1.0 SCOPE

This Design Standard outlines the engineering requirements for the aerodynamic smoothness of the DHC-8 Series 100, 200, 300 and 400 wetted surface area.

The enclosed criteria are applicable to both DHC production line and in-service repair schemes. Any deviations from these criteria must be approved by Liaison Engineering.

2.0 CRITICAL ZONES

The critical zones of the DHC-8 are defined in Table 1 and illustrated in Figures 1 and 2. (Reference AEROC 0.2.AC.0 (S100/200/300) and AEROC 84.2.AC.0 (S400)).

TABLE 1: CRITICAL ZONES

AIRCRAFT REGION	CRITICAL ZONE	FIGURE
NONMOVEABLE SURFACES		
WING	All nonmoveable wing upper and lower surfaces are in the critical zone.	1
NACELLES	All areas ahead of the firewall (including the propeller, spinner and intake duct) and areas within 1 foot of the surface of the wing.	2
FUSELAGE	The fuselage surface, including fairings, ahead of the wing rear spar. Note that for the S100/200/300, in the region near the static port, a more demanding tolerance is required (reference AEROC 8.2.AC.2 and PPS 40.13). Note also that the airstair door has a less demanding tolerance.	1
STABILIZERS (Vertical and Horizontal)	The entire surface is in the critical zone.	1
V/STAB - H/STAB FAIRING	The entire surface is in the critical zone.	1
DORSAL FIN	The entire surface is in the critical zone.	1
MOVEABLE SURFACES		
AILERONS (Including tabs)	The entire surface is in the critical zone.	1
FLAPS	Figure 2 illustrates the critical and noncritical regions for a single element flap. Within 1 foot of a nacelle or wing junction, the entire flap is included in the critical zone.	2
SPOILERS	The entire surface is in the critical zone.	1
RUDDER and ELEVATOR (including tabs)	The entire surface is in the critical zone.	1

(L) LIST OF CURRENT SHEETS UPDATED.
SHEET 12 WAS REV. 'C' NOW 'D'.

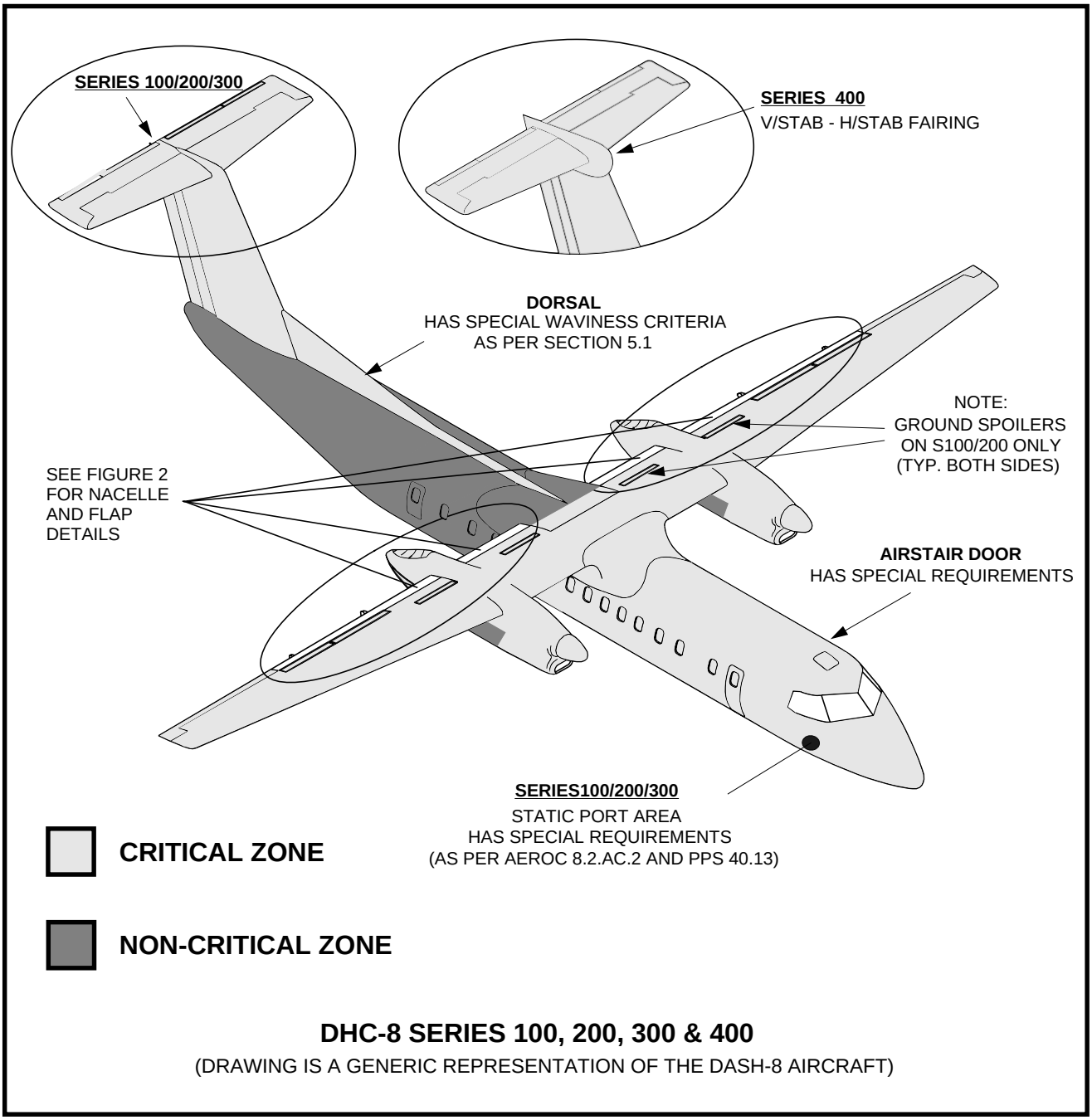
LIST OF CURRENT SHEETS																	
PAGE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
REVISION	L	E	E	C	E	E	C	D	C	D	C	D	B	B	B	C	B

SEE ENGINEERING STANDARDS APPROVAL RECORD FOR ORIGINAL SIGNATURES AND CHANGE SUMMARY

DRAWN	J. ROTSCH	**AERODYNAMIC SMOOTHNESS REQUIREMENTS, DASH 8**	**DS 95**
CHECKED	B. McDONALD		
AERO	N. ELLIS		SHEET: 1
APPROVED	S. HAMID		

REV: | REV: | REV: L - 12 MAR 04 | REV: K 29 AUG 00 | REV: J - 24 OCT 97 | APPROVED: 9 AUG 1982

FIGURE 1. CRITICAL AND NONCRITICAL ZONES



DHC-8 SERIES 100, 200, 300 & 400

(DRAWING IS A GENERIC REPRESENTATION OF THE DASH-8 AIRCRAFT)

(E) REDRAWN NO TECHNICAL CHANGE

SEE ENGINEERING STANDARDS APPROVAL RECORD FOR ORIGINAL SIGNATURES AND CHANGE SUMMARY

DRAWN	J. ROTSCH
CHECKED	B. McDONALD
AERO	N. ELLIS
APPROVED	S. HAMID

AERODYNAMIC SMOOTHNESS REQUIREMENTS, DASH 8

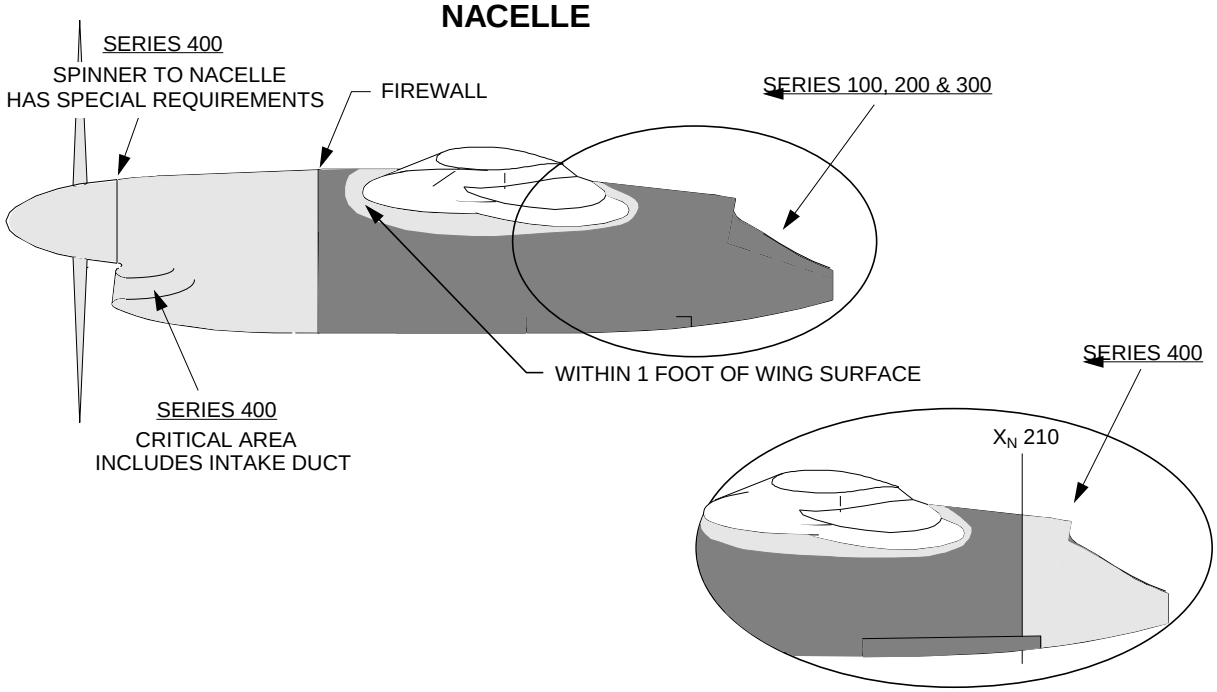
DS 95

SHEET: 2

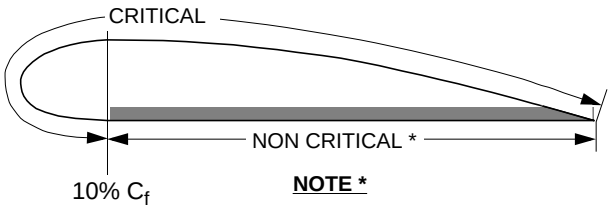
APPROVED: 9 AUG 1982 | REV: D - 13 JAN 97 | REV: E - 29 AUG 00 | REV: | REV: | REV:

FIGURE 2. CRITICAL AND NONCRITICAL ZONES (CONT'D)

NACELLE



SINGLE ELEMENT FLAP



NOTE *

FLAP LOWER SURFACE IS IN CRITICAL ZONE
WITHIN 1 FOOT OF NACELLE OR FUSELAGE JUNCTION.

CRITICAL ZONE

NON-CRITICAL ZONE

DHC- 8 SERIES 100, 200, 300 & 400

(DRAWING IS A GENERIC REPRESENTATION OF THE DASH-8 NACELLE)

(E) REDRAWN NO TECHNICAL CHANGE

REV: | REV: | REV: | REV: E - 29 AUG 00 | REV: D - 24 OCT 97 | APPROVED: 9 AUG 1982

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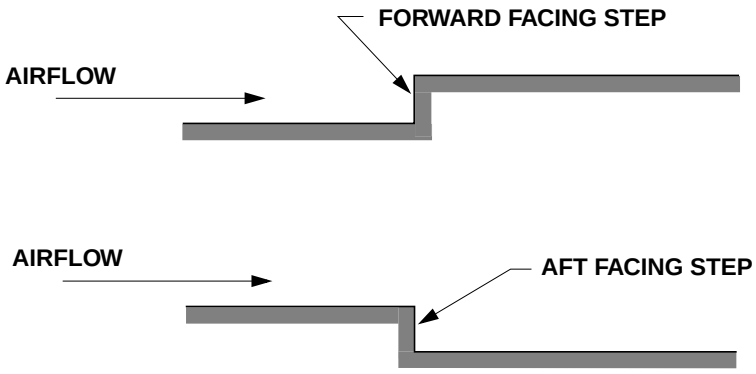
DRAWN	J. ROTSCH	**AERODYNAMIC SMOOTHNESS REQUIREMENTS, DASH 8**	**DS 95**
CHECKED	B. McDONALD		
AERO	N. ELLIS		SHEET: 3
APPROVED	S. HAMID		

3.0 STEP DISCONTINUITIES

Forward facing, aft facing, and streamwise steps due to skin laps, external doublers, etc. shall be avoided at the design stage. Refer to Figure 3 for a pictorial description of forward and aft facing steps.

FIGURE 3. STEP DISCONTINUITIES



Step discontinuities which are the result of production tolerances shall not exceed the criteria specified in Table 2. This applies to steps in fixed skins as well as steps in hinged or removable panels.

TABLE 2: STEP DISCONTINUITIES

COMPONENT	STEP DISCONTINUITIES ** (in inches - max.)		
	ALL MODELS (except where noted)		
	FWD FACING (in.)	AFT FACING (in.)	STREAMWISE (in.)
NONMOVEABLE SURFACES			
WING	0.015	0.030	0.030*
NACELLES			
Critical Zone	0.015	0.030	0.030
Noncritical Zone	0.030	0.060	0.060
Intake Duct (S400 only)	0.010	0.020	0.030
Spinner to Nacelle (S400 only)	0.015	0.030	-
FUSELAGE			
Critical Zone	0.015	0.030	0.030
Noncritical Zone	0.030	0.060	0.060
Airstair Door	0.060	0.070	0.070
Static Port Areas (S100/200/300 only)	See PPS 40.13	See PPS 40.13	See PPS 40.13
STABILIZER - Vertical	0.015	0.030	0.030
STABILIZER - Horizontal	0.015	0.030	0.030
V/STAB - H/STAB FAIRING	0.015	0.030	0.030
DORSAL FIN	0.015	0.030	0.030
MOVEABLE SURFACES			
AILERONS (including tabs)	0.015	0.030	0.030
FLAPS			
Critical Zone	0.015	0.030	0.030
Noncritical Zone	0.030	0.060	0.060
SPOILERS	0.015	0.030	0.030
RUDDER	0.015	0.030	0.030
ELEVATOR (including tabs)	0.015	0.030	0.030

* Leading edge streamwise step and gap dimensions to be taken as specified on Drawing #85720002 for the Dash-8 Series 100/200/300.

** If mismatch is greater than allowable tolerance, consult Liaison Engineering for proper procedure of chamfering and protective refinishing.

(E) REDRAWN NO TECHNICAL CHANGE

REV: | REV: | REV: | REV: E - 29 AUG 00 | REV: D - 24 OCT 97 | APPROVED: 9 AUG 1982

SEE ENGINEERING STANDARDS APPROVAL RECORD FOR ORIGINAL SIGNATURES AND CHANGE SUMMARY

DRAWN	J. ROTSCH	AERODYNAMIC SMOOTHNESS REQUIREMENTS, DASH 8	DS 95
CHECKED	B. McDONALD		
AERO	N. ELLIS		SHEET: 5
APPROVED	S. HAMID		

4.0 GAP CRITERIA

4.1 Dash-8 All Models (except Series 400 Nacelle)

Butt Joint Gaps - Fixed Skin (Figure 4)

Critical Zone

i) If h ≤ 0.010, e max not critical.

i) If h > 0.010, e max shall be ≤ 0.0625.

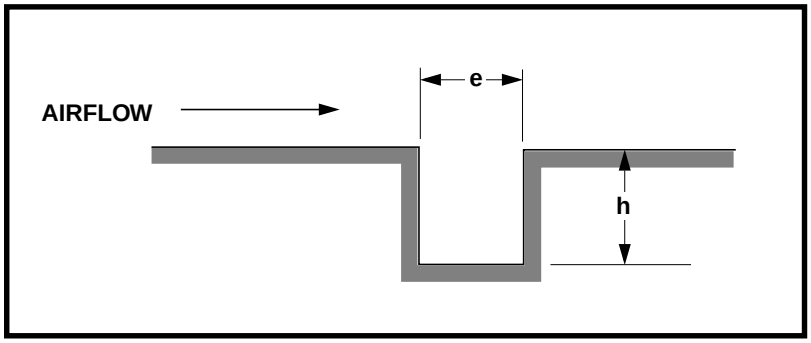
Non-critical Zone

i) If h ≤ 0.020, e max not critical.

i) If h > 0.020, e max shall be ≤ 0.125.

Note: If gap dimensions exceed criteria (ii), use aerodynamic filler. Above criteria assumes no air leakage through gap.

FIGURE 4. BUTT JOINT GAPS

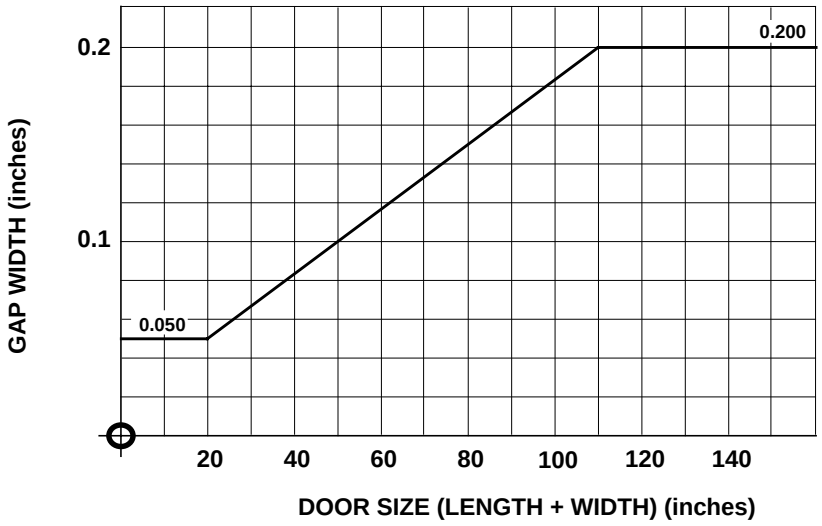


Gaps - Doors and Access Panels

Gaps in doors and access panels, in both the critical and noncritical zones, shall not be larger than shown in Figure 5:

NOTE: Criteria assumes no air leakage through gap.

FIGURE 5. DOOR AND ACCESS PANEL GAPS



4.2 Dash-8 Series 400 Nacelle

Skin gaps for the Dash-8 Series 400 nacelle shall not exceed the limits specified in Table 3.

TABLE 3: SKIN GAPS - DASH-8 SERIES 400 NACELLE

LOCATION		TRANSVERSE (inches)	STREAMWISE (inches)
CRITICAL ZONE	Fixed Skin Gaps	0.000 - 0.030	0.000 - 0.040
	Removable & Hinged Panels	0.010 - 0.100	0.010 - 0.120
NON-CRITICAL ZONE	Fixed Skin Gaps	0.000 - 0.060	0.000 - 0.070
	Removable & Hinged Panels	0.010 - 0.150	0.010 - 0.170
INTAKE DUCT		0.000 - 0.030	0.000 - 0.040
SPINNER TO NACELLE		0.370 - 0.430	-

5.0 WAVINESS CRITERIA

5.1 Streamwise (All Areas except Dorsal)

In both the critical and noncritical zones, a streamwise surface wave of length “L” shall have a crest to valley depth “h” not exceeding the greater of 0.020 inch or 0.005 L (see Figure 6).

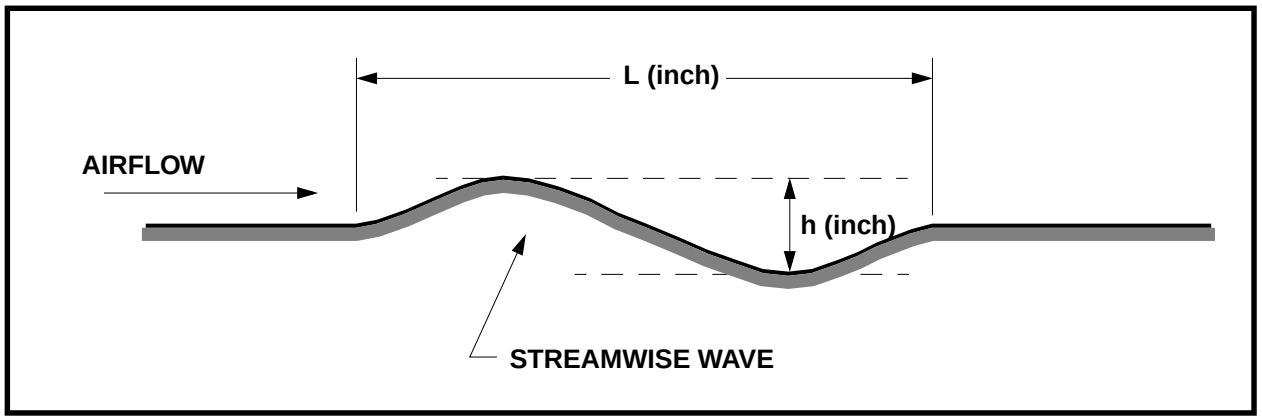
Streamwise (Dorsal)

A streamwise surface wave of length “L” shall have a crest to valley depth “h” not exceeding the greater of 0.020 inch or 0.008 L (see Figure 6).

5.2 Spanwise

In both the critical and noncritical zones, a spanwise surface wave shall not exceed the greater of 0.040 inch or 0.010 L.

FIGURE 6. WAVINESS

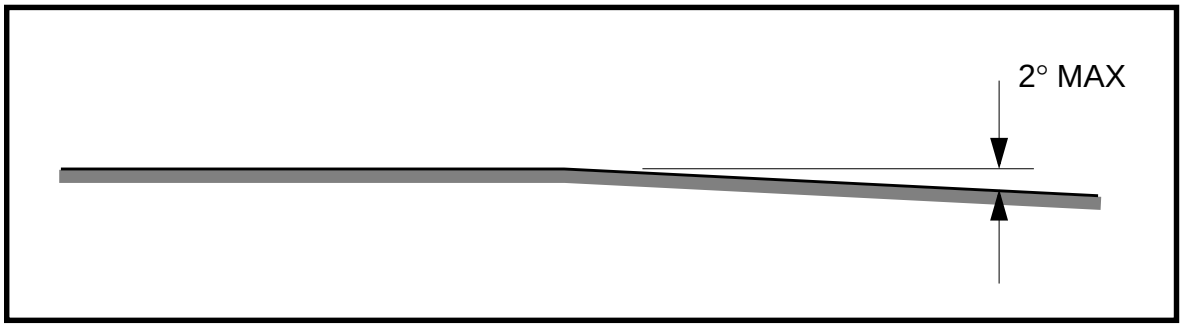


6.0 CURVATURE CRITERIA

All components are to be built to outside profile loft lines, which are generally smooth, continuous shapes, in the direction of the airflow. The finished components should reflect this.

In both the critical and noncritical zones, discontinuities in the surface curvature of the finished component shall not be greater than two degrees (2°). This criteria is illustrated in Figure 7 below and is checked by rocking a straight edge over the discontinuity.

FIGURE 7. CURVATURE



Particularly critical zones are at:

a) All “D” nose-to-spar joints (wing, stabilizer, control surfaces, flaps, etc.)

a) Wing to rear shroud joints

a) Control surface leading edges (i.e. leading edge balances, horns, etc.)

7.0 PROFILE CRITERIA

The overall external profile of the finished component(s) shall have the tolerances specified in Table 4, as measured with a master profile template, located at the specific spanwise location:

TABLE 4: PROFILE CRITERIA

COMPONENT	S100/200/300		S400	
	SPANWISE LOCATION (inches)	MAX. DEVIATION (inches)	SPANWISE LOCATION (inches)	MAX. DEVIATION (inches)
ASSEMBLED WING From "D" Nose L.E. to Flap T.E. with $\delta_f = \delta_{sp} = \delta_{ail} = 0°$	a) $Y_w = 90.6$ b) $Y_w = 261.0$ c) $Y_w = 457.0$	± 0.090* ± 0.075* ± 0.041*	a) $Y_w = 90.6$ b) $Y_w = 281.0$ c) $Y_w = 477.0$	± 0.092* ± 0.075* ± 0.041*
AILERON (Tabs Installed) $\delta_{TAB} = 0°$	a) $Y_w = 457.0$ b) $Y_w = 495.0$	± 0.030 ± 0.030	a) $Y_w = 477.0$ b) $Y_w = 515.0$	± 0.030 ± 0.030
FLAPS	a) $Y_w = 90.6$ b) $Y_w = 200.0$ c) $Y_w = 380.0$	± 0.035 ± 0.032 ± 0.021	a) $Y_w = 90.6$ b) $Y_w = 220.0$ c) $Y_w = 400.0$	± 0.035 ± 0.032 ± 0.021
VERTICAL STABILIZER/RUDDER COMBINATION ($\delta_R = 0°$)	a) Z = 256.0	± 0.110*	a) Z = 256.0	± 0.110*
RUDDER (Fore & Aft assembled)	a) Z = 256.0	± 0.110*	a) Z = 256.0	± 0.110*
HORIZONTAL STABILIZER/ELEVATOR COMBINATION ($\delta_e = 0°$)	a) $Y_H = 14.0$ b) $Y_H = 106.0$	± 0.047* ± 0.047*	a) $Y_H = 40.5$ b) $Y_H = 132.5$	± 0.047* ± 0.047*
ELEVATOR	a) $Y_H = 14.0$ b) $Y_H = 106.0$	± 0.031 ± 0.031	a) $Y_H = 40.5$ b) $Y_H = 132.5$	± 0.031 ± 0.031
V/STAB - H/STAB FAIRING	Not Applicable		All	± 0.030

NOTE: Criteria based on 0.5% of component maximum thickness.

Criteria applicable to production only, NOT in-service repair.

* Except for "Designed-in" discontinuities, such as wing/flap shroud, wing/aileron, stabilizer/elevator, fin/rudder, forward rudder/aft rudder gap, etc.

Ⓒ 8.0 FLUSH FASTENER HEAD PROTRUSION

Ⓒ 8.1 Except as noted in Para 8.2, , flushness limits for flush head fasteners, in both the critical and noncritical zones, shall be as specified in the applicable fastener installation PPS.

Ⓒ 8.2 Where special fastener flushness limits are required for a specific design application, such limits shall be called up on the particular assembly drawing

9.0 OIL CANNING

9.1 Definitions

(a) "Oil-Can"

An oil-can is defined as a permanent skin buckle which, when pressed (see details on proper inspection method), moves inward with a distinct sharp motion, and/or noise, and will remain inward; i.e., has two positions of equilibrium (in or out). At the same time at another location, the skin may bulge to an outward position. Pressure there will make the original point pop back out.

(b) "Loose Skins"

A loose skin is defined as a buckle which "pops" in and out as soon as pressure (see inspection method) is applied and removed.

(c) "Quilted Skins"

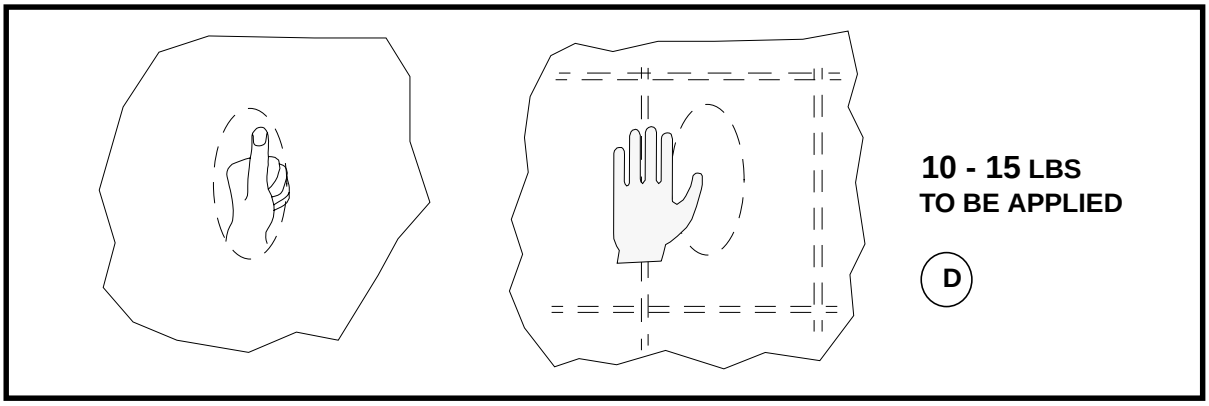
Quilted skins are panels which do not meet the previous two definitions, but show the outlines of ribs and stringers under certain lighting and skin polish conditions.

9.2 Inspection

To inspect for "oil-cans", apply light pressure to suspected area, using the thumb of one hand (see Figure 8).

Ⓒ REDRAWN, TABLE OF FASTENER FLUSHNESS LIMITS DELETED, PARA 8.2 ADDED

FIGURE 8. OIL CANNING



NOTE: Pressure should be applied with the thumb of one hand only. Do not use wrist, arm, or shoulder pressure. Excessive pressure may damage skin and or substructure.

9.3 Acceptability (Critical and Noncritical Zones)

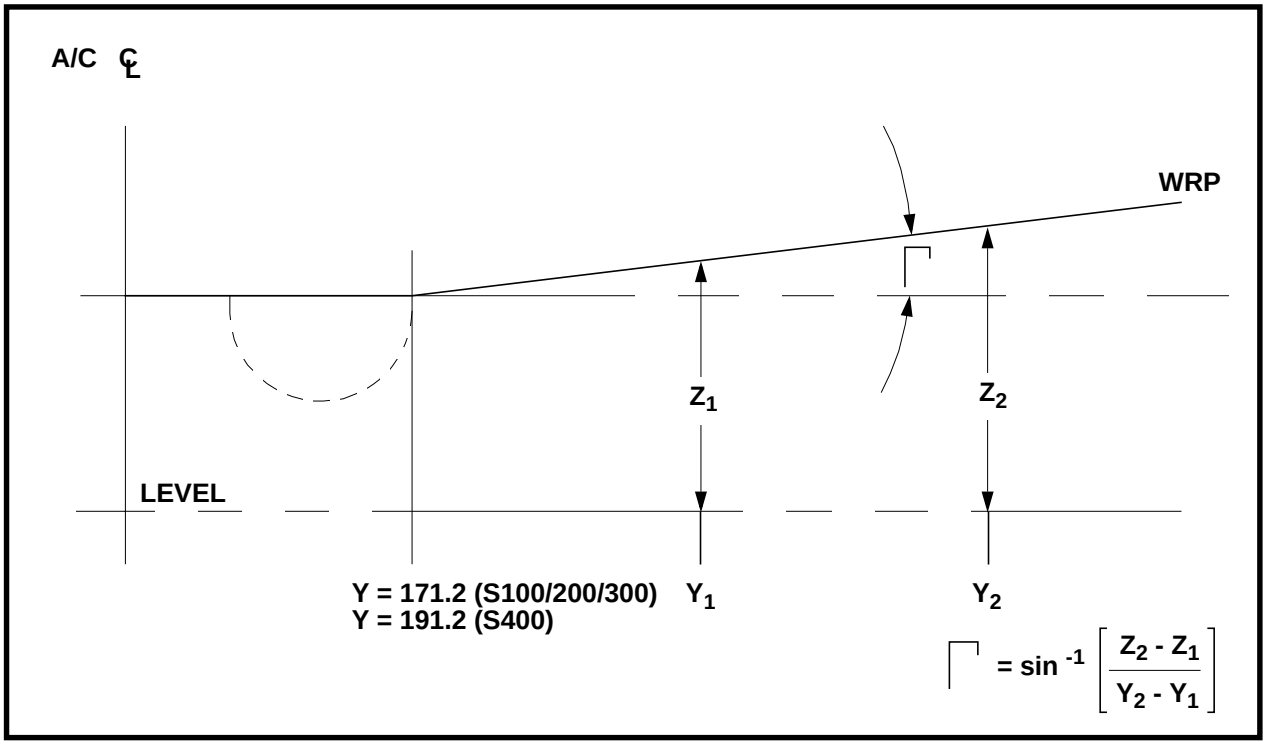
a) "Oil-Cans" are not acceptable as continual working could lead to early fatigue cracking. Refer to Engineering Liaison for corrective action.

b) "Loose or Quilted Skins" are sometimes (depending upon location and aircraft type) acceptable to Engineering, however, the mentioned conditions may be objectionable from an appearance standpoint and therefore, unacceptable to DHI customers. Disposition shall be the joint responsibility of Engineering and Inspection (MRB).

(D) REPLACED TEXT IN FIGURE 8. WITH 10-15LBS TO BE APPLIED.
REMOVED 'WRONG AND 'RIGHT' FROM FIGURES.

10.0 WING DIHEDRAL REQUIREMENTS

FIGURE 9. WING DIHEDRAL

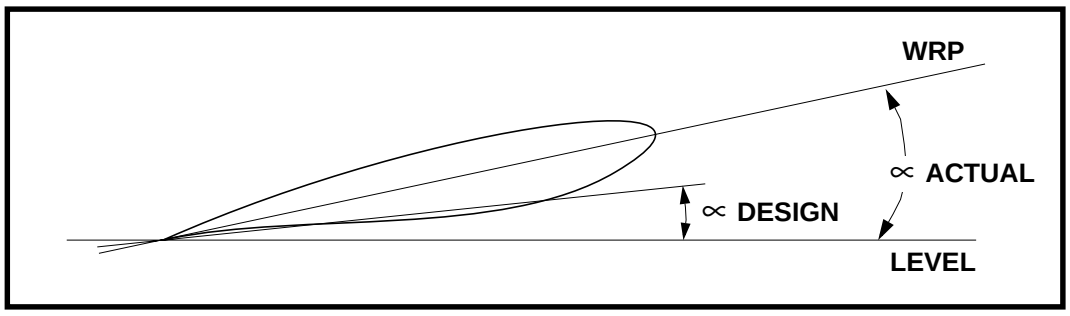


- Outboard wing dihedral angle (Γ) shall be measured between two wing stations outboard of station Y = 171.2 (S100/200/300) or Y = 191.2 (S400).
- Absolute dihedral is the difference between the actual dihedral angle measured and the nominal dihedral angle*.
- Absolute dihedral shall not exceed ± 0° 15’.

* The design dihedral = 2° 30’. Wing structural weight will reduce the design dihedral angle by approximately 0° 15’, therefore the nominal dihedral angle = 2° 15’.

11.0 WING TWIST REQUIREMENTS

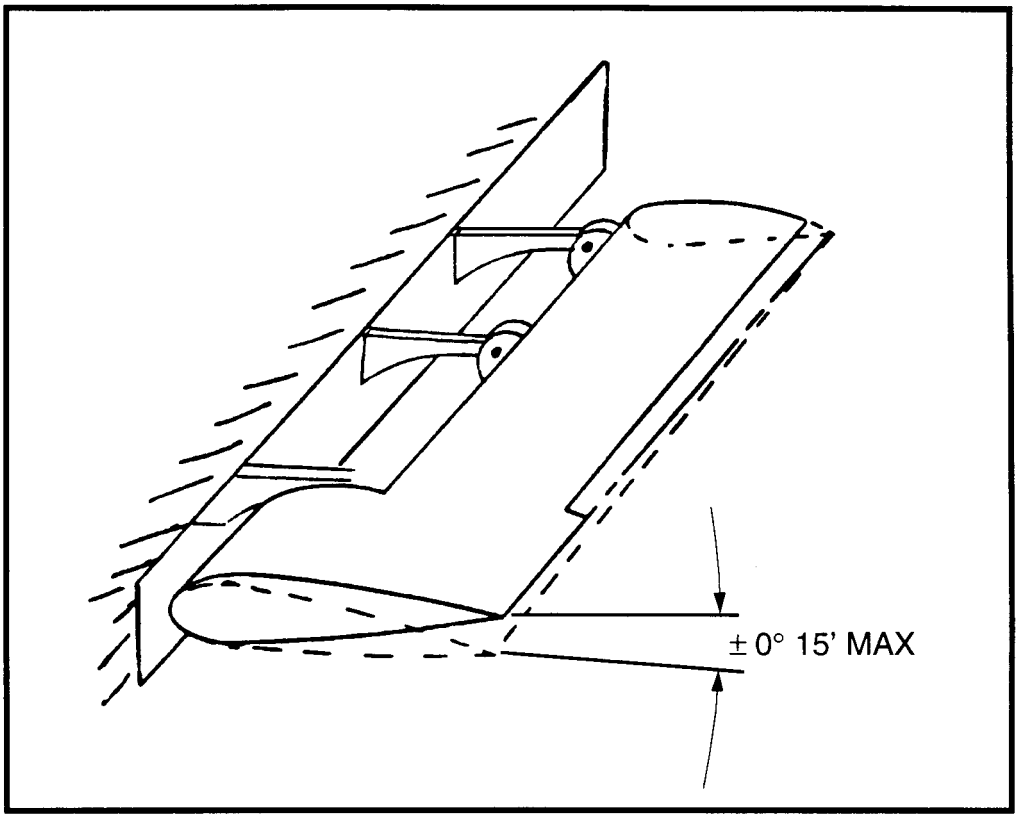
FIGURE 10. WING TWIST



- Absolute twist is the difference between the actual local wing incidence angle and the design incidence angle for that station.
- Design incidence angle can be obtained from AEROC 8.2.AC.0, Sections 3.1, and 3.2.6 for the Dash-8 Series 100, 200, and 300. Refer to AEROC 84.2.AC.0 for the Dash-8 Series 400.
- The difference in the incidence angle between the LH wing and the RH wing, measured at the same Y_W station, shall not be greater than 0° 15'.
- The absolute twist shall not exceed ± 0° 15'.

12.0 AILERON TWIST REQUIREMENTS

FIGURE 11. AILERON TWIST



- Aileron end-to-end twist shall be measured for completed ailerons (less the tab) in the assembly jig.

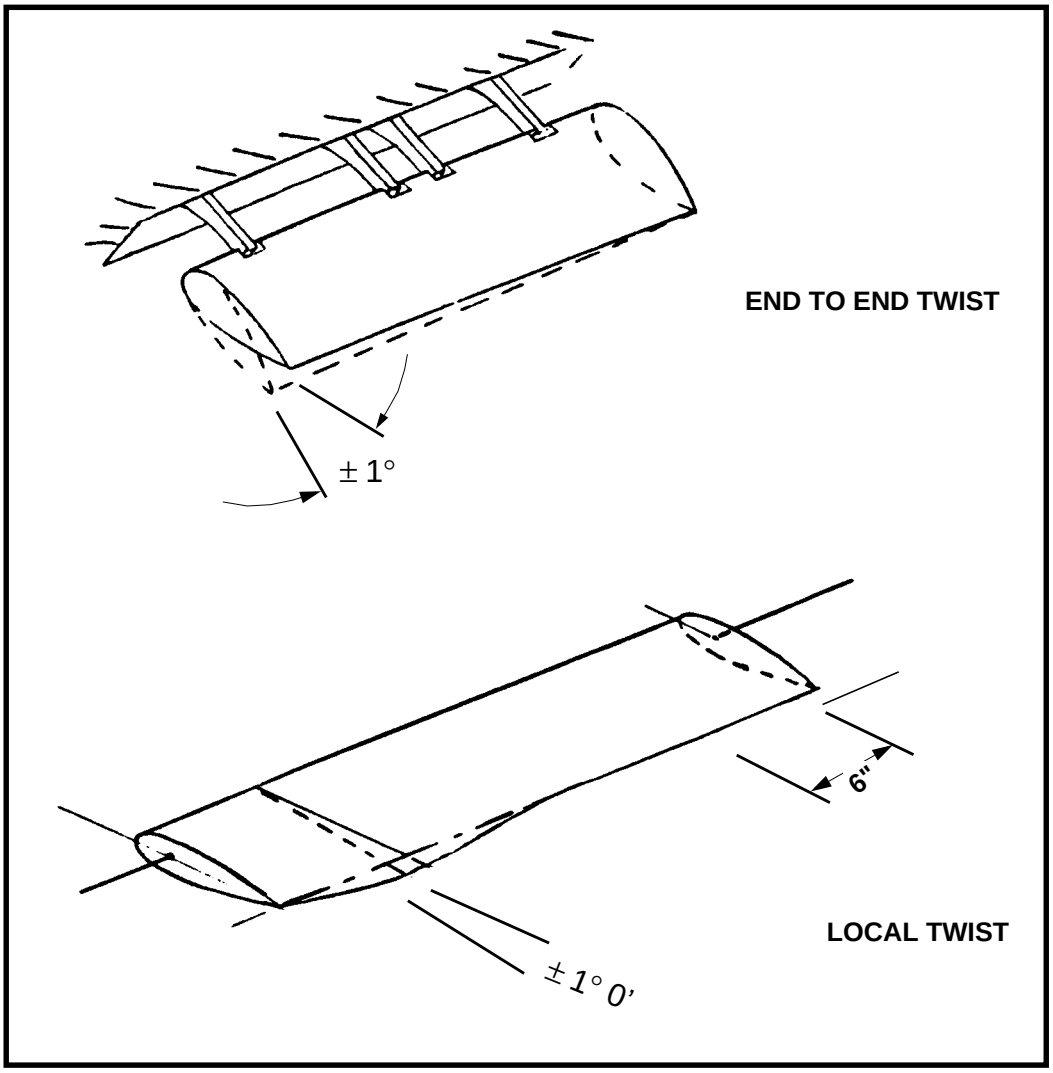
  The assembly shall be held by the hinges only, ensuring that the structure is free of loads and not binding. Twist can be determined using jig contour boards.

- Aileron end-to-end twist shall not exceed ± 0° 15'.

(B) REDRAWN NO TECHNICAL CHANGE

13.0 AILERON SPRING/TRIM TAB TWIST REQUIREMENTS

FIGURE 12. AILERON TAB TWIST

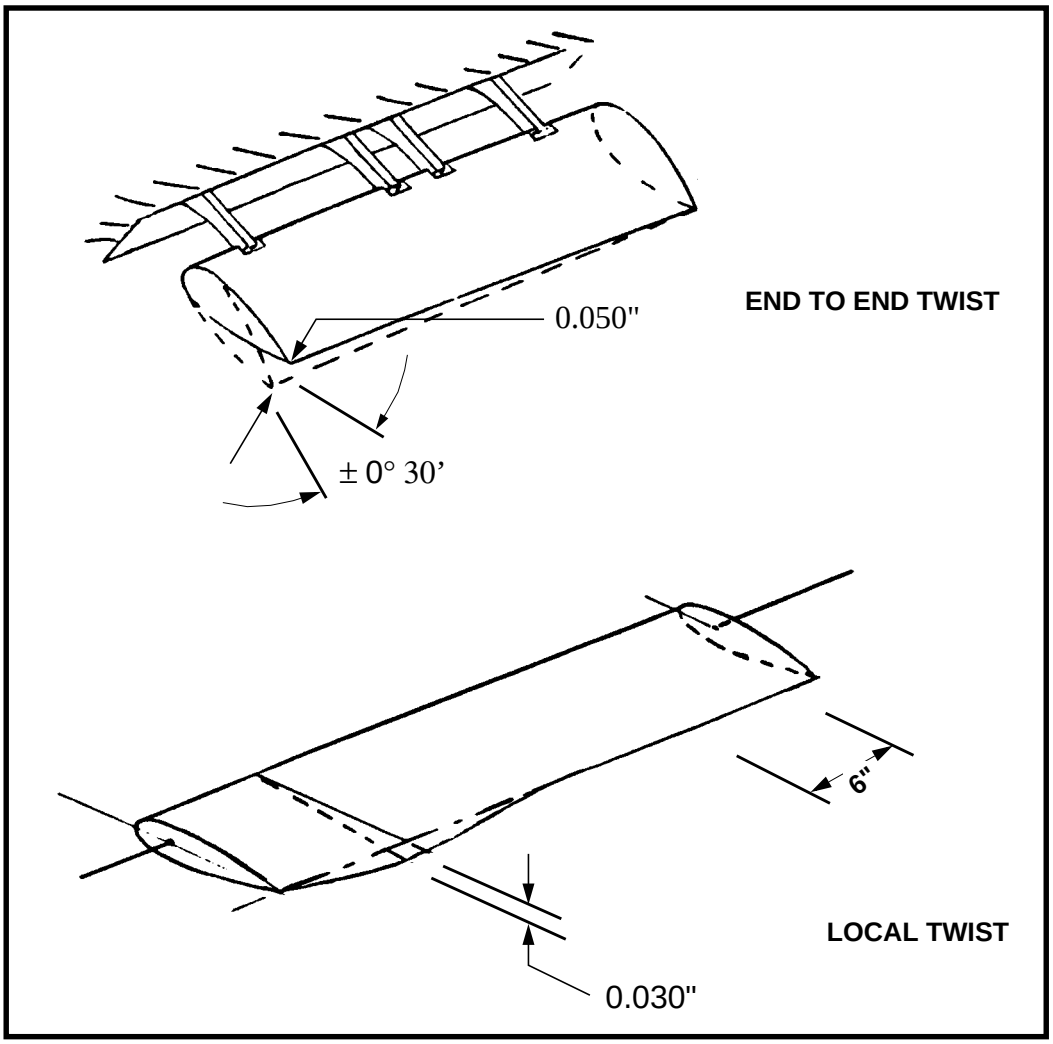


- Aileron spring/trim tab (S100/200), aileron trim and geared tab (S300) and aileron trim and ground adjustable tab (S400) end-to-end twist is measured in the assembly fixture with the tab mounted on hinges only, free of loads and not binding. Contour boards shall be used to determine the twist.
- Tab end-to-end twist shall not exceed ± 1° 0'.
- Local twist is to be measured at intervals of six inches along the span and shall not exceed ± 1° 0' deviation from contour

14.0 ELEVATOR SPRING/TRIM TAB TWIST REQUIREMENTS (S100/200/300)

NOTE - The elevator spring/trim tab twist requirements apply to the Dash-8 Series 100/200/300 only. The Dash-8 Series 400 has a powered elevator without tabs.

FIGURE 13. ELEVATOR TAB TWIST



- Elevator spring/trim tab end-to-end twist is measured in the assembly fixture with the tab mounted on hinges only, free of loads and not binding. Contour boards shall be used to determine the twist.
- Tab end-to-end twist shall not exceed ± 0° 30' or 0.050".
- Local twist is to be measured at intervals of six inches along the span and shall not exceed 0.030" deviation from contour