCY LANDING/DITCHING (Cont'd)

Before ditching, also close the outflow valves and close the cool air overboard valve to increase aircraft buoyancy.

1. SHOULDER & SEAT BELTS, SECURE . . . . SECURE

   Command all cockpit crew members to secure their shoulder harness and seat belts and make PA announcement for passengers and flight attendants.

2. LANDING GEAR:

   LANDING - GEAR DOWN . . . . . . DOWN

   Extend all landing gears that can be extended for maximum fuselage and fuel tank protection.

   DITCHING - GEAR UP . . . . UP

   PULL AURAL WARN PWR CB (1L8) AND GND PROXIMITY CMPTR AC CB (1B20).

   This will eliminate nuisance gear warning horn when flaps are extended and ground proximity warnings.

3. PACK VALVES CLOSE . . . . CLOSE

4. COOL AIR OVERBOARD VALVE CLOSE . . . . CLOSE

5. OUTFLOW VALVES CLOSE . . . . CLOSE

6. FLAPS 33 33

   Extend flaps full to get slowest possible approach speed.

7. EMERGENCY EXIT LIGHTS, ON . . . . . . ON

   Lights should be turned on just before touchdown to conserve battery life. Battery life is approximately 15 minutes.

LANDING/DITCHING

1. WHEN READY TO SECURE ENGINES, FUEL & IGNITION SWITCHES, OFF.

   Delay until the last possible moment before touchdown to have thrust available.

2. PULL FIRE CONTROLS & DISCHARGE BOTH EXTINGUISHERS TO EACH ENGINE.

   With fire pulls out, discharge both bottles.

EVACUATION

GENERAL

Emergency landings or other abnormal conditions do not always dictate the need for an emergency evacuation. However, if conditions are such that an evacuation appears necessary, the first crew member aware of this situation shall immediately advise the captain. The captain will evaluate the situation and, if necessary, will initiate the evacuation. If time does not permit contacting the captain because the nature of the emergency requires immediate action, the crew member will initiate the evacuation alarm system without further delay. When the evacuation signal sounds while the aircraft is moving on the ground, the captain will stop the aircraft and shut down the engines.

Some unusual occurrences (loud noise/engine torching, etc.) may cause concern among passengers and flight attendants as to their safety, and could result in unwarranted evacuation. To avoid this possibility, the captain should make a PA announcement to tell them that the situation is under control.

1. PARKING BRAKE ON . . . . ON

   If required, place the parking brake on.

2. FUEL & IGNITION SWITCHES OFF . . . . OFF

3. EMERGENCY EXIT LIGHTS ON . . . . ON

4. EVACUATION ALARM ON . . . . ON

5. APU & ENGINE FIRE CONTROLS PULL . . . . PULL

6. AS APPROPRIATE, FIRE EXTINGUISHERS DISCHARGED . . . . DISCHARGED

   When the evacuation is under circumstances where aircraft or engine damage is not a factor, it is not appropriate to discharge the fire extinguishers. For example, a precautionary evacuation following a bomb threat would not usually justify extinguisher discharge.

EVACUATION (Cont'd)

If there is any question regarding the condition of the aircraft or engines, it is appropriate to discharge the extinguishers because of the difficulty in assessing the extent of damage. When damage is suspected but no specific location is known, discharge one bottle to the No. 2 engine and the other bottle to the APU. For No. 1 and No. 3 engines, discharge both bottles.

7. DIRECT EVACUATION.

Proceed to cabin area. Supervise door opening and evacuation slide activation. Command and motivate passenger escape movement.

The eight cabin doors are the preferred escape routes for land and ditching evacuations. Additional escape route is the cockpit overhead hatch.

The general evacuation plan consists of the flight attendants operating their respective doors and slides The flight crew is deployed throughout the cabin to command and direct the evacuation.

It is not intended that crew members assume unnecessary risks. When everything possible has been done to provide for passenger safety, they should leave the aircraft without delay.

The ranking crew member is responsible for command of the entire group. The ranking crew member present will assume command and exert forceful direction.

Once an aircraft evacuation is started, it may be stopped only on command of the ranking crew member.

WHEN CLEAR OF AIRCRAFT.

The ranking crew member will take charge and determine that all passengers are accounted for. Have passengers move a safe distance from the aircraft and stay in one group.

Administer comfort and first aid until relieved by qualified personnel.

Do not allow passengers to reenter the aircraft until it has been determined by competent authority that it is safe.

Do not disturb, or allow to be disturbed, any wreckage or cargo except to care for injured or to prevent further damage.

Do not make any statement concerning possible cause of accident. The Public Relations Department releases this information.

Do not prevent news photographers from taking photographs, except to prevent a fire hazard.

Do not discuss anything about insurance.

Do not do or say anything that might imply that the company is admitting liability for injuries or damage.

DITCHING AREA EVALUATION

EVALUATING THE DITCHING HEADING

In order to select a proper ditching heading, a basic knowledge of sea evaluation and other factors involved is required. The problems during ditching are rapid deceleration, potential hull damage, and injury to passengers and crew. These can be minimized by selecting the optimum ditching heading.

When unable to obtain sufficient information in determining a ditching heading, best observation of the surface conditions can be made at an altitude of 2,000 feet. Lower altitude observations appear quite different and should be disregarded.

SWELLS

Generally speaking, the ditch heading will be parallel to the swell. The individual swells appear to be regular and smooth, with considerable distance between the rounded crests. Local winds have little effect on the system. Therefore, do not use swell direction to determine surface wind direction.

WAVES (OR CHOP)

This condition of the surface is caused by local winds and is characterized by surface irregularity, short distance between crests and whitecaps.

WIND CONSIDERATIONS

Wind, unless of high velocity, is a secondary consideration in establishing the runout heading. Some crosswind will usually exist and must be accepted in order to parallel the major swell.

DITCHING AREA EVALUATION (Cont'd)

These general rules will serve to guide the heading selection:

Wind 0-20 knots.
Ignore the wind and parallel the major swell. Of the two possible headings select the one which has the greatest headwind component.

Wind 20-45 knots.
Angle into the wind but avoid a heading that is more than 45° to the swell.

Wind 45 knots and above.
Wind of this force makes it necessary to consider a direct heading into the wind. The swell direction will usually be the same as the wind direction. Extreme surface turbulence and spray tend to obscure the surface and swell. Even in this situation, if swell configurations can be established, it is usually better to approach at an angle to the swell face and accept crosswind wind effect.

ESTIMATING WIND VELOCITY AND DIRECTION

Wind direction and velocity can be estimated with reasonable accuracy by observing the breaking action of wave crests. Breaking mist will fall downward in the same direction as the wave movement. The wave will overrun the spindrift streaks and produce the illusion that the streaks are sliding upwind. This apparent movement will always point, like a weather vane, to the direction from which the wind is blowing.

The appearance of whitecap and streak activity permits velocity estimates:

Calm to 10 knots.
Scattered ripples and wavelets. Whitecaps few and scattered.

10-20 knots.
Many small waves with frequent whitecaps. Extensive white foam.

20-45 knots.
Moderate high waves. Dense white water. Well defined streaks.

45 knots and above.
High rolling waves of obviously violent nature. Surface covered by dense streaks of spindrift.

DITCHING TECHNIQUES

APPROACH AND TOUCHDOWN

If possible, obtain area altimeter setting, surface conditions, and recommended ditch heading from AMVER (Automated Mutual Assistance Vessel Rescue System) via ATC.

Dump fuel to minimum.

Descend to 2,000 feet, observe swell and wind conditions. Make final confirmation of ditch heading and start descent.

Water landings require substantially different techniques than runway landings for the following reasons:

Depth perception over water is very unreliable.

Undulating water surface makes low altitude judgment difficult.

High nose attitude in stall causes low tail position which drags first and throws center section downward with great vertical force.

Therefore, the following procedures must be strictly adhered to during a water landing. When an altitude of 1,000 feet is reached:

Pull aural warning CB (IL8) and ground proximity computer AC CB (1820). Leave gear up. Lower flaps to 33°. Trim to the touchdown attitude, and maintain a speed of bug +5 knots and a sink rate of 200 FPM or less.

Proper sink rate and attitude are critical to the ditching result. Make every effort to maintain the sink rate of 200 feet per minute or less to the point of touchdown. With this fly-on method, a flare is neither necessary nor desirable.

With one or more engines inoperative, it may be necessary to use partial flaps in order to maintain a sink rate no greater than 200 feet per minute. This would be accomplished by using a flap versus speed ratio that would provide the maximum flap extension permitted by the available power. Speed should be maintained to at least minimum for the degree of flap used.

The proper touchdown spot is on the face of the swell, just downslope of the crest. The tendency to make a spot landing may induce a desire to flare and reduce power. This type of landing would be very difficult to achieve due to the unreliable depth perception and constantly changing surface height. It is most important to maintain this attitude until touchdown.

EVACUATION AFTER DITCHING

Determine which exits are usable. Open the exits and deploy the slide/raft. To operate the slide/raft in the water:

Check that the water level is below the door sill.

Check that the evacuation slide lever is in the ENGAGE position.

Remove plastic cover, stand back from door, and pull down on the red emergency door "T" handle.

If the slide/raft fails to inflate automatically, pull the red manual inflation handle located on the slide girt.

Shoes and sharp objects should be removed prior to boarding the slide/raft.

If practical, remove first aid kits and blankets from the aircraft and take them into the raft.

Life vest should be inflated just before leaving the aircraft.

Load passengers directly into the slide/raft. Direct them to move left and right alternately and towards the end of the slide/raft.

It is imperative to board one crew member in each raft to take command and activate the raft emergency equipment.

When slide/raft boarding is complete, disconnect it from the door sill by pulling on the separation handle located under the flap on top of the slide girt.

Disconnect the mooring line by pulling the quick disconnect and push away from the aircraft.

Use heaving line to aid in retrieving survivors in water.

Maneuver survivors in water to the boarding station for raft entry.

Tie rafts together using the heaving line.

Retrieve raft survival kit from the water.

Tie down emergency supplies to prevent loss in the event raft should capsize.

SEAWORTHINESS

Lower the secondary floor.

Distribute passenger load equally. Passengers sit in double rows with their backs to the outer raft tube and in the center of the slide/raft with their backs to the center. Keep low and move about only on hands and knees. Raft commander sits at sea anchor corner.

Deploy the sea anchor.

Check pressure of raft tubes as additional manual inflation may be necessary. The raft tubes should be firm but not drum tight.

SURVIVAL

The most important requirement in survival is mental attitude, the will to live.

Keep all unused equipment in the survival kit. Inventory and be able to obtain required item immediately.

Exposure to the elements is the greatest problem in survival.

FRIGID CONDITION

1. Rig the canopy immediately and inspect periodically. The temperature inside the raft will now grow warmer than the outside air temperature. It is vitally important that canopy installation start on the sea anchor side of the raft.
2. Bail raft dry and keep in this condition.
3. Remove wet clothing and wring as dry as possible. Wet clothing has limited insulation value, but when wrung as dry as possible will restore a large amount of the protective value.
4. Passengers should huddle together to make use of body heat.

SUN/HEAT CONDITION

1. Rig the canopy with the sides placed on top of the canopy and tighten draw string.
2. Bail raft dry.
3. Dampen clothing as required to increase cooling.

SURVIVAL (Cont'd)

WATER

Gathering of rain water is essential.

During a rain storm, raise the center canopy poles for a short interval to get a steep slope on the canopy top. This will allow salt deposits to wash off. Then remove the canopy center poles and allow the canopy to sag in the middle. Drain water through the grommet holes into storage bags and any other containers you can improvise.

A water de-salting kit is packed in the raft.

Do not drink unconditioned sea water. Thirst will only be increased and violent sickness follows. Continued consumption without a fresh water supply available will probably result in death about the 6th day. The plastic container furnished in this kit could be used to gather and store fresh rain water.

FOOD

Food is the least important of survival requirements. A person in normal health can survive 2 to 3 weeks without food, providing water is available. Without water, life expectancy is reduced to between 4 to 8 days.

A cardinal rule of survival is no food is to be eaten unless a pint or more of water per day is available.

SIGNALING

Radio and visual aids are provided. There is a VHF transceiver located in each raft kit. An automatic operated rescue beacon is also attached to each raft. In addition, the following signaling aids are also provided: sea dye marker, signal mirror, signal flares, flashlight and whistle. Each of these signaling aids, used at the proper time, will aid in your rescue.

Operate the VHF transceiver at least twice hourly and whenever a ship or aircraft is seen or heard. When using the VHF transceiver on 121.5, unsnap the rescue beacon antenna and submerge it in water to prevent radio interference.

Use the flares and sea dye marker only when an aircraft or ship is seen or heard.

CREW DUTY CHART

CAPTAIN

Transmit emergency message.
Instruct flight attendants, first officer, engineer, and ACM.
Brief passengers.
Have cabin alerted 30 seconds before touchdown.

AIRCRAFT EVACUATION (If required)

Direct evacuation.

Ditching - check life vest inflation.

FIRST OFFICER

As directed by captain.
Check R1 door activated.
Expedite evacuation in forward cabin.

Ditching - check life vest inflation.

ENGINEER

Subject to captain's discretion:

Secure cockpit station.
Take aisle seat R4 door area.

Check R4 and L4 doors activated.

Expedite evacuation in aft cabin.

Ditching - check life vest inflation.

FLIGHT ATTENDANT L1

Go to cockpit for captain's instructions.
Brief other attendants and passengers.
Coordinate all cabin preparation.
Advise captain when completed.
Open adjacent door.

Expedite evacuation.

Ditching - check life vest inflation.

OTHER FLIGHT ATTENDANTS

Assist in cabin preparation.
Open adjacent door.
Expedite evacuation.
Flight attendants not assigned to a door:

Move into aisles.
Expedite passenger movement to usable exits.

Ditching - check life vest inflation.

FLIGHT ATTENDANT EVACUATION STATIONS

Depending upon the number of flight attendants assigned, evacuation stations will be filled in the following order.

	F/A	EVACUATION STATIONS
1	L1	L1 door F/A seat.
2	L2	L2 door F/A seat.
3	R2	R2 door F/A seat.
4	L3	L3 door F/A seat.
5	R3	R3 door F/A seat.
6	L4	L4 door F/A seat.
7	R4	R4 door F/A seat.
8	R1	R1 door F/A seat.
9	L2B	Service center 2, left F/A seat.
10	R2B	Service center 2, right F/A seat.
11	L3B	Aisle seat at L3 door area.
12	R3B	Aisle seat at R3 door area.

* * *

GENERAL

GUIDE

GUIDE AMPLIFICATION

* * *

GENERAL

Abnormal procedures are established for situations which require precise crew action following the loss of a major system that affects the performance of the aircraft. The procedure is designed to prevent further loss of aircraft performance, to avoid development of an emergency situation, or to prepare the aircraft for landing following an emergency procedure.

Abnormal Procedures section 4.05 is a reprint of the Abnormal Procedures Guide which is carried in the cockpit. Section 4.10 is an amplification of those procedures. The amplification should be referred to when time permits after the procedural steps are completed.

When performing abnormal procedures, use deliberate actions to ensure that each step is done correctly in proper sequence and that each action has the desired effect.

* * *

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1011 ABNORMAL PROCEDURES GUIDE

ELECTRICAL

AC ESSENTIAL BUS FAILURE —— 4.10.01

1. SELECT ESSENTIAL POWER TO MANUAL POSITION OF AN OPERATING GENERATOR.
2. IF FAILURE RECURS, DO NOT SELECT ANOTHER POSITION.
3. CHECK STANDBY BUSSES POWERED.
4. IF ESSENTIAL POWER CANNOT BE RESTORED, REFER TO ESSENTIAL BUS DISTRIBUTION PAGES IN FHB FOR INOPERATIVE EQUIPMENT CONSIDERATIONS.

IDG LOW PRESS LIGHT ON —— 4.10.01

1. IF GENERATOR FIELD RELAY AUTOMATICALLY TRIPPED, DISCONNECT IDG IMMEDIATELY.
2. IF FIELD RELAY DID NOT AUTOMATICALLY TRIP, CHECK IDG TEMPERATURE, VOLTAGE & FREQUENCY. IF ABNORMAL, DISCONNECT

HIGH OR RISING IDG OIL TEMPERATURE —— 4.10.01

1. TRIP GENERATOR FIELD RELAY.
2. IF OIL TEMPERATURE CONTINUES TO RISE OR REACHES LIMIT, DISCONNECT IDG.

GENERATOR(S) INOPERATIVE —— 4.10.01

1. CHECK THAT ALL AC TIE BREAKERS ARE CLOSED.
2. MONITOR KW LOADS AND REDUCE IF NECESSARY.
3. CONSIDER STARTING APU.
4. CHECK ESSENTIAL SELECTOR FOR AUTO TRANSFER POSITION

FUEL

FUEL JETTISON —— 4.10.02

FUEL MAY BE JETTISONED WITH GEAR UP OR DOWN, & FLAPS UP - BETWEEN 180 & 300 KNOTS.
OR
FLAPS 10/22 - V_2 +20 KNOTS MAX.

1. ALL FUEL TANK PUMPS ON.
2. OPEN MASTER JETTISON VALVES.
3. OPEN ALL DUMP VALVES.
   JETTISON RATE FROM ALL TANKS IS 4500 LBS PER MINUTE.
   APPROXIMATELY 24,000 LBS FUEL REMAINS AT AUTOMATIC JETTISON TERMINATION.
4. WHEN JETTISONING IS COMPLETED:
   a. CLOSE ALL DUMP VALVES.
   b. CLOSE MASTER JETTISON VALVES.

MINIMUM FUEL APPROACH ——

USE THE FOLLOWING PROCEDURE FOR APPROACH WHEN THE FUEL QUANTITY IN ANY MAIN TANK IS KNOWN TO BE 2000 LBS. (2L OR 2R 1000 LBS) OR LESS.

1. ALL FUEL TANK PUMPS ON.
2. OPEN ALL CROSSFEED VALVES.
3. ON MISSED APPROACH, AVOID SUSTAINED NOSE HIGH ATTITUDES.
4. AVOID STEEP TURNS WHILE EXPEDITING RETURN TO APPROACH POSITION.

PNEUMATIC

SINGLE PACK OPERATION —— 4.10.02

1. CLOSE COOL AIR OVERBOARD VALVE.
2. DESCEND TO 25,000 FEET OR BELOW.

NACELLE/PYLON OVERHEAT —— 4.10.02

1. THROTTLE, CLOSE.
2. CHECK ENGINE HIGH PRESSURE VALVE CLOSED.
3. IF OVERHEAT CONDITION ALLEVIATED, CONTINUE OPERATION WITH HIGH PRESSURE VALVE CLOSED.
4. IF WARNING PERSISTS BEYOND 30 SECONDS:
   a. FUEL & IGNITION SWITCH, OFF
   b. FIRE CONTROL, PULL.
   c. FUEL PANEL, CHECK.
   d. ELECTRICAL POWER, CHECK.
   e. HYDRAULIC POWER, CHECK.
   f. PNEUMATICS, CHECK.

ANTI-ICE

WINDOW ARCING/CRACKED ——

1. PULL CIRCUIT BREAKER (2B 12 THROUGH 22) FOR AFFECTED WINDOW.

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GEAR AND BRAKES

ALTERNATE BRAKES — 4.10.03

1. IF NORMAL BRAKES ARE INOPERATIVE OR BECOME INEFFECTIVE, SELECT ALTERNATE SYSTEM C.
2. USE NORMAL BRAKING TECHNIQUE.

GEAR LEVER LOCKED — 4.10.03

1. IF A GREATER EMERGENCY EXISTS, OVERRIDE LEVER LOCK AND RETRACT GEAR.
2. CHECK TRUCK LEVEL CB (2F16) AND RESET IF TRIPPED.
3. MAKE LIGHT TEST.
4. IF ENGINE 2 FAIL ARMED LIGHT (WITH T/O FLAPS) OR TRUCK LIGHT ON, DO NOT RETRACT GEAR.
5. IF ENGINE 2 FAIL ARMED AND TRUCK LIGHTS OUT, OVERRIDE LEVER LOCK AND RETRACT GEAR.

MECHANICAL GEAR EXTENSION — 4.10.04

1. MAX IAS 250 KNOTS.
2. PLACE GEAR LEVER DOWN.
3. PULL NOSE GEAR MECHANICAL RELEASE & BY-PASS HANDLE; GEAR MAY NOT LOCK DOWN UNTIL BELOW 220 KNOTS.
   NOSE WHEEL STEERING INOPERATIVE.
4. PULL LEFT & RIGHT MAIN GEAR MECHANICAL RELEASE HANDLES.
5. IF ANY GEAR GREEN LIGHT IS NOT ON, PLACE ALTERNATE HYDRAULIC LANDING GEAR EXTENSION SWITCH TO ALTERNATE. GEAR DOOR & IN-TRANSIT LIGHTS WILL REMAIN ON.

FLIGHT CONTROLS

NO FLAP APPROACH — 4.10.04

1. REDUCE WEIGHT AS MUCH AS PRACTICAL.
2. COMPLETE LANDING PRELIMINARY CHECK LIST.
3. SELECT RUDDER LIMITER TO 30.
4. IF SLATS NOT FULLY EXTENDED, SET BUG TO V_{ref} + 50 KNOTS.
5. IF SLATS FULLY EXTENDED, SET BUG TO V_{ref} + 33 KNOTS.
6. BUG + 10 KNOTS MINIMUM.
7. GEAR DOWN.
8. PULL GND PROXIMITY CMPTR AC CB (1B20).
9. COMPLETE LANDING FINAL CHECK LIST.
10. USE NORMAL APPROACH SLOT.
    REDUCE TOWARD BUG + 5 KNOTS ON FINAL.
11. EXTEND SPOILERS MANUALLY ON TOUCHDOWN.

PARTIAL LEADING EDGE SLATS — 4.10.05

1. IF ONE OR MORE LEADING EDGE SLATS NOT EXTENDED, LOCK SLATS IN POSITION.
2. SET BUG TO V_{ref} + 20 KNOTS.
3. EXTEND FLAPS TO 22 MAXIMUM.
4. AFTER GEAR EXTENSION, PULL GND PROXIMITY CMPTR AC CB (1B20).
5. USE NORMAL APPROACH SLOT.
   REDUCE TO BUG + 5 KNOTS ON FINAL.
6. EXTEND SPOILERS MANUALLY ON TOUCHDOWN.

PARTIAL TRAILING EDGE FLAPS — 4.10.05

1. SELECT RUDDER LIMITER TO 30.
2. SET BUG TO V_{ref} + 1 KNOT FOR EACH DEGREE FLAP NOT AVAILABLE.
3. AFTER GEAR EXTENSION, PULL GND PROXIMITY CMPTR AC CB (1B20).
4. USE NORMAL APPROACH SLOT.
   REDUCE TO BUG + 5 KNOTS ON FINAL.
5. EXTEND SPOILERS MANUALLY ON TOUCHDOWN.

PITCH CONTROL JAM — 4.10.06

1. MAINTAIN PITCH ATTITUDE WITH MECHANICAL TRIM.
2. IF A & B OR C & D STABILIZER PUSH LIGHTS ON:
   a. PRESS BOTH PUSH LIGHTS TO INOP NOTE AFT COUPLER OPEN & PULL PITCH DISCONNECT LIGHTS ON.
   b. PULL PITCH DISCONNECT HANDLE.
3. IF NO PUSH LIGHTS ON, APPLY STEADY FORCE AGAINST JAM. IF STILL NO LIGHTS:
   a. PULL PITCH DISCONNECT HANDLE.
   b. PRESS STABILIZER C & D SWITCHES TO INOP & CHECK CAPTAIN'S CONTROLS.
   c. IF CONTROL NOT AVAILABLE TO CAPTAIN PRESS C & D TO ON AND A & B TO INOP.
   d USE FIRST OFFICER'S CONTROLS.
4. MAX IAS 250 KNOTS.

ROLL CONTROL JAM — 4.10.06

1. PULL ROLL DISCONNECT HANDLE.
2. PRESS SPOILER PUSH LIGHTS TO OFF.
3. IF ROLL CONTROL IS STILL MARGINAL, PRESS AILERON CROSSHATCH LIGHTS TO OFF.

RUNAWAY TRIM — 4.10.07

1. HOLD MECHANICAL TRIM WHEEL & MAINTAIN ATTITUDE WITH YOKE.
2. PRESS PITCH TRIM SWITCHES TO OFF.
3. MAINTAIN PITCH TRIM WITH MECHANICAL TRIM WHEEL.

EXCESSIVE PITCH UP DURING TAKEOFF — 4.10.07

1. DO NOT RAISE FLAPS.
2. TURN OFF ALL SPOILERS EXCEPT L & R 1 & 2.
3. USE SPEED BRAKE LEVER FOR PITCH TRIM.
4. TURN OFF DLC/AUTO SPLRS.
5. MAINTAIN BUG + 10 & MAKE NORMAL LANDING.

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ENGINE

ENGINE FLIGHT START — 4.10.07

1. MAXIMUM FLIGHT LEVEL 280.
2. FUEL & IGNITION SWITCH OFF.
3. THROTTLE CLOSED.
4. FIRE CONTROL HANDLE IN.
5. ENGINE TANK VALVE OPEN.
6. FUEL TANK PUMPS ON.
7. IF IAS UNDER 270 KNOTS & N_3 UNDER 20%.
   a. CHECK ENGINE BLEED AIR PRESSURE TO ENGINE & CHECK THAT ENGINE ISOLATION VALVE SWITCH IS OPEN.
   b. PUSH GROUND START SWITCH.
8. IF IAS OVER 270 KNOTS OR N_3 OVER 20%, PUSH FLIGHT START SWITCH
9. FUEL & IGNITION SWITCH ON.
10. WHEN ENGINE IS AT IDLE, START SWITCH OFF.
11. CHECK ELECTRICAL & HYDRAULIC SYSTEMS.

IN-FLIGHT REVERSE THRUST — 4.10.08

1. IF REVERSE LIGHT ON BUT NO YAW, BUFFET, OR LOSS OF AIRSPEED; OPERATE NORMALLY.
2. IF REVERSE LIGHT ON WITH YAW, BUFFET, OR LOSS OF AIRSPEED;
   a. SLOW TO 200 KNOTS, IF PRACTICAL.
   b. SHUTDOWN AFFECTED ENGINE.
   c. IF ENGINE 2, USE NORMAL LANDING PROCEDURES.
   d. IF ENGINE 1 OR 3, V_{ref} + 30 KNOTS BUT NOT LESS THAN 160 KNOTS FOR THE APPROACH.
      MAXIMUM FLAPS 22.
      PULL GND PROXIMITY CMPTR AC CB (1B20).
      EXTEND SPOILERS MANUALLY ON TOUCH-DOWN.

TWO ENGINE INOPERATIVE DRIFT DOWN/APPROACH — 4.10.08

DRIFT DOWN

1. SET .605 EPR, ESTABLISH 245 IAS, & MAINTAIN DRIFT DOWN CHART EPR & IAS.
2. JETTISON FUEL IF NECESSARY TO ATTAIN CHART GROSS WEIGHT/ALTITUDE COMBINATION.
3. DETERMINE RANGE CAPABILITY.
4. SELECT RUDDER LIMITER TO 30.
5. OPEN ALL CROSSFEED VALVES; USE ONE PUMP IN EACH TANK AFTER FUEL JETTISON.
6. IF NO. 2 ENGINE IS SHUT DOWN:
   a. DEPLOY RAT.
   b. PLACE B ATM TO AUTO.
   c. PLACE C ATM TO ON.
7. START APU BELOW 25,000 FEET.
   a. CLOSE ENGINE ISOLATION VALVE.
   b. OPEN APU BLEED AIR SHUTOFF.
   c. SELECT NORMAL MODE.
   d. PLACE B ATM TO ON, IF NECESSARY.
8. WHEN ALTITUDE IS STABILIZED ACCELERATE TO 2-ENGINE INOPERATIVE MRC SPEED.

APPROACH

9. COMPLETE LANDING PRELIMINARY CHECK LIST.
10. DEPRESSURIZE & TURN OFF REMAINING PACK.
11. WITH APU GENERATOR OPERATING, AC HYDRAULIC PUMPS ON.
12. SET BUG TO V_{ref} + 20 KNOTS.
13. FLAPS 0, BUG + 60 MINIMUM.
14. FLAPS 4, BUG + 40 MINIMUM.
15. FLAPS 10, BUG + 20 MINIMUM.
16. IF GO-AROUND REQUIRED:
    a. APPLY GO-AROUND THRUST
    b. RETRACT FLAPS, 10 TO 4 - BUG + 20 KNOTS.
       4 TO 0 - BUG + 40 KNOTS.
    c. BEGIN CLIMB WHEN REACHING 200 KNOTS.
17. INTERCEPTING APPROACH SLOT, EXTEND GEAR (LANDING COMMITTED).
18. PULL GND PROXIMITY CMPTR AC CB (1B20).
19. COMPLETE LANDING FINAL CHECK LIST.
20. USE NORMAL APPROACH SLOT, REDUCE TOWARD BUG + 5 KNOTS ON FINAL.
21. EXTEND SPOILERS MANUALLY ON TOUCHDOWN.

HYDRAULIC

HYDRAULIC SYSTEM FLUID LOSS — 4.10.10

1. ENGINE-DRIVEN PUMP OFF.
2. ATM, PTU & AC PUMPS OFF, AS APPLICABLE TO THE SYSTEM.
3. IF FLUID LOSS CONTINUES, ENGINE PUMP SUCTION SHUTOFF SWITCH OFF.
4. IF FLUID LOSS CONTINUES OR FLUID LEVEL INDICATES EMPTY, ENGINE PUMP SUCTION SHUTOFF SWITCH ON.
5. COMPLETE APPROPRIATE HYDRAULIC SYSTEM FAILURE PROCEDURE.

HYDRAULIC RESERVOIR FLUID HIGH TEMP — 4.10.10

1. AFTER GEAR & FLAPS ARE UP, AFFECTED SYSTEM PUMPS OFF.
2. WHEN HIGH TEMPERATURE LIGHT OUT, RESTORE SYSTEM PRESSURE.

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SINGLE HYDRAULIC SYSTEM FAILURE

SYSTEM A

1. AUTOPILOT B INOPERATIVE.
2. AUTOMATIC RUDDER BACKUP LOST.
3. NO. 2L SPOILER INOPERATIVE.
4. TAIL SKID INOPERATIVE.

SYSTEM B

1. AUTOPILOT A INOPERATIVE.
2. NORMAL BRAKE SYSTEM SOURCE INOPERATIVE; USE ALTERNATE BRAKES PROCEDURE.
3. PTU BACKUP FOR SYSTEM A INOPERATIVE.
4. NO. 1, 4, 6L & R SPOILERS INOPERATIVE.

SYSTEM C

1. NORMAL RUDDER POWER IN CRUISE LOST; AUTOMATICALLY TRANSFERRED TO SYSTEM A AT FULL PRESSURE.
2. USE MECHANICAL GEAR EXTENSION PROCEDURE; NOSE WHEEL STEERING INOPERATIVE.
3. C ACCUMULATOR PRESSURE AVAILABLE FOR GEAR EXTENSION OR ALTERNATE BRAKES.
4. PTU BACKUP FOR SYSTEM D INOPERATIVE.
5. NO. 3 & 5L & R SPOILERS INOPERATIVE.
6. EXTEND SPOILERS MANUALLY AT TOUCHDOWN.

SYSTEM D

1. NO. 2R SPOILER INOPERATIVE.

DUAL HYDRAULIC SYSTEM FAILURE

1. MAX IAS 250 KNOTS.
2. DO NOT USE SPEED BRAKES.
3. TURN OFF DLC.
4. EXTEND SPOILERS MANUALLY ON TOUCHDOWN.

SYSTEMS A & B

5. BOTH AUTOPILOTS INOPERATIVE.
6. NORMAL BRAKE SOURCE INOPERATIVE. USE ALTERNATE BRAKES PROCEDURE.
7. RUDDER MECHANICAL LIMITER INOPERATIVE.
8. BOTH RUDDER BACKUPS LOST.
9. LEFT OUTBOARD AILERON INOPERATIVE.
10. NO. 2L, 1, 4, 6L & R SPOILERS INOPERATIVE.
11. TAIL SKID INOPERATIVE.
12. HOLD SPOILER HANDLE IN POSITION ON TOUCH-DOWN.

SYSTEMS A & C

5. AUTOPILOT B INOPERATIVE.
6. NORMAL RUDDER POWER & AUTOMATIC RUDDER BACKUP IN CRUISE IS LOST, PUSH RUDDER LIMITER HYDRAULIC SWITCH TO OVRD.
7. FLAPS & SLATS INOPERATIVE. USE NO FLAP APPROACH PROCEDURE.
8. USE MECHANICAL GEAR EXTENSION PROCEDURE; NOSE WHEEL STEERING INOPERATIVE.
9. C ACCUMULATOR PRESSURE AVAILABLE FOR GEAR EXTENSION OR ALTERNATE BRAKES.
10. PTU BACKUP FOR SYSTEM D INOPERATIVE.
11. NO. 2L, 3L & R, 5L & R SPOILERS INOPERATIVE.

SYSTEMS A & D

5. AUTOPILOT B INOPERATIVE.
6. AUTOMATIC RUDDER BACKUP IS LOST.
7. NO. 2L & R SPOILERS INOPERATIVE.
8. TAIL SKID INOPERATIVE.

SYSTEMS B & C

5. AUTOPILOT A INOPERATIVE
6. NORMAL RUDDER POWER IN CRUISE LOST. AUTOMATICALLY TRANSFERRED TO SYSTEM A AT FULL PRESSURE.
7. USE MECHANICAL GEAR EXTENSION PROCEDURE; NOSE WHEEL STEERING INOPERATIVE.
8. B ACCUMULATOR PRESSURE AVAILABLE FOR NORMAL BRAKES.
9. C ACCUMULATOR PRESSURE AVAILABLE FOR GEAR EXTENSION OR ALTERNATE BRAKES.
10. PTU BACKUP FOR SYSTEMS A & D INOPERATIVE.
11. NO. 1, 3, 4, 5, 6L & R SPOILERS INOPERATIVE.

SYSTEMS B & D

5. AUTOPILOT A INOPERATIVE.
6. NORMAL BRAKE SOURCE INOPERATIVE; USE ALTERNATE BRAKES PROCEDURE.
7. PTU BACKUP FOR SYSTEM A INOPERATIVE.
8. RIGHT OUTBOARD AILERON INOPERATIVE.
9. NO. 2R, 1, 4, 6L & R SPOILERS INOPERATIVE.

SYSTEM C & D

5. NORMAL RUDDER POWER IN CRUISE IS LOST AUTOMATICALLY TRANSFERRED TO SYSTEM A AT FULL PRESSURE.
6. USE MECHANICAL GEAR EXTENSION PROCEDURE, NOSE WHEEL STEERING INOPERATIVE.
7. C ACCUMULATOR PRESSURE AVAILABLE FOR GEAR EXTENSION OR ALTERNATE BRAKES.
8. PTU BACKUP FOR SYSTEM D INOPERATIVE.
9. NO. 2R, 3, 5L & R SPOILERS INOPERATIVE

WITH ONLY SYSTEM D REMAINING

PULL ROLL DISCONNECT HANDLE AND FLY FROM THE FIRST OFFICER'S SIDE.

* * *

AC ESSENTIAL BUS FAILURE

A failure of AC Essential bus is confirmed by AC Essential bus fail light, and A autopilot tripping off if engaged. The A flight director will also show a fail flag.

Failure could be caused by AC essential selector switch being off, fault on bus, or autotransfer relay malfunction.

1. SELECT ESSENTIAL POWER TO MANUAL POSITION OF AN OPERATING GENERATOR.

   Attempt to restore Essential bus by using a manual position. If problem is relay malfunction, this will restore power.

2. IF FAILURE RECURS, DO NOT SELECT ANOTHER POSITION.

   If failure still exists, selecting another manual or automatic position will not correct problem if a bus fault exists.

3. CHECK STANDBY BUSSES POWERED.

   Check Standby bus fail lights extinguished. If AC Essential bus is still failed, AC Standby bus will autotransfer to inverter power. The standby power on light will indicate the autotransfer action. The battery charger will be disconnected, so Battery bus, inverter and AC Standby bus power will be time limited. Consideration might be given to placing standby power switch to off until approach to keep battery charged.

4. IF ESSENTIAL POWER CANNOT BE RESTORED REFER TO ESSENTIAL BUS DISTRIBUTION PAGES IN FHB FOR INOPERATIVE EQUIPMENT CONSIDERATIONS.

   Refer to the appropriate page in chapter 9, to review inoperative items and how they will affect remaining flight operation.

IDG LOW PRESS LIGHT ON

1. IF GENERATOR FIELD RELAY AUTOMATICALLY TRIPPED, DISCONNECT IDG IMMEDIATELY.

   The generator will trip on underspeed any time its oil pressure is low. If generator field relay and generator breaker open lights come on in addition to low pressure light, oil pressure is actually low, and generator should be disconnected. Disconnect is verified by checking PMG off.

2. IF FIELD RELAY DID NOT AUTOMATICALLY TRIP, CHECK IDG TEMPERATURE, VOLTAGE AND FREQUENCY. IF ABNORMAL, DISCONNECT.

   If field relay open light not on, indication may be false. To verify, check oil out temperature and oil rise for normal indications. Check voltage and frequency after opening generator breaker. Use autoparallel method if generator breaker switch is to be returned to normal position; open field relay, close generator breaker, close field relay. If any indications are abnormal, disconnect.

HIGH OR RISING IDG OIL TEMPERATURE

1. TRIP GENERATOR FIELD RELAY.

   This step isolates the generator from its load and reduces the IDG loading to a minimum. This may allow the temperature to decrease to a normal level.

2. IF OIL TEMPERATURE CONTINUES TO RISE OR REACHES LIMIT DISCONNECT IDG.

   If opening field relay does not prevent temperature increase, disconnect. If temperature reaches limit in either oil out or oil rise, disconnect. Verify disconnect by checking PMG. Monitor AC Essential bus for backup power.

GENERATOR(S) INOPERATIVE

1. CHECK THAT ALL AC TIE BREAKERS ARE CLOSED.

2. MONITOR KW LOADS AND REDUCE IF NECESSARY.

   With one generator inoperative:

   > Below 10,000 feet, maintain total electrical load to less than 81 KW by turning off all galley power and one tank pump in each tank.
   >
   > 10,000 feet and above, maintain total electrical load to less than 130 KW.

   With two generators inoperative, reduce total electrical load to less than 81 KW for all operations.

   Additional load reductions may be accomplished by deactivating the AC hydraulic pumps, 15 KW each.

GENERATOR(S) INOPERATIVE (Cont'd)

3. CONSIDER STARTING APU.

With two generators inoperative, the APU should be started when conditions permit. Observe the following limits:

> Do not attempt a start above 25,000 feet. Maximum 54 KW above 14,000 feet. With APU and one generator operating, limit total electrical load to 81 KW

Operate APU generator in parallel with engine generator if conditions permit.

4. CHECK ESSENTIAL SELECTOR FOR AUTO TRANSFER POSITION.

If No. 1 generator is inoperative, carry essential AC selector in auto B3/G2 position.

If No. 2 or 3 generator is inoperative, carry essential AC selector in auto B3/G1 position.

With APU and any generator operating, select auto B3 position.

FUEL JETTISON

FUEL MAY BE JETTISONED WITH GEAR UP OR DOWN, &
FLAPS UP - BETWEEN 180 & 300 KNOTS.
OR
FLAPS 10/22 - V_2 + 20 KNOTS MAX.

1. ALL FUEL TANK PUMPS ON.

Fuel cannot be jettisoned from a tank with inoperative fuel tank pumps.

2. OPEN MASTER JETTISON VALVES.

Check open is illuminated in master switch and all three master fuel jettison valve in-transit lights illuminate and go out.

-100: Also, check both gravity transfer valve in-transit lights illuminate and go out.

3. OPEN ALL DUMP VALVES.

Check dump is illuminated in each switch and all dump valve in-transit lights illuminate and go out.

JETTISON RATE FROM ALL TANKS IS 4500 LBS PER MINUTE.

Jettison rate is proportional to the number of operating fuel tank pumps.

APPROXIMATELY 24,000 LBS FUEL REMAINS AT AUTOMATIC JETTISON TERMINATION.

8,000 pounds of fuel will remain in each tank at automatic jettison termination.

4. WHEN JETTISONING IS COMPLETED:

   a. CLOSE ALL DUMP VALVES.

   Check dump is extinguished in each switch and all dump valve in-transit lights illuminate and go out.

   b. CLOSE MASTER JETTISON VALVES.

   Check open is extinguished in master jettison switch and all three master jettison valve in-transit lights illuminate and go out.

   -100: Also, check both gravity transfer valve in-transit lights illuminate and go out

MINIMUM FUEL APPROACH

(Use Abnormal Procedures Guide)

SINGLE PACK OPERATION

1. CLOSE COOL AIR OVERBOARD VALVE.

This will close the galley overboard valve and both avionics compartment overboard valves if open.

2. DESCEND TO 25,000 FEET OR BELOW.

NACELLE/PYLON OVERHEAT

A nacelle/pylon overheat is indicated by the illumination of C/W nacelle overheat light and both A and B loop test lights.

A possible duct leak exists in area between engine and the engine isolation valve.

1. THROTTLE, CLOSE.

NACELLE/PYLON OVERHEAT (Cont'd)

2. CHECK ENGINE HIGH PRESSURE VALVE CLOSED.

   Check that the overheat signal has closed the high pressure valve. If not closed, manually close the valve.

3. IF OVERHEAT CONDITION ALLEVIATED, CONTINUE OPERATION WITH HIGH PRESSURE VALVE CLOSED.

4. IF WARNING PERSISTS AFTER 30 SECONDS.

   With caution and warning nacelle overheat light still on, indicates a possible leak in the duct between the engine and high pressure valve.

   a. FUEL & IGNITION SWITCH, OFF.

   b. FIRE CONTROL, PULL.

      The engineer should check the following:

         For engine 1 or 3, fuel tank and emergency valves close. For engine 2, only primary and secondary valves close.

         Generator field relay and generator breaker open.

         Engine isolation valve has closed.

   c. FUEL PANEL, CHECK.

      For engine 1 or 3, close the respective tank valve. For engine 2, close its tank valve if the APU is not to be used.

      Turn off the fuel tank pumps in any tank from which fuel is not being used. Monitor fuel distribution.

   d. ELECTRICAL POWER, CHECK.

      Check that all busses are powered, active generators are operating within KW limits, and the generator field and generator breaker for the inoperative generator is open.

      Check essential power has auto backup.

   e. HYDRAULIC POWER, CHECK.

      Check that related hydraulic quantity is normal and then restore the system.

      For engine 1 or 3, turn on PTU. For engine 2, place both ATMs to ON and, during the approach, turn on both AC pumps.

   f. PNEUMATICS, CHECK.

      If all three packs are operating, close number 1 pack flow control valve and refer to Loss Of One Bleed Source procedure in 19.01.

WINDOW ARCING/CRACKED

(Use Abnormal Procedures Guide)

ALTERNATE BRAKES

1. IF NORMAL BRAKES ARE INOPERATIVE OR BECOME INEFFECTIVE, SELECT ALTERNATE SYSTEM C.

2. USE NORMAL BRAKING TECHNIQUE

   Alternate brakes have anti-skid protection provided the anti-skid switch is on.

GEAR LEVER LOCKED

1. IF A GREATER EMERGENCY EXISTS, OVERRIDE LEVER LOCK AND RETRACT GEAR.

2. CHECK TRUCK LEVEL CB (2F16) AND RESET IF TRIPPED.

   This CB controls the circuits to both the truck light and the gear lever solenoid.

3. MAKE LIGHT TEST.

   Press pilot's lights test switch and observe that engine 2 fail-armed and truck lights illuminate.

4. IF ENGINE 2 FAIL-ARMED LIGHT (WITH T/O FLAPS) OR TRUCK LIGHT ON, DO NOT RETRACT GEAR.

   The engine 2 fail-armed light on after liftoff with flaps at 10 degrees indicates one, or both, main gear strut(s) are not extended. The truck light on after liftoff indicates one, or both, main gear truck(s) are not level. Do not retract the gear if either of these lights is on.

GEAR LEVER LOCKED (Cont'd)

5. IF ENGINE 2 FAIL-ARMED AND TRUCK LIGHTS OUT, OVERRIDE LEVER LOCK AND RETRACT GEAR.

   If both lights are out with flaps at 10 degrees and the lights test proves the lights are operative, press the downlock release and raise the gear.

MECHANICAL GEAR EXTENSION

1. MAXIMUM IAS 250 KNOTS.

2. PLACE GEAR LEVER DOWN

   This arms the anti-skid and relieves any up pressure.

3. PULL NOSE GEAR MECHANICAL RELEASE & BYPASS HANDLE. GEAR MAY NOT LOCK DOWN UNTIL BELOW 220 KNOTS. NOSE WHEEL STEERING INOPERATIVE.

   This bypasses the gear selector valve assuring free fall of all the gear regardless of gear lever position. The nose gear uplock is also released and the nose gear free falls to the down and locked position. Air loads may prevent nose gear from locking down until speed decreases below 220 knots. With the nose gear mechanical release handle pulled, nose wheel steering is not available. Use rudder, brakes, and differential thrust to maintain heading during roll out and taxi.

4. PULL LEFT & RIGHT MAIN GEAR MECHANICAL RELEASE HANDLES.

   This will unlock the left and right main gear uplocks and the respective gear free falls into the down and locked position.

   If system C pressure is not available, the autoground spoilers are inoperative and truck unlevel lights may be on.

   If system C operation is normal, the reservoir high temperature light may come on. There may be decrease in quantity. These abnormal indications may occur since the fluid will bypass because the nose and bypass handle is pulled.

5. IF ANY GEAR GREEN LIGHT IS NOT ON, PLACE ALTERNATE HYDRAULIC LANDING GEAR EXTENSION SWITCH TO ALTERNATE. GEAR DOOR & IN-TRANSIT LIGHTS WILL REMAIN ON.

   This connects system C brake accumulator pressure, through separate lines, to gear down system. The main gear doors will remain open.

   If gear down and locked condition cannot be verified from cockpit, or additional proof of gear down and locked status is deemed necessary, check landing gear downlock indicators.

   The main gear indicators can be seen from cabin windows. The indicators (about 1½ inches in diameter) protrude above the wing surface ½ inch when the respective gear is down and locked. Use flashlight as necessary for illumination.

   The nose gear indicators can be seen through an optical viewer in aft bulkhead of the forward avionics center. Indicators consist of two orange rods (about 1 inch long and ¼ inch diameter) which align within one rod diameter when the gear is down and locked. Turn on wheel well lights as necessary for illumination.

   The nose wheel landing or taxi lights may also be used to illuminate the indicators. These lights will not come on unless nose gear is down and locked.

NO FLAP APPROACH

1. REDUCE WEIGHT AS MUCH AS PRACTICAL.

   Use fuel jettisoning procedure and/or burn off fuel to reduce weight to the minimum practical level.

2. COMPLETE LANDING PRELIMINARY CHECK LIST.

3. SELECT RUDDER LIMITER TO 30.

   Press rudder limiter switch to MNL. Verify $\pm$ 30 illuminated. If not, select $\pm$ 30 with $\pm$ 8/$\pm$ 30 switch. This will provide full rudder displacement which would not be available until below 164 knots.

4. IF SLATS NOT FULLY EXTENDED, SET BUG TO V_{ref} + 50 KNOTS.

   With no slats, application of ground spoilers/reverse thrust produces a mild pitch up. Use full reverse thrust after braking initiated.

NO FLAP APPROACH (Cont'd)

5. IF SLATS FULLY EXTENDED, SET BUG TO V_{ref} + 33 KNOTS.

   With full slats, application of ground spoilers/reverse thrust produces a moderate pitch up. Apply forward pressure on the control column and moderate braking before reverse thrust is selected.

6. BUG + 10 KNOTS MINIMUM.

7. GEAR DOWN.

8. PULL GND PROXIMITY CMPTR AC CB (1B20).

   This prevents ground proximity warning when flaps are not at 33 degrees when below 500 feet AGL.

9. COMPLETE LANDING FINAL CHECK LIST.

10. USE NORMAL APPROACH SLOT, REDUCE TOWARD BUG + 5 KNOTS ON FINAL.

    DLC not available with no flaps.

11. EXTEND SPOILERS MANUALLY ON TOUCH-DOWN.

    Autoground spoilers are inoperative with less than full flaps.

PARTIAL LEADING EDGE SLATS

1. IF ONE OR MORE LEADING EDGE SLATS NOT EXTENDED, LOCK SLATS IN POSITION.

   Lock the slats, using slat lock switch on slat monitor panel.

2. SET BUG TO V_{ref} + 20 KNOTS.

   This speed additive is adequate for any leading edge slat asymmetry.

3. EXTEND FLAPS TO 22 MAXIMUM.

4. AFTER GEAR EXTENSION, PULL GND PROXIMITY CMPTR AC CB (1B20).

   This prevents ground proximity warning when flaps are not at 33 degrees when below 500 feet AGL.

5. USE NORMAL APPROACH SLOT, REDUCE TO BUG + 5 KNOTS ON FINAL.

   DLC not available with 22 flaps.

6. EXTEND SPOILERS MANUALLY ON TOUCH-DOWN.

   Autoground spoilers are inoperative with less than full flaps.

PARTIAL TRAILING EDGE FLAPS

Give consideration to the need for weight reduction.

1. SELECT RUDDER LIMITER TO 30.

   Press rudder limiter switch to MNL. Verify $\pm$ 30 illuminated. If not, select $\pm$ 30 with $\pm$ 8/$\pm$ 30 switch. This will provide full rudder displacement which would not be available until below 164 knots.

2. SET BUG TO V_{ref} + 1 KNOT FOR EACH DEGREE FLAP NOT AVAILABLE.

   Subtract the number of flap degrees obtained from 33. Use the result as the V_{ref} additive for bug setting.

3. AFTER GEAR EXTENSION, PULL GND PROXIMITY CMPTR AC CB (1B20).

   This prevents ground proximity warning when flaps are not at 33 degrees when below 500 feet AGL.

4. USE NORMAL APPROACH SLOT, REDUCE TO BUG + 5 KNOTS ON FINAL.

   DLC not available.

5. EXTEND SPOILERS MANUALLY ON TOUCH-DOWN.

   Autoground spoilers are inoperative with less than full flaps.

   With full slats, application of ground spoilers/reverse thrust produces a moderate pitch up. Apply forward pressure on the control column and moderate braking before reverse thrust is selected.

PITCH CONTROL JAM

Attempt to maintain control by applying control column force. This effort may break the jam or provide push lights to indicate which side is jammed.

1. MAINTAIN PITCH ATTITUDE WITH MECHANICAL TRIM.

   The airplane can be flown with mechanical trim. Retain flap setting and speed existing at time of jam.

2. IF A & B OR C & D STABILIZER PUSH LIGHTS ON.

   Two push lights illuminated on the same side indicate the malfunctioning control path.

   A & B push lights indicate captain's control path jammed. C & D push lights indicate first officer's control path jammed.

   a. PRESS BOTH PUSH LIGHTS TO INOP, NOTE AFT COUPLER OPEN & PULL PITCH DISCONNECT LIGHTS ON.

      Pressing two push lights on the same side opens the aft coupler and, with a jam, also turns on the pull pitch disconnect light.

      The respective stabilizer servos are deactivated.

   b. PULL PITCH DISCONNECT HANDLE.

      Full control will now be available to the pilot whose stabilizer servos have not been turned off. Feel forces will be reduced one-half normal.

3 IF NO PUSH LIGHTS ON, APPLY STEADY FORCE AGAINST THE JAM. IF STILL NO LIGHTS:

   If stabilizer push lights do not appear, attempt to illuminate the lights by applying a steady force against the jam. A force of 90 pounds or greater will be required to turn on the push lights. If this still does not turn on the push lights:

   a. PULL PITCH DISCONNECT HANDLE.

      Light on in handle indicates controls have disconnected. If it is evident which side is jammed by checking the controls, turn off both stabilizer servos on the side that is jammed.

      If it is not evident which side is jammed, continue with the following steps.

   b. PRESS STABILIZER C & D SWITCHES TO INOP AND CHECK CAPTAIN'S CONTROLS.

      If aircraft responds to captain's control, procedure is completed.

   c. IF CONTROL NOT AVAILABLE TO CAPTAIN, PRESS C & D TO ON AND A & B TO INOP.

      With captain's controls still jammed, turn on the first officer's stabilizer servos and shut off the captain's.

   d. USE FIRST OFFICER'S CONTROLS.

4. MAX IAS 250 KNOTS.

   → Reduced airspeed will assure adequate stabilizer authority.

ROLL CONTROL JAM

With control forces applied against a roll jam, the monitor system will indicate which side is jammed by annunciation on the PFCS panel.

Pull roll disconnect, spoiler push, and aileron crosshatch lights will illuminate on the side of the jam.

1. PULL ROLL DISCONNECT HANDLE.

   Pilot on side not jammed must be prepared to control aircraft. Light illuminating in handle indicates controls have disconnected.

2. PRESS SPOILER PUSH LIGHTS TO OFF.

   If roll control is still marginal and more than 40 degrees of control wheel deflection is required to maintain wings level, continue with the following step.

3. IF ROLL CONTROL IS STILL MARGINAL, PRESS AILERON CROSSHATCH LIGHTS TO OFF.

   The ailerons on one side of the aircraft are now deactivated.

RUNAWAY TRIM

Recognition of runaway trim will be unwanted mechanical trim wheel motion.

1. HOLD MECHANICAL TRIM WHEEL & MAINTAIN ATTITUDE WITH YOKE.

2. PRESS PITCH TRIM SWITCHES TO OFF.

   With both pitch trim switches off, electric and autopilot pitch trim is deactivated. Selectively turning on one switch at a time may determine which system is faulty.

3. MAINTAIN PITCH TRIM WITH MECHANICAL TRIM WHEEL.

   If the faulty system cannot be determined use mechanical trim. Autopilots will be inoperative.

EXCESSIVE PITCH UP DURING TAKEOFF

1. DO NOT RAISE FLAPS.

   Flaps should remain at 10 degrees to maintain operation of the No. 1 spoilers.

2. TURN OFF ALL SPOILERS EXCEPT L & R 1 & 2.

   This selects the proper spoilers for pitch control.

3. USE SPEED BRAKE LEVER FOR PITCH TRIM.

   Move speed brake lever aft smoothly to attain the desired pitch attitude.

4. TURN OFF DLC/AUTO SPLRS.

   This will avoid any unwanted autospoiler operation.

5. MAINTAIN BUG + 10 & MAKE NORMAL LANDING.

   As flaps are extended for landing, maintain trim with speed brake lever.

ENGINE FLIGHT START

1. MAXIMUM FLIGHT LEVEL 280.

   An engine start cannot be assured above flight level 280.

2. FUEL & IGNITION SWITCH OFF.

   Deactivates all ignition circuits to engine and closes high pressure fuel shutoff valve.

3. THROTTLE CLOSED.

   Keep throttle closed to limit engine RPM to idle after light off.

4. FIRE CONTROL IN.

   When the fire control is pushed in, check the fuel panel emergency shutoff valve and engine tank valve in-transit light for indications of valve movement.

5. ENGINE TANK VALVE OPEN.

   Engine tank valve switch is in and flowbar illuminated.

6. FUEL TANK PUMPS ON.

   Tank pump switches in. Flowbars illuminated and pumps energized.

7. IF IAS UNDER 270 KNOTS & N_3 UNDER 20%.

   If the engine windmilling RPM is below normal ground starting light off RPM, the starter will crank the engine to normal ground light off RPM.

   a. CHECK ENGINE BLEED AIR PRESSURE TO ENGINE & CHECK THAT ENGINE ISOLATION VALVE SWITCH IS OPEN.

      Cycle switch to release holding coil

   b. PUSH GROUND START SWITCH.

8. IF IAS OVER 270 KNOTS OR N_3 OVER 20%, PUSH FLIGHT START SWITCH.

   At airspeeds above 270 IAS or N_3 over 20%, the engine windmill speed should be sufficient to initiate a light off.

9. FUEL & IGNITION SWITCH ON.

   If the engine is slow to accelerate after light-off, move the switch to ENRICH position.

   If engine does not continue to accelerate as starter cutout is approached (45% N_3), release starter by pressing ground start release switch push light. This may allow engine to accelerate to flight idle. Enrich mode will also aid acceleration.

ENGINE FLIGHT START (Cont'd)

10. WHEN ENGINE IS AT IDLE, START SWITCH OFF.

11. CHECK ELECTRICAL & HYDRAULIC SYSTEMS.

Check that all busses are powered, active generators are operating within KW limits, and generator breaker for any inoperative generator tripped. Check that the related hydraulic quantity is normal and then restore the system.

IN-FLIGHT REVERSE THRUST

1. IF REVERSE LIGHT ON BUT NO YAW, BUFFET, OR LOSS OF AIRSPEED; OPERATE NORMALLY.

If reverse light is on but no yaw, buffet or loss of airspeed has occurred, engine is producing forward thrust. Continue with normal flight.

2. IF REVERSE LIGHT ON WITH YAW, BUFFET, OR LOSS OF AIRSPEED·

With the light on and yaw, buffet, or loss of air speed, the engine is producing reverse thrust. Complete the following:

a. SLOW TO 200 KNOTS, IF PRACTICAL.

b. SHUTDOWN AFFECTED ENGINE.

c. IF ENGINE 2, USE NORMAL LANDING PROCEDURES.

IF ENGINE 1 OR 3:

V_{ref} + 30 KNOTS BUT NOT LESS THAN 160 KNOTS FOR THE APPROACH. MAXIMUM FLAPS 22. PULL GND PROXIMITY CMPTR AC CB (1B20). EXTEND SPOILERS MANUALLY ON TOUCHDOWN.

This prevents ground proximity warning when flaps are not at 33 degrees when below 500 feet AGL. Autoground spoilers are inoperative with less than full flaps.

TWO ENGINES INOPERATIVE DRIFT DOWN/ APPROACH

This procedure is based on the assumption that appropriate engine failure/fire procedures have been completed. 2-Engine Inoperative (Max Continuous) Drift Down chart located in 21.25.

DRIFT DOWN

1. SET .605 EPR, ESTABLISH 245 IAS, AND MAINTAIN DRIFT DOWN CHART EPR AND IAS.

Decelerate at altitude to drift down speed and use 2-Engine Inoperative (Max Continuous) thrust throughout the descent.

Adjust Drift Down EPR and IAS as altitude is lost during drift down.

2. JETTISON FUEL IF NECESSARY TO ATTAIN CHART GROSS WEIGHT/ALTITUDE COMBINATION.

If aircraft weight exceeds Drift Down gross weight/altitude combination, fuel must be immediately jettisoned until a chart gross weight/ altitude combination has been achieved. To maximize range, this should be accomplished at the highest possible altitude. After jettison completed, read distance and time to level off altitude.

3. DETERMINE RANGE CAPABILITY.

After achieving a chart gross weight/altitude combination, refer to Total Range Capability chart to determine nautical mile capability with fuel remaining. If fuel is in excess of diversion requirements, consideration should be given to additional fuel jettisoning to improve single engine altitude capability.

Nautical air mile range includes credit for drift down from cruise altitude. Do not add Drift Down distance to this value. Fuel remaining includes an allowance for an additional 15 minutes (3000 lbs) holding over destination.

4. SELECT RUDDER LIMITER TO 30.

Press mechanical limiter switch to MNL. Select ± 30 with ± 8/± 30 switch. This allows full rudder displacement which would not be available until flaps are selected.

5. OPEN ALL CROSSFEED VALVES; USE ONE PUMP IN EACH TANK AFTER FUEL JETTISON.

This ensures a fuel supply to the operating engine from any tank

DRIFT DOWN (Cont'd)

6. IF NO. 2 ENGINE IS SHUT DOWN:

   a. DEPLOY RAT.

      RAT provides a source of system B pressure. This provides full pressure at airspeeds above 160 knots.

   b. PLACE B ATM TO AUTO.

   c. PLACE C ATM TO ON.

      ATM becomes the primary source of system C pressure. This allows the ATM to run continuously.

7. START APU BELOW 25,000 FEET.

   a. CLOSE ENGINE ISOLATION VALVE.

   b. OPEN APU BLEED AIR SHUTOFF.

   c. SELECT NORMAL MODE.

   d. PLACE B ATM TO ON, IF NECESSARY.

8. WHEN ALTITUDE IS STABILIZED ACCELERATE TO 2-ENGINE INOPERATIVE MRC SPEED.

   When altitude is stabilized (about 4,000 feet), use 2-Engine Inoperative Max Range Cruise thrust setting chart, maintain chart speed, and accept a gradual increase in altitude as weight decreases.

APPROACH

9. COMPLETE LANDING PRELIMINARY CHECK LIST.

10. DEPRESSURIZE AND TURN OFF REMAINING PACK.

    Select cabin altitude to initial approach altitude to depressurize the cabin. When differential pressure is zero, turn off the remaining pack to conserve bleed air for ATMs and wing anti-ice.

11. WITH APU GENERATOR OPERATING, AC HYDRAULIC PUMPS ON.

    After APU generator has autoparalleled, turn on AC hydraulic pumps. This provides a backup for the RAT, if in use, and ATMs.

12. SET BUG TO V_{ref} + 20 KNOTS.

13. FLAPS 0, BUG + 60 MINIMUM.

14. FLAPS 4, BUG + 40 MINIMUM.

15. FLAPS 10, BUG + 20 MINIMUM.

    With hydraulic system A or C inoperative, flap and slat extension time may be increased.

16. IF GO-AROUND REQUIRED:

    a. APPLY GO-AROUND THRUST.

       Use GA mode on the EPR computer; if inoperative, use Go-Around Thrust Setting chart.

    b. RETRACT FLAPS:

       10 to 4 - BUG + 20 KNOTS.

       4 to 0 - BUG + 40 KNOTS.

    c. BEGIN CLIMB WHEN REACHING 200 KNOTS.

       Sacrifice altitude if practicable to accelerate.

17. INTERCEPTING APPROACH SLOT, EXTEND GEAR (LANDING COMMITTED).

    The aircraft is committed to land as soon as the gear is extended.

18. PULL GND PROXIMITY CMPTR AC CB (1B20)

    This prevents ground proximity warning when flaps are not at 33 degrees when below 500 feet AGL.

19. COMPLETE LANDING FINAL CHECK LIST.

20. USE NORMAL APPROACH SLOT, REDUCE TOWARD BUG + 5 KNOTS ON FINAL.

21. EXTEND SPOILERS MANUALLY ON TOUCHDOWN.

    On touchdown, autoground spoilers are inoperative with less than full flaps.

HYDRAULIC SYSTEM FLUID LOSS

1 ENGINE DRIVEN PUMP OFF.

Place engine driven pump shutoff switch off and check that flowbar goes out.

2. ATM, PTU, & AC PUMPS OFF, AS APPLICABLE TO THE SYSTEM.

For system B or C, place air turbine motor switch off and check that the ATM RPM indicator is at bottom of scale. Place AC pump switch off and check that the on light is out.

For system A or D, turn off the power transfer unit and check that flowbar goes out.

If system has been depressurized to stop a fluid leak, do not attempt to restore it solely to locate the leak. The decision to restore a system should be based on the need for some of the components operated by that system.

3. IF FLUID LOSS CONTINUES, ENGINE PUMP SUCTION SHUTOFF SWITCH OFF.

Place engine pump suction shutoff switch off and check that flowbar goes out.

4. IF FLUID LOSS CONTINUES OR FLUID LEVEL INDICATES EMPTY, ENGINE PUMP SUCTION SHUTOFF SWITCH ON.

Place engine pump suction shutoff switch on, and check flowbar on.

5. COMPLETE APPROPRIATE HYDRAULIC SYSTEM FAILURE PROCEDURE.

HYDRAULIC RESERVOIR FLUID HIGH TEMP

1. AFTER GEAR & FLAPS ARE UP, AFFECTED SYSTEM PUMPS OFF.

Turn off all pumps associated with high temperature light.

For system A or D check engine pump and PTU is off, for system B or C check engine and AC pumps and ATM is off.

2. WHEN HIGH TEMPERATURE LIGHT OUT, RESTORE SYSTEM PRESSURE.

Restore pressure using system pump that was not operating at the time overheat developed.

SINGLE HYDRAULIC SYSTEM FAILURE

(Use Abnormal Procedures Guide).

DUAL HYDRAULIC SYSTEM FAILURE

1. MAX IAS 250 KNOTS.

Reduced airspeed will assure adequate stabilizer authority.

2. DO NOT USE SPEED BRAKES.

This will avoid the possibility of asymmetric spoiler deployment and resulting pitch transients.

3. TURN OFF DLC.

Turning off both DLC switches will deactivate both DLC and autoground spoilers for landing. This will avoid the possibility of asymmetric DLC spoiler deployment and resulting pitch transients.

4. EXTEND SPOILERS MANUALLY ON TOUCHDOWN.

Spoilers will have to be operated manually since DLC and autoground spoilers have been shut off

With a loss of systems A and B, there is no hydraulic assist available to keep the spoiler handle in the extended position. It will be necessary to hold the handle in position or command the engineer to do so.

WITH ONLY SYSTEM D REMAINING

(Use Abnormal Procedures Guide).

UNRELIABLE AIRSPEED

Check for blocked pitot/static inputs or loss of radome.

Crosscheck all airspeed indicators and other air data instruments to determine which indicators or systems are in error.

If all airspeed indicators are unreliable, use the procedures listed below.

En route and descent.

Use normal cruise thrust en route. Use LRC or MRC/HOLD if necessary to reduce airflow noise and buffet to a tolerable level.

Avoid large or abrupt changes in attitude or thrust.

When initiating descent, use moderate sink rates and low thrust settings.

Approach

Plan to use all the aids available during the approach to establish the degree of indicated airspeed error as speed is reduced. Calculated ground speed from approach radar or, as a last resort, a pace aircraft in VFR conditions can be employed.

Use normal pitch attitude and approach configuration. Any time airspeed is unreliable, pitch attitude should be used as primary reference.

Crosscheck radio altimeter with other altimeters and rate of descent. Radio altimeter will be unreliable over irregular terrain.

Autopilot/flight director may be used in the A/L or APR mode if localizer and glide slope are available.

Monitor speed command during approach after the ALPHA flag appears.

Use normal approach slot and the following chart to establish attitude and thrust.

Final Approach Flaps 33.

Based on 3° glide slope. Adjust thrust to maintain body attitude. Use the glide slope if available. If not, use rate of descent.

Gross Weight X 1000	Target Body Attitude Degrees	Approximate EPR Required	Approximate Speed KTS IAS	Rate of Descent
400	5.5	1.22	V_{ref} + 15	870
350	5.0	1.18	V_{ref} + 15	820
300	5.0	1.15	V_{ref} + 15	770
250	5.0	1.13	V_{ref} + 15	710

BLOCKED PITOT/STATIC

Blocking or icing of the pitot probes will cause the airspeed/mach indicators and the barometric altimeters to be unreliable.

The airspeed and mach may drop to zero or change as the altitude changes. A blocked pitot probe could cause the airspeed to increase as the aircraft climbs and decrease as the aircraft descends.

Blocked static ports could cause the airspeed to decrease as the aircraft climbs and increase as the aircraft descends.

The altimeter will remain at its last indicated altitude if it loses static air reference.

When airspeed, mach, or altimeter appears abnormal, proceed as follows.

Establish a normal attitude and thrust for the existing regime of flight.

Crosscheck captain's, first officer's, and standby instruments to determine which is in error.

Check that pitot heat switches are on and pitot heat circuit breakers are in.

Check IVSI, TAT, SAT, EPR computer, and altitude select.

Crosscheck speed indications against performance charts to determine which system is in error.

LOSS OF RADOME

Extensive radome damage or a missing radome will result in a small decrease in airplane performance, accompanied by an increased level of airflow noise and low frequency buffeting. The pitot-static probes, temperature probes, and stall warning/angle of attack probes will produce erroneous effects on both air data sensors because of the resulting turbulent airflow around the nose. The following associated instruments and systems may be partially or totally inoperative:

Airspeed/Mach Indications

At higher speeds, the pitot-static probes will be in the turbulent wake, resulting in erratic and unreliable airspeed indications. At lower speeds, these errors will not be as pronounced and airspeed may be usable on approach.

UNRELIABLE AIRSPEED (Cont'd)

Altitude and Rate Of Climb

All altimeters with static inputs will be unreliable at higher airspeeds. Vertical speed indicators will be inaccurate at higher speeds. Both may become more usable at lower speeds. Radio altimeter will not be affected.

Autopilot/Flight Director

The autopilot or flight director may be used with any of the roll modes but no pitch mode may be used. The A/L or APR mode should provide normal operation when the glide slope is captured.

Flap Load Relief System

LRS must be considered unreliable and should be overridden.

Mach Feel and Trim

Both of these systems will be inoperative. Pitch control will be over-sensitive at higher speeds.

Rudder

Rudder mechanical and hydraulic limiting may not function properly. Avoid large rudder inputs at high speed. Override mechanical limiter as required.

Speed Command/Autothrust

The slow-fast indicators and autothrust will be unreliable at high speed. Slow fast indicators may be usable on approach after ALPHA flag appears.

Stall Warning

If nuisance stick shaker occurs, the stall warning systems may be turned off. Reset systems prior to final approach. At low speeds, stall warning may be normal.

CARE FOR VICTIM OF ELECTRICAL SHOCK

If the victim has suffered electrical shock, direct one of the crew to call a physician, if practicable, and take the following steps immediately:

Remove source of electrical current by opening all field relays or turning ground power off.

If victim is unconscious and breathing has stopped or is intermittent, apply artificial respiration without delay. Mouth-to-mouth resuscitation recommended.

Use blankets or coats to keep victim warm.

Continue artificial respiration until natural breathing is restored unless advised otherwise by a physician.

WARNING

DO NOT STOP ARTIFICIAL RESPIRATION IF VICTIM'S BODY BECOMES STIFF OR RIGID. THIS CAN BE EXPECTED IN CASES OF ELECTRICAL SHOCK.

Do not attempt to move victim until natural breathing has been restored, unless his position jeopardizes the safety of the aircraft.

After natural breathing is restored, administer oxygen and monitor victim's breathing closely. If breathing stops, resume artificial respiration.

EN ROUTE LOSS OF CREW OXYGEN SUPPLY

When the fixed oxygen supply becomes depleted during flight, the crew becomes vulnerable to both smoke and loss of cabin pressurization, due to loss of primary protective oxygen.

The following steps should be accomplished to provide the greatest margin of safety available under the circumstances:

Place the cockpit portable oxygen bottle and mask in a position readily available to the captain.

Procure two portable oxygen bottles and masks from the cabin and place them in positions readily available to the first officer and engineer.

Plan to land at the nearest suitable airport, in point of time.

Analyze the possibility of descending to a lower altitude, considering available fuel versus time to destination selected. Descent should be a secondary consideration to maintaining adequate fuel reserve, particularly when traversing widespread areas of poor terminal weather.

Review the Smoke Removal and Rapid Descent procedure in chapter 3. If subsequent loss of cabin pressure or an accumulation of smoke in the cockpit makes it necessary to use oxygen. interphone communication will not be available.

ARTIFICIAL RESPIRATION AND EXTERNAL HEART COMPRESSION

OPEN AIR PASSAGE

1. Clear mouth of foreign matter.
2. Lift up on back of neck and extend the head.

RESTORE BREATHING

1. Pinch the nostrils shut.
2. Place your mouth firmly over victim's mouth.
3. Blow hard enough to make victim's chest rise.
4. Remove your mouth to permit exhalation.
   Repeat every 5 seconds.

- If victim is a CHILD:

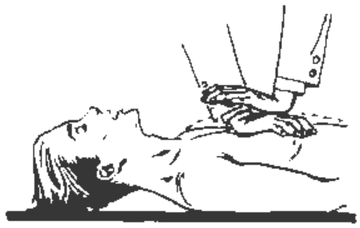
1. Cover both nose and mouth with your mouth.
2. Blow shallow breaths.
   Repeat every 3 seconds.

- If there is NO AIR EXCHANGE:

ADULT	CHILD	INFANT
Turn victim on his side . . .	Hold child with head down . . .	Hold infant by heels . . .

. . . . and slap him sharply several times between the shoulder blades in order to dislodge any foreign matter from the throat.

RESTORE CIRCULATION



The HEART has STOPPED if pupils are dilated or no pulse is noted.

1. Place heel of hand over lower half of breast bone.
2. Press down 1 1/2 to 2" and release.
   Repeat every second.

If victim requires both mouth-to-mouth respiration and external heart compression:

ONE RESCUER: Alternate between inflating the lungs twice and compressing the heart 15 times.

TWO RESCUERS: Inflate lungs on the release of every 5th external heart compression.

Many persons have been revived only after hours of artificial respiration.

* * *

ADDITIONAL PROCEDURES

CONTROLS AND INDICATORS

SCHEMATICS

SYSTEM DESCRIPTION

* * *

PACK AREA OVERHEAT LIGHT ON

1. One pack area overheat light on (A, B, or C) and pilot's annunciator panel area duct overheat light on:

   Close related pack flow control valve.

2. Three pack area overheat lights on (A, B, and C):

   Caused by leakage of bleed air in forward cargo heat exchanger.

   a. Close one pack flow control valve. If light goes out the leak is in its duct.

   b. If light remains on, reactivate the pack and check remaining packs, one at a time, until the leaking duct is isolated.

PACK FLOW CONTROL OVERHEAT LIGHT ON

Pack flow control, hot air, and hot air isolation valves lock closed.

1. Close affected pack flow control, hot air, and hot air isolation switches.
2. Select ECS monitors to tripped pack.
3. Check compressor and ACM discharge temperature.

   a. If compressor discharge temperature excessive, manually set pack warmer.

   b. If ACM discharge temperature is excessive, manually set pack cooler.

   Pack may be reset after overheat light goes out.

4. Open each valve.
5. Monitor temperatures and control pack manually if necessary.

HOT AIR DUCT OVERHEAT LIGHT ON

A hot air valve is not controlling the air temperature into the hot air manifold. Both hot air and hot air isolation valves close and lock.

1. Push each valve switch to OFF.
2. Select ECS monitor to either pack No. 2 or No. 3 hot manifold.
3. Open same hot air and hot air isolation valves and monitor temperature.

   a. If temperature stabilizes below 150°C, operate with single hot air and isolation valve open.

   b. If temperature approaches 150°C, close valves.

4. Select other pack temperature, open its hot air and isolation valve, and monitor the temperature

HOT AIR ISOLATION OVHT LIGHTS ON

An excessive temperature in the forward electronics compartment will automatically close both isolation valves.

Press both isolation valve switches to match valve position. With valves closed, hot air for zone trimming will not be available.

FLOOR HEAT FAIL LIGHT ON

System has been de-energized.

Cycle floor heat switch, to re-energize system. If light remains out, system operation will be normal.

If light remains on, push the switch to off and continue without floor heat.

PRESSURIZATION FAULT LIGHT ON

When the aircraft is above 14,000 feet and either outflow valve is out of the green band, both outflow valves lock in position. AC power is removed from the normal/standby motor.

1. Push both outflow valve switches to MNL.
2. Toggle outflow valve(s) to within the green band. Fault light will now go out.
3. Reset switches to normal and monitor operation
4. If normal operation is not satisfactory return switches to MNL and operate outflow valves manually to control pressurization.

If cabin altitude goes above 11,500 feet, outflow valves will close and remain closed until cabin goes below 11,500 feet. Then the outflow valves return to normal operation.

1. When the outflow valves close push both switches to MNL.
2. Control outflow valves manually to regain control of the cabin.

AVIONIC AIR LO FLO/OVBD LIGHT ON

Indicates that the temperature of the air in the exit duct is excessive or the air flow is restricted.

Reduce electrical loads in that compartment if possible, commensurate with flight requirements.

The following loads in the forward avionics compartment may be considered for load reduction:

One weather radar.

One VOR.

One DME.

One or two VHF comm.

If the flow is restricted to the extent that it causes a differential pressure across the fan, the overboard valve will open and the overboard light will illuminate.

When the mid electrical compartment valve opens from differential pressure across the fan, the battery charger is automatically turned off.

CARGO COMPARTMENT HOT LIGHT ON

The normal temperature control system is inoperative.

If the light does not go out shortly:

1. Press the switch to off, to deactivate the fan and turn off the hot light.

2. When the cold light comes on, manually control the system by pressing switch on.

3. When hot light comes on, continue with steps 1 and 2 to control cargo temperature.

EXCESSIVE PACK FLOW LOCKOUT

The pack flow control valve and the isolation and crossbleed valves associated with that system are automatically locked closed.

An over sensitive unit could lockout during preflight. To reactivate the system so the engine can be started or to reactivate the engine bleed during flight:

1. Press pack flow control and all bleed air valve switches on the affected system off.

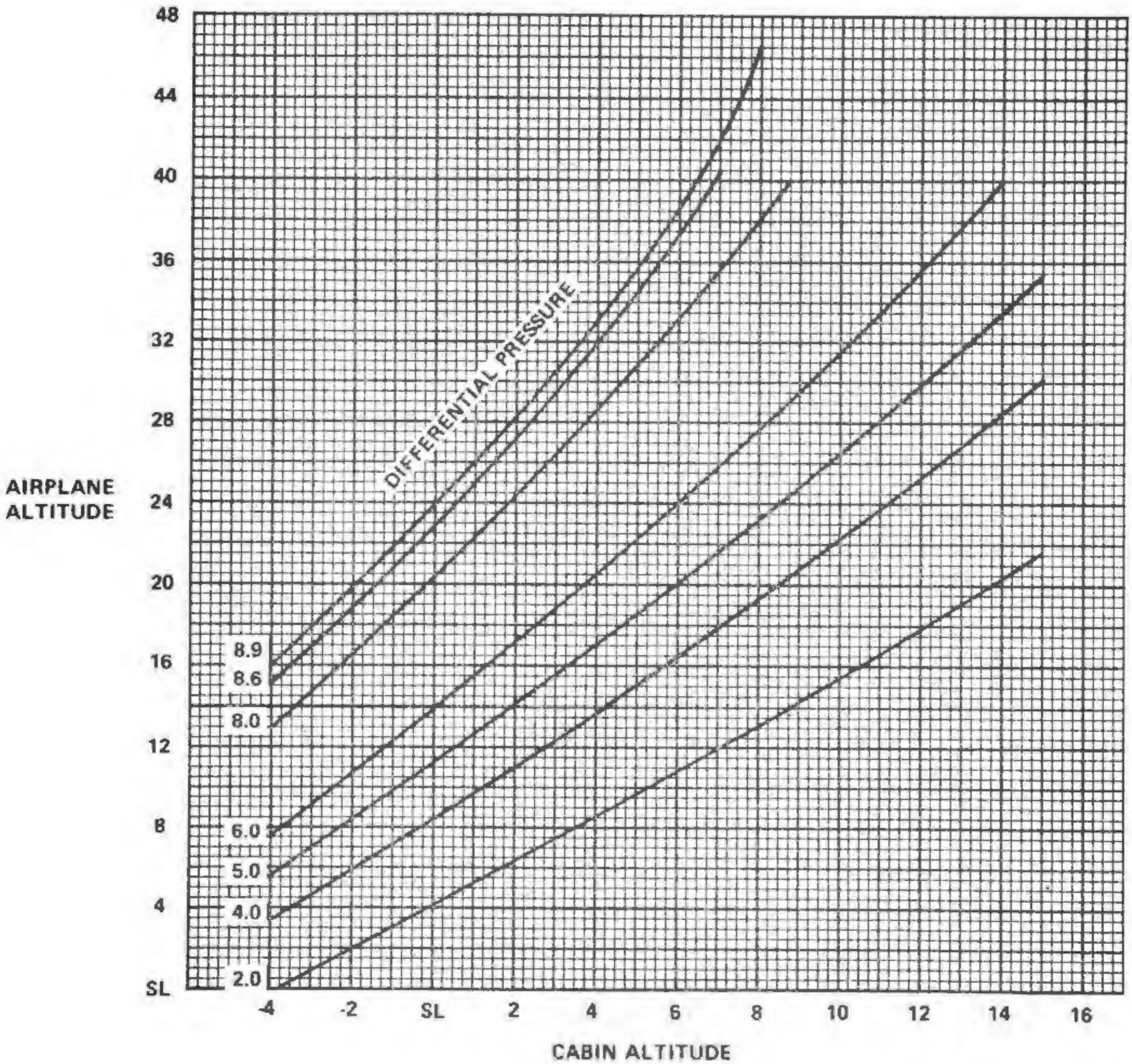
2. Open related engine isolation and crossbleed valves. Note flowbars illuminate.

3. If it is desired to reinstate a pack:

   Position pack selector to tripped pack.

   Open pack flow control valve and monitor system. If pack flow abnormal and/or system trips again, close pack flow control valve and operate with pack off.

AIRPLANE ALTITUDE VS CABIN ALTITUDE



PACK TEMPERATURE CONTROLS

PACK FLOW CONTROL SWITCH

Controls pack flow control valve to schedule a constant mass air flow. Valve is energized closed and pressure opened. Any time valve is closed both hot air and hot air isolation valves close.

IN - Arms valve to open with pressure. Flowbar is illuminated when valve opens.

OVHT - Indicates an overheat condition in either air conditioning pack compressor discharge or pack outlet and valve locked closed.
Valve locks closed if air flow to pack becomes excessive. Pack 2 valve closes if either ATM is operating and manifold pressure is less than required.

OUT - Valve is energized closed.

1H3, 4, 5 - PACK FLOW CONTROL.

PACK FLOW AREA OVERHEAT LIGHT

Overtemperature around duct from pack flow control valve to ACM is detected.

3W13, 14 - DUCT AIR OVHT DET.

RAM AIR INDICATOR

Indicates relative position of ram air exit doors. Pointer moves toward COOLER as doors open. Doors drive open on ground.

3V5, 6, 7, 8, 17, 18 - PACK AUTO/-MAN

COOL AND WARM SWITCHES

Momentary pushbutton switches for manual temperature control.

COOL - Ram air pointer moves roward COOLER until doors are full open; then turbine bypass pointer moves toward COOLER.

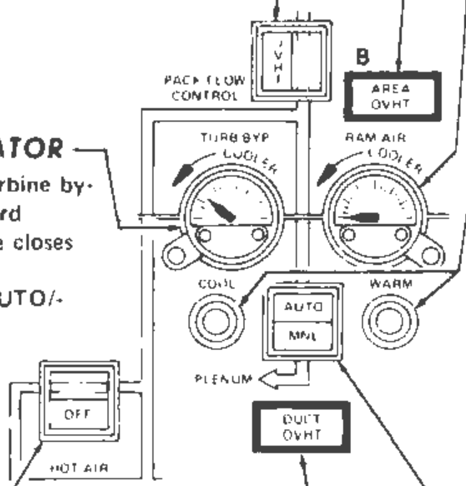
WARM - Turbine bypass pointer moves clockwise until valve is full open; then ram air pointer moves clockwise until ram air doors are fully closed for heating.

3V5, 6, 7, 8, 17, 18 - PACK AUTO/-MAN.

TURBINE BYPASS INDICATOR

Indicates relative position of turbine bypass valve. Pointer moves toward COOLER as valve closes. Valve closes after ram air door is open.

3V5, 6, 7, 8, 17, 18 - PACK AUTO/-MAN.



HOT AIR SWITCH

Hot air valve modulates to control manifold hot air temperature. Valve is energized closed and pressure opened.

IN - Arms valve to open with pressure. Flowbar is illuminated when valve opens. If the associated pack flow control valve closes or DUCT OVHT is illuminated, hot air valve is locked closed.

OUT - Valve closes, and OFF is illuminated.

3W6 - TEMP CONT HOT AIR MANIF.

PACK AUTO/MANUAL SWITCH

IN - AUTO shows switch position. Ram air doors and turbine bypass valves modulate, automatically, to provide temperature control.

OUT - MNL shows switch position. Arms COOL and WARM switches for manual control of ram air exit doors and turbine bypass valve.

3V5, 6, 7, 8, 17, 18 - PACK AUTO/MAN

DUCT OVERHEAT LIGHT

Hot air manifold overheated. Both hot air and hot air isolation valves locked closed.

3W5 - IND HOT AIR MANIF.

ZONE TEMPERATURE CONTROLS (SHEET 1)

HOT AIR ISOLATION VALVE

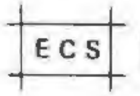
Permits isolating pack 2 and/or 3 from the hot air manifold. Valve is deenergized closed and pressure opened.

IN - Valve energized to open with pressure. Flowbar illuminated when valve open. Hot air manifold or forward avionics area overheat locks both valves closed. Valve also locks closed anytime pack flow control valve closed for any reason except for loss of air pressure.

OVHT - Forward avionics compartment overheated. Both isolation valves locked closed.

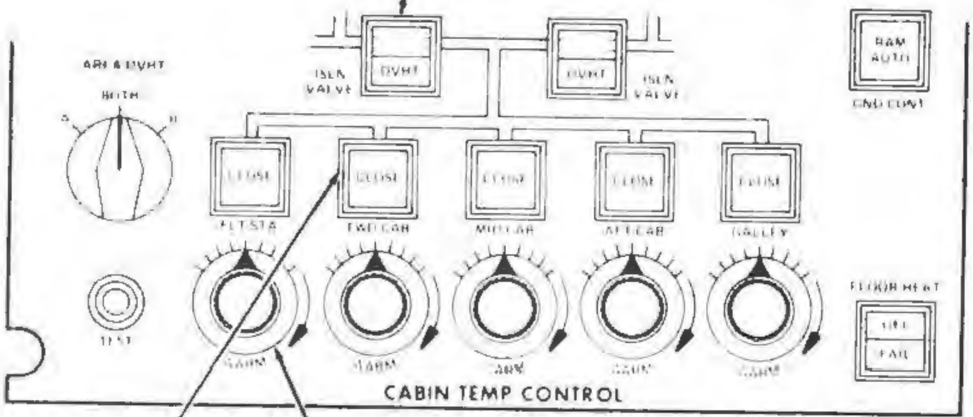
OUT - Valve closed and holding lock released.

3W7, 8 - ISLN NO. 2, NO. 3.



ECS ANNUNCIATOR LIGHT

Indicates ECS malfunction.



ZONE TRIM SWITCH

Controls respective motor-operated zone trim valve.

IN - Zone temperature controller modulates valve to maintain temperature scheduled by zone temperature selector knob.

OUT - Valve closes and CLOSE is illuminated when valve closes.

3V3, 4 - TEMP CONT FLT STA.

3V9 THROUGH 16 - ZONE CENTER TEMPERATURE CONTROL.

ZONE TEMPERATURE SELECTOR

Controls temperature of respective zone by adjusting amount of hot manifold air being added by the zone trim valve or modifying the pack output temperature by changing the position of the ram air exit door and/-or turbine bypass valves.

3V3, 4 - TEMP CONT FLT STA

3V9 THROUGH 16 - ZONE CENTER TEMPERATURE CONTROL.

ZONE TEMPERATURE CONTROL (SHEET 2)

DUCT AREA OVERHEAT LOOP SELECTOR SWITCH

Permits selection of area overheat loop sensing circuits.

BOTH - Either A or B loop illuminates AREA OVHT warning lights.

A - B loop is deactivated. If A loop senses overheat respective AREA OVHT light is illuminated.

B - A loop is deactivated. If B loop senses overheat respective AREA OVHT light is illuminated.

3W13, 14 - DUCT AREA OVHT DET.

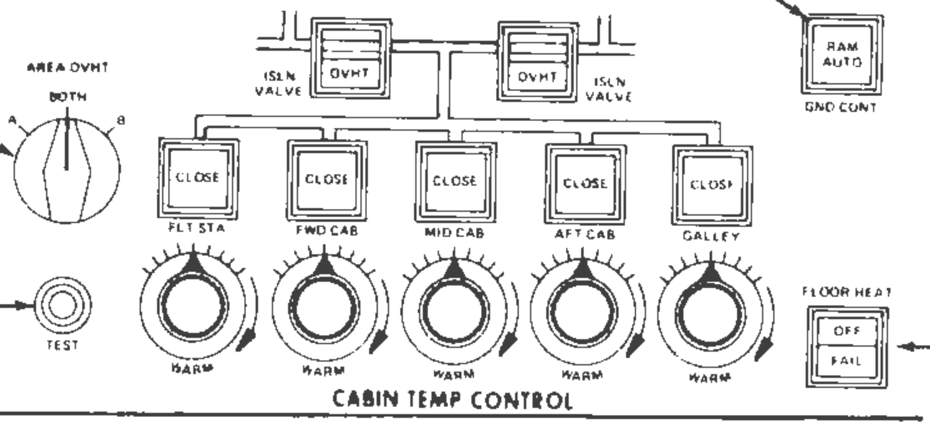
RAM/AUTO SWITCH

Permits faster warmup of cold-soaked aircraft on the ground.

IN - Ram air doors are full open when aircraft is on the ground.

OUT - RAM/AUTO light illuminates. Doors are positioned automatically by pack temperature controller.

3V5, 6, 7, 8, 17, 18 - PACK AUTO/MAN.



AREA OVERHEAT TEST BUTTON

Tests selected area overheat loop sensing circuit. When pressed, all seven AREA OVHT warning lights, wing anti-ice DUCT FAIL warning lights on WING ANTI-ICE panel, and AREA/DUCT OVERHEAT annunciator light are illuminated.

3W13, 14 - DUCT AREA OVHT DET.

FLOOR HEAT SWITCH

Controls electric floor heating elements in cabin floor.

IN - Energizes floor heating elements.

FAIL - Excessive floor temperature or an electrical fault in heating elements. All heating elements are de-energized.

OUT - DFF is illuminated and heater elements are de-energized.

3W11, 12 - FLOOR HEAT.

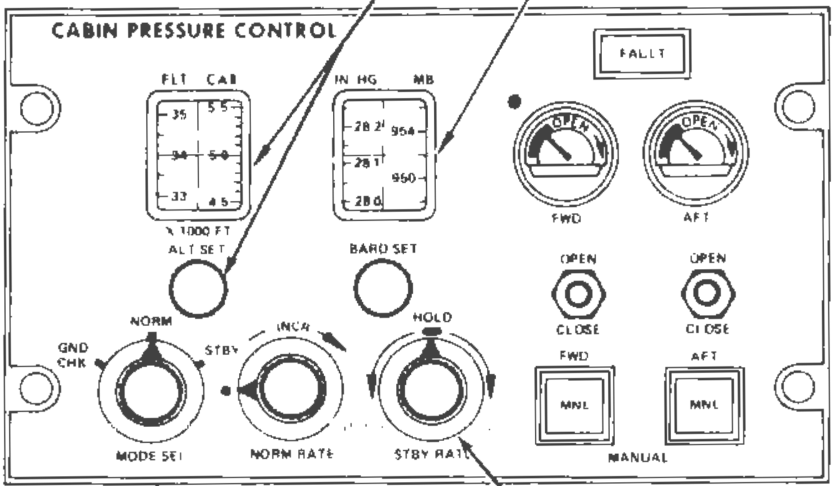
CABIN PRESSURE CONTROLS (SHEET 1)

ALTITUDE SELECT INDICATOR AND CONTROL

The ALT SET control sets selected cabin flight altitudes. FLT shows preset aircraft altitude. CAB shows cabin altitude when pressurized to maximum differential.

BAROMETRIC CORRECTION INDICATOR AND CONTROL

Control rotates tape to set barometric pressure and program pressurization controller.



STANDBY RATE CONTROL

Permits selection of manual cabin altitude rate change when mode select switch is in STBY. Pre-selected altitude function is not operative.

HOLD - Maintains existing cabin altitude.

DSCD - Rotating control from HOLD toward DSCD increases cabin altitude rate of descent from 0 to 1000 FPM.

ASCD - Rotating control from HOLD toward ASCD increases cabin altitude rate of ascent from 0 to 1000 FPM.

3X11, 12 - CABIN PRESSURE CONT STBY

MODE SELECT SWITCH

GRD CHK - Permits normal system check on the ground.

NORM - Selects fully automatic pressurization at rates selected by normal rate control. On the ground the outflow valves are fully open.

STBY - Cabin altitude rates selected by standby rate control.

3X9, 10, 11, 12 - CABIN PRESSURE CONT.

NORMAL RATE CONTROL

Permits selection of automatic cabin altitude rate of change when mode select switch is in NORM. In detent, the cabin will ascend at 500 FPM and descend at 300 FPM. Rotating the control out of detent increases or decreases cabin rate of change. Cabin altitude will level off at preselected cruise altitude.
3X9, 10 - CABIN PRESSURE CONT AUTO

CABIN PRESSURE CONTROLS (SHEET 2)

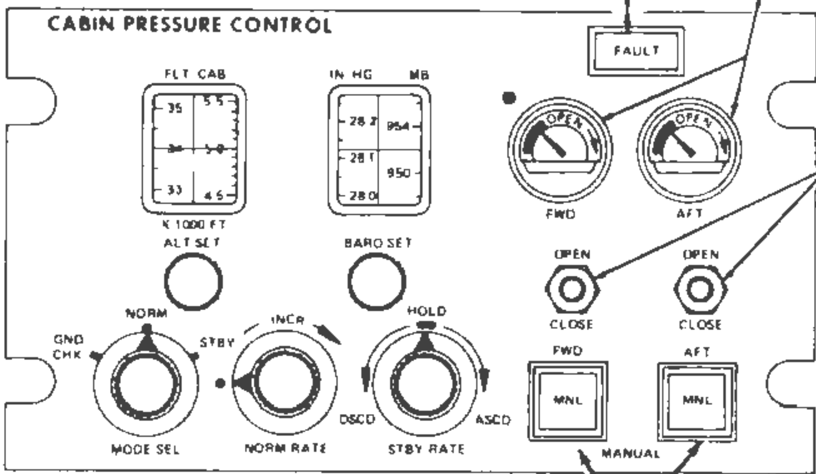
AUTO FAULT LIGHT

When aircraft above 14,000 feet and either or both outflow valve are open beyond normal limit, respective valve position indicator pointer will be above green band. Power removed from automatic control and must be positioned manually. With both selector switches in manual, the light will go out when faulty valve(s) is manually returned to its normal position.

Light also illuminates and out flow valves close when the cabin altitude exceeds 11,500 feet.

OUTFLOW VALVE POSITION INDICATORS

Pointers indicate relative position of outflow valves. Green band covers normal range Forward valve does not close beyond dot until aft valve is closed.



OUTFLOW VALVE MANUAL SWITCHES

Permits manual operation of outflow valves using DC motor when MNL is illuminated.

OPEN	- Momentary position that energizes motor to open outflow valve.
CENTER	- Spring-loaded off position.
CLOSE	- Momentary position that energizes motor to close outflow valve.

MANUAL SELECTOR SWITCHES

Selects manual or automatic control of outflow valves.

IN	MNL is illuminated and outflow valves are controlled manually by outflow valve manual switches.
OUT -	MNL is extinguished and outflow valves are automatically controlled by mode selector switch position.

1H1, 2 - MANUAL CABIN PRESS CONTROL.

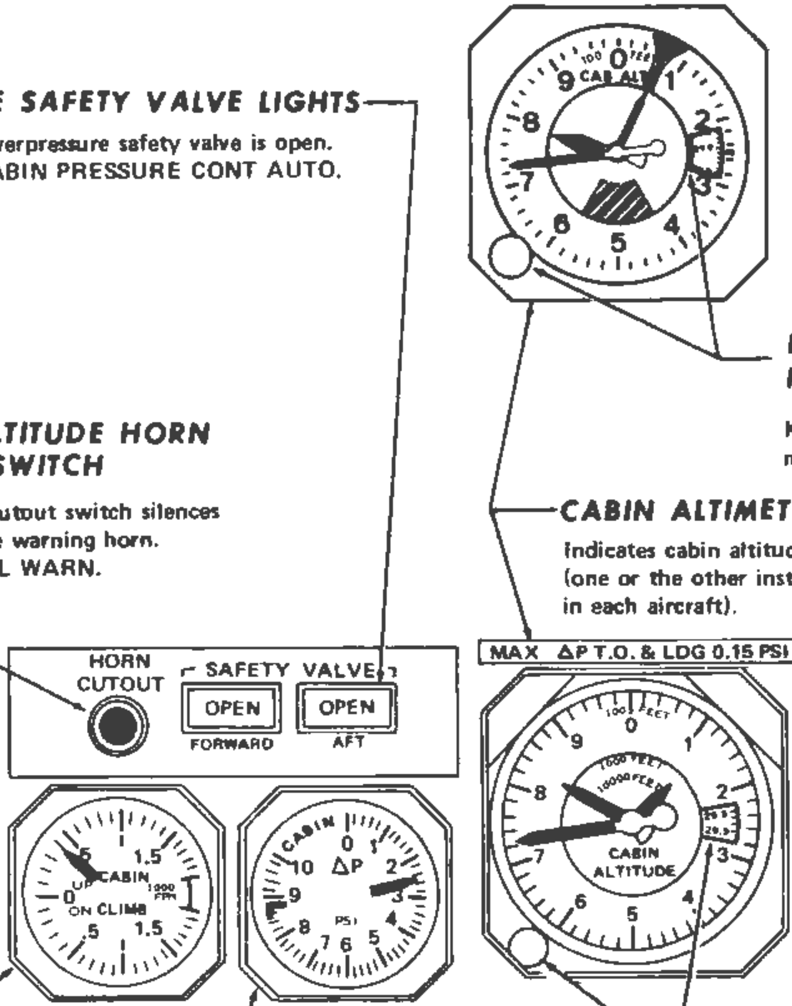
CABIN PRESSURE INDICATORS

PRESSURE SAFETY VALVE LIGHTS

Respective overpressure safety valve is open.
3X9, 10 - CABIN PRESSURE CONT AUTO.

CABIN ALTITUDE HORN CUTOUT SWITCH

Pushbutton cutout switch silences cabin altitude warning horn.
1LB - AURAL WARN.



BAROMETRIC CORRECTION KNOB AND WINDOW

Knob rotates dial to place barometric pressure setting in window.

CABIN ALTIMETER

Indicates cabin altitude (one or the other installed in each aircraft).

BAROMETRIC CORRECTION KNOB AND WINDOW

Knob rotates dial to place barometric pressure setting in window.

CABIN RATE OF CLIMB INDICATOR

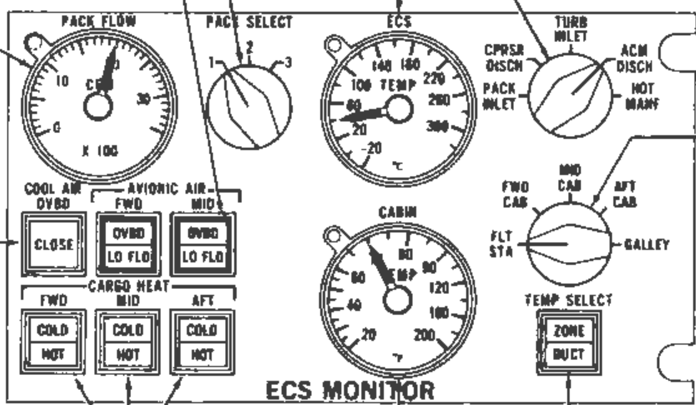
Indicates rate of cabin altitude change.

CABIN DIFFERENTIAL PRESSURE INDICATOR

Indicates difference of pressure between inside and outside of cabin.

(6173)

ECS MONITOR



PACK SELECT SWITCH

Selects individual pack for flow and temperature indication.

AVIONICS AIRFLOW INDICATORS

OVBD - Cooling air overboard valve is open.

LO FLO - Air in ventilation duct is too warm or flow is restricted.

2L5 - AVIONICS AIR MON.

PACK FLOW INDICATOR

Indicates air output of selected pack.
3V2 - PACK FLOW IND.

COOL AIR OVERBOARD SWITCH

Controls overboard cooling air valves from galley and avionics compartments.

IN - Opens galley overboard valve and arms both avionics compartment valves to open if flow is restricted. Both avionics valves open on the ground.

OUT - All three valves close.

CLOSE - Indicates switch position.

1J14 - AIR OVBD.

CARGO HEAT SWITCHES

IN - Recirculating fan is controlled by temperature sensing switch.

COLD - Temperature is too low

HOT - Temperature is too high and fan is turned off.

OUT - Recirculating fan is turned off and HOT is extinguished. COLD illuminates when temperature is too low.

3W9, 10 CARGO TEMP, FWD, MID, AFT

ECS TEMPERATURE INDICATOR

Indicates temperature for position selected by pack select switch and ECS temperature selector switch.

ECS TEMPERATURE SELECTOR SWITCH

Temperature of each component is indicated on ECS temperature indicator for selected pack.

CABIN ZONE TEMPERATURE SELECTOR

Temperature for selected zone is shown on cabin temperature indicator.

ZONE/DUCT TEMPERATURE SELECTOR SWITCH

IN - Temperature of selected zone discharge duct air is shown on cabin air temperature indicator. Duct indicates switch position.

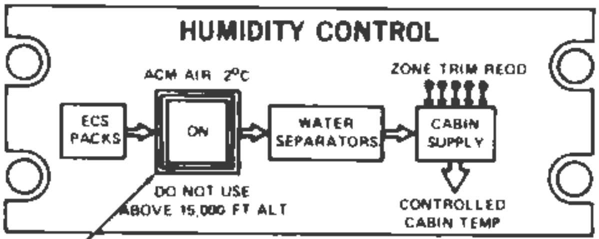
OUT - Temperature of selected zone is shown on cabin air temperature indicator. Zone indicates switch position.

CABIN AIR TEMPERATURE INDICATOR

Indicates temperature of zone or duct for the position selected on cabin temperature selector.

3V1 - ECS AIR TEMP IND.

HUMIDITY CONTROL PANEL



HUMIDITY CONTROL SWITCH

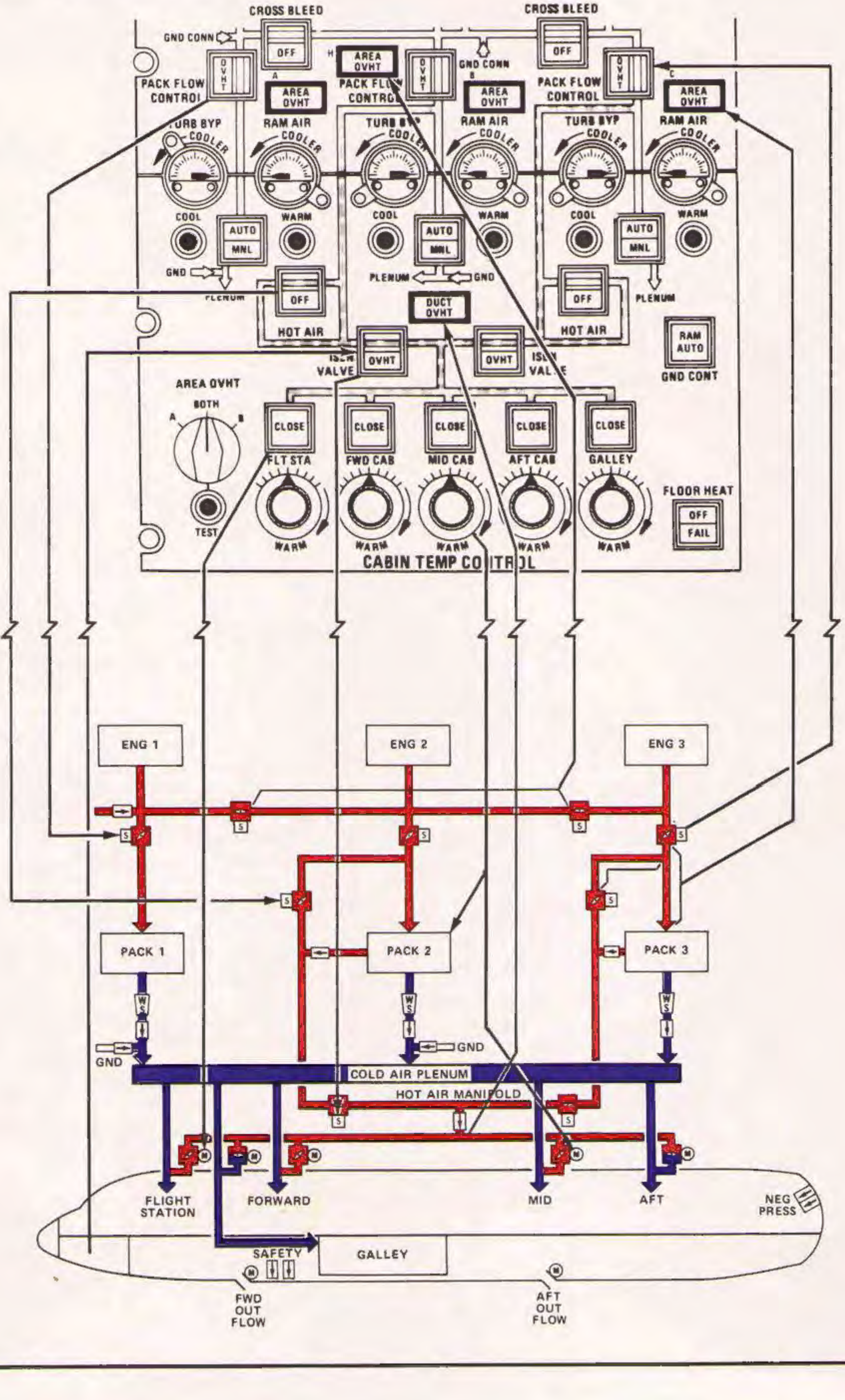
Permits overriding all signals to the pack temperature controller to cool ACM discharge air to just above freezing point.

IN - The ON light illuminates, the turbine bypass valve closes, and the ram air exhaust louvers open so that ACM discharge air is approximately + 2°C. All five zone trim switches must be IN and the trim valves operable.

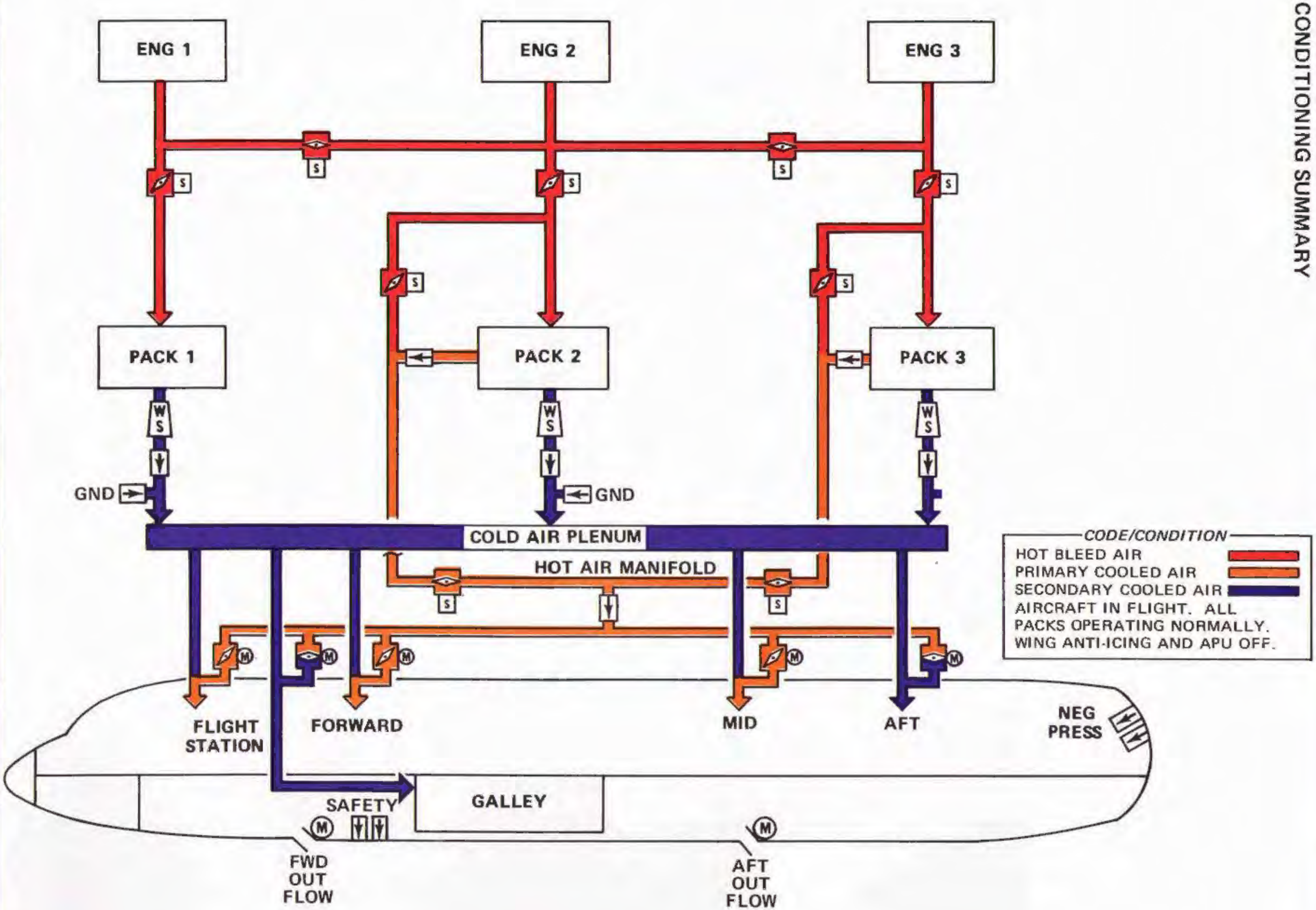
OUT - Normal switch position. Pack temperature controller responds normally to signals from the zone temperature controller.

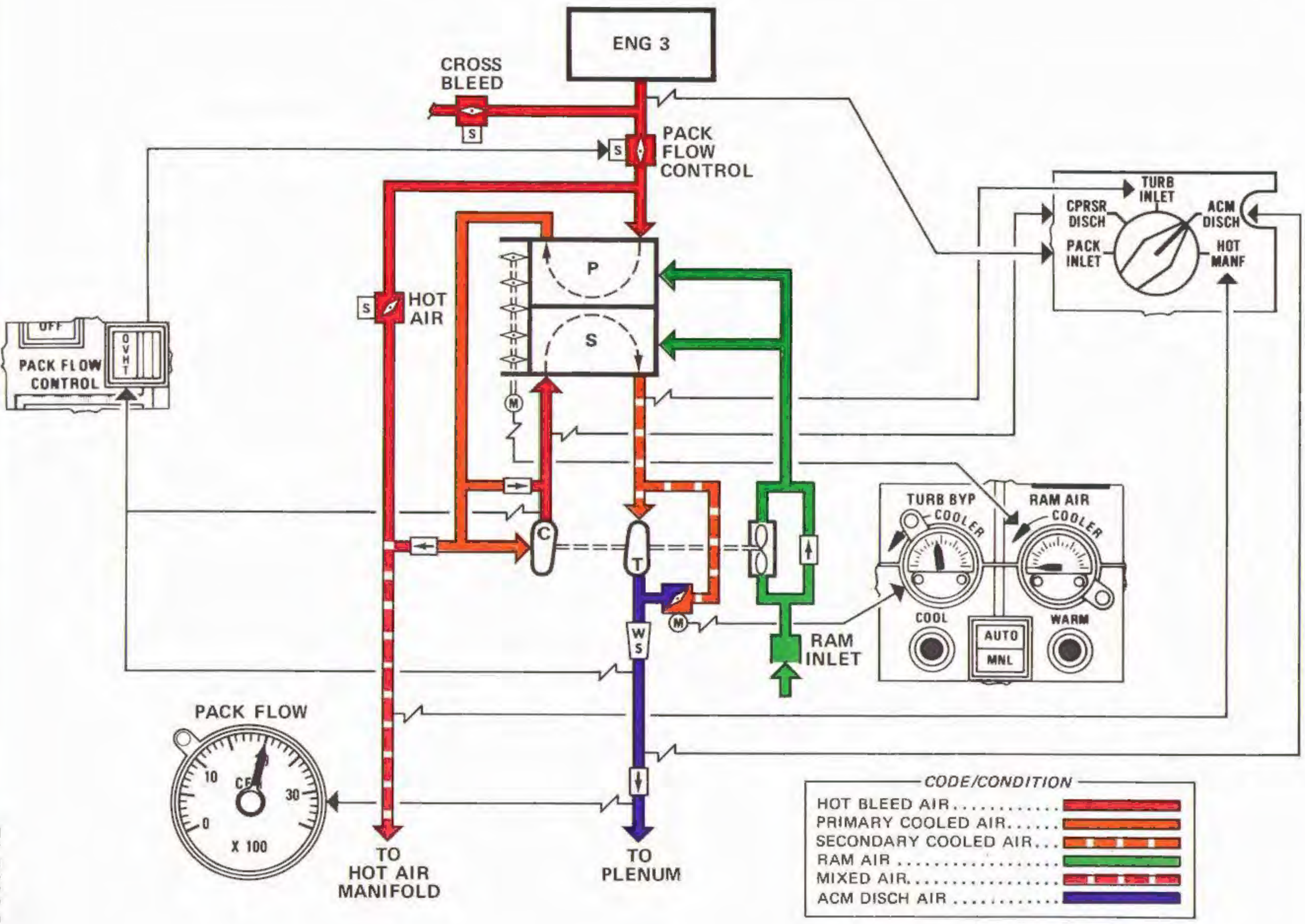
3V9 - ZONE TEMPERATURE CONTROL, FWD CAB.

AIR CONDITIONING CONTROLS



AIR CONDITIONING SUMMARY




ENG 3
CROSS BLEED
S
PACK FLOW CONTROL
HOT AIR
P
S
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T
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RAM INLET
OFF
PACK FLOW CONTROL
OVHT
TURB INLET
CPRSR DISCH
ACM DISCH
PACK INLET
HOT MANF
TURB BYP COOLER
RAM AIR COOLER
COOL
WARM
AUTO
MNL
PACK FLOW
10
CF
30
0
X 100
TO HOT AIR MANIFOLD
TO PLENUM
CODE/CONDITION
HOT BLEED AIR
PRIMARY COOLED AIR
SECONDARY COOLED AIR
RAM AIR
MIXED AIR
ACM DISCH AIR

GENERAL

The air conditioning system provides complete environmental control (pressurization, ventilation, and temperature) for the flight station, the forward, mid and aft cabin, lavatories, galley, forward avionic, and mid-electrical compartments. The air conditioning system receives bleed air from the pneumatic manifold. During flight, or on the ground, pressure is provided by engine bleed air or the auxiliary power unit (APU). On the ground, when the above sources are not operating, high pressure ground carts may be connected to the pneumatic system manifold. Also, a low pressure ground air source providing pre-conditioned air may be connected directly to the cold air plenum.

AIR CONDITIONING PACKS

The system consists of three pack control and five zone control systems. Each receives air from the pneumatic supply system, with crossbleed shutoff valves available to divide the system into separate units. The major system components consist of a pack flow control valve, an air conditioning pack, and an electronic temperature control system.

PACK OPERATION

The main purpose of each air conditioning pack is to cool the hot bleed air as required to satisfy the heating, cooling, and pressurization requirements for the five individual aircraft zones.

During minimum cooling requirements, ram air passing over the primary and secondary heat exchangers will provide sufficient cooling for this mode of operation. When additional cooling is required, the partially cooled air from the secondary heat exchanger will pass through the air cycle machine (ACM) to provide the additional cooling.

PACK FLOW CONTROL VALVE

The pack flow control valve modulates to maintain a scheduled air mass into its pack. When the pack control switch is pressed, and air pressure is present, the valve will open. When the valve opens, the flow bar in the switch will illuminate. When the switch is released, the valve closes and the flow bar light will be extinguished. When air pressure is not available, the valve closes and the flow bar light will be extinguished regardless of switch position. The other half of the switch contains an overheat malfunction light. The valve will automatically lock closed any time the related ACM overheats. An excessive air flow will also lock the valve closed.

RAM AIR SYSTEM

Cooling air for the heat exchangers enters the aircraft through a fixed opening inlet air scoop, passes over the two heat exchangers, and exhausts overboard through the ram air exit doors. During normal inflight conditions, the pack temperature controller modulates the ram air exit doors to control the volume of cooling ram air required to provide the amount of heat exchanger cooling needed. The ram air cooling capability is a function of exit door position and outside temperature. The relative position of the ram air exit doors is shown on the ram air position indicator.

If the cooling requirements exceed the ram air cooling capability (exit doors full open), additional cooling must come from the ACM. The temperature controller will modulate the turbine bypass toward close. This forces air through the ACM turbine to drive the compressor and ram air fan which is mounted on a common shaft. On the ground, the ram air exit doors are driven full open. While on the ground, cooling is provided by the ACM and the ram air fan forcing ambient air over the heat exchangers.

TURBINE BYPASS VALVE

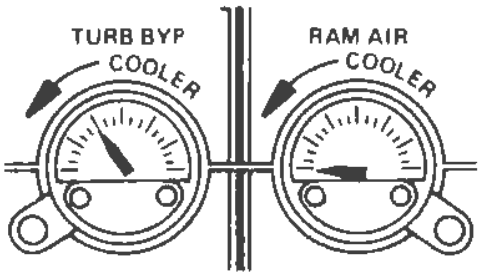
Based on cooling requirements, the pack temperature controller determines the proportion of heat exchanger output that bypasses the ACM turbine by positioning the turbine bypass valve. The turbine bypass valve is held full open until the ram air system is no longer capable of providing sufficient cooling. When additional cooling is required, the temperature controller will signal the bypass valve to start closing as required. This results in more airflow to the turbine and further cooling by expansion. Each pack produces the air temperature required by the zone asking for the coolest temperature.

RAM AIR EXIT DOOR/TURBINE BYPASS VALVE OPERATION AND INDICATOR POSITION

The following illustrations show what the panel indications should be for the operating conditions described. Each illustration shows the initial pre-position the indicators assume when in an operating mode, ground or air. They will then modulate from these positions to control temperature as required.

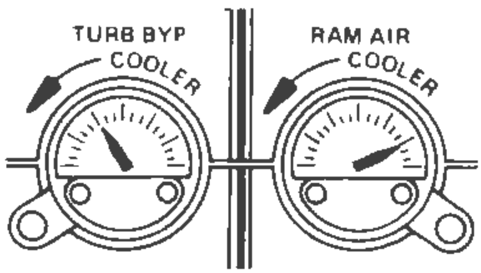
RAM AIR EXIT DOOR/TURBINE BYPASS VALVE OPERATION AND INDICATOR POSITION (Cont'd)

AIRCRAFT ON GROUND
(PACK ON OR OFF - PACK AUTO)



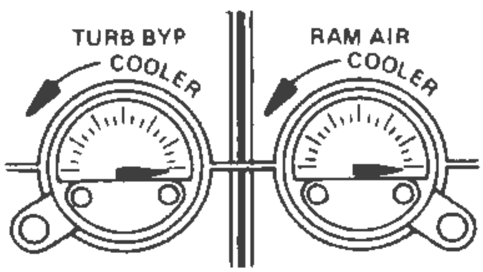
The ram air exit door indicator is normally in the nine o'clock position (open) on the ground with the pack on or off. When the pack is off, the turbine bypass indicator should be in the ten thirty to eleven o'clock position. When the pack is turned on, the turbine bypass is free to move to a cooler or warmer position, depending on cooling requirements.

AIRCRAFT IN FLIGHT
(AT LIFTOFF - PACK AUTO)



On takeoff, the gear safety switches signal the ram air exit door to automatically move from the full open position to the one-thirty/two o'clock position. This feature is incorporated to minimize cabin noise and improve passenger comfort. The turbine bypass valve will then start moving toward the three o'clock position as the outside air temperature decreases.

CRUISE CONFIGURATION (PACK AUTO)

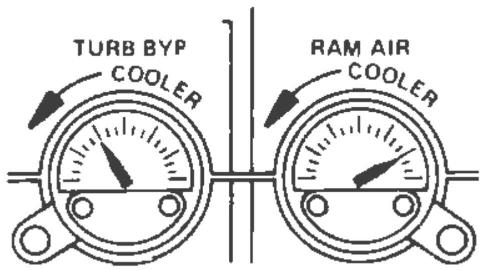


During climb, as the outside air temperature decreases, the turbine bypass valve will move to the three o'clock position. This allows the bleed air to bypass the ACM turbine. When the turbine bypass valve reaches the open position, the ram air exit door will then move from one thirty o'clock toward the full closed (three o'clock) position. The indication shown above is what you should expect to see during cruise, when cooling requirements are satisfied and the system is stabilized.

Should heating be required in any of the five zones, it will be provided by pack 2 and 3 as described under, "Hot Air Manifold and Hot Air Valve" this section.

During descent, when cooling is again required, the ram air exit door will move to the one thirty o'clock position. When additional cooling is required due to an increase in outside air temperature, the turbine bypass valve will then modulate toward cooler to satisfy the additional cooling requirement.

AIRCRAFT IN FLIGHT PACK SWITCH OFF
(PACK AUTO)



If a pack is shut down in flight, the turbine bypass valve and the ram air exit door will automatically assume the above position.

COMPRESSOR BYPASS CHECK VALVE

This valve permits primary cooled air to bypass the compressor at low ACM speed. When the ACM is operating at higher speeds, compressor discharge pressure is higher than inlet pressure. This closes the bypass check valve and routes all air through the compressor.

HOT AIR MANIFOLD

During normal operation, all packs are programmed to provide air to a temperature required by the zone calling for the coldest temperature. To prevent other zones from being too cold, packs 2 and 3 also supply temperature regulated hot air to the hot air manifold. Hot air is then ducted to the hot air trim control valves which modulate to maintain the selected temperature for each zone.

HOT AIR VALVE

The hot air valve modulates to maintain a constant, stable temperature in the hot air manifold of 95°C. It does this by sensing the temperature of the air going to the hot air manifold from the primary heat exchanger and adds enough uncooled bleed air to maintain the desired temperature.

The hot air valve is automatically closed any time the pack flow control valve is closed. If the hot air valve is manually closed when the pack is operating, the manifold will continue to receive warm air from the primary heat exchanger; however, this air is not controlled to a constant temperature. Both packs hot air valves and hot air isolation valves will lock closed automatically any time the hot air manifold temperature becomes excessive.

HOT AIR ISOLATION VALVE

The hot air isolation valves allow the isolation of a malfunctioning system. The isolation valves close any time the related pack flow control valve is closed, whenever an overheat occurs in the forward avionics compartment, or whenever the hot air manifold temperature becomes excessive.

ZONE TRIM VALVES

Each of the five hot air distribution ducts has a motor driven trim valve which modulates to control the amount of hot air being added to each zone distribution duct coming from the cold air plenum. All or any of the valves may be closed by releasing its switch. When released, the close light is armed to come on when the valve is fully closed. When the zone trim valve is closed, its temperature control signal is removed from the automatic temperature controller.

ZONE AIR DISTRIBUTION

Each of the five zones receives its main supply of air from the cold air plenum. The temperature of the air is set by the zone requiring the coldest air. The zone asking for the coldest air would normally have its trim valve closed while all the rest would be open in varying amounts depending upon temperature requirements.

CABIN TEMPERATURE SELECTOR

Each individual zone temperature is selected by its cabin temperature control knob. The mid-position is 75°F and the full range is 65°F to 85°F. The temperature control units sense the temperature in each zone and compare it with the temperature selected. If a difference exists, the zone trim valve will adjust the amount of hot air added to the zone. Normally, the zone requiring the coldest temperature will have its zone trim valve closed and use air directly from the cold air plenum. If additional cooling is required for this zone, the packs will provide cooler air for the plenum.

AUTOMATIC TEMPERATURE CONTROL

Pressing the pack auto/manual switch in will cause the auto legend to illuminate. Temperature control is provided automatically by pack temperature controllers and zone temperature controllers. The pack temperature controller responds to the pack discharge sensor signals. The zone temperature controllers provide reference signals to determine the duct temperature. These signals will schedule the proper turbine bypass valve and ram air exit door positions to provide the required pack discharge temperature.

Each zone temperature controller provides an electrical duct reference signal to the three pack temperature controllers according to a zone priority. The pack 1 controller receives duct reference commands from all five zone controllers and, through a selector circuit, regulates its pack discharge temperature to the zone calling for the coldest temperature. The pack 2 and 3 controllers respond in a similar manner, but receive duct reference commands from only the three cabin zone controllers (forward, mid, and aft cabin). Both packs 2 and 3 regulate pack discharge temperature to the coldest of these three commands; therefore, it is likely that pack 1 will operate at a different pack discharge temperature than packs 2 and 3. By design, the cold air plenum, which receives the outputs of all three packs, directs most of pack 1 output to the flight station and galley ducts. Since the duct reference signals from the flight station and galley are connected only to pack 1 controller, it is possible (but not necessary) for the flight station or galley zone controller to be controlling pack 1 output, while one of the cabin zone controllers is controlling packs 2 and 3.

MANUAL TEMPERATURE CONTROL

Release of the pack auto/manual switch will cause the manual legend to illuminate. The cool-warm switches are now armed to directly control the position of the turbine bypass and ram air exit door.

MANUAL TEMPERATURE CONTROL (Cont'd)

When the cool switch is pressed, the ram air exit door and turbine bypass valve will move toward cool in the proper sequence; that is, the ram air exit door will first move to the full open position. The turbine bypass valve will then start to close.

When the warm switch is pressed, the ram air exit door and turbine bypass will move toward warm in proper sequence; that is, the turbine bypass valve will first move to the full open position. The ram air exit door will then start closing. The valve and door operating position can be observed by monitoring the related position indicator.

ECS MONITORING

With the pack selector switch positioned to any one of the three packs, the pack flow gauge will indicate the rate of airflow from the selected pack. By positioning the ECS temperature selector switch to any one of its five positions, the related temperature may be monitored for the selected pack.

PACK OVERHEAT

A temperature of 215°C at the ACM compressor discharge or 98°C at the ACM discharge will trip the pack. If either condition occurs, the pack flow control valve will automatically lock closed. The pack switch flowbar light will go out and the overheat light portion of the switch will illuminate. With the pack shut down, the overheat light will go out when the overheat temperature no longer exists. In the case of pack number 2 or 3, the corresponding hot air and hot air isolation valves lock closed.

In the event of a pack trip, the ECS temperature selector and the pack select switch are to be used to check and monitor the compressor and ACM discharge temperatures.

With the overheat light out, the pack may be reactivated by opening the pack valve. For pack two and three the hot air and hot air isolation valves must be cycled to place them in operation.

HOT AIR MANIFOLD OVERHEAT

An overheat in the hot air manifold (150°C) will occur if either hot air valve fails to control the temperature in the hot air manifold. If this occurs, the hot air duct overheat light located between the two hot air valve switches will come on and both hot air and hot air isolation valves will lock closed. The overheat light will go out when the temperature returns to normal. All four valve switches must be pressed off to release the valve lock.

AVIONICS COMPARTMENT HOT

If the forward avionics compartment temperature becomes excessive, both hot air isolation valves lock closed. When this condition occurs, both valve switch flowbars will go out and the overheat legend portion of each will illuminate. This could be caused by a duct leak in the compartment. The overheat lights will go out when the compartment temperature returns to normal. This situation could also occur with the aircraft on the ground on a very hot day. The switches must be cycled to restore operation.

EXTERNAL CONDITIONED AIR

Preconditioned air may be introduced directly into the cold air plenum from an external source through two ground connections near the ACM compartment.

RAM AUTO GROUND CONTROL

Releasing the ram auto switch with the aircraft on the ground will allow the pack control heating signals to automatically position the ram air exit doors to provide a more rapid warmup during very cold weather. With switch released, the ram auto switch light and the ECS caution and warning light will be illuminated. During this mode of operation, with APU selected to minimum, the aircraft will be kept warm for long periods of time. If a faster warm up is required, the APU can be operated in the normal mode.

CABIN FLOOR HEAT

Automatic electric blankets maintain a constant temperature for the floor over the wing center section, the main wheel wells, and the hydraulic service center. The system reduces the loss of heat through the cabin floor over those areas that are exposed to ambient air. Excessive floor temperature de-energizes the heat elements and causes fail to be illuminated in the switch. Pressing the floor heat switch twice resets the system, providing the temperature has returned to normal. If the fail light was caused by an electrical short or open, the fail light will come on immediately when the switch is pressed in.

ECS MONITOR PANEL

The ECS monitor panel provides the means to monitor various temperatures throughout each of the ACMs and in the airflow to each pack. Points in the system that can be selected to the temperature gauge are:

ECS MONITOR PANEL (Cont'd)

Pack inlet - As the air enters crossbleed manifold.

Compressor discharge - As air leaves compressor.

Turbine inlet - As air leaves the secondary heat exchanger.

ACM discharge - As air leaves the water separator.

Hot air manifold - Only on pack 2 and 3, before air enters the hot air manifold

The pack flow indicator shows the air output rate of the selected pack in cubic feet-per-minute.

AREA DUCT OVERHEAT SENSORS

Each of the seven bleed air duct areas and the left and right wing anti-ice ducts are monitored by an A and B loop sensor. If either loop detects an area overtemperature, the related area overheat light and the area duct caution and warning light will illuminate. The area overheat lights are warning lights only. There is no automatic shutdown of the system.

Pressing the area overheat test switch will illuminate the seven area overheat lights, both wing anti-ice duct fail lights, and the area/duct overheat caution and warning light.

An overtemperature sensed around the ducts from the engine isolation valve to the crossbleed and flow control valve for systems 1 and 3, will illuminate area overheat light D for engine No. 1 and E for engine No. 3.

An overtemperature sensed around the duct from the engine isolation valve to the ATM isolation valve for system No. 2 will illuminate area overheat light J.

If overtemperature is sensed around the duct from the ATM isolation valve to the crossbleed valves and No. 2 pack flow control valve, area overheat light H will illuminate.

The ducts from each pack flow control valve run forward through the forward cargo compartment and the forward cargo heat exchanger. An overtemperature sensed around a duct in this area will illuminate the related area overheat light (A, B, or C).

Since the ducts are located close together, the duct sensors are rigged so that if one senses an overheat it will inhibit the others from providing a signal. If a duct leak occurs in the forward cargo heat exchanger compartment, a separate sensor will turn on all three pack area overheat lights (A, B, and, C). A leak in the mid or aft cargo heat exchanger will illuminate area overheat light J.

EXCESSIVE PACK FLOW LOCKOUT

An excessive flow sensor for each pack is located upstream of the related pack flow control valve inside the mid electrical compartment. The sensor will automatically close the proper valves to isolate the pack whenever an excessive flow is sensed. An excessive flow is characterized as an unrestricted leak that could cause the battery to overheat and fail if left unattended for several minutes. A leak downstream of the pack flow control valve would not be large enough to cause this problem due to the restricting characteristics of the valve An aid to recognizing the problem is the fact that this is the only fault that will automatically close and lock a crossbleed valve. For the No. 1 and No. 3 system, this includes the respective engine isolation valve, left or right crossbleed valve, and the No. 1 and No. 3 pack flow control valve. In the case of the No. 2 system, this includes the ATM isolation valve, the left and right crossbleed valves, and the No. 2 pack flow control valve.

To restore the system, it is necessary to place all associated valve switches to the valve closed position. The electrical locking circuit will be deactivated only when all switches are in this position. Placing the valve switches to the valve open position should then restore the system to normal.

CARGO COMPARTMENT HEATING

Each cargo compartment is provided with a heating system to maintain a temperature above 45^{O}F. This is accomplished by a thermostatically controlled recirculating fan which draws air from one end of the cargo compartment and passes it over the hot pneumatic (bleed) ducts located in the heat exchanger beneath the cargo compartment floor. The air is then exhausted back into the compartment.

The mid and aft compartments use the bleed duct from engine 2 and APU. The forward compartment uses all three bleeds. The cargo heat switches, with cold and hot legends, provide for control and monitoring of the system. The cold light is on any time the

CARGO COMPARTMENT HEATING (Cont'd)

compartment is below 45°F. The hot light is on any time the temperature is above 95°F. The fan turns off automatically if the hot light is on: when the hot light goes out, the fan starts. With the switch off, the fan is off and the hot light is disarmed. The cold light is armed with the switch off or on.

AVIONIC AIR VENTILATION

The forward avionics and mid electrical compartments are normally ventilated by a full-time operating fan. On the ground, the fan air exhausts overboard through its related overboard flow control valve. In flight, the overboard valves are closed by the air/ground safety switches. Fan air is then discharged under the cargo floor and overboard through the forward outflow valve. Fan operation is monitored in flight by a differential pressure switch. If a fan stops operating, the differential pressure switch closes and a signal is sent to open its related overboard flow control valve. When this occurs, the related avionics airflow overboard light will illuminate. Additionally, since the battery is located in the mid electrical compartment, the battery charger is deactivated by the differential pressure switch.

A heater element adjacent to a thermal switch is used in both the compartment cooling air ducts to monitor the air flow out of the compartment. Any time flow is reduced below a pre-determined value, the heater will warm the thermal switch and the switch will close. When this occurs, the related avionics airflow low flow light will illuminate.

GALLEY VENTILATION

The galley ventilating system fan operates continuously in flight and on the ground to remove heat and odors from the galley area and from around the ovens. The ventilating air is normally exhausted directly overboard through the overboard flow control valve. In the event of a reduced cabin air supply, the overboard flow control valve may be closed by releasing the cool air overboard switch to conserve cabin pressurization. When the valve is closed, galley air is vented into an area outboard of the forward cargo compartment and exhausted through the forward outflow valve.

COOL AIR OVERBOARD SWITCH

The cool air overboard switch, located on the engineer's panel controls the position of the overboard flow control valves for the galley, forward avionic, and mid electrical compartments.

With the aircraft airborne and the switch pressed in (open position), the galley overboard valve will be open and the forward and mid avionics compartment valves will be closed. If there is an exhaust fan failure in either avionics compartment, the related overboard flow control valve will automatically open and the related avionics compartment overboard light will illuminate. Ventilating air will now exahust directly overboard rather than through the forward outflow valve. If pressurization becomes a problem under this condition, releasing the cool air overboard switch will provide an override signal to close the galley and related avionics overboard valve. When the valve closes, the avionics overboard light will be extinguished and the cool air overboard close light will illuminate.

With the aircraft on the ground, the compartment overboard valves will be open and the overboard light will illuminate regardless of switch position. The galley overboard valve can be opened or closed with the cool air overboard switch while in the air or on the ground.

HUMIDITY CONTROL

The humidity control system increases the air conditioning system moisture removal capability. This is accomplished by driving the three pack output temperatures to approximately 2°C. The cooler temperatures permit removal of a higher percentage of moisture content by the water separators. The cold dry air is then reheated to the required temperature by the hot air zone trim system.

This system is not to be operated when airborne, even though the panel placard indicates inflight use.

WATER SEPARATOR

If ice forms in the water separator, a drop in pressure across the water separator will occur. When operating in the auto mode, a differential pressure switch will sense this drop and open the turbine bypass valve enough to allow the partially cooled bleed air to melt the ice. When the ice melts, the drop in pressure decreases. The differential pressure switch will then remove the open signal from the turbine bypass valve

When operating the pack in manual or when humidity control is on, there is no automatic de-icing of the water separator.

Water from the separator is collected and sprayed over the secondary heat exchanger to improve its cooling capability.

PRESSURIZATION CONTROL

GENERAL

The pressurization control system regulates and maintains cabin altitude and the rate of cabin pressure change as a function of settings on the pressure control panel. This is accomplished by regulating the exhaust air flow from the cabin through two motor-driven outflow valves. The pressurization control system includes the electronic cabin pressure controller, pressure control panel, two outflow valves, two cabin safety valves, and two negative pressure relief valves.

The pressurization control system provides the necessary signals to regulate the position of the outflow valves. This can be accomplished in any one of three modes of operation; normal, standby, or manual. The pressure control panel also provides a mode to conduct ground checks of the system. The normal mode is the primary mode of operation with standby and manual as backup modes. Manual selection overrides the normal and standby modes and can control either or both outflow valves.

NORMAL OPERATION

With the mode selector switch in normal and the normal rate knob at the reference dot, the cabin rate of change will automatically maintain a 500 feet per minute climb or 300 feet per minute descent. Rotating the knob from the dot will vary cabin rate of change. Maximum would be 1500 feet per minute climb and 900 feet per minute descent. Cabin altitude will level off at preselected cruise altitude.

STANDBY OPERATION

If the normal pressurization system fails, placing the mode selector switch to standby will provide modified automatic control. When the mode selector is in the standby position, rotating the standby rate selector povides the desired rate of cabin altitude change. The hold position represents zero change and signals the pressure controller to hold the cabin altitude at the level last achieved. The descend or ascend positions will signal the pressure controller to control cabin altitude rate of change in that direction proportional to selector position. The standby rate selector provides rate of change between zero and 1,000 feet per minute in either direction with disregard for cabin altitude or maximum differential. The selection is linear with no incremental detents.

MANUAL OPERATION

If the normal or standby systems are unable to control pressure, the forward/aft manual switch can be pushed in to select the manual mode of operation for either or both outflow valves. Pressing the manual switch light will latch it in, transfer the outflow valve control to manual, and illuminate the manual switchlight. Manual operation is independent of the pressure controller with control transferred to open-closed toggle switches which individually operate the outflow valves toward the open or closed position. When manually toggling outflow valves, the cabin altimeter, differential pressure indicator and rate of climb must be closely monitored while maintaining the cabin rate of change within the comfort level. The outflow valves may be operated independently. One may be selected to normal under command of the controller while the other is selected to manual.

OUTFLOW VALVE OPERATION

The cabin pressurization control system regulates and maintains cabin altitude by controlling the exhaust air flow from the cabin through two motor-driven door type outflow valves. Each valve has an actuator gear box containing an AC and a DC motor. The AC motor is used to position its outflow valve when operating in the normal and standby mode, while the manual mode uses the DC motor. The cabin altimeter, rate of climb, and differential pressure indicator are pneumatic instruments and require no electrical power The outflow valves automatically open on the ground. In flight, the forward valve will not close beyond the reference dot until after the aft valve has closed. This feature provides ventilation and cooling for the electronic compartments.

FAULT LIGHT

While operating in the normal or standby modes, if either or both outflow valves open beyond the normal green band with the aircraft above 14,000 feet, an altitude switch will deactivate the automatic control, apply both outflow valve motor brakes, and illuminate the fault light. This feature is designed to prevent the uncontrolled loss of cabin pressure.

If cabin altitude reaches approximately 11,500 feet, a closing signal will drive the outflow valves toward closed until the cabin altitude returns to a level that allows the altitude switch to open. The fault light will illuminate and remain on until the manual mode is selected for both outflow valves. This feature allows additional time for crew action in order to avoid deployment of the passenger oxygen masks.

FAULT LIGHT (Cont'd)

To obtain cabin pressure control any time during this sequence, it is necessary to revert to manual control.

To extinguish the fault light, it is necessary to select manual for both outflow valves.

CABIN SAFETY VALVES

The cabin safety valve is an automatic pressure relief valve which acts as a backup for the pressurization control system. If the present cabin to ambient differential pressure limit exceeds 8.8 PSI, the valve and related cover door opens, venting cabin air pressure to ambient. When a safety valve opens, the related safety valve open light illuminates. When the pressure is relieved, the safety valves close and the open lights go out. The external safety valve cover doors will remain open until manually closed on the ground.

NEGATIVE RELIEF VALVES

A negative pressure is created whenever the outside air pressure becomes greater than the cabin pressure. If the negative differential pressure level reaches 1 PSI, the negative relief valves open to allow ambient pressure to enter the aircraft. This will result in the cabin descent rate increasing to the aircraft descent rate.

* * *

CONTROLS AND INDICATORS

SYSTEM DESCRIPTION

LOGBOOK INSTRUCTIONS

NON-ROUTINE OPERATIONS

* * *

EXTERIOR LIGHTS CONTROLS

NOSEWHEEL LANDING LIGHT

Controls nosewheel light.

2G6, 7 - NOSE GEAR LT CONT, LAND

LANDING LIGHT SWITCHES

Controls left and right landing lights mounted in a fixed position in wing fillet leading edge.

2G9, 10 - WING LANDING

NOSEWHEEL TAXI LIGHT SWITCH

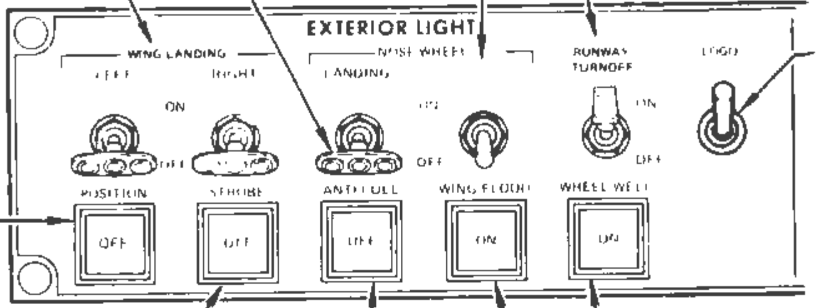
Controls low intensity taxi light mounted on nosewheel strut.

2G6, 8 - CONT TAXI

RUNWAY TURNOFF LIGHTS SWITCH

Controls lights in fuselage wing fillet leading edge.

2G4, 11 - RUNWAY TURNOFF



POSITION LIGHTS SWITCH

Controls forward and rear position lights mounted on wing tips.

IN - OFF is extinguished and position lights are energized.

OUT - OFF is illuminated and position lights are deenergized.

2K3,4,5,6 - WING POSITION

LOGO LIGHTS SWITCH

Controls logo lights.

2G1, 2 - LOGO LT

WHEEL WELL LIGHTS SWITCH

Controls wheel well lights.

IN - ON is illuminated and wheel well lights are energized.

OUT - ON is extinguished and wheel well lights are deenergized.

2K1, 2 - WHEEL WELL LT

STROBE LIGHTS SWITCH

Controls forward and aft strobe lights, mounted on each wing tip.

IN - OFF is extinguished and strobe lights are energized.

OUT - OFF is illuminated and strobe lights are deenergized.

2G5 - STROBE

ANTI-COLLISION LIGHTS SWITCH

Controls rotating lights on top and bottom of fuselage.

IN - OFF is extinguished and anti-collision lights are energized.

OUT - OFF is illuminated and anti-collision lights are deenergized.

3J15,16,17,18 - ANTI-COLL LIGHTS

WING FLOOD LIGHTS SWITCH

Controls fuselage mounted lights which illuminate wing leading edges and engine inlets.

IN - ON is illuminated and wing flood lights are energized.

OUT - ON is extinguished and wing flood lights are deenergized.

2G3 - WING FLOOD

INTERIOR LIGHT CONTROLS

FASTEN SEAT BELT SIGN SWITCH

IN - ON is illuminated, single chime sounds, and cabin FASTEN SEAT BELT and lavatory RETURN TO SEAT signs flash for 15 seconds and then remain illuminated.

OUT - ON is extinguished, single chime sounds, and cabin and lavatory sign lights are extinguished. Anytime passenger oxygen masks are presented light comes on.

2C9 - SEAT SIGNS

MAGNETIC COMPASS LIGHT SWITCH

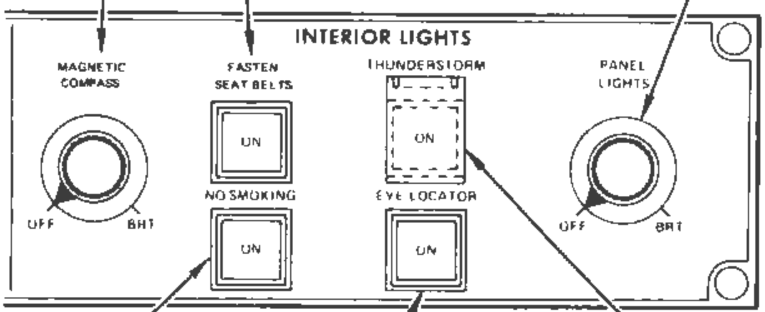
Controls brilliance of magnetic compass lighting.

1F8 - LIGHTS, STBY COMPASS

EYEBROW PANEL LIGHT SWITCH

Controls brilliance of eyebrow panel lighting.

2E3 - OVHD AND EYEBROW PANEL



THUNDERSTORM LIGHT SWITCH

IN - ON is illuminated and all dimmable flight station lights are energized to maximum brilliance regardless of dimming control position.

OUT - ON is extinguished and all flight station lights are controlled by respective dimming control.

3J2 - THUNDERSTORM LT

EYE LOCATOR LIGHT SWITCH

IN - ON is illuminated and pilots' eye position locator is illuminated.

OUT - ON is extinguished and pilots' eye position locator is off

2E1 - EYE LCT AND APRCH CHART

NO SMOKING SIGN SWITCH

IN - ON is illuminated, single chime sounds, and cabin NO SMOKING signs flash for 15 seconds and then remain illuminated.

OUT - ON is extinguished, single chime sounds, and cabin NO SMOKING signs are extinguished.

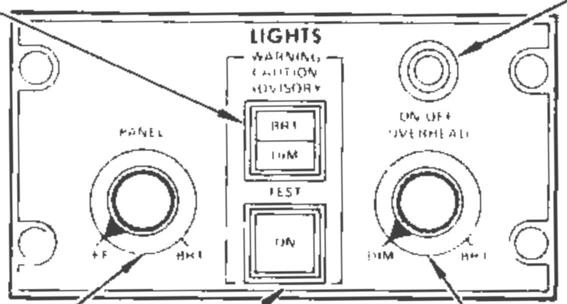
2C10 - NO SMOKING SIGNS

PILOTS' LIGHT CONTROLS

WARNING, CAUTION AND ADVISORY INTENSITY SWITCH

IN - DIM is illuminated when all pilot warning, caution and advisory lights are dimmed.

OUT BRT is illuminated when full bright illumination is provided.



GENERAL COCKPIT LIGHTING SWITCH

A pushbutton type switch controls the lights located in the flight station ceiling.

A similar type switch located just inside the flight station door also controls these lights.

Each time either switch is pressed, ON/OFF status of lights changes.

2K10 - OVHD FLOOD

PANEL BACK LIGHTING CONTROL

Controls intensity of the pilots' overhead panel back lighting.

2E3 - OVHD & EYEBROW PNL
2M7, 8, 9, 10 - OVERHEAD L, L-CTR, R-CTR & R

WARNING, CAUTION AND ADVISORY LIGHT TEST SWITCH

IN - All pilots' panel warning, caution, and advisory lights except fire warning are illuminated. Lights will remain on for 5 minutes unless switch is positioned to OUT. ON legend illuminated with switch in, even if test is terminated by the timer. Pilots' warning, caution, and annunciator lights will flash at 90 flashes per minute for a period of 10 seconds and then illuminate steadily.

OUT - ON is extinguished and individual switches control lights.

2H8, 9, 10 - PILOTS IND LT TEST 1, 2, 3

GENERAL COCKPIT INTENSITY LIGHT SWITCH

Controls intensity, from DIM to BRT, of overhead lights.

2K10 - OVHD FLOOD

PILOTS' ENGINE INSTRUMENTS LIGHTING INTENSITY SWITCH

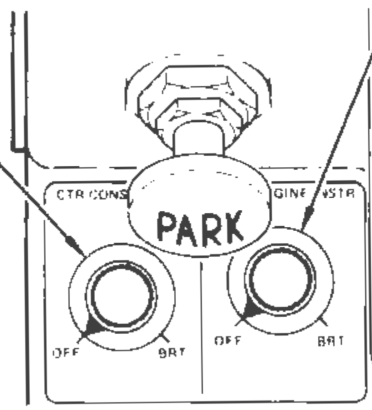
Controls intensity of integral lighting of instruments and panel back lighting.

3J13 - CTR INSTR & GLARE SHLD
1L22, 23 - CTR L & R

CENTER CONSOLE LIGHTING INTENSITY SWITCH

Controls intensity of the center console panel back lighting.

2E10, 5 - CTR CONSOLE PNL
2M1, 2, 3, 4, 5 FWD CONSOLE, AFT CONSOLE L&R AND THROT STAND



GLARESHIELD LIGHT CONTROLS

GLARESHIELD PANEL LIGHT CONTROL

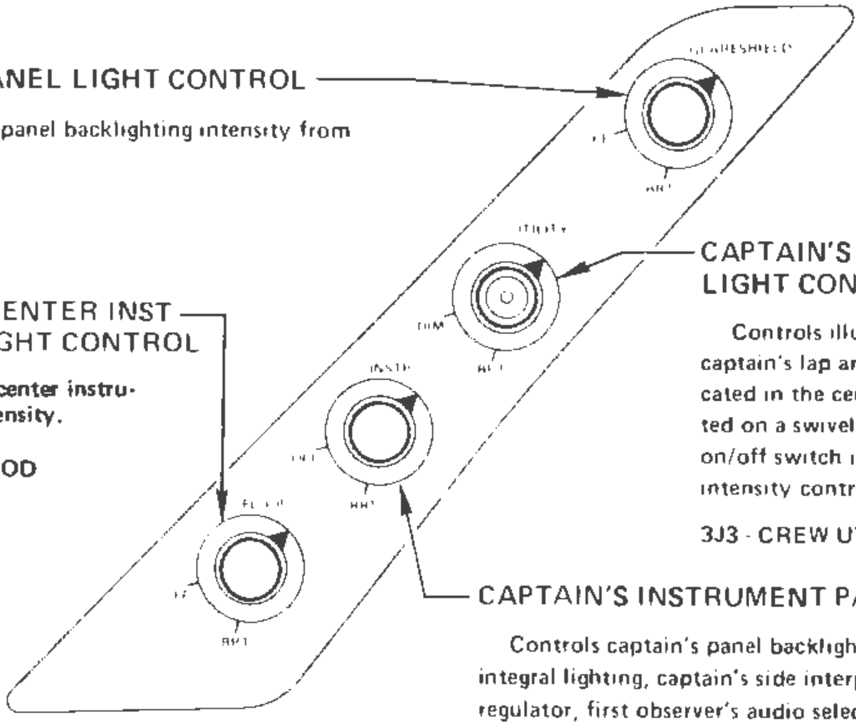
Controls glareshield panel backlighting intensity from **OFF to BRT.**

2M6 - GLARE SHLD

CAPTAIN'S AND CENTER INST PANEL FLOOD LIGHT CONTROL

Controls captain's and center instrument panel lighting intensity.

3J5 - CAPT & F/O FLOOD



CAPTAIN'S UTILITY LIGHT CONTROL

Controls illumination in captain's lap area. Light is located in the ceiling and is mounted on a swivel. Pushbutton on/off switch in center of intensity control knob.

3J3 - CREW UTILITY LIGHTS

CAPTAIN'S INSTRUMENT PANEL CONTROL

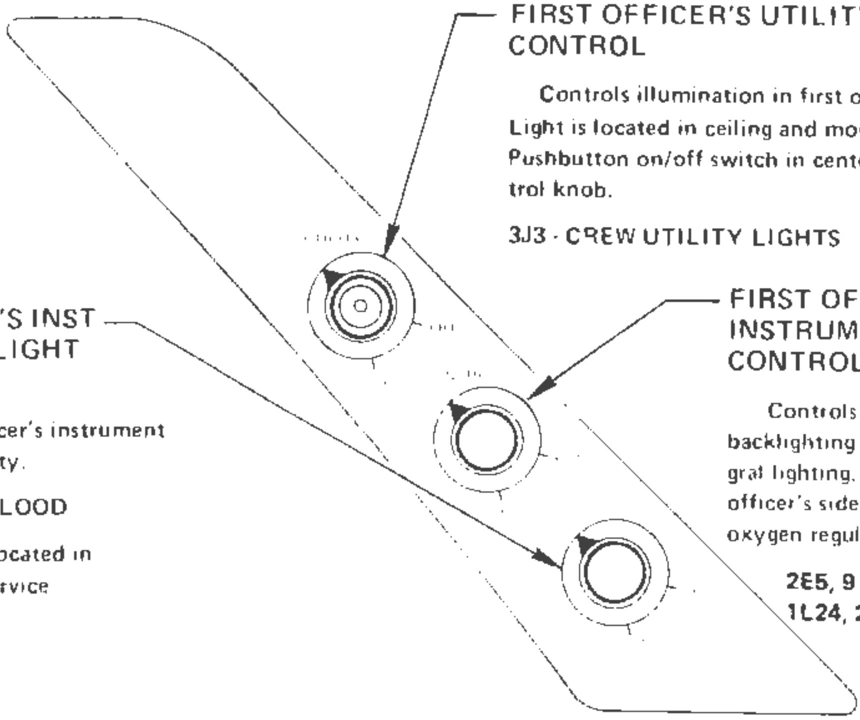
Controls captain's panel backlighting, instrument integral lighting, captain's side interphone, oxygen regulator, first observer's audio selector panel, and first and second observers' oxygen regulator panel lights.

3J12
1L20, 21 - CAPT L & R

FIRST OFFICER'S UTILITY LIGHT CONTROL

Controls illumination in first officer's lap area. Light is located in ceiling and mounted on a swivel. Pushbutton on/off switch in center of intensity control knob.

3J3 - CREW UTILITY LIGHTS



FIRST OFFICER'S INST PANEL FLOOD LIGHT CONTROL

Controls first officer's instrument panel lighting intensity.

3J5 CAPT & F/O FLOOD

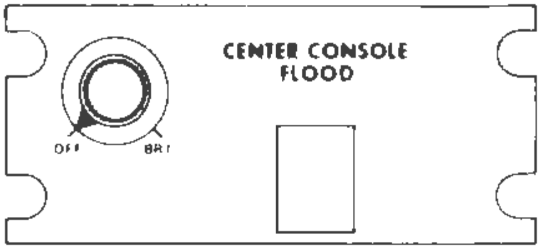
Ballast breakers are located in forward electronic service center

FIRST OFFICER'S INSTRUMENT PANEL CONTROL

Controls first officer's panel backlighting and instrument integral lighting. Also controls first officer's side interphone and oxygen regulator panel lights

2E5, 9 - F/O INSTR
1L24, 25 - F/O L & R

CENTER CONSOLE FLOOD AND INSTRUMENT STANDBY LIGHTING CONTROLS



CENTER CONSOLE FLOOD LIGHT SWITCH

Controls light intensity, from OFF to BRT, of the center console flood light. Light is emitted through a slot in the panel.

3J4 · CTR CONSOLE FLOOD

INSTRUMENT STANDBY LIGHT INTENSITY SWITCH

Controls light intensity, dim or bright, of standby lights for the main and flight engineer's instrument panels. Light comes on automatically with loss of DC essential bus.

3J11 - STBY LT RELAY

ENGINEER'S LIGHT CONTROLS

BRIGHT DIM SWITCH

IN - DIM is illuminated and all warning, caution and advisory lights are dimmed on engineer's panels.

OUT - BRT is illuminated and full bright illumination is provided.

INSTRUMENT AND SIDE PANEL INTEGRAL LIGHTS

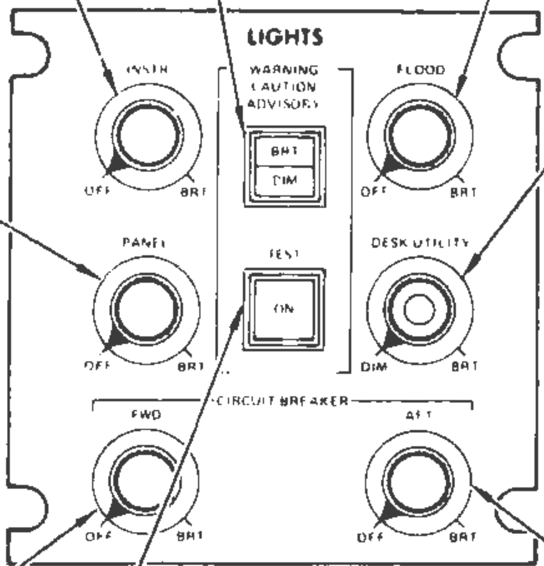
Controls illumination intensity, from OFF to BRT, of engineers panel instrument integral lights.

3BB11, 12, 13, 14 - UPPER LOWER LEFT & RIGHT

UPPER AND LOWER PANEL FLOOD LIGHT

Controls engineer's flood light above upper panel.

3J1 - F/E FLOOD LIGHTS



PANEL AND SCHEMATIC BACK LIGHTING

Controls illumination intensity, from OFF to BRT, of the system schematic lines and panel legends.

2E2 - F/E PNL
3CC9 to 18 FLT ENGR PANEL LIGHTS

DESK UTILITY LIGHT

Pushbutton switch in knob center turns light on or off. Rotating knob adjusts brightness.

3J3 - CREW UTILITY LIGHTS

PILOTS' CIRCUIT BREAKER PANEL LIGHTS

Controls panel backlighting from OFF to BRT.

2E11 CKT BRKR PNL

ENGINEER'S OVERHEAD AND AFT CIRCUIT BREAKER PANEL LIGHTS

Controls panel backlighting.

3BB9, 10 - CKT BRKR PNL CB2 CB3

TEST SWITCH

IN - ON is illuminated and all warning, caution and advisory lights on engineer's panels are illuminated except the fire detector lights. The lights will remain on for 5 minutes and then go out. ON remains illuminated with switch IN, even if test is terminated by the timer.

OUT - Terminates test at any time.

2H1, 2, 3, 4, 5 - F/E IND LT TEST

F1-5001-6-009

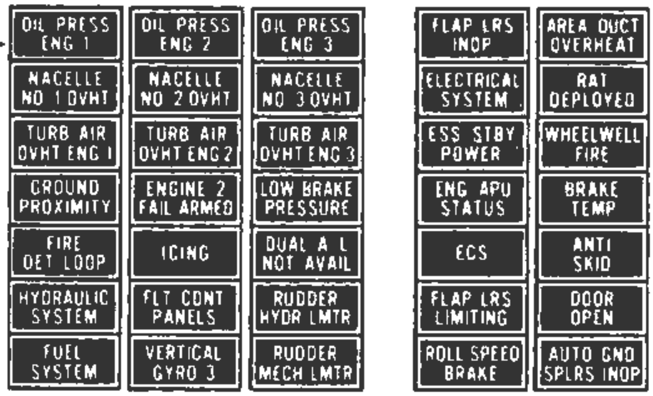
ANNUNCIATOR PANELS

1L9 - ANN RESET

CAUTION AND WARNING ANNUNCIATOR RESET

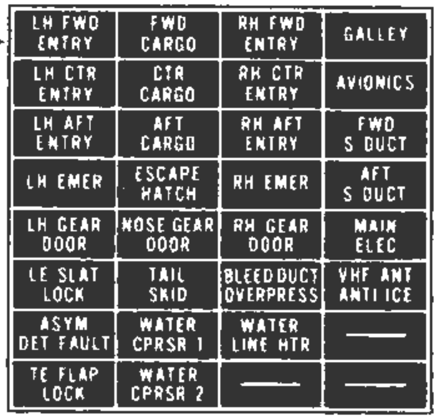
Momentary pushbutton switch to reset and extinguish the caution and warning annunciator lights.

MASTER ANNUNCIATOR PANEL



Master annunciator panel located on the pilots' center instrument panel, provides system red warning and amber caution indications. Generally, detail indications of the conditions are presented on other panels in the flight station.
Annunciator panel indications flash for 10 seconds then remain illuminated until the announced condition is corrected or until the indicator is manually reset.
On a pilot panel bulb test any reset faults that still exist will be recalled.

ENGINEERS ANNUNCIATOR PANEL



Annunciator panel at the engineer's position provides visual indications of minor hazard conditions such as doors and openings not securely closed.
Indications are illuminated until the announced condition is corrected.

APU CONTROLS

START SWITCH

Momentary switch to initiate automatic starting cycle for cranking, fuel flow, and ignition. Secondary firewall fuel shutoff valve opens if closed by fire pull.
3S13 - POWER CONTROL.

BLEED AIR SHUTOFF VALVE SWITCH

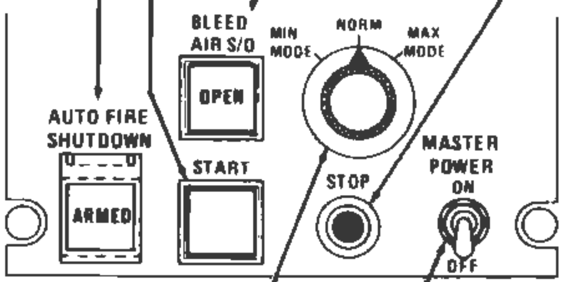
Permits opening and closing of bleed air S/O valve. Will not open until APU is up to speed.
IN - OPEN is illuminated when the valve is open.
OUT - OPEN is extinguished and valve is closed.
3S18 - APU BLEED AIR VALVE.

AUTOMATIC FIRE SHUTDOWN ARM SWITCH

Arms automatic fire shutdown protection and extinguisher discharge.
Is always armed while on the ground.
IN - ARMED is illuminated and automatic fire shutdown is available.
OUT - ARMED is extinguished and automatic fire shutdown is not available inflight.
2L8 - MLG GND SENSE.
3S13 - POWER CONTROL.
1C18 - APU FIRE SHUTDOWN.
1J7 - APU FIRE SHUTDOWN.
1J8 APU SEC EMER SHUTOFF
3B15 - PRI F W SOV.

STOP SWITCH

Momentary switch permits normal stop of APU at any time. The stop switch inputs a false overspeed signal into the shutdown circuit thereby checking out the overspeed protection on every ground shutdown.
3S13 - POWER CONTROL.



COMPRESSOR MODE SELECTOR

Selects APU compressor air flow output.
MIN - Selects reduced air flow for ground operation when requirements are low.
NORM - Supplies adequate flow for all normal operations.
MAX - Selects large airflow for rapid environmental changes.
3S13 - POWER CONTROL.

MASTER POWER SWITCH

ON - Opens primary firewall shutoff valve. Arms seconday firewall shutoff valve if closed. Arms lights on APU panel, fuel panel, and electrical panel.
OFF - Closes primary firewall shutoff valve and removes power from APU controls.
3B10 - BAT PWR.
3S13 - POWER CONTROL.

APU INDICATORS

N_G TACHOMETER
Indicates main engine speed.
3S12 - CONT PWR.

TEST SWITCH
Pressure tests tachometer by driving pointer to 3 o'clock.

OIL LOW PRESSURE
Fault flag indicates low APU oil pressure and automatic shutdown.
3S12 - CONT PWR.

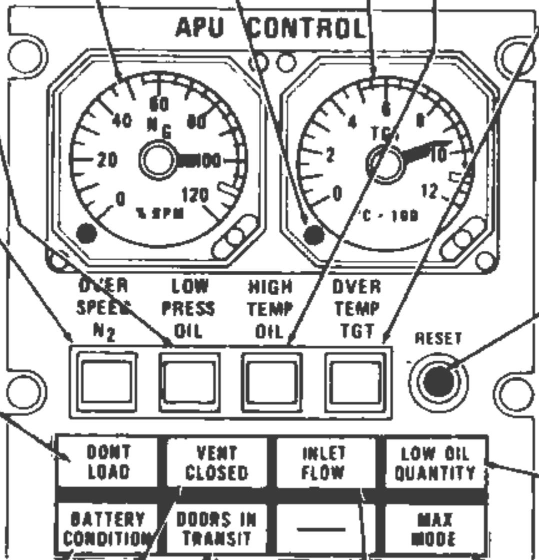
N_2 OVERSPEED
Fault flag indicates N_2 (free turbine) overspeed and automatic shutdown.
3S12 - CONT PWR.

DON'T LOAD LIGHT
DOORS IN-TRANSIT is extinguished, and APU should not be loaded because APU N_2 is below 95% or above 105% RPM.
3S12 - CONT PWR.

BATTERY CONDITION LIGHT
Battery cell is shorted or battery is overheated.
3A15 BAT CHG.

VENT CLOSED LIGHT
APU compartment vent outlet is closed by FIRE PULL handle or by auto shutdown.
3S15 - EJECTOR AND VENT VALVE.

DOORS IN-TRANSIT LIGHT
APU inlet and ejector doors are in transit.
3S13 - POWER CONTROL.



TURBINE GAS TEMPERATURE INDICATOR
Indicates TGT anytime APU master power switch is ON.
3S12 - CONT PWR.

HIGH OIL TEMPERATURE INDICATOR
Fault flag indicates high oil temperature and automatic shutdown.
3S13 - POWER CONTROL.

TGT OVERTEMPERATURE
Fault flag indicates high turbine gas temperature and automatic shutdown.
3S12 - CONT PWR.

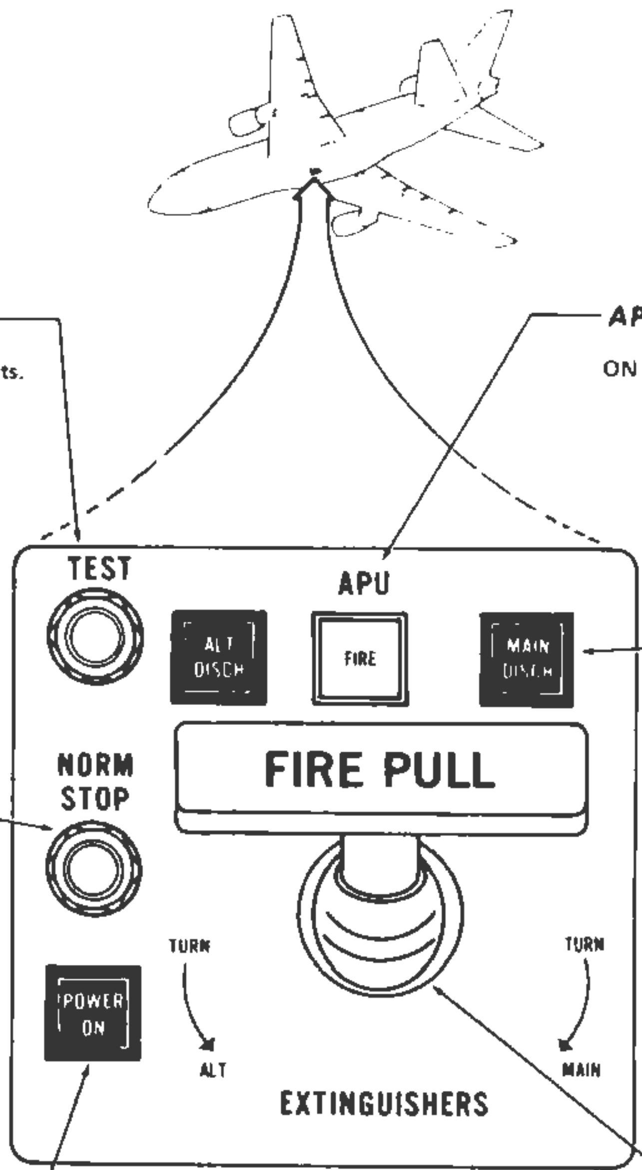
RESET SWITCH
Pushbutton switch resets indicator fault flags.
3S13 - POWER CONTROL.

LOW OIL QUANTITY LIGHT
Indicates servicing will be required.
3S11 - IGNITION

MAX MODE LIGHT
APU compressor is producing maximum air flow regardless of position of compressor mode selector.
3S13 - POWER CONTROL.

INLET FLOW LIGHT
APU has automatically shutdown due to load compressor inlet restriction.

EXTERNAL APU CONTROL PANEL



LIGHT TEST SWITCH

Tests panel annunciator lights.

APU FIRE LIGHT

ON - APU fire warning system activated.

EXTINGUISHER DISCHARGE LIGHTS

On indicates bottle pressure is below limits.

NORM STOP SWITCH

Electrically connected to F/E APU panel STOP switch.

PRESS - Results in manual shut down sequence as F/E panel STOP switch.

POWER ON LIGHT

Illuminated when APU MASTER POWER switch is on. Provides complete circuit for Master Power Switch holding coil.

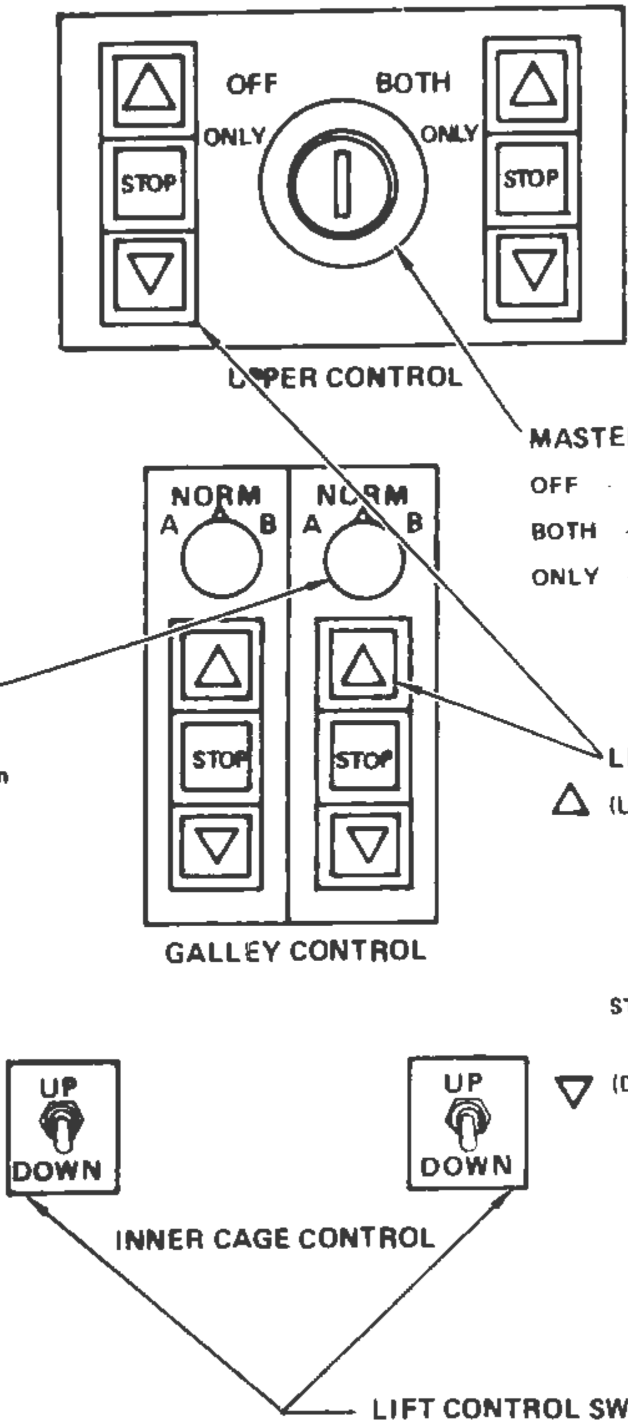
PRESS - Opens latching coil circuit, Master Power Switch trips off, removes control power from APU circuit.

FIRE PULL HANDLE

Pulling initiates fire shut down. Other functions similar to cockpit APU fire handle.

ROTATE - Clockwise discharges main bottle. Counter clockwise discharges alternate bottle.

GALLEY LIFT CONTROLS



MASTER KEY SWITCH

OFF - Power removed from both lifts.

BOTH - Power available to both lifts.

ONLY - Only selected lift powered.

MOTOR SELECTOR SWITCH

NORM - Normal position with two motors operating.

A - B motor removed from system.

B - A motor removed from system.

LIFT CONTROL SWITCHES

△ (UP) - When pressed, both motors energized to move cage up if both upper and lower doors are closed. If serving cart is stowed on top of cage lift will not operate.

STOP - Overrides any signal to stop cage.

▽ (DOWN) - When pressed, both motors energized to move cage down if both doors are closed.

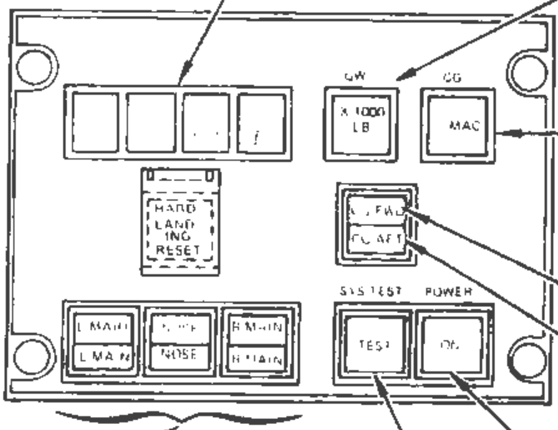
LIFT CONTROL SWITCHES

With both switches held up, the lift up circuits are powered.

With both switches held down, the lift down circuits are powered.

F1-5001-6-012

WEIGHT AND BALANCE PANEL AND COCKPIT DOOR RELEASE



GROSS WEIGHT/CENTER OF GRAVITY INDICATOR

Displays either aircraft gross weight or % mean aerodynamic chord as selected by selector switch.

GROSS WEIGHT SELECTOR SWITCH

Aircraft total gross weight displayed on indicator lights.

CENTER OF GRAVITY SELECTOR

Percent MAC displayed on indicator lights.

CENTER OF GRAVITY LIMIT LIGHTS

CG FWD - Center of gravity forward of 12%.

CG AFT - Center of gravity aft of 32%.

2F5, 6 - WEIGHT & BAL

HARD LANDING INDICATOR

Indicates stress forces felt by individual wheels. Light remains on until reset.

AMBER - 2½ feet/sec to 5 feet/sec
RED - Over 5 feet/sec

POWER SWITCH

IN - System powered and ON light illuminated.

OUT - System deactivated.

SYSTEM TEST SWITCH

Drives indicator to 100 as indication of satisfactory test. All lights illuminate while switch is pressed.

To terminate test press switch again.

COCKPIT DOOR RELEASE SWITCH

Releases lock at cockpit door.

2F9 - DOOR LATCH RELEASE

PROJECTOR OPERATING LIGHTS

FWD is illuminated when forward cabin projector is operating. AFT is illuminated when mid cabin or AFT cabin projectors are operating.

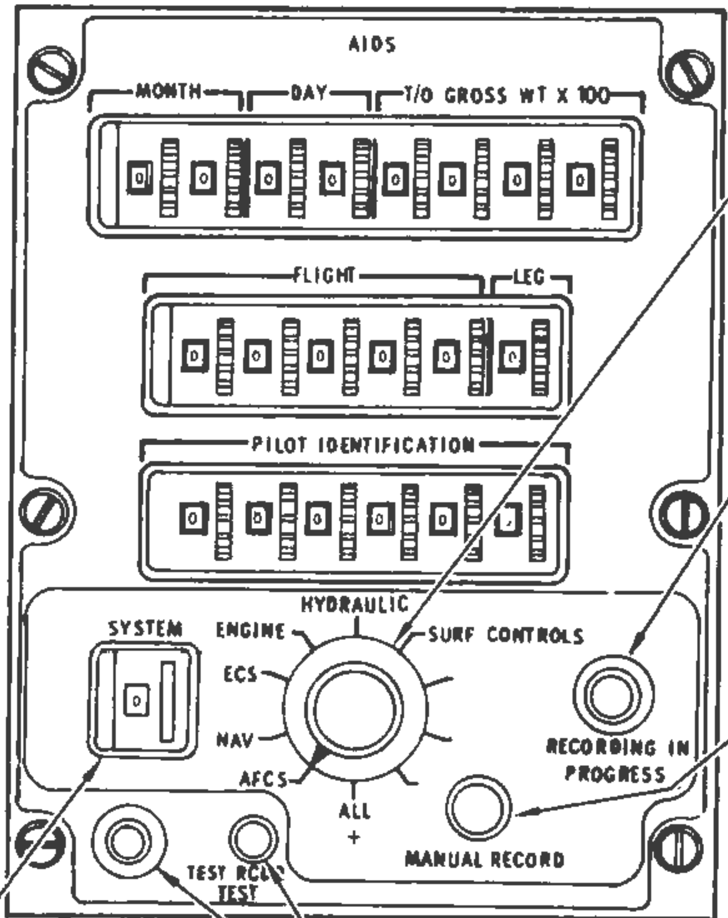
MOVIE INTERRUPT SWITCH

Guarded alternate action switch that shuts off all power to the movie projector. OFF indicates projectors are deenergized.

AIDS CONTROL PANEL AND FLIGHT RECOROER TEST CONTROL

POWER CONTROL SWITCH

Controls power to flight data recorder system. Power is being supplied except when switch reads OFF.



SYSTEM SELECTOR SWITCH

Selects system from which trouble data sample is to be recorded on incremental recorder.

RECOROING IN PROGRESS INDICATOR

Remains lighted until manual recording is complete.

MANUAL RECORD SWITCH (MOMENTARY)

Initiates sequence that will cause trouble data to be transcribed on incremental recorder.

SYSTEM THUMBWHEEL SWITCH

Selects subsystem, within a system selected on selector switch, from which data is to be recorded on incremental recorder.

FLIGHT DATA RECORDER SWITCH AND INDICATOR LIGHT

Switch checks operational status of recorder. Light indicates system is operative.

3H10, 11, 12, 13 - AIDS/FLT RLDR

F1-5002-6-014

AUXILIARY POWER UNIT (APU)

The auxiliary power unit is a self-contained unit with automatic control for starting, stopping, and maintaining safe operating limits. It is located in a fireproof compartment in the bottom aft portion of the fuselage, forward of No. 2 engine and below the S duct.

The APU is used primarily for ground operation but can be used in flight as a power source for air conditioning, hydraulic power, and electrical power. It is capable of operating up to FL 310 and can be started below FL 250.

The APU consists of a compressor, two turbine stages, and accessories. The first turbine stage (N_G) powers the compressor. The second turbine (N_2), or free turbine, drives the gear box which then drives the load compressor, generator, and cooling fan. The output shaft of the APU is controlled to a constant speed, eliminating the need for a generator constant speed drive unit (CSD). If N_2 RPM remains at 100%, the generator frequency is 400 Hz.

The APU obtains fuel from the supply line to the No. 2 engine. It has its own oil system. Starting electrical power is taken from the aircraft battery. Control power is from the DC Ground Service bus or the battery.

ELECTRONIC CONTROLLER

An electronic controller, located in the aft cargo compartment, controls all automatic functions including starting, stopping, emergency protection, and speed and load control.

GENERATOR CONTROL UNIT

The generator control unit protects and controls the APU generator. It provides protection for the electrical system from most faults, regulates the generator voltage, and controls operation of field relay, generator breaker, and AC tie breakers. It is powered by the permanent magnet generator (PMG) or DC Standby bus.

GENERATOR

The generator can be used to power the aircraft electrical system on the ground or in flight. When engine generators are not operating and external power is off, the APU generator can power the AC busses through the AC Tie bus. There is no CSD as the free turbine (N_2) maintains constant speed. The generator lubrication and cooling oil is a separate system with low pressure and overtemperature monitor lights on the electrical panel. The generator will operate in parallel with the engine generators but not with external power

LOAD COMPRESSOR

The load compressor is powered from the free turbine (N_2). It is a single stage compressor, mounted on the engine gear box drive shaft. It supplies the air demands required by air conditioning, hydraulic pumps, and engine start. Variable inlet guide vanes control the amount of air going into the load compressor to maintain a constant air mass. Before the air can be used, the bleed air shutoff valve must be opened. Any excess load compressor air is dumped into the APU engine exhaust system. Generator requirements take priority over air loads by reducing inlet guide vane angles to maintain electrical needs as the APU maximum load limit is approached.

BLEED AIR SHUTOFF VALVE

When the bleed air shutoff valve is open, APU load compressor air is connected to the aircraft pneumatic manifold. This valve is controlled by a two-position switch light. When pressed, an open light will come on when the valve opens. When the switch is released (out), the valve closes and the open light goes out. A check valve prevents backflow into the APU.

OIL SYSTEM

The APU has its own oil system. The oil pump delivers oil for required lubrication through a filter to a heat exchanger and back to the oil tank. Fault flags will appear on the APU control panel and the APU will shut down if oil temperature or pressure are abnormal. A low quantity light on the control panel will illuminate, when on the ground, if servicing is required.

AUXILIARY POWER UNIT (APU) (Cont'd)

FUEL SYSTEM

Fuel is supplied to the APU through the No. 2 engine fuel supply line. It can use fuel from any tank provided the appropriate crossfeed valves are open. The APU will start without fuel pumps operating up to an altitude of 14,000 feet. The fuel system incorporates two tandem emergency shutoff valves at the APU fire wall. The primary valve is opened by the master power switch and the secondary valve is normally open all the time. Both valves are closed by the APU fire pull handle or an automatic fire shutdown. In-transit lights on the fuel panel illuminate as the valves open or close.

EJECTOR DOOR

The ejector door is controlled by an electric actuator. Air enters the APU through a fixed opening and exits through the ejector door. As the air exits, it provides cooling for the oil heat exchanger and ventilation for the APU compartment

When the start switch is pressed, the door opens in about ten seconds. When the stop switch is pressed, the doors close after the stop sequence is completed. This takes about two minutes. As the door opens or closes, an in-transit light on the panel illuminates. If the master switch is turned off before the door closes, it will remain open. The door will close automatically with an automatic fire shutdown or if the fire handle is pulled.

VENT AIR VALVE

The motor-driven vent air valve is installed in the aft end of the APU compartment. The valve is normally open to provide ventilation. The valve is closed automatically with an auto fire shutdown or if the fire handle is pulled. An advisory light on the control panel will illuminate if the valve is closed.

ELECTRICAL START POWER

The battery supplies starting power through the master power switch. Once the APU is operating, the DC Ground Service bus provides control power.

The starter is energized after the door in-transit light goes out and is de-energized at 55% N_G

A battery condition light on the control panel indicates the status of the battery. The light will be on if the battery is overheated or a cell is shorted. An APU start should not be attempted when the battery condition light is on.

Turning on the master power switch connects the APU to the battery and arms all APU controls and indicators for operation. The battery switch does not have to be on to provide battery power to the starter

COMPRESSOR MODE SELECTOR

The compressor mode selector is a three-position switch located on the APU control panel. It provides the following modes of operation for the inlet guide vanes:

> Minimum mode - The guide vanes are in the closed position. In this position a minimum volume of air is processed by the compressor.
>
> Normal mode - The inlet guide vanes modulate to provide the amount of air needed by pneumatic loads.
>
> Maximum mode - The guide vanes are fully opened (except to protect electrical needs) and provide maximum air to the load compressor. The APU automatically shifts to this mode any time the engine ground start switch is pressed. An annunciator light indicates this mode of operation.

COOLING FAN

The cooling fan is powered though the gear box by the N_2 turbine. It draws air from the inlet opening and discharges it through the ejector door. The air is used for oil cooling and compartment ventilation. The fan operates any time the APU is operating.

TACHOMETER AND TEMPERATURE INDICATOR

The N_G tachometer is located on the control panel and indicates the RPM of the gas turbine. It is armed when the APU master switch is on.

AUXILIARY POWER UNIT (APU) (Cont'd)

The turbine gas temperature (TGT) is armed when the master power switch is on. During starting, fuel and ignition are supplied at 10% N_G.

The starting TGT limit is 760°c and after the APU is operating, the limit shifts to 1066°C. Automatic shutdown will occur and the overtemperature flag will show if either of these temperatures are exceeded.

There is no N_2 indicator, however, APU generator frequency can be used as a monitor. If the frequency is 40 Hz, N_2 is 100%. If an N_2 overspeed occurs (110%), the APU will automatically shutdown. This is equivalent to 440 Hz.

NORMAL SHUTDOWN

This is accomplished by pressing the stop switch which trips the APU generator breaker and puts the APU into an 80 second idle cool down period. At the end of this cycle, the N_2 overspeed circuit is energized causing shutdown. This also removes power from the controller, which closes the APU fuel shutoff valve.

The shutdown cycle takes about 40 additional seconds, at the end of which time the door is closed and the door light goes out.

AUTOMATIC APU SHUTDOWN

An automatic shutdown will occur if any of the following takes place:

Overspeed N_2
Low oil pressure
High oil temperature
Overtemperature TGT
} Fault flags

Restricted inlet air flow

Loss of electrical power to electronic controller.

More than 40 seconds for N_G to reach 55%.

APU fire (May be disarmed in flight if the auto-fire shutdown switch is out)

MANUAL FIRE SHUTDOWN

If the automatic feature does not operate, manual fire shutdown can be initiated by pulling the fire pull handle at the engineer's station or at the external APU control beneath the aircraft. The APU can also be stopped by pressing the stop switch at the external panel.

FAULT FLAGS

Fault flags are provided to indicate N_2 overspeed, low oil pressure, high oil temperature, and TGT temperature above limits The flags will appear any time the warning lights are tested A push-button reset switch resets the flags. The switch is located just to the right of the fault flag on the control panel. Flags in view will not prevent an APU start.

APU ADVISORY LIGHTS

The following amber lights are installed on the control panel. These are advisory lights and may not require any immediate action.

Don't load - APU is not up to speed and cannot assume any electrical or pneumatic loads. Comes on after door in-transit light goes out and goes out when N_2 is above 95%.

Door in-transit - Ejector door is opening or closing.

Vent closed - APU compartment vent valve is closed.

Low oil quantity - Oil quantity is below a re-servicing level. Armed only on the ground.

Fuel filter - Fuel filter is becoming clogged

Battery condition - The battery is too warm or a cell is shorted.

Inlet flow - The flow through the inlet guide vanes is restricted and the APU has automatically shutdown. The master power switch must be recycled to restart.

Maximum mode - The inlet guide vanes are open to produce maximum air flow.

AUXILIARY POWER UNIT (APU) (Cont'd)

MASTER ANNUNCIATOR CAUTION AND WARNING LIGHTS

The following lights on the pilots caution and warning panel indicate APU problems:

> Engine/APU status - Indicates automatic APU shutdown.
>
> Electrical system - Indicates APU generator oil overheat or pressure low.

LIGHTING SYSTEM

The aircraft lighting system is comprised of five major subdivisions. These include the cockpit, cabin, cargo and service compartments, exterior, and emergency lighting. Fluorescent or incandescent lights are used as requirements dictate. All of the emergency lighting and most of the exterior lighting is incandescent.

All instrument, annunciator, and lighted indicator lamps can be replaced from the front of the panels. Illuminated switch lights, both square and rectangular, are used in the cockpit and have front face lamp replacement capability without the use of tools. The integral panel back lighting lamps cannot be replaced without removing panels.

Separate lighting controls are provided at each crew position. The captain and first officer controls are located in the glareshield, center console, overhead panel, and eyebrow panel. The engineer controls are located in the lower left portion of his panel.

COCKPIT LIGHTING

All instruments are back lighted. A switch for each crew member controls the intensity. The magnetic compass has a separate control. A thunderstorm switch on the eyebrow panel increases all dimmed lighting to full bright, regardless of each intensity control setting.

OVERHEAD LIGHT

A single overhead dome light, which provides general cockpit lighting, has a separate dimming control on the pilot overhead panel. This light may also be turned on or off from a switch at the cockpit entrance door.

FLOOD LIGHTS

Fluorescent lights with separate dimming controls are used to floodlight the pilot and engineer instrument panels.

PANEL LIGHTS

All instrument panels are integrally backlighted. The controls for the pilot panels are on the end of the respective glareshield. The control for the engineer panel is on its lower left corner.

UTILITY LIGHTS

Individual utility lights are provided for each crew member and the two ACMs. Each light has an adjustable beam and dimming control. Controls for the captain and first officer are located on the respective glareshield side panels. The engineer utility light control is on his lower left side panel The ACM light controls are located at their positions.

ANNUNCIATOR SYSTEM

Annunciator lights include all of the warning (red), caution (amber), and advisory (white, blue, or green) lights located in the cockpit. The captain or first officer can check all annunciator lights by means of a test switch on the overhead panel. The engineer has a similar switch on the lighting panel at his station. A switch at each control also provides bright/dim control for these annunciator lights.

CABIN LIGHTING

Lights are provided for the cabin entrance areas, storage areas, lavatories, and the buffet area. Sidewall lighting is provided by fluorescent assemblies over the windows. Controls for dimming are at the left flight attendant's panel. The ceiling control is also at this panel. Self-illuminated switches are labeled the same as the lights they control or the function they perform. The emergency lights may be activated from the cockpit, forward attendant, or aft attendant panels.

EXTERIOR LIGHTS

The exterior lights include anti-collision, strobe, runway turnoff, landing and taxi, position, and leading edge wing lights. All controls are located on the eyebrow panel.

EXTERIOR LIGHTS (Cont'd)

ANTI-COLLISION LIGHTS

Two rotating lights are installed side by side on the bottom and two on the top of the fuselage.

STROBE LIGHTS

The strobe lighting system consists of a high intensity white light at each wingtip. This provides full coverage around the horizon.

RUNWAY TURNOFF LIGHTS

A fixed position runway turnoff light is installed in the leading edge of each wing fuselage fillet. They provide a wide beam for side and forward lighting while taxiing and serve as ground floodlights during servicing.

LANDING AND TAXI LIGHTS

Two landing lights are installed, one in each wing fuselage fillet. These are fixed lights, as are two fixed lights on the nose landing gear. The nose wheel lights are dual filament, one for landing and one for taxi. Separate toggle switches control the landing lights, nose landing lights, and taxi lights.

POSITION LIGHTS

Forward and rear facing position lights are provided on each wing tip.

WING FLOOD LIGHTS

The wing flood lights are placed on each side of the fuselage to illuminate the wing leading edge and the engine inlet lip. The lights provide a visual check for icing conditions.

LOGO LIGHTS

A logo light installed on each side of the horizontal stabilizer will illuminate the TWA symbol.

SWITCHLIGHT

The term switchlight is used to identify an assembly consisting of a push-button switch and a lens cap with a back lighted legend or flowbar. These switches are available in a four-lamp square configuration or a two-lamp rectangular configuration. The switches are either the momentary type or the two-position, press in - press out type.

Rectangular lenses consist of only one legend. Square lenses may be divided to form two legends to indicate more than one condition, such as on and fail, or open and closed. Different colors and types of legend may be mixed on the same square lens.

The lens assembly is gripped by the edges and pulled out of the switch housing to replace lamps. If this action is required in flight, caution should be used to prevent activating the switch when the assembly is put back in the switch housing. In some cases, the associated circuit breaker should be pulled first. When the lens assembly is replaced, be sure the top mark is up before pushing into the housing.

GALLEY LIFT

Each lift is operated by two electric motors energized from the Passenger Service busses. Either motor can operate the lift but only at half speed. For smoother operations only one motor is used during the start and stop phases.

To operate the lift, the master key on the upper control panel must be selected to the desired position. Both the upper and lower entry doors must be closed before the control panels are armed. If a serving cart is stowed on top of the cage, a switch will prevent lift operation.

The lift can be stopped or moved in either direction by the control switches located at both entry doors. The lift may also be operated from the inside using two controls positioned so that two hands are required. The lower entry door cannot be opened from the outside until the cage is full down except with a coin slot latch.

With one motor inoperative, place the selector switch on the lower galley control to the operating motor position. This will modify the circuit to provide full operation (half rate) with the selected motor.

POTABLE WATER SYSTEM

The potable water system is pressurized by two electric motor air compressors. Either compressor can supply sufficient air volume to maintain system operating pressure.

Operating power for each motor is from circuit breakers on the right hand galley circuit breaker panel. Control and indicating power is from a circuit breaker on the left hand galley circuit breaker panel.

POTABLE WATER SYSTEM (Cont'd)

System pressure is controlled by a tank pressure sensing switch for each compressor motor. When pressure is below normal, the switches close and power each compressor motor. When pressure returns to normal, the switches open to remove power from both compressor motors.

A check valve located in the outlet port of each compressor monitors compressor output. With the system demanding pressure and no compressor output sensed, the check valve will close and turn on the related engineer's water compressor fail light. When the system is not demanding pressure, the fail lights are disarmed. With one compressor inoperative, its fail light will go out when the operative compressor is able to supply normal pressure.

AIRBORNE INTEGRATED DATA SYSTEM (AIDS)

The AIDS automatically records aircraft system performance parameters at preprogramed intervals during each flight. The system performance data may also be recorded at random by use of a manual select switch. A sub-system select switch is provided to isolate a specific system if desired.

The AIDS consists of electronic units in the avionics compartment which compile the information gathered from the aircraft systems data sensors. A continuous loop recorder records data temporarily on magnetic tape. This information is stored for 5 minutes, then erased. An incremental recorder records data for permanent records. The flight recorder is included in, and receives its required data inputs from, the AIDS components. The data entry/control unit in the cockpit is used by the crew to insert flight information and to control the system.

A cassette cartridge magnetic tape in the incremental recorder is of sufficient length to satisfy the requirements of the programed automatic and any manual recordings that occur for most flights. The cassette may be removed by maintenance and its recorded information forwarded to MCI by teletype at which time it is automatically inserted into the computer.

During normal operations, continuous recording of system functions is made. This recording is automatically erased as the tape is reused. Permanent recordings are made during engine starting, after takeoff (35' radio altimeter), at 20,000' altitude, when reaching cruise altitude and setting the autopilot altitude hold, during descent when altitude hold is released, and on approach for landing when extending the landing gear. The data taken during approach is continuously recorded until shortly after touchdown.

When a recording of an event is required between programed automatic recordings, pressing the manual record switch will permit this data to be inserted on the permanent tape. At this time, the recording in progress light will be on indicating the system is functioning.

Five minutes of the recorded data on the continuous loop tape preceding the manual selection is included on the permanent tape when a manual recording is made. This gives the analyst a picture of events before and during the time a suspected malfunction occurs.

Selecting a specific system with the system selector switch will edit all other system data and only record the selected system information.

With a system that has several sub-systems (hydraulics, engines, etc.,) a system thumb wheel switch will flag out the sub-system selected.

An electric clock in the system, set to GMT, provides a time reference for data inserted in the recorders. If aircraft electrical power is lost, a battery in the system provides sufficient power to the clock for approximately 36 hours. The battery is recharged from the aircraft electrical busses. Resetting the clock is a maintenance function since it is in the electronics compartment.

AURAL WARNING CHART

CONDITION SIGNAL	ACTUATION	SILENCING (1)	TESTING
BEFORE TAKEOFF *INTERMITTENT HORN*	Any 2 throttles advanced beyond 50% T/O thrust position, and: a. Flaps not within 7.5^{o} to 28^{o} range. b. Pitch trim not within 2.5^{o} to 8.0^{o} band. c. Speed brake levers not full fwd. (spoilers down). d. Slats not extended.	Not permitted.	Aural Warning Test Panel.
BEFORE LANDING *STEADY HORN*	Gear not down and locked and: a. Flaps extended more than 30^{o}. b. Airspeed less than 180 knots and any throttle retarded (less than 57^{o}).	a. Not permitted. b. Horn cutout on center console.	Aural Warning Test Panel
CABIN ALTITUDE *INTERMITTENT HORN*	Excessive cabin altitude (above 10,000 feet).	Horn cutout next to Safety Valve light.	Aural Warning Test Panel.
AUTOPILOT DISCONNECT *WAILER*	Either autopilot switch tripped or placed off.	2-second duration. Use control wheel A/P disc switch or re-engage A/P.	Disengage each autopilot switch.
A/C OVERSPEED *CLACKER*	A/C exceeding V_{mo}/M_{mo}.	Not permitted.	Aural Warning Test Panel
ALTITUDE ALERT *C-CHORD*	500 feet approaching or 250 feet leaving preselected altitude.	1/2 second duration.	Test switch on Altitude Select Panel.
FLAP LOAD RELIEVING SYSTEM (FLRS) INOP. *BUZZER*	FLRS deactivated with flaps extended, or with flap selection after LRS deactivation.	2-second duration (1-time warning).	Aural Warning Test Panel.
ENGINE FIRE *BELL*	Overheat in engine accessory area or within core engine.	Bell cutout switch. Fire pull handle. Master fire lights. Overheat alleviated.	Fire Detection Loop Test Panel.
APU FIRE *BELL IN COCKPIT* *HORN IN AFT FUSELAGE*	Overheat in APU compartment.	Same as engine fire.	Same as for engine fire.
GALLEY SMOKE/ VENT FIRE *ALTERNATING TONE*	Excessive smoke in galley/overheat in galley exhaust.	Tone cutout switch on Galley Smoke Panel.	Galley Smoke Panel Test Switch.

(1) Correction or alleviation of abnormal conditions will silence aural signal.

AURAL WARNING CHART (Cont'd)

CONDITION SIGNAL	ACTUATION	SILENCING (1)	TESTING
WHEEL WELL FIRE *BELL*	OVHT in either main landing gear wheel well.	Bell cutout switch Master fire lights OVHT alleviated	Wheel Well Fire Test Panel
500 FEET HEIGHT SPEAKER/HEADSET *2 SECOND BEEP TONE*	While descending at 500 feet on radio altimeter. (Not heard in F/E headset)	Leaving 500 feet.	Unable.
DECISION HEIGHT *SPEAKER/HEADSET TONE*	While descending at 50 feet above selected DH on radio altimeter. (Not heard in F/E headset)	DH light on radio altimeter At DH	Unable
SELCAL *HI CHIME*	Call from selected station. (single chime).	SELCAL light	Radio Check
CABIN-COCKPIT CALL *HI-LO CHIMES*	Any flight attendant to cockpit call button activation.	Single HI-LO chime - per call	Activate call buttons
MECH-COCKPIT CALL *LO CHIME*	Activation of GND-TO-CKPT call button	Single LO chime per call	Activate GND call button
EMERG. EVACUATION *HORN*	Pressing command switch on any evacuation signal panel.	Horn cutout on each Evacuation Signal Panel	Evacuation Signal Panel Controls
"WHOOP, WHOOP, PULL UP" *VOICE*	Mode 1-4 ground proximity warning for potentially dangerous flight situation.	Not permitted unless intentionally landing with gear/flaps not in landing configuration.	Press either pull-up light
"GLIDE SLOPE" *VOICE*	Mode 5 ground proximity warning for flying excessively low on glide slope.	Press either pull-up light.	Press either pull-up light.

(1) Correction or alleviation of abnormal condition will silence aural signal.

PILOTS' CAUTION AND WARNING INDICATOR LIGHTS CHART

ANNUNCIATOR LIGHT LEGEND	ASSOCIATED INDICATORS	CONDITION
OIL PRESS ENG 1, 2, or 3 A	Oil quantity indicator Oil temperature indicator Oil pressure indicator Filter pressure light	Engine No. 1, 2, or 3 oil pressure is low, which can be cross-checked on the associated indicators.
NACELLE NO. 1, 2, or 3 OVHT A	ENG 1, 2, or 3 A and B dual loop lights	Both loops detect an overheat with both loops armed, or when selected loop detects overheat.
TURB AIR OVHT ENG 1, 2, or 3 R	Engine turbine cooling air overheat light ENG 1, 2, or 3	Both thermal switches (dual system) detect excessive air temperature at the turbine.
ENG 2 FAIL-ARMED G	ENG 2 FAIL lights (captain's and first officer's)	Indicates the ENG 2 FAIL lights are armed to illuminate with loss of engine No. 2 power while on the ground during takeoff.
LOW BRAKE PRESSURE A	Brake pressure indicator. Brake accumulator low pressure monitor lights (NORM and ALT)	Brake accumulator pressure is low.
RUDDER HYDR LMTR A	FLT CONT PANELS annunciators light PUSH light on rudder hydraulic power limiter switch.	Rudder hydraulic limiter system is not operating correctly for the flight condition.
RUDDER MECH LMTR A	FLT CONT PANELS annunciator light. PUSH light on rudder auto/ mechanical limiter switch.	Rudder mechanical limiting system is not in correct position for the flight condition.
ROLL SPEED BRAKE A	Spoiler control switches L & R 1, 2, 3, & 4 PUSH & OFF lights.	Spoilers 1 through 4 have not moved to proper mode for selected flap position. Monitor PFCS panel for specific fault.
WHEELWELL FIRE R	Both A & B wheelwell fire detection loop test lights.	Wheelwell fire detection system has been activated.

PILOTS' CAUTION AND WARNING INDICATOR LIGHTS CHART (Cont'd.)

ANNUNCIATOR LIGHT LEGEND	ASSOCIATED INDICATORS	CONDITION
VERTICAL GYRO 3 A	ADI ATT flag appears if alternate ATT is on or has been selected.	Vertical gyro 3 has failed.
FLT CONT PANELS A	ROLL SPEED BRAKE annunciator light. All OFF and FAIL lights on FCES panel except STALL WARN. All stabilizer, aileron, spoiler switch lights, PULL PITCH DISC light, PULL ROLL DISC light, and rudder OFF switch on PFCS panel. MACH FEEL monitor and control switches, rudder hydraulic power limiter switch, and rudder auto/mechanical limiter switches.	Flight control system has malfunctioned. Overhead panels should be monitored for specific fault. ROLL SPEED BRAKE annunciator may also illuminate.
AUTO GND SPLRS INOP A	Any combination of 2 FAIL, 2 OFF, NO. 1 FAIL and NO. 2 OFF, or NO. 2 FAIL and NO. 1 OFF DLC/AUTO SPLR switch light legends. Hydraulic system C LO PR light. Pressing speed brake automatic disable switch.	Automatic ground spoilers and both channels of DLC are inoperative.
FLAP LRS LIMITING A	Trailing edge flap position indicator.	Flap load relief system is functioning.
RAT DEPLOYED A	Ram air turbine switch UNLKD and PRESS lights.	RAT is deployed.
DOOR OPEN A	The top four rows of annunciator lights plus MAIN ELEC on flight engineer's annunciator panel.	Any door or opening is not securely closed. Flight engineer's annunciator panel should be monitored.

PILOTS' CAUTION AND WARNING INDICATOR LIGHTS CHART (Cont'd.)

ANNUNCIATOR LIGHT LEGEND	ASSOCIATED INDICATORS	CONDITION
ENG/APU STATUS A	Engine 1, 2, & 3 vibration caution lights (3). Engine 1, 2, & 3 oil FILTER PRESSURE lights (3). APU Overspeed N_2, Low Press Oil, High Temp Oil, and Overtemp TGT indicators.	Any engine vibration level is excessive with vibration selector in the NORM position. A pressure differential exists across any engine oil filter. APU N_2 overspeed, oil pressure low, oil temperature high, or TGT overtemperature.
ELECTRICAL SYSTEM A	Engines 1, 2, & 3 IDG disconnect switch LOW PRESS lights (3). APU generator oil PRESS or OVHT light. Generator field trip switch OPEN lights (4). FLT STA BUS FAIL lights (3). Generator breaker trip switch OPEN lights (3). Standby power indicator light ON legend.	Electrical system has an abnormal condition. Electrical power control panel should be monitored for specific fault.
ESS/STBY POWER R	Standby power indicator light ON legend. AC essential and standby bus FAIL lights. DC essential and standby bus FAIL lights.	Normal AC or DC essential/standby power source has failed. Electrical power control panel should be monitored for specific fault.
FLAP LRS INOP A	Trailing edge flap position indicator. Flap LRS INOP light on FLAP LRS OVRD switch	Flap load relief system has malfunction.
ICING A	NONE. Just after ICING illuminates, ice will begin to form on the windshield post.	Ice is forming on icing indicator probe.
ANTI-SKID A	Anti-skid switch OFF light.	Selected anti-skid system is inoperative.
BRAKE TEMP A	Brake temperature indicators and OVERHEAT light.	Brakes are overheating.
DUAL A/L NOT AVAIL A	Any system failure which would affect APFDS operation such as NAV, HDG, etc. wherein associated flag appears.	One APFDS possibly may not be engaged due to input data or computer failure.

PILOTS' CAUTION AND WARNING INDICATOR LIGHTS CHART

ANNUNCIATOR LIGHT LEGEND	ASSOCIATED INDICATORS	CONDITION
HYDRAULIC SYSTEM A	Reservoir quantity indicators (4). Reservoir fluid monitor LO QTY/HI TEM lights (4). ATM lube monitor HI TEM LO PR lights (2). ATM pump monitor HI TEM/LO PR lights (2). Brake accumulator LOW PRESS lights (2). Engine driven pump monitor HI TEM/LO PR lights (4). Engine driven pump control switch OFF lights (4).	Hydraulic system malfunction has occurred. Hydraulic system control panel should be monitored for specific fault.
FUEL SYSTEM A	Tank 1, 2L, 2R & 3 pump switch LOW lights (8). 2L & 2R INBD tank LOW light (2). ENG 1, 2, & 3 FUEL PRESSURE indicator lights (3).	Fuel system has malfunctioned. Fuel system panel should be monitored for specific fault.
FIRE DET LOOP A	Master fire warning lights. A & B fire detection loop test lights for all three engines and the APU. Related fire pull handle.	Any engine or APU fire detection loop has been activated.
AREA/DUCT OVERHEAT A	Engines 1, 2, & 3 DUCT OVHT lights. AREA OVHT lights A, B, C, D, E, J, & H (7). Wing anti-icing left and right DUCT FAIL lights.	Engine bleed air ducting is overheated or ruptured. Monitor pneumatic control system and wing anti-ice panels for specific fault.
ECS A	Pressure safety relief valve FWD & Aft OPEN lights (2). Cabin pressure auto FAULT light Manual selector switches MNL lights (2). Pack flow control switch OVHT light (3). Hot air isolation valve switch OVHT lights (2). Ram/auto switch RAM AUTO light. Floor heat switch FAIL light. Avionic airflow indicators FWD & MID OVBD & LO FLO lights (2 each). FWD, MID, & AFT cargo heat switch HOT lights (3). Cool air OVBD switch CLOSE light.	Environmental control system has malfunctioned. Pneumatic systems control panels should be monitored.

FLIGHT ENGINEER'S ANNUNCIATOR LIGHTS CHART

The top five lights in each vertical row are self-explanatory. They indicate a specific door or opening is not securely closed. DOOR OPEN light on the C and W panel also illuminates. All the lights are amber.

ANNUNCIATOR LIGHT LEGEND	ASSOCIATED INDICATORS	CONDITION
LE SLAT LOCK A	Slat segment lights and slat position indicator.	The slat brake has been activated automatically or manually by the slat lock switch.
TAILSKID A	Landing gear lever position.	Tailskid is in transit (tailskid position does not agree with landing gear lever position) or tailskid is extended and contacting the ground.
BLEED DUCT OVERPRESS A	Engine isolation valve switch flow-bar is extinguished.	Pressure downstream of engine isolation valve is excessive.
VHF ANT ANTI-ICE A	NONE	Both VHF antenna anti-ice shutoff valves fail to open.
ASYM DET FAULT A	Flap/slat position indicators.	A fault is detected in the asymmetry detection system for the leading edge slats or trailing edge flaps.
WATER CPRSR 1 A	NONE	Water compressor NO. 1 has failed
WATER LINE HEATER A	NONE	Water line heater has failed.
TE FLAP LOCK A	Flaps are locked in position shown on flaps position indicator.	Flaps are locked in position shown on flap position indicator.
WATER CPRSR 2 A	NONE	Water compressor NO. 2 has failed.

* * *

LOGBOOK POLICY & GENERAL INSTRUCTIONS

The logbook is required by FAA Regulations. It must be aboard the aircraft at departure.

The logbook is the official source for the following information:

Record of engine and aircraft performance.

History of aircraft malfunctions and corrections.

Record of operating time of aircraft and accessories.

→ Time permitting, record aircraft and engine performance data within the heavy black lines. On multiple leg flights, record the data on the longest planned flight leg. When recording this information, every block must have data or a zero entered. Failure to fill all blocks within the heavy black lines prevents teletype forwarding of the information. Take readings as soon as stabilized cruise thrust and speed are established. It is preferable to record data at the heaviest weight, even when long flight legs are flown.

Use the first officer's indicator, when two identical instruments are available from which to record data.

Take performance readings with bleed air turned off to anti-icing systems.

RED CIRCLE LOG ENTRIES

A malfunction item should be designated a red-circle item when the captain determines that it must be corrected before the flight can proceed. A red circle placed around the number preceding a malfunction item makes it a mandatory repair item and grounds the aircraft until corrections have been made.

REPETITIVE SOUAWK LOG ENTRIES

Any logbook writeup should be designated as a repetitive squawk following three unsuccessful attemps to correct the item. The repetitive notation consists of large block letters REP in red at the end of the log writeup.

Open items should not be carried forward by the same or subsequent flight crews unless some symptom has changed.

If a symptom has changed, the entry should be completely rewritten to describe the problem including all new symptoms as they exist. Reference to the previous writeup should be made immediately following the new writeup. Technical Services personnel will sign off the previous writeup by referring to the new writeup. The new entry describes the situation as it currently exists.

Flight crews shall review the logbook. If any item remains uncorrected after three unsuccessful attempts have been made to repair the problem, the engineer should mark the next entry as a REP squawk.

If the original yellow pages have been removed prior to correction of an item, Technical Services personnel will re-enter the item on the next yellow page.

Corrective action taken prior to a flight should be checked en route, whenever possible, so that the continuity of flight squawks can be maintained if the fix is unsuccessful.

COMPLETION INSTRUCTIONS

Each log page must have at least the crew names, flight number and date, captain's signature, station, gross weight, fuel, flight times, oil and airplane number information. If unable to enter the remaining information, leave the blocks empty. All recordings are subordinate to the safe operation of the flight.

When no change of crew or flight number occurs, one log page may be used for up to five flight legs.

1. Airworthiness Release, Maintenance Done, Log Checked and Station/Date.

   These four boxes will be completed by Technica Services personnel, when required, and are not the responsibility of the flight crew.

2. Flight Number

   Enter flight number by the day of origination based on local standard time. Example: Flight 95 originating on January 20, local standard time, is entered as 95-20.

3. Crew Names and Domicile

   Enter last name, initials and domicile code for the operating crew.

COMPLETION INSTRUCTIONS (Cont'd)

4. Captain's Signature

   The captain's signature denotes his review and approval of the log page.

5. Cabin Air Supply Pressure

   Enter each duct pressure indication in manifold pressure block. Enter each pack flow indication in pack flow block.

6. Station

   Enter the station code for departure and arrival station of the flight leg covered by the log entry.

7. Takeoff Gross Weight

   Enter the takeoff gross weight listed on the flight weight slip or as computed by the crew at stations not served by TWA load control personnel.

8. Takeoff Fuel

   Enter the release fuel load in pounds.

9. Category II/III Approach

   a. Satisfactory/Unsatisfactory (S/U)

      When making either an actual or practice approach using Category II/III procedures and equipment, circle the appropriate letter. If the approach is unsatisfactory due to improper functioning of the aircraft equipment enter the cause as a malfunction.

   b. Runway

      When a Category II/III entry is made, indicate the runway used including the designation left (L) or right (R) when required.

10. Landing Weight

    Enter aircraft gross weight at time of landing for the respective leg.

11. Air Time

    Use Greenwich times, based on the 24 hour clock for OUT, OFF, ON and IN times. Air time is from OFF to ON

12. Oil Add

    Enter quarts of oil added to each engine for each leg as noted on the fuel servicing form. If no oil is added, enter a zero.

    Enter the total oil added to each engine for all flight legs on the page. Make these entries in the performance data section. If the total oil added to a particular engine is more than 9 quarts, enter a dash (—) in the block and record as a code 7 flight remark.

13. Pressure Altitude

    Enter the first three digits of the indicated aircraft pressure altitude.

14. Gross Weight

    Enter the first four digits of the aircraft gross weight at the time performance readings were taken.

15. Static Air Temperature (SAT)

    Enter the indicated static air temperature in the second and third blocks. For temperature below zero, enter a "—" in the first block. If temperature is at or above zero, enter a "0" in the first block. Example: 020 is +20°C.

16. Total Air Temperature (TAT)

    Enter the indicated total air temperature in the second and third blocks. If temperature is below zero, enter a "—" in the first block. If temperature is at or above zero, enter a "0" in the first block. Example: -20 indicates -20°C.

17. Indicated Air Speed (IAS)

    Enter the indicated air speed.

18. Mach

    Enter the indicated mach.

19. Air Inlet

    Enter zeros in both blocks.

20. Bled Engines.

    Enter zeros in both blocks.

COMPLETION INSTRUCTIONS (Cont'd)

21. Log Page Number

Copy, from the log page on which you are recording data, the last three digits of the page number. This number is used to ensure proper sequencing of the data in the computer program.

22. Bleed VLV

Enter "0" for open engine isolation valve.
Enter "1" for closed engine isolation valve.

23. Engine Pressure Ratio (EPR)

Enter indicated EPR to the nearest .001 EPR. Example: 1.512 recorded as 512.

24. N_1

Enter indicated N_1 to nearest .1%. When N_1 exceeds 100% enter second, third and fourth numbers. Example: 102.3% is recorded as 023. Enter 100.0% and 100.1% as 001.

25. Turbine Gas Temperature TGT

Enter indicated TGT to the nearest degree.

26. N_2

Enter indicated N_2 to the nearest .1%.

27. Fuel Flow (F/F)

Enter indicated fuel flow to the nearest 50 pounds.

28. N_3

Enter indicated N_3 to the nearest .1%.

29. Oil Pressure

Enter the indicated oil pressure to the nearest pound.

30. Airborne Vibration Monitor (AVM)

With selector in NORM, enter fan indicated value to the nearest .1 unit.

Enter turbine indicated value to the nearest .1 unit.

31. Flight Remarks

Space is provided to indicate the three most significant engine flight remarks that can be coded using the code provided on the log page. This protion of the performance data need not be completed until the last leg on the log page.

Indicate engine number in the first block and the appropriate code number in the second block on any line. More than one remark may be shown for an engine. Example: For a #2 engine EPR log remark, enter 26.

Code 8 should be used for combinations of codes 1 through 5.

This code presumes EPR alignment. Example: For a suspected #3 engine malfunction, enter 38.

Enter zeros in any unused blocks.

Reduced Thrust

The flight remarks, engine/code columns are also used to record reduced thrust takeoffs.

The digit 5 will be used in the ENG column to denote a reduced thrust takeoff. The code column will be used to reflect the amount of EPR reduction. Enter the appropriate digit 0 through 6 to correspond to the EPR reduction used. For example, enter 1 if assumed temperature EPR is .01 less than actual temperature EPR. Enter 2 if .02 less, etc.

Engine problem data shall take precedence over reduced thrust.

32. Plane Number

Enter the assigned five digit TWA aircraft number.

The plane number should be entered on all log pages, regardless of whether time or flight leg duration requires completion of the entire data portion of the log.

33. Date

Enter the date of the first leg based on Greenwich time. Since the months of January (01) through September (09) have only one number, enter a zero in the first block for these months. Enter the last number of the year in the last block. Example: January 21, 1974, is entered 01214.

COMPLETION INSTRUCTIONS (Cont'd)

34. Plane, Flight Arrival/Date, Maintenance received blocks will be filled out by Maintenance.

35. Malfunction/Work Performed

    The captain will review the status of the items listed in the logbook prior to arrival at each station. He will designate any write up involving airworthiness of the aircraft as a red circle item. He will designate repetitive squawk items as required by the rules of that program.

Malfunction items should be numbered consecutively using the item column. Begin each malfunction entry after the "1" in the blocked off area. Each item should clearly state the component or system involved. Briefly describe the problem, and include such additional information as operating conditions, en route trouble analysis and precise instrument readings where applicable. If the description of an item extends beyond one blocked off area, continue on each successive line as needed. Just initiate the next malfunction entry after the "1" in the next complete block.

The flight crew shall not sign off malfunction items entered in the log. It is permissible, to provide Technical Services with useful information, to note that a previous malfunctioning item was not encountered on a subsequent leg. The note should not be made in the Work Performed column, but should be clearly identified as a note and entered in the Malfunction column.

Deletions or alterations to item write ups or to notes must be accomplished in the following specific manner. Draw a single line through the word, or words, so that the deleted material is still descernible. The word VOID, boldly written across a page, should be used when necessary to void an entire log page.

Red circle (1) and Repetitive (REP) symbols should be carried over <u>in red</u> to the duplicate pages as well as the original.

Entry of information other than malfunctions in the Malfunction section should be held to a minimum. When the crew feels an information type entry is necessary, it must be prefaced with a prominent heading and not numbered in the item column. Example: "Attention Engineering."

When maintenance desires to make a notation or to present some information to the flight crew, they will use a blank page, insert the information in the right hand column and place a large "X" in the left column.

Requests for information or comments pertaining to other areas of Technical Services responsibility should be made on the detachable forms provided in the back of the logbook.

When a functional check of a system is preformed by the crew, following repair and a request by maintenance, the accomplishment of the check should be entered as an unnumbered note. Flight crews are not authorized to perform inspection work and all malfunction items relative to the requested functional check must be signed off prior to release of the aircraft to the crew.

FAULT ISOLATION REPORTING METHOD (FIRM) MANUAL

FIRM provides a method of fault reporting that improves dispatch reliability by simplifying logbook entries.

FIRM procedures do not duplicate or supersede flight handbook procedures. Fault isolation reporting is to be done only after emergency, abnormal, or additional procedures have been completed.

The FIRM manual is organized in the same chapter sequence as the flight handbook. Each chapter has diagrams, fault codes, and logbook writeups for a specific system. After flight handbook procedures are completed, the sequence of fault indications that took place should be reviewed. The engineer should find the applicable FIRM code and write it in the malfunction column of the logbook preceding the corresponding description. This description is referred to as the Flight Report in the manual. FIRM codes of a significant nature should be transmitted in flight to the station of intended landing either on the maintenance frequency or via ARINC on a Maintenance Report format.

At the bottom of each FIRM diagram is a statement, "Report any fault symptom or pattern not shown above." At the end of this line an arrow points to an XX code. This code should be used whenever the exact symptoms encountered are not shown on the FIRM diagram.

* * *

FLIGHT CREW INFORMATION BULLETIN (FCIB)

Flight Crew Information Bulletins are prepared to advise flight crews of modifications, special installations, or other unusual systems which may affect aircraft operations from a flight crew standpoint. The FCIB is placed in the holder of specific aircraft only if the information is not available from one or more of the following sources:

Flight Handbook

Flight Operations Training Bulletin.

Flight Operations Bulletin.

Flight Operations Teletype Message.

A placard mounted on the FCIB holder indicates when an FCIB should be in the holder. Flight Operations Training staff is responsible for FCIB information and the placards on each aircraft.

Information on special or test installations of approximately 90 days or less are covered by FCIBs to avoid multiple flight handbook revisions of short duration.

The FCIB is not a required item for dispatch. If the placard indicates FCIB PROVIDED but the FCIB is missing, enter the discrepancy in the aircraft logbook.

TEST FLIGHTS

Flight test forms for each type TWA aircraft serve as a guide for flight crews conducting a test flight.

Technical Services personnel will provide the appropriate test flight form to be completed by the crew. If a test flight form is not available for any reason, recommended flight test procedures may be obtained through the MCI Maintenance Coordinator.

The test crew will list any malfunctions in the aircraft logbook and note if the test flight is satisfactory in the comments section of the logbook.

POST-LANDING INSPECTION REQUIREMENTS

An inspection procedure must be accomplished, prior to the next flight, for the following reported conditions:

a. Hard landing or off-runway landing.

b. Landing above maximum certified landing weight.

c. Exceeding flap-down or gear down limit speeds.

d. Whenever an outboard engine nacelle or tail contacts the ground.

e. Whenever severe turbulence is encountered.

f. Whenever excessive drag or side-loading is imposed on the gear during landing.

Should any of the above conditions occur during the course of a flight, an entry must be made in the aircraft log to alert maintenance and avoid unnecessary delay in returning the aircraft to service.

Specific inspection requirements are outlined in the maintenance manual, chapter 51, for the appropriate aircraft model.

A logbook sign-off, indicating the accomplishment of the required inspection procedure, must be made prior to the next flight.

* * *

ADDITIONAL PROCEDURES

CONTROLS AND INDICATORS

SCHEMATICS

SYSTEM DESCRIPTION

* * *

AP DISC OR CMD DISC IN VIEW

1. Reset AFCS warning panel.
2. Disengage the affected autopilot.
3. Engage opposite autopilot.
4. Switch affected flight director to operative computer.
5. Refer to the .04 section of this chapter to determine what may have caused the trip.

ATS DISC IN VIEW

1. Reset AFCS warning panel.
2. Turn off the ATS switch(es) which show fail on the pilot's overhead panel.
3. Turn the ATS switches back on, one at a time. Turn off the ATS switch that shows fail.
4. The ATS switch which does not show fail should be left on.
5. Re-engage the autothrust.

NO ALIGN IN VIEW DURING AUTOLAND

1. Reset AFCS warning panel.
2. Monitor approach and manually apply rudder if required to maintain runway alignment as yaw SAS may now be inoperative.

NO DUAL IN VIEW DURING DUAL AUTOLAND

1. Reset AFCS warning panel.
2. Monitor approach carefully as another single failure may trip the autopilots to off.

AP LIMIT IN VIEW DURING AUTOLAND

1. Disengage autopilot(s). Be prepared for any pitch lurch due to stabilizer out of trim. Retrim as necessary using stabilizer manual trim wheel.
2. Reset AFCS warning panel.

FLIGHT DIRECTOR COMMAND BAR OUT OF VIEW

1. Check flight director on and for selection of incompatible mode.
2. Check for valid radio inputs.

FLIGHT DIRECTOR FAIL FLAG IN VIEW

1. Switch affected flight director to operative computer.
2. Check for power loss or failure of computer selected when fail flag appeared

DUAL A/L NOT AVAILABLE

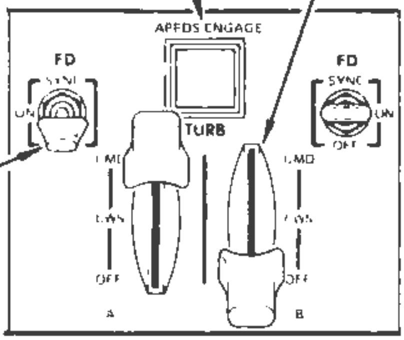
1. Check for input failure to either autopilot, yaw SAS, and speed command systems.
2. Use the automatic landing system(s) that have valid signals.

SPEED COMMAND FAIL FLAG IN ADI

1. Check for ATS fail lights on pilot's overhead panel. Turn off the ATS switch(es) that show fail.
2. Turn the ATS switches back on, one at a time. Turn off the ATS switch that shows fail.
3. The ATS switch which does not show fail should be left on.
4. Monitor ADI slow-fast pointer that does not show fail flag.

* * *

APFDS ENGAGE PANEL



TURBULENCE SWITCH

Reduces pitch and roll gains to ½, but does not change SAS. Disengage autothrust system and all modes except GO-AROUND and AUTOLAND after tracking has begun. Trips autopilot to CWS if in CMD. Provides automatic pitch trim. Drives command bars out of view. Disengage by pushing again or by disengaging AP.

FLIGHT DIRECTOR SWITCH

OFF - Command bars biased out of view.

ON - Engages FD computer. FD display given only on engaged side.

Any APFDS mode except TURB may be engaged.

Basic engage function (no flight path selected and autopilot disengaged) is pitch and roll attitude hold. Synchronized pitch and roll available.

SYNC - Synchronizes ADI command bars to existing aircraft attitude when autopilot is off and no command modes are selected. With an autopilot engaged, command bars are synchronized with the autopilot.

1A6, 24 PITCH & ROLL

AUTOPILOT SWITCH

Each solenoid-held switch controls one autopilot. Cannot be engaged unless all signals and computer are valid. Only one switch may be engaged at a time except when A/L mode is selected.

CWS - Engages one autopilot at a time in the Control Wheel Steering mode to provide:

- pitch hold up to 18°
- heading hold if bank is 3° or less
- bank hold between 3° and 35° max. Will return to 35° if engagement bank angle is greater than 35°. No navigation modes are available. Altitude hold or TURB may be engaged. Autopitch trim is operative except when force is applied to control wheel at which time control wheel electric trim is operative.

CMD - Same as CWS if no pitch or navigation modes are engaged or captured. Either or both autopilots may be engaged, depending on mode selection. Any compatible NAV and Heading/Pitch modes may be engaged. Autopitch trim operative.

OFF - Autopilot is synchronized with aircraft.

HEADING/PITCH MODE SELECTION

PITCH MODE SELECTOR SWITCHES

Requires FD on and/or AP in CMD. Only one pitch mode may be engaged at a time. Any pitch mode may be used with any approach or NAV mode except when glide slope is captured. Pressing an engage switch a second time or selecting another mode will disengage previously selected mode.

ALT - Holds altitude existing at engagement. May be engaged at any vertical speed. May also be engaged with AP in CWS or with auto capture by altitude select system.

IAS - Holds indicated airspeed existing at engagement. Disengages ATS.

MACH - Holds Mach number existing at engagement. Disengages ATS.

VS - Holds vertical speed existing at time of engagement. Rate can be varied with selector knob.

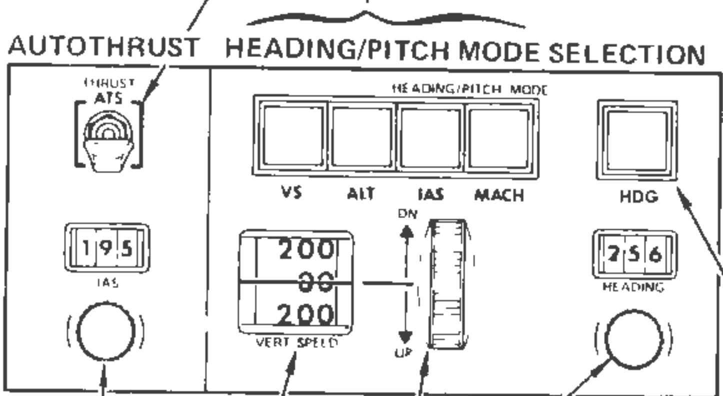
AUTOTHRUST SWITCH

Engages autothrust to hold selected speed. ALPHA automatically engaged if a speed of 1.3 Vs or less is selected. Trips off with MACH or IAS modes selected. At 33° flaps, reference shifts to 1.3 Vs and ALPHA flag covers IAS readout.

Automatically disengages with pilots' GO-AROUND switch or on landing. Also disengages with actuation of A/P disengage or ATS throttle disconnect switches.

1A1, - AUTOTHROT SERVO.

1A2, 20 - SPEED CONT.



IAS CONTROL KNOB

Provides control of the IAS reference for the speed command system.

VERTICAL SPEED DISPLAY

Synchronized to aircraft vertical speed when VS mode is not engaged. Provides readout for selected vertical speed in VS mode.

VERTICAL SPEED CONTROL WHEEL

Provides control of the vertical speed reference for the APFDS when VS mode is selected. Inoperative in all other modes.

HEADING MODE SELECTOR SWITCH

Provides heading reference for FD and/or AP in CMD. Will not engage if any NAV or APR mode is captured. Cannot be engaged in TURB mode.

HEADING CONTROL KNOB

Provides control of APFDS heading reference. Selected heading repeated on HSIs.

NAVIGATION MODE SELECTION

NAVIGATION MODE SELECT SWITCHES

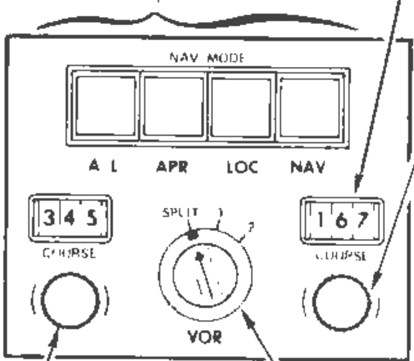
Requires a VOR frequency to engage NAV, an ILS frequency to engage A/L, APR or LOC, and a flight director ON and/or AP in CMD. Any NAV mode may be used with any pitch mode except when glide slope is captured. Pressing an engaged mode a second time or selecting another mode will disengage a previously selected mode, except for A/L when autoland tracking has begun.

A/L - Arms autopilot for approach and autoland with either one or both autopilots engaged. FD may be used for approach guidance only and will not display flare computations.

APR - Arms APFDS for capture and tracking of localizer and glide slope of category 1 quality.

LOC - Arms APFDS for capture and tracking of localizer. Glide slope capture not available. Not usable for back course approaches.

NAV - Arms APFDS for VOR capture and tracking.



COURSE DISPLAY

Indicates selected VOR course or ILS runway heading. Repeated on respective HSI.

COURSE SELECTOR KNOB

Sets No. 2 VOR receiver to desired course. Positions course pointer on first officer's HSI. Provides VOR or LOC course reference for APFDS B. When set to ILS course, provides heading information to computer for wind data integration, localizer capture, and runway alignment.

COURSE SELECTOR KNOB

Sets No. 1 VOR receiver to desired course. Positions course pointer on captain's HSI. Provides VOR or LOC course reference for APFDS A. When set to ILS course, provides heading information to computer for wind data integration, localizer capture, and runway alignment.

VOR SPLIT 1-2 SWITCH

SPLIT - APFDS A receives signals from NAV 1 radio; APFDS B receives signals from NAV 2 radio.

1. - Both APFDS receive signals from NAV 1 radio.

2. - Both APFDS receive signals from NAV 2 radio.

The VOR split 1-2 switch automatically returns to SPLIT when NAV mode is disengaged.

ALTITUDE SELECT PANEL

APPROACH	ALTITUDE	DEVIATION

ALTITUDE SELECT SYSTEM

APPROACH light on 1000 feet before reaching selected altitude, and off 250 feet before reaching selected altitude.

ALTITUDE light on 250 feet before reaching and out 250 feet on leaving selected altitude.

DEVIATION light flashes whenever deviation exceeds 500 feet and continues to flash until another altitude is selected.

C-CHORD sounds 500 feet before reaching and 250 feet on leaving selected altitude.

ALTITUDE ALERT SYSTEM TEST SWITCH

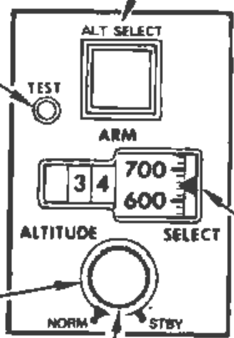
Permits check of the altitude alert system.

AIR DATA SOURCE SELECTOR SWITCH

NORM - Both altitude alert systems receive data from captain's ADC and baro from captain's altimeter.

STBY - Both altitude alert systems receive data from first officer's ADC and baro from first officer's altimeter.

1J21
1K27



ALTITUDE SELECT SYSTEM ARMING SWITCH

IN - Pressing switch the first time arms APFDS for automatic capture of selected altitude.

Switchlight remains illuminated until selected altitude is reached. ALT ARM appears in both AFCS mode annunciators. Altitude hold is automatically engaged when selected altitude is captured. After capture the arm feature is disengaged and ALT appears in both AFCS mode annunciators.

OUT - Pressing the switch a second time extinguishes switchlight and disengages function.

SELECTED ALTITUDE WINDOW

Displays altitude selected by control knob. Flag covers window with system fault.

ALTITUDE SELECTOR CONTROL KNOB

Provides selection of altitude to be automatically captured by APFDS. Provides selection of altitude reference for altitude alert system. When rotated, stops visual and aural warning until a new altitude is approached.

AFCS WARNING INDICATOR

ALERT SWITCH

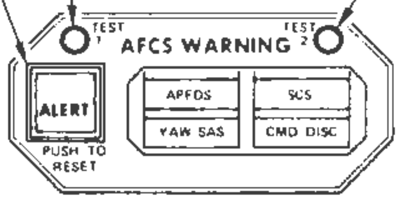
Flashes when FAIL flag comes into view. ALERT reset by pressing once. FAIL flag reset by pressing ALERT light twice. If a second failure occurs, switch may be reset without cancelling previous failure message.

TEST 1 SWITCH

On tested panel	Other panel
AP DISC	—
A/P LIMIT	A/P LIMIT
ATS DISC	—
NO FLARE	NO FLARE

TEST 2 SWITCH

On tested panel	Other panel
NO DUAL	NO DUAL
NO ALIGN	NO ALIGN
NO GA	—
CMD DISC	CMD DISC



2K18, 19 - AFCS WARNING

AP DISC

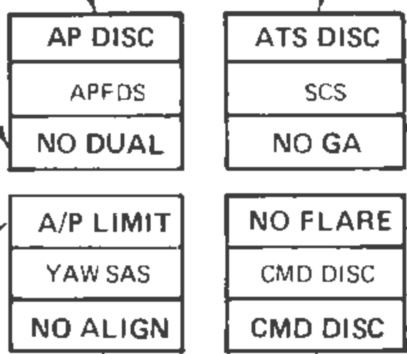
Indicates autopilot disconnect switch pressed or engage lever placed to OFF. Also in view if a major autopilot failure causes an engage lever to trip OFF.

ATS DISC

Indicates autothrust was disengaged by autopilot disconnect switch, ATS disconnect switch on throttles, or when manually disengaged. Also in view if ATS computer channel fails.

NO DUAL

Indicates A/L selected below 1500 feet and one autopilot engaged. Also in view if an autopilot failure occurs when A/L selected below 1500 feet and both autopilots engaged. As a fail message NO DUAL indicates that any additional failures could result in trips and cause the auto landing to be discontinued.



NO GA

Appears after glide slope capture if a fault is detected in the go-around computations

A/P LIMIT

Autopilot has reached limit of authority to stabilizer.

NO FLARE

Appears when A/L selected and only a FD engaged or anytime APR is selected. Also indicates a failure of flare computations.

NO ALIGN

Appears after localizer capture when A/L is selected and no autopilot is engaged or when the APR mode is being used.

Also armed to appear at 1500 feet if a failure occurs which prevents automatic runway alignment.

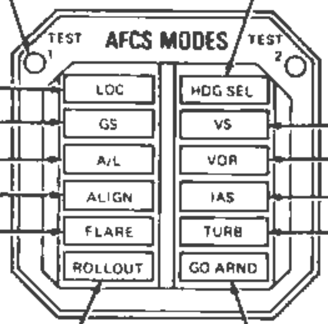
CMD DISC

Indicates autopilot has tripped CMD to CWS because there is faulty air data or radio inputs to the autopilot computer or an incompatible frequency has been selected.

AFCS MODE ANNUNCIATOR (SHEET 1)

MODE ANNUNCIATOR TEST 1 SWITCH

Both panels display modes as shown, and VS, IAS, HDG, and TURB mode switch lights illuminate.



LOC

Localizer beam captured.

GS

Glideslope captured.

A/L

Armed to appear below 1500 feet or 30 seconds after glideslope capture, whichever occurs last, if autopilot is in CMD with A/L mode engaged. Aircraft is now established in autoland track.

ALIGN

In view at 150 feet radio altitude if A/L mode is engaged and autopilot is in CMD. It indicates runway alignment has been initiated.

FLARE

In view at 50 feet radio altitude if A/L mode is engaged and autopilot is in CMD. It indicates aircraft flare has been initiated. ATS will reduce thrust to idle if engaged.

HDG SEL

Heading select mode in use.

VS

Vertical speed mode in use.

VOR

Nav mode in use and VOR captured.

IAS

Airspeed hold mode in use.

TURB

Turbulence mode is in use, cannot engage when established on autoland track or with go-around mode engaged. Autopilot trips to CWS with reduced control gains. No CMD modes are available. Flight director command bars bias from view. ATS will automatically disconnect.

GO ARND

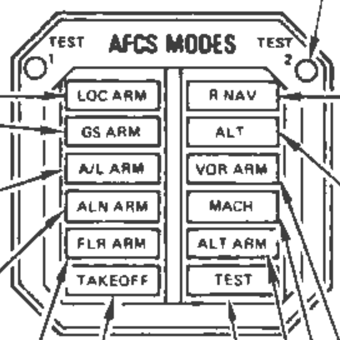
In view when the takeoff/go-around switch is pressed inflight if: Autopilot is in CMD and flaps extended to 33°, or flight director is used and autopilot is off or in CWS. ATS will disconnect. DLC will stow. A wings level and optimum pitch attitude is commanded. HDG mode may be engaged after go-around mode is pressed.

ROLLOUT

In view at touchdown if A/L mode is engaged and autopilot is in CMD. It indicates rollout guidance is initiated.

1B1, 19 - AFCS MODE IND

AFCS MODE ANNUNCIATOR (SHEET 2)



LOC ARM

Armed to capture localizer.

GS ARM

Armed for glideslope capture

A/L ARM

Armed for an automatic landing.

ALN ARM

In view at 1500 feet if A/L is in use; and indicates the align function is armed. YAW SAS goes to parallel operation.

FLR ARM

In view at 1500 feet if A/L is in use; indicates autopilot self checks have been conducted and computers are armed for flare function.

TAKEOFF

In view when the takeoff/go around switch is pressed while on the ground and a flight director is engaged. Flight director will display takeoff and climb-out commands.

MODE ANNUNCIATOR TEST 2 SWITCH

Both panels display modes as shown, and ALT, ALT ARM, and MACH mode switch lights illuminate.

R NAV

Reserved for future use with area NAV.

ALT

Altitude hold mode in use. Automatically comes into view if altitude select mode is being used and selected altitude is reached.

VOR ARM

Nav mode selected and armed for VOR capture.

MACH

Mach hold mode in use. Mach number is held by pitch attitude.

ALT ARM

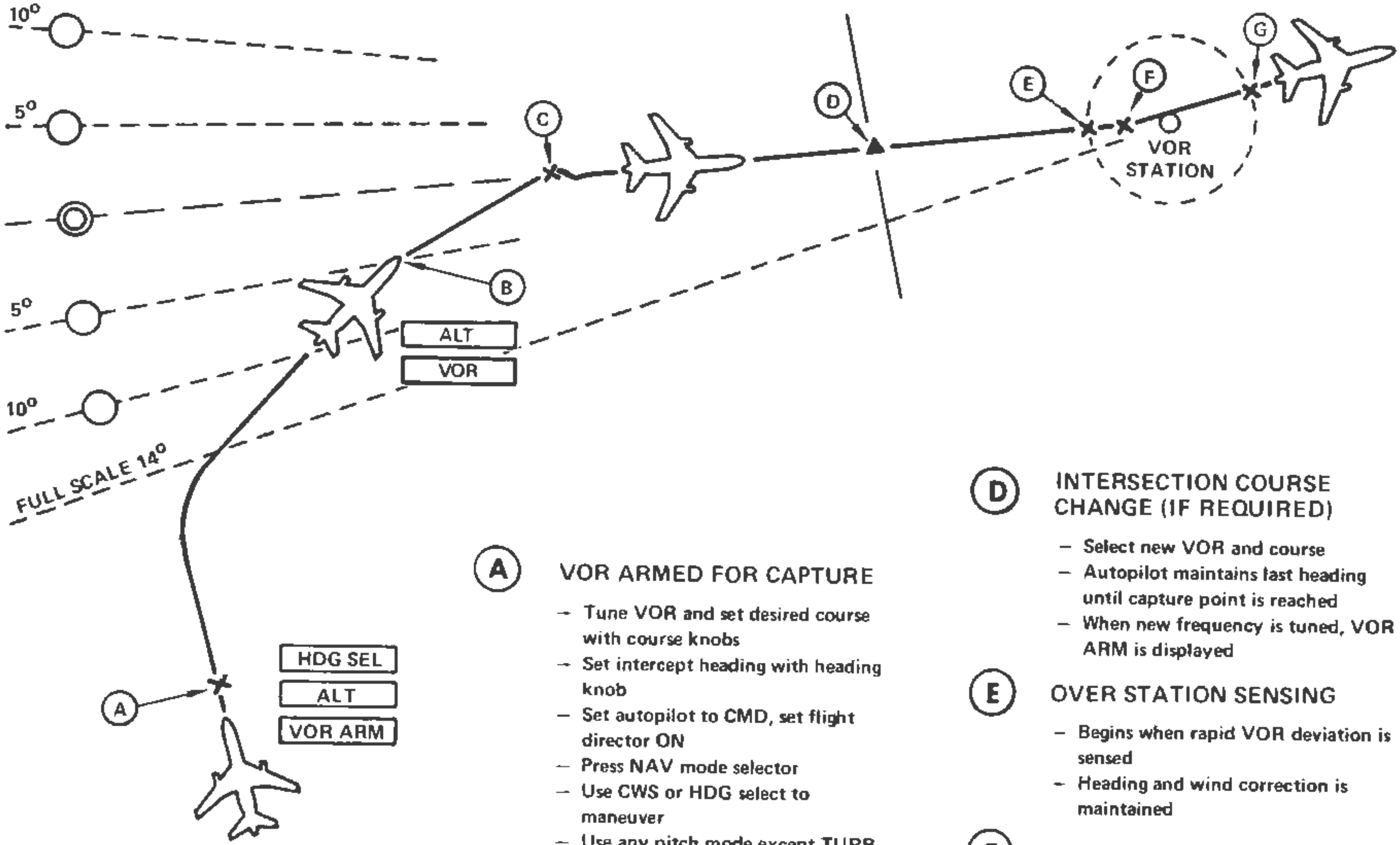
The altitude select mode is armed to capture the selected altitude.

TEST

Message appears only when pressing TEST 2 switch.

* * *

APFDS VOR PROCEDURES



A VOR ARMED FOR CAPTURE

- Tune VOR and set desired course with course knobs
- Set intercept heading with heading knob
- Set autopilot to CMD, set flight director ON
- Press NAV mode selector
- Use CWS or HDG select to maneuver
- Use any pitch mode except TURB

B VOR CAPTURE

- Capture point varies with beam rate change and angle of intercept
- HDG SEL disengages

C VOR TRACKING

- Autopilot provides for wind correction

D INTERSECTION COURSE CHANGE (IF REQUIRED)

- Select new VOR and course
- Autopilot maintains last heading until capture point is reached
- When new frequency is tuned, VOR ARM is displayed

E OVER STATION SENSING

- Begins when rapid VOR deviation is sensed
- Heading and wind correction is maintained

F COURSE CHANGE

- Course changes may be made with the course knob while passing over station

G STATION PASSAGE

- Autopilot picks up course set in course windows

AFCS WARNING INDICATIONS

ALERT | NO ALIGN | NO FLARE

- NO ALIGN will appear at LOC tracking as a reminder that the APR mode does not provide automatic runway alignment.
- NO FLARE will appear at 150 feet as a reminder that the APR mode does not provide automatic flare.

APPROACH

- Engage autopilot to CMD mode, and place both flight directors on.
- Use appropriate pitch mode.
- Use control wheel steering, or set HDG cursor and press HDG mode, use HDG knob to maneuver.
- Tune ILS and ADF, set inbound course
- Press APR mode.
- Set DH bugs on altimeters
- Set speed - Engage ATS if desired
- Monitor annunciators

LOC ARM | HDG SEL

GS ARM | VS

LOC CAPTURE

- Capture point varies with beam rate change and angle of intercept
- HDG SEL disengages

LOC

GS ARM | VS

GS CAPTURE

- Automatic pitch to 750 FPM descent until glide slope tracking begins
- Pitch mode disengages
- Approach gate appears in ADI
- ATS programs ALPHA at 33^0 flaps
- Autopilot go-around armed.

LOC

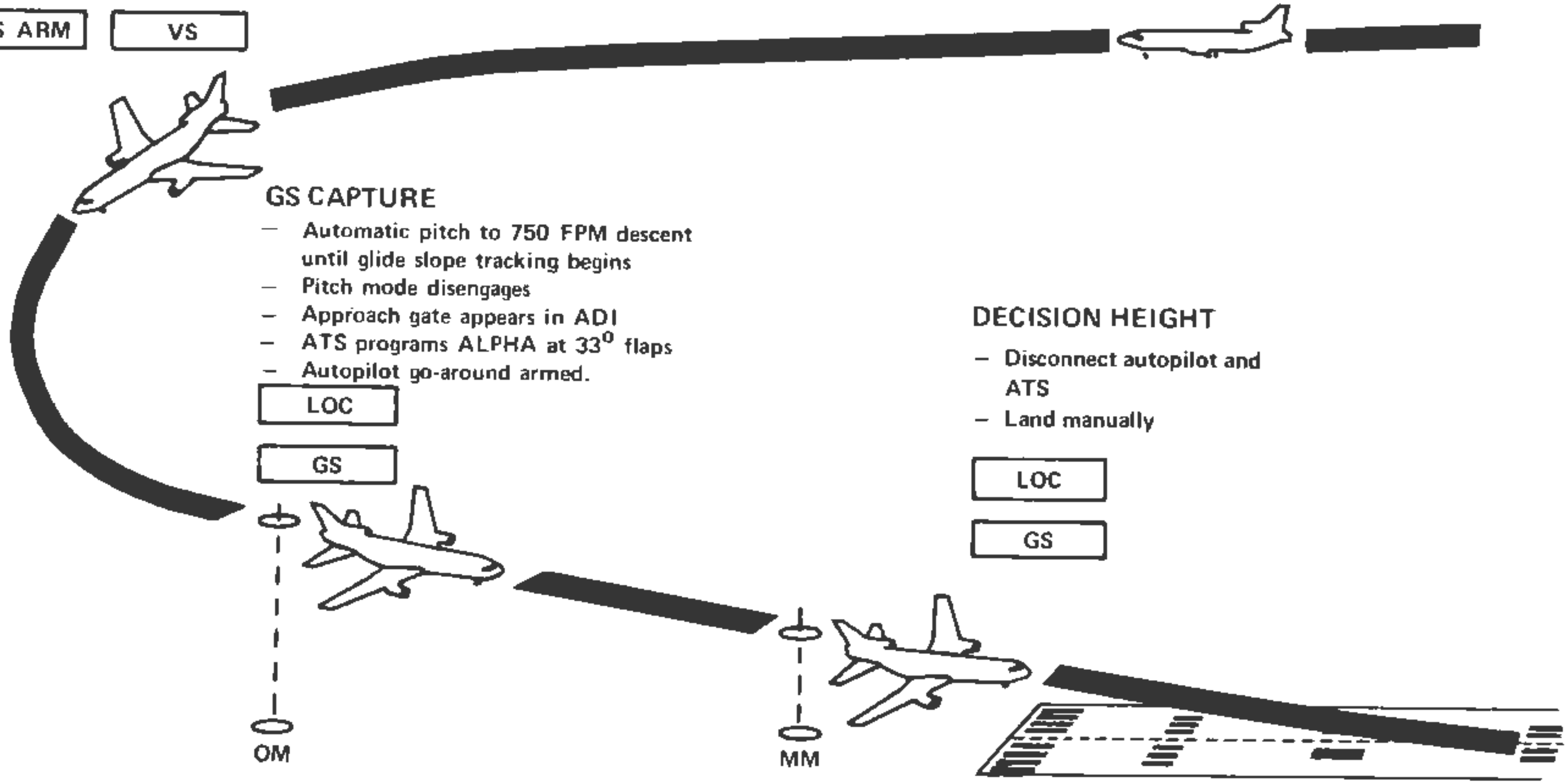
GS

DECISION HEIGHT

- Disconnect autopilot and ATS
- Land manually

LOC

GS



F1-5001-7-009

APPROACH

- Engage autopilot to CMD mode, and place both flight directors on.
- Use appropriate pitch mode.
- Use control wheel steering, or set HDG cursor and press HDG mode, use HDG knob to maneuver.
- Tune ILS and ADF, set inbound course.
- Press A/L mode.
- Engage second autopilot to CMD.
- Set AH or DH bugs on altimeters.
- Set speed and engage ATS.
- Monitor annunciators.

LOC ARM | HDG SEL
GS ARM | VS
A/L ARM

LOC CAPTURE

- Capture point varies with beam rate change and angle of intercept
- HDG SEL disengages

LOC
GS ARM
A/L ARM | VS

SINGLE AUTOPILOT A/L APPROACH

ALERT | NO DUAL

- NO DUAL appears below 1500 feet radio altitude and indicates that any single failure could trip the autopilot.
- If only one autopilot is engaged dual channel cross monitoring is not possible.
- All other functions are the same as a DUAL A/L approach.

GS CAPTURE

LOC
GS
A/L ARM

- Automatic pitch to 750 ft/min descent until GS tracking
- Pitch mode disengages
- Approach gate appears in ADI
- ATS programs ALPHA at 33° flaps
- Autopilot go-around armed.

150 FT

- Aircraft aligns with runway and sets up cross wind correction

LOC
GS
A/L
ALIGN
FLR ARM

ROLLOUT

- Command bars and
- Approach gate out of view
- Rollout bar in view
- At touchdown rollout guidance initiated.
- ATS moves throttles to idle.

LOC
GS
A/L
ALIGN
FLARE
ROLLOUT

50 FT

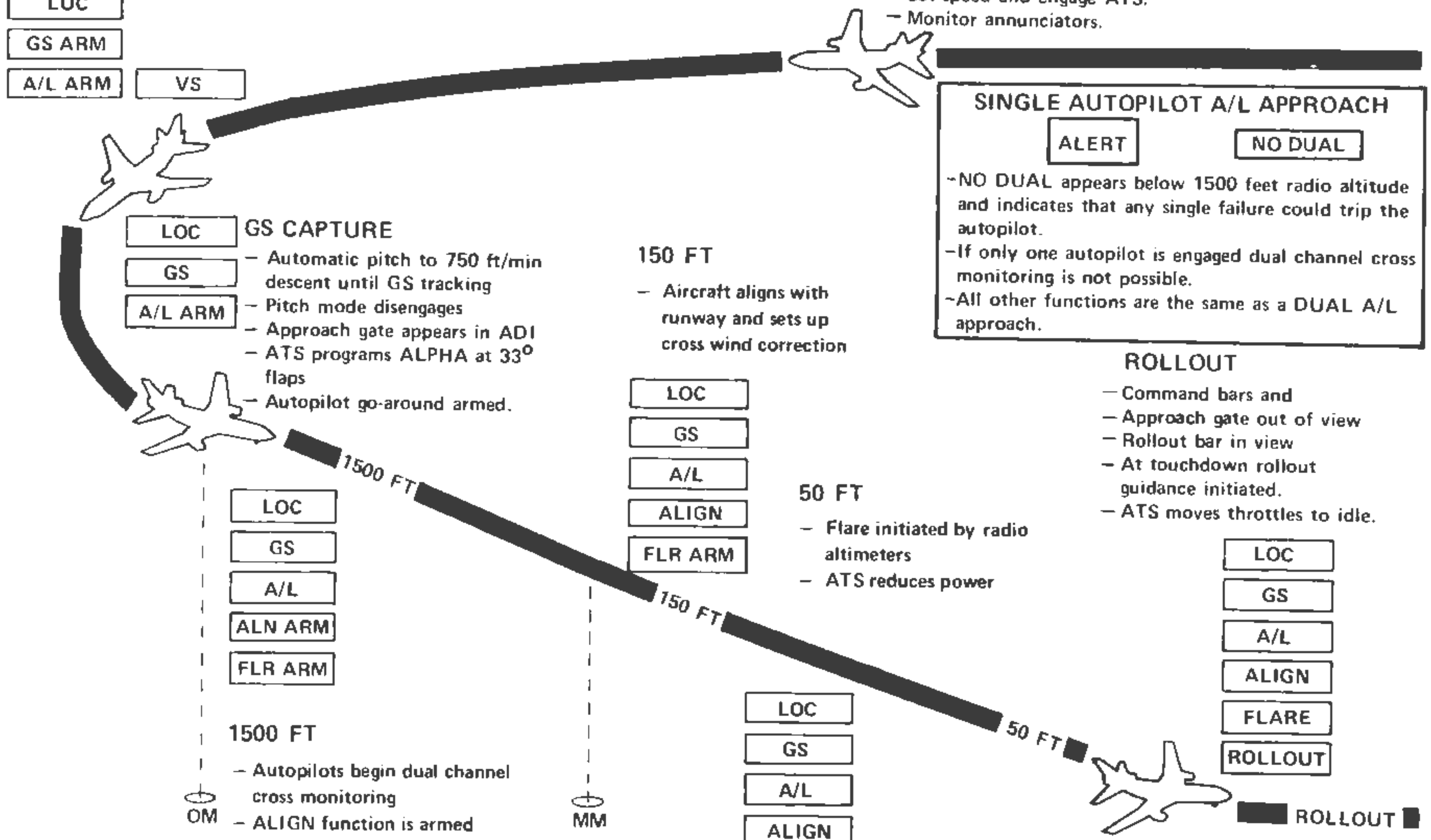
- Flare initiated by radio altimeters
- ATS reduces power

LOC
GS
A/L
ALIGN
FLARE

1500 FT

LOC
GS
A/L
ALN ARM
FLR ARM

- Autopilots begin dual channel cross monitoring
- ALIGN function is armed
- FLARE function is armed
- Rudder goes to parallel operation



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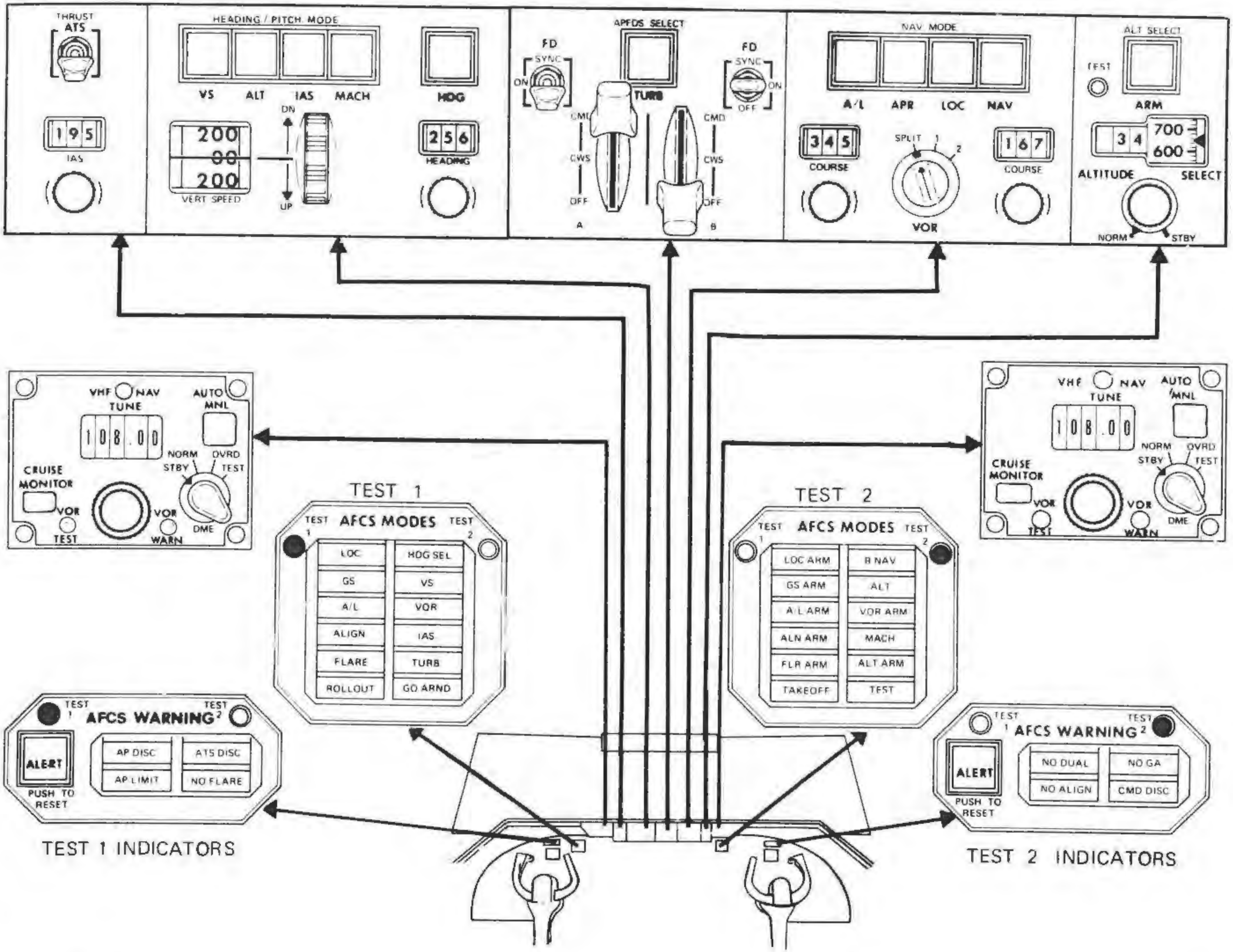
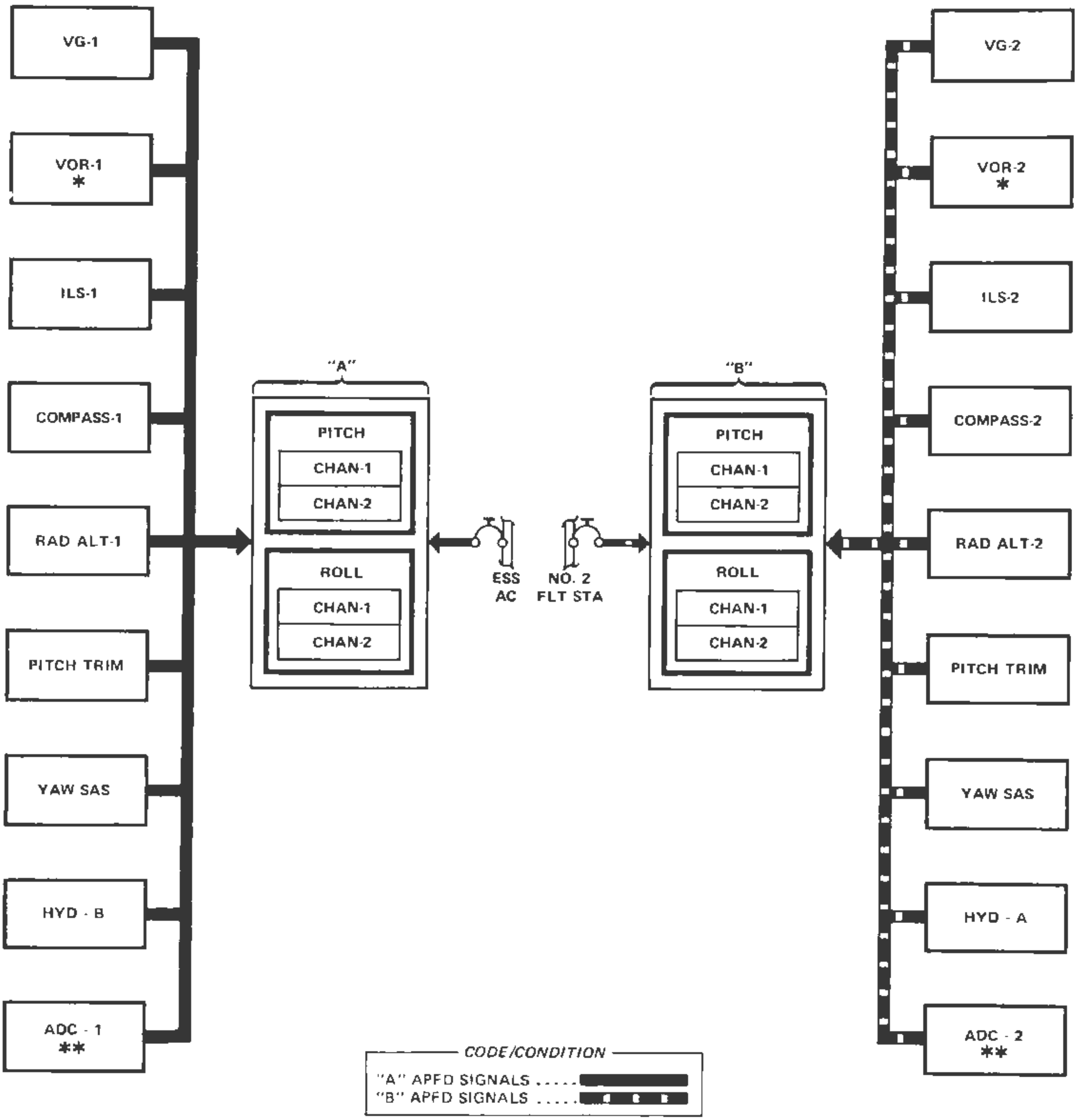
AFCS FLIGHT STATION COMPONENTS



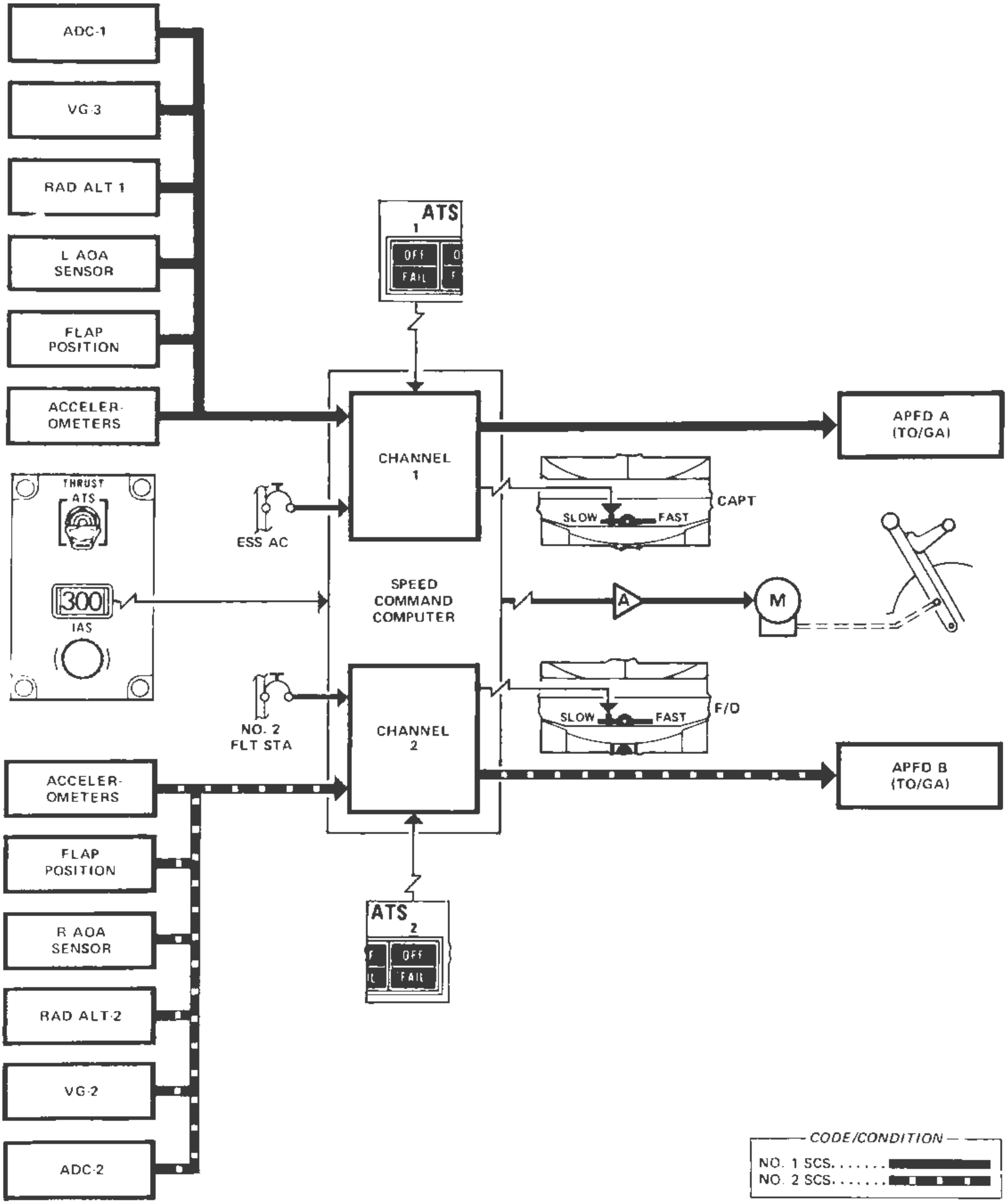
AUTOPILOT/FLIGHT DIRECTOR



* CAN BE SELECTED TO OTHER COMPUTER USING VOR SPLIT 1-2 SWITCH IN NAV MODE.

** NORM - BOTH COMPUTERS USE NO. 1 ADC (ALT NOT ENGAGED).
STBY - BOTH COMPUTERS USE NO. 2 ADC (ALT NOT ENGAGED).

SPEED COMMAND/AUTOTHRUST



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* * *

AUTOPILOT

GENERAL

There are two autopilot/flight director computers, A and B. Each has two separate channels. Only one autopilot can be engaged at a time except during an autopilot ILS approach with autoland (A/L) mode selected. With two autopilots engaged, all four channels are cross monitored after autoland track (1500 feet) is achieved. After autoland track has been achieved, a single failure will not normally interrupt the automatic approach and landing.

CONTROL WHEEL STEERING (CWS)

This is a manual mode of operation providing attitude and heading hold functions. The control wheel is used to establish the desired aircraft attitude. If approximately 18 degrees pitch or 35 degrees bank is exceeded, the aircraft will return to the maximum limit when control wheel pressure is relaxed. Altitude hold (ALT) or turbulence (TURB) are the only modes which can be selected with control wheel steering without flight director(s) on. Automatic trimming is provided while in control wheel steering. The electric control wheel trim switch can be used if control wheel pressure is applied.

COMMAND (CMD)

The command mode permits selection of automatic modes. It is the same as control wheel steering if no automatic modes are selected. It is possible to achieve a command function in one axis of control while the other axis is in a control wheel steering function. For example, if mach is the only mode selected, the autopilot pitch axis is in a command function while the roll axis is still in a control wheel steering function. Automatic trimming is provided with command selected. Electric control wheel trim switches are inoperative.

AUTOMATIC MODES

Each switch must be firmly pressed to insure the mode is engaged. Check light and mode annunciator panels for proper message to verify engagement. To select any of the automatic modes, an autopilot or flight director must be engaged. Only one pitch mode can be selected at a time. Only one approach/navigation mode can be selected at a time. The heading mode can be selected with any pitch mode and can also be selected with any approach/navigation mode providing course capture has not taken place. The turbulence mode will cause an autopilot switch to trip to control wheel steering and will disengage any other command modes if engaged. The IAS or mach modes cannot be selected with autoland or approach modes selected. IAS or mach will also trip autothrust off if selected.

Autoland (A/L) is the normal mode to be used for an autopilot ILS approach. If the ILS has any beam irregularities, or if the terrain is too uneven during the last 1500 feet, it may not provide a satisfactory approach. The approach (APR) mode does not require the sophistication and sensitivity needed by the autoland mode and can be used when ILS beam tolerances or terrain features are not adequate. The autoland mode provides automatic course capture, autoland tracking, alignment, flare, and rollout capability. It can be selected with one or two autopilots engaged. The approach mode provides localizer and glide slope capture same as the autoland mode, but does not provide alignment, flare, or rollout capability. It must be disengaged prior to landing and a manual landing accomplished.

AUTOPILOT ENGAGE REQUIREMENTS

To select control wheel steering or command, the following must be operating normally:

AUTOPILOT A	AUTOPILOT B
AC and DC Essential bus.	No. 2 flight station and No. 2 DC bus
Hydraulic system B.	Hydraulic system A.
No. 1 vertical gyro signal.	No. 2 vertical gyro signal
No. 1 compass signal.	No. 2 compass signal.
One yaw SAS channel	One yaw SAS channel.
One automatic trim channel.	One automatic trim channel.
*No. 1 VOR/ILS signal.	*No. 2 VOR/ILS signal.

* Valid signals are required only if an approach/navigation mode is to be selected while in command.

AUTOPILOT TRIPS

Force sensors are located in each control wheel hub. Under certain conditions, autopilot trips will take place if excessive pressure is exerted on either control wheel.

Pitch Mode Trip - A control wheel pitch force of approximately 15 pounds will cause any of the pitch modes (VS, ALT, IAS, MACH) to disengage. Autopilot switch will remain in command.

Roll Axis Trip - An approximate 15 pounds control wheel roll force will cause autopilot switch to trip to CWS if localizer, VOR or heading is captured but autoland track has not been achieved.

AUTOPILOT (Cont'd)

Pitch Axis Trip - An approximate 15 pounds control wheel pitch force will also cause autopilot switch to trip to CWS if glide slope is captured but autoland track has not been achieved.

After autoland track has been achieved, no control wheel pitch or roll force will trip autopilot switch.

AUTOPILOT FAILURES - TRIP TO OFF

Prior to autoland track, any of the following failures will cause its associated autopilot switch to trip off:

- AC essential or No. 2 Flight Station bus.
- A or B hydraulic system.
- No. 1 or No. 2 vertical gyro.
- No. 1 or No. 2 compass.
- Both yaw SAS channels.
- Both automatic trim channels.

After autoland track, it will normally require two major failures to interrupt the automatic landing. A single vertical gyro, compass, ILS receiver or automatic trim channel failure will not trip an autopilot switch off with both autopilots engaged. Any of the following failures will cause one or both autopilots to trip off after autoland track:

- AC essential or No. 2 Flight Station bus.
- A or B hydraulic system
- Any two vertical gyros.
- Both ILS receivers.
- Both compass systems.

AUTOPILOT FAILURES - TRIP TO CONTROL WHEEL STEERING

Prior to autoland track, any of the following failures will cause its associated autopilot switch to trip to control wheel steering:

- Radio altimeter
- Air data computer (will trip off if altitude mode selected).
- Both direct lift channels.
- VOR/ILS receiver (if its associated navigation/approach is selected, or if an incompatible frequency is tuned).

AUTOPILOT DISCONNECT

Pressing either autopilot disconnect switch will disengage either or both autopilots and autothrust. The flight directors will remain engaged if being used. The alert lights flash and the autopilot disconnect messages appear. A two second wailer also sounds. Pressing the autopilot disconnect switch again will clear the messages and lights.

FLIGHT DIRECTOR

There are two flight director systems which use the same A and B computers used by the autopilots. They also use the same automatic modes. When either flight director switch is placed on, its respective command bar will appear on its attitude director indicator. Separate flight director synchronizers are provided independent of autopilot operation. Automatic synchronization is provided for pitch and roll axis operation if a pitch and roll mode is selected. Manual flight director synchronization is provided when automatic synchronization is not provided. It is possible to have automatic synchronization in one axis and not in the other. If the flight director is on without a pitch and roll mode selected, the command bar will be initially satisfied with aircraft attitude. If a change of attitude is made, the command bar will disagree. Selecting synchronization will synchronize the command bar to the new attitude.

FLIGHT DIRECTOR DISCONNECT AND FAILURES

The flight director is disconnected by turning its respective switch off. The command bar will retract automatically at five feet during an autopilot ILS approach using the autoland mode and at 50 feet during a flight director only approach using the autoland mode. A vertical gyro, compass, or radio receiver failure, or loss of power to the autopilot/flight director computer will cause the associated command bar to retract and display the flight director flag. Alternate flight director switching is provided for both pilots so that the other computer can be selected.

FLIGHT DIRECTOR MODES

Any of the automatic modes used by the autopilot can also be used by either flight director, except turbulence. If the turbulence mode is selected, the command bar(s) will retract from view. If a flight director only ILS approach is made without autopilot, and using the A/L mode, the no align and no flare messages will appear as a reminder these capabilities are not provided.

SPEED COMMAND/AUTOTHRUST

There is one speed command computer containing two channels. The computer supplies signals for both autothrust and slow fast indicators. It receives signals from angle of attack sensors, flap position, accelerometers, and vertical gyro. An airspeed setting knob controls airspeed selection for both autothrust and slow fast indicators, provided the alpha shutter does not appear in window. The alpha shutter appears if more than 30 degrees flaps are selected or if the aircraft slows to 1.3 Vs. If autothrust is engaged, it prevents aircraft speed slowing below 1.3 Vs during an approach. The alpha shutter appears when takeoff or go-around is selected. It will remain in view until takeoff or go-around mode is disengaged.

AUTOTHRUST

Autothrust is normally selected during the approach phase of flight. The throttles are driven by a servo motor and move to satisfy the selected airspeed setting. The throttles will retard towards idle during flare and disconnect upon landing. Autothrust can also be disconnected by either throttle switch, autopilot disconnect switch, takeoff/go-around switch, selecting IAS or Mach, or turning the autothrust switch off. Autothrust will not operate if both ATS overhead panel switches display the fail legend. It will operate as long as one channel is valid.

TAKEOFF MODE

The takeoff mode is a flight director mode. The heading mode can also be selected for normal takeoff use with runway heading set in window. The command bars will initially program not less than 1.25 Vs. After flaps start retracting, 1.3 Vs is programed. After flaps are fully retracted, 1.5 Vs is programed. The takeoff mode can be disengaged by selecting any pitch mode or by turning flight director switch(es) off.

GO-AROUND MODE

This is an autopilot and flight director mode. When used with autopilot operation, more than 30 degrees flaps must be selected to achieve automatic aircraft pitch up. If either control wheel go-around switch is pressed during an autopilot approach, the aircraft will pitch up, wings level, to initially maintain not less than 1.25 Vs. Any selected automatic mode will disengage. The heading mode can be selected with go-around to provide heading commands. As flaps start retracting, 1.3 Vs is programed. With flaps fully retracted, 1.5 Vs is programed. If flaps remain at 33 degrees, the aircraft will pitch down slightly at 800 feet to program an additional 10 knot pad. To disengage the go-around mode, select any pitch mode or turn autopilot and flight directors off.

ALTITUDE SELECT/ALERT

The altitude select system is used for autopilot/flight director level off commands and to arm the altitude alert lights and aural tone for proper indications. Once a flight director or autopilot is engaged, an altitude can be set in the altitude select window and the arm switch pressed. When the altitude is reached, the arm light will go out and the altitude hold light will come on. A smooth level off will be achieved if an autopilot is engaged in command. CWS can be used with a flight director on; however, the level off is not quite as smooth. If only a flight director is engaged, the command bar will provide a visual level off command.

The altitude alert system consists of amber approach, green altitude, and flashing red deviation lights together with an aural tone. The approach light will appear when within 1000 feet of preselected altitude. The approach light goes out and the altitude light will appear when within 250 feet of preselected altitude. The deviation light will flash when the aircraft leaves selected altitude by more than 500 feet. An aural tone will be heard when approaching selected altitude by 500 feet and leaving selected altitude by 250 feet. The flashing deviation light can be extinguished by selecting a different altitude.

* * *

ADDITIONAL PROCEDURES

CONTROLS AND INDICATORS

SYSTEM DESCRIPTION

* * *

CABIN INTERPHONE USE THROUGH OXYGEN MASK AND HAND MICROPHONE

1. Press the INT and INT CABIN/SERV switches on the audio panel. Adjust the INT CABIN/SERV switch for volume.

2. If the oxygen mask is to be used, select OXY on the microphone select panel.

3. Select the desired cabin area on the cabin interphone panel and press the STA switch.

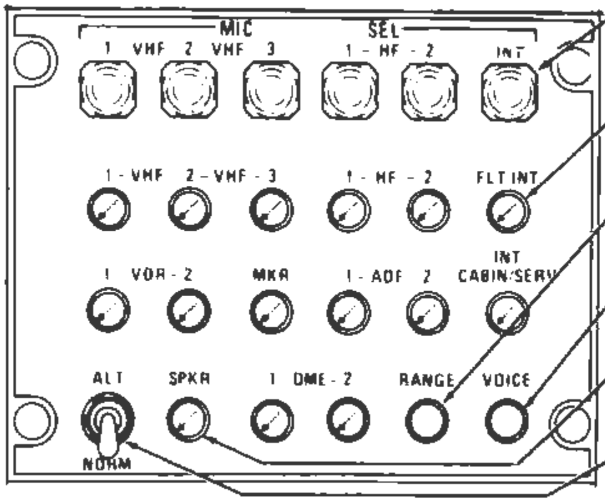
4. If the oxygen mask is being used, press the control wheel or microphone select panel press-to-talk switch when call is answered—and talk.

5. If hand mike is being used, depress the switch and talk when your call is answered.

* * *

AUDIO SELECTOR, SERVICE INTERPHONE, MICROPHONE, & HEADSET JACKS

AUDIO SELECTOR



MICROPHONE SWITCHES

Press top row switch to transmit.

VOLUME SWITCHES

Controls receiving volume. Push and rotate to adjust.

RANGE SWITCH

Filters voice audio to improve coded reception.

VOICE SWITCH

Filters coded signals to improve voice reception.

SPEAKER SWITCH

Permits captain or first officer to use speakers. Rotate to adjust volume.

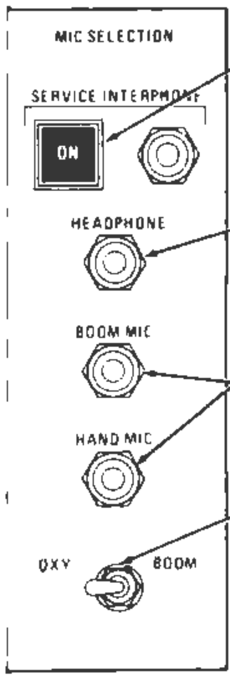
AMPLIFIER SELECTOR

Selects normal or alternate amplifier. Both identical in operation.

AUDIO CONTROL, CAPT, F/O & F/E
1A12, 13

1A15, 16 - PA NO. 1 AND NO. 2
1A14 - FLT INTPH AMPL
3C18 - FLT INTPH AMPL

ENGINEER'S MICROPHONE AND HEADSET JACK AND SERVICE INTERPHONE.



SERVICE INTERPHONE SWITCH

Press to activate service interphone system.

ENGINEER'S HEAD SET JACK

MICROPHONE JACKS

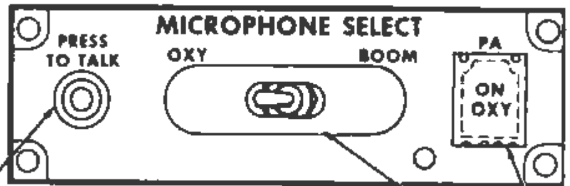
MICROPHONE SELECTOR SWITCH

OXY - The oxygen mask microphone is selected.

BOOM - The boom microphone is selected.

GND SVCE INTPH
2L1

CAPTAIN AND FIRST OFFICER'S OXYGEN MASK AND BOOM MIKE SELECTOR



PRESS TO TALK SWITCH

Activates microphone when using boom or oxygen mask microphone.

MICROPHONE SELECTOR SWITCH

OXY - The oxygen mask microphone is selected.

BOOM - The boom microphone is selected.

PA ON OXYGEN

Raise guard and press to connect oxygen mask mike to PA. Overrides VHF and interphone.

VHF, HF AND SELCAL

TRANSFER SWITCH

Selects operating frequency. Other window can be preloaded with new frequency.

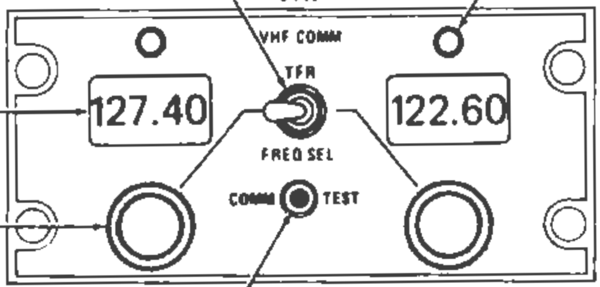
FREQUENCY LIGHT

Indicates operating frequency selected.

VHF

FREQUENCY WINDOW

FREQUENCY SELECTOR

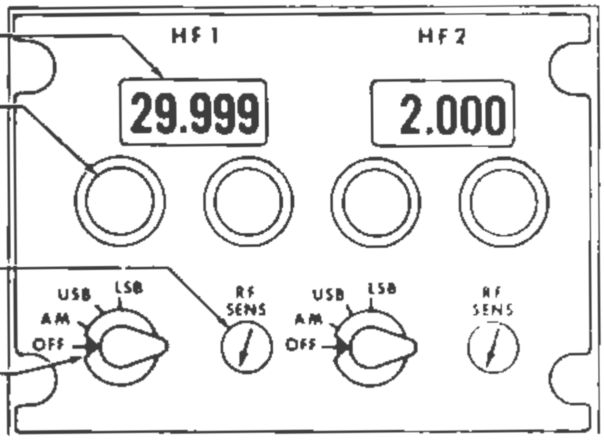


1A11 - VHF NO. 1
1C23 - VHF NO. 3
2L4 - VHF NO. 2

COMMUNICATIONS TEST SWITCH

Removes automatic squelch when pressed.

HF



FREQUENCY WINDOW

FREQUENCY SELECTOR

Selects desired frequency. Range from 2.000 to 29.999 MHz in 1-KHz steps. Transceiver range from 2.800 to 26.999 MHz

RF SENS CONTROL

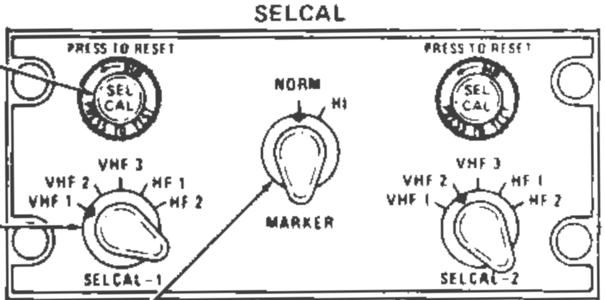
Controls squelch or receiver sensitivity.

MODE SELECTOR

OFF - HF off.
AM - Amplitude modulation provided from 2 to 30 MHz frequency range.
USB - Upper side band. Used for normal long range communication.
LSB - Lower side band.

1C1, 3 - HF NO. 1 DC, AC.
1C19, 21 - HF NO. 2 DC, AC.

SELCAL



SELCAL LIGHT

Indicates decoder is activated by selected communication system. Pressing light will reset the light and chime.

SELECTOR SWITCH

Communications system selected is monitored for coded tone.

1C5 - SELCAL

MARKER BEACON VOLUME SWITCH

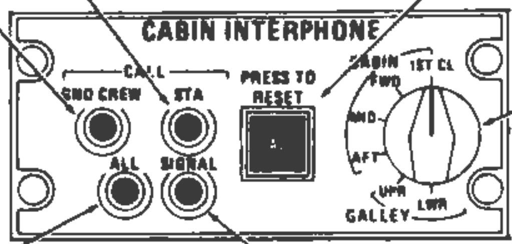
NORM - Low marker beacon sensitivity.
HI - High marker beacon sensitivity.
1D7 - MARKER BEACON.

INTERPHONE, PA, AND VOICE RECORDER

STATION SWITCH
Sounds hi-lo chime at selected station. Pink lights also appear.

GROUND CREW SWITCH
Sounds horn in nose wheel well.

CALL LIGHT
Light appears and hi-lo chime sounds when cabin interphone call is made to cockpit. Press light to reset.

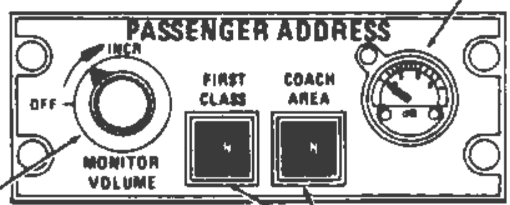


STATION SELECT SWITCH
Used with STA switch to initiate cabin interphone call to flight attendant.
1st CL-(L1 & R1 doors)
FWD-(L2 & R2 doors)
MID-(L3 & R3 doors)
AFT-(L4 & R4 doors)
UPR-(Service Center-2)
LWR-(Lower Galley)

ALL SWITCH
Sounds 3 hi-lo chimes at all flight attendant stations. Pink lights flash, then remain on steady.

SIGNAL SWITCH
Sounds single hi chime over PA amplifiers each time switch is pressed.

METER
Measures volume output of PA amplifier in coach or first class as selected. With both selected, monitors first class only. With neither selected, zero reading indicates PA being used.

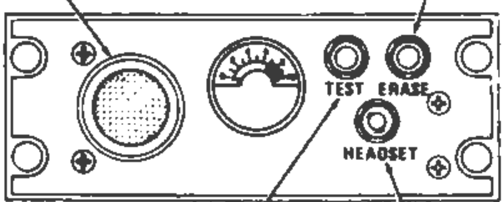


MONITOR VOLUME CONTROL
Controls volume output of cockpit speakers when monitoring passenger announcements being made from cabin attendants' panels.

CABIN AREA SELECT SWITCHES
Selects one or both cabin areas for PA monitoring or announcements.
1A15, 16 - PA NO. 1 AND NO. 2

ERASE SWITCH
With aircraft on the ground and the parking brake set, the entire 30 minutes on the tape can be erased by pressing the switch for 2 seconds.

COCKPIT MICROPHONE
Open microphone activated when essential master radio switch is on and powered.

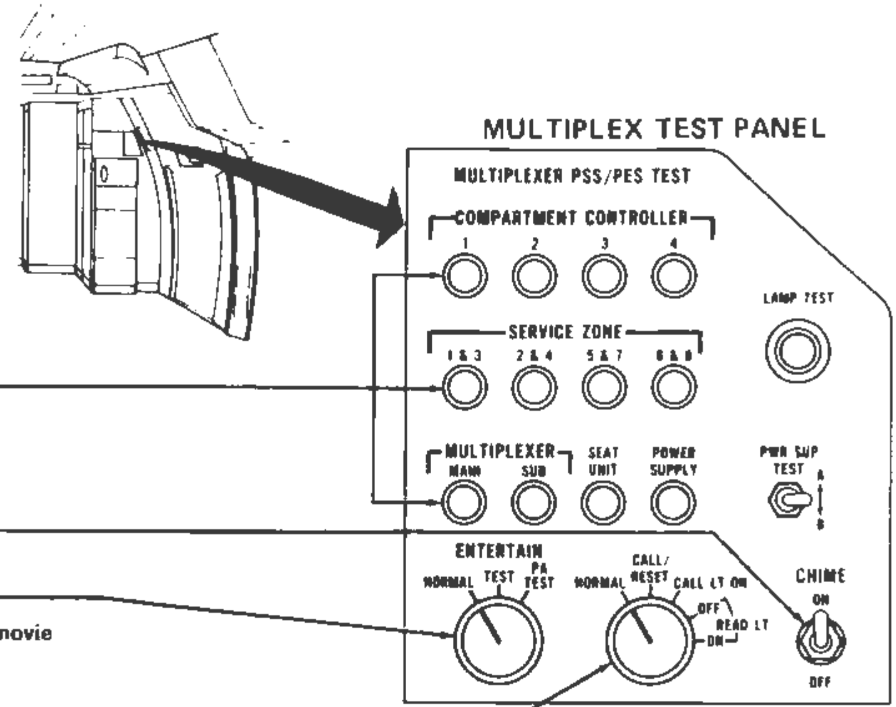


TEST SWITCH & INDICATOR
Checks the recorder unit. The needle in the meter should indicate 8 or above, in GOOD area.

1D1 - VOICE RECDR

HEADSET JACK
Permits system performance check by monitoring what is being recorded.

MULTIPLEX/GALLEY INTERPHONE

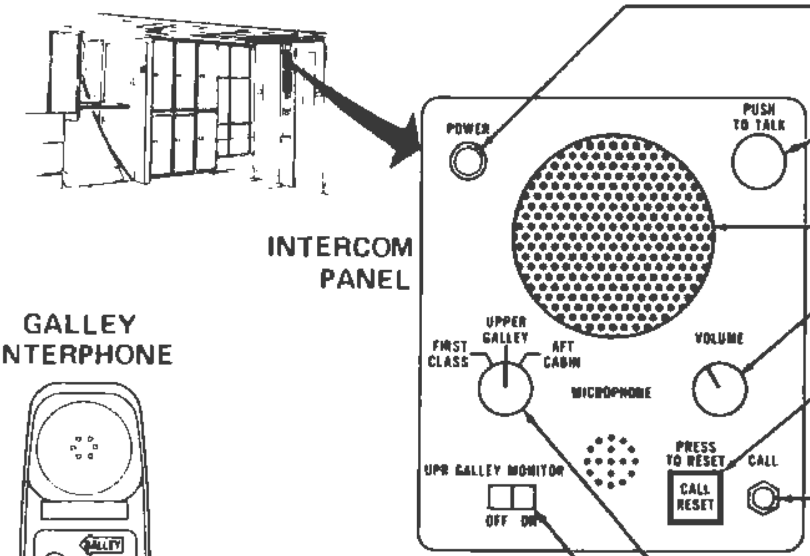


TEST PANEL LIGHTS
Appear with multiplex system fault.

CHIME SWITCH

PASSENGER ENTERTAIN
Controls testing and monitoring of stereo and movie audio.

PASSENGER SERVICE
Controls testing and monitoring of reading and attendant call lights.



GALLEY INTERPHONE

POWER LIGHT
Appears if system powered.

TALK SWITCH
Pressed to talk to galley interphone stations.

SPEAKER

VOLUME CONTROL
Controls volume of calls received.

CALL/RESET SWITCH
Appears when call made to lower galley. Press to reset light.

CALL SWITCH
Press to turn on green light and sound hi-low chime at selected station.

GALLEY INTERPHONE SELECTOR
Selects L-1, mid service center 2, or R-4 stations.

UPPER GALLEY MONITOR
Permits monitoring upper galley noises and conversation.

DUAL HANDSET
Used at L-1, mid service center-2, and R-4 stations for cabin or galley interphone communication.

* * *

FLIGHT INTERPHONE

The flight interphone system permits intercommunication between cockpit stations and nose wheel area. The system is activated when audio select panel interphone and flight interphone switches are selected. This permits use of mikes and headsets for normal communication.

Pressing the ground crew switch on the cabin interphone panel will sound a horn in the nose wheel area to alert the ground crew to communicate on flight interphone. The ground crew can also cause a chime to sound in the cockpit by pressing a switch on the nose wheel door.

SERVICE INTERPHONE

The service interphone system permits intercommunication between the cockpit and stations other than the nose wheel area.

The system is activated when the service interphone, and interphone cabin/service switches are selected. The service interphone switch is located below the engineer's table.

PASSENGER ADDRESS

Passenger address announcements can be made from the cockpit, L1, L4, and upper galley stations. The cockpit station can override any other passenger address announcement.

The system contains amplifiers for both first class and coach. The flight crew can make announcements if first class and/or coach area panel switches are on. Volume control is automatic. It is possible to monitor cockpit or cabin announcements by turning volume control monitor on. Cockpit announcements can be made by using the passenger address mike on the aft end of the pedestal or with oxygen mask mike. If the mask mike is used the guarded PA oxygen in use switch on the side panel must be selected.

CABIN INTERPHONE

The cabin interphone system provides intercommunication between all cabin and galley stations and cockpit. It is a party line system. Once a call is initiated, anyone can monitor or join in on the conversation.

The flight crew must press the interphone and interphone cabin/service switches to transmit and receive. The normal mike and headset can be used or cabin interphone handset can be used. The handset is located on the aft end of the pedestal next to the PA mike.

If the flight crew initiates a call to a cabin station, the station select switch on the overhead cabin interphone panel must be selected to the desired position. Pressing the station switch will turn on pink lights at the selected station and chimes will sound. The stations which can be selected are all doors plus upper and lower galley.

If a cabin station initiates the call to the cockpit, a call light will come on and chimes will sound in the cockpit. Cabin handset or mike and headset can be used to answer the call. Hanging up handset or pressing the call light will rearm the system and turn light off.

The cabin interphone panel all switch is selected if the flight crew desires to talk to all cabin stations on interphone. It is not necessary to move station select switch.

GALLEY INTERPHONE

The galley interphone system provides intercommunication between L1, R4, and upper and lower galley stations. Other stations cannot monitor conversation. A separate switch on their handsets permits selection of either cabin interphone or galley interphone. If a call is made to the lower galley, the caller may proceed to talk since voice will be heard in the lower galley through the galley speakers. The lower galley attendant can answer while pressing a talk switch. The lower galley also has a control switch to turn on a separate open mike in the upper galley. This permits sounds from above to be heard in lower galley. The open mike is one way only, from upper to lower galley.

ESSENTIAL COMMUNICATIONS BUS

The Essential Communications bus is normally powered by DC essential, but will auto transfer to the Battery bus if DC essential fails and the battery switch is on. To operate the No. 1 VHF, the essential radio switch must be on. The following units are powered from the Essential Communications bus:

- PA
- Audio control panels.
- Flight interphone.
- No. 1 VHF.

The No. 2 VHF, ground service, cabin and galley interphone operate from the DC Ground Service bus. The master radio switches do not have to be on. The No. 3 VHF is powered by DC bus 2 through the No. 2 master radio switch.

MULTIPLEX SYSTEM

The passenger entertainment system (PES) and passenger service systems (PSS) are both multiplexed.

The PES provides both stereo music and movie audio. The system consists of a tape reproducer, main multiplexer, sub multiplexers, seat electronic units and compartment controllers. The main multiplexer receives and converts data from the tape reproducer into a digital format. The sub multiplexers further reshape this data, including that from the movie audio, sending it to the compartment controllers. The compartment controllers provide timing and synchronization, and distribute the data to the seat electronic units and passenger earphones. An override feature of public address is provided so that passengers can hear PA announcements through their earphones, overriding all other audio.

The PSS provides individual passenger controls for reading and attendant call lights plus fresh air outlets. Compartment controllers control and synchronize the data for the eight compartment zones.

A multiplex test panel is located near the R-1 flight attendant station. This provides technical service personnel the capability of testing and monitoring the multiplexed systems. Lights appear with system faults.

*　　*　　*

* * *

TRIPPED CIRCUIT BREAKER

One reset attempt may be made if unit operation is desirable.

DIFFERENTIAL FAULT LIGHT

Field relay and generator breaker open lights will be on in addition to the differential fault light. AC tie breaker and flight station bus fail lights may also be on.

1. Do not attempt reset. Monitor remaining generator KW loads.
2. Check AC essential bus power selector switch for auto transfer protection.

ALL AC TIE BREAKER OPEN LIGHTS

This indicates possible short on AC tie bus.

1. Do not attempt reset. Operate AC busses isolated.
2. Do not connect APU or external power to AC tie bus.

AC TIE BREAKER OPEN LIGHT

1. Check generator voltage and frequency. If abnormal, disconnect. Monitor all generator KW loads.
2. If voltage and frequency are normal, do not attempt reset. Leave generator isolated powering its own bus.
3. Check AC essential bus power selector switch for auto-transfer protection.

FIELD RELAY AND GENERATOR BREAKER OPEN LIGHT

1. Monitor all generator KW loads.
2. Check generator voltage and frequency. To do this, open generator breaker and close field relay. If abnormal, disconnect.
3. If voltage and frequency normal, a reset attempt may be made. First open field relay, press generator breaker close switch, then close field relay.
4. Check AC essential bus power selector switch for auto-transfer protection.

GENERATOR BEARING LIGHT

Light indicates excessive bearing wear.

1. Open generator breaker and check voltage and frequency. Monitor all generator KW loads.
2. Check generator oil out and oil rise temperatures.
3. If any indications are abnormal, disconnect.
4. If indications are normal, leave generator breaker open. If it becomes necessary, generator can be used to power its own load bus, or power AC essential.
5. Check AC essential bus power selector switch for auto-transfer protection.

ONE GALLEY POWER BUS OFF LIGHT

Light indicates galley bus is unpowered. It could be caused by switch released or three galley remote control circuit breakers tripped on right galley panel. If circuit breakers are reset, off light will extinguish.

ALL GALLEY POWER BUS OFF LIGHTS

Lights indicate all galley busses are unpowered. This could be caused by an overloaded generator, all switches released, or galley power emergency shutoff switch activated.

1. Check electrical panel and/or with flight attendant to find source of problem.
2. To restore galley power:
   a. Generator overload:

      Release all three galley switches, then reset as desired.

   b. Galley power emergency switch activated:

      Flight attendant must release switch to restore power.

FLIGHT STATION BUS FAIL LIGHT

Light indicates flight station bus is unpowered. Generator breaker and AC tie breaker open lights may also be on, indicating main AC bus powering flight station bus has failed.

1. Check circuit breakers on panel 3, rows D and E.
2. If reset is not accomplished, check AC essential bus power switch for auto-transfer protection.

STANDBY BUS FAIL LIGHT

Light indicates standby bus is unpowered. It could be caused by bus fault or auto-transfer malfunction.

1. Check battery switch on, standby power switch in arm position and essential power normal.

2. If fail light remains on and fail flags are on captain's instrument panel, place standby power switch on. Check fail light extinguishes and flags retract from view. Battery charger is disconnected with standby power switch on.

3. If standby power cannot be restored, return standby power switch to arm position.

ESSENTIAL AC ON ALTERNATE LIGHT

Light indicates AC essential bus power has auto-transferred to secondary source. It could be caused by failure of No. 3 AC bus or the No. 3 flight station bus if switch is at the B3(G1) or B3(G2) position.

1. Check for tripped circuit breaker on panel 3, rows D and E.

2. If reset is not accomplished, place the AC essential bus power selector switch to G1(G2). Essential AC on alternate light should extinguish.

APU GENERATOR OIL OVERHEAT/PRESSURE LIGHT

Light indicates high oil temperature or low oil pressure. Shutdown APU to protect APU generator.

* * *

GALLEY, APU AND GROUND SERVICE POWER CONTROLS

GALLEY POWER SWITCHES

IN - Connects main AC bus power to the galley and ovens.

OFF - Power removed from galley bus. Illumination of three OFF lights indicates an overloaded generator, or galley power emergency shutoff switch activated in galley.

OUT - Galley and oven power is shut off and OFF is illuminated.

GALLEY CIRCUIT BREAKER PANELS

APU GENERATOR OIL OVERHEAT LIGHT

Armed by APU master switch.

OVHT - Generator adapter oil temperature is above limits.

3S15 - EJECTOR & VENT VALVE.

APU GENERATOR OIL LOW PRESSURE LIGHT

Armed when APU inlet door is open.

PRESS - Generator adapter oil pressure below limits.

3S15 - EJECTOR & VENT VALVE.

POWER METER & KVAR SWITCH

Generator load in kilowatts. When KVAR switch is pressed, meter indicates kilovolt-amp reactance.

3G16 - ELECTRIC METER SWITCH.

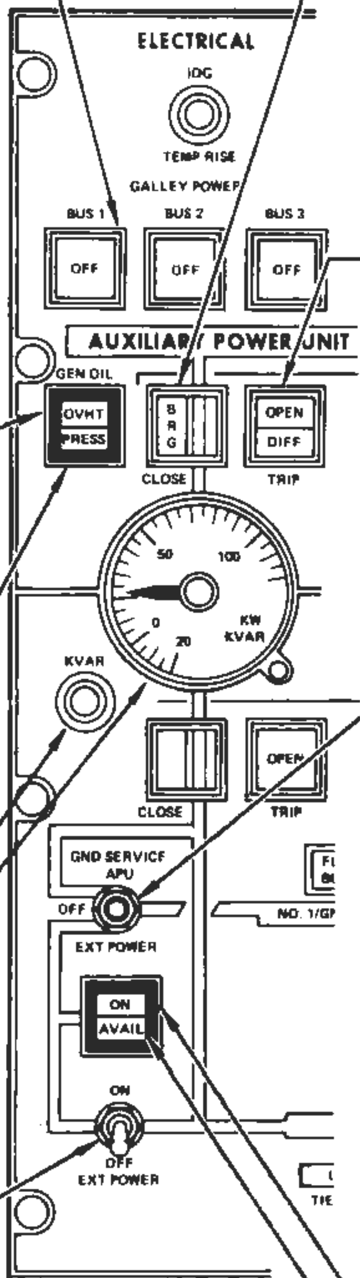
EXTERNAL POWER SWITCH

Removes any other power from AC tie bus.

ON - Connects external power to AC tie bus.

OFF - Disconnects external power from tie bus.

NO CIRCUIT BREAKER, POWERED THROUGH EXTERNAL POWER RELAY.



GENERATOR FIELD RELAY CLOSE SWITCH

A momentary switch that closes a tripped generator field relay.

Flowbar indicates the generator field relay is closed.

BRG - Excessive wear of the generator main bearing. Armed when generator up to speed.

1K15, 16, 17 - GEN CONTROL UNITS.

GENERATOR FIELD TRIP SWITCH

Opens the generator field relay and locks out the auto-close function.

OPEN - Field relay has tripped (Pulling FIRE PULL handle also trips field relay.)

DIFF - A differential fault exists.

1K15, 16, 17 - GEN CONTROL UNITS.

GROUND SERVICE SELECTOR SWITCH

Permits selecting APU or external power to energize ground service busses. Will trip to OFF on fault.

APU - Connects APU power to ground service busses only.

OFF - Ground service busses may be powered normally.

EXT POWER - Connects external power to ground service busses. Also controlled from forward attendant's panel.

3B14 GND BUS CONTROLLER.

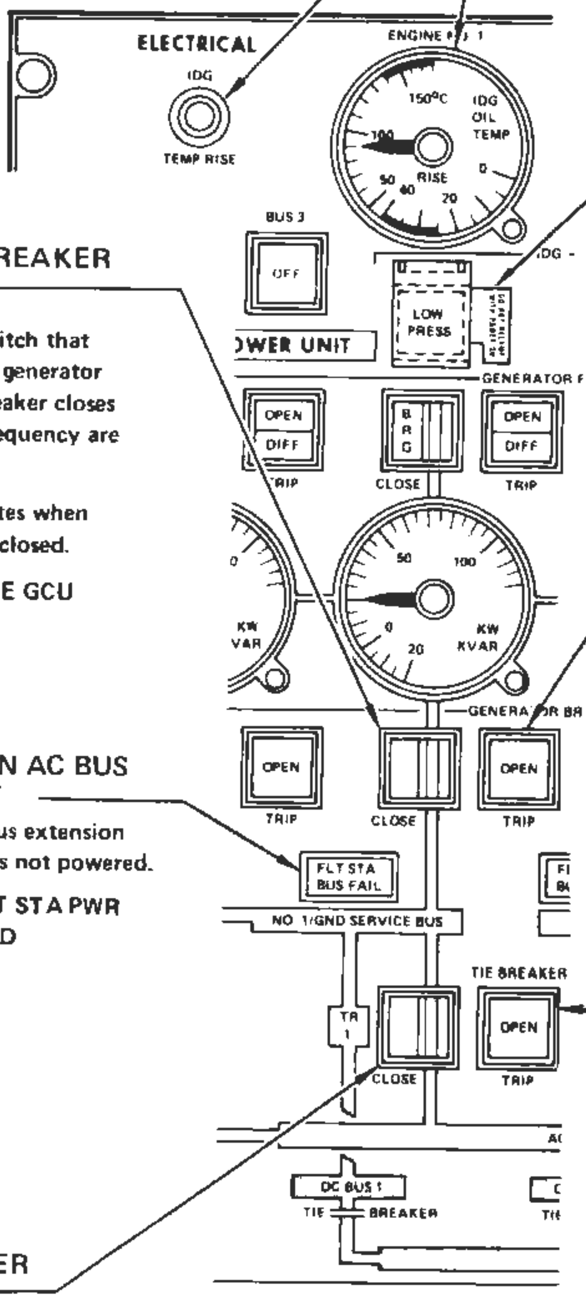
EXTERNAL POWER AVAILABLE LIGHT

AVAIL - Is illuminated when external power is connected, is within voltage and frequency limits, and has proper phase rotation.

EXTERNAL POWER ON LIGHT

ON - External power is being used on aircraft.

GENERATOR CONTROLS



IDG OIL TEMPERATURE INDICATOR AND TEMP RISE SWITCH

Normally indicates IDG oil outlet temperature. When TEMP RISE switch is pushed, indicator shows temperature rise between IDG oil inlet and outlet.

ELECTRIC METER SWITCH
3AA18 - IDG OIL TEMP

GENERATOR BREAKER CLOSE SWITCH

A momentary switch that arms a tripped main generator breaker to close. Breaker closes when voltage and frequency are correct.

Flowbar illuminates when generator breaker is closed.

CB ON RESPECTIVE GCU

IDG DISCONNECT SWITCH

A momentary switch that disconnects the IDG.

LOW PRESS - IDG oil pressure is below minimum.

3G15 - IDG DISC
3AA17 - IDG OIL LOW PRESS

GENERATOR BREAKER TRIP SWITCH

A momentary switch that manually opens main generator breaker and locks out the auto-close function.

OPEN - Generator breaker has been tripped manually or automatically.

CB ON RESPECTIVE GCU

FLIGHT STATION AC BUS FAILURE LIGHT

The respective AC bus extension in the flight station is not powered.

3E9,10,11 - FLIGHT STA PWR
3G11 - AC BUS IND

BUS TIE BREAKER TRIP SWITCH

A momentary switch that manually opens the bus tie breaker and locks out the auto-close function.

OPEN - Bus tie has been tripped open manually or by one of the automatic fault trips.

CB ON RESPECTIVE GCU

BUS TIE BREAKER CLOSE SWITCH

A momentary switch that arms a tripped bus tie breaker to close Flowbar illuminates when bus tie breaker is closed.

CB ON RESPECTIVE GCU

F1-5001-9-002

AC AND DC MONITOR

AC FREQUENCY METER

Indicates frequency for position selected by the AC meter selector. If voltage is too low for an accurate measurement the meter will indicate OFF.

FUSES IN MID
ELECTRICAL
SERVICE CENTER

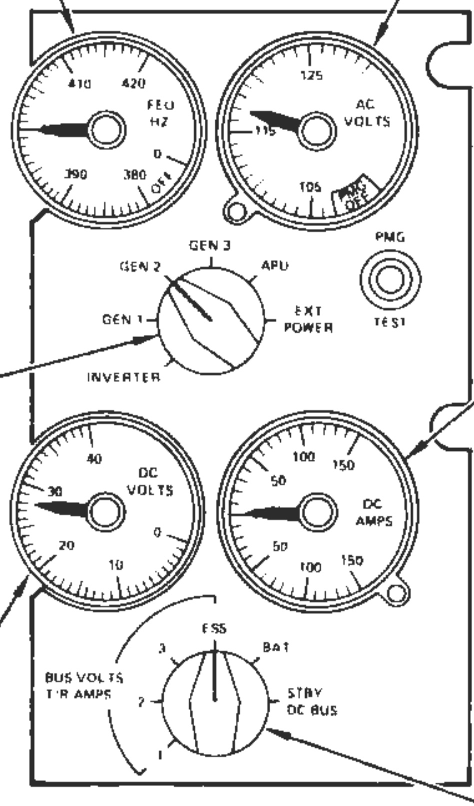
AC METER SELECTOR

Selects AC source of power for AC frequency and volt meters.

POWER SOURCE FUSES IN MID
ELECTRICAL SERVICE CENTER

DC VOLTMETER

Indicates DC voltage for the position selected.



AC VOLTMETER AND PMG TEST SWITCH

Meter indicates AC voltage for selected position or PMG volts of a selected generator when PMG test switch is pressed.

With needle pointing to PMG OFF, generator is not turning.

3G16 ELECTRIC METER SWITCH
1K18 - STBY INVERTER VOLTAGE

FUSES IN MID
ELECTRICAL
SERVICE CENTER

DC AMMETER

Indicates TR or battery amperage for position selected by the DC meter selector. No amperage is indicated for STBY DC BUS position. Battery charging is indicated by negative reading.

DC METER SELECTOR

Selects DC source of power for DC volt and amp meters. Amperage is not indicated in the STBY DC BUS position.

1B12 - STANDBY DC CONT
1K13 - DC STBY IND
3A9, 10, 11 - TIE BUS CONT
3G13 - DC AUTO XFR

ELECTRICAL SYSTEM

ANNUNCIATOR PANEL LIGHT

Indicates a malfunction in the electrical system.

STANDBY AND ESSENTIAL POWER CONTROLS

AC & DC STANDY BUS FAIL LIGHTS

3G13 - DC AUTO XFR
1K10 - AC STBY BUS SENSE
1K13 - DC STBY IND

AC & DC ESSENTIAL BUS FAIL LIGHTS

1K13 - DC STBY IND
3F14 - BUS SENSING AC ESS
3G13 - DC AUTO XFR

DC BUS ISOLATION SWITCH

OUT - Connects DC busses 1, 2, and 3 to the DC tie bus by closing all three DC tie breakers.

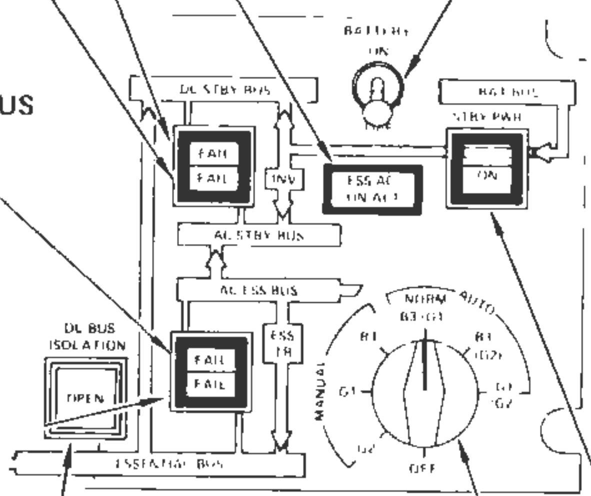
IN - OPEN. The DC tie breakers are open and DC busses 1, 2, and 3 are isolated from DC tie bus.

3A9, 10, 11 TIE BUS CONT
3A12, 13, 14 - TIE BUS PWR
3F2, 3 - DC TIE BUS CONT PWR

ESSENTIAL AC BUS ON ALTERNATE LIGHT

When essential power selector is in AUTO, the primary source of power to the AC essential bus has failed and automatic transfer to the alternate power source has occurred.

1K13 - DC STBY IND
1K11-AC ESS BUS CONT



AC ESSENTIAL BUS POWER SELECTOR SWITCH

Rotary switch selects power source for AC essential bus.

OFF - Deenergizes AC essential bus.

MANUAL - Generator 2, generator 1, or AC bus 3 provides a single power source.

AUTO - If the primary source fails, the alternate source (in parentheses) will automatically power the AC essential bus.

3E12, 13, 14 ESS POWER GEN 1, 2, AND BUS 3

BATTERY SWITCH

ON - If DC essential bus fails, battery automatically powers DC standby bus. If AC essential bus fails, and standby power switch is in ARM, battery automatically powers AC standby bus through inverter.

OFF - If AC or DC standby bus loses normal source of power, automatic transfer to battery bus will not occur.

1B12, 13 STANDBY DC CONT AND PWR

ESS STBY POWER

ESSENTIAL/STANDBY POWER ANNUNCIATOR LIGHT

AC or DC essential standby bus has failed.

STANDBY POWER INDICATOR LIGHT

Indicates conditions under which the AC and DC standby busses are powered.

ON and flowbar are not illuminated when the standby busses are powered normally.

ON - The AC and/or DC standby busses have been automatically switched to battery bus.

Flowbar is illuminated when the battery has been manually selected by the standby power switch to power both the AC and DC standby busses.

1B12, 13 STANDBY DC CONT AND PWR
1K13 - DC STBY IND

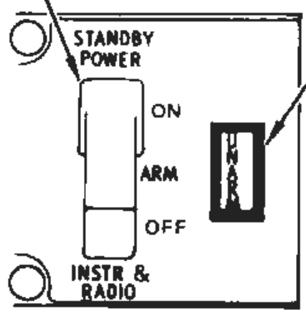
STANDBY POWER AND ATTENDANT GROUND SERVICE SWITCHES

STANDBY POWER SWITCH

ON - Powers AC & DC standby busses from battery bus regardless of battery switch position.

ARM - Powers AC standby bus from inverter on loss of AC essential power if battery switch on.

OFF - Prevents inverter from operating.



STANDBY POWER UNARM LIGHT

Indicates standby power switch is OFF or battery switch OFF.
1K13 - DC STNBY IND

GROUND SERVICE ON SWITCH

ON - Energizes ground service busses if external power available. Turns engineer's ground service switch off if it is in external power position.

GROUND SERVICE OFF SWITCH

OFF - Turns off ground service switch if it is on.

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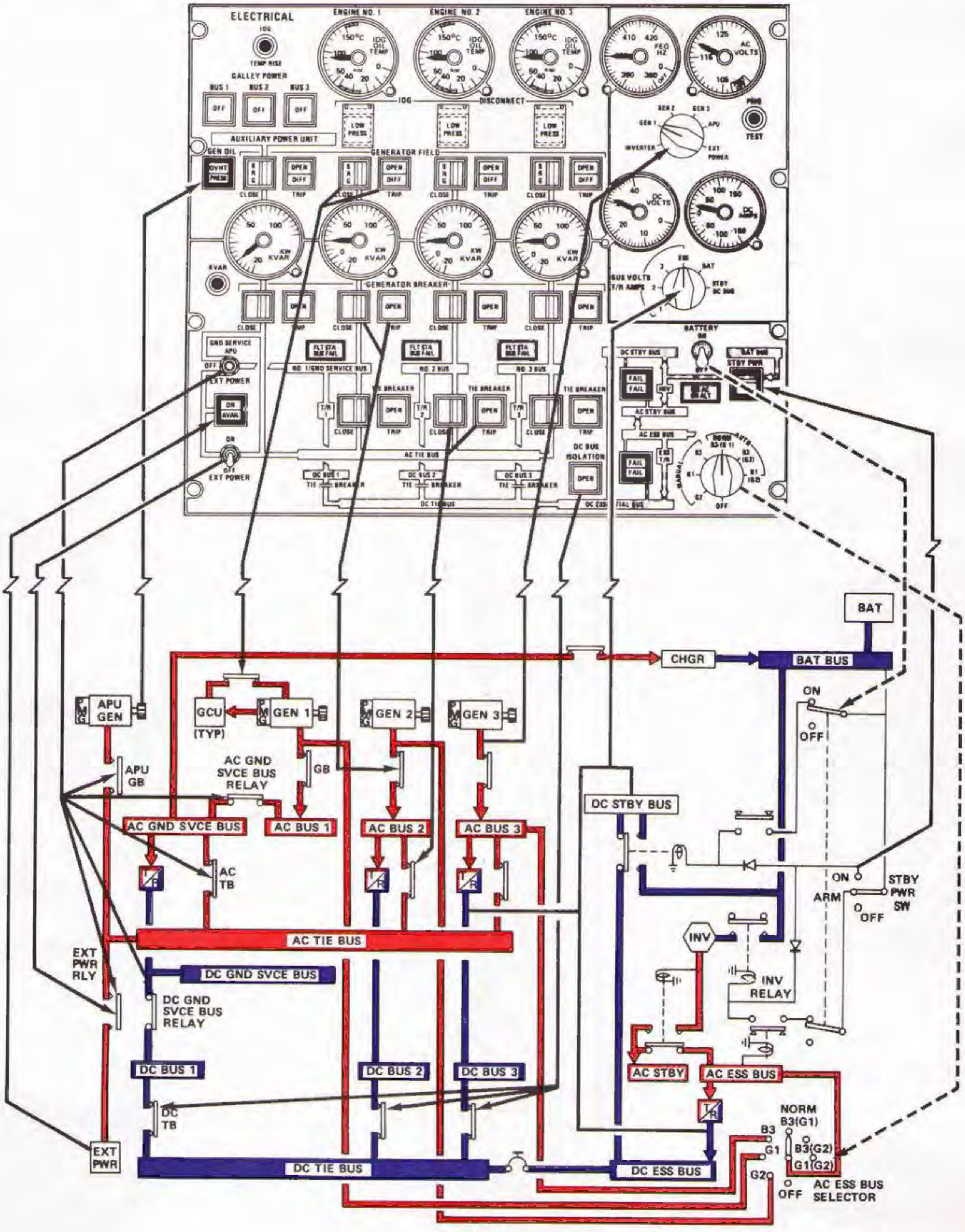
ELECTRICAL CONTROLS



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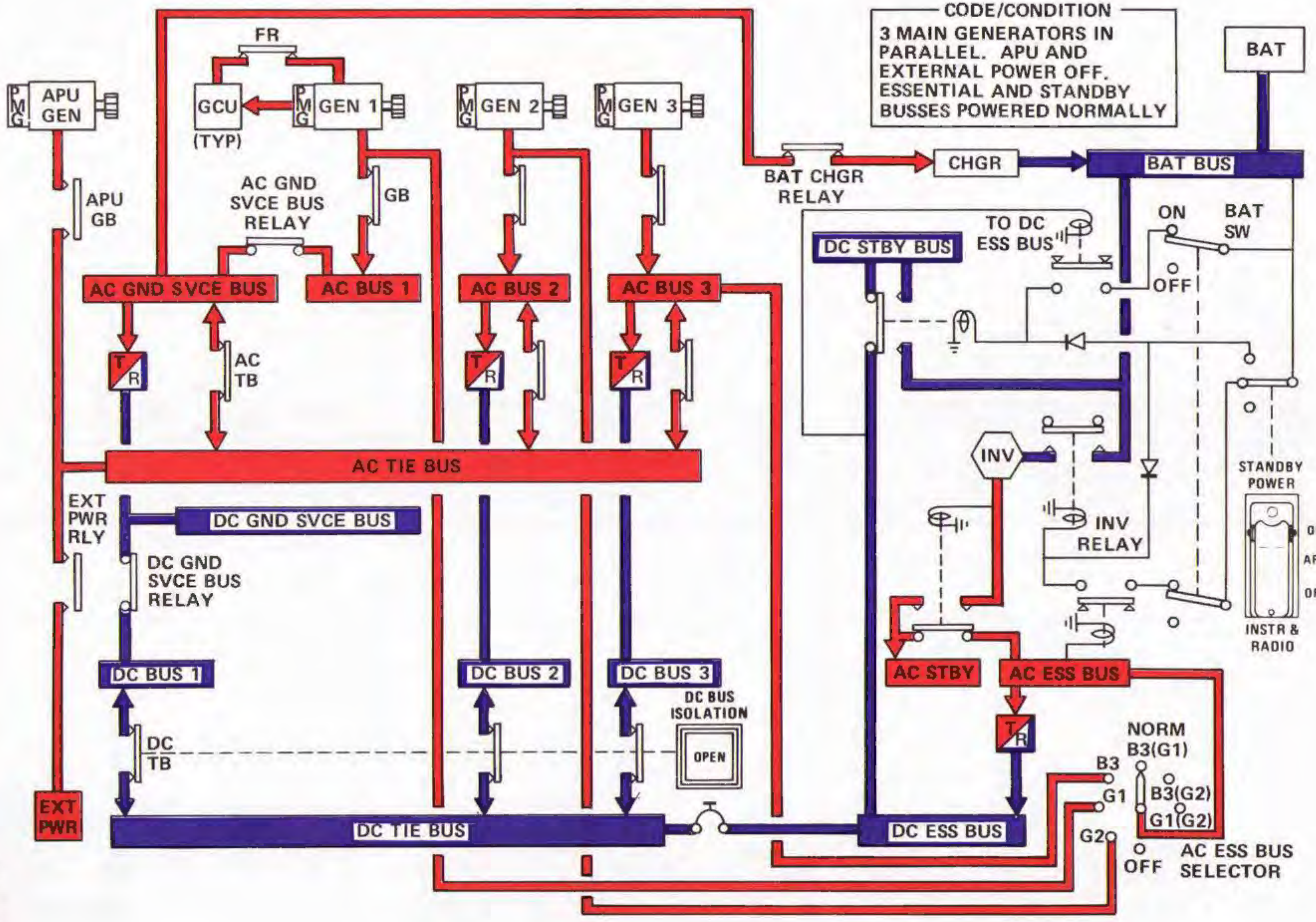
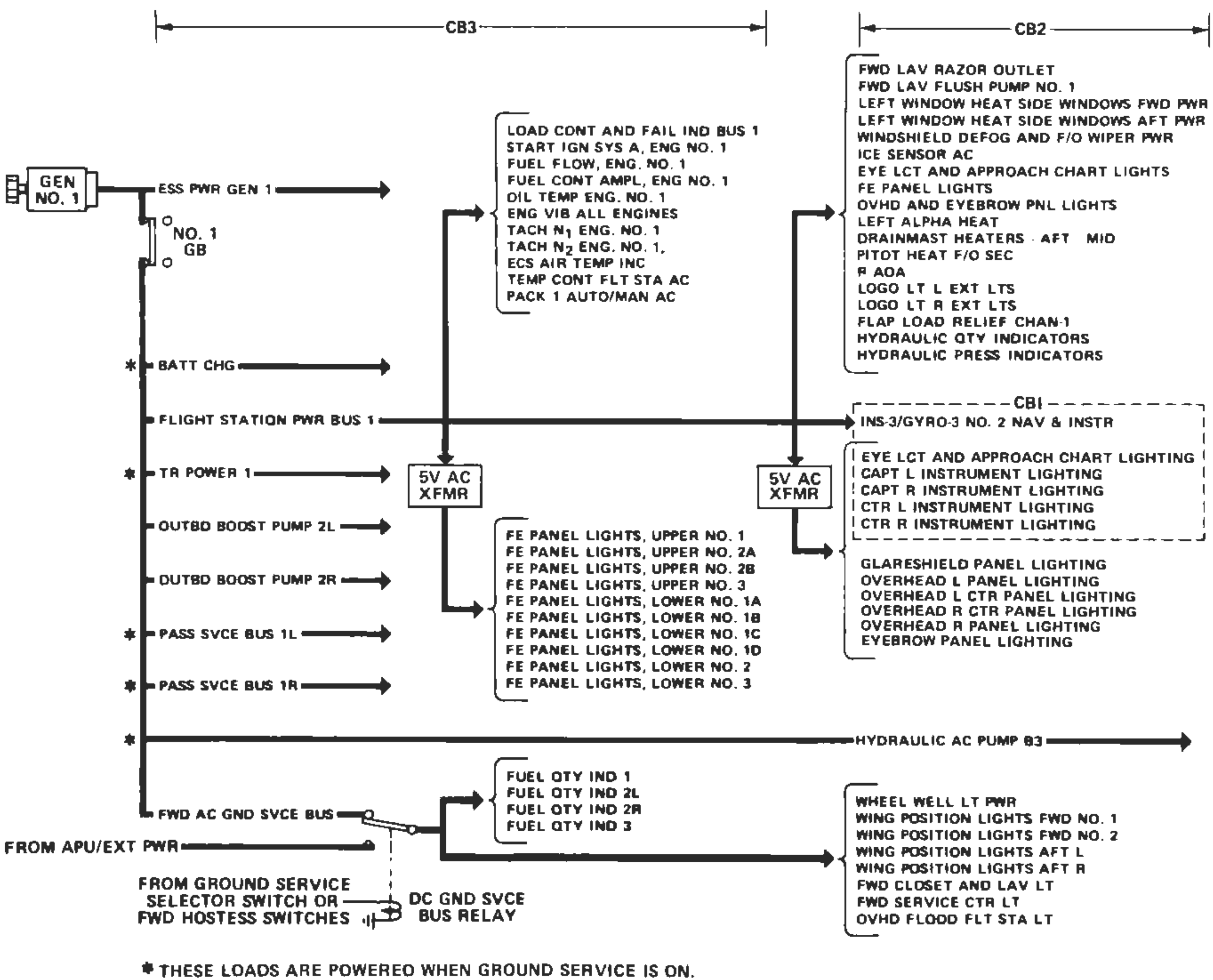
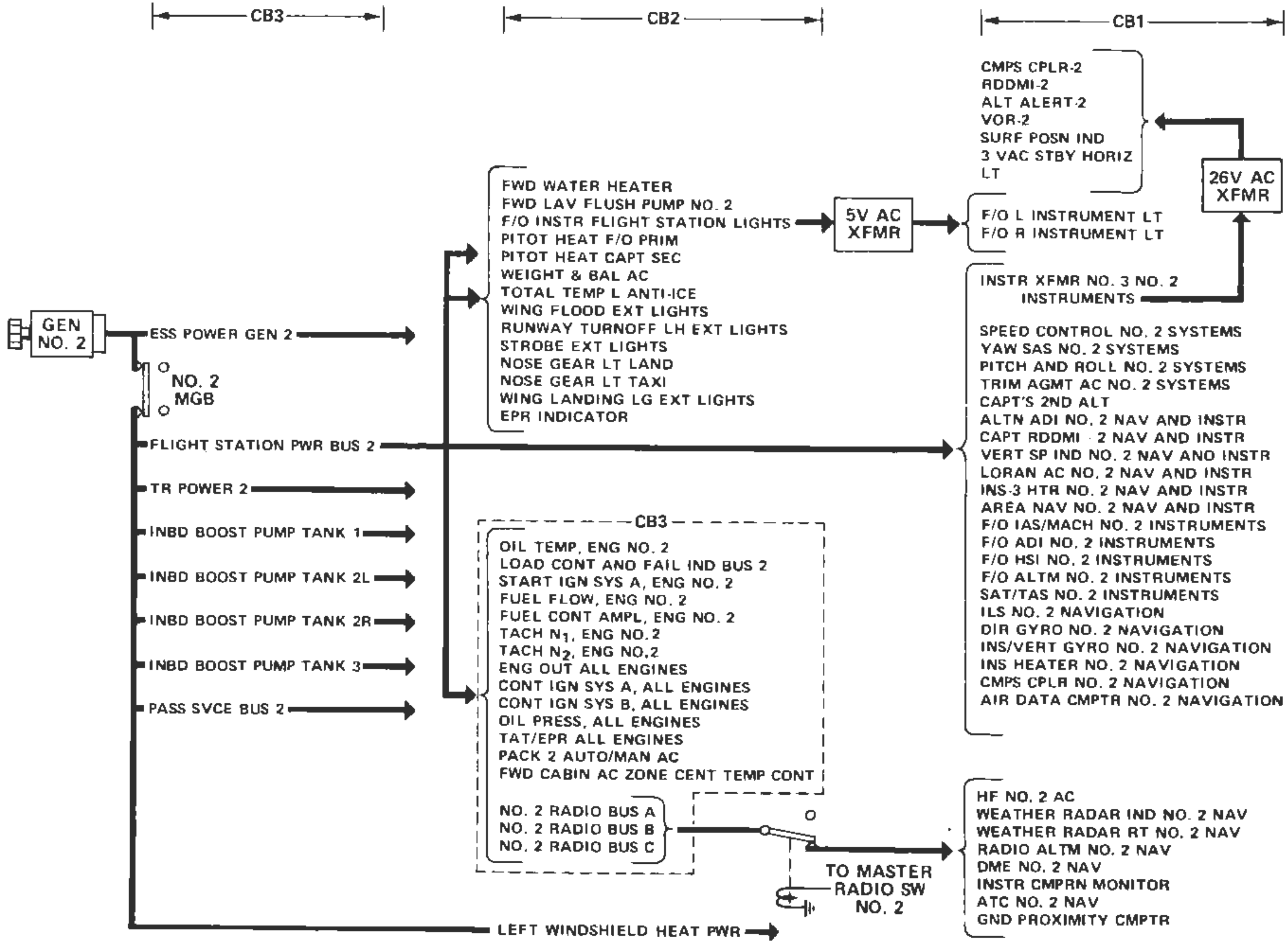

CODE/CONDITION
3 MAIN GENERATORS IN PARALLEL. APU AND EXTERNAL POWER OFF. ESSENTIAL AND STANDBY BUSSES POWERED NORMALLY
PMG
APU GEN
FR
GCU
(TYP)
GEN 1
GEN 2
GEN 3
APU GB
GB
AC GND SVCE BUS RELAY
AC GND SVCE BUS
AC BUS 1
AC BUS 2
AC BUS 3
T R
AC TB
AC TIE BUS
EXT PWR RLY
DC GND SVCE BUS
DC GND SVCE BUS RELAY
DC BUS 1
DC BUS 2
DC BUS 3
DC TB
DC BUS ISOLATION
OPEN
DC TIE BUS
EXT PWR
BAT
BAT CHGR RELAY
CHGR
BAT BUS
TO DC ESS BUS
DC STBY BUS
ON
OFF
BAT SW
INV
INV RELAY
STANDBY POWER
ON
ARM
OFF
INSTR & RADIO
AC STBY
AC ESS BUS
DC ESS BUS
NORM
B3(G1)
B3
G1
G2
B3(G2)
G1(G2)
OFF
AC ESS BUS SELECTOR

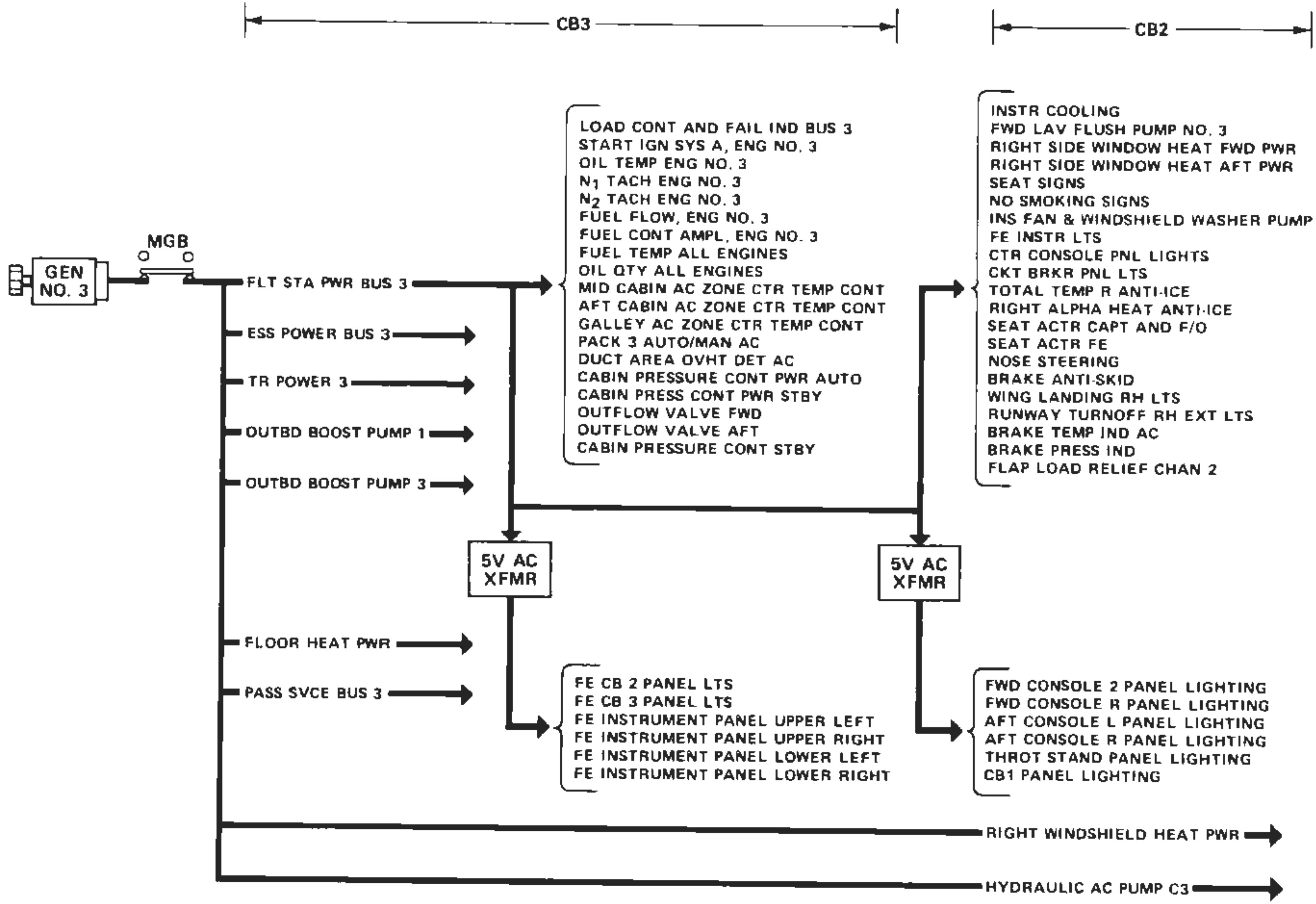
AC BUS NO. 1 AND GROUND SERVICE BUS



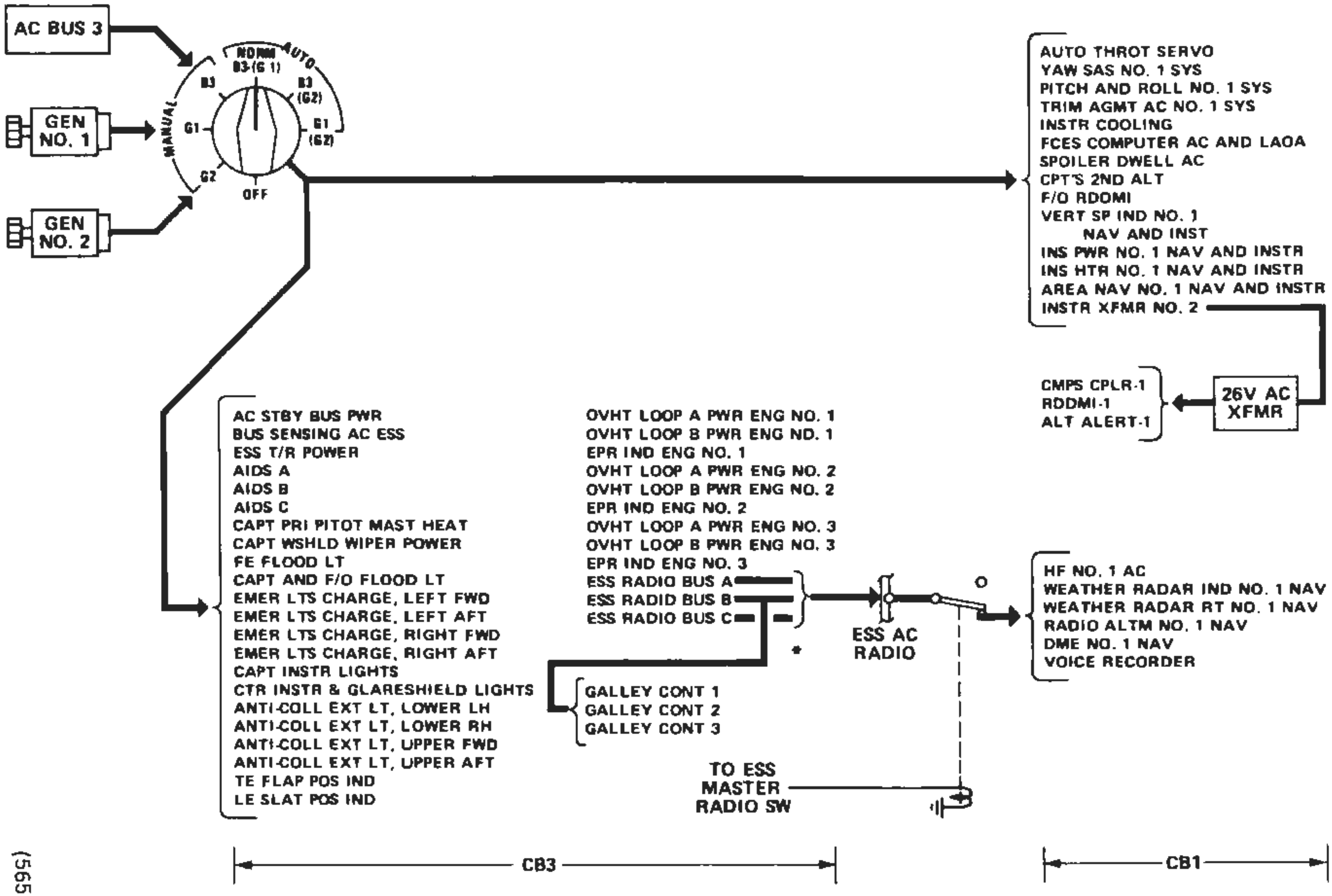
AC BUS NO. 2 AND RADIO BUS NO. 2



AC BUS NO. 3


CB3
CB2
GEN NO. 3
MGB
FLT STA PWR BUS 3
ESS POWER BUS 3
TR POWER 3
OUTBD BOOST PUMP 1
OUTBD BOOST PUMP 3
FLOOR HEAT PWR
PASS SVCE BUS 3
LOAD CONT AND FAIL IND BUS 3
START IGN SYS A, ENG NO. 3
OIL TEMP ENG NO. 3
N_1 TACH ENG NO. 3
N_2 TACH ENG NO. 3
FUEL FLOW, ENG NO. 3
FUEL CONT AMPL, ENG NO. 3
FUEL TEMP ALL ENGINES
OIL QTY ALL ENGINES
MID CABIN AC ZONE CTR TEMP CONT
AFT CABIN AC ZONE CTR TEMP CONT
GALLEY AC ZONE CTR TEMP CONT
PACK 3 AUTO/MAN AC
DUCT AREA OVHT DET AC
CABIN PRESSURE CONT PWR AUTO
CABIN PRESS CONT PWR STBY
OUTFLOW VALVE FWD
OUTFLOW VALVE AFT
CABIN PRESSURE CONT STBY
INSTR COOLING
FWD LAV FLUSH PUMP NO. 3
RIGHT SIDE WINDOW HEAT FWD PWR
RIGHT SIDE WINDOW HEAT AFT PWR
SEAT SIGNS
NO SMOKING SIGNS
INS FAN & WINDSHIELD WASHER PUMP
FE INSTR LTS
CTR CONSOLE PNL LIGHTS
CKT BRKR PNL LTS
TOTAL TEMP R ANTI-ICE
RIGHT ALPHA HEAT ANTI-ICE
SEAT ACTR CAPT AND F/O
SEAT ACTR FE
NOSE STEERING
BRAKE ANTI-SKID
WING LANDING RH LTS
RUNWAY TURNOFF RH EXT LTS
BRAKE TEMP IND AC
BRAKE PRESS IND
FLAP LOAD RELIEF CHAN 2
5V AC XFMR
5V AC XFMR
FE CB 2 PANEL LTS
FE CB 3 PANEL LTS
FE INSTRUMENT PANEL UPPER LEFT
FE INSTRUMENT PANEL UPPER RIGHT
FE INSTRUMENT PANEL LOWER LEFT
FE INSTRUMENT PANEL LOWER RIGHT
FWD CONSOLE 2 PANEL LIGHTING
FWD CONSOLE R PANEL LIGHTING
AFT CONSOLE L PANEL LIGHTING
AFT CONSOLE R PANEL LIGHTING
THROT STAND PANEL LIGHTING
CB1 PANEL LIGHTING
RIGHT WINDSHIELD HEAT PWR
HYDRAULIC AC PUMP C3

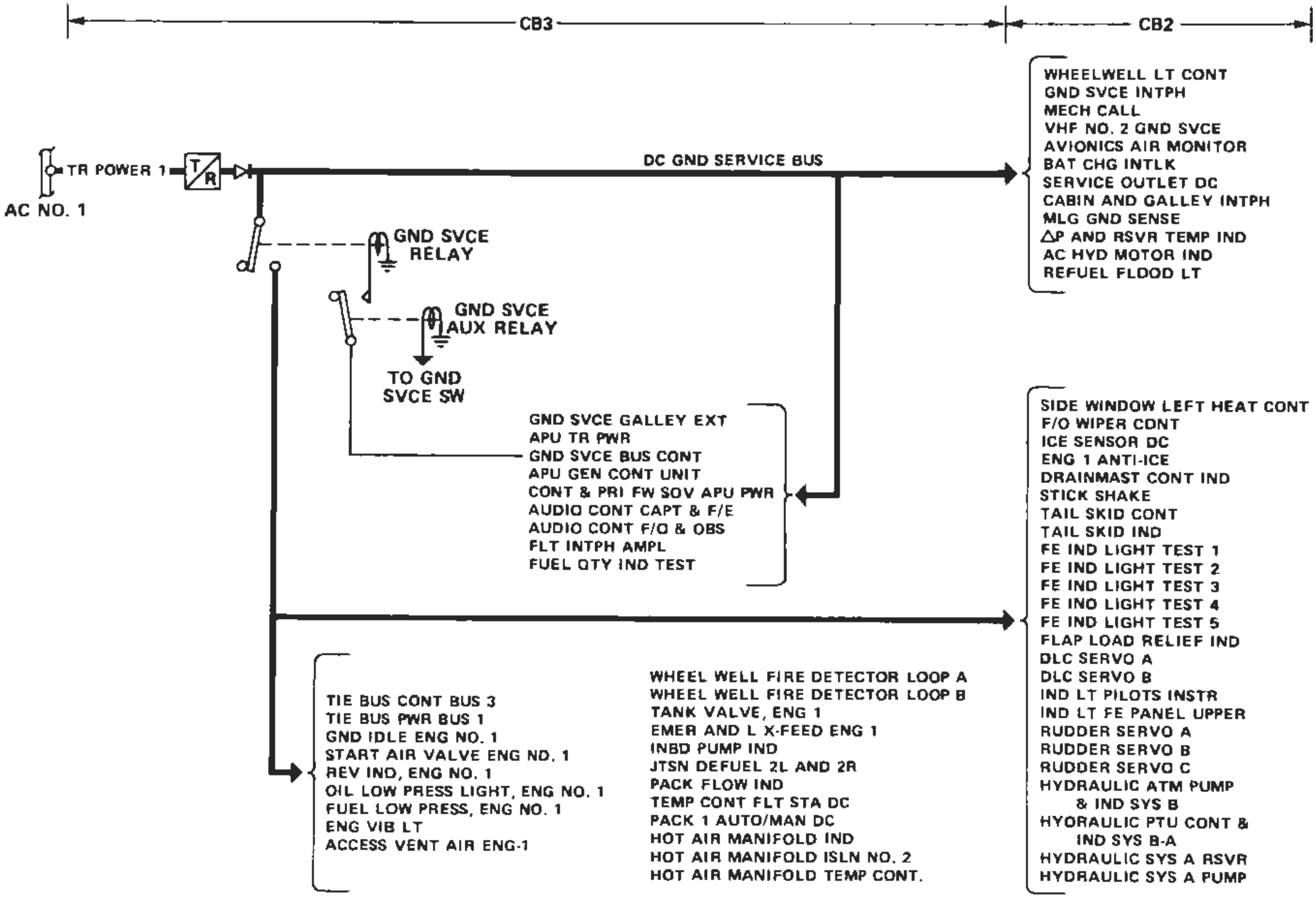
ESSENTIAL AC BUS AND ESSENTIAL RADIO BUS



* MODIFIED AIRCRAFT ONLY 3G1, 2, 3.

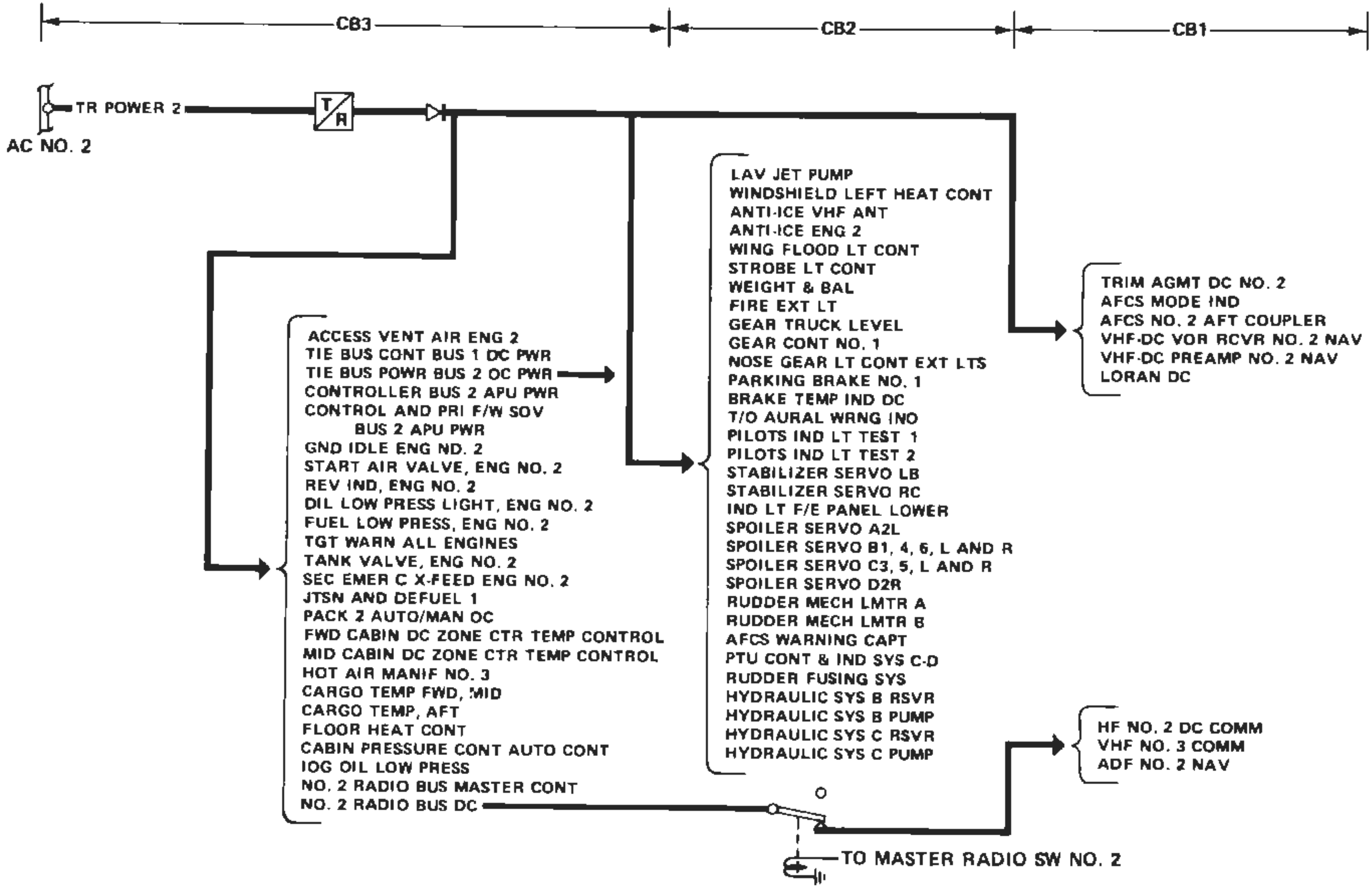
(5651)

DC BUS NO. 1 AND GROUND SERVICE BUS

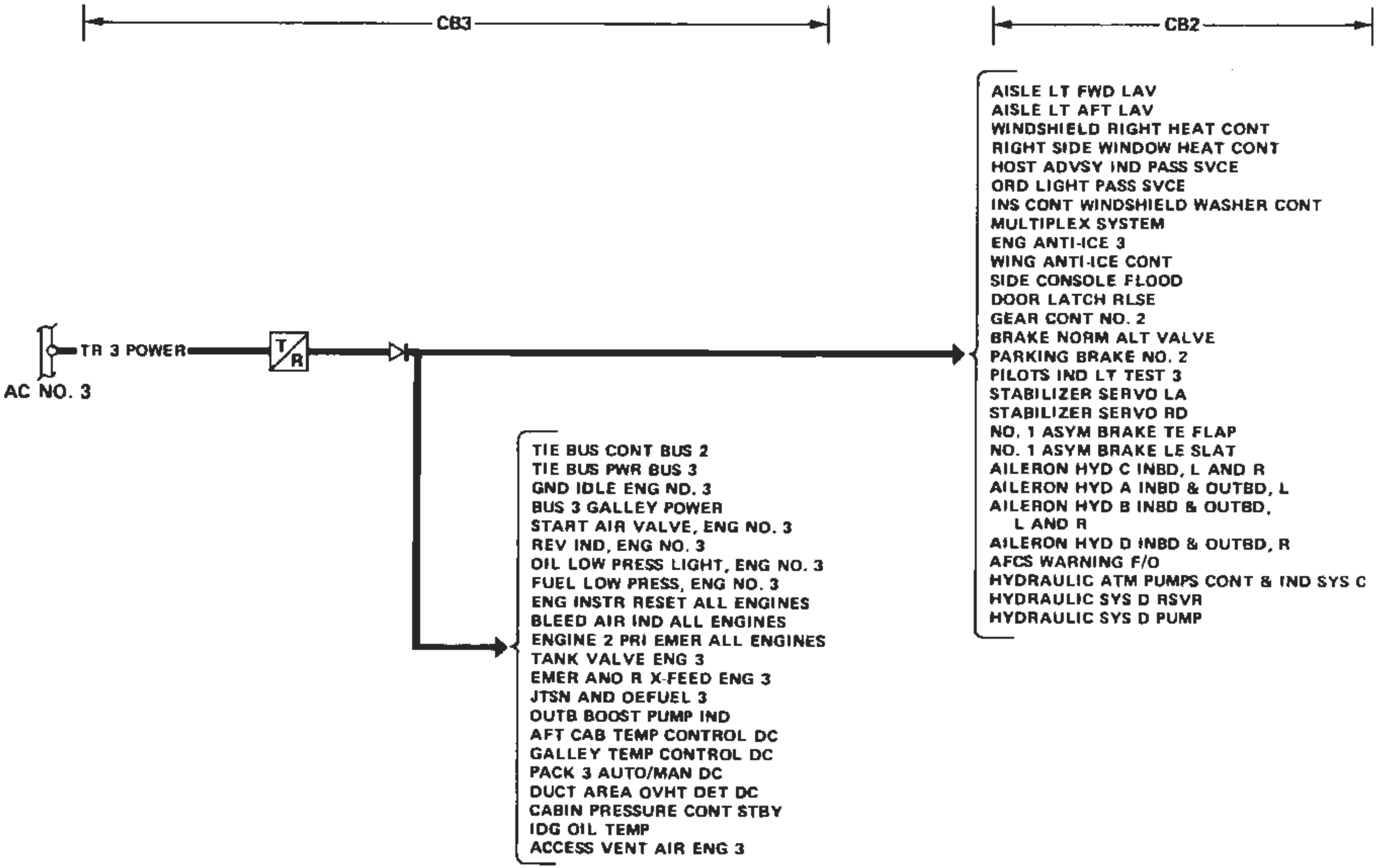


(5652)

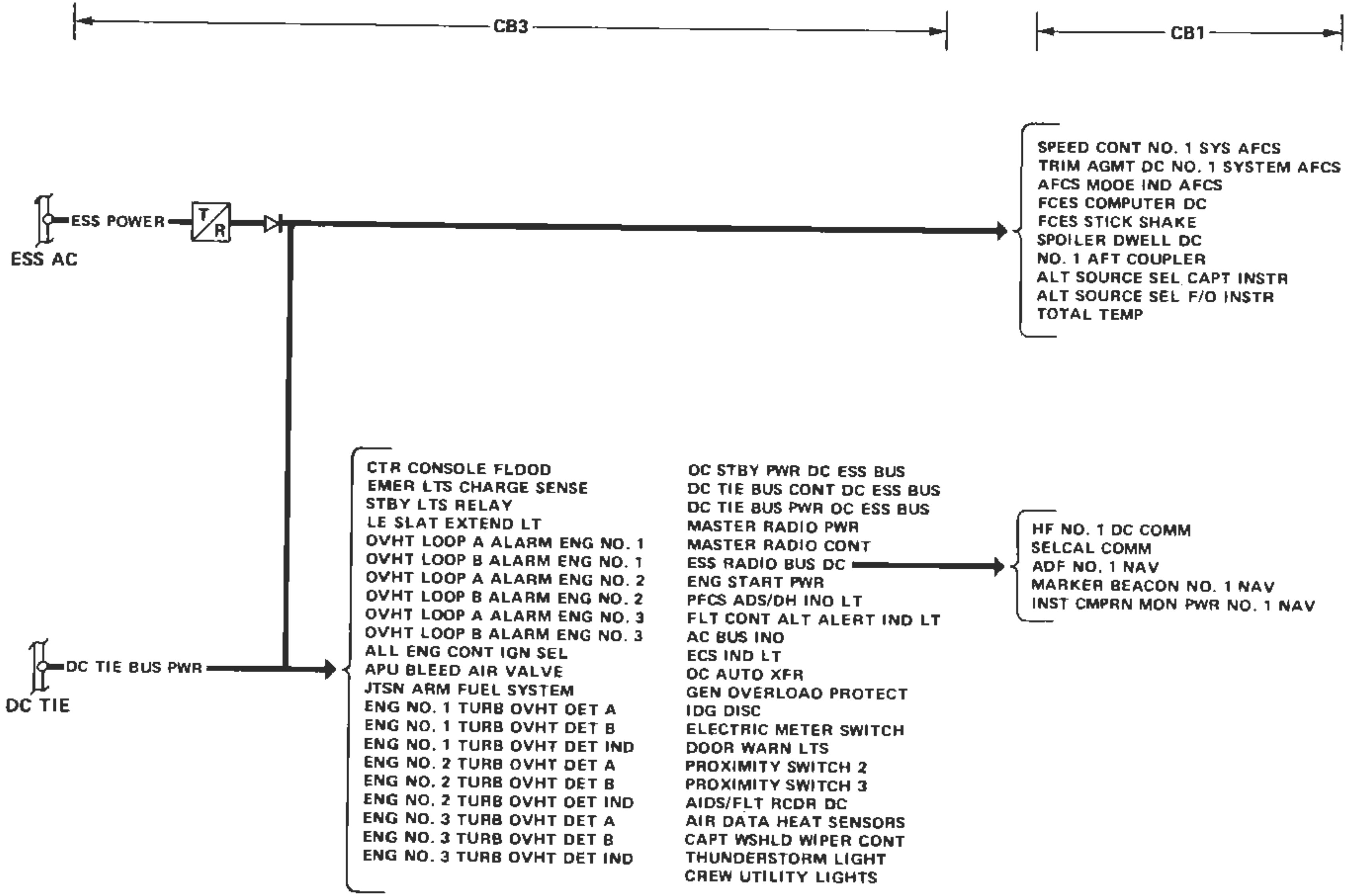
DC BUS NO. 2 AND RADIO BUS NO. 2



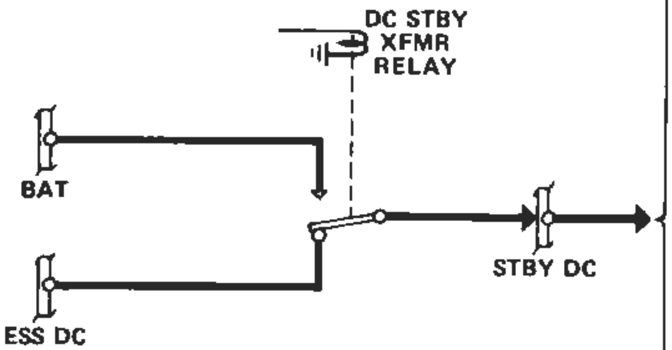
DC BUS NO. 3


CB3
CB2
AC NO. 3
TR 3 POWER
T/R
AISLE LT FWD LAV
AISLE LT AFT LAV
WINDSHIELD RIGHT HEAT CONT
RIGHT SIDE WINDOW HEAT CONT
HOST ADVSY IND PASS SVCE
ORD LIGHT PASS SVCE
INS CONT WINDSHIELD WASHER CONT
MULTIPLEX SYSTEM
ENG ANTI-ICE 3
WING ANTI-ICE CONT
SIDE CONSOLE FLOOD
DOOR LATCH RLSE
GEAR CONT NO. 2
BRAKE NORM ALT VALVE
PARKING BRAKE NO. 2
PILOTS IND LT TEST 3
STABILIZER SERVO LA
STABILIZER SERVO RD
NO. 1 ASYM BRAKE TE FLAP
NO. 1 ASYM BRAKE LE SLAT
AILERON HYD C INBD, L AND R
AILERON HYD A INBD & OUTBD, L
AILERON HYD B INBD & OUTBD, L AND R
AILERON HYD D INBD & OUTBD, R
AFCS WARNING F/O
HYDRAULIC ATM PUMPS CONT & IND SYS C
HYDRAULIC SYS D RSVR
HYDRAULIC SYS D PUMP
TIE BUS CONT BUS 2
TIE BUS PWR BUS 3
GND IDLE ENG NO. 3
BUS 3 GALLEY POWER
START AIR VALVE, ENG NO. 3
REV IND, ENG NO. 3
OIL LOW PRESS LIGHT, ENG NO. 3
FUEL LOW PRESS, ENG NO. 3
ENG INSTR RESET ALL ENGINES
BLEED AIR IND ALL ENGINES
ENGINE 2 PRI EMER ALL ENGINES
TANK VALVE ENG 3
EMER AND R X-FEED ENG 3
JTSN AND DEFUEL 3
OUTB BOOST PUMP IND
AFT CAB TEMP CONTROL DC
GALLEY TEMP CONTROL DC
PACK 3 AUTO/MAN DC
DUCT AREA OVHT DET DC
CABIN PRESSURE CONT STBY
IDG OIL TEMP
ACCESS VENT AIR ENG 3

ESSENTIAL DC BUS AND ESSENTIAL DC RADIO BUS



DC STANDBY BUS



CB1

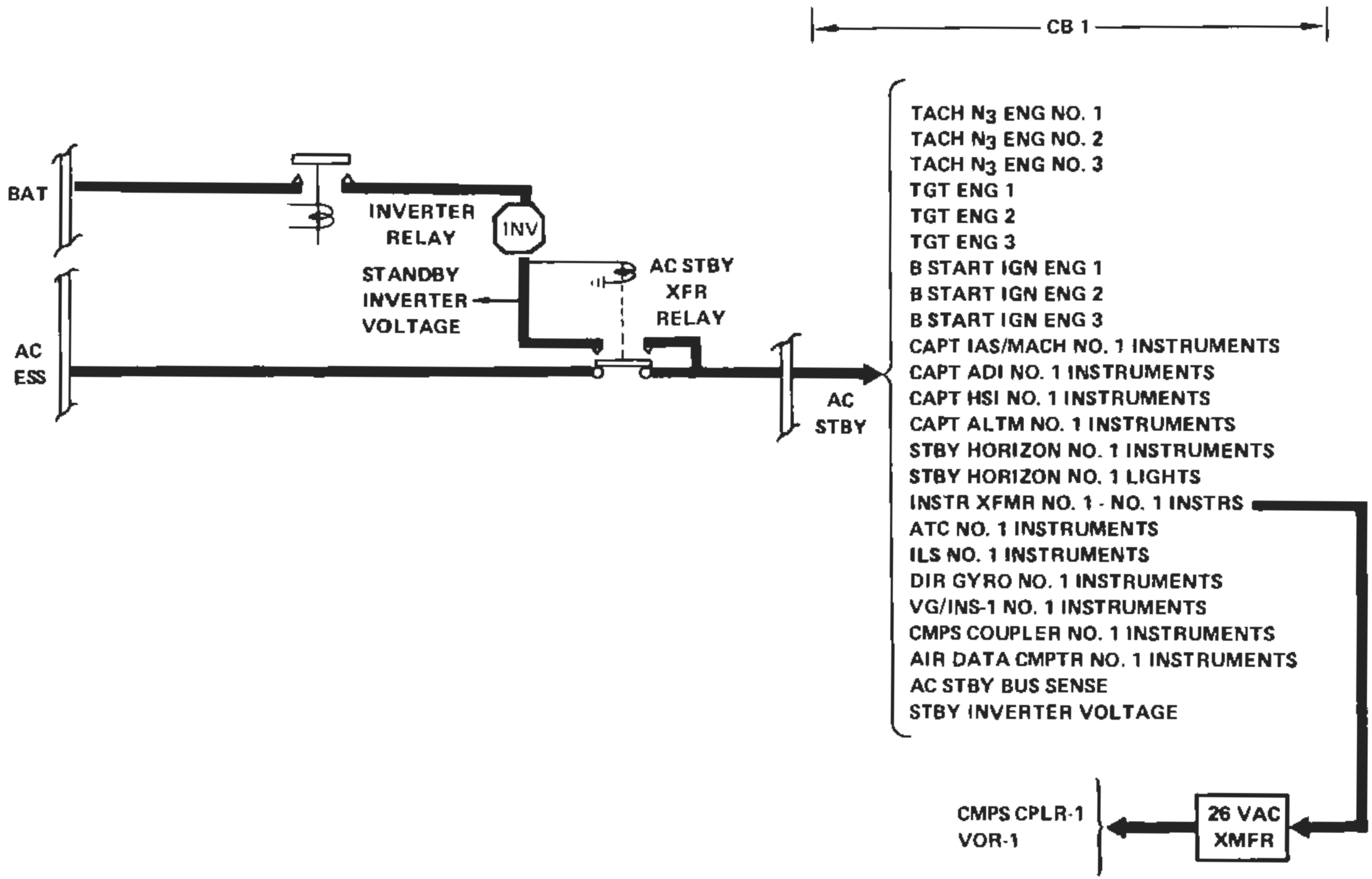
STBY COMPASS LIGHT
INSTR PNL FLOOD LIGHT
FUEL SHUTOFF ENG 1
FUEL SHUTOFF ENG 2
FUEL SHUTOFF ENG 3
ENG ISLN VALVES ENG 1
ENG ISLN VALVES ENG 2
ENG ISLN VALVES ENG 3
FUS ISLN VALVE
CROSS BLEED VALVES L
CROSS BLEED VALVES R
VHF DC VOR RCVR NO. 1 NAVIGATION
VHF DC PREAMP NO. 1 NAVIGATION
MANUAL CABIN PRESS CONTROL FWD
MANUAL CABIN PRESS CONTROL AFT
PACK FLOW CONTROL 1
PACK FLOW CONTROL 2
PACK FLOW CONTROL 3
PACK HIGH FLOW CONTROL
RAT IND LT
THRUST REVERSE ENG 1
THRUST REVERSE ENG 2
THRUST REVERSE ENG 3
MASTER ALARM PWR ENG 1 FIRE DET
MASTER ALARM PWR ENG 2 FIRE DET
MASTER ALARM PWR ENG 3 FIRE DET
MASTER ALARM PWR WHL WELL AND APU
FIRE OETECTION TEST
APU FIRE SHUTDOWN
FIREBELL PWR FIRE DETECTION
APU SEC EMER SHUTOFF FIRE DETECTION
NO. 2 ASYM BK LE SLAT, FLAP CONT
NO. 2 ASYM BK TE FLAP, FLAP CONT

START CONT ENG 1
START CONT ENG 2
START CONT ENG 3
HP3 BLEED AIR ENG 1
HP3 BLEED AIR ENG 2
HP3 BLEED AIR ENG 3
HI PRESS VALVES ENG 1
HI PRESS VALVES ENG 2

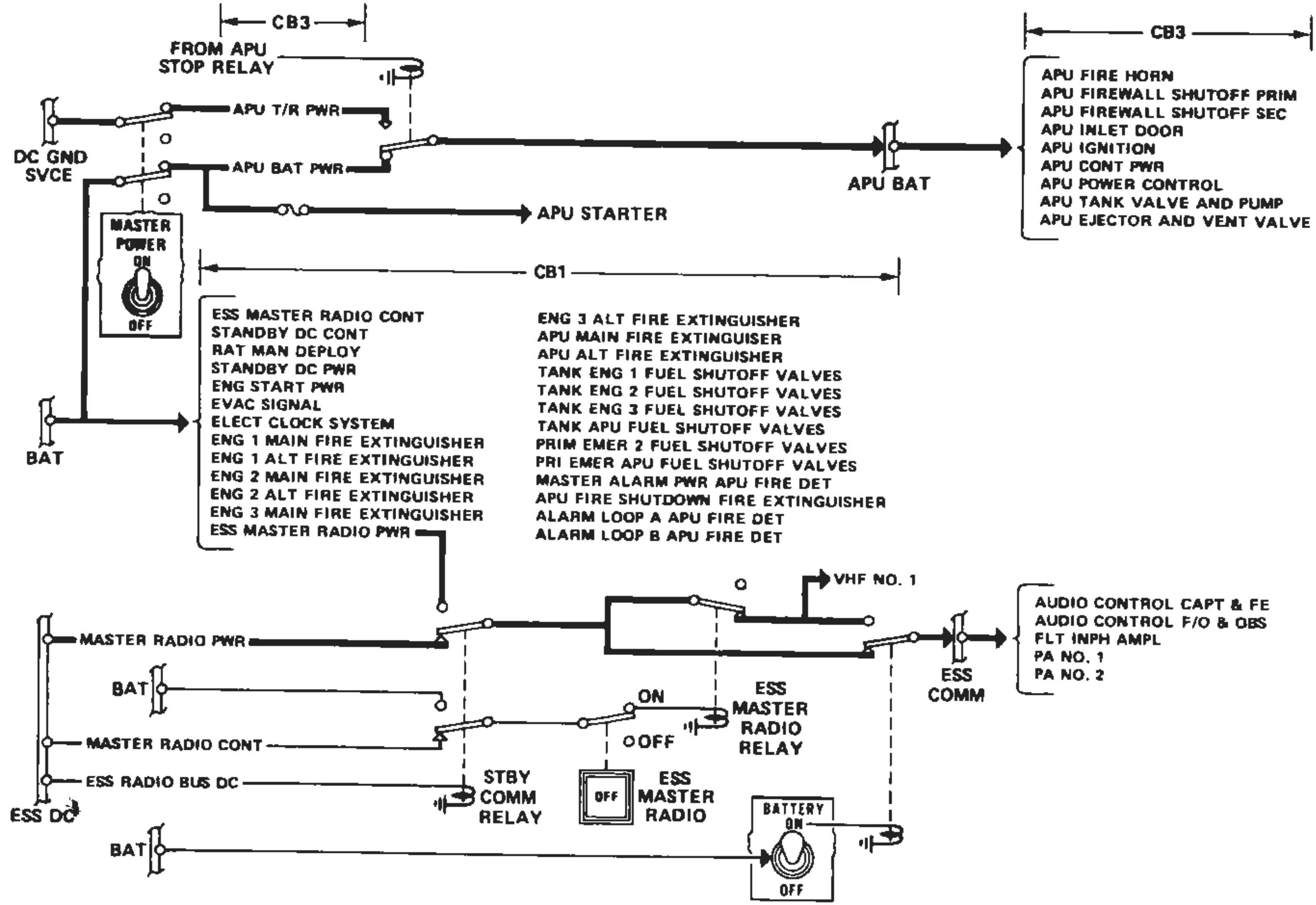
LOCK LIGHT LE SLAT, FLAP CONT
LOCK LIGHT TE FLAP, FLAP CONT
AIR OVBD
NORMAL MASK PASS OXYGEN
NORMAL GEN PAS OXYGEN
OVERRIDE MASK PASS OXYGEN
OVERRIDE GEN PASS OXYGEN
LOOP A ALARM ENG 1 FIRE DET
LOOP A ALARM ENG 2 FIRE DET
LOOP A ALARM ENG 3 FIRE DET
LOOP A ALARM APU FIRE DET
LOOP B ALARM ENG 1 FIRE DET
LOOP B ALARM ENG 2 FIRE DET
LOOP B ALARM ENG 3 FIRE DET
LOOP B ALARM APU FIRE DET
AC ESS BUS CONT
DC STBY IND
EMER UNARM IND
GEN 1 CONTROL UNITS
GEN 2 CONTROL UNITS
GEN 3 CONTROL UNITS
RAIN REPELLANT INBD
RAIN REPELLANT OUTB
RAT AUTO DEPLOY
AISLE LIGHTS
GALLEY AND LAV LIGHTS
AURAL WARN TEST
AURAL WARN OVSP
AURAL WARN MULT SND
ANN RESET
PROX SW PWR NO. 1 LANDING GEAR
PROX SW PWR NO. 4 LANDING GEAR
WARN HORN LANDING GEAR
DOOR POSN IND LANDING GEAR
ALTN GEAR CONT LANDING GEAR

HI PRESS VALVES ENG 3
ENG START BUS IND
HYD PUMP AND FIREWALL SHUTOFF
VALVE CONT
SYS A
SYS B
SYS C
SYS D

AC STANDBY BUS

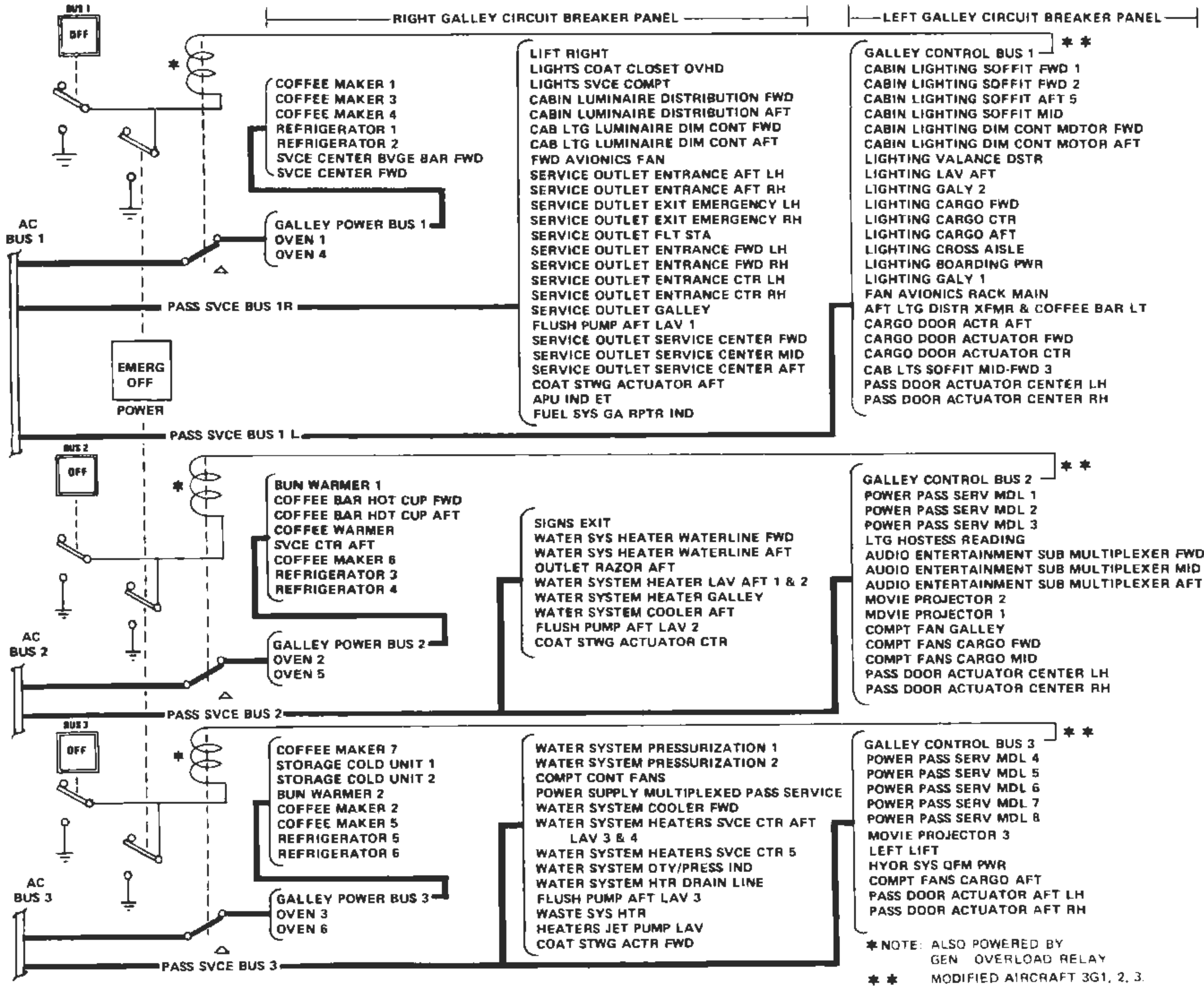


BATTERY, ESS COMM, AND APU BATTERY BUSSES



(5657)

GALLEY AND PASSENGER SERVICE BUSSES



* NOTE: ALSO POWERED BY GEN OVERLOAD RELAY

* * MODIFIED AIRCRAFT 3G1, 2, 3.

ELECTRICAL SYSTEM - GENERAL

The electrical system consists of a 115 volt, 400 Hertz AC generating system, and a 28 volt DC system. A battery and inverter provide a source of standby power. The electrical system is automatic in operation, but can be visually monitored and manually controlled. The battery provides normal starting power for the APU.

Some of the features of the electrical system are:

- Integrated drive generators
- APU generator
- Automatic paralleling of all generators
- Remote controlled circuit breakers
- Autotransfer capability for essential and standby power
- Automatic load reduction

The electrical compartment is located below the main floor, just behind the galley compartment. It contains the electrical load busses, relays, batteries, inverter, generator control units, and remote controlled circuit breakers. Access to this compartment is through the rear galley door.

Normal AC power is supplied by the three integrated drive generators. The APU generator or external power can also supply this power. All generators normally operate paralleled; however, they can operate isolated by manual control. Generators will not parallel any time external power is on.

The normal source of DC power is supplied by four transformer rectifier (TR) units. These are powered by their respective AC busses 1, 2, 3, and AC essential. Each TR in turn powers its respective DC bus 1, 2, 3, and DC essential.

Autotransfer is provided for the more critical busses such as AC Essential, AC Standby, and DC Standby. If the primary source of power fails, the bus power will autotransfer to another source. The DC Essential bus can be powered from more than one source.

A battery and inverter provide a source of standby power. The battery normally powers only the battery bus; however, it could power the AC and DC Standby busses for approximately 40 minutes under restricted use. Any time the inverter is powered, it automatically powers the AC Standby bus.

NORMAL ELECTRICAL OPERATION

The three engine-driven generators provide the normal source of electrical power when engines are operating. Prior to engine start, the APU generator is normally used to power the load busses.

When the APU is started, its generator low oil pressure light goes out and its field relay and generator breakers close. The APU generator is connected to the AC Tie bus. The AC tie breakers are normally closed, allowing the APU generator to power the load busses.

After each engine is started, the engine-driven generator's low oil pressure light goes out, the field relay closes, and the generator breaker then closes when paralleled.

Any generator is capable of powering all electrical busses. An automatic load reduction takes place, if any generator is overloaded, deactivating galley power and the two AC hydraulic pumps.

A flowbar on a relay close switch indicates that relay is closed. An open light on a relay trip switch indicates that relay is open. Field relay and generator breaker open lights are on prior to engine start. After engine start, the open lights extinguish and flowbars appear as the generators automatically parallel.

When the APU generator is operating, all four generators operate in parallel, sharing the electrical load, the APU is shut down when no longer required, leaving the three engine-driven generators operating in parallel. The APU can be restarted in flight if its generator is required; however, it is not normally started until after landing. Two generators are capable of powering all electrical loads in flight.

External power can be used on the ground instead of the APU generator. If used, generator paralleling is prevented. If the engines are operating and external power is turned on, all AC tie breakers open to prevent any paralleling. If the APU generator is operating, its generator breaker will open.

When external power is turned off with engines operating, a priority circuit allows the No. 2 AC tie breaker to close first, followed by the No. 1 and No. 3 AC tie breakers. All generators return to parallel operation, sharing the electrical loads. The APU generator would also parallel if operating.

AC GENERATING SYSTEM

Engine driven generators provide the normal source of AC power. Because the generator and its CSD are in one unit, the unit is referred to as an integrated drive generator (IDG).

Each generator uses an oil spray system for cooling and lubrication. Oil out temperature indocators monitor oil temperature as it leaves each IDG. Oil temperature rise, as it passes through the IDG, can also be monitored by pressing the IDG temp rise switch.

The maximum continuous rating of each generator is 81 KW, with an overload limit of 120 KW for 5 minutes. All generators normally operate in parallel, sharing the load.

The generator relays close automatically if the close switches are pressed in. Close and trip switches are provided for the generator field relay, generator breaker, and AC tie breaker. A generator powers its AC load bus if its field relay and generator breaker are closed. The load bus is connected to the AC Tie bus if its tie breaker is closed.

The APU generator is the same unit as the engine generator except that it has no CSD. An adapter connects the generator directly to the APU N_2 turbine. 400 Hz output frequency is maintained by driving the N_2 turbine at 100% RPM. The adapter provides an oil reservoir, pump, and cooler for the APU generator.

Each generator has its own permanent magnet generator (PMG). Any time the generator is turning, the PMG is producing AC voltage. The voltage is used to power a generator control unit and provide initial generator field excitation. PMG voltage can be checked by pressing a PMG test switch. No PMG voltage confirms the generator is not rotating.

Each engine driven generator's load controller provides equal load sharing. If any generator begins to carry more or less than its share, the torque of its transmission is varied until it again is carrying its proper load. When the APU is operating, the other generators attempt to match the APU generator load.

Each generator, except APU, has a solenoid-operated, mechanical disconnect. A guarded disconnect switch is provided for each engine driven generator. The switchlight is also a low oil pressure warning light. Pressing the disconnect switch will disconnect the generator from the engine drive. The low oil pressure, field relay open, and generator breaker open lights will come on. A disconnect switch should not be pressed prior to engine start as this could result in extensive generator damage after engine is started. If disconnected in flight, it cannot be reconnected until after landing and engine shutdown.

If lamp replacement is necessary for the low pressure light, the IDG disconnect circuit breaker, located at 3G15, should first be pulled. Pulling the circuit breaker will prevent accidential disconnect when the lens assembly is restored. A tab attached to each disconnect switch guard states "DO NOT RELAMP WITH POWER ON." as a warning.

IDG LOW PRESSURE LIGHT

The IDG low pressure light will come on if generator oil pressure below minimum pressure for continued operation. The light will also come on if a generator disconnect is initiated.

GENERATOR CONTROL UNIT (GCU)

Each of the four generators is monitored and controlled by its generator control unit. The GCU monitors the generator output for speed, voltage, and phase rotation. If no power is on the bus, or when proper phasing exists, the GCU will connect the generator to its bus. The GCU will remove the generator from the bus system and unpower it, if necessary, for any of the following faults: Over or underexcitation, over or undervoltage, differential faults, differential loads, underspeed, open phase, or overcurrent.

BEARING FAILURE INDICATION

Excessive main generator bearing wear indication is provided by a bearing light illuminating. When the main bearing wear reaches the point of allowing the generator shaft to contact a detector ring, the light will come on.

GENERATOR FIELD RELAY

The field relay opens automatically on underspeed or if the fire handle is pulled. It closes automatically when the generator is on speed and allows the PMG to excite the generator field. While it operates automantically for normal operation, it can be manually opened or closed by pressing the appropriate trip or close switch.

AC GENERATING SYSTEM (Cont'd)

The field relay will trip automatically for any of the following reasons: Under or overvoltage, open phase, underspeed, differential fault, or engine fire handle pulled. All trips must be reset manually for the automatic close function to work again. Any relay lockout is removed if power is removed from the PMG and GCU.

GENERATOR BREAKER

The generator breaker normally closes automatically if the field relay is closed and will open automatically when the field relay opens. The generator breaker closes on one of two signals; either the dead AC bus or when conditions are proper for paralleling. The generator breaker can be manually opened by pressing its trip switch. If manually opened, the manual close switch must be reset for the automatic function to again operate. Any relay lockout will be removed if power is removed from the PMG and GCU.

BUS TIE BREAKER

The bus tie breaker is opened either automatically or manually. An automatic trip will occur for over or underexcitation, difference current, undervoltage, or differential fault. The bus tie breaker will close automatically if no lockout exists and on one of two signals; either a dead bus or proper conditions for autoparallel. Any relay lockout will be removed if power is removed from the PMG and GCU.

KW/KVAR METERS

A KW/KVAR meter is provided for each generator. The meter shows the load carried by the generator. Under normal paralleled operation, each generator shares the total load equally within the tolerance of the load controller. The maximum differences allowed in loads are 6 KW when IDGs parallel, 9 KW when APU parallel, and 5 KVAR with anything in parallel. The meters normally indicate KW (real load), but will indicate KVAR (reactive load) when the KVAR switch is pressed. KVAR is normally about 50% of KW indication.

IDG TEMPERATURE GAUGE

Each IDG has a temperature gauge, indicating generator oil out temperature on a 0 to 180 degree C scale, with an amber range from 145 to 180 degrees. An IDG temperature rise switch can be pressed to show the rise in IDG oil temperature as oil passes through the generator. The rise in temperature is displayed on the 0 to 40 degree scale. The rise in temperature results from generator cooling and CSD load, and is the difference between temperature entering and leaving the generator.

MANUAL OPERATION

The generators may be controlled manually. If the generator field trip switch is pressed, both the generator field relay and generator breaker open. The generator is de-energized except for PMG voltage.

If the generator breaker trip switch is pressed, the generator breaker opens. This permits checking the unloaded generator's voltage and frequency.

A generator may be operated isolated to its own load bus by opening its AC tie breaker. This allows checking the generator voltage and frequency under load condition. It it is desired to unpower an AC bus, open the associated generator breaker and AC tie breaker. This also unpowers the respective flight station bus.

Any of the manual operations will lock out the autoclose function of the relay or breaker until the corresponding close switch is pressed.

AUTOPARALLELING

AC tie breakers control the autoparallel operation of the generators by sensing the voltages on the generator side of the generator breaker and on the Tie bus. The voltage, phasing, and frequency of each generator is compared and, when within limits, the applicable generator breaker or AC tie breaker is closed to parallel the generator with the Tie bus. Autoparallel operation is prevented if the external power switch is on.

If the APU generator is powering the Tie bus before the engines are running, the APU generator becomes the master for autoparalleling. During engine start, the generators are allowed to parallel with the APU generator after correct power and phasing conditions are met.

If a generator breaker has opened, either manually or automatically, it should be closed by autoparalleling. To autoparallel, trip the field, close the breaker, then close the field.

To autoparallel a generator when a tie breaker is open, open the field relay and then press the tie breaker close switch, and the generator breaker close switch. This will release the lock on the breaker(s) and, when the field relay close switch is pressed, the generator will autoparallel.

AC ESSENTIAL

The AC Essential bus provides AC power for most important loads. The bus is normally powered from the No. 3 AC bus, but can be selected to other sources by the AC Essential bus selector switch.

The AC Essential bus selector switch has both automatic and manual positions. There are three manual positions with single source selections that do not autotransfer. There are also three automatic positions which provide backup choice if the primary source of power fails. In an automatic position, the AC Essential bus is powered by the primary source selected but, if the primary source fails, the secondary choice automatically powers the AC Essential bus.

The B3(G1) position is normally selected because of the lighter load requirements. This is an automatic position and, if the No. 3 AC bus fails, the AC Essential bus is automatically transferred to the No. 1 generator. If the autotransfer occurs, the essential AC on alternate light illuminates as a warning.

If a power failure to the AC Essential bus takes place, the AC essential fail light on the electrical panel and the essential/standby power light on the master annunciator panel will illuminate. The AC Essential bus is the normal power source for the AC Standby bus and essential TR.

DC POWER SYSTEM

Under normal conditions, DC power is supplied by transformer rectifiers (TRs). The battery provides a standby source of DC power. There are four TR units, one for each of the four DC busses. Each of the TRs is powered from its AC bus. The No. 1, 2, and 3 AC busses power the No. 1, 2, and 3 TRs, and the essential TR is powered by the AC Essential bus. The DC system is automatically powered whenever the AC system is powered.

DC BUS ISOLATION

The DC busses are tied together, with each bus connected to the DC Tie bus through its DC tie breaker.

The three DC busses can be isolated from each other and the DC Tie bus by pressing the DC bus isolation switch. When pressed, the DC tie breakers open, the DC busses are isolated, and the DC bus isolation open light comes on. Releasing the switch will close the DC tie breakers and cause the open light to go out.

When the essential TR is the only DC power source, the DC busses are powered from the DC Essential bus if the DC bus isolation switch is closed. A failed TR is indicated by normal bus volts and zero amps on the respective DC meters when the DC bus isolation switch is closed.

BATTERY POWER

The battery always powers the battery bus regardless of battery switch position. It can power the DC Standby bus and the AC Standby bus through the static inverter. It is also the source of power for starting the APU.

The aircraft battery is a 26 volt, 22 cell, nickel cadmimum unit, mounted on the floor of the electrical compartment. It has a maximum charge potential of 38 volts; however, less than this would normally be indicated. The lowest charge possible before rapid depletion is 22 volts. The battery has a 53 ampere hour rating with a normal battery voltage of 30-34 volts. The normal operating depletion time is about 40 minutes without charging when powering the Standby busses. Attempting to start the APU will decrease this operating time.

BATTERY SWITCH

The battery switch is a two-position toggle switch. For normal flight operation, it will be on and the DC Standby bus will be powered if DC Essential bus power fails. It also allows the standby power switch, when armed, to provide an autotransfer for the AC Standby bus. When off, it disarms an automatic transfer to either Standby bus. The battery switch must be in the off position for the battery to charge if the ground service switch is activated.

BATTERY CHARGER

The charger is located in the electrical compartment. It is powered from the AC Ground Service bus as long as the battery is not being used to power either Standby bus. The charger takes three phase AC power and converts it to a DC charging potential of up to 38 volts. It is capable of charging a depleted battery in 90 minutes.

BATTERY POWER (Cont'd)

Charger voltage is higher than the normal battery voltage, so the charger is not powered when the battery is being used to power either Standby bus. The battery charger senses the voltage and temperature of the battery and provides the necessary charging current to maintain a fully charged battery. Temperature sensors are in contact with each battery cell to detect any overtemperature condition. This determines the rate of charge. When the battery is up to normal voltage, the charger will operate in a pulsing mode. When the battery temperature is too high, the battery charger is turned off.

The charger is not powered if either Standby bus is powered from the battery or if the cool air overboard valve in the electrical compartment is open during flight.

BATTERY BUS

The Battery bus is powered directly from the battery regardless of battery switch position. The Battery bus is located in the electrical compartment and a Battery bus extension is located in the cockpit. For all practical purposes, they are both the Battery bus. The Battery bus is used to power standby communications, fire extinguishing, fuel shutoff valves, emergency evacuation signals, and clocks. It also is a backup power source for APU starting.

BATTERY CONDITION LIGHT

The condition light is located on the APU control panel and indicates battery overtemperature, short, or low cell voltage. APU start should not be attempted with the light on.

DC AMMETER

The DC ammeter indicates battery charge or discharge for the various DC sources, as selected by the meter selector. The meter has both positive and negative indications ranging from 0 to 150 amperes.

When the selector switch is placed to battery, the ammeter will indicate positive (+) if the battery is furnishing power, or discharging. It will indicate negative (–) if the battery is being charged. When battery voltage is above 30 volts, the indicator will show zero with a –40 amp pulse charge each 30 seconds. When below 30 volts, a steady –40 amp charge will be maintained until at 90% of full capacity. At this point, the charger reverts to a pulsing mode to complete the charge and maintain the battery at full capacity.

DC ESSENTIAL

The DC Essential bus is normally powered from both the essential TR and the DC Tie bus. The DC Essential bus is connected to the DC Tie bus by the DC TIE BUS PWR circuit breaker. If the essential TR fails, the DC Essential bus will still be powered from the DC Tie bus. If the DC Essential bus fails, the DC Essential bus fail light and the essential/standby power light will both illuminate.

STANDBY POWER

The standby power system provides AC and DC standby power to power essential flight instruments and engine starting, navigation, communication, and lighting systems. The system includes the normal aircraft battery switch.

BATTERY SWITCH

The battery switch provides the autotransfer function for both AC and DC Standby busses. For AC autotransfer, the standby power switch must also be armed. Neither Standby bus will autotransfer with the battery switch off.

INVERTER

The static inverter converts 28 volt DC power to 115 volts, 400 Hz, single-phase AC power. It is powered from the Battery bus when the static inverter relay is energized. The relay is automatically energized if the AC Essential bus fails when the battery switch is on and the standby power switch is armed. It can also be energized by placing the standby power switch on.

AC STANDBY BUS

The AC Standby bus is normally powered from the AC Essential bus. The AC Standby bus may autotransfer or be manually transferred to the static inverter. Automatic transfer occurs if AC essential power fails, providing the battery switch is on and the standby power switch is armed. Automatic transfer of the AC Standby bus will not take place if the standby power switch is off or the battery switch is off.

Manual transfer takes place if the standby power switch is placed on. The AC Standby bus will manually transfer to the battery and inverter power, even if the Essential busses are powered or if the battery switch is off.

STANDBY POWER (Cont'd)

DC STANDBY BUS

The DC Standby bus is normally powered from the DC Essential bus but can be powered from the Battery bus if either automatic or manual transfer takes place. Automatic transfer occurs if the DC Essential bus is unpowered and the battery switch is on. Manual transfer is controlled by the standby power switch position. If this switch is on, the DC Standby bus will transfer regardless of battery switch positon.

STANDBY POWER SWITCH

This three position switch is located on the pilot overhead panel. It is normally armed in flight.

When the switch is armed and the battery switch is on, the automatic transfer circuit is armed to transfer. If the AC Essential bus loses power, the AC Standby bus will autotransfer to inverter power and the inverter becomes powered from the battery.

When the switch is on, forced transfer takes place for both Standby busses. The DC Standby bus transfers to the battery and the AC Standby bus transfers to the inverter which is now powered from the battery.

With the switch off, automatic transfer of the AC Standby bus is inhibited.

UNARM LIGHT

The unarmed light will come on if either the standby power switch or battery switch is off. This disables the AC Standby bus autotransfer function. The light is powered from the DC Standby bus.

STANDBY POWER ON LIGHT

The amber light comes on when the standby power switch is armed, the battery switch is on, and either or both Standby busses have autotransferred to battery power.

STANDBY POWER FLOWBAR LIGHT

This flowbar comes on with the standby power switch on indicating both Standby busses have transferred to the battery.

EXTERNAL POWER

An external power source, capable of providing 81 KW, 115 volt, 400 Hz, 3 phase power, can be used for ground operation. This source of power is connected through an external power receptacle. It can be used to supply power to the entire electrical system or to only the Ground Service busses.

The system consists of an external power receptacle, external power relay, bus protection panel (BPP), and control switches. An external power available light and an external power on light monitor external power. The external power switch and lights are located on the engineer's electrical panel. The BPP is located in the mid electrical service center.

EXTERNAL POWER AVAILABLE LIGHT

The available light comes on when external power is connected and the proper voltage, frequency, and phasing exist.

EXTERNAL POWER ON LIGHT

The on light illuminates when the external power switch is on, advising that external power is connected to the AC Tie bus.

BUS PROTECTION PANEL

The bus protection panel provides control and protection for the external power system. If any of the following occur, the external power relay will trip and disconnect external power from the AC Tie bus:

- Overvoltage
- Undervoltage
- Frequency out of limits

EXTERNAL POWER SWITCH

External power control is provided by a magnetically held, two-position toggle switch. When the switch is on, the external power relay is energized, connecting external power to the AC Tie bus.

EXTERNAL POWER OPERATION

When external power is on, the external power on light illuminates, the external power relay is closed, and power is connected to the AC Tie bus. External power always takes priority on the AC Tie bus and will not parallel with any other source. If the IDGs are not powered, the bus tie breakers will already be closed with power connected to each AC Load bus.

EXTERNAL POWER (Cont'd)

When the engines are started, the field relays close. Each IDG has priority over its AC Load bus and, when the bus is being powered from external power, the generator control unit causes the bus tie breaker to open. The generator breaker seeks either a dead bus or phasing signal. It closes upon receiving a dead bus signal, allowing the IDG to power its load bus.

After all engines are started, the IDGs power their AC busses isolated, because paralleling is not possible with external power. When the external power switch is turned off, the No. 2 generator control unit allows its bus tie breaker to close because a dead bus signal is sensed. The No. 1 and No. 3 close in order as their generator control units sense proper parallel phasing. The external power relay is not powered and the on light is out.

GROUND SERVICE POWER

Ground service control is provided to supply selected loads, from either external power or the APU generator, when it is not practical or desirable to power the complete electrical system.

Ground service power provides power for fueling, towing, vacuuming, lighting, battery charging, and VHF-2 There are two control switches. One is located on the engineer's electrical panel and the other is on the forward flight attendant's panel. The switch at the electrical panel provides selection of power from either the APU generator or from external power. When the ground service switch is off, ground service is powered from the No. 1 AC bus. If ground power is turned on at the flight attendant's panel, only external power source can be used. There are two switch lights at this panel, ground service on and ground service off.

If ground service power is turned on at the engineer's station, operation can be stopped at the flight attendant's panel by first pressing the on switch, then pressing the off switch. If ground service power was turned on at the flight attendant's panel, operation can be stopped at the engineer panel by first placing the switch to external power, then off.

GROUND SERVICE OPERATION

When either ground service switch is turned on, power is connected to the No. 1 AC Ground Service bus and the other loads on No. 1 AC bus are unpowered. The No. 2 and No. 3 bus tie breakers and their associated AC load busses are also de-energized At the same time the DC Ground Service bus relay is energized to separate No. 1 DC bus from the DC Ground Service bus. No. 1 TR supplies the power to the DC Ground Service bus. In addition, the normal battery charger is powered, provided the battery switch is off. The battery charger relay is not energized if either Standby bus is being powered by the battery.

If the external power switch is on, the ground service switch cannot be operated in either APU or external power position.

GALLEY POWER

Three galley busses provide the necessary AC power for ovens, refrigerator units, coffee makers, etc. These busses are powered by their respective AC load busses.

GALLEY CIRCUIT BREAKERS

The galley busses are powered through remote control circuit breakers, located on the right galley panel. Ovens are individually protected by remote control breakers on the same panel. Circuit breakers for coffee makers and refrigeration units are located on the left galley panel. Three circuit breakers are located on the CB panel for galley control bus power. Power is removed from galley busses by energizing these control relays.

GALLEY BUS POWER SWITCHES

Three galley power control switches are located on the upper left electrical panel. When pressed, their respective galley busses are powered. When released, the galley busses are not powered and off lights appear on the switches.

GALLEY POWER (Cont'd)

GALLEY POWER EMERGENCY SHUTOFF SWITCH

A galley power emergency shutoff switch is located in the lower galley on the aft overheat of the galley compartment service entrance. When this momentary guarded switch is activated, all galley power is shutoff and three off lights will appear on the engineer's galley switches. Power can be restored by pressing this emergency switch again, which will also extinguish the off lights. Three off lights will appear on the galley power switches as an indication of an automatic load reduction if a generator is overloaded. To restore power, all three galley switches must be released before resetting.

CIRCUIT BREAKER PANELS

Three circuit breaker panels are installed in the cockpit. They are identified as CB-1, CB-2, and CB-3 panels.

CB-1, or pilot overhead panel, contains important flight operation breakers within easy reach of both pilots and the engineer. Protection is provided for such critical areas as communications, navigation, flight controls, and fire detection.

CB-2, or engineer overhead panel, is within reach of the pilots as well as the engineer. Protection for items such as cockpit lights, ground service power, passenger service, hydraulic, and anti-ice is provided on this panel.

CB-2, or engineer vertical panel, is the aft panel. Protection for air conditioning, pressurization, fuel system, interior and exterior lights, and AC and DC power control are found here.

Two breaker panels are installed in the aft bulkhead of the galley, one on each side of the galley lifts. They are indentified as Left Galley and Right Galley panels. They contain breakers needed for passenger service and ground operation functions.

Circuit breakers are located by panel number, row letter, and breaker number. For example: The DC TIE BUS PWR breaker is at 3F3. The circuit breaker is located on CB-3 panel, row F, the third breaker from the left.

REMOTE CONTROL CIRCUIT BREAKER (RCCB)

There are two types of circuit breakers used to protect electrical loads. One is the normal trip/set type found on most cockpit circuit breaker panels. The other is a remote control circuit breaker (RCCB), located in the electrical compartment. Feed wires from the electrical compartment busses to other subbusses and major system loads are protected by the RCCBs. Use of these RCCBs deletes the need to route large wires through the cockpit to the respective load.

The RCCB automatically actuates to break the circuit by thermal/mechanical means if an overload occurs. The RCCB uses a ½ amp breaker in the cockpit as a trip/set switch. The RCCB unit also has a manual trip/set button; however, it is not normally needed because of the breaker in the cockpit. The system is designed so that the RCCB assumes the same condition as the cockpit trip/set breaker. Thus, normally opening or closing the trip/set breaker will also open or close the RCCB. If the RCCB is overloaded and trips, it sends a trip signal to its respective trip/set breaker in the cockpit, causing it to also trip.

Flight Station busses 1, 2, and 3, all passenger service busses, and the forward AC Ground Service bus are controlled by RCCB trip/set breakers in the cockpit.

* * *

* * *

CABIN DOOR MALFUNCTIONS

FAILURE TO OPEN DURING NORMAL OPERATION

Check that the evacuation slide selector lever is in the detach position and slide girt bar retainers are down and flush with the floor.

Remove the plastic cover, stand back from the door, and pull down on the red emergency door T handle.

FAILURE TO CLOSE DURING NORMAL OPERATION

Check that the evacuation slide selector lever is in the engage position.

Check that the internal and external red emergency T handles are stowed.

Press the door close switch. If the door does not close, call maintenance.

CABIN DOOR ANNUNCIATOR WARNING LIGHT ON

Move the evacuation slide selector lever to the detach postion.

Check that the red emergency T handle is completely stowed.

If the light goes out, return the evacuation slide selector lever to engage.

If the light stays on, move the evacuation slide selector lever to detach and press the door open switch to raise the door slightly.

Return the evacuation slide selector lever to engage, press the door close switch, and ensure the door is completely closed.

If the light stays on, call maintenance.

*　*　*

EVACUATION AND AURAL WARNING PANELS

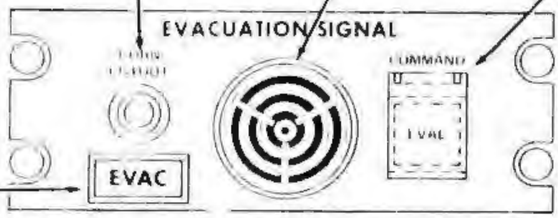
HORN CUTOUT SWITCH

A momentary pushbutton switch that silences the evacuation signal horn for its panel only.
1B17 - EVAC SIGNAL

SPEAKER HORN

Sounds when any evacuation command switch is pushed in.

1B17 - EVAC SIGNAL



EVACUATION LIGHT

Flashes when any evacuation command switch is pushed in.
1B17 - EVAC SIGNAL.

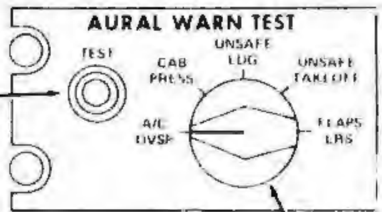
EVACUATION COMMAND SWITCH

IN	-	Energizes the evacuation signal intermittent horn and flashing EVAC light in flight station, galley, and the passenger compartment doors.
OUT	-	Evacuation signal disabled through panel that initiated signal.

1B17 - EVAC SIGNAL.

AURAL WARNING TEST SWITCH

Tests aural warning as selected.
1L6 - TEST & RESET



AURAL WARNING TEST SELECTOR

AIRCRAFT OVERSPEED	-	Clacker
CABIN PRESSURE	-	Intermittent horn
UNSAFE LANDING	-	Steady horn
UNSAFE TAKEOFF	-	Intermittent horn. Forward, center and aft cargo door lights on at engineer's annunicator panel. Door open light on at master annunicator panel.
FLAPS LOAD RELIEVING SYSTEM	-	Buzzer

1L7 - OVSP
1L8 - MULT SND

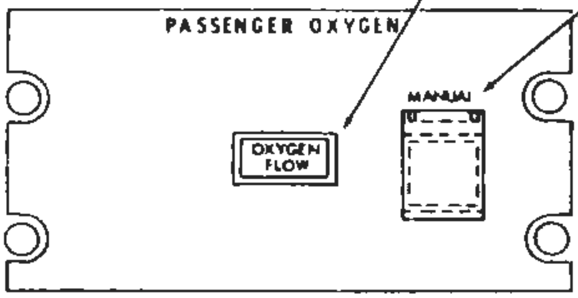
OXYGEN CONTROL PANELS

OXYGEN FLOW LIGHT

System is energized and oxygen is being generated.
1J15, 16, 17, 18 - PASS OXYGEN.

MANUAL CONTROL SWITCH

Momentary switch that bypasses automatic mode and energizes system. (Must be held in for 15 seconds.)
Masks drop from ceiling compartments and oxygen generators start operating.

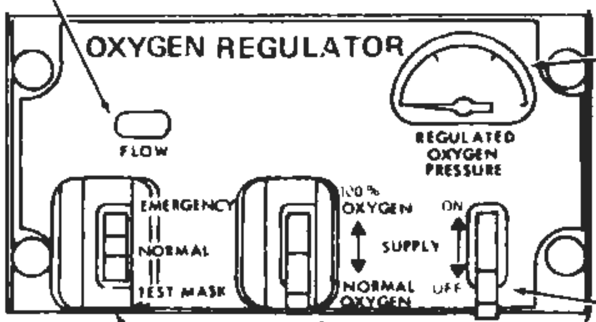


FLOW INDICATOR

Visual indication of oxygen flow from the regulator.

REGULATED OXYGEN PRESSURE INDICATOR

Oxygen line pressure to regulator from system regulator upstream.



SUPPLY LEVER

ON - Opens oxygen supply to regulator.

EMERGENCY LEVER

EMERGENCY - Provides oxygen under pressure. Use to defog smoke goggles or above 30,000 feet cabin altitude.
NORMAL - Oxygen on demand.
TEST MASK - Momentary position supplies oxygen under pressure for testing mask

OXYGEN SELECTOR LEVER

100% - Pure oxygen on demand.
NORMAL - Air/oxygen mixture on demand (ratio dependent on altitude).

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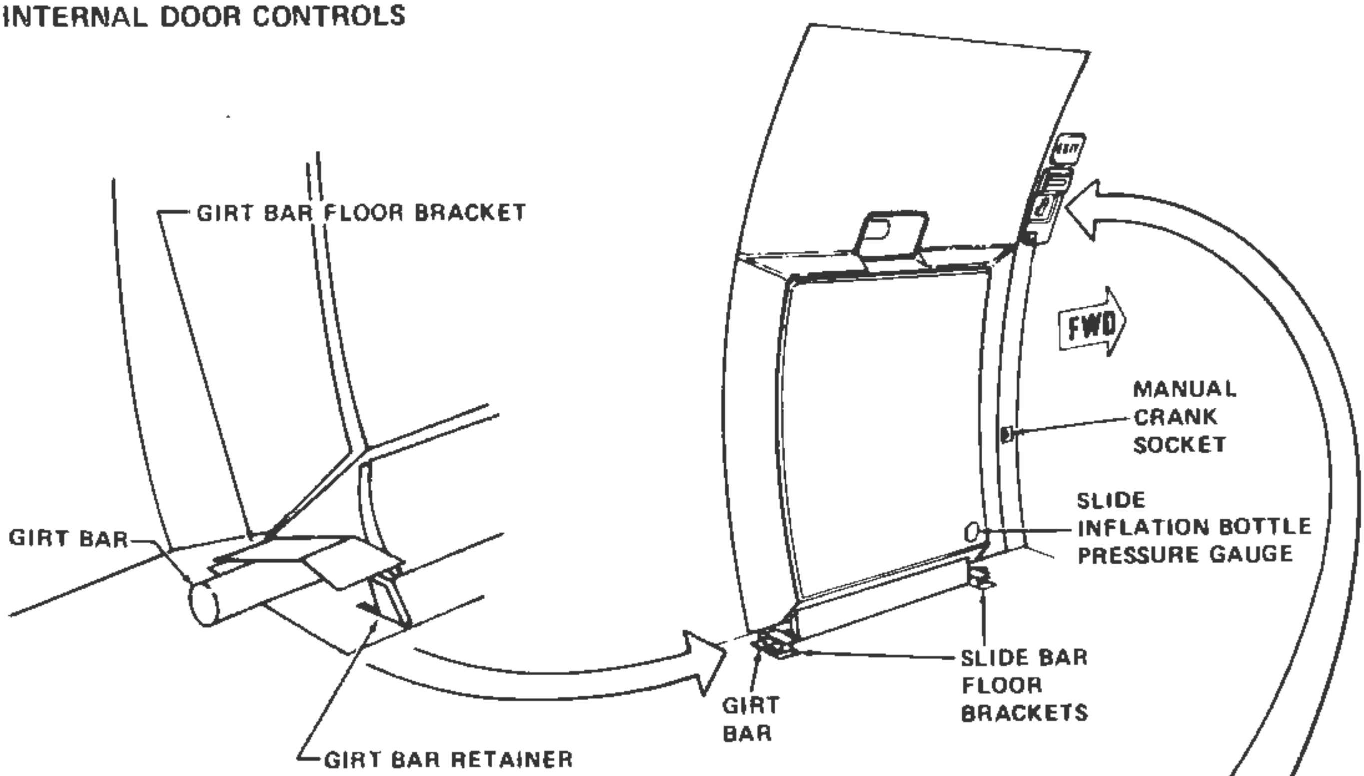
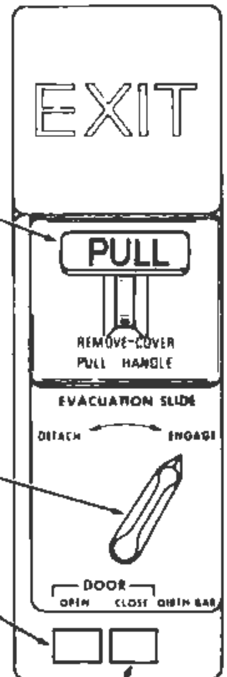
INTERNAL DOOR CONTROLS





NUMBER 4 DOORS DO NOT HAVE ELECTRICAL OPEN - CLOSE SWITCHES

EMERGENCY DOOR T HANDLE

(Forward of all passenger doors)
Permits manual operation of door.

First detent pulls the locking pin, turns on the annunciator light in the cockpit, and allows use of hand crank to close the door.

Second detent (full travel) opens the door manually.

EVACUATION SLIDE SELECTOR LEVER

DETACH - Powers the open switch and lowers girt bar retainers, thereby permitting slide to go up with the door when it is opened.

ENGAGE - Powers the close switch and raises girt bar retainers which will pull the slide from housing when door is opened.

DOOR OPEN SWITCH

Holding the switch in electrically opens a door provided the evacuation slide selector lever is in the DETACH position.
CIRCUIT BREAKERS - Galley left circuit breaker panel.

DOOR CLOSE SWITCH

Holding the switch in electrically closes a door provided the evacuation slide selector lever is in the ENGAGE position.
CIRCUIT BREAKERS - Galley left circuit breaker panel.

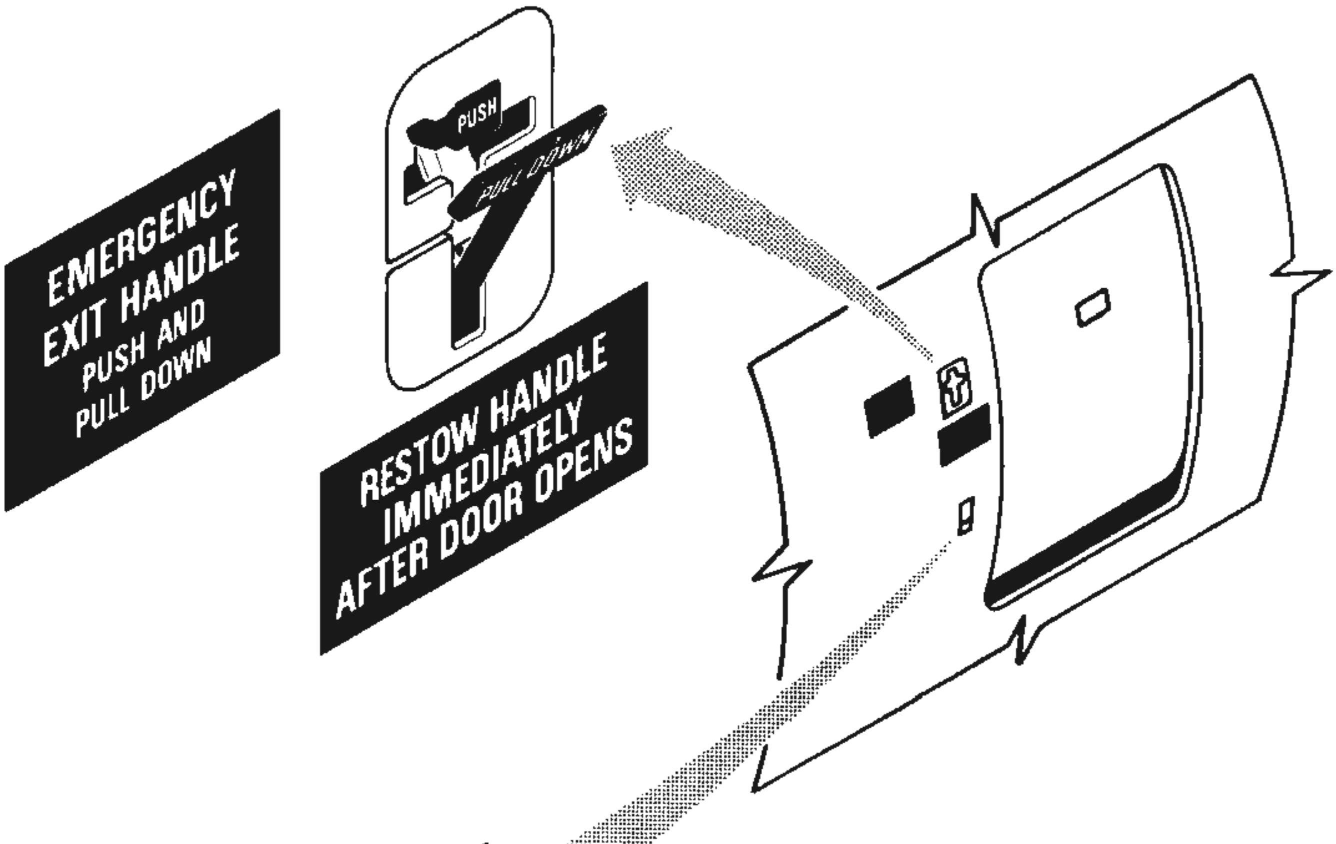
EXTERNAL DOOR CONTROLS

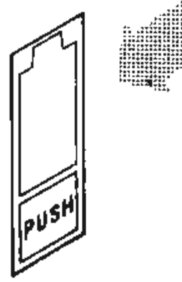
EMERGENCY EXIT HANDLE

(forward of each passenger door)
Handle has three detents:

- The first detent disengages the girt bar & arms the electrical control switch.
- The second detent withdraws the locking pin.
- The third detent declutches the door actuator.

Pulling the handle to the third detent opens the door without deploying the slide.

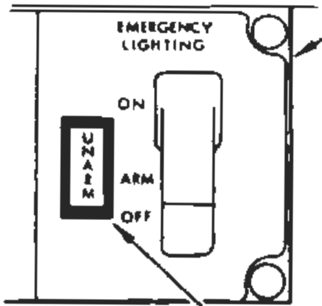




ELECTRICAL CONTROL SWITCH

Momentary toggle switch, under a protective cover, which withdraws the locking pins and operates the door when the emergency exit handle is in the first detent.

EMERGENCY LIGHT CONTROLS



EMERGENCY LIGHTS

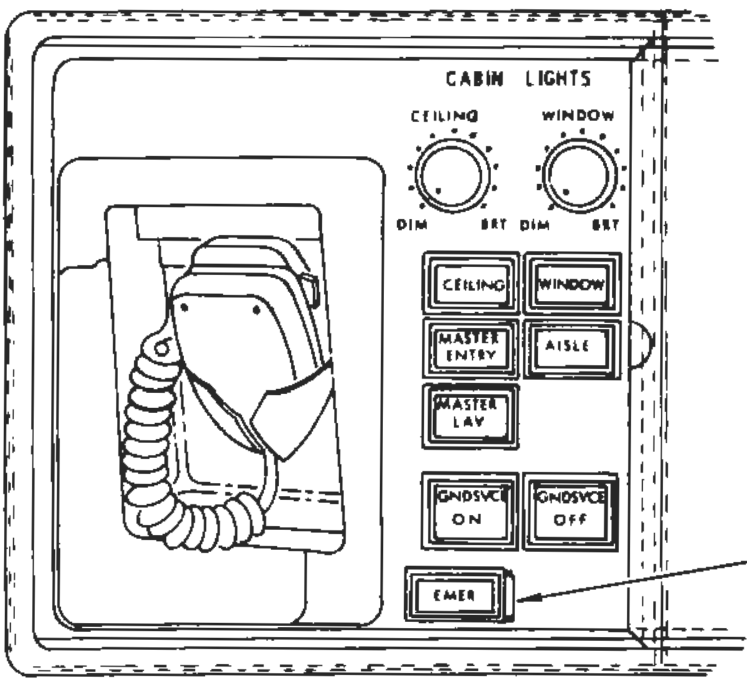
ON - Turns on emergency aisle, exit, galley elevator, cockpit escape hatch, and door lights.

ARM - Normal switch position. All emergency lights listed above illuminate automatically if essential bus 28V DC power fails.

OFF - Prevents illumination of lights if power fails. If lights illuminated, selection of ARM then OFF will turn lights OFF.

EMERGENCY LIGHTS UNARMED

Indicates the switch is not in the ARM position.
1K14 - EMER UNARM IND.



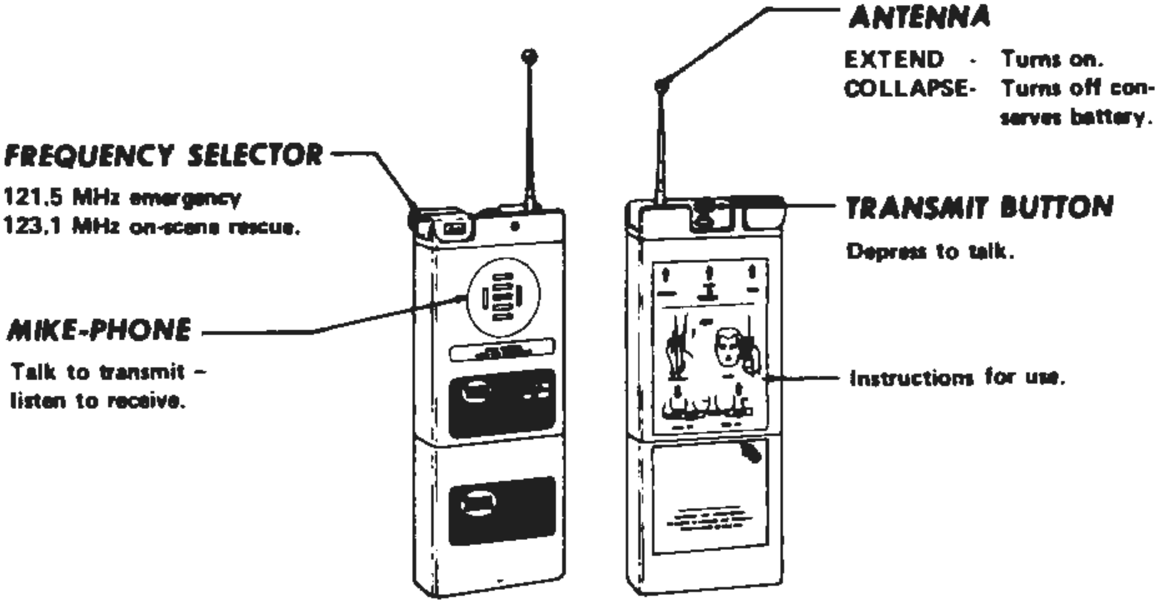
CABIN EMERGENCY LIGHT SWITCH

Push to turn on emergency lights. Pilot switch will extinguish light. Switch also on aft left panel.
3J6 thru 10 EMER LT CHARGE.

FLIGHT ATTENDANTS' PANEL
(LEFT FWD SHOWN)

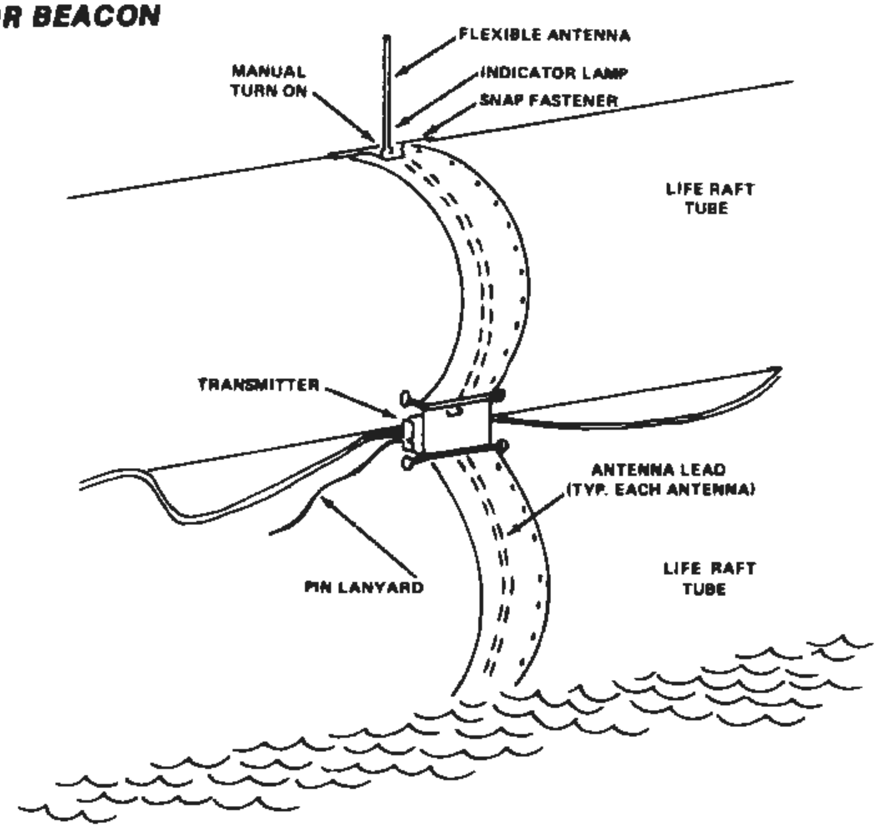
SLIDE/RAFT TRANSCEIVER AND LOCATOR BEACON

VHF TRANSCEIVER

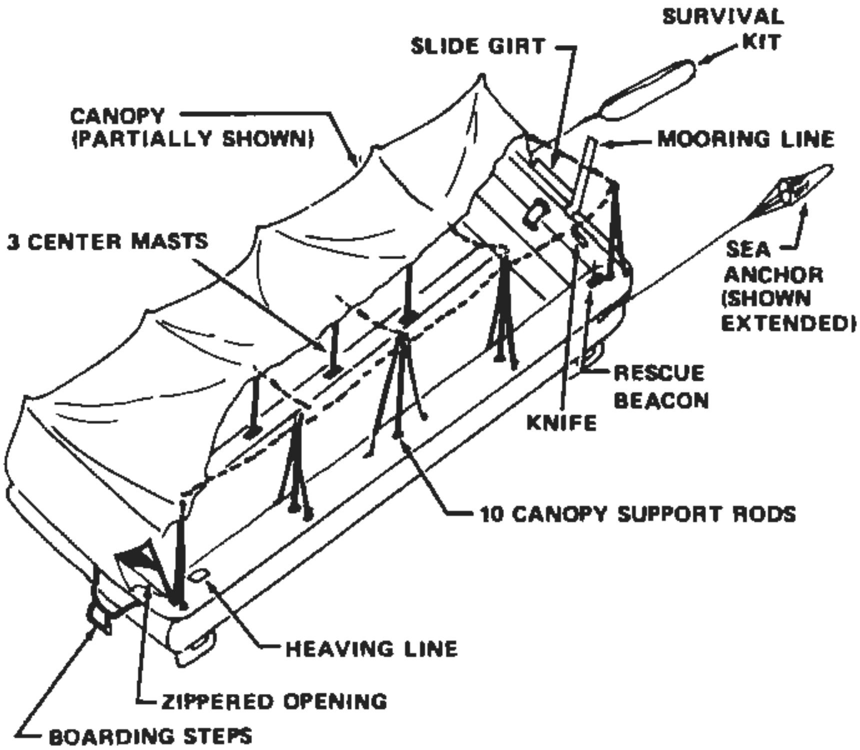


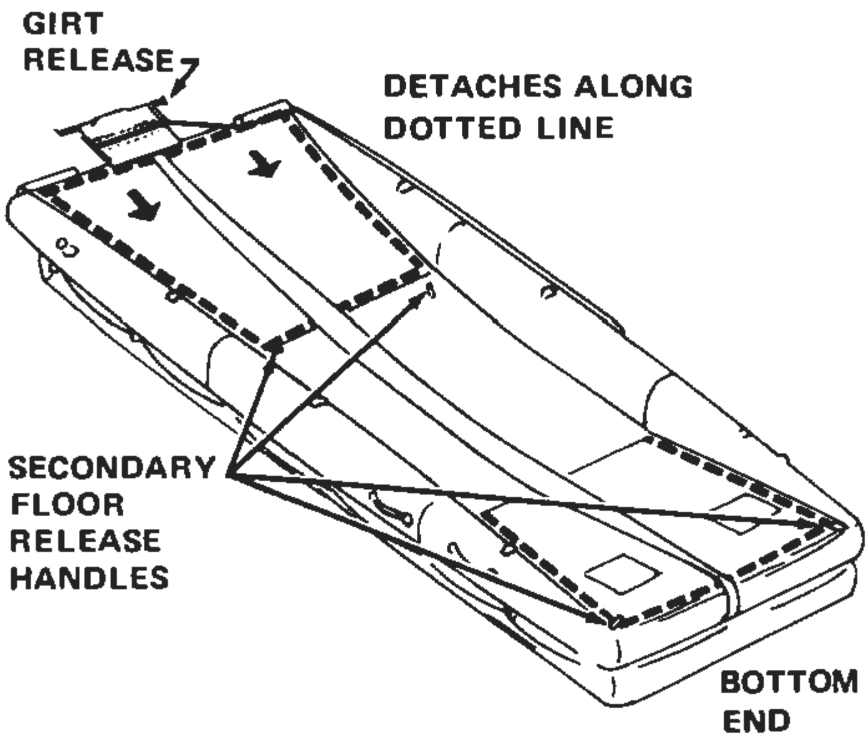
Maximum range - 250 miles
Battery life - 30 hours.

LOCATOR BEACON

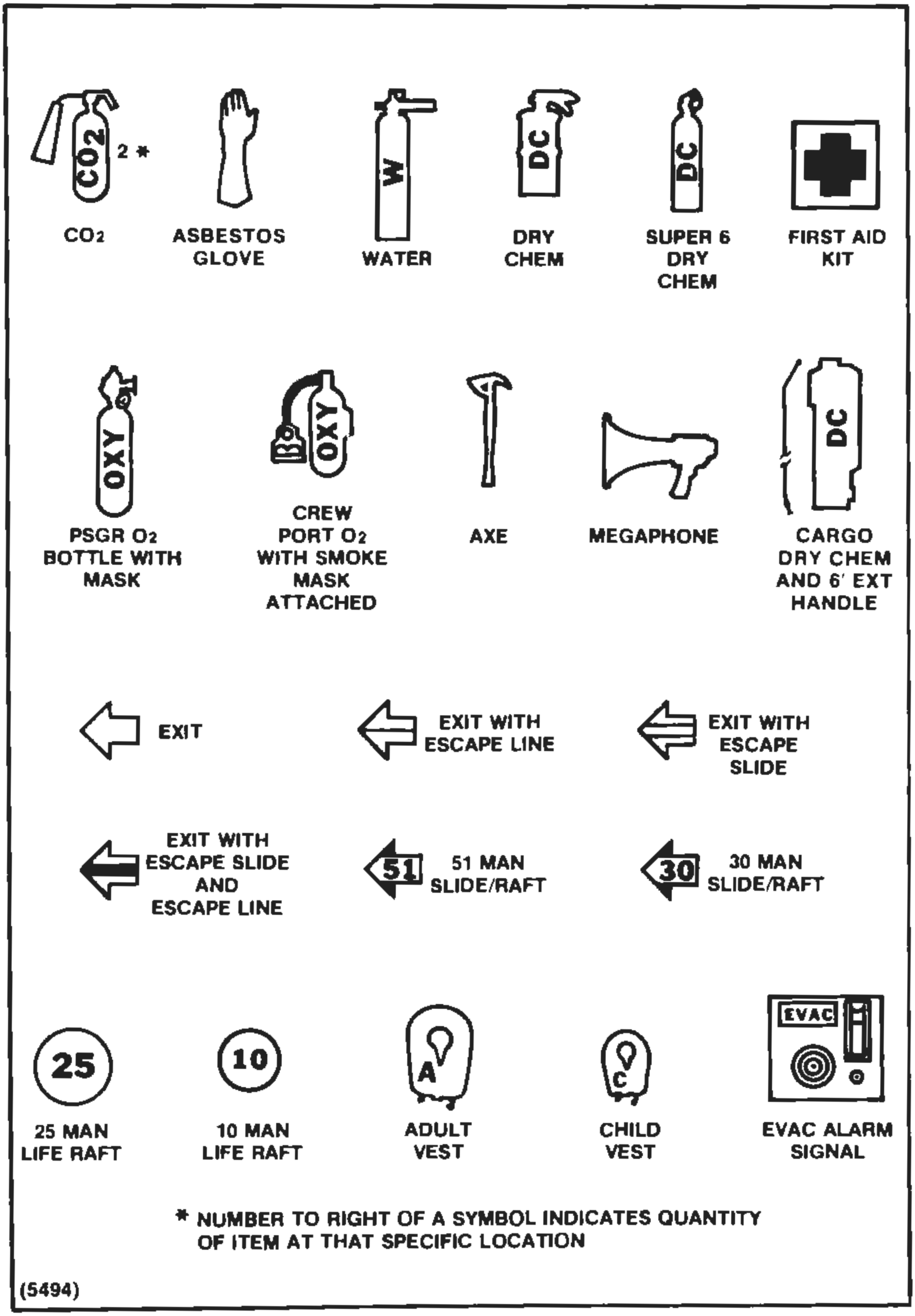


SLIDE/RAFT

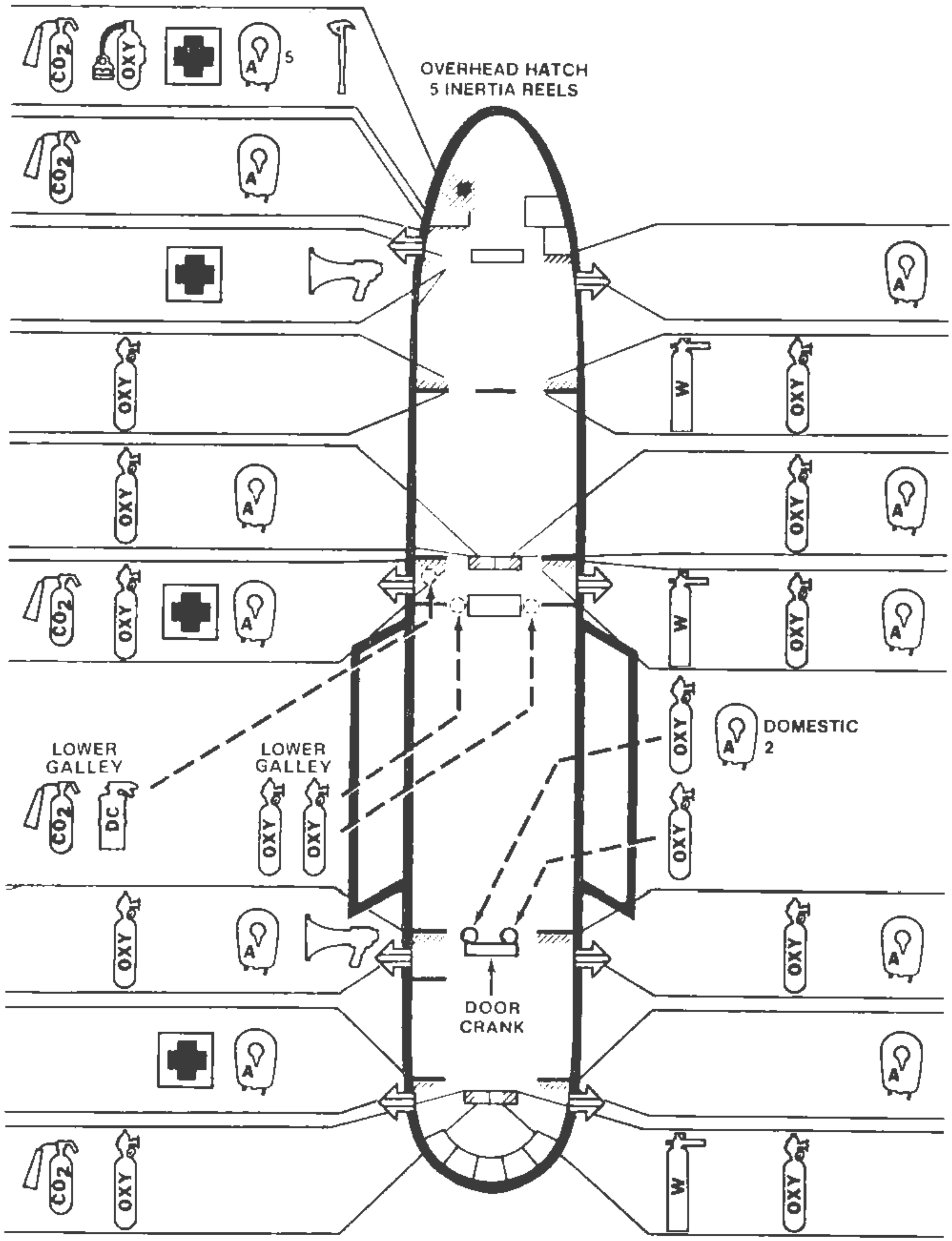

SURVIVAL KIT
SLIDE GIRT
CANOPY (PARTIALLY SHOWN)
MOORING LINE
3 CENTER MASTS
SEA ANCHOR (SHOWN EXTENDED)
RESCUE BEACON
KNIFE
10 CANOPY SUPPORT RODS
HEAVING LINE
ZIPPERED OPENING
BOARDING STEPS


GIRT RELEASE
DETACHES ALONG DOTTED LINE
SECONDARY FLOOR RELEASE HANDLES
BOTTOM END

EMERGENCY EQUIPMENT LOCATION SYMBOLS

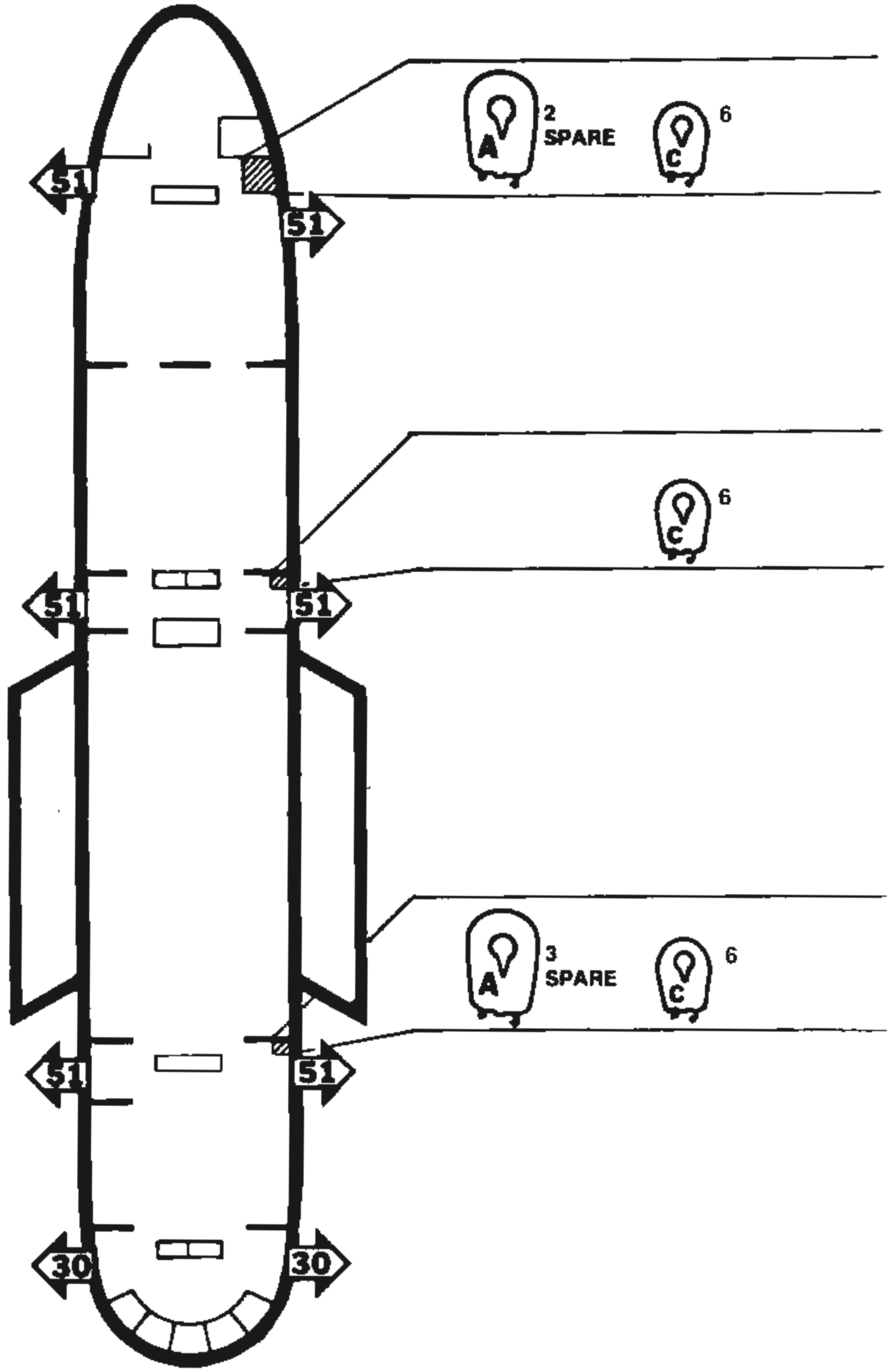


EMERGENCY EQUIPMENT LOCATIONS



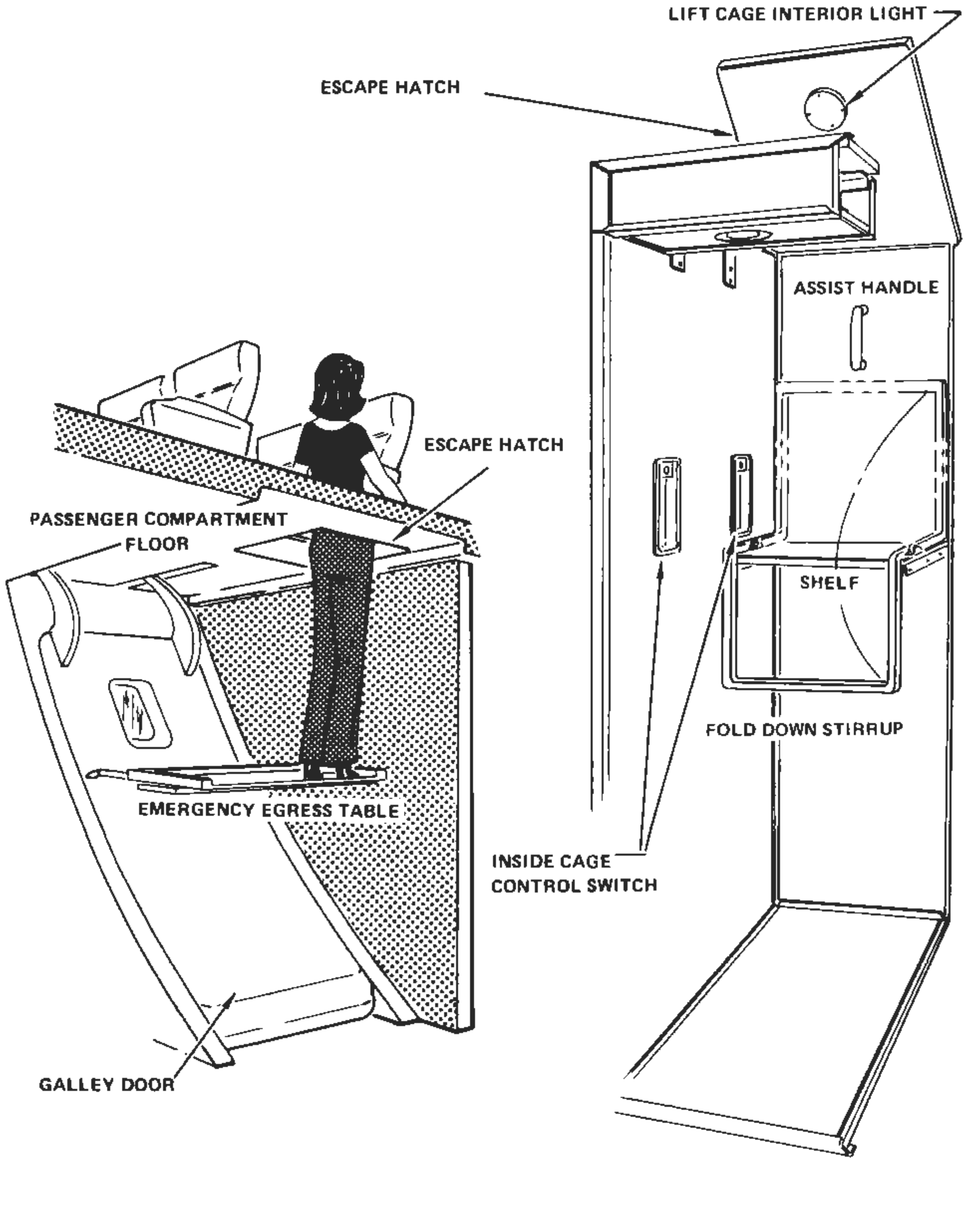
NOTE: EVACUATION ALARMS LOCATED AT EACH DOOR, GALLEY AND COCKPIT

INTERNATIONAL CONFIGURATION/DITCHING EQUIPMENT LOCATIONS



NOTE: ADULT LIFE VEST UNDER EACH PASSENGER SEAT AND UNDER OR NEAR EACH CREW SEAT. RESCUE BEACONS ON ALL SLIDE/RAFTS.

GALLEY EMERGENCY EGRESS

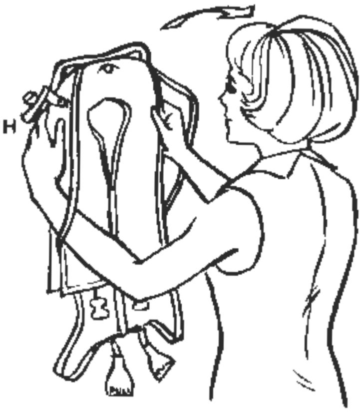


LIFE VEST

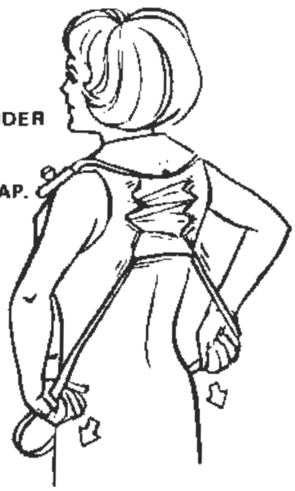
LIFE VEST PROCEDURES

1. REMOVE VEST FROM PLASTIC PACKAGE.

2. PLACE ARMS THROUGH STRAPS AND PULL VEST OVER HEAD. VEST IS REVERSIBLE, MAY BE DONNED FROM EITHER SIDE.

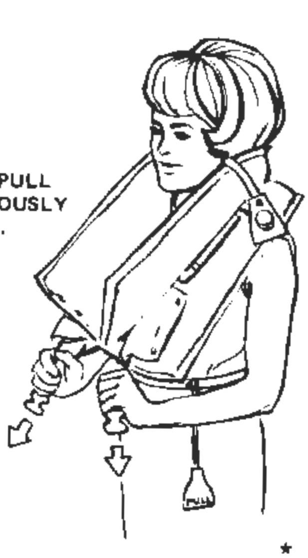


3. GRASP STRAPS UNDER ARMS AND PULL DOWNWARD TO EXTEND BACK FLAP.

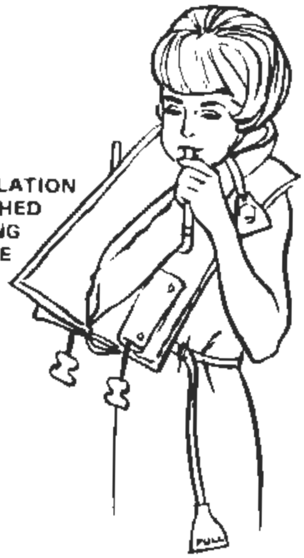


4. TIGHTEN STRAPS SECURELY ABOUT THE WAIST BY PULLING OUTWARD.

5. TO INFLATE, PULL DOWN VIGOROUSLY ON RED TABS.



6. IF NECESSARY, INFLATION CAN BE ACCOMPLISHED ORALLY BY BLOWING INTO TUBES AT SIDE OF VEST.



* * *

CABIN DOORS

There are eight cabin doors designated L-1 through L-4 and R-1 through R-4. With the gear extended, all doors are fifteen feet from the ground. There are no overwing exits. The doors open inward initially, then upward into overhead stowage areas. The doors are raised by electric motors and/or overhead springs that wind up whenever a door is closed. There are no handles on the doors. Normal and emergency operating controls are mounted adjacent to the upper, forward corner of all doors. The doors can be opened, from outside or inside, by electrical switches or emergency T handles. To operate the door electrically, the aircraft must be on the ground.

CABIN DOOR OPERATION

The main cabin doors are normally opened electrically from either the inside or the outside. To open the door, the evacuation slide selector lever must be in the detach position to arm the open switch and prevent the evacuation slide from being deployed. To close the door, the lever must be in the engage position to arm the close switch.

As the door is closed, either by the electric motor or hand crank backup, energy is stored in a spring actuator to open the door manually. Without electrical power on the aircraft, the door can be opened as follows:

From the outside, by pulling the emergency door handle. This will move the emergency slide lever to the detach position and release the door lock and motor clutch. The door will open under spring-load without extending the slide.

From the inside, by moving the emergency slide lever to the detach position and then pulling the emergency door handle. The door will now open under spring-load without extending the slide.

The two aft emergency doors can only be opened manually by the spring actuators The emergency slide lever must be in the engage position so slide will deploy if the inside emergency handle is pulled. If the outside emergency door handle is pulled, the door will open without extending the slide. To close the aft doors any time, use the manual hand crank.

DOOR SAFETY STRAPS

Door safety straps are provided for protection at an opened door when steps or jetways are not in position. A spring loaded safety strap is provided at each door. To use, pull strap across door opening and hook into strap fitting on door frame.

EVACUATION SLIDES

Doors L1 through L3 and R1 through R3 have dual lane slides. Doors L4 and R4 have single lane slides. The evacuation slides cannot be deployed with the electrical operation of the door.

OPERATION

The slides are automatically deployed and inflated during emergency door operation.

Check for the absence of fire and/or smoke around the door area.

Check the evacuation slide selector lever is in the ENGAGE position.

Remove cover over red T handle and pull down.

If a slide fails to inflate automatically, a manual inflation handle is provided on the right side of the slide girt and approximately four inches below the door sill.

USED AS FLOTATION EQUIPMENT

Open door to deploy evacuation slide as above.

When ready to release the evacuation slide, raise Velcro flap on top of girt exposing the separation handle and pull the handle.

LOWER GALLEY

The lower galley is entered from the mid-cabin via two lifts. Step into the lift cage and use both hands for lift control switch operation. To operate the lift, move the two inner cage lift control switches appropriately to run lift up or down. Limit switches will stop the lift at the end of travel.

LOWER GALLEY (Cont'd)

Egress from the lower galley is normally via the lifts. If the lifts are inoperative and the lift cages are down, egress can be made through the lift escape hatch. Use the fold down stirrup and assist handle to climb up. Egress can also be made through a passenger compartment floor escape hatch that opens into the cabin area at R-2 door aisle. Use emergency egress table to climb up. On the ground, egress can be made through the galley door. To open, pull lever on bulkhead at aft side of door. Door will slowly spring up into the galley. Push door up to ceiling to lock open. The distance to the ground is nine feet and there is no slide. To close galley door, release ceiling catch and push door down and shut.

COCKPIT ESCAPE HATCH

The escape hatch is located in the ceiling of the cockpit above the first ACM seat. A built-in ladder provides access to the hatch. Five inertia reels are stowed adjacent to the hatch for quick controlled descent to the ground. To use, pull escape hatch T handle to allow the hatch to swing open inward. Remove inertia reel, climb onto ACM seat, up the ladder and out of the hatch opening. Hold onto the inertia reel with two hands. Place over shoulder and slide down fuselage.

EMERGENCY LIGHTS

Emergency evacuation lights will illuminate on loss of DC essential power unless the control switch is off. Any flight attendant can turn on the light at the L1 and L4 door area regardless of the position of the cockpit control switch. All emergency battery packs are charged by using AC essential power when lights are not on. The cockpit escape hatch light is controlled in the bright or dim mode by the instrument standby lights control switch. To turn off the emergency lights, if activated for any reason, turn the cockpit control switch to arm and then off.

COCKPIT SEAT RESTRAINT SYSTEM

The cockpit seat restraint system includes automatic retraction, manual locking, and cinching tabs. The retractor takes up the excess belt length after extension, the mechanism must then be locked, and the cinch tabs pulled to snug the belts. The shoulder harness locks when an inertial force is applied and releases when the force is removed. A crotch strap with retractor is attached under the forward edge of the seat bucket.

FLIGHT CREW OXYGEN SYSTEM

The flight crew oxygen system utilizes diluter demand regulators and quick donning masks to supply oxygen to each crew station.

The oxygen cylinder is located forward of the engineer's panel. A shutoff valve is located on top of the cylinder and is opened to provide oxygen to the regulators. A discharge indicator is located on the fuselage below the first officer's window.

A high pressure gauge is located adjacent to the system shutoff valve and indicates correct system pressure only when the crew shutoff valve is opened.

A low pressure gauge is located in each of the five crew regulators and each should be checked against the other for approximately the same pressure reading.

A pressure/temperature correction chart on the cockpit door indicates minimum required oxygen pressure.

SMOKE GOGGLES

Smoke goggles are provided at all flight crew stations. They are designed to be worn with the quick donning oxygen masks. The goggles two plastic tubes clear the goggles of fog or smoke when placed under the oxygen mask with the emergency oxygen switch turned on.

PASSENGER OXYGEN SYSTEM

Passenger oxygen is automatically provided any time the cabin exceeds 13,000 feet. A dual control system will open all passenger oxygen mask doors and energize all the chemical canisters. Oxygen will be delivered to all the masks for a period of 18 minutes. The same signal that energized the canisters turns on the oxygen flow light on the engineer panel.

The passenger service mask doors are held closed by permanent magnets. A solenoid is energized to cancel the magnet's polarity and allow the door to spring open.

MEGAPHONE

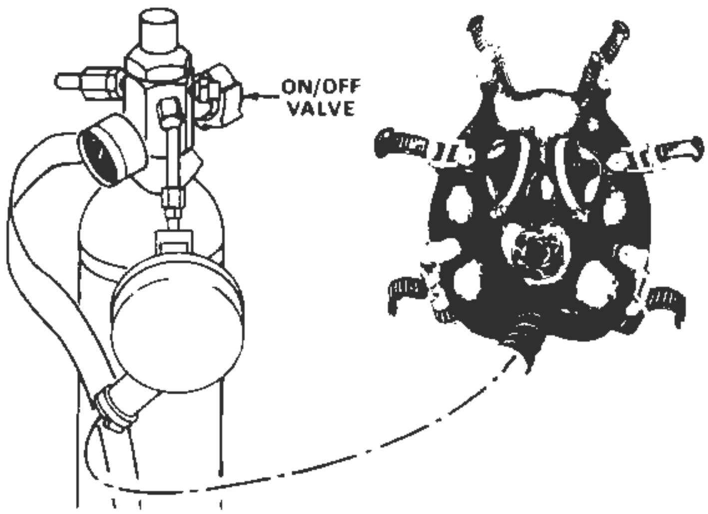
Megaphones are powered by self-contained batteries. A volume control knob under the mouthpiece permits adjustment of output level. To prevent damage of the volume control stops, do not force the knob against the end of its travel in either direction.

It is operated by setting the volume control knob at the one o'clock position, squeezing the trigger located on the handle, speaking into the mouthpiece, and adjusting the volume as necessary.

FLIGHT CREW PORTABLE OXYGEN

The flight crew portable oxygen bottle is located in the cockpit and has a full face smoke mask attached to it. It delivers 100% oxygen through a demand regulator when a supply valve is opened and the mask is donned with the mask straps tightened.

The regulator hose coupling will also accept the quick donning mask's hose connection if the smoke mask is disconnected.



PASSENGER PORTABLE OXYGEN

There are two different types of portable oxygen bottles. Either or both types may be on board.

Both bottle types are colored green and equipped with a pressure gauge, an on/off valve, a high flow outlet, and a low flow outlet.

The high flow outlet is normally used when administering first aid oxygen. It is located on the high side of the pressure gauge and is marked with red tape or paint. It provides a four liter per minute constant oxygen flow for approximately one hour.

The low flow outlet is rarely used and, therefore, capped with a gray plastic cover. It provides a two liter per minute constant flow for approximately two hours.

ZP-600

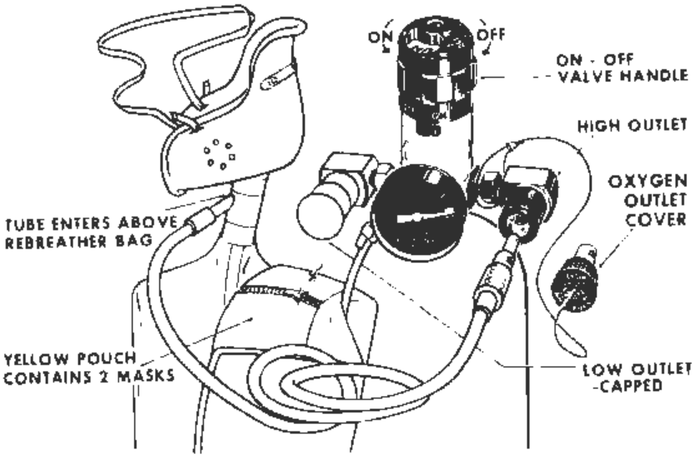
Each oxygen bottle has a yellow zipper pouch attached to the neck of the bottle. It contains two oxygen masks which are usable on this bottle only. One mask is plugged into the high flow outlet and the other mask is a spare.

To operate:

Check that the mask is properly attached.

Open the supply valve by turning counterclockwise to the full on position (viewing window will indicate when supply is on).

Check the oxygen flow by pinching off top of rebreather bag.



PASSENGER PORTABLE OXYGEN (Cont'd)

SCOTT

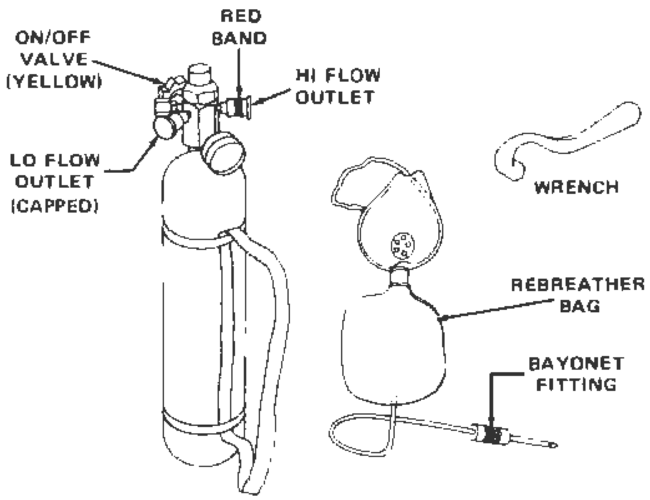
Each oxygen bottle has a mask in a clear plastic pouch attached to the bottle with the mask plugged into the Hi flow outlet. No spare masks are provided for this bottle.

To operate:

Check that the mask is properly attached.

Open the yellow supply valve counterclockwise to full on position, then close a quarter of a turn. The loose valve thus leaves no doubt as to the ON/OFF position.

Check the oxygen flow by pinching off top of rebreather bag.



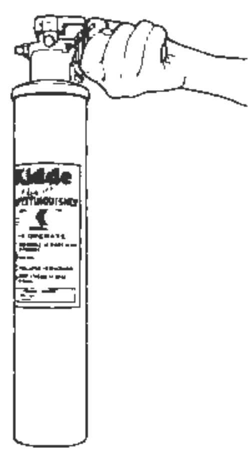
FIRE EXTINGUISHERS

Water, CO_2 and dry chemical fire extinguishers are located throughout the aircraft.

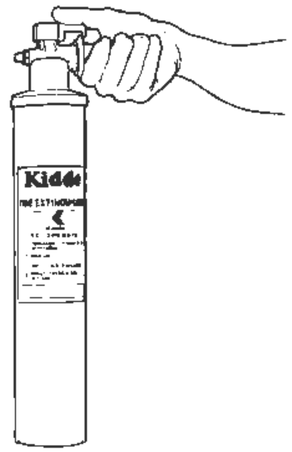
WATER

Water extinguishers are colored gray or gray-green and have a safety wire and lead seal to indicate they are in an acceptable condition. They are for fabric, wood, or paper fires only. They are not to be used on an electrical or grease type fire.

They are operated by:



Rotating the handle to right (clockwise) as far as possible to pressurize.



Depressing the lever on top of handle to discharge.

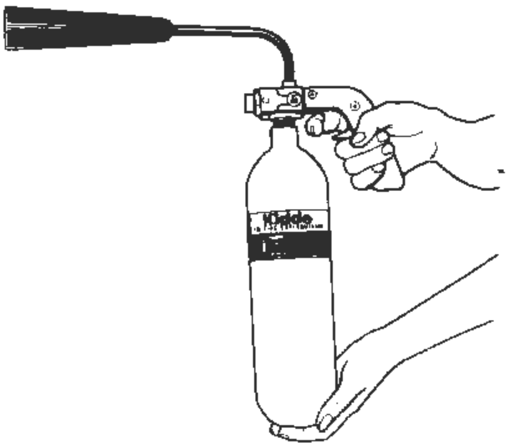
CO_2

CO_2 extinguishers are colored red with a black discharge nozzle and have a safety wire and lead seal to indicate they are in an acceptable condition. They are effective on all fire types, but primarily electrical, fuel, or grease fires.

The are operated by:

Swinging the nozzle up to help aim.

FIRE EXTINGUISHERS (Cont'd)

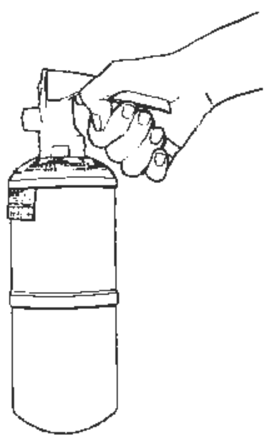


Squeezing the trigger to discharge.

DRY CHEMICAL

The small dry chemical extinguisher is only installed in the galley. It is colored red and has two red plastic tabs, one on the handle and one on the neck, to indicate it is in an acceptable condition. It is effective on all types of fires but primarily on electrical, fuel, or grease fires. It is not recommended for use in the cockpit due to possible adverse effect on instruments and electrical equipment.

It is operated by:



Squeezing the trigger handle to discharge.

PLASTIC HANDCUFFS

Each first aid kit is provisioned with five plastic handcuffs. These are to be used by or under the direction of the cockpit crew for restraining any person who, in the judgment of the captain, is a danger to the passengers or the aircraft. The handcuffs are a length of flat reinforced plastic with an eye at one end. When the tip is put through the eye, a loop is formed which then can be placed around the wrists.

They should not be drawn tighter than required to prevent dangerous actions. Once the handcuff is drawn tight, it can be removed only with wire cutters. Each handcuff is packaged with instructions showing operation and various methods of restraint.

FLOTATION SEAT CUSHIONS

All aircraft are provided with buoyant passenger seat cushions that are approved flotation equipment.

The cushions are removed from the passenger seat by pulling up and forward.

They are held with the top side of the cushion against the chest, arms around the cushions, with the hands through the straps on the underside of cushion and grasped together.

LIFE VESTS

→ Life vests are provided for all crew members. They are also provided for passengers on international flights. They are stowed within a plastic pouch, which is opened by pulling on a peel tab.

The vest is removed from the pouch in a tight fold. The jerk required to unfold the vest also pulls out plugs from a water-activated battery, which allows water to enter the battery and turn on a light attached to the vest.

It is donned by placing the arms through the strap loops, placing over head, pulling sharply downward on the straps under the armpits, and pulling the strap ends until they are tight around the waist. Both life vest chambers are inflated by pulling down vigorously on the two red inflation tabs. Each tab inflates an individual chamber. If necessary, inflation can be accomplished by blowing into tubes at the side of vest. One tube is provided for each chamber.

SLIDE/RAFTS

Number 4 doors have 30-man slide/rafts. All other doors have 51-man slide/rafts. The slide/rafts are rectangular in shape and consist of twin buoyancy tubes with a fabric deck. They have a right and a wrong side for flotation. If capsized with the wrong or "bottom" side up, the canopy can not be used.

The slide/rafts have a boarding station to assist in entry from the water. Each has accessories and survival equipment in a survival kit attached to the sea anchor end of the slide/raft with a short line.

SEPARATION AND DISCONNECT

The slide/raft can be separated from the girt by pulling the separation handle located under the flap on the left side of the slide girt. The slide/raft is still attached to the aircraft by a 25 foot mooring line. A frangible fabric section, included as an integral part of the line, is designed to part at a tension less than required to cause raft damage. The raft mooring line can be manually disconnected from the aircraft by pulling the quick disconnect tab.

SEA ANCHOR

The sea anchor must be manually deployed. It reduces drift, stabilizes the raft, and reduces the hazard of capsizing in rough water. The size of the end opening is adjustable to compensate for wind and drift. The opening is enlarged for strong winds and reduced for lighter winds.

SURVIVAL KIT

Survival equipment is located in the survival kit which is attached to the raft by a line at the sea anchor end of the raft.

MANUAL INFLATION VALVES

Manual inflation valves are installed in the buoyancy tubes. A hand pump is provided in the survival kit.

Air can be added to the tubes by inserting the pump in the valve and pumping. When the pump is removed, the valve must be closed manually.

HEAVING LINE

A 75 foot line is located on top of the buoyancy tube near the boarding station. A rubber ring is on one end and the other end is secured to the raft. It can be used for retrieving people from the water or possibly tying rafts together.

CANOPY

A canopy is provided for protection from the elements. The canopy and its support rods are located in the survival kit. The support rods must be manually installed in the sockets provided around the perimeter of the buoyancy tube to allow erection of the canopy. The center poles can then be put in place.

LIFE RAFT SIGNALING EQUIPMENT

A variety of signaling equipment is located in the survival kit attached to each slide/raft.

TRANSCEIVERS

The transceiver operates on two frequencies, 121.5 MHz and 123.1 MHz. To operate, extend the antenna, press red mic button at top of unit and speak into the microphone/speaker.

RESCUE BEACON

A rescue beacon is located on each slide/raft. The unit is automatically activated upon deployment in the water. An indicator lamp located at the base of the antenna will illuminate when the unit is operating properly. The battery will operate for approximately 66 hours. The beacon operates simultaneously on both 121.5 and 243.0 MHz with a warbled audio tone so distinctive as to be recognized as a distress signal. This tone can be checked by turning on the transceiver.

FLARES

The flares are dual signaling aids capable of producing a dense cloud or orange smoke for day use and a brilliant red light for night use. One end is designated for day use and the other end for night. It is held at arm's length on the downwind side of the raft. Each end will burn 45 seconds. After one end of the flare has been used, it may be cooled by immersing in water and retained until the opposite end is needed.

There are two types of flares:

> Metal flare.
> The night flare can be identified by a ring of small round protrusions and 3 raised bumps on the plastic cap. The pull ring is folded outward and pressed downward as a lever to break the seal. The ring is then pulled outward away from the flare, thereby providing ignition.

LIFE RAFT SIGNALING EQUIPMENT (Cont'd)

Cardboard flare.
Each end has a cap which is held with black tape. The night end can be identified by a raised, white cross. The flare is ignited by removing the cap and scratching the now exposed igniter button with the friction-coated surface of the cap.

SEA DYE MARKER

The dye marker is contained in a gauze bag which is inside a protective fabric container. The dye is capable of coloring the sea water to a brilliant green color. This provides a prominent contrast against the sea water, visible up to 10 miles from search altitudes. The time it remains effective is dependent upon wind and sea conditions.

The fabric dye container has a pair of tie straps which may be used for securing it to the raft. It is used by stripping the pull tab and agitating it in the water.

SIGNAL MIRROR

A signal mirror provides a signal for many miles, even in hazy weather. It is used by holding the mirror close to eye level, reflecting sunlight onto the back of other extended hand, and slowly raising the hand and mirror until the sun is reflected on the target.

WHISTLE

A whistle is provided to be used at night or in a fog when rescue units are close by.

FLASHLIGHT

A flashlight, with extra batteries and bulb, can be used as a signaling aid at night.

RAFT SUPPLIES

DE-SALTING KIT

The life raft de-salting kit consists of one pint plastic bag and eight chemical briquettes. Each of the briquettes is capable of neutralizing one pint of sea water suitable for drinking.

It is operated by filling the plastic container with sea water up to the line marked on the plastic bag, removing the waterproof cover from the briquette and placing it in the plastic bag. Then secure the plastic bag top with the strap and buckle assembly, and gently massage the briquette until it is completely dissolved.

To consume the water, unscrew the plug from the drain in the bottom of the bag. The plastic bag is graduated in two-ounce increments, which would be useful where necessary to practice rationing.

FIRST AID KIT

The kit contains the same first aid items as the aircraft kit, plus two tubes of sunburn ointment.

KNIFE

A knife is located on the buoyancy tube near the girt.

BAILING BUCKET AND SPONGES

Used to keep the raft dry.

HAND PUMP

The pump is used to maintain proper raft inflation.

LIFE RAFT MANUAL AND SURVIVAL MANUAL

Complete raft and survival instructions can be found in these two manuals.

RELIGIOUS BOOK

* * *

ADDITIONAL PROCEDURES

CONTROLS AND INDICATORS

SYSTEM DESCRIPTION

* * *

SINGLE FIRE DETECTION LOOP LIGHT ON

Only one fire detection loop light and the C/W fire detection loop light illuminating with the selector in the both position is an indication of a faulty loop.

Place the loop selector to the loop that is not illuminated. The faulty loop light and the C/W fire detection lights will go out.

A fire indication will still be provided from the single operative loop.

SINGLE WHEEL WELL FIRE LOOP LIGHT ON

Only one fire detection loop light and the C/W fire detection loop light illuminating with the selector in the both position is an indication of a faulty loop.

Place the loop selector to the loop that is not illuminated. The faulty loop light and the C/W fire detection light will go out.

Any fire will still provide a normal fire indication from the single loop.

SINGLE NACELLE/PYLON OVERHEAT LOOP LIGHT ON

Only one nacelle/pylon overheat detection loop light illuminating with the selector in the both position, is an indication of a loop fault.

Place the loop selector to the loop that is not illuminated. The faulty loop light will go out.

Any overheat will still provide a normal indication from the single loop.

The high pressure valve will close. If the engine isolation valve also closes, turn off both valve switches and then open the isolation valve. If desired the high pressure valve may also be opened.

* * *

FIRE WARNING AND EXTINGUISHING

ENGINE FIRE CONTROL

Control is illuminated when fire detection system has been activated by fire or test. Remains illuminated as long as fire persists.

Pulling Control:

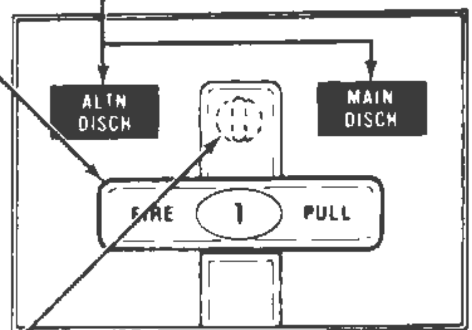
- Closes engine high pressure and isolation bleed valves.
- Closes engine hydraulic suction and pump shut-off valves.
- Closes No. 1 or No. 3 fuel emergency and tank valves. On No. 2 closes primary and secondary emergency valves (not tank valve).
- Closes accessory inlet vent.
- Opens generator field relay.
- Silences fire bell.
- Resets master fire warning lights.
- Exposes fire extinguisher discharge switch.

1C10, 11 - ENG 1 MAIN, ALTN

MAIN AND ALTERNATE DISCHARGE INDICATORS

Respective extinguisher bottle has been discharged.

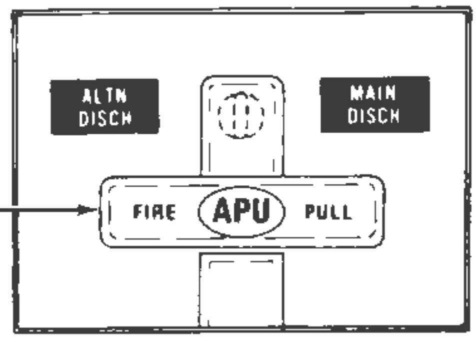
1C10, 11 - ENG 1 MAIN, ALT



FIRE EXTINGUISHER DISCHARGE SWITCH

Discharges either main or alternate extinguisher bottle.

1C10, 11 - ENG 1 MAIN, ALTN.



APU FIRE CONTROL

Operates in the same manner as engine fire control.

Pulling Control:

- Closes APU primary and secondary emergency fuel shutoff valves
- Silences external warning horn and interior bell.
- Closes APU doors.
- Energizes APU stop circuit.
- Opens generator field relay.
- Silences fire bell.
- Resets master fire warning lights
- Exposes fire extinguisher discharge switch.
- On the ground, and when armed in flight, APU shuts down and engine 2 main fire bottle discharges automatically.

1C 16, 17 - APU MAIN, ALTN

WHEEL WELL FIRE ANNUNCIATOR LIGHT

Wheel well fire dectection system has been activated.

FIRE DETECTION LOOP ANNUNCIATOR LIGHT

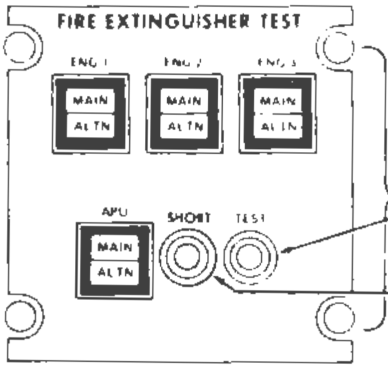
One or both engine or APU fire detection loops have been activated.

MASTER FIRE WARNING LIGHT

Engine, wheelwell, or APU fire detection system is activated. Pressing extinguishes the light, resets master fire warning system, and silences bell and APU external horn.

1J 1, 2, 3, 4 - MASTER ALARM POWER
1J6 - FIREBELL PWR

FIRE EXTINGUISHER AND FIRE DETECTION TEST LIGHTS



FIRE EXTINGUISHER TEST LIGHTS

Indicates satisfactory firing circuits to extinguisher bottles.
1C10 THRU 17 - FIRE EXTINGUISHER

FIRE EXTINGUISHER TEST SWITCH

Tests all extinguisher firing squib circuits.
2H5 - F/E IND LT TEST 5

SHORT TEST SWITCH

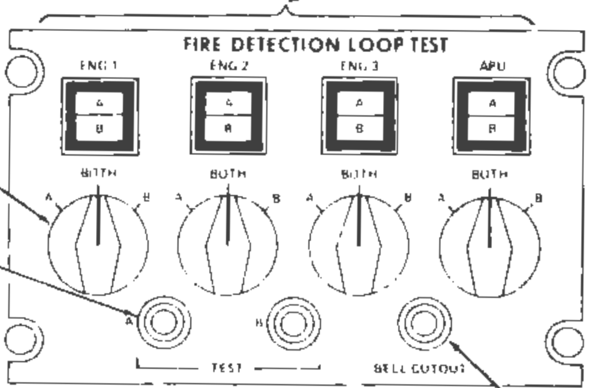
Pressing short switch while TEST switch is held in tests for short circuits in the system.

FIRE DETECTION LOOP SELECTORS

BOTH - Normal switch position. Activation of both fire loops gives fire warning. Activation of one loop illuminates FIRE DET LOOP annunciator light and the affected (A or B) fire detection loop light.
A - Disables B loop detector. Activation of A loop gives fire warning.
B - Disables A loop detector. Activation of B loop gives fire warning.
1K1 THRU 8 - FIRE DETECTION LOOP A & B ALARM

FIRE DETECTION LOOP TEST LIGHTS

A or B is illuminated to indicate satisfactory fire detection loop circuits.
1K1, 2, 3, 5, 6, 7 - FIRE DETECTION LOOP A & B ALARM, ENGINES 1, 2, 3.
1K4, 8, - FIRE DETECTION LOOP A & B ALARM, APU.
1D 16, 17, 18 - APU FIRE DETECT.

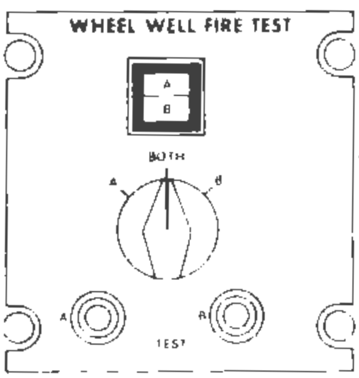


FIRE DETECTION LOOP TEST SWITCH

Tests fire warning circuit by introducing a false fire signal into the selected detector loop circuit. Selected loop test lights are illuminated if circuits are satisfactory.
1J5 - FIRE DETECTION TEST.

FIRE WARNING BELL CUTOUT SWITCH

Pressing switch shuts off fire warning bell.
1J6 - FIREBELL POWER.



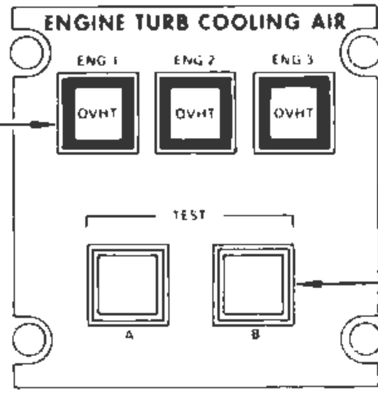
WHEEL WELL FIRE TEST PANEL

Functions in the same manner as the engine FIRE DETECTION LOOP TEST panel.
1J4 - WHL WELL APU.
1J5 - FIRE DETECTION TEST.
3S1, 2 - FIRE DETECTOR LOOP A, B.

OVERHEAT DETCTION PANELS

TURBINE AIR OVERHEAT ANNUNCIATOR LIGHTS

Both thermal switches (dual system) detect overheating.



ENGINE TURBINE COOLING AIR OVERHEAT LIGHTS

OVHT is illuminated to indicate excessive air temperature at I/P turbine.

ENGINE TURBINE COOLING AIR OVERHEAT TEST SWITCHES

Pressing both switches illuminates all 3 OVHT lights. Pressing test switch A disables the B circuits so that a fault in any A circuit will illuminate the OVHT light for that engine. Test switch B operates correspondingly.

3M1, 2, 3, 7, 8, 9, 13, 14, 15 – ENG TURBINE OVHT DETECTION

GALLEY SMOKE INDICATOR LIGHT

FLASHING - Smoke is detected in galley or test switch is at test.

STEADY - Overheat in oven exhaust duct.

LEFT GALLEY CB PANEL.

GALLEY SMOKE TEST SWITCH

TEST - Energizes warning horn and illuminates GALLEY SMOKE light.

OFF - Spring loaded center position.

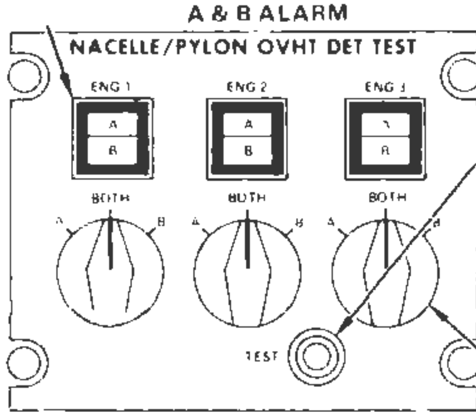
HORN CUTOUT - Silences warning horn.

LEFT GALLEY CB PANEL.

DUAL LOOP LIGHT

Amber light on indicates an overheat condition or a short circuit.

3L1, 3, 7, 9, 13, 15 ENG OVHT LOOP A & B ALARM



TEST BUTTON

Pressing test button illuminates lights to indicate system integrity.

LOOP SELECTOR SWITCHES

Select single or dual loop for operation or test. Any overheat closes engine high pressure valve.

NACELLE OVERHEAT ANNUNCIATOR LIGHTS

Both loops detect an overheat with both loops armed or when selected loop detects overheat.

BOTH - Both loop lights and nacelle overheat annunciator lights illuminate with overheat signal. Single loop light, no annunciator panel light.

A or B - Loop light and annunciator light illuminate with overheat.

3L2, 4, 8, 14, 16 - ENG OVHT LOOP A & B PWR

* * *

GENERAL

The fire protection system provides both detecting and extinguishing capability. The three engine compartments, APU, and main wheel wells have dual fire detection loops. The engines and APU have fire extinguishing capability.

There are also detection systems for engine turbine cooling air overheat, nacelle/pylon overheat, galley smoke, and galley oven exhaust duct fire.

ENGINE & APU FIRE DETECTION

There are two continuous loop, temperature sensitive, detection elements installed in each fire zone. The elements are designated loop A and loop B. The sensing elements are of the thermistor type having continuous sensing even with a break in the loop. The resistance value of the thermistor decreases as the temperature rises. When the resistance value of the loops lower to a predetermined value, a fire warning is indicated.

A fire is indicated by the illumination of the master fire warning lights on the glareshield, lights in the respective fire pull handle, the respective indicators on the fire detection loop test panel, and the fire detection loop light on the C/W panel, as well as the sounding of the fire bell. The bell is normally silenced by pressing one of the two master fire warning lights; however, pulling the fire pull handle or pressing the engineer's bell cutout switch will also silence the bell.

The system should be tested with the loop selector switch in the both position. A proper test will give the indications of a fire in all engines and the APU. If one of the loop test lights fails to illuminate, move the switch to the operative loop position and retest. That particular engine, or the APU, would still have complete fire detection and warning. With the selector in both, a malfunctioning loop would be indicated by the C/W fire detection loop light on and a loop light illuminated on the fire detection loop test panel. Selecting the opposite loop will provide complete fire detection and warning.

FIRE EXTINGUISHING

There are two fire extinguisher bottles for engine 1 and two for engine 3. Two larger fire extinguisher bottles are shared by engine 2 and the APU. Each fire extinguisher bottle may be discharged by movement of a two-position fire extinguisher discharge switch located behind the fire pull handle. Moving the fire extinguisher discharge switch to the right releases the fire extinguishing agent from the main bottle. Moving the switch to the left discharges the alternate bottle. Each bottle has a pressure switch that illuminates the respective discharge indicator light to show that the extinguisher bottle has been fired.

The fire extinguisher test switch checks the extinguisher firing circuits from the discharge switches to the squibs on the bottles. Pressing the short test switch while the fire extinguisher test switch is also being pressed checks for short circuits in the system.

APU AUTO FIRE SHUTDOWN

With the auto fire shutdown switch armed, an APU fire will cause an automatic shutdown and the engine 2 main fire extinguisher bottle will be discharged to the APU. If on the ground, the external APU fire warning horn will be activated. Should a second bottle be required, it may be discharged from the cockpit by pulling the APU fire pull handle and moving the discharge switch to the left to discharge the engine 2 alternate bottle. The automatic fire shutdown system is always armed when the aircraft is on the ground. Placing the automatic fire shutdown switch to the armed position will arm the system in flight.

WHEEL WELL FIRE DETECTION

The wheel well fire detection system functions like the engine fire detection system. With the selector switch in the both position, both A and B wheel well fire detector loops must be activated to get the complete warning. A fire is indicated by the fire bell and master fire warning lights. The C/W wheel well fire annunciator light will illuminate with A and/or B loop activated.

With the wheel well fire detection loop selector in the both position, a faulty loop is indicated by illumination of only one fire detector loop light and the C/W wheel well fire annunciator light. There is no fire extinguisher agent provided for the wheel well.

ENGINE TURBINE COOLING AIR OVERHEAT DETECTION

The turbine sections of the engines are cooled by air from the compressor sections. Air from the compressors is directed to the forward and aft faces of the N_2 and N_3 turbines and through the hollow cores of the turbine nozzle guide vanes. Two thermal switches are mounted on the engine turbine case to sense turbine air temperature. Both termal switches must detect an overheat to illuminate the turbine air overheat C/W annunicator light and the test panel overheat light.

Pressing both engine turbine cooling air overheat test switches simultaneously will illuminate all engine turbine cooling air overheat lights and C/W turbine air overheat annunciator lights. Pressing only test switch A will disable the B circuit so that a fault in any A circuit will then illuminate the overheat light for that engine. Test switch B operates in the same manner.

NACELLE/PYLON OVERHEAT DETECTION

The nacelle/pylon overheat system provides detection of leaking high pressure bleed air in the engine nacelle or pylon areas. An overheat is indicated by the illumination of the nacelle overheat light on the C/W panel and loop lights on the detector panel. The high pressure bleed valve is automatically closed when either loop is activated. When the loop selector switch is in the both position, a single loop light on will not activate the overheat light on the C/W panel. With the loop selector switch set on both, a malfunctioning loop would be indicated by a loop light on the detector panel without the C/W annunicator light on Pressing the nacelle/pylon overheat test switch with the loop selector in the both position will illuminate the A and B loop lights and the C/W overheat annunciator lights.

GALLEY SMOKE AND OVEN EXHAUST DUCT FIRE DETECTION

The galley is equipped with a smoke detector located between the galley lifts and a fire detector in the oven exhaust duct. Activation of either detector provides an aural and visual warning in the cockpit. The aural warning is the same for either detection. The galley smoke light on the engineer's panel flashes to indicate smoke and remains on steady to indicate fire in the exhaust duct. The aural warning is silenced by placing the galley smoke test switch to the horn cutoff position. Fire in the exhaust duct also sounds a warning bell in the galley. When the galley smoke panel switch is placed to the test position, the aural warning will sound and the galley smoke light will flash Moving the switch to the horn cutoff position terminates the test.

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ADDITIONAL PROCEDURES

CONTROLS AND INDICATORS

SCHEMATICS

SYSTEM DESCRIPTION

* * *

FCES PANEL - SINGLE FAIL LIGHT ON

1. Cycle the switch showing fail to OFF then on to attempt reset.

2. If unable to reset, press the switch to OFF. The remaining channel will provide normal system operation with the following exceptions:

   Pitch Trim – Electric trim will operate at a reduced rate.

   Stall Warning – No ground proximity warning provided if No. 2 channel fails.

FCES PANEL - TWO FAIL LIGHTS ON (SAME SYSTEM)

1. Press both switches showing fail to OFF.

2. Attempt to reset each switch, one at a time.

3. Leave the operative channel engaged.

4. If unable to reset either channel, press the switches to OFF and the following conditions result:

   Yaw SAS – Yaw damping, turn coordination, runway alignment and rollout guidance are not available.

   Stall Warning – Stall warning features, including automatic retraction of the DLC spoilers, will not be provided. No ground proximity warnings provided.

   Pitch Trim – Electric pitch trim and autopilots will be inoperative.

   Mach Trim – Mach trim will be inoperative.

   ATS – Autothrust system will be inoperative.

   DLC/Autospoiler – DLC and autoground spoilers will be inoperative.

   Mach Feel – Pitch control feel will remain the same as it was when the failure occurred.

FLIGHT CONTROL PANELS LIGHT ON (CAUTION WARNING PANEL)

1. Check the FCES and PFCS panels for failures.

2. The flight control panels light on the caution and warning panel will reset when the problem is corrected.

RUDDER LIMITER MECHANICAL PUSH LIGHT ON

The rudder mechanical limiter light on the caution and warning panel will also be on.

1. Press the switch showing push to MNL.

2. Select the degree of rudder travel desired with the $8^{o}/30^{o}$ switch.

RUDDER LIMITER HYDRAULIC PUSH LIGHT ON

1. Press the switch showing push to OVRD.

2. Any available hydraulic system (A, B, or C) will provide its full power to the rudder.

RUDDER HYDRAULIC LIMITER LIGHT ON

1. Check for rudder limiter hydraulic push light.

2. If push light is on, press switch to OVRD.

3. If push light is off, use caution when using rudder as it appears that hydraulic systems have failed to cut out or reduce pressure.

PITCH OR ROLL MONITOR FAIL LIGHT ON

1. Press the switch showing fail to OFF.

2. The remaining channel will provide full monitoring.

3. If both channels have failed, the affected control system will continue to operate without fail monitoring.

ONE OR TWO STABILIZER INOPERATIVE LIGHTS ON

A single inoperative light indicates a loss of hydraulic pressure to the affected actuator. Two inoperative lights indicate a feed back error and hydraulic pressure to both actuators have been shut down; reduce speed to 250 knots, this will assure adequate stabilizer authority.

Stabilizer control is still provided at normal rates.

SPOILERS L5 & 6 AND R5 & 6 PUSH LIGHTS ON

FLAPS RETRACTING

The spoilers have not switched to speed brake function.

SPOILERS L5 & 6 AND R5 & 6 PUSH LIGHT ON (Cont'd)

1. Press the spoilers L5 & 6 and R5 & 6 switches to off.

   Those spoilers will be inoperative and will not operate as speed brakes.

2. When flaps are extended for approach, press spoiler switches in.

FLAPS EXTENDING

The spoilers have not switched to aileron function.

1. Press the spoilers L5 & 6 and R5 & 6 switches to off.

   Those spoilers will be inoperative and will not operate as ailerons.

ROLL SPEED BRAKE LIGHT ON (CAUTION & WARNING PANEL)

FLAPS RETRACTING

Indicates the spoiler mixer has not disabled the L & R1 spoilers or has not switched the L & R2, 3, and 4 spoilers to speed brake functions only.

1. Press the spoiler L & R1 switch to OFF.
2. Roll the aircraft and observe the surface position indicator for inboard spoiler motion.
3. If spoiler motion is not detected, the L & R1 spoilers caused the failure and are now shut down.
4. If spoiler motion is detected, press the associated spoiler switches to OFF. This disables those spoilers.
5. When flaps are extended for approach, press spoiler switches in.

FLAPS EXTENDING

Indicates the spoiler mixer has not enabled the L & R1 spoilers or has not switched the L & R2, 3, and 4 spoilers to a combined spoiler/aileron function.

1. Check that all spoiler switches are in.
2. If all switches are in and roll speed brake light stays on, roll the aircraft and observe the surface position indicator for inboard spoiler motion.
3. If the spoilers move in roll, the L & R1 spoilers are inoperative and will not operate in DLC or as ground spoilers.
4. If the spoilers do not move, roll augmentation is not being provided.

AUTO GROUND SPOILERS INOPERATIVE LIGHT ON

1. Check for DLC/auto spoiler fail lights on.
2. If unable to restore system, auto ground spoilers are inoperative and manual ground spoiler must be used after touchdown.

FLAP LRS INOPERATIVE LIGHT ON

1. Check that the flap LRS override switch is off.
2. Observe flap limit speeds as automatic load relief is not being provided.

JAMMED PITCH TRIM

1. Use mechanical trim wheel to free jam. It may take what appears to be excessive force or movement on the trim wheel before the jam is freed (force cannot damage trim wheel mechanism).
2. If pitch trim is still jammed, column forces of 60 to 90 pounds can be experienced during approach and landing. To minimize fatigue both pilots may have to share the flying task.
3. Use normal approach slot, reduce to bug plus 10 knots on final.

RUDDER LIMITER HYDRAULIC PUSH AND NO. 2 YAW SAS FAIL LIGHTS ON DURING GROUND OPERATION

The following procedure is to be used during ground operation only.

Usually the first indication is the No. 2 yaw sas fail light does not go out when system A is pressurized. Another indication is the illumination of the rudder limiter hydraulic push light as the flaps are extended

1. Stop aircraft and park the brakes.
2. Check for fluid loss in system A.

   If fluid loss in system A caused the rudder fusing system to actuate, the necessary maintenance must be accomplished prior to flight.

3. Maintain hydraulic system A pressure.

RUDDER LIMITER HYDRAULIC PUSH AND NO. 2 YAW SAS FAIL LIGHTS ON DURING GROUND OPERATION (Cont'd)

4. Pull the MLG GND SENSE circuit breaker (2L8).

   This places aircraft systems in flight. Rudder pedal steering will be disengaged.

5. Pull and reset the RUDDER FUSING SYS circuit breaker (2L16).

   It may be necessary to cycle this circuit breaker several times. Allow a four second interval between cycles to permit a time delay in the rudder fuse to operate.

6. After fault lights are out, reset the MLG GND SENSE circuit breaker (2L8).

* * *

PRIMARY FLIGHT CONTROL SYSTEM PANEL

PITCH AND ROLL MONITOR SWITCHES

Monitors respective control system for jam. Turns on proper push lights to alleviate problem.

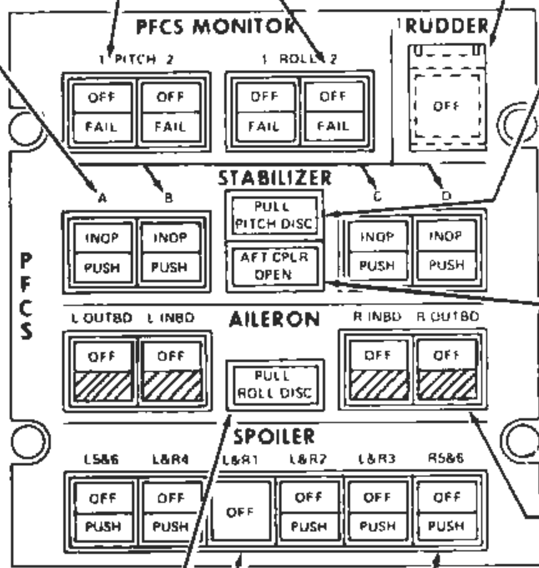
IN - Normal position with no lights illuminated. Power to monitor is turned on and FAIL light is armed.
FAIL - Shows monitor failure.
OUT - OFF shows switch position. Power to monitor is turned off and FAIL light is disarmed.
1A6, 24 - PITCH & ROLL

RUDDER OFF SWITCH

IN - Normal position.
OUT - OFF shows switch position. By-passes all hydraulic actuators and rudder will trail.
2K 12, 13, 14 - RUDDER SERVO A, B, C.

STABILIZER SWITCHES

IN - Normal position
PUSH (A & B or C & D) Indicates a pitch control path mechanical jam has occurred and requires pilot action.
INOP indicates hydraulic power is removed for any reason.
OUT - INOP is illuminated and actuator is bypassed. When both A & B or C & D have been shut down, aft coupler will open.
2H 16, 17, 18, 19 - STABILIZER SERVO B, C, A & D.



PULL PITCH DISCONNECT LIGHT

Illuminated when aft coupler has opened and a pitch jam exists.

AFT COUPLER OPEN LIGHT

Separation of aft coupler has taken place. May be reclosed by relatching switches.

AILERON SWITCHES

IN - Normal position.
CROSS HATCH - Jam in respective control path. Spoiler PUSH lights and PULL ROLL DISCONNECT will be on.
OUT - OFF shows switch position only.
2J 19, 20, 21, 22 - AILERON SERVO C, A, B & D.

PULL ROLL DISCONNECT LIGHT

Either left or right roll control path is jammed.

SPOILER L AND R1 SWITCH

IN - Normal position.
OUT - Shuts down No. 1 spoilers. OFF shows switch position.
2J16 - SPOILER SERVD B.

SPOILER CONTROL SWITCHES

IN - Normal position. Servos are powered.
PUSH - Respective control path is jammed.
OUT - OFF shows switch position only.
When PUSH is illuminated only in spoiler switches L5 & 6 and R5 & 6, respective spoilers are operating in wrong mode for flap position.
2J15, 16, 17, 18 - SPOILER SERVO A, B, C & D.

ROLL SPEED BRAKES

ROLL SPEED BRAKES

Spoilers 1 through 4 did not shift to proper mode of operation for the selected flap position or input control to No. 1 spoilers is jammed with flaps extended and hydraulic pressure to those spoilers has shut down.

AUTO GROUND SPOILERS INOP LIGHT

AUTO GND SPLRS INOP

Fault in autoground spoiler system. Use manual spoilers on touchdown.

FLIGHT CONTROL ELECTRONIC SYSTEM

MONITOR AND CONTROL PANEL FOR FLIGHT CONTROL ELECTRONICS SYSTEM

Each flight control system has two independent channels of monitored operation. A fault causes automatic channel shutdown. Certain faults in one channel may shut down both channels.

IN - No legend is illuminated and system is in normal operation. FAIL light armed. When FAIL is illuminated, the system monitor has detected a fault and automatically deactivated the faulty channel.

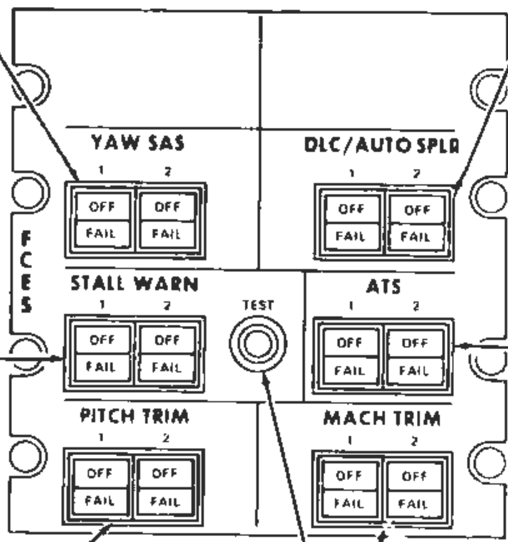
OUT - The channel is deactivated and the FAIL light is not armed. OFF shows switch position.

YAW STABILITY AUGMENTATION SYSTEM SWITCHES

When one operating channel has failed, the other channel provides normal system operation. When operating channels have failed, autopilot turn coordination, runway align and rollout guidance are not available.
1A5, 23 - YAW SAS

DIRECT LIFT/AUTO SPOILER SWITCHES

When one operating channel has failed, the other channel provides normal system operation. When both channels have failed, manual ground spoilers are available.
2H14, 15 - DLC SERVO A, B.



STALL WARNING SWITCHES

When one operating channel has failed, the other channel provides normal stick shaker operation.
1B6, 2F2 - STICK SHAKE.

AUTO THRUST SWITCHES

When one operating channel has failed, the other channel provides normal autothrust operation.
1A1 - AUTO THRUST SERVO.

PITCH TRIM SWITCHES

When one operating channel has failed, the other channel provides trim but at a slower rate. When both operating channels have failed, only mechanical trim is available.
1A7, 8, 25, 26 - TRIM AGMT AC, DC.

MACH TRIM SWITCHES

When one operating channel has failed, the other channel provides normal mach trim operation.
1A7, 8, 25, 26 - TRIM AGMT AC, DC.

STALL WARNING TEST SWITCH

Provides means for checking both stall warning channels on the ground.

SLAT MONITOR INDICATOR

LE SLAT LOCK

LEADING EDGE SLAT LOCK LIGHT

Slats are locked in position shown on slat monitor.

FLAP LRS INOP

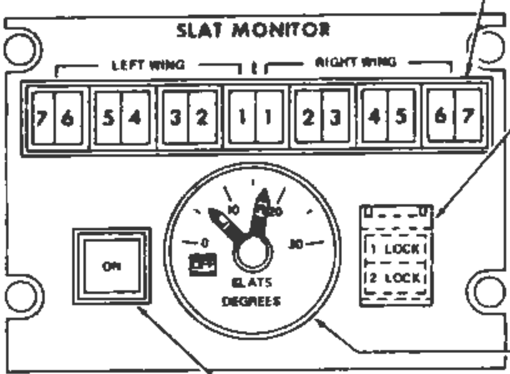
FLAP LRS INOP LIGHT

Flap load relief is not available.

FLAP LRS LIMITING

FLAP LRS LIMITING LIGHT

Flap load relief system is functioning.



SLAT SEGMENT LIGHTS

Individual lights for each of the left and right wing slat segments. If segment is fully extended, its number will be illuminated when slat monitor switch is latched in.
3K18 - LE SLAT EXTEND LT.

SLAT LOCK SWITCH

Permits locking or unlocking slats.

IN - Locks slats in position. 1 LOCK and 2 LOCK are illuminated.
OUT - Unlocks slats. LOCK lights go out.
2H22 - NO. 1 ASYM BRAKE LE SLAT.
1J10 - NO. 2 ASYM BRAKE LE SLAT

SLAT POSITION INDICATOR

Indicates position of both left and right slats. OFF flag indicates loss of power to the indicator.
3K17 - POSN IND LE SLAT.

SLAT MONITOR SWITCH

IN - Provides power to the individual slat segment lights. ON indicates switch position.
OUT - ON is extinguished and slat segment lights go out if they were illuminated.
3K18 - LE SLAT EXTEND LT.

ASYM DET FAULT

ASYMMETRY DETECTION FAULT LIGHT

Indicates a fault is detected in the asymmetry detection system for the leading edge slats or trailing edge flaps.

SECONDARY FLIGHT CONTROLS

SPEED BRAKE AUTOMATIC DISABLE SWITCH

A momentary switch that controls power assist to speed brake lever. Pressing the switch removes hydraulic assist to the spoiler servo valve and disables auto ground spoilers and DLC. This increases the force required to move the lever and lever must be held in desired position. Lights on the handle indicate that hydraulic power is removed from spoiler control through switch action. Pressing the switch a second time restores normal operation.

2H14, 15 - DLC SERVO A, B.

SPEED BRAKE LEVER

Controls symmetrical extension of spoiler panels and provides manual override of automatic spoiler systems. Warning horn sounds intermittently if lever is not at 0 degree when any two throttles are advanced for takeoff. Lever follows movement of spoilers in DLC and AGS.

2J15, 16, 17, 18 - SPOILER SERVO A, B, C, D.

FLAP CONTROL LEVER

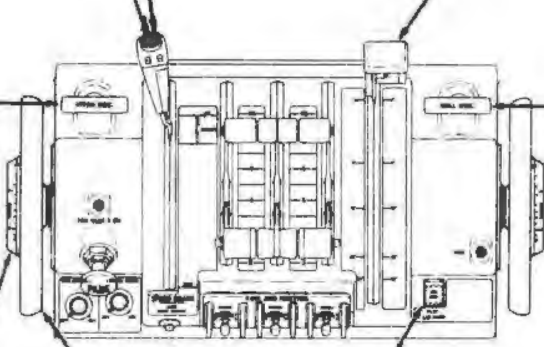
Controls flaps and slats. Mechanical gate at 4 degrees provides proper sequencing of slat/flap extension and retraction. Warning horn sounds intermittently if flaps are not in takeoff position and any two throttles are advanced for takeoff. Steady horn sounds if landing flaps are selected when landing gear is not down and locked. Horn cannot be silenced.

PITCH DISCONNECT HANDLE

Mechanically disconnects the control columns from each other. Rotating 90 degrees locks handle in the disconnected position. Can be reconnected in flight. Lights on when not connected.

ROLL CONTROLS DISCONNECT HANDLE

Mechanically disconnects the control wheels from each other when pulled. Rotating 90 degrees locks the handle in the disconnected position. Can be reconnected in flight. Lights on when not connected.



PITCH TRIM POSITION INDICATORS

Indicate neutral position of artificial trim system in terms of stabilizer angle. Warning horn sounds intermittently if trim is not set in the takeoff range and any two throttles are advanced for takeoff.

FLAP LOAD RELIEF SYSTEM OVERRIDE SWITCH

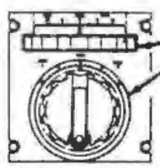
Disables flap load relief and aural warning systems. Flaps will synchronize with the flap lever position when the flap load relief system is overridden. Cannot be reset in flight.

LRS INOP illuminated anytime system is inoperative.

2H12, 20 - FLAP LOAD RELIEF CHAN 1, 2.

MECHANICAL PITCH TRIM WHEEL

Provides manual mechanical control of pitch trim and provides manual override of electric trim.



ROLL AND YAW TRIM CONTROLS AND POSITION INDICATORS

Provide manual mechanical control and indicate degrees of aileron and rudder trim.

MACH FEEL AND RUDDER LIMITER

RUDDER HYDRAULIC LIMITER LIGHT

RUDDER HYDR LMTR

Incorrect rudder hydraulic pressure for flight condition.

RUDDER MECHANICAL LIMITER LIGHT

RUDDER MECH LMTR

Rudder mechanical limiter not in correct position for flight condition.

RUDDER AUTO/MANUAL MECHANICAL LIMITER SWITCH

Indicates rudder limiting system status and permits controlling mechanical limiter if system malfunctions.

IN - Normal position. No lights illuminated. PUSH legend, illuminated when mechanical limiter is not in correct position for existing flight condition.

OUT - PUSH is extinguished and MNL is illuminated to indicate the automatic mechanical limiting feature is deactivated. Also, the 8°/30° mechanical switching feature is armed.

2K15, 16 - RUDDER MECH LIMITER A, B.

MACH FEEL INDICATOR

Normal system operation is indicated when readout corresponds to aircraft mach number. Nulls to 0.73 with loss of power to indicator.
When both channels fail, mach indicator remains at indication shown at time of failure.
1A7, 8, 25, 26 - TRIM AGMT AC, DC.

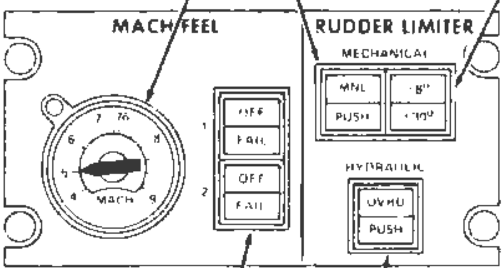
MANUAL RUDDER LIMITING SWITCH

Permits manual selection of 8° or 30° rudder travel when auto/manual mechanical limiter switch is OUT. Either the 8° or 30° light will be on indicating limiter position.

IN - Selects full rudder travel of 30° by removing mechanical stops.

OUT - Limits rudder travel to 8° by positioning mechanical stops.

2K15, 16 - RUDDER MECH LIMITER A, B.



MACH FEEL SWITCHES

IN - FAIL is illuminated when monitor has detected a fault in a channel and has automatically deactivated the channel. Certain faults in a single channel may deactivate both channels.

OUT - Channel is deactivated. One channel provides normal system operation. With both channels off feel force remains at value that existed on failure. OFF indicates switch position.

1A7, 8, 25, 26 - TRIM AGMT AC, DC.

RUDDER HYDRAULIC POWER LIMITER SWITCH

Provides monitoring automatic system and controlling rudder hydraulic pressure.

IN - Normal position. No lights illuminated. PUSH legend, illuminated when rudder power channels A and C are inoperative with flaps up or when full rudder power control is not available with flaps down.

OUT - PUSH is extinguished and OVRD is illuminated to indicate automatic hydraulic rudder limiting is deactivated. Also, all available hydraulic system pressure is restored.

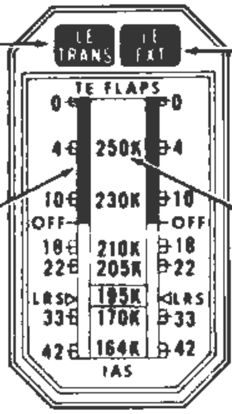
2K12, 13, 14 - RUDDER SERVO A, B ,C.

SURFACE POSITION INDICATORS

TRAILING EDGE FLAP LOCK LIGHT
Flaps are locked in position shown on flap position indicator.

LEADING EDGE SLAT IN-TRANSIT LIGHT
Indicates leading edge slats are not in selected position.
3K18 - LE SLAT EXTEND LT.

TRAILING EDGE FLAP POSITION INDICATOR
A moving tape indicates position of the left and right trailing edge flaps. Tape moves to OFF position with power removed from instrument.
3K16 - POS IND TE FLAP.



LEADING EDGE SLAT EXTENDED LIGHT
Indicates leading edge slats are fully extended.
3K18 LE SLAT EXTEND LT.

FLAP LIMITING SPEED INDICATOR
Limiting speed for that degree of flap extension is indicated by IAS blocks.

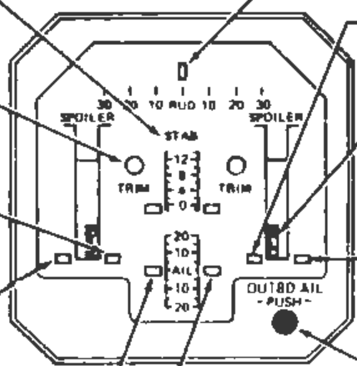
STABILIZER

STABILIZER AUTO-TRIM WARNING FLAGS
With autopilot engaged indicates aircraft is not in trim.

SPOILER L2, 3 AND 4
Sensor on L4.

SPOILER L5 AND 6
Sensor on L5.

AILERON
Normally indicates position of inboard ailerons.



RUDDER

SPOILER R2, 3 AND 4
Sensor on R2.

DLC RANGE
Indicates range of spoiler travel during DLC operation.

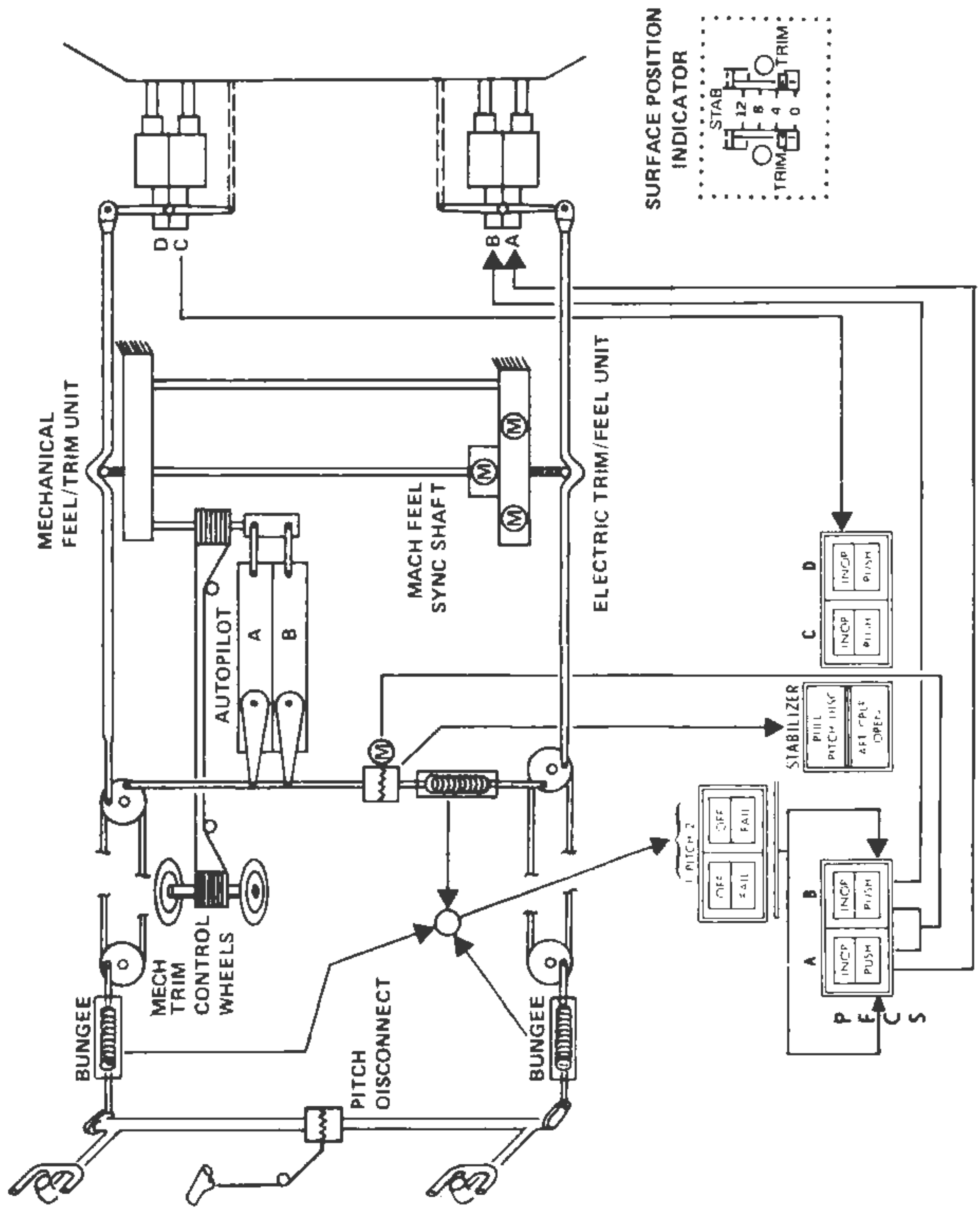
SPOILER R5 AND 6
Sensor on R6.

OUTBOARD AILERON SWITCH
When pressed, outboard aileron position is indicated by aileron indicator.

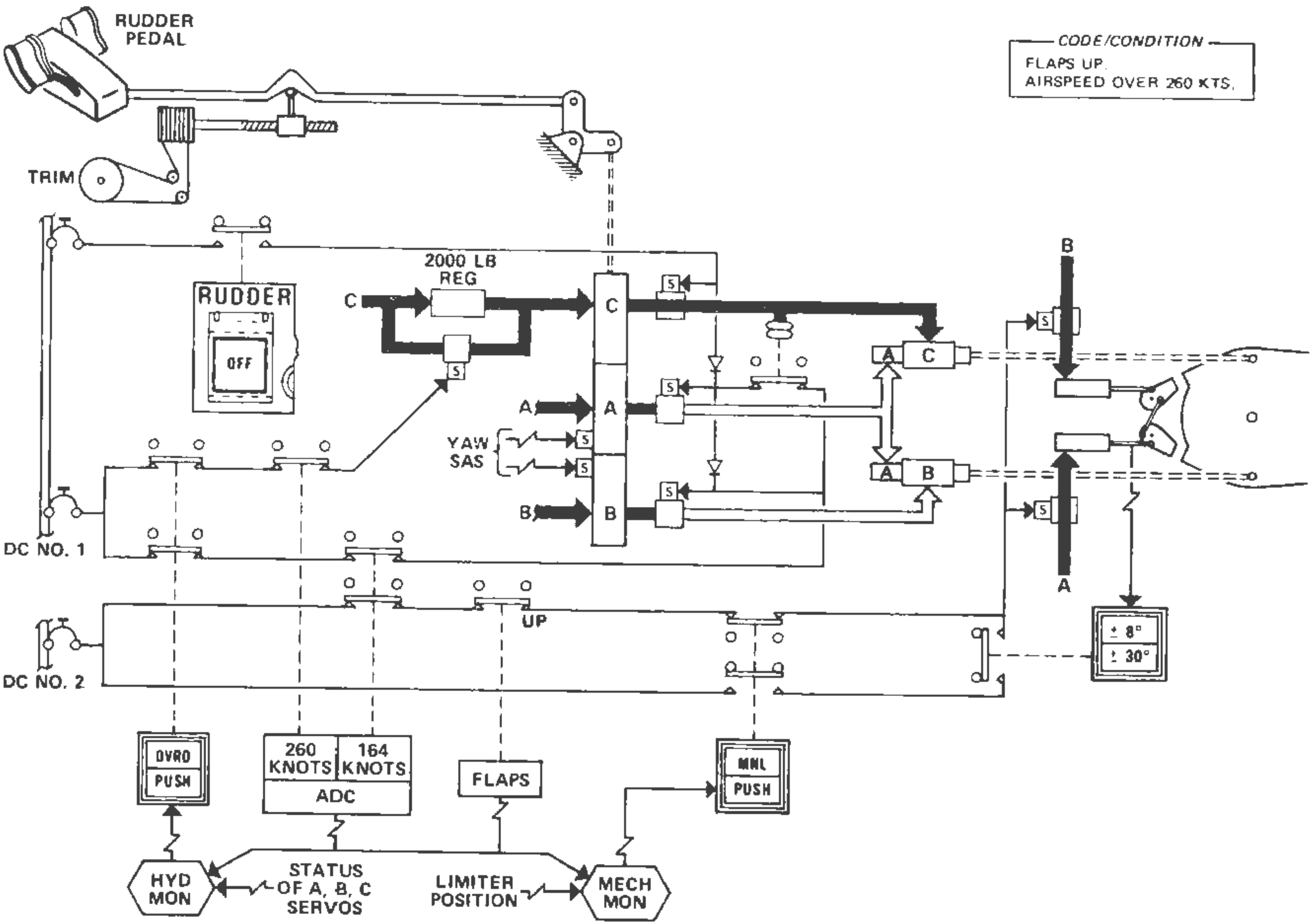
SURFACE POSITION INDICATOR
1J23 - SURF POSN IND.

* * *

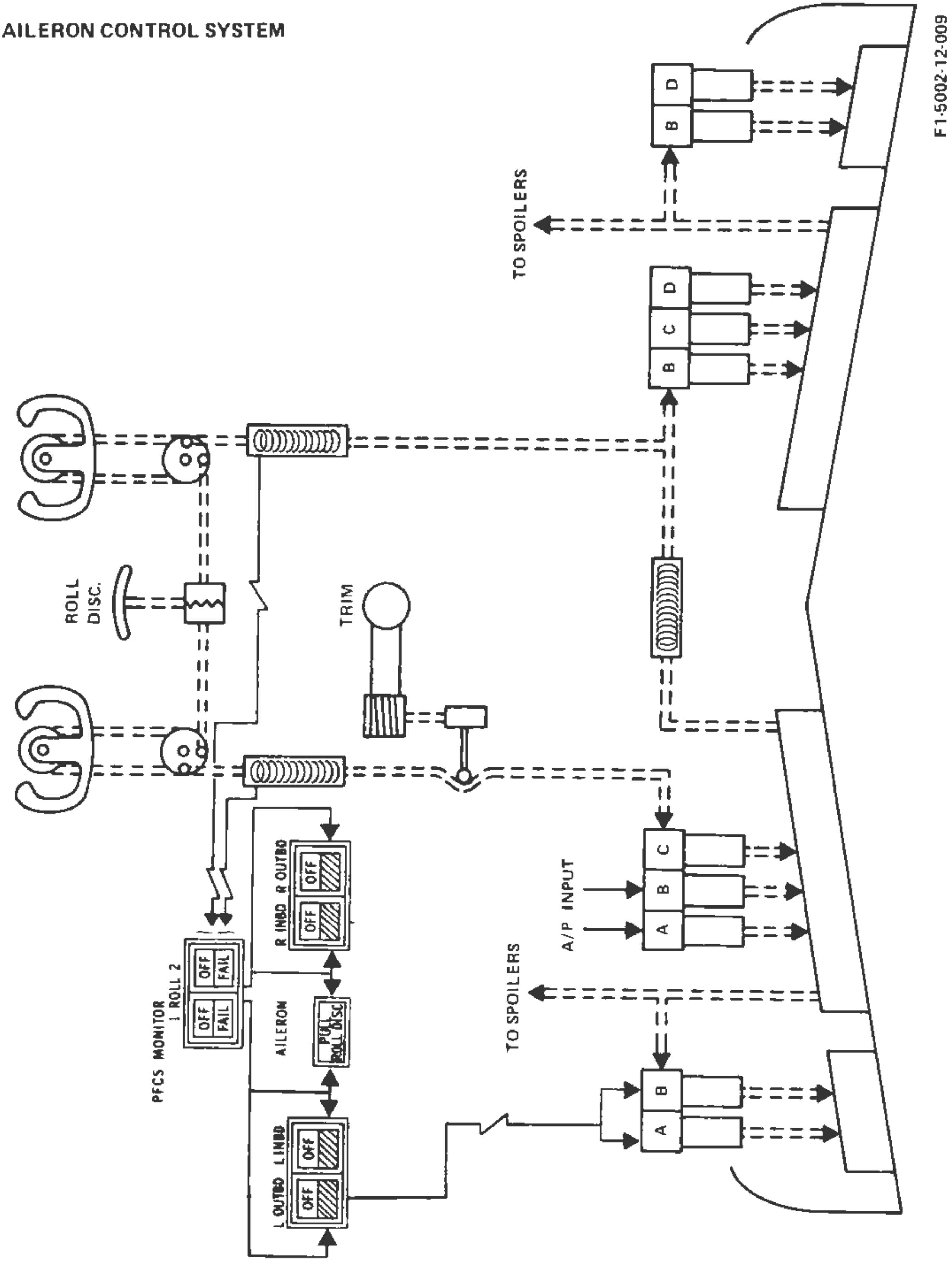
STABILIZER CONTROL SYSTEM



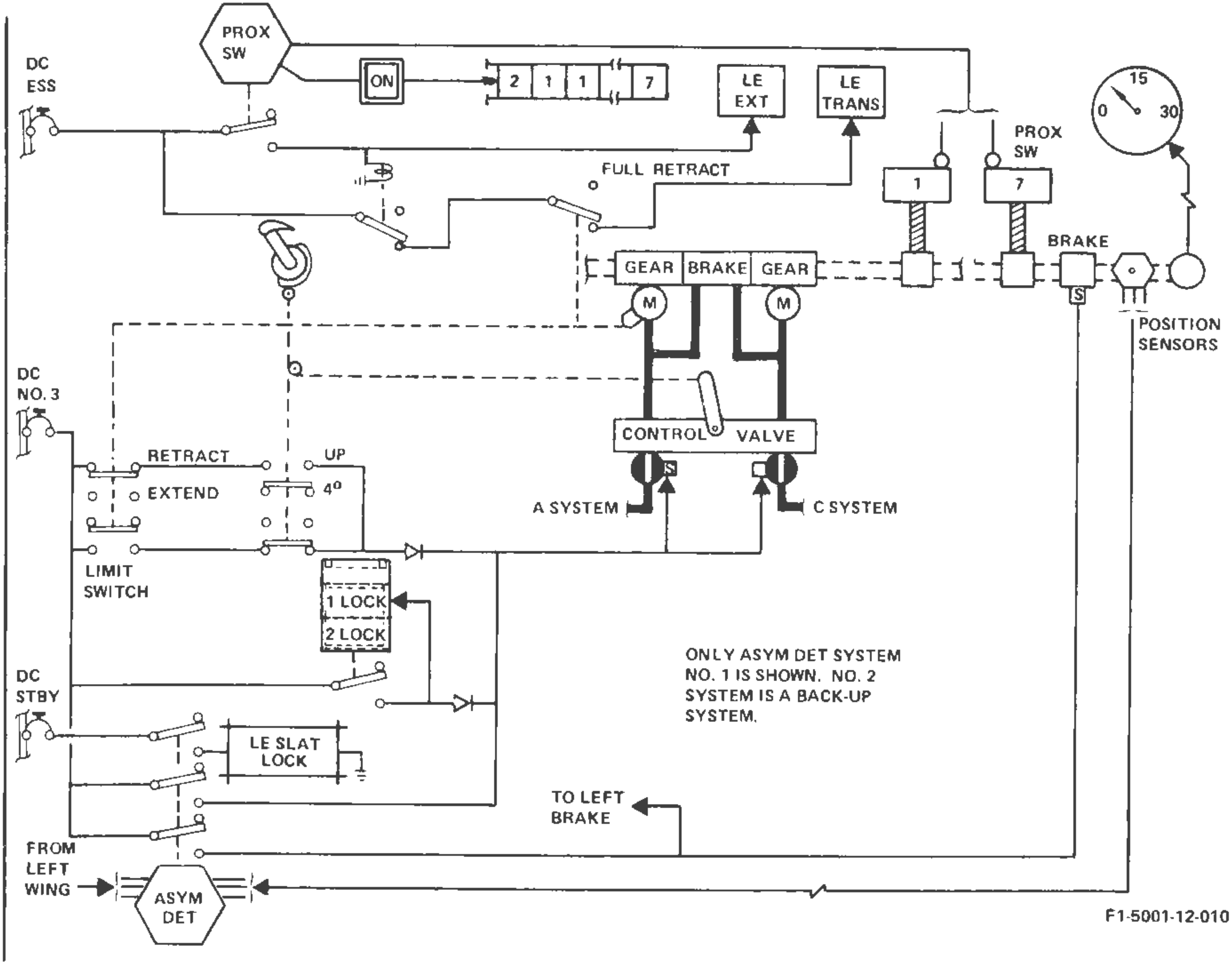
RUDDER CONTROL SYSTEM



AILERON CONTROL SYSTEM



LEADING EDGE SLAT CONTROL SYSTEM



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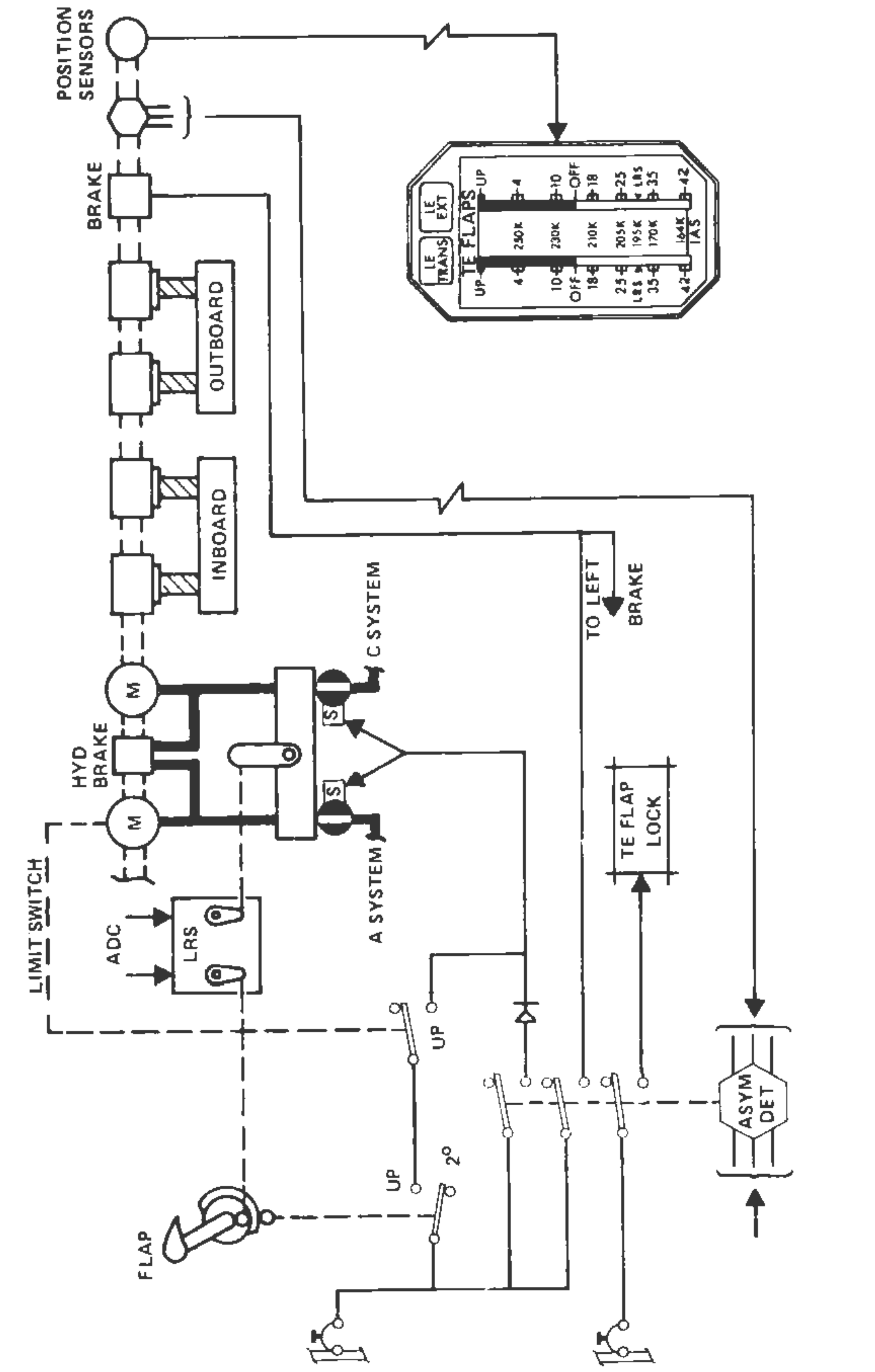
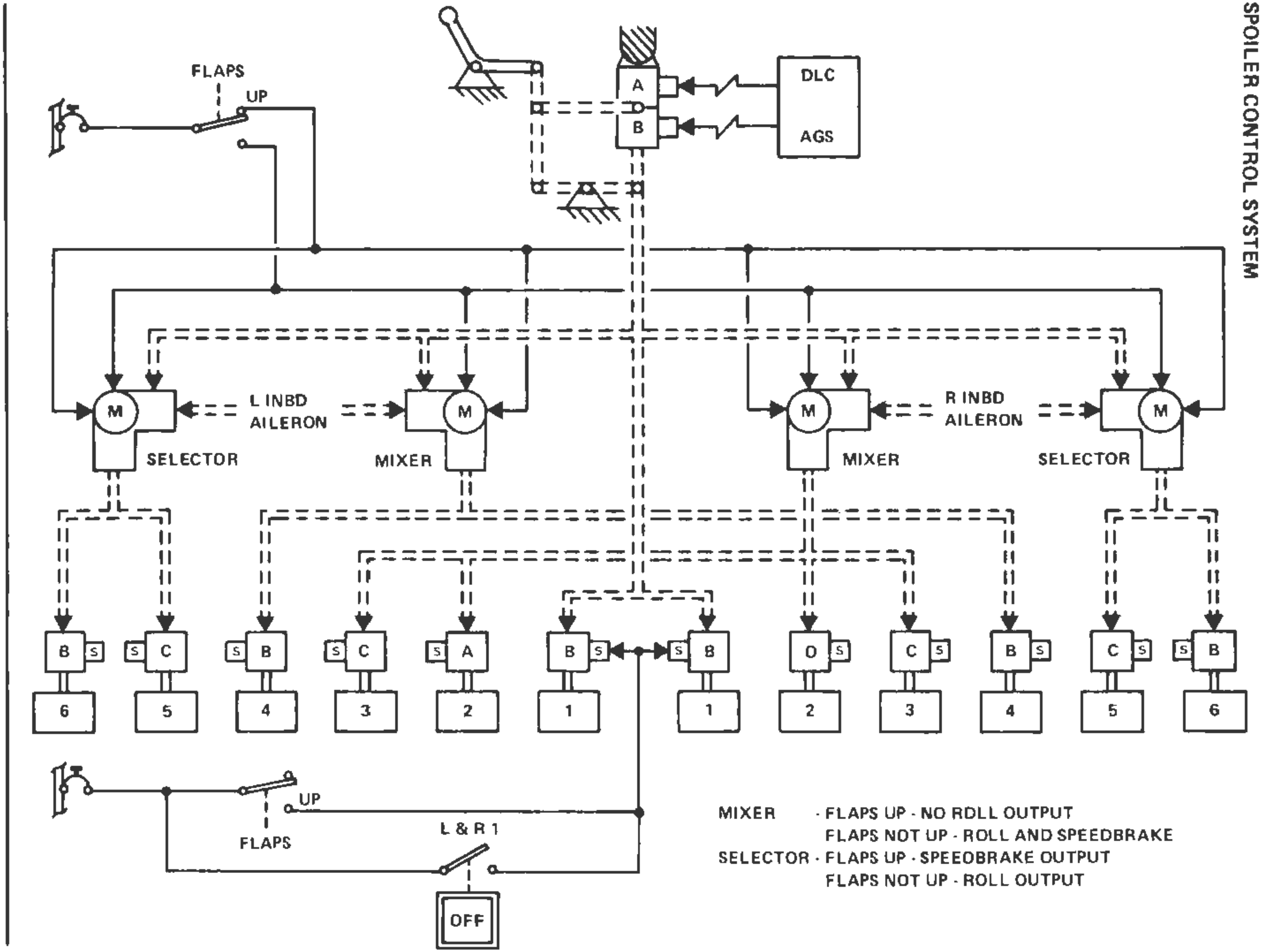
TRAILING EDGE FLAP CONTROL SYSTEM



SPOILER CONTROL SYSTEM



MIXER - FLAPS UP - NO ROLL OUTPUT
FLAPS NOT UP - ROLL AND SPEEDBRAKE
SELECTOR - FLAPS UP - SPEEDBRAKE OUTPUT
FLAPS NOT UP - ROLL OUTPUT

FLIGHT CONTROLS

The primary flight controls are the rudder, horizontal stabilizer, ailerons, and spoilers. These primary controls are augmented by trailing edge flaps and leading edge slats. All the flight controls are hydraulically powered with no manual operation.

PRIMARY FLIGHT CONTROL SYSTEMS PANEL

The function of the pitch and roll monitors is to detect jams and opens in the primary flight control systems. The monitors consist of two subsystems, the sensing and the warning system. Sensing consists of bungees in the cable paths that are instrumented to detect a fault when the bungee breakout load exceeds a predetermined level. The warning system utilizes the signals from the bungees to determine the location of the jam or open and activates lights on the Primary Flight Control Systems panel.

Pitch and roll monitoring each has two channels of operation. Failure of a single channel is annunciated by its fail light. A single channel failure does not disable the monitoring function. If both channels have failed, the affected control system will continue to operate without fail monitoring.

The Primary Flight Control Systems panel also provides control of hydraulic power to actuators in the stabilizer, aileron, spoiler, and rudder systems.

FLIGHT CONTROL ELECTRONICS SYSTEM PANEL

The Flight Control Electronics System panel monitors and provides on-off control of certain electronic systems. Each flight control electronic system has two independent channels of monitored operation. A fault causes automatic channel shutdown. Certain faults in one channel may shut down both channels.

RUDDER

Directional control is achieved by a single rudder mounted on the vertical stabilizer. The rudder is powered by hydraulic systems A, B, and C.

RUDDER HYDRAULIC LIMITER

The rudder is force limited by reducing hydraulic pressure as speed is increased. Systems A and B are automatically shut down when indicated airspeed is more than 164 knots. System C pressure is reduced to 2000 PSI when indicated airspeed is above 260 knots. As the aircraft slows down, the hydraulic systems are restored at the same speed references. If system C fails, system A automatically takes over at full pressure.

↓ *-100:* The higher takeoff gross weight changes the rudder hydraulic limiter schedule. System A shuts down, system C reduces to 2000 PSI and system B remains at 3000 PSI when the airspeed goes above 164 knots. When the airspeed is greater than 260 knots, system B pressure shuts down. Therefore, in cruise above 260 knots, system C at 2000 PSI is the only hydraulic power available to the rudder ↑

One switch on the rudder limiter panel (pilot's overhead) monitors for proper pressure to the rudder. The push legend will come on if hydraulic systems A and C are inoperative with the flaps up, or when full rudder power is not available with the flaps down. Pressing the hydraulic limiter switch off will deactivate the automatic rudder limiting and restore all available hydraulic pressure. At this time, override will be illuminated indicating the automatic hydraulic limiting has been overridden.

A guarded rudder switch is provided on the primary flight control systems panel to shutoff all rudder pressure should some malfunction cause unwanted movement. Pressing this switch to off bypasses all hydraulic pressure to the rudder and it will trail.

There is a hydraulic fuse in the system A pressure line to the rudder. Its purpose is to close and shut off system A to the rudder with a system A fluid loss at the rudder. This will conserve system A for powering other units.

RUDDER MECHANICAL LIMITER

A mechanical limiter, using dual hydraulic actuators powered by systems A and B, physically limits rudder travel at higher speeds. Either actuator, when powered, will limit the rudder to 8 degrees of travel from neutral. The rudder is mechanically limited when flaps are less than 3 degrees and airspeed is more than 164 knots. It is not limited if flaps are more than 3 degrees or airspeed is less than 164 knots.

Two mechanical switches on the rudder limiter panel (pilot's overhead) monitor for proper mechanical limiter position. The $8^{\circ}/30^{\circ}$ switch continuously displays rudder mechanical limiter position. The adjacent switch push legend will come on if the rudder mechanical limiter is not in the correct position for existing flight conditions. Pressing the mechanical switch off deactivates the automatic mechanical limiting feature, turns on the MNL light, and arms the $8^{\circ}/30^{\circ}$ switch. Rudder mechanical limiting position can now be manually selected.

RUDDER TRIM

Rudder trim is a mechanical input into the rudder control to change the neutral position of rudder pedal input to the hydraulic control valves. Trim inputs will move the rudder a maximum of 10 degrees either side of neutral. The rudder pedals will follow trim inputs.

RUDDER (Cont'd)

YAW STABILITY AUGMENTATION SYSTEM (YAW SAS)

Yaw SAS provides full time turn coordination and yaw damping. With the autopilot engaged in auto/land mode and the aircraft below 1500 feet on approach, the system shifts to a parallel mode and the rudder pedals move with the rudder. Normally, yaw SAS is in series with the rudder controls and is not felt in the rudder pedals.

There are two channels of yaw SAS. Both channels normally operate continuously, but either channel will provide full system operation. Channel 1 uses hydraulic system B, and Channel 2 uses hydraulic system A.

Control and monitoring of the yaw SAS is provided on the flight controls electronic system panel on the pilot's overhead. Failure of each channel is annunciated by a fail light. A single failure does not disable the yaw SAS. If both channels have failed, yaw damping, turn coordination, automatic runway alignment and rollout will not be provided.

PITCH CONTROL

Pitch control is achieved by means of a movable horizontal stabilizer. Elevators are mechanically operated by the horizontal stabilizer and act to increase the horizontal stabilizer effectiveness in pitch control when the stabilizer is deflected. Four hydraulic systems provide power to four actuators which, in unison, move the horizontal stabilizer as commanded by the pilots or autopilot. Any one of the hydraulic actuators is capable of providing sufficient stabilizer motion to control the aircraft.

There are two pitch control systems; the captain's and the first officer's. The captain's control path is directly connected to the left hydraulic package and the first officer's to the right hydraulic package. Each package controls two of the hydraulic actuators. Each actuator is powered by a separate hydraulic system.

The two control paths are coupled together by a pitch coupler at the flight station and so act effectively as one system. To assure that each control package gets the same control signal at the same time, regardless of cable tensions, an aft synchronizing bar couples the two control paths together again at the stabilizer.

Bungee cartridges, one in each control path and one in the aft coupler, act as solid links during normal operation. If either control path should jam, pilot forces exerted on the control column will apply breakout forces to the affected bungee. Bungee switches will sense the breakout and signal the monitor systems.

The stabilizer control is monitored by two pitch monitors. If a jam is detected in the left pitch control path, the pitch monitor will cause push legends to appear in stabilizer A and B switches on the primary flight controls system panel. Pressing the stabilizer A and B switches off causes shutdown of the stabilizer A and B actuators, A and B inoperative lights to come on, and electrically opens the aft pitch coupler. The aft coupler open light then comes on and also turns on the pull pitch disconnect light. This is the signal to pull the manual pitch disconnect handle to separate the left and right pitch control paths. The right or copilot's control path is now controlling the stabilizer through stabilizer C and D actuators. A jam in the right pitch control path is annunciated in a similar manner except that stabilizer C and D push lights come on.

The manual pitch disconnect can be reconnected in flight. The aft pitch coupler will automatically recouple in flight by turning on stabilizer A and B or C and D switches as appropriate.

Stabilizer A, B, C, and D switches inoperative legend will also come on when hydraulic power is removed from the actuator. The inoperative lights will be on whenever the respective hydraulic system is shut down.

PITCH TRIM

Control feel forces are artificially supplied by feel units in the control path. Trim or feel change is obtained by shifting the neutral point of the feel units. An electrical unit in the left control path and a mechanical unit in the right control path are coupled together so any input into either unit is also transferred to the other unit.

The mechanical trim wheels provide the trim input to the right control path mechanical unit. All electrical trim inputs to the left control path unit come from a combination of six electric motors. There are two motors for each of the three systems: Pitch trim, Mach trim, and Mach feel.

As the mechanical unit adjusts trim, it also mechanically feeds the trim position into the autopilot.

Either pilots' control wheel switch or autopilot trim powers a pair of motors. Autopilot engagement inhibits pilot trim except when force is being applied to pitch axis while in CWS or on the ground. The two motors are in parallel and operate together. If either channel fails, the trim speed is reduced. The autopilot senses control position and trim position to determine automatic trim requirements.

PITCH CONTROL (Cont'd)

Control and monitoring of pitch trim is provided on the flight control electronics system panel. Failure of each channel is annunciated by a fail legend. A single failure does not disable pitch trim; however, single channel pitch trim will be at a slower rate. If both channels have failed only mechanical trim is available.

The mechanical trim wheels provide a means of overriding any electrical trim malfunction.

MACH TRIM

Mach trim adjusts trim input depending on the aircraft's mach. Two mach trim motors are connected in series. Channel 1 is normally operating with channel 2 in automatic standby. Air data computer 1 provides mach for channel 1 and air data computer 2 for channel 2.

Control and monitoring of mach trim is provided on the Flight Control Electronics System panel. Failure of each channel is annunciated by a fail legend. Single channel operation will provide normal mach trim operation.

MACH FEEL

Mach feel adjusts the spring tension of the trim system depending on the aircraft's mach number. The higher the mach number, the greater the spring force controls must work against. The left electrical trim unit contains two motors, either of which can operate mach feel. A connecting shaft also schedules the same feel change into the mechanical unit. Channel 1 is normally operating with channel 2 in automatic standby. Air data computer 1 provides mach for channel 1 and air data computer 2 for channel 2.

Control and monitoring of mach feel is provided on the mach feel panel on the pilot's overhead. The mach feel indicator shows normal system operation when the readout is the same as aircraft mach number. Failure of each channel is annunciated by a fail legend. Single channel operation will provide normal mach feel. If both channels have failed, the mach feel will remain at the mach number at the time of failure.

AILERONS

Roll control is achieved by hydraulically powered inboard and outboard ailerons. All ailerons operate full time. Added roll control is provided by differential spoiler operation when the flaps are extended.

The captain's control path operates the left inboard aileron control valve directly. The left inboard aileron is the master for all ailerons. The first officer's wheel is coupled to the captain's wheel and also directly moves the left inboard aileron control valve. This control valve distributes hydraulic power to each of three actuators. A separate hydraulic system operates each actuator.

The left inboard aileron is mechanically connected to the control valves of the left outboard aileron and the right inboard aileron. The left outboard control valve distributes hydraulic power to each of two actuators. The right inboard valve distributes hydraulic power to the three right inboard actuators. The right inboard aileron is mechanically connected to the right outboard aileron control valve and thus becomes the master for the outboard aileron.

Each inboard aileron is mechanically connected to the spoiler mixer and selector units on its side and provides spoiler roll response after flaps are extended.

A control path exists from the first officer's control wheel to the right inboard aileron control valve, but it is not normally effective due to a lost motion device in the path.

The aileron trim wheel shifts the neutral point of an artificial trim system by changing spring loading. Trim inputs are a maximum of 7 degrees aileron movement either side of neutral.

→MONITORING

The aileron and spoiler roll control is monitored by two roll monitors. If a jam is detected in the left roll control path, the roll monitors will cause the cross hatch lights to come on in the left inboard and outboard switches, the push lights to come on in the left and right 4, left 5 and 6 spoiler switches, and the pull roll disconnect light comes on. These are the hydraulic actuators controlled by the left control path. Pressing the spoiler switches off causes shutdown of the actuators. Pull roll disconnect light on is the signal to pull the manual roll disconnect handle to separate the left and right control paths. The right or first officer's control path is now directed to the right inboard aileron and associated spoiler actuators. Shutting off the aileron cross hatched switches will be a matter of judgment, depending on the seriousness of the restriction.

A jam in the right control path is annunciated in a similar manner except that the right inboard and outboard aileron cross hatch lights come on, the left and right 2, left and right 3, the right 5 and 6 spoiler push lights, and the pull roll disconnect light come on. Pressing these switches off causes shutdown of the actuators.

With the two control paths separated and one side jammed, roll capability is reduced.

SPOILERS

There are six hydraulically operated spoiler panels on each wing. They are numbered 1 to 6 from the wing root outboard. Various spoiler panels function as in-flight speed brakes, roll control and direct lift control when flaps are extended, and as automatic ground spoilers.

→ROLL AUGMENTATION

Roll augmentation is provided only after flaps are extended more than 3 degrees. Spoiler panels will only extend a maximum of 40 degrees on the side toward the turn. If spoilers are already extended, they will extend further on the one side, but will not decrease on the other.

Each spoiler is powered by a single system, but the system distribution is such that any hydraulic system failure affecting the outboard four spoilers, where maximum roll authority exists, will be symmetrical.

→SPEED BRAKES

Spoilers extend symmetrically with pilot manual input to the speed brake lever or automatically for direct lift control or ground spoilers. A hydraulic servo provides the automatic input. A followup causes the lever to move with the spoilers. The pilot can manually override the servo hydraulic power, but may also remove its hydraulics by pressing the disable switch on top of the lever. Without hydraulic assist, manual movement of the lever requires increased force and the speed brake lever must be held in desired position.

→DIRECT LIFT CONTROL

Direct Lift Control (DLC) is used during the approach. When activated, spoilers 1 through 4 extend to 8 degrees and then modulate between 16 degrees and 0 degree to control the lift of the wing in response to control column movement.

Direct lift control operates when flaps are extended beyond 30 degrees and any two throttles are retarded below maximum continuous thrust.

Direct lift control is deactivated with any of the following:

- Stall warning.
- Go around switch activated.
- Any of two throttles advanced.
- Flaps retracted to less than 30 degrees.
- Pilot manual override.
- Pilot assist disable switch pressed.
- System failures.

→AUTOGROUND SPOILERS

Autoground spoilers are armed when the flaps are extended beyond 30 degrees and any two throttles are retarded less than maximum continuous thrust. An on the ground signal will now extend spoilers 1 through 4 to 60 degrees. The system will also extend spoilers when reverse thrust is selected on any two throttles.

Autoground spoilers are deactivated by any of the following:

- Any two throttles advanced.
- Flaps retracted to less than 30 degrees.
- Pilot assist disable switch pressed.
- Loss of hydraulic system C.
- System failure.

→MONITORING

Direct lift control and autospoiler operation is monitored on the flight control electronics system panel. Failure of each channel is annunciated by a fail light. A single failure does not disable direct lift control or autospoilers. If both channels have failed, only manual operation of speed brakes and ground spoilers is available. All faults which inhibit autoground spoiler deployment will cause the autoground spoilers inoperative light to come on at the pilot's annunciator panel. Manual operation of ground spoilers will then be required.

→Push Lights

Left and right spoilers 5 and 6 operate as speed brakes only with the flaps up. With the flaps beyond 3 degrees, these spoiler panels shift to roll control only. If the spoilers left and right 5 and 6 have not shifted to the proper mode of operation, push lights come on in the left 5 and 6 and right 5 and 6 spoiler switches. Pressing these switches off shuts down these spoiler actuators.

→Roll Speed Brake Light

Left and right spoiler No. 1 functions as speed brakes with the flaps beyond 3 degrees and are disabled with the flaps up. If these spoilers did not disable with the flaps up, the roll speed brake light comes on at the pilot's annunciator panel. In this case, pressing the left and right 1 switch off shuts down these spoiler actuators.

The roll speed brake light also comes on if spoiler panels 2, 3, and 4 do not shift to the proper function with flap operation. Flaps up; roll input not deactivated. Flaps down; roll function not activated.

↓ A jam in the No. 1 spoiler input control automatically shuts down these spoilers and turns on the roll ↑ speed brake light.

SPOILER OPERATION

	PANEL NO. 1	PANEL NO. 2, 3 & 4	PANEL NO. 5 & 6
FLAPS UP	DEACTIVATED	SPEED BRAKES	SPEED BRAKES
FLAPS 3^{o} OR MORE	SPEED BRAKES	SPEED BRAKES & ROLL AUGMENTATION	ROLL AUGMENTATION
FLAP LEVER 30^{o} OR MORE	DLC OR SPEED BRAKES	SPEED BRAKES, ROLL AUGMENTATION & DLC	ROLL AUGMENTATION
ON GROUND	AUTO & MANUAL GROUND SPOILER	AUTO & MANUAL GROUND SPOILER ROLL AUGMENTATION	ROLL AUGMENTATION

FLAPS AND SLATS

The trailing edge flaps consist of four flap surfaces on each wing, two inboard surfaces and two outboard surfaces. Seven slat segments are on the leading edge of each wing. They are numbered 1 to 7 from the wing root outboard. The flaps and slats are powered hydraulically by systems A and C. Either hydraulic system will drive all the flaps and slats. The flaps and slats are controlled by a single flap handle on the center console. The flaps may be selected to 0, 4, 10, 22, and 33 degrees. The slats have two positions; fully retracted or fully extended.

FLAPS

The first movement of the flap handle on extension opens a switch to de-energize two valves to supply system A and C pressure to the flap control valve. The flap handle also positions the flap control valve to release a brake and power two hydraulic motors. The hydraulic motors drive a single torque tube to move all the flap panels. When the flaps reach the selected position, the flap control valve is repositioned to remove hydraulic power from the motors and to set the brake. When the flaps are fully retracted, a motor limit switch closes and energizes the valves to close and remove hydraulic power from the system and set the brake.

Flap position is indicated on the center instrument panel. Position sensors at the outboard ends of the torque tubes transmit the flap position to the two tapes in the flap indicator. One tape is for the left wing flaps and one for right wing flaps.

Flap asymmetry is sensed by position sensors also at the outboard ends of the torque tubes. When an asymmetric condition is detected, both system A and C pressures are shut off, a brake at the left and right outboard ends of the drive is set, and the trailing edge flap lock light comes on at the engineer's annunciator panel. This asymmetric lock can only be reset on the ground. Any fault in the flap asymmetry detection system will cause the asymmetric detector fault light to come on at the engineer's annunciator panel.

A flap load relief system (LRS) is located in the flap control path between the flap handle and the control valve. The unit acts as a solid link unless flaps are extended more than 28 degrees at indicated airspeeds greater than 164 knots. With a flap selection greater than 28 degrees, the flap load relief system will keep the control valve at 28 degrees until the airspeed decreases below 164 knots. If the airspeed increases to more than 164 knots the flaps will return to 28 degrees. Both air data computers provide airspeed inputs to the LRS. When the LRS is operating, the flap LRS limiting light will come on at the pilot's annunciator panel. Any malfunction of the LRS will cause automatic shutdown of the system. If the flaps are extended any amount, a buzzer will sound for two seconds and a flap LRS inoperative light will come on at the pilot's annunciator panel. Pressing the flap LRS switch off deactivates the system.

FLAPS AND SLATS (Cont'd.)

SLATS

The first movement of the flap handle on extension opens a switch to de-energize two valves to supply system A and C pressure to the slat control valve. The flap handle also positions the slat control valve to release a brake and power two hydraulic motors. The hydraulic motors drive a single torque tube to extend all the slats. When the slats are fully extended, motor position switches energize two valves to remove hydraulic power from the motors and set the brake. When the flap handle is moved from the 4 degree position to 0, the hydraulic valves are de-energized open and the slat control valve is positioned to release the brake and retract the slats. When fully retracted, the brake is again set and hydraulic power removed from the system.

Slat position is indicated both on the center instrument panel and the engineer's slat monitor. On the flap position indicator, an amber leading edge in-transit light will be on any time all the slats are not in the selected position. A green leading edge extended light will be on when all the slats are extended. The slat monitor on the engineer's panel has a slat position indicator that shows the position of the left and right slats. The position of each individual slat can be verified by pressing the slat monitor switch on. The slat segments that are fully extended will indicate green at this time.

Slat asymmetry is sensed by position sensors at the outboard ends of the torque tube. When an asymmetic condition is detected, both system A and C pressures are shut off, a brake at the left and right outboard ends of the drive is set, and the leading edge slat lock light comes on at the engineer's annunciator panel. This asymmetric lock can only be reset on the ground. Any fault in the slat asymmetry detection system will cause the asymmetry detector fault light to come on at the engineer's annunciator panel.

Manual operation of the slat lock system is provided on the slat monitor. Pressing the slat lock switch on locks all the slats in position. When the slats are manually locked in position, 1 lock and 2 lock lights will be on. The slats may be unlocked by pressing the slat lock switch off.

STALL WARNING

Two separate channels operate the stick shaker. Normally channel 2 is active to operate the first officer's stick shaker. Failure of channel 2 causes fail light to come on at the flight control electronics system panel, and automatic changeover to channel 1. Channel 1 then operates the first officer's stick shaker. When No. 2 is turned off, No. 1 operates the captain's stick shaker. Impending stall is sensed by modifying angle-of-attack with flap and slat position. A stall warning will also cause automatic retraction of the direct lift control spoilers.

Stall warning can be tested by turning off one channel at a time and pressing the test switch. The stick shaker should then operate.

* * *

ADDITIONAL PROCEDURES

CONTROLS AND INDICATORS

SCHEMATICS

SYSTEM DESCRIPTION

*   *   *

AIR DATA COMPUTER FAILURE

The simultaneous appearance of fail flags on the captain's or first officer's mach indicator, corrected altimeter, TAS or SAT indicators indicates that the related ADC is not providing correct data.

1. Check related ADC power source (CBs 1G8, 27).
2. If power appears normal, switch the failed ADC instruments to the operative ADC with the appropriate instrument source select switch.
3. Switch transponder and altitude alert system to operating ADC.
4. If failed ADC has affected autopilot or flight director, disengage affected APFDS and engage the other APFDS.

GROUND PROXIMITY FAIL LIGHT

Indicates electrical power failure to ground proximity warning system computer, radio altimeter No. 1, or first officer's air data computer.

1. Check GROUND PROX WARNING CB (1B20).
2. Check captain's radio altimeter and first officer's flight instruments for flags.
3. If ground proximity fail light remains on, no ground proximity warnings will be provided. Make log entry including date, time and conditions.

INSTRUMENT TOLERANCES

A log book write up is required if the following tolerances are exceeded:

1. ELECTRIC ALTIMETERS

   See the general information section of the TWA Operations manual (Jeppesen) for published ramp elevations and altimeter tolerances.

2. INDICATED AIRSPEED

IAS (KTS)	Max Difference (knots)
100-150	3
160-190	4
200-250	5
300-	6

3. MACH INDICATOR

Mach No.	Max Difference (mach)
.000-.700	.010
.750-	.015

4. STATIC AIR TEMPERATURE

   Max Tolerance ± 3°C

   To determine if SAT is within tolerance, enter temperature conversion chart, chapter 21, with indicated TAT and first officer's mach.

5. TRUE AIRSPEED

   Max Tolerance ± 5 knots.

   Use Jeppesen computer and first officer's airspeed indication to compare.

6. STANDBY ALTIMETER

   Ground

   Set altimeter setting in altimeter. Max tolerance for the airport ramp elevation is + 50 to -10 feet.

   Flight

   Max difference between standby and electric altimeters:

Altitude (ft)	Max Difference (ft)
0-	40
5,000-	70
10,000-	110
20,000-	180
25,000-	210
30,000-	240
35,000-	280

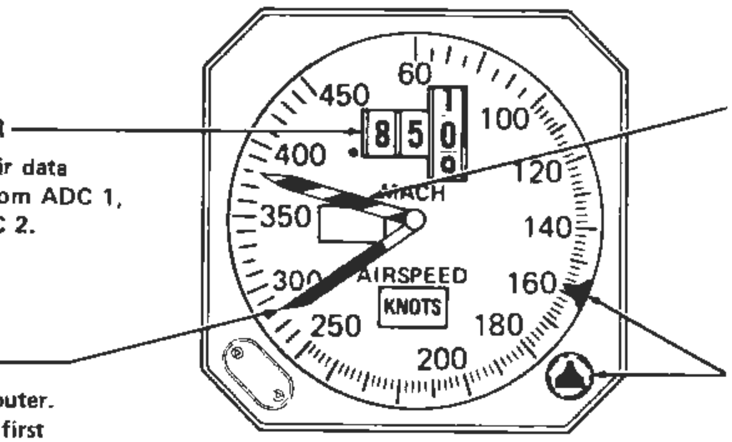
7. STANDBY AIRSPEED

   Max difference between standby airspeed and electric indicated airspeed:

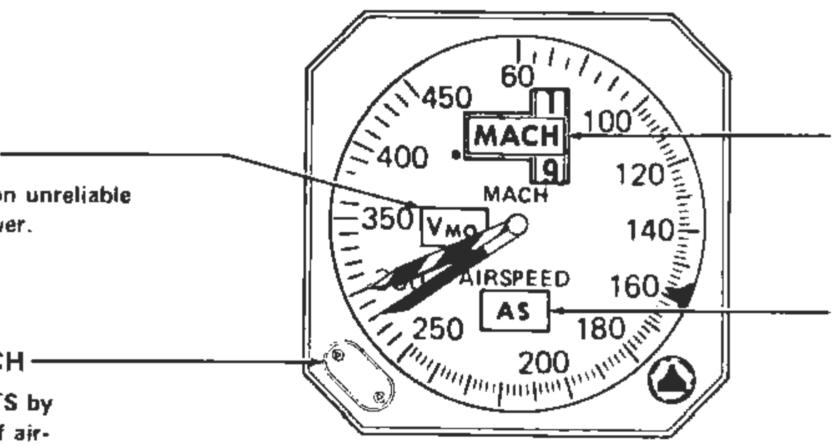
IAS (kts)	Max Difference (kts)
100-150	5
160-190	6
200-250	7
300-	8

* * *

AIRSPEED/MACH INDICATOR



NORMAL INDICATION – NO FAILURE



ALL FAILURE
WARNING FLAGS SHOWING

1F1 - IAS/MACH IND-1
1F19 - IAS/MACH IND-2.

RADIO ALTIMETER

DECISION HEIGHT BUG

Moves with tape. Tone starts when 50 feet from index. DH light on as altitude is pessed.

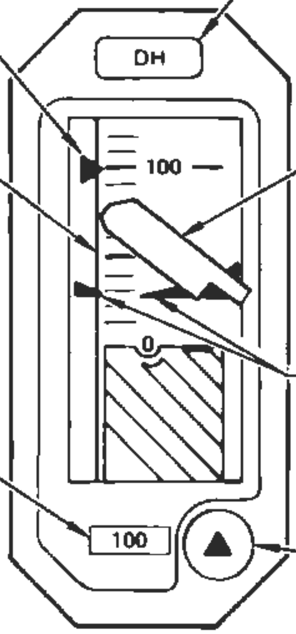
ALTITUDE INDEX

Tape movement displays altitude from zero to 2500 ft.

1D4, 22 - RADIO ALTM

DECISION HEIGHT WINDOW

Indicates decision height setting. Displays altitude from zero to 499 feet. Covered by black mask above 500 feet and white mask below zero.



DECISION HEIGHT WARNING LIGHT AND RESET SWITCH

On when below decision height altitude. When pressed resets DH light.

FLAG

Indicates loss of reliable radio altitude indication.

AIRCRAFT POINTER

Stationary pointers indicate height above terrain.

DECISION HEIGHT SETTING KNOB

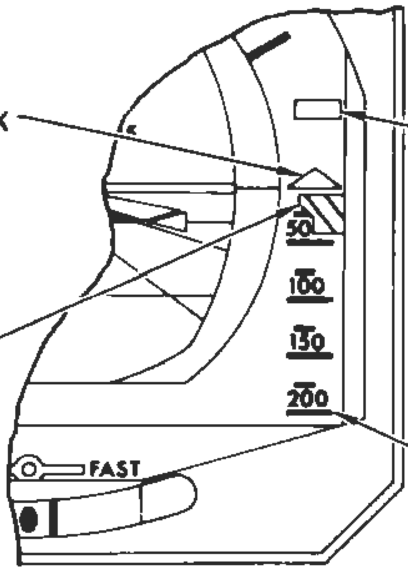
Sets DH in window and places bug on tape at selected decision height.

ZERO TERRAIN ALT INDEX

Fixed reference.

RADIO ALT POINTER

Indicates altitude above terrain. The pointer is slaved to related radio altimeter pointer.



DECISION HEIGHT LIGHT

Aircraft has reached decision height. The light is slaved to related radio altimeter DH light.

RADIO ALTITUDE SCALE

Displays radio altitude from 200 feet to 0.

Scale and pointer biased out of view if radio altimeter fails, or if aircraft is above 200 feet.

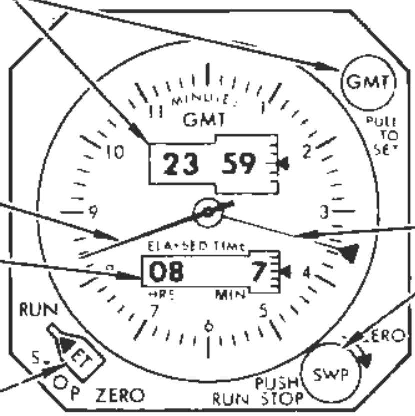
FLIGHT DATA AND CLOCK

GLARESHIELD PANEL

REMOTE SWEEP TIME CONTROL

Push to start sweep time, push to stop, rotate to reset to zero.

PILOTS' CLOCK



1B18 - ELECTRIC CLOCK SYSTEM

GMT SET KNOB

23 HRS, 59 MIN

SWEEP SECOND HAND

ELAPSED TIME DISPLAY

Records to 99 hrs. 59 min.

SWEEP MINUTE INDEX

SWEEP TIME CONTROL KNOB

Push to start sweep time, push to stop, rotate to reset to zero.

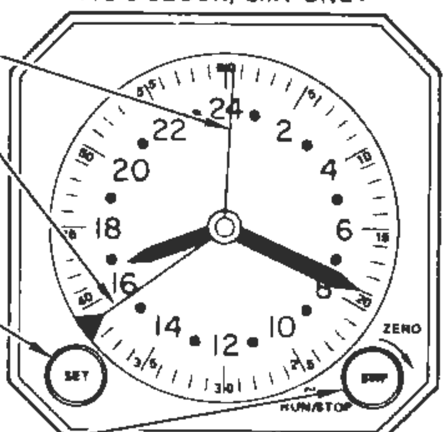
ELAPSED TIME CONTROL KNOB

RUN - Starts elapsed time

STOP - Stops time

ZERO - Resets to zero

F/E'S CLOCK, GMT ONLY



SWEEP SECOND HAND

SWEEP MINUTE INDEX

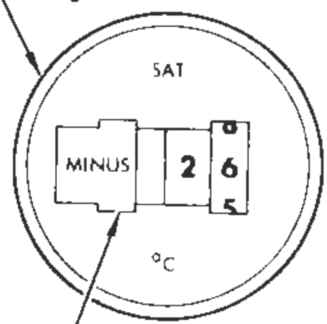
Records to 24 minutes.

SET KNOB

To set pull and then rotate.

SWEEP TIME CONTROL

Push to start, push to stop, and rotate to reset to zero. Controls both second and minute sweep hands.



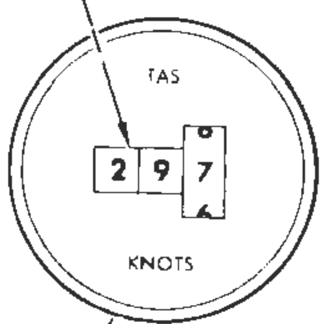
STATIC AIR TEMP

Computed by ADC No. 2
Range -99°C to +50° C .

FAIL INDICATION

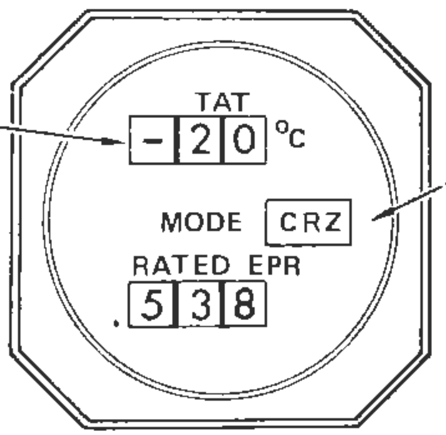
Warning flag covers indicator with power or signal loss.

1F27 - SAT/TAS



TRUE AIRSPEED

Computed by ADC No. 2.
Range 150 to 650 knots.



TOTAL AIR TEMP

Data is from TAT probe.

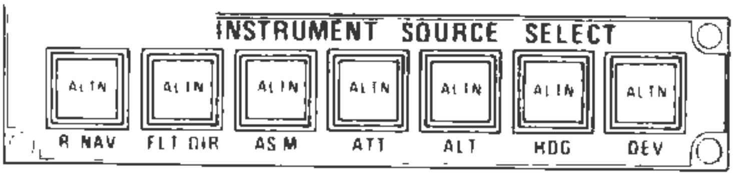
EPR MODE SELECTED

EPR LIMIT

EPR limit from EPR computer.
3R-12 - TAT/EPR

(F1-5001-13-005)

INSTRUMENT COMPARISON MONITOR AND SOURCE SELECT



ALTERNATE SOURCE SELECT PANEL

OUT - No lights on.

IN - ALTN indicates alternate source of data is selected. Except for ATT and FLT DIR it is not possible for the captain and first officer to use the same selection. The selector pressed first has priority.

R NAV - Future installation

FLT DIR - Selects other computer to command bar. Both may be selected to ALTN at the same time.

AS/M - Selects other ADC to airspeed/mach indicator.

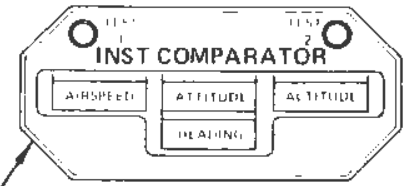
ATT - Selects No. 3 gyro to ADI. Both ATT switches may be in ALTN at the same time.

ALT - Selects other ADC to altimeter and vertical speed indicator.

HDG - HSI selected to other compass system.

DEV - HSI and ADI gate and rollout display are selected to other nav. radio.

1E1, 2 - ALT SOURCE SEL CAPT INSTR - F/O INSTR



INSTRUMENT COMPARATOR PANEL

TEST 1 - Displays all comparison flags on both pilots' indicators. The ATT flag in the ADI appears on the side that is activated. If both pilots' test 1 are pressed at the same time all comparison flags except attitude will appear and the vertical gyro 3 light will be illuminated.

TEST 2 - Displays all monitor flags.

1D8, 26 - INSTR COMPARISON, PWR

LEGEND (TYPICAL)

COMPARISON FLAGS

Indicates captain's and first officer's instruments are displaying a significant difference.

Normal condition. Power off or instruments operating properly.

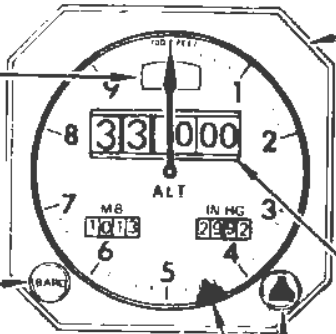
MONITOR FLAGS

Indicates comparison monitor failure.

Indicates failure of No. 3 gyro when not selected.

1E24, INS 3, GYRO 3

VERTICAL SPEED INDICATOR & ALTIMETERS



1F4 – ALTM
1F22 – ALTM

STATIC SYSTEM CORRECTION FLAG

Indicates failure of air data computer to correct for static error.

BARO

Knob sets barometric pressure. Also captain's baro knob adjusts both auto-pilots altitude select in NORM mode. First officer's knob adjusts both auto-pilots in STBY mode.

CORRECTED ALTIMETER

Displays corrected altitude from air data computer. Captain ADC 1, first officer ADC 2. Alternate selector switches permit either altimeter to be operated by either ADC.

FLAGS

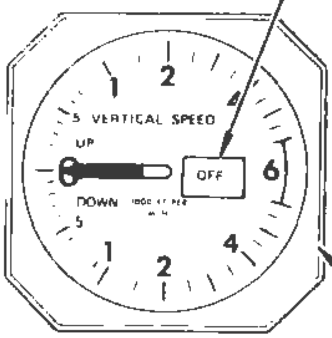
OFF – Indicates failure of the instrument or total failure of air data inputs.

NEG – Indicates below sea level.

ALTITUDE REFERENCE BUG AND SET KNOB

OFF FLAG

Indicates loss of power or unreliable indication.

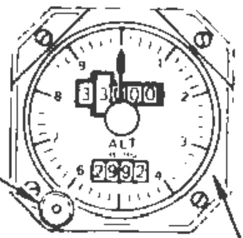


VERTICAL SPEED INDICATOR

Is operated by the air data computer, captain's by AOC 1, first officer's by ADC 2. The alternate selector switch may be used to switch vertical speed inputs to the apposite ADC.

BARO KNOB

Sets barometric pressure in inches of mercury.



STANDBY ALTIMETER

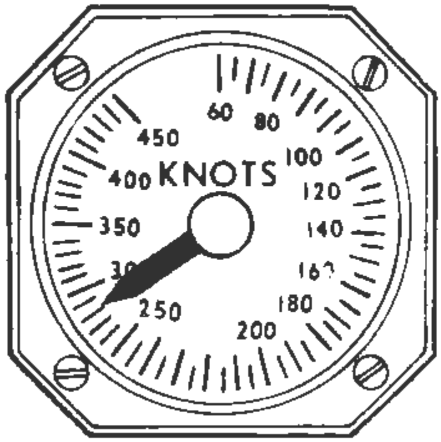
Pneumatic instrument. Direct reading from first officer's static system and is not corrected for static system errors.

F1-5002-013-002

STANDBY HORIZON AND AIRSPEED INDICATOR

STANDBY AIRSPEED

Direct uncorrected pitot static indications from first officers system.



INSTRUMENT LIGHTS

OFF FLAG

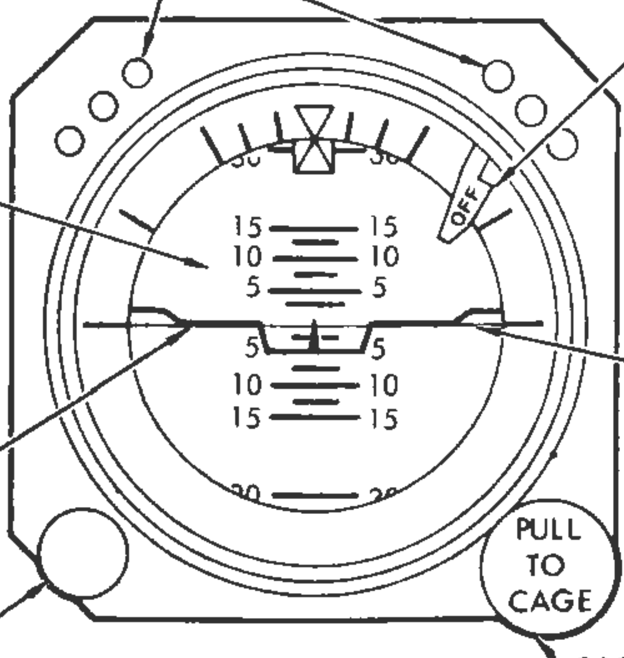
Indicates loss of power.

ATTITUDE DISPLAY

Operated by self contained gyro.

HORIZON BAR

AIRCRAFT REFERENCE



PITCH KNOB

Adjusts aircraft reference vertically.

IF6, 7 STBY HRZN INSTR.LT

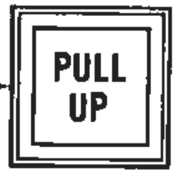
CAGE KNOB

May be pulled to erect horizon.

Aircraft must be level and OFF flag out of view before erection.

F1-5001-13-007

GROUND PROXIMITY LIGHTS



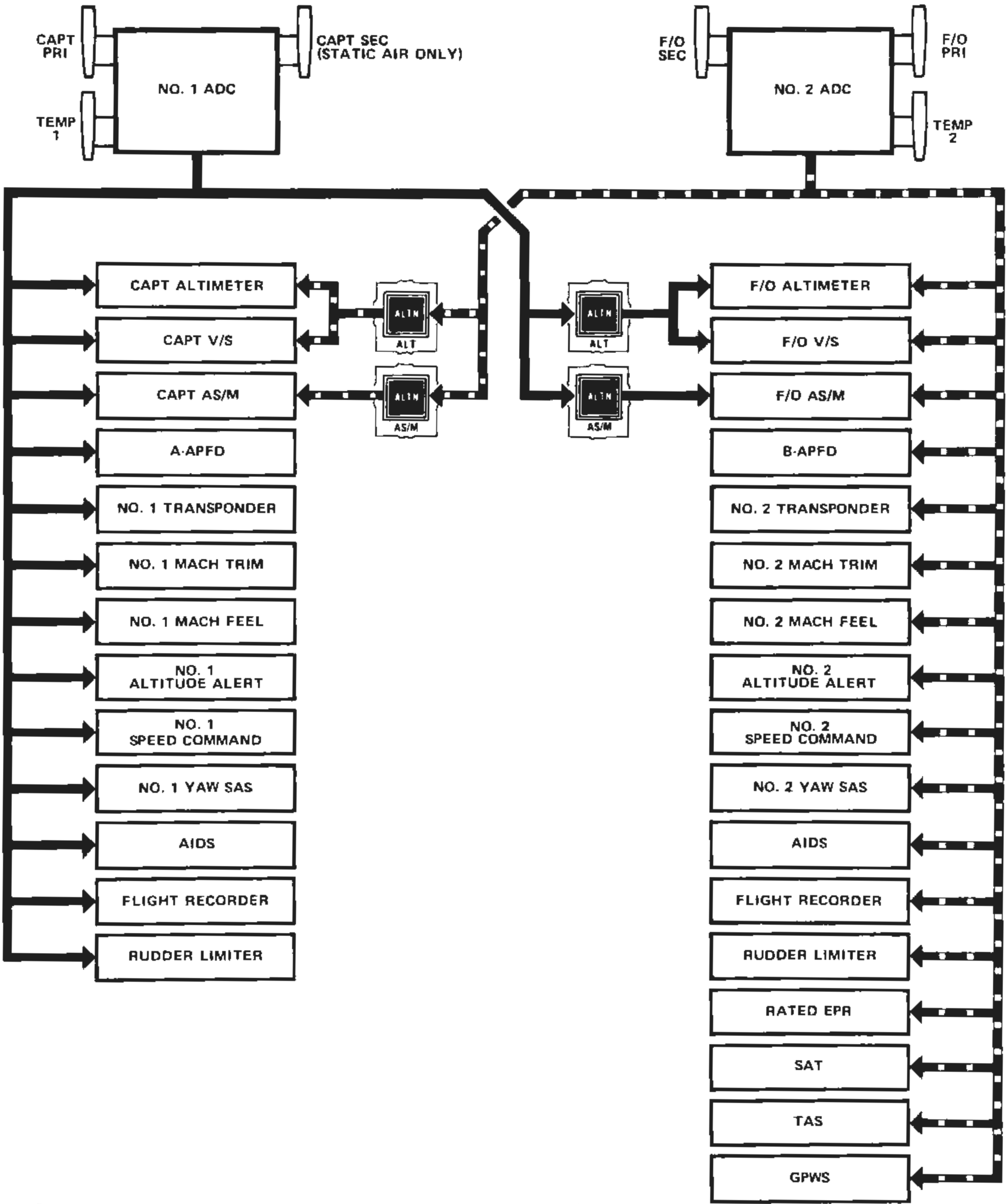
PULL UP WARNING LIGHT

Red light above radio altimeters indicates ground proximity warning for mode 1-4 potentially dangerous flight situation.
1B21 GND PROXIMITY LTS DC.

GROUND PROXIMITY WARNING FAIL LIGHT

Amber light on pilot's caution and warning panel indicates ground proximity warning system has failed. Light appears if power fails to GPWS computer, No. 1 radio altimeter or No. 2 air data computer. No ground proximity warnings will be received.
1B20 - GND PROXIMITY CMPTR AC.

PITOT STATIC/AIR DATA



AIR DATA COMPUTERS

Two independent air data computers receive pitot static and air temperature data from their respective probes. This information is distributed to electric altimeters, airspeed/mach and vertical speed indicators and other electronic units listed below.

Two pitot static probes, located on the forward side of the aircraft, provide the ram and static air inputs. The static air lines are interconnected for balanced pressure sensing.

The standby altimeter and airspeed indicator receive raw data from the first officer's pitot static probes and do not require any electrical power.

An air data computer failure is indicated by fail flags on the respective altimeter, vertical speed and airspeed/mach indicators. Alternate switching is provided.

NO. 1 ADC

- Captain's airspeed/mach
- Captain's altimeter
- Captain's vertical speed
- A autopilot/flight director computer
- No. 1 transponder
- No. 1 mach trim
- No. 1 mach feel
- → No. 1 speed command
- No. 1 altitude alert/select
- ⇄ No. 1 YAW SAS
- Rudder limiter
- Flight recorder
- → AIDS

NO. 2 ADC

- First officer's airspeed/mach
- First officer's altimeter
- First officer's vertical speed
- B autopilot/flight director computer
- No. 2 transponder
- No. 2 mach trim
- No. 2 mach feel
- AIDS
- Flight recorder
- → No. 2 speed command
- No. 2 altitude alert/select
- → No. 2 YAW SAS
- → Rudder limiter
- ← Rated EPR
- ← SAT
- → TAS
- → Ground proximity warning

ALTERNATE SWITCHING

Alternate switches are available for both pilots. This includes switching for failures on airspeed indicator, altimeter, vertical speed, horizontal situation indicator and attitude director indicator. Except for the attitude and flight director switches, only one pilot can use an alternate switch at a time.

The air data instruments are designed so that each instrument can be switches to the other air data computer by pressing an alternate switch. Alternate switching is available if an instrument fails individually, or if an air data computer fails, resulting in several instrument failures. Failure of bus power, such as AC essential, AC standby, or No. 2 Flight Station bus, will cause several instrument flags to appear, however, alternate switching will not remove flags. DC Essential bus is required for switching action.

INSTRUMENT COMPARATOR SYSTEM

The instrument comparator system consists of an instrument comparator monitor unit and two instrument comparator warning indicators. The monitor unit contains four monitor channels which process attitude, airspeed, altitude, and heading information. If differences exist between the captain's and first officer's instruments, a warning annunciator appears on both comparator indicators.

If both HSIs differ by more than 6 degrees, heading annunciators appear. If both airspeed indicators differ by more than 6 knots, airspeed annunciators appear. Attitude annunciators will appear after one of the three vertical gyros has failed and the remaining two gyros differ by more than 5 degrees. Altitude annunciators will appear if both altimeters differ by 100-240 feet if the vertical speed is less than 800 feet per minute.

An instrument comparator monitor channel failure is indicated by the barber pole monitor annunciator. The appearance of one of these annunciators indicates a loss of power to the monitoring channel.

RADIO ALTIMETERS

Two independent radio altimeter systems provide altitude information up to 2500 feet above terrain. The altitude signals are supplied to the vertical tape instruments, ADIs, and autopilot computers. The system is designed to read zero altitude at touchdown.

Each pilot has a vertical tape readout up to 2500 feet above the terrain. A decision height (DH) bug is provided which can be set at altitudes from zero to 500 feet.

Each ADI provides radio altitude information up to 200 feet. It is a repeat indication from the vertical tape.

An aural and visual indication is provided at specified altitudes. Decision height lights illuminate on the ADI and vertical tape during descent. A beep tone also is heard. The decision height lights illuminate when the decision height setting is reached. A beep tone is heard at 500 feet and 50 feet prior to this setting, increasing in volume until the actual decision height is reached, then stops. The decision height lights can be extinguished by pressing the vertical tape DH light.

The autopilot computer(s) receive a 1500 feet radio altitude signal which is one of the requirements for autoland track. At 150 feet, the radio altitude signal is supplied for the align sequence to begin. At 50 feet, signals program the flare function to begin. At 5 feet, the rollout bar appears.

An off flag will appear on the vertical tape indicator if the respective receiver/transmitter unit fails or the indicator malfunctions. When an off flag appears, a shutter also covers the ADI altitude indication.

GROUND PROXIMITY WARNING SYSTEM (GPWS)

The GPWS is designed to provide a warning for five modes of operation, considered potentially dangerous flight situations. The system consists of a computer, two red pull-up warning lights, and an amber ground proximity fail light. It gives aural warnings over a cockpit speaker.

The computer is powered by the No. 2 flight station bus. It receives signals from the No. 1 radio altimeter, No. 2 air data computer, No. 2 ILS receiver, landing gear lever position, and flap position.

A loss of electrical power to the computer or one of the system inputs is indicated by the amber ground proximity fail light. Warnings will not be received if this fail light is on. Failure of the No. 2 ILS receiver will not turn the failure light on; it will only cancel the glide slope mode without affecting the other four modes.

The warnings for modes 1 through 4 are the red pull-up lights accompanied by the words "whoop, whoop, pull up" sound over the cockpit speaker. The "glide slope" sound is the only warning provided in mode 5. All ground proximity warnings operate continuously until the aircraft is flown out of the warning zones; however, the glide slope warning can be cancelled by pressing either pull-up light. The glide slope mode will automatically reset when the aircraft flies below 50 feet or above 1000 feet, a VOR frequency is selected, or gear/flaps are recycled. All warnings are deactivated below 50 feet.

Warnings from modes 1 through 4 have priority over a mode 5 warning if they are triggered simultaneously. Stall warning has priority over GPWS. If No. 2 stall warning channel fails, or switch is released to off, no ground proximity warnings will be received.

Warnings are provided under the following conditions:

Mode 1 excessive descent rate.
This mode is active when the aircraft is descending between 2000 and 50 feet.

Mode 2 excessive terrain closure rate.
This mode has two closure rates, depending on flap configuration, which warn of flying toward rising terrain.

Mode 3 altitude loss after takeoff.
This mode is active when climbing from 100 to 700 feet AGL.

Mode 4 not in landing configuration.
This mode is active from 500 feet to 50 feet AGL. A warning is given if the aircraft descends:

1. Through 500 feet and the landing gear lever is not down.
2. Through 200 feet if flaps are not at 33 degrees.

This mode reverts to Mode 3 when below 500 feet and a missed approach is initiated.

GROUND PROXIMITY WARNING SYSTEM (GPWS) (Cont'd)

Mode 5 low on glide slope.
This mode is active when between 1000 feet and 50 feet, No. 2 ILS receiver is tuned to a valid glide slope signal, and the gear is down. The aural "glide slope" warning is heard if the aircraft exceeds 1 1/3 dots below the glide slope if the above conditions are met. Glide slope warnings are repeated at increasing frequency as altitude decreases. At 300 feet the volume of the aural warning increases if the aircraft is still low. No visual warning is given for this mode.

The system is tested on the ground by pressing either pull-up light. The ground proximity and pull-up lights illuminate. "Whoop, whoop, pull up" will be heard once followed by "glide slope". The aural test warnings will be at a lower volume level than if the warning were received during flight.

* * *

ADDITIONAL PROCEDURES

CONTROLS AND INDICATORS

SCHEMATICS

SYSTEM DESCRIPTION

* * *

GROUND FUEL TRANSFER

If it is necessary to transfer fuel from tank to tank, use the following procedure.

1. Turn on both tank pumps in supplying tank.
2. At the right fueling station.
    a. Turn on system power switch.
    b. Open the fueling valve of the tank to be supplied.
    c. Open the defueling valve of the supply tank.
    d. Open isolation valve if the involved tanks are in opposite wings.
    e. Monitor quantity indicators. When correct amount is transferred, close fueling, defueling, and isolation valves. Turn off system power switch.
3. Turn off tank pumps.

FUELING WITH INOPERATIVE QUANTITY INDICATOR

1. Release dripless measuring sticks in tanks to be serviced.
2. Fill tanks using normal fueling procedures.
3. Determine fuel level by observing dripless sticks. When desired quantity is obtained, stop fueling and secure all dripless sticks.

TANK 1A OR 3A TRANSFER VALVE FAILURE
-100

1. Press failed transfer valve switch off.
2. Open appropriate gravity transfer valve.
3. When tank quantity drops to 800 pounds, close gravity transfer valve.

Remaining fuel will be automatically transferred by the scavenge system.

* * *

FUEL JETTISON PANEL

TEST KNOB

Turning knob clockwise checks fuel flow rate and fuel used system circuits.
Turning knob counter-clockwise checks only indicators operation. FF indicators drive to preset value and, as long as knob is held, fuel used indicators drive at that rate.

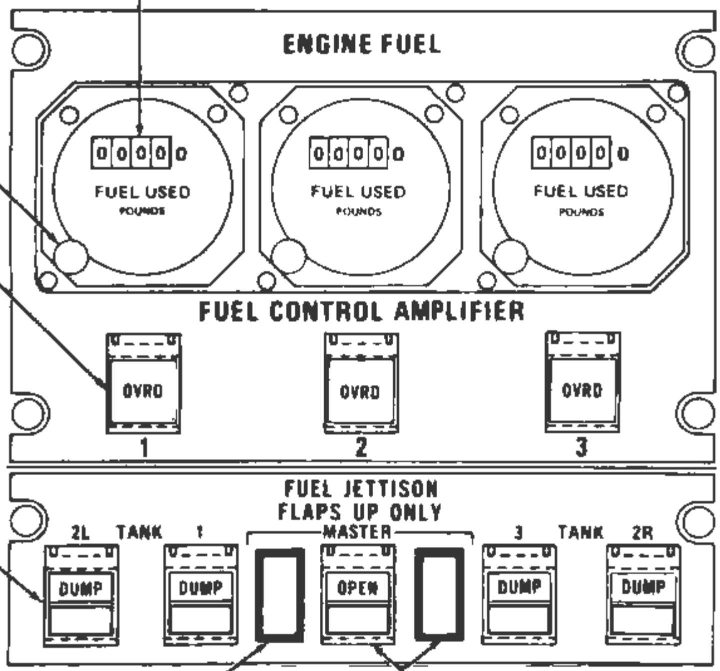
FUEL USED INDICATOR

Indicates fuel used since last reset.
3P5, 11, 17 - FUEL FLOW.

FUEL CONTROL OVERRIDE SWITCH

Overrides TGT and N_2 fuel limiting system.

IN - OVRD is illuminated. TGT and N_2 fuel limiting system inoperative.
OUT - OVRD is extinguished.
3P6, 12, 18 - CONT AMP.



FUEL DUMP SWITCH

Controls dump valves. Intransit light indicates power to valve motor.

IN - DUMP is illuminated to indicate switch position only. Unless dumping is terminated sooner, dump valves will close automatically at preset minimums.
OUT - DUMP is extinguished
3U3 - JTSN & DEFUEL 2L & 2R.
3U11, 12 - JTSN & DEFUEL 1 & 2.

JETTISON MASTER SWITCH

Controls jettison valves and cross-ship isolation valve. Arms dump switches.

IN - OPEN is illuminated to indicate switch position only. In-transit light indicates power to cross-ship valve motor.
OUT - OPEN is extinguished, the jettison valves and cross-ship isolation valves are closed, and the dump valve switches are disarmed.
3U18 - JTSN ARM.

JETTISON VALVE IN-TRANSIT LIGHT

Indicates power to left and right wing fuel jettison valve motors.
3U18 - JTSN ARM

FUEL CONTROL PANEL (SHEET 1)

TOTAL FUEL QUANTITY INDICATOR

Indicates total fuel on board and gross weight.
3U2 - INBD PUMP IND.

GROSS WEIGHT SET KNOB

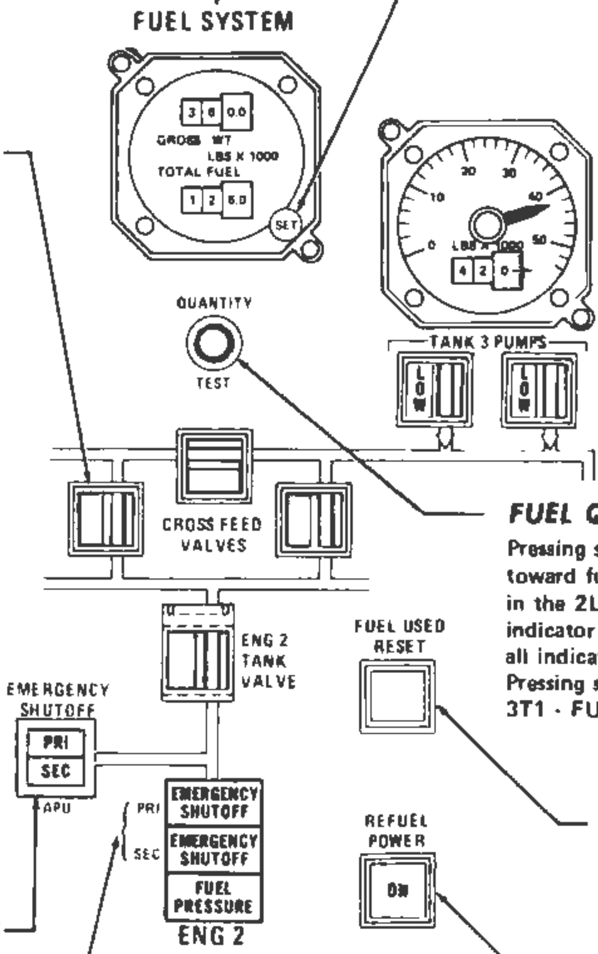
Used to set initial gross weight. Readout is automatic thereafter.

CROSSFEED VALVE SWITCH

In-transit light; indicates power to valve motor.

IN - Flowbar is illuminated to indicate switch position and crossfeed valve is opened.
OUT - Flowbar is extinguished and crossfeed valve is closed.

3T7, 10, 13 - EMER & XFEED.



FUEL QUANTITY TEST SWITCH

Pressing switch drives all quantity indicators toward full and illuminates the LOW light in the 2L and 2R INBD fuel low quantiy indicator switch. Releasing switch returns all indicators to actual quantity readings. Pressing switch could terminate fueling.
3T1 - FUEL QTY IND TEST.

FUEL USED RESET SWITCH

Reset fuel used indicators to zero.

APU EMERGENCY SHUTOFF VALVE IN-TRANSIT LIGHTS

Primary and secondary valve controlled by APU master switch and engineer or external APU fire pull.
Fire signal will also close both valves if system armed.

1D15 - FUEL SHUTOFF VALVE APU
3S7, 8 - FIRE WALL SHUTOFF.
1J7, 8 - APU FIRE SHUTDOWN & APU SEC EMER SHUT-OFF
3B15, 16 - CONTROL & PRI FW SOV.

ENG 2 EMER SHUTOFF VALVE IN-TRANSIT LIGHTS

Illuminated to indicate power to valve motors controlled by No. 2 engine fire pull handle.
3T10 - SEC EMER CX FEED.
1D14 - PRI EMER 2.

REFUEL POWER SWITCH

On in illuminated to indicate master switch at refuel panel is armed.
When pressed on is extinguished, power is removed from fueling panel and refueling is terminated.
GALLEY CB PANEL.

FUEL CONTROL PANEL (SHEET 2)

2L/2R INBD LOW/QUANTITY SWITCH

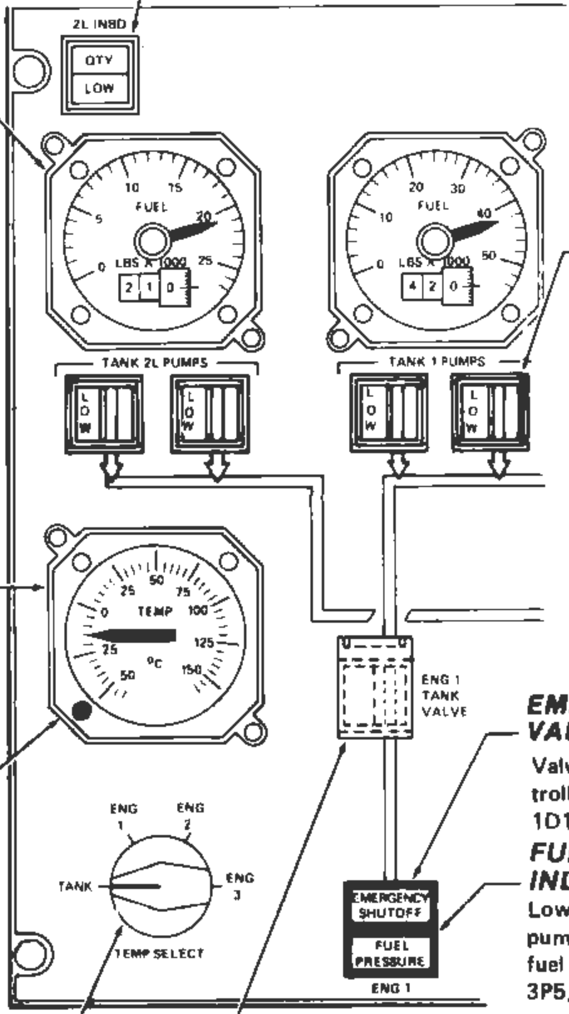
IN - QTY is illuminated and fuel quantity indicator shows inboard tank fuel quantity only.

OUT - QTY is extinguished and fuel quantity indicator shows both inboard and outboard tank fuel quantity.

LOW - Inboard tank fuel quantity is below 700 pounds.

QUANTITY INDICATOR

Individual tank fuel quantity.
3T1, 2, 3, 4, 5 - FUEL QTY IND.



TANK PUMP SWITCH

IN - Flow bar indicates switch position. Pump is energized.

LOW - Pump pressure is below minimum, or one phase is open on pump motor.

OUT - Flowbar is extinguished and pump is deenergized.

3U2 - INBD PUMP IND.
-100 - 3U1 - INBD PUMP IND.
3U5 THRU 3U10, 13, 14 - BODST PUMPS.
-100 - 3U3, 4, 7 THRU 10, 13, 14.
3U15 - OUTB PUMP IND.

TEMPERATURE INDICATOR

Tank 2L fuel temperature or temperature of fuel at fuel control inlet as selected.
3R13 - FUEL TEMP

TEMPERATURE TEST SWITCH

Tests fuel temperature indicator by driving pointer to 12 o'clock position.

EMERGENCY SHUTOFF VALVE IN-TRANSIT LIGHT

Valve motor energized. Valve controlled by fire control.
1D10 - FUEL SHUTOFF VALVE.

FUEL PRESSURE INDICATOR

Low output from engine low pressure pump, or excessive pressure drop across fuel filter.
3P5, 10, 16 - FUEL LOW PRESS.

TEMPERATURE SELECTOR SWITCH

Selects tank 2L or engine 1, 2, 3 fuel control inlet temperature to be read on fuel temperature indicator.
3R13 - FUEL TEMP.

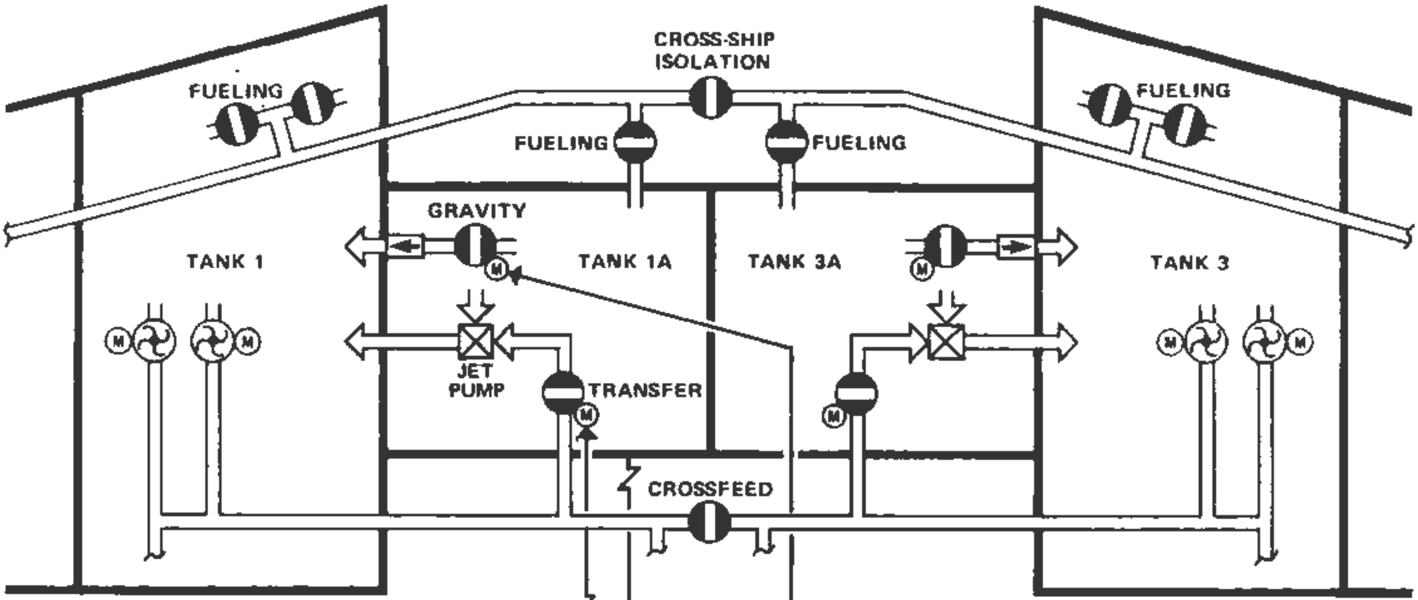
ENGINE TANK VALVE SWITCH

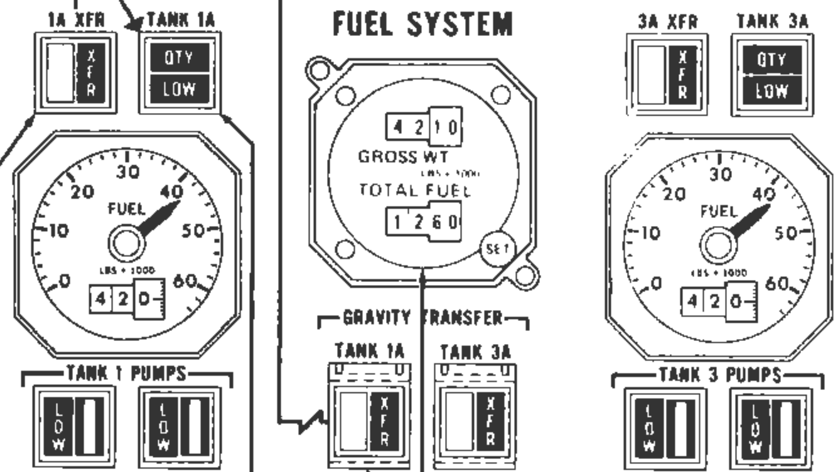
IN - Flowbar illuminates to indicate switch position. Valve is opened, in-transit light indicates power to valve motor. Fire control closes No. 1 and 3 valve and its flowbar goes out. No. 2 valve not closed by its fire control.

OUT - Flowbar goes out. Valve is closed.

3T6, 9, 12 - ENG 1 TANK VALVE.
1D10, 11, 12 - FUEL SHUTOFF VALVE.

CENTER TANK FUEL SYSTEM – *100*





CENTER TANK TRANSFER SWITCH

In-transit light indicates power to valve motor.

- IN - Arms valve to open when tank 1 or 3 can accept fuel. Arms the LOW light. XFR illuminates whenever fuel is transferring.
- OUT - Closes valve and disarms the LOW light.
- 3U5, 6 - SCAVENGE VALVE TANK 1 & 1A, 3 & 3A.
- 3U16 - SCAVENGE VALVE TANK 1A & 3A.

CENTER TANK LOW/QUANTITY SWITCH

- IN - QTY illuminates and indicator shows tank 1A (3A) quantity only.
- OUT - QTY is extinguished and indicator shows tank 1(1A)/3(3A) quantity.
- LOW - 1A/3A quantity is below 150 pounds if tank transfer switch is in.

TOTAL FUEL QUANTITY INDICATOR

3T5 - FUEL QTY IND 3.

CENTER TANK GRAVITY TRANSFER SWITCH

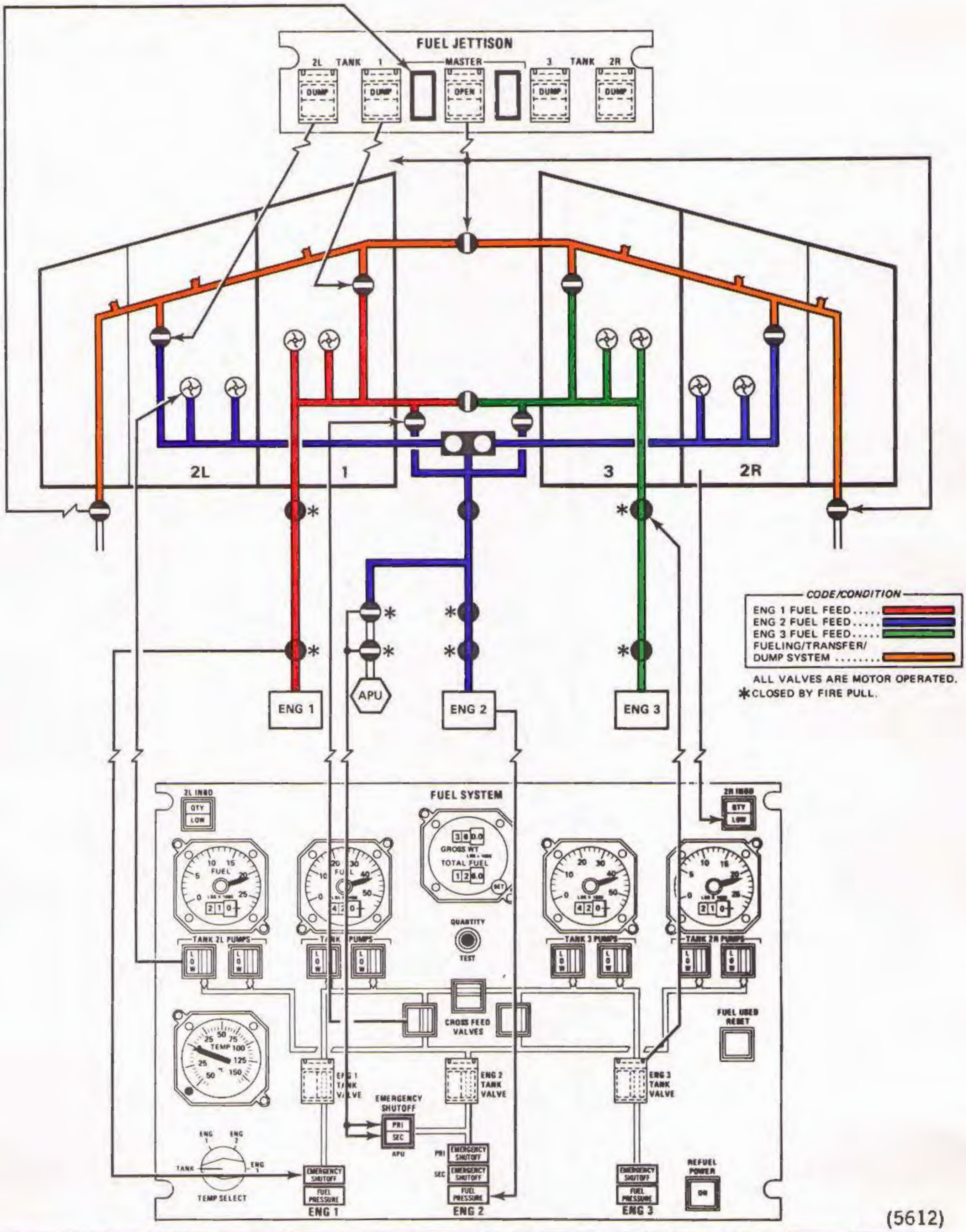
In-transit light indicates power to valve motor.

- IN - Opens valve. XFR illuminates to indicate switch position. Fuel transfers when level in main tank permits. All but 800 pounds can be gravity transferred.
- OUT - Closes valve.

Gravity transfer valve opens automatically when the Master Jettison switch is latched in.

1H14, 15 - GRAVITY FEED VALVE TANK 1A, 3A.

FUEL CONTROLS



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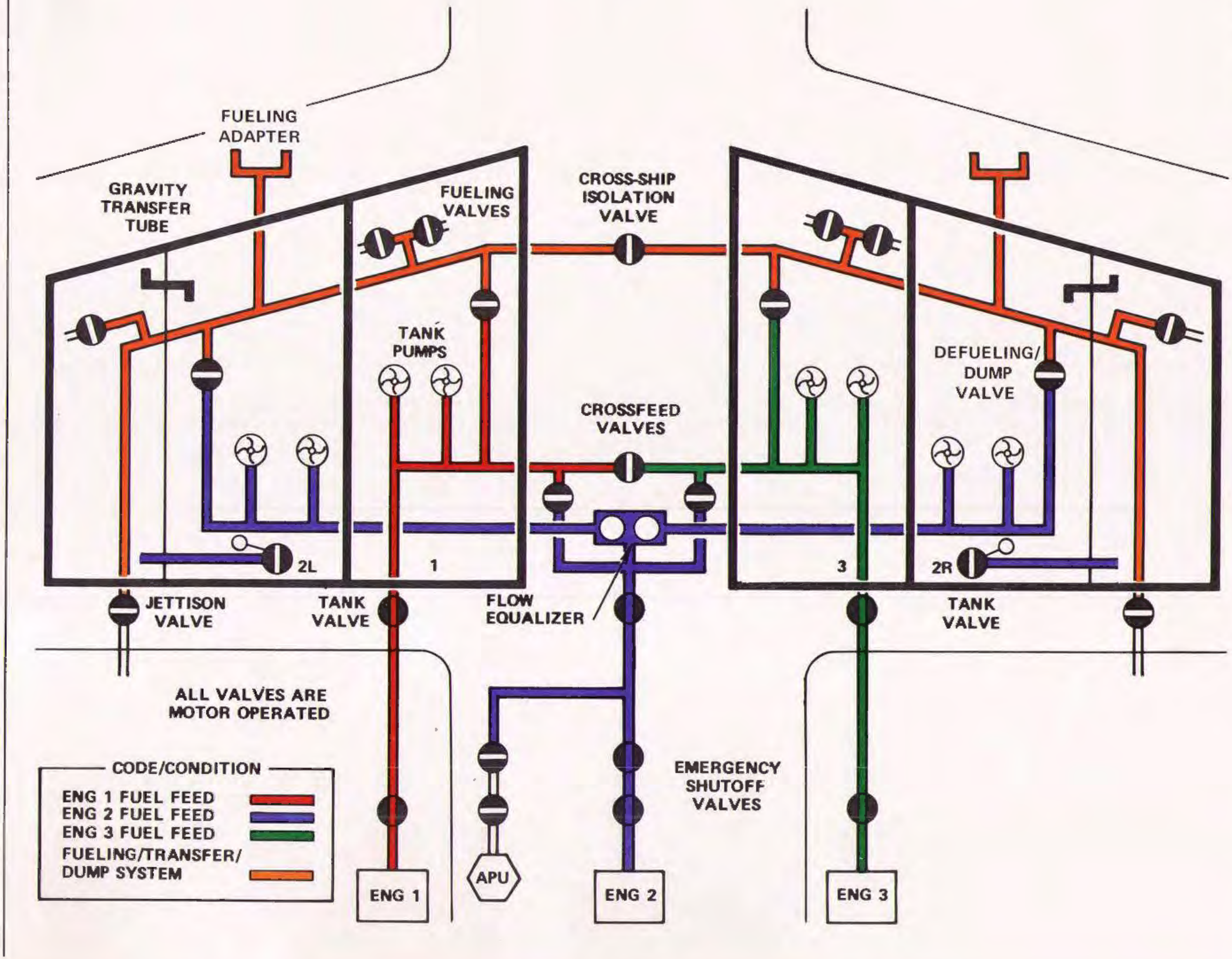
FUELING ADAPTER
GRAVITY TRANSFER TUBE
FUELING VALVES
CROSS-SHIP ISOLATION VALVE
TANK PUMPS
DEFUELING/ DUMP VALVE
CROSSFEED VALVES
2L
1
3
2R
JETTISON VALVE
TANK VALVE
FLOW EQUALIZER
TANK VALVE
ALL VALVES ARE MOTOR OPERATED
EMERGENCY SHUTOFF VALVES
CODE/CONDITION
ENG 1 FUEL FEED
ENG 2 FUEL FEED
ENG 3 FUEL FEED
FUELING/TRANSFER/ DUMP SYSTEM
ENG 1
APU
ENG 2
ENG 3

GENERAL

The basic fuel system consists of four tanks, all located in the wing, which function as a three tank system. Tanks are numbered 2L, 1, 3, and 2R, from left to right. On the *-100* aircraft, two auxiliary tanks, 1A and 3A, are installed in the center section. Although any tank can supply fuel to any engine, tank 1 normally supplies fuel to engine 1, tanks 2L and 2R supply engine 2, and tank 3 supplies engine 3.

The tanks have necessary sub-systems for engine feed and crossfeed, APU feed, quantity indicating, venting and scavenging, pressure and gravity fueling, defueling, and pressure jettisoning.

TANKS 2L and 2R

A fuel flow equalizer permits tanks 2L and 2R to act as one tank. The fuel flow equalizer performs as two pumps geared together. As fuel goes through one side, an equal amount must pass through the other side. Should the equalizer gears jam, a bypass feature permits continued fuel flow but the equaling feature is lost.

Tanks 2L and 2R have an inboard and outboard compartment for structural reasons. This design keeps fuel outboard as long as possible to reduce wing bending moments and aircraft drag. The compartments are connected by an automatic float transfer valve. Fuel is used from the inboard compartment until about 1,000 pounds remain. 1,000 pounds is the capacity of the surge box which contains the 2L and 2R tank (boost) pumps. Fuel from the outboard compartment is then automatically transferred by the float valve to maintain the 1,000 pound surge box level until the outboard compartment is depleted.

TANKS 1A and 3A *-100*

Tanks 1 and 1A and 3 and 3A operate as single tanks. Fuel in tanks 1A/3A must be transferred to tanks 1/3 to be utilized. Pressure transfer is accomplished by jet transfer pumps in tanks 1A and 3A. The jet pump power source is pressure from the tank pumps in tanks 1 and 3. Any time the tank pump(s) in 1 and 3 are on, pressure is available to the jet pumps. If necessary, fuel in tanks 1A/3A can be transferred to tanks 1/3 by gravity transfer valves. The gravity transfer method leaves approximately 800 pounds in each tank which will ultimately be transferred by the scavenge system.

APU FEED

The APU is fed from the engine 2 fuel line through two DC motor-actuated emergency shutoff valves. These valves are controlled by the APU fire control and the APU master switch. Any fuel tank that is providing fuel to engine 2 is also delivering fuel to the APU.

FUEL QUANTITY INDICATING

Fuel on board is shown at the engineer's panel by a total fuel quantity indicator and fuel quantity indicators for tanks 1/1A, 2L, 2R, and 3/3A. The total fuel quantity indicator derives its own information and does not read the tank quantity indicators.

The fuel quantity test switch drives all tank and total quantity indicators towards full. The switch should not be used during fuel servicing. If the indicators are driven to fuel service quantities, fueling is automatically terminated.

Fuel quantity/low switches permit selective indication of fuel quantity and provide low level warning for tanks 2L and 2R inboard and tanks 1A and 3A.

MEASURING STICKS

Dripless measuring sticks in each tank permit a manual reading of tank quantity. The system consists of a float ring with magnets encircling a stick with a metal tip. Fuel quantity is determined by pulling the stick all the way down, then raising it until it magnetically couples with the float. Quantity, in pounds, is read on the stick at the point where it enters the wing.

FUEL TANK VENTING

Each wing has a vent collector tank located near the wing tip. Each tank vents overboard through a standpipe line containing a flame arrestor in a scoop. The scoop is flush with the wing lower surface near the wing tip. Any fuel entering the vent lines is captured and returned to the tank 2 outboard compartment by the scavenge system.

FUEL TANK SCAVENGE

The scavenge system removes water from the bottom of the tanks and delivers it to the surge boxes where it is pumped to the engines. The system also scavenges what would otherwise be trapped fuel. Tank pumps supply the pressure for the operation of scavenge system jet pumps.

TANK PUMP AND VALVES

Tanks 1, 2L, 2R, and 3 each have two identical AC motor-driven tank (boost) pumps located in the surge box. The pumps in a given tank are powered from separate busses. One tank pump can supply the maximum fuel requirements of two engines.

In addition to the tank pumps, each main tank has a DC motor-actuated tank valve controlled by a fuel panel switch or engine fire control (tank 2 valve controlled by switch only.) The respective engine fire control also controls the DC motor-actuated emergency shutoff valve(s) at the engine firewall

Three DC motor-actuated crossfeed valves are provided. Two crossfeed valves can supply all engines from any tank.

All fuel valves have an in-transit light which illuminates when the valve motor is energized during valve opening or closing.

PRESSURE FUELING

Two pressure fueling stations, located just outboard of each wing engine, are used to fuel the aircraft. The right fueling station contains the controls and indicators necessary for fueling. A cross-ship isolation valve ties the two wings together when fueling from one station. Controls in the right fueling station permit the presetting of the quantity of fuel to be loaded into each tank. The system then automatically stops the fueling process when the preset level is reached. Controls are provided to pre-check this automatic shutoff feature.

Tanks 2L and 2R are fueled through the outboard compartment. Fuel enters the outboard compartment and flows through the float valve until 1,000 pounds is contained in the inboard compartment. The outboard compartment then fills before fuel spills through a cross-fill transfer line by gravity into the inboard compartment. This ensures that the outboard is full before more than 1,000 pounds is put into the inboard compartment.

Tanks 1A and 3A cannot be fueled unless the required fuel load is in excess of the capacity of tanks 1 and 3. When the fueling station quantity indicators are preset to a quantity greater than the capacity of tanks 1 and 3, tanks 1A and 3A fueling valves are automatically opened to accept the excess fuel load.

GRAVITY FUELING

Tanks 2L and 2R each have only one fueling valve. The failure of these valves would require overwing gravity fueling. Tanks 1 and 3 have dual fueling valves and pressure fueling can be accomplished through a single valve. Gravity fueling is not available for tanks 1 and 3.

DEFUELING

Defueling is accomplished by applying suction to the fuel hose adaptors or by operating the tank pumps. DC motor-actuated defueling/dump valves are in the lines that connect the engine feed system to the fuel manifold for outflow to the adaptors. These are the same valves that allow fuel to be moved from a tank during fuel jettison. These valves are controlled by defuel switches on the control panel at the right fueling station.

FUEL JETTISON

The master jettison switch opens the cross-ship isolation valve, both wing jettison valves and, if installed, tank 1A and 3A gravity transfer valves. The master switch also arms the four tank dump valve switches. The four tank dump valve switches open the tank dump/defuel valves. All valves are DC-motor actuated.

When the fuel in the 2L or 2R inboard tank is reduced to under 1,000 pounds, fuel is transferred from the outboard section but not fast enough to replace the fuel being burned and jettisoned. To protect against fuel starvation, the dump valve automatically closes whenever the inboard compartment fuel level drops to 900 pounds. As soon as more fuel is transferred from the outboard compartment, the valve automatically reopens. The 2L and 2R dump valves will continue to cycle, as indicated by the in-transit lights on the jettison panel, until the fuel level drops to the automatic shutoff level of 4,000 pounds (8,000 total in tank 2). Automatic shutoff level is also 8,000 pounds for tanks I and 3.

Jettison rate is proportional to the number of operating tank pumps. The jettison rate with all tank pumps operating is 4,500 pounds per minute.

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ENGINE PUMP OPERATION WITH SUCTION SHUTOFF OR PUMP SHUTOFF VALVE CLOSED

If either valve is closed, an entry must be made in the logbook. Include the time of operation and whether the engine was running or windmilling.

ATM LUBE HIGH TEMPERATURE OR LOW PRESSURE LIGHT ON

Turn ATM off.

ATM PUMP OUTPUT LOW PRESSURE OR CASE DRAIN HIGH TEMPERATURE LIGHT ON

Turn ATM off.

ENGINE PUMP OUTPUT LOW PRESSURE OR CASE DRAIN HIGH TEMPERATURE LIGHT ON

1. Turn off engine pump shutoff switch.
2. Restore system pressure if possible.

ATM OVERSPEED TEST

If an ATM overspeed test is accomplished, it will be necessary to turn the ATM control to OFF and to cycle circuit breakers 2L-13 or 2L-19 before turning the control back to AUTO in order to release the ATM overspeed lockout.

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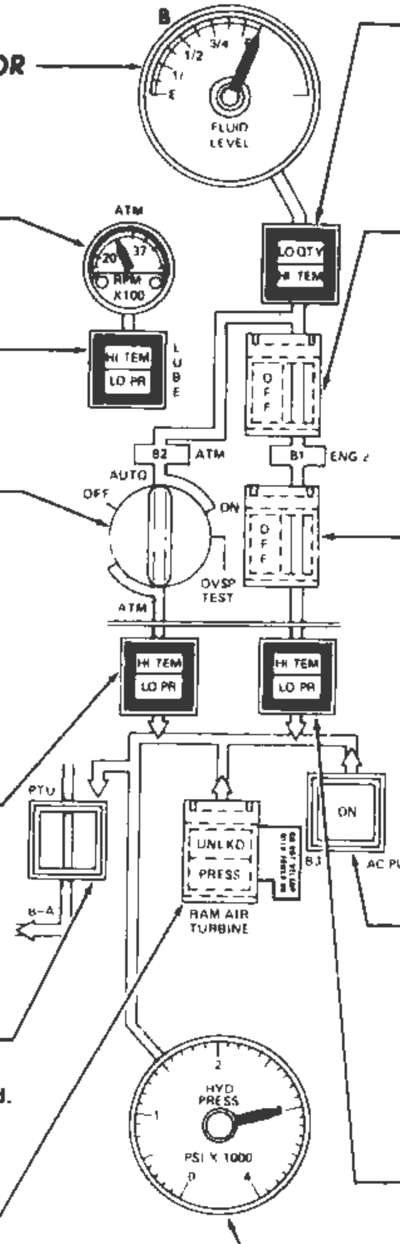
HYDRAULIC SYSTEM



RESERVOIR QUANTITY INDICATOR

2M12 - QTY

ATM TACHOMETER

ATM LUBE MONITOR LIGHTS

HI TEM - Oil temperature exceeds limit.
LO PR - Pressure is below limits. ATM run signal arms light.

ATM SWITCH

OFF - ATM is shutdown.
AUTO - ATM runs with a decrease in its system pressure.
ON - ATM runs constantly without cycling.
OVSP TEST - Activates overspeed shutdown to lockout ATM.
2L13 - ATM PUMP CONT & IND SYS B.
2L19 - ATM PUMP CONT & IND SYS C.

ATM PUMP MONITOR LIGHTS

HI TEM - Case drain fluid temperature exceeds limit.
LO PR - Pump output pressure is below limit. ATM switch must be in ON or OVSP TEST to arm both lights.

PTU SWITCH

Pressing switch illuminates flowbar and starts PTU if associated system is pressurized. Pressing again stops PTU and flowbar goes out.
2L14, 15 - PTU CONT & IND, SYS B, A, SYS C, D.

RAM AIR TURBINE SWITCH/INDICATOR

Pressing switch deploys RAT and places it in operation.
UNLKD - RAT uplocks are released.
PRESS - Pressure is being supplied.
1L3 - RAT AUTO DEPLOY.
1B14 - RAT MAN DEPLOY.
3G10 - IND LT RAT.

RESERVOIR FLUID MONITOR LIGHTS

LO QTY - Reservoir quantity low.
HI TEM - Reservoir fluid temperature exceeds limit.
2M14, 16, 18, 20 - RSVR.

SUCTION SHUTOFF SWITCH

Controls valve on suction side of pump. Valve also controlled by fire pull.
IN - Valve opens and flowbar shows switch position.
OUT - Valve closes and OFF shows switch position.
1L15, 16, 17, 18 - PUMP & FIREWALL SHUTOFF VALVE CONT.
2M15, 17, 19, 21 - IND LT PUMP.

PUMP SHUTOFF SWITCH

Controls depressurizing valve. Valve is also controlled by fire pull.
IN - Valve opens and flowbar shows switch position.
OUT - Pump is depressurized and OFF shows switch position.
1L15, 16, 17, 18 - PUMP & FIREWALL SHUTOFF VALVE CONT.
2M15, 17, 19, 21 - IND LT PUMP.

AC PUMP SWITCH

IN - Pump starts and ON shows switch position.
OUT - Pump shutdown and ON goes out.
2L10 - AC HYD MOTOR IND.
2L12 - AC PUMP B3.
2L22 - AC PUMP C3.

ENGINE DRIVEN PUMP MONITOR LIGHTS

HI TEM - Case drain fluid temperature exceeds limit.
LO PR - Pump output pressure is below limit. Engine pump switches must be in to arm light.
2M15, 17, 19, 21 - IND LT PUMP.

SYSTEM PRESSURE INDICATOR

2M13 - PRESS

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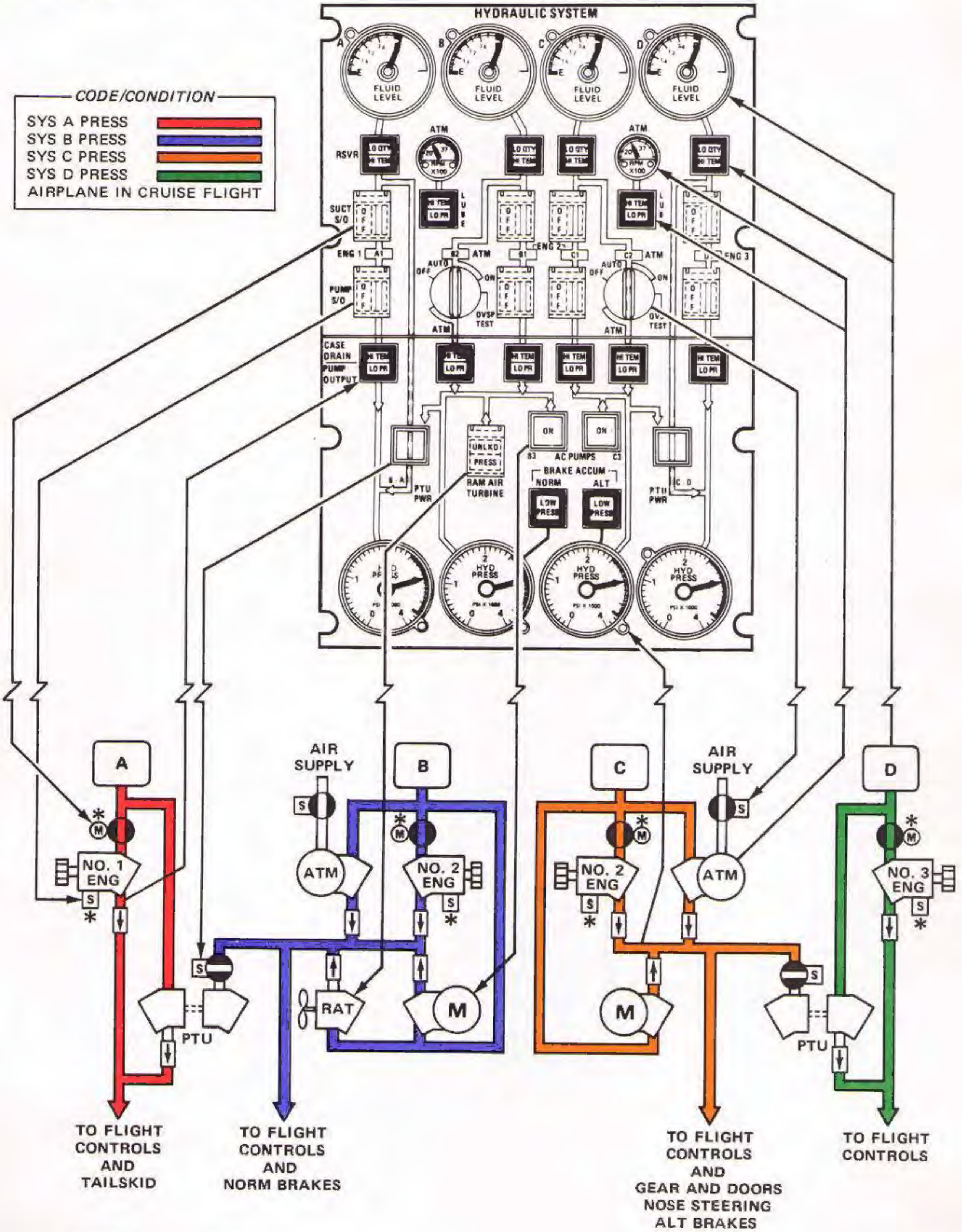
HYDRAULIC CONTROLS



*CLOSED BY FIRE PULL

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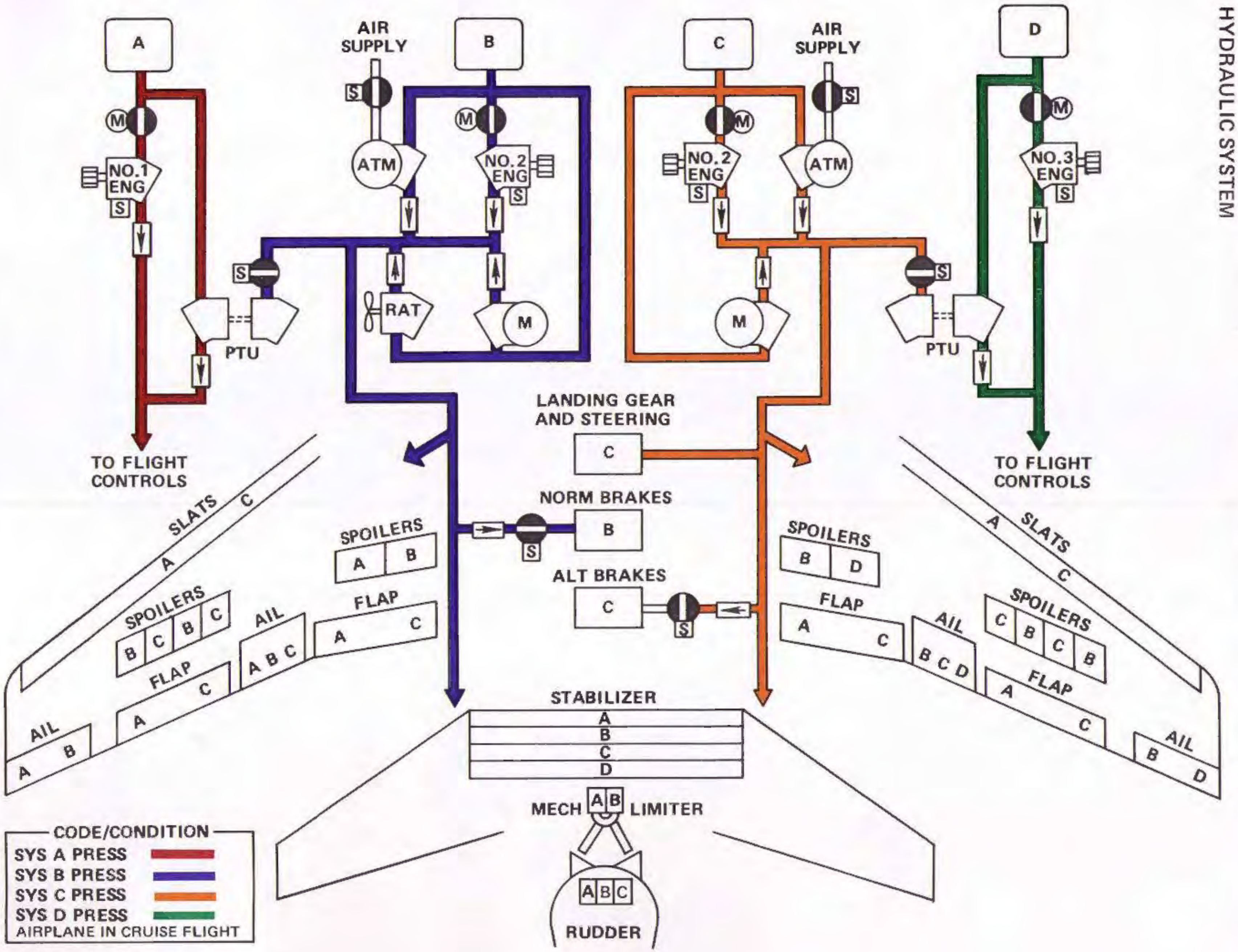
HYDRAULIC SYSTEM



HYDRAULIC POWER

There are four separate and independent 3000 PSI hydraulic systems. Hydraulic power is used to operate the fully powered flight controls, trailing edge flaps, leading edge slats, spoilers, landing gear, main wheel brakes, tail skid and nose wheel steering.

The hydraulic power panel is located on the engineer's upper instrument panel. The pilots annunciator panel has one hydraulic system warning light that comes on when any warning light on the engineer's hydraulic panel is on.

The four hydraulic systems are identified as A, B, C, and D. Each system has an engine driven pump as the primary source of pressure. System A engine pump is driven by engine No. 1. System B and C engine pumps are driven by engine No. 2. System D engine pump is driven by engine No. 3.

Each system has a backup source of pressure. System A has a power transfer unit (PTU). This is a motor pump with the motor portion powered by system B and the pump portion, that produces pressure, in system A. System D also has a power transfer unit, transferring power from system C to system D.

Systems B and C each have an air turbine motor (ATM) which is driven from the aircraft's pneumatic product. Systems B and C also have AC electric pumps, provided primarily for ground operation. System B also has a ram air turbine (RAT). This is a self contained unit that is deployed into the airstream as a source of hydraulic power in flight with all engines below 51% N_3 or all four engine pumps shut down and both ATM's off.

All normal servicing and maintenance is done in the hydraulic compartment. All the major hydraulic power system components are located here. This is an unpressurized area in the fuselage between the main gears and is not accessible in flight.

ENGINE DRIVEN PUMP CONTROLS

SUCTION SHUTOFF

One guarded switch controls the suction shutoff valve of each engine pump. When the suction shutoff switch is in, the flowbar is on and the motor driven shutoff valve is open. The flowbar is the indication that the switch is on. Turning the switch off closes the suction shutoff valve, turns out the flowbar, and turns on the off legend. The off legend is an indication of switch position.

PUMP SHUTOFF

One guarded switch provides on-off control of each engine pump depressurizing valve. When the pump shutoff switch is in, the flowbar is on, and the pump automatically varies its displacement to produce maximum output at approximately 2850 PSI, reducing to zero output at 3000 PSI. The flowbar is the indication that the switch is in. Pressing the switch off energizes the pump depressurizing valve solenoid and stops pressure output from that pump, turns out the flowbar, and turns on the off legend. The off legend is the indication of switch position.

FIRE PULL HANDLE

The fire pull handle also controls the suction shutoff valve and the pump depressurizing valve. Pulling the fire pull handle will shut off fluid to and depressurize that engine pump. In the case of engine No. 2 this will shut down system B and C engine driven pumps. The switch flowbars, however, will remain on until the respective engine pump switches are turned off.

AIR TURBINE MOTORS

System B and C have air turbine motor driven pumps located in the left and right fuselage wheel well fairing area. The air turbine motors are driven by air from the aircraft's pneumatic duct. Overspeed protection is provided which will close the air valve stopping air turbine motor operation. Each air driven motor is controlled by a rotary switch with four positions as follows:

OFF - The air valve supplying the air turbine motor is closed.

AUTO - The air turbine motor will operate for a timed interval only during the time that system pressure is below normal.

ON - The air turbine motor will operate continuously maintaining normal system pressure.

OVERSPEED TEST - A false overspeed signal is introduced into the air turbine motor control circuit and stops the air turbine motor.

Operation of the air turbine motors is indicated on two tachometers; one for system B and one for system C. The normal air turbine motor operation is in the 3700 RPM green band.

If the air turbine motor is keeping system B or C in operation, the switch could be selected to ON to avoid cycling.

POWER TRANSFER UNITS

There are two power transfer units, one with the motor portion in system B and the pump portion in system A, transferring power from system B to A. A similar unit transfers power from system C to D. When the power transfer unit is the only source of pressure, system pressure will be about 2500 PSI. This is the result of a pressure loss in the transfer of power. One switch controls the operation of each power transfer unit. Pressing the switch on starts the power transfer unit and turns on the flowbar. Pressing the switch off stops the power transfer unit and turns off the flowbar.

ELECTRIC PUMPS

System B and C each have an AC electric pump provided primarily for ground operation and checkout of systems. One switch controls each electric pump. Pressing the switch on starts the electric pump and illuminates the on legend. Pressing the switch off stops the electric pump and turns off the on legend. Starting both electric pumps and both power transfer units will pressurize all four systems.

RAM AIR TURBINE

The ram air turbine is a propeller driven hydraulic pump designed specifically to power system B primary flight controls. The ram air turbine will extend through doors in the underside of the fuselage forward of the hydraulic compartment. Automatic deployment takes place in flight if all three engines fail or if all engine hydraulic pumps and air turbine motors are shutoff. When the ram air turbine is deployed, the unlocked light will be on. When the ram air turbine pump reaches operating pressure the pressure light will be on. The ram air turbine may also be deployed manually by pressing the switch. The indications will be the same as for automatic deployment.

WARNING LIGHTS

PUMP LOW PRESSURE

There is one low pressure light for each engine pump and each air turbine motor pump. This light will come on when pressure is too low for normal operation. The air turbine motor low pressure light is armed when the ATM is selected to on or overspeed test. The engine pump low pressure light is only armed when the suction shutoff switch and the pump shutoff switch are on.

CASE DRAIN HIGH TEMPERATURE

There is one case drain high temperature light for each engine pump and each air turbine motor pump. This light will come on when the case drain fluid temperature is too high for normal operations.

RESERVOIR LOW QUANTITY

Each system reservoir has a low quantity light that comes on when the fluid level is too low for normal operation.

RESERVOIR HIGH TEMPERATURE

Each system reservoir has a high temperature light that comes on when the temperature of fluid returning to that reservoir is too high for normal operation.

AIR TURBINE MOTOR LUBRICATION

Each air turbine motor gear box lubrication system has two warning lights. The high temperature light comes on when the gear box oil is too hot for normal operation. The low pressure light comes on when the gear box oil pressure is too low for normal operation. The high temperature light is armed all the time. The low pressure light is armed when the air turbine motor has a run signal.

*   *   *

* * *

ENGINE ANTI-ICE VALVE DOES NOT OPEN

If the heat light does not come on after the switch is turned on, or the heat light goes out when system operating, ice may build up on the cowl lip. Consideration should be given to reducing thrust on the affected engine to minimize fan blade damage in event of ice ingestion.

ENGINE ANTI-ICE HIGH PRESSURE LIGHT ON

The anti-ice valve has failed to regulate pressure. Continue to operate system as required. The pressure relief valve will maintain proper pressure within the cowl lip.

WING ANTI-ICE DUCT FAIL LIGHT ON

A probable rupture in the affected duct.

1. Turn off both wing anti-ice systems.
2. Avoid icing conditions.

WING ANTI-ICE OVHT LIGHT ON

Automatic system unable to control temperature.

1. Turn off auto switch and observe that valve open lights goes out.
2. When overheat light goes out, system may be turned on again by using manual switch.
3. When overheat light illuminates, close manual switch and continue with steps 2 and 3 as long as icing conditions exists.

AIR DATA SENSOR HEAT ALPHA OFF LIGHT ON

This could result in a false signal to stall warning or autothrottle systems.

1. With left off light on; turn off No. 1 stall warning and autothrottle switch.
2. With right off light on; turn off No. 2 stall warning and autothrottle switch.

WINDSHIELD DAMAGE

If delamination or shattering of the thin tempered outer glass (front face) occurs, vision may become obscured.

Windshield heat becomes inoperative and the affected control panel will indicate failure. No aircraft or cabin altitude change is necessary.

Pull related circuit breaker(s) for damaged window(s).

Allow window to cool as much as possible, then operate windshield washer system to assist the airstream in removing the glass particles. Reduced airspeed may be necessary to allow fluid to cover windshield.

WINDSHIELD HEAT FAULT LIGHT

Intermittent fault light indicates system is operating on the overheat temperature sensor. Allow system to operate this way until fault can be corrected.

Steady fault light indicates loss of heat to related windshield.

1. If the WINDSHIELD PWR breaker (2B-16/19) and WINDSHIELD CONT breaker (2B-15/18) are closed, open the associated control breaker, pause a few seconds, and reclose breaker.
2. If WINDSHIELD PWR breaker (2B-16/19) is open, the associated WINDSHIELD CONT breaker (2B-15/18) must be opened prior to closing the power breaker. Close control breaker after power breaker is closed.

If fault light remains on consideration should be given to ice accumulation.

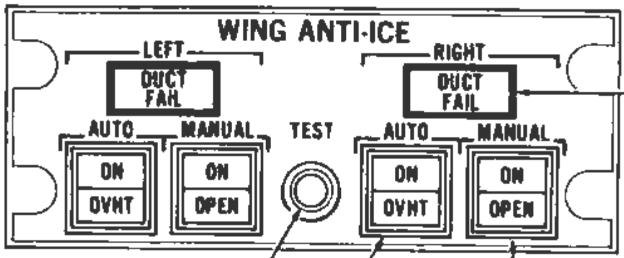
DRAIN MAST HEATER LIGHT ON

Indicates related heater element failure or temperature below normal.

If light remains illuminated for more than a few seconds, select other heater. Light should go out as unit warms up.

* * *

ENGINE AND WING ANTI-ICE



DUCT FAIL LIGHT

Temperature around duct is excessive. Tested with ECS area overheat test switch.

WING ANTI-ICE TEST SWITCH

Bypasses air/ground sensing to check system when airplane is on the ground with power and air pressure available.

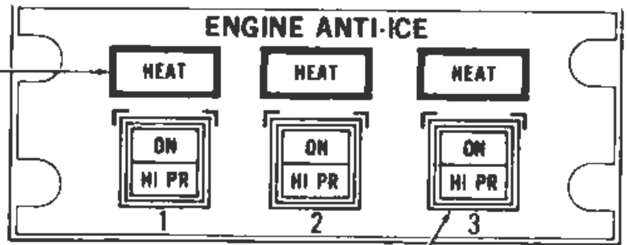
AUTOMATIC SWITCH

IN - ON indicates switch position. Energizes wing anti-ice valve to open with pressure.
OUT - Deactivates automatic mode.
OVHT - Slat temperature excessive either automatic or manual.

MANUAL SWITCH

IN - ON indicates switch position. Bypasses automatic control unit and energizes wing anti-ice valve to open with pressure.
OUT - Deactivates manual mode.
OPEN - Pressure in wing heating duct, manual or automatic.

2D22 - WING ANTI-ICE CONT.



HEAT LIGHT

Pressure in cowl leading edge.

CONTROL SWITCH

IN - ON indicates switch position. Energizes valve to open with pressure. No. 2 switch also activates VHF antenna anti-ice.
HI PR - Indicates overpressure in cowl. System will continue to function using overpressure relief valve.
OUT - Deactivates system.
2D15, 19, 20 - ENG ANTI-ICE.

VHF ANTENNA ANTI-ICE LIGHT

Light on indicates no heat to VHF antenna when No. 2 engine anti-ice is on.

AIR DATA SENSOR HEAT AND DRAIN MAST HEATER PANELS

(C & W PANEL)

ICING LIGHT

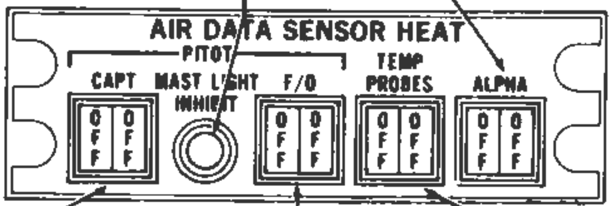
Ice on icing probe.
2D12, 13 - ICE SENSOR AC, DC.

ALPHA (ANGLE-OF-ATTACK) HEATER SWITCH

IN - Energizes the left and right alpha probe heaters.
OFF - Indicates heater failure or temperature below normal. On cold days it may take as much as five minutes to reach operating temperature.
OUT - OFF indicates switch position and de-energized heat.
2E12, 22 - LEFT ALPHA HEAT, RIGHT ALPHA HEAT.

MAST LIGHT INHIBIT SWITCH

Pressing switch extinguishes the off legend if the mast heater has failed. Off remains illuminated after pressing switch if the pitot probe heater has failed.



CAPTAIN'S PITOT HEAT SWITCH

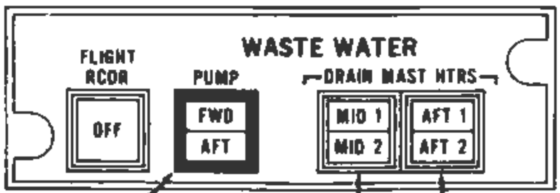
IN - Energizes captain's left and right pitot mast and probe heaters.
OFF - Indicates heater failure.
OUT - OFF indicates switch position and de-energizes heater.
3H14, 2E18 - CAPT PRI PITOT MAST HEAT, PITOT CAPT SEC.

FIRST OFFICER'S PITOT HEAT SWITCH

IN - Energizes first officer's left and right pitot mast and probe heaters.
OFF - Indicates heater failure.
OUT - OFF indicates switch position and de-energized heater.
2E16, 17 - F/O SEC, F/O PRIM.

TEMPERATURE PROBE HEATER SWITCH

IN - Energizes left and right temperature probe heaters.
OFF - Indicates heater failure.
OUT - OFF indicates switch position and de-energized heater.
2E19, 20 - TOTAL TEMP, L - R.



FLUSH PUMP LIGHTS FWD & AFT

FWD/AFT indicates failure of one or more of three flush pumps per system.
2B3, 6, 9 - FWD LAV FLUSH PUMP NO. 1, NO. 2 NO. 3. AFT PUMPS CB'S ON RIGHT GALLEY PANEL.

DRAIN MAST HEATER SWITCH

IN - Energizes the No. 1 mast heater and de-energizes the No. 2 heater.
MID 1/AFT 1 indicates heater failure or temperature below normal.
OUT - Energizes the No. 2 mast heater and de-energizes the No. 1 heater.
MID 2/AFT 2 indicates heater failure or temperature below normal.
2E 13, 14, 15 - DRAIN MAST CONT IND, MID, AFT.

WINDSHIELD HEAT CONTROLS

DEFOG FAN CONTROL SWITCH

IN - Energizes defog fan. ON is illuminated to show switch position only.

OUT - De-energizes defog fan and ON is extinguished.

2C13 - WINDSHIELD DEFOG & F/O WIPER PWR.

WINDSHIELD HEAT TEST SWITCH

With windshield heat switches OUT or IN and side window heat switches IN, pressing test switch tests windshields and side windows. Test result and test light indications are as follows:

NORMAL - Six fault lights cycle on and off at one to two cycles per second.

CONTROL CIRCUIT FAULT - Fault light is illuminated steadily.

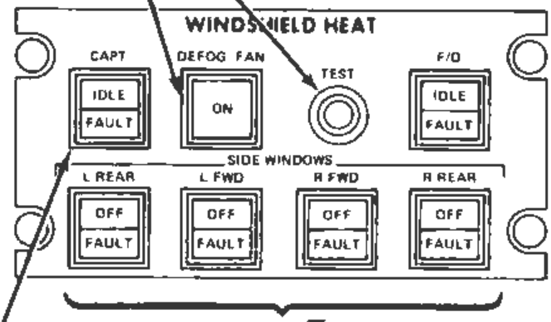
OVERHEAT CONTROL CIRCUIT FAULT

Fault light flashes then goes out.

HEATER ELEMENT BURNED OUT

Fault light is on before test; during test, FAULT light cycles on and off at one to two cycles per second.

2B18 - RIGHT WINDSHIELD CONT.



CAPTAIN'S WINDSHIELD HEAT CONTROL SWITCH

OUT - IDLE is illuminated whenever power is applied to the airplane and shows switch position. Low temperature warmup cycle is operating.

IN - Normal temperature control system is operating. IDLE is extinguished.

FAULT - On steady indicates no heat to window. On and off intermittently - window is operating on overheat controller.

2B15, 16, 18, 19 - WINDSHIELD CONT, PWR.

WINDOW HEAT CONTROL SWITCHES

OUT - Window heat system de-energized. OFF is illuminated to show switch position only.

IN - System operating on normal cycle. OFF is extinguished.

FAULT - On steady indicates no heat to window. On and off intermittently - window is operating on overheat controller.

2B12, 13, 14, 20, 21, 22 - SIDE WINDOWS.

WINDSHIELD WIPER CONTROLS

WINDSHIELD WIPER CONTROL SWITCH

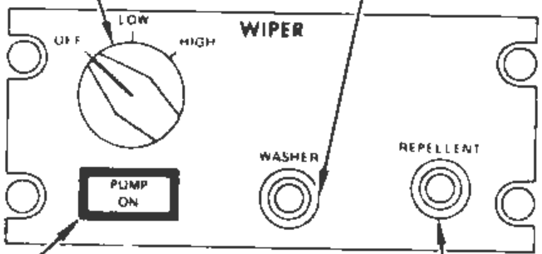
Controls on, off, and speed of respective windshield wiper.

3H 15, 17 - CAPT WINDSHIELD
WIPER CONT, PWR

WINDSHIELD WASHER PUMP SWITCH

Momentary switch, when pressed, operates washer pump and applies fluid to both windshields until pressed again. Volume is controlled by knobs located on left & right side panels.

2C 21 - WINDSHIELD WASHER PUMP



CAPTAIN'S

WINDSHIELD WASHER PUMP LIGHT

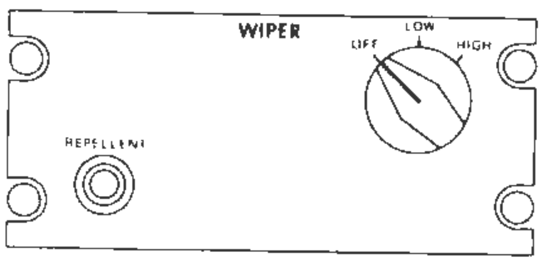
PUMP ON is illuminated to indicate that the pump is operating

2C 19 - WINDSHIELD WASHER
CONT

RAIN REPELLENT SWITCH

Pressing momentary switch releases measured amount of fluid to respective windshield.

1L1, 2 — RAIN REPELLENT



FIRST OFFICER'S

2C13-15 - F/O WIPER
PWR AND CONT

WING ANTI-ICE

The wing leading edge slats outboard of each pod are anti-iced by engine bleed air. Anti-ice air is obtained from the pneumatic manifold. A pressure regulating shutoff valve in each wing controls airflow downstream of the valve. A telescoping duct connects the supply duct to the anti-ice (piccolo) ducts in the slat leading edges. The piccolo ducts are perforated and direct the air against the slat skin. The slats may be heated when extended or retracted.

The left and right wing anti-ice systems are activated and monitored separately by switches and lights on the wing anti-ice panel. The system is normally operated in the automatic mode. The manual mode is used only if the regulating shutoff valve fails to open in the automatic mode.

During automatic operation, a temperature controller maintains slat skin temperature below 108°C. When this temperature is reached, the valve closes. The valve remains closed until the temperature has decreased to 38°C, then reopens to repeat the cycle. An overheat light in the switch light illuminates if the slat skin temperature reaches 120°C. A duct fail light on the control panel illuminates when the bleed air area overheat warning system senses an excessive temperature around the anti-ice supply ducts.

WING ANTI-ICE OPERATION

The system cannot be operated on the ground, except for testing. The left and right systems are identical. The systems can be operated separately but the operation of one without the other is not recommended. Ice accumulation on only one wing could result in serious control problems.

AUTOMATIC OPERATION

When the automatic switch light is pressed in, the wing anti-ice control circuit is energized, the engine high pressure bleed air valves are signalled to open, and the mixing ejector allows the necessary hot air to the anti-ice regulating shutoff valve. When the shutoff valve opens, the open legend in the manual switch light comes on. The skin temperature sensor in the wing slat is a dual sensor unit. One sensor controls the anti-ice valve and the other controls the overheat light. When the slat skin temperature reaches 120°C, the overheat light illuminates. Turning off anti-ice allows the slat to cool. There is no automatic shutdown for wing overheat. When the slat temperature reaches 38°C, the overheat light goes out. The wing anti-ice may then be operated manually using the overheat indications.

MANUAL OPERATION

The manual mode of operation overrides the automatic mode. If the open light does not illuminate when the automatic switch is pressed in, the manual switch may be used. The valve will open and the open light will illuminate. When operating in the manual mode, the temperature controller is deactivated.

TESTING WING ANTI-ICE ON THE GROUND

When either automatic or manual switch light is pressed in and air pressure is available, pressing the test switch will open the wing anti-ice valve and the open light will come on. When the test switch is released, the valve closes and the open legend goes out.

ENGINE INLET COWL ANTI-ICE

The engine inlet cowl and the P_1 probe on each engine are anti-iced by low pressure bleed air. Anti-icing airflow is controlled by a pressure regulating shutoff valve. When the engine anti-ice valve is open, it supplies bleed air to a distribution ring in the nose cowl and to the body of the P_1 probe. The distribution ring incorporates a series of holes through which anti-icing air is directed against the cowl inner skin, then exhausted into the engine fan inlet. A spring-loaded relief valve is provided to prevent overpressure in the nose cowl plenum.

The three engine anti-icing systems are individually activated and monitored by switches and lights located on the pilot overhead panel. When the engine anti-ice switch light is in, system operation is initiated and the heat light is illuminated. The operating condition of each system is sensed by two pressure switches. These switches are located just downstream of the engine anti-ice valve. Pressure downstream of the regulating valve will illuminate the heat light, showing that the valve is open. The other switch, set to show excessive pressure, will illuminate the high pressure light.

ENGINE INLET COWL ANTI-ICE (Cont'd)

HIGH PRESSURE LIGHT

The engine anti-ice valve functions as a pressure regulator. During normal operation, pressure in the engine anti-ice supply duct is automatically controlled to the distribution ring. If the anti-ice valve should fail to regulate and allow the pressure to exceed limits, the high pressure switch will turn on the high pressure light. If anti-ice duct pressure becomes excessive, a pressure relief valve located in the inlet cowl leading edge plenum opens, spilling the excess air overboard. The system may be operated safely with the high pressure light on as the pressure relief valve will vent excessive pressure overboard. In the event of an electrical or mechanical failure of the anti-ice valve, it can be manually locked open for dispatch.

VHF ANTENNA ANTI-ICE

The VHF antenna anti-ice system prevents ice accumulation on the No. 1 VHF antenna located on top of the forward fuselage. The antenna is anti-iced by hot air from number two and three packs. The airflow to the antenna is controlled by two electrically operated shutoff valves, one from each pack. When one or both valves are open, air is ducted to the VHF antenna. The VHF antenna anti-icing system is inoperative on the ground. This prevents overheating of the VHF antenna due to insufficient airflow.

The VHF antenna anti-ice annunciator light is located on the engineer's annunicator panel. It is illuminated during flight any time both VHF antenna shutoff valves fail to open when the number 2 engine anti-ice switch is on. The VHF antenna anti-ice light is extinguished whenever one or both of the VHF antenna anti-ice shutoff valves has opened.

The VHF antenna is automatically anti-iced in flight when the number two engine anti-ice control switch is on and the number two or three pack flow control valves are open.

WINDSHIELD HEAT, SIDE WINDOWS AND DEFOG FAN

The windshield and side window temperature controls incorporate electric heaters and temperature sensors embedded in the windows. The windshield has a conductive coating beneath the outer glass abrasion shield. The side window conductive coating is between the thick acrylic layers.

The windshield heat control panel, on the pilot overhead, has six switch lights for controlling heat. There is also a defog fan switch and a test button for checking the system. The two windshield switches have idle (out) and on (in) positions. The idle position provides low heat to the windshields. The on position provides normal heat. Pulling the system circuit breakers is the only way to turn off the heat.

The four side windows have on (in)/off(out) switches which provide normal heat when on. The normal heat to all windows is applied through a ramp scheduler to prevent sudden heat changes in the windows.

WINDSHIELD FAULT LIGHTS

There are fault lights in each of the switch lights. When the switches are in position to apply heat to the windows, the fault light is armed to indicate a malfunction in the circuit. The test switch provides a means to check the control circuits. When the test switch is pressed, all fault lights cycle on and off at about two times per second. Windshields will test in either the idle or on position; the side windows must be on to test.

DEFOG FAN

The defog fan is provided to assist in windshield warm up after the aircraft has been cold soaked. It blows ambient cockpit air over the windshields and the forward side windows. If the airplane is cold soaked, the defog fan should be turned on to prevent fogging and to assist in warming the windshield to operating temperature.

WINDSHIELD RAIN REPELLENT

The system consists of a pressurized fluid container and a manifold with a pressure gauge and float type quantity indicator. The fluid is distributed to the windshields through four nozzles supplied by solenoid valves and electric timers. The timers and solenoid valves are activated by push-buttons on the captain's and first officer's windshield wiper panels. Each time one of the buttons is pressed, a measured amount of fluid is sprayed on that windshield.

The fluid container is an aerosol pressurized throwaway can located outboard of the first ACM seat. The pressure gauge on the manifold has a green band and a red band to indicate system pressure. A float gauge with a refill mark shows the fluid level. Normal indications are pressure in the green band and refill mark out of view.

WINDSHIELD RAIN REPELLENT (Cont'd)

The captain's and first officer's controls may be operated individually. Fluid applications may be necessary every two to five minutes depending on rain intensity and airspeed. Windshield wipers may be used with repellent if required Rain repellent should not be used on a dry windshield or in light rain.

WINDSHIELD WIPERS

The captain and first officer have identical wiper controls. Each can select off, low, or high for his individual wiper. The high position gives about twice the wiper speed as the low position. When turned off, the wiper motor drives the blade to a parked position at the windshield base. Windshield wipers may be operated with rain repellent for better visibility. They are also used with windshield washers for windshield cleaning.

WINDSHIELD WASHERS

The windshield washer system is provided to spray washer fluid on the windshield panels. Although normally used for windshield cleaning, it may also be used to assist in removing a shattered outside surface on a windshield. The windshield washer has a one gallon capacity reservoir and a spray system consisting of an electrically operated pump, a control switch, two manual control valves, and two spray nozzles for each panel.

The manual control valves, located on the pilots' left and right consoles, open the line for the fluid and adjust the rate of flow to the windshield panel. With the control valves open, the system is operated by pressing the on/off pump switch on the captain's windshield wiper panel. The pump will continue to run until the switch is pressed a second time. The pump on light is turned on with the pump switch pressed in. When the system is not in use, the manual control valves should be turned off to prevent inadvertent siphoning of the fluid.

AIR DATA SENSOR HEAT

The air data sensor heat controls and indicators are on the pilot overhead panel. The panel contains four switches with two off legends in each switch. When the switches are out the off legends illuminate. Normal operation is with all switches latched in and all off lights out.

PITOT/STATIC PROBES

Each of the four pitot/static probes has dual heating elements, one for probe and one for mast. Each off light monitors both heaters in each pitot/static probe. A mast inhibit switch is provided to determine which heater is inoperative if an off light illuminates.

TOTAL AIR TEMPERATURE PROBES

The two total air temperature probes have single heaters. The switch light has an off light for each probe. The off light will illuminate if there is a loss of heat to the related probe.

ALPHA SENSORS

There is a dual heating element in each of the two alpha (angle of attack) sensors. Each sensor has an internal thermostat which reverts to a low heat when the sensor is sufficiently heated. The off light goes out when the probe is heated to normal operating temperature. The off light comes on if there is a loss of heat to the probe.

ICE DETECTOR

The ice detector system consists of an ice detector mounted on the left side of the fuselage just aft of the radome and an icing caution light located on the pilots C and W panel. The detector probe vibrates ultrasonically at a resonant frequency of approximately 40,000 Hz. When ice forms on the sensing element, the probe frequency decreases. The detector circuit detects the change in probe vibration by comparing it with a reference oscillator frequency. At a predetermined frequency change, the ice detector circuit is activated. Once activated, the C and W icing light illuminates steady and a timer circuit is triggered. The operation of the timer circuit switches a probe heater on for a set period to remove the ice from the probes. After approximately 60 seconds, if the icing condition no longer exists, the timer circuit switches the system to the detector mode and the icing light will be extinguished. If the icing condition remains during the 60 second period, the C and W light remains on and the probe activates the circuit to repeat the cycle. This cycling will continue until icing conditions are no longer present.

WATER SUPPLY AND DRAIN LINE HEATERS

Heaters are provided to protect the waste system, water supply, and drain lines from freezing. Dual parallel heater assemblies are provided for additional protection. The drain heaters operate automatically whenever the temperature in the mast drops below a predetermined value.

Switches on the engineer's panel allow selection of the number one or two heater element. With the switch out the number one (normal) is selected. If the internal temperature in the masts drops below normal value, the selected switch light will illuminate. The light will go out when the temperature returns to normal.

The water lines have dual, thermostatically controlled electric heaters. If the temperature decreases enough to require supplemental heating, the secondary heater is energized. This causes the water line heater annunciator light to illuminate on the engineer's panel. When the water line temperature increases to normal value, the secondary heater de-energizes and the water line heater light goes out.

* * *

ADDITIONAL PROCEDURES

CONTROLS AND INDICATORS

SYSTEM DESCRIPTION

* * *

ANTI-SKID OFF LIGHT ILLUMINATED

The selected anti-skid system is inoperative and brakes have reverted to manual braking.

1. Select other brake system. If OFF light goes out, the system is normal.

2. If OFF light remains on, turn anti-skid off.

BRAKING WITH ANTI-SKID INOPERATIVE

When anti-skid protection is not available to one or more of the main wheels, there is a high probability of blowing tires if brakes are used early in the landing roll.

To reduce or eliminate the probability of blowing tires, it is recommended that brakes not be used until the deceleration effects of spoilers and reverse thrust have slowed the aircraft to near taxi speed.

When necessary to apply brakes, use caution with brake pedal inputs.

ANTI-SKID RELEASE LIGHT ON

1. Test both anti-skid systems.

2. Select the brake system that will provide the best braking.

A MAIN GEAR NOT RETRACTING

This is indicated by the landing gear door, in-transit, and individual door lights remaining on after gear retraction attempted.

1. Place gear lever down. When gear is down and locked, attempt another gear retraction.

2. If lights remain on, place gear lever to neutral.

3. Pull nose, left, and right main gear uplock mechanical release handles.

4. When gear is down and locked, stow the mechanical uplock release handles.

5. Place alternate hydraulic landing gear extension switch to alternate for 5 seconds.

6. Place gear lever up, when gear is up and lights out, return gear lever to neutral.

7. If lights remain on, return gear lever to neutral and maximum airspeed 250 knots.

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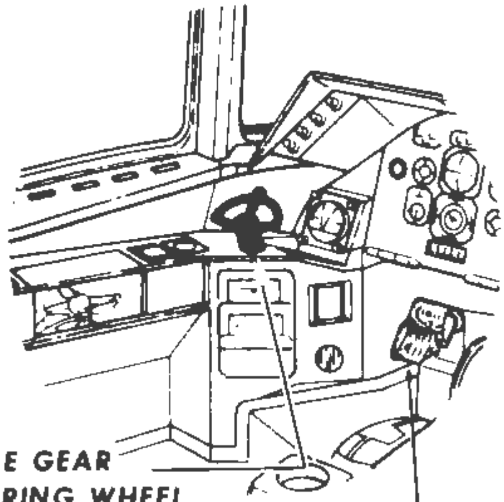
LANDING GEAR



NOSE GEAR STEERING WHEEL

Rotates nose wheel for steering when weight of aircraft is on the nose gear (strut compressed). Centering cam centers nose wheel when strut is extended.

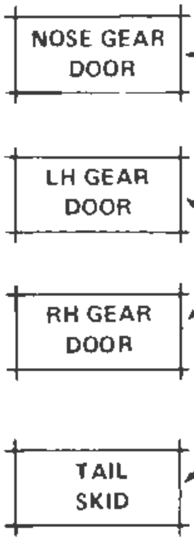
RUDDER PEDAL STEERING

Provides up to 10 degrees of steering. Disconnected in flight. Steering wheel overrides rudder pedal steering.
2F19 - NOSE STEERING.
2L8 - MLG GND SENSE.

DOWN LOCK RELEASE

Push to release gear lever if ground sense mechanism malfunctions. Either truck unlevel or strut not extended will lock landing gear lever down.

LANDING GEAR DOOR LIGHTS



NOSE GEAR DOOR

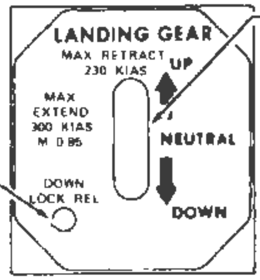
Left or right nose gear door is not closed.

LH GEAR DOOR OR RH GEAR DOOR

Respective inboard gear door is not closed and locked.

TAIL SKID LIGHT

Tail skid position does not agree with landing gear lever position.
2F13 - TAIL SKID IND.

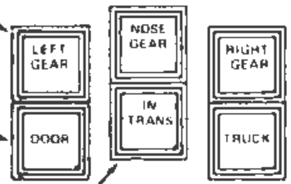


LANDING GEAR LEVER

Three-position lever with detents in each position controls landing gear and tail skid hydraulic operation.

UP	Retracts gear and applies inflight brakes.
NEUTRAL	Isolates the gear system from the hydraulic supply.
DOWN	Releases inflight brakes. Arms anti-skid system. Cannot be moved from down position when aircraft is on ground.

2F17, 18 - GEAR CONT No. 1, No. 2
2F12 - TAIL SKID CONT.



GEAR POSITION LIGHTS

Respective gear down and locked.
1L13 - DOOR POS IND.

DOOR POSITION LIGHT

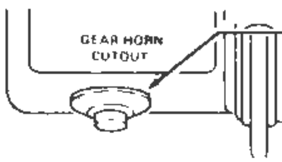
One or more gear doors open.
1L13 - DOOR POS IND

IN-TRANSIT LIGHT

Gear or doors in-transit or not in agreement with gear lever. Will not come on with gear up, doors closed, and gear lever neutral.
1L13 - DOOR POS IND.

TRUCK LIGHT

A truck not level. Gear lever locked in down position.
2F16 - TRUCK LEVEL.



GEAR WARNING HORN CUTOUT

Pressing button silences warning horn. Horn sounds when any throttle is retarded to idle with all gear not down and speed below 180 knots.
1L12 - WARN HORN.

LANDING GEAR MANUAL UPLOCK RELEASES AND DOWNLOCK MECHANICAL INDICATORS

VIEW LENS COVER RELEASE KNOB

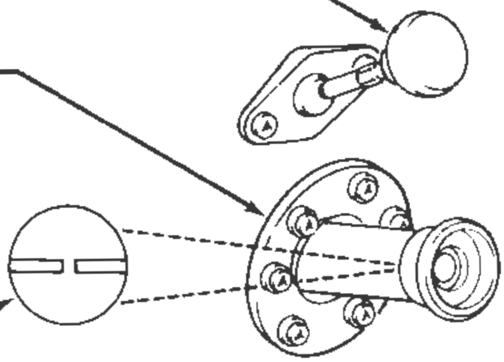
Pull to uncover view lens.

NOSE GEAR VIEW LENS

Mounted on aft bulkhead of forward avionics compartment used to check alignment of nose gear down lock mechanical indicator. Wheel well lights must be turned on at pilots' eyebrow panel.

NOSE GEAR DOWN-LOCK MECHANICAL INDICATOR

Two orange pins are aligned when nose gear is down and locked.



MAIN GEAR DOWN AND LOCKED INDICATORS

Extends to indicate respective main landing gear is down and locked.

TOP OF EACH WING
ABOVE MAIN GEAR

MANUAL GEAR EXTENSION HANDLES

Release landing gear uplocks mechanically, gear doors remain open. Gear and gear door position indicators operate normally. Gravity and air loads force gear down.

Nose gear handle bypasses landing gear selector valve.

ALTERNATE EXTENSION SWITCH

Extends all three landing gears, regardless of landing gear lever positions, by use of C system accumulator pressure. Acts as backup to gravity free fall manual extension.
Gear doors remain open. Gear and door position indicators operate normally to show doors open. In-transit light remains illuminated.
1L14 - ALTN GEAR CONT.

BRAKE TEMPERATURE AND ANTI-SKID PANELS

BRAKE OVERHEAT LIGHT

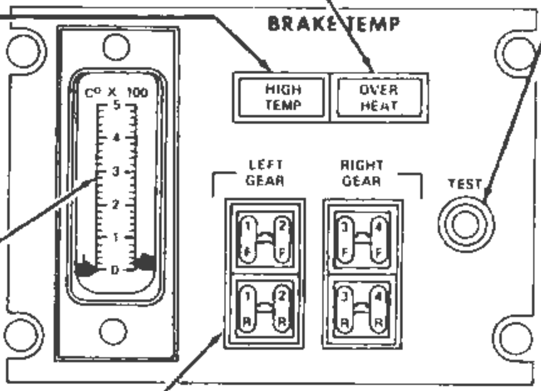
Any brake overheated.
If wheel brake temperature selector is pressed, light is monitoring selected brake only.
2G19, 20 - TEMP IND.

BRAKE TEMP LIGHT

Any brake overheat signal.
2G19, 20 - TEMP IND.

BRAKE HIGH TEMP LIGHT

High temperature signal from any brake.
2G19, 20 - TEMP IND.



BRAKE TEMPERATURE TEST SWITCH

Pressing switch will cause a 100°C increase on temperature indicator for the pair of brakes selected.
2G19, 20 - TEMP IND.

BRAKE TEMPERATURE INDICATORS

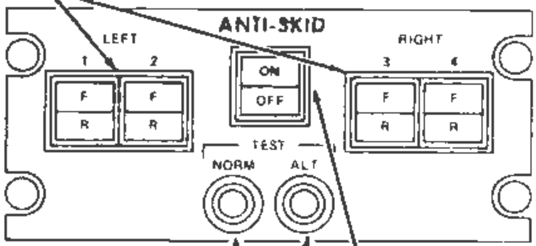
Indicate temperature of individual brakes as selected by brake temperature selector.
2G19, 20 - TEMP IND.

BRAKE TEMPERATURE SELECTORS

IN - Illuminates switch light and brake temperature indicator displays respective temperature.
OUT - Extinguishes switch light and brake temperature indicator reads zero. Prior to selecting a new temperature source, old source must be turned off.
2G19, 20 - TEMP IND.

ANTI-SKID LIGHTS

All lights are illuminated during system test. Individual lights indicate system has operated to release brakes on a skidding locked wheel.
2F22 - ANTI-SKID.



ANTI-SKID LIGHT

Indicates selected anti-skid system is inoperative.
2F22 - ANTI-SKID

ANTI-SKID SWITCH

IN - ON is illuminated and anti-skid system operative with gear lever in down position. OFF is illuminated when parking brake is set.
OUT - OFF is illuminated and there is no anti-skid protection available. No lights illuminated when gear lever is either neutral or up.
2F22 - ANTI-SKID.

NORMAL AND ALTERNATE TEST SWITCHES

When individually pressed, illuminates all lights to indicate anti-skid system is operative.
2F22 - ANTI-SKID.

BRAKE SYSTEM

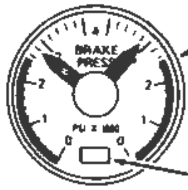
LOW PRESSURE LIGHTS

Indicates low accumulator hydraulic pressure.
2G22 - PARKING BRAKE NO. 2

HYDRAULIC PANEL

BRAKE PRESSURE INDICATOR

Indicates pressure on fluid side of normal and alternate brake accumulators



OFF FLAG

BRAKE SYSTEM SELECT SWITCH

NORM SYS B - Selects normal system for brakes.
ALT SYS C - Selects alternate system for brakes.
2G18, 22 - PARKING BRAKE NO.1 & NO. 2.

MAIN INSTRUMENT PANEL

PARK

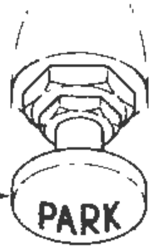
PARK SELECT B SYS

PARKING BRAKE WARNING LIGHTS

Indicate parking brake is on and there is pressure to the brakes.
2G18 - PARKING BRAKE NO. 1.

PARKING BRAKE KNOB

With rudder pedals depressed, parking brakes are set by pulling knob lever.
Disarms anti-skid system and illuminates anti-skid off light.
2G22 - PARKING BRAKE NO. 2.



CENTER CONSOLE

LOW BRAKE PRESSURE

LOW BRAKE PRESSURE LIGHT

Brake accumulator pressure is low.

* * *

LANDING GEAR

The landing gear consists of two, four-wheel truck type gears and a steerable dual-wheel nose gear. A retractable tail skid is provided to prevent damage to the aircraft in case of inadvertent overrotation during takeoff or landing. The landing gear is powered by hydraulic system C. The tail skid is powered by hydraulic system A. All the gears and the tail skid are operated by a single lever controlling an electric switch on the pilot's center instrument panel. Landing gear down and locked indication, gear and door warning lights, and truck unlevel lights are located beneath the gear lever. The engineer's annunciator panel has gear door and tail skid position lights. A gear warning horn will sound due to various unsafe conditions.

A cockpit operated, mechanical gear extension system unlocks the gears to free fall into the down and locked position.

An alternate hydraulic gear extension system using the alternate brake system C accumulator will also extend and lock all the gears down.

LANDING GEAR LEVER

The lever has UP - NEUTRAL - DOWN positions. The lever electrically controls the gear selector valve to hydraulically power the landing gear and the tail skid up and down. The gear lever is locked in the down position until the struts are extended and the trucks are level after takeoff. In an emergency the gear lever can be unlocked by pushing the down lock release button.

PILOT'S GEAR POSITION LIGHTS

Six lights for gear position are located on the pilot's center instrument panel:

Left gear, nose gear, right gear - Green lights that indicate that the respective gear is down and locked.

Door - Red light that indicates that one or more gear doors are open.

In-trans - Red light that indicates that any gear or any door is in-transit or not in agreement with the gear lever.

Truck - Amber light that indicates a truck is not level.

ENGINEER DOOR ANNUNCIATOR

Amber lights for the left and right main gear and nose gear door will be on when the respective door is not up and locked. The amber tail skid light is on any time the tail skid position does not agree with the gear lever position.

MECHANICAL GEAR EXTENSION

Mechanical extension of all the landing gears is provided by means of three pull handles. One handle for each gear is located in the cockpit under a cover at the aft of the center console. This mode of extension is entirely mechanical. Cables attach directly to the gear uplocks and the hydraulic system bypass valve. The gear will free fall aided by aerodynamic forces. Positive locking of all gears in the down position is aided by overcenter springs. The handles remain latched out and must be stowed before attempting to retract the gear. The main gear doors will remain open after manual gear extension.

ALTERNATE HYDRAULIC GEAR EXTENSION

An alternate hydraulic gear extension system is provided for use when the normal and manual operation fails to lock all the gears down. This system uses the alternate brake accumulator in system C as a source of power. When activated by a single switch located adjacent to the manual gear extension handles, system C brake accumulator pressure powers positive gear extension using separate lines. The gear extends and locks down, however the main gear doors will remain open.

MECHANICAL DOWN LOCK INDICATORS

Main gear mechanical down lock indicators, operated by the down lock, extend through the upper surface of the left and right wing when the respective gear is down and locked. These indicators may be viewed from the cabin. Nose gear down lock indicators are visible through an inspection tube on the aft bulkhead of the forward avionics compartment. Pulling a knob at that location uncovers the end of the inspection tube Two alignment rods are then visible indicating that the nose gear is down and locked. Turn on the wheel well lights on the pilot's eyebrow panel to see the pins.

TAIL SKID

Tail skid operation is controlled by the gear lever. When the gear lever is up, hydraulic system A compresses the tail skid shock strut to retract the tail skid. When the gear lever is down, the tail skid shock strut is released to the extended position. The position of the tail skid is indicated on the engineer's annunciator panel.

GEAR WARNING HORN

The gear warning horn sounds when any throttle is retarded to idle with all the gears not locked down and the airspeed below 180 knots. This warning may be silenced by pushing the gear horn cutout switch. The gear warning horn will also sound if the wing flaps are extended greater than 30 degrees with the gears not locked down. This warning cannot be silenced.

LANDING GEAR (Cont'd.)

NOSE WHEEL STEERING

Hydraulic system C pressure is used for nose wheel steering. The steering wheel provides 67 degrees of nose wheel steering. The rudder pedals may be used for up to 10 degrees of steering. The steering wheel overrides rudder pedal steering.

The rudder pedals are disconnected from the steering system:

When the steering wheel exceeds 7 degrees of travel.

When the rudder pedal force input opposes steering wheel input.

When the aircraft is in flight.

A centering cam in the nose strut centers the nose wheel when the strut is extended.

BRAKES

Each main gear wheel has a multiple disc brake installed. These brakes are normally powered by hydraulic system B. If hydraulic system B is not available system C can be selected as an alternate source of brake pressure. Each system is separated by a shuttle valve. Hydraulic fuses in both systems prevent complete fluid loss due to any leak in the brake area. Anti-skid is incorporated in each brake system to provide maximum braking efficiency. A parking brake is provided with the brake pedals, which permits setting the brakes using the normal brake system B.

BRAKE SYSTEM SELECTOR

A brake system selector on the pilot's center instrument panel permits the pilot to select either normal system B or alternate system C. The selector switch is normally positioned to normal system B.

BRAKE PRESSURE INDICATOR

A dual pressure indicator above the brake system selector switch indicates pressure in the normal and alternate brake system. This indicator reads the fluid side of each brake accumulator downstream of each brake system isolation check valve. Normal indication is 3000 PSI.

BRAKE ACCUMULATOR LOW PRESSURE LIGHTS

Normal and alternate brake accumulator low pressure lights are located on the engineer's hydraulic panel adjacent to system B and C pressure indicator. These lights come on if the respective brake accumulator pressure is low.

PARKING BRAKES

The brakes are parked by depressing the brake pedals and pulling the parking brake lever on the captain's side of the center console. The parking brake warning lights on the left and right side of the center console indicate that the parking brake is on and there is pressure applied to the brakes. The parking brakes are released by depressing the brake pedals. Brakes may be parked and released from either pilot position. The brakes will remain parked only in the normal system B selector position. When the parking brake lever is in the parked position the brake return lines are blocked and anti-skid turned off to conserve normal brake accumulator pressure. If selected to alternate system C with brakes parked, the return lines are not blocked and system C accumulator pressure will be depleted rapidly.

IN FLIGHT BRAKES

Automatic braking is applied using gear up pressure as long as the gear lever is in the up position.

BRAKE TEMPERATURE MONITOR

The brake temperature monitor is a means of determining the temperature of each main wheel brake. The brake temperature lights on the engineer's panel and the pilot's caution and warning panel are active all the time. The brake temperature indicator is only active if one of the brake temperature selectors is pushed in. The high temperature light on the engineer's panel will come on if any brake temperature is in the amber band. The overheat light on the engineer's panel and the brake temperature light on the pilot's caution and warning panel will come on if any brake temperature is in the red band. When these lights come on the overheated brake can be identified by pushing the brake selector switches in. A valid temperature reading is only available when one selector is in. The brake temperature test switch is used in conjunction with each temperature selector switch. Pressing the test switch will cause the selected pair of brake temperatures to increase 100°C. If this increases into the amber or red band, the high temperature and overheat light will also come on

ANTI-SKID

There are two anti-skid systems; one for normal and one for alternate brakes. Separate anti-skid valves are in each system. Normal or alternate anti-skid is selected when the brake system selector is positioned. Anti-skid is turned on and off with a switch on the anti-skid panel located on the pilot's overhead panel. The on light illuminates when the system is turned on and the gear lever is down. The off light illuminates with system failure, parking brakes set, or the anti-skid turned off.

ANTI-SKID (Cont'd.)

The individual brake anti-skid lights come on when that brake is being released on a skidding or locked wheel. The anti-skid light on the pilot's annunciator panel comes on when the selected anti-skid system is inoperative. The indication of normal anti-skid operation with the gear lever down is the on light illuminated. The individual release lights will not be on in flight. There is no touchdown protection. Prior to landing the brakes are not released by the anti-skid system. Anti-skid protection becomes available after initial wheel spinup on touchdown. Testing is provided for both the normal and alternate anti-skid. The gear lever must be down and normal system B selected to test anti-skid. Pressing each test switch individually will turn on all the release lights to indicate operative anti-skid systems.

* * *

ADDITIONAL PROCEDURES

CONTROLS AND INDICATORS

SCHEMATICS

SYSTEM DESCRIPTION

* * *

↓ADI FLAGS

ATT

1. Select alternate ATT.
2. Check CB-1 panel for tripped breaker.

FD

1. Check both VHF NAV radio frequencies agree.
2. Select alternate FLT DIR if flag remains in view.
3. Check CB-1 panel for tripped breaker.

R/O

Check CB-1 panel for tripped breaker.

GATE

Check CB-1 panel for tripped breaker.

HSI FLAGS

HDG

1. If VOR or ILS annunciated, select alternate HDG.
2. If RNAV annunciated, select alternate RNAV.
3. Check CB-1 panel for tripped breaker.

NAV

1. If VOR or ILS annunciated, select alternate DEV.
2. If RNAV annunciated, select alternate RNAV.
3. Check CB-1 panel for tripped breaker.

GS

1. Select alternate DEV.
2. Check CB-1 panel for tripped breaker.

RMI FLAGS

HDG

Check CB-1 panel for tripped breaker. Do not rely on pointers if flag remains in view.

POINTER

1. Check CB-1 panel for tripped breaker.
2. Select pointer to other data (VOR/ADF) if flag remains in view.

DME

1. Check CB-1 panel for tripped breaker.
2. Use other DME data if flag remains in view.

ILS CRUISE MONITOR LIGHT

1. Check CB-1 panel for tripped breaker.
2. Select usable ILS frequency and check for NAV/GS flags on HSI.
3. If NAV/GS flags appear on HSI, this confirms ILS receiver malfunction.

RADAR FAULT LIGHTS

ANT/RT

Select other radar system if mode other than TEST being used.

TRANSPONDER FAULT LIGHT

1. Select other transponder.
2. Check CB-1 panel for tripped breaker.

VERTICAL GYRO 3 LIGHT

Check CB-1 panel for tripped breaker. Dual autopilot operation not provided if light remains on.

INS MSU LIGHT

BAT

1. Turn off INS.
2. Follow appropriate instrument fail flag procedures.

INS CDU LIGHT

BAT

1. Attempt to restore normal INS electrical power.
2. If normal INS power cannot be restored, INS operating time can be extended by selecting AT[T] on MSU.

INS CDU LIGHT (Cont'd)

3. Turn off INS if MSU BAT light appears.

WARN

1. Turn off INS if MSU BAT light appears, or if MSU is in the ATT mode.

2. Select STS on CDU if MSU is in the NAV mode and check action code in right CDU window.

3. Press CDU TEST switch repeatedly and record all malfunction codes. If action code reappears, enter action and malfunction code(s) in aircraft log.

4. Follow the appropriate action code procedure:

   01 - Turn off INS and follow the appropriate fail flag procedure.

   02 - Follow the appropriate FINC light procedure if FINC light on. If no FINC light is on, leave INS in NAV mode, but use another INS for primary navigation. Monitor STS on CDU. If 02 changes to 01, turn off INS.

   03 - Check HSI for unreliable data. Select alternate RNAV if unreliable.

   04 - Select STBY, then NAV to re-align INS. After inserting present position, select STS, press and release TEST switch until all codes clear and WARN light goes out.

FINC LIGHT

1. Check CDU for WARN light, action and malfunction code. Check HSI for unreliable data.

2. Select alternate RNAV if No. 1 or No. 2 INS FINC light on.

3. Select unaffected autopilot/flight director.

INS IN FLIGHT RESTART

1 Select ATT on MSU. After warm up, attitude data only will be provided.

2. Maintain aircraft in stabilized flight until ATT flag retracts from view on ADI.

* * *

ATTITUDE DIRECTOR INDICATOR (ADI) FLAGS AND VERTICAL GYRO 3 LIGHT

ROLLOUT BAR

Appears at 5 feet with autopilot engaged in A/L mode to provide roll-out guidance after landing.

BANK ANGLE INDEX

Indicates aircraft bank angle in 10 degree increments.

HORIZON LINE

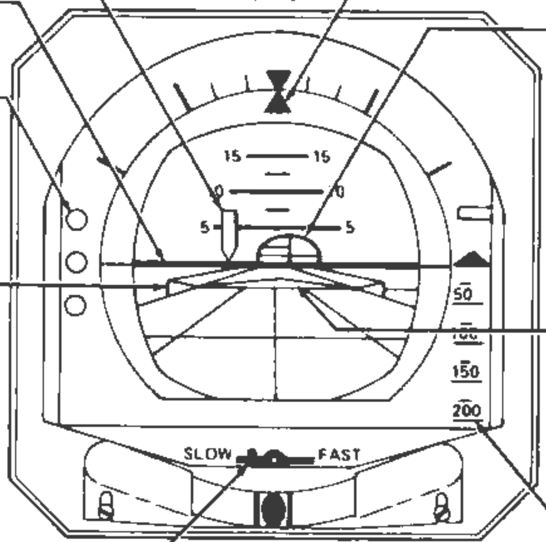
APPROACH GATE

Appears at glide slope capture with A/L or APR mode selected. Receives localizer and glide slope signals. Retracts from view at 5 feet when rollout bar appears. Full scale deflection is 1/3 dot localizer and one dot glide slope deviation.

MARKER BEACON LIGHTS

Repeat inner, middle and outer marker beacon lights from panel marker beacon lights.

ADI



COMMAND BAR

Appears when respective flight director switch turned on. Retracts when switch is turned off, FD flag appears, TURB mode selected, 5 feet with autopilot engaged in A/L mode, 50 feet with only flight director engaged in A/L mode.

AIRCRAFT SYMBOL

Fixed aircraft reference indicating aircraft attitude with ADI card movement.

RADIO ALTITUDE

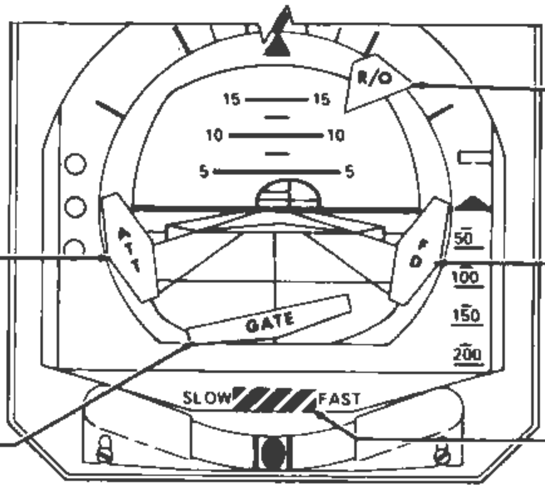
Repeat radio altitude displayed for final 200 feet of radio altimeter vertical tape. Shutter covers data when above 200 feet.

SLOW-FAST POINTER

Indicates aircraft speed in relation to selected IAS on ATS panel. Full scale deflection is 10 knots.

1F2, 20 - ADI
1E19 - ALTN ADI

FAIL FLAGS DISPLAYED



ROLLOUT FLAG

Rollout guidance not provided. Rollout bar will not appear.

ATTITUDE FLAG

Vertical gyro/INS attitude data not valid, ADI power failed, or attitude data differs from other two sources.

FLIGHT DIRECTOR FLAG

Flight director signal not valid or radio frequencies not compatible. Command bar will not appear.

GATE FLAG

Approach gate data not valid. Approach gate will not appear.

SLOW-FAST FLAG

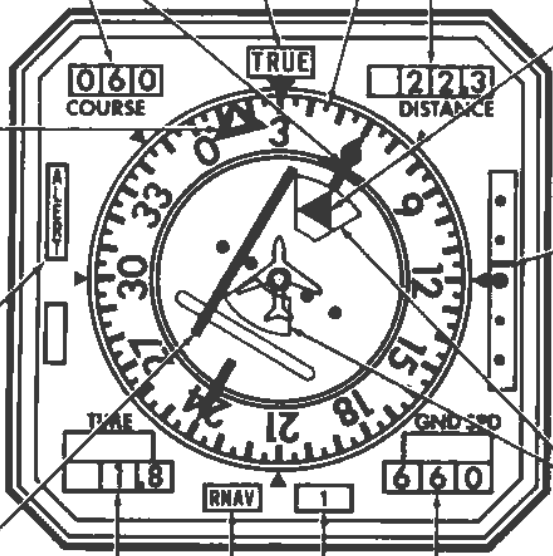
Speed command signal not valid.

VERTICAL GYRO 3 LIGHT

No. 3 vertical gyro/INS attitude data not valid or differs from other two attitude sources.

1E24, INS 3, GYRO 3

HORIZONTAL SITUATION INDICATOR (HSI)



MAG/TRUE DISPLAY

MAG - HSI displays magnetic heading.
TRUE - (-100), HSI displays true heading when RADIO/INS switch in INS.
HDG - Flag appears if heading data not valid.

COURSE CURSOR AND WINDOW DISPLAY

Indicates selected LOC/VOR course. (-100), indicates INS desired track if VOR frequency selected and RNAV displayed.

HEADING CURSOR

Both HSI cursors controlled by glareshield heading selector. Indicates magnetic heading and agrees with glareshield heading selection when MAG displayed on HSI.

ALERT LIGHT (-100)

Appears when within 2 minutes of next waypoint if RNAV displayed, MSU in NAV and VOR frequency selected

DEVIATION BAR

Indicates LOC/VOR deviation or INS crosstrack deviation on -100 aircraft when RNAV displayed and VOR frequency selected.

One dot = VOR-5°, LOC-1¼°, INS-3¾ NM

TIME DISPLAY (-100)

Indicates time in minutes to next waypoint. Appears if MSU selected to NAV and route waypoints loaded.

COMPASS CARD

Indicates magnetic or true heading when MAG or TRUE displayed.

DISTANCE DISPLAY (-100)

Indicates NM distance to next waypoint. Appears when MSU selected to NAV and route waypoints loaded.

TO/FROM POINTER

Indicates to or from VOR station when VOR frequency selected. (-100) indicates to next waypoint when RNAV displayed, if MSU in NAV and CDU in AUTO.

GLIDE SLOPE DISPLAY

Bar indicates glide slope deviation when ILS frequency selected. One dot = ¼°. GS fail flag appears if glide slope data not valid. Bar and flag will not appear on -100 aircra when RNAV displayed.

NAV FLAGS

Fail flags appear if localizer/VOR/INS data not valid.

GROUND SPEED DISPLAY (-100)

Indicates aircraft ground speed in knots. Appears when MSU in NAV.

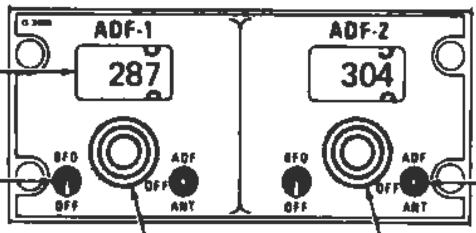
RNAV/VOR/ILS DISPLAY

VOR - Appears when VOR frequency selected. (-100), appears when RADIO/INS switch in RADIO and VOR frequency selected.
ILS - Appears when ILS frequency selected.
RNAV - (-100) appears when RADIO/INS switch in INS.

1F3 - CAPT HSI
1F21 - F/O HSI
1E8 - AREA NAV
1E26 - AREA NAV
1G7 - CMPS COUPLER
1G26 - CMPS CPLR
1K21 - VOR-1
1J22 - VOR-2
1G4, 22 - ILS
1D9 - INSTR XFMR NO. 2
1D27 - INSTR XFMR NO. 3

ADF AND TRANSPONDER

ADF



FREQUENCY WINDOW

Displays selected frequency.

BFO

Provides a tone which allows unmodulated CW keying to be heard when selected to BFO. A high pitched tone will be heard when frequency indicator approaches receivable signal, decreasing in pitch until no audio is heard when receiver is on frequency of receivable signal.

ADF/ANTENNA SELECTOR

ADF - Automatic direction finding. ADF pointers on RMI indicat magnetic bearing to ADF station when selected to ADF

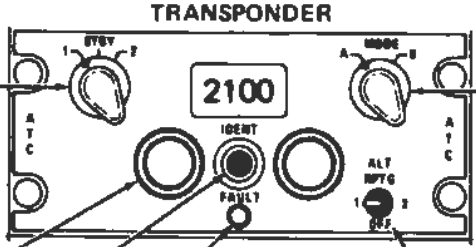
ANT - Used for range reception.

FREQUENCY SELECTOR

Controls selected frequency in window from 190-1750 Khz.

1D6, 24 - ADF

TRANSPONDER



TRANSPONDER SELECTOR SWITCH

No. 1 - No. 1 transponder used.

STBY - Both transponders warming up but not operating.

No. 2 - No. 2 transponder used.

CODE SELECTOR

IDENTIFICATION SWITCH

Momentarily pressing switch increases output signal to permit positive aircraft identification by blossoming target.

FAULT LIGHT

Indicates internal transponder fault.

CODE WINDOW

Selected code displayed.

MODE SELECTOR SWITCH

A - Used for normal operation. Transponder responds to three pulse interrogation signal with 8 micro-second spacing.

B - Transponder responds to interrogation signal with 17 micro-second spacing.

ALTITUDE REPORTING SWITCI

1 - No. 1 ADC used for altitude reporting with mode C interroga tion signal.

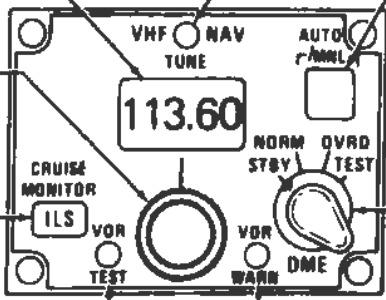
2 - No. 2 ADC used for altitude reporting with mode C interrogation signal.

OFF - Altitude reporting function inoperative.

1G3, 21 - ATC

VHF NAV RADIO, DME, AND RMI

VHF NAV RADIO AND DME



FREQUENCY WINDOW
Displays VOR/ILS frequency.

FREQUENCY SELECTOR
Selects VOR/ILS frequency from 108.00-117.95 MHz.

ILS CRUISE MONITOR LIGHT
Appears if ILS self test fails with VOR frequency selected.

VOR TEST SWITCH AND WARN LIGHT
Tests VOR receiver with any VOR frequency selected. VOR WARN light appears, indicating VOR test being made.

INOPERATIVE

DME SELECTOR

STBY - Receiver warmed up but not transmitting. Dashes appear in RMI windows.

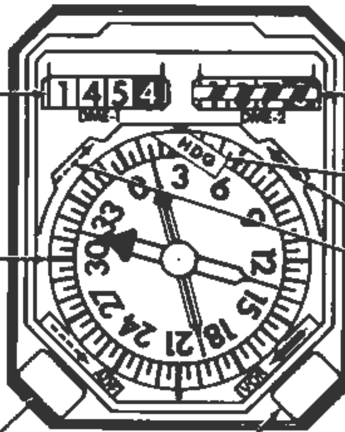
NORM - Provides data to 200 NM.

OVRD - Provides data to 390 NM.

TEST - Tests DME receiver and causes DME flag, dashes and zeros to appear in RMI windows.

1G1, 2 - VHF DC VOR RCVR, PREAMP
1G19, 20 - VHF DC VOR RCVR, PREAMP

RMI



DME WINDOW
Displays DME NM distance.

RMI COMPASS CARD
Displays magnetic heading.

POINTER SELECTORS
Press to display VOR/ADF data. Left switch selects No. 1 pointer to No. 1 ADF/VOR. Right switch selects No. 2 pointer to No. 2 ADF/VOR.

DME FAIL FLAG
DME data not valid.

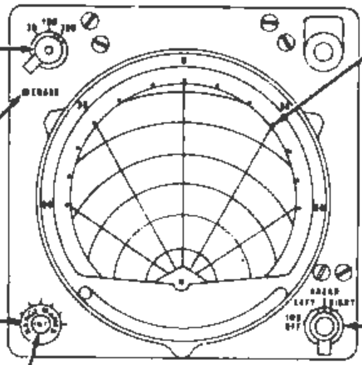
HDG FAIL FLAG
Indicates heading signal not valid.

POINTER FAIL FLAGS
Indicates pointer data not valid.

1E20 - CAPT RDDMI
1E3 - F/O RDDMI
1K25 - RDDMI 1
1J20 - RDDMI 1
1G7 - CMPS COUPLER
1G26 - CMPS CPLR
1O5, 23 - DME

WEATHER RADAR

RADAR INDICATOR



RANGE SELECTOR

30 NM - One 25 NM range mark.
100 NM - Four 25 NM range marks.
300 NM - Six 50 NM range marks.

ERASE SWITCH

Erases indicator display.

RANGE MARKS

Controls brilliance of range marks.

INTENSITY CONTROL

Controls brilliance of target returns.

POLAROID FILTER CONTROL

Moved left for bright daylight display; right for red night display.

BEARING MARKERS

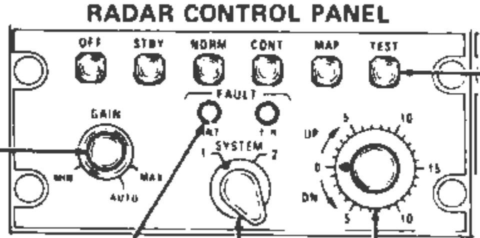
White dots at 10° intervals from 0° to 60°.
Gray dots at 45°.
Bearing lines at 0°, 30°, 60°.

CENTER SCAN SWITCH

OFF	-	Indicator turned off, no display.
AHEAD	-	180°sweep, centering on nose of aircraft.
LEFT/RIGHT	-	Sweep offset to provide scanning of left or right sector of indicator. Apex shifted to provide more range.

1D2, 20 - WEA RAD IND.
1D3, 21 - WEA RAD R/T.

RADAR CONTROL PANEL



GAIN CONTROL

AUTO - Receiver sensitivity automatically controlled to provide best display.
Manual control provided when taken out of AUTO position.

FAULT LIGHTS

ANT - Fault in antenna circuit.
RT - Receiver/transmitter fault.
Both lights on indicate TEST selected or stabilization fault.

SYSTEM SELECTOR

Selects No. 1 or No. 2 receiver/transmitter, using respective vertical gyro/INS for automatic stabilization control, ($\pm 25^{\circ}$ in pitch/$\pm 40^{\circ}$ in roll)

ANTENNA TILT CONTROL

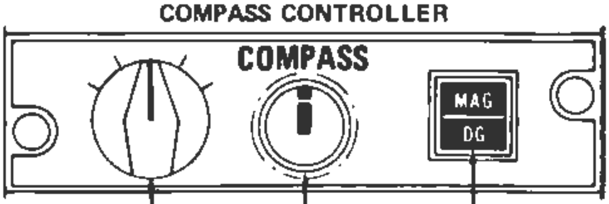
Adjusts antenna $\pm 14^{\circ}$ from horizontal reference. Establishes reference in pitch for automatic stabilization.

MODE SELECTORS

OFF	-	Radar off.
STBY	-	Selected receiver/transmitter warming up. Takes approximately 3½ minutes. Antenna erect but not scanning.
NORM	-	Normal operation providing approximate 3° beam. Uses selected system with other system being warmed up.
CONT	-	Displays steep gradients when intensity of storm cell exceeds receiver intensity level.
MAP	-	Expands beam width for ground contouring. Effective below FL250.
TEST	-	Warms up both systems and tests radar circuits by displaying test pattern on indicator. Both fault lights appear. No radar transmission, but antenna scans.

COMPASS AND MASTER RADIO SWITCHES

COMPASS CONTROLLER



HEADING SET CONTROL

Adjusts HSI and associated RMI card at slow or fast rate in MAG or DG mode. First index left or right is for slow alignment. Full over left or right is for fast alignment.

ALIGNMENT SYNC INDICATOR

Indicates degree of synchronization between flux valve and directional gyro. Operative in MAG.

MAG/DG SWITCH

MAG - Applies magnetic correction. Normal mode of operation.

DG - Flux valve removed from compass system. No magnetic corrections. Designed for polar operation.

1G7 - COMPS COUPLER
1G26 - CMPS CPLR

MASTER RADIO SWITCHES

ESSENTIAL RADIO SWITCH

Powers No. 1 VHF, ADF, DME, radar, radio altimeter, voice recorder, SELCAL, marker beacon, and instrument comparator power.

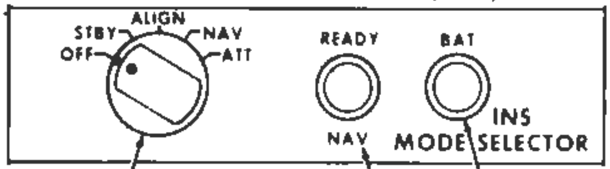
NO. 2 RADIO SWITCH

Powers No. 3 VHF, NO. 2 DME, transponder, radar, radio altimeter, ground proximity warning, and instrument comparator monitor.

3F4, 5 - MASTER RADIO PWR, CONT.
3AA12 - MASTER CONT NO. 2 RADIO BUS.

INS MODE SELECTOR UNIT, RADIO/INS SWITCH, AND FAILED INERTIAL NAVIGATION COMPARISON LIGHT

INS MODE SELECTOR UNIT (MSU)



MODE SELECTOR

Selects INS mode of operation.

OFF - INS off.

STBY - INS being warmed up.

ALIGN - INS alignment and battery check provided. (Not TWA procedure).

NAV - INS alignment, attitude, and navigation data provided.

ATT - INS attitude data provided without navigation data.

BAT FAIL LIGHT

Red light indicates INS battery voltage too low while INS is operating on battery. INS will shut down.

READY NAV LIGHT

Green light appears after INS alignment com plete, indicating INS navigation data availabl

1E8	-	AREA NAV	NO. 1 INS
1G6	-	VG/INS-1	
1E6	-	INS PWR	
1E7	-	INS HTR	
1E26	-	AREA NAV	NO. 2 INS
1G24	-	INS/VERT GYRO	
1G25	-	INS HTR	
1J21	-	ALT ALERT - 2	
1E24	-	INS - 3/GYRO - 3	NO. 3 INS
1E25	-	INS - 3 HTR	
1J21	-	ALT ALERT - 2	

RADIO/INS SWITCH

RADIO - HSI displays MAG and VOR or ILS data.

INS - HSI displays TRUE and RNAV. INS data provided to HSI if MSU in NAV mode.

1E1 - CAPTS INSTR ALT SOURCE SEL.

1E2 - F/O INSTR ALT SOURCE SEL.

FAILED INERTIAL NAVIGATION COMPARISON (FINC) LIGHT

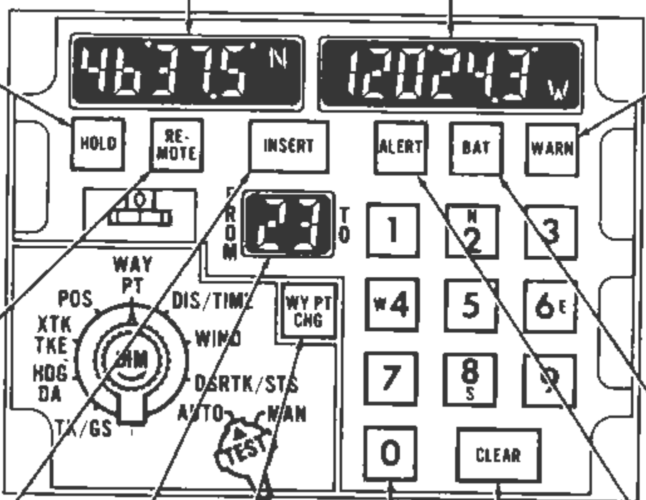
Red light indicates INS computed present position out of tolerance for navigation purposes.

INS CONTROL DISPLAY UNIT (CDU)

DATA WINDOWS

LEFT - Displays numerical data and latitude to 1/10 of a minute. Comprised of a five digit display plus symbols for decimal, left/right displacement and north/south latitude.

RIGHT - Displays numerical data and longitude to 1/10 of a minute. Comprised of a six digit display plus symbols for decimal, degrees, left/right displacement and east/west longitude.



HOLD SWITCH

Freeze position display in data windows

If REMOTE switch is engaged on all three INS, pressing HOLD freezes present position display on all INS

REMOTE SWITCH

Amber light illuminates to indicate system ready to accept remotely loaded waypoint data. Also use with HOLD switch to freeze present position display. REMOTE must be selected on each INS. Pressing REMOTE a second time releases remote function.

INSERT SWITCH

When illuminated, indicates computer ready to accept data. Light goes out when data inserted in computer.

FROM/TO WINDOW

Displays waypoint sequence on which the navigation information is being computed.

WAYPOINT SEQUENCE CHANGE SWITCH

When pushed, illuminates to indicate system is ready to accept a waypoint sequence change in From/To window. Light goes out when a sequence change is inserted or when CLEAR is pressed.

WARN LIGHT

Red light comes on if out of tolerance condition exists in INS. If data selector is placed to STS (status), Action code display appears in right data window. Pressing TEST switch resets WARN light if malfunction has cleared.

BATTERY LIGHT

Amber light indicates INS is using INS battery power.

ALERT LIGHT

Amber light indicates aircraft is within two minutes of waypont. Goes out when INS switches to next navigation leg. If AUTO/MANUAL switch in MAN, light will flash indicating leg switching did not occur.

CLEAR SWITCH

Provides clearing of data which appears in data windows or From/To window but has not been inserted.

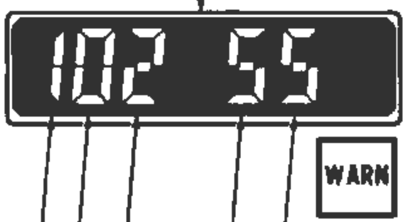
KEYBOARD SWITCHES

Switches insert numerical and directional data into computer. Type of data being loaded depends on position of data selector.

INS STATUS CODES

RIGHT DATA WINDOW

When the data selector switch is in DSTRK/STS position, the right data window displays codes to identify operational status, malfunctions, and performance index.



OPERATING MODE

Code 0 = Computer not in NAV mode.
Code 1 = Computer in NAV mode.

ACTION AND MALFUNCTION CODES

When INS WARN light is on, action codes indicate action to be taken. Pressing TEST switch causes malfunction codes to be displayed. When all malfunction codes have been displayed, the second and third digits will again indicate an action code or go blank.

01 - INS failure that may damage equipment.
02 - Failure of NAV mode.
03 - INS NAV data to HSI and AP/FD system unreliable. CDU display is still valid, (does not illuminate WARN light).
04 - (Ground only) INS alignment unsatisfactory.

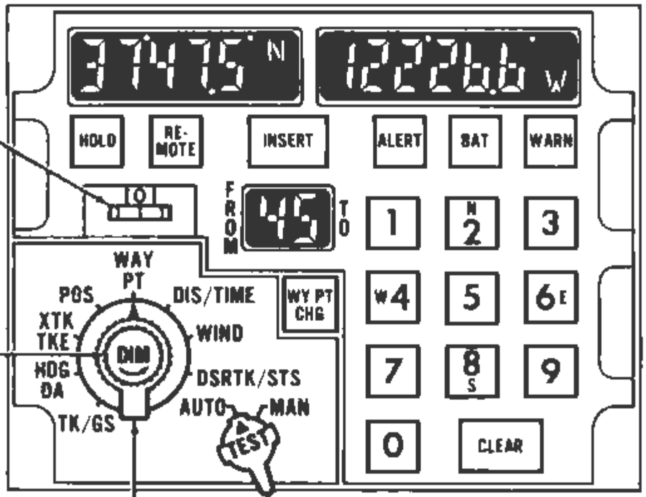
DESIRED PERFORMANCE INDEX

5	- INS uses stored correction factors from previous flight.
4 to 0	- Correction factors are recalibrated during alignment. At turn on, INS displays 5. Lower index may be loaded if desired.

ACTUAL PERFORMANCE INDEX

9	- Standby mode, INS warmup.
8	- Platform leveling, attitude mode available.
7	- Coarse azimuth, gate position must be inserted before fine alignment starts.
6	- Fine alignment.
5	- INS ready to navigate using stored correction factors from previous flight.
4 to 0	- INS starts recalibrating correction factors. A actual performance index gets lower, the system operates more on recalibrated correction factors and less on stored correction factors from previous flights.

INS DATA, WAYPOINT AND AUTO/MAN SELECTORS



WAYPOINT SELECTOR

Assigns a number (1 to 9) to waypoints as they are loaded. Number indicates which waypoint will be displayed in data window if data selector is in WAYPT position.

DIM SWITCH

Controls lights for data windows, annunciators and FROM/TO display.

DATA SELECTOR

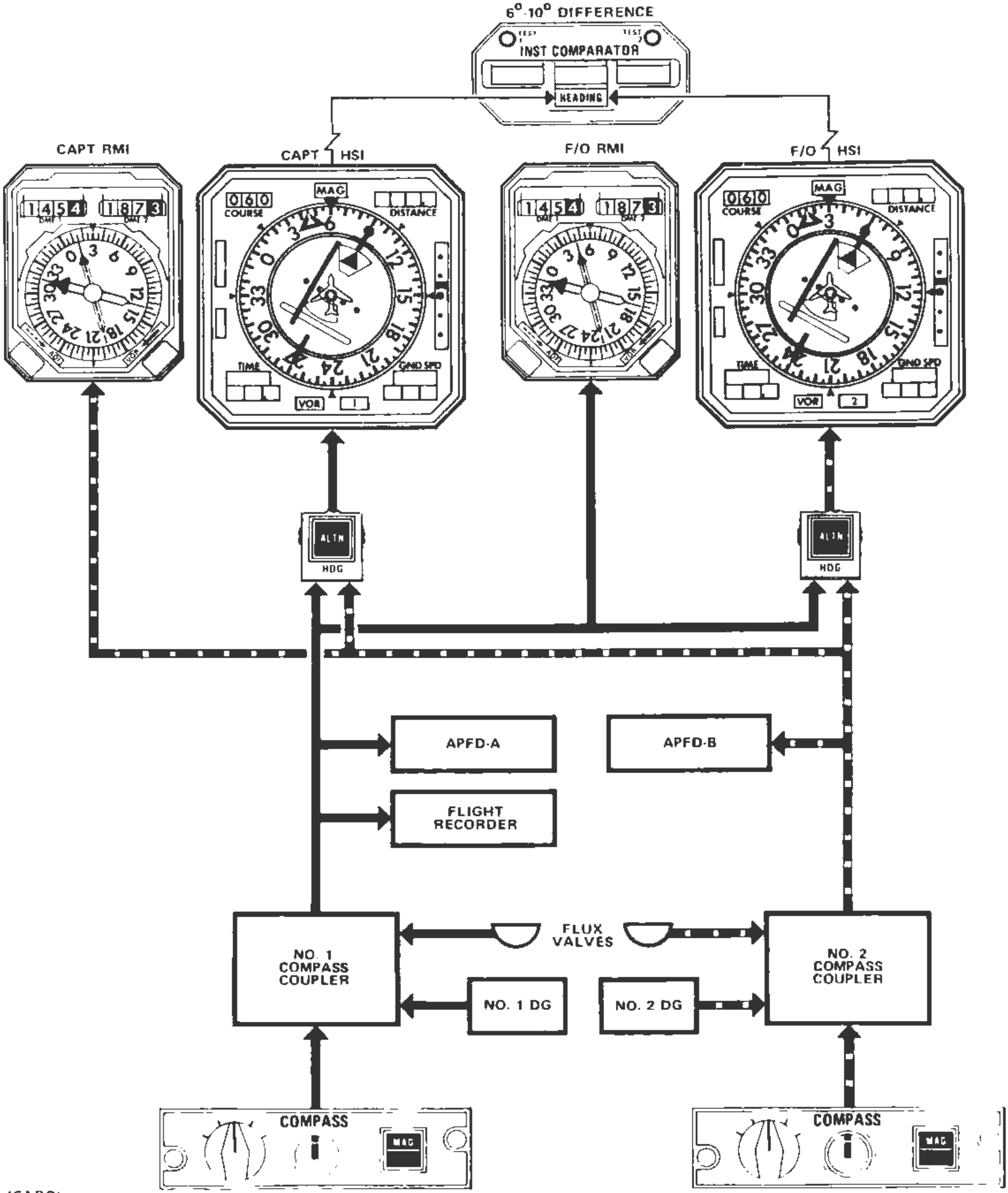
TK-GS	-	(Track/ground speed). True track in tenths of degrees. Ground speed in knots.
HDG-DA	-	(Heading/drift angle). True heading in tenths of degrees. Drift angle shows angular difference between true heading and track in degrees left or right of heading.
XTK-TKE	-	(Cross track distance/track angle error). Cross track distance shows lateral distance from desired track to present position in tenths of miles left or right of desired track. Track angle error shows angular difference between desired track and actual track in degrees left or right of desired track.
POS	-	(Position). Displays present position of aircraft in latitude and longitude to tenths of minutes. Also used to load gate position for alignment.
WAYPT	-	(Waypoint). Displays coordinates of waypoint that is selected by waypoint selector.
DIS/TIME	-	(Distance/time). Distance shows nautical miles from present position to next waypoint indicated in FROM/TO window. Shows minutes from present position to next waypoint indicated in FROM/TO window.
WIND	-	(Wind). True wind direction in degrees and velocity in knots. Not valid if TAS fails.
DSRTK/STS	-	(Desired track/status). Shows desired track from last waypoint along great circle flight path to next waypoint inserted in FROM/TO window. System status and action/malfunction codes displayed in right data window.

AUTO/MANUAL SELECTOR

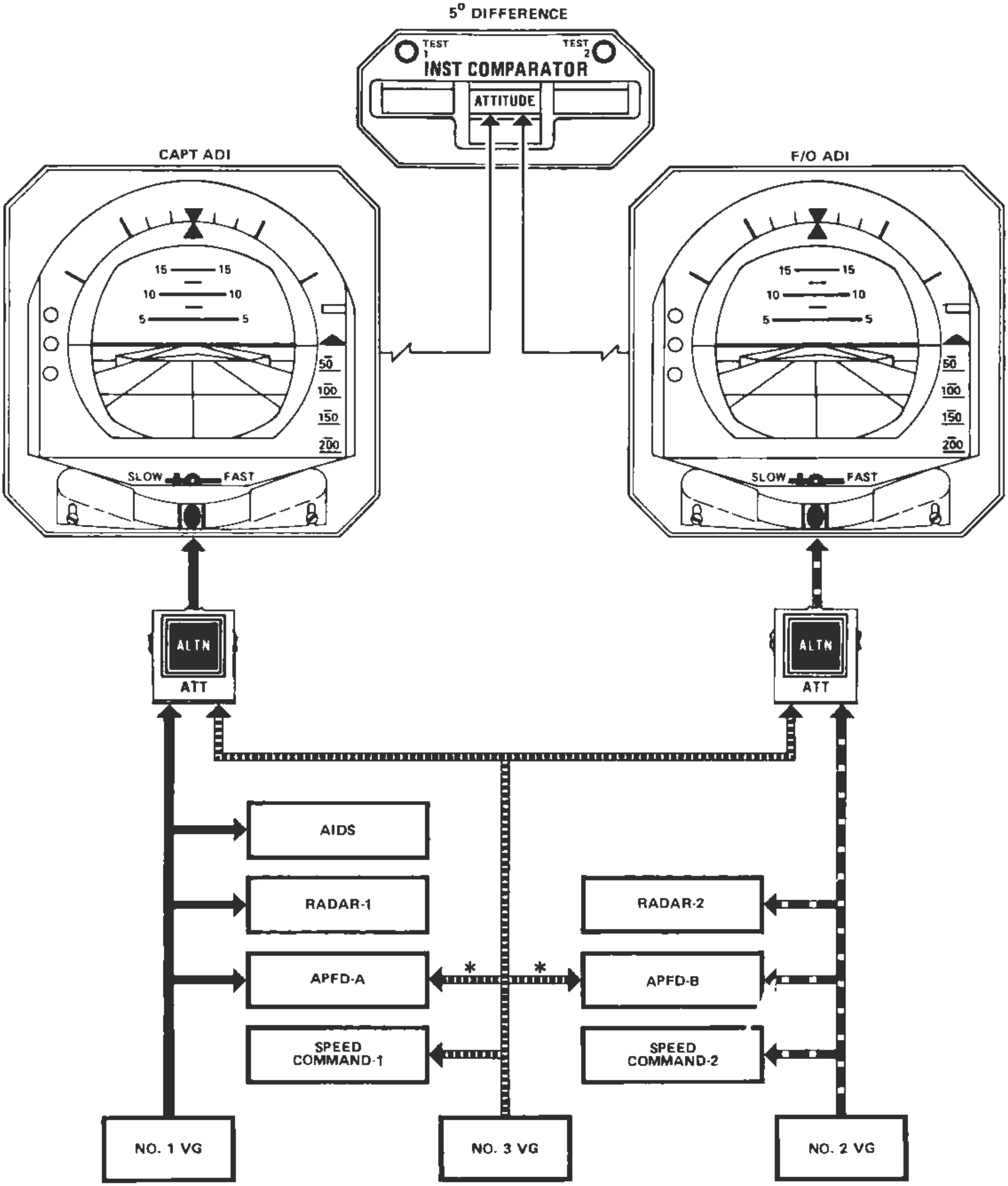
AUTO	-	System will automatically sequence WAYPOINTS in numerical order in FROM TO window: 1-2, 2-3, 8-9, 9-1, 1-2.
MAN	-	Automatic leg switching won't occur. System continues to fly extension of leg shown in FROM-TO window.
TEST (WARN light off)	-	Tests lights in mode selector, control display unit and INS fine light.
TEST (WARN light on)	-	Causes malfunction code to appear in right data window. If malfunction was transient, pressing TEST also resets WARN light.

* * *

COMPASS SYSTEM



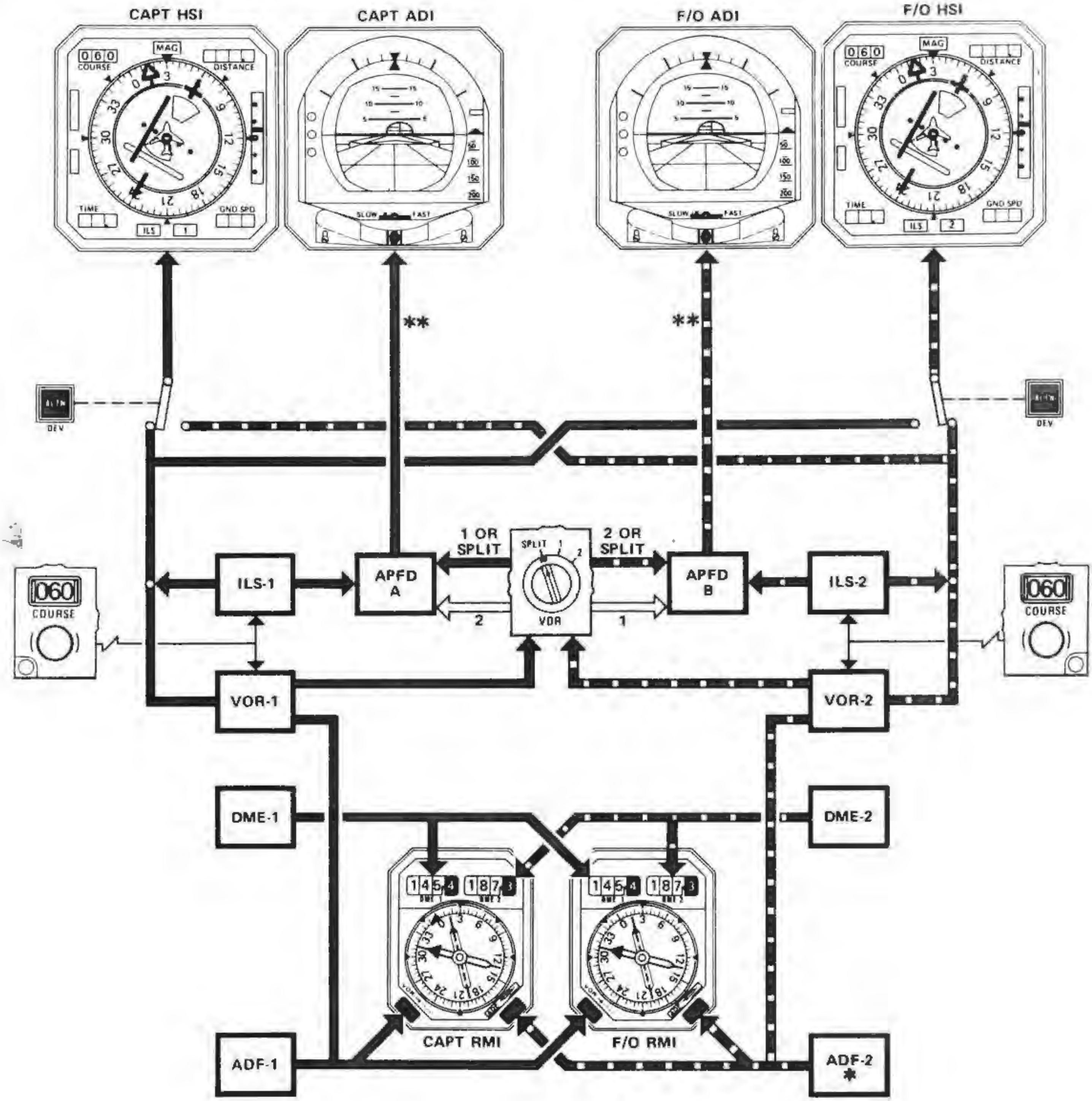
VERTICAL GYRO SYSTEM



*AUTO SELECTED AFTER AUTOLAND TRACK-DUAL AUTOPILOTS ENGAGED, IF NO. 1 OR NO. 2 VG FAILS.

(6191)

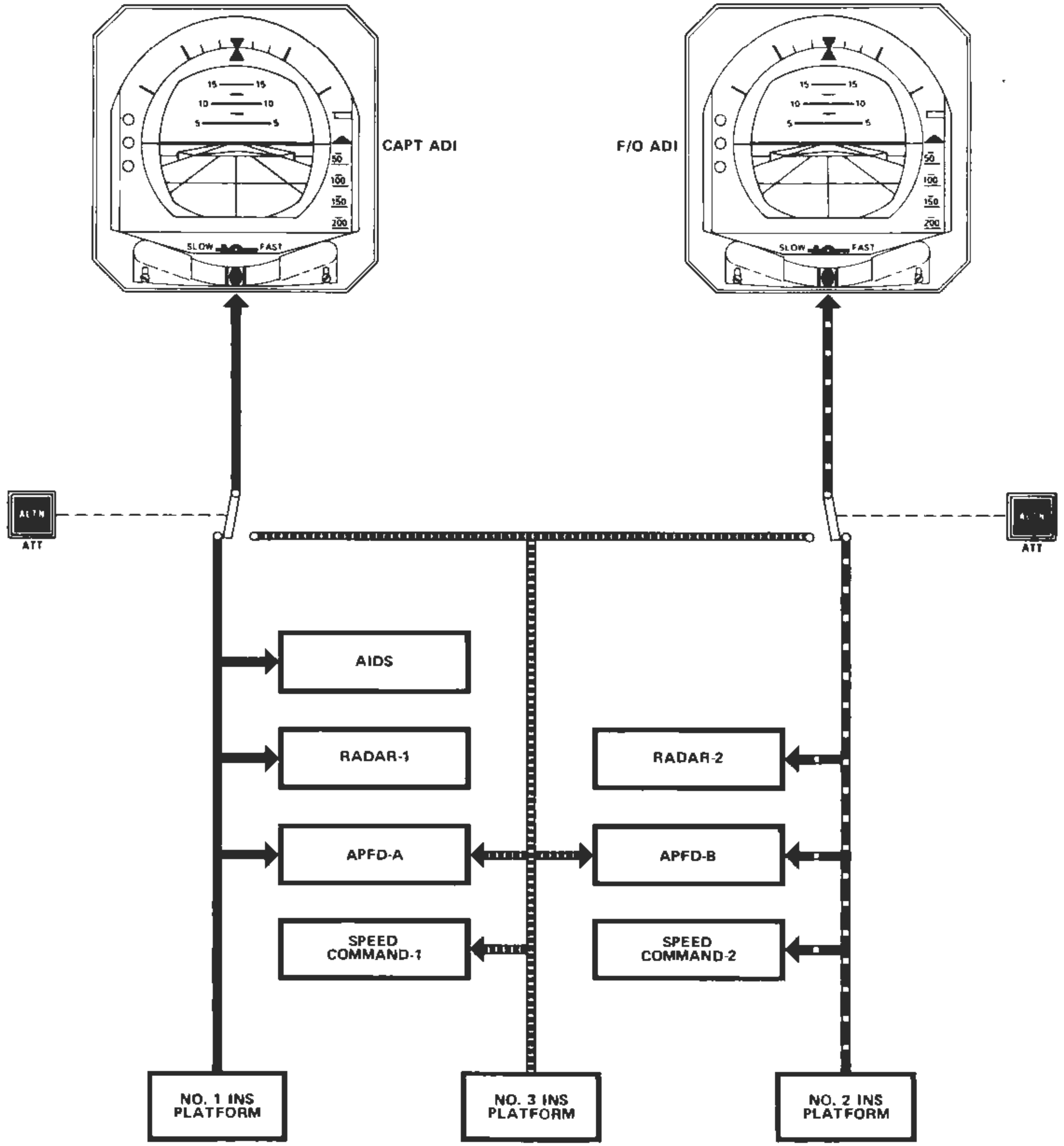
VHF NAVIGATION SYSTEM



CODE/CONDITION
NO. 1 RADIO SIGNALS..........
NO. 2 RADIO SIGNALS..........
NORMAL OPERATING CONDITIONS.

* -100 AIRCRAFT
** ILS SIGNAL TO APPROACH GATE AND ROLLOUT BAR.

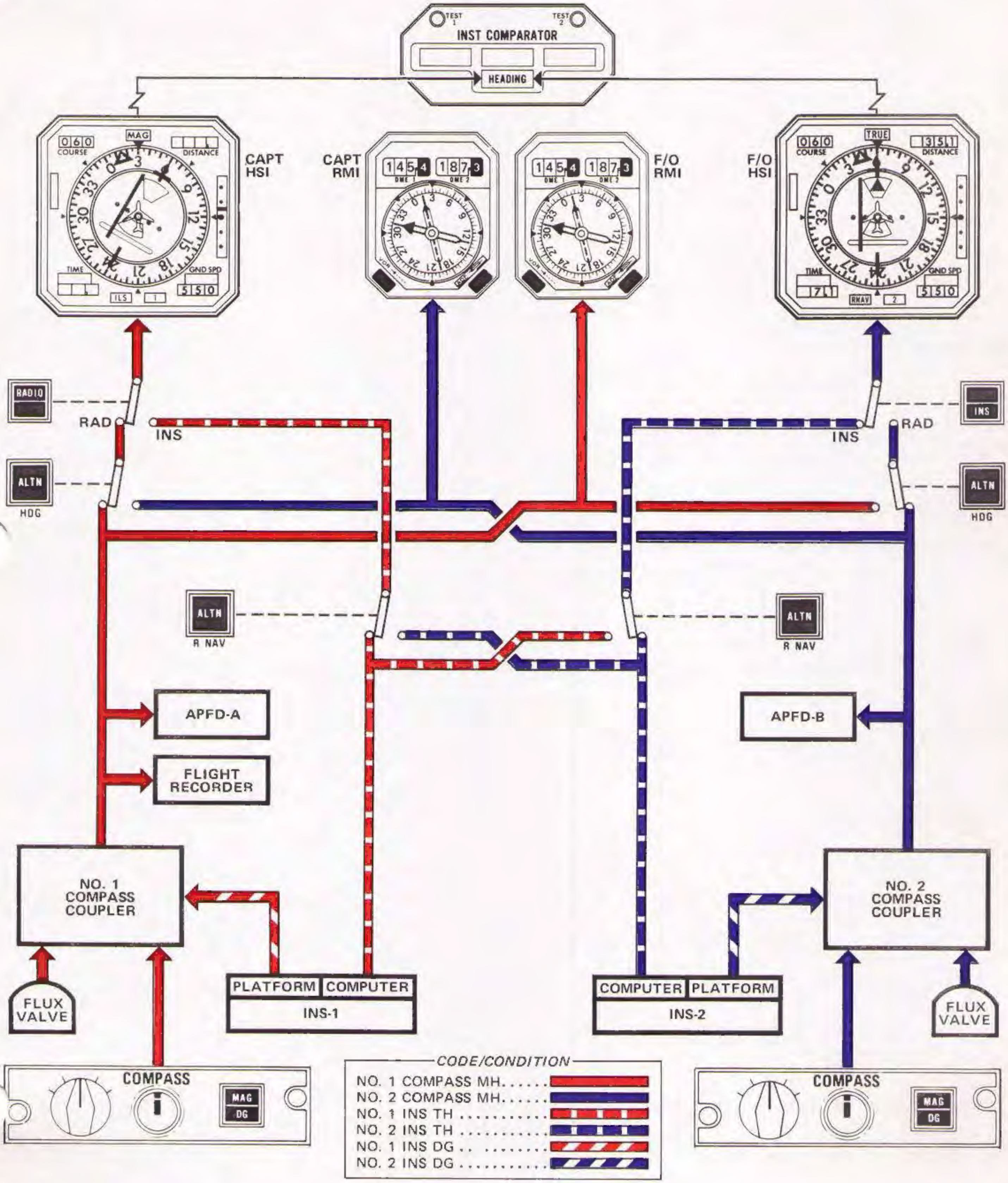
INS ATTITUDE SYSTEM



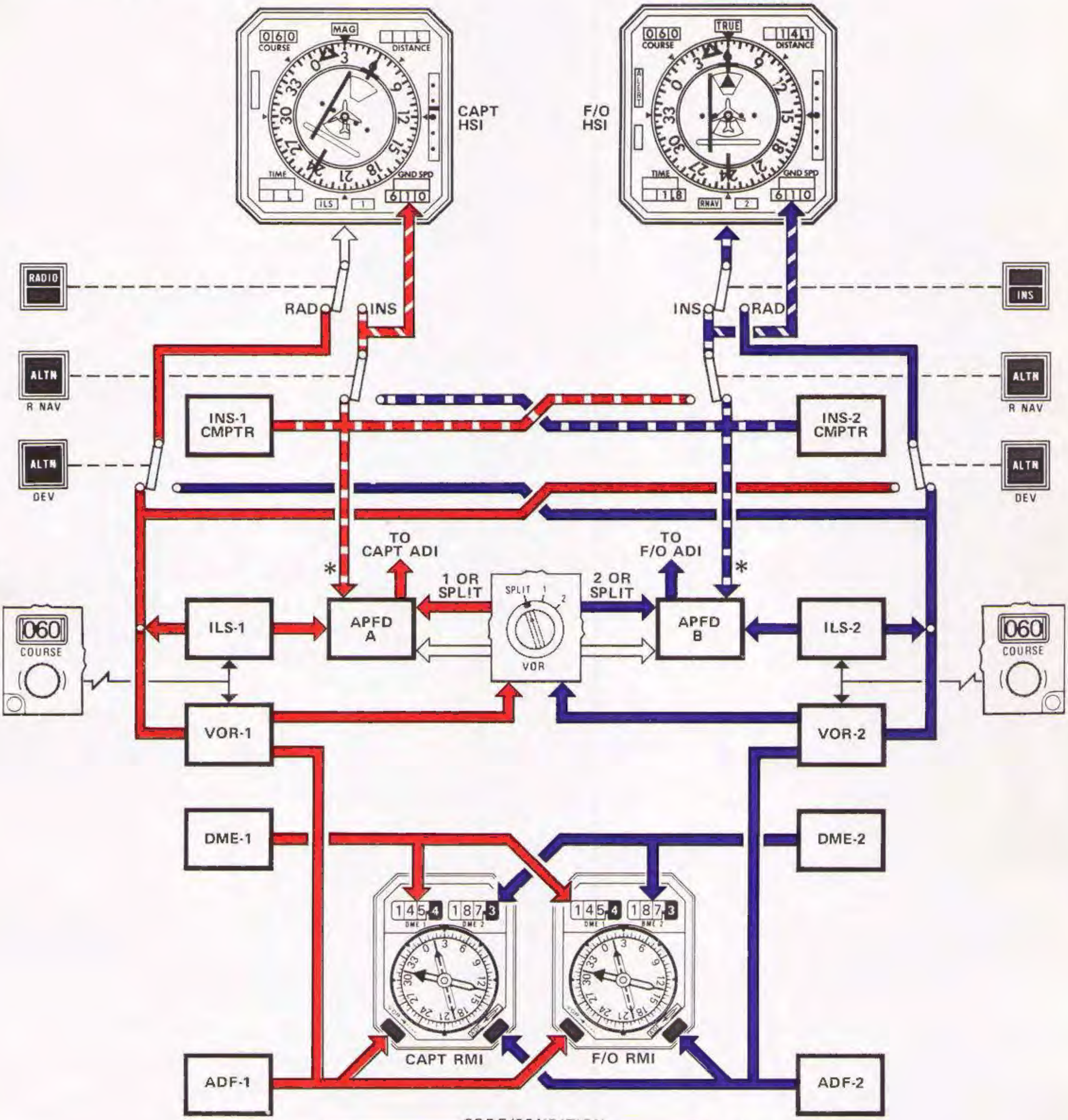
CODE/CONDITION

NO. 1 INS ATTITUDE......
NO. 2 INS ATTITUDE......
NO. 3 INS ATTITUDE......

INS COMPASS SYSTEM



INS NAVIGATION SYSTEM



CODE/CONDITION

NO. 1 RADIO NAV SIGNAL.........
NO. 2 RADIO NAV SIGNAL.........
NO. 1 INS NAV SIGNAL............
NO. 2 INS NAV SIGNAL............
NO. 1 GROUND SPEED SIGNAL.....
NO. 2 GROUND SPEED SIGNAL.....

* IF APFD IN NAV MODE AND HSI INITIALLY SELECTED TO INS.

COMPASS

There are two compass systems, each consisting of a directional gyro, flux valve, coupler, compensator, controller, and accessory unit. These components are located in the forward avionics compartment except for the controllers on the pilots' overhead panel and the flux valves in the wingtips.

The No. 1 compass provides heading information to the captain's HSI, first officer's RMI, flight recorder, and autopilot/flight director A.

The No. 2 compass provides heading information to the first officer's HSI, captain's RMI, and autopilot/flight director B.

Each compass system has MAG and DG modes of operation. In MAG the directional gyro output is automatically synchronized to the flux valve output in the compass coupler. This is the normal mode of operation. In DG the flux valve is removed and the heading output is taken directly from the directional gyro. This mode of operation is designed for flights in polar areas where MAG is not reliable. A heading set control on the compass controller permits manual alignment of the compass cards to any desired heading. This action would be required after operating for a period of time in DG because of precession.

When electrical power is initially applied, the compass cards automatically align at a fast rate. From then on, a slow alignment rate is used. Cycling the MAG/DG switch reverts the system to fast alignment rate.

HDG fail flags will appear on the corresponding HSI and RMI cards when power fails to the compass system or if the heading signal is not valid. Alternate HDG switching is provided to remove the HSI HDG flag.

INS COMPASS

On *-100* aircraft, DGs are removed and DG breakers banded. INS units are installed to provide true heading when the RADIO/INS switch is selected to INS. Magnetic heading is provided from the compass system when RADIO is selected.

The RMI cards always display magnetic heading and cannot be switched to an INS.

The HDG fail flag appears on the HSI if INS heading data is not valid. The alternate RNAV switch must be selected to remove the HDG flag if the HSI has been selected to INS.

The autopilot/flight director system can use only magnetic heading data, even if TRUE is displayed on its corresponding HSI.

ATTITUDE

Three vertical gyros are provided on other than *-100* aircraft. They provide the necessary attitude signals for ADI, AIDS, autopilot/flight director, speed command, and radar stabilization. The No. 3 vertical gyro is used when alternate ATT is selected. It is automatically selected by a failed autopilot after autoland track has been established if both autopilots are engaged.

Each vertical gyro erects at a fast rate when electrical power is applied and is available for use in approximately three to four minutes.

An ATT flag appears on the corresponding ADI if power fails to the ADI, the vertical gyro fails, its attitude signal is not valid, or if it differs from the other two gyros by approximately 5 degrees in pitch or roll output. A VERTICAL GYRO 3 light appears if the No. 3 gyro fails, its attitude signal is not valid, or if it differs from the other two gyros by approximately 5 degrees in pitch or roll output. The autopilot switch trips off if its corresponding vertical gyro fails prior to being established on autoland track and cannot be re-engaged. A FD flag appears on an ADI if the flight director is being used when the vertical gyro fails. The command bar retracts from view.

INS ATTITUDE

On *-100* aircraft, three INS systems are installed. Vertical gyros are located on the INS platforms to provide the necessary attitude signals with the MSU in ATT or NAV.

An ATT flag appears on the ADI if the INS attitude signal is not valid or if its INS fails. Alternate ATT can be selected to remove the flag and select the No. 3 INS for attitude information.

If the MSU is selected to ATT, only the INS platform is being used to supply the necessary attitude information. Computer navigation data is not available.

VOR

Two VOR receivers provide VOR data to RMI pointers, HSI deviation bar, and autopilot/flight director if the NAV mode is selected.

VOR (Cont'd)

Course selectors on the glareshield control VOR course data to the HSI and APFDS. An HSI to-from indicator indicates if the selected course is to or from the VOR station.

A VOR split 1-2 switch controls VOR data to the autopilot/flight directors when NAV mode is selected. In the split position, the VOR data is split so that each autopilot/flight director will use its normal VOR. In the 1 or 2 position, the selected autopilot/flight director will use the No. 1 or No. 2 VOR.

A VOR warn light appears on the VHF NAV tune panel when the VOR test switch is pressed.

A NAV flag appears on the HSI, when a VOR frequency is tuned, if power fails to the VOR receiver, the VOR signal is not valid, or the VOR ground transmitter fails. Alternate DEV switching is provided to switch the HSI deviation bar to the other VOR receiver. The autopilot switch trips to CWS if the NAV flag appears and a FD flag will appear on the ADI with command bar retracting from view. Alternate FLT DIR can be selected to remove the FD flag and permit the command bar to come in view again.

ILS

Two ILS receivers contain both localizer and glide slope channels. They provide ILS data to the HSI deviation and glide slope bars, ADI approach gate and rollout bar, and autopilot/flight director when A/L, APR, or LOC is selected.

An automatic ILS self-test is made every 3-4 seconds, testing the two ILS channel circuits. If this self-test fails with a VOR frequency selected, an ILS cruise monitor light appears on the VHF NAV tune panel, warning that its ILS receiver capability is not available prior to ILS operation. If the ILS self-test fails with an ILS frequency selected, the light will not appear; however, NAV and GS flags appear on the HSI.

NAV and GS flags also appear on the HSI when the corresponding ILS receiver fails or is not providing valid data. Alternate DEV switching can be used to remove these flags, switching the deviation and glide slope bars to the other ILS receiver. If an automatic landing is being made, the R/O and GATE flags also appear when the ILS receiver fails; however, these flags cannot be switched. The rollout bar and approach gate receive ILS data from their respective autopilot/flight director computers. When these fail flags appear, the corresponding autopilot switch trips to CWS if the receiver failure takes place prior to autoland track. The autopilot will not trip to CWS after autoland track if both autopilots are engaged and one ILS receiver fails.

VOR/ILS WITH INS

On *-100* aircraft, the HSI will display VOR, ILS, or INS navigation data, depending on the position of the MSU and RADIO/INS switches.

ATT MODE

If the MSU is selected to ATT, only VOR or ILS data can be displayed. If the RADIO/INS switch is in INS, NAV and HDG flags appear on the HSI.

NAV MODE

If the MSU is selected to NAV, information displayed on the HSI depends on RADIO/INS switch position and VOR or ILS frequency. If INS is selected with a VOR frequency, INS data is displayed on the HSI perimeter windows and course deviation bar. TRUE and RNAV are displayed. If INS is selected with an ILS frequency tuned, MAG and ILS are displayed; however, the HSI perimeter windows continue to provide INS data with course deviation and glide slope bars providing ILS data. The HSI alert light is inoperative.

ADF

Two ADF receivers are provided on *-100* aircraft and one ADF receiver on all other aircraft.

The ADF provides bearing data to the RMI pointers when the ADF control panel is selected to the ADF position and the RMI pointer is selected to ADF.

DME

Two DME receivers provide nautical mile distance data in their corresponding RMI window when VOR and some ILS frequencies are selected. The DME control is located on the glareshield VHF NAV tune panel and has four modes:

STBY - being warmed up for use.

NORM - provides 200 NM capability.

OVRD - provides 390 NM capability.

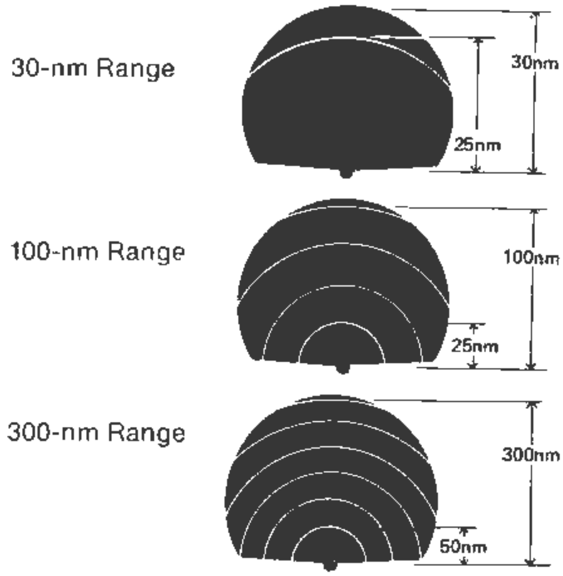
TEST - Flags, dashes and zeros appear in RMI window.

RADAR

The radar systems contain two indicators, one control panel, one split axis antenna, and two receiver/transmitter units.

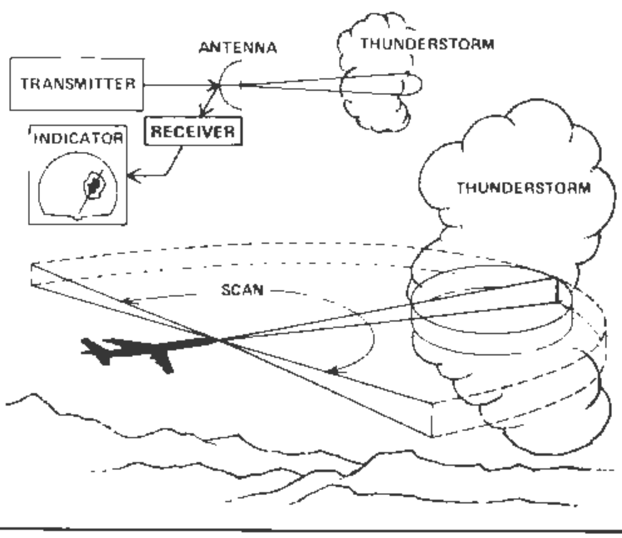
RANGE MARKS

The range marks control is used to regulate the brightness of range marks which appear on the indicator. The range marks vary, as indicated:



ANTENNA BEAM

Radar fires bursts of radiation energy at a very fast rate but each burst is of short duration. Radar spends most of its time receiving rather than transmitting. At the same time the antenna energy is released, a pulse is also sent to the indicators resulting in a sweep trace. The antenna scans 180 degrees, providing an approximate 3 degree beam slicing out a cross section of a storm cell as shown below:



RADAR INTERFERENCE

Dotted lines may appear on the indicator if other X-band radar equipment is being operated in high density traffic areas. This is sometimes called rabbit tracking or radar interference. Select CONT mode if it becomes too bothersome.

ICE OR WATER ON RADOME

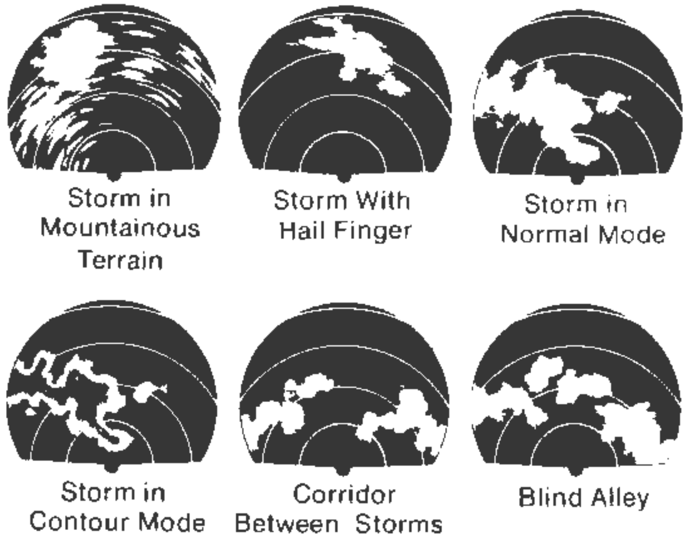
Ice or heavy concentration of water on the radome does not cause radar failure but can hamper normal operation. They can increase the attenuation, resulting in less sensitivity. Non-existing targets or target distortion will sometimes be displayed on the indicator. Tilt or bearing indications may also seem erroneous.

RADAR TARGETS

Weather radar is designed to show water droplets, not clouds or turbulence. The size of the rain drop is more important than the number of drops. Ice crystals and hail are not readily detectable because they are poor reflectors unless coated with water.

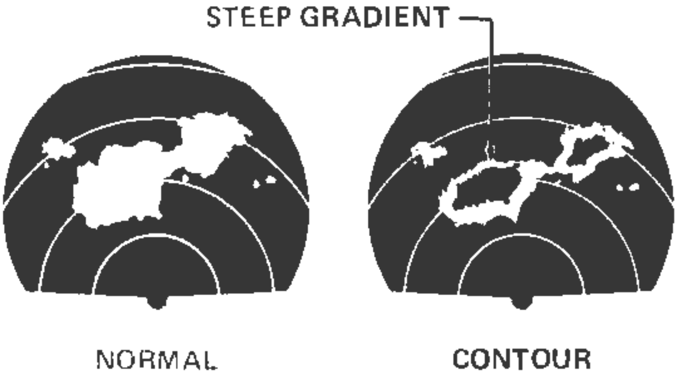
Although turbulence is not directly displayed, indications of its presence can be assumed by a very bright return, return more than 60 miles from aircraft, steep rain gradient, or unusual shapes on indicator.

The use of CONT mode can be effective in providing data relating to steep gradients. Returning signals which exceed preset receiver intensity level are blanked on indicator, causing a black hole to appear indicating heavy precipitation. A steep rain gradient is indicated if the change in rainfall density versus distance is very small. The steeper the gradient, the greater the associated turbulence. These are some examples of unusual shapes, contouring, and steep gradients:



Storm in Mountainous Terrain | Storm With Hail Finger | Storm in Normal Mode

Storm in Contour Mode | Corridor Between Storms | Blind Alley



INERTIAL NAVIGATION SYSTEM (INS) *-100*

On *-100* aircraft, three inertial navigation systems are installed. Each INS consists of a mode selector unit (MSU), control display unit (CDU), navigation unit (NU), and battery.

Each NU has a computer and platform. The computer provides INS navigation data to the CDU, HSI, and autopilot/flight director. The platform contains accelerometers, vertical gyros and a directional gyro. The platform vertical gyros provide attitude data to the corresponding ADI, radar, speed command, AIDS, and autopilot/flight director. The directional gyro provides compass stabilization.

INS accelerometers sense aircraft movement which is used to compute navigation data. Each INS provides its own display of navigation data and indications of its own operating status. The HSI also displays INS data such as aircraft ground speed, distance, course, and time to next waypoint.

Air data computers provide altitude and true airspeed data; however, if the air data computers fail, INS will not be seriously affected. If TAS is not provided, the wind display will show zeros.

CONTROL DISPLAY UNIT (CDU)

Each INS has a CDU which is used to insert data into the INS computer and to display the information.

MODE SELECTOR UNIT (MSU)

There are five modes of operation; however, the ALIGN mode is not presently used. The NAV mode is the normal international operating mode. It provides system alignment, navigation, and attitude data. The ATT mode provides attitude data from the INS platform to the corresponding ADI and electronic units.

BATTERY

Each INS has its own battery to provide INS power when normal aircraft power fails. Each battery can power its INS for approximately 15 minutes to provide attitude and navigation data. An INS cannot be started if its battery is not in good condition. An amber CDU BAT light appears when operating on standby battery and a red MSU BAT light appears to indicate its voltage is too low to continue operating.

RNAV ANNUNCIATORS

RNAV appears on the HSI when the corresponding RADIO/INS switch is selected to INS. INS data is displayed on the HSI if its MSU is in the NAV mode.

RNAV appears on the AFCS mode panel when an autopilot/flight director is coupled to INS.

RADIO/INS SWITCHES

These two switches control the HSI displays. When INS is selected, RNAV and TRUE appear on the HSI and INS data is displayed if its MSU is in the NAV mode. When RADIO is selected, VOR or ILS and MAG appear, indicating normal radio and magnetic heading data are displayed on the HSI.

* * *

ADDITIONAL PROCEDURES

CONTROLS AND INDICATORS

SCHEMATICS

SYSTEM DESCRIPTION

* * *

ENGINE DUCT OVERHEAT LIGHT ON

The ejector has not been ahle to control the high pressure bleed temperature. To prevent excessive temperatures from reaching the manifold, the high pressure and engine isolation valves close and lock out.

1. Press high pressure and engine isolation valve switches to OFF to release lockout.
2. Check that the duct overheat light goes out shortly after the valves close.
3. Select ECS temperature monitor to the affected pack inlet.
4. Open only the engine isolation valve and monitor temperatures.

BLEED DUCT OVERPRESSURE LIGHT ON

The high pressure and engine isolation valves were unable to contain a system overpressure. The affected engine isolation valve closes and the bleed duct overpressure light comes on.

1. Press the engine isolation and high pressure switches to OFF. If normal pressure returns after the engine isolation switch is pressed, the bleed duct overpressure light will go out.
2. Open the engine isolation valve and monitor the pressure.

ENGINE BLEED AREA OVERHEAT LIGHT ON

Engine 1 or 3 (D or E) - Close the related engine isolation and crossbleed valves.

Engine 2 (J) - Close the ATM isolation valve and engine 2 isolation valve.

CROSSBLEED MANIFOLD AREA OVERHEAT LIGHT ON (H)

Close both crossbleed valves and the ATM isolation valve.

LOSS OF ONE BLEED SOURCE

1. Use two packs (normally turn off No. 1).
2. Turn on ATMs as required. Use RAT if B ATM not available and No. 2 engine shut down.
3. Use engine and wing anti-ice in normal manner if required.
4. Maintain minimum of 13 PSI duct pressure. If necessary, turn off No. 3 pack (single pack operation).

   If wing anti-ice is on and duct pressure remains low, select manual and heat one wing at a time for 45 seconds. Leave system off for 3 to 5 minutes between cycles.

LOSS OF TWO BLEED SOURCES

APU may be used subject to altitude and bleed source mix restrictions.

1. Use one pack (normally No. 2).
2. Close cool air overboard valves.
3. Descend to 25,000 feet or below.
4. If No. 2 engine is shut down:

   Deploy RAT.
   Place B ATM to AUTO.
   Place C ATM to ON.
   When commencing approach, turn on both AC pumps.
5. Use engine anti-ice in normal manner if required.
6. Before starting approach, select cabin altitude to initial approach altitude to depressurize the cabin. When differential pressure is zero, turn off the remaining pack to conserve hleed air for the ATMs and wing anti-ice.

* * *

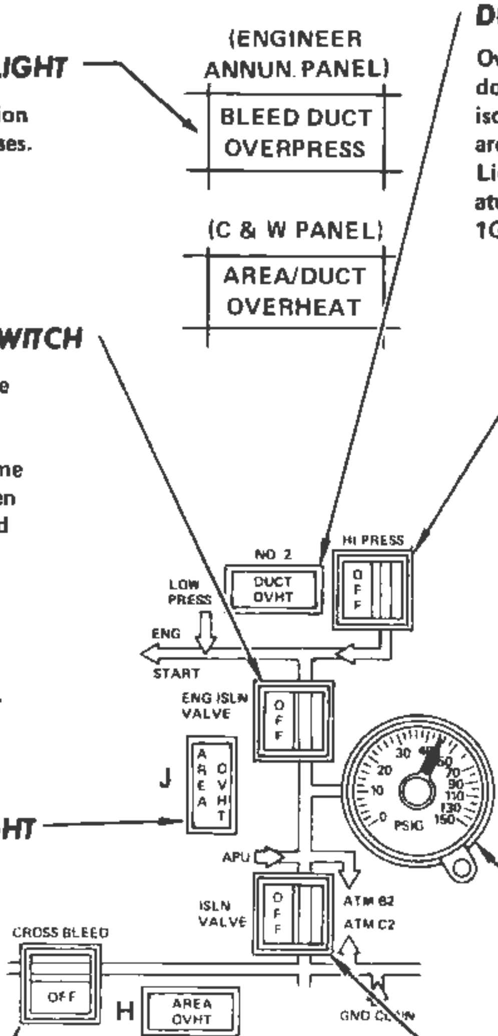
ENGINE BLEED CONTROL

BLEED DUCT OVERPRESSURE LIGHT

Pressure downstream of engine isolation valve is excessive. Isolation valve closes.

DUCT OVERHEAT LIGHT

Overtemperature is sensed in duct downstream of ejector. Engine isolation and high pressure valves are closed.
Light is extinguished when temperature is reduced.
1G10, 11, 12 - ENG ISLN VALVES.



ENGINE ISOLATION VALVE SWITCH

Controls valve which acts as a pressure regulator and check valve. Valve is energized closed and pressure opened.

- IN - Flowbar is illuminated anytime valve is open. Valve will open on engine start. Valve is held closed by the fire pull, duct overpressure or overheat, or excessive flow to its pack.
- OUT - Valve closes and OFF illuminated. Holding coil released.

1G 10, 11, 12 - ENG ISLN VALVES.

HIGH PRESSURE SWITCH

Controls high pressure valve to supply additional air as needed. Valve is energized closed and pressure opened.

- IN - Flowbar is illuminated when valve is open. Valve closes when low pressure bleed is adequate. Valve is held closed by fire control or nacelle overheat. 1 and 3 are also held closed by excessive flow to their pack.
- OUT - Valve closes and OFF is illuminated. Holding coil released.

1G13, 14, 15 - HI PRESS VALVES.

ENGINE AREA OVERHEAT LIGHT

Overtemperature is sensed around ducts from engine isolation valve to crossbleed and flow control valve for systems 1 and 3 or from engine isolation valve to ATM isolation valve for system 2.
3W13, 14 - DUCT OVHT DET.

DUCT PRESSURE INDICATOR

Indicates pressure downstream of engine isolation valve.
3R17 - BLEED AIR IND.

CROSSBLEED VALVE SWITCH

Permits connecting or isolating any or all systems.

- IN - Energizes valve to open with pressure. Flowbar is illuminated when valve is open. Held closed with excessive flow to pack 1 or 2.
- OUT - Valve closes. Flowbar is extinguished and OFF light illuminated.

1G17, 18 - CROSSBLEED VALVES.

CROSSBLEED AREA OVERHEAT LIGHT

Overtemperature is sensed around duct from isolation valve to crossbleed and No. 2 pack flow control valve.
3W13, 14 - DUCT AREA OVHT DET.

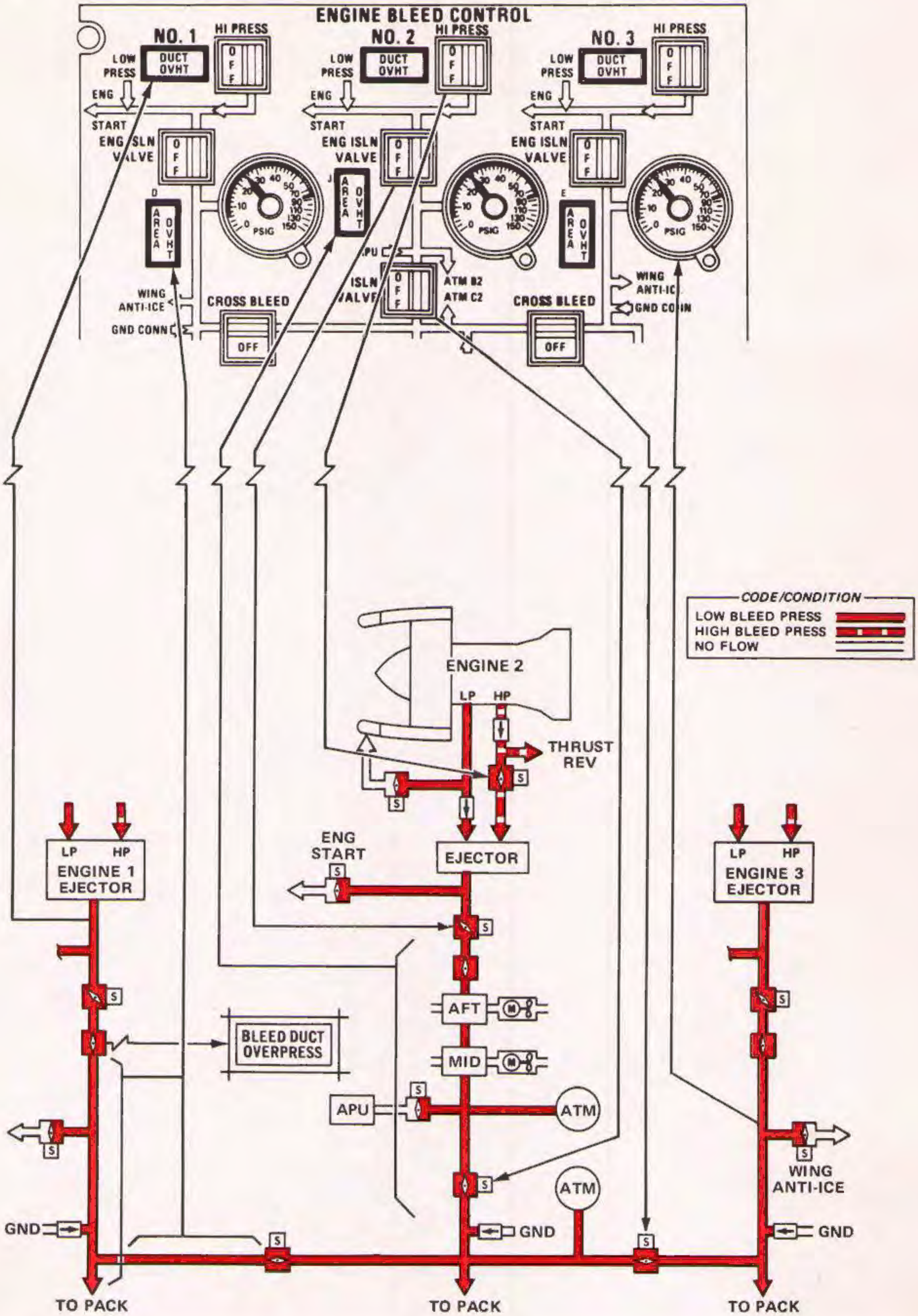
ATM ISOLATION VALVE SWITCH

Permits isolation of ATMs and No. 2 engine pressure duct from the crossbleed manifold.

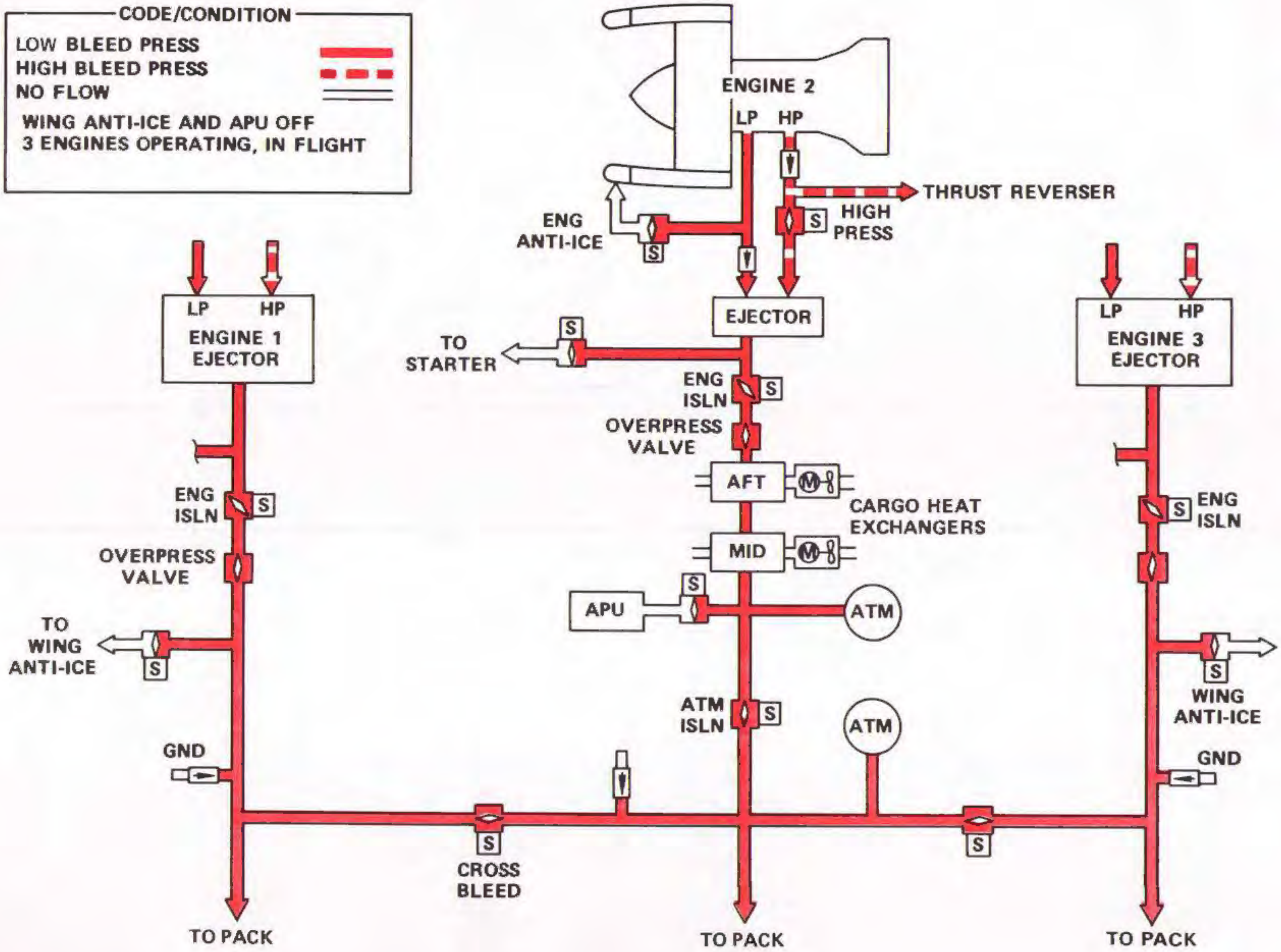
- IN - Energizes valve to open with pressure. Flowbar is illuminated when valve is open. Held closed with excessive flow to pack 2.
- OUT - Valve closes. Flowbar is extinguished and OFF light is illuminated.

1G16 - FUS ISLN VALVE.

BLEED CONTROLS



BLEED AIR SUMMARY



GENERAL

The pneumatic system includes the following:

Engine bleed air.

APU load compressor.

High pressure ground air.

→ Pneumatic manifold.

Duct air pressure indications.

Bleed air duct and area overheat warnings.

The systems using bleed air from the pneumatic system are:

Air conditioning/pressurization.

Wing and engine anti-ice.

Engine thrust reversers.

Engine starters.

B and C hydraulic system air turbine-driven pumps.

The engine bleed air system is composed of independent and identical systems from each of the three engines. Low pressure bleed air taken from N_2 and high pressure bleed air from N_3 are connected to a common manifold.

The APU load compressor system connects the APU compressor discharge air to the pneumatic manifold through the number two engine duct.

Three connections for high pressure ground air (external air cart) connect directly into the pneumatic manifold.

Three instruments on the engineer's bleed air panel indicate pressure in the engine ducts downstream of the engine isolation valve.

The duct overheat warning system includes temperature sensors, thermal switches with automatic shutdown of a faulty unit, and warning lights on the pilots' and engineer's panels.

Continuous-type dual temperature sensors are installed along the outside of each high temperature bleed air duct and component to detect significant hot air leakage.

ENGINE BLEED AIR

There are two sources of bleed air from the engine:

Low pressure bleed air from N_2.

High pressure bleed air from N_3.

The bleed air control system regulates the pressure and temperature of air supplied to pneumatic accessories and to the air conditioning system. Low pressure air is bled from each of the three engines during normal flight operation. When this low pressure air is not adequate to support the pneumatic systems, as with the engines at idle, the high pressure bleed valve opens and admits high pressure air. The variable area ejector nozzle, which regulates the amount of high pressure air to be used, modulates to maintain the required system temperature.

HIGH PRESSURE BLEED VALVE

The high pressure bleed valve is an electrically signaled, pneumatically activated valve. With the high pressure switch in, the flowbar is illuminated when the valve opens. With the switch out, the valve is energized closed and the off legend portion of the switch is illuminated.

The high pressure valve is signaled closed during normal operation when the following occurs:

Engine isolation valve closes.

Adequate low pressure air available.

The high pressure valve is held closed by the following malfunctions:

Nacelle/pylon overheat.

Engine duct overheat.

When the valve is closed by a malfunction, it is held closed by a holding coil until the switch is pressed to off.

ENGINE ISOLATION VALVE

The engine isolation valve opens with air pressure. The flowbar is illuminated when the valve is open. The valve modulates to regulate the downstream pressure. It also acts as a check valve to prevent reverse flow except during certain operations. The valve will open for reverse flow during engine start or when the APU/ground air to reversers switch is on with air pressure available.

ENGINE ISOLATION VALVE (Cont'd)

Engine duct pressure sensors are located downstream of each engine isolation valve. Pressure indicators on the engineer's bleed air panel are provided to monitor and compare bleed duct pressures.

Engine isolation valves are signaled closed for:

Duct overheat.

Bleed duct overpressure.

→ Fire control pulled.

Excessive pack flow, (1 and 3 only).

The valve is held closed by a malfunction holding coil after any fault until the switch is pressed to off.

BLEED DUCT EJECTOR

During most normal operation, low pressure air is adequate to supply the pneumatic manifold. When high pressure air is needed, the ejector opens to allow sufficient high pressure air into the duct to maintain pressure and/or temperature. A bullet-type valve in the ejector varies its position to control the amount of high pressure air being added. The ejector normally controls to a pressure sensed downstream and will add just enough high pressure air to maintain pressure. A temperature sensor will keep downstream air from exceeding nominal values. When wing anti-ice is turned on, the bullet modulates to maintain a higher required temperature downstream.

OVERPRESSURE VALVE

A fast-acting valve downstream of each isolation valve protects the system from overpressure. If the isolation valve fails to maintain pressure, the overpressure valve will close while the excessive pressure exists. It also signals the engine isolation valve to lock closed and turns on the bleed duct overpressure light on the engineer's annunicator panel. When the pressure returns to normal, the overpressure valve opens but the isolation valve remains closed. The light remains on until the engine isolation valve switch is pressed to off.

→PNEUMATIC MANIFOLD

The pneumatic manifold system includes all ducting and valves used to connect the sources of pneumatic pressure to the systems that use it.

ATM ISOLATION VALVE

The ATM isolation valve permits isolation of air turbine motors from each other. It also permits isolation of number two engine and APU air bleed duct from the crossbleed manifold. With the isolation valve switch in, the valve is signaled to open with pressure. When the valve opens, the flowbar illuminates.

With the switch out, the valve closes, the flowbar goes out, and the off legend in the switch illuminates. Excessive flow to the number two pack will close the ←ATM isolation valve.

CROSSBLEED VALVES

The crossbleed valves permit connection, or isolation of, any or all bleed sources. With the crossbleed switch in, the valve opens with air pressure. The flowbar is illuminated when the valve is open. The respective valve is held closed with excessive flow to pack one or three. Both are held closed with excessive flow to pack two. With the crossbleed switch out, the valve closes, the flowbar is extinguished, and the off light illuminates.

APU LOAD COMPRESSOR

The APU load compressor portion of the pneumatic ←system consists of a check valve to prevent reverse flow of the APU load compressor bleed air and a bleed air shutoff valve with its switch on the engineer's APU control panel.

The function of this system is to admit or isolate flow of load compressor discharge air from the APU ←into the pneumatic manifold.

When the APU is operating with the don't load light out, opening and closing of the APU load compressor bleed air shutoff valve is controlled by the bleed air shutoff switch. When the switch is in, the valve is electrically armed to open if air pressure is available. When the valve is open, the open light illuminates. When the switch is out, the valve closes and the open light is extinguished.

HIGH PRESSURE GROUND AIR

The high pressure ground air system consists of three identical ground air connections which attach directly to the pneumatic manifold. Access to the connections is through three hinged doors under the forward portion of the wing center section.

HIGH PRESSURE GROUND AIR (Cont'd)

Three ground air connections are provided to assure sufficient flow capacity to operate the required systems when using ground air. At least two connections are required for engine starting or for operating more than one air conditioning pack. When all three air conditioning packs are in use, all three ground air connections are needed.

BLEED AIR OVERHEAT WARNINGS

DUCT OVERHEATS

Engine bleed duct overheats are detected by temperature sensors just downstream of the ejector.

The overheat is caused by the ejector failing to control air input from the high pressure bleed. When the overheat is sensed, the duct overheat light on the bleed air panel and the area/duct overheat light on the pilots' C and W panel illuminates. The high pressure and the engine isolation valves close (flowbars extinguish) and lock closed. They will remain locked closed until both switches are pressed to off. After the duct overheat light goes out, the engine isolation valve may be reopened if required.

NACELLE/PYLON OVERHEATS

Two temperature sensor loops run along each duct of the bleed air system. The nacelle/pylon overheat system monitors the area between each engine and the engine isolation valve for bleed air leaks. If the system detects excessive heat, it turns on the respective nacelle overheat light on the pilots' C and W panel and closes and locks out the high pressure bleed valve. Both A and B loop lights of the nacelle/pylon overheat detection system on the engineer's panel should also be on.

AREA OVERHEATS

The area overheat system monitors the ducting between the engine isolation valves and the ACMs through dual sensors that send signals to the proper area overheat light(s). The area overheat system is divided into seven areas with letter designators beside the lights. A, B, and C area overheat lights monitor the ducts from the pack valves to the ACMs. Their functions are covered in Air Conditioning, chapter five. Lights D and E monitor the areas between number one and three engine isolation valves and the crossbleed valves. Light J monitors the area between number two engine isolation valve and the ATM isolation valve. Light H monitors the crossbleed manifold area.

If an area overheat or duct fail light comes on, the area/duct overheat light on the pilots' C and W panel also comes on. No valves are automatically closed by the area overheat system. The appropriate switch(es) must be pressed off to isolate the source of the bleed air leak.

Two duct fail lights on the wing anti-ice panel monitor the wing anti-ice ducts for excessive external temperatures. The duct fail lights are tested by the area overheat system test and will also turn on the area/duct overheat light on the pilots' C and W panel when activated.

* * *

ADDITIONAL PROCEDURES

CONTROLS AND INDICATORS

SCHEMATICS

SYSTEM DESCRIPTION

* * *

REPORTING ENGINE AND COMPONENT MALFUNCTIONS

In case a malfunction of any type occurs, use AIDS manual record switch to obtain data during and after the malfunction. All pertinent information should be recorded in the logbook. The report should include:

1. Time abnormal indications were observed.
2. Time engine was shut down, if applicable.
3. Length of time engine operated at zero oil pressure.
4. Length of time engine windmilled at zero pressure.
5. Length of time engine windmilled.
6. Any trouble-shooting attempted and the results.
7. Note if AIDS manual recording made.

CROSS STARTING

1. Obtain ground clearance to accelerate the operating engine.
2. Advance throttle on the operating engine until obtaining pressure shown below:

STARTING AIR PRESSURE PSI		
	ALTITUDE	
TEMP ^{o}F	SEA LEVEL	5000 FT
-20	33	28
20	29	25
60	27	22
100	24	19

   Starts may be made at slightly lower pressure but start may be prolonged.

3. Use normal starting procedure for the remaining engines.

OIL PRESSURE CHANGE

1. If oil pressure drops below minimums, shut down the engine.
2. If oil pressure increases rapidly:

   Check oil quantity; if quantity shows an increase, oil is being contaminated with fuel. Shut down the engine.

OIL FILTER PRESSURE LIGHT ON

When the filter pressure warning light comes on, it indicates the main oil filter is becoming clogged and should be replaced.

If other indications of failure are noted, the engine should be shut down.

MANUAL START VALVE OPERATION

If a start valve fails to open after the start switch is pushed, it may be opened manually by a mechanic at the engine.

Communication between cockpit and mechanic is important.

1. Place service interphone switch on.
2. Push ground start switch.
3. Have mechanic open start valve, and check that valve open light comes on.
4. At 20% N_3, move fuel and ignition switch to ON or ENRICH as necessary and advise the mechanic.
5. When engine reaches 45% N_3, tell mechanic to close the start valve.
6. Check that valve open light goes out and ground start switch releases.

BATTERY START

With the battery as the only electrical power and an air source available:

Check that the battery switch is on and the standby power switch armed.

Use Manual Start Valve Operation procedure to start first engine.

Use Cross Starting procedure to start remaining engines.

ENGINE FAILS TO ACCELERATE IN FLIGHT

If an engine fails to accelerate from the flight idle position:

1. Press flight start switch to on.
2. Hold fuel and ignition switch to enrich until engine operation normal.
3. Press flight start switch to off.

FUEL CONTROL AMPLIFIER OVERRIDE

If a thrust loss occurs associated with a decrease in fuel flow for fixed throttle position, the fuel flow amplifier may have caused the loss. If the engine has not flamed out and no other mechanical failures are evident, attempt to restore thrust as follows:

1. Retard throttle to maintain N_3 below 80% to prevent possible RPM and TGT overshoot when fuel control amplifier is overridden.
2. Press the fuel control amplifier OVRD switch. This opens the amplifier control circuit and permits the variable orifice at the fuel control to fully open. With an inoperative amplifier, RPM, and TGT must be maintained within limits manually.
3. Adjust the throttle to maintain EPR and N_1 equal to the remaining engines. Do not exceed RPM or TGT limits.
4. Press the AIDS manual record switch and enter the time the OVRD switch was activated, in the aircraft log. Include engine indications before and after overriding the system.

S DUCT LIGHT(S) ON

The FWD and AFT S-duct lights on the F/E annunciator panel indicate the status of the two latches on the single access door into the S-duct.

Do not start the engine or initiate a takeoff with either latch annunciator light on, until the access door is inspected to determine it is closed and latched.

During takeoff or flight:

One light on - continue normal flight.

Both lights on

Do not shut down the engine unless it's necessary for other reasons.

Limit airspeed to 270 knots.

Land as soon as practical.

VIBRATION MONITOR

A significant increase, 1.0 unit or more, must be reported as a malfunction. Record readings once each flight during stabilized cruise if AIDS inoperative.

If a significant increase is noted, crosscheck other engine instrumentation for related indications. Report all related indications and describe any vibrations that may be noted.

ENGINE SHUTDOWN WITH BATTERY FAILURE

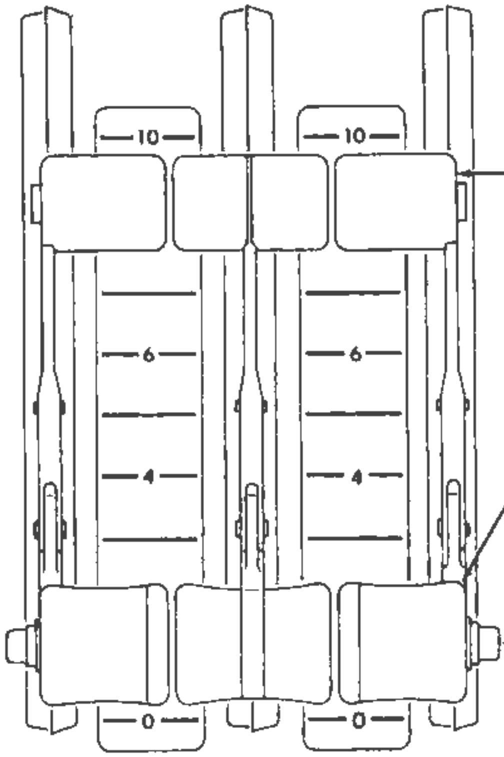
With battery failure or battery voltage less than 22 volts, the last engine shut down must be a wing engine having an operating generator.

Proceed as follows:

1. Place battery and standby power switches off.
2. Shut down number 2 and a wing engine.
3. Close the engine tank valve on the remaining engine. Expect a delay of approximately two minutes at ground idle before engine RPM decreases.
4. When engine RPM decreases, turn off the fuel and ignition switch.

* * *

POWERPLANT CONTROLS



THRUST REVERSER LEVERS

Selects and regulates reverse thrust. Interlock prevents engine acceleration until reverser is extended. Actuating any two reverse levers will automatically extend ground spoilers.
1H16, 17, 18 - THRUST REVERSERS

THROTTLE LEVERS

Regulates engine forward thrust. Advancing any two throttles will retract ground spoilers when the aircraft is on the ground.
3N2, 8, 14 - GND IDLE

AUTOMATIC THROTTLE DISCONNECT SWITCHES

Pushbutton switches on throttle levers one and three. Either switch disconnects the autothrottle system.
1A1 - AUTO THROT SERVO

REVERSER INDICATOR LIGHTS

REVERSER OPERATING - Reverser is in transit or fully deployed.
REVERSER IN TRANSIT - Reverser is in transit. Light out when reverser fully deployed.

3N4, 10, 16 - REV IND.

(C&W PANEL)

OIL PRESSURE LOW ANNUNCIATOR

Oil pressure below minimum limit.
3N5, 11, 17 - OIL LO PRESS LIGHT.

TURBINE AIR OVERHEAT ANNUNCIATOR

Cooling air to the turbine disks is insufficient.

ENGINE NO. 2 FAIL/ARMED LIGHT

Engine No. 2 fail system is armed to operate on ground with takeoff flaps and N_2 above 83%.
3R7 - ENG OUT IND.

ENGINE/APU STATUS ANNUNCIATOR

Oil filter pressure light or engine vibration caution light is activated on engineers panel. APU has automatically shut down.

(GLARESHIELD)

PUSH TO RESET

ENGINE NO. 2 FAIL LIGHTS

No. 2 engine failure, with system armed.

ENGINE INSTRUMENTS

N_1 MAXIMUM INDICATOR LIGHTS
RPM exceeds 101.5%.

ENGINE PRESSURE RATIO INDICATOR
Ratio of exhaust pressure to engine inlet pressure, value is proportional to thrust output. Primary thrust setting instrument.
3L5, 11, 17 - EPR IND.
2H6

MAXIMUM INDICATOR LIGHT RESET
Resets TGT red maximum indicator light and N_2 overspeed pointer.
3R 15 - ENG INSTR RESET.

TGT MAXIMUM INDICATOR LIGHTS
RED - Flashes for 5 seconds when the TGT exceeds 775 degrees. If the temperature is not reduced during this time, light remains on until manually reset.
AMBER - TGT exceeds 745 degrees.

N_3 MAXIMUM INDICATOR LIGHTS
RPM exceeds 95.5%.

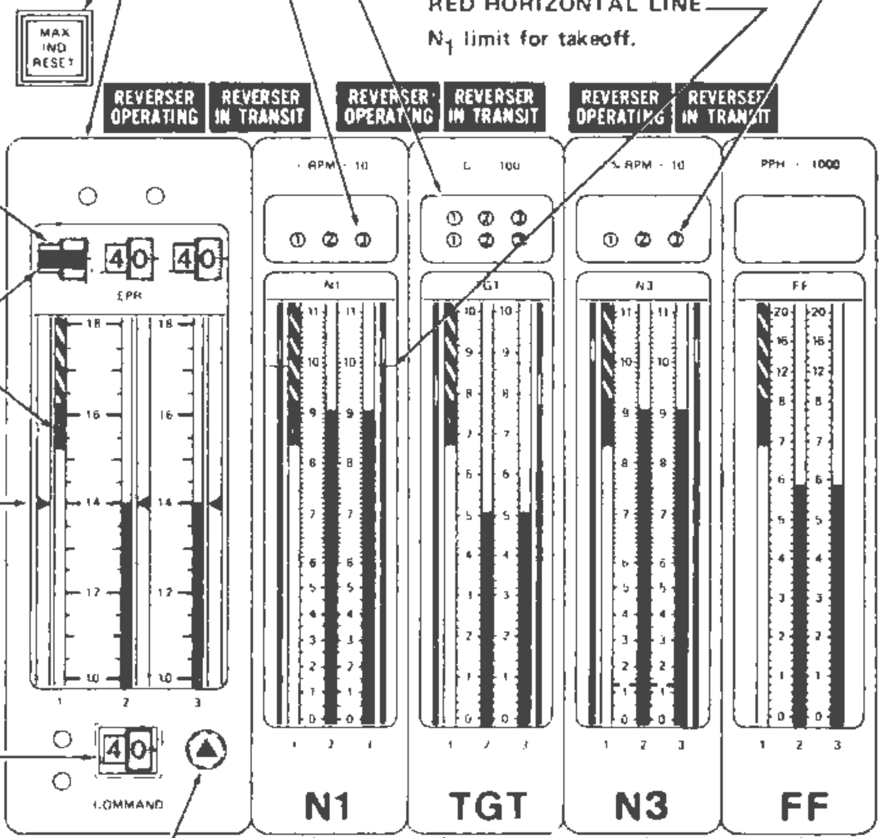
RED HORIZONTAL LINE
N_1 limit for takeoff.

VERNIER COUNTER
Numerical EPR indicated by tape.

OFF FLAG
Flag indicates loss of power to instrument.

EPR BUG
Positioned by EPR set knob.

SET COUNTER
Indicates EPR bug position.



EPR SET KNOB
Positions EPR bug and numerical value in set counter.

N_1 TACHOMETER
Indicates % RPM of the fan (LP) compressor. Secondary thrust setting instrument.
3P2, 8, 14 - TACH N_1.

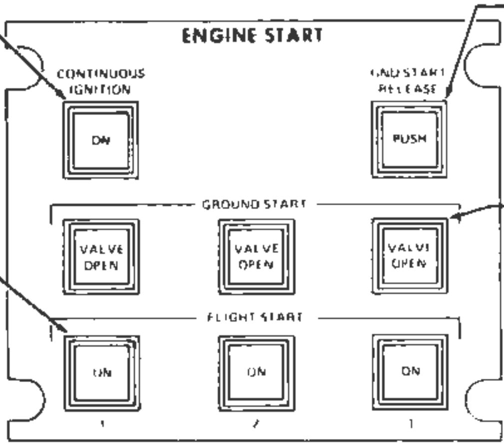
N_3 TACHOMETER
Indicates % RPM of the HP compressor.
1E10, 11, 12 - TACH N_3

TURBINE GAS TEMPERATURE INDICATOR
Indicates temperature of exhaust gas entering N_1 turbine inlet.
1F10, 11, 12 - TGT.

FUEL FLOW INDICATOR
Indicates pounds per hour rate of metered fuel delivered to the engine.
3P5, 11, 17 - FUEL FLOW.

ENGINE START CONTROLS TAT/EPR

PILOTS' OVERHEAD START PANEL



CONTINUOUS IGNITION SWITCH

IN - ON is illuminated. Both low energy ignition systems energized when the fuel and ignition switch is on.

OUT - Deenergizes both low energy ignition systems.

3R8, 9 - CONT IGN, SYS A SYS B

FLIGHT START SWITCH

IN - ON is illuminated. Both high energy ignition systems energized when the fuel and ignition switch is on.

OUT - Deenergizes both high energy ignition systems.

3N6, 12, 18 - START IGN SYS A
1F13, 14, 15 - B START IGN.

GROUND START RELEASE SWITCH

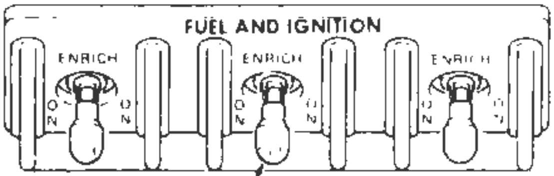
PUSH is illuminated when ground start switch is pressed and goes out when N_3 reaches 51%. When pressed, start valve closes and ignition is terminated.

GROUND START SWITCH

Arms high energy ignition system and arms engine start valve to open with pressure. VALVE OPEN and PUSH are illuminated. At 45% N_3 VALVE OPEN light goes out. At 51% N_3 the ground start switch releases.

3N6, 12, 18 - START IGN SYS A
1F13, 14, 15 - B START IGN
3N3, 9, 15 - START AIR VALVE
3F10 - ENG START PWR

CENTER CONSOLE FUEL AND IGNITION SWITCH PANEL



FUEL AND IGNITION SWITCHES

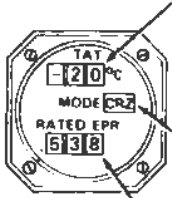
ON - Completes all ignition circuits to engine and opens high pressure fuel shutoff valves on fuel control.

OFF - Deactivates all ignition circuits to engine and closes high pressure fuel shutoff valves.

ENRICH - Momentary position which adds fuel for cold day starts or slow start acceleration.

1E13, 14, 15 - START CONT.
1F14, 15, 16 - B START IGN.

TAT/EPR GAGE



TAT

Shows total air temperature. Failure flag appears over indicator with power loss or system failure. TAT failure will cause flag to appear over EPR indicator.

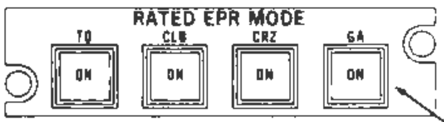
MODE

Selected flight mode is indicated.

RATED EPR

Indicates limit for selected mode. Failure flag appears over indicator with power loss, system failure, or failure of TAT indicator.

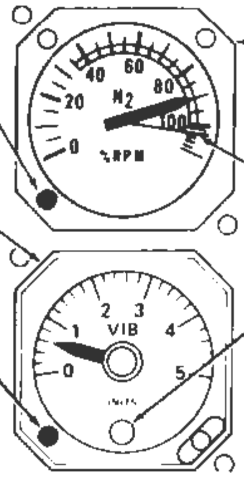
3R12 - TAT/EPR.



EPR MODE SELECTOR SWITCHES

Selects the TAKEOFF, CLIMB, CRUISE or GO-AROUND flight mode for the EPR computer. ON is illuminated when its respective switch is pressed and the other ON lights are extinguished.

N_2, AVM, OIL INDICATORS



N_2 TACHOMETER TEST SWITCH
Tests indicator by driving wide pointer to the 12 o'clock position.

N_2 TACHOMETER
Indicates % RPM of intermediate pressure compressor.
3P3, 9, 15 - TACH N_2.

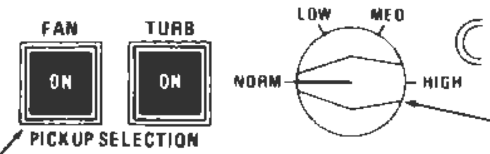
OVERSPEED POINTER
Indicates maximum attained RPM and remains at this point until reset with MAX IND RESET switch on pilot's panel.

ENGINE VIBRATION INDICATOR
Vibration level as selected by pickup selector and filter selector.
3R2 - ENG VIB.

ENGINE VIBRATION CAUTION LIGHT
Filter vibration level is reaching abnormal condition.
3R3 - ENG VIB LT

VIBRATION MONITOR TEST SWITCH
Tests indicator by driving pointer to the 3 o'clock position illuminating engine vibration caution light.

TEST SWITCH
Tests vibration system and indicators with test signal to pickups.



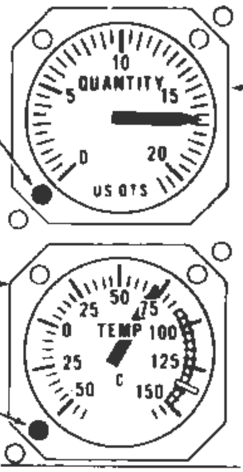
VIBRATION PICKUP SELECTORS

FAN - Select fan pickup from all engine systems simultaneously.
TURB - Selects turbine pickup signal from all engine systems simultaneously.

ON light illuminated when switch is in. With both ON lights extinguished, both fan and turbine pickup accelerometers are operating.

BROAD BAND VIBRATION FILTER SELECTOR
Rotary switch selects frequency filter to be read on all engines simultaneously.

NORM - Monitors a broad band of frequencies.
HIGH - Monitors the higher frequencies.
MED - Monitors only the middle frequencies.
LOW - Monitors only the lower frequencies.

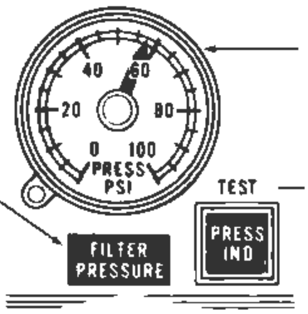


OIL QUANTITY TEST SWITCH
Test oil quantity indicator by driving pointer to 12 o'clock position.

OIL QUANTITY INDICATOR
Usable oil remaining in the engine oil tank.
3R14 - OIL QTY.

OIL TEMPERATURE INDICATOR
Oil temperature after passing through filter.
3P1, 7, 13 OIL TEMP.

OIL TEMPERATURE TEST SWITCH
Tests oil temperature indicator by driving pointer to 12 o'clock position.

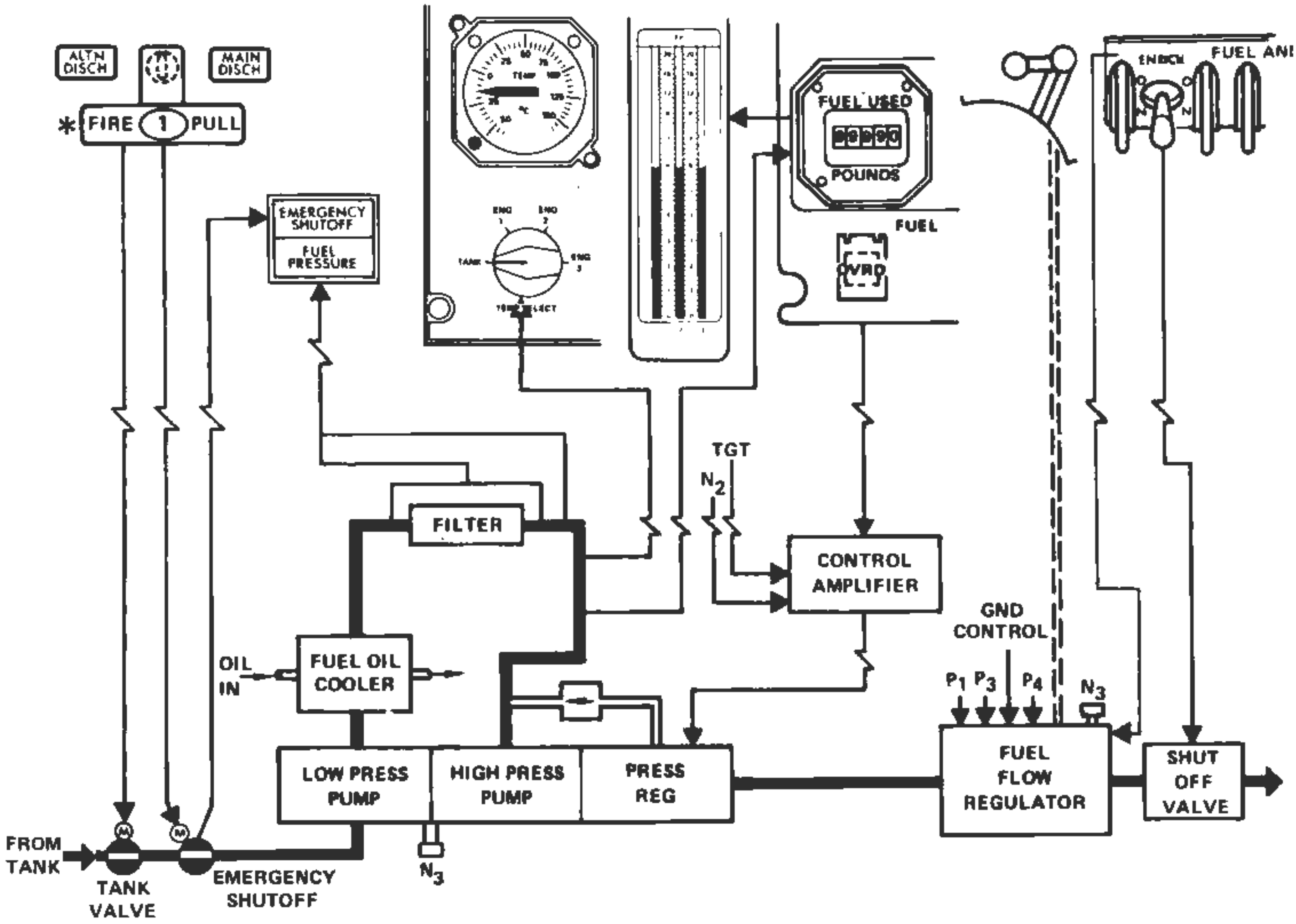


OIL PRESSURE INDICATOR
Pressure in oil distribution system.
3R10 - OIL PRESS.

FILTER PRESSURE LIGHT
Pressure differential exists across oil filter. Filter is becoming clogged.
3N5, 11, 17 - OIL LO PRESS LIGHT.

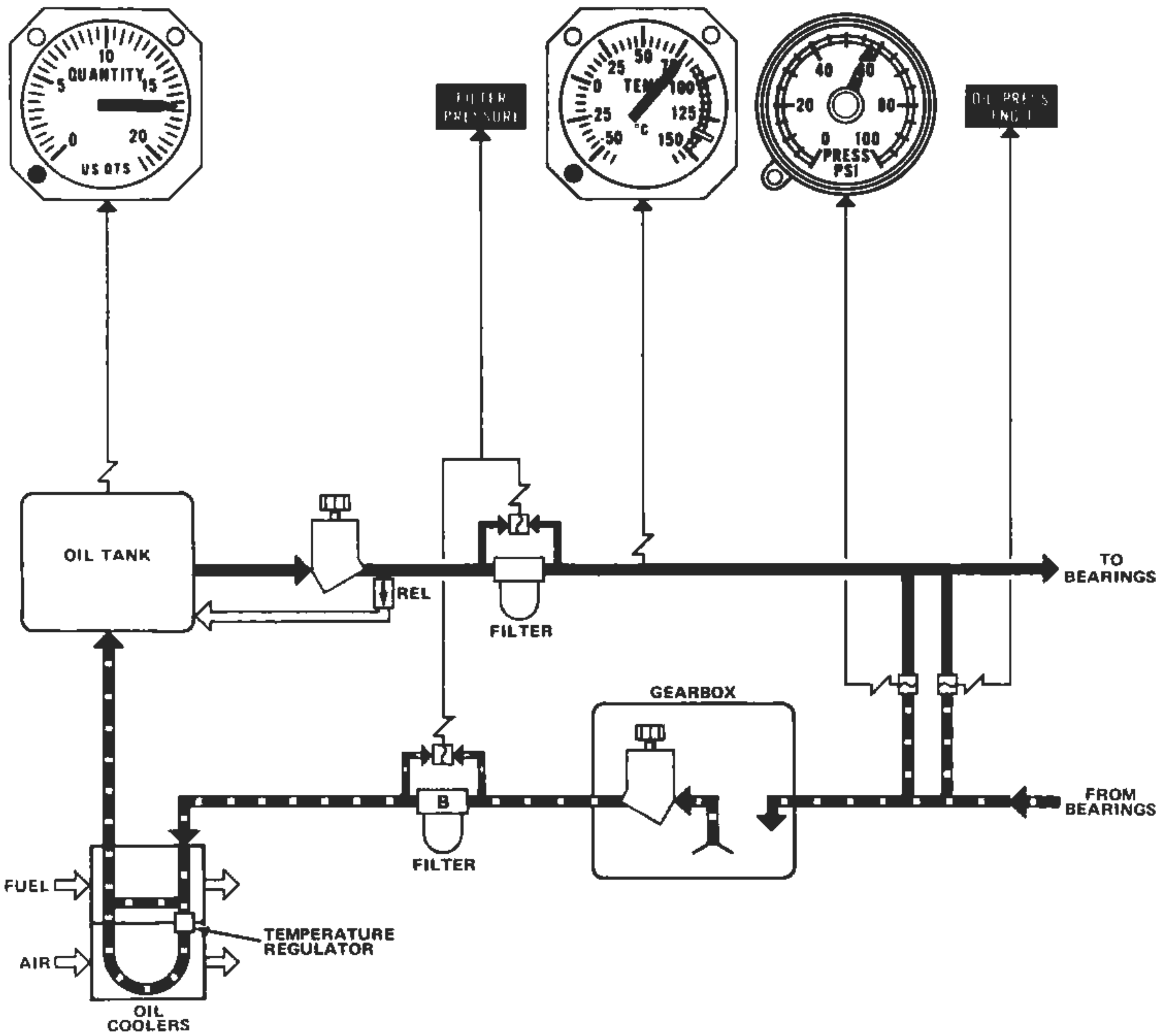
INDICATOR TEST
Drives oil pressure indicator pointers to 9 o'clock position.

ENGINE FUEL SYSTEM



*NO. 2 FIRE CONTROL CLOSES TWO EMERGENCY SHUTOFF VALVES BUT NOT TANK VALVE.

ENGINE OIL SYSTEM



ENGINE DESCRIPTION

The RB211 is a high bypass ratio (5:1) engine consisting of three axial flow compressors in series, an annular combustion chamber, and five turbines. The takeoff thrust rating is 42,000 pounds.

N_1 is the low pressure compressor and consists of a single stage fan, without inlet guide vanes, driven through its own shaft by a three stage turbine. The speed of the fan is displayed by the N_1 vertical scale tachometer. The fan (N_1) accounts for approximately 75 percent of the engine thrust.

N_2 is the intermediate compressor which is a seven stage unit driven through its own independent shaft by a single stage turbine. It provides the primary bleed air source for various aircraft pneumatic systems and accessories. The speed of N_2 is displayed by a conventional radial tachometer.

N_3 is the high pressure compressor which is a six stage unit driven through its own shaft by a single stage turbine. N_3 bleed air is used to augment N_2 bleed air as the situation demands. A vertical scale tachometer displays N_3 speed.

N_3 drives an accessory gear box which is mounted on the fan case. The accessory gear box provides drives for the engine oil pumps, fuel pumps, fuel flow regulator, hydraulic pumps, and the integrated drive generator.

COMPRESSOR AIRFLOW CONTROL

To maintain airflow stability, the N_2 compressor is fitted with variable inlet guide vanes and two surge bleed valves. At low RPM, the guide vanes are closed and the bleed valves are open. During acceleration, the guide vanes progressively open and the bleed valves close at a predetermined compression ratio. The N_3 compressor incorporates two bleed valves. During starting, the bleed valves are open. At 51% N_3, one valve closes while the second valve operates in unison with the N_2 bleed valves.

COOLING AND SEALING AIR

Air is taken from the compressors for engine internal cooling and pressurization of oil seals. Compressor air continuously anti-ices the N_1 nose spinner.

INSTRUMENTS

GENERAL

Each vertical instrument contains three independent scales, one representing each engine. Vertical instruments display EPR, N_1, TGT, N_3, and F/F. AC power is required for their operation. Each segment of the instrument incorporates a built-in testing device that causes a crosshatched portion of the vertical tape to appear at the top of the scale should a malfunction occur.

EPR INDICATOR

The EPR indicator system is provided with pressure pickups in the engine inlet cowl and in the fan and turbine exhaust ducts. A digital tape position readout above each scale provides an easy reading of EPR developed and is used for fine throttle adjustments. The command window displays the numerical position of three bugs. The bugs are adjusted simultaneously by a single control on the instrument face.

N_1 TACHOMETER

Fan speed is displayed by the N_1 tachometer and is used as the alternate thrust setting instrument. An overspeed indicator light above each scale will illuminate whenever maximum fan speed has been exceeded. The light may be extinguished by correcting the overspeed condition or pressing the max indicator reset switchlight.

N_2 TACHOMETER

The N_2 speed is displayed on a conventional dial instrument on the engineer's panel. The instrument contains an overspeed pointer that is moved off its preset position by the RPM indicating pointer. Once moved off its preset position, the pointer will indicate the overspeed that has occurred. The overspeed pointer may be reset by pressing the max indicator reset switchlight.

N_3 TACHOMETER

The N_3 tachometer displays the speed of the high pressure compressor and incorporates all the features of the N_1. It also provides control for deactivating the starter circuits and hydraulic system ram air turbine deployment. N_3 displays a horizontal engine starting reference mark across the scales at 20%.

INSTRUMENTS (Cont'd)

TURBINE GAS TEMPERATURE

Thermocouples in the low pressure nozzle assembly sample the turbine gas temperature which is displayed on the vertical scale instrument. Over temperature lights above each scale will illuminate whenever maximum temperature limits are exceeded. The lights may be reset by reducing the temperature or pressing the max indicator reset switchlight.

FUEL FLOW

Fuel flow is measured in a conventional manner. A flow transmitter at the outlet of the low pressure fuel pump generates signals for the flow indicator on the pilot's panel and fuel used indicator on the engineer's panel.

ENGINE 2 FAIL INDICATOR

The system is armed when the aircraft is on the ground, takeoff flaps are set, and N_2 RPM increases through 83%. A green, engine 2 fail armed light on the C/W annunciator panel will illuminate.

Should engine 2 fail before liftoff (as sensed by N_2 RPM decreasing through 80%), both amber engine 2 fail lights on the glareshield will illuminate. Pressing either light will extinguish both lights and reset the system.

After liftoff, the system is deactivated and the engine 2 fail armed light extinguishes.

ENGINE START AND IGNITION

The engine starting system consists of a pneumatic starter which rotates the N_3 rotor assembly through the accessory gear box drive. The starter can be driven by an external air supply, or by bleed air from the APU or any operating engine. The ignition system consists of two dual-output, high and low energy igniter units, and two igniter plugs. Controls for selection of ignition and initiation of the start cycle are located on the overhead panel. Fuel and ignition switches are located just aft of the throttles.

When the ground start switch is pressed, a relay is energized to hold the start switch in until the start sequence is completed. The ground start switch controls the following:

Signals the APU to go to max mode if running.

Arms the engine isolation and start valves to open.

Valve open light illuminates when air opens the start valve.

Push legend in ground start release switch illuminates.

Arms the fuel and ignition switch for high energy ignition.

When the fuel and ignition switch is placed on:

Engine high pressure fuel shutoff valve opens.

Ignition circuit is completed to both ignitors.

At 45% N_3 the following occurs:

Start valve and engine isolation valve de-energized to close.

Ground start valve open light extinguishes.

At 51% N_3 the following occurs:

Ground start switch releases.

Push legend in ground start release switch extinguishes.

Ignition terminates.

GROUND START RELEASE

If the push legend is on, pressing the ground start release switch will terminate the start by:

Releasing the ground start switch.

Closing the start and engine isolation valves.

Terminating ignition.

CONTINUOUS IGNITION

The continuous ignition switch provides low energy ignition to both ignitors in all three engines if the respective fuel and ignition switch is in the on or enrich position.

FLIGHT START

The flight start switch provides high energy ignition to both ignitors if the fuel and ignition switch is in the on or enrich position.

ENGINE FUEL

GENERAL

Fuel from the aircraft fuel system is delivered to the engine under tank pump pressure through the emergency shutoff valve(s). Fuel enters the low pressure engine pump where its pressure is increased and then routed through the fuel oil cooler, fuel filter, fuel flow transmitter and into the high pressure engine driven pump. The low and high pressure pumps are driven by a common shaft from the N_3 compressor. Output of the high pressure engine pump is regulated in flow and pressure before it enters the fuel flow regulator where final metering is accomplished. The fuel then passes through an electrically controlled shutoff valve before entering the distribution manifold and combustion chamber nozzles.

OPERATION

The low pressure engine pump increases tank pump pressure to meet the inlet pressure requirements of the high pressure pump. The low pressure pump is capable of operating with a negative inlet pressure to sustain operation with inoperative aircraft fuel tank pumps.

The oil cooler utilizes fuel to cool the oil; therefore, the rate of oil system heat reduction is dependent on the fuel flow through the cooler. Any throttle position changes may affect oil temperature due to changes of fuel flow rates through the cooler.

The low pressure filter has sufficient capacity to permit continuous engine operation for all phases of flight. Pressure sensors at the filter inlet and outlet measure the differential pressure across the filter. At a predetermined pressure drop, the fuel pressure light on the fuel system panel will illuminate. This light will also illuminate when a pressure loss is sensed at the filter outlet due to a low pressure pump failure.

A thermal bulb at each filter outlet measures fuel temperature. A selector switch at the fuel panel provides a means of selecting any engine or the 2L tank position. The temperature of the selected position is displayed on the fuel temperature indicator on the fuel panel.

The fuel flow transmitter measures the rate of fuel flow to the engine. This measurement is displayed on the pilot's fuel flow indicator in pounds consumed per hour and on the engineer's fuel used indicator in total pounds consumed since the indicator was last reset.

High pressure pump output is dependent on engine speed; therefore, it is necessary to control fuel flow to the engine for steady running and transient conditions. A bypass valve senses pressure at the fuel flow regulator inlet and bypasses fuel back to the high pressure pump when the fuel regulator inlet pressure reaches a predetermined value. When more fuel is required during acceleration, the bypass valve closes reducing bypass flow and increasing fuel flow to the engine.

The engine incorporates a fuel control system. The system senses N_2 speed and turbine gas temperature. When limitations are reached in either of these parameters, an electrical actuator on the fuel pressure regulator bypasses fuel back to the high pressure pump. This reduces fuel flow causing the engine to decrease speed and temperature. The amount of fuel flow reduction is proportional to the amount of N_2 RPM or TGT overshoot. The system may be deactivated by use of the fuel control override switch on the engineer's panel.

The fuel flow regulator is basically a hydromechanical governor. The regulator has air pressure inputs from the engine inlet, the inlet and outlet of the high pressure compressor, RPM sense from N_3, and throttle position selected from the cockpit. By comparing all parameters, the regulator schedules fuel flow to meet thrust requirements imposed by throttle position.

An air/ground sensor incorporated in the fuel regulator increases minimum RPM to meet flight idle requirements. After touchdown, engine RPM is reduced to ground idle which is low enough to satisfy taxi operation without excessive braking.

The enrich position of the fuel and ignition switch increases fuel flow while starting at low ambient temperatures. When using enrich, the switch must be held in position; when released, it will return to the on position.

The aircraft is not equipped with a fuel heater system.

ENGINE OIL

The engine oil system is of the full flow type in which the pump pressure and capacity is designed to meet all phases of engine operation

ENGINE OIL (Cont'd)

The oil tank is an integral part of the accessory gear drive. The tank is normally gravity filled but contains provisions for pressure filling. A dipstick installed for manual inspections of the oil level is graduated in pint increments. The tank incorporates a visual sight gauge to indicate oil level. The quantity indicator transmitter is of the capacitance type and displays the quantity of oil remaining in the tank on the engineer oil quantity indicator. The indicator is graduated in quarts.

The oil pressure pump, driven by N_3, receives oil from the tank and delivers it to a pressure relief valve. The relief valve controls the pressure entering the lubrication system.

The oil filter has a differential pressure switch that senses filter inlet and outlet pressures. If the filter begins to clog, the differential pressure will be affected. At a predetermined value, the pressure switch is activated and illuminates the C/W annunciator engine/APU status light and the engineer's filter pressure light.

The engine oil pressure indicator displays a differential of pressures between the pressure lubrication and scavenge oil system. An oil low pressure light on the C/W annunciator panel will come on whenever oil pressure drops below limits for engine operation. The oil temperature is measured as the oil enters the pressure distribution system.

A scavenge system returns the oil from the rotor bearing cases and gear boxes to the oil tank. En route, the oil passes through a scavenge filter which incorporates a differential pressure switch to provide a warning in the cockpit should the filter become clogged.

A fuel/oil cooler, cools the oil to an acceptable level before it enters the tank; if not, a temperature regulator re-routes the oil through an air/oil cooler in the fan duct, then to the tank.

An air/oil separator in the oil tank vent system separates the air in the system from the oil; the oil is dumped into the gear box and the air overboard through the engine vent system.

ENGINE PRESSURE RATIO COMPUTER

The EPR system continuously computes and displays on the pilots' instrument panel the maximum permissible EPR for the selected engine mode, utilizing the inputs of altitude, mach number and total air temperature. The system adjusts the maximum permissible EPR to account for all engine bleeds, i.e., wing and engine anti-ice and any or all ECS packs using engine bleed air. On the ground, it will not recognize engine anti-ice and will not function with probe heat on.

The computer furnishes a rated EPR for each of the selectable engine ratings; takeoff (T/O), climb (CLB), cruise (CRZ), and go-around (GA).

AIRBORNE VIBRATION MONITOR

The airborne vibration monitor (AVM) system shows the engine vibration level continuously.

Two vibration pickup sensors are on each engine; one is mounted on the upper fan case, the other on the turbine case. The pickups are simple accelerometers using crystals and a mass insulated from one another. As the engine vibrates during operation, the pickups move with the engine while the mass inside the pickup tends to remain at rest. This results in varying acceleration, which generates signal impulses proportional to the forces of vibration felt by the pickup.

The pickup signal passes through a signal conditioner, is amplified, and sent to the vibration indicator.

The engine vibration indicator displays the vibration level in units The indicator is on the engineer's panel and selector switches are provided to select either turbine or fan vibrations.

A frequency selector switch allows the examination of a vibration reading to determine what portion of it is attributed to high, low, and mid frequencies. The selector switch is usually kept in the normal position to read the sum of all frequencies.

With the engine operating, vibrations can be obtained simultaneously from the three turbine and fan pickups. Either the fan or turbine vibration can be read by holding in the respective switch. The amount of vibration in any one band of frequencies may be checked by the selector switch. The accepted vibration level for any RPM will vary between engines. If any one scale of indicators shows zero reading with the engine operating, the AVM system for that scale is malfunctioning.

THRUST REVERSER

The thrust reverser system consists of a fan air stream reverser driven by an air motor using high pressure bleed air. The system is controlled by the reverse throttle levers in the cockpit. Two lights associated with the system, the in-transit and operating lights, indicate reverser position and operation.

As the fan sleeve reverser is moved aft, blocker doors that are mechanically linked to the sleeve divert the fan air through deflectors outboard and toward the front of the aircraft.

Selecting reverse thrust with the throttles at idle releases mechanical locks and permits a pneumatic motor to drive the reversers to their reverse thrust position. A mechanical interlock stop in the mechanism limits reverse lever travel until the fan reverser is in the full reverse position.

When the reversers are in their full reverse thrust position, the in-transit light goes out and the interlock stops release. After the interlock stops have been released, the reverse levers may be lifted to the maximum reverse thrust position. The reverser system is deactivated in flight by ground sensing switches.

In the event of a rejected takeoff, lifting any two reverse levers will cause the spoilers to be deployed. To prevent possible reverser damage or personal injury, a reverse interlock stop check should not be attempted during preflight. The fan latch pins should be visually inspected at preflight walkaround inspections.

* * *

INTRODUCTION

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CONFIGURATION DEVIATION LIST

WEIGHT AND BALANCE DATA

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FLIGHT PLANNING CHARTS

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THRUST SETTING CHARTS

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PLANNING INFORMATION AND PERFORMANCE DATA

The flight planning and performance data needed by flight crews and flight dispatch personnel to operate this aircraft is contained in the following publications:

1011 Flight Handbook, chapter 21
1011 Flight Planning
1011 Aircraft Performance
1011 Takeoff Charts

Flight Dispatch offices and Flight Operations staff personnel requiring complete planning and performance data references should subscribe to the entire group of publications listed above.

The material in the 1011 Flight Handbook includes all chart premises, planning policies, and flight crew instructions for use of all material contained in the various publications. It also contains all planning charts and performance data required in flight for routine and contingency operations.

The Flight Planning manual is maintained for crew use at regular stations. Copies are also available at Flight Dispatch offices. This manual contains all charts and data necessary for routine flight planning prior to actual flight.

The Aircraft Performance manual is stowed aboard the aircraft. It contains performance data used on an irregular or non-routine basis for crosschecking aircraft performance parameters. The information contained is not critical and a flight may be conducted without the manual aboard. Flight Dispatch will provide any en route requirement for data and the manual should be replaced at the first practical opportunity.

The Takeoff Chart manual, issued only to staff and dispatch offices, contains copies of all takeoff performance charts issued for the aircraft. Individual charts are routinely provided at the particular station and intended for one-time use by the flight crew.

* * *

MINIMUM EQUIPMENT LIST (MEL)

The Minimum Equipment List (MEL) indicates items of normal equipment which may be inoperative for flight dispatch without adversely affecting the airworthiness of the aircraft.

Items which are related to the airworthiness of the aircraft but not included in the MEL are required to be operative. Items obviously basic to airworthiness, such as tires, flight controls, or engines, do not appear.

Equipment not affecting airworthiness, such as passenger convenience or entertainment items, also does not appear and is not required for dispatch.

When the captain and dispatcher are unable to determine the category for an unlisted item or when the status of a partially inoperative item needs clarification, they should contact Operational Planning. Operational Planning will contact the appropriate Flight Operations staff member for an interpretation. A confirming teletype message will be sent to all concerned parties. The flight should not be delayed awaiting the confirming message, however, since it will become a part of the flight records.

The captain and dispatcher are responsible only to determine that the flight in question can be conducted safely under the conditions anticipated using the MEL; however:

> Under no condition shall a flight be dispatched with less operative equipment than that required by the MEL.
>
> The captain may require equipment over and above that specified in the MEL when in his judgment it is needed for the conditions under which the flight is to be conducted.
>
> When multiple permissible items exist, the captain will assure that any interface or inter-relationship between inoperative systems or components, or the exposure to additional failures, will not result in a degradation in the level of safety or cause an undue increase in the crew workload.

The following definitions apply for the purpose of implementing the MEL:

> VFR conditions are considered to exist when airport ceiling and visibility are forecast and reported at all times at least 1000 feet above the initial approach altitude and 3 miles, and en route operation from point of takeoff to point of landing can be conducted with visual ground contact.
>
> All other operating conditions shall be considered IFR.

Under special circumstances specific test or ferry flights may be conducted with inoperative equipment beyond that allowed by the MEL upon specific authorization by NYCWO.

When dispatched under the provisions of the MEL, an appropriate placard must be installed in clear view of the captain.

PLACARDING POLICY

Maintenance policy provides for a standard temporary cockpit placard and procedure for inoperative or missing components.

In the upper portion of the standard placard are entries for airplane number, station, logbook pages involved, and description of malfunction or deactivation. This portion is completed by the appropriate maintenance agency and attached to the outside front cover of the logbook.

The lower section of the placard is a tearoff containing the words INOPERATIVE and MALFUNCTION. The portion containing the appropriate word is applied on or adjacent to the affected instrument or control.

When corrective actions are made, both sections of the placard are to be removed.

A system and/or component is considered inoperative any time it does not accomplish its intended purpose and/or does not consistently function within its designed operating limits or tolerances.

MINIMUM EQUIPMENT LIST INDEX

The MEL is arranged by ATA system numbers. This cross index is presented in alphabetical order as an aid in locating items. The appropriate ATA system number is listed in the right-hand column.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
21 AIR CONDITIONING AND PRESSURIZATION		
-21-01 Pack Flow Control Valves	3	One may be inoperative. Inoperative valve must be locked and closed. Dispatching with one valve closed: If a second valve should fail en route, position cool air overboard switch to close and descend to 25,000' or below.
-21-21 Compressor Overheat Trip System	3	One overtemperature switch per pack may be inoperative provided associated compressor and ACM discharge temp indication is operative.
-21-24 Pack Discharge Overheat Trip System	3	Should it be necessary to use manual temperature control system, maintain associated compr disch temp and ACM disch temp below the following limits: For inoperative compressor overtemperature switches, limit compr disch temp to less than 200°C. For inoperative pack discharge overtemperature switch(es), limit ACM disch temp to less than 80°C.
-22-07 Instrument Panel/Pedestal Cooling Fan	1	In the event of failure en route, the airplane may continue the flight or series of flights but may not depart the station designated by MCIMD without being repaired.
-24-02 → Galley Exhaust Airflow Control Valve (Cool Air Overboard)	1	The close function may be inoperative provided there are no extended overwater flights.
-24-06 Galley Exhaust Fan	1	May be inoperative provided galley exhaust airflow control valve is operative open and mid electrical service center fan is ground operative. See additional information for item 21-24-02.
-25-01 Forward Avionic Service Center Exhaust Airflow Sensor	1	May be inoperative provided: The differential pressure sensing circuit is placed in the no pressure position. Exhaust flow control valve is operative. Exhaust fan is operative. NOTE: The FESC flow control valve will remain open in flight and on the ground, so overboard light will remain illuminated. Valve can be closed by unlatching cool air overboard switch.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
21 AIR CONDITIONING AND PRESSURIZATION (Cont'd)		
-25-02 Mid Electrical Service Center Exhaust Airflow Sensor	1	May be inoperative provided: The differential pressure sensing circuit is placed in the no pressure position. Exhaust airflow control valve is operative. Exhaust fan is operative. A new or recycled battery which has been maintained on a continuous pulse or trickle charge is installed prior to each takeoff.
-25-03 Forward Avionic Service Center Exhaust Fan	1	Fan may be inoperative provided: Fan is free to windmill. Fan C/B (on left galley C/B panel) is pulled and banded. Fwd avionics "LO FLO" light is operative. During maintenance/passenger loading operations the electrical system must be in the GND SERV mode. Within 15 minutes of switching from GND SERV mode to power on main busses, pressurize aircraft to obtain cabin altitude 250-300 feet below field elevation (to establish adequate FESC equipment cooling). DO NOT EXCEED 0.15 PSID. May not depart a station where repairs or replacement may be made.
-25-04 Mid Electrical Service Center Exhaust Fan	1	May be inoperative provided: Exhaust flow control system is otherwise operative, a fully charged battery is installed as determined by normal operation of battery charger prior to each takeoff, and no more than one (1) APU start (or attempted start) is made. Battery charger CB pulled whenever cabin differential pressure is less than 1 PSI. Galley modules are not serviced with dry ice.
-25-05 Forward Avionic Service Center Exhaust Fan Differential Pressure Switch	1	Switch may be inoperative provided the differential pressure sensing circuit is placed in the no pressure position and exhaust flow valve is operative. Exhaust fan is operative. NOTE: The FESC flow control valve will remain open in flight and on the ground, so overboard light will remain illuminated. Valve can be closed by unlatching cool air overboard switch.
-25-06 Mid Electrical Service Center Fan Differential Pressure Switch	1	Must be operative for transoceanic operation. May be inoperative provided: Exhaust air flow control valve is operative. Exhaust fan is operative. Differential pressure sensing system is placed in the "No Pressure" position. A new or recycled battery which has been maintained on a continuous pulse or trickle charge is installed prior to each takeoff.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
21 AIR CONDITIONING AND PRESSURIZATION (Cont'd)		
-25-09 Forward Avionic Service Center (FESC) Flow Control Valve	1	Close control of the valve may be inoperative provided: All packs are operative. The MESC flow control valve (see 21-25-10) is operative. NOTE: FESC overboard light will remain illuminated in flight.
-25-10 Mid Electrical Service Center (MESC) Flow Control Valve	1	Close control of the valve may be inoperative provided: All packs are operative. The FESC flow control valve (see 21-25-09) is operative. No extended overwater flights. NOTE: MESC overboard light will remain illuminated in flight.
-25-17 Inertial Navigation System Exhaust Fan	1	May be inoperative provided avionics service center exhaust fan is operative (see 21-25-03).
-31-01 Cabin Pressure Control	1	Normal or standby modes may be inoperative provided manual mode is operative and both outflow valves are operative. Select operative mode.
-31-03 Forward Outflow Valve	1	Valve must be operative. Valve may be operated with the Normal or Standby mode inoperative provided the Manual mode is operative and provided the aft outflow valve is operative in all modes. (See 21-31-01)
-31-04/-52 Aft Outflow Valve and/or Actuator	1	Valve may be inoperative provided the valve is closed and both cabin safety valves are operative. (See MEL item 21-31-01). Valve may be operated with the Normal or Standby mode inoperative provided the Manual mode is operative and provided the forward outflow valve is operative in all modes.
-32-01 Forward and Aft Cabin Safety Valves	2	One may be inoperative if closed, provided both cabin outflow valves are operative.
-32-05 Cabin Safety Valve Open Indicators	2	Both may be inoperative provided both cabin safety valves are operative.
-33-01 Cabin Altitude and Differential Pressure Indicator	1	Either the cabin altitude or cabin pressure indication may be inoperative provided the other is operative. Operate the cabin pressure control system in the auto mode. Select flight altitude and read cabin altitude from the tape. The operative gauge should indicate the same cabin altitude as selected on the tape or max normal pressure differential. For pressure selections less than max differential, refer to chart (FHB 5.01) to get the pressure vs. cabin altitude relationship.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
21 AIR CONDITIONING AND PRESSURIZATION (Cont'd)		
-33-02 Cabin Rate-of-Climb Indicator	1	May be inoperative provided normal pressurization mode, cabin altimeter, and differential pressure indicators are operative.
-41-02 Hot Air Manifold Temp Control Valves	2	May be inoperative. Inoperative valve(s) must be in the closed position.
-41-05 Hot Air Manifold Temp Control Sensors	2	May be inoperative provided associated hot air valve(s) are closed.
-41-17 Hot Air Manifold Isolation Valves	2	One valve may be inoperative open or closed. Both valves may be inoperative closed provided: They are manually closed. The ECS monitor panel temperature indications are operative (see 21-21-24).
-41-19 Hot Air Duct Overheat Switch	1	May be inoperative provided hot air manifold temperature control valves are closed.
-43-00 Floor Heat System and Components 21-43-01 thru 21-43-08	-	System and any of its components may be inoperative provided the associated circuit breaker (3W11 and 12) for electrical controlled devices are pulled.
-44-00 Cargo Heating System and Components 21-44-04 thru 21-44-17	3	Forward, mid, and aft cargo compartment fan(s) may be inoperative.
	3	Forward, mid, and aft cargo compartment fan cycling switch(es) may be inoperative in the open position.
	3	Forward, mid, and aft cargo compartment overtemperature switch(es) may be inoperative provided associated fan circuit breaker is pulled and collared.
	3	Forward, mid, and aft cargo compartment cold indication switch(es) may be inoperative. NOTE: Whenever aft cargo heating system is inoperative, live cargo heat requirement must be considered.
-51-01 Dual Pack Heat Exchangers	3	One may be inoperative provided associated flow control valve is manually closed.
-51-04 Ram Cooling Header and Check Valve	3	May be inoperative provided associated pack(s) not operated on the ground.
-51-07 Pack Air Cycle Machines	3	One only may be inoperative for transoceanic operation. Two may be inoperative provided: All other components in the affected air cycle system are operative. The turbine bypass valve on the affected ACM is locked open. The associated ram air exhaust actuator and indicator are operative.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
21 AIR CONDITIONING AND PRESSURIZATION (Cont'd)		The associated flow control valve is operative and opened only in flight. The associated ACM discharge temperature is monitored. The remaining pack is fully operative. (See 21-21-01 and 21-62-16.)
-51-22 Pack Water Separators	3	Three may be inoperative provided associated ACM outlet temperature control system is operated in manual mode for ground operation and corresponding turbine bypass valve is positioned open. (See 21-63-09/11.)
-61-01 Auto Temp Selector	5	Any combination or all may be inoperative provided:
-61-02 Zone Auto Temp Controllers	5	Associated Zone Control Valves are closed (21-61-07); or
-61-07 Zone Auto Control Valves	5	Both hot air isolation valves are closed (21-41-17); or
-61-12 Zone Duct Temp Sensors (Auto Control)	5	Trim air pressure regulator and shutoff valve is closed (21-61-27).
-61-17 Zone Temp Sensors	5	
-61-27 Trim Air Pressure Regulator and Shutoff Valve	1	May be inoperative open or closed. With valve closed, all trim air is shut off.
-62-01 Pack Temperature Controllers	3	Three may be inoperative provided associated pack(s) can be operated automatically or manually (see 21-63-09/11) and ECS temperature indication system (on ECS monitor panel) is operative. For manual operation, select manual on the auto/mnl selector switch for the pack(s) with the inoperative temperature controller(s). Select ACM discharge and monitor ECS and cabin zone temperature on the ECS monitor panel. Control cabin temperature to a comfortable level by varying the position of the turbine bypass and ram air doors with the cool and warm switches as required. If one or two packs are controlling in auto, manually select the same approximate ACM discharge temperature for the pack(s) with the disabled controller. Monitor temperatures during aircraft speed and altitude changes.
-62-04 Ram Air Exit Door Actuators	3	One may be inoperative. Two may be inoperative provided one of the remaining is fully operative and the other is fixed in mid position.
-62-13 Pack Ram Air Exit Door	3	One may be inoperative. Two may be inoperative provided one of the remaining is fully operative and the other is fixed in mid position.
-62-16 Turbine Bypass Valves	3	Two may be inoperative provided: All other components in the affected air cycle system are operative. → The inoperative valve is locked open. (If the valve cannot be locked open, the pack valve must be locked closed.)

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
21 AIR CONDITIONING AND PRESSURIZATION (Cont'd)		
		The associated ram air exhaust actuator and indicator are operative. The associated flow control valve is operative and opened only in flight. The associated ACM discharge temperature is monitored. The remaining pack is fully operative. (See 21-21-01 and 21-51-07).
-62-19 Pack Ice Sensors	3	Three may be inoperative provided ACM outlet temperature is maintained above zero degrees C. (See 21-63-09/11.)
-62-22 Pack Temperature Discharge Sensors (Auto Control)	3	Three may be inoperative provided associated pack(s) can be operated manually. All indications of the ECS monitor panel of the associated pack must be operative. (See 21-63-09/11.)
-62-28 Ram Air/Turbine Bypass Position Indicators	6	If only one turbine bypass valve is operative, its associated indicator must be operative.
-63-03 Pack Flow Indicator	1	Any or all may be inoperative.
-63-05 Pack Flow Rate Transducer	3	
-63-06 Pack Flow Transducer Signal Conditioner	1	
-63-09 ECS Temperature Indicator	1	May be inoperative provided it is not required for other MEL item support. (See 21-21-24, 21-51-22, and 21-62-01/19/22.)
-63-11 ECS Temperature Sensors	15	Fifteen may be inoperative provided the inoperative sensor(s) are not required for other MEL support. (See 21-24-24, 21-51-22, 21-62-01/19/22.)
-63-27 → Cabin Temperature Indicator	1	May be inoperative. ACM discharge temperature indicator must be operative.
-63-30 Zone/Duct Temperature Sensor	10	May be inoperative. If duct temperature sensor is inoperative, the ACM discharge temperature indicator must be operative.
-63-40 Temperature Probe signal Conditioner	1	May be inoperative. ACM discharge temperature indicator must be operative.
22 AUTOFLIGHT		
-01-00 Autopilot/Flight Director System		
Autopilots	2	One autopilot system must be operative for transoceanic operation. Both autopilots may be inoperative provided landing minimums are not predicated on autopilot use. (See 27-61-00 for DLC/AGS requirements.)
Flight Directors	2	Both may be inoperative unless landing minimums are predicated on Flight Director use.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
22 AUTOFLIGHT (Cont'd)		
-10-02 Nav Mode System/Controls	2	Both course-set functions must be operative. Should one course-set function become inoperative en route, the airplane may continue the flight or series of flights but may not depart the station designated by MCIMD without being repaired. VOR SPLIT 1 - 2 function is operative. DEV altn source select function is operative or RMI VOR function is operative for course presentation on the affected side. Operations conducted in VFR conditions.
-10-03 Heading/Pitch Modes	5	Five may be inoperative (including VS indicator on the glare shield).
-10-05 AFCS Mode Annunciators	48	The following mode annunciators may be inoperative in both panels provided respective mode engage switch light is operative: MACH IAS VS TURB With both autopilots and both Flight Directors inoperative, all mode annunciators may be inoperative.
-10-06 AFCS Warning Annunciators	-	
Alert Lights	2	Both may be inoperative provided autopilots and ATS are not engaged. First officer's may be inoperative provided annunciators in both warning panels are operative for any APFDS mode to be engaged.
AP Disc Annunciator	2	For auto-flight, both may be inoperative provided Captain's alert light and A/P disc aural warning is operative.
ATS Disc Annunciator	2	Both may be inoperative if ATS is not engaged. One may be inoperative for ATS engagement provided both alert lights are operative.
No Flare Annunciator	2	Both may be inoperative if flare mode is not required.
AP Limit Annunciator	2	Both may be inoperative provided A/P is inoperative or not engaged in the command mode.
No Dual Annunciator	2	Both may be inoperative if dual A/L mode not required and not engaged. Must be operative for dual A/L operation.
No Align Annunciator	2	Both may be inoperative if align mode is not required.
No GA Annunciator	2	First officer's annunciator may be inoperative provided both alert lights are operative. Both annunciators may be inoperative provided both alert lights are operative and no automatic go-arounds are made.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
22 AUTOFLIGHT (Cont'd)		
CMD Disc Annunciator	2	Both may be inoperative if command mode is not engaged. First officer's annunciator may be inoperative for command mode engagement provided both alert lights are operative.
-10-07 Flight Control Electronic Systems (FCES) Panel Switch Lights		
→ Off	12	Six may be inoperative.
Fail	12	The fail indication in any channel which is operative and engaged must be operative.
-10-12 Flight Control Auxiliary Unit (FCAU)	1	All functions/indicators of the FCAU may be inoperative provided: The unit is installed and connected. The SPI (see 27-00-01) is fully operative. It does not render any other system or equipment inoperative.
-10-21 AP Disconnect Switches (on Control Wheels)	2	One may be inoperative for autoflight provided the command mode is not engaged at altitude lower than initial approach altitude.
-10-99 Autotrim Flags (in Surface Position Indicator)	2	Both may be inoperative. With autotrim flags inoperative, ascertain autotrim is synchronized prior to disengaging autopilot to preclude undesirable transients. Compare SPI stabilizer position with trim setting. As mechanical pitch trim wheels rotate with autotrim inputs, they provide good visual indication of autotrim setting.
-11-01 Pitch AFCS Computers	2	Both may be inoperative. With pitch computers inoperative, the autopilots and Flight Directors are inoperative. (See 22-01-00).
-11-03/04 Altitude Alert System	2	One channel may be inoperative provided all functions (altitude selection, alert lights, aural signal) are operative on remaining channel. Capture modes may be inoperative. Select operative channel (NORM or STANDBY) on Altitude Select Panel and test system prior to each takeoff. Should both channels become inoperative en route, the airplane may continue the flight or series of flights but may not depart the station designated by MCIMD without being repaired. See 33-18-04 for altitude alert aural signal.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
22 AUTOFLIGHT (Cont'd)		
-13-01 Roll AFCS Computers	2	Both may be inoperative. With roll computers inoperative, the autopilots and Flight Directors are inoperative. (See 22-01-00.)
-13-02 Roll Lateral Accelerometers	3	May be inoperative provided landing minimums are not predicated on the use of APFDS modes which are rendered inoperative (APR, A/L).
-13-03 Roll AFCS Transducers	2	One may be inoperative provided the non-associated Yaw SAS channel is operative. See 22-15-00. Associated A/P is placarded inoperative.
-15-00 Yaw SAS	2	One Yaw SAS channel may be inoperative. NOTE: When dispatching with a Yaw SAS channel inoperative: Dual autoland is not available. Single autoland limited to crosswind component of less than 10 knots. Autopilot channel associated with inoperative Yaw SAS channel is inoperative. (See 22-13-03.) Flare and align mode/warning indications may be inoperative on captain's <u>or</u> first officer's side. (See 22-13-01.) Heading hold and heading select modes of autopilot associated with the inoperative Yaw SAS channel may be downgraded. (See 22-15-01.) (A/P "A" for Channel 1, A/P "B" for Channel 2 Yaw SAS.) Dutch roll damping and turn coordination are not adversely affected.
-15-02 Yaw Rate Gyros	2	One rate gyro may be inoperative provided both Yaw SAS computers are operative. (Both SAS channels remain operative.) With an inoperative Yaw SAS channel, the two rate gyros associated with the operative Yaw SAS channel must be operative. With Channel 1 inoperative, rate gyros 2 and 3 must be operative. With Channel 2 inoperative, rate gyros 1 and 3 must be operative.) (See 22-15-00.) NOTE: Heading hold and select modes of the associated autopilot may be degraded. (A/P "A" for Channel 1, A/P "B" for Channel 2 of Yaw SAS.)
-15-03 Rudder Position Transducers (Dual)	2	May be inoperative provided landing minimums are not predicated on the use of the align/rollout modes.
-17-01 FCES Computer Channels	2	

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
22 **AUTOFLIGHT (Cont'd)**		
-17-02 PFCS Monitor		
Roll	2	One may be inoperative provided: The control switch of the inoperative channel is maintained in the off position. The SPI is fully operative. (See 27-00-01.) One off indication may be inoperative provided the other roll channel and associated lights are operative and engaged. Any channel that is operative and engaged must have an operative fail indication.
Pitch	2	One may be inoperative provided: The control switch of the inoperative channel is maintained in the off position. The SPI is fully operative (27-00-01). The jam and open cable detectors of the operative channel are verified by ground checkout prior to the first flight of each day. One off indication may be inoperative provided the other pitch channel and associated lights are operative and engaged. Any channel that is operative and engaged must have an operative fail indication.
-17-16 Stall Warning Systems	2	Both channels must be operative for takeoff. If a channel fails in flight, the control switch for the failed channel must be unlatched (off) to permit operation on other channel.
-18-00 Trim Augmentation Systems (FCES Panel)		
Pitch Trim System	2	One channel may be inoperative. With either channel inoperative, trim application is half the normal dual-channel rate.
Mach Trim Systems	2	One channel may be inoperative provided at least one autopilot is operative. Both channels may be inoperative provided both autopilots are operative and one is engaged above .55 mach.
Mach Feel Systems	2	Both mach feel channels are required operative. One OFF light may be inoperative. Both FAIL lights are required operative.
-31-00 ATS (Autothrottle System)	2	Both channels may be inoperative provided landing minimums are not predicated on use of autothrottles, and throttle handling characteristics are not adversely affected (binding, creeping, etc.) by ATS deactivation. The ATS may be operated with both ATS disconnect switches (on throttles) inoperative. With the SCS computer inoperative, the entire speed control system (SLO-FAST indication and ATS) is inoperative.

EQUIPMENT ITEM		REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
22	**AUTOFLIGHT (Cont'd)**		
-31-05	Longitudinal (Dual) Accelerometers	1	May be inoperative. Speed Command System will be inoperative
-31-06	Angle of Attack Sensors	2	Place switch of inoperative stall warning channel off when it becomes inoperative in flight.
-31-07	Speed Command System Computer	1	May be inoperative. (Renders entire SCS inoperative.)
-31-08	ATS DISC Switches (On Throttles)	2	Both may be inoperative.
23	**COMMUNICATIONS**		
-11-00	HF Communications Systems	2	International - Wherever HF is required for communication, tw systems must be operative for dispatch except when flight is pla ned on northern eastbound and westbound flights with reference to Keflavik-Prince Christian-Goose Bay, refer to operations specification. Domestic - Both systems may be inoperative.
-22-00	Selcal System	2	Both may be inoperative.
-23-00	VHF System	3	One may be inoperative.
-31-11	Passenger Address System	1	Must be operative from the flight deck and at least two flight attendant stations at all times. The aircraft may continue the flight or series of flights with other portions of the system inoperative for a maximum of 25 flight hours, but may not depart a station designated by MCIMD without being repaired.
-41-00	Interphone System	1	Must be operative. Upper galley to lower galley interphone may be inoperative.
-41-04	Flight Attendant Cockpit Call Signal	1	May be inoperative. If cockpit to cabin call or lower galley call system inoperative, both the public address and cabin interphone system must be operative. If cabin to cockpit call system inoper ative flight crew must monitor interphone at all times.
-43-00	Ground Service Interphone System	1	May be inoperative.
-51-04	Audio Selector Control Panels		
	Cockpit	-	One required for each person on flight deck duty.
	Forward Electronics Service Center (FESC)	1	May be inoperative.
-51-05	Headsets	3	One required for each flight crew member on duty in the cockpit.
-51-07	Microphones (Cockpit)	3	One required for each flight crew member on duty in the cockpit.
-51-08	Oxygen Mask Microphone	5	One required for each flight crew member on duty in the cockpit.

EQUIPMENT ITEM		REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
23	**COMMUNICATIONS (Cont'd)**		
-51-11	Flight Station Communications Speakers	2	Both may be inoperative provided procedures are not predicated on their use.
-51-12	Interphone Amplifiers	2	The flight interphone amplifier must be operative.
-71-00	Voice Recorder System	1	In the event of malfunction or failure of the voice recorder, the airplane may continue the flight or series of flights, but may not depart a station designated by MCIMD without being repaired.
24	**ELECTRICAL POWER**		
-11-10	IDG Oil Temp Indicating System	3	One may be inoperative on an operative IDG provided associated loadmeter(s) is operative.
-11-11	Real Load Division Controller	3	May be inoperative provided channel(s) affected are operated in isolated mode. Maintain BTB of affected channel(s) in open position. Affected channel's bus loads may be out on tie bus if desired by opening GB and closing BTB. An inoperative load controller does not adversely affect generators 1 and 2 as power source for essential AC bus.
-20-01	Generator Fault Annunciator (Service Center)	1	May be inoperative unless required by maintenance procedures
-21-01	IDG Assembly (Generator)	3	All must be operative for transoceanic operation. One may be inoperative provided the following are operative: Bus tie system Overload protection system Auto/manual control functions No bearing lights illuminated on operating generators. Refer to Generator(s) Inoperative procedure in 4.10 for operating restrictions. When it becomes necessary to dispatch with a generator system drive disconnected, the IDG should be serviced with oil at least to the top of the full band. Refer to Chapter 12 of Maintenance Manual.
-21-05	Generator Control Unit (GCU)	3	One required for each operative generator. (See 24-21-01).
-21-07	Generator Breaker (GB)	3	One may be inoperative in the open position provided the bus tie system, the overload system, and the other two IDGs are operative, and all other auto and manual control functions are operative. When GB-1 or GB-2 is failed open, the generator is available as a source of power to the essential and standby busses. With a GB-3 failed open, generator 3 is inoperative as a power source. (See 24-21-01). With a GB failed open, carry essential AC switch as follows: Auto B3 (G2) with GB-1 open. Auto B3 (G1) with GB-2 or GB-3 open.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
24 ELECTRICAL POWER (Cont'd)		
-21-00 IDG Loadmeters	3	Loadmeter indications which may be inoperative are as follows: KVAR select function of KVAR indication may be inoperative. KW indication must be operative on at least two operative generators. If KVAR or KW indication is inoperative on any loadmeter, the associated IDG oil temp indicating system must be operative and both A.C. meters (freq and volts) must be operative.
-21-10 Voltmeter, AC/PMG	1	PMG test function and/or PMG voltage indication may be inoperative provided loadmeter, freqmeter, and AC voltage indications are operative on all channels with an operative generator.
-21-11 Freqmeter, AC	1	May be inoperative provided the AC voltmeter and three loadmeters are operative, and three generators are operative in parallel mode. Must be operative for APU generator parallel operation.
-24-01 APU Generator	1	May be inoperative. (See 24-21-01). Must be operative for transoceanic operation eastbound; westbound may be inoperative subject to special approval from NYCWO.
-24-02 APU Generator Control Unit	1	Must be operative when APU generator is operative.
-24-04 APU Generator Breaker	1	Auro and/or manual control may be inoperative. (See 24-21-01) If both auto and manual opening are inoperative, maintenance must open or remove relay. Must be operative for transoceanic operation eastbound, westbound may be inoperative subject to special approval from NYCWO.
-24-06 APU Loadmeter	1	KW function must be operative when generator is operative.
-25-22 Main Battery Cooling Fan	1	May be inoperative.
-31-01 Transformer Rectifier	4	Any one except essential TR may be inoperative provided all DC busses and all DC bus tie relays are operative. NOTE: Total TR DC electrical load is not to exceed 145 amps.
-31-05 DC Voltmeter	1	May be inoperative.
-31-06 DC Ammeter	1	
-32-00 Standby Power System	1	
-32-04 Battery Charger	1	Must be operative for transoceanic operation. The charger may be inoperative provided a new or recycled battery which has been maintained on a continuous pulse or trickle charge is installed prior to each takeoff and no more than one APU start (or attempted start) is made. With the charger inoperative, the aircraft may continue the flight or series of flights but may not depart a station designated by MCIMD without being repaired.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
25 EQUIPMENT/FURNISHINGS		
-11-01/03 Crew Seat Assembly	-	May be inoperative provided:
Electrical Adjustment		Electrical connector is disconnected on inoperative seat(s) or Appropriate CB (2F-10 or 2F-11) is opened and banded.
Manual Adjustment		Must be operative.
-11-06 Flight Deck Observer Shoulder Harness	0	
-11-08 Flight Deck Crew Shoulder Harness	3	If a harness becomes inoperative, the aircraft may continue the flight or series of flights, but may not depart a station where repairs or replacement can be made.
-12-07 Eye Locator System	1	May be inoperative.
-21-00 Passenger Seats		May be inoperative. One approved seat and seat belt required for each passenger. Seat recline mechanism must be operative, or seat must be secured in retracted (stowed) position. The passenger seat assigned to attendant use must be the seat most accessible to the exit and placarded "Flight Attendant Seat."
-21-08 Flight Attendant Shoulder	-	Seat belt portion required on all F/A seats if occupied. Shoulder harness portion required for all forward facing F/A seats occupied during T/O or landing.
-31-03 Galley Attendant Seat	2	Required for each position occupied. Seat must have a seat belt.
-32-00 Galley Lift Systems	2	One may be inoperative in the full down position and galley may be used provided: The number of serving carts that may be removed from the galley at any time is limited to the number of main deck cart tie-downs that are permitted to be used for takeoff and landing. Upper door of inoperative lift is placarded to prohibit stowing of carts on top of the inoperative lift when galley is occupied. Cabin interphone, including chimes and call lights, and galley interphone systems are operative. If the remaining lift should become inoperative en route, the galley must be evacuated, secured, and not used. Both may be inoperative provided galley is not used and remains unoccupied. Lifts may be used for cart stowage. The airplane may continue the flight or series of flights, but may not depart a station designated by MCIMD without being repaired.
-52-00 Automatic Cargo Handling	2	Two may be inoperative.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
25 EQUIPMENT/FURNISHINGS (Cont'd)		
-61-08 Emergency Escape Descent Reels	5	
-61-10/11/17/19 Passenger → Door/Slide Assembly	8	One door or door slide may be inoperative provided: (See 52-12-01 for inoperative door) All components on the remaining passenger door systems are fully operative (door warning system lights 52-71-00 excepted). For maintenance procedures see M. M. chapter 25-60-00. Affected door is not used for passenger loading. Procedures have been made known to the crew to evacuate the airplane with the door inoperative. Passenger seating restrictions: Passenger seating will be restricted for designated areas as shown in the seating configuration chart in the FHB 21.05 and appropriate loading manuals. Either door or door slide inoperative will restrict passenger seating in the entire designated area. One flight attendant may be stationed in the vicinity of each door within the restricted area. Tapes or ropes will be used to block access to the unusable seats and will be installed prior to passenger boarding. The tapes and ropes shall be of conspicuous contrasting colors. Conspicuous signs and placards will also be located in the area indicating these seats are not to be occupied. A conspicuous barrier strap or rope shall be placed across the inoperative door along with a placard stating the door is inoperative. Emergency exit sign/light associated with the inoperative exit must be covered to obscure the sign. Main passenger aisles, cross aisles, and exit access areas must not be blocked. Passengers must be briefed not to attempt to use the inoperative exit. In the event of malfunction or failure, the airplane may continue the flight or series of flights but may not depart the station designated by MCIMD without being repaired.
-62-01 Self Powered Portable Megaphone	2	If megaphone(s) are inoperative, malfunctioning, or missing, the airplane may continue the flight or series of flights but may not depart a station designated by MCIMD without being repaired.
-62-04 Evacuation Signal System	1	May be inoperative.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
26 FIRE PROTECTION		
-11-01 Engine Fire Detection System	2	Either loop (A or B) may be inoperative. Selector must be on operative loop for dispatch.
-11-06 APU Fire Detection System	2	Both loops (A and B) may be inoperative provided the APU is rendered inoperative. Either loop (A or B) may be inoperative for APU operation. Selector must be on operative loop for dispatch.
-11-09 Fire Alarm Bell	1	
-11-14 APU Fire Shutoff System	1	May be inoperative if APU is not left unattended during ground operation.
-11-28 Wheel-Well Fire Detection System	2	Either loop (A or B) may be inoperative. Selector must be on operative loop for dispatch.
-15-00 Galley Smoke/Overheat Detection System		
Smoke Detection System	1	
Overheat Detection System	1	Galley overheat warning system aural and visual must be operative in the cockpit and galley when ovens are to be used.
-21-03 Fire Extinguisher Bottle Thermal Discharge Indicator	3	Three may be missing provided bottle pressures are checked visually (gauge) and/or bottle weighed prior to each flight.
-21-06 Fire Extinguisher Bottle Discharge Indicators (Main/Altn Disch Lights)	8	One per system may be inoperative provided bottle pressures are checked visually (gauge) prior to each flight.
-22-01 Portable Fire Extinguishers		Required as shown on Emergency Equipment diagram, chapter 10 of flight handbook.
4 Pound CO_2	-	
2 Pound CO_2	-	
Water Type	-	
27 FLIGHT CONTROLS		
-00-01 Surface Position Indicator (SPI) System	1	May be inoperative provided a visual flight control check is accomplished prior to flight. See Autotrim Flags (22-10-99) for interface with autopilot operation.
-11-04 Pitch and Roll Disconnect Lights (In Disconnect T-Handle)		
Pitch Disconnect Light System	1	Light may be inoperative provided connect function and control coupled status is verified prior to dispatch.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
27 **FLIGHT CONTROLS (Cont'd)**		
Roll Disconnect Light System	1	Light may be inoperative provided connect function and control coupled status is verified prior to dispatch.
-21-09 Yaw SAS Engage Valves	2	One may be inoperative.
-21-14 Rudder Damper	4	One may be inoperative.
-21-17 Rudder Hydraulic Limiter	1	
-21-18 Rudder Mechanical Limiter	1	The auto mode may be inoperative. Manual mode and limiter position indicating lights must be operative. Set manual and 30° with mechanical limiter switches prior to takeoff. During climbout, the rudder mechanical limiter light will illumi nate (when flaps are retracted and airspeed is above 164 knots), indicating limiter is in wrong mode. Selecting 8° limiter position will extinguish annunciator light. During descent, rudder mechanical limiter light will illuminate (when speed is less than 164 knots <u>or</u> flaps are extended), indicating limiter is in wrong position. Selecting 30° position will extinguish light.
-41-00 PFCS Panel		
Stabilizer Control Switch INOP Indicators	4	One INOP light may be failed ON or OFF provided proper opera tion and control of the affected channel is verified prior to each takeoff.
-41-02 Stick Shaker	2	
-41-14 Pitch Autopilot Servo	1	May be inoperative. (See 22-01-00.)
-41-23 Pitch Autopilot Engage	2	Two may be inoperative. (See 22-01-00.)
→ -50.01 Aural Warning Signals Pre-Takeoff		See Item 33-18-04
-51-06 Flap Load Relief System (LRS)	1	May be inoperative. Deactivate system using the "Flap LRS Ovrd" switch. Repairs or replacement must be made within 25 hours time.
-51-67 Trailing Edge Flap Lock Light	1	May be inoperative provided: Leading edge slat lock light is operative. Flap position indicating system is operative. (See 27-52-00, 27-81-46).
-52-00 Flap Position Indicating System (Transmitters, Gauge, etc.)	1	May be inoperative. Prior to takeoff, verify that flaps follow lever selections. Verify slat indicating system is operative. (See 27-82-00.)

EQUIPMENT ITEM		REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
27	**FLIGHT CONTROLS (Cont'd)**		
-61-00	DLC/Auto Ground Spoiler System	2	Both channels may be inoperative provided landing minimums are not predicated on the use of autoland (A/L) mode. With both channels inoperative: Turn off both DLC/Auto Ground Spoiler control switches. DLC is inoperative and landing touchdown zone is increased. Auto deployment of ground spoilers (at touchdown and reversing) is inoperative. Manual speed braking (flight and ground) is not impaired. Prior to dispatch verify: Roll assist spoiler operation is not impaired. Manual deployment of spoilers is normal and spoilers faired. Manual reversion switch and lights on speed brake lever are operative.
-61-08	DLC/AGS Servo Hydro-Assist System	2	One hydro-assist channel (A or B) may be inoperative. The manual reversion switch (on speed brake lever) must be operative.
-61-17	Spoiler Panel Actuators	12	
-81-46	Leading Edge Slat Lock Light	1	May be inoperative provided: Trailing edge flap lock light is operative. The 14 slat position indicating lights at the FE station are operative. The "LE TRANS" and "LE EXT" lights on the flap gauge are operative. The slat degree gauge is operative.
-82-00	Slat Position Monitor System	1	The 14 slat position indication lights at the FE station may be inoperative provided the "LE TRANS" and "LE EXT" lights on the flap gauge, the slat degree gauge at the FE station and the leading edge slat lock light are operative.
	Flap/Slat Indicator	1	The slat "LE EXT" light may be inoperative provided all 14 slat position indication lights, the slat degree gauge at the FE station, the "LE TRANS" light and the leading edge slat lock light are operative.
	Slat Degree Gauge	1	May be inoperative provided "LE EXT", "LE TRANS", all 14 slat position indicating lights and the leading edge slat lock light are operative.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
28 FUEL		
-11-08 Scavenge Valve Tank 1/3	2	One may be inoperative open or closed: With valve inoperative closed, limit operations to a maximum of 40 flight hours. With valve inoperative open, the normal transfer system of associated (1A/3A) tank should be considered inoperative as rate of transfer is impaired. (See 28-27-02).
-11-11 Single Scavenge Pumps/ Compound Scavenge Pumps (Tanks 1A and 3A) (if installed)	2	One (single or compound) pump may be inoperative in each (1A/3A) tank. Both pumps may be inoperative in either (1A/3A) tank for a maximum of 40 flight hours. If center section fuel is not required all 4 pumps may be inoperative
-11-22 Scavenge System Valve (Tanks 1A/3A) (if installed)	2	One may be inoperative open or closed. With valve inoperative closed, limit operations to maximum of 40 flight hours. Both may be inoperative if center section fuel is not required.
-21-01 Refueling Adapters	4	Four may be inoperative provided fueling/dump valves in tank 2L and 2R are operative. (See 28-22-01.)
-21-03 Refueling Cross-Ship Isolation Valve	1	May be inoperative.
-21-05 Refuel Shutoff Valves (Fueling Valves)	-	One valve may be inoperative in each (1, 2L, 2R, and 3) fuel tanks: Valve is considered operative if it can be opened and closed using its respective fuel level control switch, or using approved bypass switches. (28-21-07). With all valves inoperative except one in tanks 1 and 3, refuel 2L/2R over-wing and pressure fuel tanks 1 and 3. See MM 12-10-00 for servicing procedures. On aircraft with center section fuel: Both refuel valves may be inoperative in tank 1 and/or tank 3 provided the affected tank(s) can be refueled by transfer of fuel from the respective center section tank (1A/3A). Tank 1A/3A refuel valves may be inoperative provided center section fuel is not required.
-21-07 Fuel Level Control Switches (Float Switches)	-	One float switch may be inoperative in each fuel tank. All float switches may be inoperative on aircraft with center section fuel or with approved refuel bypass switches for tanks 1 and 3. (28-21-05).

EQUIPMENT ITEM		REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
FUEL (Cont'd)			With float switches inoperative in tanks 2L, 2R, 1A, or 3A, use fuel bypass switches. With both float switches inoperative in tanks 1 and/or 3, use approved fuel bypass switches (if installed) or refuel tanks 1 and 3 by transfer from tanks 1A and 3A respectively (if installed). See MM 12-10-00 for servicing procedures.
-22-01	Defuel/Jettison Valves		
	Tanks 2L and 2R	2	All four may be inoperative. Fuel cannot be dumped from a tank with an inoperative valve.
	Tanks 1 and 3	2	It is not a requirement to be able to dump fuel. However, if fuel is dumped with one or more dump valves inoperative, the lateral unbalance and performance limitations listed in the FHB must be observed. → All valves must be operative for transoceanic operation.
-24-01	Fuel Boost Pump Assemblies	8	One pump in each tank may be inoperative. Should both pumps in any one tank become inoperative en route, the fuel pressure warning light may illuminate at altitudes above 30,000 feet. (Engines will operate tank-to-engine without boost pump pressure up to 37,100 feet.) If fuel pressure light illuminates, open crossfeeds to establish pressure feed. If both pumps in 2L or 2R fail en route, it may be necessary to turn off the operative 2L or 2R pumps to equalize fuel feed from 2L/2R tanks.
-24-13	Fuel Flow Equalizer (2L/2R)	1	May be inoperative provided equalizer bypass is not restricted and all boost pumps in 2L and 2R are operative. Monitor fuel quantity gauges closely and if either tank 2L or 2R decreases faster than the other tank, turn the boost pumps off and on in that tank as required to maintain an equal amount remaining in each tank.
-25-01	APU Boost Pump	1	May be inoperative.
-25-04	APU Tank Valve	1	Use boost pump in either tank 2L or 2R to supply pressure to the APU through the engine 2 tank valve.
-26-01	Crossfeed Valves	3	One may be inoperative provided en route fuel management does not require crossfeed. Inoperative valve must be manually closed and electrical connector removed.
-27-01	2L/2R Float Valves	2	In the event of malfunction or failure, the airplane may continue the flight or series of flights but may not depart the station designated by MCIMD without being repaired.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
FUEL (Cont'd)		
-27-02 Normal Fuel Transfer Valves (Tanks 1A/3A if installed)	2	One may be inoperative closed, provided the gravity transfer system is operative in both 1A and 3A tanks. Both valves may be inoperative closed if center section fuel is not required.
-27-07 Gravity Fuel Transfer Valve (Tanks 1A/3A, if installed)	2	One may be inoperative closed, provided the normal transfer systen is operative in both (1A/3A) tanks. (See 28-27-02.) Both valves may be inoperative provided center section fuel is not required.
-28-41-XX Tank Quantity Low Indication Lights (Tanks 1A/3A, if installed)	2	Either or both may be inoperative provided the affected tank quantity indication system (selection and gauge reading) is operative.
-31-01 Fuel Jettison Valves	2	Both may be inoperative, provided valve(s) are closed and electrical connector removed. An operative fuel dump system is not a requirement. However, fuel can be dumped evenly from all tanks through one jettison valve provided the cross-ship isolation valve (28-21-03) is operative. If the cross-ship isolation valve is inoperative, the lateral unbalance and performance limitations must be observed. → Both valves must be operative for transoceanic operation.
-41-00 Fuel Quantity Indicating Systems	4	One may be inoperative provided associated fuel used indication is operative, the affected engine fuel flow gauge is operative, and fuel quantity is checked by fuel tank drip sticks prior to each takeoff. (See 28-41-24.)
No. 2L/R Inboard Fuel Quantity Low Indicating Lights	2	One may be inoperative provided the associated quantity indicator and float operated tank transfer valve are operative.
-41-19 Fuel Totalizer	1	May be inoperative.
-41-20 Refuel Panel Tank Quantity Indicators	4	Four may be inoperative provided associated quantity indicator in flight station is operative and refuel shutoff bugs do not impair fueling shutoff valve operation.
-41-24 and -41-29 Fuel Tank Dripsticks	12	Twelve may be inoperative. Cockpit quantity indicating system must be operative on tank(s) with inoperative dripsticks.
-44-01 Boost Pump Low Pressure Indicating Systems	8	Light required for operative fuel pump. Fuel pump with inoperative light must be considered inoperative. See item 28-24-01.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
29 HYDRAULIC SYSTEM		
-11-07 Engine Driven Pumps (A-1, B-1, C-1, D-1)	4	Must be operative for transoceanic operation. B-1 may be inoperative provided B-2 is operative. Deactivate inoperative pump per Maintenance Manual 29-11-07. Depressurization function on one pump may be inoperative. With B-1 inoperative: Carry associated ATM in on position. Turn associated AC pump on (if available) for takeoff and landing. Ensure all sources of bleed air are available to ATMs (crossbleeds and isolation valves open).
-11-08 AC Motor Driven Pumps (B-3, C-3)	2	Both may be inoperative.
-11-33 PTU B-A, C-D (Power Transfer Units)	2	B-A PTU may be inoperative provided A-1, B-1, and B-2 pumps are operative. C-D PTU may be inoperative provided C-1, C-2, and D-1 pumps are operative.
-11-40 ATM Control System	2	Automatic control on one ATM may be inoperative provided associated manual control is operative.
-11-51 Depressurization Function/ Switch (Engine Driven Pumps)	4	May be inoperative on inoperative pumps. One may be inoperative on an operative pump. (See 29-11-07).

EQUIPMENT ITEM		REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
29	**HYDRAULIC SYSTEM (Cont'd)**		
-11-71	Air Turbine Driven Pump (B-2)	2	B-2 may be inoperative provided B-1 is operative. Turn B-2 ATM control switch off and placard inop, verify B-2 ATM control and indications CB (2L-13) is closed. With B-2 ATM inoperative: Select ALT-SYS C for braking. Turn B-3 AC pump on (if available) for takeoff and landing.
-31-06	Hydraulic Quantity Indicators (Service Ctr)	1	May be inoperative.
-31-07	Fluid Temperature Indicator (Service Ctr)	1	May be inoperative.
-31-08	Pressure Indicating System	4	One may be inoperative provided the associated low pump output (Lo Pr Lights) indicating systems are operative. For system "A" and "D," select A-1 or D-1 pump on prior to engine start and note Lo Pr light illuminate. Check light extinguished after engine start with pump on. For systems "B" and "C," check B-1 and C-1 pump Lo Pr lights prior to engine start. Check Lo Pr light for B-2 and C-2 pumps illuminate as respective pump is turned on.
-31-10	Fluid Quantity Indicating System	4	One may be inoperative provided reservoir quantity is verified as adequate for flight and low quantity indicating system is operative. (LO QTY LIGHTS.)
-31-14	Reservoir Air Pressure Indicating Systems (Service Ctr)	4	Four may be inoperative.
-31-15	Pressure Indicating	2	All may be inoperative.
-31-16	System (Service Ctr)	2	
-32-00	Reservoir Low Quantity Indicating (Lights)	4	Four may be inoperative provided associated quantity indicating system is operative.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
29 HYDRAULIC SYSTEM (Cont'd)		
-32-01 Pump Low Pressure Warning (Lights)	6	Two may be inoperative provided the associated pressure indicating system is operative.
-32-02 Pump Case Drain High Temperature Indicating (Lights)	6	Four may be inoperative provided associated reservoir high temperature indicating system(s) is operative.
-32-03 Reservoir High Temperature Indicating (Lights)	4	Four may be inoperative provided associated pump case drain high temperature indicating system(s) is operative.
-33-00 ATM Indicating Systems	2	Both may be inoperative. Prior to flight: Check ATM operation in on position and overspeed shutdown circuit: Shut down other pumps in system. Turn ATM on and verify normal pressure output. Select OVSP TEST. Note immediate system pressure drop as ATM deactivates. Note Lo Pr light illuminated. Select ATM to off. Trip and reset associated ATM CONT & IND C/B (2L13 and 2L19 for B-2 and C-2 respectively). Turn pump on and verify normal operation. Check ATM operation in AUTO. Note normal on-off cycling time of approximately 17 seconds.
30 ICE AND RAIN PROTECTION		
-13-00 Wing Anti-Ice System	1	Either auto or manual modes may be inoperative provided the the valve open and system overheat lights are operative. Both modes may be inoperative provided aircraft is not operated in icing conditions.
-13-02 Wing Anti-Ice System Regulating Shutoff Valve	2	Both may be inoperative provided aircraft is not operated in icing conditions. Inoperative valve(s) must be in closed position.
-13-04 Wing Anti-Ice Dual Temperature Sensors (Controls Anti-Ice Valves and Overheat Light)	2	Both may be inoperative provided aircraft is not operated in icing conditions and anti-ice system is not used.
-13-35 Duct Fail Detect/Indicating System	2	One loop may be inoperative.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
30 ICE AND RAIN PROTECTION (Cont'd)		
-21-01 Engine Anti-Ice Control Valves	3	
Inoperative Closed		One may be inoperative closed provided aircraft is not operated in icing conditions.
Inoperative Open		Valve(s) may be inoperative open provided it is locked in open position. With an inoperative anti-ice valve locked open, the high pressure and heat lights will illuminate (with respective engine anti-ice control switch on or off) whenever anti-ice air pressure (IP Air) is high enough to close the respective pressure switch(es). Anti-ice EPR reduction from Thrust Setting charts must be applied.
-21-13 Engine Anti-Ice System Heat and Hi PR Indicating Systems	6	One heat and high pressure indication may be inoperative provided the aircraft is not operated in icing conditions. For operation in icing conditions, one high pressure indication may be inoperative provided relief valve overboard duct is installed. With an inoperative anti-ice valve locked open (as per 30-21-01), the associated high pressure and heat lights may be inoperative.
-31-00 Air Data Sensor Heat Systems		
Pitot	4	One pitot heater may be inoperative, provided aircraft not operated in visible moisture or icing conditions. Mast heater on inoperative pitot head may be inoperative.
Alpha (Angle of Attack)	2	
Pitot Mast Heaters	4	Two pitot mast heaters may be inoperative.
Temp Probes	2	Left probe heater may be inoperative. "A" autopilot must be placarded inoperative. (See 34-14-06.)
-41-01 Windshield-Heat System	2	One may be inoperative provided: All packs are operative. Aircraft is not operated in icing conditions. Temperature at arrival airport is 50°F/10°C or higher. Defogging fan is operative.
-41-03 Side Window Temperature Controllers	4	Captain's forward side window must be operative. Others may be inoperative.
-41-07 Windshield Defogging Fan	1	May be inoperative provided windshield heat system is operative.
-42-00 Windshield Rain Repellent System	1	May be inoperative provided windshield wipers are operative and weather minimums are not predicated on its use.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
30 **ICE AND RAIN PROTECTION (Cont'd)**		
-43-00 Windshield Washer System	1	
-44-00 Windshield Wiper Systems	2	Both may be inoperative provided aircraft is not operated in precipitation within arrival and departure airport traffic areas.
-51-00 VHF Antenna Anti-Ice Shutoff Valve	2	May be inoperative.
-51-03 VHF Antenna Anti-Ice Light	1	May be inoperative.
-71-00 Potable Water Drain Mast Heaters	4	One may be inoperative in each mast.
-81-00 Ice Detection System	1	May be inoperative.
31 **INSTRUMENTS**		
-21-01 Electric Clock	3	May be inoperative provided a mechanical clock is provided at captain's or first officer's instrument panel.
-21-02 Clock Time Base	1	
-31-01 Digital Flight Data Recorder	1	If the recorder malfunctions or fails, the airplane may continue the flight or series of flights but may not depart the station des nated by MCIMD without being repaired.
-31-06 Flight Data Entry Panel	1	If a malfunction or failure occurs, the airplane may continue the flight or series of flights but may not depart the station designated by MCIMD without being repaired.
-32-00 AIDS	1	Those portions of the system not required for digital flight data recorder operation may be inoperative. If a malfunction or failure occurs to a portion of the system required for digital flight data recorder operation, the airplane may continue the flight or series of flights but may not depart the station designared by MCIMD without being repaired.
-41-00 Onboard Weight and Balance System (If installed)	1	May be inoperative.
32 **LANDING GEAR**		
-43-01 Brake Assembly	8	One automatic adjuster assembly (out of six) may be inoperative (missing) on each brake assembly. Two brake adjuster assemblies may be inoperative (Missing) on each brake assembly for a maximum of ten (10) landings provided the two adjusters are not adjacent and, when the brakes are released, the pressure plate retracts sufficiently to prevent dragging brakes.
-43-12 Alternate Brake Accumulator (C-System Accum.)	1	

EQUIPMENT ITEM		REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
32 LANDING GEAR (Cont'd)			
-43-13	Brake Accumulator Air Charge Gauges (Service Ctr)	2	Both may be inoperative provided the accumulators have the proper air charge and the minimum number of full brake applications are available. Charge accumulators to the maximum hydraulic pressure indication, and then turn off all hydraulic pumps in the affected system Select brake accumulator to be checked and apply several full brake applications until the brake pressure gauge falls to zero. The last pressure reading before the pressure falls to zero will be the accumulator air charge. There shall be a minimum of 4 full brake applications on the B accumulator and 8 on the C accumulator.
-44-00	Anti-Skid System	2	One may be inoperative. Both may be inoperative provided: Thrust reversers are operative. Reference is made to Braking With Anti-Skid Inoperative in FHB 17.01. Takeoff restrictions in FHB 21.50 observed. Landing restrictions in FHB 21.60 observed.
-44-06	Anti-Skid Control/Monitor System	2	Cockpit test system may be inoperative.
-45-00	Brake Temperature Indicating System	1	May be inoperative.
-46-03	Brake Accumulator Pressure Transmitters	2	One may be inoperative provided the associated brake accumulator low pressure warning lights and the hydraulic system pressure gauges are operative. Charge accumulator to full hydraulic pressure and turn off all pumps in the system. Select brake accumulator to be checked and apply several full brake applications. The low pressure warning light shall come on during brake applications and there shall be a minimum of 4 full brake applications on the B system and 8 on the C system.
-46-04	Accumulator Low Pressure Lights (Normal and Alternate Brakes)	2	One may be inoperative provided associated brake accumulator (B and C) pressure indicating systems are operative.
-48-00	Parking Brake System	1	
-48-01	Parking Brake Indicator Lights	2	May be inoperative. Pilot must monitor the brakes at all times when the wheel chock are not in place.
-51-04	Rudder Pedal Steering Disconnect	1	May be inoperative provided: Nose wheel steering with steering wheel is operative.

EQUIPMENT ITEM		REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
32	**LANDING GEAR (Cont'd)**		
-61-12	Tail Skid Light	1	May be inoperative.
-71-00	Tail Skid Control System	1	May be inoperative provided skid is extended.
33	**LIGHTS**		
-10-00	Cockpit and Instrument Lighted Systems	-	Lights sufficient to clearly illuminate all instruments and controls must be provided.
-17-00	CW Annunciator Panel	1	Flasher function may be inoperative provided it does not affect the operation of the individual lights. (See 33-17-99.)
-17-99	CW Annunciator Panel Lights		Some lights may be inoperative off as per following:
	Fire Det Loop	1	May be inoperative provided engine fire detection system is checked prior to each flight. Loop selectors must be maintained in the A or B position with detection loop light inoperative.
	Fuel System	1	May be inoperative.
	Icing	1	May be inoperative.
	Dual A/L Not Avail	1	May be inoperative off. May be inoperative on (illuminated) provided dual A/L mode is not engaged for autopilot use in Category IIIa conditions.
	Rudder Hyd Limiter	1	May be inoperative.
	Rudder Mech Limiter	1	May be inoperative.
	Low Brake Pressure	1	May be inoperative provided both brake accumulator pressure gauges and their low pressure warning lights are operative.
	ECS	1	May be inoperative.
	Vertical Gyro 3	1	May be inoperative when the No. 3 vertical gyro is inoperative (34-21-04).
	Flaps LRS Limiting	1	May be inoperative provided flap gauge is operative.
	Brake Temp	1	May be inoperative.
	Anti-Skid	1	May be inoperative provided all lights on anti-skid panel are operative.
	Engine Low Oil Pressure	3	One may be inoperative provided respective oil pressure, temperature and quantity gauge are operative and monitored.
-18-04	Aural Warning System	-	See exceptions to individual aural warnings as follows:
	Flaps LRS Aural Signal	1	May be inoperative profided the flap LRS inoperative light on C.W is operative.
	Pre-Landing Aural Signal (Steady Horn)	1	Aural signal must be operative. The airspeed inhibit function may be inoperative provided horn silence is operative.

EQUIPMENT ITEM		REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
33	**LIGHTS (Cont'd)**		
	Aural Warning Signals Pre-Takeoff	1	May be inoperative provided slat extended light and flap position indicator are operative. NOTE: T.O. aural warning can be deactivated (with no adverse effect on other aural warning functions) by opening and collaring the T/O Aural WRN C/B 2H-7). Check speed brake handle and stabilizer trim for take off position.
-21-00	Aisle and Ceiling Lights	-	Lighting must be sufficient for flight attendants to perform their duties.
-25-01	Galley Lights	-	May be inoperative provided galley is not occupied.
-29-02	Lavatory Return to Cabin Signs	-	May be inoperative provided PA system and all cabin speakers are inoperative.
-29-12	No Smoking and Seat Belts Signs	5	May be inoperative provided the chime system, PA system, all cabin speakers, and cockpit-to-cabin interphone are operative, and appropriate PA announcements are made. The airplane may continue the flight or series of flights, but may not depart the station designated by MCIMD without being repaired
-31-00	Cargo Compartment Lighting	-	May be inoperative.
-33-00	Wheel Well Lighting	7	Seven may be inoperative for day operations. Main landing wheel well lighting may be inoperative for both day and night operations. Nose wheel well lighting is required for night operations.
-41-01	Anti-Collision Lights (Red)	4	All may be inoperative for day operation. For night operation, four may be inoperative if both FWD and one AFT hight intensity strobe lights are operative, otherwise one upper and one lower anti-collision lights must be operative. (See 33-41-03)
-41-03	High Intensity Strobe Lights	4	Four may be inoperative.
-41-05	Strobe Light Flasher	1	May be inoperative.
-43-01	Landing Lights (Wing and Nose)	4	Four may be inoperative for day operation. For night operation, two lights are required, one on each side.
-43-03	Landing/Taxi Lights		May be inoperative for day operation.
	Taxi Lights	2	May be inoperative.
	Landing Lights	4	One may be inoperative on each side of the aircraft.
	Nose Gear Taxi Lights	2	May be inoperative.

EQUIPMENT ITEM		REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
33 LIGHTS (Cont'd)			
-43-04	Runway Turnoff Lights	2	May be inoperative.
-44-00	Navigational Position Lights	4	None required for daytime operation. One bulb in each light may be inoperative for night operation.
-45-00	Wing Flood Lights	2	May be inoperative.
-51-02	Interior Emergency Lights	53	A maximum of 13 lights may be inoperative provided the flight station emergency light is operative and the inoperative lights are not adjacent or opposite and at least two of the three lights at each entry door are operative. However, only one exit locator sign on the entire airplane may be inoperative provided the adjacent door exit light is operative. Inoperative light must be repaired or replaced within 25 flight hours.
-51-08	Exterior Emergency Lights	8	These lights may be inoperative during daylight hours only.
34 NAVIGATION			
-00-01	Instrument Source Select	-	Any or all may be inoperative provided the affected instruments function properly from isolated sources and inoperative switches are not moved during flight.
-11-00	Radio Altimeter Systems	2	No. 2 radio altimeter may be inoperative. In the event of malfunction or failure of No. 1 radio altimeter, the airplane may continue the flight or series of flights but may not depart the station designated by MCIMD without being repaired repaired. Both must be operative if weather minimums below 200-1/2 or RVR 2400.
-13-03	Standby Airspeed	1	
-13-04	Standby Altimeter	1	
-14-01	Air Data Computers	2	
-14-03	Altimeters (Servoed)	-	One must be operative on each pilot's panel.
-14-04	Airspeed/Mach Indicating Systems	2	The mach indication may be inoperative on one indicator. One overspeed aural warning system must be operative.
-14-05	Vertical Speed Indicators	2	Vertical speed indicator on captain's side may be inoperative if V/S display on pitch mode panel is operative and an operating VASI and/or ILS glide slope is available on landing runway. Cat II or IIIa weather conditions are not encountered (22-10-03).
-14-06	TAT Sensors	2	Left sensor may be inoperative. See 34-15-01/02. "A" auto-pilot must be placarded inoperative.
-14-08	TAS Indicating Systems	1	May be inoperative.
-15-01	SAT Indicating Systems	1	Either SAT or TAT may be inoperative (see 34-14-06).

EQUIPMENT ITEM		REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
34	**NAVIGATION (Cont'd)**		
-15-02	TAT Indicating Systems	1	Either SAT or TAT may be inoperative (see 34-14-06).
-16-01	Instrument Comparison Monitor/Warning System	1	May be inoperative.
21-04	Vertical Gyros/Inertial Navigation Systems (Attitude Mode)	3	One may be inoperative provided landing minimums are not predicated on dual A/L operation. (Three VGs/INSs required for engagement of both autopilots in the A/L mode.)
-21-07	Attitude Director Indications	2	Both ADIs must have an operative horizon indication for normal dispatch. (The standby horizon may be substituted for one inoperative ADI for day VFR conditions only.)
-21-08 ←	Standby Horizon Indicator	1	May be inoperative for day VFR conditions only.
-22-00	MHRS (Magnetic Heading Reference System) Directional Gyro Compass System.	2	One directional gyro may be inoperative for VFR flight condition providing compass heading indication is available on each pilot's instrument panel. NOTE: Flight recorder requirements must be considered if applicable.
-22-07	Standby Magnetic Compass	1	May be inoperative provided both DG systems are operative. The airplane may continue the flight or series of flights but may not depart the station designated by MCIMD without being repaired.
-33-01	ILS Receivers	2	No. 1 may be inoperative. In the event of malfunction or failure No. 2 system, the airplane may continue the flight or series of flights but may not depart the station designated by MCIMD without being repaired. Both must be operative if weather minimums below 200-1/2 or RVR 2400.
-35-00	Marker Beacon System	1	May be inoperative for VFR conditions, or may be inoperative for IFR conditions provided ADF operative and weather at destination forecast to remain at or above 250-3/4 or 4000 RVR. Marker lights in ADIs may be inoperative.
-42-00	Inertial Navigation Systems (Navigation Mode)	3	On those routes where self-contained navigation required for all or part of the filed route, three INSs operable in NAV mode are required unless special approval is obtained from NYCWO. For transatlantic operation on routes specified in Operations Specifications via Keflavik-Prince Christian-Goose Bay one INS is to be operative in NAV mode. In cases where this is permissible, it must have NYCWO concurrence eastbound.
-42-01	INS Navigation Comparator System	0	
-42-02	HSI Counter Readouts (INS and Course)	0	
-43-00	Ground Proximity Warning	1	In event of malfunction or failure of GPWS, the airplane may continue the flight or series of flights, but may not depart the station designated by MCIMD without being repaired.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
34 NAVIGATION (Cont'd)		
-44-00 Weather Radar System	2	One may be inoperative. Both may be inoperative under following conditions: Under VFR conditions. Under night VFR or under IFR conditions provided current weather reports indicate no thunderstorms or other potentially hazardous weather conditions, which can be detected by weather radar, exist en route. At through stations when current weather reports indicate thunderstorms or other potentially hazardous weather conditions which can be detected by weather radar do exist en route provided the captain: Reviews the Company Jet Route Selection Advisory Forecast. Reviews latest available weather reports and flash advisories. Receives from dispatch any information deemed significant regarding thunderstorms or other hazardous weather conditions. Plans flight to select routes or altitudes which will avoid forecast hazardous thunderstorm areas; and circumnavigates thunderstorms en route whenever feasible. On any training, test, or ferry flight. NOTE: Dispatch Release. It will be necessary to include in the dispatch release this statement, "Airborne weather radar not operative and not required, "whenever the captain and flight dispatcher are advised by Maintenance that the airborne weather radar is inoperative and it is determined by the captain and the dispatcher that this facility is not required for the particular weather conditions. The captain is responsible to assure entry is made on the dispatch release form at the station if not already included in the dispatch message or supplement.
-51-00 DME Systems	2	One may be inoperative.
-53-00 ATC Transponders System	2	One ATC transponder with operative altitude encoder must be operative at flight origination. If both ATC transponders or altitude encoders become inoperative en route the aircraft may continue to the airport of ultimate destination, including any intermediate stops or proceed to a place where suitable repairs can be made or both. Appropriate authorization from ATC centers is necessary.
-55-03 VOR Preamplifier (Dual)	2	Both may be inoperative.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
34 **NAVIGATION (Cont'd)**		
-55-04 HSI (Horizontal Situation Indicator)	2	One HSI compass card may be inoperative for VFR flight conditions provided both RMI(s) are operative. (See 34-57-08). Both digital readouts may be inoperative.
-57-00 ADF (Automatic Direction Finder System)	-	May be inoperative providing marker beacon system functioning. International - One may be inoperative.
-57-08 RMI	2	One may be inoperative provided associated HSI and the other RMI is operative.
35 **OXYGEN**		
-10-00 Crew and Passenger Oxygen	2	Supplemental oxygen not required for passengers on flights below FL100.
-21-00 Passenger Oxygen System		The automatic presentation system may be inoperative provided: The manual deploy system is operative. The flight is limited to 25,000 feet or lower. Two passenger service modules (PSMs) may be inoperative in each cabin zone without flight altitude restriction provided: No two inoperative PSMs are adjacent (fore and aft, left and right). Affected seats are blocked to prevent occupancy. Appropriate placards (do not occupy, oxygen not available) are provided.
-31-01/31-06 Portable Oxygen Dispensing Units	-	A minimum of one servicable unit for each flight attendant on duty is required. The two units in the lower galley must be installed whenever the lower galley is occupied.
36 **PNEUMATICS SYSTEMS**		
-11-01 High Pressure (HP) Bleed Valves	3	One may be inoperative closed. Valve must be locked closed.

EQUIPMENT ITEM		REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
36 PNEUMATIC SYSTEMS (Cont'd)			
-11-04	High Pressure Bleed Valve Controllers	3	One may be inoperative provided high pressure bleed valve is locked closed.
-11-08	Bleed Air (Mixing) Ejectors	3	One may be inoperative provided the associate HP valve is closed or ejector locked closed.
-11-11	Bleed Air Temperature Sensing Systems	3	One may be inoperative provided associated HP valve is closed.
-11-14	Bleed Air Overtemperature Switches	6	One for each bleed system may be inoperative. Both may be inoperative in one system provided associated HP valve is closed.
-11-18	Engine Isolation Valves	3	One may be inoperative provided: Valve is closed after engine start. Crossbleed valves are operative. All engine driven hydraulic pumps are operative. (See 29-11-07/71.) If engine 1 or 3 isolation valve is inoperative, the opposite pack flow control valve must be operative. (See 21-21-01).
-11-41	Overpressure Shutoff Valves	3	One may be inoperative provided: Associated HP valves are operative. Associated HP overpressure switch(es) are operative. Engine isolation valves are operative.
-11-44	HP Overpressure Switch	3	One may be inoperative provided associated 36-11-41 and 36-11-18 are operative or associated 36-11-01 is closed.
-12-02 →	APU Discharge Duct (APU bleed air shutoff valve)	1	May be inoperative provided valve is manually locked closed for flight. With APU air inoperative for flight, valve may be manually opened to permit APU air ground use.
-14-01 →	ATM Isolation Valve (8") (AFT Fuselage Duct Isolation Valve)	1	May be inoperative provided: Valve is secured open. Engine isolation and crossbleed valves are operative.
-14-02	Crossbleed Valves (6")	2	
-21-01	Bleed Pressure Indicators	3	One may be inoperative provided crossbleed valves are operative.
-22-01	Area Overheat Detection System	1	One detection system loop (A <u>or</u> B) may be inoperative provided loop selector is on the operative loop.
-22-99	Nacelle/Pylon Overheat Detection System	1	One detection system loop (A <u>or</u> B) may be inoperative provided loop selector is on the operative loop.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
49 AUXILIARY POWER UNIT		
-00-01 APU	1	May be inoperative. APU bleed valve must be closed and APU not used. APU inlet door may be inoperative in any position. Must be operative for transoceanic operation eastbound; westbound, may be inoperative subject to special approval from NYCWO. (See 24-24-01)
THE FOLLOWING PERTAINS TO AN OPERATIONAL APU.		
-00-03 APU Fault Flag Reset	1	May be inoperative.
-11-05 APU Air Inlet Door Actuator	1	May be inoperative open.
-11-15 Vent Closed Light	1	May be inoperative - confirm vent is open.
-11-16 Doors In-Transit Light	1	May be inoperative.
-31-14 Fuel Filter Light	1	May be inoperative.
-31-15 Low Fuel Pressure Light	1	May be inoperative.
-31-16 APU Firewall Shutoff Valves	2	Both must be operative.
-51-03 Load Compressor Controller	3	APU mode (minimum-normal-maximum) selection may be inoperative.
-51-18 Don't Load Light	1	May be inoperative provided APU frequency meter is checked for proper frequency before loading.
-71-03 TGT Overtemp Flag	1	May be inoperative provided autoshutdown function is not impaired.
-75-03 N_2 Overspeed Flag	1	May be inoperative provided autoshutdown function not impaired.
-91-05 Oil High Temp Flag	1	May be inoperative provided autoshutdown function not impaired.
-91-06 Low Oil Pressure Flag	1	May be inoperative provided autoshutdown function not impaired.
-91-07 Low Oil Quantity Light	1	May be inoperative provided oil quantity is checked for proper servicing.
52 DOORS		
-10-00 Passenger/Crew	8	See 25-61-10/11/17/19 (Passenger Door/Slide Assembly)
-12-01 Cabin Door Actuation Systems	8	Electrical actuation on two doors may be inoperative provided the mechanical actuation is operative and the functional check per L-1011 MM 52-12-00 is accomplished for each inoperative door. Hand crank actuation on two doors may be inoperative provided the electrical actuation is operative and the emergency mode mechanical actuation is operative and the functional check per L-1011 MM 52-12-00 is accomplished for each inoperative door.
-34-00 Cargo Door Actuation Systems (C-1, C-2, C-3 Doors)	3	Normal <u>or</u> manual actuation may be inoperative provided the affected door(s) are verified to be latched closed and locked. If associated door light in the flight station is inoperative, see 52-71-00.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
52 DOORS (Cont'd))		The center viewing port on cargo doors and (if installed) the external green light cannot be used to determine that the door is closed/locked.
-34-03/-04/-05 Cargo Door Guide Fittings	18	One corner fitting per door may be inoperative or missing provided: Door is closed manually and guided into place by hand pushing on the corner of the door corresponding to the missing guide fitting. Door is verified closed, latched, and locked by normal or alternate means. If the loss of a cargo door guide corner fitting results in any damage to the fuselage (including door) structure, any such damage must be repaired per proper procedures outlined in the structural repair manual prior to the next flight. Both center guide fittings must be operative.
-36-00 Cargo Door Actuation System (C-1A Door)	1	Normal <u>or</u> manual actuation may be inoperative provided the door is verified to be latched closed and locked. The C-1A door lock viewing windows are not approved for verification that the door is closed/locked. See 52-71-00 for C-1A door lights.
-71-00 Door Warning Light System	-	The C&W annunciator panel door open light must be operative. Other door lights may be inoperative as follows:
Cabin Door Service Door, S-Duct Door, Galley Door and Escape Hatch Lights	14	Six lights may be inoperative provided the associated door(s) are verified closed and locked. (See MM 52-12-26 for cabin doors.)
C-1, C-2, C-3 Cargo Door Green Lights (if installed)	3	May be inoperative.
C-1, C-2, C-3 Cargo Door Lights (in flight station)	3	May be inoperative (on or off) provided the affected door(s) are verified latched closed and locked in accordance with procedures contained in LAC MM 52-34-00. Actuator circuit breaker of the affected(s) must be opened and collared. Center viewing port on doors and (if installed) the external green lights cannot be used to determine that the doors is closed/locked.
56 WINDOWS		
-10-01 Windshield	2	If the chemcor (outer glass layer) is damaged or gross delamination/bubbling produces objectionable vision loss/distortion, it may be removed on one windshield provided: Maintenance procedures are followed for removal of chemcor and (if necessary) the PVB layer. Visibility through affected windshield is acceptable to the captain.

EQUIPMENT ITEM		REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
56	WINDOWS (Cont'd)		Aircraft is not operated in icing conditions. Temperature at arrival airports is 50° F or higher. Other windshield is normal. See Windshield Heat System (30-41-01)
73	FUEL AND CONTROL ENGINE		
-11-04	High Pressure Fuel Shutoff Valves	3	
-21-00	Fuel Control Amplifiers (TGT/N_2 Top Limiting)	3	Three may be inoperative provided: All engine indicating systems for the affected engine(s) are operative. Engine parameters are manually maintained within operating limits. The respective override switch is in override. An engine may be operated a maximum of 25 flight hours with its overtemp/overspeed control system inoperative.
-21-01	Fuel Flow Regulator Ground Idle Control	3	One may be inoperative provided associated thrust reversing system(s) are operable.
-21-07	Start Enrichment	3	
-31-00	Fuel Pressure Warning NOTE: This includes both the low pump pressure and filter differential pressure functions.	3	One may be inoperative provided the following is accomplished before dispatch: Change the fuel filter. Alternate: the removed filter may be re-used if it is clean and otherwise in serviceable condition. (Filter check must not exceed 25 hours) Check engine driven fuel pump. Run engine; if T.O. power is available, fuel pump is serviceable. Advise MCI coordinator of condition.
-34-00	Fuel Used/Fuel Flow System	3	One fuel flow and/or fuel used indication may be inoperative provided the associated fuel quantity indicating system is operative. (See items 28-41-24/29.)
-37-00	Fuel Temperature Indicating System	1	May be inoperative provided all oil temp indicating systems are operative; or if one engine has inoperative oil temp per MEL, then that engine must have fuel temp indication operative.
74	IGNITION ENGINE		
-11-01	High Energy Ignition Systems	6	One high energy ignition system may be inoperative on each engine. Only one B ignition system may be inoperative.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
74 IGNITION ENGINE (Cont'd)		
-31-02 Continuous Ignition Systems	6	One continuous ignition system (A or B) may be inoperative on each engine.
75 AIR		
-21-00 Zone 1 Vent Valves	3	May be inoperative open or closed.
77 INDICATING ENGINE		
-11-00 EPR Indicating Systems	3	One may be inoperative provided: Prior to loss of EPR indication, all engine parameters were normal. N_1, N_2, N_3, and FF of associated engine are operative. N_1 values from takeoff thrust chart must be used. For takeoff, reduce runway zero wind and climb limit weights 6000 lbs. Reduced thrust operations are prohibited. The digital indication may be inoperative on all EPR indicators. EPR must be returned to operative condition at the first station where repairs or replacements can be made, but in no case later than 40 flight hours. Maintenance Foreman at station dispatching aircraft with EPR inoperative will notify MCIMD, by message, that EPR will need correction per MEL. He must obtain acknowledgement.
-12-00 Limit Lights (N_1, N_3, TGT)	12	Limit lights may be inoperative.
-12-04 N_1 RPM Indicating System	3	One may be inoperative. The associated EPR N_2 and N_3 RPM and fuel flow indicating systems must be operative.
-12-06 N_2 RPM Indicating Systems	3	
-12-07 N_3 RPM Indicating Systems	3	The N_3 RPM indicating systems may be inoperative as follows: One N_3 RPM indicating system may be completely inoperative provided the associated EPR, N_1, and FF are operative, and the following special start procedure is observed: Press ground start switch and hold switch depressed if necessary. Note start valve OPEN indication. Note N_2 rotation and oil pressure indication.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
77 INDICATING ENGINE (Cont'd)		Actuate fuel/ignition switch at positive indication of N_1 rotation (greater than 2%). Monitor TGT for lightoff within 30 seconds of fuel/ignition on. At 15% N_1 or 420° TGT (whichever occurs first) release START ENRICH. At 15 to 16% N_1 press ground start release switch or release start switch (if it was manually held depressed). Note start valve OPEN light out. At stabilized idle, verify that engine parameters compare normally with other engine(s). NOTE: Nominal N_1 values during start cycle are as follows: 2% N_1 — 20% N_3 4% N_1 — LIGHTOFF 6% N_1 — 30% N_3 14% N_1 — 46% N_3 16% N_1 — 51% N_3 Nominal time (from start valve open) to 20% N_3 is 17 to 20 seconds with 24 PSI APU air. With 40 PSI ground air, time to 20% N_3 is 8 to 10 seconds. NOTE: Wait two minutes before reengagement of starter following an abandoned start. The N_3 indicating systems may be partially inoperative as follows: All auto-cutoff functions associated with engine starting may be inoperative provided engine start switches can be manually operated.
-13-00 Rated EPR System	1	May be inoperative.
-14-00 Engine Out Indicating System (Engine #2)	1	May be inoperative. If inoperative: For takeoff, reduce runway zero wind and climb limit weights 8000 lbs.
-21-00 TGT Indicating Systems	3	
-22-00 Turbine Cooling Air Overheat Detection System	3	One channel (A or B) per engine may be inoperative. Circuit breaker associated with an inoperative channel must be pulled and collared. Should both channels on any one engine fail en route, the airplane may continue the flight or series of flights but may not depart the station designated by MCIMD without being repaired.
-31-00 AVM (Airborne Vibration Monitor Systems)	3	One channel (fan or turbine) may be inoperative on each engine. Both channels may be inoperative provided an engine is not operated for more than 40 flight hours with AVM inoperative and maintenance procedures are not predicated on its use.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
78 EXHAUST ENGINE		
-31-00 Cold Stream Reverser	3	One may be inoperative provided it is deactivated and stowed in the forward thrust position and an anti-skid system is operative.
-31-33 Reverser Indicating Lights		All lights associated with an inoperative reverser may be inoperative. The following applies to lights on operative reversers:
Reverser Intransit	3	One fan reverser "intransit" indication may be inoperative provided the respective reverser is checked for proper stowage each time it is operated.
Reverser Operating	3	
79 OIL ENGINE		
-31-01 Oil Pressure Indicating Systems	3	
-31-02 Oil Filter Pressure Light	3	All may be inoperative provided it is determined that malfunction is in the caution system and a daily check is made for strainer clogging.
-31-03 Oil Pressure Low Light System	3	One may be inoperative provided the respective oil pressure, temperature, and quantity gauge are operative and monitored.
-34-00 Oil Temperature Indicating Systems	3	One may be inoperative provided associated fuel temperature indicating system is operative. Add 15°C to indicated fuel temperature to obtain an approximate oil temperature.
→ -37-00 Oil Quantity Indicating	3	One may be inoperative provided tank quantity is verified as adequate for flight. Maximum oil consumption is less than one U.S. quart/hour.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
80 STARTING		
-11-02 Start Valve Open Indication	3	One may be inoperative. Starter control valve with inoperative valve open light system must be visually verified to be closed after engine start. Establish ground communications. Select associated high pressure switch off prior to start. Initiate normal start procedure. Verify ground start switch is unlatched at 51% N_3. Inform ground crew to verify starter control valve is closed and to close and latch engine side cowls. Select high pressure switch as desired.
-11-08 Starter Control Valves	3	One may be inoperative. Inoperative valve must be manually closed after engine start. Establish ground communications. Select associated high pressure switch off prior to start. Inform ground crew to open starter control valve. Initiate normal start procedure. Select associated engine isolation valve switch to off when N_3 indicates 47%. Inform ground crew to close starter control valve. Verify ground start valve open light is extinguished. Inform ground crew to close and latch engine side cowls. Select high pressure and engine isolation switches as desired.

* * *

CONFIGURATION DEVIATION LIST (CDL)

An aircraft may be dispatched in revenue service with certain parts, such as plates and doors, removed as specified in the CDL.

All parts which may be missing for flight and the conditions under which the flight may be conducted are shown on the CDL.

PLACARDING

When dispatched under the provisions of the list, an appropriate placard will be installed on the instrument panel in clear view of the captain.

An appropriate logbook entry will also be made describing the missing part.

PERFORMANCE PENALTIES

When dispatched under the provisions of this list, notification of the missing part will be included in the Dispatch Release Message whenever a performance penalty is shown in the Remarks column of the list.

Performance penalties indicated in the Remarks column of the list shall be applied to the appropriate takeoff and landing computations for the flight.

Except where items are grouped together under a single gross weight performance penalty, when more than one item from the CDL (or the MEL) are missing or inoperative the performance penalties shall be cumulative.

CONFIGURATION DEVIATION LIST INDEX

The CDL is arranged by ATA system numbers. This index is presented in alphabetical order as an aid in locating items. The appropriate ATA system number is listed in the right-hand column.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
21 AIR CONOITIONING		
-32-01 Cabin Pressure Safety Valve Fairing Doors (728989-1)	2	May be missing with no weight penalty.
23 COMMUNICATIONS		
-23-02 VHF Antenna (565-8262-5A	3	One may be missing with no weight penalty.
-61-01 Static Dischargers (601-1011) Wing Tips (6) (601D-1B) Outboard Aileron (14) (611D-1B) Elevator (10) Rudder (7) Vertical Stab (3) Horiz Stab (4)	44	Any or all may be missing. No weight penalty.
28 FUEL		
-41-24 thru -41-29 Fuel Level Sight Gauges (Dripless Sticks) (724408)	12	No weight penalty. NOTE: If an aircraft is dispatched with an inoperative fuel gauge per the MEL, sight gauges are required in the tank with the inoperative gauge.
32 LANDING GEAR		
-12-02 Main Landing Gear Fixed Door (1530924)	2	Both may be missing provided the following reductions are mad per unit: For takeoff, reduce runway zero wind and climb limit weights 400 lbs. For landing, reduce critical temperature 1°F. If forecast temperature is above the adjusted critical temperature, subtract 2100 Lbs/°F. The maximum operating speed is 270 KIAS. NOTE: The airspeed indicator must be adjusted to set the limit airspeed and sound the aural warning at 270 KIAS. The maximum operating altitude is 34,000 feet. The conditions for severe turbulent air penetration are unchanged except the recommended airspeed is 250 to 260 KIAS. For dispatch fuel, use M. 84 speed schedule trip fuel from either Flight Planning Tables or computer Flight Planning system at appropriate altitude.
-12-03 Main Landing Gear Hinged Door (1566649 or 1529059)	2	Same as above (-12-02).
-32-71 Tail Skid Control Valve Access Cover (1537400-113)	1	May be missing with no performance penalty.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
33 LIGHTS		
-43-02 Wing Landing Light Lens Cover (671988)	2	*# Each unit make following adjustments: For takeoff, reduce runway zero wind and climb limit weights 100 lbs. For landing, reduce critical temperature 1°F. If forecast temperature is above the adjusted critical temperature, subtract 2100 lbs/°F.
-44-02 Wing Tip Light Lens Cover (672552)	2	*#Weight penalty same as above.
-45-00 Wing Flood Light Lens (672552)	2	May be missing with no weight penalty.
-51-02 Passenger Door Emerg. Evacuation Light Lens	8	May be missing with no weight penalty.
49 AUXILIARY POWER UNIT		
-11-04 APU Air Inlet Door (738077-1)	1	May be missing. No weight penalty.
52 DOORS		
-34-00 C2 Cargo Door Fairing (1533890)	1	May be missing: For takeoff, reduce runway zero wind and climb limit weights 500 lbs. For landing, reduce critical temperature 1°F. If forecast temperature is above the adjusted critical temperatur subtract 2100 Lbs/°F.
53 FUSELAGE ACCESS DOORS		
-19-00 Ground Landing Gear Door Control Access - L & R (1568722)	2	
-32-01 -32-51 AC Power Receptacle Access (1505709)	1	*#All components listed under this section are service doors and may be missing in any number or combination. The same performance reduction should be used for any number of doors missing; however, the figures are based on the increased drag caused by all these doors being off at the same time.
-33-51 High Pressure Air Connection (1513906)	3	For takeoff, reduce runway zero wind and climb limit weights 200 lbs. For landing, reduce critical temperature 1°F. If forecast temperature is above the adjusted critical temperature, subtract 2100 lbs/°F.
-34-02 -34-51 and -52 ATM Servicing Inspection Access - Left and Right (1515636)	2	
-35-02 -35-51 Potable Water Service Door (1545619)	1	
-35-01 -35-53 Forward Waste System Service Panel (1521313)	1	

EQUIPMENT ITEM		REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
53 FUSELAGE ACCESS DOORS (Cont'd)			
-35-03 -35-53	Aft Waste System Service Panel (1504609)	1	
-36-00	APU Emergency Shutoff Panel Access (1503703)	1	
-36-00	Stabilizer Servo Access Doors (Lower Aft Fuselage) (1538614-157) Left Hand (1538615-141) Right Hand	2	Both may be missing.
-37-02 -37-56	Ground Air Conditioning Receptacle Access-L&R (1521320)	2	
-52-02	Wing to Fuselage Fairings (1515604) Forward (1515605) Aft	4	All may be missing. If either of the two fairings on one wing are missing, remove the other fairing and seal in accordance with MISSING OVERWING FILLETS - MAINTENANCE PRACTICES, cahpter 53 in the Maintenance Manual. Performance adjustments each side: for takeoff, reduce runway zero wind and climb limit weights 750 lbs. For landing, reduce critical temperature 2°F. If forecast temperature is above the adjusted critical temperature, subtract 2100 lbs/°F.
54 FILLETS/FAIRINGS			
-52-01	Elevator Inboard Gap Fairing (1554958)	2	*One or both may be missing. No weight penalty.
-51-54	Pylon Glove Fairing (Wing)	2	Both may be missing. For takeoff, reduce runway zero wind and climb limit weights 1000 lbs. For landing, reduce critical temperature 1°F. If forecast temperature is above the adjusted critical temperature, subtract 2100 lbs/°F.
-52-53	Pylon Glove Fairing (Center) (1544137)	1	*May be missing. For takeoff, reduce runway zero wind and climb limit weights 1000 lbs. For landing, reduce critical temperature 1°F. If forecast temperature is above the adjusted critical temperature, subtract 2100 lbs/°F.
55 STABILIZERS			
-16-00	Lower Aft Airgate Seals (1532199-101/102)		Both may be missing. Limit weights should be reduced by the following amount per side: For takeoff, reduce runway zero wind and climb limit weights 200 lbs. For landing, reduce critical temperature 1°F. If forecast temperature is above the adjusted critical temperature, subtract 2100 lbs/°F.

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
57 WING		
-51-00 Interslat Seals, Slat End Seals (Chordwise)		(Following Remarks apply to all 51-00 items.)
Inboard Slats Seals		
Inboard Slat End Seal No. 1 Slat (1531392)	1 L/R	All may be missing any combination on either or both left and right wings. The limit weights should be reduced by the following amount per seal. For takeoff, reduce runway zero wind and climb limit weights 250 lbs. For landing, reduce critical temperature 1°F. If forecast temperature is above the adjusted critical temperature, subtract 2100 lbs/°F.
Interslat Seal No. 1 to No. 2 Slat (1531393, 1561752, 1592982)	1 L/R	NOTE: The outboard interslat seals, when missing, expose the rubber boots on the telescoping anti-icing duct. Therefore, when these seals are missing, inspect the rubber boots prior to each flight. If damaged, they must be repaired prior to flight in forecast icing conditions.
Interslat Seal No. 2 to No. 3 Slat (1531393, 1592983, 1561751)	1 L/R	NOTE: Part and dash numbers vary with aircraft mod status.
Outboard Slats Seals		
Inboard Slat End Seal No. 1 Slat (1526828)	1 L/R	
Interslat Seal No. 1 to No. 2 Slat (1526829, 1561751, 1592984)	1 L/R	
Interslat Seal No. 2 to No. 3 Slat (1526829, 1561751, 1592985)	1 L/R	
Interslat Seal No. 3 to No. 4 Slat (1526829, 1561751, 1592986)	1 L/R	
Outboard Slat End Seal No. 4 Slat (1526077, 1565599)	1 L/R	
-51-01 Upper Trailing Edge Wedge #1 Inboard Slat (1526334)	1 L/R	All may be missing in any combination on either or both left and right wings. No weight penalty. NOTE: Part and dash numbers vary with aircraft mod status.
-51-02 Upper Trailing Edge Wedge #2 Inboard Slat (1526335)	1 L/R	
-51-03 Upper Trailing Edge Wedge #3 Inboard Slat (1526336)	1 L/R	
-51-05 Upper Trailing Edge Wedge #1 Outboard Slat (1526074, 1565596)	1 L/R	

EQUIPMENT ITEM	REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
57 WING (Cont'd)		
-51-07 Upper Trailing Edge Wedge #2 Outboard Slat (1526075, 1565597)	1 L/R	All may be missing in any combination on either or both left and right wings. No weight penalty. <u>NOTE:</u> Part and dash numbers vary with aircraft mod status.
-51-09 Upper Trailing Edge Wedge #3 Outboard Slat (1526076, 1565598)	1 L/R	
-51-11 Upper Trailing Edge Wedge #4 Outboard Slat (1526077, 1565599)	1 L/R	
-51-04 No. 1 Outboard Slat Lower Trailing Edge Tab/Cover (1526662, 1586639)	3 L/R	No more than two may be missing from any one outboard slat segment and no more than a total of four may be missing from each left and right wing slats outboard of pylon. The maximum operating speed is 270 KIAS. <u>NOTE:</u> The airspeed indicator must be adjusted to set the limit airspeed and sound the aural warning at 270 KIAS. No weight penalty. <u>NOTE:</u> Part and dash numbers vary with aircraft mod status.
-51-06 No. 2 Outboard Slat Lower Trailing Edge Tab/Cover (1526663, 1586640)	3 L/R	
-51-08 No. 3 Outboard Slat Lower Trailing Edge Tab/Cover (1526664, 1586641)	3 L/R	
-51-10 No. 4 Outboard Slat Lower Trailing Edge Tab/Cover (1526665, 1586642)	3 L/R	
-52-01 Seal - No. 1 Spoiler Trailing Edge (1529101-143) (1529101-144)	1L 1R	Any or all Trailing Edge Seal corners may be missing up to 4.25 inches in length. No weight penalty.
-52-02 Seal - No. 2 Spoiler Trailing Edge (1529102-153) (1529102-154)	1L 1R	
-52-03 Seal - No. 3 Spoiler Trailing Edge (1529103-143) (1529103-144)	1L 1R	
-52-04 Seal - No. 4 Spoiler Trailing Edge (1529104-139) (1529104-140)	1L 1R	

EQUIPMENT ITEM		REQUIRED FOR ALL FLIGHT CONDITIONS EXCEPT AS PROVIDED FOR IN REMARKS	REMARKS
57 WING (Cont'd)			
-52-05	Seal - No. 5 Spoiler Trailing Edge (1529105-143) (1529105-144)	1L 1R	Any or all Trailing Edge Seal corners may be missing up to 4.25 inches in length. No weight penalty.
-52-06	Seal - No. 6 Spoiler Trailing Edge (1529106-147) (1529106-148)	1L 1R	
-54-00	Canoe Flap Track Fairings No. 1 Outboard No. 2 Inboard No. 2 Outboard No. 3 Inboard No. 3 Outboard No. 4 Inboard No. 4 Outboard (1530554, 555, 957, 021, 564, 566 and 847)	10	* Not more than 1 unit may be removed on the left or right wing. For takeoff, reduce runway zero wind and climb limit weights 800 lbs. For landing, reduce critical temperature 1°F. If forecast temperature is above the adjusted critical temperature, subtract 2100 lbs/°F.
71 POWERPLANT AND PYLON			
-11-00	Nose Cowl Thermal Anti-Icing Air Blowout Door Engine #1 and #3	2	One or both may be missing with no weight penalty.
78 EXHAUST			
-31-16	Fan Thrust Reverser Blocker Doors	45	Three doors may be missing on one engine. The complete Blocker Door Assembly, consisting of flap assembly (front and rear), finger bracket assembly, and operating link must be removed, and revers must be deactivated. Refer to MEL 78-31-00 for operational limitations with cold stream reverser inoperative. For takeoff, reduce runway zero wind and climb limit weights 2000 lbs. For landing, reduce critical temperature 1°F. If forecast temperature is above the adjusted critical temperature, subtract 2100 lbs/°F. A statement must be included on the placard specifying that reverse thrust is not available on the affected engine.

* Placard must be installed on instrument panel.

Missing part must be specified on Dispatch Release.

* * *

WEIGHT AND BALANCE

ACFT	CONFIG	COCKPIT/CABIN		OPTG WEIGHT	BRN
11001 thru 11004	34-234	3	9	246,200	793
11005 thru 11024	34-234	3	9	244,000	793
31025 thru 31031	30-251	3(INTL)	12	247,800	593
		3(DOM)	11	247,800	593

The weights shown above do not include baggage containers.

For each crew member changed from the above complement, make the following adjustments:

Each additional cockpit crew member, reduce BRN two units and increase operating weight as follows:

Domestic - 190 lbs   International - 205 lbs

Each added or subtracted cabin crew member, no change in BRN, but adjust operating weight as follows:

	Domestic	International
Male	170	185
Female	150	165

Minimum number of cabin crew members required for dispatch with passengers is five with 250 seats or less, and six with 251 seats or more.

STABILIZER TRIM COMPUTER INSTRUCTIONS

The plastic stabilizer trim computer is used as follows:

1. Select the Basic Reference Number (BRN) from this section.

2. Place the computer outer scale hairline over the BRN.

3. Move inner slide so passenger zero reference line is under the hairline.

4. Move outer scale to number of passengers in Area I (First Class).

   Passenger Areas I, II, III, IV correspond to A, B, C, and D on the Load Balance Record.

5. Move inner slide so passenger zero reference line is under the hairline.

6. Continue entering passenger numbers in the same manner. Area II extends from the class divider to the number 2 doors. Area IV extends aft from the number 3 doors. Area III is between the number 2 and 3 doors and is not on the computer because its location does not affect the center of gravity. It is accountable for weight only.

7. Enter cargo weights in the same manner as above. If more than 18,000 pounds is loaded in the forward or aft container compartments, move the inner slide to the zero reference under the hairline and add the weight. The scale is linear.

   -100: Enter cargo weights in the same manner as passenger weights.

   The capacity of the cargo compartments is as follows:

Forward container	22,000 pounds
Aft container	26,000 pounds
Aft bulk	9,650 pounds

   However, for each pound over 18,000 in the aft container compartment, the capacity of the aft bulk compartment must be reduced by 1/2 pound.

8. After passenger numbers and cargo weights have been entered, check zero fuel center of gravity. Read the aircraft zero fuel weight on the outer scale. The zero fuel weight must be to the left of the blue alternate fuel line and below 325,000 pounds.

STABILIZER TRIM COMPUTER INSTRUCTIONS (Cont'd)

-100: The zero fuel weight must be to the left of the fuel only line and below 320,000 pounds.

9. Move inner slide so that the alternate fuel zero reference line is under the outer scale hairline. Move outer scale to total fuel load.

-100: Move inner slide so that the fuel zero reference line is under the outer scale hairline. Move outer scale to total fuel load.

10. On the outer scale read takeoff gross weight and parallel the solid lines to read center of gravity at the top of the computer. You are not restricted if the takeoff weight falls in the yellow fuel only area.

11. Use the stabilizer trim placard on the engineer's panel to convert center of gravity to a takeoff stabilizer trim setting.

TAKEOFF TRIM SETTING-FLAP 10°

c.g.%MAC	STAB TRIM SETTING
12	6
14	6
16	5.5
18	5
20	5
22	4.5
24	4.5
26	4
28	3.5
30	3.5
32	3

PASSENGER DOOR/SLIDE ASSEMBLY INOPERATIVE

Passenger Seating Restrictions

The following passenger seating restrictions are to be observed with a door/slide inoperative:

L1 or R1 - No passengers authorized in row 6 (-100:5) and forward.

L2 or R2 - No passengers authorized in rows 6 through 22 (-100:7-23) inclusively.

L3 or R3 - No passengers authorized in rows 22 through 34 (-100:23-34) inclusively.

L4 or R4 - No passengers authorized in row 34 and aft.

Stabilizer Trim Setting

The load control agent will use a special chart to compute the CG. The engineer should convert this CG to a stabilizer trim setting using the panel placard.

If the engineer determines a stabilizer trim setting in the normal manner, it should be within 1 1/2 units of the load control agent's computation. If a difference greater than 1 1/2 units exists, the load control agent should recheck the weight and balance computation.

* * *

FLIGHT PLANNING POLICY

TWA's Flight Planning Policy has the basic objective of operating as economically as possible. Flights will be planned and operated at minimum cost cruise speed and as close to minimum cost altitude as possible. There will be no deviation from this policy for the purpose of making up time. The scheduled air times are calculated to produce a standard percentage of arrivals on time and are based on historical performance on each route segment.

When equipment is substituted for another model having a different minimum cost cruise speed, the minimum cost cruise speed for the aircraft being flown will be utilized.

Planned trip fuel for all domestic and intra-European flights will be based on minimum cost altitude. Long range cruise may be used en route when required.

Transoceanic trip fuel is normally calculated on the next lower directional altitude (2000' lower up to and including flight level 290 and 4000' lower above 290) to provide for enroute contingencies such as restricted altitude, alternate track, etc.

Re-release dispatch procedures may be used whenever necessary to extend a flight to non-stop operation.

LRC will be used for flight planning only when payload cannot be carried at minimum cost cruise speed.

Considering the policy outlined above, flights should be planned as follows:

Considering total payload available and/or holding requirements, plan flight at minimum cost cruise speed and as near minimum cost altitude as possible.

If payload cannot be accomodated, plan flight at long range cruise at optimum altitude utilizing re-release procedures as required.

If payload still cannot be accommodated, consider only mail allocation and revenue passenger load and calculate fuel requirements at minimum cost cruise or long range cruise at optimum altitude utilizing re-release procedures as necessary.

If insufficient fuel for the flight still exists, then consider only revenue passenger load to meet requirements. If this does not allow sufficient fuel, then a fuel stop will be considered and the full payload accepted if possible if a fuel stop is planned. Calculate fuel requirements at minimum cost cruise speed.

Additional capability is provided for enroute contingencies in the company reserve fuel on domestic and 10% time enroute fuel on international.

MINIMUM FUEL FOR TAKEOFF

Company reserve fuel for domestic flights must be on board at blockout for planning purposes, however, it may be used at any time after blockout if required.

The taxi fuel specified for the particular airplane will normally be on board the aircraft at blockout. In the case of unusual situations, such as to avoid a lengthy delay, the flight may depart the gate without the taxi fuel. When making this decision the captain must ensure that conditions are such that all fuel requirements will be met at time of takeoff.

Minimum fuel for takeoff is the greater of:

Fuel required for operation to destination plus FAA reserve; plus fuel required to most distant alternate as specified in the flight release, if one is required.

Minimum takeoff fuel for the specific aircraft model.

DOMESTIC RESERVE FUEL

Reserve requirements for all domestic flights are:

FAA Reserve	11,000 pounds
Company Reserve	4,000 pounds

INTERNATIONAL RESERVE FUEL

International reserve fuel is 8,000 pounds plus 25 pounds per minute of planned flight time but never less than 11,000 pounds. For example, for a planned flight time of 7:00, the required fuel reserve would be:

	8,000 pounds
+ 420 minutes X 25	10,500 pounds
Total reserve fuel	18,500 pounds

The 8,000 pounds represents a 30 minute hold at 1,500 feet.

This same reserve fuel formula must be used when operating under a re-release. Re-release dispatch procedures may be used whenever necessary to extend a flight to non-stop operation.

For dispatch to those stations for which there is no approved alternate, such as Santa Maria and Keflavik, the required reserve is 30,000 pounds.

HOLDING FUEL

Computer flight plans and dispatch release fuels are normally adequate to provide a margin for holding of a routine nature. Adding fuel for the specific purpose of holding should be done only when an assessment of forecast conditions for the flight show that delays are probable.

The arbitrary addition of extra fuel based on unidentified contingencies is wasteful and should be avoided. Unless the need can be specifically identified, normal reserves should be considered as adequate for planning purposes.

MINIMUM COST ALTITUDE/WIND TRADE

The Minimum Cost Altitude/Wind Trade chart provides a means of determining the minimum cost altitude for any flight as a function of weight and wind component differences. The solid line labeled Reference Optimum Altitude gives the minimum cost altitude for a given weight and zero wind gradient condition (the same wind at all altitudes). The light lines labeled Compensating Wind Required give the additional more favorable wind component (less headwind or more tailwind) required to justify flying at other than the reference optimum altitude.

This chart takes into account all the variables that affect cost. When the speed is optimized, as it is when flying minimum cost speed, the other factors of weight and wind will determine the altitude where the aircraft should operate for minimum cost. The chart takes into account the change in true airspeed and fuel flow at the various altitudes.

The relationship of weight, altitude, and wind effect on minimum cost continually changes as the flight progresses. These variables should be periodically assessed to assure that the aircraft is being operated at the best altitude. To use the chart:

1. Enter chart with the estimated initial cruise weight when flight planning, or existing cruise weight when in flight.

2. Go up the chart from the weight to the Reference Optimum Altitude line. Go straight left and read the optimum altitude. Optimum altitude is minimum cost altitude if the wind components are the same for all altitudes.

3. If wind components are not the same for all altitudes, read the compensating wind required values at the intersection of the cruise weight and various altitudes above and below the optimum altitude. Example: When aircraft weight is 380,000 lbs., the optimum altitude is 35,000 feet. The compensating wind required to fly at 31,000 feet at the same cost is 15 knots.

4. If the forecast (or actual) wind component for an altitude above or below the optimum altitude is more favorable than the wind component for the optimum altitude by an amount greater than the required compensating wind value, use that altitude as the minimum cost altitude.

   For example: If the forecast wind component is -40 knots for the 35,000 feet optimum altitude and -20 knots for 31,000 feet, use 31,000 as the minimum cost altitude. Only 15 knots more favorable wind is required at 31,000 feet and the actual favorable wind component is 20 knots.

5. If the minimum cost altitude is an odd altitude which is not a proper altitude for the direction of flight, select the next odd altitude <u>above</u> the minimum cost altitude. For example, if minimum cost altitude is 35,000 feet and flight is eastbound, select 37,000 feet. Do not select an altitude more than 2000 feet above the minimum cost altitude. If the minimum cost altitude is an even altitude, select the proper odd altitude for the direction of flight 1000 feet above or below the minimum cost altitude.

6. Plan to use the selected altitude until aircraft weight decreases to where the selected altitude is 2000 feet below minimum cost altitude. Then step-climb 4000 feet (2000 feet above minimum cost altitude) to the next highest altitude for the direction of flight.

7. Use the Minimum Cost Cruise chart to determine acceptable aircraft climb capability to the selected altitude. If climb capability to the selected altitude is not available, use the next highest possible altitude.

ALTERNATE PLANNING

This chart assumes an en route climb to optimum altitude, cruise at long range cruise, and a normal descent and approach to the alternate airport. The chart is applicable to both domestic and international planning.

Time and fuel figures are based on the preceding assumptions except for altitudes 10,000 feet and below which are based on 250 knots IAS.

The TAS value given is for the cruise portion.

To use chart:

1. Obtain nautical ground miles from Distance To Alternate Airports chart or from appropriate en route chart.

ALTERNATE PLANNING (Cont'd)

2. Enter column nearest ground mileage to find approximate true airspeed.

3. Determine ground speed by applying forecast wind to approximate true airspeed.

4. Place true airspeed over ground speed on Jeppesen computer and find nautical air miles over nautical ground miles.

$$\frac{TAS}{GS} = \frac{NAM}{NGM}$$

5. Enter column nearest to nautical air mileage to obtain altitude, time, fuel, and cruise TAS.

ESTIMATING LANDING WEIGHT

Estimated landing weight is the sum of the operating weight, plus estimated payload, plus total reserve fuel. The first eight blocks of the Jet Flight Plan/Fuel Log can be used for this calculation.

1. FAA reserve.

2. TWA reserve.

3. Holding fuel should be computed for any forecast ATC delay. An estimated figure, based on prior experience, should be temporarily inserted to provide a more realistic landing weight if it is anticipated that fuel in addition to minimum reserve is needed. FAA and TWA reserves are intended to cover unanticipated delays en route. TWA reserves can also be used for unanticipated ground delays.

4. Fuel to alternate is determined by following the instructions for the Alternate Planning charts in this section.

5. Total reserve fuel requirement is determined by totaling the amounts entered in the FAA reserve. TWA reserve, hold, and fuel to alternate blocks.

6. Operating weight can be obtained from section 05.01 of this chapter, Flight Dispatch, or chapter 20 of the Aircraft Weight Handbook kept at major station load control offices.

7. Payload is obtained from the load control agent or from Flight Dispatch.

8. Landing weight is determined by totaling the amounts entered in the total reserve, operating empty weight, and payload blocks.

FLIGHT PLANNING

These charts are located in the Flight Planning manual, and in the Aircraft Performance manual aboard the aircraft. There are charts for minimum cost and long range cruise speeds. They provide total time, total fuel and average cruise true airspeed for any combination of cruise altitude, estimated landing weight, nautical air mile distance, and forecast static air temperature at cruise altitude.

The fuel values shown are for brake release to landing. They include fuel for takeoff, climb, cruise over destination, and a constant increment for desecent and approach.

The time values shown are for brake release to over destination plus a constant increment for descent and approach.

True airspeed values shown are the average for the cruise portion of the flight. Planning data shown in a block with a single asterisk (*) following the true airspeed is predicated on a single 4000 foot step climb. If two asterisks (**) follow the speed, two step climbs are necessary.

To use Flight Planning chart:

1. Determine nautical ground miles (NGM) by reference to Jeppesen en route chart(s), Distance Between Regular Airports chart in section 15.01 this chapter, Flight Planning manual, or Jeppesen Operations Manual center stored flight plan data.

2. Determine estimated landing weight following the instructions under Estimating Landing Weight in this section.

3. Select minimum cost cruise altitude following instructions for Flight Planning Policy and instructions for the Minimum Cost Altitude/Wind Trade chart in this section. However, use estimated <u>average</u> cruise weight instead of initial cruise weight for selecting the altitude. For long flights use average weight prior to a planned 4000 foot step climb.

4. Select the Flight Planning chart which will accomodate the selected altitude, estimated landing weight, and distance to destination.

5. Obtain the approximate true airspeed at the intersection of the nautical ground mile distance, estimated landing weight and forecast cruise altitude temperature. Use the mileage column closest to the ground distance.

FLIGHT PLANNING (Cont'd)

6. Determine ground speed by applying forecast wind to approximate true airspeed.

7. Use forecast wind at selected altitude and TAS to obtain NAM by setting computer $\frac{TAS}{GS} = \frac{NAM}{NGM}$

8. Re-enter chart using NAM as distance and obtain trip time, trip fuel required, and average cruise TAS opposite forecast temperature for the estimated landing weight. Interpolate as necessary between adjoining weight, distance, and temperature blocks for best accuracy.

9. When chart shows a single (*) or double (**) asterisk following the TAS, a single or double step climb may be necessary under certain conditions. For one asterisk, an initial cruise altitude 4,000 feet below chart altitude will be necessary. When two asterisks are shown, an initial cruise altitude 8,000 feet below chart will be necessary. In any case, follow the instructions under Minimum Cost Altitude Wind/Trade chart using estimated initial cruise weight to determine the initial cruise altitude of the aircraft.

CLIMB PERFORMANCE

These charts are located in the Flight Planning manual. They provide climb fuel and climb time from brake release to top of climb, no wind climb distance, and average climb true air speed for any combination of takeoff (brake release) weight, cruise altitude and static air temperature at cruise altitude.

The Climb Performance chart data is based on using a normal en route speed schedule. This includes 250 knots IAS to 10,000 feet, then 320 knots until reaching Mach. 82 and Mach. 82 thereafter. This speed schedule gives optimum total trip time and rate of climb at no sacrifice in trip fuel for most flight conditions. The weight index at the top of each chart is the takeoff brake release weight.

A note at the bottom of each chart provides a climb fuel correction for each 1000 feet the departure airport is above sea level.

To Use Chart:

1. Determine estimated takeoff weight by adding trip fuel requirement to estimated landing weight.

2. Select the Climb chart for the estimated takeoff (brake release) weight. If the estimated takeoff weight falls between two 5000 pound increment charts, use the higher takeoff weight chart.

3. Enter chart with the selected cruise altitude, and forecast temperature for the selected cruise altitude.

4. Obtain the climb fuel, climb time, no wind climb distance, and average climb true airspeed in the block for the temperature to the right of the selected altitude. Interpolate between temperature blocks as necessary.

* * *

DISTANCES BETWEEN REGULAR AIRPORTS

AIRPORT	N. DIST	ROUTE
IAD-LAS	1830	IAD CSN J149 J134 BUM J110 PGS STAR LAS
LAX	2015	IAD CSN J149 J134 PKE STAR LAX
LGA	215	IAD VCTRS SWAN POINT V44 V123 RBV LGA
ORD	556	IAD CSN J149 FWA FWA311 CGT097 CGT CGT356 NILES ORD
PHX	1760	IAD CSN J42 MEM J66 LIT J6 ABQ J18 SJN STAR PHX
SFO	2135	IAD CSN J149/J134 FLM J134 STL J24 MKC J80 OAL STAR SFO
STL	606	IAD CSN J149 J134 STL
LAS-LAX	204	LAS SID GOODSPRINGS ONE CLARK HEC STAR LAX
ORD	1350	LAS VALLEY-1 DVC J146 GLD PWE J64 BDF JOT WARREN ORD
SFO	424	LAS HIDDEN HILLS ONE PAHRUMP BTY J92 OAL STAR SFO
STL	1223	LAS SID DVC J146 GLD J80 SLN BSP BSP-1 STL
LAX-IAD	2015	LAX SID PKE J134 FLM J24 CRW J8 BERGOO LDN V174 BLUERIDGE IAD
LAS	204	LAX SID DAG-4 HALLORAN-1 STAR LAS
ORD	1570	LAX DAG-4 BLD J146 GLD PWE J64 BDF JOT WARREN ORD
PHX	320	SID SEAL BEACH BLH J65 PHX
SFO	296	SID BSR BSR THREE STAR SFO
STL	1407	SID PKE J96 SLN BSP BSP-1 STL
LGA-IAD	210	SBJ V3 MXE V474 V39 EMI EMI 245 V223 HRN IAD
MCI	1215	SID J80 MCI
ORD	692	LGA SID DKK J36/HL36 J36 J94 V84 PAP1 ORD
STL	770	LGA SID J110 STL
MCI-IND	400	J24
IND-MCI	385	J80
ORD-IAD	498	ORD VCTRS EON J30 FRR HRN IAD
LAS	1340	ORD ICTRS IOW J60 BCE BCE-1 LAS
LAX	1565	ORD VCTRS IOW LMN J64 PGS PGS-2 LAX
LGA	692	ORD VCTRS SBN J146 FTG FTG106 MIP MIP108 PENNWELL LGA
PHL	630	ORD-VCTR EON J30 J152 HAR HAR 110 LRP V210 BUCKTOWN PHL
PHX	1185	ORD VCTRS BDF J18 SJN STAR PHX
ORD-PIT	365	ORD VCTR VWV J60 CLE ACO V337 CALCUTTA PIT
PIT-ORD	394	PIT BSV BSV 297 J60 DOLLY CGT 088 CGT CGT 356 NILES ORD
SFO	1630	ORD SID DBQ J94 LCU J158 MVA MVA-3 SFO
PHL-ORD	630	PHL SID J64 FWA FWA 311 CGT 097-CGT CGT 356 NILES ORD
PHX-LAX	334	PHX J65 GBN297 STAR LAX
ORD	1185	PHX SID SJN J18 J26 JOT WARREN ORD
SFO	622	PHX J65 PMD AVE BSR STAR SFO
STL	1100	PHX SID SJN J19 BUM STAR STL
PMD-MCI	1165	J6 HEC J64 ALS G102 SLN J80 MCI
SFO-IAD	2135	SFO STAR LIN J84 EKR J56 DEN J80 MKC J24 STL J134 FLM J24 CRW J8 BERGOO LDN V174 BLUERIDGE IAD
LAS	360	SFO SID LIN J84 J92 BTY STAR LAS
LAX	296	SFO SID AVE AVE-3 STAR LAX
ORD	1630	SFO SID SAC J32 BAM J94 DBQ RFD RFD090 LAKEWOOD ORD
PHX	626	SFO SID AVE PMD J65 PHX
STL	1523	SID LIN J84 EKR J56 DEN J80 SLN BSP BSP-1 STL
STL-IAD	606	STL J134 FLM J24 CRW J8 BERGOO LDN V174 BLUERIDGE IAD

DISTANCES TO ALTERNATE AIRPORTS

TERMINAL	ALTERNATE	DIST NM
IAD	BAL	45
	BDL	315
	EWR	205
	LGA	215
	PHL	125
LAS	LAX	204
	PHX	237
	PMD	190
	SFO	424
LAX	LAS	204
	PHX	320
	PMD	50
	SFO	296
LGA	BAL	160
	BDL	110
	BOS	198
	EWR	15
	IAD	210
	PHL	85
ORD	IND	175
	MCI	359
	STL	230
PHX	LAS	240
	LAX	334
	PMD	325
	SFO	622
PIT	CMH	117
	CLE	116
	IND	295
SFO	LAS	360
	LAX	296
	OAK	25
	PHX	626
	PMD	280
STL	IND	215
	MCI	200
	ORD	245

DISTANCES BETWEEN REGULAR AIRPORTS

DISTANCES TO ALTERNATE AIRPORTS

AIRPORT	N. DIST	ROUTE	TERMINAL	ALTERNATE	DIST NM
LAS	1223	STL J24 MKC J80 SLN J102 ALS J64 PGS STAR LAS			
LAX	1407	STL J24 MKC J80 SLN J102 ALS J64 PGS PGS-2 LAX			
LGA	773	STL TOY BIB LEU ROD J29 J146 ETG ETG 106 MIP MIP 108 PENNWELL LGA			
PHX	1100	STL J19 SJN STAR PHX			
SFO	1523	STL J24 MKC J80 OAL STAR SFO			

ALTERNATE PLANNING

DIST NAM	20	40	60	80	100	120	140	160	180	200
OPTM ALT	2000	6000	10000	14000	17000	20000	23000	25000	27000	28000
TIME	.11	.13	.16	.19	.22	.24	.27	.30	.32	.34
FUEL	3300	4700	5500	6300	7100	7900	8600	9400	10100	10700
TAS	257	272	327	350	367	384	401	412	423	430

DIST NAM	220	240	260	280	300	320	340	360	380	400
OPTM ALT	30000	31000	32000	33000	33000	34000	35000	35000	35000	36000
TIME	.36	.39	.41	.44	.47	.49	.51	.54	.56	.59
FUEL	11400	12000	12600	13100	13800	14400	15000	15600	16200	16800
TAS	440	448	454	459	459	462	467	467	468	473

DIST NAM	420	440	460	480	500	520	540	560	580	600
OPTM ALT	36000	37000	37000	37000	37000	37000	37000	37000	37000	37000
TIME	1.02	1.05	1.07	1.10	1.12	1.15	1.17	1.20	1.23	1.25
FUEL	17400	18000	18600	19200	19800	20400	21100	21700	22300	22900
TAS	473	475	475	475	475	475	475	475	475	475

DIST NAM	620	640	660	680	700	720	740	760	780	800
OPTM ALT	37000	37000	37000	37000	37000	37000	37000	37000	37000	37000
TIME	1.28	1.30	1.33	1.35	1.38	1.40	1.43	1.45	1.48	1.50
FUEL	23500	24100	24700	25300	25900	26500	27200	27800	28500	29000
TAS	476	476	476	476	476	476	476	476	476	476

NOTES:

1. FUEL INCLUDES ENROUTE TRIP REQUIREMENT AT LRC FROM DESTINATION TO ALTERNATE WITH ADDITIONAL FUEL FOR APPROACH AND LANDING AT ALTERNATE AIRPORT.
2. TIME IS CONSISTANT WITH THE ABOVE FLIGHT PLAN.
3. TIME AND FUEL FIGURES BELOW 10,000 FEET ARE BASED ON AN INDICATED AIRSPEED OF 250 KNOTS.

MINIMUM COST ALTITUDE SELECTION

REFERENCE		WIND IMPROVEMENT ALTITUDE														
WEIGHT	ALT	390	380	370	360	350	340	330	320	310	300	290	280	270	260	250
310	390	0	3	6	10	15	24	27	35	41	52	55	63			
320	380	1	0	2	7	11	17	23	29	37	43	48	54			
330	380	2	0	2	5	8	13	18	24	30	36	41	48			
340	370		2	0	2	6	9	14	19	25	30	36	42	49		
350	370		1	0	1	4	7	12	15	21	26	32	38	44	51	
360	360			2	0	2	5	9	12	18	23	28	33	39	47	
370	350				1	0	3	6	10	15	20	24	30	35	42	
380	350				2	0	2	4	8	12	17	21	26	31	39	45
390	340					1	0	4	6	9	14	18	22	28	34	41
400	340					2	0	1	4	6	11	15	19	24	31	37
410	330						1	0	3	4	8	12	16	21	28	34
420	330						2	0	1	2	5	9	13	18	24	31
430	320							2	0	1	2	5	10	15	21	28

REFERENCE ALTITUDE IS MINIMUM COST ALTITUDE WITH ZERO WIND GRADIENT

INTERSECTION OF WEIGHT AND WIND IMPROVEMENT ALTITUDE SHOWS INCREASED TAIL-WIND OR DECREASED HEADWIND VALUES (KNOTS) NECESSARY TO FLY OTHER THAN REFERENCE ALTITUDE FOR SAME COST

WHEN TEMPERATURE IS ABOVE STANDARD, CHECK CRUISE THRUST SETTING CHART TO DETERMINE IF ALTITUDE SELECTION IS LIMITED BY CLIMB CAPABILITY

* * *

GENERAL

Thrust setting charts are included for all possible flight requirements. In descending order of thrust required, charts are provided for:

- Takeoff
- Go-around
- Maximum continuous (engine out) climb
- 1-engine long range cruise
- 2-engine long range cruise
- Maximum climb
- Normal climb
- Hold-flaps 10
- Hold-flaps 4
- Minimum cost cruise
- Long range cruise
- Maximum range cruise
- Hold-flaps 0

In addition to the thrust setting charts in this chapter, there is an Aircraft Performance Manual (APM) in the cockpit. The APM contains charts with detailed data that is used to cross check suspected engine problems or instrument errors.

Thrust settings should be monitored by reference to the TAT/EPR indicator which displays maximum EPR for the mode selected.

TAKEOFF

The takeoff chart reflects the maximum permissible EPR and an expected N_1 for any combination of local pressure and temperature. EPR values are valid only when set at speeds between 40 and 80 knots. A note on the chart requires a .005 EPR reduction when one ECS pack is using engine bleed air. There is no anti-ice penalty with takeoff thrust.

Thrust output is directly related to local pressure and temperature. Local, or station, pressure is a product of sea level pressure (altimeter setting) as modified by field elevation. Pressure decreases by 1.0 inch of mercury (Hg) for each 1000 feet or .10 inch of pressure per 100 feet. Station pressure can be determined by subtracting 10% of the field elevation from the altimeter setting, for example:

Altimeter setting	30.24 in. Hg.
Field elevation - 740 ft. (740 x 10%)	-.74
Station pressure	29.50 in. Hg.

The takeoff chart is entered with station pressure and temperature to determine EPR and N_1. Interpolate for both pressure and temperature.

GO-AROUND

The go-around chart is essentially a takeoff chart corrected for the increased ram effect at go-around speeds. Station pressure and temperature are used to determine EPR and N_1, interpolating as necessary. No EPR reduction is required for engine bleeds.

Normally, the go-around (GA) mode of the EPR computer should be used for go-around thrust EPR.

NORMAL CLIMB

Normal climb is used for climb at all but the higher altitudes. Read EPR and N_1 at the intersection of the altitude/speed column and the total air temperature (TAT) line. A note on the chart requires an EPR reduction with anti-ice on.

Normally, the cruise (CRZ) mode of the EPR computer should be used for normal climb thrust EPR.

MAXIMUM CLIMB

Maximum climb is used for climb at the higher altitudes and weights. Determine EPR and N_1 in the same manner as normal climb.

Normally, the climb (CLB) mode of the EPR computer should be used for maximum climb thrust EPR.

MAXIMUM CONTINUOUS (ENGINE OUT) CLIMB

The maximum continuous chart reflects maximum permissible EPR and expected N_1 as limited by TAT and altitude. This thrust is intended for emergency use, such as engine out climb. It must be used to ensure obstacle clearance following engine loss on takeoff. Use altitude/speed and TAT to determine EPR and N_1. A note on the chart requires an EPR reduction with anti-ice on.

MINIMUM COST CRUISE

These charts present the thrust setting required, for heavy and light weights at high and low altitudes, to achieve Minimum Cost Cruise speed for any combination of weight and altitude. The charts are also used to determine acceptable climb performance capability to cruise altitudes and 1.3G maneuver capability.

MINIMUM COST CRUISE (Cont'd)

To use the charts:

The box at the intersection of cruise flight level and aircraft gross weight gives the IAS and Mach required for Minimum Cost Cruise speed, average EPR to maintain that speed, and the hottest total air temperature (TAT) at which the stated EPR can be used.

If existing TAT is equal to, or colder than, the temperature value shown, accelerate to the given IAS and set the EPR shown. A note on the chart requires an EPR reduction with anti-ice on. If TAT is hotter than the temperature value shown, use the cruise (CRZ) mode of the EPR computer to set EPR and accept the resulting cruise speed.

CLIMB PERFORMANCE CAPABILITY TO CRUISE ALTITUDES

The Minimum Cost Cruise chart is also used to determine acceptable climb performance capability to cruise altitudes. If data is presented in an altitude/gross weight block, acceptable climb capability to that altitude is available provided there is not a substantial temperature deviation from standard. Standard temperatures are indicated for each altitude in the altitude blocks.

Maximum temperature deviation is described on the chart by two distinctive lines, one for 15° hotter than standard and another for 20° hotter than standard. If existing temperatures are hotter than these values, it is not desirable to climb above the respective temperature limit line.

For inflight purposes, when desiring to climb to a higher altitude, assume the temperature deviation at the higher altitude will be the same as at the existing altitude.

1.3G MANEUVER CAPABILITY

Buffet guidance for a 1.3G maneuver is described by the designated boundary line. Operations at or below the 1.3G line will provide sufficient maneuver margin in light to moderate turbulence and in banks to 45°.

LONG RANGE CRUISE (LRC)

This is the speed schedule which will produce 99% of the maximum range for a specific altitude, weight and engine condition. 1% range is sacrificed for a 4 to 6% gain in speed. Use of the charts is the same as the Minimum Cost Cruise charts.

3-ENGINE

Where temperature is given in a block, the EPR shown equals the maximum cruise thrust rating at that temperature. Long range cruise is the speed schedule used for cruise to alternate airports. Alternate flight planning is predicated on the use of LRC.

2 AND 1-ENGINE

Where temperature is given in a block, the EPR shown equals the maximum continuous thrust rating at that temperature.

MAXIMUM RANGE CRUISE (MRC)

This chart schedules the mininum thrust and speed for maximum endurance at a sacrifice of no more than 1% range. Use of the chart is the same as the Minimum Cost Cruise charts.

HOLD

FLAPS 10/4

These charts provide an average EPR to attain a desired IAS for any combination of weight and of altitude from 2,000 to 20,000 feet. Use of the charts is the same as the Minimum Cost Cruise charts.

FLAPS 0

This chart schedules maximum endurance for a clean configuration in racetrack holding patterns. The speeds are 1.1 minimum drag speed (true maximum endurance for level flight). The 10% margin compensates for increased G loading in turns, thus avoiding the necessity of adding thrust during the turn. Use of the chart is the same as the Minimum Cost Cruise charts.

CRUISE PERFORMANCE CHARTS

Cruise performance charts are found in the Aircraft Performance Manual which is carried in the cockpit. The charts provide detailed performance data. The data can be used to cross check suspected engine problems or instrument errors.

CRUISE PERFORMANCE CHARTS (Cont'd)

Data in the boxes consist of the scheduled mach, TAT, IAS, TAS, EPR, N_1, fuel flow (F/F), and nautical air miles per 1000 pounds of fuel (NAM/1000#) for a given weight and outside air temperature (OAT).

Data in boxes to the right of a line made of pound (#) symbols reflects insufficient thrust available to meet the scheduled speed.

EPR (A/L) is presented in each block. (A) is the average setting required on all engines to maintain the speed schedule for that altitude and temperature. (L) is the EPR limit of the maximum cruise thrust rating for that speed, altitude, and temperature, accounting for air conditioning bleed.

Temperatures given on all charts are outside air temperature (OAT) and the corresponding total air temperature (TAT). Indicated static air temperature (SAT) equals OAT.

The letter B is inserted in certain high weight, high altitude performance blocks. It denotes that at this weight and altitude the airplane will experience buffet at the speed shown if gust loads in excess of 1.3G, greater than moderate turbulence, or a 45° bank are encountered.

To cross check the accuracy of the machmeter and TAS on the Jeppesen computer, align pressure altitude with calibrated airspeed (CAS) and read true mach number. CAS equals IAS. Set the 1.0 temperature recovery line on indicated TAT and read TAS.

To use chart:

1. Select appropriate chart for desired speed schedule and altitude.
2. Locate the performance block at the intersection of the existing aircraft weight and OAT, interpolating as necessary. The resulting performance values are those that the aircraft should produce.
3. Adjust aircraft speed to the IAS shown in the performance block and set average EPR on all engines.
4. After approximately five minutes, check IAS value against performance block value. If IAS varies by more than 5 knots adjust EPR as necessary, but not more than limit EPR, to regain chart IAS.
5. Use the center engine for EPR adjustment. If it is necessary to set the center engine EPR .015 more than the wing engines, wing engine EPR should be increased by .005 and the center engine again used for EPR adjustments.
6. Before deviating from chart average EPR, carefully check accuracy of speed, temperature, thrust instruments and weight calculations. If it is necessary to deviate from chart average EPR to obtain chart speed, make a corresponding logbook writeup.
7. If aircraft speed is substantially reduced, select the climb (CLB) mode of the EPR computer for maximum permissible EPR for acceleration to chart speed.
8. When engine or engine and wing anti-ice is on, apply the anti-ice reduction shown on the chart to limit EPR.

* * *

TAKEOFF

OAT (AMB)		STATION PRESSURE - IN H_G													
		30		29		28		27		26		25		24	
Deg F	Deg C	EPR	N1	EPR	N1	EPR	N1	EPR	N1	EPR	N1	EPR	N1	EPR	N1
-22	-30	.532	84.7	.539	85.1	.547	85.6	.554	86.0	.561	86.5	.568	87.0	.576	87.6
-18	-28		85.0		85.4		85.9		86.4		86.9		87.4		87.9
-15	-26		85.4		85.8		86.3		86.7		87.2		87.7		88.3
-11	-24		85.7		86.1		86.6		87.1		87.6		88.1		88.6
-8	-22		86.1		86.5		87.0		87.4		87.9		88.4		89.0
-4	-20		86.4		86.8		87.3		87.8		88.3		88.8		89.4
0	-18		86.8		87.2		87.7		88.1		88.6		89.1		89.7
3	-16		87.1		87.5		88.0		88.5		89.0		89.5		90.1
7	-14		87.4		87.8		88.3		88.8		89.3		89.8		90.4
10	-12		87.8		88.2		88.7		89.2		89.7		90.2		90.8
14	-10		88.1		88.5		89.0		89.5		90.0		90.5		91.1
18	-8		88.4		88.8		89.4		89.8		90.3		90.9		91.5
21	-6		88.8		89.2		89.7		90.2		90.7		91.2		91.8
25	-4		89.1		89.5		90.0		90.5		91.0		91.5		92.1
28	-2		89.4		89.8		90.4		90.9		91.4		91.9		92.5
32	0		89.8		90.2		90.7		91.2		91.7		92.2		92.8
36	2		90.1		90.5		91.0		91.5		92.0		92.6		93.2
39	4		90.4		90.8		91.4		91.9		92.4		92.9		93.5
43	6		90.7		91.2		91.7		92.2		92.7		93.2		93.8
46	8		91.1		91.5		92.0		92.5		93.0		93.6		94.2
50	10		91.4		91.8		92.3		92.8		93.4		93.9		94.5
54	12		91.7		92.1		92.7		93.2		93.7		94.2		94.8
57	14		92.0		92.5		93.0		93.5		94.0		94.6		95.2
61	16		92.4		92.8		93.3		93.8		94.3		94.9	.576	95.5
64	18		92.7		93.1		93.6		94.2		94.7	.568	95.2	.572	95.6
68	20		93.0		93.4		94.0		94.5	.561	95.0	.565	95.3	.564	95.3
72	22		93.3		93.7		94.3	.554	94.8	.557	95.1	.556	95.0	.555	95.0
75	24		93.6		94.1	.547	94.6	.550	94.8	.549	94.8	.548	94.8	.547	94.7
79	26		93.9	.539	94.4	.542	94.6	.541	94.5	.540	94.5	.539	94.5	.538	94.5
82	28		94.3	.534	94.4	.533	94.3	.532	94.3	.531	94.3	.530	94.2	.529	94.2
84	29	.532	94.3	.530	94.3	.529	94.2	.528	94.2	.527	94.2	.526	94.1	.525	94.1
86	30	.527	94.2	.525	94.2	.524	94.1	.523	94.0	.522	94.0	.521	94.0	.520	94.0
90	32	.518	94.0	.516	93.9	.515	93.8	.514	93.7	.513	93.7	.512	93.7	.511	93.6
93	34	.509	93.6	.507	93.6	.506	93.5	.505	93.4	.504	83.4	.503	93.3	.502	93.3
97	36	.500	93.3	.498	93.3	.497	93.2	.496	93.1	.494	93.1	.493	93.0	.492	93.0
100	38	.491	93.0	.489	92.9	.488	92.9	.487	92.8	.485	92.7	.484	92.7	.483	92.7
104	40	.482	92.7	.480	92.6	.479	92.5	.478	92.5	.476	92.4	.475	92.4	.474	92.4
106	41	.477	92.6	.476	92.5	.475	92.4	.474	92.4	.472	92.3	.471	92.3	.470	92.3
108	42	.473	92.4	.472	92.4	.471	92.3	.469	92.2	.468	92.2	.467	92.1	.466	92.1
111	44	.464	92.1	.463	92.1	.462	92.0	.461	91.9	.460	91.9	.459	91.9	.458	91.8
115	46	.456	91.8	.455	91.8	.454	91.7	.453	91.6	.452	91.6	.451	91.6	.449	91.5
118	48	.448	91.6	.447	91.5	.446	91.4	.445	91.3	.443	91.3	.442	91.3	.441	91.2
122	50	.440	91.3	.439	91.2	.438	91.1	.436	91.0	.435	91.0	.434	91.0	.433	90.9

NOTES:
1. To obtain station pressure, read indicated altitude as pressure (1000' = 1.0 in. HG) and subtract from altimeter setting.
2. All EPR values are preceded by 1 aud are valid for speeds between 40-80 knots.
3. Max TGT 728°C for five minutes, 738°C for two minutes, during takeoff but the total time at takeoff conditions must not exceed five minutes.
4. When operating one ECS pack with engine bleed air, reduce EPR by .005.

GO-AROUND

OAT (AMB)		STATION PRESSURE - IN H_G						
DEG F	DEG C	30	29	28	27	26	25	24
-15	-26	.516/85.5	.523/85.9	.531/86.4	.538/86.9	.545/87.4	.552/87.8	.560/88.2
-11	-24	/85.9	/86.3	/86.8	/87.2	/87.8	/88.2	/88.5
-8	-22	/86.2	/86.6	/87.1	/87.6	/88.1	/88.5	/88.9
-4	-20	/86.6	/87.0	/87.5	/87.9	/88.4	/88.9	/89.2
0	-18	/86.9	/87.3	/87.8	/88.2	/88.8	/89.2	/89.5
3	-16	/87.2	/87.6	/88.1	/88.6	/89.1	/89.5	/89.9
7	-14	/87.5	/87.9	/88.4	/88.9	/89.4	/89.8	/90.2
10	-12	/87.9	/88.3	/88.8	/89.2	/89.7	/90.2	/90.6
14	10	/88.2	/88.6	/89.1	/89.6	/90.1	/90.5	/90.9
18	-8	/88.5	/88.9	/89.4	/89.9	/90.4	/90.9	/91.3
21	-6	/88.8	/89.2	/89.7	/90.2	/90.7	/91.1	/91.6
25	-4	/89.1	/89.5	/90.0	/90.6	/91.1	/91.6	/92.0
28	-2	/89.4	/89.8	/90.3	/90.9	/91.4	/91.9	/92.3
32	0	/89.7	/90.1	/90.6	/91.2	/91.7	/92.2	/92.6
36	2	/90.0	/90.4	/90.9	/91.5	/92.0	/92.5	/93.0
39	4	/90.3	/90.7	/91.2	/91.9	/92.4	/92.9	/93.3
43	6	/90.7	/91.1	/91.6	/92.2	/92.7	/93.2	/93.6
46	8	/91.1	/91.5	/92.0	/92.5	/93.0	/93.5	/94.0
50	10	/91.5	/91.9	/92.4	/92.9	/93.4	/93.9	/94.4
54	12	/91.8	/92.2	/92.7	/93.2	/93.7	/94.2	/94.7
57	14	/92.1	/92.6	/93.1	/93.5	/94.0	/94.5	/95.0
61	16	/92.4	/92.8	/93.3	/93.9	/94.4	/94.9	.560/95.3
64	18	/92.8	/93.2	/93.8	/94.2	/94.7	.552/95.2	.555/95.5
68	20	/93.1	/93.5	/94.1	/94.5	.545/95.0	.549/95.1	.548/95.1
72	22	/93.4	/93.9	/94.4	.538/94.9	.543/95.2	.542/95.0	.541/94.9
75	24	/93.7	/94.1	.531/94.7	.536/95.0	.536/95.0	.535/94.9	.534/94.6
79	26	/94.0	.523/94.5	.529/94.7	.528/94.8	.527/94.7	.526/94.6	.525/94.4
82	28	.516/94.3	.520/94.7	.519/94.5	.518/94.5	.518/94.4	.517/94.3	.516/94.1
86	30	.513/94.5	.512/94.4	.511/94.3	.510/94.2	.509/94.1	.508/94.0	.507/93.8
90	32	.501/94.0	.499/94.0	.498/93.9	.498/93.8	.497/93.7	.496/93.6	.495/93.5
93	34	.491/93.8	.490/93.8	.489/93.7	.487/93.6	.486/93.5	.485/93.4	.484/93.2
97	36	.482/93.5	.481/93.5	.480/93.4	.478/93.3	.477/93.2	.476/93.1	.475/93.0
100	38	.474/93.2	.473/93.2	.472/93.1	.470/93.0	.468/92.9	.467/92.8	.466/92.7
104	40	.465/92.9	.464/92.9	.463/92.8	.461/92.7	.459/92.6	.458/92.5	.457/92.4
108	42	.456/92.6	.455/92.6	.454/92.5	.452/92.4	.451/92.3	.450/92.2	.449/92.1
110	44	.448/92.3	.447/92.3	.446/92.2	.444/92.1	.443/92.0	.442/91.9	.441/91.8
115	46	.439/92.0	.438/92.0	.437/91.9	.436/91.8	.435/91.7	.434/91.6	.433/91.6
118	48	.427/91.7	.426/91.7	.425/91.6	.423/91.5	.427/91.4	.426/91.3	.425/91.3
120	49	.424/91.5	.423/91.5	.422/91.4	.420/91.4	.423/91.3	.422/91.2	.421/91.2

NOTES: 1. All EPR Values are preceded by 1.

DATA PRESENTED IS: EPR/N_1

NORMAL CLIMB/MAXIMUM CRUISE

LOW ALTITUDE

TAT DEG C	PRESSURE ALTITUDE - FEET						
	0	5000	10000	10000	15000	20000	25000
	250 KTS	250 KTS	250 KTS	320 KTS	320 KTS	320 KTS	320 KTS
40	.398/88.7	.395/89.1		.391/90.7			
38	.404/88.8	.403/89.4		.400/91.0	.396/91.4		
36	.404/8[illegible].5	.412/89.7	.408/90.0	.409/91.2	.405/91.7		
34	.404/88.2	.421/90.0	.417/90.3	.418/91.5	.414/91.9		
32	.404/87.9	.430/90.2	.426/90.6	.427/91.7	.423/92.1	.419/92.5	
30	.404/87.6	.438/90.5	.435/90.9	.436/92.0	.432/92.4	.428/92.7	
28	.404/87.3	.438/90.2	.444/91.1	.440/91.9	.441/92.6	.437/92.9	
26	.404/87.0	.438/89.9	.453/91.3	.440/91.6	.450/92.8	.446/93.1	.441/93.5
24	.404/86.7	.438/89.6	.462/91.6	.440/91.3	.459/93.0	.455/93.3	.450/93.7
22	.404/86.5	.438/89.3	.471/91.8	.440/91.0	.468/93.2	.464/93.5	.459/93.9
20	.404/86.2	.438/89.0	.472/91.5	.440/90.7	.468/92.9	.473/93.7	.468/94.0
18	.404/85.9	.438/88.6	.472/91.2	.440/90.4	.468/92.6	.482/93.9	.477/94.2
16	.404/85.6	.438/88.3	.472/90.9	.440/90.1	.468/92.2	.491/94.2	.486/94.4
14	.404/85.3	.438/88.0	.472/90.6	.440/89.8	.468/91.9	.493/93.9	.496/94.6
12	.404/85.0	.438/97.7	.472/90.3	.440/89.4	.468/91.6	.493/93.6	.505/94.8
10	.404/84.7	.438/87.4	.472/90.0	.440/89.1	.468/91.3	.493/93.3	.515/95.1
8	.404/84.4	.438/87.1	.472/89.6	.440/88.8	.468/91.0	.493/93.0	.516/94.8
6	.404/84.1	.439/86.8	.472/89.3	.440/88.5	.468/90.6	.493/92.6	.516/94.5
4	.404/83.8	.438/86.5	.472/89.0	.440/88.2	.468/90.3	.493/92.3	.516/94.2
2	.404/83.5	.438/86.2	.472/88.7	.440/87.9	.468/90.0	.493/92.0	.516/93.8
0	.404/83.2	.438/85.9	.472/88.4	.440/87.5	.468/89.7	.493/91.6	.516/93.5
-2	.404/82.9	.438/85.5	.472/88.0	.440/87.2	.468/89.3	.493/91.3	.516/93.1
-4	.404/82.6	.438/85.2	.472/87.7	.440/86.9	.468/89.0	.493/90.9	.516/92.8
-6	.404/82.2	.438/84.9	.472/87.4	.440/86.6	.468/88.7	.493/90.6	.516/92.4
-8	.404/81.9	.438/84.6	.472/87.1	.440/96.2	.468/88.3	.493/90.3	.516/92.1
-10	.404/81.6	.438/84.3	.472/86.7	.440/85.9	.468/88.0	.493/89.9	.516/91.7
-12	.404/81.3	.438/93.9	.472/86.4	.440/85.6	.468/87.7	.493/89.6	.516/91.4
-14	.404/81.0	.438/83.6	.472/86.1	.440/85.3	.468/97.3	.493/89.2	.516/91.0
-16	.404/80.7	.438/83.3	.472/85.7	.440/84.9	.468/87.0	.493/88.9	.516/90.7
-18	.404/80.4	.438/83.0	.472/85.4	.440/84.6	.468/86.6	.493/88.5	.516/90.3
-20	.404/80.1	.438/82.7	.472/85.1	.440/84.3	.468/86.3	.493/88.2	.516/90.0
-22	.404/79.7	.438/82.3	.472/84.7	.440/83.9	.468/86.0	.493/87.8	.516/89.6
-24	.404/79.4	.438/82.0	.472/84.4	.440/83.6	.468/85.6	.493/87.5	.516/89.3
-26	.404/79.1	.438/81.7	.472/84.0	.440/83.3	.468/85.3	.493/87.1	.516/88.9
-28	.404/78.8	.438/81.3	.472/83.7	.440/82.9	.468/84.9	.493/86.8	.516/88.5
-30	.404/78.5	.438/81.0	.472/83.4	.440/82.6	.468/84.6	.493/86.4	.516/88.2
-32	.404/78.1	.438/80.7	.472/83.0	.440/82.2	.468/84.2	.493/86.1	.516/87.8
-34	.404/77.8	.438/80.3	.472/82.7	.440/81.9	.468/83.9	.493/85.7	.515/87.5
-36	.404/77.5	.438/80.0	.472/82.3	.440/81.6	.468/83.5	.493/85.4	.516/57.1
-38	.404/77.2	.438/79.7	.472/82.0	.440/81.2	.468/83.2	.493/85.0	.516/86.7
-40	.404/76.8	.438/79.3	.472/81.6	.440/80.9	.468/82.8	.493/84.6	.516/86.3

IF ANTI-ICE ON, REDUCE EPR FOR ENGINE BY .008, FOR ENGINE AND WING BY .014.

DATA PRESENTED IS: | EPR/N1 |

NORMAL CLIMB/MAXIMUM CRUISE

HIGH ALTITUDE

TAT DEG C	PRESSURE ALTITUDE - FEET						
	27000	29000	31000	33000	35000	37000	39000
	320 KTS	M.820	M.820	M.820	M.820	M.820	M.820
40							
38							
36							
34							
32							
30							
28							
26							
24	.448/93.8						
22	.457/94.0	.454/94.0					
20	.466/94.1	.463/94.2					
18	.475/94.3	.472/94.4					
16	.484/94.5	.482/94.5	.478/94.4				
14	.494/94.7	.491/94.7	.487/94.5				
12	.503/94.9	.501/94.9	.497/94.7	.492/94.5			
10	.513/95.1	.510/95.2	.506/95.0	.502/94.7			
8	.523/95.4	.520/95.5	.516/95.3	.512/95.0	.507/94.8		
6	.525/95.2	.531/95.8	.526/95.6	.522/95.3	.517/95.1	.511/94.7	.504/94.4
4	.525/94.9	.534/95.7	.537/95.9	.532/95.6	.527/95.4	.521/95.0	.514/94.7
2	.525/94.6	.534/95.3	.547/96.2	.542/96.0	.537/95.7	.531/95.3	.524/95.0
0	.525/94.2	.534/95.0	.552/96.3	.552/96.3	.547/96.0	.541/95.6	.534/95.3
-2	.525/93.9	.534/94.6	.552/95.9	.562/96.6	.557/96.3	.551/96.0	.544/95.6
-4	.525/93.5	.534/94.3	.552/95.6	.570/96.9	.566/96.7	.561/96.3	.554/95.9
-6	.525/93.2	.534/93.9	.552/95.2	.570/96.5	.576/97.0	.570/96.6	.563/96.2
-8	.525/92.8	.534/93.6	.552/94.8	.570/96.1	.585/97.3	.579/96.9	.572/96.5
-10	.525/92.5	.534/93.2	.552/94.5	.570/95.8	.585/96.9	.587/97.1	.581/96.7
-12	.525/92.1	.534/92.9	.552/94.1	.570/95.4	.585/96.6	.590/96.9	.583/96.5
-14	.525/91.8	.534/92.5	.552/93.8	.570/95.0	.585/96.2	.590/96.6	.583/96.1
-16	.525/91.4	.534/92.1	.552/93.4	.570/94.7	.585/95.8	.590/96.2	.583/95.8
-18	.525/91.1	.534/91.8	.552/93.0	.570/94.3	.585/95.5	.590/95.8	.583/95.4
-20	.525/90.7	.534/91.4	.552/92.7	.570/93.9	.585/95.1	.590/95.4	.583/95.0
-22	.525/90.3	.534/91.1	.552/92.3	.570/93.6	.585/94.7	.590/95.1	.583/94.6
-24	.525/90.0	.534/90.7	.552/91.9	.570/93.2	.585/94.3	.590/94.7	.583/94.3
-26	.525/89.6	.534/90.3	.552/91.6	.570/92.8	.585/94.0	.590/94.3	.583/93.9
-28	.525/89.2	.534/90.0	.552/91.2	.570/92.4	.585/93.6	.590/93.9	.583/93.5
-30	.525/88.9	.534/89.6	.552/90.8	.570/92.1	.585/93.2	.590/93.5	.583/93.1
-32	.525/88.5	.534/89.2	.552/90.4	.570/91.7	.585/92.8	.590/93.2	.583/92.7
-34	.525/88.1	.534/88.9	.552/90.1	.570/91.3	.585/92.4	.590/92.8	.583/92.3
-36	.525/87.8	.534/88.5	.552/89.7	.570/90.9	.585/92.0	.590/92.4	.583/92.0
-38	.525/87.4	.534/88.1	.552/89.3	.570/90.5	.585/91.6	.590/92.0	.583/91.6
-40	.525/87.0	.534/87.7	.552/88.9	.570/90.1	.585/91.2	.590/91.6	.583/91.2

IF ANTI-ICE ON, REDUCE EPR FOR ENGINE BY .008, FOR ENGINE AND WING BY .014.

DATA PRESENTED IS: | EPR/N1 |

MAXIMUM CLIMB **LOW ALTITUDE**

TAT DEG C	PRESSURE ALTITUDE - FEET						
	0	5000	10000	10000	15000	20000	25000
	250 KTS	250 KTS	250 KTS	320 KTS	320 KTS	320 KTS	320 KTS
40	.417/89.9	.413/90.3		.410/91.9			
38	.422/90.0	.422/90.6		.419/92.1	.413/92.4		
36	.422/89.7	.430/90.8	.426/91.2	.428/92.4	.422/92.6		
34	.422/89.4	.438/91.1	.434/91.4	.437/92.7	.431/92.9		
32	.422/89.1	.447/91.3	.443/91.7	.447/92.9	.440/93.1	.435/93.5	
30	.422/88.8	.455/91.5	.452/91.9	.456/93.1	.449/93.4	.444/93.7	
28	.422/88.5	.455/91.2	.461/92.1	.460/93.1	.458/93.6	.453/93.9	
26	.422/88.2	.455/90.9	.470/92.3	.460/92.8	.468/93.8	.463/94.1	.456/94.3
24	.422/87.9	.455/90.6	.479/92.6	.460/92.5	.477/94.0	.472/94.3	.465/94.5
22	.422/87.6	.455/90.3	.488/92.8	.460/92.2	.485/94.2	.482/94.6	.475/94.7
20	.422/87.3	.455/90.0	.489/92.5	.460/91.8	.485/93.9	.491/94.8	.484/94.9
18	.422/87.0	.455/89.7	.489/92.2	.460/91.5	.485/93.6	.501/95.0	.494/95.1
16	.422/86.7	.455/89.3	.489/91.9	.460/91.2	.485/93.3	.510/95.3	.503/95.3
14	.422/86.4	.455/89.0	.489/91.6	.460/90.9	.485/93.0	.512/95.1	.512/95.6
12	.422/86.1	.455/88.7	.489/91.3	.460/90.6	.485/92.6	.512/94.8	.521/95.8
10	.422/85.8	.455/88.4	.489/90.9	.460/90.3	.485/92.3	.512/94.4	.531/96.1
8	.422/85.5	.455/88.1	.489/90.6	.460/89.9	.485/92.0	.512/94.1	.532/95.8
6	.422/85.2	.455/87.8	.489/90.3	.460/89.6	.485/91.6	.512/93.8	.532/95.5
4	.422/84.9	.455/87.5	.489/90.0	.460/89.3	.485/91.3	.512/93.4	.532/95.1
2	.422/84.6	.455/87.2	.489/89.6	.460/89.0	.485/91.0	.512/93.1	.532/94.8
0	.422/84.3	.455/86.8	.489/89.3	.460/88.6	.485/90.7	.512/92.7	.532/94.5
-2	.422/84.0	.455/86.5	.489/89.0	.460/88.3	.485/90.3	.512/92.4	.532/94.1
-4	.422/83.7	.455/86.2	.489/88.7	.460/88.0	.485/90.0	.512/92.1	.532/93.8
-6	.422/83.4	.455/85.9	.489/88.3	.460/87.7	.485/89.7	.512/91.7	.532/93.4
-8	.422/83.1	.455/85.6	.489/88.0	.460/87.3	.485/89.3	.512/91.4	.532/93.1
-10	.422/82.7	.455/85.2	.489/87.7	.460/87.0	.485/89.0	.512/91.0	.532/92.7
-12	.422/82.4	.455/84.9	.489/87.3	.460/86.7	.485/88.6	.512/90.7	.532/92.4
-14	.422/82.1	.455/84.6	.489/87.0	.460/86.3	.485/88.3	.512/90.3	.532/92.0
-16	.422/81.8	.455/84.2	.489/86.7	.460/86.0	.485/88.0	.512/90.0	.532/91.6
-18	.422/81.5	.455/83.9	.489/86.3	.460/85.7	.485/87.6	.512/89.6	.532/91.3
-20	.422/81.1	.455/83.6	.489/86.0	.460/85.3	.485/87.3	.512/89.3	.532/90.9
-22	.422/80.8	.455/83.3	.489/85.6	.460/85.0	.485/86.9	.512/88.9	.532/90.6
-24	.422/80.5	.455/82.9	.489/85.3	.460/84.7	.485/86.6	.512/88.6	.532/90.2
-26	.422/80.2	.455/82.6	.489/85.0	.460/84.3	.485/86.2	.512/88.2	.532/89.8
-28	.422/79.9	.455/82.3	.489/84.6	.460/84.0	.485/85.9	.512/87.9	.532/89.5
-30	.422/79.5	.455/81.9	.489/84.3	.460/83.6	.485/85.5	.512/87.5	.532/89.1
-32	.422/79.2	.455/81.6	.489/83.9	.460/83.3	.485/85.2	.512/87.1	.532/88.7
-34	.422/78.9	.455/81.2	.489/83.6	.460/82.9	.485/84.8	.512/86.8	.532/88.4
-36	.422/78.5	.455/80.9	.489/83.2	.460/82.6	.485/84.5	.512/86.4	.532/88.0
-38	.422/78.2	.455/80.6	.489/82.9	.460/82.2	.485/84.1	.512/86.0	.532/87.6
-40	.422/77.9	.455/80.2	.489/82.5	.460/81.9	.485/83.7	.512/85.7	.532/87.3

IF ANTI-ICE ON, REDUCE EPR FOR ENGINE BY .008, FOR ENGINE AND WING BY .014.

DATA PRESENTED IS: EPR/N1

MAXIMUM CLIMB **HIGH ALTITUDE**

TAT DEG C	PRESSURE ALTITUDE - FEET						
	27000	29000	31000	33000	35000	37000	39000
	320 KTS	M.820	M.820	M.820	M.820	M.820	M.820
40							
38							
36							
34							
32							
30							
28							
26							
24	.464/94.7						
22	.474/94.9	.473/95.0					
20	.483/95.1	.482/95.2					
18	.493/95.3	.491/95.4					
16	.502/95.5	.500/95.5	.497/95.4				
14	.511/95.7	.509/95.8	.506/95.6				
12	.520/95.9	.518/96.0	.515/95.9	.512/95.7			
10	.529/96.2	.527/96.2	.524/96.1	.521/95.9			
8	.538/96.4	.536/96.5	.533/96.4	.530/96.2	.526/96.0		
6	.540/96.2	.545/96.8	.542/96.6	.539/96.5	.536/96.3	.531/96.0	.526/95.7
4	.540/95.9	.548/96.6	.551/96.9	.548/96.7	.545/96.5	.540/96.3	.534/96.0
2	.540/95.5	.548/96.3	.560/97.1	.557/97.0	.553/96.8	.548/96.5	.543/96.2
0	.540/95.2	.548/95.9	.564/97.1	.565/97.2	.561/97.0	.556/96.7	.551/96.4
-2	.540/94.8	.548/95.6	.564/96.8	.572/97.3	.568/97.1	.563/96.9	.558/96.5
-4	.540/94.5	.548/95.2	.564/96.4	.577/97.4	.574/97.2	.570/97.0	.564/96.6
-6	.540/94.1	.548/94.9	.564/96.0	.577/97.0	.580/97.3	.576/97.0	.570/96.7
-8	.540/93.8	.548/94.5	.564/95.7	.577/96.6	.586/97.4	.581/97.1	.576/96.7
-10	.540/93.4	.548/94.2	.564/95.3	.577/96.3	.586/97.0	.586/97.1	.581/96.7
-12	.540/93.1	.548/93.8	.564/95.0	.577/95.9	.586/96.6	.588/96.8	.582/96.5
-14	.540/92.7	.548/93.4	.564/94.6	.577/95.5	.586/96.3	.588/96.4	.582/96.1
-16	.540/92.4	.548/93.1	.564/94.2	.577/95.2	.586/95.9	.588/96.1	.582/95.7
-18	.540/92.0	.548/92.7	.564/93.9	.577/94.8	.586/95.5	.588/95.7	.582/95.3
-20	.540/91.6	.548/92.3	.564/93.5	.577/94.4	.586/95.1	.588/95.3	.582/95.0
-22	.540/91.3	.548/92.0	.564/93.1	.577/94.1	.586/94.8	.588/94.9	.582/94.6
-24	.540/90.9	.548/91.6	.564/92.8	.577/93.7	.586/94.4	.588/94.5	.582/94.2
-26	.540/90.5	.548/91.2	.564/92.4	.577/93.3	.586/94.0	.588/94.2	.582/93.8
-28	.540/90.2	.548/90.9	.564/92.0	.577/92.9	.586/93.6	.588/93.8	.582/93.5
-30	.540/89.8	.548/90.5	.564/91.6	.577/92.5	.586/93.2	.588/93.4	.582/93.1
-32	.540/89.4	.548/90.1	.564/91.2	.577/92.2	.586/92.9	.588/93.0	.582/92.7
-34	.540/89.1	.548/89.8	.564/90.9	.577/91.8	.586/92.5	.588/92.6	.582/92.3
-36	.540/88.7	.548/89.4	.564/90.5	.577/91.4	.586/92.1	.588/92.2	.582/91.9
-38	.540/88.3	.548/89.0	.564/90.1	.577/91.0	.586/91.7	.588/91.8	.582/91.5
-40	.540/87.9	.548/88.6	.564/89.7	.577/90.6	.586/91.3	.588/91.5	.582/91.1

IF ANTI-ICE ON, REDUCE EPR FOR ENGINE BY .008, FOR ENGINE AND WING BY .014.

DATA PRESENTED IS: | EPR/N1 |

MINIMUM COST CRUISE (M.84)

HIGH ALTITUDE HEAVY WEIGHT

ALTITUDE / STD TEMP	GROSS WEIGHT - LBS															
	450000	445000	440000	435000	430000	425000	420000	415000	410000	405000	400000	395000	390000	385000	380000	375000
36000 -56.													281 .585	281 .575	281 .567	281 .559
35000 -54.										288 .577	288 .569	288 .561	288 .555	288 .549	288 .543	288 .536
34000 -52.							295 .570	295 .563	295 .556	295 .551	295 .545	295 .539	295 .532	295 .526	295 .521	295 .515
33000 -50.				301 .563	301 .557	301 .551	301 .546	301 .540	301 .534	301 .528	301 .523	301 .517	301 .513	301 .508	301 .503	301 .499
32000 -48.		308 .551	308 .547	308 .540	308 .535	308 .529	308 .524	308 .519	308 .514	308 .509	308 .505	308 .501	308 .496	308 .492	308 .488	308 .484
31000 -46.	315 .534	315 .529	315 .524	315 .519	315 .515	315 .510	315 .506	315 .502	315 .498	315 .494	315 .489	315 .485	315 .481	315 .478	315 .474	315 .470
30000 -44.	320 .513	320 .509	320 .505	320 .501	320 .497	320 .493	320 .489	320 .485	320 .481	320 .477	320 .474	320 .470	320 .467	320 .463	320 .460	320 .456
29000 -42.	320 .490	320 .486	320 .482	320 .478	320 .475	320 .471	320 .467	320 .464	320 .460	320 .457	320 .453	320 .450	320 .446	320 .443	320 .439	320 .436
28000 -40.	320 .470	320 .466	320 .463	320 .459	320 .456	320 .452	320 .448	320 .445	320 .441	320 .438	320 .435	320 .431	320 .428	320 .425	320 .422	320 .418
27000 -38.	320 .452	320 .448	320 .445	320 .441	320 .438	320 .434	320 .431	320 .427	320 .424	320 .421	320 .418	320 .415	320 .411	320 .408	320 .405	320 .402
26000 -37.	320 .435	320 .431	320 .427	320 .424	320 .421	320 .417	320 .414	320 .411	320 .408	320 .405	320 .402	320 .399	320 .396	320 .393	320 .390	320 .387

1. CHART EPR IS THAT REQUIRED FOR MACH 0.84 OR 320 KNOTS IAS.
2. IF SAT IS HOTTER THAN STD + 15 DEGREES C OR ANTI ICE IS ON, CHECK CRUISE MODE OF TAT/EPR INDICATOR FOR EPR LIMIT.
3. ALL WEIGHT-ALTITUDE COMBINATIONS SHOWN HAVE AT LEAST 1.35G MANEUVER MARGIN.
4. ACCEPTABLE CLIMB PERFORMANCE LIMITS:
   15 DEGREE C HOTTER THAN STANDARD
   20 DEGREE C HOTTER THAN STANDARD

DATA PRESENTED IS:

IAS
EPR

MINIMUM COST CRUISE (M.84)

HIGH ALTITUDE
LIGHT WEIGHT

ALTITUDE / STD TEMP	GROSS WEIGHT - LBS 370000	365000	360000	355000	350000	345000	340000	335000	330000	325000	320000	315000	310000	305000	300000	295000
41000 -57.															251 .566	251 .556
40000 -57.												257 .566	257 .557	257 .550	257 .542	257 .533
39000 -57.								263 .576	263 .566	263 .557	263 .550	263 .542	263 .534	263 .527	263 .519	263 .513
38000 -57.					269 .573	269 .564	269 .556	269 .549	269 .542	269 .534	269 .527	269 .520	269 .514	269 .507	269 .502	269 .496
37000 -57.	276 .578	276 .569	276 .561	276 .554	276. .547	276 .540	276 .533	276 .526	276 .520	276 .513	276 .508	276 .502	276 .497	276 .491	276 .486	276 .481
36000 -56.	281 .552	281 .547	281 .540	281 .533	281 .526	281 .520	281 .514	281 .508	281 .503	281 .498	281 .493	281 .487	281 .482	281 .477	281 .473	281 .468
35000 -54.	288 .530	288 .524	288 .518	288 .512	288 .507	288 .502	288 .497	288 .492	288 .487	288 .482	288 .478	288 .473	288 .469	288 .464	288 .460	288 .456
34000 -52.	295 .510	295 .505	295 .501	295 .496	295 .491	295 .486	295 .482	295 .477	295 .473	295 .469	295 .465	295 .461	295 .457	295 .453	295 .449	295 .445
33000 -50.	301 .494	301 .490	301 .485	301 .481	301 .477	301 .473	301 .468	301 .465	301 .461	301 .457	301 .453	301 .449	301 .446	301 .442	301 .439	301 .435
32000 -48.	308 .479	308 .475	308 .472	308 .468	308 .464	308 .460	308 .457	308 .453	308 .450	308 .446	308 .443	308 .439	308 .436	308 .433	308 .430	308 .427
31000 -46.	315 .467	315 .463	315 .460	315 .456	315 .453	315 .449	315 .446	315 .443	315 .440	315 .437	315 .434	315 .431	315 .428	315 .425	315 .422	315 .419
30000 -44.	320 .453	320 .450	320 .447	320 .443	320 .440	320 .437	320 .434	320 .431	320 .428	320 .426	320 .423	320 .420	320 .417	320 .414	320 .412	320 .409
29000 -42.	320 .433	320 .430	320 .427	320 .424	320 .421	320 .418	320 .415	320 .412	320 .409	320 .406	320 .403	320 .401	320 .398	320 .395	320 .393	320 .390
28000 -40.	320 .415	320 .412	320 .409	320 .406	320 .404	320 .401	320 .398	320 .395	320 .392	320 .389	320 .387	320 .384	320 .381	320 .379	320 .376	320 .373
27000 -38.	320 .399	320 .396	320 .394	320 .391	320 .388	320 .385	320 .382	320 .379	320 .377	320 .374	320 .371	320 .369	320 .366	320 .363	320 .361	320 .359
26000 -37.	320 .384	320 .381	320 .378	320 .376	320 .373	320 .370	320 .367	320 .365	320 .362	320 .360	320 .357	320 .354	320 .352	320 .349	320 .347	320 .344

1. CHART EPR IS THAT REQUIRED FOR MACH 0.84 OR 320 KNOTS IAS.
2. IF SAT IS HOTTER THAN STD + 15 DEGREES C OR ANTI ICE IS ON, CHECK CRUISE MODE OF TAT/EPR INDICATOR FOR EPR LIMIT.
3. ALL WEIGHT-ALTITUDE COMBINATIONS SHOWN HAVE AT LEAST 1.35G MANEUVER MARGIN.
4. ACCEPTABLE CLIMB PERFORMANCE LIMITS:
   15 DEGREE C HOTTER THAN STANDARD
   20 DEGREE C HOTTER THAN STANDARD

DATA PRESENTED IS: IAS / EPR

MINIMUM COST CRUISE (320 IAS)

LOW ALTITUDE
HEAVY WEIGHT

ALTITUDE STD TEMP	GROSS WEIGHT - LBS 450000.	440000.	430000.	420000.	410000.	400000.	390000.	380000.	370000.
25000 -35.	320/.762 .418/*	320/.762 .411/*	320/.762 .405/*	320/.762 .399/*	320/.762 .392/*	320/.762 .386/*	320/.762 .381/*	320/.762 .375/*	320/.762 .369/*
24000 -33.	320/.748 .402/*	320/.748 .396/*	320/.748 .389/*	320/.748 .383/*	320/.748 .378/*	320/.748 .372/*	320/.748 .367/*	320/.748 .361/*	320/.748 .356/*
23000 -31.	320/.734 .387/*	320/.734 .381/*	320/.734 .375/*	320/.734 .369/*	320/.734 .364/*	320/.734 .358/*	320/.734 .353/*	320/.734 .348/*	320/.734 .343/*
22000 -29.	320/.720 .372/*	320/.720 .367/*	320/.720 .361/*	320/.720 .356/*	320/.720 .350/*	320/.720 .345/*	320/.720 .340/*	320/.720 .335/*	320/.720 .330/*
21000 -27.	320/.706 .359/*	320/.706 .353/*	320/.706 .348/*	320/.706 .343/*	320/.706 .338/*	320/.706 .333/*	320/.706 .328/*	320/.706 .323/*	320/.706 .318/*
20000 -25.	320/.693 .346/*	320/.693 .340/*	320/.693 .335/*	320/.693 .330/*	320/.693 .325/*	320/.693 .321/*	320/.693 .316/*	320/.693 .311/*	320/.693 .307/*
19000 -23.	320/.680 .333/*	320/.680 .328/*	320/.680 .323/*	320/.680 .318/*	320/.680 .313/*	320/.680 .309/*	320/.680 .304/*	320/.680 .300/*	320/.680 .296/*
18000 -21.	320/.668 .321/*	320/.668 .316/*	320/.668 .311/*	320/.668 .307/*	320/.668 .302/*	320/.668 .298/*	320/.668 .294/*	320/.668 .289/*	320/.668 .286/*
17000 -19.	320/.656 .309/*	320/.656 .304/*	320/.656 .300/*	320/.656 .295/*	320/.656 .291/*	320/.656 .287/*	320/.656 .283/*	320/.656 .279/*	320/.656 .276/*
16000 -17.	320/.644 .298/*	320/.644 .294/*	320/.644 .289/*	320/.644 .285/*	320/.644 .281/*	320/.644 .277/*	320/.644 .273/*	320/.644 .270/*	320/.644 .266/*
15000 -15.	320/.632 .288/*	320/.632 .284/*	320/.632 .280/*	320/.632 .276/*	320/.632 .272/*	320/.632 .268/*	320/.632 .264/*	320/.632 .261/*	320/.632 .257/*
14000 -13.	320/.620 .278/*	320/.620 .274/*	320/.620 .270/*	320/.620 .266/*	320/.620 .262/*	320/.620 .259/*	320/.620 .255/*	320/.620 .252/*	320/.620 .249/*
13000 -11.	320/.609 .269/*	320/.609 .265/*	320/.609 .261/*	320/.609 .257/*	320/.609 .254/*	320/.609 .250/*	320/.609 .247/*	320/.609 .244/*	320/.609 .241/*
12000 -9.	320/.598 .259/*	320/.598 .256/*	320/.598 .252/*	320/.598 .249/*	320/.598 .245/*	320/.598 .242/*	320/.598 .239/*	320/.598 .236/*	320/.598 .233/*
11000 -7.	320/.587 .251/*	320/.587 .247/*	320/.587 .244/*	320/.587 .240/*	320/.587 .237/*	320/.587 .234/*	320/.587 .231/*	320/.587 .228/*	320/.587 .225/*
10000 -5.	320/.577 .243/*	320/.577 .239/*	320/.577 .236/*	320/.577 .233/*	320/.577 .229/*	320/.577 .226/*	320/.577 .223/*	320/.577 .221/*	320/.577 .218/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN 320 KNOTS IAS.
2. ANTI-ICE CORRECTION:
   USE CHART EPR UNLESS CRZ MODE OF THE TAT/EPR INDICATOR SHOWS A LESSER VALUE.

DATA PRESENTED IS: | IAS/MACH |
|---|
| EPR/ |

MINIMUM COST CRUISE (320 IAS)

LOW ALTITUDE
LIGHT WEIGHT

ALTITUDE STD TEMP	GROSS WEIGHT - LBS 370000.	360000.	350000.	340000.	330000.	320000.	310000.	300000.	290000.
25000 -35.	320/.762 .369/*	320/.762 .364/*	320/.762 .359/*	320/.762 .354/*	320/.762 .348/*	320/.762 .343/*	320/.762 .339/*	320/.762 .334/*	320/.762 .329/*
24000 -33.	320/.748 .356/*	320/.748 .350/*	320/.748 .345/*	320/.748 .340/*	320/.748 .335/*	320/.748 .331/*	320/.748 .326/*	320/.748 .322/*	320/.748 .317/*
23000 -31.	320/.734 .343/*	320/.734 .338/*	320/.734 .333/*	320/.734 .328/*	320/.734 .323/*	320/.734 .319/*	320/.734 .314/*	320/.734 .310/*	320/.734 .306/*
22000 -29.	320/.720 .330/*	320/.720 .325/*	320/.720 .321/*	320/.720 .316/*	320/.720 .312/*	320/.720 .307/*	320/.720 .303/*	320/.720 .299/*	320/.720 .295/*
21000 -27.	320/.706 .318/*	320/.706 .314/*	320/.706 .309/*	320/.706 .305/*	320/.706 .301/*	320/.706 .297/*	320/.706 .293/*	320/.706 .289/*	320/.706 .286/*
20000 -25.	320/.693 .307/*	320/.693 .302/*	320/.693 .298/*	320/.693 .294/*	320/.693 .290/*	320/.693 .287/*	320/.693 .283/*	320/.693 .280/*	320/.693 .276/*
19000 -23.	320/.680 .296/*	320/.680 .292/*	320/.680 .288/*	320/.680 .284/*	320/.680 .281/*	320/.680 .277/*	320/.680 .274/*	320/.680 .270/*	320/.680 .267/*
18000 -21.	320/.668 .286/*	320/.668 .282/*	320/.668 .278/*	320/.668 .274/*	320/.668 .271/*	320/.668 .267/*	320/.668 .264/*	320/.668 .261/*	320/.668 .258/*
17000 -19.	320/.656 .276/*	320/.656 .272/*	320/.656 .268/*	320/.656 .265/*	320/.656 .262/*	320/.656 .258/*	320/.656 .255/*	320/.656 .252/*	320/.656 .249/*
16000 -17.	320/.644 .266/*	320/.644 .263/*	320/.644 .259/*	320/.644 .256/*	320/.644 .253/*	320/.644 .250/*	320/.644 .247/*	320/.644 .244/*	320/.644 .241/*
15000 -15.	320/.632 .257/*	320/.632 .254/*	320/.632 .251/*	320/.632 .248/*	320/.632 .245/*	320/.632 .242/*	320/.632 .239/*	320/.632 .236/*	320/.632 .233/*
14000 -13.	320/.620 .249/*	320/.620 .246/*	320/.620 .243/*	320/.620 .240/*	320/.620 .237/*	320/.620 .234/*	320/.620 .231/*	320/.620 .228/*	320/.620 .226/*
13000 -11.	320/.609 .241/*	320/.609 .237/*	320/.609 .235/*	320/.609 .232/*	320/.609 .229/*	320/.609 .226/*	320/.609 .224/*	320/.609 .221/*	320/.609 .218/*
12000 -9.	320/.598 .233/*	320/.598 .230/*	320/.598 .227/*	320/.598 .224/*	320/.598 .221/*	320/.598 .219/*	320/.598 .216/*	320/.598 .214/*	320/.598 .211/*
11000 -7.	320/.587 .225/*	320/.587 .222/*	320/.587 .220/*	320/.587 .217/*	320/.587 .214/*	320/.587 .212/*	320/.587 .209/*	320/.587 .207/*	320/.587 .205/*
10000 -5.	320/.577 .218/*	320/.577 .215/*	320/.577 .212/*	320/.577 .210/*	320/.577 .207/*	320/.577 .205/*	320/.577 .203/*	320/.577 .200/*	320/.577 .198/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN 320 KNOTS IAS.
2. ANTI-ICE CORRECTION:
   USE CHART EPR UNLESS CRZ MODE OF THE TAT/EPR INDICATOR SHOWS A LESSER VALUE.

DATA PRESENTED IS:

IAS/MACH
EPR/

LONG RANGE CRUISE

HIGH ALTITUDE HEAVY WEIGHT

ALTITUDE	GROSS WEIGHT - LBS								
STD TEMP	440000.	430000.	420000.	410000.	400000.	390000.	380000.	370000.	360000.
39000 -57.									
37000 -57.								275/.841 .578/- 7	275/.840 .560/- 4
35000 -54.					287/.841 .568/- 4	287/.840 .553/- 1	286/.838 .540/+ 2	286/.836 .527/+ 4	285/.834 .514/+ 7
33000 -50.		300/.840 .556/- 1	300/.838 .544/+ 2	299/.837 .531/+ 4	298/.835 .519/+ 7	298/.833 .508/+ 9	297/.830 .497/+11	295/.827 .487/+13	294/.824 .477/*
31000 -46.	312/.835 .521/+ 8	311/.833 .510/+10	310/.831 .500/+12	309/.829 .491/+13	308/.826 .482/+15	306/.822 .472/+17	305/.818 .463/*	303/.814 .453/*	301/.809 .443/*
29000 -42.	322/.826 .483/+16	320/.823 .475/+18	319/.820 .466/+19	317/.816 .457/+21	315/.811 .449/*	313/.806 .440/*	311/.801 .431/*	308/.794 .421/*	305/.786 .412/*
28000 -40.	326/.820 .467/+20	324/.816 .458/+22	322/.812 .450/+24	320/.807 .441/*	318/.802 .433/*	315/.796 .424/*	312/.789 .415/*	309/.781 .406/*	305/.773 .396/*
27000 -38.	329/.813 .451/+24	327/.808 .443/+26	325/.803 .434/*	323/.797 .426/*	320/.791 .417/*	317/.783 .409/*	313/.775 .400/*	310/.767 .391/*	306/.759 .382/*
26000 -37.	332/.803 .435/+27	330/.798 .427/*	327/.792 .419/*	324/.785 .411/*	321/.778 .402/*	317/.770 .393/*	314/.762 .385/*	310/.754 .376/*	307/.746 .368/*
25000 -35.	334/.793 .420/*	331/.786 .412/*	328/.779 .404/*	325/.772 .396/*	321/.764 .387/*	318/.757 .379/*	314/.749 .371/*	311/.741 .362/*	307/.733 .354/*
24000 -33.	335/.780 .405/*	332/.773 .397/*	329/.766 .389/*	325/.759 .381/*	322/.751 .373/*	319/.744 .365/*	315/.736 .357/*	312/.729 .350/*	308/.721 .342/*
23000 -31.	336/.767 .390/*	333/.760 .383/*	329/.753 .375/*	326/.746 .367/*	323/.739 .360/*	319/.732 .352/*	316/.724 .345/*	313/.717 .337/*	309/.709 .330/*
22000 -29.	337/.754 .376/*	333/.747 .369/*	330/.741 .362/*	327/.734 .355/*	324/.727 .347/*	320/.720 .340/*	317/.712 .333/*	313/.705 .325/*	310/.697 .318/*
21000 -27.	337/.742 .363/*	334/.735 .356/*	331/.729 .349/*	328/.722 .342/*	324/.715 .335/*	321/.708 .328/*	317/.700 .321/*	314/.693 .314/*	310/.685 .306/*
20000 -25.	338/.730 .350/*	335/.723 .344/*	332/.717 .337/*	329/.710 .330/*	325/.703 .324/*	322/.696 .317/*	318/.688 .310/*	314/.681 .303/*	310/.673 .296/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN LRC SPEED.
2. IF ACTUAL TAT IS HOTTER THAN CHART TAT USE THE CRZ MODE OF THE TAT/EPR INDICATOR TO DETERMINE EPR.
3. ANTI-ICE CORRECTION:
   WHEN TAT IS SHOWN REDUCE CHART EPR .008 FOR ENGINE, .014 FOR ENGINE AND WING
   WHERE TAT IS REPLACED BY AN ASTERISK (*) USE CHART EPR UNLESS THE CRZ MODE OF THE TAT/EPR INDICATOR SHOWS A LESSER VALUE.

DATA PRESENTED IS:

IAS/MACH
EPR/TAT

LONG RANGE CRUISE

HIGH ALTITUDE LIGHT WEIGHT

ALTITUDE STD TEMP	GROSS WEIGHT - LBS 360000.	350000.	340000.	330000.	320000.	310000.	300000.	290000.	280000.
41000 -57.							251/.841 .565/- 8	250/.839 .546/- 4	249/.837 .528/ 0
39000 -57.				263/.841 .565/- 6	262/.839 .548/- 3	261/.837 .532/+ 1	260/.835 .516/+ 4	259/.832 .501/+ 7	258/.828 .487/*
37000 -57.	275/.840 .560/- 4	274/.839 .545/ 0	274/.837 .530/+ 2	273/.835 .516/+ 5	272/.832 .502/*	271/.829 .490/*	269/.824 .477/*	267/.820 .465/*	265/.814 .452/*
35000 -54.	285/.834 .514/+ 7	284/.832 .502/+ 9	283/.829 .490/*	281/.825 .479/*	280/.821 .468/*	278/.816 .456/*	276/.810 .444/*	273/.802 .433/*	269/.794 .420/*
33000 -50.	294/.824 .477/*	292/.820 .466/*	290/.815 .456/*	288/.810 .445/*	286/.803 .434/*	283/.796 .423/*	279/.786 .412/*	275/.776 .400/*	271/.766 .388/*
31000 -46.	301/.809 .443/*	298/.803 .434/*	296/.796 .424/*	292/.787 .413/*	288/.778 .402/*	285/.769 .392/*	281/.759 .381/*	276/.749 .370/*	272/.738 .359/*
29000 -42.	305/.786 .412/*	301/.778 .402/*	297/.769 .392/*	294/.760 .382/*	290/.751 .372/*	286/.741 .363/*	282/.732 .353/*	278/.723 .343/*	274/.713 .333/*
28000 -40.	305/.773 .396/*	302/.764 .387/*	298/.755 .377/*	294/.747 .368/*	290/.738 .359/*	287/.729 .349/*	283/.720 .340/*	279/.710 .330/*	274/.700 .321/*
27000 -38.	306/.759 .382/*	302/.751 .373/*	299/.742 .364/*	295/.734 .355/*	291/.725 .346/*	287/.716 .337/*	283/.707 .327/*	279/.697 .318/*	275/.687 .309/*
26000 -37.	307/.746 .368/*	303/.738 .359/*	299/.730 .350/*	296/.721 .342/*	292/.713 .333/*	288/.704 .324/*	284/.694 .315/*	280/.685 .306/*	275/.675 .297/*
25000 -35.	307/.733 .354/*	304/.726 .346/*	300/.718 .338/*	297/.709 .329/*	293/.700 .321/*	289/.691 .312/*	284/.682 .304/*	280/.672 .295/*	276/.662 .286/*
24000 -33.	308/.721 .342/*	305/.713 .334/*	301/.705 .326/*	297/.697 .318/*	293/.688 .309/*	289/.679 .301/*	285/.669 .293/*	280/.660 .284/*	276/.650 .276/*
23000 -31.	309/.709 .330/*	305/.701 .322/*	301/.693 .314/*	297/.684 .306/*	293/.675 .298/*	289/.667 .290/*	285/.657 .282/*	281/.648 .274/*	276/.638 .266/*
22000 -29.	310/.697 .318/*	306/.689 .310/*	302/.681 .303/*	298/.672 .295/*	294/.663 .287/*	290/.655 .280/*	285/.645 .272/*	281/.636 .265/*	277/.627 .257/*
21000 -27.	310/.685 .306/*	306/.677 .299/*	302/.669 .292/*	298/.660 .285/*	294/.652 .277/*	290/.643 .270/*	286/.634 .263/*	281/.625 .256/*	277/.615 .248/*
20000 -25.	310/.673 .296/*	307/.665 .289/*	303/.657 .282/*	299/.648 .275/*	295/.640 .268/*	290/.631 .261/*	286/.622 .254/*	282/.613 .247/*	277/.604 .240/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN LRC SPEED.
2. IF ACTUAL TAT IS HOTTER THAN CHART TAT USE THE CRZ MODE OF THE TAT/EPR INDICATOR TO DETERMINE EPR.
3. ANTI-ICE CORRECTION:
   WHEN TAT IS SHOWN REDUCE CHART EPR .008 FOR ENGINE, .014 FOR ENGINE AND WING
   WHERE TAT IS REPLACED BY AN ASTERISK (*) USE CHART EPR UNLESS THE CRZ MODE OF THE TAT/EPR INDICATOR SHOWS A LESSER VALUE.

DATA PRESENTED IS:

IAS/MACH
EPR/TAT

LONG RANGE CRUISE

LOW ALTITUDE
HEAVY WEIGHT

ALTITUDE STD TEMP	GROSS WEIGHT - LBS 440000.	430000.	420000.	410000.	400000.	390000.	380000.	370000.	360000.
25000 -35.	334/.793 .420/*	331/.786 .412/*	328/.779 .404/*	325/.772 .396/*	321/.764 .387/*	318/.757 .379/*	314/.749 .371/*	311/.741 .362/*	307/.733 .354/*
24000 -33.	335/.780 .405/*	332/.773 .397/*	329/.766 .389/*	325/.759 .381/*	322/.751 .373/*	319/.744 .365/*	315/.736 .357/*	312/.729 .350/*	308/.721 .342/*
23000 -31.	336/.767 .390/*	333/.760 .383/*	329/.753 .375/*	326/.746 .367/*	323/.739 .360/*	319/.732 .352/*	316/.724 .345/*	313/.717 .337/*	309/.709 .330/*
22000 -29.	337/.754 .376/*	333/.747 .369/*	330/.741 .362/*	327/.734 .355/*	324/.727 .347/*	320/.720 .340/*	317/.712 .333/*	313/.705 .325/*	310/.697 .318/*
21000 -27.	337/.742 .363/*	334/.735 .356/*	331/.729 .349/*	328/.722 .342/*	324/.715 .335/*	321/.708 .328/*	317/.700 .321/*	314/.693 .314/*	310/.685 .306/*
20000 -25.	338/.730 .350/*	335/.723 .344/*	332/.717 .337/*	329/.710 .330/*	325/.703 .324/*	322/.696 .317/*	318/.688 .310/*	314/.681 .303/*	310/.673 .296/*
19000 -23.	339/.718 .339/*	336/.712 .332/*	333/.705 .326/*	329/.698 .319/*	326/.691 .312/*	322/.684 .306/*	318/.676 .299/*	315/.669 .292/*	311/.661 .285/*
18000 -21.	340/.707 .327/*	337/.700 .321/*	333/.693 .314/*	330/.686 .308/*	326/.679 .301/*	322/.672 .295/*	319/.665 .288/*	315/.657 .282/*	311/.650 .275/*
17000 -19.	340/.695 .316/*	337/.688 .309/*	334/.681 .303/*	330/.674 .297/*	326/.668 .291/*	323/.660 .285/*	319/.653 .279/*	315/.646 .272/*	312/.638 .266/*
16000 -17.	341/.683 .305/*	337/.676 .299/*	334/.670 .293/*	330/.663 .287/*	327/.656 .281/*	323/.649 .275/*	319/.642 .269/*	316/.635 .263/*	312/.627 .258/*
15000 -15.	341/.672 .294/*	338/.665 .289/*	334/.658 .283/*	331/.652 .277/*	327/.645 .272/*	324/.638 .266/*	320/.631 .260/*	316/.624 .255/*	312/.616 .249/*
14000 -13.	342/.660 .285/*	338/.654 .279/*	335/.647 .274/*	331/.641 .268/*	328/.634 .263/*	324/.627 .257/*	320/.620 .252/*	316/.613 .246/*	312/.606 .241/*
13000 -11.	342/.649 .275/*	339/.643 .270/*	335/.636 .265/*	332/.630 .260/*	328/.623 .254/*	324/.616 .249/*	320/.609 .244/*	317/.602 .238/*	313/.595 .233/*
12000 -9.	342/.638 .266/*	339/.632 .261/*	335/.626 .256/*	332/.619 .251/*	328/.612 .246/*	324/.606 .241/*	321/.599 .236/*	317/.591 .230/*	312/.584 .225/*
11000 -7.	343/.628 .258/*	339/.621 .253/*	336/.615 .248/*	332/.609 .243/*	328/.602 .238/*	325/.595 .233/*	321/.588 .228/*	316/.580 .223/*	312/.573 .218/*
10000 -5.	343/.617 .250/*	340/.611 .245/*	336/.605 .240/*	332/.598 .235/*	328/.591 .230/*	324/.584 .225/*	320/.577 .221/*	316/.570 .216/*	312/.562 .210/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN LRC SPEED.
2. ANTI-ICE CORRECTION:
   USE CHART EPR UNLESS CRZ MODE OF THE TAT/EPR INDICATOR SHOWS A LESSER VALUE.

DATA PRESENTED IS: | IAS/MACH |
| EPR/ |

LONG RANGE CRUISE

LOW ALTITUDE
LIGHT WEIGHT

ALTITUDE	GROSS WEIGHT - LBS								
STD TEMP	360000.	350000.	340000.	330000.	320000.	310000.	300000.	290000.	280000.
25000	307/.733	304/.726	300/.718	297/.709	293/.700	289/.691	284/.682	280/.672	276/.662
-35.	.354/*	.346/*	.338/*	.329/*	.321/*	.312/*	.304/*	.295/*	.286/*
24000	308/.721	305/.713	301/.705	297/.697	293/.688	289/.679	285/.669	280/.660	276/.650
-33.	.342/*	.334/*	.326/*	.318/*	.309/*	.301/*	.293/*	.284/*	.276/*
23000	309/.709	305/.701	301/.693	297/.684	293/.675	289/.667	285/.657	281/.648	276/.638
-31.	.330/*	.322/*	.314/*	.306/*	.298/*	.290/*	.282/*	.274/*	.266/*
22000	310/.697	306/.689	302/.681	298/.672	294/.663	290/.655	285/.645	281/.636	277/.627
-29.	.318/*	.310/*	.303/*	.295/*	.287/*	.280/*	.272/*	.265/*	.257/*
21000	310/.685	306/.677	302/.669	298/.660	294/.652	290/.643	286/.634	281/.625	277/.615
-27.	.306/*	.299/*	.292/*	.285/*	.277/*	.270/*	.263/*	.256/*	.248/*
20000	310/.673	307/.665	303/.657	299/.648	295/.640	290/.631	286/.622	282/.613	277/.604
-25.	.296/*	.289/*	.282/*	.275/*	.268/*	.261/*	.254/*	.247/*	.240/*
19000	311/.661	307/.653	303/.645	299/.637	295/.629	291/.620	286/.611	282/.602	277/.593
-23.	.285/*	.279/*	.272/*	.265/*	.259/*	.252/*	.245/*	.238/*	.231/*
18000	311/.650	307/.642	303/.634	299/.626	295/.617	291/.609	287/.600	282/.591	277/.581
-21.	.275/*	.269/*	.263/*	.256/*	.250/*	.243/*	.237/*	.230/*	.223/*
17000	312/.638	308/.631	304/.623	300/.615	295/.606	291/.598	286/.589	282/.579	277/.570
-19.	.266/*	.260/*	.254/*	.248/*	.242/*	.235/*	.229/*	.222/*	.216/*
16000	312/.627	308/.620	304/.612	300/.604	296/.595	291/.587	286/.577	282/.568	277/.559
-17.	.258/*	.252/*	.246/*	.240/*	.233/*	.227/*	.221/*	.215/*	.208/*
15000	312/.616	308/.609	304/.601	300/.593	295/.584	291/.575	286/.566	281/.557	277/.548
-15.	.249/*	.243/*	.237/*	.231/*	.225/*	.220/*	.213/*	.207/*	.201/*
14000	312/.606	308/.598	304/.590	300/.582	295/.573	291/.565	286/.556	281/.547	277/.538
-13.	.241/*	.235/*	.229/*	.224/*	.218/*	.212/*	.206/*	.200/*	.194/*
13000	313/.595	308/.587	304/.579	300/.571	295/.562	291/.554	286/.545	281/.537	277/.528
-11.	.233/*	.227/*	.222/*	.216/*	.210/*	.205/*	.199/*	.193/*	.187/*
12000	312/.584	308/.576	304/.568	299/.560	295/.552	290/.544	286/.535	281/.527	277/.519
-9.	.225/*	.220/*	.214/*	.209/*	.203/*	.198/*	.192/*	.186/*	.180/*
11000	312/.573	308/.565	304/.558	299/.550	295/.542	290/.534	286/.526	281/.518	277/.510
-7.	.218/*	.212/*	.207/*	.202/*	.196/*	.191/*	.185/*	.179/*	.174/*
10000	312/.562	308/.555	304/.547	299/.540	295/.532	291/.524	286/.517	282/.509	277/.501
-5.	.210/*	.205/*	.200/*	.195/*	.189/*	.184/*	.179/*	.173/*	.168/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN LRC SPEED.
2. ANTI-ICE CORRECTION:
   USE CHART EPR UNLESS CRZ MODE OF THE TAT/EPR INDICATOR SHOWS A LESSER VALUE.

DATA PRESENTED IS: | IAS/MACH |
| EPR/ |

MAXIMUM RANGE CRUISE

HIGH ALTITUDE

ALTITUDE	GROSS WEIGHT - LBS								
STD TEMP	440000.	420000.	400000.	380000.	360000.	340000.	320000.	300000.	280000.
41000 -57.								243/.817 .559/- 7	239/.807 .519/+ 2
39000 -57.						256/.821 .580/-10	253/.813 .539/- 1	249/.803 .507/*	245/.789 .479/*
37000 -57.					266/.816 .553/- 2	263/.807 .521/+ 4	259/.797 .494/*	254/.783 .469/*	249/.769 .442/*
35000 -54.			279/.818 .563/- 3	276/.810 .531/+ 3	272/.801 .506/*	268/.790 .482/*	264/.778 .458/*	258/.764 .434/*	252/.747 .409/*
33000 -50.	292/.818 .564/- 2	289/.811 .534/+ 3	286/.803 .511/+ 8	282/.794 .489/*	278/.783 .468/*	273/.771 .446/*	268/.757 .423/*	261/.740 .400/*	254/.721 .377/*
31000 -46.	299/.804 .512/+ 9	295/.795 .492/+13	291/.785 .473/*	287/.775 .453/*	282/.763 .433/*	277/.749 .412/*	270/.732 .391/*	263/.714 .369/*	254/.692 .347/*
29000 -42.	305/.786 .475/+18	301/.776 .456/*	296/.766 .438/*	291/.754 .419/*	285/.740 .400/*	278/.724 .381/*	271/.705 .361/*	262/.684 .340/*	252/.660 .319/*
28000 -40.	307/.777 .457/*	303/.767 .439/*	298/.755 .422/*	292/.742 .403/*	286/.727 .385/*	279/.710 .366/*	271/.691 .346/*	261/.669 .326/*	251/.645 .306/*
27000 -38.	309/.767 .440/*	305/.756 .423/*	299/.744 .406/*	293/.730 .388/*	286/.714 .370/*	279/.696 .352/*	270/.675 .333/*	260/.653 .313/*	250/.630 .294/*
26000 -37.	311/.757 .424/*	306/.745 .407/*	300/.732 .390/*	294/.717 .373/*	287/.700 .356/*	278/.681 .338/*	269/.660 .319/*	259/.638 .301/*	250/.615 .282/*
25000 -35.	313/.746 .408/*	307/.733 .392/*	301/.719 .376/*	294/.704 .359/*	286/.686 .342/*	277/.666 .324/*	268/.645 .306/*	259/.623 .289/*	249/.602 .272/*
24000 -33.	314/.734 .393/*	308/.721 .377/*	301/.706 .361/*	294/.689 .345/*	285/.671 .328/*	276/.651 .311/*	267/.630 .295/*	258/.610 .278/*	249/.589 .261/*
23000 -31.	315/.722 .379/*	308/.708 .363/*	301/.692 .348/*	293/.675 .332/*	284/.656 .315/*	275/.636 .299/*	266/.616 .283/*	257/.597 .267/*	248/.577 .252/*
22000 -29.	315/.709 .364/*	308/.694 .350/*	300/.678 .334/*	292/.660 .319/*	283/.641 .303/*	274/.622 .288/*	266/.603 .273/*	257/.584 .258/*	248/.564 .242/*
21000 -27.	315/.696 .351/*	308/.680 .336/*	299/.663 .321/*	291/.645 .306/*	282/.627 .292/*	274/.609 .277/*	265/.591 .263/*	257/.572 .248/*	248/.553 .233/*
20000 -25.	315/.681 .338/*	307/.665 .323/*	298/.648 .309/*	290/.631 .295/*	282/.613 .281/*	273/.596 .267/*	265/.578 .253/*	256/.560 .239/*	247/.541 .225/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN MRC SPEED.
2. IF ACTUAL TAT IS HOTTER THAN CHART TAT USE THE CRZ MODE OF THE TAT/EPR INDICATOR TO DETERMINE EPR.
3. ANTI-ICE CORRECTION:
   WHEN TAT IS SHOWN REDUCE CHART EPR .008 FOR ENGINE, .014 FOR ENGINE AND WING
   WHERE TAT IS REPLACED BY AN ASTERISK (*) USE CHART EPR UNLESS THE CRZ MODE OF THE TAT/EPR INDICATOR SHOWS A LESSER VALUE.

DATA PRESENTED IS: IAS/MACH
EPR/TAT

MAXIMUM RANGE CRUISE

LOW ALTITUDE

ALTITUDE	GROSS WEIGHT - LBS								
STD TEMP	440000.	420000.	400000.	380000.	360000.	340000.	320000.	300000.	280000.
25000	313/.746	307/.733	301/.719	294/.704	286/.686	277/.666	268/.645	259/.623	249/.602
-35.	.408/*	.392/*	.376/*	.359/*	.342/*	.324/*	.306/*	.289/*	.272/*
24000	314/.734	308/.721	301/.706	294/.689	285/.671	276/.651	267/.630	258/.610	249/.589
-33.	.393/*	.377/*	.361/*	.345/*	.328/*	.311/*	.295/*	.278/*	.261/*
23000	315/.722	308/.708	301/.692	293/.675	284/.656	275/.636	266/.616	257/.597	248/.577
-31.	.379/*	.363/*	.348/*	.332/*	.315/*	.299/*	.283/*	.267/*	.252/*
22000	315/.709	308/.694	300/.678	292/.660	283/.641	274/.622	266/.603	257/.584	248/.564
-29.	.364/*	.350/*	.334/*	.319/*	.303/*	.288/*	.273/*	.258/*	.242/*
21000	315/.696	308/.680	299/.663	291/.645	282/.627	274/.609	265/.591	257/.572	248/.553
-27.	.351/*	.336/*	.321/*	.306/*	.292/*	.277/*	.263/*	.248/*	.233/*
20000	315/.681	307/.665	298/.648	290/.631	282/.613	273/.596	265/.578	256/.560	247/.541
-25.	.338/*	.323/*	.309/*	.295/*	.281/*	.267/*	.253/*	.239/*	.225/*
19000	314/.667	306/.651	297/.634	289/.617	281/.601	273/.584	265/.566	256/.548	247/.530
-23.	.325/*	.311/*	.297/*	.284/*	.271/*	.257/*	.244/*	.230/*	.217/*
18000	313/.652	305/.636	297/.620	289/.605	281/.588	273/.572	264/.555	255/.537	247/.520
-21.	.313/*	.299/*	.287/*	.274/*	.261/*	.248/*	.235/*	.222/*	.209/*
17000	312/.638	304/.623	296/.608	288/.592	280/.577	272/.560	264/.544	255/.527	247/.509
-19.	.301/*	.289/*	.276/*	.264/*	.252/*	.239/*	.227/*	.214/*	.201/*
16000	311/.625	303/.610	295/.595	288/.580	280/.565	272/.549	263/.533	255/.516	246/.499
-17.	.290/*	.278/*	.266/*	.255/*	.243/*	.231/*	.219/*	.206/*	.193/*
15000	310/.612	303/.598	295/.584	287/.569	279/.554	271/.538	263/.522	255/.506	246/.489
-15.	.280/*	.268/*	.257/*	.246/*	.234/*	.222/*	.211/*	.199/*	.186/*
14000	309/.600	302/.586	295/.572	287/.557	279/.543	271/.528	263/.512	255/.496	246/.480
-13.	.270/*	.259/*	.248/*	.237/*	.226/*	.215/*	.203/*	.191/*	.179/*
13000	309/.588	302/.575	294/.561	287/.547	279/.532	271/.518	263/.502	254/.487	246/.470
-11.	.261/*	.250/*	.239/*	.229/*	.218/*	.207/*	.196/*	.184/*	.172/*
12000	308/.577	301/.563	294/.550	286/.536	279/.522	271/.508	263/.493	254/.477	245/.461
-9.	.252/*	.241/*	.231/*	.221/*	.210/*	.200/*	.188/*	.177/*	.165/*
11000	308/.565	301/.552	293/.539	286/.526	278/.512	271/.498	262/.483	254/.468	245/.452
-7.	.243/*	.233/*	.223/*	.213/*	.203/*	.192/*	.181/*	.170/*	.158/*
10000	308/.554	300/.542	293/.529	286/.516	278/.503	270/.489	262/.474	254/.459	245/.443
-5.	.235/*	.225/*	.216/*	.206/*	.196/*	.185/*	.174/*	.163/*	.152/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN MRC SPEED.
2. ANTI-ICE CORRECTION:
   USE CHART EPR UNLESS CRZ MODE OF THE TAT/EPR INDICATOR SHOWS A LESSER VALUE.

DATA PRESENTED IS:

IAS/MACH
EPR/

HOLD-FLAPS 10

ALTITUDE	GROSS WEIGHT - LBS								
STD TEMP	440000.	420000.	400000.	380000.	360000.	340000.	320000.	300000.	280000.
20000 -25.	230/.505 .486/+17	230/.505 .469/*	225/.494 .448/*	220/.482 .426/*	214/.470 .404/*	208/.457 .382/*	201/.443 .359/*	195/.429 .336/*	188/.414 .313/*
19000 -23.	230/.495 .466/+21	230/.495 .451/*	225/.484 .430/*	220/.473 .409/*	214/.461 .388/*	208/.448 .366/*	201/.434 .344/*	194/.420 .322/*	188/.406 .300/*
18000 -21.	230/.486 .448/*	230/.486 .433/*	225/.475 .413/*	219/.464 .393/*	214/.451 .372/*	207/.438 .351/*	201/.425 .330/*	194/.411 .309/*	188/.397 .288/*
17000 -19.	230/.476 .431/*	230/.476 .416/*	225/.466 .397/*	219/.454 .377/*	213/.442 .357/*	207/.429 .337/*	201/.416 .316/*	194/.403 .296/*	187/.389 .277/*
16000 -17.	230/.467 .414/*	230/.467 .400/*	225/.457 .381/*	219/.445 .362/*	213/.433 .342/*	207/.420 .323/*	200/.408 .304/*	194/.395 .285/*	187/.382 .266/*
15000 -15.	230/.458 .398/*	230/.458 .384/*	225/.447 .366/*	219/.436 .347/*	213/.424 .329/*	206/.412 .310/*	200/.400 .291/*	194/.387 .273/*	187/.374 .255/*
14000 -13.	230/.450 .382/*	230/.449 .369/*	224/.438 .351/*	218/.427 .333/*	212/.415 .315/*	206/.404 .297/*	200/.392 .280/*	194/.379 .263/*	187/.367 .245/*
13000 -11.	230/.441 .367/*	230/.440 .354/*	224/.430 .337/*	218/.418 .320/*	212/.407 .303/*	206/.396 .286/*	200/.384 .269/*	194/.372 .253/*	187/.360 .236/*
12000 -9.	230/.433 .353/*	230/.432 .340/*	224/.421 .324/*	218/.410 .307/*	212/.399 .291/*	206/.388 .275/*	200/.377 .259/*	194/.365 .243/*	187/.352 .227/*
11000 -7.	230/.425 .339/*	229/.423 .327/*	223/.413 .311/*	218/.402 .295/*	212/.392 .280/*	206/.381 .264/*	200/.369 .249/*	193/.358 .233/*	187/.346 .218/*
10000 -5.	230/.417 .326/*	229/.415 .314/*	223/.405 .299/*	218/.395 .284/*	212/.384 .269/*	206/.373 .254/*	200/.362 .240/*	193/.351 .225/*	187/.339 .209/*
9000 -3.	230/.409 .314/*	229/.407 .302/*	223/.397 .288/*	218/.387 .273/*	212/.377 .259/*	206/.366 .245/*	200/.355 .230/*	193/.344 .216/*	187/.332 .201/*
8000 -1.	230/.402 .302/*	229/.399 .291/*	223/.390 .277/*	217/.380 .263/*	212/.370 .249/*	206/.359 .236/*	200/.349 .222/*	193/.338 .208/*	187/.326 .193/*
7000 1.	230/.395 .290/*	229/.392 .280/*	223/.382 .267/*	217/.373 .253/*	212/.363 .240/*	206/.353 .227/*	199/.342 .213/*	193/.331 .200/*	186/.320 .186/*
6000 3.	230/.387 .280/*	228/.384 .270/*	223/.375 .257/*	217/.366 .244/*	211/.356 .231/*	205/.346 .218/*	199/.336 .205/*	193/.325 .192/*	186/.314 .179/*
5000 5.	230/.381 .270/*	228/.377 .260/*	223/.368 .247/*	217/.359 .235/*	211/.349 .223/*	205/.340 .210/*	199/.329 .198/*	193/.319 .185/*	186/.308 .172/*
4000 7.	230/.374 .260/*	228/.370 .250/*	223/.362 .238/*	217/.352 .226/*	211/.343 .215/*	205/.333 .202/*	199/.323 .190/*	193/.313 .177/*	186/.302 .165/*
3000 9.	230/.367 .251/*	228/.364 .241/*	223/.355 .230/*	217/.346 .218/*	211/.337 .207/*	205/.327 .195/*	199/.317 .183/*	193/.307 .171/*	186/.297 .158/*
2000 11.	230/.361 .242/*	228/.357 .233/*	222/.348 .221/*	217/.340 .210/*	211/.331 .199/*	205/.321 .187/*	199/.312 .176/*	193/.302 .164/*	186/.291 .152/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN HOLD-FLAPS 10 SPEED.
2. ANTI-ICE CORRECTION:
   USE CHART EPR UNLESS CRZ MODE OF THE TAT/EPR INDICATOR SHOWS A LESSER VALUE.

DATA PRESENTED IS:

IAS/MACH
EPR/

HOLD-FLAPS 4

ALTITUDE	GROSS WEIGHT - LBS								
STD TEMP	440000.	420000.	400000.	380000.	360000.	340000.	320000.	300000.	280000.
20000 -25.	247/.540 .462/*	241/.529 .442/*	236/.517 .422/*	230/.504 .402/*	224/.491 .381/*	217/.477 .360/*	210/.463 .339/*	203/.448 .318/*	196/.432 .296/*
19000 -23.	247/.530 .444/*	241/.518 .425/*	236/.506 .406/*	230/.494 .386/*	223/.481 .366/*	217/.467 .346/*	210/.453 .325/*	203/.438 .305/*	196/.423 .285/*
18000 -21.	247/.520 .427/*	241/.508 .409/*	235/.496 .390/*	229/.484 .370/*	223/.471 .351/*	217/.457 .331/*	210/.444 .312/*	203/.429 .292/*	196/.415 .273/*
17000 -19.	247/.509 .411/*	241/.498 .393/*	235/.486 .374/*	229/.474 .356/*	223/.461 .337/*	216/.448 .318/*	210/.434 .299/*	203/.420 .281/*	196/.406 .262/*
16000 -17.	247/.500 .395/*	241/.488 .377/*	235/.476 .359/*	229/.464 .341/*	222/.452 .323/*	216/.439 .305/*	209/.426 .287/*	202/.412 .270/*	195/.398 .252/*
15000 -15.	246/.490 .379/*	241/.478 .362/*	235/.467 .345/*	228/.455 .328/*	222/.443 .310/*	216/.430 .293/*	209/.417 .276/*	202/.404 .259/*	195/.390 .242/*
14000 -13.	246/.480 .365/*	240/.469 .348/*	234/.458 .332/*	228/.446 .315/*	222/.434 .298/*	215/.421 .282/*	209/.409 .266/*	202/.396 .249/*	195/.382 .233/*
13000 -11.	246/.471 .350/*	240/.460 .335/*	234/.448 .319/*	228/.437 .303/*	222/.425 .287/*	215/.413 .271/*	209/.401 .255/*	202/.388 .240/*	195/.375 .224/*
12000 -9.	246/.461 .337/*	240/.450 .322/*	234/.439 .306/*	228/.428 .291/*	221/.417 .276/*	215/.405 .261/*	209/.393 .246/*	202/.380 .230/*	195/.367 .215/*
11000 -7.	245/.452 .324/*	239/.442 .309/*	233/.431 .294/*	227/.420 .280/*	221/.409 .265/*	215/.397 .251/*	208/.385 .236/*	202/.373 .222/*	195/.360 .207/*
10000 -5.	245/.443 .311/*	239/.433 .297/*	233/.422 .283/*	227/.412 .269/*	221/.401 .255/*	215/.389 .241/*	208/.378 .227/*	202/.366 .213/*	195/.353 .199/*
9000 -3.	245/.435 .299/*	239/.425 .286/*	233/.414 .273/*	227/.404 .259/*	221/.393 .246/*	215/.382 .232/*	208/.370 .219/*	201/.359 .205/*	194/.346 .191/*
8000 -1.	244/.426 .288/*	239/.416 .276/*	233/.406 .263/*	227/.396 .250/*	221/.385 .237/*	214/.374 .224/*	208/.363 .210/*	201/.352 .197/*	194/.340 .183/*
7000 1.	244/.418 .278/*	238/.409 .265/*	233/.399 .253/*	227/.389 .240/*	221/.378 .228/*	214/.367 .215/*	208/.356 .202/*	201/.345 .189/*	194/.333 .176/*
6000 3.	244/.410 .268/*	238/.401 .256/*	232/.391 .244/*	226/.381 .232/*	220/.371 .219/*	214/.360 .207/*	208/.350 .195/*	201/.339 .182/*	194/.327 .169/*
5000 5.	244/.403 .258/*	238/.393 .246/*	232/.384 .235/*	226/.374 .223/*	220/.364 .211/*	214/.354 .200/*	208/.343 .187/*	201/.332 .175/*	194/.321 .163/*
4000 7.	244/.395 .249/*	238/.386 .237/*	232/.377 .226/*	226/.367 .215/*	220/.357 .204/*	214/.347 .192/*	207/.337 .180/*	201/.326 .168/*	194/.315 .156/*
3000 9.	243/.388 .240/*	238/.379 .229/*	232/.370 .218/*	226/.360 .207/*	220/.351 .196/*	214/.341 .185/*	207/.331 .173/*	201/.320 .162/*	194/.310 .150/*
2000 11.	243/.381 .231/*	238/.372 .221/*	232/.363 .210/*	226/.354 .200/*	220/.344 .189/*	214/.335 .178/*	207/.325 .167/*	201/.315 .155/*	194/.304 .145/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN HOLD-FLAPS 4 SPEED.
2. ANTI-ICE CORRECTION:
   USE CHART EPR UNLESS CRZ MODE OF THE TAT/EPR INDICATOR SHOWS A LESSER VALUE.

DATA PRESENTED IS:

IAS/MACH
EPR/

HOLD-FLAPS 0

HIGH ALTITUDE

ALTITUDE STD TEMP	GROSS WEIGHT - LBS 440000.	420000.	400000.	380000.	360000.	340000.	320000.	300000.	280000.
41000 -57.								240/.809 .559/- 7	234/.791 .519/+ 2
39000 -57.						254/.815 .579/-10	249/.801 .541/- 2	242/.783 .506/*	235/.760 .475/*
37000 -57.					263/.807 .554/- 3	257/.791 .521/+ 4	250/.773 .492/*	242/.751 .465/*	234/.726 .438/*
35000 -54.			276/.810 .562/- 3	271/.796 .532/+ 3	265/.781 .504/*	258/.762 .479/*	250/.741 .454/*	241/.717 .430/*	232/.692 .405/*
33000 -50.	288/.810 .563/- 2	284/.798 .536/+ 3	278/.784 .510/+ 8	272/.768 .486/*	265/.749 .464/*	257/.729 .442/*	248/.706 .420/*	239/.683 .396/*	230/.659 .371/*
31000 -46.	291/.785 .511/+ 9	285/.770 .490/+13	279/.754 .469/*	271/.735 .449/*	263/.716 .429/*	255/.695 .408/*	246/.673 .386/*	238/.651 .363/*	229/.628 .340/*
29000 -42.	292/.755 .471/*	285/.739 .453/*	277/.721 .434/*	269/.702 .416/*	261/.682 .396/*	253/.662 .375/*	245/.642 .354/*	236/.620 .334/*	228/.599 .313/*
28000 -40.	291/.739 .453/*	284/.722 .436/*	276/.704 .418/*	268/.686 .399/*	260/.667 .380/*	252/.647 .359/*	244/.627 .340/*	236/.606 .320/*	227/.585 .300/*
27000 -38.	290/.723 .437/*	283/.706 .419/*	275/.688 .402/*	268/.670 .383/*	260/.651 .364/*	251/.632 .345/*	243/.613 .326/*	235/.593 .307/*	227/.572 .288/*
26000 -37.	289/.707 .420/*	282/.690 .404/*	274/.6T2 .386/*	267/.655 .367/*	259/.636 .349/*	251/.618 .331/*	243/.599 .313/*	234/.580 .295/*	226/.560 .277/*
25000 -35.	288/.691 .405/*	281/.674 .388/*	273/.657 .370/*	266/.640 .352/*	258/.622 .335/*	250/.604 .318/*	242/.586 .300/*	234/.567 .283/*	226/.548 .266/*
24000 -33.	287/.675 .389/*	280/.659 .372/*	273/.642 .355/*	265/.625 .339/*	257/.608 .322/*	250/.591 .305/*	242/.573 .289/*	234/.555 .272/*	226/.536 .256/*
23000 -31.	286/.660 .373/*	279/.644 .357/*	272/.628 .341/*	264/.612 .325/*	257/.595 .309/*	249/.578 .293/*	241/.561 .278/*	233/.543 .262/*	225/.525 .246/*
22000 -29.	285/.646 .358/*	278/.630 .343/*	271/.614 .328/*	264/.599 .312/*	256/.582 .297/*	249/.566 .282/*	241/.549 .267/*	233/.532 .252/*	225/.514 .237/*
21000 -27.	285/.631 .344/*	278/.616 .330/*	270/.601 .315/*	263/.586 .300/*	256/.570 .286/*	248/.554 .272/*	241/.538 .257/*	233/.521 .243/*	225/.504 .228/*
20000 -25.	284/.618 .331/*	277/.603 .317/*	270/.589 .303/*	263/.573 .289/*	255/.558 .275/*	248/.543 .262/*	241/.527 .248/*	233/.511 .233/*	225/.494 .219/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN HOLD-FLAPS 0 SPEED.
2. IF ACTUAL TAT IS HOTTER THAN CHART TAT USE THE CRZ MODE OF THE TAT/EPR INDICATOR TO DETERMINE EPR.
3. ANTI-ICE CORRECTION:
   WHEN TAT IS SHOWN REDUCE CHART EPR .008 FOR ENGINE, .014 FOR ENGINE AND WING WHERE TAT IS REPLACED BY AN ASTERISK (*) USE CHART EPR UNLESS THE CRZ MODE OF THE TAT/EPR INDICATOR SHOWS A LESSER VALUE.

DATA PRESENTED IS:

IAS/MACH
EPR/TAT

HOLD-FLAPS 0

LOW ALTITUDE

ALTITUDE STD TEMP	440000.	420000.	400000.	380000.	360000.	340000.	320000.	300000.	280000.
25000 -35.	288/.691 .405/*	281/.674 .388/*	273/.657 .370/*	266/.640 .352/*	258/.622 .335/*	250/.604 .318/*	242/.586 .300/*	234/.567 .283/*	226/.548 .266/*
24000 -33.	287/.675 .389/*	280/.659 .372/*	273/.642 .355/*	265/.625 .339/*	257/.608 .322/*	250/.591 .305/*	242/.573 .289/*	234/.555 .272/*	226/.536 .256/*
23000 -31.	286/.660 .373/*	279/.644 .357/*	272/.628 .341/*	264/.612 .325/*	257/.595 .309/*	249/.578 .293/*	241/.561 .278/*	233/.543 .262/*	225/.525 .246/*
22000 -29.	285/.646 .358/*	278/.630 .343/*	271/.614 .328/*	264/.599 .312/*	256/.582 .297/*	249/.566 .282/*	241/.549 .267/*	233/.532 .252/*	225/.514 .237/*
21000 -27.	285/.631 .344/*	278/.616 .330/*	270/.601 .315/*	263/.586 .300/*	256/.570 .286/*	248/.554 .272/*	241/.538 .257/*	233/.521 .243/*	225/.504 .228/*
20000 -25.	284/.618 .331/*	277/.603 .317/*	270/.589 .303/*	263/.573 .289/*	255/.558 .275/*	248/.543 .262/*	241/.527 .248/*	233/.511 .233/*	225/.494 .219/*
19000 -23.	283/.605 .318/*	276/.591 .305/*	269/.576 .292/*	262/.562 .279/*	255/.547 .265/*	248/.532 .252/*	240/.516 .238/*	233/.500 .225/*	225/.484 .211/*
18000 -21.	283/.592 .306/*	276/.578 .294/*	269/.564 .281/*	262/.550 .268/*	255/.536 .256/*	248/.521 .243/*	240/.506 .230/*	232/.490 .216/*	225/.474 .203/*
17000 -19.	282/.580 .295/*	275/.566 .283/*	268/.553 .271/*	262/.539 .259/*	255/.525 .246/*	247/.511 .234/*	240/.496 .221/*	232/.481 .208/*	225/.465 .195/*
16000 -17.	282/.568 .284/*	275/.555 .273/*	268/.542 .261/*	261/.529 .249/*	254/.515 .237/*	247/.501 .225/*	240/.486 .213/*	232/.471 .200/*	225/.456 .187/*
15000 -15.	281/.557 .274/*	275/.544 .263/*	268/.531 .252/*	261/.518 .240/*	254/.505 .229/*	247/.491 .217/*	240/.477 .205/*	232/.462 .192/*	225/.447 .179/*
14000 -13.	281/.546 .265/*	274/.534 .254/*	268/.521 .243/*	261/.508 .232/*	254/.495 .220/*	247/.482 .209/*	240/.468 .197/*	232/.453 .185/*	224/.438 .172/*
13000 -11.	281/.535 .255/*	274/.523 .245/*	268/.511 .234/*	261/.498 .223/*	254/.486 .212/*	247/.473 .201/*	240/.459 .189/*	232/.445 .178/*	224/.430 .165/*
12000 -9.	280/.525 .246/*	274/.513 .236/*	267/.501 .226/*	261/.489 .215/*	254/.477 .205/*	247/.464 .194/*	240/.450 .182/*	232/.436 .171/*	224/.422 .159/*
11000 -7.	280/.515 .238/*	274/.504 .228/*	267/.492 .218/*	261/.480 .207/*	254/.468 .197/*	247/.455 .186/*	239/.442 .175/*	232/.428 .164/*	224/.414 .153/*
10000 -5.	280/.506 .229/*	274/.494 .220/*	267/.483 .210/*	260/.471 .200/*	254/.459 .189/*	247/.446 .179/*	239/.433 .168/*	232/.420 .157/*	224/.406 .147/*

GROSS WEIGHT - LBS

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN HOLD-FLAPS 0 SPEED.
2. ANTI-ICE CORRECTION:
   USE CHART EPR UNLESS CRZ MODE OF THE TAT/EPR INDICATOR SHOWS A LESSER VALUE.

DATA PRESENTED IS: | IAS/MACH |
| EPR/ |

2-ENGINE LONG RANGE CRUISE

HEAVY WEIGHT

ALTITUDE	GROSS WEIGHT - LBS								
STD TEMP	440000.	430000.	420000.	410000.	400000.	390000.	380000.	370000.	360000.
25000 -35.								298/.712 .569/+ 2	295/.705 .557/+ 5
24000 -33.						305/.714 .573/+ 2	302/.708 .562/+ 5	299/.701 .551/+ 7	296/.694 .539/+10
23000 -31.					309/.710 .565/+ 4	306/.703 .555/+ 7	303/.697 .544/+10	300/.690 .533/+12	297/.683 .521/+15
22000 -29.				313/.705 .558/+ 7	311/.699 .547/+ 9	307/.693 .537/+12	304/.686 .526/+14	301/.679 .515/+17	297/.671 .503/+19
21000 -27.			318/.701 .550/+10	315/.695 .540/+12	312/.688 .530/+14	308/.681 .519/+17	305/.674 .508/+19	301/.667 .497/+22	298/.659 .486/+24
20000 -25.	325/.702 .552/+10	322/.696 .542/+12	319/.690 .533/+15	316/.684 .523/+17	312/.677 .512/+19	309/.670 .502/+21	305/.662 .491/+24	302/.655 .480/+26	298/.647 .469/+28
19000 -23.	326/.691 .535/+14	323/.685 .525/+16	320/.679 .515/+19	316/.672 .505/+20	313/.665 .495/+23	309/.658 .484/+25	306/.651 .474/+28	302/.644 .463/+30	298/.636 .453/*
18000 -21.	327/.680 .517/+18	323/.674 .508/+20	320/.667 .498/+22	317/.660 .488/+24	313/.654 .478/+27	310/.647 .468/+29	306/.640 .458/+31	303/.632 .447/*	299/.625 .437/*
17000 -19.	327/.669 .500/+22	324/.662 .491/+24	320/.656 .481/+26	317/.649 .471/+28	314/.642 .462/+30	310/.635 .452/+32	307/.628 .442/*	303/.621 .432/*	299/.614 .422/*
16000 -17.	327/.657 .483/+26	324/.651 .474/+28	321/.644 .465/+30	317/.638 .455/+32	314/.631 .446/+34	310/.624 .436/*	307/.618 .427/*	303/.610 .417/*	300/.603 .407/*
15000 -15.	328/.646 .467/+29	325/.640 .458/+32	321/.633 .449/+33	318/.627 .440/+36	314/.620 .431/*	311/.614 .421/*	307/.607 .412/*	304/.600 .402/*	300/.593 .393/*
14000 -13.	328/.635 .452/+33	325/.629 .443/+35	322/.623 .434/+37	318/.616 .425/+39	315/.610 .416/*	311/.603 .407/*	308/.596 .398/*	304/.589 .388/*	300/.582 .379/*
13000 -11.	329/.624 .436/+37	325/.618 .428/+39	322/.612 .419/+41	319/.606 .410/*	315/.599 .402/*	311/.593 .393/*	308/.586 .384/*	304/.579 .375/*	300/.572 .365/*
12000 -9.	329/.614 .422/+40	326/.608 .413/+43	322/.602 .405/*	319/.596 .396/*	315/.589 .388/*	312/.583 .379/*	308/.576 .370/*	304/.569 .361/*	300/.562 .352/*
11000 -7.	329/.604 .407/+44	326/.598 .399/*	323/.592 .391/*	319/.585 .382/*	316/.579 .374/*	312/.572 .366/*	308/.566 .357/*	304/.559 .348/*	300/.552 .340/*
10000 -5.	330/.594 .394/*	326/.588 .385/*	323/.582 .377/*	319/.575 .369/*	316/.569 .361/*	312/.562 .353/*	308/.556 .344/*	304/.549 .336/*	300/.542 .328/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN BEST ENGINE OUT SPEED.
2. TAT IS THE LIMITING TEMPERATURE OF MAX CONTINUOUS THRUST FOR EPR SHOWN.
3. ANTI-ICE CORRECTION:
   WHEN TAT IS SHOWN REDUCE CHART EPR .008 FOR ENGINE, .014 FOR ENGINE AND WING
   WHERE TAT IS REPLACED BY AN ASTERISK (*) USE CHART EPR.

DATA PRESENTED IS: IAS/MACH
EPR/TAT

2-ENGINE LONG RANGE CRUISE

LIGHT WEIGHT

ALTITUDE	GROSS WEIGHT - LBS								
STD TEMP	360000.	350000.	340000.	330000.	320000.	310000.	300000.	290000.	280000.
33000 -50.									258/.733 .604/-12
31000 -46.							268/.727 .594/- 7	264/.718 .579/- 3	261/.709 .564/+ 1
29000 -42.					277/.720 .583/- 2	274/.712 .569/+ 1	270/.704 .555/+ 4	267/.695 .541/+ 7	263/.686 .527/+11
28000 -40.				281/.716 .577/ 0	278/.709 .564/+ 3	275/.701 .550/+ 6	271/.692 .537/+ 9	268/.684 .523/+12	264/.674 .508/*
27000 -38.			286/.713 .570/+ 1	283/.705 .558/+ 4	279/.698 .545/+ 8	276/.689 .532/+10	272/.681 .518/+13	268/.671 .504/*	264/.661 .489/*
26000 -37.		290/.709 .564/+ 3	287/.702 .552/+ 6	284/.694 .539/+ 9	280/.686 .527/+12	277/.678 .513/+15	273/.668 .500/*	268/.659 .486/*	264/.649 .471/*
25000 -35.	295/.705 .557/+ 5	292/.698 .546/+ 8	288/.691 .534/+10	285/.683 .521/+13	281/.674 .508/+16	277/.665 .495/+19	273/.656 .482/*	269/.647 .468/*	265/.637 .454/*
24000 -33.	296/.694 .539/+10	293/.687 .528/+13	289/.679 .516/+15	285/.671 .503/+18	281/.662 .490/+21	277/.653 .477/*	273/.644 .464/*	269/.635 .451/*	265/.625 .438/*
23000 -31.	297/.683 .521/+15	293/.675 .510/+17	290/.667 .497/+20	286/.659 .485/+23	282/.650 .473/*	278/.641 .460/*	274/.632 .448/*	270/.623 .435/*	265/.614 .422/*
22000 -29.	297/.671 .503/+19	294/.663 .492/+22	290/.655 .480/+24	286/.647 .468/*	282/.638 .456/*	278/.630 .444/*	274/.621 .432/*	270/.612 .419/*	266/.603 .406/*
21000 -27.	298/.659 .486/+24	294/.651 .474/+27	290/.643 .463/*	286/.635 .452/*	282/.627 .440/*	278/.618 .428/*	274/.610 .416/*	270/.601 .404/*	266/.592 .391/*
20000 -25.	298/.647 .469/+28	294/.640 .458/*	291/.632 .447/*	287/.624 .436/*	283/.616 .424/*	279/.607 .413/*	275/.599 .401/*	270/.590 .389/*	266/.581 .377/*
18000 -21.	299/.625 .437/*	295/.617 .427/*	291/.610 .416/*	287/.602 .405/*	283/.594 .394/*	279/.586 .383/*	275/.577 .372/*	271/.568 .361/*	266/.559 .349/*
16000 -17.	300/.603 .407/*	296/.596 .397/*	292/.588 .387/*	288/.581 .377/*	284/.573 .366/*	280/.564 .355/*	275/.556 .345/*	271/.547 .334/*	266/.539 .324/*
14000 -13.	300/.582 .379/*	296/.575 .369/*	292/.568 .359/*	288/.560 .350/*	284/.552 .340/*	280/.544 .330/*	275/.536 .320/*	271/.527 .311/*	267/.519 .301/*
12000 -9.	300/.562 .352/*	296/.555 .343/*	292/.547 .334/*	288/.540 .325/*	284/.532 .316/*	280/.524 .307/*	276/.517 .298/*	271/.509 .289/*	267/.501 .280/*
10000 -5.	300/.542 .328/*	296/.535 .319/*	292/.528 .311/*	288/.521 .303/*	284/.513 .294/*	280/.506 .286/*	276/.499 .278/*	272/.491 .270/*	268/.484 .261/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN BEST ENGINE OUT SPEED.
2. TAT IS THE LIMITING TEMPERATURE OF MAX CONTINUOUS THRUST FOR EPR SHOWN.
3. ANTI-ICE CORRECTION:
   WHEN TAT IS SHOWN REDUCE CHART EPR .008 FOR ENGINE, .014 FOR ENGINE AND WING
   WHERE TAT IS REPLACED BY AN ASTERISK (*) USE CHART EPR.

DATA PRESENTED IS: | IAS/MACH |
| EPR/TAT |

2-ENGINE INOPERATIVE (MAX CONTINUOUS)
DRIFT DOWN / TOTAL RANGE CAPABILITY

DRIFT DOWN

GROSS WEIGHT	ALTITUDE	EPR	IAS	NAM	TIME (MIN)
372,000	35,000	.605	245	440	96
371,800	33,000			432	95
371,600	31,000			425	94
371,300	29,000			415	92
371,000	27,000			405	90
370,700	25,000			395	88
370,400	23,000			385	86
370,100	21,000	.601	240	371	84
369,800	19,000	.594		357	82
369,400	17,000	.585		342	79
368,800	15,000	.574		323	75
368,200	13,000	.560		300	72
367,400	11,000	.546	235	275	66
366,00	9,000	.532		245	59
364,000	7,000	.518		205	50
360,000	5,000	.505		125	32
353,000	4,000	.491		0	0

TOTAL RANGE CAPABILITY

NAUTICAL AIR MILE RANGE	350	400	450	500	550	600	650	700	750	800	850	900
FUEL REMAINING (X 100 #)	213	237	261	285	308	331	356	381	404	427	450	474

950	1,000	1,050	1,100	1,150	1,200	1,250	1,300	1,350	1,400	1,450	1,500
498	523	547	571	595	619	643	668	692	716	740	764

The data presented is valid for temperatures as hot as ISA + 9°C. Anti-ice EPR reduction is unnecessary.

2-ENGINE INOPERATIVE MRC

ALTITUDE STD TEMP	GROSS WEIGHT - LBS							
	360000.	350000.	340000.	330000.	320000.	310000.	300000.	290000.
15000 -15.								
14000 -13.								
13000 -11.								
12000 -9.								234/.440 .546/+13
11000 -7.							238/.438 .543/+14	234/.431 .525/+18
10000 -5.							238/.430 .522/+18	234/.423 .505/+22
9000 -3.						241/.429 .519/+19	237/.422 .502/+23	233/.415 .486/+26
8000 -1.					245/.427 .516/+20	241/.421 .500/+24	237/.414 .483/+27	233/.407 .467/+31
7000 1.				249/.426 .512/+21	245/.419 .496/+24	241/.413 .481/+28	237/.406 .465/+31	233/.399 .449/+35
6000 3.				248/.418 .493/+25	245/.412 .478/+28	241/.405 .463/+32	237/.398 .447/+35	233/.392 .432/+39
5000 5.			252/.416 .489/+26	248/.410 .475/+29	244/.404 .460/+32	241/.398 .445/+36	237/.391 .430/+39	233/.384 .416/+43
4000 7.		256/.415 .485/+27	252/.409 .471/+30	248/.403 .457/+33	244/.396 .443/+36	240/.390 .429/+40	236/.384 .414/+43	232/.377 .400/*
3000 9.	259/.413 .481/+17	255/.407 .467/+31	252/.401 .454/+34	248/.395 .440/+37	244/.389 .426/+41	240/.383 .412/+44	236/.376 .398/+48	232/.370 .384/*
2000 11.	259/.405 .463/+32	255/.400 .450/+35	251/.394 .437/+38	248/.388 .424/+41	244/.382 .410/+45	240/.376 .397/+49	236/.369 .383/*	232/.363 .370/*
1000 13.	259/.398 .446/+36	255/.392 .433/+39	251/.387 .421/+42	247/.381 .408/+46	244/.375 .395/+49	240/.369 .382/*	236/.363 .369/*	232/.356 .356/*
0 15.	258/.391 .430/+40	255/.385 .418/+43	251/.379 .405/+47	247/.374 .392/+50	243/.368 .380/+53	239/.362 .367/*	235/.356 .355/*	231/.350 .342/*

1. EPR IS THE AVERAGE REQUIRED TO MAINTAIN BEST 2 ENGINE OUT SPEED.
2. TAT IS THE LIMITING TEMPERATURE OF MAX CONTINUOUS THRUST FOR EPR SHOWN.
3. ANTI-ICE CORRECTION:
   WHEN TAT IS SHOWN REDUCE CHART EPR .008 FOR ENGINE, .014 FOR ENGINE AND WING
   WHERE TAT IS REPLACED BY AN ASTERISK (*) USE CHART EPR.

DATA PRESENTED IS:

IAS/MACH
EPR/TAT

MAXIMUM CONTINUOUS (ENGINE OUT) CLIMB

TAT DEG C	PRESSURE ALTITUDE - FEET								
	0	5000	10000	0	5000	10000	0	5000	10000
	200 KTS	200 KTS	200 KTS	220 KTS	220 KTS	220 KTS	240 KTS	240 KTS	240 KTS
40	.436/90.5	.431/90.6		.434/90.6	.429/90.8		.432/90.8	.427/91.0	
38	.445/90.7	.440/90.9		.443/90.9	.437/91.1		.440/91.0	.435/91.3	
36	.453/91.0	.448/91.2		.451/91.1	.446/91.3		.449/91.3	.444/91.5	.442/92.0
34	.461/91.2	.457/91.4		.460/91.3	.455/91.6	.451/91.9	.458/91.5	.453/91.8	.451/92.2
32	.470/91.4	.465/91.6	.461/92.0	.468/91.6	.463/91.8	.460/92.2	.466/91.8	.462/92.0	.459/92.5
30	.478/91.7	.474/91.9	.470/92.2	.474/91.7	.472/92.1	.469/92.4	.467/91.5	.471/92.3	.469/92.7
28	.481/91.5	.483/92.1	.479/92.4	.474/91.4	.481/92.3	.478/92.7	.467/91.2	.480/92.5	.478/93.0
26	.481/91.2	.491/92.4	.488/92.7	.474/91.1	.490/92.6	.487/92.9	.467/90.9	.489/92.8	.487/93.2
24	.481/90.9	.500/92.6	.497/92.9	.474/90.8	.499/92.8	.496/93.2	.467/90.6	.498/93.0	.496/93.5
22	.481/90.6	.509/92.9	.506/93.2	.474/90.5	.508/93.1	.505/93.5	.467/90.3	.502/93.0	.505/93.7
20	.481/90.3	.516/93.0	.515/93.5	.474/90.1	.510/92.9	.515/93.7	.467/90.0	.502/92.7	.514/94.0
18	.481/90.0	.516/92.7	.524/93.8	.474/89.8	.510/92.5	.524/94.0	.467/89.7	.502/92.3	.524/94 3
16	.481/89.7	.516/92.4	.533/94.0	.474/89.5	.510/92.2	.533/94.3	.467/89.4	.502/92.0	.533/94.6
14	.481/89.4	.516/92.1	.542/94.3	.474/89.2	.510/91.9	.542/94.6	.467/89.1	.502/91.7	.539/94.6
12	.481/89.0	.516/91.8	.551/94.6	.474/88.9	.510/91.6	.546/94.6	.467/88.7	.502/91.4	.539/94.3
10	.481/88.7	.516/91.4	.553/94.4	.474/88.6	.510/91.3	.546/94.2	.467/88.4	.502/91.1	.539/94.0
8	.481/88.4	.516/91.1	.553/94.1	.474/88.3	.510/90.9	.546/93.9	.467/88.1	.502/90.7	.539/93.6
6	.481/88.1	.516/90.8	.553/93.7	.474/88.0	.510/90.6	.546/93.6	.467/87.8	.502/90.4	.539/93.3
4	.481/87.8	.516/90.5	.553/93.4	.474/87.6	.510/90.3	.546/93.2	.467/87.5	.502/90.1	.539/93.0
2	.481/87.5	.516/90.1	.553/93.1	.474/87.3	.510/90.0	.546/92.9	.467/87.2	.502/89.8	.539/92.6
0	.481/87.2	.516/89.8	.553/92.7	.474/87.0	.510/89.6	.546/92.5	.467/86.9	.502/89.4	.539/92.3
-2	.481/86.8	.516/89.5	.553/92.4	.474/86.7	.510/89.3	.546/92.2	.467/86.5	.502/89.1	.539/92.0
-4	.481/86.5	.516/89.1	.553/92.0	.474/86.4	.510/89.0	.546/91.9	.467/86.2	.502/88.8	.539/91.6
-6	.481/86.2	.516/88.8	.553/91.7	.474/86.0	.510/88.6	.546/91.5	.467/85.9	.502/88.5	.539/91.3
-8	.481/85.9	.516/88.5	.553/91.4	.474/85.7	.510/88.3	.546/91.2	.467/85.6	.502/88.1	.539/90.9
-10	.481/85.5	.516/88.1	.553/91.0	.474/85.4	.510/88.0	.546/90.8	.467/85.2	.502/87.8	.539/90.6

IF ANTI-ICE ON, REDUCE EPR FOR ENGINE BY .008, FOR ENGINE AND WING BY .014.

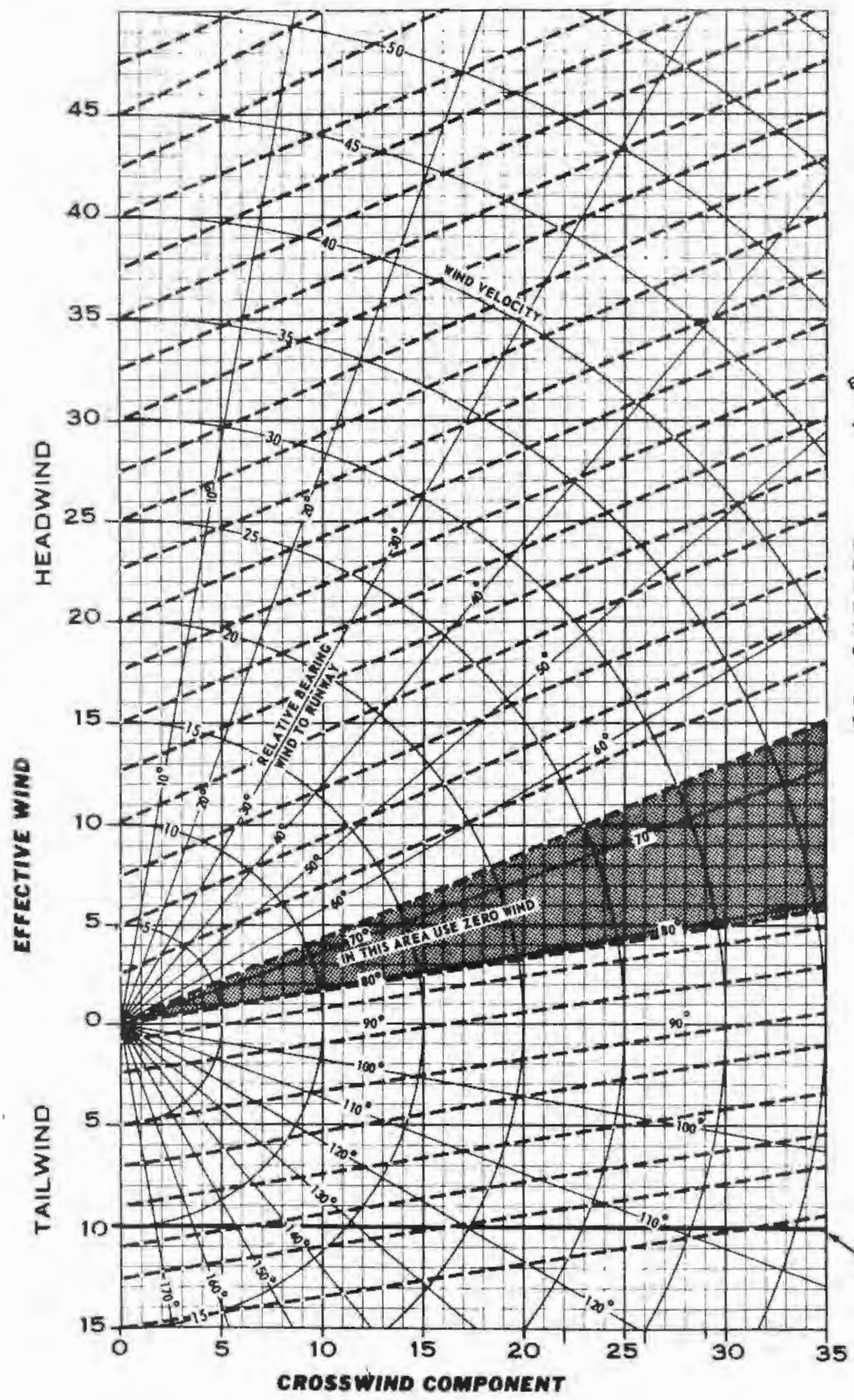
DATA PRESENTED IS: | EPR/N1 |

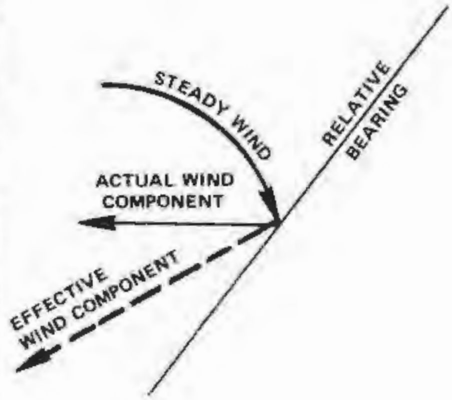
RELATIVE BEARING - WIND TO RUNWAY

Rwy No.	REPORTED WIND DIRECTION																																		
	360	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	190	200	210	220	230	240	250	260	270	280	290	300	310	320	330	340	350
1	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20
2	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30
3	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40
4	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50
5	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60
6	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70
7	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80
8	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90
9	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100
10	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110
11	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120
12	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130
13	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140
14	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150
15	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160
16	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170
17	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
18	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170
19	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160
20	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150
21	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140
22	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120	130
23	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110	120
24	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100	110
25	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90	100
26	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80	90
27	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70	80
28	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60	70
29	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50	60
30	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40	50
31	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30	40
32	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20	30
33	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10	20
34	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0	10
35	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10	0
36	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180	170	160	150	140	130	120	110	100	90	80	70	60	50	40	30	20	10

INSTRUCTIONS: ENTER RELATIVE BEARING TABLE AT RUNWAY NUMBER AND READ WIND RELATIVE BEARING UNDER REPORTED WIND DIRECTION.

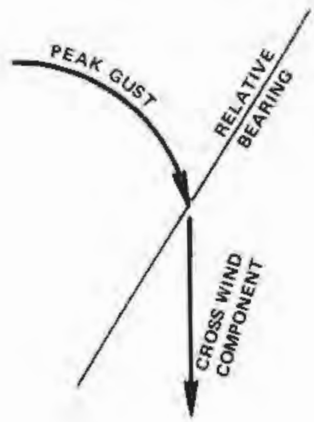
EFFECTIVE AND ACTUAL WIND COMPONENT





ENTER WITH STEADY WIND. PROCEED TO THE RELATIVE BEARING LINE AND READ THE ACTUAL AND EFFECTIVE WIND COMPONENT.
THE EFFECTIVE WIND COMPONENT COMPENSATES FOR CROSSWIND DRAG.

ENTER WITH PEAK GUST TO FIND CROSS-WIND COMPONENT.



TEMPERATURE CONVERSION

TAT DEG C	INDICATED MACH NUMBER																	
	.56	.58	.60	.62	.64	.66	.68	.70	.72	.74	.76	.78	.80	.82	.84	.86	.88	.90
	AMBIENT AIR TEMP- (SAT) -CENTIGRADE																	
40	22	21	19	18	17	15	14	13	11	10	8	7	5	4	2	0	-1	-3
38	20	19	18	16	15	14	12	11	9	8	6	5	3	2	0	-1	-3	-5
36	18	17	16	14	13	12	10	9	7	6	5	3	2	0	-2	-3	-5	-6
34	16	15	14	12	11	10	8	7	6	4	3	1	0	-2	-3	-5	-6	-8
32	14	13	12	11	9	8	7	5	4	2	1	0	-2	-4	-5	-7	-8	-10
30	12	11	10	9	7	6	5	3	2	1	-1	-2	-4	-5	-7	-8	-10	-12
28	11	9	8	7	6	4	3	2	0	-1	-3	-4	-6	-7	-9	-10	-12	-13
26	9	8	6	5	4	2	1	0	-2	-3	-4	-6	-7	-9	-10	-12	-13	-15
24	7	6	4	3	2	1	-1	-2	-3	-5	-6	-8	-9	-11	-12	-14	-15	-17
22	5	4	3	1	0	-1	-3	-4	-5	-7	-8	-9	-11	-12	-14	-15	-17	-18
20	3	2	1	-1	-2	-3	-4	-6	-7	-8	-10	-11	-13	-14	-16	-17	-19	-20
18	1	0	-1	-2	-4	-5	-6	-7	-9	-10	-12	-13	-14	-16	-17	-19	-20	-22
16	-1	-2	-3	-4	-5	-7	-8	-9	-11	-12	-13	-15	-16	-18	-19	-21	-22	-24
14	-3	-4	-5	-6	-7	-9	-10	-11	-12	-14	-15	-17	-18	-19	-21	-22	-24	-25
12	-5	-6	-7	-8	-9	-10	-12	-13	-14	-16	-17	-18	-20	-21	-23	-24	-26	-27
10	-6	-8	-9	-10	-11	-12	-14	-15	-16	-17	-19	-20	-22	-23	-24	-26	-27	-29
8	-8	-9	-11	-12	-13	-14	-15	-17	-18	-19	-21	-22	-23	-25	-26	-28	-29	-30
6	-10	-11	-12	-14	-15	-16	-17	-18	-20	-21	-22	-24	-25	-26	-28	-29	-31	-32
4	-12	-13	-14	-15	-17	-18	-19	-20	-22	-23	-24	-26	-27	-28	-30	-31	-33	-34
2	-14	-15	-16	-17	-18	-20	-21	-22	-23	-25	-26	-27	-29	-30	-31	-33	-34	-36
0	-16	-17	-18	-19	-20	-21	-23	-24	-25	-26	-28	-29	-30	-32	-33	-35	-36	-37
-2	-18	-19	-20	-21	-22	-23	-25	-26	-27	-28	-30	-31	-32	-34	-35	-36	-38	-39
-4	-20	-21	-22	-23	-24	-25	-26	-28	-29	-30	-31	-33	-34	-35	-37	-38	-39	-41
-6	-21	-23	-24	-25	-26	-27	-29	-29	-31	-32	-33	-34	-36	-37	-38	-40	-41	-43
-8	-23	-24	-25	-27	-28	-29	-30	-31	-32	-34	-35	-36	-38	-39	-40	-42	-43	-44
-10	-25	-26	-27	-28	-30	-31	-32	-33	-34	-35	-37	-38	-39	-41	-42	-43	-45	-46
-12	-27	-28	-29	-30	-31	-33	-34	-35	-36	-37	-39	-40	-41	-42	-44	-45	-46	-48
-14	-29	-30	-31	-32	-33	-34	-36	-37	-38	-39	-40	-42	-43	-44	-45	-47	-48	-49
-16	-31	-32	-33	-34	-35	-36	-37	-39	-40	-41	-42	-43	-45	-46	-47	-49	-50	-51
-18	-33	-34	-35	-36	-37	-38	-39	-40	-42	-43	-44	-45	-46	-48	-49	-50	-52	-53
-20	-35	-36	-37	-38	-39	-40	-41	-42	-43	-45	-46	-47	-48	-49	-51	-52	-53	-55
-22	-37	-38	-39	-40	-41	-42	-43	-44	-45	-46	-48	-49	-50	-51	-52	-54	-55	-56
-24	-38	-39	-40	-41	-43	-44	-45	-46	-47	-48	-49	-51	-52	-53	-54	-56	-57	-58
-26	-40	-41	-42	-43	-44	-45	-47	-48	-49	-50	-51	-52	-54	-55	-56	-57	-59	-60
-28	-42	-43	-44	-45	-46	-47	-48	-49	-51	-52	-53	-54	-55	-57	-58	-59	-60	-62
-30	-44	-45	-46	-47	-48	-49	-50	-51	-52	-54	-55	-56	-57	-58	-60	-61	-62	-63
-32	-46	-47	-48	-49	-50	-51	-52	-53	-54	-55	-57	-58	-59	-60	-61	-63	-64	-65
-34	-48	-49	-50	-51	-52	-53	-54	-55	-56	-57	-58	-59	-61	-62	-63	-64	-65	-67
-36	-50	-51	-52	-53	-54	-55	-56	-57	-58	-59	-60	-61	-62	-64	-65	-66	-67	-68
-38	-52	-53	-53	-54	-55	-56	-58	-59	-60	-61	-62	-63	-64	-65	-67	-68	-69	-70
-40	-53	-54	-55	-56	-57	-58	-59	-60	-61	-63	-64	-65	-66	-67	-68	-69	-71	-72

RANGE CAPABILITY

1-ENGINE INOPERATIVE (25,000 FEET/20,000 FEET)

FUEL	GROSS WEIGHT							
REMAINING	390,000	380,000	370,000	360,000	350,000	340,000	330,000	320,000
70,000	/1690	1890/1725	1910/1760					
60,000	/1440	1580/1470	1600/1500	1625/1525	1650/1550			
50,000	/1190	1300/1215	1320/1240	1340/1265	1360/1290	1385/1305	1410/1320	1440/1335
40,000	/ 940	1020/ 965	1050/ 990	1070/1005	1090/1020	1110/1035	1130/1050	1150/1065
30,000	/ 700	760/ 715	775/ 730	790/ 745	810/ 760	825/ 770	840/ 780	855/ 790

3-ENGINE (14,000 FEET/10,000 FEET)

FUEL	GROSS WEIGHT					
REMAINING	390,000	380,000	370,000	360,000	350,000	340,000
70,000		1570/1500				
60,000		1330/1225	1360/1255	1390/1285		
50,000		1100/1020	1120/1040	1140/1060	1165/1080	
40,000			890/ 825	910/ 840	925/ 855	940/ 875
30,000				695/ 625	705/ 635	715/ 650

1. To determine nautical air mile range, intersect fuel remaining with present gross weight. Range is based on Long Range Cruise thrust or 1-Engine Inoperative Long Range Cruise thrust.

2. 2-Engine Inoperative range capability is in Section 25 of this Chapter.

* * *

TAKEOFF DATA

CHART DESCRIPTION

Takeoff performance charts are provided for all authorized runways. They contain all the required performance data for takeoff except thrust setting information. The charts are divided into two sections: takeoff data and the takeoff data worksheet. Takeoff data can be further subdivided into four sections: weights, speeds, associated information, and notes.

The weight section consists of a Temperature column, a Rwy Zero Wind column and a Climb Limit column:

The Temperature column covers the usual span of temperatures up to the airport maximum operating temperature.

The Rwy Zero Wind weight column is used to determine the runway limit weight. It accounts for runway length and gradient, airport elevation, brake energy limitations, and obstacle clearance. If sufficient obstacle clearance cannot be provided utilizing the standard takeoff profile, a turn will be specified on the chart. All turn calculations are based on initiating a 15° banked turn to a specific heading at 300 feet above the ground.

The Climb Limit column reflects the maximum weight at which the aircraft can satisfy the minimum FAA climb requirements for the station elevation and associated temperature.

In some cases, runway condition and climb performance is such that the Rwy Zero Wind and Climb Limit columns may list weights in excess of the structural limit weight. The actual takeoff weight must never exceed the structural limit weight.

The takeoff speed section consists of an actual gross weight column and V_1, V_r, V_2, V_2 minimum, and V_{mcg} speeds.

The associated information at the top of the chart consists of aircraft, engine, flap configuration, and airport characteristics used to determine performance data. This information should be cross checked against available conditions.

The note section on the left side of the chart contains speed corrections for V_1 and V_2 and weight corrections for altimeter setting and wind. Runway notes contain information on noise abatement, turn procedures, clearway used, etc. The bottom two lines provide slush and anti-skid inoperative adjustments.

WEIGHT DEFINITIONS

Following are definitions for the weights needed to complete the takeoff data worksheet.

ADJUSTED RUNWAY ZERO WIND WEIGHT - Accounts for performance adjustment to the runway zero wind weight. These adjustments are usually temporary or apply only in particular circumstances. Performance adjustments that commonly affect the zero wind weight are: MEL/CDL items, or temporary changes of runway length. Other adjustments may also be specified.

RUNWAY LIMIT WEIGHT - Accounts for the minimum field length requirements and is always used as a basis for making V_1 adjustments. It is determined by correcting the adjusted runway zero wind weight for the effective headwind or tailwind component.

ANTI-SKID INOPERATIVE/SLUSH MAXIMUM WEIGHT - Accounts for the loss of rejected takeoff capability due to an inoperative anti-skid system or loss of performance due to the presense of slush, wet snow, or standing water. It is determined by subtracting specified weight penalties from the runway limit weight. Anti-skid inoperative and slush adjustments may not be taken at the same time.

The slush restriction is intended to apply only when the runway is generally covered by water, slush, or wet snow and does not imply that the depth of isolated puddles is a limitation. However, particular attention must be given the liftoff end of the runway where the effects on acceleration are the most severe. Takeoffs will not be made on runways on which more than 1/2 inch slush, standing water, or wet snow is present.

CLIMB LIMIT WEIGHT - Accounts for the FAA required minimum climb gradient capability. It is derived from the Climb Limit column of the chart. No wind adjustment is permitted. This weight may be adjusted for MEL/CDL items.

STRUCTURAL LIMIT WEIGHT - This is the maximum weight at which the aircraft has been certified to take off.

MAXIMUM TAKEOFF WEIGHT - This is the most limiting of all the weights defined above.

ACTUAL WEIGHT - This is the gross takeoff weight as shown on the Load Balance Record. The actual weight must never exceed the maximum takeoff weight.

THRUST SETTING DEFINITIONS

ALLOWABLE THRUST - This is the maximum level of thrust available to meet the takeoff weight performance requirements. Allowable thrust EPR and N_1 are obtained by entering the takeoff thrust setting chart with the actual temperature and station pressure.

REDUCED THRUST - This is the level of thrust needed to meet the actual takeoff weight performance requirements. Whenever the actual takeoff weight is less than allowed by the takeoff chart, the actual takeoff weight is matched to the chart to obtain a performance temperature higher than actual temperature. The performance temperature and station pressure are used to obtain an assumed thrust EPR from the takeoff thrust setting chart.

TAKEOFF DATA WORKSHEET INSTRUCTIONS

INITIAL ENTRIES

All applicable items should be entered on the takeoff data worksheet for each takeoff. The following steps are to be accomplished:

1. Enter actual temperature, wind, altimeter setting, and field elevation in the spaces so designated.
2. Record actual takeoff weight in the ACTUAL WT box.

SPECIAL NOTES

Review the takeoff chart note section and observe any limitations or instructions required to validate the performance data computed, such as turn required, noise reduction, intersection takeoff, etc. These notes may specify a performance adjustment to the runway zero wind weight.

REDUCED THRUST TAKEOFF WEIGHTS

A reduced thrust takeoff should be made whenever the actual takeoff weight permits it.

The captain may elect to resume the use of allowable thrust at any time during a reduced thrust takeoff.

Restrictions to reduced thrust takeoff are as follows:

Maximum assumed temperature is 106°F.

No credit can be taken for headwind. No actual or effective tailwind component is permitted.

The runway must be clean and dry.

The anti-skid system must be operative.

The aircraft must not be operating under any weight restrictions that affect the runway zero wind or climb limit weights.

All EPR gauges must be operative.

The maximum permissible difference between allowable and assumed EPR is .06.

To determine reduced thrust takeoff weights proceed with the following steps:

1. Determine the performance temperature as follows:

   Select a chart entry temperature of 106°F or the highest temperature on the takeoff chart if less than 106°F.

   Read the runway zero wind and climb limit weights shown opposite the chart entry temperature. If the actual weight is equal to or less than these weights, use the chart entry temperature as the performance temperature.

   If the actual weight exceeds the runway zero wind or climb limit weights at the chart entry temperature, reduce the chart entry temperature until the runway or climb weight (whichever is lowest) matches the actual weight. Use the resulting temperature as the performance temperature.

   Do not use a performance temperature less than actual temperature. Check that a performance temperature of less than 106°F does not fall into the constant EPR area for the existing station pressure on the Takeoff Thrust Setting chart. If it does, no thrust reduction is achieved and a reduced thrust takeoff cannot be made.

   If the altimeter setting is below 29.70, reduce the performance temperature 1°F for each .10 below 29.70.

   Enter the performance temperature in the PERF TEMP space of the takeoff data worksheet.

2. Enter the runway zero wind weight shown opposite the performance temperature in the RWY LIMIT WT box.

TAKEOFF DATA WORKSHEET INSTRUCTIONS (Cont'd)

3. Read the climb limit weight opposite the performance temperature. Read the structural limit weight at the bottom of the chart.

   Enter the climb limit or structural limit weight, whichever is lightest, in the STRUCT/CLIMB box.

4. Compare the RWY LIMIT WT and STRUCT/CLIMB entries. Select the lightest weight and enter it in the MAX TAKEOFF WT box.

ALLOWABLE THRUST TAKEOFF WEIGHTS

Use the following steps when reduced thrust is not used for takeoff.

1. Determine the performance temperature as follows:

   If the altimeter setting is 29.70 or greater, the actual temperature is also the performance temperature.

   If the altimeter setting is below 29.70, increase the temperature 1°F for each .10 below 29.70.

   Enter the performance temperature in the PERF TEMP space of the takeoff data worksheet.

2. Enter the chart with the performance temperature and obtain the runway zero wind weight. Enter it in the RWY ZERO WIND space of the takeoff data worksheet.

3. Enter performance adjustments in the PERFORMANCE ADJ space. These adjustments could be for MEL/CDL items, or temporary change of runway length. Check the takeoff chart for any special notes that may require a performance adjustment.

   Apply the performance adjustment to the runway zero wind weight. Enter the resulting weight in the ADJ RWY ZERO WIND box.

4. Multiply the effective wind component by the wind factor shown on the chart and enter the result in the RWY WIND ADJ space.

   Apply the wind adjustment to the adjusted runway zero wind weight and enter the result in the RWY LIMIT WT box.

5. Apply anti-skid inoperative or slush weight adjustment as required. Enter this adjustment in the ASI/SLUSH ADJ space.

   The weight penalty for anti-skid inoperative is shown at the bottom of the takeoff chart.

   The slush adjustment is equal to 10% of the amount shown in the RWY LIMIT WT box.

   Subtract the penalty from the runway limit weight and enter the result in the ASI/SLUSH MAX WT box. Anti-skid inoperative and slush adjustments may not be taken at the same time.

6. Read the climb limit weight opposite the performance temperature.

   Apply any climb limit adjustments for MEL/CDL items.

   Read the structural limit weight at the bottom of the chart.

   Compare the climb limit and structural limit weights after applying the above adjustments. Select the lightest weight and enter it in the STRUCT/CLIMB box.

7. Compare the weights entered in the RWY LIMIT WT box, ASI/SLUSH box, and STRUCT/CLIMB box. Enter the lightest one in the MAX TAKEOFF WT box.

8. The weight in the ACTUAL WT box must not exceed the weight in the MAX TAKEOFF WT box.

TAKEOFF SPEEDS

Takeoff speeds are determined by entering the speed section of the chart with actual weight as recorded in the ACTUAL WT box. Speed figures are computed as follows:

1. Determine V_{mcg} and V_2 min by entering the speed section with actual airport temperature. Interpolate if necessary. For temperatures hotter than 105°F or colder than 15°F use the last V_{mcg} and V_2 min shown. Enter V_{mcg} and V_2 min in the spaces provided.

2. Read the V_1 opposite the actual weight. Reduce V_1 one knot for every 2000 pounds that the weight in the ACTUAL WT box is less than the weight in the RWY LIMIT WT box. V_1 may not be less than V_{mcg}.

TAKEOFF DATA WORKSHEET INSTRUCTIONS (Cont'd)

3. Determine V_r by entering the speed section with performance temperature and actual weight. Interpolate as necessary between listed temperatures. For temperatures hotter than 105°F or colder than 15°F use the last V_r shown. V_r may not be less than V_1. Enter V_r in the space provided.

4. Read V_2 for the actual weight and enter in the space provided on the worksheet. V_2 may not be less than V_2 min.

THRUST SETTING

Determine the thrust data as follows:

Station Pressure.

Read field elevation as pressure (1000' = 1.0 in Hg.) and subtract from altimeter setting to determine station pressure. Enter the station pressure on the STA PR line.

Allowable Thrust.

Enter the takeoff thrust setting chart with actual temperature and station pressure. Read the allowable thrust EPR and N_1 and enter in the spaces provided.

Assumed Thrust.

When reduced thrust is planned, enter the takeoff thrust chart with station pressure and performance temperature and read the EPR. Enter the EPR in the assumed EPR space.

If the performance temperature falls within the constant EPR area, no EPR reduction is achieved and a reduced thrust takeoff cannot be made.

When necessary, increase the assumed EPR to meet the maximum permissible difference limit, but do not change the performance temperature, weights, or speeds previously entered.

Initial Climb N_1.

Enter climb thrust setting chart with actual temperature and read N_1 opposite takeoff field elevation plus 3000 feet. Enter on the INITIAL CLIMB N_1 line.

SAMPLE PROBLEM 1 - REDUCED THRUST

The numbered steps in this example correspond with the circled numbers on the sample takeoff data worksheet.

Conditions: A takeoff is desired from ORD runway 32R. Actual weight is 400,000 pounds, temperature is 60°F, altimeter setting 29.74, and wind is 10 knots from 320°. Reduced thrust will be used.

1. Enter temperature, wind, altimeter setting, V_{mcg}, and V_2 min in the appropriate spaces. Compute station pressure.

2. Enter the actual weight.

3. Enter the chart with the actual weight (400,000) at 106°F. If actual weight is greater than either of the weights shown at 106°F, proceed up the chart until a temperature is found (104°F) whose weights (runway zero wind/climb limit, whichever is lower) equals, or is slightly greater than, the actual weight. Enter this temperature on the PERF TEMP line.

4. Enter the 104°F runway zero wind weight (402,900) on the RWY ZERO WIND line. Since there can be no wind corrections or performance adjustments for a reduced thrust takeoff, enter the same value in the RWY LIMIT WT box.

5. Compare the 104°F climb limit weight with the structural limit weight at the bottom of the page. Enter the lowest weight in the STRUCT/CLIMB box.

6. Compare the weights in the RWY LIMIT WT box and the STRUCT/CLIMB box. Enter the lowest weight in the MAX TAKEOFF WT box.

7. Use actual weight and the SPEED CORRECTIONS box to determine V_1. Interpolate as necessary.

8. Use actual weight and performance temperature to determine V_r. Interpolate as necessary.

9. Use actual weight to determine V_2. Interpolate as necessary.

10. Enter all of the above speeds in their respective spaces at the top of the worksheet.

11. Use thrust-setting charts to determine EPR values. Performance temperature must be used to determine assumed-thrust EPR. Actual temperature is used to determine allowable-thrust N_1 and EPR. The maximum permissible difference between reduced and allowable EPR is .06.

SAMPLE PROBLEM 1 (Cont'd)

AC PACKS OFF

ORD 32R
1011 RB211-22B OFF 10 POS FLAPS
LENGTH 10003. ELEV 667.
OBSTACLE LIMITED GRAD 0.03

32R

8 9

ACT G/W	V1	VR-TEMP DEG F 15	45	75	105	V2
450	159	159	159	159	160	165
440	157	157	157	157	158	164
420	153	152	152	152	154	162
400	149	148	148	148	149	159
380	147	144	144	144	145	156
360	142	139	139	139	141	153
340	137	135	135	135	136	149
320	133	130	130	130	131	146
300	127	124	124	124	126	142
280	122	123	123	123	120	139
260	117	123	123	123	117	135
VMCG		117	117	117	111	
V2 MIN		142	142	142	135	

1

SPEED CORRECTIONS
REDUCE V1 1. KT/2000 LB ACTL WT IS BELOW RWY LIMIT WT BUT NOT LESS THAN VMCG.

FOR V2 USE GREATER OF V2 FOR TAKEOFF WEIGHT OR V2 MIN FOR AMBIENT TEMPERATURE.

WEIGHT CORRECTIONS
ALT SETTING-FOR EACH .10 IN HG BELOW 29.70 USE 1 DEG HOTTER TEMP

WIND-ADJUST RWY ZERO WIND
ADD 610 LBS/KT EFF H.W.
SUB 3360 LBS/KT EFF T.W.

7

402,900
-400,000
2,900=1KT
149-1=148

TEMP DEG F	RWY ZERO WIND	CLIMB LIMIT
-10	4691	4500
0	4656	4500
10	4617	4500
20	4574	4500
30	4538	4500
40	4501	4500
42	4494	4500
44	4487	4500
46	4480	4500
48	4472	4500
50	4465	4500
52	4458	4500
54	4450	4500
56	4443	4500
58	4436	4500
60	4428	4500
62	4422	4500
64	4415	4500
66	4408	4500
68	4401	4500
70	4394	4500
72	4387	4500
74	4380	4500
76	4373	4500
78	4366	4500
80	4360	4500
82	4335	4500
84	4310	4500
86	4285	4500
88	4260	4469
90	4235	4428
92	4206	4388
94	4177	4349
96	4148	4309
98	4119	4269
100	4090	4230
102	4059	4192
104	4029	4154
106	3999	4116
108	3969	4078
110	3538	4041
115	3872	3951
120	3805	3861
127	3714	3745

3

SLUSH MAX WT-REDUCE R W LIMIT WT BY 10 PERCENT.
ASI MAX WT- REDUCE R W LIMIT WT BY 14000 LBS.

DO NOT EXCEED STRUCTURAL LIMIT WEIGHT

1011

430,000

10

V_1 148 V_R 149 V_2 159
V_{MCG} 117 V_{2min} 142

11

	ASSUMED	ALLOWABLE
EPR	.480	.539
N_1%		93

INITIAL CLIMB N_1 ____ % STAB TRIM ____

1

TEMP 68 °F 20 °C ALTM 29.74
WIND 320/10 –ELEV .67
PERF TEMP 104 STA PR 29.07

4

RWY ZERO WIND 402,900
PERFORMANCE ADJ(±) ____
ADJ RWY ZERO WIND ____
RWY WIND ADJ(±) ____
RWY LIMIT WT 402,900
ASI/SLUSH ADJ(–) ____
ASI/SLUSH MAX WT ____
5 STRUCT/CLIMB 415,400
6 **MAX TAKEOFF WT** 402,900
2 ACTUAL WT 400,000

LDG WT ____ GA EPR ____
ATIS ____

SAMPLE PROBLEM 2 - ALLOWABLE THRUST

The numbered steps in this example correspond with the circled numbers on the sample takeoff data worksheet.

Conditions: A takeoff is desired from SFO runway 10R. Actual weight is 400,000 pounds, temperature is 40°F, altimeter setting 30.01, and wind is 10 knots from 100°. There is slush and water on the runway so an allowable thrust takeoff must be made.

1. Enter temperature, wind, altimeter setting, V_{mcg}, and V_2 min in the appropriate spaces. Compute station pressure.
2. Enter the actual weight.
3. Since the altimeter setting is above 29.70, actual temperature becomes performance temperature. Enter 40°F on the PERF TEMP line.
4. Enter the 40°F runway zero wind weight (466,300) on the RWY ZERO WIND line. There are no MEL/CDL adjustments in this particular problem so enter the same value in the ADJ RWY ZERO WIND box.
5. Compute the runway zero wind adjustment for the effective headwind (7,000 pounds). Enter the value on the RWY WIND ADJ line and add to the adjusted runway zero wind value. Enter the sum in the RWY LIMIT WT box.
6. Enter the slush adjustment, shown on the bottom of the chart, on the ASI/SLUSH ADJ line. Subtract this value from the runway limit weight and enter the result in the ASI/SLUSH MAX WT box.
7. Compare the 40°F climb limit weight with the structural limit weight at the bottom of the chart. Enter the lower value in the STRUCT/CLIMB box.
8. Compare all of the boxed weights and enter the lowest in the MAX TAKEOFF WT box.
9. Use actual weight and the SPEED CORRECTIONS box to determine V_1. Interpolate as necessary.
10. Use actual weight and temperature to determine V_r. Interpolate as necessary.
11. Use actual weight to determine V_2. Interpolate as necessary.
12. Enter all of the above speeds in their respective spaces at the top of the worksheet.
13. Use actual temperature with the thrust-setting chart to determine EPR and N_1.

V_2 AND BOUNDARY SPEED PLACARD

V_2 SPEEDS 10° FLAPS		V_{ref} SPEEDS 33° FLAPS
IAS KNOTS	WEIGHT	IAS KNOTS
163	430,000	158
162	420,000	156
160	410,000	154
159	400,000	152
157	390,000	150
156	380,000	148
154	370,000	146
153	360,000	144
151	350,000	142
149	340,000	140
147	330,000	137
146	320,000	135
144	310,000	133
142	300,000	131
140	290,000	128
139	280,000	126
137	270,000	124
135	260,000	121
STD. DAY-SEA LEVEL CONDITION		

-100

V_2 SPEEDS 10° FLAPS		V_{REF} SPEED 33° FLAPS
IAS KNOTS	WEIGHT	IAS KNOTS
169	466,000	166
168	460,000	164
166	450,000	162
165	440,000	160
163	430,000	158
162	420,000	156
160	410,000	154
159	400,000	151
157	390,000	149
156	380,000	147
154	370,000	145
153	360,000	142
151	350,000	140
149	340,000	138
147	330,000	136
146	320,000	133
144	310,000	131
142	300,000	129
140	290,000	127
139	280,000	124
137	270,000	122
135	260,000	120
STD. DAY SEA LEVEL CONDITION		

TAKEOFF WITH ONE ECS PACK ON

Use the following steps when operating one ECS pack with engine bleed air:

1. Obtain the Runway Zero Wind and Climb Limit weights from the Takeoff Performance Data chart. Use the performance adjustment block to reduce the Runway Zero Wind weight by 4000 pounds. Reduce the Climb Limit weight by 4000 pounds.
2. Obtain the EPR from the Takeoff Thrust Setting chart and reduce by .005.

SAMPLE PROBLEM 2 (Cont'd)

AC PACKS OFF

SFO 10R
1011 RB211-22B OFF 10 POS FLAPS
LENGTH 10600. ELEV 10.
BRK ENERGY LIMITED GRAD 0.04

10R (10) (11) (12)

ACT G/W	V1	VR-TEMP DEG F 15	45	75	105	V2
450	157	159	159	159	160	165
440	157	156	156	156	158	164
[illegible]	[illegible]	[illegible]	[illegible]	152	153	[illegible]
400	150	148	148	148	149	159
[illegible]	[illegible]	[illegible]	[illegible]	143	145	156
360	142	139	139	139	140	153
340	137	135	135	135	136	149
320	132	130	130	130	131	146
300	127	124	124	124	125	142
280	122	124	124	124	120	139
260	116	124	124	124	118	135
VMCG		118	118	118	113	
V2 MIN		143	143	143	136	

(1)

SPEED CORRECTIONS
REDUCE V1 1 KT/2000 LB ACTL WT IS BELOW RWY LIMIT WT BUT NOT LESS THAN VMCG.

FOR V2 USE GREATER OF V2 FOR TAKEOFF WEIGHT OR V2 MIN FOR AMBIENT TEMPERATURE.

(3) WEIGHT CORRECTIONS
ALT SETTING-FOR EACH .10 IN HG BELOW 29.70 USE 1 DEG HOTTER TEMP

WIND-ADJUST RWY ZERO WIND
ADD 700 LBS/KT EFF H.W.
SUB 3340 LBS/KT EFF T.W.

(5)

(9) 473,300
400,000
73,300=37 KTS
150-37=113 KTS

TEMP DEG F	RWY ZERO WIND	CLIMB LIMIT
-10	4883	4500
0	4840	4500
10	4794	4500
20	4748	4500
30	4706	4500
[illegible]	4663	4500
42	4656	4500
44	4649	4500
46	4642	4500
48	4635	4500
50	4628	4500
52	4621	4500
54	4614	4500
56	4607	4500
58	4600	4500
60	4593	4500
62	4585	4500
64	4577	4500
66	4570	4500
68	4562	4500
70	4554	4500
72	4546	4500
74	4538	4500
76	4530	4500
78	4523	4500
80	4515	4500
82	4510	4500
84	4505	4500
86	4486	4500
88	4465	4500
90	4444	4500
92	4414	4500
94	4384	4461
96	4355	4420
98	4325	4379
100	4255	4338
102	4263	4300
104	4231	4262
106	4199	4223
108	4167	4185
110	4134	4147
115	4064	4055
120	3995	3963
130	3858	3793

(6) SLUSH MAX WT-REDUCE R W LIMIT WT BY 10 PERCENT.
ASI MAX WT- REDUCE R W LIMIT WT BY 14000 LBS.

DO NOT EXCEED STRUCTURAL LIMIT WEIGHT

1011

430,000

V_1 118 V_R 148 V_2 159

V_{MCG} 118 V_{2min} 143

	ASSUMED	ALLOWABLE
EPR	—	.532
N1%		90

(13)

INITIAL CLIMB N1 ____ % STAB TRIM ____

(1) TEMP 40 °F 20 °C ALTM 30.01
WIND 100/10 -ELEV 1

(3) PERF TEMP 40 STA PR 30.00

RWY ZERO WIND 466,300

(4) PERFORMANCE ADJ(±) —

ADJ RWY ZERO WIND 466,300

(5) RWY WIND ADJ(±) 7,000

RWY LIMIT WT 473,300

ASI/SLUSH ADJ(−) 47,330

(6) ASI/SLUSH MAX WT 425,970

(7) STRUCT/CLIMB 430,000

(8) **MAX TAKEOFF WT** 425,970

(2) ACTUAL WT 400,000

LDG WT ____ GA EPR ____

ATIS ____

GENERAL

Landing charts are primarily planning charts. Their purpose is to determine a maximum landing weight for the runway and conditions forecast for the time of arrival.

The Airport Landing Gross Weight Data charts provide landing weight information computed for 33° flaps for all conditions.

The weights shown in the Max Weight Zero Wind columns may be in excess of the maximum certificated landing weight, if sufficient runway length is available. The weights are shown in this manner to provide landing performance guidance, should an emergency situation dictate an overweight landing.

There are two weights listed on the landing charts that may normally never be exceeded at the actual time of arrival. These weights are:

The maximum certificated landing weight.

The weights listed in the Wet Dispatch or Arrival Below 3/4 or 4000 RVR column. The weights in this column are an arrival limit only when the visibility is less than 3/4 mile or 4000 RVR at the time of initiating the approach.

CHART DESCRIPTION

AIRPORT COLUMN

The Airport column contains the station identification, aircraft model, runway number and runway length. When special information about a runway is required, the runway number will be preceded by an alphabetical code. The information will then be listed in the station block. Runway length is measured from the landing displaced threshold if applicable.

DRY DISPATCH COLUMN

The Dry Dispatch column is based on stopping within 60% of the runway length without using reverse thrust and contains all the data necessary to determine runway limited landing weights for normal operations. It includes the maximum weight zero wind gross weights and the headwind and tailwind accountability factors used to adjust the zero wind weight for the actual wind component.

WET DISPATCH OR ARRIVAL BELOW 3/4 OR 4000 RVR COLUMN

The weights in this column are based on a requirement to have 15% additional runway over the dry dispatch requirements whenever the runway is forecast to be wet, or whenever an approach is made with less than 3/4 mile or 4000 RVR visibility. This is actually two columns combined into one. The wet dispatch part applies only at the time of dispatch. The arrival below 3/4 or 4000 RVR part is a limitation only at the time of initiating the approach.

This column is used to plan for an appropriate landing weight when the arrival runway is forecast to be wet or slippery. A forecast wet or slippery runway is defined as follows:

Precipitation heavier than light when the temperature is 26°F or higher.

If the forecast calls for precipitation to end, the runway shall be considered to be wet or slippery for at least 30 minutes after the end of the forecast.

Where probability of precipitation is forecast, whether continuous or intermittent, 50% or greater is considered wet.

When the visibility is below 3/4 mile or 4000 RVR at the time of initiating the approach, the weights in this column are an actual limit and should not be exceeded.

ANTI-SKID INOPERATIVE COLUMN

The anti-skid inoperative weights take into account the increased stopping distance that may be required with anti-skid inoperative. This column applies only when being dispatched with anti-skid inoperative. An anti-skid inoperative dispatch must always be a dry dispatch.

AIRPORT TEMPERATURE LIMITS COLUMN

The Airport Temperature Limits column contains information based on go-around capability and maximum certificated temperature limits. This column is a required consideration only at the time of dispatch.

Airport Critical Temperature:

The airport critical temperature is the hottest temperature that a missed approach can be made at maximum certificated landing gross weight.

Two missed approach configurations are used to determine go-around capability. They are the engine out missed approach figured with gear up and flaps 10°, and the all engine missed approach figured with gear down and flaps 33°. The airport critical temperature is based on the most restrictive of these capabilities.

The Pounds Per °F Above Crit Temp factor allows the certificated landing weight to be adjusted for the loss in performance above critical temperature.

CHART DESCRIPTION (Cont'd)

Maximum Airport Operating Temperature:

The maximum airport operating temperature is a limitation established in certification. Dispatch to a destination forecasting a temperature in excess of the maximum airport operating temperature is not permitted; however, landing is permitted if the actual temperature on arrival exceeds maximum airport operating temperature.

MAXIMUM PLANNED LANDING WEIGHT

To determine the maximum planned landing weight, proceed as follows:

1. Select the desired airport, aircraft model, runway and landing column. Read the maximum zero wind weight.

2. If zero wind weight is less than maximum certificated landing weight, and a headwind component is forecast, the landing weight may be increased by the actual headwind component in knots times the Add Lbs/Kt. HW value. The landing weight may be increased only to the maximum certificated landing gross weight.

3. If a tailwind is forecast, reduce the maximum weight zero wind by the actual tailwind in knots times the Sub Lbs/Kt. TW value. An actual tailwind of 10 knots may not be exceeded.

4. Check the airport temperature column and determine missed approach capability. If the forecast temperature is in excess of the airport critical temperature but below maximum operating temperature, subtract the product of the excess temperature and the Sub Lb/°F from the maximum certificated landing gross weight.

   When an MEL/CDL item requires reducing the published critical temperature below the forecast temperature, reduce the Max Structural Weight by the published Sub Lb/°F factor in the normal manner. If a Sub Lb/°F factor is not shown, use 2100 Lb/°F.

5. The maximum planned landing gross weight is the lesser of the gross weights calculated above and should never exceed the maximum certificated landing weight.

TAILWIND LIMITS

The following tailwind limits apply at the actual time of arrival.

Runways clean and dry:

No tailwind is permitted on runways shorter than 6000'. 10 knots tailwind is permitted on runways of 6000' and longer.

Runways NOT clean and dry:

No tailwind is permitted on runways shorter than 6500'. 5 knots tailwind is permitted on runways of 6500' to 7000', provided the total surface wind is 10 knots or less. 10 knots tailwind is permitted on runways of 7000 and longer.

SLUSH

To avoid damage to the aircraft, landing shall not be made in standing water, slush, or wet snow in excess of 1" depth. This depth limitation is intended for general conditions of the runway and not isolated puddles. However, particular attention should be given to the approach end of the runway in evaluating this condition.

OVERWEIGHT LANDING

An overweight landing is defined as a landing made at a weight greater than the maximum certificated landing weight. When a landing is made over the maximum certificated landing weight, note in the logbook that an overweight landing was made and indicate whether the landing was "normal" or "hard." An overweight landing inspection will be conducted. Additionally, the emergency authority form must be completed. Refer to the Flight Operations Policy Manual for details.

In the event that some emergency exists necessitating a flight return or an unscheduled landing en route, use the following guidelines to determine the need for fuel dumping.

ALL ENGINES OPERATING

SCD - Fuel should not be dumped provided aircraft weight is equal to or less than the maximum landing weight determined from the landing gross weight charts. The maximum landing weight is determined in the normal manner except that it can exceed the maximum certificated landing weight and critical temperature adjustment is not necessary.

A headwind component cannot be used to increase the maximum landing weight above the maximum certificated landing weights. If a tailwind component exists, it must be used to reduce the published maximum zero wind landing weight.

If aircraft weight is greater than the maximum landing weight determined from the landing charts, weight should be reduced by dumping fuel to the maximum landing weight.

OVERWEIGHT LANDING (Cont'd)

ONE ENGINE INOPERATIVE

Fuel should be dumped to the lowest of the maximum landing weight determined under All Engines Operating, or the engine out missed approach limit weight. To determine the engine out missed approach weight, use the Engine Out Maximum Landing Gross Weight Charts in this section.

BRAKE ENERGY

Whenever the brake temperatures go into the red area a minimum of fifty minutes ground time should be observed unless maintenance ascertains a shorter period.

ENGINE OUT MAXIMUM LANDING GROSS WEIGHT

ALTITUDE - FT.

TEMPERATURE - °F	SL	500	1,000	1,500	2,000	2,500	3,000	4,000	5,000	6,000
60	466.0	466.0	466.0	466.0	466.0	466.0	466.0	466.0	454.0	442.0
62									454.0	442.0
64									454.0	439.0
66									454.0	436.0
68									451.0	433.0
70									448.0	430.0
72								466.0	443.0	426.0
74								457.0	439.0	423.0
76								453.0	436.0	419.0
78								449.0	432.0	415.0
80							466.0	446.0	428.0	411.0
82							459.0	441.0	424.0	407.0
84						466.0	455.0	437.0	420.0	403.0
86						460.0	451.0	433.0	416.0	400.0
88					466.0	456.0	447.0	430.0	413.0	396.0
90					461.0	452.0	443.0	426.0	409.0	392.0
92				466.0	456.0	448.0	439.0	422.0	405.0	389.0
94				461.0	452.0	444.0	434.0	418.0	401.0	385.0
96				456.0	448.0	439.0	430.0	414.0	398.0	381.0
98			466.0	452.0	444.0	435.0	426.0	410.0	394.0	378.0
100			457.0	448.0	439.0	431.0	422.0	406.0	390.0	374.0
102		466.0	453.0	444.0	435.0	427.0	418.0	402.0	386.0	370.0
104		460.0	448.0	440.0	431.0	423.0	415.0	398.0	382.0	367.0
106	466.0	455.0	444.0	435.0	428.0	419.0	411.0	394.0	379.0	368.0
108	458.0	450.0	440.0	432.0	424.0	415.0	407.0	390.0	375.0	360.0
110	454.0	445.0	436.0	428.0	420.0	411.0	403.0	387.0	372.0	356.0
112	450.0	441.0	432.0	424.0	416.0	408.0	399.0	383.0	368.0	353.0
114	445.0	437.0	427.0	420.0	412.0	404.0	396.0	379.0	364.0	
116	441.0	432.0	423.0	415.0	408.0	400.0	392.0	375.0		
118	436.0	428.0	419.0	411.0	404.0	396.0	388.0			
120	432.0	424.0	415.0	408.0	400.0	392.0	384.0			

EXAMPLE: IF THE TEMPERATURE IS 97°F AND THE FIELD ELEVATION IS 3000 FT., THE AIRCRAFT WEIGHT CANNOT EXCEED 428,000 LBS. TO MEET THE ENGINE OUT MAXIMUM LANDING GROSS WEIGHT.

NOTE: LANDING GROSS WEIGHT MUST NOT EXCEED RUNWAY LIMITED WEIGHTS ON LANDING CHARTS

* * *

AIRPORT				DRY Dsp.			WET Dsp or Arrival Below ¾ or 4000 RVR			ANTI SKID-INOP			APT TEMP LIMITS Missed APP		
STATION 1011 LANDING DATA PAGE 1011.01 1 DEC 78	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	APT CRIT TEMP	● SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
ALBUQUERQUE, NEW MEXICO	1011	8	12774	500000	0	8530	500000	0	9330	477600	0	9330	109	1690	110
ALBUQUERQUE INT'L APT.		T 8 -T 26	8600	443200	0	7440	380000	0	7270	295400	1840	5520			
ALT. 5352 FT.		17 - 35	8993	463800	0	7410	399900	0	7360	312500	1880	5560			
T TEMPORARY RWY LENGTH		T 17	9000	464100	0	7410	400200	0	7360	312800	1880	5570			
DUE TO HIP.		26	13373	500000	0	8610	500000	0	9430	500000	0	9430			
		T 35	10000	500000	0	7760	448300	0	7430	356500	1960	5670			
AMARILLO, TEXAS AMARILLO AIR TERMINAL ALT. 3605 FT.	1011	4 - 22	13500	500000	0	8570	500000	0	9370	500000	0	9370	117	0	117
ATLANTA, GEORGIA	1011	8 - 26	10000	500000	0	9010	498600	0	8010	402700	0	6370	126	0	126
HARTSFIELD ATLANTA INT'L		K 8 -K 26	8750	500000	0	7690	486500	0	7910	390500	0	6340			
ALT. 1026 FT.		9L- 27R	9001	458800	0	7940	392900	0	7710	304800	2010	6120			
K IFR LANDING DUE TO DISPLACED G/S.		9R- 27L	9000	500000	0	7740	448200	0	7930	353700	2110	6240			
BALTIMORE, MARYLAND	1011	10 - 28	9452	500000	0	7770	480700	0	7950	385700	0	6470	129	0	129
BALT-WASH INT'L ALT. 146 FT.		15R- 33L	9519	500000	0	7790	484100	0	7950	389100	0	6480			
BANGOR, MAINE BANGOR INTERNATIONAL ALT. 192 FT.	1011	15 - 33	11438	500000	0	8110	500000	0	8930	484900	0	8930	129	0	129
BOSTON, MASSACHUSETTS	1011	4L	7860	460400	0	7970	394900	0	7800	306800	2060	6290	130	0	130
LOGAN INTERNATIONAL APT.		4R	8838	500000	0	7800	449700	0	7960	356100	2150	6410			
ALT. 20 FT.		Y 4R	10000	500000	0	8010	500000	0	8020	414800	0	6560			
* TO BE USED WHEN VESSELS >		9	7000	335100	2070	7430	280000	2100	6880	N.A.					
NOT IN HARBOR. >		* 9 -* 27	7000	405800	0	7850	343900	2060	7500	263300	1970	6180			
Y DAY VFR ONLY.		15R	9190	500000	0	7740	468300	0	7960	373900	0	6460			
		22L	10000	500000	0	7850	491700	0	7920	397100	0	6520			
		22R	7032	407900	0	7860	345800	2060	7510	265000	1970	6190			
>		27	7000	385900	0	7760	325700	2080	7340	248300	1940	6140			
		33L	10080	500000	0	8010	500000	0	8070	418800	0	6570			
BRUSSELS, BELGIUM	1011	2 - 20	9249	500000	0	7730	470000	0	7970	375100	0	6440	129	0	129
BRUSSELS NATIONAL APT.		7L	11680	500000	0	8130	500000	0	8980	497200	0	8980			
ALT. 180 FT.		7R	10125	500000	0	8010	500000	0	8070	419100	0	6550			
K IFR LANDING DUE TO		Z 20	8524	497800	0	7900	431100	0	7940	338700	2110	6340			
DISPLACED G/S.		25L	10535	500000	0	8050	500000	0	8420	439700	0	6600			
Z NIGHT OR IFR DUE TO		25R	11936	500000	0	8150	500000	0	9000	500000	0	9000			
DISPLACED THRESHOLD.		K 25R	10038	500000	0	8080	500000	0	8700	465000	0	6660			
		Z 25R	11125	500000	0	8090	500000	0	8750	469300	0	6670			

NOTE: PLANNED LDG. WT. MUST NOT EXCEED THE FOLLOWING MAXIMUM CERTIFICATED LDG. WT.

1011	1011-100
358,000	368,000

● SUB. FROM CERTIFICATED LDG WT
> DENOTES NEW DATA
N.A NOT AUTHORIZED
FOR ADDITIONAL T W RESTRICTIONS SEE LDG INST IN F H B

AIRPORT				DRY Dsp.			WET Dsp or Arrival Below ¾ or 4000 RVR			ANTI SKID-INOP			APT TEMP LIMITS Missed APP		
STATION 1011 LANDING DATA PAGE 1011.02 1 DEC 78	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	APT CRIT TEMP	*SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
CHICAGO, ILLINOIS	1011	4L- 22R	7500	431800	0	7930	367600	2010	7600	283200	1980	6130	127	0	127
O'HARE INTERNATIONAL APT		4R- 22L	8071	466900	0	7970	400700	0	7800	311500	2040	6200			
ALT. 667 FT.		5L- 27R	7416	426500	0	7910	362700	2020	7560	279100	1970	6120			
Q HOLD SHORT OF		9R- 27L	10141	500000	0	8050	500000	0	8070	414000	0	6450			
INTERSECTION.		K 9R	8821	500000	0	7880	494000	0	7900	398100	0	6410			
K IFR LANDING DUE TO		14L- 32R	10003	500000	0	7980	500000	0	7980	407100	0	6440			
DISPLACED G/S.		Q 14L	8700	500000	0	7860	436000	0	7940	342600	2100	6270			
		14R- 32L	11600	500000	0	8180	500000	0	9020	486200	0	9020			
		Q 14R	10200	500000	0	8050	500000	0	8110	416900	0	6460			
		K 32R	8623	500000	0	7800	484300	0	7940	388300	0	6390			
CINCINNATI, OHIO	1011	9R- 27L	7800	448100	0	7940	382900	0	7670	296200	2000	6120	126	0	126
GREATER CINCINNATI APT.		18 - 36	9501	500000	0	7790	475700	0	7950	379800	0	6330			
ALT. 890 FT.															
CLEVELAND, OHIO	1011	5R- 23L	8998	500000	0	7740	450700	0	7960	356100	2120	6290	127	0	127
HOPKINS INTERNATIONAL															
ALT. 792 FT.															
COLORADO SPRINGS, COLO.	1011	D 3	8374	421800	0	7340	359800	1770	7000	278500	1790	5400	102	1770	107
CITY OF COLO SPRINGS MUN		12 - 30	8511	429200	0	7360	366800	1760	7060	284400	1800	5420			
ALT. 6172 FT.		17 - 35	11013	500000	0	8350	486000	0	7550	391800	0	5690			
D DAY USE ONLY.															
COLUMBUS, OHIO.	1011	10R- 28L	10700	500000	0	8140	500000	0	8510	439700	0	6490	127	0	127
PORT COLUMBUS INT'L APT.		K 28L	9100	500000	0	8050	500000	0	8050	410100	0	6420			
ALT. 816 FT.															
K IFR LANDING DUE TO															
DISPLACED G/S.															
DAYTON, OHIO	1011	6L- 24R	9500	500000	0	7800	474300	0	7940	378400	0	6310	126	0	126
COX DAYTON MUN. AIRPORT		6R- 24L	7000	395900	0	7730	334900	2020	7300	255900	1910	6000			
ALT. 1008 FT.		18 - 36	7000	395900	0	7730	334900	2020	7300	255900	1910	6000			
DENVER, COLORADO	1011	8R- 26L	10004	500000	0	7760	448700	0	7430	356900	1970	5680	109	1690	110
STAPLETON INT'L APT		17L- 35R	12000	500000	0	8540	500000	0	8910	444000	0	5900			
ALT. 5331 FT.		17R- 35L	11500	500000	0	8510	500000	0	8640	422200	0	5840			
DES MOINES, IOWA	1011	12L- 30R	9000	500000	0	7740	449000	0	7940	354500	2110	6260	126	0	126
DES MOINES MUNICIPAL APT															
ALT. 957 FT.															
DETROIT, MICHIGAN	1011	3C	8500	492000	0	7910	425200	0	7910	333000	2080	6250	127	0	127
METRO WAYNE COUNTY APT.		3L- 21R	10500	500000	0	8080	500000	0	8370	432100	0	6500			
ALT. 639 FT.		3R- 21L	10000	500000	0	7980	500000	0	7980	407300	0	6440			
		9 - 27	8702	500000	0	7860	436400	0	7940	343000	2100	6280			
		21C	8500	492000	0	7910	425200	0	7910	333000	2080	6250			

NOTE: PLANNED LDG. WT. MUST NOT EXCEED THE FOLLOWING MAXIMUM CERTIFICATED LDG. WT.

1011	1011-100
358,000	368,000

- * SUB. FROM CERTIFICATED LDG WT
- \> DENOTES NEW DATA
- N.A. NOT AUTHORIZED
- FOR ADDITIONAL T.W RESTRICTIONS SEE LDG INST. IN F.H.B.

TRANS WORLD AIRLINES

JET AIRCRAFT AIRPORT LANDING GROSS WEIGHT DATA

1011

AIRPORT				DRY Dsp			WET Dsp or Arrival Below ¾ or 4000 RVR			ANTI SKID-INOP			APT TEMP LIMITS		
													Missed APP		
STATION 1011 LANDING DATA PAGE 1011.93 1 DEC 78	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	APT CRIT TEMP	*SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
DUBLIN, IRELAND DUBLIN AIRPORT ALT. 222 FT.	1011	6 - 24 17 - 35	7500 6800	436300 390700	0 0	7950 7780	371900 329900	0 2070	7670 7350	286900 251800	2010 1940	6210 6120	129	0	129
EDMONTON, ALTA CANADA EDMONTON INT'L APT ALT. 2373 FT.	1011	1 - 19 11 - 29	11000 10200	500000 500000	0 0	9390 9110	500000 491700	0 0	8620 7710	435700 397800	0 0	6290 6190	121	0	121
FORT LAUDERDALE, FLORIDA HOLLYWOOD INT'L APT. ALT. 10 FT.	1011	9L 27R	7452 7441	435100 434400	0 0	7940 7940	371000 370400	0 0	7680 7670	286200 285700	2010 2010	6240 6240	130	0	130
FRANKFURT, GERMANY FRANKFURT/MAIN AIRPORT ALT. 368 FT.	1011	7L- 25R 7R 25L	12795 12303 11450	500000 500000 500000	0 0 0	8230 8190 8120	500000 500000 500000	0 0 0	9080 9050 8930	500000 500000 483000	0 0 0	9080 9050 8930	128	0	128
GANDER, NEWFOUNDLAND GANDER INTERNATIONAL APT ALT. 496 FT. K IFR LANDING DUE TO DISPLACED G/S.	1011	4 14 - 32 22 K 32	10500 8900 10200 7600	500000 500000 500000 499100	0 0 0 0	8060 7780 8030 7890	500000 448600 500000 432200	0 0 0 0	8360 7970 8110 7940	433900 354300 419000 339400	0 2130 0 2100	6530 6330 6490 6290	128	0	128
GENEVA, SWITZERLAND COINTRIN APT. ALT. 1411 FT. K IFR LANDING DUE TO DISPLACED G/S.	1011	5 K 5 23	11860 10843 12795	500000 500000 500000	0 0 0	8350 8350 8430	500000 500000 500000	0 0 0	9150 9140 9210	488700 487800 500000	0 0 0	9150 9140 9210	125	0	125
GLASGOW, U.K. GLASGOW APT. ALT. 26 FT.	1011	6 24	8419 7720	493200 451800	0 0	7910 7960	426600 386700	0 0	7920 7760	334900 299600	2110 2040	6360 6270	130	0	130
GOOSE, NEWFOUNDLAND. GOOSE AIRPORT. ALT. 160 FT. K IFR LANDING DUE TO DISPLACED G/S.	1011	9 - 27 16 - 34 K 27	11050 9570 9550	500000 500000 500000	0 0 0	8080 7800 8050	500000 486500 500000	0 0 0	8710 7940 8430	465900 391500 440700	0 0 0	6670 6480 6600	129	0	129
HALIFAX, NOVA SCOTIA HALIFAX INTERNATIONAL ALT. 477 FT.	1011	6 - 24 15 - 33	8800 7700	500000 446400	0 0	7820 7970	443400 381200	0 0	7960 7710	349500 294800	2120 2010	6320 6190	128	0	128
INDIANAPOLIS, INDIANA WEIR COOK AIRPORT ALT. 797 FT.	1011	4L- 22R 13 - 31	10005 7604	500000 437000	0 0	7990 7930	500000 372400	0 0	7990 7610	405700 287300	0 1980	6410 6110	127	0	127

NOTE: PLANNED LDG. WT. MUST NOT EXCEED THE FOLLOWING MAXIMUM CERTIFICATED LDG. WT.

1011	1011-100
358,000	368,000

* SUB. FROM CERTIFICATED LDG WT
> DENOTES NEW DATA
N A NOT AUTHORIZED
FOR ADDITIONAL T W RESTRICTIONS SEE LDG. INST IN F H B

TRANS WORLD AIRLINES

JET AIRCRAFT
AIRPORT LANDING GROSS WEIGHT DATA

AIRPORT				DRY Dsp.			WET Dsp or Arrival Below ¾ or 4000 RVR			ANTI SKID-INOP			APT TEMP LIMITS Missed APP		
STATION 1011 LANDING DATA PAGE 1011.04 1 DEC 78	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	APT CRIT TEMP	*SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
JACKSONVILLE, FLORIDA	1011	7 - 25	8000	468800	0	7960	402900	0	7840	313700	2070	6310	130	0	130
JACKSONVILLE INT'L APT.		13 - 31	7701	450600	0	7960	385500	0	7760	298700	2040	6270			
ALT. 29 FT.															
KANSAS CITY, MISSOURI	1011	1 - 19	10801	500000	0	8200	500000	0	8570	441900	0	6460	126	0	126
KANSAS CITY INT'L APT.		K 1	9381	500000	0	8160	500000	0	8290	421400	0	6410			
ALT. 1025 FT.		9 - 27	9500	500000	0	7800	474100	0	7940	378200	0	6300			
K IFR LANDING DUE TO		K 9	8220	500000	0	7750	459800	0	7940	364500	2130	6270			
DISPLACED G/S.															
KEFLAVIK, ICELAND	1011	3 - 21	10000	500000	0	7990	500000	0	7990	413000	0	6530	129	0	129
KEFLAVIK AIRPORT		7 - 25	6962	402000	0	7840	340200	2060	7450	260300	1960	6150			
ALT. 169 FT.		12 - 30	10013	500000	0	8000	500000	0	8000	413600	0	6530			
LAS VEGAS, NEVADA	1011	1R	9279	500000	0	7730	449100	0	7790	356000	2070	6100	122	0	122
MC CARRAN INTERNATIONAL		7	10963	500000	0	8390	500000	0	8630	436100	0	6310			
ALT. 2171 FT.		19L	8910	496200	0	7720	429900	0	7730	338400	2040	6060			
		25	12636	500000	0	8480	500000	0	9270	500000	0	9270			
LISBON, PORTUGAL	1011	3	12483	500000	0	8200	500000	0	9060	500000	0	9060	128	0	128
LISBON AIRPORT		18	7874	458100	0	7980	392400	0	7780	304300	2030	6230			
ALT. 374 FT.		21	11968	500000	0	8160	500000	0	9020	500000	0	9020			
LONDON, ENGLAND	1011	8	9075	500000	0	7710	460700	0	7980	366100	2170	6410	129	0	129
GATWICK AIRPORT		26	9290	500000	0	7730	472000	0	7970	376900	0	6440			
ALT. 202 FT.															
LONDON, ENGLAND	1011	5 - 23	7733	449700	0	7970	384700	0	7750	297900	2030	6260	129	0	129
HEATHROW AIRPORT		10L	11801	500000	0	8140	500000	0	8980	500000	0	8980			
ALT. 80 FT.		10R	11000	500000	0	8080	500000	0	8680	464400	0	6680			
T TEMPORARY RWY LENGTH		28L	12000	500000	0	8150	500000	0	8990	500000	0	8990			
DUE TO WIP.		T 28L	11615	500000	0	8120	500000	0	8960	495400	0	8960			
		28R	12902	500000	0	8210	500000	0	9040	500000	0	9040			
LONG BEACH, CALIFORNIA	1011	12	8651	500000	0	7860	439200	0	7950	346300	2130	6380	129	0	129
LONG BEACH AIRPORT		30	10000	500000	0	8010	500000	0	8010	414300	0	6550			
ALT. 58 FT.															
LOS ANGELES, CALIFORNIA	1011	6L - 24R	8924	500000	0	7770	453400	0	7970	359400	2160	6410	129	0	129
LOS ANGELES INT'L APT.		6R	9953	500000	0	7970	500000	0	7970	411100	0	6530			
ALT. 126 FT.		W 7R	11697	500000	0	8130	500000	0	8970	498900	0	8970			
* IFR LANDING DUE TO		24L	10284	500000	0	8020	500000	0	8190	427800	0	6580			
DISPLACED G/S.		* 25L	10101	500000	0	8090	500000	0	8740	468900	0	6680			
BEARING STRENGTH WT		W 25L	11387	500000	0	8110	500000	0	8900	483300	0	8900			
LIMITED TO 325,000 LBS.															
W BEARING STRENGTH WT															
LIMITED TO 325,000 LBS.															

NOTE: PLANNED LDG. WT. MUST NOT EXCEED THE FOLLOWING MAXIMUM CERTIFICATED LDG. WT.

1011	1011-100
358,000	368,000

* SUB FROM CERTIFICATED LDG WT
> DENOTES NEW DATA
N.A NOT AUTHORIZED
FOR ADDITIONAL TW RESTRICTIONS SEE LDG INST IN F.H.B.

1011

AIRPORT				DRY Dsp.			WET Dsp or Arrival Below ¾ or 4000 RVR			ANTI SKID-INOP			APT TEMP LIMITS Missed APP		
STATION 1011 LANDING DATA PAGE 1011.05 1 DEC 78	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	APT CRIT TEMP	*SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
LOUISVILLE, KENTUCKY STANDIFORD FIELD ALT. 497 FT.	1011	1 - 19	7800	452300	0	7980	386900	0	7740	299600	2020	6190	128	0	128
		11 - 29	7249	417500	0	7890	354400	2030	7520	272200	1970	6130			
LYON, FRANCE SATOLAS APT. ALT. 814 FT. K IFR LANDING DUE TO DISPLACED G/S.	1011	18 - 36	13123	500000	0	8340	500000	0	9150	500000	0	9150	127	0	127
		K 36	11842	500000	0	8320	500000	0	9130	500000	0	9130			
MADRID, SPAIN BARAJAS AIRPORT ALT. 1998 FT.	1011	1 - 19	12139	500000	0	8460	500000	0	9250	494200	0	9250	122	0	122
		15 - 33	13451	500000	0	8540	500000	0	9320	500000	0	9320			
MANCHESTER, ENGLAND MANCHESTER AIRPORT ALT. 256 FT.	1011	6 - 24	8600	500000	0	7880	434600	0	7950	341800	2110	6340	129	0	129
MARSEILLE, FRANCE MARIGNANE AIRPORT ALT. 66 FT.	1011	14L	8622	500000	0	7870	437500	0	7950	344800	2130	6380	129	0	129
		14R	7776	454900	0	7970	389600	0	7780	302100	2040	6270			
		32L	7431	433300	0	7940	369300	0	7660	284700	2010	6230			
		32R	9465	500000	0	7780	482100	0	7950	387200	0	6480			
MIAMI, FLORIDA MIAMI INTERNATIONAL APT. ALT. 10 FT. K IFR LANDING DUE TO DISPLACED G/S.	1011	9L- 27R	10502	500000	0	8050	500000	0	8400	440200	0	6630	130	0	130
		9R- 27L	9350	500000	0	7770	476700	0	7950	382100	0	6480			
		12 - 30	9601	500000	0	7830	489300	0	7920	394700	0	6510			
		K 27L	8100	500000	0	7740	463700	0	7960	369400	0	6450			
MILWAUKEE, WISCONSIN GENERAL MITCHELL FIELD ALT. 723 FT. K IFR LANDING DUE TO DISPLACED G/S.	1011	K 1L	8439	500000	0	7760	474400	0	7960	378600	0	6350	127	0	127
		7R	8011	462800	0	7970	396700	0	7770	308000	2030	6180			
		25L	7488	430500	0	7920	366400	2010	7580	282200	1980	6110			
MINNEAPOLIS, MINNESOTA MINNEAPOLIS ST PAUL INTL ALT. 840 FT.	1011	4	8256	475900	0	7950	409400	0	7820	319000	2040	6190	127	0	127
		11L- 29R	8201	472700	0	7950	406300	0	7810	316300	2040	6180			
		11R- 29L	10000	500000	0	7990	500000	0	7990	404900	0	6400			
		22	7256	414400	0	7840	351600	2020	7460	269800	1950	6060			
MONTREAL, QUE., CANADA. MONTREAL/MIRABEL INT'L. ALT. 270 FT.	1011	6 - 24	12000	500000	0	8150	500000	0	9010	500000	0	9010	129	0	129
		11 - 29	12000	500000	0	8150	500000	0	9010	500000	0	9010			
NEWARK, NEW JERSEY NEWARK INTERNATIONAL APT ALT. 18 FT.	1011	4L	7449	434900	0	7940	370800	0	7680	286000	2010	6240	130	0	130
		4R	8610	500000	0	7870	437300	0	7940	344600	2130	6390			
		22L	8211	481300	0	7940	415000	0	7880	324500	2090	6340			
		22R	7749	453600	0	7960	388400	0	7770	301200	2040	6280			

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1011	1011-100
358,000	368,000

* SUB FROM CERTIFICATED LDG WT
> DENOTES NEW DATA
N.A. NOT AUTHORIZED
FOR ADDITIONAL T.W. RESTRICTIONS SEE LDG. INST. IN F.H.B.

AIRPORT				DRY Dsp			WET Dsp or Arrival Below ¾ or 4000 RVR			ANTI SKID-INOP			APT TEMP LIMITS Missed APP		
STATION 1011 LANDING DATA PAGE 1011.36 1 DEC 78	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	APT CRIT TEMP	●SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
NEWBURGH, NEW YORK	1011	9	7951	461800	0	7980	395900	0	7790	307300	2040	6220	128	0	128
STEWART AIRPORT		27	7016	402600	0	7830	340700	2050	7420	260800	1940	6100			
ALT. 471 FT.															
NEW YORK, NEW YORK	1011	4L	11352	500000	0	8110	500000	0	8880	483100	0	8880	130	0	130
J.F. KENNEDY INT'L APT.		4R- 22L	8400	492300	0	7920	425700	0	7920	334100	2110	6360			
ALT. 12 FT.		13L	9015	500000	0	7730	459200	0	7970	365100	2170	6440			
		13R	11972	500000	0	8150	500000	0	8990	500000	0	8990			
		22R	8330	498300	0	7930	421800	0	7910	330600	2100	6350			
		31L	11252	500000	0	8100	500000	0	8820	478100	0	6720			
		31R	8976	500000	0	7750	457100	0	7970	363200	2170	6430			
NEW YORK, NEW YORK.	1011	4	6999	404400	0	7850	342600	2060	7490	262300	1970	6180	130	0	130
LA GUARDIA AIRPORT.		13	6999	405700	0	7850	343800	2060	7500	263300	1970	6180			
ALT. 22 FT.		22	6999	405700	0	7850	343800	2060	7500	263300	1970	6180			
		31	6820	393900	0	7800	332900	2070	7410	254300	1950	6160			
NICE, FRANCE	1011	5 - 23	9678	500000	0	7860	493100	0	7910	398600	0	6520	130	0	130
COTE D AZUR AIRPORT >		T 23	7546	441000	0	7950	376600	0	7710	291000	2020	6250			
ALT. 13 FT.															
T TEMPORARY RWY LENGTH DUE TO WIP.															
OAKLAND, CALIFORNIA	1011	11 - 29	10000	500000	0	8010	500000	0	8020	414900	0	6560	130	0	130
METRO OAKLAND INT'L APT.															
ALT. 6 FT.															
OKLAHOMA CITY, OKLAHOMA	1011	17R- 35L	9800	500000	0	7900	485800	0	7880	390000	0	6300	125	0	125
WILL ROGERS WORLD APT.															
ALT. 1294 FT.															
ORLANDO, FLA. >	1011	18L- 36R	11002	500000	0	8080	500000	0	8680	464300	0	6670	129	0	129
ORLANDO INT'L APT. >		18R- 36L	12002	500000	0	8150	500000	0	9000	500000	0	9000			
ALT. 96 FT.															
OTTAWA, CANADA	1011	7 - 25	8000	465700	0	7980	399600	0	7820	310600	2050	6240	128	0	128
OTTAWA INTERNATIONAL APT		14 -N 32	9400	500000	0	7740	476000	0	7970	380500	0	6420			
ALT. 374 FT.		D 32	10000	500000	0	7980	500000	0	7980	410500	0	6490			
N NIGHT USE ONLY.															
D DAY USE ONLY.															
PALM SPRINGS, CALIF. >	1011	12 - 30	7013	402600	0	7830	340800	2050	7420	260800	1940	6110	128	0	128
PALM SPRINGS MUN APT.															
ALT. 448 FT.															

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1011	1011-100
358,000	368,000

● SUB. FROM CERTIFICATED LDG WT.
> DENOTES NEW DATA
N.A. NOT AUTHORIZED
FOR ADDITIONAL T.W RESTRICTIONS SEE LDG INST IN FHB

TRANS WORLD AIRLINES
JET AIRCRAFT AIRPORT LANDING GROSS WEIGHT DATA

AIRPORT				DRY Dsp.			WET Dsp or Arrival Below ¾ or 4000 RVR			ANTI SKID-INOP			APT TEMP LIMITS Missed APP		
STATION 1011 LANDING DATA PAGE 1011.07 1 DEC 78	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	APT CRIT TEMP	*SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
PALMDALE, CALIFORNIA AIR FORCE PLANT #42 ALT. 2542 FT. K IFR LANDING DUE TO DISPLACED G/S. D DAY USE ONLY.	1011	D 4	12000	500000	0	8440	500000	0	9140	480300	0	9140	120	0	120
		7 - 25	12002	500000	0	8440	500000	0	9150	481400	0	9150			
		D 22	12000	500000	0	8440	500000	0	9150	481300	0	9150			
		K 25	10662	500000	0	8420	500000	0	8960	465300	0	6350			
PARIS, FRANCE CHARLES DE GAULLE INT'L ALT. 387 FT.	1011	9 - 27	11811	500000	0	8150	500000	0	9010	500000	0	9010	128	0	128
		10 - 28	9072	500000	0	7700	458800	0	7980	364000	2150	6370			
PARIS, FRANCE ORLY AIRPORT ALT. 292 FT.	1011	2L	7874	456400	0	7980	390800	0	7780	303100	2040	6240	129	0	129
		7	10991	500000	0	8080	500000	0	8670	461100	0	6630			
		8	10892	500000	0	8070	500000	0	8620	456200	0	6620			
		20R	7874	458900	0	7980	393200	0	7790	305100	2040	6240			
		25	11975	500000	0	8150	500000	0	9010	500000	0	9010			
		26	9465	500000	0	7760	480100	0	7960	384700	0	6440			
PHILADELPHIA, PA. PHILADELPHIA INT'L APT. ALT. 23 FT.	1011	9L- 27R	9501	500000	0	7800	484200	0	7940	389500	0	6500	130	0	130
		9R- 27L	10499	500000	0	3050	500000	0	8400	439900	0	6620			
PHOENIX, ARIZONA SKY HARBOR INT'L AIRPORT ALT. 1128 FT. T TEMPORARY RWY LENGTH DUE TO WIP.	1011	8L- 26R	11000	500000	0	8220	500000	0	8680	450400	0	6470	126	0	126
		8R	10302	500000	0	3160	500000	0	8220	416300	0	6390			
		T 8R-T 26L	7002	394700	0	7700	333900	2020	7270	255200	1900	5980			
		26L	9596	500000	0	7830	477700	0	7920	381900	0	6300			
PITTSBURGH, PENNSYLVANIA GREATER PITTSBURGH INT'L ALT. 1203 FT.	1011	10C	10000	500000	0	8010	496500	0	7850	400800	0	6340	125	0	125
		10L- 28R	10500	500000	0	8190	500000	0	8390	425100	0	6400			
		10R	10000	500000	0	8010	496500	0	7850	400800	0	6340			
		14 - 32	8100	462600	0	7930	396600	0	7700	308100	2010	6110			
		28C	9500	500000	0	7800	472000	0	7920	376400	0	6280			
		28L	9500	500000	0	7800	472000	0	7920	376400	0	6280			
PRESTWICK, ENGLAND PRESTWICK AIRPORT ALT. 66 FT. K IFR LANDING DUE TO DISPLACED G/S.	1011	13	9000	500000	0	7740	457900	0	7970	363800	2170	6430	129	0	129
		K 13	7989	500000	0	7740	457400	0	7970	363300	2170	6420			
		31	9800	500000	0	7900	498700	0	7890	404100	0	6530			
SACRAMENTO, CALIFORNIA SACRAMENTO METROPOLITAN ALT. 23 FT.	1011	16 - 34	8600	500000	0	7870	436700	0	7940	344100	2130	6380	130	0	130
ST. JOSEPH, MISSOURI ROSECRANS MEMORIAL APT. ALT. 826 FT.	1011	17 - 35	8059	464500	0	7960	398400	0	7770	309500	2030	6160	127	0	127

NOTE: PLANNED LDG. WT. MUST NOT EXCEED THE FOLLOWING MAXIMUM CERTIFICATED LDG. WT.

1011	1011-100
358,000	388,000

* SUB FROM CERTIFICATED LDG. WT
> DENOTES NEW DATA
N.A. NOT AUTHORIZED
FOR ADDITIONAL TW RESTRICTIONS SEE LDG INST IN FHB

AIRPORT				DRY Dsp.			WET Dsp or Arrival Below ¾ or 4000 RVR			ANTI SKID-INOP			APT TEMP LIMITS Missed APP		
STATION 1011 LANDING DATA PAGE 1011.08 1 DEC 78	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL H W	SUB LB/KT ACTUAL T W	APT CRIT TEMP	*SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
ST.LOUIS. MISSOURI	1011	6 - 24	7602	439100	0	7950	374400	0	7650	289000	1990	6150	128	0	128
LAMBERT ST. LOUIS INT'L		12R	9560	500000	0	7780	481900	0	7950	386100	0	6400			
ALT. 589 FT.		30L	10018	500000	0	7990	500000	0	7990	408800	0	6450			
SAN DIEGO.CALIFORNIA >	1011	9	8697	500000	0	7840	442100	0	7950	349000	2140	6400	130	0	130
SAN DIEGO INT'L APT. >		K 9	7200	480700	0	7950	414400	0	7880	324000	2090	6330			
ALT. 15 FT. >		27	7584	443400	0	7950	378800	0	7720	292900	2030	6260			
K IFR LANDING DUE TO DISPLACED G/S.															
SAN FRANCISCO. CALIF.	1011	1L- 19R	7001	406300	0	7850	344000	2060	7500	263500	1970	6180	130	0	130
SAN FRANCISCO INT'L APT.		1R	8400	492300	0	7920	425700	0	7920	334100	2110	6360			
ALT. 12 FT.		10L	11870	500090	0	8120	500000	0	8950	492600	0	8950			
K IFR LANDING DUE TO		10R- 28L	10600	500000	0	8060	500000	0	8460	445100	0	6640			
DISPLACED G/S. >		T 10R-T 28L	8880	500000	0	7780	452000	0	7960	358300	2160	6420			
T TEMPORARY RWY LENGTH		19L	9500	500000	0	7800	484300	0	7940	389600	0	6500			
DUE TO WIP.		K 19L	8250	500000	0	7750	471500	0	7960	377000	0	6470			
		28R	11870	500000	0	8140	500000	0	8980	500000	0	8980			
SAN JOSE. CALIFORNIA	1011	12R	8901	500000	0	7780	452700	0	7970	358900	2160	6420	129	0	129
SAN JOSE MUNICIPAL APT.		30L	7426	433100	0	7940	369100	0	7660	284600	2010	6230			
ALT. 56 FT.															
SANTA MARIA. AZORES	1011	1 - 19	10000	500000	0	7980	500000	0	7980	411300	0	6510	129	0	129
SANTA MARIA AIRPORT															
ALT. 305 FT.															
SHANNON, IRELAND	1011	6	10500	500000	0	8050	500000	0	8390	439700	0	6620	130	0	130
SHANNON AIRPORT		24	10039	500000	0	8010	500000	0	8040	416400	0	6560			
ALT. 47 FT.															
STANSTED, ENGLAND >	1011	5 -P 23	10000	500000	0	7980	500000	0	7980	410800	0	6500	128	0	128
STANSTED AIRPORT >		23	9633	500000	0	7800	488000	0	7940	392500	0	6450			
ALT. 347 FT.															
P PRIOR PERMISSION REQUIRED.															
SYRACUSE, NEW YORK	1011	10 - 28	9005	500000	0	7700	454900	0	7980	360300	2140	6360	128	0	128
SYRACUSE-HANCOCK INT'L		T 10 -T 28	7000	402000	0	7830	340200	2050	7420	260300	1940	6110			
ALT. 421 FT.		14	7500	434400	0	7950	370000	0	7640	285300	1990	6170			
T TEMPORARY RWY LENGTH		32	7500	414500	0	7880	351600	2040	7510	269800	1960	6130			
DUE TO WIP.															
TAMPA, FLORIDA	1011	5 - 27	7000	405800	0	7850	343800	2060	7500	263300	1970	6180	130	0	130
TAMPA INTERNATIONAL APT.		18L- 36R	8300	486400	0	7930	420000	0	7900	328900	2100	6350			
ALT. 27 FT.		18R- 36L	8700	500000	0	7840	442100	0	7950	349100	2140	6400			
K IFR LANDING DUE TO DISPLACED G/S.		K 36L	7450	495000	0	7910	428300	0	7930	336500	2110	6360			

NOTE: PLANNED LDG. WT. MUST NOT EXCEED THE FOLLOWING MAXIMUM CERTIFICATED LDG. WT.

1011	1011-100
358,000	368,000

* SUB FROM CERTIFICATED LDG WT
> DENOTES NEW DATA
N.A. NOT AUTHORIZED
FOR ADDITIONAL T.W. RESTRICTIONS SEE LDG. INST IN F.H.B.

AIRPORT				DRY Dsp			WET Dsp or Arrival Below ¾ or 4000 RVR			ANTI SKID-INOP			APT TEMP LIMITS Missed APP		
STATION 1011 LANDING DATA PAGE 1011.09 1 DEC 78	MODEL	RUNWAY NUMBER	RUNWAY LENGTH	MAX WEIGHT ZERO WIND	ADD LB KT ACTUAL HW	SUB LB/KT ACTUAL TW	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL HW	SUB LB/KT ACTUAL TW	MAX WEIGHT ZERO WIND	ADD LB/KT ACTUAL HW	SUB LB/KT ACTUAL TW	APT CRIT TEMP	* SUB LB/°F ABOVE CRIT TEMP	MAX APT OPR TEMP
TORONTO, CANADA >	1011	5L	10500	500000	0	8070	500000	0	8360	433000	0	6520	128	0	128
TORONTO INTERNATIONAL		5R - 23L	9500	500000	0	7760	479100	0	7960	383300	0	6350			
ALT. 569 FT.		14 - 32	11050	500000	0	8110	500000	0	8710	460300	0	6580			
K IFR LANDING DUE TO		K 14	9335	500000	0	8050	500000	0	8210	424800	0	6500			
DISPLACED G/S.		23R	10325	500000	0	9050	500000	0	8210	424300	0	6490			
TUCSON, ARIZONA	1011	11L	10900	500000	0	9370	500000	0	8530	428200	0	6250	120	0	120
TUCSON INTERNATIONAL APT		29R	12000	500000	0	8430	500000	0	9140	480300	0	9140			
ALT. 2630 FT.															
TULSA, OKLAHOMA	1011	8	7375	423800	0	7900	360200	2020	7540	277000	1970	6110	127	0	127
TULSA INTERNATIONAL APT.		17L - 35R	10000	500000	0	7940	500000	0	7980	406500	0	6430			
ALT. 676 FT.		26	7700	444300	0	7960	379300	0	7670	293100	2000	6150			
WASHINGTON, D.C.	1011	1L - 19R	11500	500000	0	8120	500000	0	8960	486300	0	8960	129	0	129
DULLES INTERNATIONAL APT		1R - 19L	11500	500000	0	8120	500000	0	8960	486300	0	8960			
ALT. 313 FT.		12 - 30	10000	500000	0	7980	500000	0	7980	411200	0	6500			
WINDSOR LOCKS, CONN.	1011	6 - 24	9501	500000	0	7780	483000	0	7950	387900	0	6470	129	0	129
BRADLEY INTERNATIONAL		15 - 33	6846	394200	0	7800	333200	2070	7390	254500	1940	6140			
ALT. 173 FT.															
WINNIPEG, CANADA	1011	13 - 31	8700	500000	0	7860	434700	0	7920	341500	2090	6250	127	0	127
WINNIPEG INT'L APT.		18 - 36	11000	500000	0	8150	500000	0	8680	454900	0	6540			
ALT. 783 FT.		D 25	7000	398300	0	7770	336900	2040	7340	257600	1920	6040			
D DAY USE ONLY.															

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1011	1011-100
358,000	368,000

* SUB. FROM CERTIFICATED LDG WT
> DENOTES NEW DATA
N A NOT AUTHORIZED
FOR ADDITIONAL TW RESTRICTIONS SEE LOG INST IN FHB