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APPENDIX I

EQUIPMENT CATALOGUE

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## APPENDIX II

### DEVIATIONS

#### 1. Role

Requirement: Specification AIR 7-4, Paragraph 2.2.1 and 2.2.2

The ----- role of the aircraft shall be high altitude, all weather, night and day interception ----- etc.

Deviation: The aircraft will not, in effect, utilize its maximum potential under adverse weather conditions.

Reason for Deviation and Remarks: No radome material as yet developed will withstand heavy rain impingement at supersonic speeds.

#### 2. Detail Design Spotfacing

Requirement: Specification ARDCM 80-1, paragraph 8.10(b)1

Bosses or extra material shall be provided on surfaces to be spotfaced.

Deviation: Bosses or extra material will not always be provided on surfaces to be spotfaced.

Reason for Deviation and Remarks: Weight saving. Bosses will be omitted on surfaces to be spotfaced where it can be shown that adequate strength qualities exist.

#### 3. Detail Design, Castings

Requirement: ARDCM 80-1, paragraph 3.260

In the design of magnesium alloy castings, wall thickness shall not be less than 5/32 (0.15625) inch, -----.

Deviation: Minimum wall thickness of magnesium castings may be taken to 0.13 inch in certain limited areas of the castings.

Reason for Deviation and Remarks: To save weight in the more lightly stressed portions of castings.

#### 4. Combat Load Factor

Requirement: AIR 7-4, paragraph 3.3.1

The combat performance at combat weight shall not be less than a

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4. Combat Load Factor (Cont'd)

Requirement: (Cont'd)

combat load factor of 2 at a combat speed of Mach 1.5 and at a combat altitude of 50,000 feet.

Deviation: Combat load factor at combat speed of Mach 1.5, combat altitude of 50,000 feet, and combat weight, is 1.5.

Reason for Deviation and Remarks: J-75 engine performance does not permit the above requirement to be attained (Reference AIR 7-4 paragraph 4.1.2).

5. Take-Off Distance

Requirement: Specification AIR 7-4, paragraph 3.9.1

The aircraft shall be capable of taking off safely in still air at maximum gross weight from 6,000 ft. runways at sea level and at a standard summer temperature of 38°C.

Deviation: Take-off distance in still air at maximum gross weight (67,730 lb.) at sea level and standard summer temperature of 38°C, to clear a 50 ft. obstacle with maximum thrust (afterburners operating) is 6,300 ft.

Reason for Deviation and Remarks: J-75 engine performance does not permit the above requirement to be attained (Reference AIR 7-4 paragraph 4.1.2).

6. Combat Ceiling

Requirement: Specification AIR 7-4, paragraph 3.8.1

The combat ceiling at combat weight shall not be less than 60,000 ft.

Deviation: The combat ceiling at combat weight is 57,200 ft.

Reason for Deviation and Remarks: J-75 engine performance does not permit the above requirement to be attained (Reference AIR 7-4 paragraph 4.1.2).

7. Limit Ground Loads

Requirement: Bulletin ANC-2a, Table 4-1

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7. Limit Ground Loads (Cont'd)

Requirement: (Cont'd)

The design requirements specified by ANC-2 call for a 12,000 pound load straight ahead and a 6,000 pound load inclined at  $45^{\circ}$  to the aircraft longitudinal axis.

Deviation: The aircraft is designed for a 10,000 pound load straight ahead and 6,000 pounds at  $45^{\circ}$ .

Reason for Deviation and Remarks: These loads were established at the 17th meeting of the Co-ordinating Committee, 2 March 1955, Item No. 9 and confirmed by letter S1038-105-11 (ACE-1) dated 22 August 1955.

8. Yaw Velocity in Flat Spins

Requirement: Specification MIL-S-5702, paragraph 4.3.2.1

Flat Spins: The yawing velocity (in this condition) shall be 5.0 radians per second for fighters and pilot trainers -----.

Deviation: The yawing velocity in a flat spin shall be taken as 3.5 radians per second.

Reason for Deviation and Remarks: On the basis of all available data it is not considered that a yaw velocity of 3.5 radians per second can be exceeded.

9. Load Factors in Rolling Pull-Out

Requirement: Specification MIL-S-5702, paragraph 4.2.1.1

Rolling Pull-Out - For this condition, all points within the positive  $V_n$  diagram up to and including a load factor of  $1 + \frac{2}{3} \Delta n$  shall be considered ----

$$\begin{aligned} &\text{CF-105 requirement where } n = 7.33 \\ &(\Delta n = n - 1) \\ &1 + \frac{2}{3} \times (7.33 - 1) = 5.22 \end{aligned}$$

Deviation: The positive load factors to be considered for a rolling pull-out will be based on  $\frac{2}{3} n_1$

$$\begin{aligned} &\text{CF-105 consideration where } n_1 = 7.33 \\ &\frac{2}{3} \times 7.33 = 4.89 \end{aligned}$$

Reason for Deviation and Remarks: Requirement of superseded specification 1803 (original contractual specification) used prior to the introduction of MIL-S-5702.

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10. Piano Hinge Pins

Requirement: Specification ARDCM 80-1, paragraph 5.451

Where the removal of the control surface is accomplished by removal of the hinge pin (piano type hinge) the continuous length of pin shall not exceed 48 inches.

Deviation: The aileron hinge pins exceed this length and are intended to be removeable.

Reason for Deviation and Remarks: Established assembly and removal practice permits handling of the long hinge pins.

11. Canopy Jettison

Requirement: Specification CAP 479, paragraph 22.30 (1)

Canopies in single and tandem cockpit aircraft ----- and shall be jettisonable in flight -----.

Deviation: The canopy hatches shall be openable but not jettisonable in flight.

Reason for Deviation and Remarks: A non-jettisonable canopy provides enhanced crew safety, elimination of possible damage to airframe structure, and ability to ground test.

12. Windshield Angle

Requirement: Specification ARDCM 80-1, paragraph 6.21

Flat panels in those areas used for vision in taking-off, flying ----- should be placed at an angle of incidence no greater than 55° -----.

Deviation: The angle of incidence of the windshield shall be 65°.

Reason for Deviation and Remarks: Aerodynamic requirement.

13. Visibility of Wing Tips to Pilot

Requirement: Specification CAP 479, paragraph 20.22

The pilot should be able to see both wing tips in fighters - for formation flying.

Deviation: Wing tips not visible to pilot.

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13. Visibility of Wing Tip to Pilot (Cont'd)

Reason for Deviation and Remarks: Impossible to achieve with accepted aircraft configuration and limitations on pilot movement imposed by required accoutrements.

14. Landing Gear Retraction Time

Requirement: Specification ARDCM 80-1, paragraph 7.60

The time of operation of the landing gear at temperatures between  $-65^{\circ}\text{F}$  to  $-20^{\circ}\text{F}$  shall not exceed a value which is double the fastest time selected for the  $-20^{\circ}\text{F}$  to  $+120^{\circ}\text{F}$  range.

Deviation: Design based on a retraction time of 5 seconds at  $-20^{\circ}\text{F}$  and 30 seconds at  $-65^{\circ}\text{F}$ .

Note: ARDCM 80-1 requirement for retraction time:- 10 seconds (Reference paragraph 7.601).

Reason for Deviation and Remarks: The above criteria adopted as basis for design to save weight imposed by larger piping (Refer to Item 4 of the Minutes of the CF105 Development Co-ordinating Committee's 20th Meeting, 22nd June 1955).

15. Emergency Flying Controls

Requirement: Specification ARDCM 80-1, paragraph 9.205

Where power boost or power control systems are employed, an emergency manual or power means shall be provided -----.

Deviation: Two separate hydraulic power circuits are used. Both are normally in use, but either system alone will provide sufficient power for adequate control of the aircraft.

Reason for Deviation and Remarks: The two separate hydraulic power circuits, with each being capable of automatically carrying on when the other has failed, provide a better emergency means of operation than a specific emergency source of power. Two pumps are installed in each power circuit.

16. Flying Controls Rigidity and Balance

Requirement: Specification ARDCM 80-1, paragraph 9.206

----- When power control systems are used, the rigidity and balance of the control surfaces shall be such as to preclude flutter or undesirable oscillations if the actuator or any one of the actuators used is disconnected for any reason, including battle damage.

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16. Flying Controls Rigidity and Balance (Cont'd)

Deviation: The rigidity of each control surface is dependent on multiple connections to the control tube. The control surfaces are not balanced.

Reason for Deviation and Remarks: This requirement is not compatible with the design aims of a fully powered, irreversible flying control system and, if it were met, it would involve prohibitive weight penalties.

17. Elevator Interconnectors

Requirement: Specification ARDCM 80-1, paragraph 9.210a

Elevators shall be rigidly interconnected or consist of a continuous structure.

Deviation: Each elevator is linked to a separate corresponding actuator and is not connected to the other elevator.

Reason for Deviation and Remarks: Space requirements dictate use of two actuators. This requirement is not met due to the difficulty of achieving the necessary degree of synchronization between two actuators when connected to a single surface and used in a stability augmented system.

18. Cable Guards

Requirement: Specification ARDCM 80-1, paragraph 8.315.1

All pulleys and quadrants shall be provided with stationary guards fitting close to the points of tangency of the control cables.

Deviation: Tension regulating quadrants are equipped with cable guards attached to the quadrants themselves.

Reason for Deviation and Remarks: The above guards move with their respective quadrants and are much simpler and lighter than normal fixed guards. The moveable guards provide ample protection against cables jumping the cable grooves on the quadrants.

19. Control Cable Duplication

Requirement: Specification ARDCM 80-1, paragraph 9.210 a and b

(a) ----- the direct (elevator control) system shall be duplicated from the base of the ----- control column to the elevator spars.

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19. Control Cable Duplication (Cont'd)

Requirement: (Cont'd)

- (b) Where cables are used for the rudder control on aircraft equipped with a single rudder, duplicate cables shall be provided from each rudder pedal to the rudder mast.

Deviation: Single mechanical control linkages are installed between all control surface actuator valves and the pilot's controls.

Reason for Deviation and Remarks: Complexity and space reasons.

20. Control Cable Spacing

Requirement: Specification ARDCM 80-1, paragraph 9.207

Cables of any one control surface shall be separated by at least three inches, preferably more.

Deviation: In a few places, notably where the two cables for a particular control surface change direction at pulleys, the cables are not spaced according to the above requirement.

Reason for Deviation and Remarks: Space restriction. Fairleads or guide tubes are installed where necessary.

21. Engine Air Intake Screens

Requirement: Specification ARDCM 80-1, paragraph 16.625

Where retractable inlet screens are not provided with axial flow engines, the airframe manufacturer shall mount a retractable screen in the inlet duct of the aircraft.

Deviation: Screens not provided.

Reason for Deviation and Remarks: Penalty to performance and weight does not justify complexity required for very doubtful protection. High location of air inlets is considered adequate protection.

22. Engine Isolation

Requirement: Specification ARDCM 80-1, paragraph 15.620

All engines of (multi-engine) aircraft, which are located adjacent to one another in the fuselage or in nacelles shall be isolated from one another by a stainless steel firewall. This firewall shall be as liquid and gas-tight as possible.

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22. Engine Isolation (Cont'd)

Deviation: A composite structure has been used to fulfill the conditions quoted. An aluminum shroud effectively forms an air tight barrier between Zone 2 and the fuselage bay. Insulation blankets attached to the aluminum shroud to provide flame resistance.

Reason for Deviation and Remarks: Weight

23. Engine Isolation

Requirement: Specification ARDCM 80-1, paragraph 15.620

Each engine installation of all aircraft, regardless of the number or relative position of the engines, shall incorporate a stainless steel diaphragm that separates the burner and tail pipe section from the accessory and compressor section.

Deviation: Titanium is used to separate the burner and tail pipe section from the accessory and afterburner section.

Reason for Deviation and Remarks: Weight

24. Firewall and Shut-Off Valves

Requirement: Specification CAP 479, paragraph 23.22

Firewall shut-off valves shall be incorporated in fuel, oil, and hydraulic fluid lines which pass through the firewall, in all twin and multi-engine aircraft. The shut-off valves shall be located as near as possible to the firewall and yet still be in a location not liable to be swept by a nacelle fire. Valves already provided in these systems can be used to perform the functions of firewall shut-off valves if the controls are convenient to the pilot, second pilot or flight engineer in an emergency, or are automatically closed by operation of the fire fighting controls.

Deviation: Shut-off cocks not installed for engine and accessories oil systems. Hydraulic system does not enter engine compartment - i.e. does not pass through firewall.

Reason for Deviation and Remarks: Shut-off cocks are not provided in engine oil and accessories oil systems since both are high rate of flow systems with small total capacity. If leakage of either feed or return lines should occur, almost the whole system would be drained before the fault could be detected and shut-off valves operated.

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25. Purging of Fuel Tanks

Requirement: Specification ARDCM 80-1, paragraph 16.400

----- A purging system shall be provided for all combat aircraft.

Deviation: A purging system is not provided.

Reason for Deviation and Remarks: All purging systems at present available would be ineffective in this system. Requirements for purging deleted from AIR 7-4 at Issue 2, implying not required. This was agreed at 7th Co-ordinating Meeting, 14 July 1954, Item 39.

26. Tank Selection - Refueling

Requirement: Specification ARDCM 80-1, paragraph 14.323 (j)

It shall be possible to select any tanks for filling, and conversely, to avoid filling any tanks. This is necessary for either c.g. control, selective fuel loading or to avoid the filling of battle damaged tanks or tanks with inoperative fuel booster pumps.

Deviation: Selective tank filling is not provided.

Reason for Deviation and Remarks: Automatic c.g. control is provided by means of the fuel proportioners. Use of selective tank filling would act directly against the object of providing automatic control of c.g. position.

27. Installation or Removal of Fuel Tanks

Requirement: Specification ARDCM 80-1, paragraph 13.421 (c)

It shall be possible to remove tanks without removing any other part of the aircraft, except cowling or access panels. No disassembly of structural parts shall be required.

Deviation: Structural tie tubes must be removed (in sequence) to remove and install fuselage fuel cells.

Reason for Deviation and Remarks: Permits an "economical" fuselage structure.

R.C.A.F. approved at Co-ordinating Committee Meeting - 14 December 1955.

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28. Fuel System Component Identification

Requirement: Specification MIL-F-8615, paragraph 3.5

Each fuel system component shall be marked by a red colour in conformance with Army-Navy Aircraft Color Standard Code No. 509.

Deviation: No colour marking will be made on fuel system components.

Reason for Deviation and Remarks: Authorized by C105 Co-ordinating Committee at the 23rd Meeting held 23rd November 1955.

29. Refueling Connection

Requirement: Specification ARDCM 80-1, paragraph 16.323(14.323b)

Refueling shall be accomplished through the use of a single adaptor unless otherwise specified -----.

Deviation: Two refueling adaptors are installed.

Reason for Deviation and Remarks: To permit refueling within the specified time. Agreed at 18th Meeting of CF105 Development Co-ordinating Committee.

30. Fuel Drain Valves

Requirement: Specification ARDCM 80-1, paragraph 15.432 (13.432)

The sump shall be provided with ----- an approved (Specification 28208) self-locking drain valve.

Deviation: Combination service and condensate drain valves, to Company Specification E-368 are installed.

Reason for Deviation and Remarks: Drain valves to Specification 28208 will not meet temperature requirements.

31. Collector Tank Outlets

Requirement: Specification ARDCM 80-1, paragraph 15.431

The fuel outlet fitting from all tanks ----- shall be of a booster pump flange conforming with AN 4135, AN 4130-10 or AN 4128 -----.

Deviation: Booster pump mounting does not conform to the above requirement.

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31. Collector Tank Outlets (Cont'd)

Reason for Deviation and Remarks: Structural strength requires minimum size mounting holes in the tank base.

32. Instrument Mounting

Requirement: Specification ARDCM 80-1, paragraph 19.00

A minimum clearance of 10 inches shall be provided behind the instrument board to accommodate the instruments and connections when installed.

Deviation: The clearance at the top corners of the instrument panel is less than 10 inches.

Reason for Deviation and Remarks: The clearance at the top corners of the instrument panel is reduced by the inboard slope of the wind-screen panel.

33. Hydraulic Fittings

Requirement: Specification ARDCM 80-1, paragraph 10.21

Standard approved hydraulic components as indexed in specification MIL-H-5440, related specifications and ANA Bulletins shall always be used where applicable.

Deviation: All connections shall be flareless type in accordance with Company standards. The hydraulic connecting pipes for the flying controls parallel serves and control surface actuators will be of 4130 seamless steel tubing to Specification MIL-T-6736.

Reason for Deviation and Remarks: Flareless type connections to Company Standards incorporate better sealing and strength features. Flexible tubing designed for 4,000 psi is not available and use of swivel type fittings is precluded by space and weight considerations.

34. Emergency Wheel Brakes

Requirement: Specification MIL-H-5440A, paragraph 3.10.1

All hydraulically operated services which are essential to safety in flight or landing, except types I and IV brake systems, shall be provided with emergency devices ----- . The emergency system shall be completely independent of the main systems up to, but not necessarily including the shuttle valve, the actuating cylinder or the motor.

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34. Emergency Wheel Brakes (Cont'd)

Deviation: The emergency braking system makes use of the normal braking anti-skid return lines and is physically interconnected in brake valve, transfer valve and anti-skid valve.

Reason for Deviation and Remarks: (1) The above deviation obviates the necessity of installing another hydraulic pipe run on the main landing gear main struts.

(2) Failure of the normal brake pressure piping in this design will not prevent operation of brakes from the emergency supply.

35. Moisture Traps - Hydraulic System

Requirement: Specification CAP 479, paragraph 24.45

Traps shall be provided to collect the drain off moisture from the ----- hydraulic systems.

Deviation: No traps are provided in the hydraulic systems.

Reason for Deviation and Remarks: The hydraulic systems are of the airless type and are sealed from contact with the atmosphere which would otherwise be the main cause of moisture entering the systems.

36. Moisture Elimination - Pneumatic System

Requirement: Specification CAP 479, paragraph 24.32 and 24.45

Pneumatic systems shall incorporate a dehydrating device. Traps shall be provided to collect and drain off moisture from the pneumatic ----- systems.

Deviation: No dehydrating device is fitted. A trap is provided only in the low pressure services sub-systems.

Reason for Deviation and Remarks: The air supplied to the sub-systems is too hot for effective dehydration except in the case of the low pressure services sub-system. A filter which incorporates a drainable moisture trap will be fitted to the low pressure sub-system.

37. Alternators and Drives Accessibility

Requirement: Specification MIL-E-7614, paragraph 3.5.2 and 3.6.1

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37. Alternators and Drives Accessibility

Requirement: (Cont'd)

The generator shall be accessible for inspection of all brushes, commutators and slip rings while installed.

The constant speed drive and flexible shaft shall be accessible for inspection and servicing while installed and for removal for servicing without requiring the removal of other accessories except the generator.

Deviation: The alternators and constant speed drives shall be accessible for inspection, servicing and/or removal only when the engines are removed.

Reason for Deviation and Remarks: This is precluded by the engine installation.

38. Switches - Space Provisions

Requirement: Specification MIL-E-7080, paragraph 3.4.1.4

Space shall be provided on each switch panel containing four or more switches, for subsequent installation of one spare switch conforming to Drawing AN 3022 and one switch conforming to Drawing AN 3023.

Deviation: No space provided for spare switches.

Reason for Deviation and Remarks: Space limitations on switch panels prevent installation of additional switches.

39. Cable Grouping

Requirement: Specification MIL-W-5088, paragraph 3.7.3

Cable groups shall contain no more than 26 cables unless all of the wiring is pertinent to a single item of equipment.

Deviation: More than 26 cables are used in a single group in some instances.

Reason for Deviation and Remarks: Space limitations and the number of services provided in the airplane occasionally require the use of more than 26 cables in a single group.

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40. Cable Routing

Requirement: Specification MIL-W-5088, paragraph 3.7.3.5

Cables to each equipment which must operate to maintain flight of the aircraft under normal or emergency conditions shall be separately routed from other cables.

Deviation: Cables essential to maintain flight under normal and emergency conditions are not separated from other cables.

Reason for Deviation and Remarks: Space limitations prevent separate routing of cables essential to maintain flight.

41. Cable Spacing

Requirement: Specification MIL-W-5088, paragraph 3.7.4.1

Cables shall be routed separately and not closer than six inches to fluid and gas lines. A minimum of one half inch separation shall be provided when the cables and oxygen lines and associated equipment are rigidly clipped and the cables are covered with approved insulating material; a separation of less than one half inch will not be acceptable.

Deviation: Some cables are less than one half inch from fluid and gas lines.

Reason for Deviation and Remarks: Space limitations.

42. Cable Grouping

Requirement: Specification MIL-W-5088, paragraph 3.7.3.4

Cables of the primary electrical power system shall not be bundled or grouped with distribution circuit cables.

Deviation: Power source cables are bundled with distribution cables in some instances.

Reason for Deviation and Remarks: Space limitations prevent segregation of cables.

43. Batteries Disconnect

Requirement: Specification CAP 479, paragraph 70.05 (3)

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#### 43. Batteries Disconnect (Cont'd)

##### Requirement: (Cont'd)

Disconnect - A quick disconnect device shall be provided at the battery terminals to disconnect the battery from the electrical system.

Deviation: No quick disconnect device shall be provided at the battery terminals. Nut-type terminals are used with a cover provided for terminal insulation, corona barrier and high creepage protection.

Reason for Deviation and Remarks: Weight saving factor and reliability of a hermetically sealed nickel cadmium battery preclude the necessity for quick disconnect devices.

#### 44. Warning Lights

##### Requirement: Specification ARDCM 80-1, paragraph 6A.172 (b)

The caution indicator system shall consist of a master indicator light and an indicator panel. The master light shall be red in color and shall be labelled "Master Caution" -----.

----- The caution indicator panel ----- shall provide a suitable visual indication, red in color -----.

Deviation: One master warning light and the caution indicators are amber in color.

Reason for Deviation and Remarks: The warning light system proposed by Avro was approved by the R.C.A.F. Reference letter S1038-105-4(ACE-1) dated 23 August 1955.

#### 45. Circuit Breakers

##### Requirement: Specification CAP 479, paragraph 21.62 (1)

In single or tandem pilot aircraft, the circuit breakers shall be located forward on the inboard face of the right console.

Deviation: The circuit breakers shall be located on a circuit breaker panel in the nose wheel bay.

Reason for Deviation and Remarks: Limitation of space precludes the installation of circuit breakers in the cockpit.

Circuit breakers are used for protection only and not as combination protection and switch. Trip free breakers are used which cannot be closed when a fault in the circuit exists.

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#### 46. Interference Limits and Methods of Measurement

Requirement: Specification MIL-I-6051, paragraph 4.2.3.5

----- accomplished. Where in an electronic system any receiver output is normally fed into a radio interphone amplifier, the headset and output meter shall be connected in the amplifier output circuit. The controls for the radio-interphone amplifier shall be adjusted for the conditions of normal system operation.

Deviation: The controls for radio interphone system AN/AIC-10 shall not be set as required for normal operation, but as required for the emergency mode.

Reason for Deviation and Remarks: When the output is measured with the interphone system selected for normal operation, the gain and the inherent noise of the AN/AIC-10 amplifier will give an incorrect measure of the noise content of the particular system under test. When the interphone system is set to emergency mode of operation the input to the amplifier is directly connected to the output circuit resulting in no noise being introduced or amplified by the interphone system.

#### 47. Quick Disconnects - Crew Services

Requirement: Specification CAP 479, paragraph 21.83

The quick disconnect assembly receptacle, which incorporates the oxygen connection, micro-telephone lead, anti "g" connector, etc., shall be located on the left-hand side of the seat.

Deviation: The quick disconnect assembly is located on the right-hand side of the seat.

Reason for Deviation and Remarks: R.C.A.F. letter S1038CF105-16 (ACE) dated 9 December 1954, permits mounting on right-hand side of seat.

#### 48. Crew Relief Provisions

Requirement: Specification CAP 479, paragraph 42.30

Relief horns shall be installed in all aircraft having an endurance of more than three hours.

Deviation: Relief horns are not installed.

Reason for Deviation and Remarks: This requirement arises only as a result of a secondary role, and as weight prejudices primary role performance, relief horns are not installed.

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49. Drinking Liquid Containers

Requirement: Specification CAP 479, paragraph 42.20

Aircraft having an endurance of more than three hours shall have installed, insulated drinking liquid containers of sufficient capacity to provide one pint of liquid per occupant.

Deviation: Drinking liquid containers are not installed.

Reason for Deviation and Remarks: The requirement arises only as a result of a secondary role, and as weight prejudices primary role performance, drinking liquid containers are not installed.

50. Thermal Radiation Protection

Requirement: Specification ARDCM 80-1, paragraph 23.137

All combat fighter, bomber and reconnaissance aircraft shall provide stowable hoods, curtains, or other devices incorporating 14.77 ounce bleached white cotton duck fabric conforming to specification MIL-D-10861, Type II, for protection of the following items from thermal radiation caused by the explosion of nuclear weapons:

- (a) All aircrew members
- (b) Crew members' personal equipment
- (c) Exposed wiring.

These devices shall preclude any light rays originating outside the aircraft from striking any of the above items in the aircraft when the devices are in the unstowed or protecting position. The pilot's protective device shall be operable and stowable in 20 seconds or less. Protective devices for other members of the aircrew must be operable and stowable in 4 minutes or less.

Deviation: Protection from thermal radiation is not installed.

Reason for Deviation and Remarks:

51. Baggage and Tool Compartment

Requirement: Specification CAP 479, paragraph 41.04

All aircraft shall be equipped with a baggage and tool compartment or locker, provided with suitable door locks.

Deviation: Provision of a baggage and tool compartment at present not intended.

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51. Baggage and Tool Compartment (Cont'd)

Reason for Deviation and Remarks: The R.C.A.F. has no requirement at the present time for any ground handling or servicing equipment to be stowed aboard the aircraft. Reference letter S1032-105-11 (ACE-1), dated 26 July 1955.

52. Stowage(s) in Radar Operators Cockpit

Requirement: Specification CAP 479, paragraph 20.62

A convenient stowage shall be provided for writing pads, logbook, maintenance manuals, spare fuses and tools.

Deviation: The above stowage(s) are not provided.

Reason for Deviation and Remarks: Not compatible with operational role of the aircraft.

53. Flashlight Stowage in Cockpits

Requirement: Specification CAP 479, paragraph 20.24

Map stowage shall include provision for stowage of a flashlight.

Deviation: Flash light stowage not provided.

Reason for Deviation and Remarks: Space at a premium.

54. Fire Extinguishing System

Requirement: Specification CAP 479, paragraph 23.72 and 23.73

Separate extinguishing systems shall be provided for each power plant.

Separate extinguishing distribution systems shall be provided for all potential fire zones other than power plant compartments.

Deviation: The extinguishing systems are not separate

Reason for Deviation and Remarks: To comply with these requirements would involve an increase from two to three bottles with a consequent increase in weight.

55. Fire Axe

Requirement: Specification CAP 479, paragraph 23.100

Stowage shall be provided for a fire axe in all cabin type aircraft.

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55. Fire Axe (Cont'd)

Deviation: Fire axe is not installed.

Reason for Deviation and Remarks: Twenty first meeting of Co-ordinating Committee, 20 July 1955, Item XV, Minute 42(j) states: "axes are not required in either cockpit".

56. Crash Fire Extinguishing

Requirement: Specification CAP 479, paragraph 23.74

The automatic system shall provide one discharge of agent to each power plant, and one discharge of agent to each potential fire zone other than cargo compartments.

Deviation: No discharge to hydraulics bay in crash case.

Reason for Deviation and Remarks: To comply with these requirements would involve an increase from two to three bottles with a consequent increase in weight.

57. Hand Fire Extinguisher

Requirement: Specification CAP 479, paragraph 23.75

All aircraft, except single seat types, shall have at least one hand fire extinguisher in each crew compartment.

Deviation: Hand fire extinguishers are not installed.

Reason for Deviation and Remarks: Seventeenth meeting of Co-ordinating Committee, 2 March 1955, Item 19 cancels requirement for cockpit fire extinguishers.

58. Overheat Detection - Turbojet Engine Installations

Requirement: Specification CAP 479, paragraph 23.61

Overheat Detection System - An overheat detection system of approved type shall be installed in all turbojet ----- propelled aircraft.

Deviation: No specific overheat detection system is installed.

Reason for Deviation and Remarks: Fire warning system is based on overheat temperature and additional overheat protection would, therefore, be duplication.

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59. Duct Pressure Drop

Requirement: Specification ARDCM 80-1, paragraph 12.443

Total duct pressure drop, including bends and elbows, shall not exceed 3 in Hg. from engine or cabin supercharger air manifold ----- to cabin pressure level.

Deviation: Total duct pressure drop will exceed the above requirement.

Reason for Deviation and Remarks: System design is predicated on a large pressure drop through the system (Volume and cooling).

60. Ducting Alignment

Requirement: Specification ARDCM 80-1, paragraph 12.444

At least 6 in. of flexible duct shall be provided immediately adjacent to each fitting on one fitting side only in order to provide for rapid alignment of the tubing during fitting connections. At least 6 in. of flexible ducting shall also be provided in the turbine discharge fitting of the cabin cooling unit, to minimize the effect of aircraft and duct vibration upon turbine wheel vibration characteristics.

Deviation:

- (1) Not complied with at some connections.
- (2) The expansion cooling turbine and outlet ducting will constitute a firm assembly which will be rigidly installed.

Reason for Deviation and Remarks: Non-compliance only where impracticable or a different design approach is rendered necessary by the basic design of the aircraft as a whole.

61. Ground Air Disconnects

Requirement: Specification ARDCM 80-1, paragraph 8.52

Connections shall be provided on the aircraft, at applicable stations for air conditioning on the ground. These connections shall have a nominal diameter of either 5 in. or 8 in. and shall be in accordance with NAS 400 or NAS 401.

Deviation: One 2½ in. and one 3 in. quick disconnect air conditioning system coupling shall be installed for hot high pressure air and cool low pressure air respectively.

Reason for Deviation and Remarks: The type and size of couplings which are installed are compatible with the duct sizes. Confirmed by R.C.A.F. letter S1038-105-11 (ACE-1) dated 22 August 1955.

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62. Air Conditioning

Requirement: Specification ARDCM 80-1, paragraph 12.442

A ram air duct shall be installed so as to provide for ingress of ram ventilating air into the cabin when air from the pressure source is not used.

Deviation: Ram air is not provided for ventilating the cockpit.

Reason for Deviation and Remarks: The pressure suits worn by the crew render the supply of ventilation air unnecessary. The ram air supply can be most advantageously used to provide some degree of cooling for equipment vitally necessary for flight, at moderate speeds only.

63. De-Frosting - Transparent Areas

Requirement: Specification CAP 479, paragraph 26.06

Means shall also be provided for preventing the fogging and frosting of all transparent areas provided for the use of the crew.

Deviation: No such provision for rear cockpit windows.

Reason for Deviation and Remarks: Not compatible with operational role of aircraft.

64. Jack Pad Installation

Requirement: Specification MIL-J-8711, paragraph 3.3.4.2

Axle jack pads installed on main and nose alighting gear must be integral with or permanently attached to the alighting gear, unless deviation is specifically granted by the procuring activity.

Deviation: The nose gear axle jack pads are not integral with or permanently attached to the nose gear. A special bar is required.

Reason for Deviation and Remarks: Configuration of nose landing gear precludes use of integral jack pad.

Confirmed at 13th Meeting of CF105 Co-ordinating Committee, 1st December 1954, Item 22, Minute 49a.

65. Jack Pads - Stowage

Requirement: Specification MIL-J-8711, paragraph 3.5

Provision shall be made to stow all removable jack pads within the aircraft.

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65. Jack Pads - Stowage (Cont'd)

Deviation: No provision made for stowing jack pads.

Reason for Deviation and Remarks: The R.C.A.F. has no requirement at the present time for any ground handling or servicing equipment to be stowed aboard the aircraft. Reference letter S1032-105-11 (ACE-1) dated 26 July 1955.

66. Mooring Fittings

Requirement: Specification ARDCM 80-1, paragraph 8.521

When detachable fittings are furnished, they shall be securely fastened in the baggage or tool compartment.

Deviation: No provision made for stowing mooring fittings.

Reason for Deviation and Remarks: The R.C.A.F. has no requirement for any ground handling or servicing equipment to be stowed aboard the aircraft. Reference letter S1032-105-11 (ACE-1) dated 26 July 1955.

67. Mooring Points

Requirement: Specification ARDCM 80-1, paragraph 8.521

A mooring fitting shall be provided ----- near the (aircraft) tail. In the case of a nosewheel installation, an additional fitting shall be provided near the nose wheel ----- two wing mooring points on each side of the plane of symmetry shall be provided.

Deviation: Three mooring points, one on each landing gear, shall be provided.

Reason for Deviation and Remarks: (1) The configuration and weight distribution in the aircraft make the provision of three mooring points, one on each landing gear, a most practicable arrangement.

(2) The distance between the landing gears coupled with the small amount of weight outside the triangle formed by the landing gears will furnish good stability when the aircraft is moored.

68. Leveling Provisions

Requirement: Specification ARDCM 80-1, paragraph 8.53

Provisions for measuring and leveling shall be in accordance with Specification MIL-M-6756.

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68. Leveling Provisions (Cont'd)

Deviation: A special fixture is used for harmonizing armament and "leveling" the aircraft in a 4° 4' nose up attitude.

Reason for Deviation and Remarks: The method used is considered to be more suitable for the CF105 and was agreed at the third meeting of the Maintenance Sub-Committee, 30 November 1954 (Reference paragraph 11(b)).

69. Air Conditioning, Controls, Interconnection

Requirement: Specification ARDCM 80-1, paragraph 12.442

A valve in the ram air line shall be mechanically or electrically linked with both the emergency pressurized air shut-off valve (in the cabin air duct) and the cabin air dump valve. The linkage shall provide for positive operation of the three valves when operating personnel desire to operate any one of the three.

Deviation: (1) No emergency, pressurized air shut-off valve will be installed in the cabin air duct.

(2) The ram air shut-off valve is not linked to the dump valve.

Reason for Deviation and Remarks: (1) A normal system ON-OFF valve which will shut off the flow of conditioning air from the heat exchanger to all conditioned compartments is fitted.

(2) Individual control of the dump valve and the ram air valve will permit control more suited to the system.

(3) Air conditioning system approved in principle at 15th Co-ordinating Committee Meeting, 7 January 1955.

70. Oxygen Regulator

Requirement: Specification CAP 479, paragraph 21.80

In single pilot aircraft the oxygen regulator, oxygen pressure gauge and oxygen flow indicator shall be located forward on the left or right hand console, readily visible and accessible to the pilot with his shoulder harness locked.

Deviation: Separate pressure demand regulators are mounted on the pilot's and radar operator's ejection seats.

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70. Oxygen Regulator (Cont'd)

Reason for Deviation and Remarks: The above requirement cannot be met on aircraft equipped with pressure demand, high altitude, bail out oxygen equipment in conjunction with ejector seats. (Reference CF105 Oxygen System Sub-Panel Meeting I.A.M., 23 September 1954, Item 3, paragraph 7a)

71. Pilot's Operating Instructions, Stowage

Requirement: Specification CAP 479, paragraph 41.03(1)

A stowage shall be provided in all aircraft for the pilot's operating instructions, within reach of the pilot with his shoulder harness locked.

Deviation: Storage provision for pilot's operating instructions at present not intended.

Reason for Deviation and Remarks: Requirement not compatible with the role of the aircraft.

72. Isolation of Electrical Equipment

Requirement: Specification ARDCM 80-1, paragraph 13.615

Electrical equipment and fuel should be isolated to prevent ignition of the fuel by arcing of broken electrical and fuel lines resulting from battle damage, accidental breaking or normal arcing. ----- Fuel, oil and hydraulic lines and equipment shall never be located in a position where leaking fluid will come in contact with electrical equipment through either the effect of gravity, air flow or battle damage, and hydraulic lines will be routed below electrical equipment and wires whenever they cross paths, pursuant to specification MIL-E-7563.

Deviation: Electrically operated fuel control valves and associated electrical cables are located inside the fuel tanks.

Fuel and hydraulic lines and electrical cables are located in close proximity in the fuselage under the wing and aft of station 485.

Reason for Deviation and Remarks: The fuel tanks in the wing sections are integral with the wing structure and space limitations in other sections of the airplane preclude possibilities for wider separation of electrical components and cables from fuel and hydraulic lines. Where possible, adequate insulation and explosion proof type components and connectors are installed to avoid possible arcing and fire hazards.

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73. Circuit Breaker - Space Provisions

Requirement: Specification CAP 479, paragraph 70.24 (6)

Space shall be provided on the circuit breaker panels for the installation of at least one additional circuit breaker for each group of six breakers.

Deviation: Space is not provided for an additional circuit breaker for each group of six circuit breakers.

Reason for Deviation and Remarks: Space limitation on the panel prevents the fulfillment of the requirement.

74. Afterburner Controls

Requirement: Specification CAP 479, paragraph 21.591 (3)

The afterburner control shall be actuated by movement of the power control lever through a detent or gate in the direction of increased thrust.

Deviation: The afterburners are switched on by depression of the power control lever knobs.

Reason for Deviation and Remarks: On the J75 Model JT4A-23 engine the afterburner is operable at constant power over a range of engine power to give a power range between the Military and Maximum Thrust Ratings. It is therefore, necessary to "bring in" the afterburner by micro-switch operation and use part of the power lever movement for variation of the augmented engine power (Approved by R.C.A.F., Reference letter S1038-105-19 (ACE-1) 25 October 1955)..

75. Speed Brakes

Requirement: Specification AIR 7-4, paragraph 4.4.1

Actuation of the speed brakes shall have a minimum effect on the trim or attitude of the aircraft throughout the speed range of the aircraft.

Deviation: A pitch-up condition will occur when the speed brakes are opened at speeds in excess of Mach 1.0.

Reason for Deviation and Remarks: Use of the speed brakes at speeds in excess of Mach 1.0 will not be required to fulfill the intended role of the aircraft.

In the manual mode of control the damping system will automatically counteract the pitch-up condition, and in the emergency mode the change of trim required will be within the trim range.

The pitch-up condition may be used to advantage in dive recovery.

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76. Brake Parachute Control

Requirement: Specification CAP 479, paragraph 21.32

The (Brake Parachute Control) actuating motion shall be to pull backward or downward ----- to deploy the parachute and upward or forward to jettison the parachute.

Deviation: Motion is downward to deploy and inboard and down to jettison.

Reason for Deviation and Remarks: Design of control motion dictated by the nature of the release mechanism in the rear fuselage. (Cockpit approved at 15th Meeting of Co-ordinating Committee, 19th January 1955, Item XVI, paragraph 33.)

77. Cockpit Head Room

Requirement: Specification CAP 479, paragraph 20.21

No part of the canopy roof or canopy shall be within  $8\frac{1}{2}$ " of the pilot's eye-line, within a distance extending forward 21 inches from the intersection of the eye line and the seat back line, or the forward face of the pilot's headrest.

Deviation: The clearance at the pilot's eye-line, 21 inches ahead of the forward face of the pilot's headrest is  $6\frac{1}{2}$  inches (approximately).

Reason for Deviation and Remarks: Aerodynamic canopy contour requirement (Cockpit approved at 15th Meeting of Co-ordinating Committee, 19 January 1955, Item XVI, paragraph 33.)

78. Canopy Structure

Requirement: Specification CAP 479, paragraph 20.21

There should be no rigid member immediately above the pilot's head in any position in which the cabin roof can be locked.

Deviation: The canopy hatches incorporate rigid structure over the pilot's head when in the closed and locked position.

Reason for Deviation and Remarks: Rigid structure required to strengthen canopy hatches (Cockpit approved at 15th Meeting of Co-ordinating Committee, 19 January 1955, Item XVI, paragraph 33).

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79. Canopy Opening

Requirement: Specification ARDCM 80-1, paragraph 6A.102

Provision must be made for instant opening of cockpit enclosures at any flight speed.

Deviation: The maximum speed for canopy opening shall be 420 knots EAS at any load factor within the flight envelope.

Reason for Deviation and Remarks: The cockpit and canopy structure have been designed to cover emergency opening of the canopy up to 420 knots EAS with 25° of yaw. Indications are that in normal flight attitude with zero yaw emergency opening of the canopy up to 720 knots EAS will be permissible (Reference letter 3801/08/J, September 16th 1955 to R.C.A.F.).

80. Vision

Requirement: Specification CAP 479, paragraph 20.22

The view downward and directly forward shall not be less than 15 degrees below the horizontal.

Deviation: The view downward and directly forward shall be 12½ degrees below the horizontal.

Reason for Deviation and Remarks: Windscreen configuration dictated by performance requirements (Cockpit approved 15th meeting of Co-ordinating Committee, 19 January 1955, Item XVI, paragraph 33).

81. Air Conditioning - Water Separator

Requirement: Specification ARDCM 80-1, paragraph 12.445

When an expansion turbine is used for cooling air, a water separator shall be provided to remove condensed moisture.

Deviation: Water separator is not provided.

Reason for Deviation and Remarks: (1) Weight and space penalty.  
(2) Effective water separator not available (Cabin inlet temperature is maintained at 55°F min. below 20,000 feet to reduce fogging. Provision is made for pilot to select 95°F inlet temperature if fogging should occur).  
(3) Air conditioning system approved in principle at 15th Co-ordinating Committee Meeting, 19 January 1955.

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82. Anti-G Suit Control Valves

Requirement: Specification CAP 479, paragraph 21.82

The anti-G suit control shall be located on the left hand side of the cockpit adjacent to the seat.

Deviation: In each cockpit the valve shall be installed on the right side of the seat.

Reason for Deviation and Remarks: The seat adjustment handle for each crew seat is on the left side, leaving little space for other equipment (Cockpit approved at 15th Meeting of Co-ordinating Committee, 19 January 1955, Item XVI, paragraph 33).

83. Booster Pump Inlets

Requirement: Specification ARDCM 80-1, paragraph 16.331(b)

Booster Pumps

----- There shall be no obstructions (not even short lengths of lines) between the tank and the pump inlet.

Deviation: Each booster pump has two longitudinal pipes.

Reason for Deviation and Remarks: Inlet pipes are required to insure flow under extreme aircraft attitudes, such as inverted flight.

84. Fuel Tank Locations

Requirement: Specification ARDCM 80-1, paragraph 15.421(a)

----- No fuel tanks shall be located in or over the engine compartment or over the tail pipe or afterburner section.

Deviation: Tanks No. 5, 7 and 8, R and L, are located partly over the engines.

Reason for Deviation and Remarks: The aircraft layout makes the present fuel tank locations a necessity.

85. Inverted Flight Fuel Supply

Requirement: Specification ARDCM 80-1, paragraph 16.311

----- design shall be such as to provide for full continuous fuel flow from the tank to the engine for at least 1 minute during inverted flight for jet fighter (aircraft) -----.

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85. Inverted Flight Fuel Supply (Cont'd)

Deviation: Provision is made for 15 seconds inverted flight at sea level and approximately 45 seconds at combat altitude with maximum power.

Reason for Deviation and Remarks: It is not possible to provide sufficient inverted flight capacity for 1 minute at all engine and afterburner fuel flows without installing a prohibitively large collector tank. Requirement not compatible with the performance of the aircraft at maximum power.

86. Engine Fuel Feed

Requirement: Specification ARDCM 80-1, paragraph 16.320

-----, the fuel system must be designed so that fuel from each tank can be made directly available to the engine(s) in case of boost pump failure or in the event of a damaged main tank.

Deviation: Fuel from each tank will not be directly available to either engine.

Reason for Deviation and Remarks: To provide fuel from each tank directly to the engine(s) would involve considerable penalties in weight and system complexity.

87. Fuel System - Strike Loss

Requirement: Specification AIR 7-4, paragraph 6.4.2

The fuel system shall be designed ----- and shall be such that in the event of a single strike the maximum amount of fuel is retained but in any case not more than 20% of the fuel in the tanks shall be lost or made unavailable to the engine.

Deviation: 50% of the fuel will be lost, if a strike is made on a collector tank.

Reason for Deviation and Remarks: The pressurized fuel system used on the CF105 requires the use of a collector tank, the loss under these conditions being unavoidable.

88. Location of Refueling Adaptors

Requirement: Specification ARDCM 80-1, paragraph 16.323(14.323g)

The ground servicing adaptor shall be located such that servicing personnel shall require no ladders, supports or elevating devices to insert the nozzle.

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88. Location of Refueling Adaptors (Cont'd)

Deviation: Elevating devices are required to couple refueling nozzles to the two adaptors.

Reason for Deviation and Remarks: (1) R.C.A.F. requested two refueling points and accessibility to them with the aircraft resting on the bottom of the fuselage.

(2) Location away from the bottom of the fuselage is an overriding requirement for simultaneous re-arming and other system checks during turn-around time.

89. Layout of Fuel System

Requirement: Specification ARDCM 80-1, paragraph 16.322(14.322)

During normal operation each engine ----- (shall receive) fuel from its main tank.

Deviation: During normal operation, fuel is fed from both collector (main) tanks to both engines.

Reason for Deviation and Remarks: The engine fuel proportioning unit drains equal flows of fuel from each sub-system and provides an outlet to each engine from a single manifold, according to the demand of each engine. This is to maintain aircraft lateral balance during operation of the fuel system.

90. Fuel Flow Meters

Requirement: Specification ARDCM 80-1, paragraph 19.241

Flowmeters are required on all jet propelled aircraft -----.

Deviation: Fuel flowmeters are not installed.

Reason for Deviation and Remarks: The specific requirement was deleted when Specification AIR 7-4 was raised from issue 1 to issue 2.

91. Hinged Doors

Requirement: Specification ARDCM 80-1, paragraph 8.6.2

If hinged doors are used, the hinges shall be located so that the air stream tends to keep them closed, -----.

Deviation: The forward fuselage electronics compartment door is hinged along its aft edge.

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91. Hinged Doors (Cont'd)

Reason for Deviation and Remarks: If hinged along the forward edge this door could not be opened with the nose jack in position.

92. Tail Skid

Requirement: Specification ARDCM 80-1, paragraph 7.10

Any aircraft equipped with a tricycle landing gear shall be provided with a tail skid or buffer which will adequately protect the control surfaces and the rear portion of the structure from damage and which will provide clearance between the ground and all parts of the structure in the event of a tail down landing.

Deviation: Neither a tail skid nor buffer is installed.

Reason for Deviation and Remarks: Requirement waived by Co-ordinating Committee in the interests of weight saving.

93. Turning Radius

Requirement: Specification ARDCM 80-1, paragraph 7.300

The nose wheel shall swivel through an angle which will permit turns to be made about one wheel as a pivot.

Deviation: Nose wheel swivel will be limited to 55° each way to limit the inner bogie to a described circle of approximately 8.5 ft. radius at maximum turn rate.

Reason for Deviation and Remarks: Minimum safe turning circle of the landing gear bogies is estimated to be 8.5 ft. radius and is accepted by the Co-ordinating Committee.

94. Removal and Replacement of Fuel Nozzles

Requirement: Specification ARDCM 80-1, paragraph 15.241

The following (components) shall be readily removable and replaceable without removing the engine, tanks, or important parts of the aircraft structure:-

Fuel Nozzles.

Deviation: The fuel nozzles are not accessible for removal, or replacement, with the engines installed.

Reason for Deviation and Remarks: Prohibitive weight penalties do not justify the provision of access.

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95. Interchangeability of Power Plants

Requirement: Specification ARDCM 80-1, paragraph 15.25

The power plant installations of multi-engine aircraft shall be identical, permitting complete interchangeability.

Deviation: The complete power plants are not interchangeable as the following are handed:

- (1) Front and rear engine mount attachments
- (2) Heat exchanger duct
- (3) Starter motor and accessories gearbox take-off
- (4) Compressor bleed valve outlets
- (5) High pressure air take-off

Reason for Deviation and Remarks: Engine design dictates the necessity for handing items (1) to (4).

Item (5) is handed from weight considerations.

96. Instrument Installation

Requirement: Specification AIR 7-4, paragraph 8.2.4

All air lines and electrical leads shall be flexible and fitted with quick disconnects and shall be of sufficient length to allow easy instrument removal.

Deviation: Air lines are not fitted with quick disconnects

Reason for Deviation and Remarks: Space and weight limitations prevent installation of quick disconnects on air lines.

97. Panel Space Provision

Requirement: Specification AIR 7-4, paragraph 8.2.3

Panel space shall be provided for 5 x 5 $\frac{1}{2}$  inches case size for the directional indicator and the artificial horizon.

Deviation: Space for 5 x 5 $\frac{1}{2}$  inches case size for artificial horizon and directional indicator shall not be provided.

Reason for Deviation and Remarks: Interim R.C.A.F. requirements for artificial horizon and directional indicator override this requirement.

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98. Power Plant Controls Identification

Requirement: Specification ARDCM 80-1, paragraph 6A.14 and 6A.140

- (1) Power plant controls for each engine shall be located and identified in accordance with MIL-STD-203.
- (2) All power plant controls shall be clearly marked in accordance with Specification 98-24105.

Deviation: Power plant controls (throttles) are not identified.

Reason for Deviation and Remarks: Because of location and orientation, it is impossible to confuse the throttles with other controls.

99. Limit Flight Loads

Requirement: Specification AIR 7-4, paragraph 5.2.2.1

At the gross weight for stress analysis, the limit load factor as defined in Specification MIL-S-5700 shall not be less than +7.33 and -3.0.

Deviation: The positive limit load factor decreased from 7.33 as skin temperature increases.

Reason for Deviation and Remarks: Weakening of structure due to temperature rise.

100. Weight for Stress Analysis

Requirement: Specification AIR 7-4, paragraph 5.2.1.2

The gross weight for stress analysis shall not be less than the normal gross weight less 50% of the combat mission fuel.

Deviation: The gross weight for stress analysis is 47,000 lb.

Reason for Deviation and Remarks: It is in the interest of the primary role of the aircraft to accept lower load factors at low altitude rather than add weight.

101. Normal Gross Weight

Requirement: Specification AIR 7-4, paragraph 5.2.1.1

The normal gross weight and the normal weight for take-off shall be the weight of the aircraft fully loaded with primary armament and fuel for the combat mission.

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101. Normal Gross Weight (Cont'd)

Deviation: A normal take-off weight of 55,000 pounds used for stress analysis.

Reason for Deviation and Remarks: Of necessity, the weights to be used for stressing were established in the early stages of design.

102. Maximum Gross Weight

Requirement: Specification AIR 7-4, paragraph 5.2.1.3

The maximum gross weight and the maximum weight for take-off shall be the weight of the aircraft fully loaded with primary armament, full internal fuel, and external fuel for the overload range mission.

Deviation: A maximum take-off weight of 65,000 pounds used for stress analysis.

Reason for Deviation and Remarks: Of necessity, the weights to be used for stressing were established in the early stages of design.

103. Landing Weights

Requirement: Specification MIL-S-5701, paragraph 3.2.2.10 and 3.2.2.11

"----- the normal design landing weight shall not be less than the applicable take-off weight less the following items; 75% of fuel (internal and external) carried in the basic mission for fighters (and) bombs, rockets, missiles and ammunition."

"----- the maximum design landing weight shall not be less than the maximum take-off weight less the following items; assist take-off fuel, droppable fuel and tanks, dumpable fuel, any other items normally expended during or immediately after take-off (except bombs, rockets, missiles, and ammunition shall be retained)."

Deviation: A normal landing gross weight of 45,000 lb. used for stress analysis. A maximum landing gross weight of 55,000 lb. used for stress analysis.

Reason for Deviation and Remarks: Of necessity, the weights to be used for stressing were established in the early stages of design.

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104. Engine Change

Requirement: Specification AIR 7-4, paragraph 6.1.3

The engine and afterburner installation shall be designed so that the complete unit in operating condition may be removed and another installed and ready for running in not more than thirty minutes. This shall be accomplished with no special tools other than an engine sling and an engine hoist or suitable trolley. The thirty minute period shall not include time required to set up or synchronize the engine controls.

Deviation: It is not known whether or not this requirement will be met.

Reason for Deviation and Remarks: Engine change time has yet to be determined.

105. Fuel Strainers

Requirement: Specification ARDCM 80-1, paragraph 16.333

The aircraft fuel system shall incorporate the necessary strainers or filters to ensure that the particle size of contaminants in the fuel delivered to the engine(s) is within the limits set forth in the applicable engine Model Specifications.

Since engine specifications MIL-E-5007 and MIL-E-8593 require engines to be capable of satisfactory performance on fuel strained to 200 mesh, strainers shall be utilized and shall be the responsibility of the aircraft manufacturer.

Deviation: An 8 mesh strainer is fitted at each booster pump inlet.

Reason for Deviation and Remarks: The size of 200 mesh strainers capable of handling high performance engine and afterburner fuel flow requirements with low pressure loss is prohibitive. There are no manual fuel filler openings for ingress of foreign matter. Filtered fuel is supplied from pressure refueling ground equipment and the tank pressurization air is strained by 200 mesh air filters.

106. Ignition Circuit

Requirement: Specification ARDCM 80-1, paragraph 9.522

Single and twin engine aircraft shall utilize ignition systems with dual circuitry, each circuit being separately fused. The dual circuitry shall extend back to the power source.

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106. Ignition Circuit (Cont'd)

Deviation: Single wire circuitry is installed for the ignition system.

Reason for Deviation and Remarks: The part of the system supplied on the engine has a single ignition circuit.

Weight economy measure.

Engine relight in the air is accommodated by means of a separate circuit which is connected to the common ignition point on each engine.

107 Reverse Current Cut-Outs - Accessability

Requirement: Specification CAP 479, paragraph 70.26 (1)

The reverse current cut-out(s) shall be accessible for unhampered inspection and maintenance while the engines are running with the aircraft on the ground.

Deviation: The reverse current cut-outs are not accessible for unhampered inspection and maintenance when installed.

Reason for Deviation and Remarks: The reverse current protection devices require an air conditioned location and are therefore installed in the transformer rectifier unit and alternator controls box. These protection devices are accessible only when the transformer rectifier unit and alternator controls box is removed from the aircraft (Resetting of these units is accomplished, on observation of DC failure warning light, by means of a switch located in the pilot's cockpit).

108. Flying Controls Hydraulic Circuits

Requirement: Specification AIR 7-4, paragraph 4.7.3.2

- (1) The aircraft shall be capable of meeting the scramble requirement of paragraph 3.4.1 under all climatic conditions when housed in a readiness hangar (32°F inside at -40° outside).

Specification AIR 7-4, paragraph 4.7.3.3

- (2) The aircraft shall be capable of meeting the scramble requirement of paragraph 3.4.1, with a delay of not more than one minute, when dispersed in the open. Details of the environmental conditions involved in this case will be provided by the Department.

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108. Flying Controls Hydraulic Circuits (Cont'd)

Requirement: (Cont'd)

Specification ARDCM 80-1, paragraph 10.02

- (3) Flight controls system shall be designed for operation at temperatures between  $+160^{\circ}\text{F}$  and  $-65^{\circ}\text{F}$ . After the initial break-away, the increase in force required to operate the control system at  $-65^{\circ}\text{F}$  shall not exceed 150% of the force required at  $+70^{\circ}\text{F}$ .

Deviation:

- (1) Conformity cannot be guaranteed below  $-40^{\circ}\text{F}$  ambient (See (1) and (2) below).
- (2) & (3) The design of the Flying Control Hydraulic System will permit full operation from  $0^{\circ}\text{F}$  to  $250^{\circ}\text{F}$ . Adequate control with limited maneuverability will be available down to  $-20^{\circ}\text{F}$ . At environmental temperatures below  $-20^{\circ}\text{F}$ , a delay of over 1 minute will be required for the necessary control exercising to warm the system up to  $-20^{\circ}\text{F}$ . At  $-65^{\circ}\text{F}$  this will require a delay of about 5 minutes (estimated).

Reason for Deviation and Remarks:

- (1) Temperature conditions within readiness hangars are not available for ambient temperatures below  $-40^{\circ}\text{F}$ .
- (2) & (3) It is necessary to cater for temperatures as high as  $250^{\circ}\text{F}$  present during flights. The weight penalty for installing piping of adequate size to permit full control operation down to  $-65^{\circ}\text{F}$  would not be justified since the hydraulic fluid would be above  $0^{\circ}\text{F}$  with the aircraft airborne. The fluid must be at a minimum temperature of  $-20^{\circ}\text{F}$  before take-off.

109. Oil Cooler Air Flaps

Requirement: Specification ARDCM 80-1, paragraph 15.530

Oil cooler air exit flaps shall be employed whenever an air-to-oil cooler is utilized in a turbine installation. The flaps shall be thermostatically controlled and shall control the engine oil inlet temperature so as not to exceed the value specified in the engine model specification.

Deviation: Oil cooler inlet flaps are used, with two positions only.

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109. Oil Cooler Air Flaps (Cont'd)

Reason for Deviation and Remarks: Inlet flaps are used to maintain high engine inlet efficiency. This air to oil cooler is supplementary to the main cooling system at high speed and high altitude.

110. Structural Tests

Requirement: Specification MIL-S-5700, paragraph 5.2 and 5.3

Para. 5.2 Structural Tests - Static The structural tests required for approval of the airplane strength shall be as outlined in MIL-S-5710.

Para. 5.3 Structural Tests - Flight The flight tests required for approval of the airplane strength shall be in accordance with MIL-S-5711.

Deviation: Structural ground and flight tests will be conducted under a program based on the requirements of MIL-S-5710 and MIL-S-5711 with some requirements deleted, added, or amended as agreed upon by the R.C.A.F. and the Company.

Reason for Deviation and Remarks: To permit a program which is compatible to the aircraft configuration and R.C.A.F. requirements to be established.

111. Piping Connections - Fuel System

Requirement: Specification ARDCM 80-1, paragraph 13.322

All fittings ----- shall conform to Air Force-Navy or U.S. Air Force Standards.

Deviation:

- (1) Flexible couplings to Company Specification are used.
- (2) Flareless type fittings to Company Specifications are used.

Reason for Deviation and Remarks:

- (1) Special flexible couplings required to meet temperature requirement.
- (2) Flareless type fittings are used in accordance with latest design practice to give a higher vibration life than may be achieved with AN flared type fittings.

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APPENDIX III

ENGINEERING DATA

To be added.

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# MODEL SPECIFICATION AMENDMENT

<u>AIRCRAFT TYPE</u> ARROW 1	<u>CONTRACT</u>	AMENDMENT NO.1 Page 2 of 3
SUBJECT Applicable Specifications and Publications - Contractual Clarification		E.C.P.
		MOD. NO.
REASON FOR CHANGE		EFFECTIVITY
		RETROFIT
EFFECT ON PERFORMANCE		
WEIGHT CHANGE		EFFECT ON BALANCE

## AMENDMENT

PARAGRAPH 1.1

PAGE 1 (Cont'd)

Add (Cont'd)

Contractor specifications and publications shall be approved by the RCAF prior to forming a part of this specification.

At the discretion of the Company subsequently dated RCAF approved issues may be used.

Delete

AIR 31-2 (Issue 6) - Acceptance of New and Newly Erected Aeroplanes of an Approved Type  
(This specification listed in error)

PARAGRAPH 1.4

PAGE 4

Delete

Deviations are set forth in Appendix II to this document and are indicated throughout the text by the appropriate deviation number encircled in the left-hand margin. A definition of "Deviation" appears in paragraph 6.2. From the date of approval by the R.C.A.F. of the Model Specification, additional deviations from the requirements of the specifications listed in paragraph 1.1 shall be submitted in the form of Specification Amendments.

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## MODEL SPECIFICATION AMENDMENT

<u>AIRCRAFT TYPE</u> ARROW 1	<u>CONTRACT</u>	AMENDMENT NO. 1 Page 3 of 3
SUBJECT Applicable Specifications and Publications - Contractual Clarification		E.C.P.
		MOD. NO.
		EFFECTIVITY
REASON FOR CHANGE		RETROFIT
EFFECT ON PERFORMANCE		
WEIGHT CHANGE		EFFECT ON BALANCE

### AMENDMENT

PARAGRAPH 1.4

PAGE 4 (cont'd)

### Add

Deviations are set forth in Appendix II to this document and are indicated throughout the text by the appropriate deviation number encircled in the left-hand margin. A definition of "Deviation" appears in paragraph 6.2. From the date of approval by the RCAF of the Model Specification, required additional deviations from the requirements of the specifications listed in paragraph 1.1 shall be submitted in the form of Specification Amendments.





MODEL SPECIFICATION  
AMENDMENT NOTICE

TO RCAF  
DATE 26 SEP 57

SPECIFICATION TITLE

Model Specification for Arrow 1  
Supersonic Aircraft.

COPY NO. 38  
SPEC. NO. AAMS-105/1  
ISSUE NO. 1

SOEP

Attached is a copy of Amendment No. 1 together with amended pages 1, 1a, 4 and 192, for inclusion in your copy of the above noted specification.

This amendment is to be filed in Appendix IV of the specification. Pages 1, 1a, and 4, marked "REV. SEP 57", replace the existing pages, which are obsolete. Please destroy the obsolete pages in accordance with existing security regulations.

The RCAF has stated that this specification is now approved with the incorporation of the subject amendment.

R.B. Cairns  
Model Specification Section

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## SECTION I

### APPLICABLE SPECIFICATIONS AND PUBLICATIONS

#### 1.1 Referenced Specifications

The following specifications and publications of the issue in effect on 23 April, 1954, shall form a part of this specification to the extent stated in this specification. The applicable paragraphs of this specification shall, in each case, state the extent to which the aircraft design complies with the following specifications. Failure to list non-compliance with the requirements of the specifications listed in this paragraph, which, by a reasonable engineering interpretation should apply to this specification, shall indicate the Contractor's intention to meet all such requirements even though no specific mention is made of the requirement in this specification. Where the Contractor does not intend to comply with such requirements a deviation shall be raised.

Contractor specifications and publications shall be approved by the RCAF prior to forming a part of this specification.

At the discretion of the Company subsequently dated RCAF approved issues may be used.

AIR 7-4 Issue 3	R.C.A.F. Specification for Supersonic All-Weather Interceptor Aircraft Type CF105
CAP 479	Manual of Aircraft Design Requirements for the Royal Canadian Air Force
ARDCM 80-1	Handbook of Instructions for Aircraft Designers
PWA Spec. No. 2605	Pratt and Whitney Aircraft, JT4A-25 Turbo-Jet Engine Specification
PWA Spec. No. 2611	Pratt and Whitney Aircraft, JT4A-23 Turbo-Jet Engine Specification
RCAF Spec. C-28-96	Luminescent Material, Fluorescent - Radioactive
EL-5040-1	Aircraft Doppler Radar System
INST 11-1	Regulator, Oxygen
MIL-B-5087A	Bonding, Electrical (for Aircraft)

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REV. SEP 57

1.1 Referenced Specifications (Cont'd)

MIL-W-5088A	Wiring, Aircraft, Installation of
MIL-I-5099A	Indicator, Cabin Air Pressure, 1-7/8 Inch Dial, Type MA-1
MIL-H-5440A	Design, Installation and Tests of Aircraft Hydraulic Systems
MIL-F-5572A	Fuel, Aircraft Reciprocating Engine
MIL-O-5606 (2)	Oil, Hydraulic, Aircraft, Petroleum Base
MIL-F-5616	Fuel, Aircraft Engine, Grade JP-1
MIL-F-5624 (c)	Fuel, Aircraft Turbine and Jet Engine, Grades JP-3 and JP-4

cont'd on page 2

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### 1.1 Referenced Specifications (Cont'd)

Avrocan E-266	Environmental Testing, Aeronautical and Associated Equipment, General Specification for CF105 Aircraft
Avro Report QC-E-9	Interchangeability - Working Lists
Avro Report P/AERO DATA/89	Detailed Analysis of Flying Qualities of CF-105
Avro Report SR-4	Compliance with ABC Standards
Dowcan 200 (Issue 1)	Silicone Based Fluid (26 Oct. 1954)

### 1.2 Precedence of Requirements

From the date of RCAF approval of this Model Specification the requirements of this Specification shall possess the first order of precedence. Otherwise, in the event of conflict between the requirements of the specifications, publications, and documents referenced in this Model Specification, the order of precedence for compliance shall be as follows:

- (a) AIR 7-4 - R.C.A.F. Specification for Supersonic All-Weather Interceptor Aircraft Type CF-105
- (b) CAP 479 - Manual of Aircraft Design Requirements for the Royal Canadian Air Force
- (c) ARDCM 80-1 - Handbook of Instructions for Aircraft Designers
- (d) The remaining specifications referenced in this specification.

### 1.3 Specification Amendments

Any alteration to this Model Specification, whether or not such alteration results in a physical change to the aircraft, shall be submitted by the Company to the R.C.A.F. in the form of a "Specification Amendment".

### 1.4 Deviations

Deviations are set forth in Appendix II to this document and are indicated throughout the text by the appropriate deviation number encircled in the left-hand margin. A definition of "Deviation" appears in paragraph 6.2. From the date of approval by the RCAF of the Model Specification, required additional deviations from the requirements of the specifications listed in paragraph 1.1 shall be submitted in the form of Specification Amendments.

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APPENDIX IV

AMENDMENTS TO MODEL SPECIFICATION

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