DV 20 E

AIRPLANE MAINTENANCE MANUAL

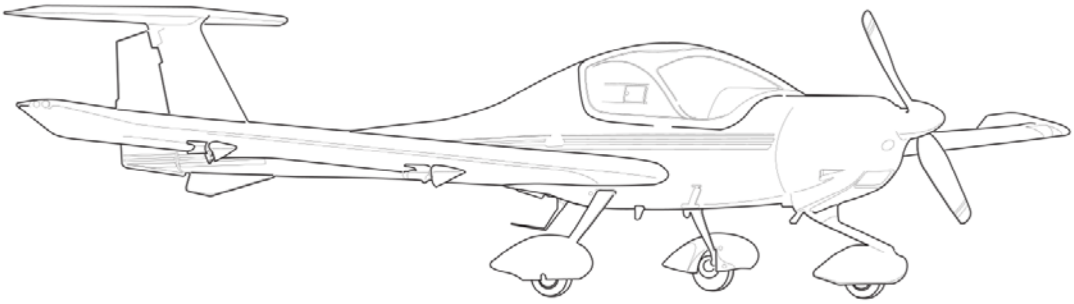

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TABLE OF CONTENTS

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Record of Revision

1. Record of Revision

Use this check list to record and control all of the revisions which you put in this Airplane Maintenance Manual (AMM). Put the affected pages of the revision into the AMM as soon as you get them. Remove and destroy the pages which are superseded. Complete the table below when you have put the revision in the AMM.

Revision Number	Date Issued	Inserted On	Inserted By	Revision Number	Date Issued	Inserted On	Inserted By
Original	15 Dec 2015						
1	25 Jan 2016						
2	15 Mar 2022						

2. Record of Incorporated Temporary Revisions

The following Temporary Revisions are incorporated into the DV 20 E AMM by Revision 2:

Temporary Revision Number	Description of Temporary Revision
AMM-TR-MÄM-20-446	Weighing Report Improvement
AMM-TR-MÄM-20-450	Wiring Improvement
AMM-TR-MÄM-20-459	Fuel Pressure Sensor Location
AMM-TR-MÄM-20-460	Manual Corrections
AMM-TR-OÄM-20-245	External Alternator
AMM-TR-OÄM-20-271	LED Taxi- and Landing Lights

LIST OF EFFECTIVE PAGES

1. General

The list of effective pages uses this abbreviation:

– TOC = Table of Contents.

– ROR = Record of Revisions

– LOEP = List of Effective Pages

All Sections have a Title Page and a Table of Contents. The TOC can have one page or it can have many pages.

Each revision to the Airplane Maintenance Manual will have a new List of Effective Pages.

Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date
TOC	i	15 Mar 2022	01-00	Title 1	15 Mar 2022	02-00	6	15 Mar 2022
TOC	ii	15 Mar 2022	01-00	Title 2	15 Mar 2022	02-00	7	15 Mar 2022
TOC	iii	15 Mar 2022	01-00	TOC 1	15 Mar 2022	02-00	8	15 Mar 2022
TOC	iv	15 Mar 2022	01-00	TOC 2	15 Mar 2022	03-00	Title 1	15 Mar 2022
ROR	v	15 Mar 2022	01-00	1	15 Mar 2022	03-00	Title 2	15 Mar 2022
ROR	vi	15 Mar 2022	01-00	2	15 Mar 2022	03-00	TOC 1	15 Mar 2022
LOEP	1	15 Mar 2022	01-00	3	15 Mar 2022	03-00	TOC 2	15 Mar 2022
LOEP	2	15 Mar 2022	01-00	4	15 Mar 2022	03-00	1	15 Mar 2022
LOEP	3	15 Mar 2022	01-00	5	15 Mar 2022	03-00	2	15 Mar 2022
LOEP	4	15 Mar 2022	01-00	6	15 Mar 2022	03-00	3	15 Mar 2022
LOEP	5	15 Mar 2022	02-00	Title 1	15 Mar 2022	03-00	4	15 Mar 2022
LOEP	6	15 Mar 2022	02-00	Title 2	15 Mar 2022	03-00	5	15 Mar 2022
LOEP	7	15 Mar 2022	02-00	TOC 1	15 Mar 2022	03-00	6	15 Mar 2022
LOEP	8	15 Mar 2022	02-00	TOC 2	15 Mar 2022	04-00	Title 1	15 Mar 2022
LOEP	9	15 Mar 2022	02-00	1	15 Mar 2022	04-00	Title 2	15 Mar 2022
LOEP	10	15 Mar 2022	02-00	2	15 Mar 2022	04-00	TOC 1	15 Mar 2022
LOEP	11	15 Mar 2022	02-00	3	15 Mar 2022	04-00	TOC 2	15 Mar 2022
LOEP	12	15 Mar 2022	02-00	4	15 Mar 2022	04-00	1	15 Mar 2022
			02-00	5	15 Mar 2022	04-00	2	15 Mar 2022

Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date
04-00	3	15 Mar 2022	05-28-00	4	15 Mar 2022	05-28-91	1	15 Mar 2022
04-00	4	15 Mar 2022	05-28-00	5	15 Mar 2022	05-28-91	2	15 Mar 2022
05-00	Title 1	15 Mar 2022	05-28-00	6	15 Mar 2022	05-28-92	1	15 Mar 2022
05-00	Title 2	15 Mar 2022	05-28-50	1	15 Mar 2022	05-28-92	2	15 Mar 2022
05-00	TOC 1	15 Mar 2022	05-28-50	2	15 Mar 2022	05-50	1	15 Mar 2022
05-00	TOC 2	15 Mar 2022	05-28-50	3	15 Mar 2022	05-50	2	15 Mar 2022
05-00	TOC 3	15 Mar 2022	05-28-50	4	15 Mar 2022	05-50	3	15 Mar 2022
05-00	TOC 4	15 Mar 2022	05-28-50	5	15 Mar 2022	05-50	4	15 Mar 2022
05-00	1	15 Mar 2022	05-28-50	6	15 Mar 2022	05-50	5	15 Mar 2022
05-00	2	15 Mar 2022	05-28-50	7	15 Mar 2022	05-50	6	15 Mar 2022
05-00	3	15 Mar 2022	05-28-50	8	15 Mar 2022	05-50	7	15 Mar 2022
05-00	4	15 Mar 2022	05-28-50	9	15 Mar 2022	05-50	8	15 Mar 2022
05-00	5	15 Mar 2022	05-28-50	10	15 Mar 2022	06-00	Title 1	15 Mar 2022
05-00	6	15 Mar 2022	05-28-50	11	15 Mar 2022	06-00	Title 2	15 Mar 2022
05-10	1	15 Mar 2022	05-28-50	12	15 Mar 2022	06-00	TOC 1	15 Mar 2022
05-10	2	15 Mar 2022	05-28-50	13	15 Mar 2022	06-00	TOC 2	15 Mar 2022
05-10	3	15 Mar 2022	05-28-50	14	15 Mar 2022	06-00	1	15 Mar 2022
05-10	4	15 Mar 2022	05-28-50	15	15 Mar 2022	06-00	2	15 Mar 2022
05-20	1	15 Mar 2022	05-28-50	16	15 Mar 2022	06-00	3	15 Mar 2022
05-20	2	15 Mar 2022	05-28-50	17	15 Mar 2022	06-00	4	15 Mar 2022
05-20	3	15 Mar 2022	05-28-50	18	15 Mar 2022	06-00	5	15 Mar 2022
05-20	4	15 Mar 2022	05-28-70	1	15 Mar 2022	06-00	6	15 Mar 2022
05-21	1	15 Mar 2022	05-28-70	2	15 Mar 2022	06-00	7	15 Mar 2022
05-21	2	15 Mar 2022	05-28-70	3	15 Mar 2022	06-00	8	15 Mar 2022
05-22	1	15 Mar 2022	05-28-70	4	15 Mar 2022	07-00	Title 1	15 Mar 2022
05-22	2	15 Mar 2022	05-28-70	5	15 Mar 2022	07-00	Title 2	15 Mar 2022
05-28-00	1	15 Mar 2022	05-28-70	6	15 Mar 2022	07-00	TOC 1	15 Mar 2022
05-28-00	2	15 Mar 2022	05-28-90	1	15 Mar 2022	07-00	TOC 2	15 Mar 2022
05-28-00	3	15 Mar 2022	05-28-90	2	15 Mar 2022	07-00	1	15 Mar 2022

Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date
07-00	2	15 Mar 2022	11-30	1	15 Mar 2022	20-00	TOC 2	15 Mar 2022
07-00	3	15 Mar 2022	11-30	2	15 Mar 2022	20-00	1	15 Mar 2022
07-00	4	15 Mar 2022	11-30	3	15 Mar 2022	20-00	2	15 Mar 2022
08-00	Title 1	15 Mar 2022	11-30	4	15 Mar 2022	20-10	1	15 Mar 2022
08-00	Title 2	15 Mar 2022	12-00	Title 1	15 Mar 2022	20-10	2	15 Mar 2022
08-00	TOC 1	15 Mar 2022	12-00	Title 2	15 Mar 2022	20-10	3	15 Mar 2022
08-00	TOC 2	15 Mar 2022	12-00	TOC 1	15 Mar 2022	20-10	4	15 Mar 2022
08-00	1	15 Mar 2022	12-00	TOC 2	15 Mar 2022	21-00	Title 1	15 Mar 2022
08-00	2	15 Mar 2022	12-00	1	15 Mar 2022	21-00	Title 2	15 Mar 2022
08-10	1	15 Mar 2022	12-00	2	15 Mar 2022	21-00	TOC 1	15 Mar 2022
08-10	2	15 Mar 2022	12-10	1	15 Mar 2022	21-00	TOC 2	15 Mar 2022
08-10	3	15 Mar 2022	12-10	2	15 Mar 2022	21-00	1	15 Mar 2022
08-10	4	15 Mar 2022	12-10	3	15 Mar 2022	21-00	2	15 Mar 2022
08-10	5	15 Mar 2022	12-10	4	15 Mar 2022	21-00	3	15 Mar 2022
08-10	6	15 Mar 2022	12-10	5	15 Mar 2022	21-00	4	15 Mar 2022
08-10	7	15 Mar 2022	12-10	6	15 Mar 2022	21-00	101	15 Mar 2022
08-10	8	15 Mar 2022	12-10	7	15 Mar 2022	21-00	102	15 Mar 2022
08-20	1	15 Mar 2022	12-10	8	15 Mar 2022	21-00	201	15 Mar 2022
08-20	2	15 Mar 2022	12-20	1	15 Mar 2022	21-00	202	15 Mar 2022
08-20	3	15 Mar 2022	12-20	2	15 Mar 2022	21-00	203	15 Mar 2022
08-20	4	15 Mar 2022	12-20	3	15 Mar 2022	21-00	204	15 Mar 2022
11-00	Title 1	15 Mar 2022	12-20	4	15 Mar 2022	21-00	205	15 Mar 2022
11-00	Title 2	15 Mar 2022	12-20	5	15 Mar 2022	21-00	206	15 Mar 2022
11-00	TOC 1	15 Mar 2022	12-20	6	15 Mar 2022	21-00	207	15 Mar 2022
11-00	TOC 2	15 Mar 2022	12-30	1	15 Mar 2022	21-00	208	15 Mar 2022
11-00	1	15 Mar 2022	12-30	2	15 Mar 2022	21-00	209	15 Mar 2022
11-00	2	15 Mar 2022	20-00	Title 1	15 Mar 2022	21-00	210	15 Mar 2022
11-20	1	15 Mar 2022	20-00	Title 2	15 Mar 2022	21-00	211	15 Mar 2022
11-20	2	15 Mar 2022	20-00	TOC 1	15 Mar 2022	21-00	212	15 Mar 2022

Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date
23-00	Title 1	15 Mar 2022	24-00	Title 2	15 Mar 2022	24-60	203	15 Mar 2022
23-00	Title 2	15 Mar 2022	24-00	TOC 1	15 Mar 2022	24-60	204	15 Mar 2022
23-00	TOC 1	15 Mar 2022	24-00	TOC 2	15 Mar 2022	24-60	205	15 Mar 2022
23-00	TOC 2	15 Mar 2022	24-00	1	15 Mar 2022	24-60	206	15 Mar 2022
23-00	1	15 Mar 2022	24-00	2	15 Mar 2022	24-60	207	15 Mar 2022
23-00	2	15 Mar 2022	24-00	3	15 Mar 2022	24-60	208	15 Mar 2022
23-10	1	15 Mar 2022	24-00	4	15 Mar 2022	25-00	Title 1	15 Mar 2022
23-10	2	15 Mar 2022	24-00	5	15 Mar 2022	25-00	Title 2	15 Mar 2022
23-10	3	15 Mar 2022	24-00	6	15 Mar 2022	25-00	TOC 1	15 Mar 2022
23-10	4	15 Mar 2022	24-30	1	15 Mar 2022	25-00	TOC 2	15 Mar 2022
23-10	101	15 Mar 2022	24-30	2	15 Mar 2022	25-00	1	15 Mar 2022
23-10	102	15 Mar 2022	24-31	1	15 Mar 2022	25-00	2	15 Mar 2022
23-10	201	15 Mar 2022	24-31	2	15 Mar 2022	25-10	1	15 Mar 2022
23-10	202	15 Mar 2022	24-31	101	15 Mar 2022	25-10	2	15 Mar 2022
23-10	203	15 Mar 2022	24-31	102	15 Mar 2022	25-10	201	15 Mar 2022
23-10	204	15 Mar 2022	24-31	201	15 Mar 2022	25-10	202	15 Mar 2022
23-10	205	15 Mar 2022	24-31	202	15 Mar 2022	25-10	203	15 Mar 2022
23-10	206	15 Mar 2022	24-31	203	15 Mar 2022	25-10	204	15 Mar 2022
23-50	1	15 Mar 2022	24-31	204	15 Mar 2022	25-10	205	15 Mar 2022
23-50	2	15 Mar 2022	24-60	1	15 Mar 2022	25-10	206	15 Mar 2022
23-50	101	15 Mar 2022	24-60	2	15 Mar 2022	25-10	207	15 Mar 2022
23-50	102	15 Mar 2022	24-60	3	15 Mar 2022	25-10	208	15 Mar 2022
23-50	201	15 Mar 2022	24-60	4	15 Mar 2022	25-60-00	1	15 Mar 2022
23-50	202	15 Mar 2022	24-60	5	15 Mar 2022	25-60-00	2	15 Mar 2022
23-50	203	15 Mar 2022	24-60	6	15 Mar 2022	25-60-00	3	15 Mar 2022
23-50	204	15 Mar 2022	24-60	101	15 Mar 2022	25-60-00	4	15 Mar 2022
23-60	1	15 Mar 2022	24-60	102	15 Mar 2022	25-60-00	101	15 Mar 2022
23-60	2	15 Mar 2022	24-60	201	15 Mar 2022	25-60-00	102	15 Mar 2022
24-00	Title 1	15 Mar 2022	24-60	202	15 Mar 2022	25-60-00	201	15 Mar 2022

Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date
25-60-00	202	15 Mar 2022	27-10	201	15 Mar 2022	27-30	2	15 Mar 2022
25-60-00	203	15 Mar 2022	27-10	202	15 Mar 2022	27-30	3	15 Mar 2022
25-60-00	204	15 Mar 2022	27-10	203	15 Mar 2022	27-30	4	15 Mar 2022
25-60-00	205	15 Mar 2022	27-10	204	15 Mar 2022	27-30	101	15 Mar 2022
25-60-00	206	15 Mar 2022	27-10	205	15 Mar 2022	27-30	102	15 Mar 2022
26-00	Title 1	15 Mar 2022	27-10	206	15 Mar 2022	27-30	201	15 Mar 2022
26-00	Title 2	15 Mar 2022	27-10	207	15 Mar 2022	27-30	202	15 Mar 2022
26-00	TOC 1	15 Mar 2022	27-10	208	15 Mar 2022	27-30	203	15 Mar 2022
26-00	TOC 2	15 Mar 2022	27-10	209	15 Mar 2022	27-30	204	15 Mar 2022
26-00	1	15 Mar 202	27-10	210	15 Mar 2022	27-31	1	15 Mar 2022
26-00	2	15 Mar 2022	27-20	1	15 Mar 2022	27-31	2	15 Mar 2022
27-00	Title 1	15 Mar 2022	27-20	2	15 Mar 2022	27-31	3	15 Mar 2022
27-00	Title 2	15 Mar 2022	27-20	3	15 Mar 2022	27-31	4	15 Mar 2022
27-00	TOC 1	15 Mar 2022	27-20	4	15 Mar 2022	27-31	101	15 Mar 2022
27-00	TOC 2	15 Mar 2022	27-20	5	15 Mar 2022	27-31	102	15 Mar 2022
27-00	TOC 3	15 Mar 2022	27-20	6	15 Mar 2022	27-31	201	15 Mar 2022
27-00	TOC 4	15 Mar 2022	27-20	101	15 Mar 2022	27-31	202	15 Mar 2022
27-00	1	15 Mar 2022	27-20	102	15 Mar 2022	27-31	203	15 Mar 2022
27-00	2	15 Mar 2022	27-20	201	15 Mar 2022	27-31	204	15 Mar 2022
27-00	201	15 Mar 2022	27-20	202	15 Mar 2022	27-50	1	15 Mar 2022
27-00	202	15 Mar 2022	27-20	203	15 Mar 2022	27-50	2	15 Mar 2022
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27-00	204	15 Mar 2022	27-20	205	15 Mar 2022	27-50	4	15 Mar 2022
27-10	1	15 Mar 2022	27-20	206	15 Mar 2022	27-50	5	15 Mar 2022
27-10	2	15 Mar 2022	27-20	207	15 Mar 2022	27-50	6	15 Mar 2022
27-10	3	15 Mar 2022	27-20	208	15 Mar 2022	27-50	101	15 Mar 2022
27-10	4	15 Mar 2022	27-20	209	15 Mar 2022	27-50	102	15 Mar 2022
27-10	101	15 Mar 2022	27-20	210	15 Mar 2022	27-50	103	15 Mar 2022
27-10	102	15 Mar 2022	27-30	1	15 Mar 2022	27-50	104	15 Mar 2022

Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date
27-50	201	15 Mar 2022	28-10	210	15 Mar 2022	31-10	3	15 Mar 2022
27-50	202	15 Mar 2022	28-20	1	15 Mar 2022	31-10	4	15 Mar 2022
27-50	203	15 Mar 2022	28-20	2	15 Mar 2022	31-10	101	15 Mar 2022
27-50	204	15 Mar 2022	28-20	3	15 Mar 2022	31-10	102	15 Mar 2022
27-50	205	15 Mar 2022	28-20	4	15 Mar 2022	31-10	201	15 Mar 2022
27-50	206	15 Mar 2022	28-20	101	15 Mar 2022	31-10	202	15 Mar 2022
27-50	207	15 Mar 2022	28-20	102	15 Mar 2022	31-20	1	15 Mar 2022
27-50	208	15 Mar 2022	28-20	201	15 Mar 2022	31-20	2	15 Mar 2022
28-00	Title 1	15 Mar 2022	28-20	202	15 Mar 2022	31-20	101	15 Mar 2022
28-00	Title 2	15 Mar 2022	28-20	203	15 Mar 2022	31-20	102	15 Mar 2022
28-00	TOC 1	15 Mar 2022	28-20	204	15 Mar 2022	31-20	201	15 Mar 2022
28-00	TOC 2	15 Mar 2022	28-20	205	15 Mar 2022	31-20	202	15 Mar 2022
28-00	1	15 Mar 2022	28-20	206	15 Mar 2022	31-50	1	15 Mar 2022
28-00	2	15 Mar 2022	28-40	1	15 Mar 2022	31-50	2	15 Mar 2022
28-00	3	15 Mar 2022	28-40	2	15 Mar 2022	31-50	3	15 Mar 2022
28-00	4	15 Mar 2022	28-40	101	15 Mar 2022	31-50	4	15 Mar 2022
28-10	1	15 Mar 2022	28-40	102	15 Mar 2022	31-50	101	15 Mar 2022
28-10	2	15 Mar 2022	28-40	201	15 Mar 2022	31-50	102	15 Mar 2022
28-10	101	15 Mar 2022	28-40	202	15 Mar 2022	31-50	201	15 Mar 2022
28-10	102	15 Mar 2022	28-40	203	15 Mar 2022	31-50	202	15 Mar 2022
28-10	201	15 Mar 2022	28-40	204	15 Mar 2022	31-60	1	15 Mar 2022
28-10	202	15 Mar 2022	31-00	Title 1	15 Mar 2022	31-60	2	15 Mar 2022
28-10	203	15 Mar 2022	31-00	Title 2	15 Mar 2022	31-60	3	15 Mar 2022
28-10	204	15 Mar 2022	31-00	TOC 1	15 Mar 2022	31-60	4	15 Mar 2022
28-10	205	15 Mar 2022	31-00	TOC 2	15 Mar 2022	31-60	5	15 Mar 2022
28-10	206	15 Mar 2022	31-00	1	15 Mar 2022	31-60	6	15 Mar 2022
28-10	207	15 Mar 2022	31-00	2	15 Mar 2022	31-60	101	15 Mar 2022
28-10	208	15 Mar 2022	31-10	1	15 Mar 2022	31-60	102	15 Mar 2022
28-10	209	15 Mar 2022	31-10	2	15 Mar 2022	31-60	201	15 Mar 2022

Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date
31-60	202	15 Mar 2022	32-10	209	15 Mar 2022	32-40	8	15 Mar 2022
31-60	203	15 Mar 2022	32-10	210	15 Mar 2022	32-40	101	15 Mar 2022
31-60	204	15 Mar 2022	32-10	211	15 Mar 2022	32-40	102	15 Mar 2022
31-60	205	15 Mar 2022	32-10	212	15 Mar 2022	32-40	201	15 Mar 2022
31-60	206	15 Mar 2022	32-20	1	15 Mar 2022	32-40	202	15 Mar 2022
31-60	207	15 Mar 2022	32-20	2	15 Mar 2022	32-40	203	15 Mar 2022
31-60	208	15 Mar 2022	32-20	101	15 Mar 2022	32-40	204	15 Mar 2022
31-60	209	15 Mar 2022	32-20	102	15 Mar 2022	32-40	205	15 Mar 2022
31-60	210	15 Mar 2022	32-20	201	15 Mar 2022	32-40	206	15 Mar 2022
31-60	211	15 Mar 2022	32-20	202	15 Mar 2022	32-40	207	15 Mar 2022
31-60	212	15 Mar 2022	32-20	203	15 Mar 2022	32-40	208	15 Mar 2022
32-00	Title 1	15 Mar 2022	32-20	204	15 Mar 2022	32-40	209	15 Mar 2022
32-00	Title 2	15 Mar 2022	32-20	205	15 Mar 2022	32-40	210	15 Mar 2022
32-00	TOC 1	15 Mar 2022	32-20	206	15 Mar 2022	32-40	211	15 Mar 2022
32-00	TOC 2	15 Mar 2022	32-20	207	15 Mar 2022	32-40	212	15 Mar 2022
32-00	1	15 Mar 2022	32-20	208	15 Mar 2022	32-40	213	15 Mar 2022
32-00	2	15 Mar 2022	32-20	209	15 Mar 2022	32-40	214	15 Mar 2022
32-10	1	15 Mar 2022	32-20	210	15 Mar 2022	32-40	215	15 Mar 2022
32-10	2	15 Mar 2022	32-20	211	15 Mar 2022	32-40	216	15 Mar 2022
32-10	101	15 Mar 2022	32-20	212	15 Mar 2022	33-00	Title 1	15 Mar 2022
32-10	102	15 Mar 2022	32-20	213	15 Mar 2022	33-00	Title 2	15 Mar 2022
32-10	201	15 Mar 2022	32-20	214	15 Mar 2022	33-00	TOC 1	15 Mar 2022
32-10	202	15 Mar 2022	32-40	1	15 Mar 2022	33-00	TOC 2	15 Mar 2022
32-10	203	15 Mar 2022	32-40	2	15 Mar 2022	33-00	1	15 Mar 2022
32-10	204	15 Mar 2022	32-40	3	15 Mar 2022	33-00	2	15 Mar 2022
32-10	205	15 Mar 2022	32-40	4	15 Mar 2022	33-20	1	15 Mar 2022
32-10	206	15 Mar 2022	32-40	5	15 Mar 2022	33-20	2	15 Mar 2022
32-10	207	15 Mar 2022	32-40	6	15 Mar 2022	33-20	101	15 Mar 2022
32-10	208	15 Mar 2022	32-40	7	15 Mar 2022	33-20	102	15 Mar 2022

Chapter Page	Page	Revision Date	Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date
33-20	201	15 Mar 2022	34-10	204	15 Mar 2022	51-00	1	15 Mar 2022
33-20	202	15 Mar 2022	34-10	205	15 Mar 2022	51-00	2	15 Mar 2022
33-40	1	15 Mar 2022	34-10	206	15 Mar 2022	51-00	3	15 Mar 2022
33-40	2	15 Mar 2022	34-20	1	15 Mar 2022	51-00	4	15 Mar 2022
33-40	101	15 Mar 2022	34-20	2	15 Mar 2022	51-10	1	15 Mar 2022
33-40	102	15 Mar 2022	34-20	101	15 Mar 2022	51-10	2	15 Mar 2022
33-40	201	15 Mar 2022	34-20	102	15 Mar 2022	51-10	3	15 Mar 2022
33-40	202	15 Mar 2022	34-20	201	15 Mar 2022	51-10	4	15 Mar 2022
33-40	203	15 Mar 2022	34-20	202	15 Mar 2022	51-20	1	15 Mar 2022
33-40	204	15 Mar 2022	34-20	203	15 Mar 2022	51-20	2	15 Mar 2022
33-40	205	15 Mar 2022	34-20	204	15 Mar 2022	51-20	3	15 Mar 2022
33-40	206	15 Mar 2022	34-30	1	15 Mar 2022	51-20	4	15 Mar 2022
33-40	207	15 Mar 2022	34-30	2	15 Mar 2022	51-20	201	15 Mar 2022
33-40	208	15 Mar 2022	34-30	101	15 Mar 2022	51-20	202	15 Mar 2022
33-40	209	15 Mar 2022	34-30	102	15 Mar 2022	51-20	203	15 Mar 2022
33-40	210	15 Mar 2022	34-50	1	15 Mar 2022	51-20	204	15 Mar 2022
34-00	Title 1	15 Mar 2022	34-50	2	15 Mar 2022	51-20	205	15 Mar 2022
34-00	Title 2	15 Mar 2022	34-50	3	15 Mar 2022	51-20	206	15 Mar 2022
34-00	TOC 1	15 Mar 2022	34-50	4	15 Mar 2022	51-20	207	15 Mar 2022
34-00	TOC 2	15 Mar 2022	34-50	5	15 Mar 2022	51-20	208	15 Mar 2022
34-00	1	15 Mar 2022	34-50	6	15 Mar 2022	51-20	209	15 Mar 2022
34-00	2	15 Mar 2022	34-50	101	15 Mar 2022	51-20	210	15 Mar 2022
34-10	1	15 Mar 2022	34-50	102	15 Mar 2022	51-20	211	15 Mar 2022
34-10	2	15 Mar 2022	34-50	201	15 Mar 2022	51-20	212	15 Mar 2022
34-10	101	15 Mar 2022	34-50	202	15 Mar 2022	51-20	213	15 Mar 2022
34-10	102	15 Mar 2022	51-00	Title 1	15 Mar 2022	51-20	214	15 Mar 2022
34-10	201	15 Mar 2022	51-00	Title 2	15 Mar 2022	51-20	215	15 Mar 2022
34-10	202	15 Mar 2022	51-00	TOC 1	15 Mar 2022	51-20	216	15 Mar 2022
34-10	203	15 Mar 2022	51-00	TOC 2	15 Mar 2022	51-20	217	15 Mar 2022

Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date
51-20	218	15 Mar 2022	52-10	3	15 Mar 2022	53-10	10	15 Mar 2022
51-20	219	15 Mar 2022	52-10	4	15 Mar 2022	55-00	Title 1	15 Mar 2022
51-20	220	15 Mar 2022	52-10	5	15 Mar 2022	55-00	Title 2	15 Mar 2022
51-20	221	15 Mar 2022	52-10	6	15 Mar 2022	55-00	TOC 1	15 Mar 2022
51-20	222	15 Mar 2022	52-10	101	15 Mar 2022	55-00	TOC 2	15 Mar 2022
51-30	1	15 Mar 2022	52-10	102	15 Mar 2022	55-00	1	15 Mar 2022
51-30	2	15 Mar 2022	52-10	201	15 Mar 2022	55-00	2	15 Mar 2022
51-30	3	15 Mar 2022	52-10	202	15 Mar 2022	55-10	1	15 Mar 2022
51-30	4	15 Mar 2022	52-10	203	15 Mar 2022	55-10	2	15 Mar 2022
51-30	5	15 Mar 2022	52-10	204	15 Mar 2022	55-10	201	15 Mar 2022
51-30	6	15 Mar 2022	52-10	205	15 Mar 2022	55-10	202	15 Mar 2022
51-30	7	15 Mar 2022	52-10	206	15 Mar 2022	55-20	1	15 Mar 2022
51-30	8	15 Mar 2022	52-40	1	15 Mar 2022	55-20	2	15 Mar 2022
51-30	9	15 Mar 2022	52-40	2	15 Mar 2022	55-20	201	15 Mar 2022
51-30	10	15 Mar 2022	53-00	Title 1	15 Mar 2022	55-20	202	15 Mar 2022
51-60	1	15 Mar 2022	53-00	Title 2	15 Mar 2022	55-30	1	15 Mar 2022
51-60	2	15 Mar 2022	53-00	TOC 1	15 Mar 2022	55-30	2	15 Mar 2022
51-60	3	15 Mar 2022	53-00	TOC 2	15 Mar 2022	55-30	201	15 Mar 2022
51-60	4	15 Mar 2022	53-00	1	15 Mar 2022	55-30	202	15 Mar 2022
51-60	5	15 Mar 2022	53-00	2	15 Mar 2022	55-40	1	15 Mar 2022
51-60	6	15 Mar 2022	53-10	1	15 Mar 2022	55-40	2	15 Mar 2022
52-00	Title 1	15 Mar 2022	53-10	2	15 Mar 2022	55-40	201	15 Mar 2022
52-00	Title 2	15 Mar 2022	53-10	3	15 Mar 2022	55-40	202	15 Mar 2022
52-00	TOC 1	15 Mar 2022	53-10	4	15 Mar 2022	55-40	203	15 Mar 2022
52-00	TOC 2	15 Mar 2022	53-10	5	15 Mar 2022	55-40	204	15 Mar 2022
52-00	1	15 Mar 2022	53-10	6	15 Mar 2022	56-00	Title 1	15 Mar 2022
52-00	2	15 Mar 2022	53-10	7	15 Mar 2022	56-00	Title 2	15 Jan 2022
52-10	1	15 Mar 2022	53-10	8	15 Mar 2022	56-00	TOC 1	15 Mar 2022
52-10	2	15 Mar 2022	53-10	9	15 Mar 2022	56-00	TOC 2	15 Mar 2022

Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date
56-00	1	15 Mar 2022	57-10	206	15 Mar 2022	71-00	Title 1	15 Mar 2022
56-00	2	15 Mar 2022	57-10	207	15 Mar 2022	71-00	Title 2	15 Mar 2022
56-10	1	15 Mar 2022	57-10	208	15 Mar 2022	71-00	TOC 1	15 Mar 2022
56-10	2	15 Mar 2022	57-10	209	15 Mar 2022	71-00	TOC 2	15 Mar 2022
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56-10	4	15 Mar 2022	57-50	1	15 Mar 2022	71-00	2	15 Mar 2022
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56-10	6	15 Mar 2022	57-50	201	15 Mar 2022	71-00	102	15 Mar 2022
56-11	1	15 Mar 2022	57-50	202	15 Mar 2022	71-00	103	15 Mar 2022
56-11	2	15 Mar 2022	57-50	203	15 Mar 2022	71-00	104	15 Mar 2022
56-11	3	15 Mar 2022	57-50	204	15 Mar 2022	71-00	105	15 Mar 2022
56-11	4	15 Mar 2022	57-60	1	15 Mar 2022	71-00	106	15 Mar 2022
57-00	Title 1	15 Mar 2022	57-60	2	15 Mar 2022	71-00	201	15 Mar 2022
57-00	Title 2	15 Mar 2022	57-60	201	15 Mar 2022	71-00	202	15 Mar 2022
57-00	TOC 1	15 Mar 2022	57-60	202	15 Mar 2022	71-10	1	15 Mar 2022
57-00	TOC 2	15 Mar 2022	61-00	Title 1	15 Mar 2022	71-10	2	15 Mar 2022
57-00	1	15 Mar 2022	61-00	Title 2	15 Mar 2022	71-10	201	15 Mar 2022
57-00	2	15 Mar 2022	61-00	TOC 1	15 Mar 2022	71-10	202	15 Mar 2022
57-10	1	15 Mar 2022	61-00	TOC 2	15 Mar 2022	71-20	1	15 Mar 2022
57-10	2	15 Mar 2022	61-00	1	15 Mar 2022	71-20	2	15 Mar 2022
57-10	3	15 Mar 2022	61-00	2	15 Mar 2022	71-20	201	15 Mar 2022
57-10	4	15 Mar 2022	61-10	1	15 Mar 2022	71-20	202	15 Mar 2022
57-10	5	15 Mar 2022	61-10	2	15 Mar 2022	71-60	1	15 Mar 2022
57-10	6	15 Mar 2022	61-10	101	15 Mar 2022	71-60	2	15 Mar 2022
57-10	201	15 Mar 2022	61-10	102	15 Mar 2022	75-00	Title 1	15 Mar 2022
57-10	202	15 Mar 2022	61-10	103	15 Mar 2022	75-00	Title 2	15 Mar 2022
57-10	203	15 Mar 2022	61-10	104	15 Mar 2022	75-00	TOC 1	15 Mar 2022
57-10	204	15 Mar 2022	61-10	201	15 Mar 2022	75-00	TOC 2	15 Mar 2022
57-10	205	15 Mar 2022	61-10	202	15 Mar 2022	75-00	1	15 Mar 2022

Chapter Section	Page	Revision Date	Chapter Section	Page	Revision Date
75-00	2	15 Mar 2022	78-00	1	15 Mar 2022
75-00	201	15 Mar 2022	78-00	2	15 Mar 2022
75-00	202	15 Mar 2022	78-00	101	15 Mar 2022
76-00	Title 1	15 Mar 2022	78-00	102	15 Mar 2022
76-00	Title 2	15 Mar 2022	78-00	201	15 Mar 2022
76-00	TOC 1	15 Mar 2022	78-00	202	15 Mar 2022
76-00	TOC 2	15 Mar 2022	79-00	Title 1	15 Mar 2022
76-00	1	15 Mar 2022	79-00	Title 2	15 Mar 2022
76-00	2	15 Mar 2022	79-00	TOC 1	15 Mar 2022
76-00	3	15 Mar 2022	79-00	TOC 2	15 Mar 2022
76-00	4	15 Mar 2022	79-00	1	15 Mar 2022
76-00	101	15 Mar 2022	79-00	2	15 Mar 2022
76-00	102	15 Mar 2022	79-21	1	15 Mar 2022
76-00	201	15 Mar 2022	79-21	2	15 Mar 2022
76-00	202	15 Mar 2022	79-21	101	15 Mar 2022
76-00	203	15 Mar 2022	79-21	102	15 Mar 2022
76-00	204	15 Mar 2022	79-21	201	15 Mar 2022
77-00	Title 1	15 Mar 2022	79-21	202	15 Mar 2022
77-00	Title 2	15 Mar 2022	92-00	Title 1	15 Mar 2022
77-00	TOC 1	15 Mar 2022	92-00	Title 2	15 Mar 2022
77-00	TOC 2	15 Mar 2022	92-00	TOC 1	15 Mar 2022
77-00	1	15 Mar 2022	92-00	TOC 2	15 Mar 2022
77-00	2	15 Mar 2022	92-00	1	15 Mar 2022
77-00	3	15 Mar 2022	92-00	2	15 Mar 2022
77-00	4	15 Mar 2022	wiring diagrams as listed in Chapter 92		
78-00	Title 1	15 Mar 2022			
78-00	Title 2	15 Mar 2022			
78-00	TOC 1	15 Mar 2022			
78-00	TOC 2	15 Mar 2022			

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CHAPTER 01

INTRODUCTION

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TABLE OF CONTENTS

CHAPTER 01

INTRODUCTION

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CHAPTER 01
INTRODUCTION

1. General

This Airplane Maintenance Manual contains the data necessary to do the maintenance of the DV 20 E airplane. It contains a full description of the systems, trouble shooting procedures, component removal and installation procedures and maintenance instructions. It does not contain maintenance data for components removed from the airplane (Maintenance Shop data).

The Airplane Maintenance Manual contains the wiring diagrams for the electrical system.

Use the DV 20 E Airplane Flight Manual, latest revision with the Airplane Maintenance Manual, and the related Service Bulletins. Additional maintenance data is referenced in Chapter 05-00.

2. Revision Service

The manufacturer provides a revision service for the Airplane Maintenance Manual. The revision shows design changes to the airplane or changes in procedures. Each page of the manual shows the date of issue. If the page has changed, it shows the date of the revision.

3. Warning, Cautions and Notes

Obey all the usual safety precautions and maintenance instructions when doing maintenance.

This Airplane Maintenance Manual also contains warnings, cautions and notes before applicable instructions:

WARNING: **A WARNING TELLS THE PERSON DOING THE MAINTENANCE THAT INJURY OR DEATH IS POSSIBLE IF THEY DO NOT STRICTLY FOLLOW THE INSTRUCTIONS.**

CAUTION: A CAUTION TELLS THE PERSON DOING THE MAINTENANCE THAT DAMAGE TO EQUIPMENT IS POSSIBLE IF THEY DO NOT FOLLOW THE INSTRUCTIONS.

Note: A Note tells the person doing the maintenance how to make the task easier.

4. Manual Configuration

This manual is written using the regulations of the Air Transport Association of America Specification iSpec2200. Each system is given a chapter number from the ATA iSpec2200. Where applicable, a chapter contains sections for each sub-system.

The specification AECMA Simplified English has been used to write this Airplane Maintenance Manual. This is a mandatory requirement of the ATA iSpec2200.

There are only 3 sources of words available to use in Simplified English (SE).

– Approved words from the SE Guide. These words have defined meanings and selected parts of speech.

– Technical names as defined in the SE Guide. Used only as adjectives or nouns.

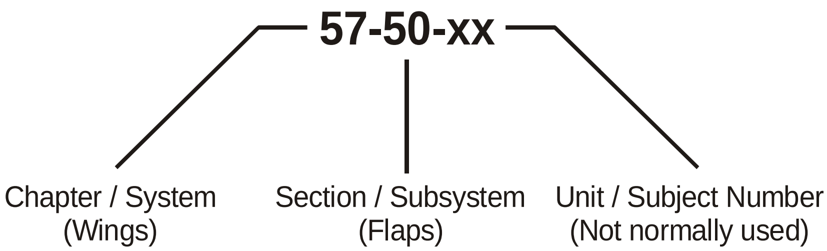
– Manufacturing processes as defined in the SE Guide. Always used as verbs.

To obtain a copy of the SE Guide contact ASD-STAN, Avenue de Tervuren, B-1150 Brussels, Belgium. Tel: +32-2775-81-26, Fax:+32-2763-35-65, Email: contact@asd-stan.org

This manual does not use the ATA iSpec2200 Airplane Maintenance Task Oriented Support System (ATMOSS) or the ATA iSpec2200 Production Management Data Base (PMDB).

A. The ATA iSpec2200 Numbering System

The ATA iSpec2200 numbering system uses 3 pairs of numbers, for example:



The first pair of numbers shows the system. System 57 are the wings. Chapter 57 contains the data for the wings.

The second pair of numbers shows the sub-system. Sub-system 50 is the Trailing Edge Flap. Chapter 57, Section 50 contains the data for the trailing edge flaps installation.

The third pair of numbers shows a unit. A unit could be the flap itself. Only complex systems use unit numbers.

For simple systems, the main chapter has all of the data and there are no section/sub-system break-downs.

B. Groups of Chapters

The chapters are put together in these groups:

Group A	Introduction	Chapters 01-02
Group B	Airplane General	Chapters 03-12
Group C	Airframe Systems	Chapters 20-35
Group D	Structure	Chapters 51-57
Group E	Propeller	Chapter 61
Group F	Engine	Chapters 71-81

A separation sheet divides each chapter. The separation sheet shows the number of the chapter and the title.

The main contents of each group of chapters is given below:

(1) Group A - Introduction

Chapter 01 tells you about the Airplane Maintenance Manual, and Chapter 2 tells you how to use the Airplane Maintenance Manual.

(2) Group B - Airplane General

Chapter 03 gives you a general description of the airplane and its systems.

Chapter 04 gives you data about the Airworthiness Limitations and certification of the airplane.

Chapter 05 contains the Scheduled Maintenance Checklist. Some tasks require a maintenance procedure. The scheduled maintenance checklist identifies the Section in the manual that gives the maintenance procedure for the task. It also tells you where to find general information.

Chapters 06 to 10 tell you about the dimensions of the airplane and general procedures such as towing, parking and weighing.

Chapter 11 tells you about the placards and markings which are important for the safe operation of the airplane.

Chapter 12 contains servicing tasks such as refueling and lubrication. It also contains data about cleaning the airplane.

(3) Group C - Airframe Systems

Chapter 20 contains the standard practices for airframe maintenance.

Chapters 21 to 35 tell you about the airframe systems. They include the avionics systems (such as communications (Chapter 23)) and the mechanical systems (such as flight controls (Chapter 27)).

Chapter 31 shows the location of the instruments. The chapter which is applicable to the system gives the details. For example, Chapter 27 gives the details for the flap position indicator.

(4) Group D - Structure

Chapter 51 contains data about the design of the airframe. It also gives instructions for assessing damage to the airframe and how to do minor repairs.

Chapters 52 to 57 tell you about each part of the structure.

(5) Group E - Propeller

Chapter 61 contains the maintenance procedures for the propeller. Refer to the propeller manufacturer’s manual for other data.

(6) Group F - Engine

This group of chapters describes the engine and its systems. It contains the maintenance procedures for maintenance of the engine on the airplane. Refer to the engine manufacturer’s manual for other data.

C. Chapter Configuration

The first page of each chapter shows the number of the chapter and the title. The second page shows the contents. Where applicable, each chapter and section contains the topics that follow:

– Description and Operation.

– Trouble-Shooting.

– Maintenance Practices. Where applicable the maintenance practices give data on these procedures:

- Servicing.
- Removal and Installation.
- Adjustment/Tests.
- Checking/Testing.
- Cleaning/Painting.
- Repairs.

5. Page Numbering System

This manual uses the ATA iSpec2200 page block-numbering system. The page number is at the bottom of the page at the outer edge. It is adjacent to the chapter/section number.

Each topic in a section has numbers from these page blocks:

– Description and Operation - Pages 1 to 99.

– Trouble Shooting - Pages 101 to 199.

– Maintenance Procedures - Pages 201 to 299.

6. Figures

Figures are given numbers in sequence. The first figure in a chapter or section is Figure 1.

7. Record of Revisions

The Airplane Maintenance Manual has a Record of Revisions. Use the Record of Revisions to show when changes were included in the Airplane Maintenance Manual.

8. List of Effective Pages

This Airplane Maintenance Manual has a List of Effective Pages. The List of Effective Pages shows you the number and effective date of each page contained in the Airplane Maintenance Manual.

CHAPTER 02

ORGANIZATION AND HANDLING OF THE MANUAL

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TABLE OF CONTENTS

CHAPTER 02

ORGANIZATION AND HANDLING OF THE MANUAL

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CHAPTER 02
ORGANIZATION AND HANDLING OF THE MANUAL

1. General

For data about a system, look in the list of chapters and find the chapter number. The first page of each chapter after the title page shows the contents.

2. Applicability

Data applicable to a series of airplane is marked with an applicability note. For example:

Valid for S/N 20.E001 thru 20.E005.

This shows that you can use this data for airplane with serial numbers 20.E001 through 20.E005 inclusive.

3. Revisions

The manufacturer makes changes to the Airplane Maintenance Manual to show design changes, maintenance procedure changes or other changes. Each group of changes is called a ‘Revision’.

A manual revision contains these items:

– The changed pages.

– The reason for the revision.

– Instructions for putting the revision into the Airplane Maintenance Manual.

– A new List of Effective Pages (LOEP).

A vertical bar in the left margin of the page shows the changes. Where a figure is changed, a small hand points to the change if necessary.

4. Temporary Revisions

Temporary revisions correct errors, or they give temporary instructions. The manufacturer sends them to the airplane owners quickly. The manufacturer uses yellow paper for temporary revisions. The manufacturer usually puts the contents of a temporary revision in the next approved revision.

5. Service Bulletins

Service Bulletins get issued when necessary. They give the operator more information on inspections, maintenance, repairs or modifications.

Service Bulletins have 4 categories:

A. Alert Service Bulletins

Alert Service Bulletins are issued if there is an immediate danger (risk of damage or total loss). They are sent immediately by the fastest means to all known addresses of operators and service stations which are affected.

B. Mandatory Service Bulletins

Mandatory Service Bulletins include the description of a problem and the solution. If you do not follow a mandatory Service Bulletin, failures or malfunctions can result during further operation.

You must do the work given in a Mandatory Service Bulletin.

C. Recommended Service Bulletins

Recommended Service Bulletins give data about:

- A minor problem and its correction.
- A better technical design.

If you do not follow a Recommended Service Bulletin, it will not cause a failure. But it may cause increased maintenance work.

If you do follow a Recommended Service Bulletin:

- The maintenance work may be reduced (for example, reduced wear, increased life).
- The operational behavior will be improved (for example, easier engine starting).

D. Optional Service Bulletins

Optional Service Bulletins give data about optional equipment that you can install in an airplane (for example, sailplane towing device).

The airplane owner makes the decision to follow an Optional Service Bulletin.

6. Service Information

A Service Information tells the operator about permitted installations or provided information to installed or additional equipment. It also gives the applicable technical data.

7. Concession-Reports and Non-Conformance-Reports

Concession- and Non-Conformance-Reports are tools to approve and document deviations from the standard manufacturing processes during construction and assembly of an individual airplane (for example, handling of a mis-drilled hole in the fuselage). In case the operator or the maintenance organization needs to be informed as a consequence of the deviations for that particular airplane (for example, the use of a special sparepart is necessary or a different limit in a control surface balancing report applies), these Concession- and Non-Conformance-Reports are contained in the airplane log. Before you do maintenance, check the airplane log for such Concession- and Non-Conformance Reports.

8. Abbreviations

Where possible, the abbreviations used correspond with the related regulations.

A	Ampere
ACL	Anti-Collision Light
ADF	Automatic Direction Finder
A.M.E.	Aircraft Maintenance Engineer
Ah	Ampere-Hour
A&P	Aircraft and Power Plant Mechanic
ASI	Airspeed Indicator
CAN	Controller Area Network
CFRP	Carbon Fiber Reinforced Plastic
DME	Distance Measuring Equipment
ECU	Engine Control Unit
ELT	Emergency Locator Transmitter
FRP	Fiber Reinforced Plastic
GFRP	Glass Fiber Reinforced Plastic
GPS	Global Positioning System
G/S	Glide Slope
IAU	Integrated Avionics Unit
ICS	Integrated Cockpit Unit
IFR	Instrument Flight Rules
HSI	Horizontal Situation Indicator

LOC	Localizer
EMU	Engine Monitoring Unit
MFD	Multi-Function Display
OAT	Outside Air Temperature
PFD	Primary Flight Display
P/N	Part Number
SB	Service Bulletin
S/N	Serial Number
TBO	Time Between Overhaul
TSMOH	Time Since Major Overhaul
UHF	Ultra High Frequency
TTSN	Total Time Since New
TTSO	Total Time Since Overhaul
V	Volt
VFR	Visual Flight Rules
VHF	Very High Frequency
VOR	VHF Omni-directional Ranging
VSI	Vertical Speed Indicator

9. Conversion Factors and Abbreviations

Dimension Unit [Abbreviation]	Conversion Factor SI to US/Imperial	Conversion Factor US/Imperial to SI
Length		
Meter [m]	[m] / 0.3048 = [ft]	
Millimeter [mm]	[mm] / 25.4 = [in]	
Kilometer [km]	[km] / 1.852 = [nm]	
	[km] / 1.609 = [sm]	
Inch [in]		[in] x 25.4 = [mm]
Foot [ft]		[ft] x 0.3048 = [m]
Nautical mile [nm]		[nm] x 1.852 = [km]
Statute mile [sm]		[sm] x 1.609 = [km]
Velocity		
Kilometers per hour [km/h]	[km/h] / 1.852 = [kts]	
	[km/h] / 1.609 = [mph]	
Meters per second [m/s]	[m/s] x 196.85 = [fpm]	
Miles per hour [mph]		[mph] x 1.609 = [km/h]
Knots [kts]		[kts] x 1.852 = [km/h]
Feet per minute [fpm]		[fpm] / 196.85 = [m/s]
Rotational Speed		
Revolutions per minute [RPM]		[RPM] = [min^{-1}]
Pressure		
Bar [bar]	[bar] x 14.5038 = [psi]	
Hectopascal [hPa] = Millibar [mbar]	[hPa] / 33.864 = [inHg]	
	[mbar] / 33.864 = [inHg]	
Pounds per square inch [psi]		[psi] / 14.5038 = [bar]
Inches of mercury column [inHg]		[inHg] x 33.864 = [hPa]
		[inHg] x 33.864 = [mbar]

Dimension Unit [Abbreviation]	Conversion Factor SI to US/Imperial	Conversion Factor US/Imperial to SI
Force or Weight		
Newton [N]	[N] / 4.448 = [lb]	
Decanewton [daN]	[daN] / 0.4448 = [lb]	
Pound [lb]		[lb] x 4.448 = [N]
		[lb] x 0.4448 = [daN]
Mass ('Weight')		
Kilogram [kg]	[kg] / 0.45359 = [lb]	
Pound [lb]		[lb] x 0.45359 = [kg]
Volume		
Liter [l]	[l] / 3.7854 = [US gal]	
	[l] / 0.9464 = [US qts]	
	[l] / 4.5461 = [Imp gal]	
	[l] / 61.024 = [in^3]	
US gallon [US gal]		[US gal] x 3.7854 = [l]
US quart [US qt]		[US qt] x 0.9464 = [l]
Imperial gallon [Imp gal]		[Imp gal] x 4.5461 = [l]
Cubic inch [in^3]		[in^3] x 61.024 = [l]
Torque		
Newton meter [Nm]	[Nm] / 1.3558 = [lbf.ft.]	
	[Nm] x 8.851 = [lbf.in.]	
Foot pound [lbf.ft.]		[lbf.ft.] x 1.3558 = [Nm]
Inch pound [lbf.in.]		[lbf.in.] / 8.851 = [Nm]
Temperature		
Degree Celsius [°C]	[°C] x 1.8 + 32 = [°F]	
Degree Fahrenheit [°F]		([°F] - 32) / 1.8 = [°C]

Note: In this Airplane Maintenance Manual masses are referred to as weights. The authors accept that this is technically incorrect but have used the expression for simplicity and convenience.

10.Torque Conversion Graphs

Use Figure 1 for conversion of torque values Nm - lbf.ft. Use Figure 2 for conversion of Nm - lbf.in.

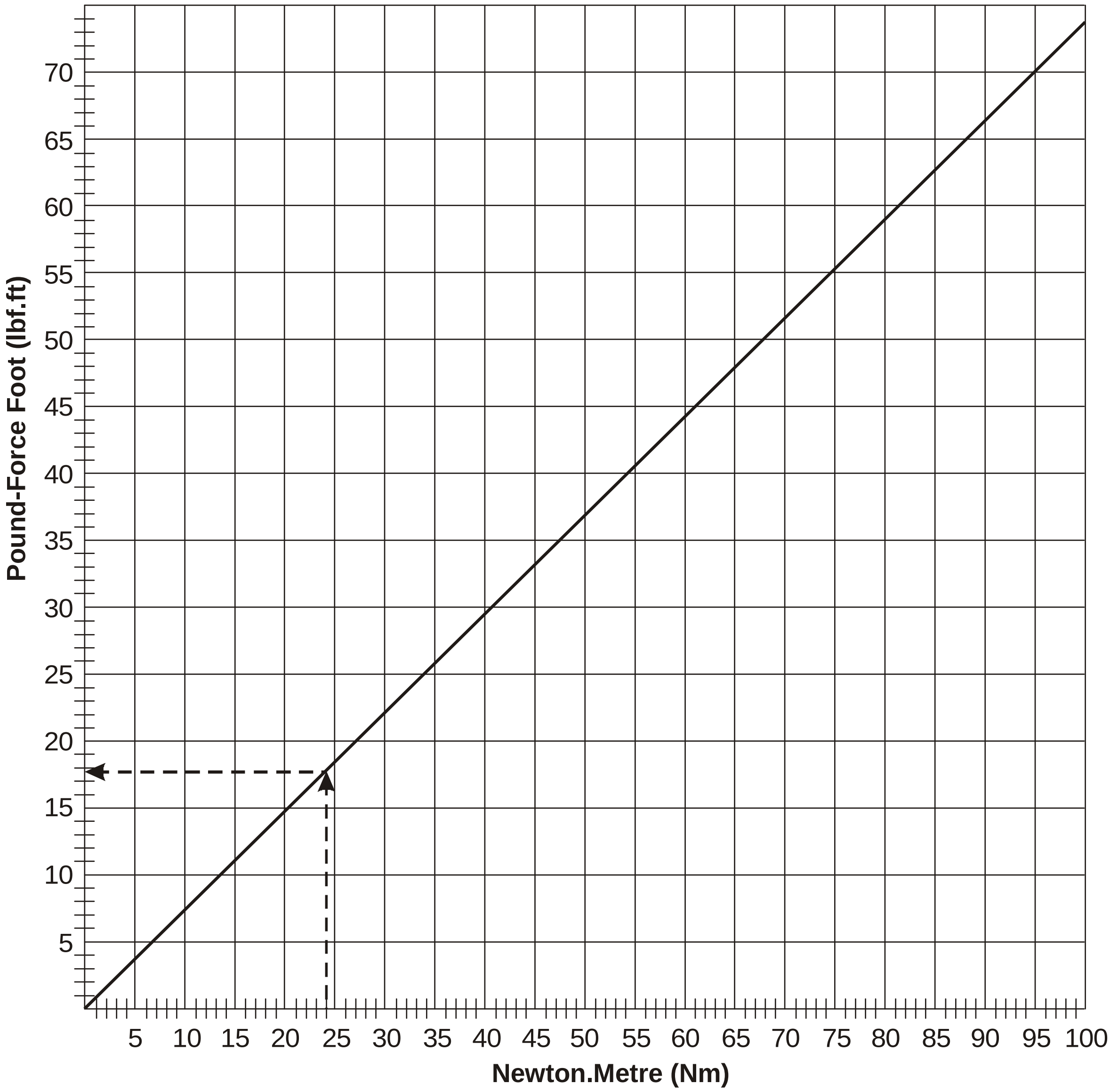

Figure 1: Nm - lbf.ft.

Find the Nm value on the horizontal axis. Move vertically to the solid black diagonal line. Then move horizontally to the vertical axis. Read the value in lbf.ft.

Example: To convert 24 Nm to lbf.ft., find 24 Nm on the horizontal axis (see the dashed line). Follow the dashed line vertically to the solid black diagonal line. Then follow the dashed line horizontally to the vertical axis. Read the value of 17.7 lbf.ft.

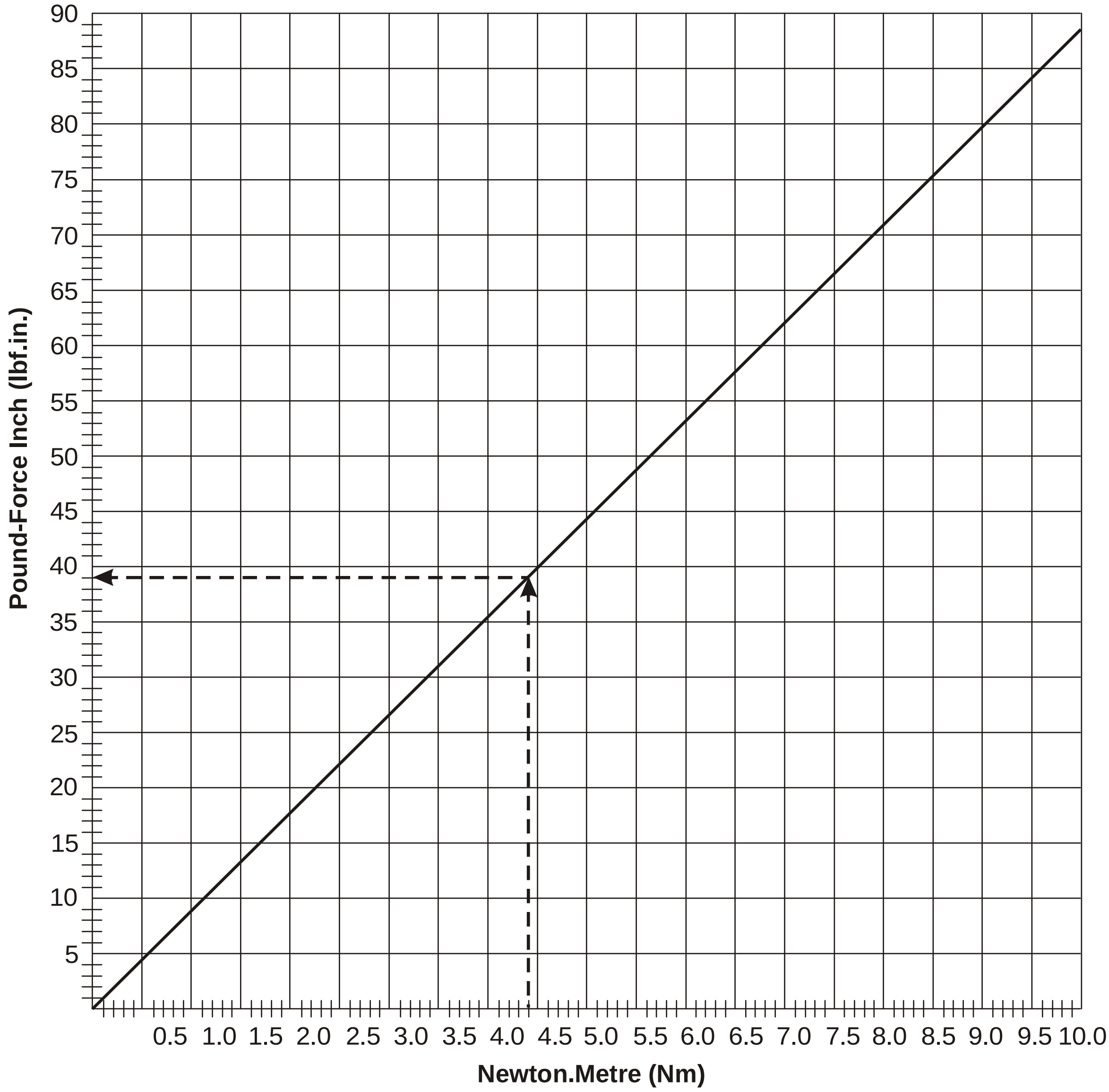

Figure 2: Nm - lbf.in.

Find the Nm value on the horizontal axis. Move vertically to the solid black diagonal line. Then move horizontally to the vertical axis. Read the value in lbf.in.

Example: To convert 4.4 Nm to lbf.in., find 4.4 Nm on the horizontal axis (see the dashed line). Follow the dashed line vertically to the solid black diagonal line. Then follow the dashed line horizontally to the vertical axis. Read the value of 39 lbf.in.

CHAPTER 03

GENERAL DESCRIPTION OF THE AIRPLANE

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TABLE OF CONTENTS

CHAPTER 03

GENERAL DESCRIPTION OF THE AIRPLANE

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CHAPTER 03
GENERAL DESCRIPTION OF THE AIRPLANE

1. General

Diamond Aircraft Industries GmbH, N. A. Otto-Straße 5, 2700 Wiener Neustadt, Austria, is the manufacturer of the DV 20 E airplane.

2. Description

The DV 20 E is a single-engine, two seat, low-wing monoplane. It has a cantilever wing and a ‘T’ tail. The airplane structure is fiber-reinforced plastic composite. This gives a very strong but light structure.

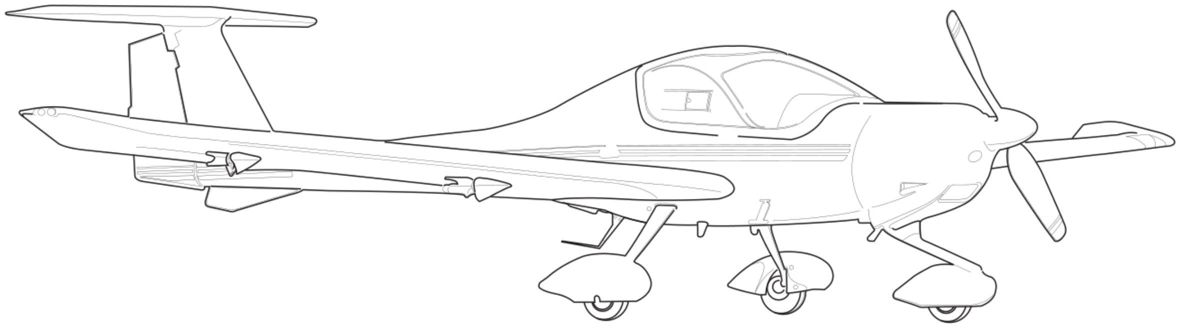

Figure 1: DV 20 E Airplane

The semi-monocoque fuselage is a glass-fiber reinforced-plastic (GFRP) shell with GFRP bulkheads and stiffeners. Uni-directional carbon fiber bands give extra strength and stiffness in many areas. Left and right half-shells bond together with a center section to make the fuselage. The center section makes the bottom of the cockpit. It has the main bulkheads which connect to the spars in each wing. The vertical stabilizer has two GFRP half-shells that are part of the fuselage shells.

The cantilever wing is a semi-monocoque structure. Each wing has two I-shaped spars with webs made form GFRP/rigid foam sandwich and caps made from CFRP bands. Each wing has top and bottom shells made of GFRP/rigid foam sandwich which bond to the spars. GFRP ribs and webs bond to the spars and shells to complete the structure.

The wings attach to the fuselage. Each wing has a stump-spar. A main bolt attaches each wing to the fuselage main bulkhead. Standard ailerons and electrically operated flaps attach to the trailing edge of the wing.

The horizontal stabilizer is a semi-monocoque structure. It has top and bottom shells made of GFRP. The shells bond to GFRP spars and ribs. The trailing edge has a conventional elevator.

The one-piece canopy has a large quantity of wrap-around glazing. This gives a good all-round view from the cockpit.

A polyurethane paint finish protects the outside skin from ultraviolet rays and humidity.

The fixed tricycle landing gear has optional fairings attached to each leg. The main legs attach to the fuselage main bulkhead. The nose leg attaches to the forward fuselage. Each main wheel has a disc brake. Hydraulic pressure operates each disc brake.

The flight control system uses conventional ailerons, elevator and rudder. The DV 20 E has two control sticks and two rudder pedal assemblies to operate the primary flight-controls. Push-pull rods operate the ailerons and elevator. Cables operate the rudder. An electric motor operates the wing flaps and the elevator trim.

The DV 20 E is powered by a BRP Rotax 912 iSc3 Sport four-stroke horizontally opposed four cylinder engine. The propeller is driven by an integrated gearbox. The ignition system and the fuel injection system are controlled by an ECU.

The airplane has an aluminum fuel tank in the fuselage behind the main bulkhead. The fuel filler is located on the LH side aft of the canopy. Flexible hoses connect the tank to the fuel pumps under the floor. Electrically driven pumps supply fuel to the engine. The tank has a fuel quantity probe which operate the cockpit indicating systems.

The airplane has two sources of electrical power. A 12 Volt battery supplies power when the engine is not running. An alternator which is dedicated to the airframe provides power when the engine is running. A separate alternator supplies electric power to the ECU and the fuel pumps. Switches and circuit breakers control all electrical devices.

The DV 20 E has a full range of flight instruments. These include Pitot/static instruments to show airspeed and altitude, as well as electrically driven instruments to show direction. Most indications are shown on the G500. Backup instruments are installed on the instrument panel.

The airplane has an electronic engine instrument and a fuel quantity indicator.

The airplane also has radio and navigation aids installed.

3. Equipment Data

The table below gives you the name and address of the manufacturers who supply systems and/or equipment for the DV 20 E. This will help you get more data on a system and/or equipment.

ATA Chapter	Equipment/System	Address
23, 31, 34	Garmin G500 System and Avionic Components	Garmin International Inc. 1200 E. 151st Street Olathe, KS 66062 USA Tel: (913) 397-8200 Fax: (913) 397-8282 Homepage: www.garmin.com
25	Emergency Locator Transmitter (ELT):	Artex Aircraft Supplies 14405 Keil Road NE Aurora, Oregon 97002 USA Tel: (503) 678-7929 Fax: (503) 678-7930 Website: www.artex.net
Note: The airspeed indicator must have the markings specified in Chapter 2 of the Airplane Flight Manual, Doc. No. 4.01.25-E, latest revision.		
31	Backup Airspeed Indicator, Backup Altimeter:	United Instruments Inc. 3625 Comotara Avenue Wichita, Kansas 67226 USA Tel: (316) 636-9203 Fax: (316) 636-9243 Website: www.unitedinst.com
31	Backup Attitude Gyro:	Mid-Continent Instrument Co., Inc. 7706 E, Osie, Wichita, Kansas 67207 USA Tel: (316) 683-5619 Fax: (316) 683-1861 Website: www.mcico.com

ATA Chapter	Equipment/System	Address
32	Wheels and Brakes:	Parker Hannifin Corporation Aircraft Wheel and Brake Division 1160 Center Road Avon, Ohio 44011 USA Tel: (440) 9376211
33	Position / Strobe Lights:	Whelen Engineering Company, Inc. Route 145, Winthrop Rd. Chester, CT 06412-0684 USA Tel: (860) 526-9504 Fax: (860) 526-2009 Website: www.whelen.com
61	Propeller:	MT-Propeller Entwicklung GmbH Flugplatzstr. 1 94348 Atting Germany Tel.: +49 (9429) 94090 Fax: +49 (9429)8432 Homepage: www.mt-propeller.de MT-Propeller USA, Inc. 1180 Airport Terminal Drive DeLand, FL 32724 Tel.: (386) 736- 7762 Fax: (386) 736-7696 E-mail: mtprop@bellsouth.net
72	Rotax 912 iSc3 Sport Engine:	BRP-Powertrain Gmbh & Co KG Rotaxstraße 1 4623 Gunskirchen Austria Homepage: www.flyrotax.com

4. Handling of Identification Data

No person shall remove, change, or place identification information on any airplane, engine, propeller, propeller blade, or propeller hub, without the approval of the competent national Airworthiness Authority.

If a deviation from the procedure above is necessary, any person performing maintenance work may in consultation with the competent national Airworthiness Authority:

– Remove, change, or place the identification plate on any airplane, engine, propeller, propeller blade, or propeller hub.

– Remove an identification plate, when necessary during maintenance operations.

– No person shall install an identification plate, removed in accordance with the procedures above, on any aircraft, engine, propeller, propeller blade, or propeller hub other than the one from which it was removed.

CHAPTER 04

AIRWORTHINESS LIMITATIONS

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TABLE OF CONTENTS

CHAPTER 04

AIRWORTHINESS LIMITATIONS

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CHAPTER 04
AIRWORTHINESS LIMITATIONS

THIS AIRWORTHINESS LIMITATIONS SECTION IS APPROVED BY EUROPEAN AVIATION SAFETY AGENCY (EASA) IN ACCORDANCE WITH THE APPLICABLE CERTIFICATION PROCEDURES AND THE TYPE CERTIFICATION BASIS. IT SPECIFIES THE AIRWORTHINESS LIMITATIONS REQUIRED BY CS-VLA.

THIS AIRPLANE MAINTENANCE MANUAL CHAPTER 04 (AIRWORTHINESS LIMITATIONS) IS APPROVED WITH EASA APPROVAL NO.10056462.

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1. Airworthiness Limitations

This Chapter is approved and shows the mandatory limitations which were established as a result of the certification process.

The time limits given in Chapter 04 must be applied to ensure Continued Airworthiness of the DV 20 E.

Note: Regular inspections of the airplane including replacement and overhaul of certain components are required to ensure Continued Airworthiness of the DV 20 E.

For possible airworthiness limitations of engine, propeller, components and vendor equipment refer to the applicable Maintenance Data as listed in Section 05-00.

A. Airframe

A comprehensive airframe inspection is mandatory after 6,000 hours of flight.

B. Paint

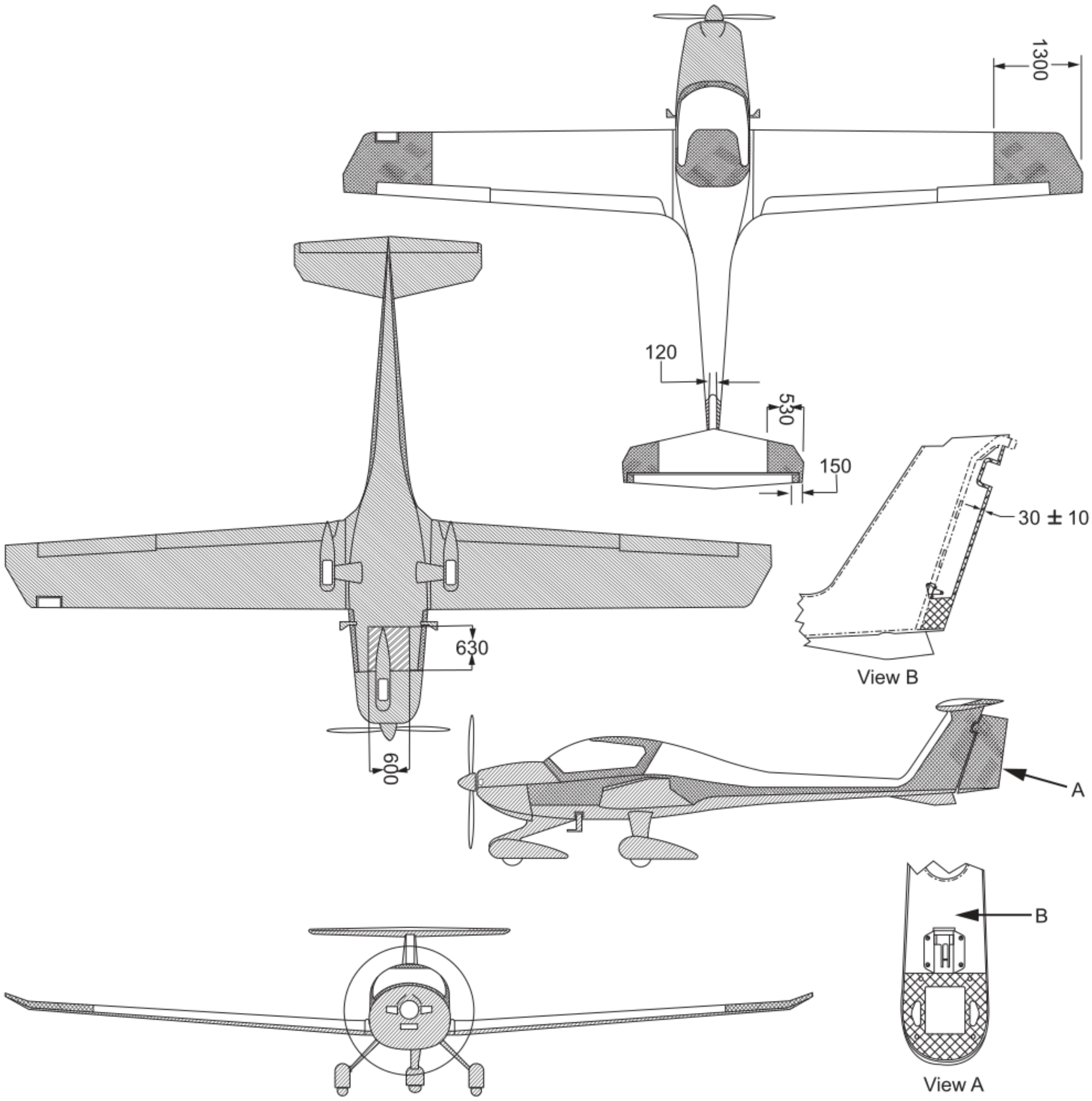
It is mandatory to paint certain parts of the DV 20 E airplane white. This will help to keep the temperature of the composite structure below the structural temperature limit for the flight [54 °C (129 °F)]. Paint colors, markings, and placards are subject to the following zone restrictions. (Refer to Figure 1):

(1) Zone I You must paint this area white. You can only paint areas of registration marks, placards and minor trim different colors.

(2) Zone II You can paint this area any color with average solar absorptivity of 0.5 or less (Yellow, light green etc.). Or you can paint areas of registration marks, placards and minor trim different colors on a white background.

(3) Zone III You can paint this area any color. If you paint this area any color other than white, you must install a structural temperature indicator (Thermindex Chemicals RTP-55/RED). The indicator must be installed in the area of color, close to the airplane center line. Where possible, install the indicator near the fuel drain.

(4) Zone IV You must paint this area with fire resistant paint.



- Zone 1- Must be white, exept for registration marks, placards and minor trim

- Zone 2- May be any colour with average solar absorptivity of 0.5 or less (yellow, light green, etc.) or registration marks, placards, and minor trim on white background.

- Zone 3- May be any colour.

- Zone 4- Fire resistant paint.

CHAPTER 05

TIME LIMITS AND MAINTENANCE CHECKS

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TABLE OF CONTENTS

CHAPTER 05
TIME LIMITS AND MAINTENANCE CHECKS

Section 05-10
Time Limits

Section 05-20
Scheduled Maintenance Checks

Section 05-21
Flight-Line Checks

Section 05-22
25 Hour Engine Check

Section 05-28
Maintenance Checklist DV 20 E

Section 05-28-00
Maintenance Checklist DV 20 E Engine

Section 05-28-50
Maintenance Checklist Airframe

Section 05-28-70
6000 Hour Inspection

Section 05-28-90
Maintenance Report

Section 05-28-91
Engine Ground Test Record

Section 05-28-92
Check Flight Report

Section 05-50
Unscheduled Maintenance Checks

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CHAPTER 05
TIME LIMITS AND MAINTENANCE CHECKS

1. General

This chapter will help you to do the maintenance of the DV 20 E airplane correctly. All of the usual tasks are easy to do and no special tools are necessary. Refer to Chapter 04-00 and Chapter 05-00 to help you when you do maintenance and inspections.

Do the scheduled maintenance checks given in this chapter at the recommended times. These checks are the minimum required to keep the airplane in a good technical condition.

These checks do not over-ride the requirements of the airworthiness authority of the country where the airplane is registered. You must make sure that all Airworthiness Directives, Service Bulletins and any other requirements of the Airworthiness Authority are completed as required.

The airplane manufacturer can change the time between checks. If this happens, the airplane manufacturer will publish the change as a revision to the Airplane Maintenance Manual.

You can decrease the time between scheduled maintenance checks if the airplane's operation makes it necessary. You must not extend the time between scheduled maintenance checks without the Airworthiness Authority's approval.

2. Chapter Configuration

A. Section 05-10

Section 05-10 contains the recommended time limits for maintenance checks. It also contains the recommended time between overhaul for components. Use the data in Section 05-10 to find when to do the maintenance.

B. Section 05-20

Section 05-20 contains information about the maintenance checklist organization.

C. Section 05-21

Section 05-21 contains information about the Flight Line Checks.

D. Section 05-28

Section 05-28 contains the Maintenance Checklist for the DV 20 E airplane. The Section is subdivided into engine and airframe sections and the 6000 hr inspection and provides checklists for the engine, the propeller, the airframe and the corresponding reports.

(1) Section 05-28-00

DV 20 E Maintenance Checklist for the engine: Maintenance checks schedule for 100, 200 and 1000 hour checks on the engine and propeller.

(2) Section 05-28-50

DV 20 E Maintenance Checklist for the airframe: Maintenance checks schedule for 100, 200 and 1000 hour checks on the airframe.

(3) Section 05-28-70

DV 20 E Maintenance Checklist for the 6000 hr inspection.

(4) Section 05-28-90

DV 20 E Maintenance Report.

(5) Section 05-28-91

DV 20 E Engine Ground Test Reports.

(6) Section 05-28-92

DV 20 E Check Flight Report.

E. Section 05-50

Section 05-50 contains the unscheduled Maintenance checks. Do these checks after hard landings, propeller damage, engine fire and lightning strike.

F. Referenced Maintenance Data

Use latest revision of referenced maintenance data.

Supplier	Document Name	Document No.
Artex	Installation and Maintenance Manual for the ME406 ELT	570-1600
BRP Powertrain	Rotax Operator’s Manual 912 iS	OM-912i / 898740
BRP Powertrain	Rotax Maintenance Manual 912 iS	MML-912i / 898742
Cleveland/Parker	Cleveland/Parker Maintenance Manual	AWBCMM0001-13
Cleveland/Parker	Cleveland/Parker Product Catalog	AWBPC0001-15
Cleveland/Parker	Cleveland/Parker Technician’s Service Guide	AWBTSG0001-10
Garmin	Garmin G600/G500 System Maintenance Manual	190-00601-05
mt-Propeller	mt-Propeller Operation and Installation Manual	E-124, ATA 61-01-24
mt-Propeller	mt-Propeller Operation and Installation Manual for the Hydraulic Constant Speed Governor	E-1048, ATA 61-20-48
Goodyear	Aircraft Tire Care & Maintenance	700-862-931-538 02/15

3. Definitions

In this Airplane Maintenance Manual, the following words have special meanings:

Adjust.	To put into a specified position or condition. For example, adjust the clearance to 1 mm.
Check.	A technical name for a group of maintenance tasks. For example, the 100 hour check.
Examine.	To look carefully at an item. It includes steps such as these:

- Make sure that the item:

  Is complete.
  Is correctly attached.
  Has no loose parts.
  Shows no signs of leaks.
  Is not cracked or damaged.
  Is not worn.

- Make sure that:

  The surface protection is not damaged.
  All locking devices are installed correctly.

- Make sure that items such as pipes and cables:

  Look serviceable.
  Do not rub against other items.

- For log books and other technical records:

  To find outstanding faults.
  To make sure they are up-to-date and correctly maintained.

Inspection.	The procedure which compares an object with its standard or specification.
Measure.	To find out the dimensions, capacity or quantity of something.
Monitor.	To look at something over a period of time. For example, monitor the engine speed indicator.

Record.	(1) Technical name for something that shows what was done. For example, write the result of the test in the engine record.
	(2) The act of making a record. For example, record the result of the test in the Airplane Maintenance Log.
Replace.	To remove an item and install a serviceable item in the same location.
Set.	To put equipment into a given adjustment, condition or mode. For example, set the altimeter scale to 1013 mbar (= 1013 hPa).
Task.	An assigned work or a procedure. For example, each step of the task has an identification letter.
Test.	That which you do when you operate or examine an item to make sure that it agrees with the applicable specifications. For example, disconnect the systems which are not necessary for the test. Or do an engine test.

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Section 05-10
Time Limits

1. General

All scheduled maintenance checks have time limits. You must do the scheduled maintenance within the time limits.

Some components installed in the airplane have a fixed time between overhaul (TBO), (for example the engine). Refer to Paragraph 4.

2. Regulatory Authorities

The recommended time limits given in this Chapter were created to meet the requirements of the certification process.

Note: National Regulatory Authorities can have different requirements. You must make sure that you meet the requirements of the Regulatory Authority of the country where the airplane is registered.

3. Scheduled Maintenance Time Limits

Refer to Sections 05-20 through 05-28.

The following recommended hourly and calendar time limits apply to the scheduled maintenance checks necessary to maintain the airplane in a good technical condition. Do the scheduled maintenance at the intervals and within the tolerances shown below.

A. Recurring Maintenance Inspections

Note: Where an interval is given in both flight hours and calendar years, the limit which is reached first must be applied. The next interval starts with the Flying Hours **and** Calendar Time of the latest performed Scheduled Maintenance Check.

Note: National requirements may require different maintenance schedules.

Scheduled Maintenance Check	Interval	
	Flight Hours	Calendar Time
100 Hour Check.	100 ± 10	
200 Hour Check.	200 ± 10	12 months ± 30 days
1000 Hour Check.	1000 ± 50	
6000 Hour Inspection.	6000 ± 50	12 years ± 6 months

Note: The 6000 hour airframe check is mandatory for Airworthiness.

The intervals between the inspections must be adhered to within the tolerances shown. These tolerances must not be added up. For example: if the 100 hour inspection was done at 110 hours, the next inspection must be done at 200 ±10 hours, not 210 ±10 hours.

If an inspection is done earlier than allowed by the specified tolerance, all subsequent inspection intervals are counted from that inspection. For example: If the 100 hour inspection was done at 83 hours, the next inspection must be done at 183 ±10 hours.

Some inspection items must be done at other intervals than the standard intervals listed in the table above. In these cases, the maintenance interval (for example, 800 hrs.) is shown as a number in the maintenance checklists. Refer to Section 05-20, Paragraph 2.

B. Scope of Maintenance Inspections

Do the items marked X in the Maintenance Checklist.

4. Component Time Limits

A. Maintenance Requirements

Overhaul the following components at the times indicated:

ATA Ch.	Component	Maintenance Requirement	Interval		Kind of Ope.
			hrs.	yrs.	
28	Fuel cap, Newton.	Overhaul.	-	1 ± 30 days	VFR
34	Pitot static heat system (if installed).	Functional check.	1000	1 ± 30 days	VFR
34	Pitot-static system.	Clean system, perform leakage test. (Refer to Section 34-10)	-	2 ± 30 days	NVFR
34	Altimeter(s) including altimeter on G500.	Check for correct indication.	-	2 ± 30 days	VFR
34	Magnetic compass.	Compensate.	-	2 ± 30 days	NVFR
34	Transponder.	System check.	-	2 ± 30 days	NVFR

B. Airplane Life-Limited Components

Replace the following components at the times indicated:

Component	Time Between Replacement
Fuel filter (firewall forward).	100 hours or 1 year whichever comes first.
Rotax 912 iSc Sport and parts.	According to engine maintenance manual. Except fuel lines which are part of the airplane (all fuel lines firewall aft, fuel return line firewall forward, and fuel supply lines firewall forward up to the engine).
Propeller.	According to mt-Propeller Operation and Installation Manual.
Governor.	According to mt-Propeller Operation and Installation Manual for hydraulic constant speed governor.
Fuel filler hose.	8 years ± 60 days.
Brake fluid.	3 years ± 30 days.

5. Component Time Tracking

To make sure that component overhaul/replacement is done at the correct time you must record the data that follows in the Airplane Maintenance Log for each component requiring overhaul/replacement:

– Serial Number.

– Flight hours and date at installation.

– Flight hours and date at removal.

Section 05-20
Scheduled Maintenance Checks

1. General

Do the scheduled maintenance checks in this Section at the intervals (flight hours and calendar time) stated in Section 05-10, Paragraph 3.

Note: Only persons or maintenance organizations authorized by national Regulatory Authorities of the country where the airplane is registered may do these checks. The inspection level for each item is a general visual inspection unless differently specified.

2. Maintenance Checklist Organization

Do the scheduled maintenance checks with reference to the Maintenance Checklist in this Section. Before starting a check, complete the requirements of Paragraphs 2 and 3 of the checklist. Do all the applicable tasks on the checklist.

Note: For maintenance of airplanes do the items marked X in the Maintenance Checklist.

Note: The interval columns "100", "200", and "1000" are used for maintenance items which must be done at intervals of 100, 200, or 1000 flight hours.

Note: The interval column "time" is used for Maintenance items which must be done at certain calendar time intervals. These items are marked with the explicit time interval.

Note: Where an interval is given in both flight time and calendar years, the limit which is reached first must be applied.

Note: Some inspection items must be done at other intervals than the standard intervals (100, 200, or 1000 hrs.). In these cases, the maintenance interval is shown in the column for the next shorter interval instead of an X. For example, an item which must be done every 800 hours is identified by the words "800 hrs." in the 200 hrs. column.

All of the applicable items must be signed by authorized maintenance personnel. Record the completion of the check in the airplane log book. Complete a copy of the Maintenance Report (refer to Section 05-28-90).

The Maintenance Checklist is divided into the following Sections:

A. Section 05-28-00: Engine Compartment

All items forward of the firewalls. It includes the cowlings and the propeller.

B. Section 05-28-50 - Airframe

(1) Front Fuselage

All items on the outside of the front fuselage from the firewall to the trailing edge of the wing. It includes the nose landing gear, external parts of the main landing gear and the canopy.

(2) Cockpit

All items inside the fuselage shell from the aft face of the firewall to the aft face of the spar bridge and seatback. It also includes the internal parts of the main landing gear and the brake system.

(3) Center Fuselage, Internal

All items inside the fuselage shell below the baggage compartment floor from the aft face of the spar bridge and seatback to the B-bulkhead. It includes the fuel tank and the control systems on the aft control bulkhead, the baggage compartment, the battery box and the GPS antenna.

(4) Rear Fuselage

All items on the outside of the fuselage from the trailing edge of the wing to the front of the vertical stabilizer.

(5) Tail

All items of the fuselage, vertical stabilizer and horizontal stabilizer aft of the rear fuselage.

(6) Wings

All items on the inside and outside of the left and right wings. It includes the ailerons, flaps and Pitot head.

(7) General

Those items which include more than one zone at the same time. It includes items such as control checks which need one person in the cockpit and another person at the control surface.

C. Section 05-28-70 - 6000 Hour Inspection

All 6000 hour inspection items listed in the tables must be performed within 6000 hours of flight time and every 6000 hours thereafter.

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Section 05-21
Flight-Line Checks

1. General

These checks include the pre-flight and post-flight checks. Do these checks each day the airplane is used.

2. Flight-Line Checks

The Pre-Flight Check must be done before the first flight of the day. It shows the pilot the general condition of the airplane and the engine. It is important for flight safety. Look in the airplane log-book for problems before doing the pre-flight check.

WARNING: DO ALL THE STEPS OF THE PRE-FLIGHT CHECK CAREFULLY. ACCIDENTS CAN OCCUR IF THE PRE-FLIGHT CHECK IS NOT DONE CORRECTLY.

The schedule for the pilot's pre-flight check is furnished in the Airplane Flight Manual for the DV 20 E.

3. Post-Flight Check

Do the post-flight check after the last flight of the day. The post-flight check includes all the steps of the pre-flight check.

You must also:

– Refuel the airplane (Section 12-10).

– Record in the log book each problem found in flight and during the post-flight check.

– Park the airplane (Sections 10-00 and 10-10).

– If necessary, moor the airplane (Section 10-20).

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Section 05-22
25 Hour Engine Check

1. General

The 25 hour engine check must only be done at 25 hours since new.

Do all the tasks on the checklist. All items must be signed maintenance personnel. Record the completion of the 25 hour engine check in the engine log book and in the airplane log book.

Enter the applicable data in the blocks below:

Registration : ____________________	Date : _________________
Airplane S/N: ____________________	Airplane Operating Hours : _________________
Engine S/N : ____________________	Engine Operating Hours : _________________

2. Checklist for the 25 Hour Engine Check

Do a 25 hours check in accordance with the engine maintenance manual.

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Section 05-28
Maintenance Checklist DV 20 E
Section 05-28-00
Maintenance Checklist DV 20 E Engine

1. General

Enter the applicable data in the blocks below:

Registration : ____________________	Date : ____________________
Airplane S/N : ____________________	Engine S/N : ____________________
Airplane Operating Hours : ____________________	Engine hours, TTSN : ____________________
Inspection : ____________________ (100, 200, 1000, 6000 hrs, Annual Insp.)	Propeller S/N : ____________________ Propeller hours, TTSN : ____________________

2. Preparation

Do the following items before you start the applicable check:

		Interval			
	Inspection Items	**100**	**200**	**1000**	**Initials**
1.	Before you do the inspection: – Read the applicable Airworthiness Directives. – Read the applicable Service Bulletins.	X	X	X	
2.	Examine the Log Books. Look specially for: – Life limited parts. – Reported problems.	X	X	X	
3.	Clean the airplane fully. (Refer to Section 12-30).	X	X	X	

3. Engine Ground Test

Do an engine ground test as follows (complete a copy of the Engine Ground Test Record as part of the engine ground test. (Refer to Section 05-28-91)):

		Interval			
	Inspection Items	**100**	**200**	**1000**	**Initials**
	WARNING: DO NOT LET PERSONS GO INTO THE DANGER AREA OF THE PROPELLER. PROPELLERS CAN CAUSE INJURY OR DEATH. **WARNING: SET THE PARKING BRAKE TO ON. IF YOU DO NOT DO THIS, THE AIRPLANE CAN MOVE. THIS CAN CAUSE INJURY OR DEATH.**				
1.	Set the parking brake to ON.	X	X	X	
2.	Put the chocks against the airplane main wheels.	X	X	X	
3.	Do an engine ground run. (Refer to Section 71-00 and the engine maintenance manual).	X	X	X	
4.	Check engine instruments.	X	X	X	
5.	Perform Cabin Heat and Defrost check: – With engine running, select Heat ON, and Defrost. – Check to ensure that warm air is coming out from the defrost vents on top of the instrument panel cover. – With Cabin Heat still ON, select Floor, and ensure that warm air is coming from the floor vents.		X	X	
6.	Do an operational test of the fuel shut-off valve for correct operation. (Refer to Chapter 28-20). Upon completion of the test: – Reset the fuel shut-off valve to open.		X	X	
7.	Shut engine down.	X	X	X	
8.	Examine the engine for oil/fuel/coolant leaks.	X	X	X	

4. Maintenance Checklist Engine

A. Engine

		Interval			
	Inspection Items, Engine	**100**	**200**	**1000**	**Initials**
	WARNING: MAKE SURE THE EXHAUST SYSTEM IS COOL BEFORE YOU DO MAINTENANCE ON THE ENGINE. THE EXHAUST SYSTEM CAN BE HOT. THIS CAN CAUSE INJURY TO PERSONS. **WARNING: DO NOT GET OIL ON YOU. OIL CAN CAUSE SKIN DISEASE.** **WARNING: DO NOT GET FUEL ON YOU. FUEL CAN CAUSE SKIN DISEASE. DO NOT ALLOW FIRE NEAR FUEL. FUEL BURNS AND CAN CAUSE INJURY TO PEOPLE AND DAMAGE TO EQUIPMENT.**				
1.	Remove the top and bottom cowlings. Examine the cowlings. Make sure that the fasteners are serviceable. Look for cracks and areas that have got too hot. Check rubber seals.	X	X	X	
2.	Clean the engine and engine compartment. Refer to Section 12-30 and the engine maintenance manual.	X	X	X	
3.	Do engine maintenance in accordance with the engine maintenance manual.	X	X	X	
4.	Do an propeller maintenance in accordance with the propeller operation and installation manual.		X	X	
5.	Cut open the used oil filter: – Look for contamination and metal abrasion. – If the filter contains particles of metal, refer to the engine manufacturer.	X	X	X	

		Interval			
	Inspection Items, Engine	**100**	**200**	**1000**	**Initials**
6.	Check the following systems and parts for breakage, looseness, leakage, chafing, kinks and cracks: – Coolant, drain, vent, fuel and oil hoses. – Oil and coolant radiator. – Air filter box and air filter. – Air box with manifolds. – Alternate air system. – Cabin heat system. – Electrical system. – Exhaust. – Push pull cables. – Cylinder air duct and fins.	X	X	X	
7.	Check air filter in accordance with the engine maintenance manual.	X	X	X	
8.	Check oil tank breather for blockage.	X	X	X	
	NOTE: Extended operations with low engine temp. in conjunction with high air humidity may lead to blockage of the breather pipe.				
9.	Check engine mount for cracks, deformation, corrosion, and missing fasteners and safetying devices. – Check condition of shock mounts. – Check engine suspension points.	X	X	X	
10.	Check torque of nut on engine mount to firewall bolts.		X	X	
11.	Open heat exchanger of the cabin heat system to check muffler for cracks and leakage.	X	X	X	

		Interval			
	Inspection Items, Engine	**100**	**200**	**1000**	**Initials**
12.	Clean gascolator. – Check for fuel leakage.	X	X	X	
13.	Clean the fuel separator.			X	
14.	Do a check of the airplane battery. Look specially for: – Charge and capacity. – Corrosion, pitting, burn marks or damage on battery terminals. – Incorrect mounting. (Refer to Section 24-31).	X	X	X	
15.	Inspect the wiring for poor condition.	X	X	X	

Section 05-28-50
Maintenance Checklist Airframe

1. Front Fuselage

		Interval			
	Inspection Items, Front Fuselage	**100**	**200**	**1000**	**Initials**
1.	Visually examine the complete surface of the front fuselage. Look especially for damage (dents, cracks, holes, scratches, and delamination). Examine the paint coat.	X	X	X	
2.	Examine the canopy. Check the latching components for corrosion, wear and damage. – Inspect the aft mount and rear hinge, the forward attaching points, the rubber stopper and the balance spring. – Look for delamination of the structure and leaks or breaks in the plexiglass seal. Make sure that the canopy locking mechanism will release. (Refer to Chapter 52-10).	X	X	X	
3.	Do the canopy latch force test. (Refer to Chapter 52-10).	X	X	X	
4.	Remove the wheel fairings. Look for cracks on the fairing mounts. (Refer to Chapter 32-40).	X	X	X	
5.	Inspect the jacking pad for incorrect attachment, damage and missing parts.	X	X	X	
6.	Lift the airplane on jacks. (Refer to Chapter 07-10).	X	X	X	
7.	Examine the tires. Look especially for cuts and wear. Measure the tire pressure. (Refer to Chapter 12-10).	X	X	X	
8.	Examine the rims of the main and the nose-wheel. Look especially for cracks.	X	X	X	
9.	Examine the wheel bearings. Look especially for play, corrosion and irregular operation.	X	X	X	
10.	Remove the main wheels. Clean and lubricate the bearings. (Refer to Chapter 12-20).		X	X	

		Interval			
	Inspection Items, Front Fuselage	**100**	**200**	**1000**	**Initials**
11.	Examine the brake lining. Look especially for wear. Minimum thickness 3.0 mm (0.12 in).	X	X	X	
12.	Examine the brake disks. Look especially for wear. Minimum thickness 3.8 mm (0.15 in).	X	X	X	
13.	Install the main wheels. (Refer to Chapter 32-40).		X	X	
14.	Examine the main landing gear. – Inspect for cracks and deformation. – Inspect the strut for distortion, corrosion and paint condition. – Inspect mounting hardware for security and damage.	X	X	X	
15.	Check for abnormal tire wear and correct tire pressure. (Refer to Chapter 12-10 and Chapter 32-10).	X	X	X	
16.	Examine the nose-wheel assembly. Look especially for correct attachment, cracks and deformation.	X	X	X	
17.	Examine the nose-gear journal-bearings in the bottom of the fuselage. Look especially for play.	X	X	X	
18.	Examine the bearing in the shock absorber retainer and strut bushings. Look especially for play.	X	X	X	
19.	Examine the nose landing gear shock absorber assembly as follows: – Inspect for damage, corrosion or cracks. – Inspect rubber dampers for deterioration, cracks or damage. – Inspect for proper attachment and loose components.	X	X	X	
20.	Remove the NLG fork. (Refer to Chapter 32-20).	X	X	X	

		Interval			
	Inspection Items, Front Fuselage	**100**	**200**	**1000**	**Initials**
21.	Inspect the fork for cracks, corrosion and deformation. – Carefully inspect the NLG fork for cracks. – Look especially for cracks in radius areas.	X	X	X	
22.	Visually examine the NLG fork pivot. – Look especially for cracks in the radius where the fork makes contact, corrosion and wear. Any corrosion needs to be assessed, treated and/or the component replaced – Inspect the pivot stud threads of the lower end of the strut for cracks/damage.	X	X	X	
23.	Lubricate the NLG fork pivot as per Chapter 12-00 and install the NLG fork as per Chapter 32-00.	X	X	X	
24.	Visually examine the NLG strut condition. Look especially for distortion, corrosion and condition of the paint. Ensure that there is no excessive play in the NLG strut pivot. Allowable radial play is 0.05 mm (0.002 in). If play is excessive remove strut and inspect condition of flanged bushings.			X	
25.	Do a test for play and caster friction. (Refer to Chapter 32-20). The friction should be 3-5 N (6.75-11.25 lbs) at the axle.		X	X	
26.	Lubricate the spherical bearing at the top of the shock absorber assembly. (Refer to Chapter 12-20).			X	
27.	Lower the airplane off jacks. (Refer to Chapter 07-10).	X	X	X	
28.	Install the wheel fairings, if installed.	X	X	X	
29.	Examine the exterior placards. Make sure that they are not damaged and that none are missing.		X	X	

2. Cockpit

		Interval			
	Inspection Items, Cockpit	**100**	**200**	**1000**	**Initials**
1.	Remove the seat shells. (Refer to Chapter 25-10).	X	X	X	
2.	Examine the safety belts for general condition and security of the metal fitting in the surrounding composite. Make sure that the lock mechanism operates correctly. – Insert the connector into the buckle and pull on the connector. Make sure that the ratchet holds the connector. The connector must fall freely from buckle when held in a vertical position and when you open the cover to the release position.	X	X	X	
3.	Examine the safety hammer installation: – Check attachments for looseness. – Check release mechanism for interference or improper function.		X	X	
4.	Examine the cable ties and electrical connectors. Pull lightly to make sure they are not loose.	X	X	X	
5.	Examine the control sticks. Make sure that the control stick attachments are not loose and do not catch.	X	X	X	
6.	Examine the control stick stops.	X	X	X	
7.	Examine the Pitot-static system water traps.	X	X	X	
8.	Examine the stall warning hose. Look especially for contamination by water. (Refer to Chapter 34-20).	X	X	X	
9.	Examine the flap-actuator indicator and position switches. Look especially for correct attachment and operation.	X	X	X	
10.	Examine the flap-actuator stops and support. Look especially for correct attachment. Examine for security of the bracket on the laminate and cracks in the surrounding laminate.	X	X	X	

		Interval			
	Inspection Items, Cockpit	**100**	**200**	**1000**	**Initials**
11.	Examine the locking-device for the wing main-bolt. Look especially for: – Correct operation. – Condition.	X	X	X	
12.	Examine the mounting for the landing gear. Look especially for correct attachment and lock devices.	X	X	X	
13.	Examine the rudder pedals. Look especially for correct attachment and function. (Refer to Chapter 27-20).	X	X	X	
14.	Examine the complete rudder control system (cables, pulleys, brackets, hardware, and surrounding structure). Look especially for correct attachment, function, wear, damage and corrosion. (Refer to Chapter 27-20).	X	X	X	
15.	Examine the brake pipes/hoses and components. Look especially for leakage.	X	X	X	
16.	Examine the brake reservoirs on the co-pilots side. Make sure the fluid level is correct. The fluid level must be 12 to 25 mm (1/2 to 1 in) below the top face of the reservoir filler hole.	X	X	X	
17.	Examine the instruments. Make sure that: – The markings are clear. – The function is correct. – Switches are correctly attached.	X	X	X	
18.	Examine the interior placards. Make sure that they are not damaged and that none are missing.	X	X	X	
19.	Remove the instrument panel cover.	X	X	X	
20.	Visually inspect the fuel shut-off cover box. Ensure that the seal around the box is intact and not deteriorated.			X	

		Interval			
	Inspection Items, Cockpit	**100**	**200**	**1000**	**Initials**
21.	Visually examine the cockpit area for any signs of fuel leaks. Follow along the fuel hose conduit and fuel hoses from the drain trap block, along the floor of the cockpit to the fuel shut-off valve. Make sure that there are no signs of fuel leaks.	X	X	X	
22.	Examine the instrument panel. Make sure that: – Wiring is correctly attached. – Instruments are correctly attached. – Hoses are correctly attached. – Circuit breakers are correctly attached.	X	X	X	
23.	Examine the compass. Make sure that: – The compass is correctly attached. – The fluid level is correct.		X	X	
24.	Install the instrument panel cover.	X	X	X	

3. Center Fuselage, Internal

		Interval			
	Inspection Items, Center Fuselage, Internal	**100**	**200**	**1000**	**Initials**
1.	Examine the rear windows (LH and RH): – Examine the acrylic glass windows for damage. Look specially for cracks. – Examine the bonding between the windows and the frames. (Refer to Section 56-10).		X	X	
2.	Examine the fire extinguisher. Make sure that the fire extinguisher will release and the fire extinguisher contents are full. (Refer to Chapter 26-00).	X	X	X	
3.	Examine the baggage net. Make sure that the spring clips operate correctly.	X	X	X	
4.	Examine the ELT. (Refer to Chapter 25-60).	X	X	X	
5.	Remove the center fuselage panels on the bottom of the airplane for access.	X	X	X	
6.	Remove the baggage compartment floor for access. (Refer to Chapter 25-10).	X	X	X	
7.	Remove the B-Bulkhead cover plate (disconnect antenna) for access. Visually examine the interior of the tail section. Look especially for signs of damage and foreign objects..			X	
8.	Inspect the push rod guides for the elevator for incorrect attachment and freedom of movement.		X	X	
9.	Inspect the flap control mechanism on the aft control bulkhead for damage, corrosion, in correct attachment and lock devices.	X	X	X	
10.	Inspect the aileron control system on the aft control bulkhead for wear, damage, corrosion, incorrect attachment and lock devices.	X	X	X	
11.	Do a cable tension test of the rudder control cable. (Refer to Chapter 27-20).	X	X	X	

		Interval			
	Inspection Items, Center Fuselage, Internal	**100**	**200**	**1000**	**Initials**
12.	Inspect the rudder control lever and cables on the B-bulkhead for damage, corrosion, incorrect attachment and lock devices.	X	X	X	
13.	Inspect the rudder control cables in the center fuselage for wear, damage, corrosion and incorrect lock devices.	X	X	X	
	WARNING: DO NOT GET FUEL ON YOU. FUEL CAN CAUSE SKIN DISEASE. DO NOT ALLOW FIRE NEAR FUEL. FIRE BURNS AND CAN CAUSE INJURY TO PEOPLE AND DAMAGE TO EQUIPMENT.				
14.	Remove and clean the gascolator filter bowl. Install the gascolator filter bowl. (Refer to Chapter 28-20).	X	X	X	
15.	Examine the fuel tank strap. Look especially for rub marks.	X	X	X	
16.	Examine the fuel tank and fuel lines for leakage, damage, chafings or material deterioration	X	X	X	
17.	Examine the fuel system electrical cables and ground strap. Look especially for rub marks.	X	X	X	
18.	Examine the filler neck of the fuel tank and the filler cap. Look especially for fuel leaks and damage.	X	X	X	
19.	Examine the fuel vent pipe. Look especially for rub marks and damage. Make sure the vent pipe is clear.	X	X	X	
20.	Examine the cable ties and electrical connectors. Pull lightly to make sure they are not loose.	X	X	X	

		Interval			
	Inspection Items, Center Fuselage, Internal	**100**	**200**	**1000**	**Initials**
21.	With the wings removed perform a visual inspection and a tap test of the spar bridge. – Examine the condition of the laminates and the bond to the fuselage. – Look especially around: – The LH and RH A-bolt bushing. – The B-bolt bushing. – The MLG brackets. – The LH and RH top aft outer corners (behind the back-rest). – The seat fastener through the side of the spar bridge (if applicable). Do a visual inspection of the inside spar bridge. Refer to Chapter 51-10.			X	
22.	Install the B-Bulkhead cover plate (connect antenna).			X	
23.	Install the bottom center fuselage panels.	X	X	X	

4. Rear Fuselage

		Interval			
	Inspection Items, Rear Fuselage	**100**	**200**	**1000**	**Initials**
1.	Examine the complete surface of the rear fuselage. Examine around the inside and outside of the window including surrounding structure and seal. Look especially for damage (dents, cracks, holes, scratches, and delamination).	X	X	X	
2.	Visually inspect the condition of the paint for chips, scratches, UV damage.	X	X	X	
3.	Examine the push rod guides for the elevator push-rod. Look especially for correct attachment and freedom of movement.	X	X	X	
4.	Examine the rudder-control cables and turnbuckles. Look especially for wear, damage, corrosion and correct lock devices.	X	X	X	

5. Tail

		Interval			
	Inspection Items, Tail	**100**	**200**	**1000**	**Initials**
1.	Examine the complete surface of the aft part of the fuselage, vertical stabilizer, and horizontal stabilizer. Look especially for damage (dents, cracks, holes, scratches and delamination). Look especially around the access panels.	X	X	X	
2.	Visually examine the drain holes in the horizontal stabilizer. Make sure that they are open.		X	X	
3.	Visually examine the condition of the paint. Look for chips, scratches, UV damage.	X	X	X	
4.	Examine the lower fin. Look especially for damage to the bottom of the fin and correct attachment.	X	X	X	
5.	Remove the rudder. – Visually examine the hinge pin for cracks, corrosion and fit in the composite. – If sleeve installed over the hinge pin: Replace the sleeve if it is damaged or worn. – Lubricate the hinge bushes. Refer to Chapter 55-40.		X	X	
6.	Visually inspect the drain holes in the rudder for blockage.		X	X	
7.	View through the access holes in the vertical stabilizer spar and visually inspect internal composite components for disbonding with skin, and for delamination and cracks.		X	X	
8.	Examine the rudder mounting and control cable connections.	X	X	X	
9.	Examine the rudder support bracket.	X	X	X	
10.	Visually examine the rudder pivot bearing for corrosion and wear.		X	X	
11.	Examine the bottom edge of the rudder. Look especially for cracks and deformation.	X	X	X	
12.	Examine the rudder-stop reinforcement bars. Look especially for cracks and corrosion.	X	X	X	

		Interval			
	Inspection Items, Tail	**100**	**200**	**1000**	**Initials**
13.	Examine the trim actuator. Look especially for correct attachment and wear.		X	X	
14.	Examine the fork assembly on the trim actuator. Look especially for cracks and corrosion.		X	X	
15.	Remove the horizontal stabilizer. Examine the horizontal stabilizer for damage. (Refer to Chapter 55-10).			X	
16.	Examine the elevator for damage. Look especially for correct attachment and lock devices. (Refer to Chapter 27-30).	X	X	X	
17.	Visually inspect the drain holes in the elevator for blockage.		X	X	
18.	Examine the elevator hinges and control horn. Check the laminate around the hinges and the control horn fasteners for cracks, corrosion or delamination. Look especially for too much play. Play allowed: – Axial: ± 1.50 mm (± 0.06 in). – Radial:± 0.25 mm (± 0.01 in).	X	X	X	
19.	Remove the elevator horizontal push-rod and examine it for damage. Look especially for rub marks and excessive wear. The maximum wear permitted is 0.38 mm (0.015 in). Measure the amount of wear as follows: – Take a measurement of the push-rod diameter at the edge of the paint. – Take a measurement of the push-rod diameter at the middle of the wear mark. – Compare the two measurements. If the maximum wear permitted is exceeded, replace the push-rod. Install the pushrod. (Refer to Chapter 27-30).			X	

		Interval			
	Inspection Items, Tail	**100**	**200**	**1000**	**Initials**
20.	Inspect the elevator vertical push rod for corrosion in the following areas: – Under the trim spring mounts by removing the roll pin. – Upper and lower trim spring mounts. – Under the chaffing protection sleeve of the center bushing.			X	
21.	Examine the forward mounting brackets for the horizontal stabilizer.			X	
22.	Install the horizontal stabilizer. (Refer to Chapter 55-10).			X	
23.	Install the rudder. (Refer to Chapter 55-40).		X	X	

6. Wings

		Interval			
	Inspection Items, Wings	**100**	**200**	**1000**	**Initials**
1.	Examine the complete surface of the wings. Look especially for damage (dents, cracks, holes, and delamination). Examine the paint coat.		X	X	
2.	Remove the wings (Refer to Chapter 57-10). – Examine the A bolts and bushings for security in surrounding composite, tightness of fit of pin/bolt, cracks, corrosion, wear and distortion. – Replace the A bolts if there is more than 0.1 mm (0.004 in) of radial play. – Grease the A bolts. – Examine the B-bolts and bushings for security in surrounding composite, tightness of fit of pin/bolt, cracks, corrosion, wear and distortion. – Replace the B bolts if there is more than 0.1 mm (0.004 in) of radial play. – Grease the B-bolts. Refer to Chapter 12-20.			X	
3.	Visually examine the ailerons. Look especially for damage (dents, cracks, holes and delamination).	X	X	X	
4.	Examine the aileron hinges and control horns. Check the laminate around the hinges and the control horn fasteners for cracks, corrosion or delamination. Look especially for too much play. Play allowed: – Axial: ± 1.00 mm (± 0.04 in). – Radial: ± 0.25 mm (± 0.01 in).	X	X	X	
5.	Visually examine the drain holes in the ailerons. Make sure that they are open.		X	X	

		Interval			
	Inspection Items, Wings	**100**	**200**	**1000**	**Initials**
6.	Visually examine the mass balance attachment through the access hole on the lower surface. Inspect for cracks in the laminate and bonding paste around the fasteners.	X	X	X	
7.	Examine the flaps. Look especially for damage (dents, cracks, holes and delamination).	X	X	X	
8.	Remove the flap push-rods and examine them for damage. Look especially for rub marks and excessive wear. The maximum wear permitted is 0.125 mm (0.005 in). Measure the amount of wear as follows: – Take a measurement of the push-rod diameter at the edge of the paint. – Take a measurement of the push-rod diameter at the middle of the wear mark. – Compare the two measurements. If the maximum wear permitted is exceeded, replace the push-rod. Install the pushrods.			X	
9.	Examine the flap hinges and control horn. Check the laminate around the hinges and the control horn fasteners for cracks or delamination. Look especially for too much play. Play allowed: – Axial: ± 1.00 mm (± 0.04 in). – Radial: ± 0.25 mm (± 0.01 in).	X	X	X	
10.	Remove the flap and aileron bellcrank access panels in the wing (Refer to Chapter 52-40). – Examine the aileron and flap control system. Look especially for correct attachment and lock devices. (Refer to Chapter 27-10 and Chapter 27-50). – Install the access panels.	X	X	X	

		Interval			
	Inspection Items, Wings	**100**	**200**	**1000**	**Initials**
11.	Examine the Pitot head. Look especially for correct attachment.	X	X	X	
12.	Inspect the vent and drain holes in the wings, fuselage and control surfaces for blockage.	X	X	X	
13.	Do a test for axial play in the B-bolts. (Refer to Chapter 57-10).	X	X	X	
14.	Remove the aileron push-rods and examine them for damage. Look especially for rub marks and excessive wear. The maximum wear permitted is 0.25 mm (0.010 in). Measure the amount of wear as follows: – Take a measurement of the push-rod diameter at the edge of the paint. – Take a measurement of the push-rod diameter at the middle of the wear mark. – Compare the two measurements. If the maximum wear permitted is exceeded, replace the push-rod. Install the aileron push-rods. Refer to Chapter 27-10.			X	
15.	Install the wings. (Refer to Chapter 57-10).			X	

7. General

		Interval			
	Inspection Items, General	**100**	**200**	**1000**	**Initials**
1.	Examine the Pitot-static system. Look especially for leaks. Do a low-range static leak test. (Refer to Chapter 34-10). Do a Pitot test. (Refer to Chapter 34-10). Make sure that the Pitot-static system is clean.			X	
2.	Lubricate the airplane. Refer to Chapter 12-20.		X	X	
3.	Measure the play in the aileron and elevator controls with the control surfaces locked. (Refer to Chapter 27-30). Look especially for too much play. Do the test at the top of the control stick. Maximum play allowed: – 10 mm (0.375 in). Refer to Chapter 27-10.	X	X	X	
4.	Do a system test for the correct range of movement of the aileron control system. Refer to Chapter 27-10.	X	X	X	
5.	Do a system test for the correct range of movement of the rudder control system. Refer to Chapter 27-20.	X	X	X	
6.	Do a system test for the correct range of movement of the elevator control system. Refer to Chapter 27-30.	X	X	X	
7.	Do an actuator-motor test of the trim-system. Look especially for correct operation and indication.	X	X	X	
8.	Do a system test of the flap system. (Refer to Chapter 27-50). Look especially at the pre-load. With the flaps set to CRUISE in the up position. – Correct pre-load: 30 - 50 N (6.7 - 11.2 lbs).		X	X	
9.	Do an operational test of the external lights.	X	X	X	

		Interval			
	Inspection Items, General	**100**	**200**	**1000**	**Initials**
10.	Examine the airplane. Look especially for loose items and tools. Close all access panels. Install the following items: – Engine cowlings. – The instrument panel cover. – The seat shells. – The control-stick boots.	X	X	X	
	WARNING: DO NOT LET PERSONS INTO THE DANGER AREA OF THE PROPELLER. PROPELLERS CAN CAUSE INJURY OR DEATH. **WARNING: SET THE PARKING BRAKE TO ON. IF YOU DO NOT DO THIS THE AIRPLANE CAN MOVE. THIS CAN CAUSE INJURY OR DEATH.**				
11.	Set the parking brake to ON.	X	X	X	
12.	Put the chocks against the main airplane wheels.	X	X	X	
13.	Do the post maintenance operational test. – For the engine run procedures refer to the Airplane Flight Manual. – For the operational test refer to the engine maintenance and operation manual. – Record the data (Refer to Paragraph 7).	X	X	X	
14.	Examine the engine for leakage.	X	X	X	
15.	Do a maintenance check flight. Record the engine ground test and the maintenance check flight reports in the Aircraft Maintenance Log.			X	

Section 05-28-70
6000 Hour Inspection

1. General

Note: All 1000 hour inspection items must be performed in addition to the 6000 hour inspection items below.

A. Engine Ground Test

Perform all inspection items described in 1000 hour interval.

B. Maintenance of Checklist Zones

Perform all inspection items described in 1000 hour interval along with the following:

(1) Engine Compartment

	Inspection Items, Engine Compartment	Initials
1.	Visually examine the forward firewall. Examine the condition of the paste fillet and fire paint over the edge of the fire shield on the front face of the firewall. Check for cracks, damage and disbond from the fire shield.	

(2) Front Fuselage

	Inspection Items, Front Fuselage	Initials
1.	Do a visual inspection and a tap test of the fuselage skin. Inspect for disbonding between internal composite components and skin.	
2.	After removing the main wheels, visually examine the condition of the axles. Look especially for cracks and corrosion.	
3.	Visually examine the MLG struts and shims in the outboard brackets. Check for the correct fit of the components.	
4.	Remove, disassemble and clean the brake cylinders (4x) and calipers (2x).	
5.	Replace the o-rings and assemble the brake cylinders (4x) and calipers (2x).	
6.	Remove the NLG strut. (Refer to Chapter 32-20).	
7.	Visually examine the NLG strut upper journal assembly lock bolt. Look especially for cracks and corrosion.	

	Inspection Items, Front Fuselage	Initials
8.	Do a visual inspection of the NLG bushings in the T-panel on the bottom of the fuselage. – Check for the security of the bushing in the T-panel. – Perform a tap test to check for the condition of the surrounding laminate. – Check the bond of the T-panel to the floor panel and to the fuselage skin.	
9.	Install the nose landing gear strut. (Refer to Chapter 32-20).	

(3) Cockpit

	Inspection Items, Cockpit	Initials
1.	Visually examine the seats and seat attachments. Look especially for cracks, delamination and damage around the fastener holes.	
2.	Visually examine the cockpit floor. Look especially for cracks or delamination around the aft rudder pedal bracket, boarding step, and the throttle quadrant opening.	
3.	Visually examine the MLG and A-bolt attachment brackets. Look especially for: – Cracks in, or corrosion of the bracket. – Disbond from the laminate. – Delamination in the surrounding laminate.	
4.	Visually examine the firewall. Inspect the condition of the laminate when viewed from the cockpit side for cracks, discoloration and delamination. Particularly around the engine mount fastener holes and the battery box. Examine the structure for security of the attaching bolts on the firewall and cracks in the surrounding laminate.	

(4) Fuselage

	Inspection Items, Fuselage	**Initials**
1.	Visually examine the B-bulkhead. Look for cracks and delamination, especially around the fuel tank attachments.	
2.	Visually examine the rudder yoke assembly, its attachment, and surrounding structure under the B-bulkhead.	
3.	Perform a visual inspection and tap test of the fuselage skin. – Inspect for disbonding between internal composite components and skin.	
4.	Perform a visual inspection and a tap test of the vertical stabilizer. – Inspect for disbonding between internal composite components (spar) and the skin. – Inspect vertical stabilizer (fuselage) skin around the lower tail fin.	
5.	Perform a visual inspection and a tap test of the horizontal stabilizer. – Inspect for disbonding between internal composite components (including leading/trailing edges) and the skin. – Inspect for disbonding and cracks above or below the overlap seam.	
6.	Visually examine the forward mounting bracket of the horizontal stabilizer. Look especially for: – Cracks in the bond to the plate. – Delamination in the rib around the fasteners.	
7.	Perform a visual inspection and a tap test of the rudder. – Examine the skin for delamination, cracks, dents and scratches. – Examine the paint for chips, scratches and UV damage. – Examine for damage to the foam core. – Examine for a disbond between the skin and the foam core.	
8.	Visually examine the bushings at the aft horizontal stabilizer attachment. Examine for corrosion, cracks, delamination or cracks in composite around bushing.	

	Inspection Items, Fuselage	Initials
9.	Perform a visual inspection and tap test of the elevator. – Examine the skin for delamination, cracks, dents and scratches. – Examine the paint for chips, scratches and UV damage. – Examine for damage to the foam core. – Examine for a disbond between the skin and the foam core.	
10.	Perform a visual inspection of the elevator hinges, attaching hardware including the bronze bushings, and surrounding structure. Look especially for damage and wear.	

(5) Wings

	Inspection Items, Wings	Initials
1.	Perform a visual inspection and tap test of the upper and lower wing skins. Examine for damage to the core or a disbond between the skin and core.	
2.	Perform a visual inspection and tap test of the leading edge. Examine for disbonds and cracks above or below the overlap seam.	
3.	Perform a visual inspection and tap test to examine the main spar bonding with the wing skins.	
4.	Perform a visual inspection and tap test of the wing roots (in front and behind the spar) to examine the bonding with the skins.	
5.	At the lower wing, remove the tie-down ring to check for damage to the hole. Check for delamination, cracks and elongation of the hole.	
6.	Visually examine the internal ribs through the lower wing inspection panels. – Check for the condition of the laminate on the ribs. – Check for cracks and delamination around the bellcrank brackets and a disbond between the bracket and rib. – Check the condition of the bellcrank brackets. Look especially for cracks, elongation of the bellcrank mounting holes, corrosion and chipped paint.	

	Inspection Items, Wings	Initials
7.	Perform a visual inspection and tap test of the trailing edge spar. – Examine for the condition of the laminate and bond of the trailing edge to the skin. – Examine for the bonding of the flap and aileron hinges to the trailing edge and skin. – Examine the bonding of the flap up-stop rib to the trailing edge and skin.	
8.	Visually examine the main spar flange joint and web, outboard from the root rib. Look through the root rib openings. Look for signs of damage (delamination).	
9.	Visually examine the main spar web sandwich structure, outboard from the root rib. Look through the root rib openings. Look for condition of laminate, delamination, condition of core.	
10.	Visually examine the wing roots (in front and behind the spar) to inspect the joints with the main spar and spar stump. Examine the condition of the laminate. Look especially for damage (cracks and delamination).	
11.	Visually examine the main bolt bushing in the spar web. Look especially for corrosion or wear of bushing, bond of bushing in spar stump. Ensure a tight fit of the main pin within the bushing.	
12.	Perform a visual inspection and tap test of the ailerons. – Examine the paint for chips, scratches and UV damage. – Inspect the skin for delamination. – Inspect for damage to the core or disbond between the skin and the core. – Inspect the ribs for bonding with the skins.	
13.	Perform a visual inspection and tap test of the flaps. – Examine the paint for chips, scratches and UV damage. – Inspect the skin for delamination. – Inspect for damage to the core or disbond between the skin and the core. – Inspect the ribs for bonding with the skins.	
14.	Visually examine the main pin bushing in the spar stump. Replace the main pin bushing if it is damaged.	

	Inspection Items, Wings	Initials
15.	Visually examine the main pin bushing in the spar bridge. Replace the main pin bushing if it is damaged.	

Section 05-28-90
Maintenance Report

1. Maintenance Report

Complete a copy of the Maintenance Report after all of the applicable maintenance tasks in the Maintenance Checklist have been initialed.

DV 20 E	
Airplane Serial Number:	Registration Number:
Check: ___________ (100 hr, 200 hr, 1000 hr, 6000 hr, Annual)	
REMARKS:	
The airplane is airworthy with respect to its maintenance condition. ___________________ ___________________ ___________________ Place Date Authorized	

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Section 05-28-91
Engine Ground Test Record

1. Engine Ground Test Record

Do the engine test in accordance with Section 71-00 and record results and comments.

WARNING: DO NOT STAND WITHIN THE DANGER AREA OF THE PROPELLER. THE PROPELLER CAN CAUSE DEATH OR INJURY TO PERSONS.

WARNING: YOU MUST MAKE SURE THAT THE ENGINE IS SAFE BEFORE YOU TURN THE PROPELLER. MAKE SURE THAT:
- THE ELECTRIC MASTER SWITCH IS SET TO "OFF".
- THE ENGINE MASTER SWITCH IS SET TO "OFF".
- THE THROTTLE LEVER IS SET TO "IDLE".

WARNING: DO NOT GET OIL ON YOU. OIL CAN CAUSE SKIN DISEASE.

WARNING: DO NOT GET FUEL ON YOU. FUEL CAN CAUSE SKIN DISEASE. DO NOT ALLOW FIRE NEAR FUEL. FUEL BURNS AND CAN CAUSE INJURY TO PEOPLE AND DAMAGE TO EQUIPMENT.

WARNING: WHEN YOU COMPLETE AN INSPECTION, MAKE SURE THAT YOU REMOVE ALL LOOSE ITEMS/TOOLS FROM THAT AREA. LOOSE ITEMS/TOOLS CAN PREVENT FULL MOVEMENT OF THE AIRPLANE CONTROLS. THIS CAN CAUSE DEATH OR INJURY TO PERSONS.

CAUTION: YOU MUST ATTACH BLANKS/CAPS TO HOLES/PIPES WHEN YOU REMOVE COMPONENTS. IF YOU DO NOT DO THIS, UNWANTED DEBRIS CAN ENTER THE HOLES/PIPES. THIS CAN CAUSE BLOCKAGE TO THE AIRPLANE SYSTEMS.

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Section 05-28-92
Check Flight Report

1. Check Flight Report

Note: The maintenance check flight must be done in accordance with the applicable national regulations.

Diamond AIRCRAFT	MAINTENANCE CHECK FLIGHT (See Maintenance Checklist for Applicability)	DV 20 E Page 1 of 2	
Registration:	Pilot:	Airdrome:	
Date:	Take-Off:	Landing:	

Functional Check, Flight Behavior	Findings		
	N/A	NO	YES
Fuel quantity indicator			
ACL, Navigation lights			
Warning and Caution lights			
Altimeter, QNH adjustment			
Radio, radio check			
Navigational instruments			
Electrical fuel pumps			
Engine starting behavior, cold			
Engine Monitoring Unit			
Ammeter			
Manifold air pressure / temperature			
Parking brake			
Wing flaps			
Lane selection			
Idle RPM > 1400			
Take off power RPM 5600 ± 200			
Taxiing behavior, take-off behavior			
Backup airspeed indicator			

Diamond AIRCRAFT	MAINTENANCE CHECK FLIGHT (See Maintenance Checklist for Applicability)	DV 20 E Page 2 of 2

Registration:	Pilot:	Airdrome:
Date:	Take-Off:	Landing:

Functional Check, Flight Behavior	Findings		
	N/A	NO	YES
Backup altimeter			
Backup artificial horizon			
Compass			
Behavior during climb			
Coolant temperature			
Cabin heat/cabin air			
Behavior during high speed flight			
Trim/trim range			
Behavior during low speed flight			
Stall warning			
Landing behavior			
Fuel shut-off valve			
Engine starting behavior, warm			
Engine shut down behavior			

Remarks:

Signature Pilot: ______________________

Section 05-50
Unscheduled Maintenance Checks

1. General

Unscheduled maintenance checks are necessary after any incident that could cause damage to the airplane.

2. Hard Landing Check

Figure 1 shows the hard landing check areas. You must do a hard landing check when the pilot makes a report of a hard landing. Or when ground handling applies unusual loads.

A. Equipment

Item	Quantity	Part No.
Slide sheets.	4	Commercial.

B. Procedure

	Detail Steps/Work Items	Key Items
	CAUTION: IF YOU THINK THE AIRPLANE HAS DAMAGE TO AN AREA THAT TRANSMITS A LOAD, YOU MUST ASK THE AIRPLANE MANUFACTURER FOR ADVICE.	
(1)	Examine the landing gear fittings. Look specially for cracks.	Use a mirror and a flashlight.
(2)	Examine the fuselage and center wing structure where the landing gear attaches. Look specially for: – Disbonds. – Delamination of the CFRP structure. – Damage to the mounting brackets.	Refer to Section 32-10.

	Detail Steps/Work Items	Key Items
(3)	Examine the landing gear struts. Look specially for: – Bending. – Cracks.	Refer to Section 32-10.
(4)	Measure the maximum deflection of the main landing gear struts as follows: – Lift the airplane on jacks. – Lay a straight rod on the upper surface of the strut. – Measure the maximum gap between the rod and the strut.	Refer to Chapter 07-10. Make sure that the ends of the rod are resting on the upper bend radius and lower bend radius of the strut. If the gap is less or equal to 3 mm (0.12 in) examine the strut for corrosion and cracks particularly in the area of the maximum gap. If the gap is more than 3 mm (0.12 in) replace the strut as per Chapter 32-10.
(5)	Check toe-in and camber.	Refer to Section 32-10.
(6)	Examine the tires. Look specially for cuts in the side walls.	Refer to Section 32-40.
(7)	Examine the brake discs. Look specially for damage. Turn the wheel and make sure the disc is not bent.	
(8)	Examine the wheels. Look specially for cracks or distortion of the rims. Look specially for play and irregular running of the wheel bearings.	
(9)	Examine the nose-gear assembly. Look especially for deformation of the upper cross bar of the engine mount.	
(10)	Examine the top-hat contour in the bottom of the fuselage for delamination. Look especially in the area of the bearings for the nose-gear assembly.	

	Detail Steps/Work Items	Key Items
(11)	Remove the load from the nose-gear and examine it. Look specially for more than the usual play.	
	CAUTION: IF YOU THINK THE AIRPLANE HAS DAMAGE TO AN AREA THAT TRANSMITS A LOAD, YOU MUST ASK THE AIRPLANE MANUFACTURER FOR ADVICE.	
(12)	Remove and disassemble the NLG shock damper assembly; examine components. Examine the shock damper rod for deformation.	Refer to Chapter 32-20.
(13)	Examine the control surfaces. Look specially for: – Correct attachment of the hinges. – Correct attachment of the mass balance to the structure.	
(14)	Examine the leading edge of the wing for damage.	
(15)	Examine the area of the spar attachments to the wing shells. Look specially for cracks.	
(16)	Examine the leading edge of the horizontal and vertical stabilizers for damage.	
(17)	Examine the engine mounts.	
(18)	Examine the engine mount points on the firewall.	
(19)	Examine the propeller. Look specially to see if the propeller has touched the ground.	
(20)	Examine instrument panel shock mounts for damage.	Hard landings can cause instrument glass to crack due to failed shock mount.

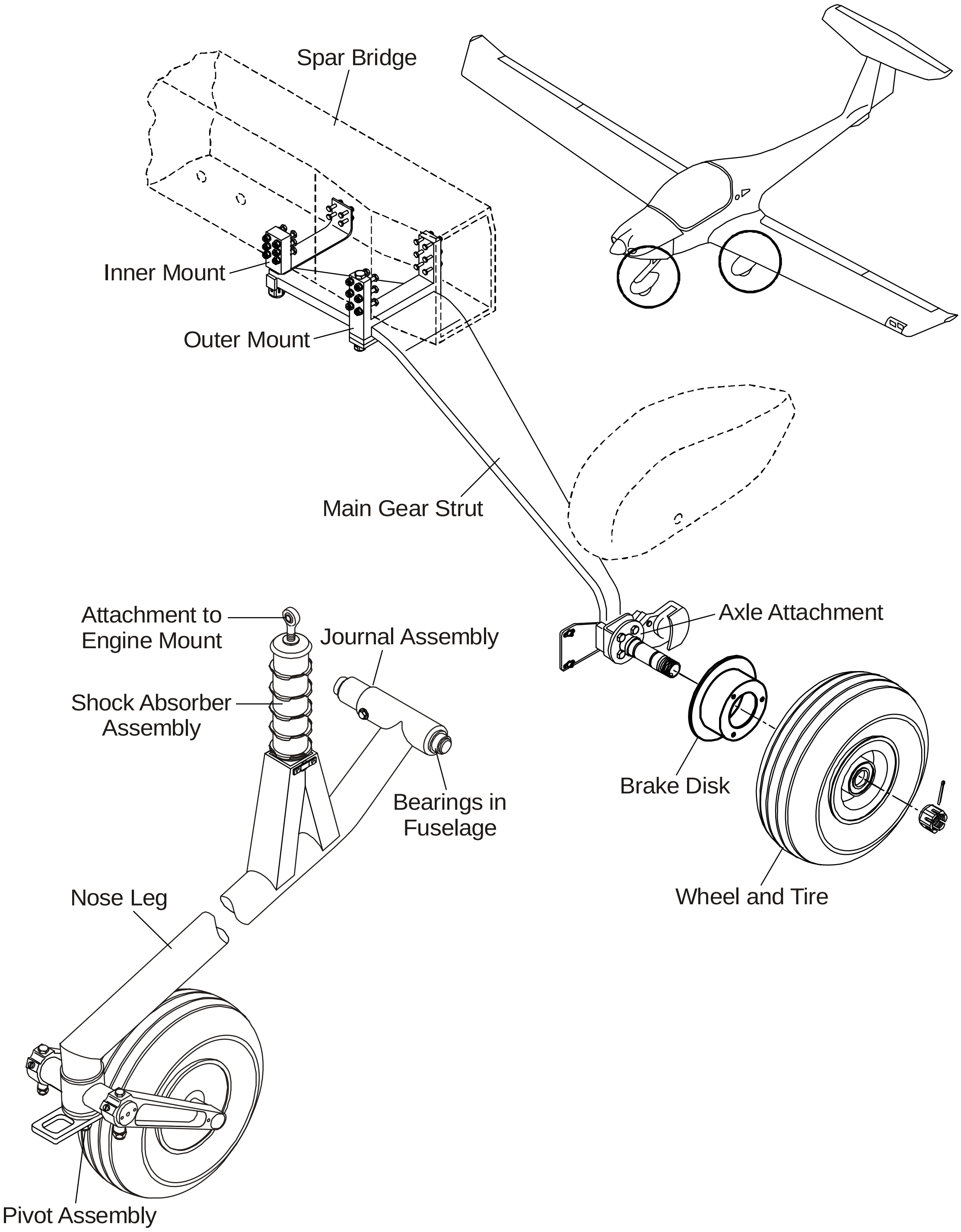

Figure 1: Hard Landing Check Areas

3. Propeller Strike

A propeller strike can be a moving propeller (engine running) which has hit a solid object. Or it can be a moving object that hits a propeller that is not moving.

A. Propeller Strike with the Engine Running

If the propeller has hit a solid object while the engine was running:

	Detail Steps/Work Items	Key Items
(1)	Remove the propeller.	Refer to Chapter 61.
(2)	Remove engine. Refer to Chapter 71-00.	
(3)	Do an inspection of the engine mount.	Refer to Section 71-20.
(4)	Do an inspection of the propeller.	Refer to the Propeller Owner's Manual.

B. Propeller Hit by a Moving Object

If a propeller which is not moving is hit by a moving object:

	Detail Steps/Work Items	Key Items
(1)	Do an inspection of the propeller. If the propeller must be removed to do a repair other than minor dressing of the blades, you must do the inspection procedure specified for a moving propeller strike.	Refer to the Propeller Installation and Operation Manual.
(2)	Inspect the airplane for damage.	

4. Engine Fire

WARNING: BEFORE YOU DO WORK ON THE AIRPLANE MAKE SURE THE FIRE HAS BEEN EXTINGUISHED. LET THE ENGINE COOL AND DISCONNECT THE BATTERY.

WARNING: FIRE CAN SERIOUSLY WEAKEN CFRP. IF YOU FIND ANY DAMAGE TO CFRP, DO NOT OPERATE THE AIRPLANE. ASK THE MANUFACTURER FOR ADVICE.

	Detail Steps/Work Items	Key Items
(1)	Remove the engine cowlings.	Refer to Section 71-10.
(2)	Disconnect the airplane battery.	Refer to Section 24-31.
(3)	Examine the engine cowlings. Look specially for signs of fire damage.	
(4)	Examine the electrical cables. Look specially for signs of fire damage.	Replace damaged cables.
(5)	Examine the fuel lines. Look specially for signs of fire damage to the fire-protection sleeves.	Replace damaged fuel lines.
(6)	Examine the engine oil lines. Look specially for signs of fire damage to the fire-protection sleeves.	Replace damaged oil lines.
(7)	Examine the engine. Look specially for: – Damage to the engine air filter. – Damage to gaskets and seals. – Damage to the engine shock mounts. – Damage to the engine mount. – Damage to pipes/hoses.	Make a record of the damage you find and ask the engine manufacturer for advice before you repair or operate the engine.
(8)	Examine the fuselage. Look specially for: – Blisters on the paint or burn marks. – Disbonding of the fuselage skin from the firewall.	If you find any damage, ask the airplane manufacturer for advice.

	Detail Steps/Work Items	Key Items
	WARNING: DO NOT GET FIRE EXTINGUISHER PARTICLES ON YOU. THE CHEMICALS USED TO EXTINGUISH A FIRE CAN BE CAUSTIC/POISONOUS. WHEN YOU CLEAN THE ENGINE REFER TO THE FIRE EXTINGUISHER MANUFACTURER'S SAFETY INSTRUCTIONS. USE SAFETY MASKS AND GLOVES AS RECOMMENDED.	
(9)	Clean the engine. Make sure you clean all the fire extinguisher particles from the engine.	Refer to the manufacturer of the fire extinguisher.
(10)	Connect the airplane battery.	Refer to Section 24-31.
(11)	Trouble-shoot the engine. Find the cause of the engine fire. Repair the defect if possible.	Ask the engine manufacturer for advice before you repair or operate the engine.
(12)	Install the engine cowlings.	Refer to Section 71-10.
(13)	Do an engine test.	Refer to the engine maintenance manual, latest revision.

5. Overspeed Flap Extension

	Detail Steps/Work Items	Key Items
(1)	Inspect flaps, flap attachment brackets, hinges, horns and flap control rods for any signs of damage.	
(2)	Remove the flap bellcrank (inside fuselage).	Refer to Section 27-50.
(3)	Inspect the flap bellcrank for any visual signs of damage.	Look in particular around the weld joints of the bellcrank arms.
(4)	Inspect the flap bellcrank using LPI or MPI.	A certified individual should be used. In case of signs of damage or cracks, the bellcrank shall be replaced.

6. Battery Backup Switch Seal broken

	Detail Steps/Work Items	Key Items
(1)	Find out the reason for the broken seal.	
(2)	Replace the seal.	

CHAPTER 06

DIMENSIONS AND AREAS

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TABLE OF CONTENTS

CHAPTER 06

DIMENSIONS AND AREAS

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CHAPTER 06
DIMENSIONS AND AREAS

1. General

The DV 20 E uses the System Internationale (SI) for dimensions and areas. Imperial dimensions are also given in brackets. For example: Wing span 10.87 m (35 ft 8 in).

Conversions between SI units and imperial units are given in Chapter 02.

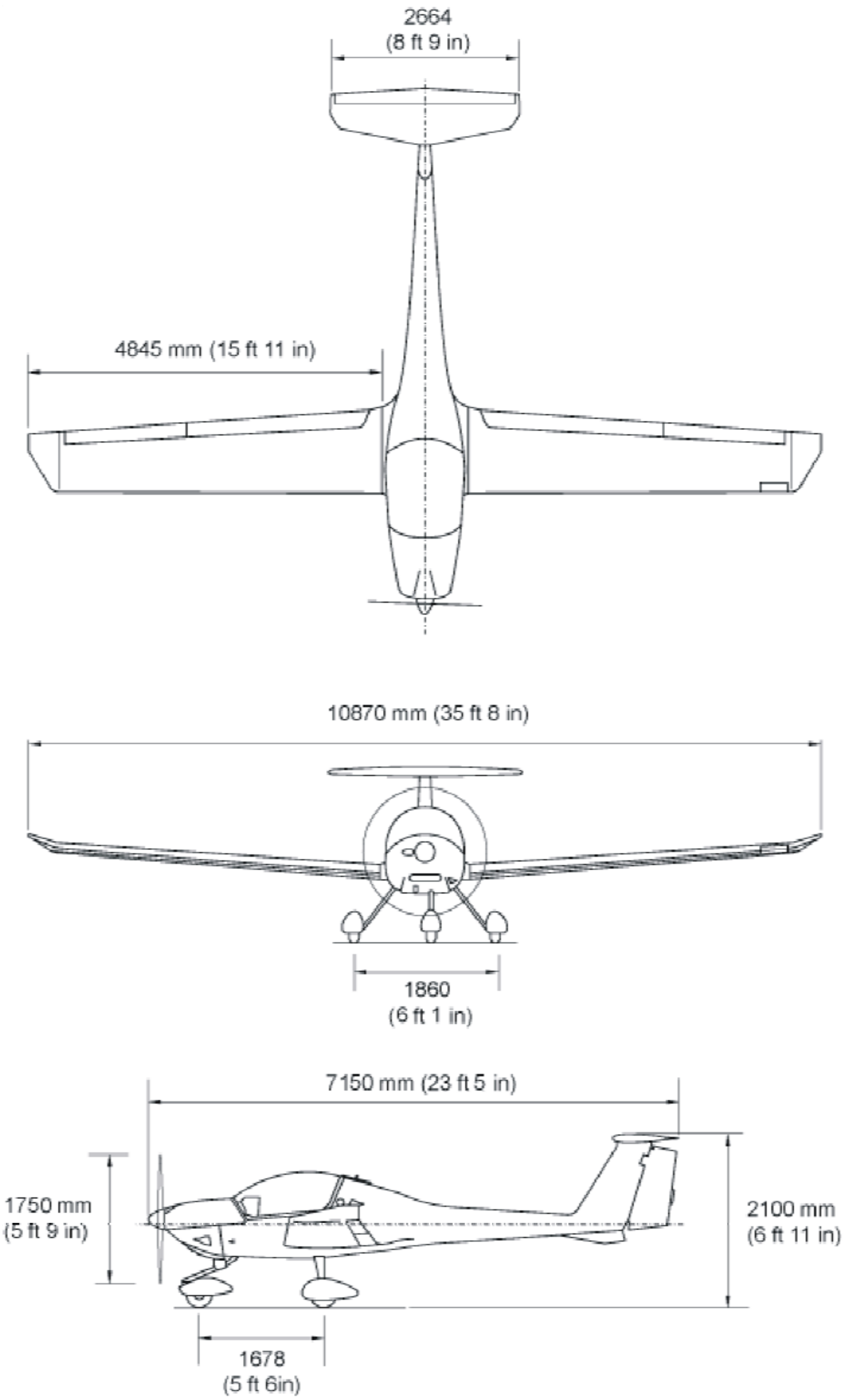

Figure 1: DV 20 E Overall Dimensions (Approximate Values)

2. Dimensions

DV 20 E Dimensions	
Overall Dimensions	
Wing span	10.87 m (35 ft 8 in)
Length	7.15 m (23 ft 5 in)
Height (nominal)	2.10 m (6 ft 11 in)
Wing	
Airfoil	Wortmann FX63-137/20-HOAC
Wing area	11.6 m² (125 ft²)
Dihedral (nominal)	4°
Aspect ratio	10
Sweep back	1°
Horizontal Tail Surfaces	
Span	2.66 m (8 ft 9 in)
Angle of incidence	-4°
Landing Gear (typical static, normal load)	
Wheel track	1.86 m (6 ft 1 in)
Wheel base	1.68 m (5 ft 6 in)
Main Wheel	
Tire: Goodyear	380*150/6.00-15 5.00 - 5 (6 PLY)
Tire inflation pressure	2.3 bar (33 PSI)
Nose Wheel	
Tire: Goodyear	5.00 - 4 (6 PLY)
Tire inflation pressure	1.8 bar (26 PSI)

3. Adjustment Reports

The measurements of the DV 20 E are recorded on an Adjustment Report and the Main Landing Gear Toe-In and Camber Report at the factory when the airplane is built. See Figures 2 thru 10. These reports become part of the airplane records.

When you measure the dimensions, use the Adjustment Report as reference to show any deviations.

4. Weight and Static Moments of Control Surfaces

WARNING: IF YOU REPAINT (OR DO REPAIRS TO) THE CONTROL SURFACES, YOU MUST MAKE SURE THAT THE WEIGHT AND STATIC MOMENTS OF THE CONTROL SURFACES ARE IN THE LIMITS GIVEN IN THE CONTROL SURFACE BALANCE REPORT. THIS WILL PREVENT CONTROL SURFACE FLUTTER.

To measure the static moments you must remove the control surface from the airplane. Refer to Section 51-60 for the measuring procedure.

If the values are not within the limits in the Control Surface Balance Report, you must ask the manufacturer for advice before you adjust the balancing weight.

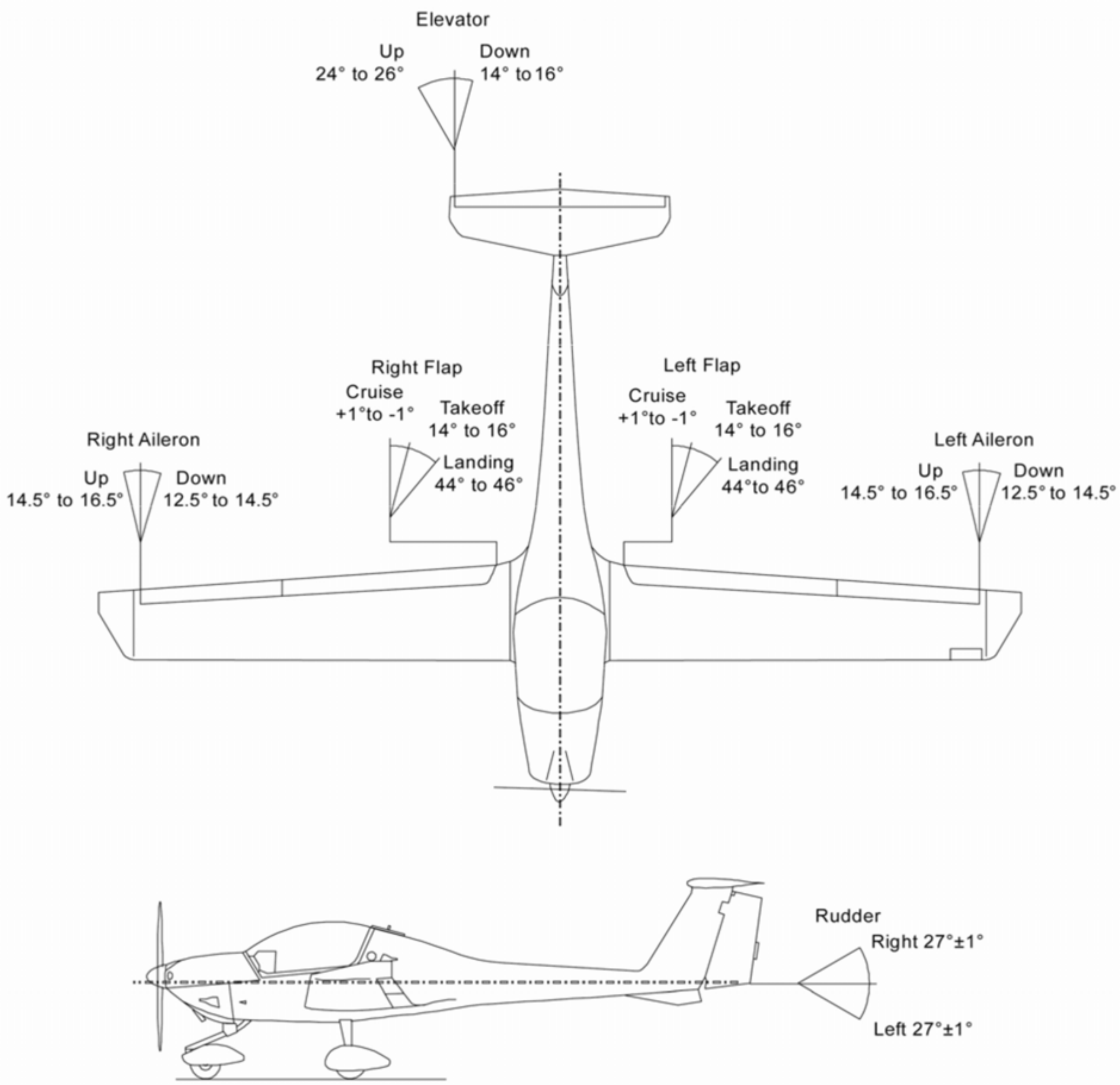

Figure 2: Control Surface Deflections

(1) Control Surface Adjustment Reports

Diamond AIRCRAFT — **DV 20 E**

Control Surface Weight & Balance Report

Legend:
( ) Nominal Weight, may vary
[1] Includes Hinges & Control Surface Horn
[2] Include installed Hinges, Control Horn & Mass Balance
[3] Include Mass Balance Only
[4] Include Lower Mounting Bracket
[5] Composite part only

Date:

Aircraft S/N:

	Weight					Static Moments			
	Before Balancing		Weight Req'd to Balance [3]	After Balancing		Trailing Edge Weight (kg)	Arm (cm)	Moment	
	Limits (kg)	Actual (kg)		Limits (kg)	Actual (kg)			Limits (kg-cm)	Actual (kg-cm)
Aileron, LH	(1.6 to 2.1) [1]		(0.65) kg	2.1to 2.7 [1]				2.55 to 6.71 [1]	
Aileron, RH	(1.6 to 2.1) [1]		(0.65) kg	2.1to 2.7 [1]				2.55 to 6.71 [1]	
Flap, LH	3.00 to 4.00 [1]							28.55 to 37.2 [1]	
Flap, RH	3.0 to 4.00 [1]							28.55 to 37.2 [1]	
Elevator	(2.25) to 2.75 [5]		0.79 max kg					0 to 3.5 [2]	
Rudder	(2.0 to 2.8) [5]		(1.9) kg	3.3 to 4.7 [4]				13.25 to 18.35 [4]	

Figure 3: Control Surface Weigh & Balance Report

Diamond AIRCRAFT	DV 20 E Control Surface Adjustment Report										Date:			
											Aircraft S/N:			
	FLAP						AILERON				ELEVATOR		RUDDER	
Preload Values:	LH (3 to 5 kg):			RH (3 to 5 kg):										
	Cruise		Take Off		Landing		UP		DOWN		UP	DOWN	LH	RH
	LH Flap	RH Flap	LH Flap	RH Flap	LH Flap	RH Flap	LH	RH	LH	RH				
Limits [deg.]	0° ±1°		15° down ±1°		45° down ±1°		15.5° ±1°		13.5° ±1°		25 ±1°	15 ±1°	27° ±1°	
Actual [deg.]	°	°	°	°	°	°	°	°	°	°	°	°	°	°

Figure 4: Control Surface Adjustment Report

ITEM		LIMITS	ACTUAL
DIHEDRAL	LEFT RIGHT	290 - 330 mm (3.77° - 4.29°)	
LEADING EDGE SWEEP BACK	LEFT RIGHT	20 - 55 mm (0.26° - 0.72°)	
SYMMETRY CHECK	LEFT RIGHT	max. diff. 50 mm	
RUDDER CABLE TENSION		13.25 - 7.33 kg	
CANOPY UNLATCHING FORCE		4.5 - 9.0 kg (10 - 20 lbs) No outside handles	
		6.8 - 11.3 kg (15 - 25 lbs) With outside handles	
HORIZONTAL STABILIZER INCIDENCE		4° ± 0.5°	
MAIN LANDING GEAR CAMBER		0° - 4° (0° - 2° desirable)	
MAIN LANDING GEAR TOE IN		0° ± 0.5° per side Total Toe (Included angle) 0° ± 0.5°	
MAIN LANDING GEAR TRACK		1860 mm NOMINAL	
NOSE GEAR FRICTION		3.06 - 5.10 kg	

Figure 5: Adjustment Report, General Items (Metric Dimensions)

CHAPTER 07

LIFTING AND SHORING - GENERAL

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TABLE OF CONTENTS

CHAPTER 07

LIFTING AND SHORING - GENERAL

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CHAPTER 07
LIFTING AND SHORING - GENERAL

1. General

The DV 20 E has no lifting points. You must use straps to lift the airplane. Two persons can lift the wings, or the horizontal stabilizer, or any of the airplane control surfaces.

2. Lifting the Airplane on Jacks

The DV 20 E airplane has two jacking points. They are located under the fuselage at the root ribs. To support the rear fuselage a trestle with a former is positioned in front of the tail skid.

Refer to Figure 1.

WARNING: IF THE WIND SPEED IS MORE THAN 10 KM/HR (6 KNOTS), DO NOT LIFT THE AIRPLANE ON JACKS IN THE OPEN.

A. Equipment

Item	Quantity	Part Number
Airplane jacks (adequate lifting capacity).	2	Commercial.
Hold down strap or weighted belt	1	Commercial.
Tail trestles.	1	Commercial.

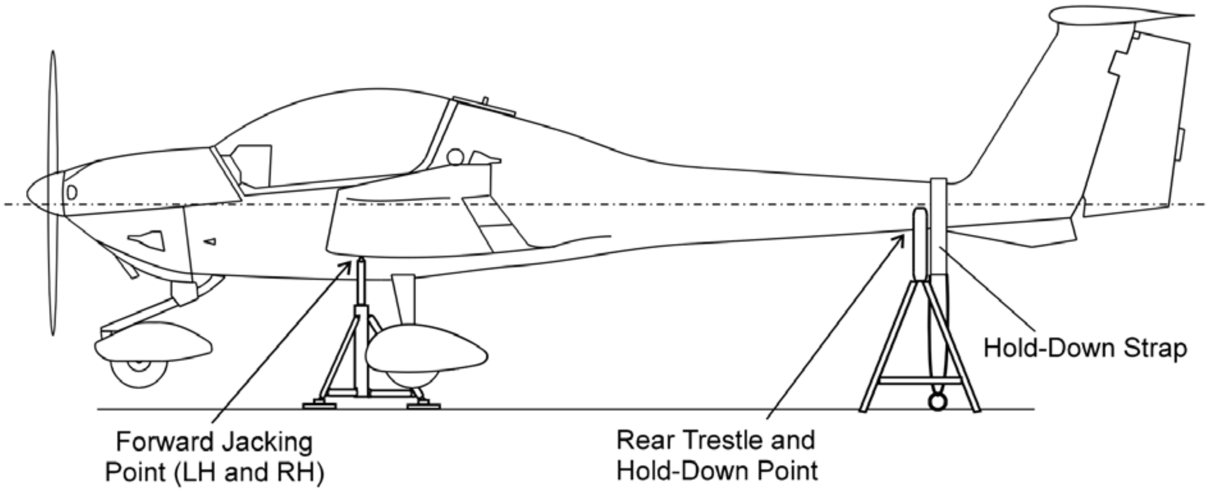

Figure 1: Lifting the Airplane on Jacks

B. Lifting the Airplane

Detail Steps/Work Items		Key Items/References
CAUTION: IF THE AIRPLANE IS IN THE OPEN THEN ALIGN IT INTO THE WIND. MAXIMUM WIND SPEED: 10 KM/H (6 KTS).		
(1)	Apply the parking brake.	
(2)	Put chocks under the main wheels.	
(3)	Put the tail trestle into position under the fuselage	In front of the tail skid.
(4)	Put the hold-down strap in position on the rear fuselage.	
(5)	Put the 2 jacks into position under the main jacking points. Extend the jacks to engage with the jacking plates.	Refer to Figure 1.
(6)	Put the jack into position under the tail jacking point. Extend the jack until to engage with the lower fin skid plate.	
(7)	Remove the chocks and release the parking brake.	
(8)	Extend the jacks until the airplane wheels are clear of the ground.	Operate all the jacks together to keep the airplane level.
(9)	Tie the tail down with the hold down strap.	If you do not have a mooring point in the ground, you can attach a heavy weight to the strap.

C. Lowering the Airplane

Detail Steps/Work Items		Key Items/References
WARNING: MAKE SURE THAT THE AREA UNDER THE AIRPLANE IS CLEAR BEFORE YOU LOWER THE AIRPLANE WITH THE JACKS.		
(1)	Release the hold-down strap.	
(2)	Remove the trestle from under the rear fuselage.	
(3)	Retract the jacks until the airplane wheels are on the ground.	Retract the jacks together to keep the airplane level at all times.
(4)	Apply the parking brake. Put chocks under the wheels.	
(5)	Retract the jacks fully and move the jacks clear of the airplane.	

D. Rear Fuselage Trestle Point

The trestle for the rear fuselage must have the same profile as the fuselage. Put the trestle under the rear fuselage in front of the tail skid.

CHAPTER 08

WEIGHING AND LEVELLING

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TABLE OF CONTENTS

CHAPTER 08

WEIGHING AND LEVELLING

Section 08-10

Weighing

Section 08-20

Levelling

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CHAPTER 08
WEIGHING AND LEVELLING

1. General

This Chapter tells you how to weigh the airplane. It also tells you how to level the airplane. Use the procedures in Section 08-10 to weigh the airplane and to calculate the airplane moment. Use the procedures in Section 08-20 to level the airplane.

Note: In this Airplane Maintenance Manual masses are referred to as weights. The authors accept that this is technically incorrect but have used the expression for simplicity and convenience.

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Section 08-10
Weighing

1. General

Only operate the airplane within the permitted range of weight and center of gravity limits. This will give good flight performance and good handling qualities. It is also necessary for safety.

If you make any changes to the airplane that will alter the weight (or the center of gravity), then you must calculate the new weight of the airplane. You must also calculate its center of gravity.

Only an approved person can weigh the airplane. The national Airworthiness Authority of the country where the airplane is registered gives approval for persons to weigh the airplane. It also gives the time limits.

Use the Weighing Report when you do the weight and balance calculations (Refer to Figure 3).

The reference plane for the DV 20 E is a transverse, vertical plane in front of the airplane. It is at right angles to the horizontal reference line. The reference plane is located at the most forward point of the root rib on the wing.

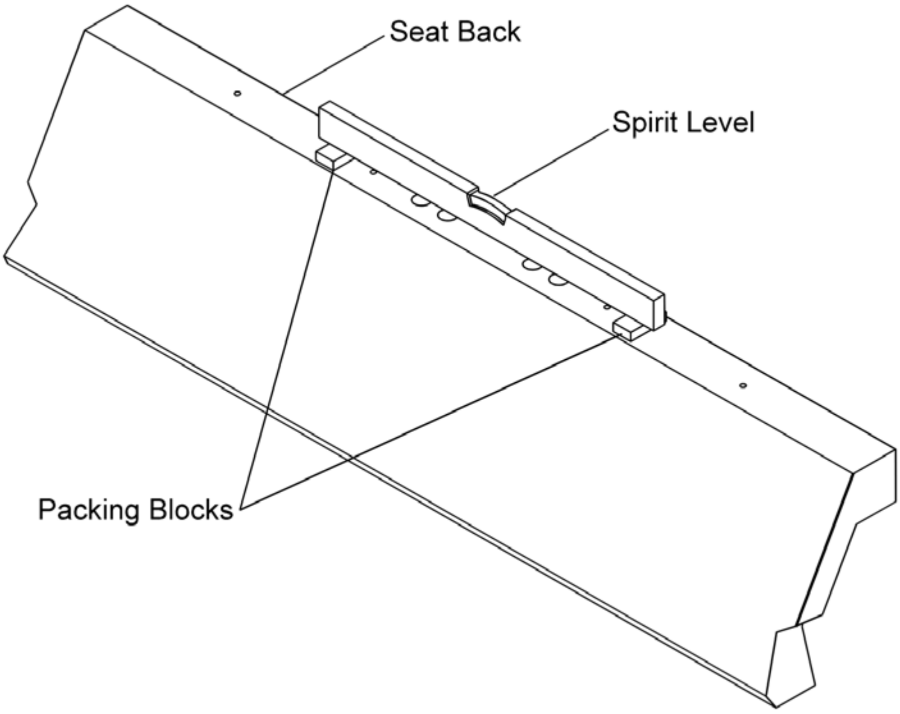
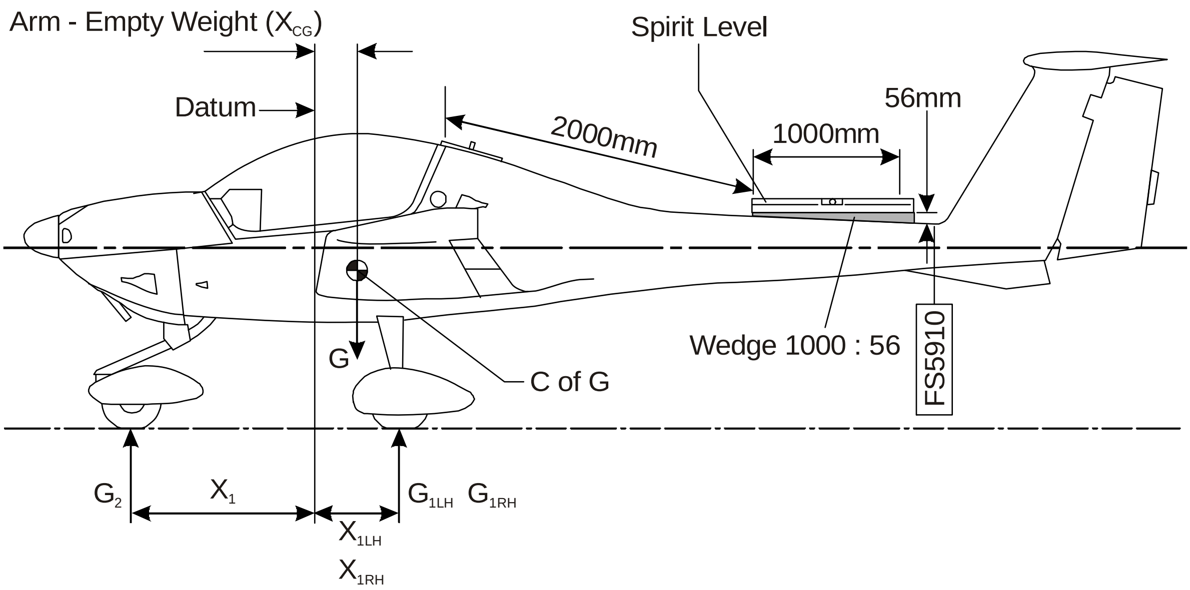


Figure 1: Level the Airplane Laterally



Legend:

X_1 = Arm, Reference Plane to center line of main wheels.

X_2 = Arm, Reference Plane to center line of nose wheel.

G_1 = G_{1LH} + G_{1RH} = Net weight, main wheel scales LH and RH.

G_2 = Net weight, Nose wheel scale.

G = G_{1LH} + G_{1RH} + G_2 = Empty Weight.

X_{CG} = Arm - Empty Weight center-of-gravity (calculated).

Figure 2: Weighing Dimensions

2. Weighing

If you use mechanical scales to weigh the airplane, you must also use wooden blocks under the wheels to level the airplane. You must obey the manufacturers' instructions on the scales.

A. Equipment

Items	Quantity	Part Number
Mechanical scales (the scales used for the main wheels must be the same).	3	Commercial.
Spirit level.	1	Commercial.
Plumb line.	1	Commercial.
Wedge, slope 1000:56.	1	Local Manufacture.
Ramps.	3	Local Manufacture.

Note: If you use airplane jacks to lift the airplane onto the ramps, you must move the airplane a small distance back and forward to allow the landing gear to spread. This will prevent side loads on the scales causing errors.

Before you weigh the airplane do these items:

- Make sure the airplane has all its equipment. The equipment must be in the location shown in the Equipment Inventory. The Equipment Inventory is included in Section 6.5 of the Airplane Flight Manual.
- Defuel the airplane to the unusable fuel level. The unusable fuel level is 9 liters (approx. 2.4 US gal). Refer to Section 12-10.
- Add engine oil and operating fluids up to the maximum level. Refer to Section 12-10.
- Clean the airplane and dry it.
- Remove all objects which are not part of the Equipment Inventory (for example tools, baggage, etc.). The Equipment Inventory is included in Section 6.5 of the Airplane Flight Manual.

B. Weighing Procedure

	Detail Steps/Work Items	Key Items/References
	Note: Weigh the airplane in a closed room. This will avoid any wind causing weighing errors.	
(1)	Make a copy of the Weighing Report form.	Figure 3.
(2)	Zero the scales.	Refer to the scale manufacturer‘s instructions.
(3)	Close the canopy.	
(4)	Move the airplane onto the scales.	The scales under the main wheels must be of the same type.
	CAUTION: DO NOT ALLOW THE AIRPLANE TO RUN OFF THE SCALES. THIS WILL CAUSE DAMAGE TO THE WHEEL FAIRINGS.	
(5)	Engage parking brake or use wheel chocks.	
(6)	Make the airplane level laterally: – Put a spirit level on the backrest of the seats. – If necessary, use additional thin blocks between the scale and the main wheel on the low side to bring the sprit level horizontal.	Refer to Figure 1. If necessary, use 2 packing blocks of equal thickness to clear the safety belt attachments.

	Detail Steps/Work Items	Key Items/References
(7)	Make the airplane level longitudinally: – Place a wedge on the rear fuselage with the thin end forward. – Place a spirit level on the wedge.	Refer to Figure 2. – Put thin blocks between the nose wheel and the scale to bring the spirit level horizontal. – Reduce the air pressure in the nose wheel tire to bring the spirit level horizontal.
(8)	Remove the levelling equipment from the airplane.	
(9)	Read the value from the left main wheel scale. Enter the value on the weighing form under MAIN G_{1LH} Gross.	
(10)	Read the value from the right main wheel scale. Enter the value on the weighing form under MAIN G_{1RH} Gross.	
(11)	Read the value from the nose wheel scale. Enter the value on the weighing form under NOSE G_2 Gross.	
(12)	Use the plumb line to mark the position of the reference plane on the floor: – Hold the plumb line against the leading edge of each wing at the root rib. – Mark these position on the floor. – Draw a straight line between the 2 points you marked on the floor.	Do this on each side.
(13)	Use the plumb line to mark the position of the nose wheel center line on the floor.	
(14)	Use the plumb line to mark the position of each main wheel center line on the floor.	
(15)	Lift the airplane off the scales with the jacks.	Refer to Section 07-10.
(16)	Read the weight of the wooden blocks on each of the scales. Record the values in the column headed TARE in the Weighing Report.	

	Detail Steps/Work Items	Key Items/References
(17)	Remove the scales and the ramps.	
(18)	Measure the distance X_{1LH}. Record the value in the Weighing Report.	
(19)	Measure the distance X_{1RH}. Record the value in the Weighing Report.	
(20)	Measure the distance X_2. Record the value in the Weighing Report.	
(21)	Refer to the calibration records for the weighing scales. If necessary, correct the Gross and Tare values of MAIN G_{1LH}, MAIN G_{1RH}, and NOSE G_2.	
(22)	Subtract each Tare value from the related Gross value. Record the result under Net in the Weighing Report.	
(23)	Lower the airplane with the jacks.	
(24)	Calculate the Empty Weight, G, from the Net values.	G = Net G_{1LH} + Net G_{1RH} + Net G_2
(25)	Calculate the Empty Weight Moment, M.	M = $(G_{1LH} * X_{1LH})+(G_{1RH} * X_{1RH}) + (G_2 * X_2)$
(26)	Calculate the position of the Empty Weight Center-of-Gravity, X_{CG}.	X_{CG} = M / G
(27)	Record the Empty Weight (G) and the Empty Weight Moment (M) in the Airplane Flight Manual.	

WEIGHING REPORT

Model: DV 20 E Serial Number:___________ Registration:_____________

Data with reference to the Type Certificate Data Sheet and the Airplane Flight Manual.

Reference Plane: Vertical plane at the leading edge of wing at the root rib.

Horizontal reference line: Wedge 1000:56, 2000 mm aft of the canopy rim.

Equipment Inventory - dated:_______ Cause for Weighing:______________________________

Weight and Balance Calculations (Weighing at the wheels)

Weight Condition: Including brake fluid, engine oil (MAX level), coolant and unusable fuel (2.4 US gal / 9 liters).

Support	Gross	Tare	Net
MAIN G_{1LH}			
MAIN G_{1RH}			
NOSE G_2			
		Empty Weight	

Lever Arm
X_{1LH} =
X_{1RH} =
X_2 =

Calculate the Empty Weight, G = MAIN G_{1LH} + MAIN G_{1RH} + NOSE G_2.	G =
Calculate the Empty Weight Moment, M = $(G_{1LH} * X_{1LH})+(G_{1RH} * X_{1RH}) - (G_2 * X_2)$.	M =
Calculate the Empty Weight Center-of-Gravity position, X_{CG} = M/G.	X_{CG} =
Maximum permitted all-up-weight: Max AUW (see AFM).	
Maximum useful load = Max AUW - G.	

Record the Empty Weight (G) and the Empty-Weight Moment (M) in the Airplane Flight Manual.

Place/Date	Authorizing Stamp	Authorizing Signature

Figure 3: Weighing Report

Section 08-20
Levelling

1. General

These procedures tell you how to make the airplane level. See Section 07-10 for lifting the airplane with jacks.

Make the airplane level with jacks unless you are weighing the airplane. If you weigh the airplane, change the airplane tire pressures or use blocks to make the airplane level (see Section 08-10).

2. Make the Airplane Level with Jacks

A. Equipment

Items	Quantity	Part Number
Airplane jacks.	3	Commercial.
Wing trestle.	2	Commercial.
Nose trestle.	1	Commercial.
Spirit level.	1	Commercial.
Wedge, slope 1000:56.	1	Local Manufacture.

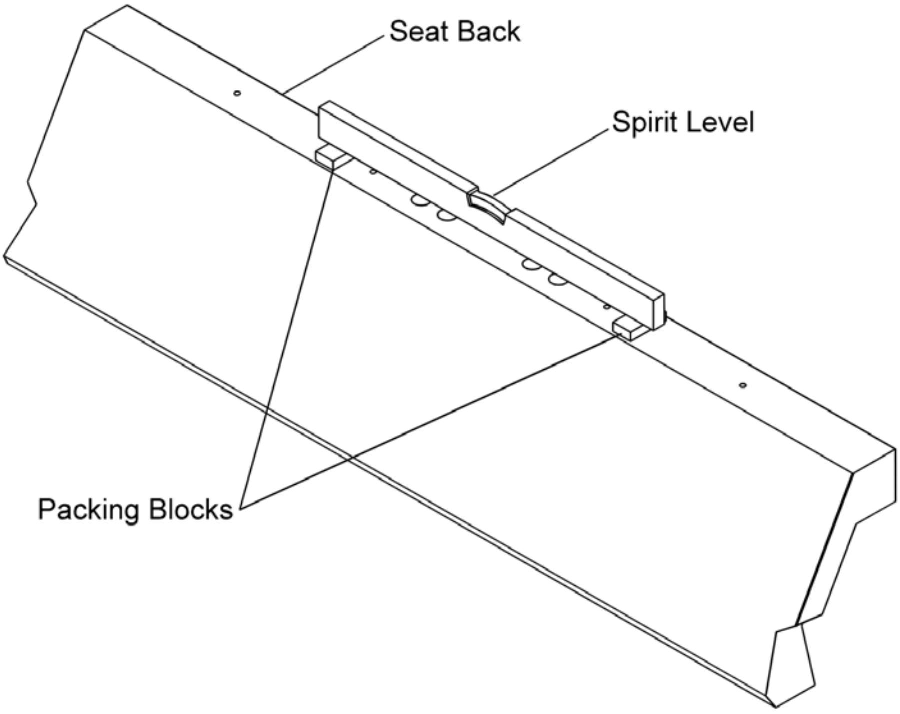


Figure 1: Level the Airplane Laterally

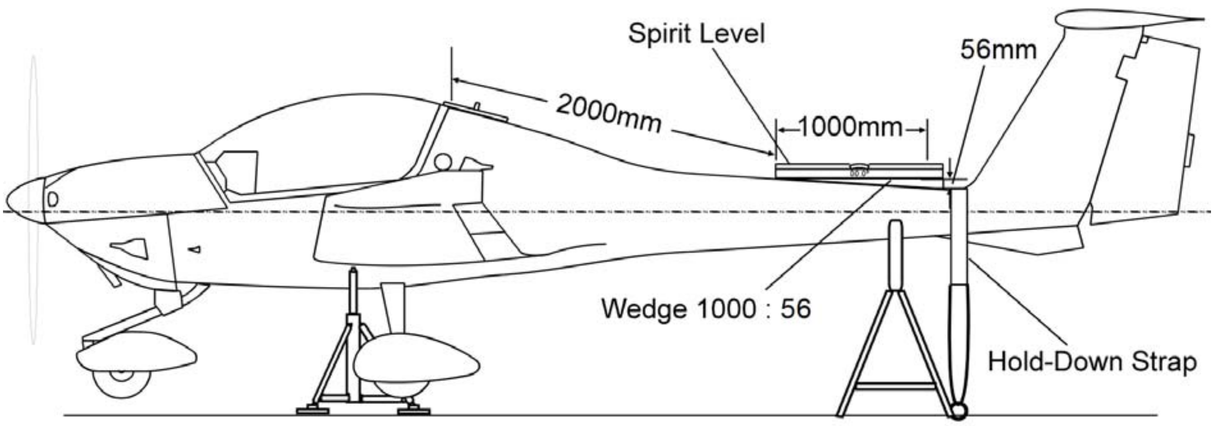


Figure 2: Level the Airplane Longitudinally

B. Level the Airplane with Jacks Procedure

	Detail Steps/Work Items	Key Items/References
	Note: Level the airplane in a closed room. This will avoid any wind causing levelling errors.	
(1)	Lift the airplane on jacks.	Refer to Section 07-10.
(2)	Make the airplane level laterally: – Put a spirit level on the back rest of the seat. – Adjust the main jacks to bring the sprit level horizontal.	Refer to Figure 1. If necessary, use two packing blocks of equal thickness to clear the safety belt attachments.
(3)	Make the airplane level longitudinally: – Place a wedge on the rear fuselage with the thin end forward. – Place a spirit level on the wedge. – Adjust the tail jack to bring the spirit level horizontal.	Refer to Figure 2.
(4)	Remove the levelling equipment from the airplane.	

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CHAPTER 11

PLACARDS AND MARKINGS

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TABLE OF CONTENTS

CHAPTER 11

PLACARDS AND MARKINGS

Section 11-20

Exterior Placards and Markings

Section 11-30

Interior Placards and Markings

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CHAPTER 11
PLACARDS AND MARKINGS

1. General

Placards are used for identification and indication. They show the function, operation and operating limitations of systems and equipment.

This chapter shows you the location of the exterior placards and markings and the location of the interior placards.

Self-adhesive plastic foil is used for all placards except for the metal manufacturers placard located on the skid-plate.

Replace damaged placards.

2. Replace Plastic Foil Placards

A. Material

Item	Quantity	Part Number
Solvent.	A/R	Commercial.

B. Replace a Placard

Use this procedure for both internal and external foil placards.

	Detail Steps/Work Items	Key Items/References
(1)	Remove the old placard: – Warm the placard with a hot air blower. – Lift one corner of the placard. – Carefully pull the placard off.	Do not over-heat the composite structure.
WARNING:	**DO NOT GET SOLVENT ON YOUR SKIN. DO NOT BREATHE SOLVENT VAPOR. SOLVENT CAN CAUSE DISEASE OR ILLNESS.**	
(2)	Clean the surface where the new placard will go.	Use a commercial solvent. There must be no grease or dirt on the surface. Obey the solvent manufacturer's instructions.
(3)	Remove the protective backing from the new placard.	
(4)	Put the new placard into the correct position. Make the placard smooth with a clean cloth.	Refer to the related Figure in this Chapter.

Section 11-20

Exterior Placards and Markings

1. General

Figure 1 and 2 show the exterior placards and markings for the DV 20 E airplane.

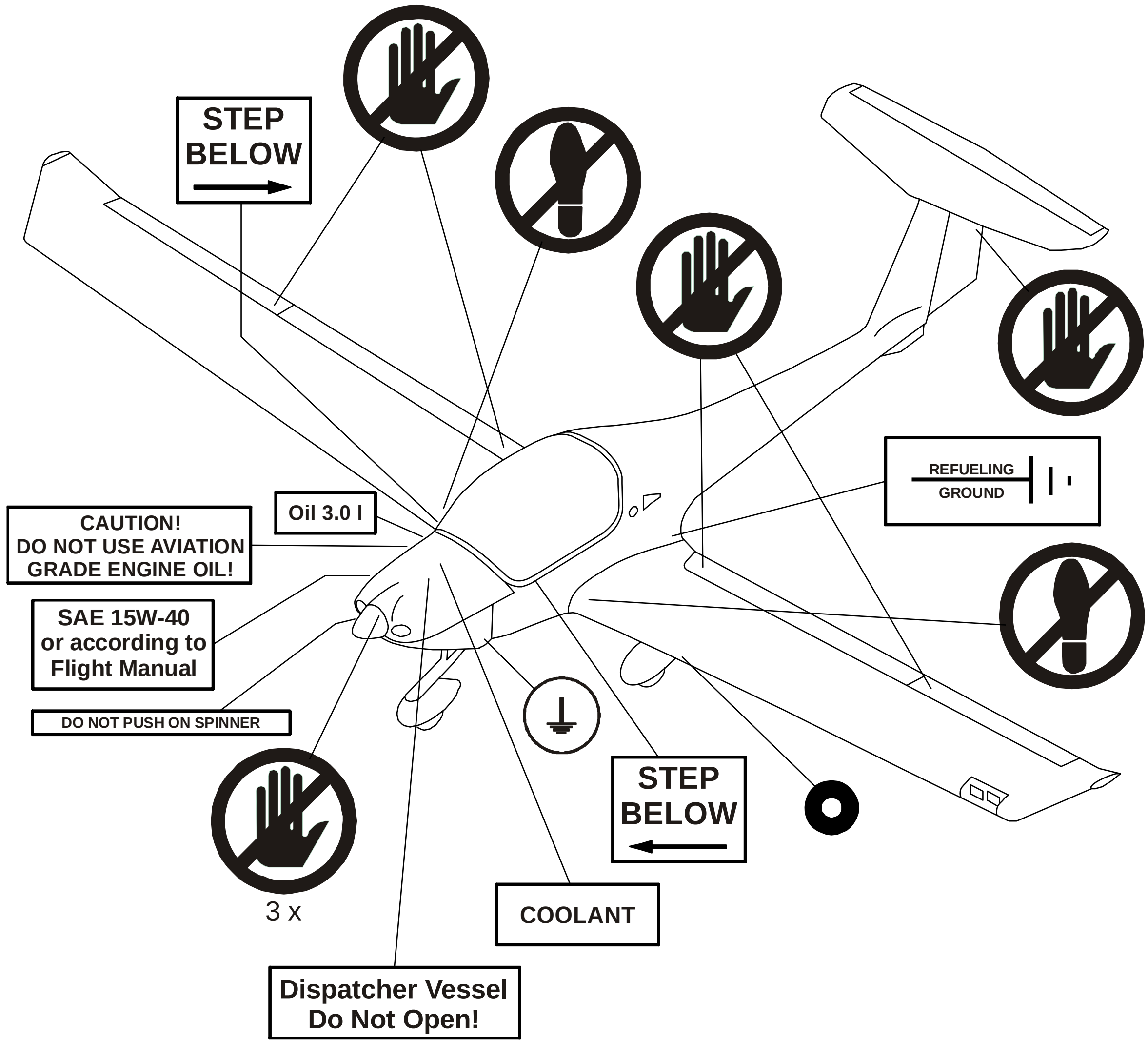

Figure 1: Exterior Placards (Sheet 1 of 2)

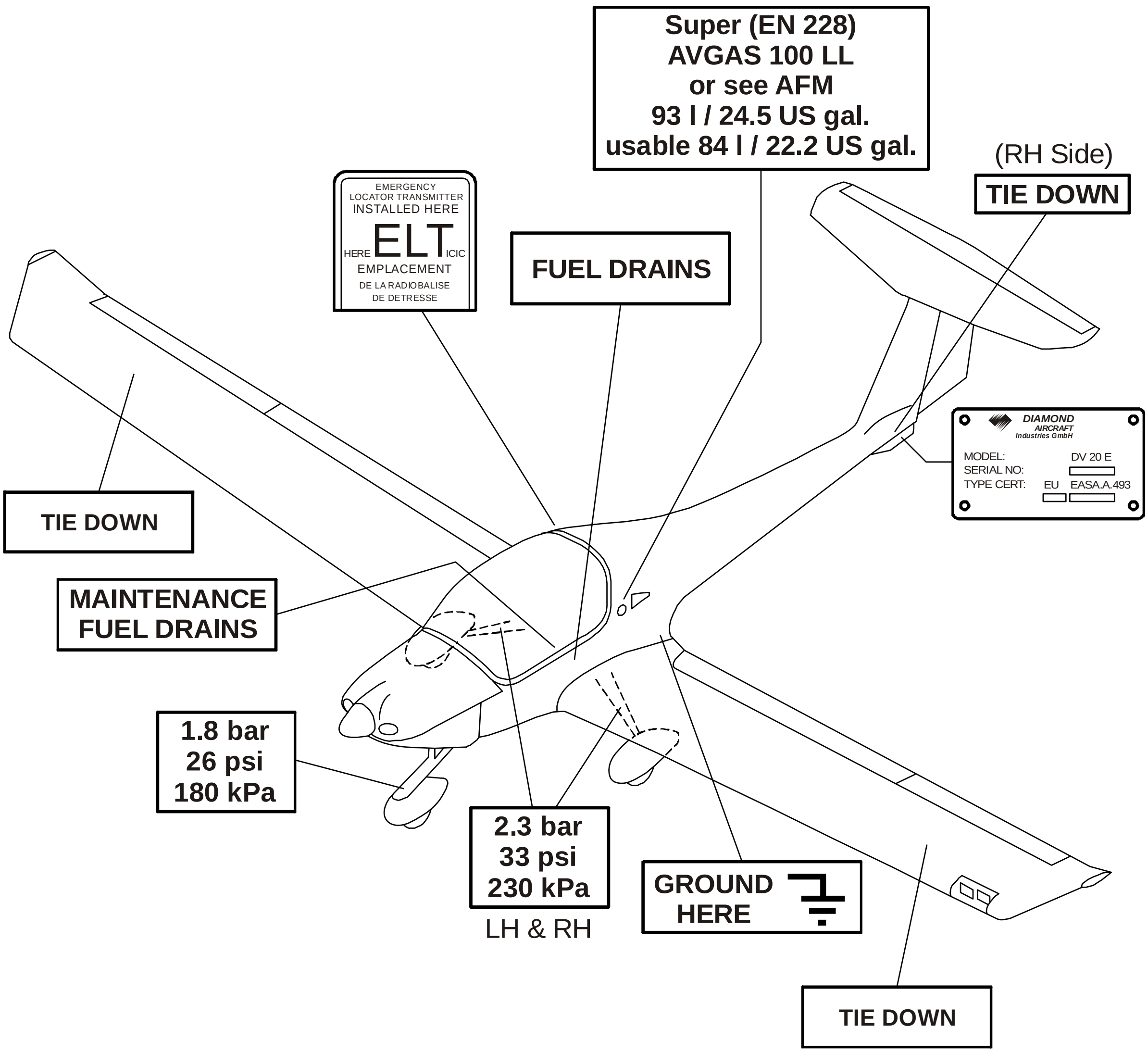

Figure 2: Exterior Placards (Sheet 2 of 2)

Section 11-30
Interior Placards and Markings

1. General

Figures 1, 2 and 3 show the interior placards and markings.

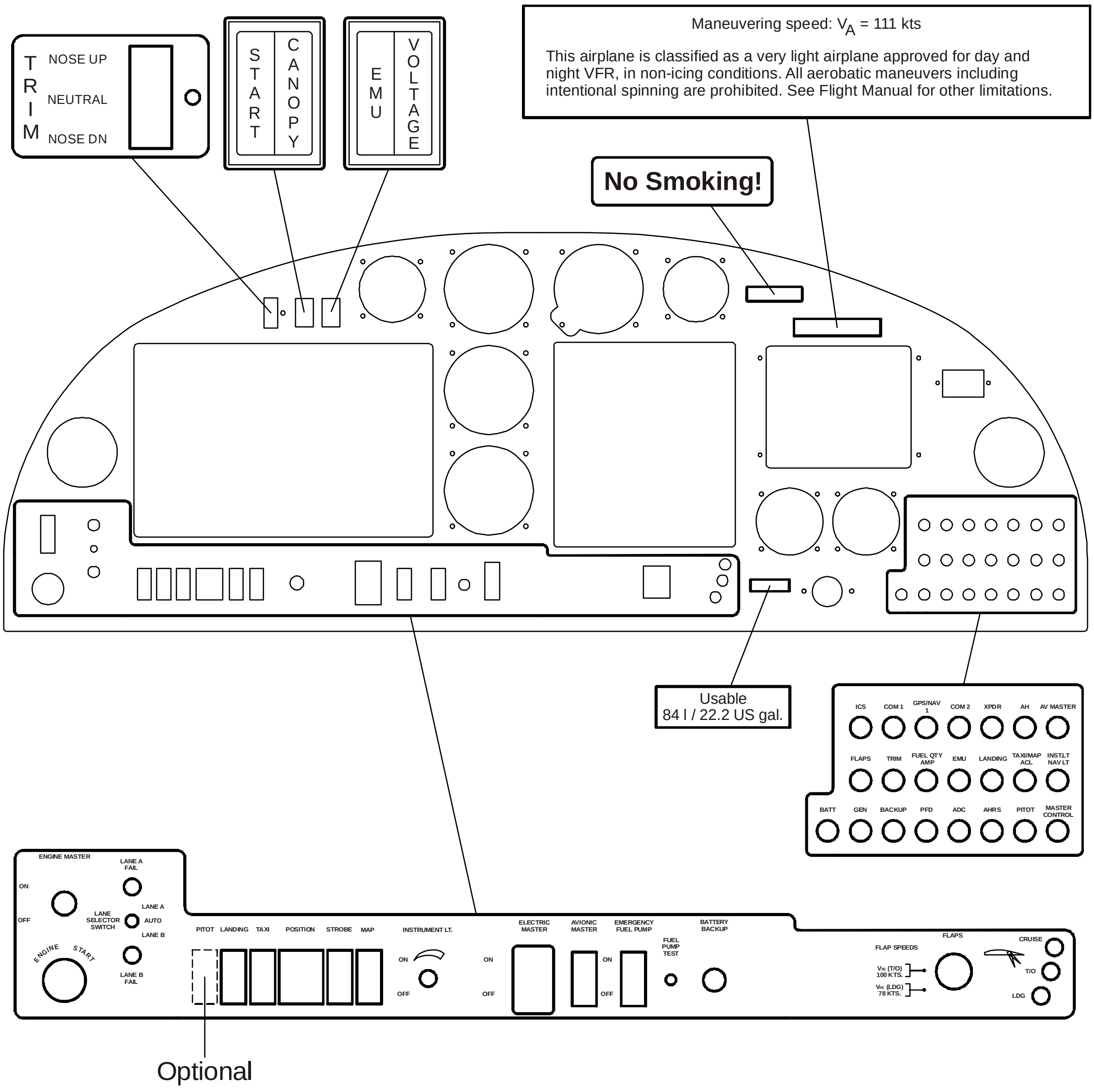

Figure 1: Interior Placards and Markings (Sheet 1 of 2)

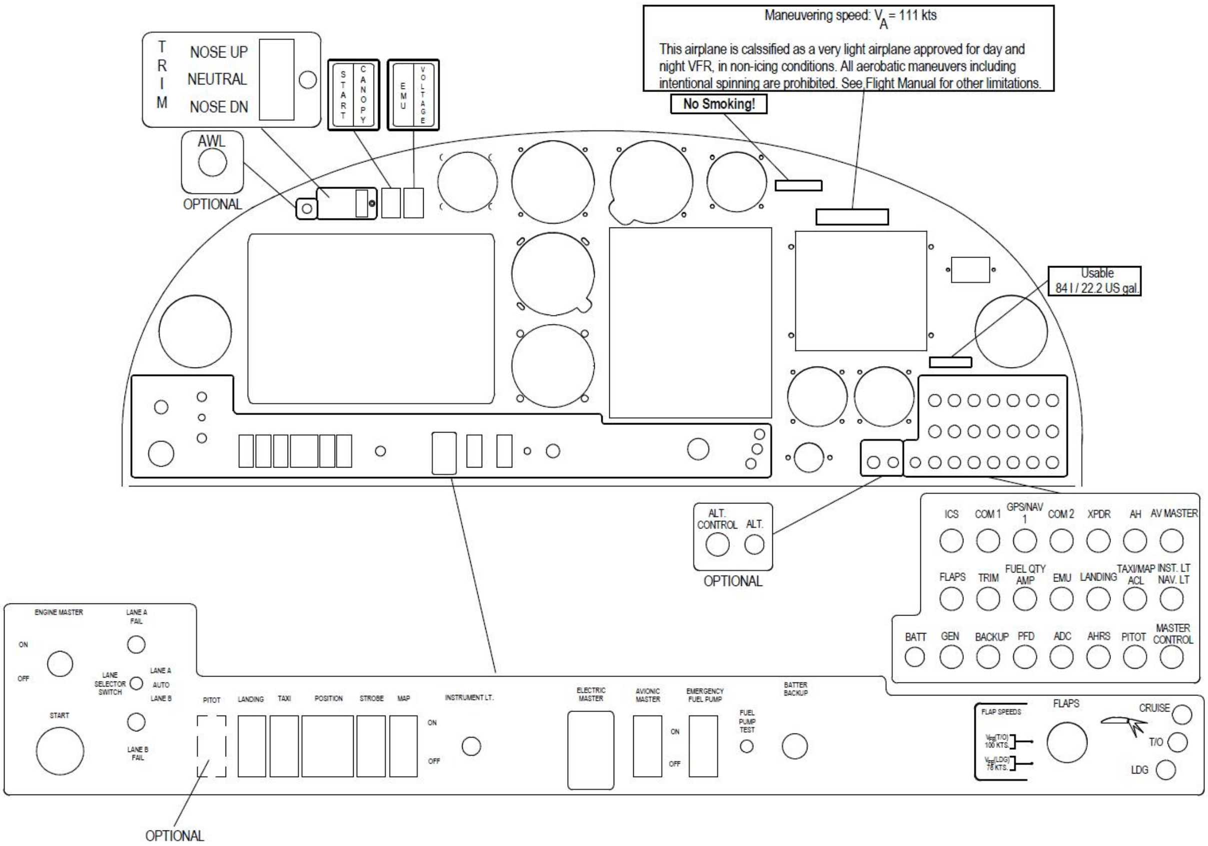

Figure 2: Interior Placards and Markings (if OÄM 20-245/b) is installed

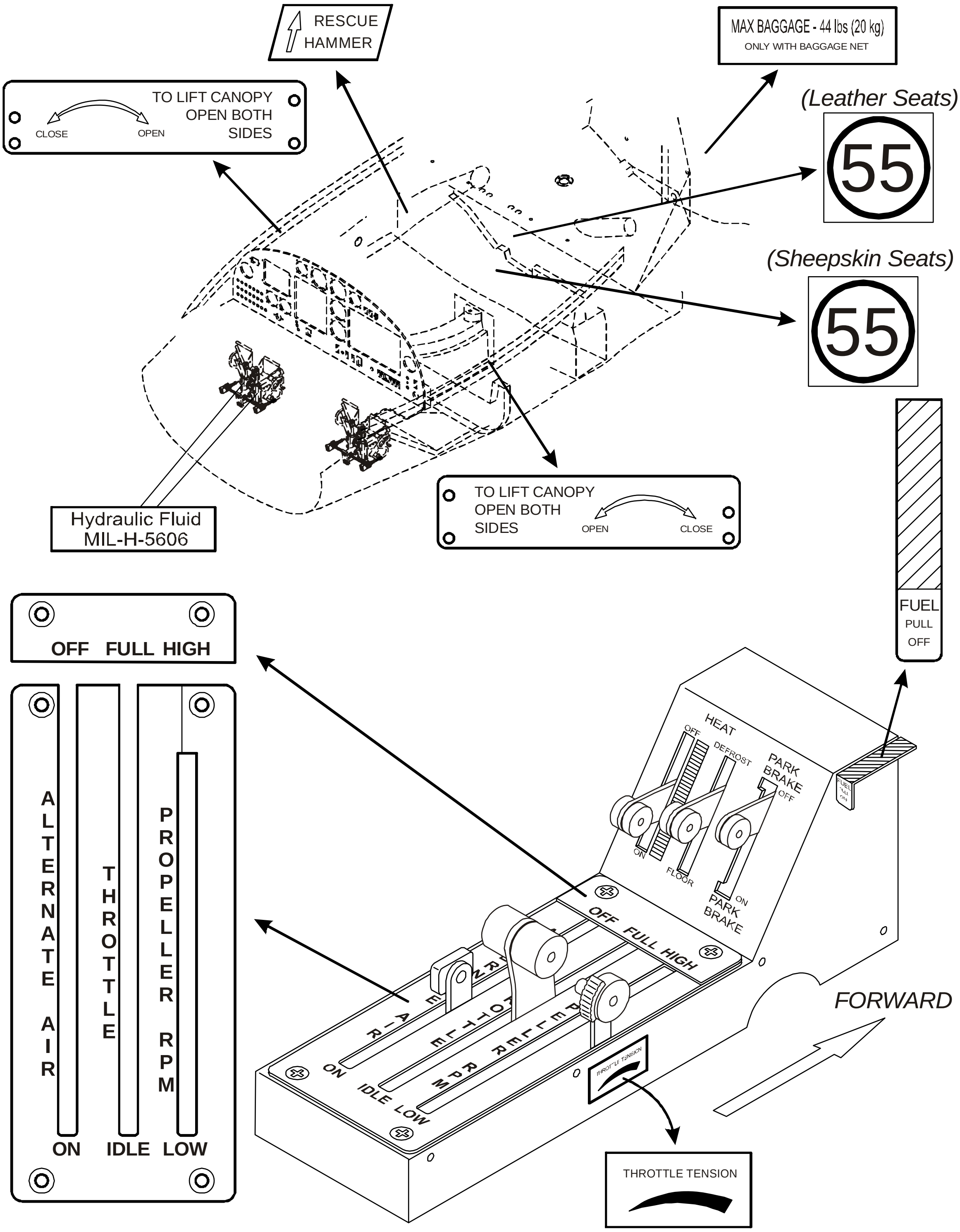

Figure 3: Interior Placards and Markings (Sheet 2 of 2)

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CHAPTER 12

SERVICING - GENERAL

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TABLE OF CONTENTS

CHAPTER 12

SERVICING

Section 12-10

Replenishment

Section 12-20

Scheduled Servicing

Section 12-30

Unscheduled Servicing

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CHAPTER 12
SERVICING

1. General

This Chapter gives the servicing tasks which apply to the whole airplane:

– Section 12-10. Replenishment procedures for various systems.

– Section 12-20. Lubrication data.

– Section 12-30. Cleaning and snow and ice removal.

The procedures for preventive and corrective maintenance of systems are given in the related Chapter of this manual. Refer to Chapter 05 for the time limits and servicing schedules.

Note: The designation of "left" and "right" as well as of "forward" and "aft" is based on the airplane's direction of flight.

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Section 12-10
Replenishment

1. General

Use the procedures in this Section to replenish the fluid systems of the airplane.

Figure 1 shows the location of the servicing points.

2. Fuel System

A tank in the fuselage holds the fuel for the DV 20 E airplane. The tank can hold 93 liters (24.5 US gal) of fuel. The tank is located below the baggage compartment floor.

The tank filler-neck is located on the left side of the fuselage about 15 cm (6 in) aft of the canopy. It is about 45 cm (18 in) above the left wing root. The fuel tank drain is located below the tank. The drain pipe comes through the fuselage bottom skin.

WARNING: DO NOT ALLOW FIRE, SPARKS OR HEAT NEAR FUEL. FUEL BURNS VIOLENTLY AND CAN CAUSE INJURY TO PERSONS AND DAMAGE TO THE AIRPLANE.

WARNING: DO NOT GET FUEL ON YOUR SKIN. FUEL CAN CAUSE SKIN DISEASE.

WARNING: CONNECT THE AIRPLANE AND THE FUEL SUPPLY VEHICLE TO ELECTRICAL GROUND BEFORE REFUELING. IF YOU DO NOT GROUND THE AIRPLANE, STATIC ELECTRICITY CAN CAUSE FIRE DURING REFUELING.

WARNING: MAKE SURE THAT A SUITABLE FIRE EXTINGUISHER IS AVAILABLE AT ALL TIMES DURING REFUELING/DEFUELING.

WARNING: TURN OFF ALL GROUND EQUIPMENT IN THE REFUELING AREA.

WARNING: DO NOT OPERATE ELECTRICAL SWITCHES IN THE AIRPLANE DURING REFUELING.

WARNING: REFUELING WITH PERSONS ON BOARD IS PROHIBITED.

CAUTION: USE ONLY THE FUEL TYPES GIVEN IN CHAPTER 2 OF THE AIRPLANE FLIGHT MANUAL.

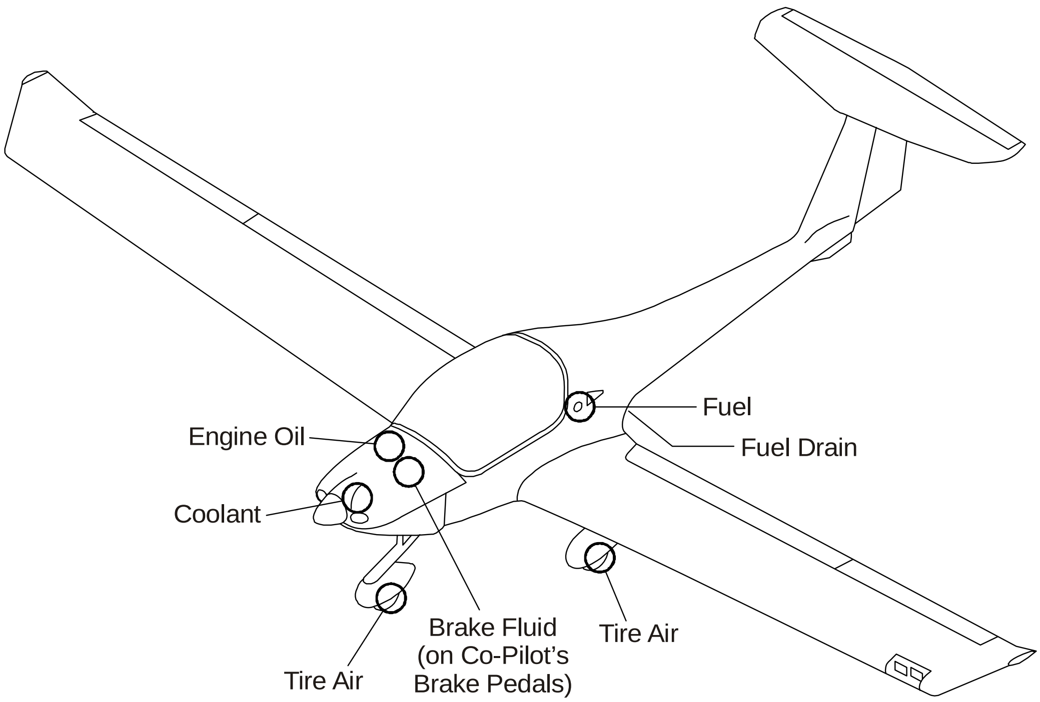

Figure 1: Replenishing Points

3. Refueling/Defueling

A. Refueling

	Detail Steps/Work Items	Key Items/References
(1)	Shut down the engine.	
(2)	ENGINE MASTER OFF.	
(3)	All occupants leave the airplane.	
(4)	Ground the airplane electrically.	At the refueling connection.
(5)	Ground the refueling vehicle electrically.	
(6)	Remove the fuel filler cap.	
(7)	Refuel the airplane.	
(8)	Install the fuel filler cap.	Make sure that the filler cap is locked.
(9)	Remove the ground cable from the airplane.	
(10)	Remove the ground cable from the refueling vehicle.	

B. Defueling

	Detail Items/Work Steps	Key Items/References
(1)	Ground the airplane electrically.	At the refueling connection.
(2)	Put a suitable container below the drain valve.	Make sure that you have enough containers to hold all the fuel.
(3)	Open the drain valve.	
(4)	When the fuel stops draining, close the drain valve.	Make sure that the drain valve is seated correctly.
(5)	Remove the ground cable from the airplane.	At the refueling ground connection.

4. Fuel Contamination Test

A. Equipment

Item	Quantity	Part Number
Glass container.	1	Commercial.

B. Fuel Contamination Test Procedure

	Detail Steps/Work Items	Key Items/References
(1)	Put the glass container under the fuel tank drain valve.	
(2)	Open the drain valve.	
(3)	When the fuel container is half full, close the drain valve.	Make sure that the drain valve is seated correctly.
(4)	Let the fuel in the glass container stand for 1 minute.	
(5)	Examine the fuel: – It must be clear or dyed. – Look specifically for small drops of water in the bottom of the glass container. – Look for small particles of solid material.	If you find any contamination you must do the test again. If you still find contamination after 3 tests, you must drain the fuel tank. Flush the tank (use fuel) and fill it with clean fuel.

5. Engine Oil System

WARNING: ENGINE OPERATION WITH NO OIL (OR VERY LOW OIL LEVEL) WILL CAUSE ENGINE MALFUNCTION OR DAMAGE.

The engine installed in the DV 20 E has a dry sump oil system. The oil tank can hold 3.4 liters (3.6 US quarts).

A. Replenish the Oil System

Refer to the AFM.

6. Brake System

The brake fluid reservoirs are located on the brake master cylinders on the co-pilot's side. You get access in the cockpit below the instrument panel.

WARNING: DO NOT GET BRAKE FLUID ON YOUR SKIN OR IN YOUR MOUTH. BRAKE FLUID IS TOXIC AND CAN CAUSE INTERNAL INJURY.

CAUTION: REMOVED SPILLED BRAKE FLUID IMMEDIATELY. BRAKE FLUID CAN CAUSE DAMAGE TO PAINT AND OTHER MATERIALS.

A. Fill the Brake System Reservoirs

Detail Steps / Work Items		Key Items / References
(1)	Clean the top of the brake fluid reservoir and filler cap.	
(2)	Remove the filler cap.	
(3)	Fill the reservoir to the correct level.	Use hydraulic fluid per MIL-PRF-5606. 12 to 25 mm (0.5 to 1 in) below the top of the filler hole.
(4)	Install the filler cap.	

7. Tires

The DV 20 E uses these tires:

– Main tire: 5.00 x 5 - pressure 2.3 bar (33 PSI).

– Nose tire: 5.00 x 4 - pressure 1.8 bar (26 PSI).

A. Examine the Tires and Measure the Pressure

Detail Steps / Work Items		Key Items / References
(1)	Examine the tires. Look specially for: – Cuts and friction damage. – Correct alignment of the slippage markers.	Move the airplane as necessary so that each part of each tire can be seen. If the slippage markers do not align, remove the wheel for shop maintenance.
(2)	Measure the tire pressure. If necessary, inflate the tires to the correct pressure.	Main tire: 2.3 bar (33 PSI). Nose tire: 1.8 bar (26 PSI).

8. Cooling System

A. Adding Coolant

Detail Steps / Work Items		Key Items / References
(1)	Prior to adding coolant, the reason for the loss of the liquid must be investigated and corrected (e.g. leaky hose connections).	
	NOTE: Refer to the AFM for approved coolants.	
(2)	Make sure the engine is cold.	
(3)	Remove the top cowling.	Refer to Chapter 71.
(4)	Open the pressure cap on top of the engine.	
(5)	Fill the dispatcher vessel up completely.	The level in the equalizing reservoir must not exceed the maximum marking.
(6)	Close the pressure cap.	
(7)	Let the engine run for approximately 3 minutes at increased idle speed.	
(8)	Fill up dispatcher vessel completely as described above.	The maximum coolant quantity is approximately 2.5 liters (2.6 US quarts).
(9)	Check the condition of the rubber sealing rings.	

B. Draining of the Cooling System

Detail Steps / Work Items		Key Items / References
(1)	Open the hose connection on the radiator on the lower right hand side.	Refer to Chapter 75.

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Section 12-20
Scheduled Servicing

1. General

This Section gives lubrication data. It tells you where components are located. It gives a list of approved lubricants. It also gives components which MUST NOT be lubricated.

Most systems and components have maintenance-free bearings. These can be sealed ball/roller bearings or Teflon bushes. These bearings MUST NOT be lubricated. Table 1 shows the bearings which MUST NOT be lubricated.

Table 1 - Items Which MUST NOT Be Lubricated	
Rudder pedal sled.	DO NOT LUBRICATE
Flap rod-end bearings.	DO NOT LUBRICATE
Aileron rod-end bearings.	DO NOT LUBRICATE
Elevator rod-end bearings.	DO NOT LUBRICATE
Nose wheel bearings (1)	DO NOT LUBRICATE
Throttle control cable (2)	DO NOT LUBRICATE
Elastomeric spring (3)	DO NOT LUBRICATE

Notes:

(1) The nose wheel bearings are sealed and maintenance-free.

(2) The throttle control cable is sealed and maintenance free.

(3) The elastomeric spring is maintenance free.

2. Lubrication Schedule

Table 2 shows the lubrication schedule. Clean each lubrication point before lubrication.

See Figures 1 and 2 for the location of the lubrication points listed on the left side of the table. The center column shows the type of lubricant. The right column shows the lubrication interval.

Table 2 - Lubrication Schedule

Location		Type of Lubricant						Interval
No.	See Figure 1 and 2	1	2	3	4	5	6	(Hours) see Notes (1), (2)
(NS)	Parking brake, cabin heat, defrost, and alternate air control cables		●					200
(1)	Brake pedal pivot (see Note 4)		●					100
(2)	Rudder cable S-tubes			●				200
(3)	Flap actuator universal pivot block	●						1000
(4)	Stick support pivot pins	●						1000
(5)	Flap actuator extension rod			●				200
(6)	Upper rudder pivot bearing	●						200
(7)	Main wheel bearings (see Notes 3 and 7)	●						200
(8)	Brake caliper locating pins						●	1000
(9)	Nose landing gear fork pivot (see Note 4)	●						100
(10)	Nose landing gear transverse tube interior (see Note 4)					●		1000
(11)	Upper nose landing gear journal bearing (left and right) (see Note 4)	●						1000
(12)	Elastomeric spring top mounting spherical bush	●						1000
(13)	Horizontal stabilizer front mounting spherical bush	●						1000
(14)	Battery terminals				●			1000
(15)	Cable eyes on rudder	●						200
(NS)	Rudder hinge bushing			●				200

Table 2 - Lubrication Schedule								
Location		Type of Lubricant						Interval
No.	See Figure 1 and 2	1	2	3	4	5	6	(Hours) see Notes (1), (2)
(16)	Flap, Aileron, Elevator hinge bearings (Oil Lite) (see Note 5)		●					200
(17A)	Flap horn bearing	●						200
(17)	B-bolt spherical bearing	●						1000
(18)	B-bolt below spherical bearing (not threaded) (see Note 6)	●						1000
(19)	B-bolt shank and mid-bar end fitting					●		1000
(20)	A-bolt spherical bearing	●						1000
(21)	A-bolt	●						1000
(22)	Wing bolts (wing attachment)	●						1000
(23)	Main bolts locking device		●					200
(24)	Nose landing gear strut axle stud end					●		100

Notes:

(NS) Item is not shown in the Figures.

(1) Lubricate at the time shown or at every disassembly/assembly.

(2) Lubricate more frequently in severe climates or operating conditions.

(3) Lubricate the main wheel bearing felt seals with wheel bearing grease.

(4) Lubricate at the time shown and at annual service.

(5) The flap, aileron and elevator hinge bearings may also be lubricated with engine oil.

(6) Do not grease on the threads. It will reduce the friction of the lock-nut.

(7) CAUTION: DO NOT MIX AVIATION WHEEL BEARING GREASES WITH EACH OTHER. IF USING OTHER APPROVED GREASES, COMPLETE REMOVAL OF CONTAINED GREASE AND BEARING CLEANING IS REQUIRED. REPLACEMENT OF PREVIOUSLY LUBRICATED FELT GREASE SEALS IS ALSO REQUIRED.

Table 3 - Lubricant Specifications		
Specification	**Product**	**Manufacturer**
TYPE 1		
MIL-G-81322	AeroShell Grease 22	Shell Oil Company
DOD-G-24508 A Preferred for MLG wheel bearings. Not compatible with MIL-G-81322 (For main wheel bearings and felt seals lubrication only)	Mobil Aviation Grease SHC 100	Exxon Mobil Oil Corp.
TYPE 2		
MIL-L-7870	Royco 363	Royal Lubricants Co. Inc.
	Brayco 363	Bray Oil Co.
Warm climates only	LPS 2	LPS
TYPE 3		
Greaseless Lubricant	LPS 1	LPS
TYPE 4		
VV-P-236 (petrolatum)	Royco 1	Royal Lubricants Co. Inc.
	DC 4	Dow Corning
TYPE 5		
MIL-C-16173 (Grade 2)	LPS 3	LPS
MIL-C-16173 (Grade 4)	CRC SP-400	CRC Industries Inc.
TYPE 6		
MIL-A-907	Loctite Antiseize 767	Loctite

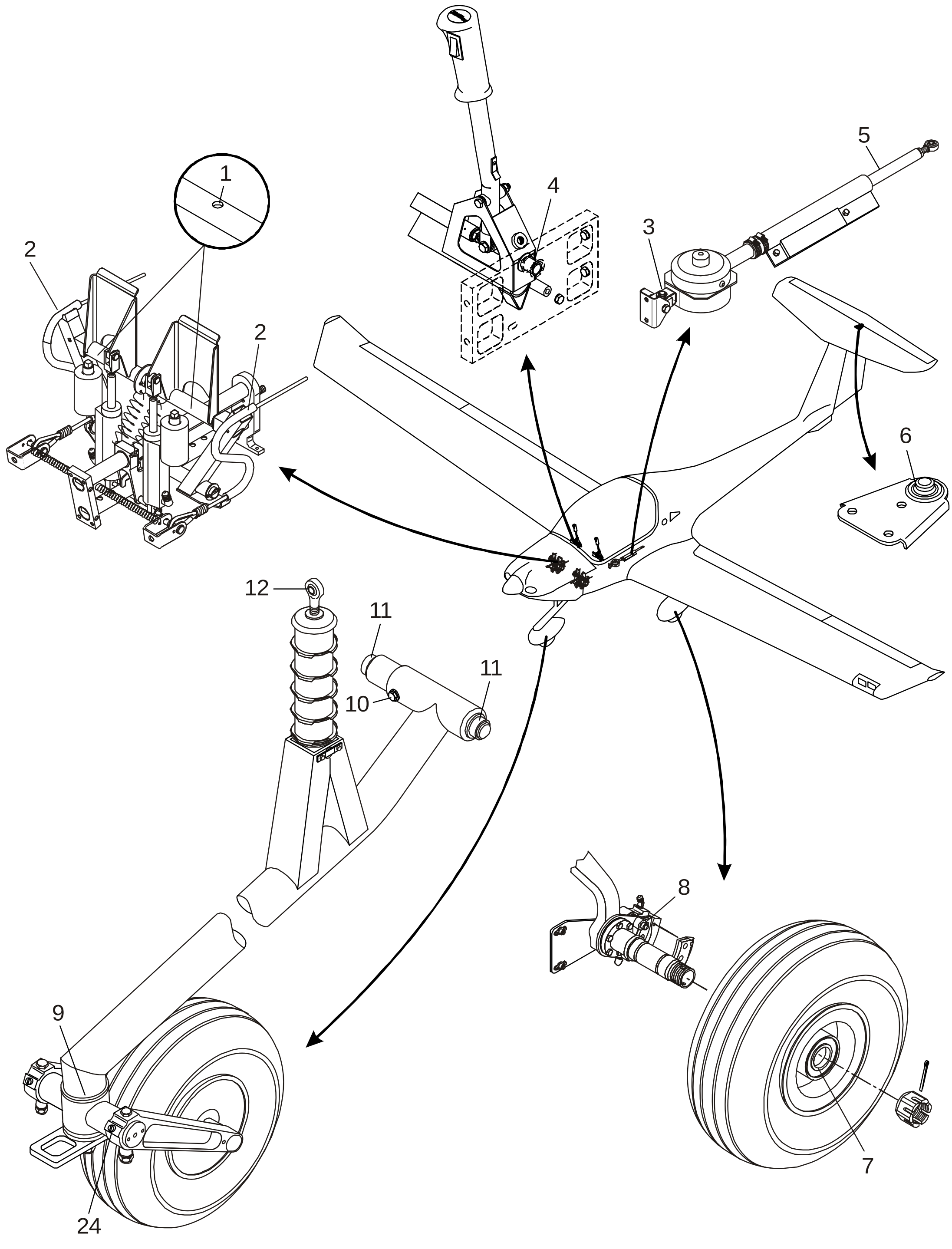

Figure 1: Lubrication Points Sheet 1

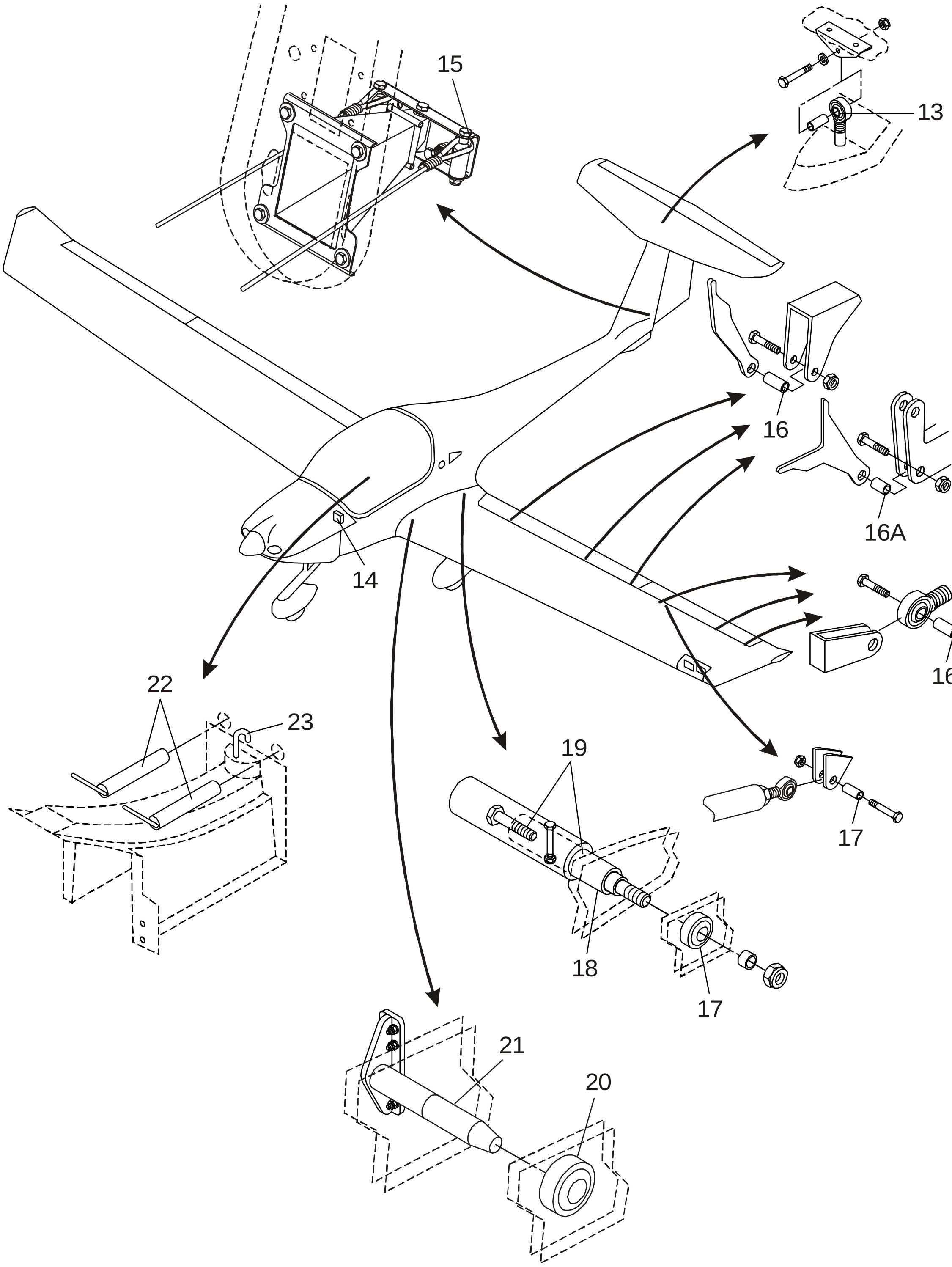

Figure 2: Lubrication Points Sheet 2

Section 12-30
Unscheduled Servicing

1. General

This Section describes how to clean the airplane. It also describes how to remove snow and ice from the airplane.

2. Exterior Cleaning

The outer surfaces of the DV 20 E must be kept clean to maintain the good performance characteristics of the airplane. The leading edge of the wings are specially important.

Protect all control surface bearings and other lubricated components before cleaning the airplane.

Use large quantities of water to clean the airplane. If necessary, add a mild cleaning agent to the water. Remove excess dirt or dead insects immediately after flight. Dried on dirt and dead insects are very difficult to remove.

CAUTION: DO NOT USE CLEANING OR POLISHING AGENTS WHICH CONTAIN SILICON. IF THE AIRPLANE NEEDS REPAIR AT SOME TIME, SILICON CAN PREVENT REPAIR MATERIALS FROM BONDING CORRECTLY.

Approximately once a year, apply a silicone-free automotive polish to the outer surface of the airplane.

3. Canopy Cleaning

CAUTION: DO NOT RUB THE CANOPY GLASSES WHILE THEY ARE DRY. DO NOT USE DIRTY CLOTHS OR SPONGES. ACRYLIC GLASS SCRATCHES VERY EASILY WITH THE SMALLEST PARTICLES OF DUST OR DIRT.

Clean the canopy with large quantities of clean water. Use clean sponges and good chamois leather that you should not use for any other purpose.

Polish dull or scratched areas using a special acrylic cleaner. Remove scratches with special acrylic glass polishing systems (e.g. Micro-Mesh).

4. Interior Cleaning

Clean the interior of the airplane cabin with a flame-proof vacuum cleaner.

5. Engine Cleaning

Use a cold cleaning agent (e.g. Berner Cold Cleaner No.13618.0).

CAUTION: DO NOT CLEAN THE ENGINE WHILE THE ENGINE IS HOT.

CAUTION: DO NOT USE HIGHLY FLAMMABLE OR CORROSIVE CLEANING AGENTS TO CLEAN THE ENGINE.

CAUTION: DO NOT LET THE CLEANING AGENT GET INTO ELECTRICAL COMPONENTS AND ENGINE INTAKES.

CAUTION: DO NOT START THE ENGINE UNTIL ALL OF THE CLEANING AGENT HAS EVAPORATED.

Protect all electrical components and cables. Use polythene bags to seal intakes and other areas that you want to keep dry. After washing you can dry the engine using compressed air (< 8 bar (116 PSI).)

6. Snow and Ice Removal

Remove snow and ice as soon as possible to prevent water from the melting snow or ice re-freezing and causing damage.

CAUTION: DO NOT USE SHARP OBJECTS TO REMOVE SNOW OR ICE. YOU CAN DAMAGE THE AIRPLANE STRUCTURE.

Use soft brushes to remove snow from the surfaces.

Put the airplane in a heated hangar to remove ice or spray de-icing fluid onto ice-covered surfaces using a suitable spray bottle. For approved de-icing fluids refer to AFM, Section 8.7.

Use a soft piece of cloth to wipe the airplane dry.

CHAPTER 20

STANDARD PRACTICES

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TABLE OF CONTENTS

CHAPTER 20

STANDARD PRACTICES

Section 20-10

Standard Practices - Airframe

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CHAPTER 20
STANDARD PRACTICES

1. General

This Chapter gives you the standard practices for the DV 20 E airplane. Use industry standard practice where no specific practice is given.

This Chapter has the following Section:

– Section 20-10. Standard Practices - Airframe.

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Section 20-10
Standard Practices - Airframe

1. General

This Section gives you data about the fasteners (bolts/screws/nuts) used in the DV 20 E airplane and their related torque values. This Section tells you the procedures used to tighten the fasteners.

Note: Use the standard torque values listed on the subsequent pages of this section where no specific values are given.

Note: Composite structures can have a different thickness for the same component or assembly. You must always make sure that you use the correct length of fastener. The length of fastener given in the Illustrated Parts Catalogue may NOT be correct for all components or assemblies.

2. Bolt and Nut Types Used in the Airplane

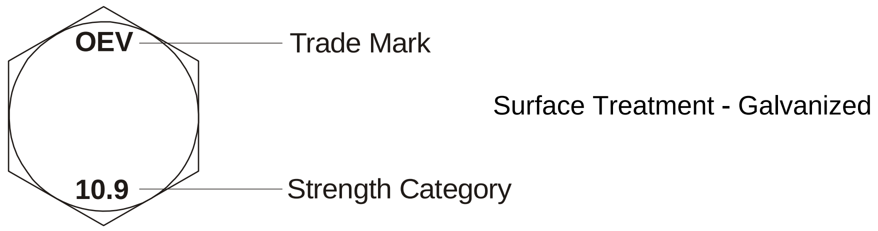
The DV 20 E airplane uses these bolts:

- DIN bolts.
- LN bolts.
- AN bolts.

The minimum strength for the bolts is DIN specification 8.8. Letters and numbers on the head of the bolt identify the bolt type. The surface treatment also identifies the bolt.

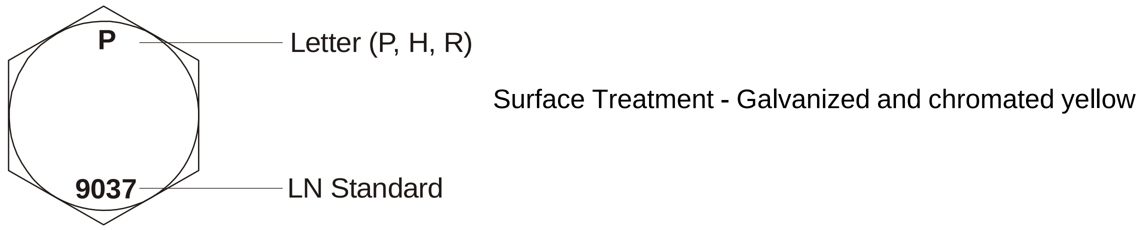
A. DIN Bolt

Bolt Head Identification



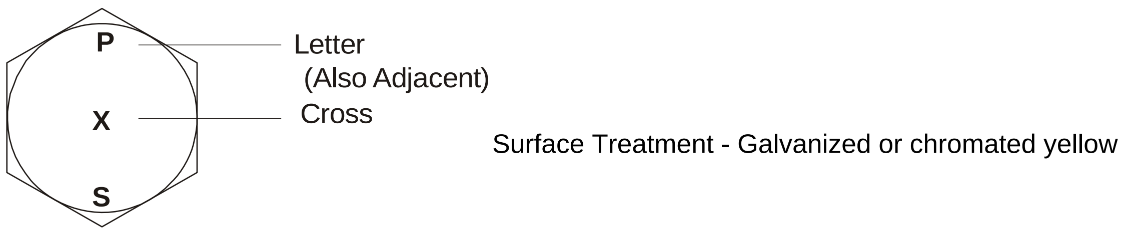
B. LN Bolts

Bolt Head Identification



C. AN Bolts

Bolt Head Identification



The DV 20 E uses these types of standard nuts: DIN934, DIN 985, AN 364, AN 365, MS21042, MS21044, LN 9338.

3. Standard Torque Values

A. AN Fine Threads

Bolt Size	Torque (Nm)	Torque (lbf.ft.)
10 - 32	1.6	1.2
1/4 - 28	6.2	4.6
5/16 - 24	13.6	10
3/8 - 24	20.7	15.3
7/16 - 20	37.7	27.8
1/2 - 20	54.2	40
9/16 - 18	90.4	66.7
5/8 - 18	124.3	91.7

B. AN Coarse Thread Series

Bolt Size	Torque (Nm)	Torque (lbf.ft.)
10 - 24	1.6	1.2
1/4 -20	5.7	4.2
5/16 - 18	10.2	7.5
3/8 - 16	20.9	15.4
7/16 - 14	28.9	21.3
1/2 - 13	54.2	40
9/16 - 12	79	58.3
5/8 - 11	101.6	75

C. DIN and LN Specifications

Metric Thread	Torque (Nm)	Torque (lbf.ft.)
M4	1.8	1.3
M5	3.6	2.7
M6	6.4	4.7
M8	16	11.8
M10	32	23.6
M12	60	44.3

4. Special Torque Values

Part	Torque (Nm)	Torque (lbf.ft.)
Propeller to engine nuts.	Refer to Propeller Maintenance Manual.	
Bolts attaching the engine mount to the firewall.	40	29.5
Fuel drain valve.	1 - 3	0.74 - 2.21
Bolts attaching the main landing gear brake back plates to the caliper.	Refer to Cleveland/Parker Maintenance Manual, latest revision or placard on brake cylinder assy.	
Main landing gear bolt, inner	0.16 ±0.02 in	Height of spring washers 4 ± 0.5 mm
Main landing gear bolts, outer	14.75	20.0

.

5. Torque Measurement

For self-locking nuts, add the torque value of the locking device (friction or brake torque) to the value in the table. Read the friction value from the torque wrench before the nut seats.

Where a bolt is tightened from the bolt-head, add the value of the shaft friction (the friction of the bolt in the attached part) to the value in the table. Read the friction value from the torque wrench before the bolt seats.

CHAPTER 21

HEATING AND VENTILATION

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TABLE OF CONTENTS

CHAPTER 21

HEATING AND VENTILATION

Trouble-Shooting

Maintenance Practices

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CHAPTER 21
HEATING AND VENTILATION

1. General

The DV 20 E airplane has separate systems to supply hot air and cold air. The hot air system can supply air from ambient temperature to warm. The system supplies the footwells or the windscreen. The cold air system can supply ambient air to adjustable vents at each side of the instrument panel. Cold air also cools the avionic equipment in the instrument panel.

2. Description and Operation

Figure 1 shows the heating and ventilation system schematic diagram.

A. Cabin Heat System

The cabin heat system has the following components:

– An air intake at the front of the bottom cowling.

– A coolant radiator. A part of the air that goes through the coolant radiator is guided into the cabin heat system.

– A heat-exchanger. A shroud around the exhaust muffler makes the heat exchanger. The shroud has an air inlet connection at the front on the right. It also has a warm air outlet connection at the back on the left.

– A heat control valve. The heat control valve attaches to the front face of the firewall at the bottom. The cabin heat valve has two outlets. One outlet lets hot air flow into the engine compartment. The other outlet lets the hot air flow through the firewall into the distribution box.

– A flap in the heat control valve controls the flow of warm air to the outlets. It closes one outlet as it opens the other outlet.

– A distribution box. The distribution box attaches to the sides of the center console at the front. The distribution box has four outlets. Two outlets let hot air flow to the canopy windscreen and the other two outlets let hot air flow to the floor at each side of the center console.

– A flap in the distribution box controls the flow of warm air to the outlets. It closes two of the outlets as it opens the other two outlets.

– A CABIN HEAT control lever at the front of the center console. A bowden cable connects the lever to the flap of the heat control valve.

– A DEFROST/FLOOR control lever at the front of the center console. A bowden cable connects the lever to the distribution control valve.

Ambient air goes into the engine compartment through the intake at the front of the bottom cowling and the coolant radiator. A large flexible hose connects the intake to the front of the heat exchanger. The hot exhaust muffler makes the air hot. The air flows out of the heat-exchanger through a large flexible hose to the heat control valve.

The CABIN HEAT control lever moves the flap in the heat control valve. In the OFF position (fully forward) no hot air can flow into the cockpit. Move the lever aft (towards the ON position) to let gradually more hot air flow into the cabin.

The DEFROST/FLOOR control lever moves the flap in the distribution box. In the DEFROST position (fully forward) the hot air flows to the windscreen. Move the lever aft (towards the FLOOR position) to let the hot air flow to the floor.

B. Cold Air System

Ambient air enters the cockpit through a NACA duct on each side of the forward fuselage. Flexible hoses connect the ducts to ventilation nozzles on each side of the instrument panel. Each nozzle can adjust to point the airflow as necessary. Turning the nozzle flap controls the amount of air flowing into the cockpit.

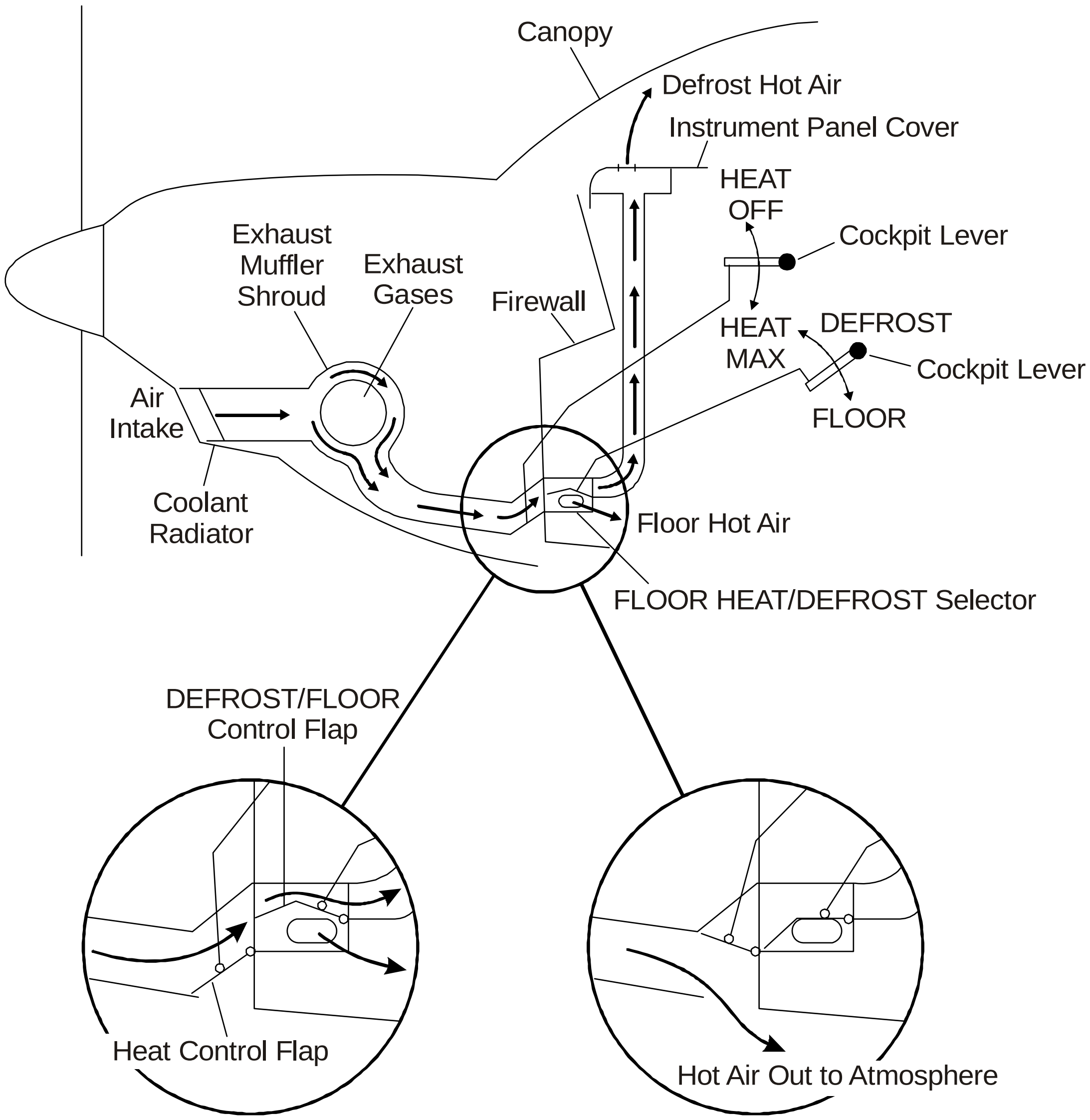

Figure 1: Heating and Ventilation Schematic Diagram

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Trouble-Shooting

1. General

This table explains how to troubleshoot the air conditioning system. If you find the trouble in column 1, do the repair given in column 3.

Trouble	Possible Cause	Repair
Burning smell in the cockpit.	Exhaust heat-exchanger cracked.	Replace or repair the heat exchanger.
Heating system supplies warm air when set to OFF.	Control cable out of adjustment.	Adjust the heat valve control cable.
Heating system cannot be selected to the windscreen/ floor.	Control cable out of adjustment.	Adjust the distribution box control cable.

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Maintenance Practices

1. General

This chapter describes about the Maintenance Practices for the distribution and heating systems. It also describes how to remove/install and adjust components.

2. Remove/Install the Heat Control Valve

A. Remove the Heat Control Valve

Detail Steps/Work Items		Key Items/References
(1)	Remove the engine cowlings.	Refer to Chapter 71-10.
WARNING:	**IF THE ENGINE HAS BEEN RUNNING, TAKE CARE WHEN YOU TOUCH THE HEAT CONTROL VALVE. THE HEAT CONTROL VALVE GETS HOT.**	
(2)	Release the worm drive clamp which holds the flexible hose to the heat control valve. Then disconnect the hose from the valve.	
(3)	Set the HEAT control lever to ON. Loosen the screw which holds the bowden cable to the lever in the heat control valve. – Move the bowden cable clear.	
(4)	Remove the four bolts and the washers that attach the heat control valve to the firewall.	
(5)	Remove the heat control valve from the firewall.	

B. Install the Heat Control Valve

Detail Steps/Work Items		Key Items/References
(1)	Put the heat control valve in position on the firewall.	Use Product PR 812, (MIL-S-38249 Type 1) Fire Wall Sealant.
(2)	Install the washers and bolts that attach the valve to the firewall.	
(3)	Set the cockpit control lever to OFF. Then move it forward about 3 mm (0.1 in).	
(4)	Put the bowden cable in position on the heat control valve. Adjust the nuts on the outer sheath adjuster to a mid position.	Make sure that the inner cable is through the end fitting on the flap lever of the heat control valve.
(5)	Set the flap in the heat control valve to fully close the hole in the firewall.	
(6)	Tighten the screw in the end fitting on the flap lever to hold the inner cable.	
(7)	Do a test for correct operation of the heat control valve.	
(8)	Connect the flexible hose to the heat control valve. Tighten the worm drive clamp.	
(9)	Install the engine cowlings.	Refer to Chapter 71-10.

3. Test/Adjust the Heat Control Valve

Detail Steps/Work Items		Key Items/References
(1)	Remove the engine cowlings.	Refer to Chapter 71-10.
(2)	Set the CABIN HEAT control lever in the cockpit to OFF.	There must be 'bounce' of about 3 mm (0.1 in) between the back of the lever and the cockpit stop.
	WARNING: IF THE ENGINE HAS BEEN RUNNING, TAKE CARE WHEN YOU TOUCH THE HEAT CONTROL VALVE. THE HEAT CONTROL VALVE GETS HOT.	
(3)	Make sure that: – The flap fully closes the opening to the distribution box.	Look or feel inside the heat control valve.
(4)	If necessary, adjust the outer sheath of the cable that goes through the distribution box to give the correct 'bounce'.	
(5)	Set the CABIN HEAT control lever in the cockpit to ON (fully forward).	
(6)	Make sure that: – The flap fully closes the outlet to the engine compartment.	
	CAUTION: MAKE SURE THAT THE FLAP ON THE HEAT CONTROL VALVE FULLY CLOSES THE FIREWALL OUTLET WHEN YOU SET THE CABIN HEAT CONTROL LEVER TO OFF. THIS IS TO STOP FIRE OR EXHAUST FUMES FROM GOING INTO THE COCKPIT IN AN EMERGENCY.	
(7)	Install the engine cowlings.	Refer to Chapter 71-10.

4. Remove/Install the Distribution Box

A. Remove the Distribution Box

	Detail Steps/Work Items	Key Items/References
	WARNING: DO NOT STAND WITHIN THE DANGER AREA OF THE PROPELLER. IF THE ENGINE STARTS, THE PROPELLER CAN CAUSE DEATH OR INJURY TO PERSONS. **WARNING: YOU MUST MAKE SURE THAT THE ENGINE IS SAFE BEFORE YOU DO WORK ON THE CABIN HEAT SYSTEM. DISCONNECT THE SPARK PLUG LEADS. MAKE SURE THAT:** **- THE ENGINE MASTER SWITCH IS IN THE "OFF" POSITION.** **- THE ELECTRIC MASTER SWITCH IS IN THE "OFF" POSITION.** **- THE BATTERY BACKUP SWITCH IS IN THE “OFF” POSITION.** **- THE THROTTLE IS SET TO "IDLE".** **WARNING: IF THE ENGINE HAS BEEN RUNNING, TAKE CARE WHEN YOU TOUCH THE HEAT CONTROL VALVE AND THE DISTRIBUTION BOX. THE HEAT CONTROL VALVE AND THE DISTRIBUTION BOX GETS HOT.**	
(1)	Disconnect the airplane battery.	Refer to Chapter 24-31.
(2)	Remove the engine cowlings.	Refer to Chapter 71-10.
(3)	Remove the heat control valve.	Refer to Paragraph 2A.
(4)	Remove the control knobs from the following levers at the center console: – PARKING BRAKE. – HEAT control ON/OFF. – HEAT distribution DEFROST FLOOR.	

Detail Steps/Work Items		Key Items/References
(5)	Remove the engine controls face plate from the center console cover: – Remove the four screws.	
(6)	Remove the center console cover from the center console: – Remove the six screws from the two sides of the center console cover.	
(7)	Disconnect the cable wire end of the HEAT DEFROST-FLOOR control from the lever at the control quadrant. – Loosen the swivel attachment.	
(8)	Disconnect the outer sheath of the HEAT DEFROST-FLOOR control bowden cable from the tab at the control quadrant. – Remove the two nuts.	
(9)	Disconnect the cable wire end of the HEAT ON-OFF control from the lever at the control quadrant. – Loosen the swivel attachment.	
(10)	Disconnect the outer sheath of HEAT ON-OFF control bowden cable from the tab at the control quadrant. – Remove the two nuts.	
(11)	Remove the distribution box installation screws from the center console at the left and right footwells.	

Detail Steps/Work Items		Key Items/References
(12)	Remove the support block from the distribution box: – Remove the nut from the heat valve bowden cable at the support block. – Turn the bowden cable outer sheath and remove from the support block. – Remove the two screws that attach the support block to the distribution box.	
(13)	Carefully pull the distribution box forward into the engine compartment. – Remove the two hot air distribution hoses.	Sufficient to get access to the hot air distribution hoses at the rear of the distribution box.
(14)	Remove the distribution box.	

B. Install the Distribution Box

Detail Steps/Work Items		Key Items/References
(1)	Install the HEAT DEFROST-FLOOR bowden control cable to the distribution box before you install it in the center console.	
(2)	Install the two hot air distribution pipes to the rear of the distribution box before you install it in the center console. – Tighten the worm-drive clamps.	
(3)	Carefully put the HEAT DEFROST-FLOOR bowden control cable in position in the center console. Then put the distribution box in position in the center console.	From the engine compartment.
(4)	Put the HEAT ON-OFF bowden control cable in position: – From the control quadrant into the hole at the top of the distribution box.	

Detail Steps/Work Items		Key Items/References
(5)	Turn the HEAT ON-OFF bowden control cable and install to the support block: – Install the bowden cable lock nut.	
(6)	Install the support block to the top of the distribution box.	
(7)	Install the distribution box to the sides of the center console: – Install the two screws in the left and right footwells.	
(8)	Install the outer sheath of the HEAT DEFROST-FLOOR control bowden cable to the tab at the control quadrant: – Install the two nuts.	
(9)	Install the cable wire end of the HEAT DEFROST-FLOOR control to the lever at the control quadrant. – Tighten the screw in the swivel attachment.	
(10)	Install the outer sheath of HEAT ON-OFF control bowden cable to the tab at the control quadrant. – Install the two nuts.	
(11)	Install the cable wire end of the HEAT ON-OFF control to the lever at the control quadrant. – Tighten the screw in the swivel attachment.	
(12)	Do a test for correct operation of the DEFROST-FLOOR control valve. If necessary, adjust the bowden cable.	Refer to Paragraph 3.
(13)	Install the heat control valve.	Refer to Paragraph 2B.

Detail Steps/Work Items		Key Items/References
(14)	Install the center console cover to the center console.	
(15)	Install the face plate to the center console cover.	
(16)	Install the control knobs from the following levers at the center console: – PARKING BRAKE. – HEAT control ON/OFF. – HEAT distribution DEFROST FLOOR.	
(17)	Do a controls freedom of movement check.	
(18)	Connect the airplane battery.	Refer to Chapter 24-31.
(19)	Do an engine test.	Refer to the DV 20 E Airplane Flight Manual.

5. Test/Adjust the Distribution Box

Detail Steps/Work Items		Key Items/References
(1)	Set the CABIN HEAT control lever in the cockpit to DEFROST.	There must be 'bounce' of about 3 mm (0.1 in) between the back of the lever and the cockpit stop.
WARNING:	**IF THE ENGINE HAS BEEN RUNNING, TAKE CARE WHEN YOU TOUCH THE HEAT CONTROL VALVE. THE HEAT CONTROL VALVE GETS HOT.**	
(2)	Remove the heat control valve.	Refer to Paragraph 2A.
NOTE:	Only do steps 3 through 7 if you must adjust the distribution valve range of movement.	
(3)	Disconnect the airplane battery.	Refer to Chapter 24-31.
(4)	Install the control knobs from the following levers at the center console: – PARKING BRAKE. – HEAT control ON/OFF. – HEAT distribution DEFROST FLOOR.	
(5)	Remove the engine controls face plate from the center console cover. – Remove the four screws.	
(6)	Remove the center console cover from the center console:	
(7)	Remove the six screws from the two sides of the center console cover.	
(8)	Make sure that: – The flap fully closes the two openings to the FLOOR distribution holes.	Look or feel inside the distribution box valve.

Detail Steps/Work Items		Key Items/References
(9)	Set the CABIN HEAT control lever in the cockpit to FLOOR.	There must be 'bounce' of about 3 mm (0.1 in) between the top of the lever and the cockpit stop.
(10)	Make sure that: – The flap fully closes the two openings to the DEFROST distribution holes.	Look or feel inside the distribution box valve.
(11)	If necessary, adjust the outer sheath of the cable that goes through the tab in the control quadrant to give the correct 'bounce'.	
(12)	Install the heat control valve.	Refer to Paragraph 2B.
	NOTE: Only do steps 14 through 21 if you had to do steps 3 through 7.	
(13)	Do a check for loose items in the cockpit.	Look specially in the area of the control quadrant.
(14)	Install the center console cover to the center console:	
(15)	Install the engine controls face plate to the center console cover.	
(16)	Install the control knobs from the following levers at the center console: – PARKING BRAKE. – HEAT control ON/OFF. – HEAT distribution DEFROST FLOOR.	
(17)	Do a control freedom of movement check.	
(18)	Connect the airplane battery.	Refer to Chapter 24-31.

6. Remove/Install the Heat Exchanger Shroud

A. Remove the Heat Exchanger Shroud

Detail Steps/Work Items		Key Items/References
(1)	Remove the engine cowlings.	Refer to Chapter 71-10.
	WARNING: IF THE ENGINE HAS BEEN RUNNING, TAKE CARE WHEN YOU TOUCH THE HEAT CONTROL VALVE. THE HEAT CONTROL VALVE GETS HOT.	
(2)	Release the worm drive clamps which attach the inlet and outlet hoses to the heat exchanger.	
(3)	Disconnect the inlet and outlet hoses from the heat exchanger.	
(4)	Release the screws which hold the shroud to the muffler.	
(5)	Remove the shroud from the muffler.	

B. Install the Heat Exchanger Shroud

Detail Steps/Work Items		Key Items/References
(1)	Put the shroud in position on the muffler with the joint at the rear.	
(2)	Install the screws which hold the flanges of the shroud together.	
(3)	Connect the inlet and outlet hoses from the heat exchanger.	
(4)	Tighten the worm drive clamps which hold the hoses.	
(5)	Install the engine cowlings.	Refer to Chapter 71-10.

7. Inspect the Heat Exchanger

WARNING: NO CRACKS ARE PERMITTED IN THE EXHAUST MUFFLER. CRACKS ALLOW CARBON MONOXIDE TO ENTER THE HEATING SYSTEM. CARBON MONOXIDE IS POISONOUS.

Detail Steps/Work Items		Key Items/References
(1)	Remove the heat-exchanger shroud.	Refer to Paragraph 6A.
(2)	Examine the inside of the shroud. Look especially for soot marks and cracks.	If you find soot marks, the exhaust muffler is cracked. You must remove it for repair or replace it.
(3)	Examine the outer face of the exhaust muffler. Look specially for soot marks and cracks.	Use a magnifying glass and a strong light. If you find soot marks or cracks, you must remove the muffler for repair or replace it.
(4)	Install the heat exchanger shroud.	Refer to Paragraph 6B.

CHAPTER 23

COMMUNICATIONS

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TABLE OF CONTENTS

CHAPTER 23

COMMUNICATIONS

Section 23-10

Speech Communication

Trouble-Shooting

Maintenance Practices

Section 23-50

Audio Integration

Trouble-Shooting

Maintenance Practices

Section 23-60

Static Discharging

CHAPTER 23
COMMUNICATIONS

1. General

This Chapter describes about the following communications and communications related systems:

– Chapter 23-10. Speech Communication.

– Chapter 23-50. Audio Integrating.

– Chapter 23-60. Static Discharging (including bonding).

This chapter gives you only the on-airplane data about the systems and components. Refer to the manufacturer's handbooks for shop data.

2. Description

A. Speech Communication

The basic speech communication system has the following components:

– Garmin GTN 650 COM/NAV/GPS.

– Garmin GTR 225A COM.

– COM antennas.

B. Audio Integrating

The basic audio integrating system has the following components:

– GMA 340 voice activated intercom.

– Press-to-transmit buttons on each control stick.

– Mic and phone jack-sockets for each pilot.

– A cabin speaker.

C. Static Discharging

The composite structure of the DV 20 E airplane makes a special bonding system necessary. Copper foil tape with conductive adhesive and bonding wire connect metal components. They also connect the ground planes for antennas.

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Section 23-10
Speech Communication

1. General

The DV 20 E airplane has dual VHF communications. The basic dual system has GTN 650 COM/NAV/GPS utilizing a GTR 225A as the COM 2.

The audio panel with speaker amplifier operates the cabin speaker.

Figure 1 shows the antenna locations. The #1 VHF COM antenna is a dipole. It is installed in the leading edge of the vertical stabilizer. The #2 VHF COM antenna is a 1/4 wave whip. It is installed below the bottom skin of the fuselage. The antenna ground plane is copper adhesive tape. The ground plane connects to the airplane static bonding system.

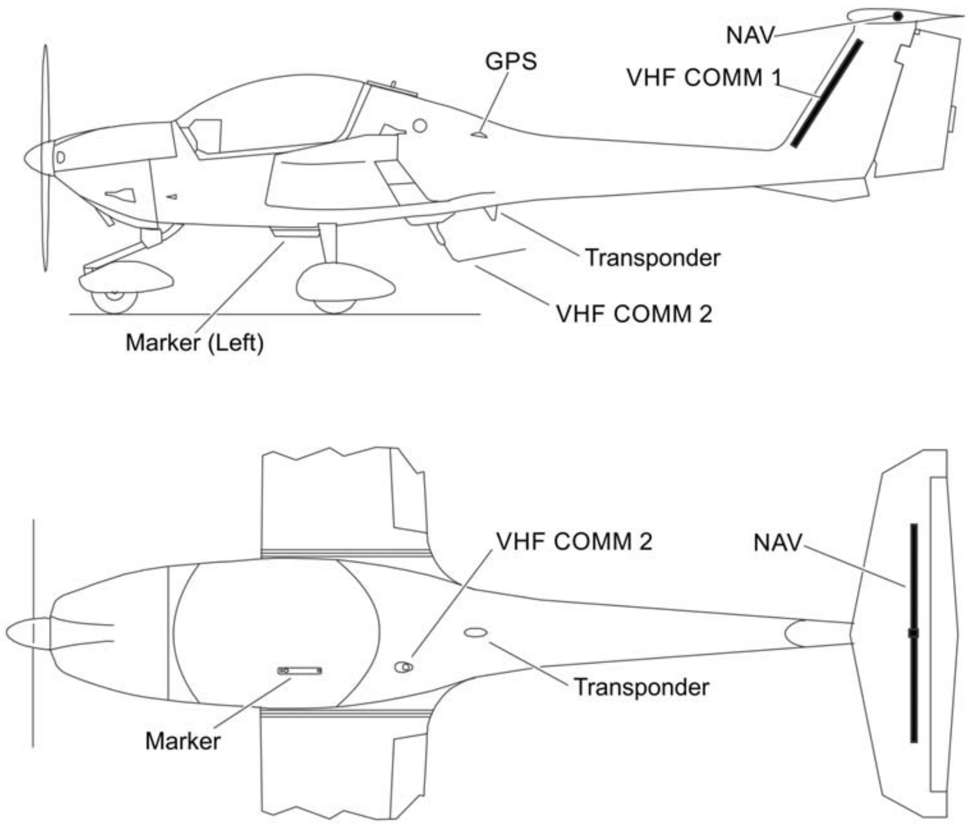

Figure 1: Antenna Locations

2. Description

A. GTN 650

The GTN 650 is a VHF communications transceiver and a GPS receiver. (Refer to Chapter 34-50 for GPS functions). It also includes VOR/Localizer and glideslope receivers. It uses a Secure Digital (SD) card to load and store various types of data. For basic flight operations, the SD card is required for terrain, obstacle, and safe taxi database storage as well as Jeppesen aviation database updates.

The equipment can receive COM signals from 118.00 MHz to 136.976 MHz in 25 KHz and 8.33 kHz increments. The display is a 600 by 266 pixel, 4.9 inch diagonal color LCD with touchscreen controls.

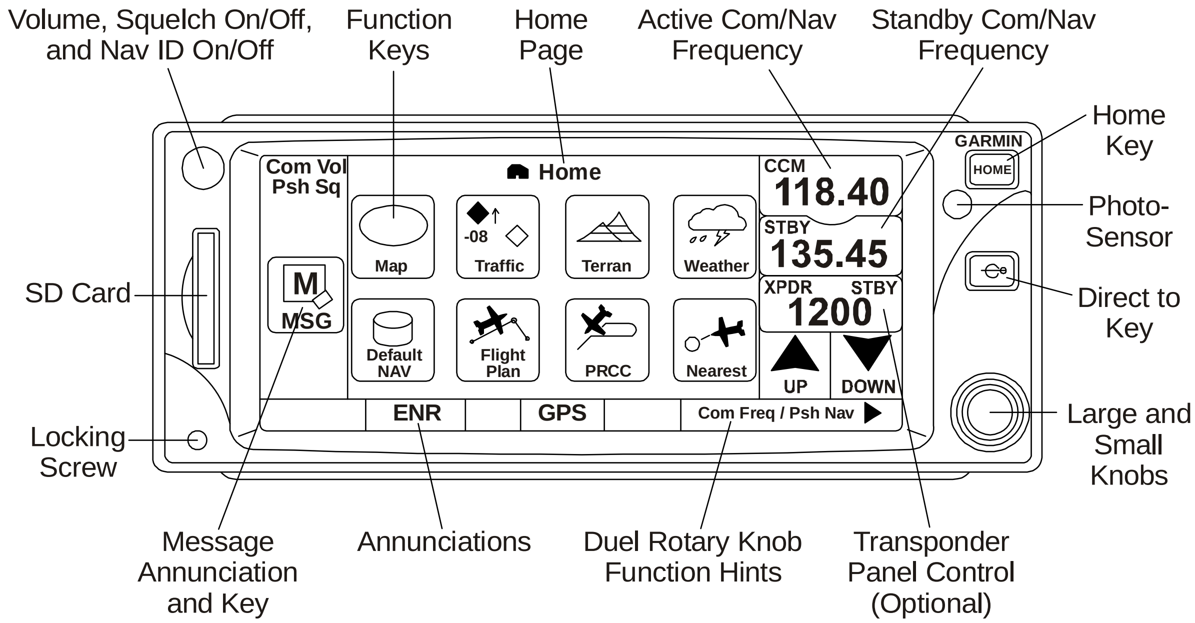

Figure 2: GTN 650 COM/NAV/GPS

The GTN 650 has the following controls:

(a) Left-Hand Knob

Volume / Squelch Knob - controls audio volume for the selected COM radio or Nav receiver and other volume levels for external audio input devices that are controlled via the GTN interface, if installed. Pressing the Volume knob momentarily will disable the automatic squelch control for the COM radio, when active.

(b) Right-Hand Keys and Knobs

HOME Key - Pressing the HOME Key displays the Home page, the main screen for accessing the GTN features. Pressing and holding the HOME key will open the Default Navigation page from any other page.

Direct-To Key - provides access to the direct-to function, which allows you to enter a waypoint and establishes a direct course to the selected destination.

Large and Small Concentric Knobs - used for data entry, such as in the Waypoint or Direct-To functions, and to set the frequencies for the communications transceiver or the VOR/Localizer in units so equipped.

To operate the unit set the ELECTRIC MASTER switch and AVIONICS MASTER switch to ON. The related circuit-breakers must be closed. Turn the COM power/Volume knob clockwise from the OFF position. The display will show the frequency last stored in the non-volatile memory. The INST. LT knob controls the brightness of the display.

Refer to the operators handbook provided with the equipment for additional information.

B. Garmin GTR 225A COMM

The GTR 225A Comm Radio provides a VHF Communications transceiver in a small footprint. The unit has the ability to monitor the standby COM frequencies and stores the most-used frequencies. The GTR 225A operates in the aviation voice band, from 118.000 to 136.975 MHz, in 25 KHz and 8.33 kHz steps.

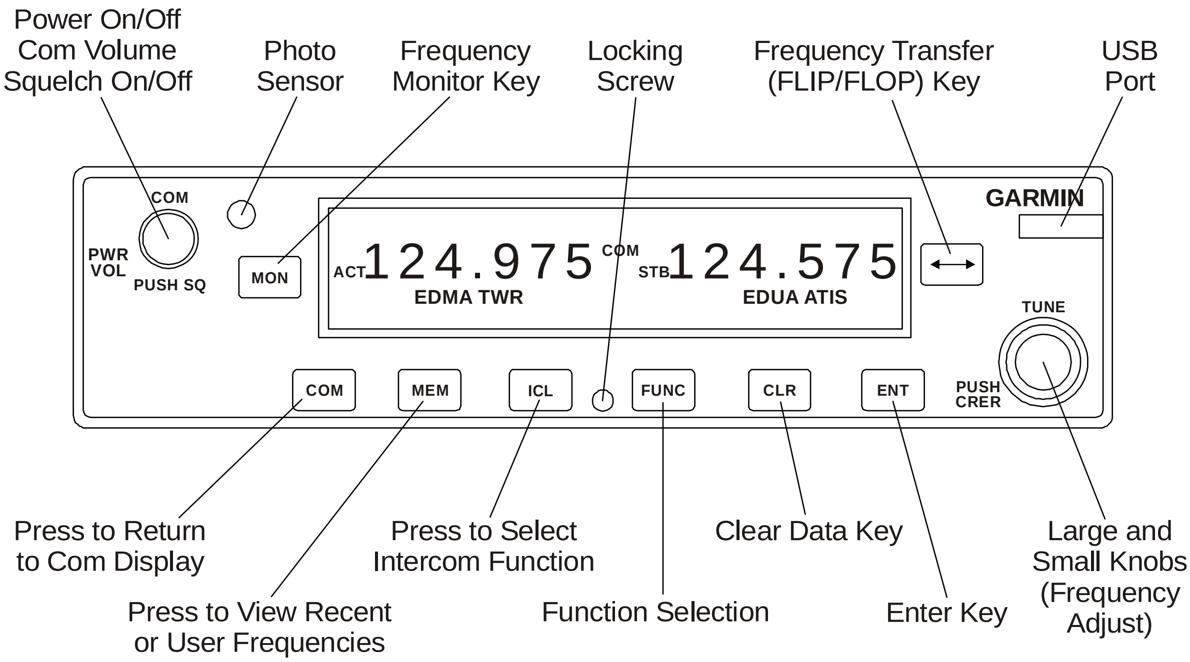

Figure 3: GTR 225A COM

Trouble-Shooting

1. General

This table tells you how to troubleshoot the speech communication system. If you find the trouble in column 1 do the repair given in column 3.

Trouble	Possible Cause	Repair
Note: For the faults shown below: use the hand mic, set the intercom to OFF, listen to the speaker or pilot's headphones.		
Radio check reports readability good, strength poor due to low modulation.	Mic output low. Faulty radio.	Replace the defective mic. Replace the radio.
Radio check reports readability poor, strength good.	Faulty radio. Faulty mic.	Replace the radio. Replace the defective mic.
Radio check reports readability poor, strength poor.	Co-ax connector faulty.	Examine the co-ax and connections for condition and security.
Received audio is poor.	Faulty radio. Faulty antenna	Replace the radio. Replace the antenna.
Short range in transmit mode, but reception is OK.	Faulty radio.	Replace the radio.
Faults not covered with hand mic and speaker:		
No voice modulation when transmitting from one pilot's side. The other pilot's side is OK	Audio integrating fault.	Refer to Chapter 23-50.
Cannot transmit. Transmit annunciator not shown in COM display.	Faulty mic PTT switch. PTT wiring circuit open. Faulty audio panel mic select switch. Faulty radio.	Replace defective mic. Do a test for continuity. Refer to Chapter 92 for wiring diagrams. Replace the audio panel. Refer to Chapter 23-50. Replace the radio.

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Maintenance Practices

1. General

This part gives you the data to remove/install and adjust/test the components of the speech communication systems on the airplane. See the component manufacturers manuals for more data and for shop data.

2. Remove/Install the Garmin GTN 650

A. Remove the Garmin GTN 650

Detail Steps/Work Items		Key Items/References
(1)	Open the COM1 and GPS/NAV1 circuit-breakers.	
(2)	Put a 3/32 allen wrench into the access hole for the locking screw. Engage the screw.	
(3)	Turn the screw counter-clockwise until the unit disengages from the mounting rack.	
CAUTION: DO NOT PULL ON THE KNOBS. DO NOT PRY THE FACE-PLATE. YOU CAN DAMAGE THE UNIT. CAUTION: DO NOT TOUCH THE CONNECTOR CARD AT THE REAR OF THE UNIT. THE ELECTROSTATIC CHARGE ON YOUR BODY CAN DAMAGE THE UNIT.		
(4)	Pull gently on the sides of the unit to remove it from the mounting rack.	
(5)	Install the protective covers on the rear connectors of the unit.	

B. Install the Garmin GTN 650

	Detail Steps/Work Items	Key Items/References
(1)	Remove the protective covers from the rear connectors on the unit.	
(2)	Slide the unit into the rack. Engage the locking screw so that the latch front lobe touches the rack.	
(3)	Turn the locking screw clockwise so that the rear lobe engages the mounting rack.	
CAUTION: DO NOT OVER-TIGHTEN THE LOCKING SCREW. YOU CAN DAMAGE THE LOCKING MECHANISM.		
(4)	Continue to turn the screw until the unit is fully installed in the mounting rack.	
(5)	Close the COM1 and GPS/NAV1 circuit-breakers.	
(6)	Do a functional test.	Refer to Paragraph C.

C. Garmin GTN 650 Adjustment/Test

If possible, do an operational flight check after the radio has been replaced. Alternatively, use a test set to make sure that the system operates correctly. Refer to the appropriate installation manual for performance specifications.

Detail Steps/Work Items		Key Items/References
(1)	Do a test of each control function.	Refer to Chapter 23-50
(2)	Make sure that the database date is valid.	Once the database has been acknowledged, the instrument panel self-test page will appear. Refer to the units Pilot's Guide and Reference for Instrument Panel Self-Test.

D. Database Loading

The GTN 650 utilizes various databases. With the exception of the Terrrain database which is stored in a single SD memory card that is inserted into the vertical slot on the left side of the panel, the Aviation, Basemap, Safetaxi and Obstacle databases which reside internal to the GTN. Refer to the GTN 650 Pilot’s Guide for Data Card use.

3. Remove/Install the GTR 225A VHF COM Transceiver

A. Remove the GTR 225A VHF COM Transceiver

Detail Steps/Work Items		Key Items/References
(1)	Open the COM2 circuit-breaker.	
(2)	Put a 3/32 allen wrench into the access hole for the locking screw in the front panel. Engage the screw.	Refer to Figure 4.
(3)	Turn the screw counter-clockwise until the unit disengages from the mounting rack.	
	CAUTION: DO NOT PULL ON THE KNOBS. DO NOT PRY THE FACE-PLATE. YOU CAN DAMAGE THE UNIT. CAUTION: DO NOT TOUCH THE CONNECTOR CARD AT THE REAR OF THE UNIT. THE ELECTROSTATIC CHARGE ON YOUR BODY CAN DAMAGE THE UNIT.	
(4)	Pull gently on the sides of the unit to remove it from the mounting rack.	
(5)	Install the protective covers on the rear connectors of the unit.	

B. Install the GTR 225A VHF COM Transceiver

	Detail Steps/Work Items	Key Items/References
(1)	Remove the protective covers from the rear connectors on the unit.	
(2)	Insert the transceiver slowly into the mounting rack.	Refer to Figure 4.
(3)	Insert a 3/32 inch allen wrench into the hole in the front panel.	
CAUTION: DO NOT OVER-TIGHTEN THE LOCKING SCREW. YOU CAN DAMAGE THE LOCKING MECHANISM.		
(4)	Continue to turn the screw until the unit is fully installed in the mounting rack.	
(5)	Close the COM2 circuit-breaker.	
(6)	Do an operational test.	Refer to Paragraph C.

C. Operational Test of the GTR 225A VHF COM Transceiver

Detail Steps/Work Items		Key Items/References
(1)	Do a test of each control function.	Refer to Chapter 23-50.
(2)	Tune the unit to a local frequency.	Make sure that the receiver output produces a clear and understandable audio output.
(3)	Verify the transmitter by contacting another station and getting a report of reliable communications.	

4. Antennas

Use a thin coat of 'Penatrox' (Manufacturer: Burndy) or 'Noalox' (Manufacturer: Ideal) corrosion inhibitor between the aluminum antenna backing plate and the copper foil ground plane. Apply a bead of Dow Corning 732 RTV around the antenna to give a waterproof seal.

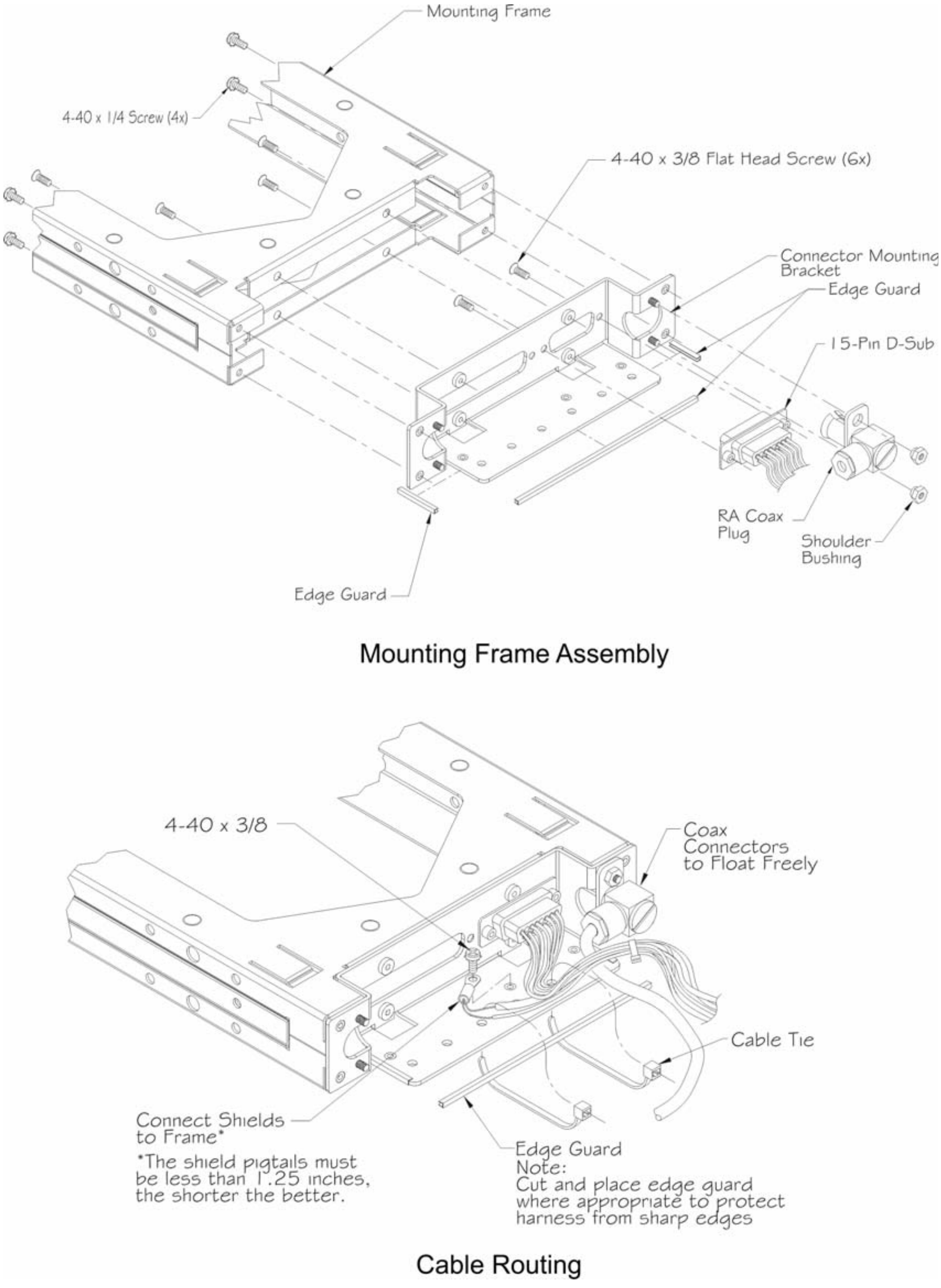


Figure 4: GTR 225A VHF COM Transceiver Removal/Installation

Section 23-50
Audio Integration

1. General

The DV 20 E airplane has a voice-activated (VOX) intercom. This gives hands-free intercom when the pilots use head-sets. Press-to-transmit switches are installed in the handle of each control stick. The microphone and the phone jack-sockets are located between the pilot's seats at shoulder height. There is also a microphone jack-socket and cabin speaker installed below the pilot's seat.

The audio panel with speaker amplifier operates the cabin speaker.

2. Description

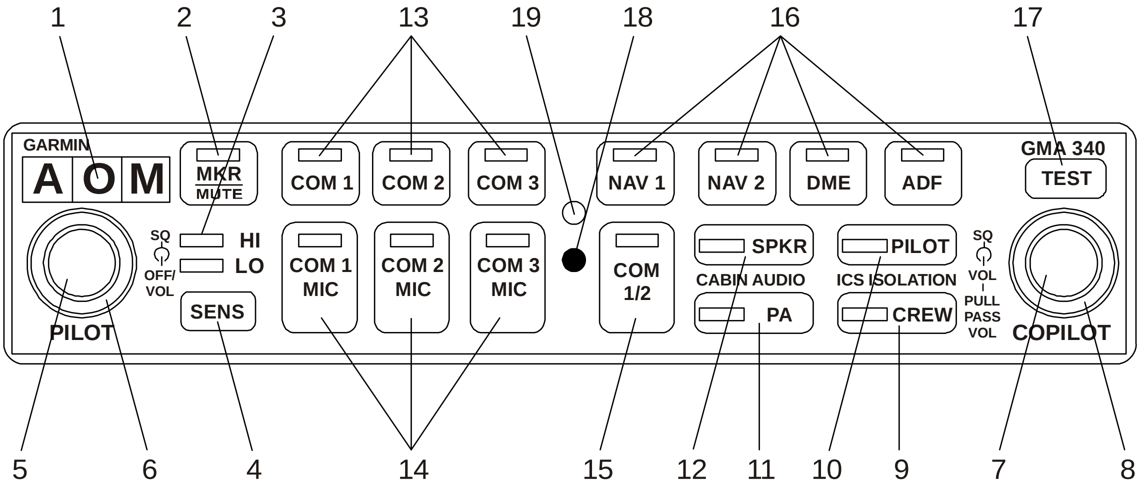
A. Garmin GMA 340 Audio Panel

Figure 1 shows the GMA 340 Audio Panel. The Garmin GMA 340 is a panel mounted TSO'd audio panel that provides control of the airplane audio system. The GMA 340 provides flexibility in switching up to three microphone and audio receiver communication inputs. Audio selection of NAV 1, NAV 2, ADF, DME and marker audio is available on the GMA 340. The GMA 340 includes a voice activated (VOX) intercom system and a three-lamp marker beacon receiver and display.

The VOX intercom uses rotary knobs for volume and squelch adjustment while selection of all other functions is accomplished with the use of push-buttons.

Marker HI and LO and button annunciation is accomplished with LED devices. Front panel backlighting of button function, squelch and volume control knobs is provided by LEDs controlled by the airplane lighting bus.

On the GMA 340 the split com function allows the pilot and copilot to talk on COM 1 and COM 2 simultaneously.



1. Marker Beacon Lights
2. Marker Beacon Receiver Audio Select/Mute Button
3. Marker Beacon Receiver Sensitivity Indicator LEDs
4. Marker Beacon Receiver Sensitivity Selection Button
5. Unit On/Off, Pilot Intercom System (ICS) Volume
6. Pilot ICS Voice Activated (VOX) Intercom Squelch Level
7. Copilot ICS Volume Control
8. Copilot VOX Intercom Squelch Level
9. Crew Isolation Intercom Mode Button
10. Pilot Isolation Intercom Mode Button
11. PA Function Button (not used)
12. Speaker Function Button
13. Transceiver Audio Selector Buttons
14. Transmitter (Audio/MIC) Selection Button
15. Split COM Button
16. Aircraft Radio Audio Selection Button
17. Annunciator Test Button
18. Locking Screw Access
19. Photocell - Automatic Annunciator Dimming

Figure 1: GMA 340 Audio Panel

Trouble-Shooting

1. General

This table tells you how to trouble-shoot the audio integrating system. If you find the trouble in column 1 do the repair given in column 3.

Refer to Garmin GMA 340 Audio Panel, Maintenance Manual, Doc No.190-00149-02, latest revision, for detailed troubleshooting procedure.

Trouble	Possible Cause	Repair
No voice modulation when transmitting from co-pilot's side on head-set. Pilot's side OK.	Faulty head-set. Open mic audio line. Faulty audio panel.	Replace head-set. Do a test of the mic audio wiring. Refer to Chapter 92 for the wiring diagrams. Replace the audio panel.
No voice modulation when transmitting from pilot’s side on head-set. Co-pilot’s side OK.	Faulty head-set. Open mic audio line. Faulty audio panel.	Replace head-set. Do a test of the mic audio wiring. Refer to Chapter 92 for the wiring diagrams. Replace the audio panel.
Cannot transmit. Transmit annunciator (if available) not showing on COM display.	Faulty mic PTT switch. PTT wiring circuit open. Faulty COM unit. Faulty audio panel.	Replace the defective PTT switch. Do a test of the PTT wiring. Refer to Chapter 92 for the wiring diagrams. Replace the COM unit. Replace the audio panel.
No intercom audio on pilot’s head-set. Receives radio transmissions correctly.	PILOT mode (GMA 340) selected. Faulty audio panel.	Select ALL mode. Replace the audio panel.

Trouble	Possible Cause	Repair
No audio on pilot's head-set with the audio panel switched OFF.	Faulty head-set.	Replace head-set.
	Open audio line.	Do a test of the head-set audio wiring. Refer to Chapter 92 for the wiring diagrams.
No audio on co-pilot's or passenger headsets.	Open audio line.	Do a test of the head-set audio wiring. Refer to Chapter 92 for the wiring diagrams.
	Faulty audio panel.	Replace the audio panel.

Maintenance Practices

1. General

This part gives you the data to remove/install and adjust/test the components of audio integrating system on the airplane. See the component manufacturers manuals for more data and for shop data.

2. Remove/Install the GMA 340 Audio Panel

A. Remove the GMA 340 Audio Panel

Detail Steps/Work Items		Key Items/References
(1)	Open the ICS circuit-breaker.	
(2)	Put a 3/32 allen wrench into the access hole for the locking screw. Engage the screw.	
(3)	Turn the screw counter-clockwise until the unit disengages from the mounting rack.	
CAUTION: DO NOT PULL ON THE KNOBS. DO NOT PRY THE FACE-PLATE. YOU CAN DAMAGE THE UNIT. CAUTION: DO NOT TOUCH THE CONNECTOR CARD AT THE REAR OF THE UNIT. THE ELECTROSTATIC CHARGE ON YOUR BODY CAN DAMAGE THE UNIT.		
(4)	Pull gently on the sides of the unit to remove it from the mounting rack.	
(5)	Install the protective covers on the rear connectors of the unit.	

B. Install the GMA 340 Audio Panel

Detail Steps/Work Items		Key Items/References
(1)	Remove the protective covers from the connectors on the replacement unit.	
(2)	Slide the unit into the rack. Engage the locking screw so that the latch front lobe touches the rack.	
(3)	Turn the locking screw clockwise so that the rear lobe engages the mounting rack.	Until the unit locks.
CAUTION: DO NOT OVER-TIGHTEN THE LOCKING SCREW. YOU CAN DAMAGE THE LOCKING MECHANISM.		
(4)	Continue to turn the screw until the unit is fully installed in the mounting rack.	
(5)	Close the ICS circuit-breaker.	
(6)	Do a functional test.	

C. Adjustment/Test of the GMA 340 Audio Panel

Detail Steps/Work Items		Key Items/References
(1)	Do the lamp test as follows:	
	– Apply power to the unit by rotating the pilot intercom knob clockwise.	Refer to item 5 in Figure 1.
	– Press the TEST button to confirm the operation of the LEDs.	Refer to item 17 in Figure 1.
	– Cover the photocell with a finger and observe that the LED annunciators dim automatically.	Refer to item 19 in Figure 1.
	– Check the front panel backlighting and dimming function.	Make sure that each annunciation is illuminated.

Detail Steps/Work Items		Key Items/References
(2)	Do a failsafe operation check as follows: – Turn the power OFF to the unit by rotating the pilot intercom knob counter clockwise. – Check the failsafe operation by exercising the COM 1 microphone, microphone key and audio over the headphones. – Apply power to the unit by rotating the pilot intercom knob clockwise.	
(3)	Do the operational check of the transceiver as follows: – Do a ramp test radio check by exercising the installed receivers, microphone, microphone key and audio over the headphones and speaker.	Make sure that the communications are loud and clear and PTT operation is correct.
(4)	Do the Intercom System (ICS) check as follows: – Set the intercom to the ALL mode. – Plug in the headsets at each ICS position. – Adjust squelch and volume for each position. – Check pilot and copilot ICS positions for isolation and proper operation of volume and squelch controls.	Refer to items 8 and 7 in Figure 1. Make sure that the ICS is working properly. Refer to items 5, 6, 7 and 8 in Figure 1.
(5)	Do the airplane receivers check as follows: – Check for pilot/copilot audio isolation when pressing the COM 1/2 button. – Press the SPKR button.	Refer to item 15 in Figure 1. Refer to item 12 in Figure 1. Make sure that any selected audio is heard over the speaker.

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Section 23-60
Static Discharging

1. General

A special bonding system is necessary for the composite structure of the DV 20 E airplane. The composite structure does not conduct electricity. Copper foil tape bonds to the inside of the structure to make a conducting path. A special conductive adhesive bonds the tape to the structure. Bonding wires connect the foil to all metal components and antenna ground planes.

2. Description

Figure 1 shows the bonding installation in the airplane.

The copper tape in the fuselage makes a loop. One end of the loop connects to the firewall at a feed-thru connection. The engine bonding wire connects to the feed-thru connection on the front face of the firewall. The other end of the loop connects to the right side of the firewall in the same way.

The copper tape goes along each side of the fuselage. The side tapes are connected by a piece of copper tape on the forward face of the B-bulkhead. Pop-rivets attach faston tabs to each end of the tape on the B-bulkhead. Jumper wires connect the faston tabs to the 2 copper tapes which go aft of the B-bulkhead.

Bonding jumper wires connect to all main metal components. Pop rivets through the structure and the copper tape hold faston connectors. The jumper wires attach to the connectors. Copper tape also makes the ground planes for antennas. The strips of copper tape over-lap each other.

The conductive adhesive for the tape bonds the strip together. It also bonds the ground plane to the bonding loop.

You can test the bonding system like other bonding systems. The maximum resistance values between connection points must not be more than standard bonding connection tolerances.

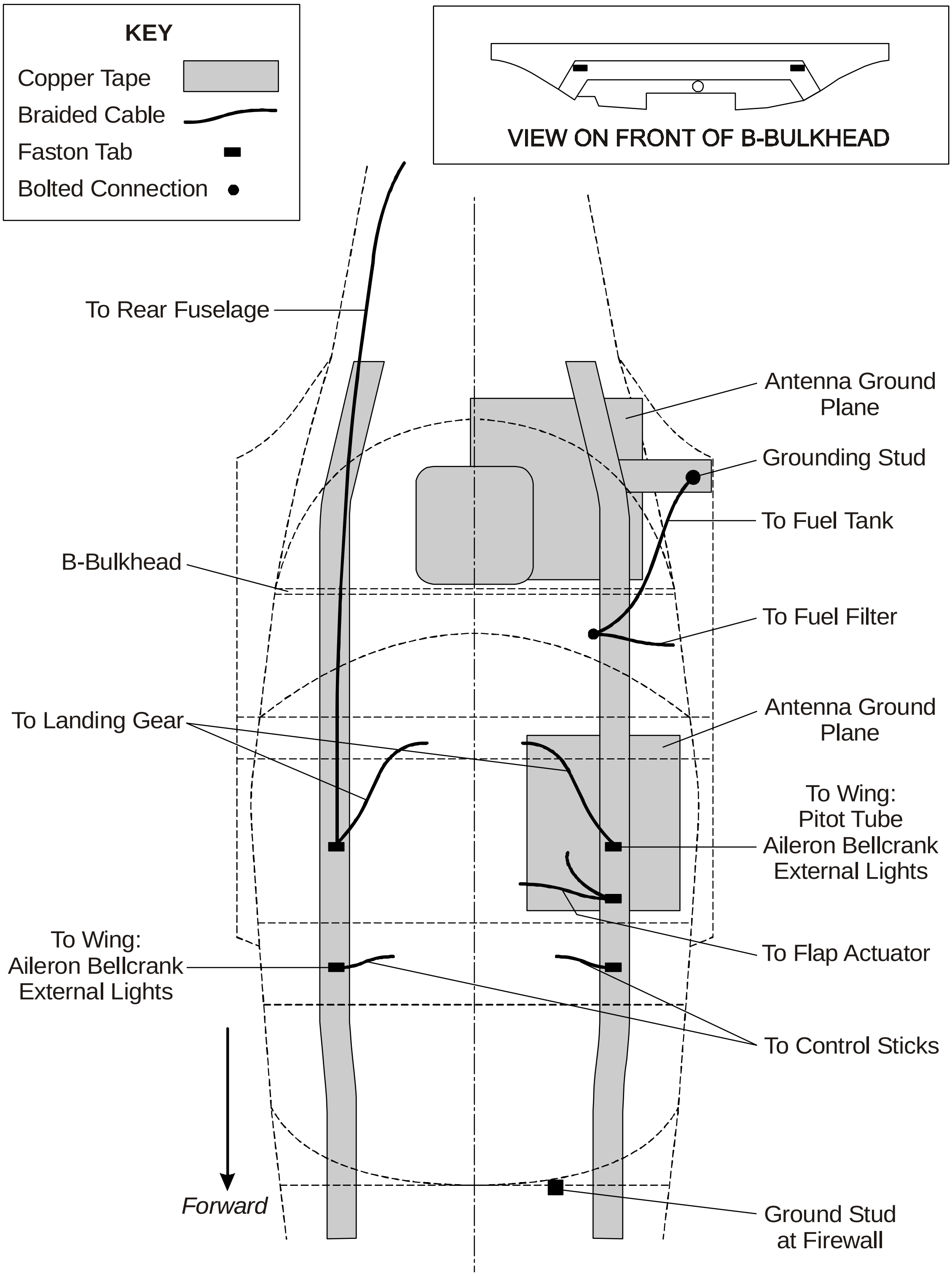

Figure 1: Bonding

CHAPTER 24

ELECTRICAL POWER

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TABLE OF CONTENTS

CHAPTER 24

ELECTRICAL POWER

Section 24-30

DC Generation

Section 24-31

Battery System

Trouble-Shooting

Maintenance Practices

Section 24-60

DC Electrical Load Distribution

Trouble-Shooting

Maintenance Practices

CHAPTER 24
ELECTRICAL POWER

1. General

The DV 20 E has a 14 V DC electrical system. This chapter describes the electrical system of the DV 20 E.

This Chapter has only simplified schematic diagrams and location diagrams. Refer to Chapter 92 for the wiring diagrams. Refer to the related Chapter for data about the system.

For Trouble-Shooting and Maintenance Practices for this system, refer to these Sections:

– Section 24-30. Electrical power generation.

– Section 24-31. Battery system.

– Section 24-60. Power distribution.

Note: Equipment which is certified for installation in the DV 20 E is listed in Section 6.5 of the Airplane Flight Manual. Such equipment may be installed in accordance with the Airplane Maintenance Manual.
Any equipment which is not listed in Section 6.5 of the Airplane Flight Manual is called “Additional Equipment”. The installation of Additional Equipment is a modification which must be handled in accordance with nation regulations or a Service Bulletin.
Throughout this chapter the nomenclatures “generator” and “alternator” are used for the same component. For DV 20 E airplane purposes, the terms “generator” and “alternator” are interchangeable in this document.

2. 14 VDC System Description and Operation

Figure 1 shows the simplified electrical system schematic diagram.

A. Power Supplies

(1) Main Battery

The main battery is located on the front left hand side of the firewall. It is a 12 V, 25 Ah sealed battery. It connects to the firewall ground point, the battery relay and the BACKUP circuit breaker.

(2) Alternators

The BRP Rotax 912 iS engine has an internal alternator with two isolated coils, thus individual alternators. Each alternator is controlled by its own regulator, both located on the fuse box. Refer to Section 24-30 for more information of DC Generation.

(3) External Alternator (optional)

The external alternator is in the scope of supply of the BRP Rotax 912iS engine. The external alternator is controlled by an integrated regulator. Refer to Section 24-30 for more information of DC Generation.

Note: When doing prolonged maintenance on the airplane with external power connected to the electrical system, pull the ALT.CONTROL and ALT circuit breakers to prevent damage to the external alternator.

B. Power Supply Control

(1) Battery Relay

The battery relay is located on the front left hand side of the firewall, next to the main battery. The output connects directly to the starter relay and the shunt of the ammeter. The coil + of the relay is tied to the battery +. The ELECTRIC MASTER switch provides the coil ground when set to the ON position.

(2) Bus Structure

All buses are flat metal strips connecting rows of circuit-breakers. The circuit-breakers are located on the instrument panel on the right side.

(3) Main Bus

The main bus provides power for the consumers. Each consumer has a circuit-breaker to protect the circuit. The main bus also connects to the avionic bus via the avionic master relay. A circuit-breaker protects the supply to the relay.

(4) Avionics Master Relay

The avionics master relay connects the main bus to the avionics bus. The AVIONIC MASTER switch controls the relay.

(5) AVIONIC MASTER Switch

With the AVIONIC MASTER switch set to OFF:

– The avionic master relay is energized to disconnect the avionics bus from the main bus.

With the AVIONIC MASTER switch set to ON:

– The avionic master relay is de-energized to connect the avionics bus to the main bus.

(6) Engine Master Relay

The Engine Master relay connects the main bus to the GEN circuit-breaker. The ELECTRIC MASTER and ENGINE MASTER switches control the engine master relay. The GEN circuit-breaker connects to the fuse box and the start power relay.

(7) Start Power Relay

The start power relay connects only during engine start-up, the ECU, ignition system and Lane A/B Fail lamps with the main battery. The start power relay is controlled by the Engine Monitoring Unit (EMU). As long as the relay is energized, the EMU caution lamp is ON.

(8) Battery Backup Switch

The Battery Backup switch is located at the bottom center of the instrument panel. The switch has a guard to prevent inadvertent operation. The normal position of the Battery Backup Switch is OFF. During emergency procedures (engine restart in flight) the switch can be selected to ON to connect the main battery and electrical ground to the engine management system (ECU). When selected ON, the EMU caution lamp is also ON.

(9) ENGINE MASTER Switch

The ENGINE MASTER switch is located on the left, center of the instrument panel switch panel. It has four sets of contacts. When set to ON, each set of contacts connects one input to outputs as follows:

- Lane A power supply to Lane A.
- Lane B power supply to Lane B.
- Main fuel pump power supply to the main fuel pump.
- The engine master relay is energized. The start interlock relay is energized. The Hobbsmeter is energized.

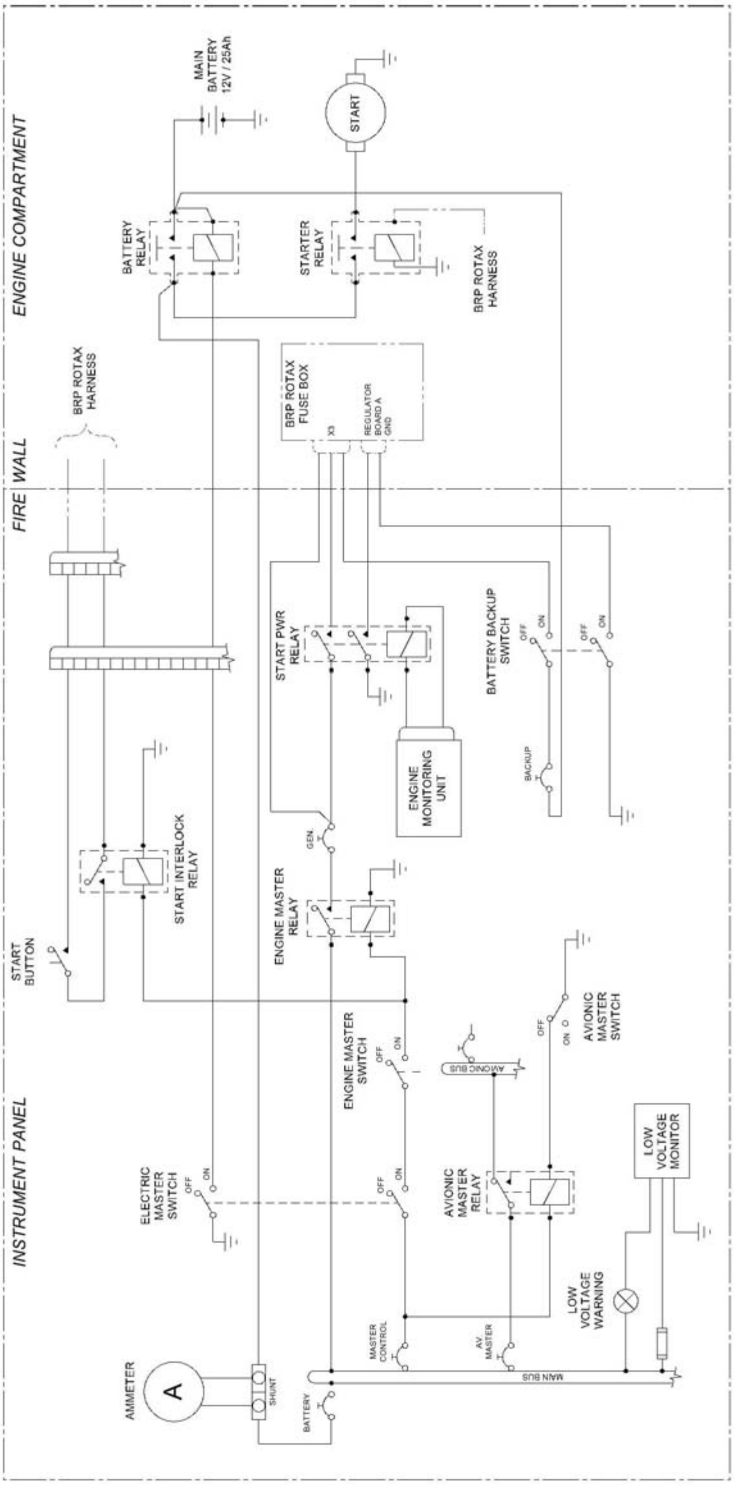

Figure 1: Electrical Schematic (Simplified)

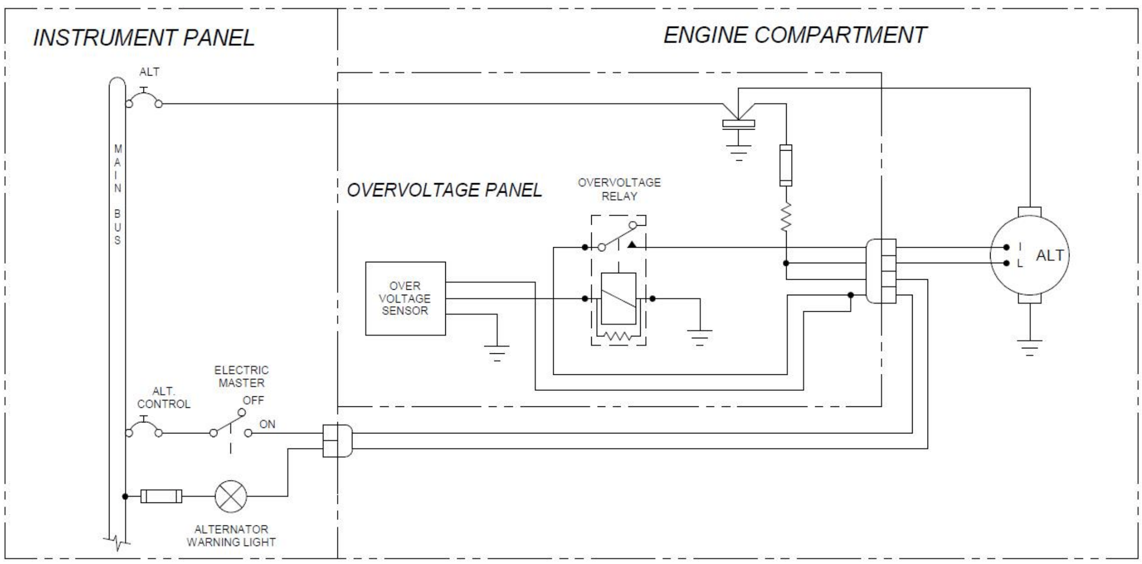

Figure 2: External Alternator Electric Schematic Simplified (if OÄM 20-245/b is installed)

3. Electrical Loads

Electrical Loads	
Description	Current (A)
Audio Panel (GMA 340)	2.20
Comm#1 (GTN 650)	0.45
GPS/NAV (GTN 650)	2.20
Transponder (GTX 328)	1.60
Comm#2 (GTR 225)	0.59
PFD/MFD (GDU 620)	3.90
AHRS (GRS 77)	0.60
ADC (GDC 74A)	0.41
Cooling fan	0.32
Relays	0.80
Flap control system (only during operation)	5.00
Powerplant instrument (EMU 912iS evo)	0.60
Annunciation lights	0.50
Position lights	1.00
Strobe lights	2.00
Taxi light	2.50
Taxi light (LED, if OÄM 20-271 is installed)	0.90
Landing light	2.50
Landing light (LED, if OÄM 20-271 is installed)	0.90
Map light	0.10
Instrument panel lights	0.17
Hour meter	0.10
Artifical horizon	0.55
Fuel pumps	min. 10.00 each
ECU	1.20
ECU lamps	0.25
Fuse box	0.40
Pitot heat	5.0

Section 24-30
DC Generation

1. General

The DC generation system for the DV 20 E has these components:

– Alternators.

– Alternator current sensor.

– Voltage regulators.

This Section gives you only the simplified description for the generation system. Refer to Section 24-00 and to the engine manufacturer's documentation for the full system description, operation and troubleshooting.

2. Description and Operation

A. Power Supplies

If OÄM 20-245 is installed, the BRP Rotax 912iS engine has an optional external alternator. The external alternator is controlled by an internal regulator. With sufficient propeller speed the external alternator supplies the airplane system and charges the battery.

Note: When doing prolonged maintenance on the airplane with external power connected to the electrical system, pull the ALT.CONTROL and ALT circuit breakers to prevent damage to the external alternator.

B. Alternators

The BRP Rotax 912 iS has an internal alternator with two isolated coils, thus individual alternators. Each alternator is controlled by its own regulator. During engine start, the engine management system (EMS) is powered by the battery. With sufficient engine speed, alternator B takes over this function. After the EMS system check, alternator A takes over the supply of the EMS system (engine), if the switching threshold is exceeded. Alternator B is then used to supply the airplane systems and for charging the battery.

C. Alternator Current Sensor

An alternator current sensor (shunt) is located in the instrument panel connected into the battery feeder line.

This shunt measures the current from or to the battery.

D. Alternator regulators

The electrical system of the BRP Rotax 912 iS also includes two separate regulators.

The alternator regulators are on the fuse box in the engine compartment. One controls the output of alternator A and the other controls the output of alternator B.

The optional external alternator has an integrated regulator installed.

Section 24-31

Battery System

1. General

This Section tells you about the battery system. See Section 24-00 and 24-32 for the description and operation of the battery in the electrical generation system.

The battery is mounted at the left side of the firewall. When the generator voltage is greater than the battery voltage, the generator charges the battery.

The ammeter shows the current flowing to or from the battery. Additional a low voltage monitor is implemented into the system. When both generators are operating, the low voltage warning is OFF. If a generator fails, the battery is not being charged and the low voltage warning comes ON and the ammeter shows a discharge (-) of the battery.

The battery supplies current to the main bus through the battery relay. The battery relay is installed on the firewall. A 50 A circuit-breaker protects the battery system.

The main battery is maintenance free.

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Trouble-Shooting

1. General

The table below lists the defects you could have with the battery system. If you have the trouble detailed in the Trouble column read across to the Possible Cause column. Then do the repair given in the Repair column.

Trouble	Possible Cause	Repair
Main battery voltage low.	Battery capacity low. Alternator output low.	Do a capacity test. If necessary, replace the battery. Trouble-Shoot the alternator, refer to Section 24-31.
Main battery will not connect to the battery bus.	Battery relay defective. ELECTRIC MASTER switch defective. Battery system wiring defective.	Replace the battery relay. Replace the ELECTRIC MASTER switch. Do a test of the battery system wiring. Refer to Chapter 92 for the wiring diagrams.
Ammeter shows zero at all times.	Defective ammeter. Defective ammeter shunt.	Replace the ammeter. Replace the shunt.

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Maintenance Practices

1. General

Keep the battery clean. Remove grease and other contaminants from the battery case. Remove dirt from the area of the terminals. Protect the terminals and cable lugs with Dow Corning compound 4 (DC4).

If you do not use the airplane regularly you must remove the battery for charging.

CAUTION: INSTALL ONLY A BATTERY WHICH IS APPROVED BY THE AIRPLANE MANUFACTURER.

2. Safety Precautions

Obey the maintenance instructions of the battery manufacturer.

Always disconnect the battery when you do work on the electrical system. Disconnect the negative cable first. Connect the negative cable last.

3. Remove/Install the Battery

A. Remove the Battery from the Airplane

	Detail Steps/Work Items	Key Items/References
(1)	Remove the top engine cowling.	
(2)	Remove the battery retaining clamp: – Remove the bolt, nut and 2 washers from the clamp.	
(3)	Disconnect the negative cable from the battery.	
(4)	Disconnect the positive cable from the battery.	
(5)	Remove the battery from the airplane.	

B. Install the Battery in the Airplane

	Detail Steps/Work Items	Key Items/References
(1)	Make sure that the battery is clean and dry.	
(2)	Move the battery into position in the battery mount.	
	CAUTION: MAKE SURE THAT YOU CONNECT THE CABLES TO THE CORRECT TERMINALS. INCORRECT CONNECTION CAN DAMAGE THE ELECTRICAL AND AVIONIC SYSTEMS.	
(3)	Connect the positive cable to the positive battery terminal.	Apply Dow Corning compound (DC4) to the battery terminal and the cable lug.
(4)	Connect the negative cable to the negative battery terminal.	Apply Dow Corning compound (DC4) to the battery terminal and the cable lug.
(5)	Install the battery retaining clamp: – Put the battery retaining clamp into position over the battery. – Install the bolt, 2 washers and nut onto the clamp.	Make sure that the clamp is seated correctly.
(6)	Install the top engine cowling.	

4. Disconnect/Connect the Battery for Maintenance

A. Disconnect the Battery for Maintenance

	Detail Steps/Work Items	Key Items/References
(1)	Remove the top engine cowling.	
(2)	Disconnect the negative cable from the battery.	
(3)	Disconnect the positive cable from the battery.	

B. Connect the Battery after Maintenance

	Detail Steps/Work Items	Key Items/References
CAUTION: MAKE SURE THAT YOU CONNECT THE CABLES TO THE CORRECT TERMINALS. INCORRECT CONNECTION CAN DAMAGE THE ELECTRICAL AND AVIONIC SYSTEMS.		
(1)	Connect the positive cable to the positive battery terminal.	Apply Dow Corning compound (DC4) to the battery terminal and the cable lug.
(2)	Connect the negative cable to the negative battery terminal.	Apply Dow Corning compound (DC4) to the battery terminal and the cable lug.
(3)	Install the top engine cowling.	

5. Remove/Install the Battery Relay

A. Remove the Battery Relay

	Detail Steps/Work Items	Key Items/References
(1)	Remove the top engine cowling and instrument panel cover.	
(2)	Disconnect the main battery: – Disconnect the negative cable from the negative battery terminal. – Disconnect the positive cable from the positive battery terminal.	
(3)	Remove the nuts and washers attaching the cables to the relay.	
(4)	Disconnect the electrical cables of the battery relay.	
(5)	Remove the bolts, washers and nuts attaching the relay to the firewall.	
(6)	Move the relay clear of the airplane.	

B. Install the Battery Relay

	Detail Steps/Work Items	Key Items/References
(1)	Put the relay in position on the firewall and install the bolts, washers and nuts.	
(2)	Connect the electrical cables to the relay.	Refer to Chapter 92 for the wiring diagrams.
(3)	Connect the cables to the main battery: – Connect the positive cable to the positive battery terminal. – Connect the negative cable to the negative battery terminal.	Apply Dow Corning compound (DC4) to the battery terminal and the cable lug.
(4)	Install the top engine cowling and instrument panel cover.	
(5)	Do a test for correct operation of the battery relay.	

Section 24-60
DC Electrical Load Distribution

1. General

This Section tells you about the system which supplies DC electrical power for other systems. The DC electrical load distribution system has these components:

– Main bus.

– Avionic bus.

– Battery relay.

– Engine Master relay.

– Avionics Master relay.

– Start Power relay.

– Switches.

– Circuit-breakers.

– Fuses.

Figure 1 shows the electrical system bus structure diagram of the electrical distribution system.

Figure 3 shows the instrument panel layout.

This Section gives you the Trouble-Shooting and Maintenance Practices for the electrical distribution system. Refer to Section 24-00 for the full system description and operation.

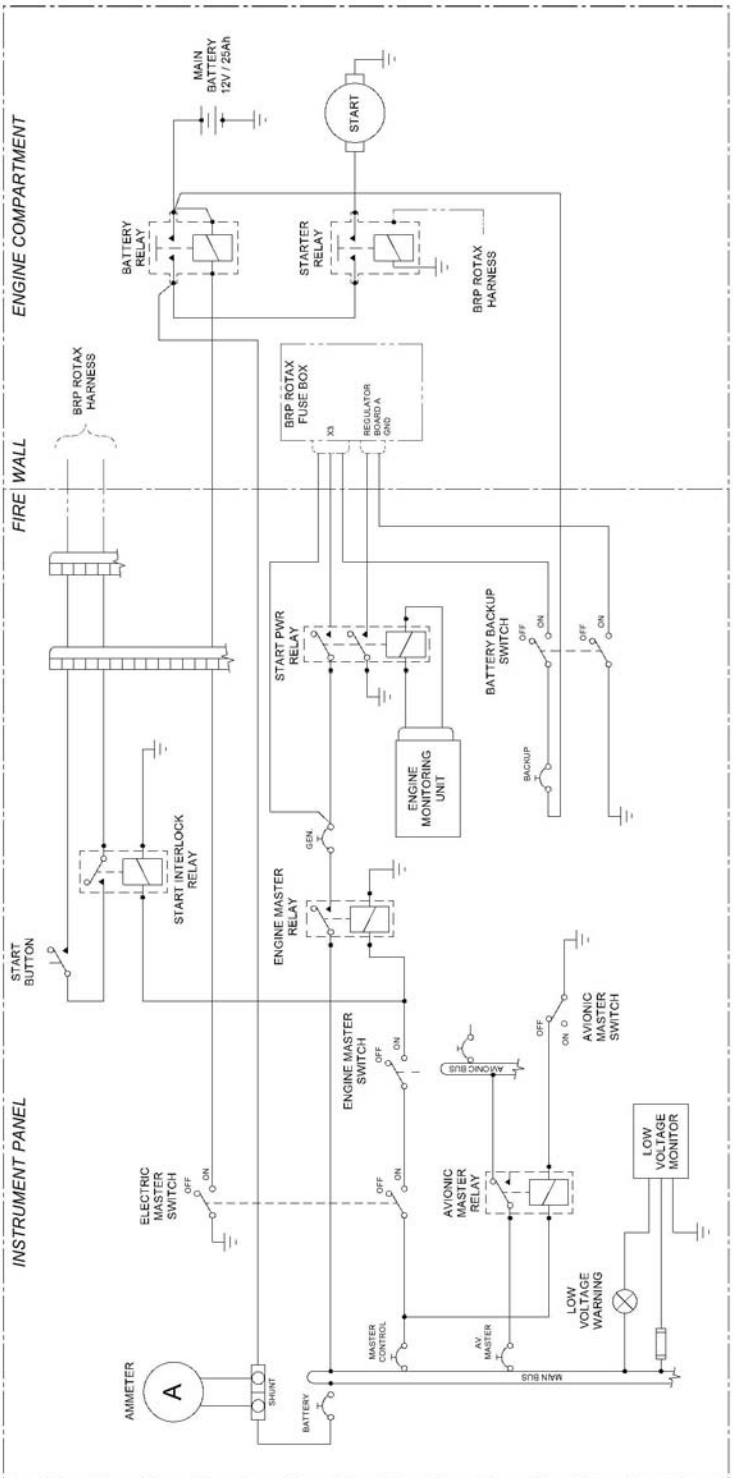

Figure 1: Electrical System Bus Structure Diagram

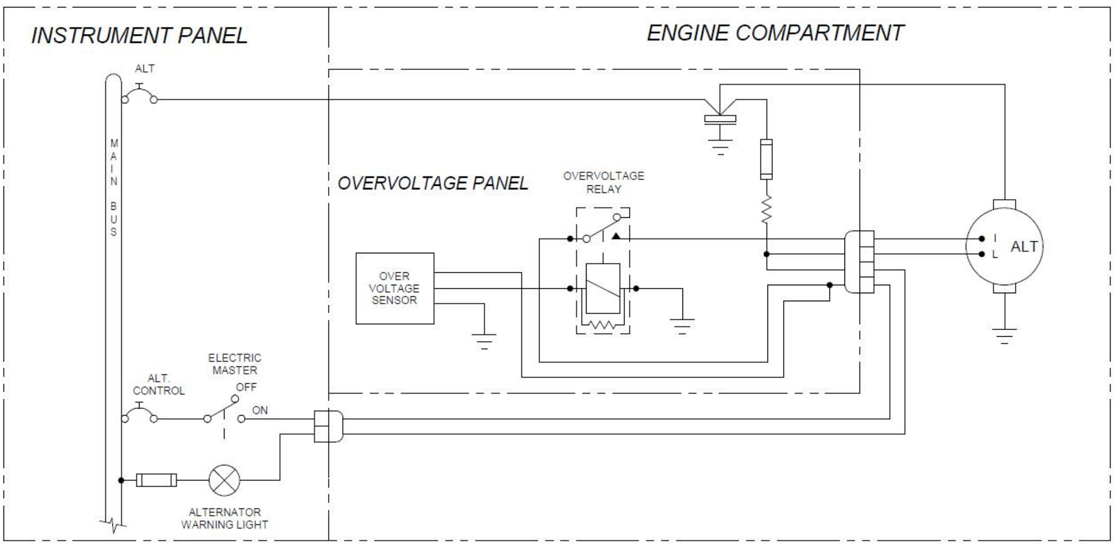

Figure 2: Addition to Electrical Bus Structure Diagram (if OÄM 20-245/b is installed)

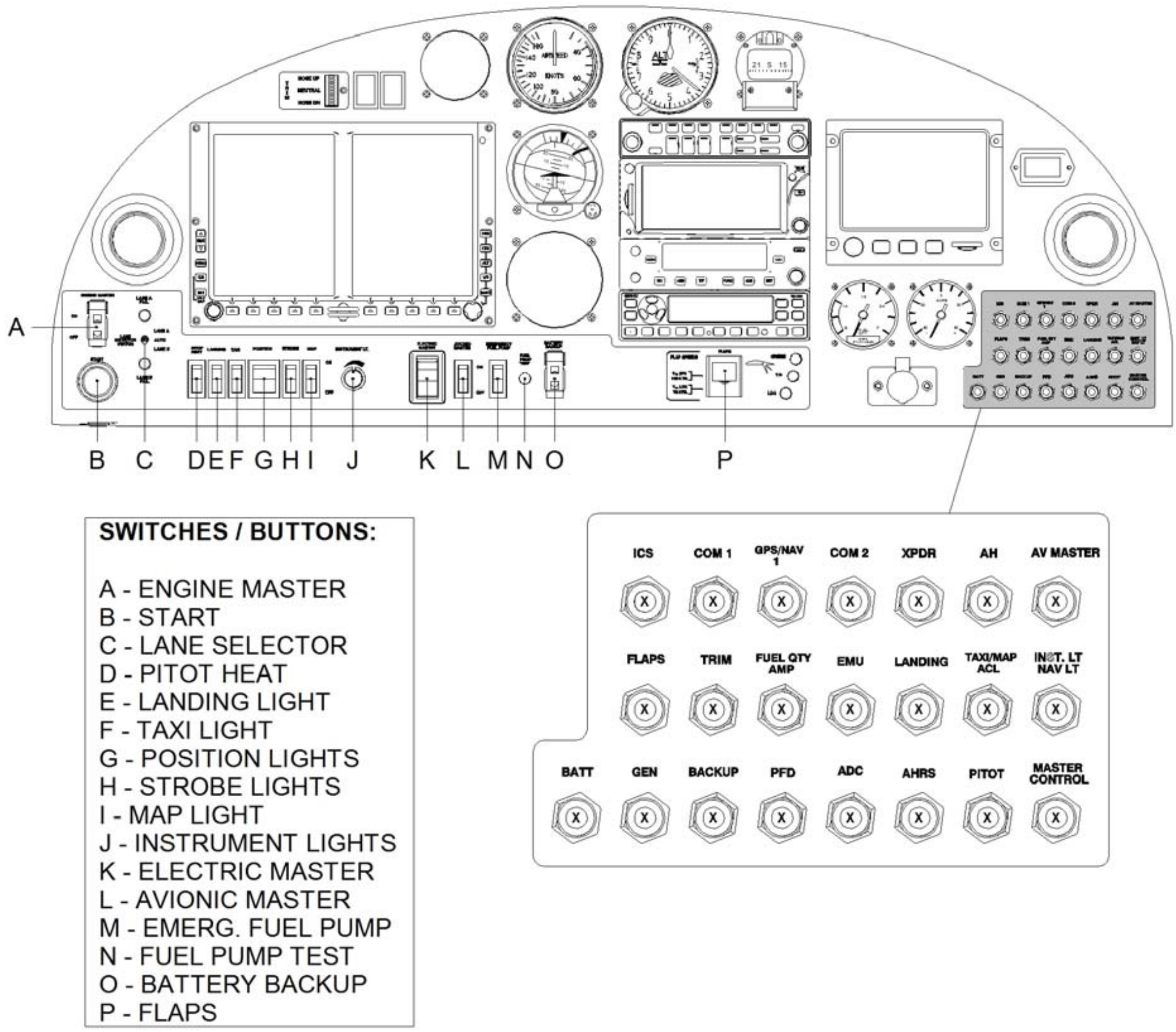

Figure 3: Electrical Switches and Circuit-Breakers

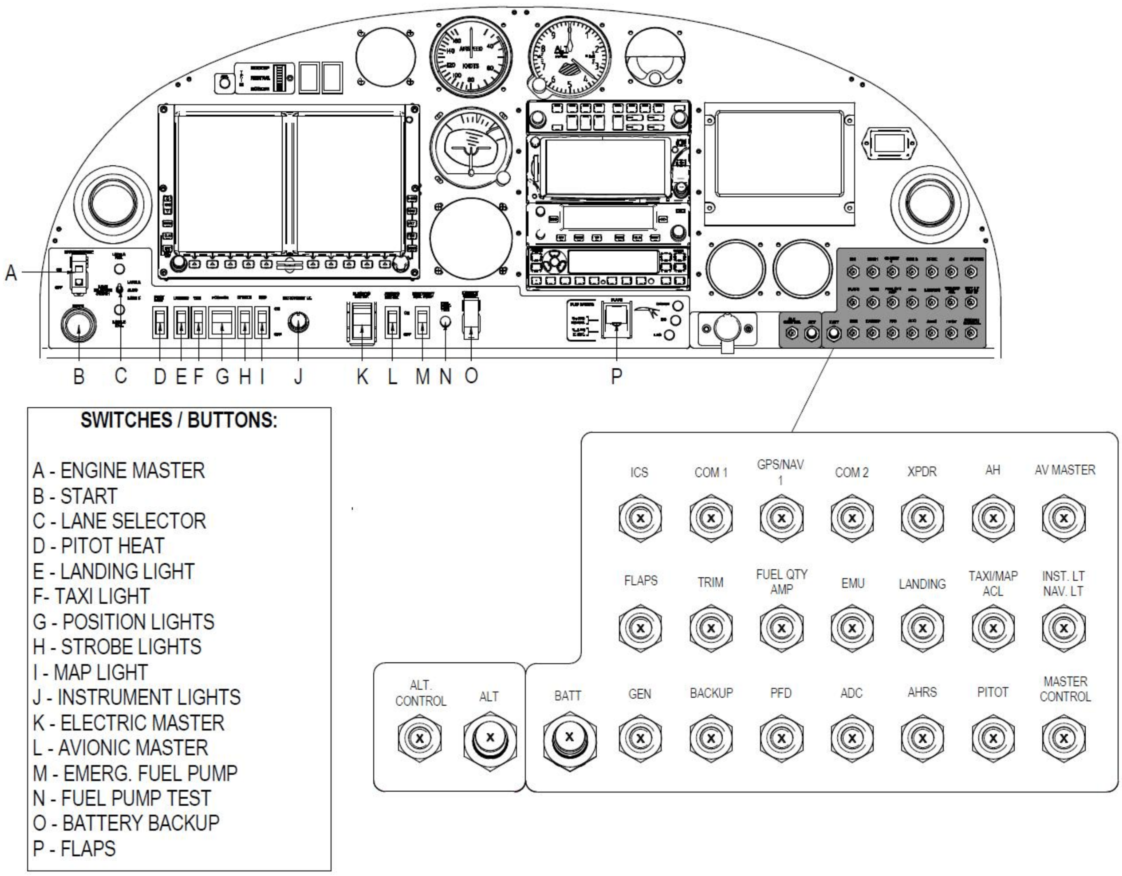

Figure 4: Electrical Switches and Circuit-Breakers (if OÄM 20-245/b is installed)

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Trouble-Shooting

1. General

Make sure that the alternator is supplying power and that there is 14 VDC on the main bus. For faults on a piece of equipment, or a system, refer to the applicable Chapter. For example, for no oil pressure indication, see Chapter 77 - Engine Indicating. The table below lists the defects you could have with the DC load distribution system. If you have the trouble detailed in the Trouble column, read across to the Possible Cause column. Then do the repair given in the Repair column.

Trouble	Possible Cause	Repair
There is 14 VDC on the main bus but not on the avionic bus.	AVIONIC MASTER switch set to OFF.	Set the AVIONIC MASTER switch to ON.
	AV. MASTER circuit-breaker not set.	Set the AV. MASTER circuit breaker.
	Avionics master relay defective.	Replace the avionics master relay.
	A failure of the cables which connect the main bus to the avionics bus.	Do a continuity test of the cables. Refer to Chapter 92 for the wiring diagrams. Repair/replace defective cables.

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Maintenance Practices

1. General

This Section tells you how to remove/install components of the DC load distribution system. Refer to the component manufacturers' manuals for more data and shop data.

2. Electrical Safety

The DV 20 E has a low voltage DC electrical system. When correctly maintained it is safe to work on. The battery can supply heavy current through low resistance circuits (for example, if you connect the positive battery terminal and the negative battery terminal with a wrench by accident).

Always follow the usual safety practices for working on electrical equipment. Allow only qualified persons to maintain the electrical system.

CAUTION: DISCONNECT THE BATTERY BEFORE DOING MAINTENANCE ON THE ELECTRICAL SYSTEM. MAKE SURE THAT YOU DISCONNECT THE NEGATIVE LEAD FIRST.

CAUTION: AFTER DOING ELECTRICAL MAINTENANCE ALWAYS DO A CONFIDENCE TEST OF THE SYSTEM WITH A 12 VOLT POWER SUPPLY THAT HAS OVER-CURRENT PROTECTION. DO THIS BEFORE CONNECTING THE BATTERY.

CAUTION: USE ONLY DV 20 E SPARE PARTS APPROVED BY THE MANUFACTURER.

3. Remove/Install the Avionics Master Relay

A. Remove the Avionics Master Relay

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the battery for maintenance.	Refer to Section 24-31.
(2)	Remove the instrument panel cover.	
(3)	Disconnect the electrical cables from the relay.	
(4)	Remove the bolt, washer and nut which attach the relay to the instrument panel floor.	
(5)	Move the relay clear of the airplane.	

B. Install the Avionics Master Relay

	Detail Steps/Work Items	Key Items/References
(1)	Put the relay in position on the instrument panel floor.	
(2)	Install the bolt, washer and nut which attach the relay to the instrument panel floor.	
(3)	Connect the cables to the relay.	Refer to Chapter 92 for the Wiring Diagrams.
(4)	Install the instrument panel cover.	
(5)	Connect the battery.	Refer to Section 24-31.
(6)	Do a test of the relay: – Set the ELECTRIC MASTER switch to ON. – Set the AVIONIC MASTER switch to ON. – Set the AVIONIC MASTER switch to OFF. – Set the ELECTRIC MASTER switch to OFF.	The equipment connected to the avionic bus must operate.

4. Remove/Install a Circuit-Breaker

A. Remove a Circuit-Breaker

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the main battery for maintenance.	Refer to Section 24-31.
(2)	Remove the instrument panel cover.	
(3)	Remove the nuts and washers which attach the circuit-breakers to the instrument panel.	Do this for all circuit-breakers attached to the same bus bar.
(4)	Remove the screw which connects the circuit-breaker to the copper bus bar.	
(5)	Disconnect the wires from the circuit-breaker.	
(6)	Shift back the copper bus bar together with the remaining circuit-breakers.	
(7)	Remove the circuit-breaker from the instrument panel.	

B. Install a Circuit-Breaker

	Detail Steps/Work Items	Key Items/References
(1)	Put the circuit-breaker in position in the instrument panel.	
(2)	Move the copper bus bar forward together with the remaining circuit-breakers.	
(3)	Connect the wires to the circuit breaker.	Refer to Chapter 92 for the Wiring Diagrams.
(4)	Install the screw which attaches the circuit-breaker to the copper bus bar.	
(5)	Install the nuts and washers which attach the circuit-breakers to the instrument panel.	
(6)	Install the instrument panel cover.	
(7)	Connect the main battery.	Refer to Section 24-31.

	Detail Steps/Work Items	Key Items/References
(8)	Do a functional test of the circuit-breaker: – Set the ELECTRIC MASTER switch to ON. – Operate the electrical system related to the circuit-breaker you will test. – Pull the circuit-breaker. – Close the circuit-breaker. – Set the ELECTRIC MASTER switch to OFF.	Apply the full electrical load to the system. The system must stop operating. Make sure there is no electrical power supplied to the system.

5. Remove/Install an Instrument Panel Switch

This procedure applies to the following switches:

– PITOT.

– LANDING, TAXI, POSITION, STROBE and MAP lights.

– AVIONIC MASTER.

– EMERGENCY FUEL PUMP.

Use procedures given in Sub-paragraphs C and D for other switches.

A. Remove a Clip-Secured-Type Instrument Panel Switch

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the battery for maintenance.	Refer to Section 24-31.
(2)	Remove the instrument panel cover.	
(3)	Disconnect the electrical cables from the switch that you will remove.	

	Detail Steps/Work Items	Key Items/References
(4)	Remove the switch from the instrument panel: – Press the locking clips at the side of the switch to release the switch from the instrument panel. – Move the switch backwards through the instrument panel and clear of the airplane.	 With your fingers from the back of the instrument panel.

B. Install a Clip-Secured-Type Instrument Panel Switch

	Detail Steps/Work Items	Key Items/References
(1)	Hold the spring clips on the switch compressed and put the switch in position in the instrument panel.	From the front of the instrument panel. Make sure that the clips have expanded and that the switch is correctly located.
(2)	Connect the electrical cables to the switch.	Refer to Chapter 92 for the Wiring Diagrams.
(3)	Install the instrument panel cover.	
(4)	Connect the main battery.	Refer to Section 24-31.
(5)	Do a functional test of the switch: – Set the ELECTRIC MASTER switch to ON. – Set the switch that you have installed to ON. – Set the switch that you have installed to OFF. – Set the ELECTRIC MASTER switch to OFF.	 The system must operate correctly. The system must switch off.

Use the procedures in Sub-paragraphs C and D for these nut secured switches/buttons:

– START.

– ENGINE MASTER.

– LANE SELECTOR.

– FUEL PUMP TEST.

– BATTERY BACKUP.

C. Remove a Nut-Secured-Type Instrument Panel Switch

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the main battery for maintenance.	Refer to Section 24-31.
(2)	Remove the instrument panel cover.	Refer to Section 25-10.
(3)	Remove the nut and washer that attaches the switch to the airplane panel.	
(4)	Move the switch backwards and clear of the instrument panel to give access to disconnect the electrical cables from the switch.	
(5)	Disconnect the electrical cables from the switch and move the switch clear of the airplane.	

D. Install a Nut-Secured-Type Instrument Panel Switch

	Detail Steps/Work Items	Key Items/References
(1)	Move the switch into position near to the switch electrical cables.	
(2)	Connect the electrical cables to the switch.	Refer to Chapter 92 for the Wiring Diagrams.
(3)	Move the switch into position in the instrument panel.	Hold the switch in position.
(4)	Install the washer and nut that attach the switch to the instrument panel.	
(5)	Install the instrument panel cover.	Refer to Section 25-10.
(6)	Reconnect the main battery.	Refer to Section 24-31.
(7)	Do a functional test of the switch: – Set the ELECTRIC MASTER key switch to ON. – Set the switch that you have installed to ON. – Set the switch that you have installed to OFF. – Set the ELECTRIC MASTER key switch to OFF.	The system must operate correctly. The system must switch off.

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CHAPTER 25

EQUIPMENT/FURNISHINGS

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TABLE OF CONTENTS

CHAPTER 25

EQUIPMENT FURNISHINGS

Section 25-10

Flight Compartment

Maintenance Practices

Section 25-60

Emergency Equipment

Trouble-Shooting

Maintenance Practices

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CHAPTER 25
EQUIPMENT FURNISHINGS

1. General

This chapter describes about the equipment and furnishing in the flight compartment. Chapter 25-10 includes the cabin trim panels, pilot's seats and safety belts. Chapter 25-60 gives the data for the Emergency Location Transmitter (ELT).

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Section 25-10

Flight Compartment

1. General

The flight compartment contains fixed seats for two pilots. Each pilot has a safety belt. The fuselage shell has fabric wall panels. GFRP or CFRP moldings make the instrument panel cover and the center console. Refer to Chapter 25-60 for data about the Emergency Locator Transmitter (ELT).

2. Description

A. Pilot’s Seats

Each pilot's seat has the following three parts:

– A molded GFRP backrest which is integral with the bulkhead.

– A molded GFRP or CFRP seat pan which also makes the outer arm rest for the seat.

– A full-length padded seat cushion.

B. Safety Belts

Each pilot's seat has a four-point safety belt with a central lock. The pilot can adjust each of the four straps to give the correct fit. Shoulder straps with inertia reels are optional. Replace frayed or damaged straps.

C. Fabric Wall Panels

Fabric wall panels bond to the inside of the fuselage shell. Each panel has a map pocket. Optionally some airplane may have GFRP or CFRP wall panels with fabric coverings. The panels are attached with Velcro and screws.

D. Instrument Panel Cover

A CFRP cover goes over the instrument panel. The outer face of the cover is painted. The cover has two air vents for avionic cooling. The air vents are used as hand-holds to help the pilot's to go in or out of the cockpit. Screws attach the cover to the instrument panel. The instrument panel cover has a de-frost manifold. The de-frost manifold connects to the cabin heating system. The manifold supplies warm air to the front of the canopy to prevent misting.

E. Center Console Access Panel

The center console has an access panel for the controls in the center console.

F. Baggage Compartment Floor Panel

The baggage compartment floor has three pieces. You can remove the center piece by itself. The outer pieces make stowage boxes. The pieces are made of GFRP or CFRP.

G. Baggage Net

A net attaches to the front of the floor panel. Quick-release hooks attach it to the roll bar.

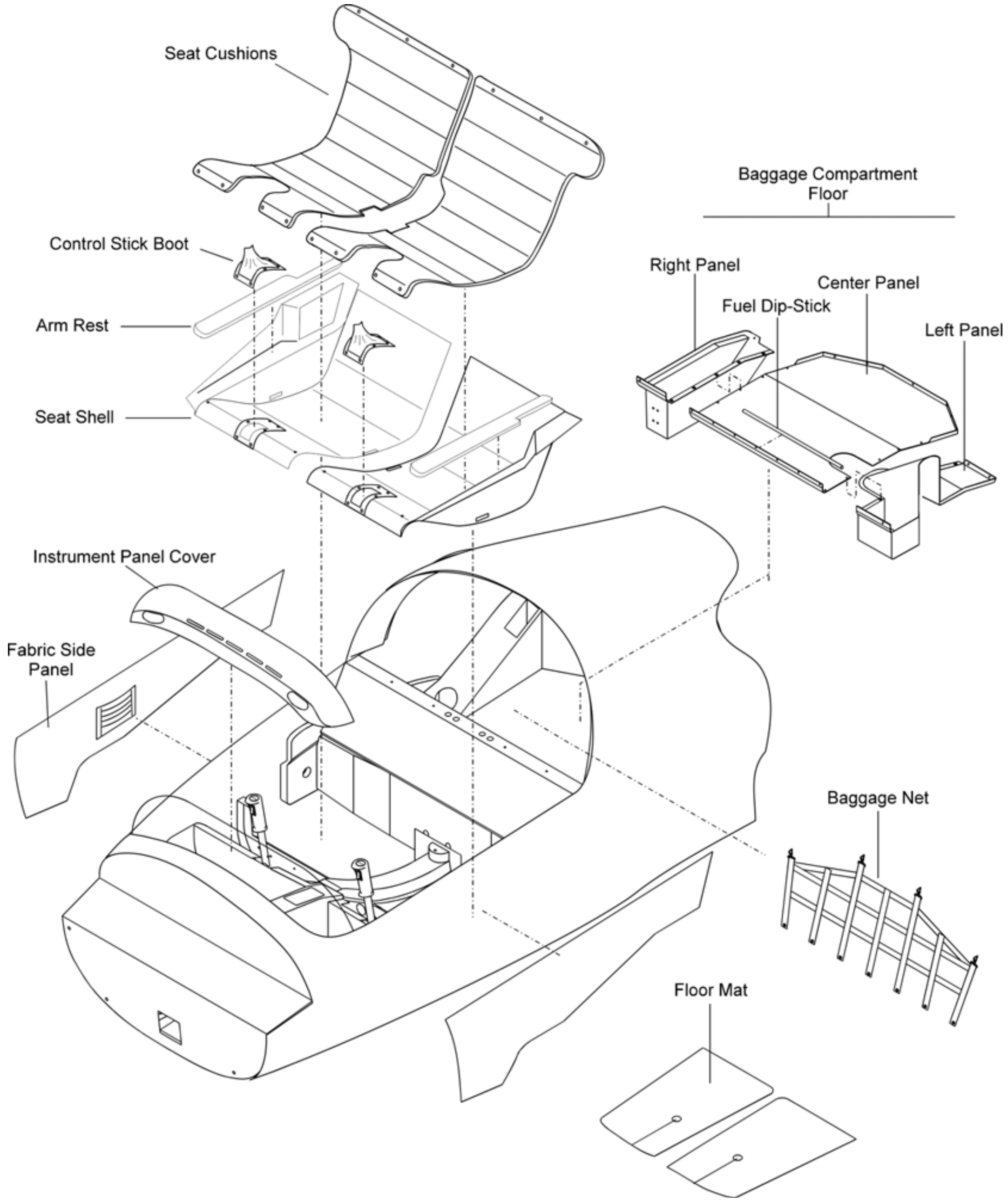

Figure 1: Flight Compartment Furnishing Locations

Maintenance Practices

1. General

The following maintenance practices describe how to remove/install the seats and other furnishings. Refer to Chapter 25-60 for data about the ELT.

2. Remove/Install a Pilot's Seat

A. Remove a Pilot's Seat

	Detail Steps/Work Items	Key Items/References
(1)	Release the press-studs which hold the seat cushion and remove the seat cushion.	
(2)	Remove the boot for the control stick.	
(3)	Remove the five screws from the seat shell.	
(4)	Lift the seat a little: – Release the quick-release fastener for the outer strap. – Move the inner strap through the hole in the seat shell.	Take care not to loose the rubber strips from the holes.
(5)	Remove the seat shell.	

B. Install a Pilot's Seat

	Detail Steps/Work Items	Key Items/References
(1)	Make sure that there are no unwanted items below the seat.	
(2)	Make sure that the outer strap is in position in the seat shell.	
(3)	Move the inner strap through the hole in the seat shell.	Make sure that the rubber strips are in position on the hole.
(4)	Put the seat shell in position.	
(5)	Install the attaching screws.	
(6)	Install the boot for the control stick.	
(7)	Install the seat cushion.	

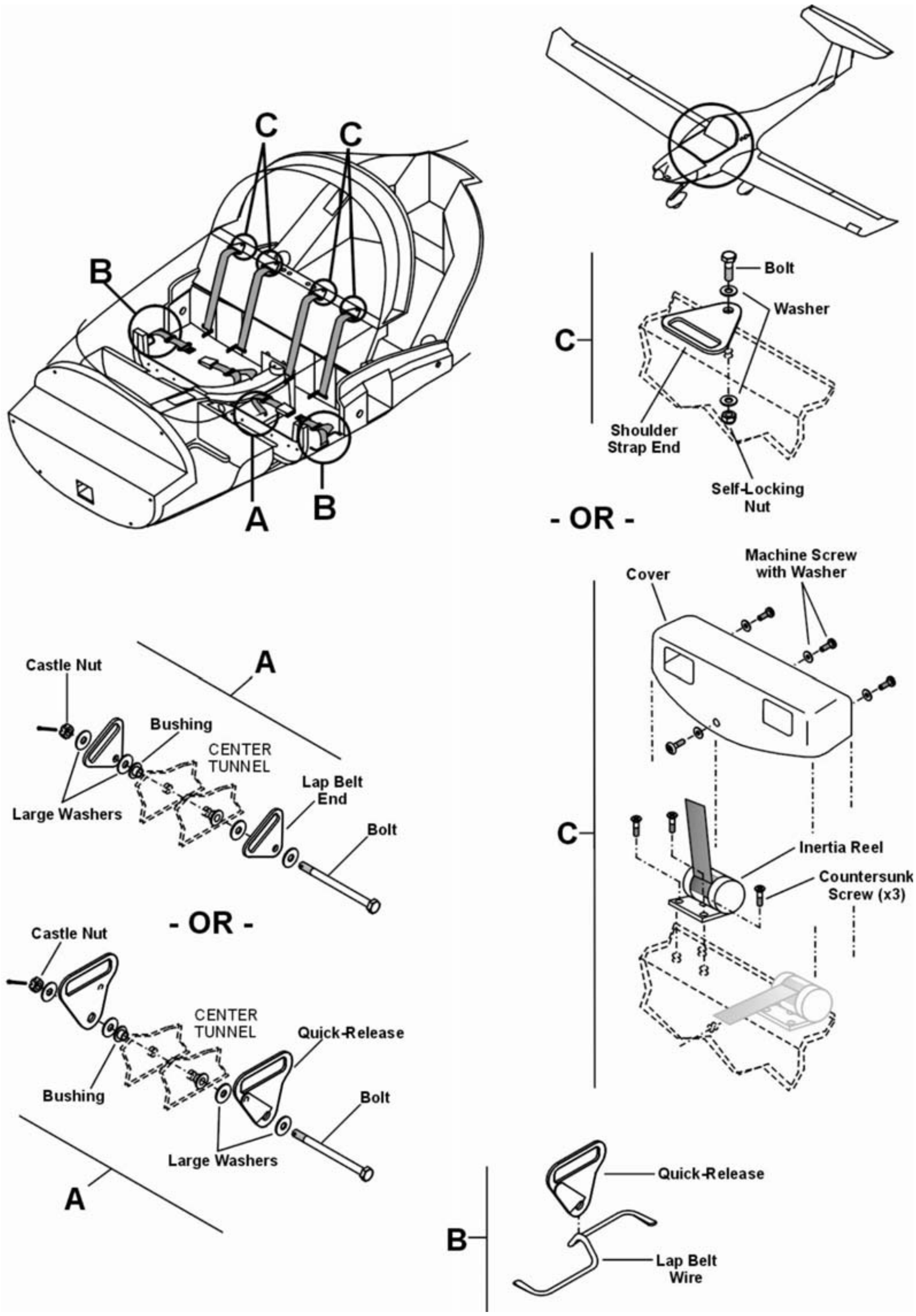

Figure 2: Safety Belt Installation

3. Remove/Install a Safety Belt

A. Remove a Safety Belt

	Detail Steps/Work Items	Key Items/References
(1)	Release the bolts that attach the shoulder straps, or remove the cover and the three screws that attach the inertia reels.	Refer to Figure 2.
(2)	Remove the seat shell.	Refer to Paragraph 2.
(3)	Remove the lap strap with the central lock by releasing the quick release.	
(4)	Loosen the mounting bolt for the lap strap without a central lock. Pull the strap from the mounting, or release the quick release.	

B. Install a Safety Harness

	Detail Steps/Work Items	Key Items/References
(1)	Connect the lap strap without the central lock onto the mounting using the quick release.	
(2)	Install the mounting ball with the ends of the lap straps with the central lock, or install quick release.	
(3)	Install the seat shell.	Refer to Paragraph 2.
(4)	Put the shoulder straps in position and install the attaching bolts. Or attach the inertia reels with the three screws and install the plastic covers.	Refer to Chapter 92 for wiring diagrams.

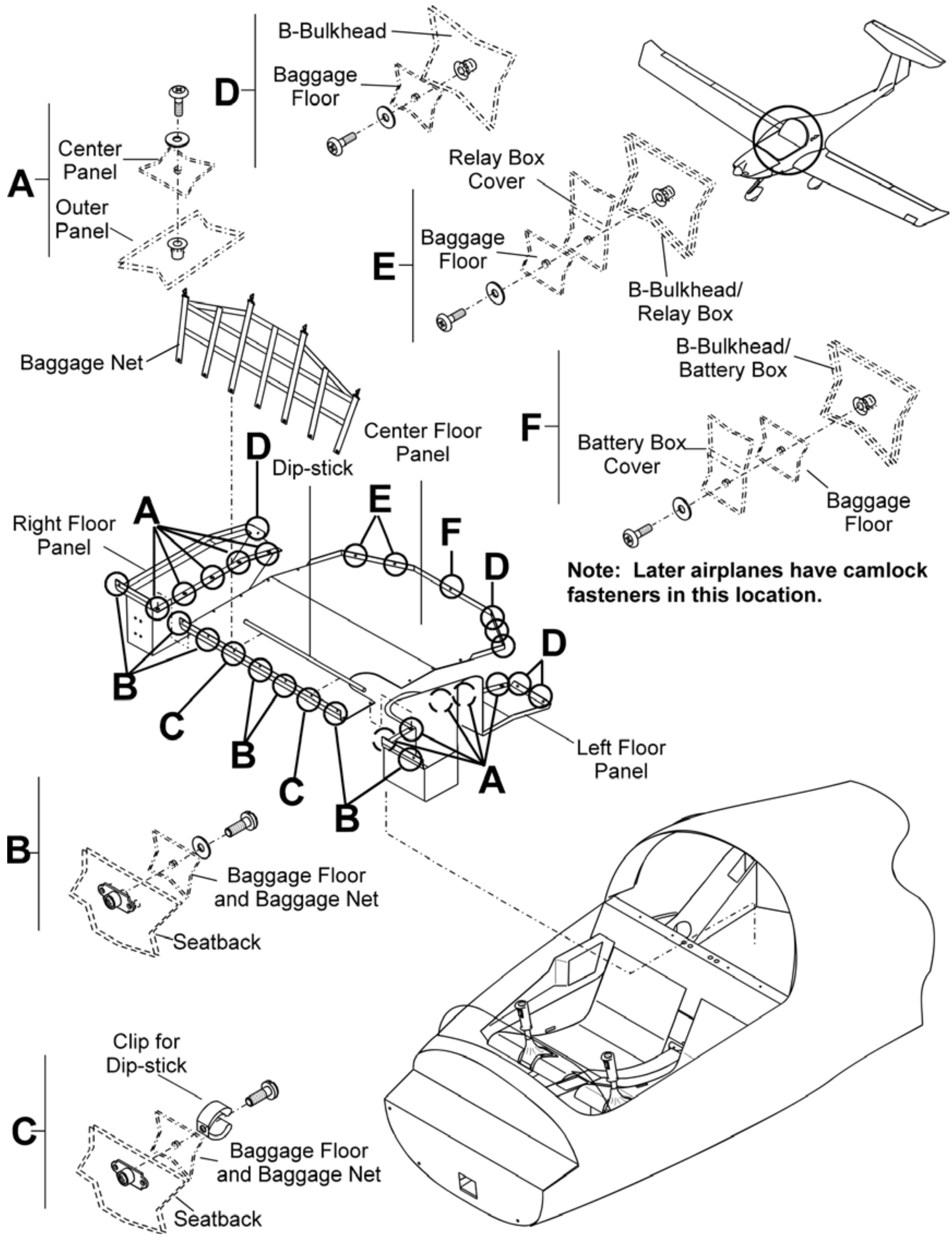

Figure 3: Baggage Compartment Floor Panel Installation

4. Remove/Install the Instrument Panel Cover

A. Remove the Instrument Panel Cover

	Detail Steps/Work Items	Key Items/References
(1)	Remove the screws which attach the instrument panel cover to the instrument panel and the fuselage.	
(2)	Lift the cover far enough to give access to the defrost hoses..	
(3)	Loosen the hose clamps on the defrost hoses. Remove the hoses from the cover.	
(4)	Lift the cover clear of the airplane.	

B. Install the Instrument Panel Cover

	Detail Steps/Work Items	Key Items/References
(1)	Do a check for unwanted items in the area between the firewall and the instrument panel.	For example: tools.
(2)	Put the instrument panel cover in position just above the instrument panel.	
(3)	Connect the defrost hoses to the cover.	
(4)	Tighten the hose clamps on the defrost hoses.	
(5)	Lower the cover into position on the instrument panel.	
(6)	Install the attaching screws.	

5. Remove/Install the Baggage Compartment Floor Panel

Refer to Figure 3.

A. Remove the Baggage Compartment Floor Panel

	Detail Steps/Work Items	Key Items/References
(1)	Remove inertia reel covers, if fitted.	
(2)	Remove the screws around the aft edge of the center floor panel.	
(3)	Remove the screws along the joints for the left and right panels.	
(4)	Remove the fuel dip-stick from the clips.	
(5)	Remove the screws along the front edge of the center panel.	Note the location of the baggage net and the gripper clips for the dip-stick.
(6)	Lift the center panel clear.	
(7)	If necessary, remove the screws from the outer edges of the outer panels.	Only remove the outer panels, if necessary.
(8)	Lift the outer panel clear.	

B. Install the Baggage Compartment Floor Panel

	Detail Steps/Work Items	Key Items/References
(1)	Make sure that there are no unwanted items below the floor panel.	
(2)	If necessary, put the outer floor panels in position.	
(3)	Install the screws around the edge of the outer panels.	
(4)	Put the center floor panel in position.	
(5)	Loosely install the screws along the forward edge of the panel.	Each screw attaches the baggage net. Two screws also attach the clips for the dip-stick.
(6)	Loosely install the screws along the joints of the left and right panels and the center panel.	

	Detail Steps/Work Items	Key Items/References
(7)	Loosely install the screws along the aft edge of the center panel.	
(8)	Install inertia reel covers, if fitted.	
(9)	Tighten all of the screws.	

6. Cleaning

A. Seats

The seat cushions are a fire resistant material. Clean the cushions with a vacuum cleaner. Use a mild soap solution to remove stains.

B. Safety Belts

Use a mild soap solution to remove dirt from the safety belts.

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Section 25-60

Emergency Equipment

1. General

This chapter describes about the optional ARTEX ELT model ME 406. Refer to the manufacturer's Operator's Manual for more data.

2. Description

A. ELT Equipment

(1) Location

The ME 406 ELT is located in a mounting bracket on the right side of the rear fuselage compartment adjacent to the baggage tray. A strap attached to the mounting bracket holds the ME 406 ELT in position. The ME 406 ELT has an antenna installed through a side bracket hole in accordance with the Artex ME 406 Manual.

(2) Signal Transmission

The ME 406 ELT transmits signals automatically after a crash on the emergency frequencies of 121.5 and 406.028 Megahertz (MHz). Every 50 seconds the transmitter transmits a signal on the 406.028 MHz frequency to a satellite. The signal to the satellite contains the serial number of the ELT transmitter or the airplane ID, a country code and a unique identity code. The satellite will also give the emergency services a more accurate location for the airplane.

(3) Functional Test

Do regular functional tests (Refer to the Maintenance Practices in this Section).

B. ELT Batteries

The ME 406 ELT has its own battery pack to supply electrical power. When the ELT is ON and transmitting, the batteries will keep the ELT transmitting the 121.5 MHz frequency until battery power is drained out and will transmit the 406.028 MHz frequency for up to 24 hours.

It is important to monitor the battery expiry dates for the battery pack. The expiry date for the battery pack is shown on the identity plate for the transmitter. The battery pack must be replaced:

- After use in an emergency.
- After the transmitter has been accidentally switched ON for an unknown period of time.
- After 1 hour of accumulated use (testing).
- On or before the battery pack expiry date.

3. Operation

A. ELT

The ELT has a switch with the following two positions:

- ON
- ARM

The ON position is for ground test. When the airplane is in use, the switch must be in the ARM position.

(1) Emergency Operation

If the airplane crashes, then the accelerometer senses the crash. The accelerometer sets the transmitter to ON. The transmitter transmits the international distress frequency and on 406.028 MHz. The battery in the ELT supplies power to the transmitter. The battery can operate the ELT for at least 50 hours.

(2) Test

If you switch the ELT to 'ON', then the following occurs:

- A LED flashes in the ELT unit.

NOTE: If more than 1 flash is observed, refer to the ELT Installation manual 570-1600.

- If you set the radio to 121.5 MHz, you can hear three audio sweeps tone from the ELT.

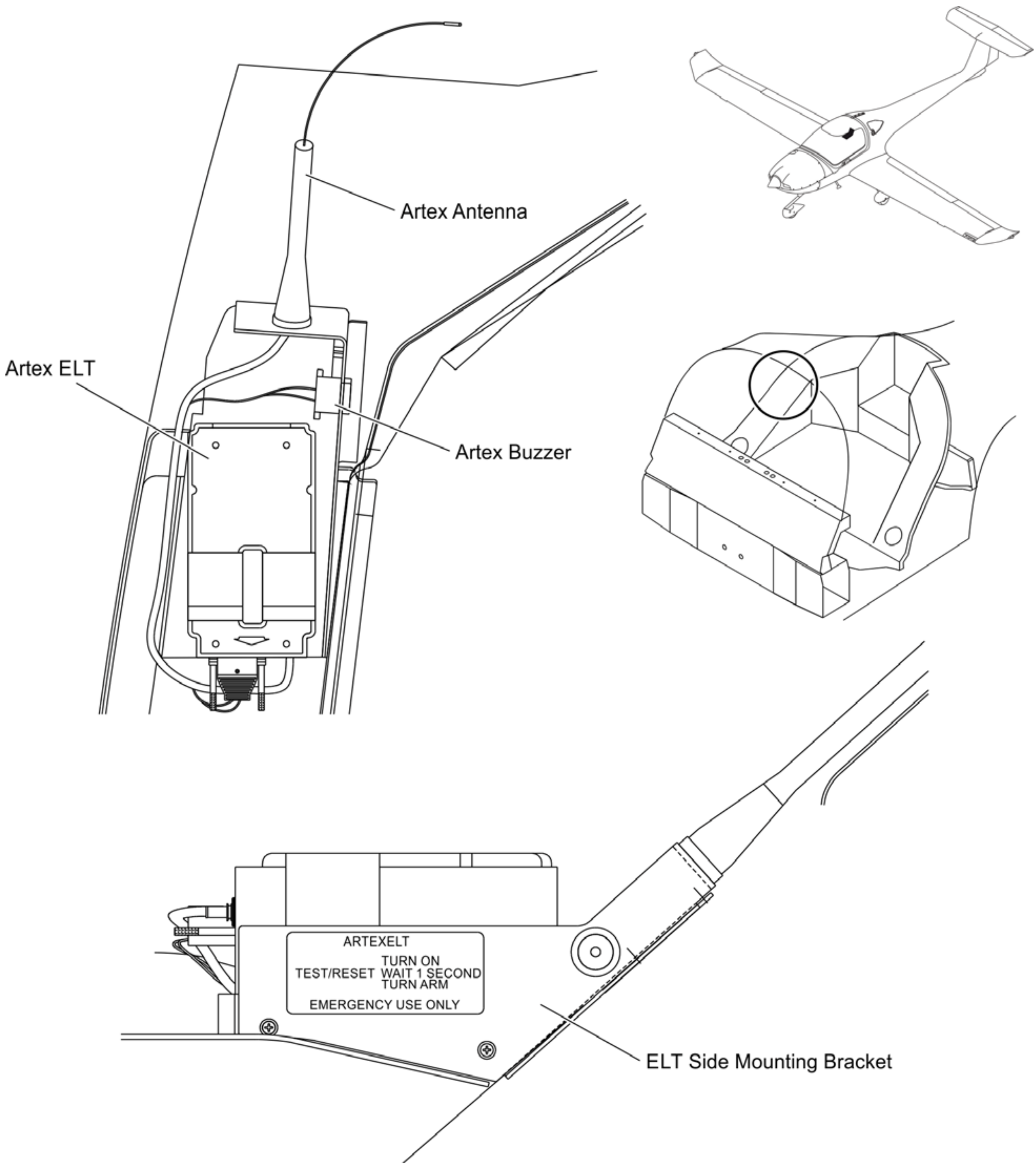

Figure 1: ARTEX Model ME 406 ELT Installation

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Trouble-Shooting

1. General

This table explains how to troubleshoot the ELT system. If you find the trouble in column 1, do the repair given in column 3.

Trouble	Possible Cause	Repair
ELT does not operate on test.	ELT batteries discharged.	Replace the ELT batteries.
	ELT defective.	If the ELT batteries are serviceable, then replace the ELT.

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Maintenance Practices

1. General

This chapter describes how to:

– Remove and install the ELT.

– Test the ELT in the airplane.

– Replace the batteries in the ELT.

This chapter also describes the periodic maintenance necessary to maintain the ELT equipment in a serviceable condition.

2. Remove/Install the ELT

A. Remove the ELT

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect all the cables from ELT.	At the ELT.
(2)	Release the strap that holds the ELT in its mounting and remove the ELT from the airplane.	
	NOTE: If the ELT is moved to a different airplane which it was originally registered with, then the ELT must be registered and the product label re-marked to indicate the new programming and/or new country of registry.	

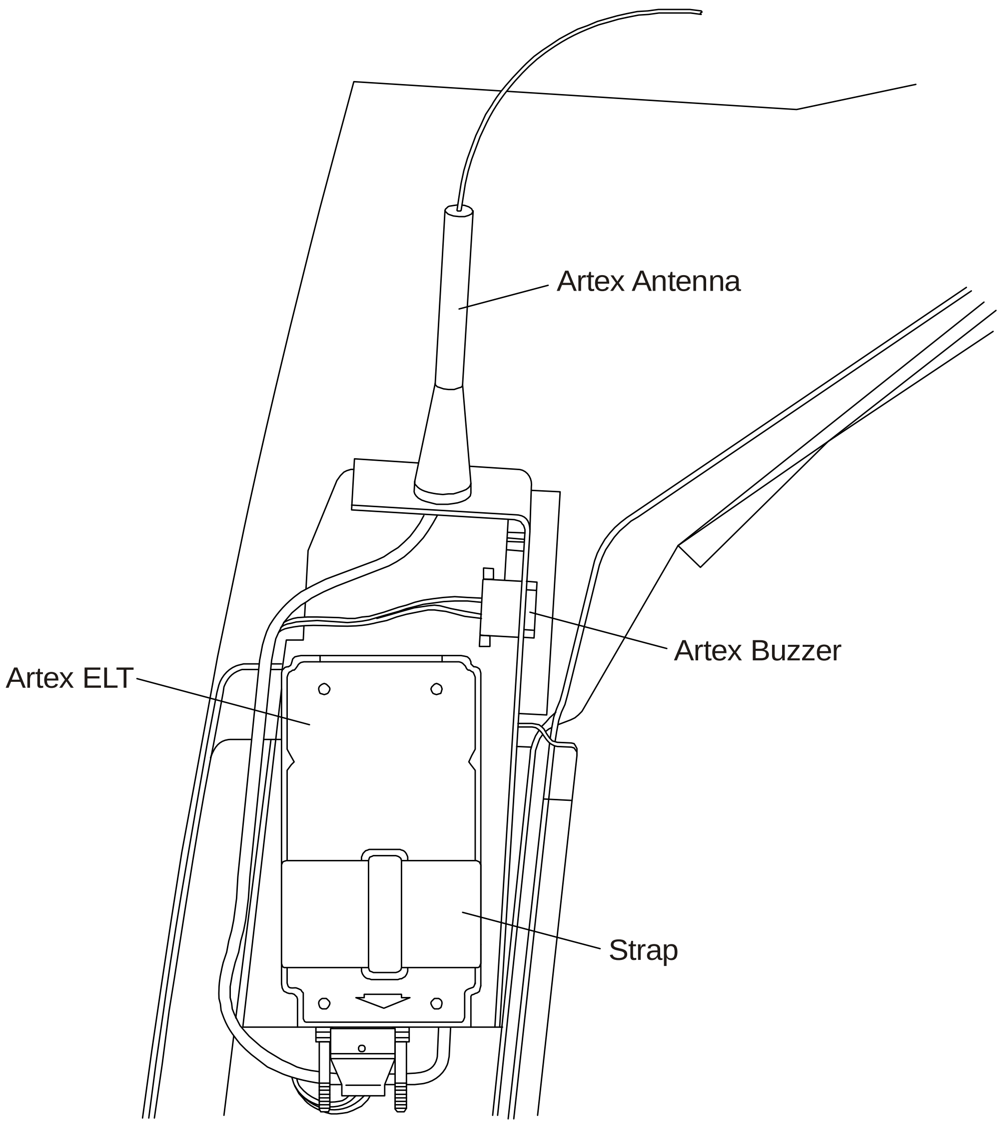

Figure 2: Removal/Installation of ME 406 ELT

B. Install the ELT

	Detail Steps/Work Items	Key Items/References
	NOTE: If the ELT is moved to a different airplane which it was originally registered with, then the ELT must be registered and the product label re-marked to indicate the new programming and/or new country of registry.	
(1)	Put the ELT into position to the mounting bracket.	
(2)	Secure the ELT with the strap.	
(3)	Connect all the cables to the ELT that were disconnected during removal.	
(4)	Do a test for the correct operation of the ELT.	Refer to Paragraph 3.

3. ELT Functional Test

CAUTION: DO NOT ALLOW THE TEST DURATION TO EXCEED 5 SECONDS. THE ELT WILL TRANSMIT A 406.025 MHZ SIGNAL AFTER THE ELT IS ACTIVE FOR APPROXIMATELY 47 SECONDS. THE SATELLITE SYSTEM CONSIDERS THIS TRANSMISSION TO BE A VALID DISTRESS SIGNAL.

NOTE: Do this test only during the first 5 minutes of each hour. If you are at a location with a control tower or other monitoring facility, tell them before you do the test.

	Detail Steps/Work Items	Key Items/References
(1)	Set the AVIONICS MASTER switch to ON.	
(2)	Set the radio to receive on 121.5 MHz.	
(3)	Set the ELT switch to ON for 1 second.	
(4)	Make sure that the receiver voices three audio sweep tones.	
(5)	Set the ELT switch to ARM.	Pay special attention to the LED activity upon entering the 'ARM' condition. If a problem is detected, the LED provides a coded signal following the initial 1 second pulse. Refer to the ME 406 ELT manufacturer's Operator's Manual for coded signals.
(6)	Make sure that the ELT unit flashes once.	
(7)	Set the AVIONICS MASTER switch to OFF.	

4. Replace the ELT Batteries

You must only use a battery pack that is supplied by the equipment manufacturer.

NOTE: The battery pack contains components that are sensitive to static electricity. You must take electro-static discharge precautions before doing work on the battery pack.

NOTE: The battery pack is connected to the ELT by a short electrical cable assembly. You must take care not to strain this cable when you separate the battery pack from the ELT.

	Detail Steps/Work Items	Key Items/References
(1)	Remove the ELT from the airplane ELT mounting.	Refer to Paragraph 2.
(2)	Remove the battery pack as follows: – Remove the eight screws from the battery side cover. – Carefully move the battery pack a short distance clear of the ELT. – Disconnect the wiring harness. – Move the battery pack clear of the ELT.	Hold the battery pack to the ELT with your hand to prevent the battery pack separating from the ELT.
(3)	Do a visual inspection of the underside of the ELT (the battery pack side). Look especially for corrosion or other damage to the ELT casing.	
(4)	Prepare the new battery pack for installation.	
(5)	Lay the battery pack on the work surface with the batteries facing up.	
(6)	Install the replacement seal.	In the slot along the perimeter housing.
(7)	Position the ELT over the battery pack and plug the connector into the battery assembly.	Make sure that the cable is not twisted and that the connector is correctly attached.
(8)	Mate the ELT to the battery.	Make sure that the seal is positioned correctly.

	Detail Steps/Work Items	Key Items/References
(9)	Install the 8 screws that attach the battery pack to the ELT.	
(10)	Install the ELT in the airplane mounting and attach the Battery Pack Replacement Date label to the top surface of the ELT protective cover where it can be easily seen.	Refer to Paragraph 2.
(11)	Record the details of the ELT battery pack replacement date in the airplane log-book.	
(12)	Do a functional test of the ELT.	Refer to Paragraph 3.

5. ELT Periodic Inspection

The ELT installation must be inspected at least once every 12 months to maintain serviceability.

	Detail Steps/Work Items	Key Items/References
(1)	Examine the ELT and the ELT mounting tray, look specially for: – Security of the fasteners. – Security of all mechanical assemblies.	
(2)	Examine the cable which connects the ELT. Look specially for: – Cuts or abrasions to the outer sheath of the cable.	
(3)	Read the expiry date of the system battery and replace the battery if necessary.	Refer to Paragraph 4.

CHAPTER 26

FIRE PROTECTION

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TABLE OF CONTENTS

CHAPTER 26

FIRE PROTECTION

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CHAPTER 26
FIRE PROTECTION

1. General

This chapter describes the fire extinguisher installed in the airplane. Refer to the manufacturer's manual for more data about the fire extinguisher.

2. Description

Figure 1 shows the installation of the fire extinguisher in the airplane. The fire extinguisher is located behind the right seat in the baggage compartment. Bolts attach the mounting bracket for the fire extinguisher to the baggage compartment floor. The extinguisher uses a dry powder which is non-toxic. The powder does not leave a residue.

The only on-airplane maintenance is:

– Monitor the pressure indicator. It must show in the green sector.

– Make sure that the seal wire is not broken.

– Make sure that the extinguisher is correctly held in the mounting.

If the seal wire is broken, remove the extinguisher for weighing. Weight data is given on the extinguisher body.

You must replace the extinguisher (or return it to the manufacturer for repair) when:

– The weight is incorrect.

– The pressure is too low.

– The extinguisher has been used.

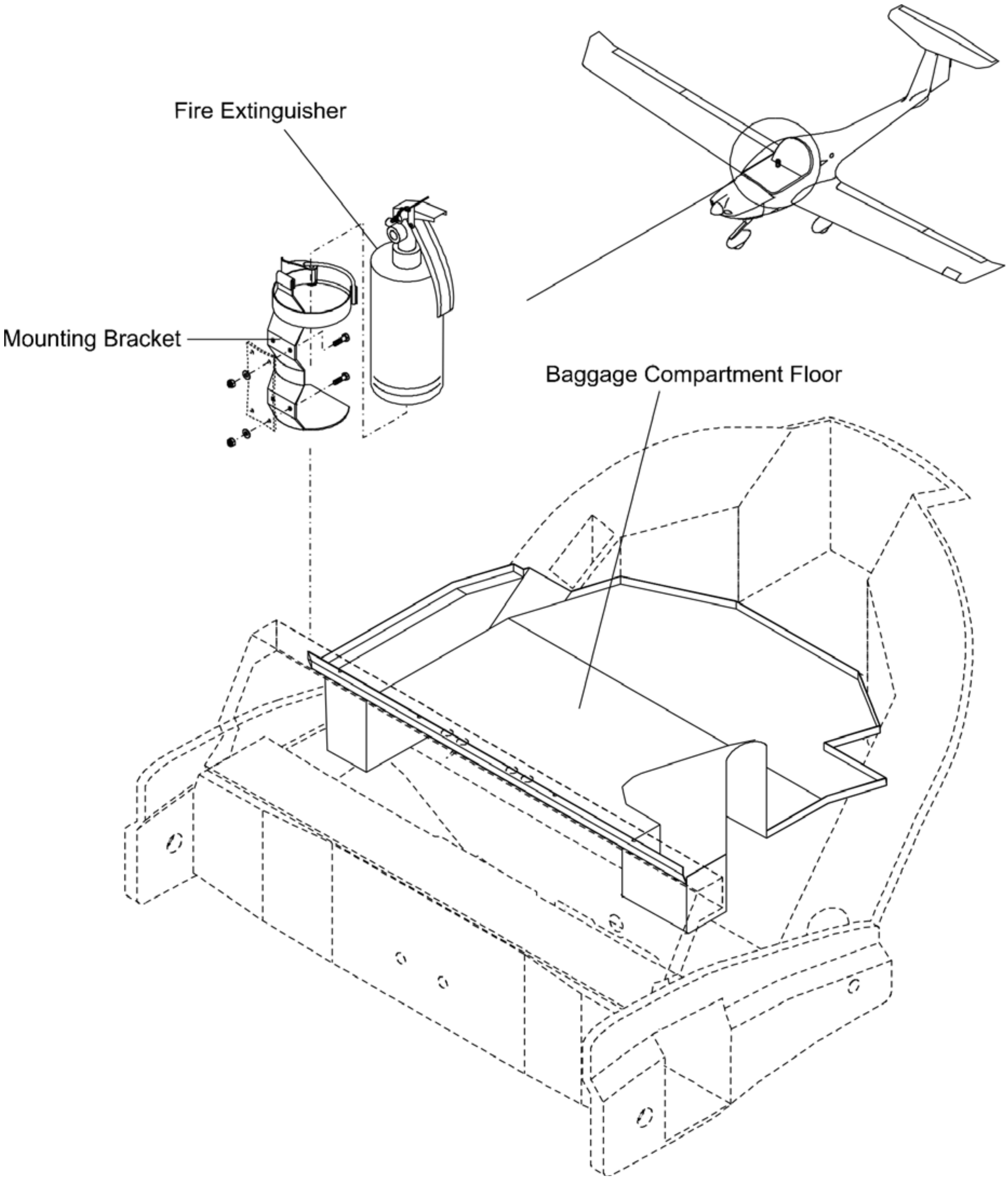

Figure 1: Fire Extinguisher Installation

CHAPTER 27

FLIGHT CONTROLS

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TABLE OF CONTENTS

CHAPTER 27

FLIGHT CONTROLS

Maintenance Practices

Section 27-10

Flight Controls - Aileron and Tabs

Trouble-Shooting

Maintenance Practices

Section 27-20

Flight Controls - Rudder and Tab

Trouble-Shooting

Maintenance Practices

Section 27-30

Flight Controls - Elevator

Trouble-Shooting

Maintenance Practices

Section 27-31

Flight Controls - Elevator Trim-Mechanical

Trouble-Shooting

Maintenance Practices

Section 27-50

Flight Controls - Flaps

Trouble-Shooting

Maintenance Practices

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CHAPTER 27
FLIGHT CONTROLS

1. General

This chapter describes about the operation and the adjustment of the flight controls. It also describes about the assembly of the flight controls. Refer to the related section for the data on a specified system.

This chapter describes how standard parts are used to make the flight controls for each system.

2. Description

The DV 20 E airplane has the usual flight controls. An elevator attached to the horizontal stabilizer gives longitudinal control. Ailerons attached to the trailing edge of each wing give lateral control. The rudder attached to the Vertical Stabilizer gives yaw control. Flaps attached to the trailing edge of each wing give extra lift for landing and for take-off.

The DV 20 E airplane has a control stick for each pilot. The pilot can set the elevator trim with a control switch in the control stick.

Each pilot has a rudder pedal assembly. The assembly attaches to the cockpit floor. The pilot can adjust the position of the rudder pedals with a T-grip selector on the rudder pedal assembly.

The pilot moves each primary control through a system of control rods and bellcranks. Cables operate the rudder. An electric actuator operates the flaps.

3. Control Rods

The control rods used in the DV 20 E airplane have standard end fittings. Also most rods use a standard diameter tube. Only the length of the rods is special.

Figure 1 shows an example of a standard control rod. The rod has adjustable end fittings. Each end fitting has an eye end with a threaded shaft. The eye end has a bearing. A lock nut on the threaded shaft locks the eye end in position. You can turn the eye end to adjust the length of the rod.

A steel tube connects the end fittings. Threaded inserts are welded into position in the end of each steel tube. A safety hole is drilled in each end of the steel tube. The safety hole shows you if the installation of the eye end to the insert in the steel tube is correct. If you can push the safety wire through the hole to the other side, the eye end installation is not correct. If you cannot push the safety wire through the hole, the eye end installation is correct.

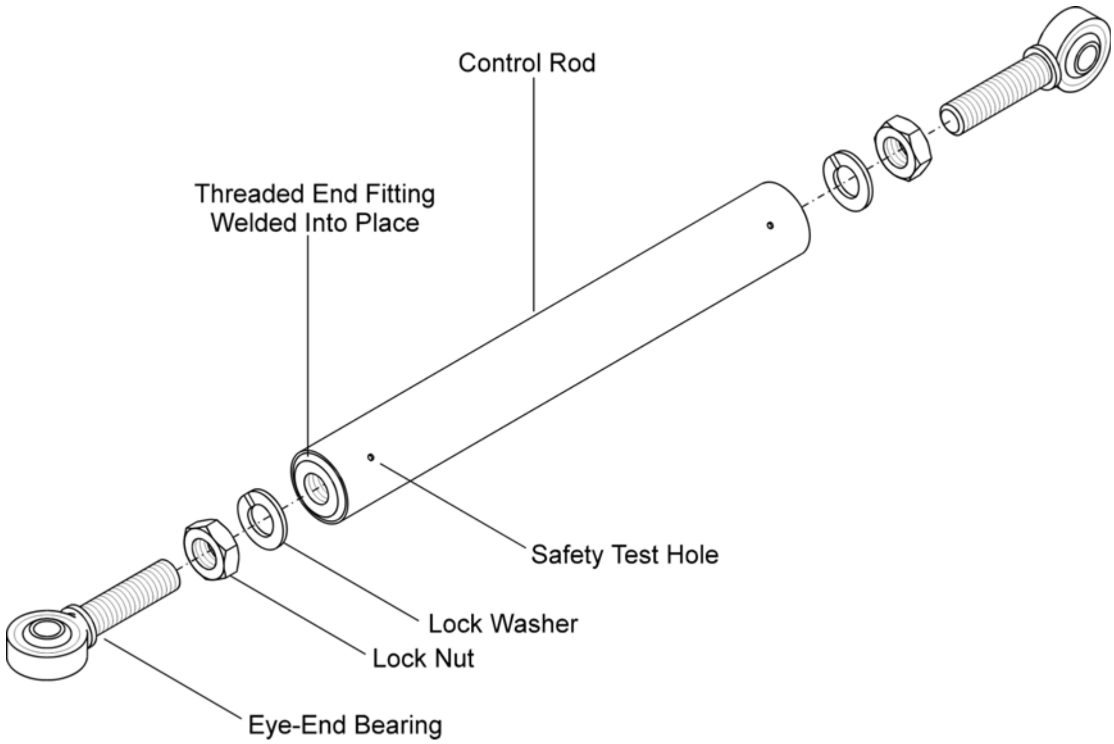

Figure 1: Standard Control Rod

Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the control stick.

WARNING: DO ALL THE STEPS OF THE CONTROL STICK INSTALL PROCEDURE CAREFULLY. CONTROL FAILURE CAN OCCUR IF THE CONTROL STICK INSTALLATION PROCEDURE IS NOT DONE CORRECTLY. THIS CAN CAUSE DEATH OR INJURY TO PERSONNEL.

WARNING: WHEN YOU DO WORK ON THE AIRPLANE CONTROLS, MAKE SURE THAT THE AREA AROUND THE CONTROLS/CONTROL SURFACES ARE CLEAR OF PERSONNEL/EQUIPMENT. IF YOU DO NOT DO THIS, INJURY TO PERSONNEL AND DAMAGE TO CONTROL SURFACES CAN OCCUR.

WARNING: WHEN YOU COMPLETE WORK ON THE CONTROLS, MAKE SURE THAT YOU REMOVE ALL LOOSE ITEMS/TOOLS FROM THAT AREA. LOOSE ITEMS/TOOLS CAN PREVENT FULL MOVEMENT OF THE AIRPLANE CONTROLS. THIS CAN CAUSE DEATH OR INJURY TO PERSONS.

2. Remove/Install the Control Stick

A. Remove the Control Stick

	Detail Steps/Work Items	Key Items/References
(1)	Remove the pilots' seats.	Refer to Section 25-10.
(2)	Make sure that the area around the controls/ control surfaces is clear of personnel/ equipment.	
(3)	Cut the tie-wraps that hold the electrical cables to the control stick. – Disconnect the electrical cables from the control stick. – Disconnect the ground cable from the control stick connection.	Refer to Section 27-10, Figure 1.
(4)	Disconnect the aileron control rod from the control stick: – Remove the bolt that connects the aileron control rod to the control stick.	Refer to Section 27-10, Figure 1.
(5)	Disconnect the control stick from the torque tube assembly: – Remove the bolt that connects the control stick to the torque tube assembly. – Move the control stick clear of the torque tube assembly.	Refer to Section 27-10, Figure 1.

B. Install the Control Stick

	Detail Steps/Work Items	Key Items/References
(1)	Examine the bearing of the aileron control rod. Make sure it is serviceable before you install the control stick.	Refer to Section 27-10, Figure 1.
(2)	Put the control stick in position in the torque tube assembly. – Install the bolt that holds the control stick to the torque tube assembly.	Refer to Section 27-10, Figure 1. Torque to 5.6 Nm (4.2 lbf-ft).
(3)	Put the aileron control rod in position in the control stick. – Install the bolt that holds the aileron control rod to the control stick.	Refer to Section 27-10, Figure 1. Make sure that the aileron control rod is at right angles to the control stick with the control sticks centered. Torque to 4.5 Nm (3.3 lbf-ft) (Shear nut).
(4)	Connect the ground cable to the control stick.	Make sure that the cable does not limit the movement of the control stick.
(5)	Connect the electrical cables to the control stick. – Crimp the two connections. – Tie-wrap the cables to the control stick.	Make sure that the cable does not limit the movement of the control stick.
(6)	Do a functional test of the press to transmit button and the trim switch.	Refer to Section 23-10.
(7)	Search for loose foreign objects of the area. Make sure that you remove all foreign objects.	
(8)	Do a test for correct operation of the controls and full range of movement. – If necessary, adjust the controls. – If necessary for your airworthiness authority, do a second inspection of the controls.	Refer to Section 27-10 and Section 27-30.
(9)	Install the pilots' seats.	Refer to Section 25-10.

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Section 27-10

Flight Controls - Aileron and Tabs

1. General

The DV 20 E airplane has two control sticks that operate the ailerons. The aileron control system uses control rods and bellcranks.

A fixed trim tab attaches to the trailing edge of the left aileron.

Figure 1 shows the aileron controls in the fuselage, and Figure 2 shows the aileron controls in the wing.

2. Description

The DV 20 E airplane has a control stick for each pilot (Figure 1). Control rods connect to the bottom of the control sticks. The control rods connect to the bellcrank at the forward control bulkhead. The forward bellcrank at the control bulkhead connects to a control rod under the center console. The control rod connects to the rear control bellcrank.

The rear control bellcrank connects to the two long control rods in the wing. Each long control rod has 2 push rod guides. The first push rod guide attaches to the flap-control rib. The center rib holds the second push rod guide. The two long control rods connect to the two aileron bellcranks, one in each wing. Short control rods connect the aileron bellcranks to the aileron horns.

Each aileron bellcrank in the wing has a slot. A bolt with a sleeve goes through the slot. The ends of the slot hit the sleeve for the aileron gust stops. You cannot adjust the range of the gust stops. You can adjust the short control rods to move the range up or down.

The aileron mass balance attaches to a lever at the outboard end of the aileron.

The left aileron has a fixed trim tab. The fixed trim tab can only be adjusted on the ground.

3. Operation

If you move the control sticks to the left:

– The control rods connected to the stick move to the right

– The forward bellcrank moves the control rod below the center console to the rear

– The control rod below the center console moves the rear bellcrank so that the long control rods in the wing move to the left

– The aileron bellcrank in the left wing moves the short control rod attached to the left aileron horn to the rear

– The left aileron moves up

– The control rod in the right wing also moves to the left. It pulls the aileron bellcrank which moves the control rod attached to the right aileron horn forward

– The right aileron moves down.

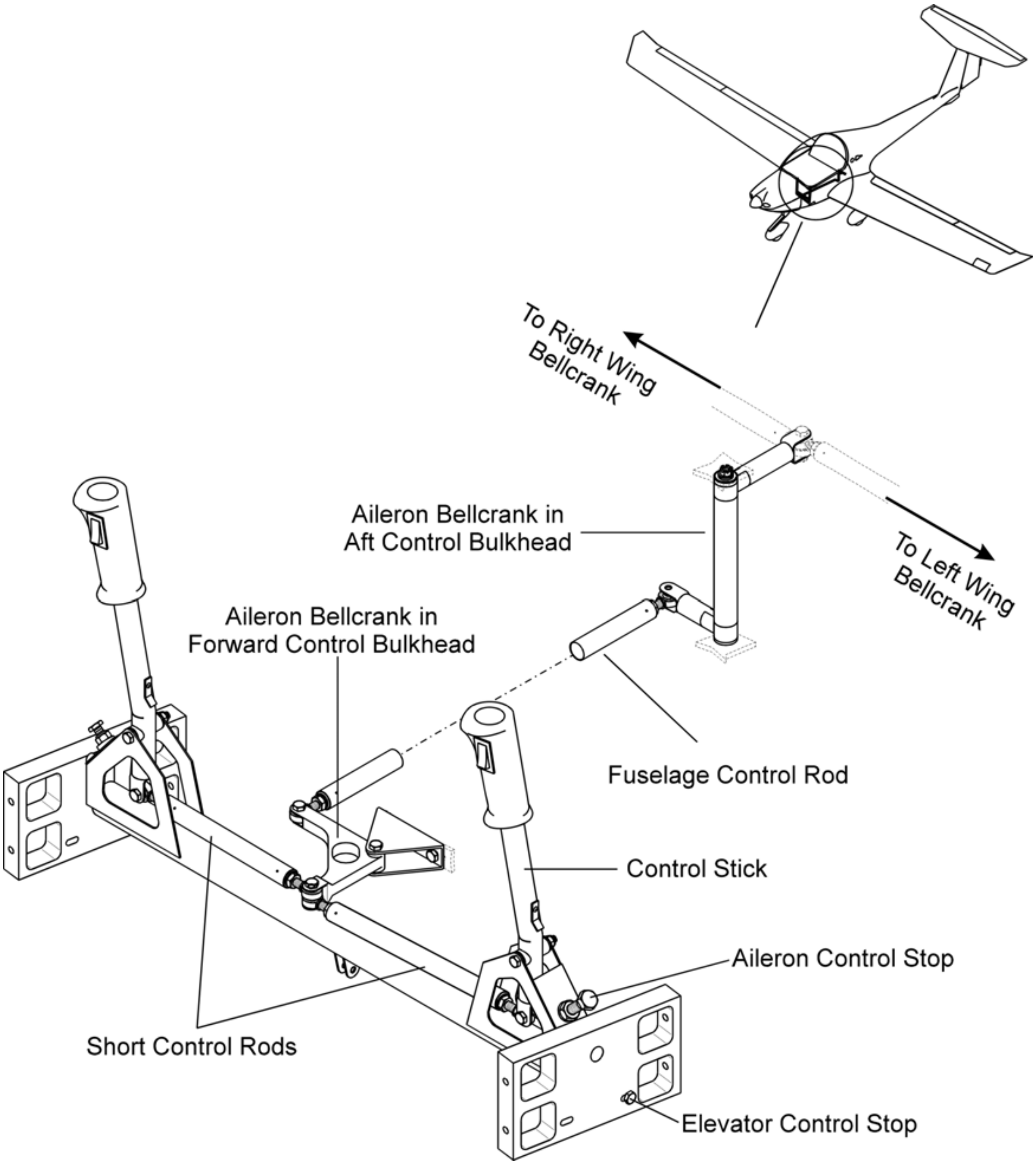

Figure 1: Aileron Controls in the Fuselage

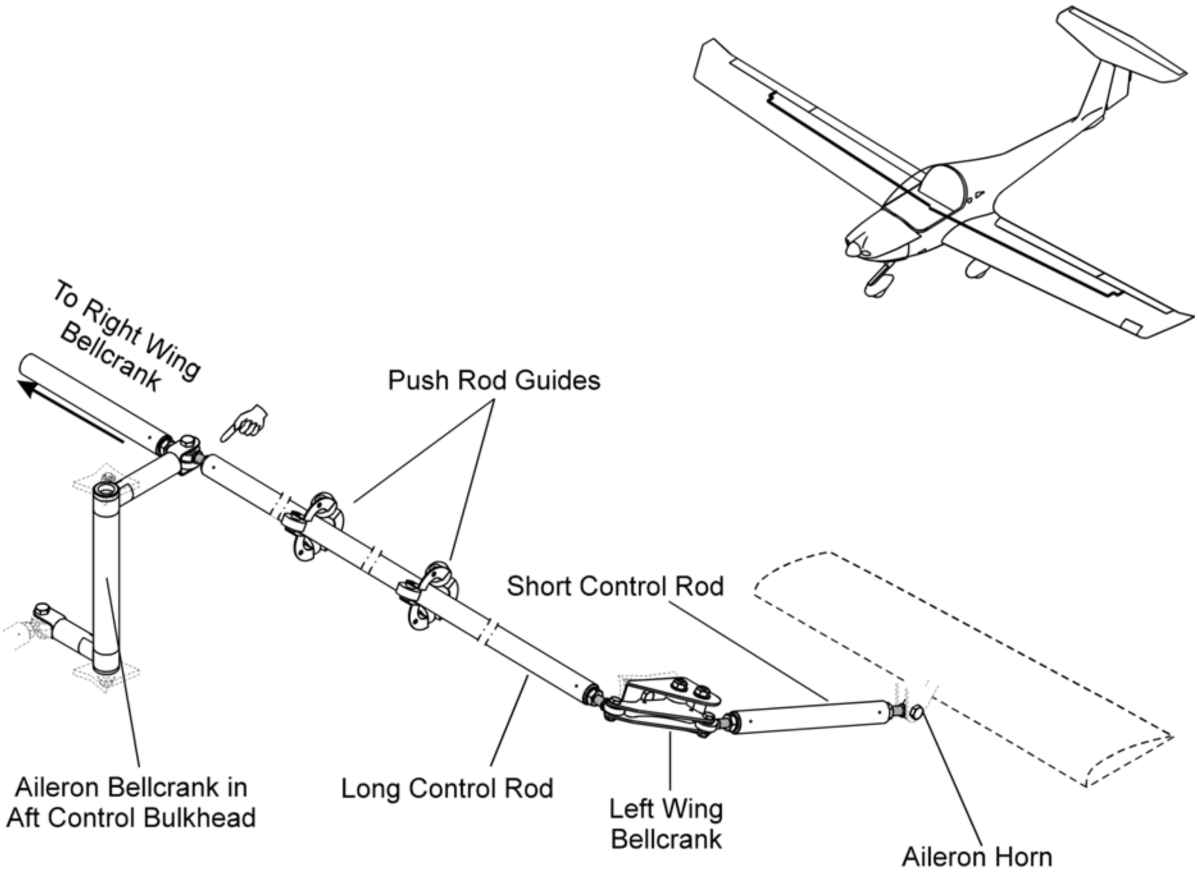

Figure 2: Aileron Controls in the Wing

Trouble-Shooting

1. General

The table below lists defects you could have in the aileron control system. If you have the trouble detailed in the Trouble column read across to the Possible Cause column. Then do the repair given in the Repair column.

Trouble	Possible Cause	Repair
Airplane moves about its longitudinal axis.	Aileron control rods need adjusting.	Adjust the aileron control rods.
Aileron controls stiff/catch.	Bearings defective.	Replace the defective eye end.

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Maintenance Practices

1. General

The following maintenance practices describe how to do test procedures on the aileron control system and how to adjust the aileron control system. Refer to paragraphs 4 and 5 for removal, installation and access data on the control rods and bellcranks. Refer to Section 57-60 to remove/install the ailerons.

WARNING: WHEN YOU DO WORK ON THE AIRPLANE CONTROLS, MAKE SURE THAT THE AREA AROUND THE CONTROLS/CONTROL SURFACES ARE CLEAR OF PERSONNEL/EQUIPMENT. IF YOU DO NOT DO THIS, INJURY TO PERSONNEL AND DAMAGE TO CONTROL SURFACES CAN OCCUR.

WARNING: WHEN YOU COMPLETE WORK ON THE CONTROLS, MAKE SURE THAT YOU REMOVE ALL LOOSE ITEMS/TOOLS FROM THAT AREA. LOOSE ITEMS/TOOLS CAN PREVENT FULL MOVEMENT OF THE AIRPLANE CONTROLS. THIS CAN CAUSE DEATH OR INJURY TO PERSONS.

2. Aileron Control System Test for Correct Range of Movement

A. Equipment

Item	Quantity	Part Number
Control stick lock.	1	20-1000-01-00
Protractor	1	Commercial.

B. Aileron Control Test Procedure

	Detail Steps/Work Items	Key Items/References
(1)	Make a copy of the Control Adjustment Report. – Use it to record the measurements.	Refer to Section 06-00.
(2)	Set the flaps to the CRUISE position.	Refer to Section 27-50.
(3)	Make sure the control stick is centered. – Install the control stick lock.	
Note:	Use a protractor to make all measurements at the aileron control surfaces. Make the measurement between the top surface of the aileron, and the top surface of the flap.	
(4)	Measure the distance between the trailing edge of each aileron and the trailing edge of the flap. – Record these measurements.	The left aileron must align with the right aileron.
(5)	Remove the control stick lock.	
WARNING:	**WHEN YOU DO WORK ON THE AIRPLANE CONTROLS, MAKE SURE THAT THE AREAS AROUND THE CONTROLS/CONTROL SURFACES ARE CLEAR OF PERSONS/EQUIPMENT. IF YOU DO NOT DO THIS, INJURY TO PERSONNEL AND DAMAGE TO CONTROL SURFACES CAN OCCUR.**	
(6)	Move the control stick fully to the left and hold it against the stop.	
(7)	Measure the angle between the trailing edge of the left aileron and the trailing edge of the flap. – Record these measurements.	The left aileron must be between 15 and 17 degrees up.
(8)	Measure the angle between the trailing edge of the right aileron and the trailing edge of the flap. – Record these measurements.	The right aileron must be between 12 and 14 degrees down.

	Detail Steps/Work Items	Key Items/References
(9)	Move the control stick fully to the right and hold it against the stop.	
(10)	Measure the angle between the trailing edge of the right aileron and the trailing edge of the flap. – Record these measurements.	The left aileron must be between 15 and 17 degrees up.
(11)	Measure the angle between the trailing edge of the left aileron and the trailing edge of the flap. – Record these measurements.	The right aileron must be between 12 and 14 degrees down.

3. Aileron Control System Adjustments

If you cannot get the correct range of movement of the aileron control system, use this procedure to adjust the system. Gust travel refers to the amount of travel remaining at the control surface with the control stick held against the cockpit stop.

WARNING: IF YOU DO AN ADJUSTMENT OF A CONTROL ROD, MAKE SURE THAT THE CONTROL ROD IS STILL IN SAFETY. IF YOU DO NOT DO THIS, THE CONTROL ROD CAN DISCONNECT. THIS CAN CAUSE DEATH OR INJURY TO PERSONS.

A. Equipment

Item	Quantity	Part Number
Control Stick Lock	1	20-1000-01-00.
Quick grips	2	Commercial.

B. Aileron Adjustment Procedure

	Detail Steps/Work Items	Key Items/References
(1)	Remove the following items for access: – Pilots' seats. – Center fuselage access panels. – Aileron bellcrank access panels under each wing.	 Refer to Section 25-10. Refer to Section 52-40. Refer to Section 52-40.
(2)	Make sure the control stick is centered. – Install the control stick lock.	

WARNING: WHEN YOU DO WORK ON THE AIRPLANE CONTROLS, MAKE SURE THAT THE AREAS AROUND THE CONTROLS/CONTROL SURFACES ARE CLEAR OF PERSONS/EQUIPMENT. IF YOU DO NOT DO THIS, INJURY TO PERSONNEL AND DAMAGE TO CONTROL SURFACES CAN OCCUR.

	Detail Steps/Work Items	Key Items/References
(3)	Do a check of the two aileron control rods that connect the control sticks to the bellcrank at the forward control bulkhead.	The control sticks must be at 90 degrees to the aileron control rods (when you look from the front/rear of the airplane).
	WARNING: IF YOU DO AN ADJUSTMENT OF A CONTROL ROD, YOU MUST MAKE SURE THAT THE CONTROL ROD IS STILL IN SAFETY. IF YOU DO NOT DO THIS, THE CONTROL ROD CAN DISCONNECT. THIS CAN CAUSE DEATH OR INJURY TO PERSONS.	
(4)	If necessary, adjust the length of the aileron control rods.	
	– Release the bolts that hold the aileron control rods to the control sticks.	
	– Adjust the length of the control rods.	Use a piece of safety lock wire to make sure that the aileron control rods that you have adjusted are still safe.
	– Install the bolts that hold the aileron control rods to the control sticks.	Torque to 6.5 Nm (4.6 lbf-ft).
(5)	Do a check of the aileron control rod from the bellcrank at the forward control bulkhead to the bellcrank at the aft control bulkhead.	The aileron control rod must be at 90 degrees to the bellcrank arm at the forward control bulkhead. And the aileron control rod must be at 90 degrees to the bellcrank lower arm at the aft control bulkhead.
(6)	If necessary, adjust the length of the aileron control rod.	
	– Release the bolt that holds the aileron control rod to the bellcrank at the forward control bulkhead.	
	– Adjust the length of the control rod.	Use a piece of safety lock wire to make sure that the aileron control rods that you have adjusted are still safe.
	– Install the bolt that holds the aileron control rod to the bellcrank.	Torque to 6.5 Nm (4.6 lbf-ft).

	Detail Steps/Work Items	Key Items/References
(7)	Do a check of the aileron control rods from the bellcrank at the aft control bulkhead to the bellcranks at the left/right wings.	The aileron control rod must be at 90 degrees to the bellcrank arm at the forward control bulkhead. And the aileron control rod must be at 90 degrees to the bellcrank lower arm at the aft control bulkhead.
(8)	If necessary, adjust the length of the aileron control rods.	
	– Release the bolt that holds the aileron control rod to the bellcrank at the forward control bulkhead.	
	– Adjust the length of the control rod	Use a piece of safety lock wire to make sure that the aileron control rods that you have adjusted are still safe.
	– Install the bolt that holds the aileron control rod to the bellcrank	Torque to 6.5 Nm (4.6 lbf-ft).
(9)	Set the flaps to the CRUISE position.	
(10)	Do a check of the aileron control rods from the bellcranks at the left/right wings to the left/right aileron horns.	Adjust the aileron control rods to give 0 degree. Measure between the aileron and the flap.

	Detail Steps/Work Items	Key Items/References
(11)	Remove the control stick lock: – Loosen the aileron stops in the cockpit. – Make sure the stops are clear of the control sticks when the controls hit the stops in the wing. – Move the control stick fully to the right and hold it against the stop. – Measure the gust travel of the left and right ailerons. – Move the control stick fully to the left and hold it against the stop. – Measure the gust travel of the left and right ailerons.	The measurement must be between 15 and 17 degrees with the aileron up and 12 and 14 degrees with the aileron down. The measurement must be between 15 and 17 degrees with the aileron up and 12 and 14 degrees with the aileron down.
(12)	If necessary, adjust the length of the aileron control rod at the aileron: – Release the bolts that hold the aileron control rod to the aileron horns. – Adjust the length of the control rod. – Install the bolt that holds the aileron control rod to the bellcrank.	Use a piece of safety lock wire to make sure that the aileron control rods that you have adjusted are still safe. Torque to 6.5 Nm (4.6 lbf-ft).
(13)	Clamp the ailerons to the flaps with quick grips.	
(14)	Measure the play in the aileron controls with the control surfaces locked. Look especially for too much play. Do the test at the top of the control stick	Maximum play allowed: 10 mm (0.375 in).
(15)	Make sure the control stick is centered. – Install the control stick rod.	Refer to step 17.

	Detail Steps/Work Items	Key Items/References
(16)	Do a check of the aileron control rod from the bellcrank at the forward control bulkhead to the bellcrank at the aft control bulkhead.	The aileron control rod must be at 90 degrees to the bellcrank arm at the forward control bulkhead. And the aileron control rod must be at 90 degrees to the bellcrank lower arm at the aft control bulkhead.
(17)	If necessary, adjust the length of the aileron control rod.	
	– Release the bolt that holds the aileron control rod to the bellcrank at the forward control bulkhead.	
	– Adjust the length of the control rod.	Use a piece of safety lock wire to make sure that the aileron control rods that you have adjusted are still safe.
	– Install the bolt that holds the aileron control rod to the bellcrank.	Torque to 6.5 Nm (4.6 lbf-ft).
(18)	Remove the quick grips from between the ailerons and the flaps. Then remove the control lock from the control stick.	
(19)	Do a check of the aileron range of movement.	Refer to Paragraph 2.
(20)	Adjust the aileron stops on the torque tube assembly with the controls against the gust stops in the wing:	
	– Turn the stop bolts in to touch the control stick.	
	– Then turn the stop bolts in by 1¼ turns after they touch the control stick.	
	Note: By each turn in of the stop bolt you will reduce the amount of aileron travel available.	
(21)	Make sure there is gust travel available.	
	– If necessary, adjust the stop bolts more.	

	Detail Steps/Work Items	Key Items/References
(22)	Do a check of the aileron range of movement.	Refer to Paragraph 2.
(23)	Do an inspection of all the controls that you have adjusted. – If necessary for your airworthiness authority, do a second inspection of the controls.	
(24)	Install the following items: – Pilots' seats. – Center fuselage access panels. – Aileron bellcrank access panels under each wing.	 Refer to Section 25-10. Refer to Section 52-40. Refer to Section 52-40.

4. Aileron Control Rod Access

Aileron Rod	Remove/Install Access	References
Between the control stick and the bellcrank at the forward control bulkhead.	Pilots' seats.	Refer to Section 25-10.
Between the bellcrank at the forward control bulkhead and the bellcrank at the aft control bulkhead.	Pilots' seats. Fuselage center access panels. Baggage compartment floor. Fuel tank.	Refer to Section 25-10. Refer to Section 52-40. Refer to Section 52-40. Refer to Section 28-10.
Between the bellcrank at the aft control bulkhead and the bellcrank in the left/right wing.	Wing left/right.	Refer to Section 57-10.
Between the bellcrank in the left/right wing and the left/right aileron.	Aileron bellcrank access panels under each wing.	Refer to Section 52-40.

5. Aileron Bellcrank Access

Aileron Rod	Remove/Install Access	References
Bellcrank at the forward control bulkhead.	Pilots' seats.	Refer to Section 25-10.
Bellcrank at the forward control bulkhead.	Pilots' seats Fuselage center access panels. Baggage compartment floor. Fuel tank.	Refer to Section 25-10. Refer to Section 52-40. Refer to Section 52-40. Refer to Section 28-10.
Bellcrank in the left/right wing.	Aileron bellcrank access panels under each wing.	Refer to Section 52-40.

Section 27-20
Flight Controls - Rudder and Tab

1. General

The DV 20 E airplane has the usual rudder control system. Each pilot has a rudder pedal assembly. The pilot can adjust the pedal position. Control cables connect the pedal assembly to the rudder. A fixed trim tab gives a small amount of adjustment to the rudder trim. You can only adjust the fixed trim tab on the ground.

2. Description

The DV 20 E airplane has a set of rudder control pedals for each pilot. The pedal assembly can be adjusted. Figure 1 shows the rudder control system. Figure 2 shows the rudder pedal assembly. The system has the following parts:

– A rudder pedal assembly for each pilot at the front of the cockpit. The forward part of each pedal connects to a brake master cylinder (Section 32-40).

– An adjuster for each pilot attached to the aft face of the rudder pedal assembly.

– A yoke (lever) assembly in the center of the fuselage behind the seats. The yoke attaches to the bottom of the B-bulkhead.

– A rudder lower mounting-bracket at the rear of the fuselage. The rudder attaches to the mounting bracket.

– Cable assemblies.

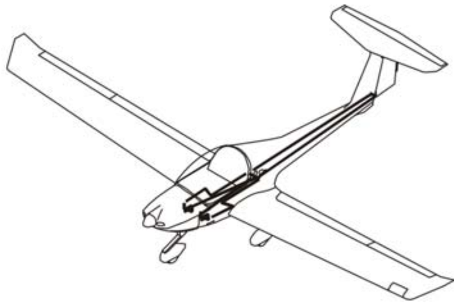
– Six bolts attach each rudder pedal assembly to the cockpit floor.

Each rudder pedal assembly has two pedals. Each pedal has a lever and a foot pad. The pedal has an "S" shaped tube. The lower part of the "S" shaped tube aligns with the pivot of the pedal. The upper part of the "S" shaped tube aligns with the foot pad of the pedal.

Four control cables ('Cockpit cables') go from the firewall to enter the bottom of each "S" shaped tube. Each cable goes through a tube and comes out at the top. Each cable goes from the pedal assembly to the yoke in the center fuselage.

Each outboard control cable goes through teflon tubes in the aft face of the floor panel. Each outboard control cable goes inboard through 2 guide pulleys on the forward control bulkhead. The cables connect each outer pedal to the yoke in the center fuselage.

Each inboard control cable goes through teflon tubes in the forward control bulkhead. The cables connect each inner pedal to the yoke in the center fuselage.



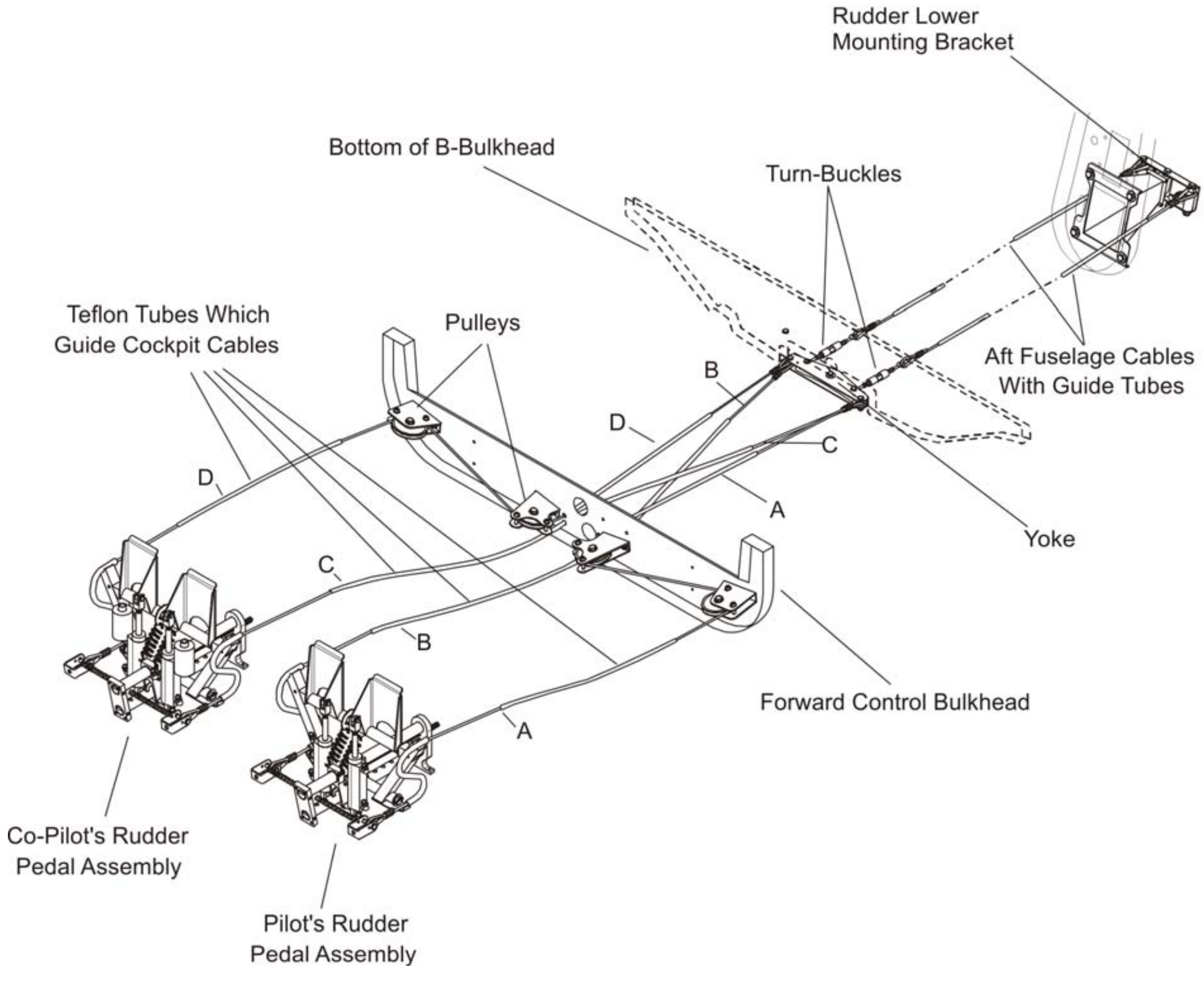


Figure 1: Rudder Control System

Two cables ('Aft Fuselage cables') attach to the rear of the yoke in the center fuselage. The two cables have turnbuckles which can adjust the rudder control system. The two aft fuselage cables go through Teflon tubes in the rear fuselage. The cables attach to the rudder mount on the rudder mounting bracket.

3. Operation

If you move the left rudder pedal forward:

– The top of the "S" shaped tube moves forward.

– The "S" shaped tube pulls the left cockpit cable.

– The left cockpit cable moves the left side of the yoke forwards.

– The yoke pulls the left aft fuselage cable forwards.

– The left aft fuselage cable moves the rudder to the left.

– The rudder movement pulls the right aft fuselage cable aft.

– The right aft fuselage cable moves aft with the right side of the yoke.

– The right side of the yoke pulls the right cockpit cables aft. And the cables pull the "S" shaped tubes on the right rudder pedals aft.

If you move the right rudder pedal forward:

– The right cockpit and aft fuselage cables move forward.

– The rudder moves to the right.

– The left cables moves aft.

– The left cables pull the left rudder pedals aft.

You can adjust the position of the rudder pedals. When you pull on the adjuster handle, the latch disengages from the bottom sledge tube. If you pull further, the pedal assembly moves along the sledge tube towards you. Release the handle, then push with your feet on both pedals. The latch will lock.

If you push with both feet while you pull the handle, the pedal assembly moves along the sledge tubes away from you. Release the handle, then push with your feet on both pedals. The latch will lock.

When you adjust the position of the pedals, the control cables move through the "S" shaped tubes.

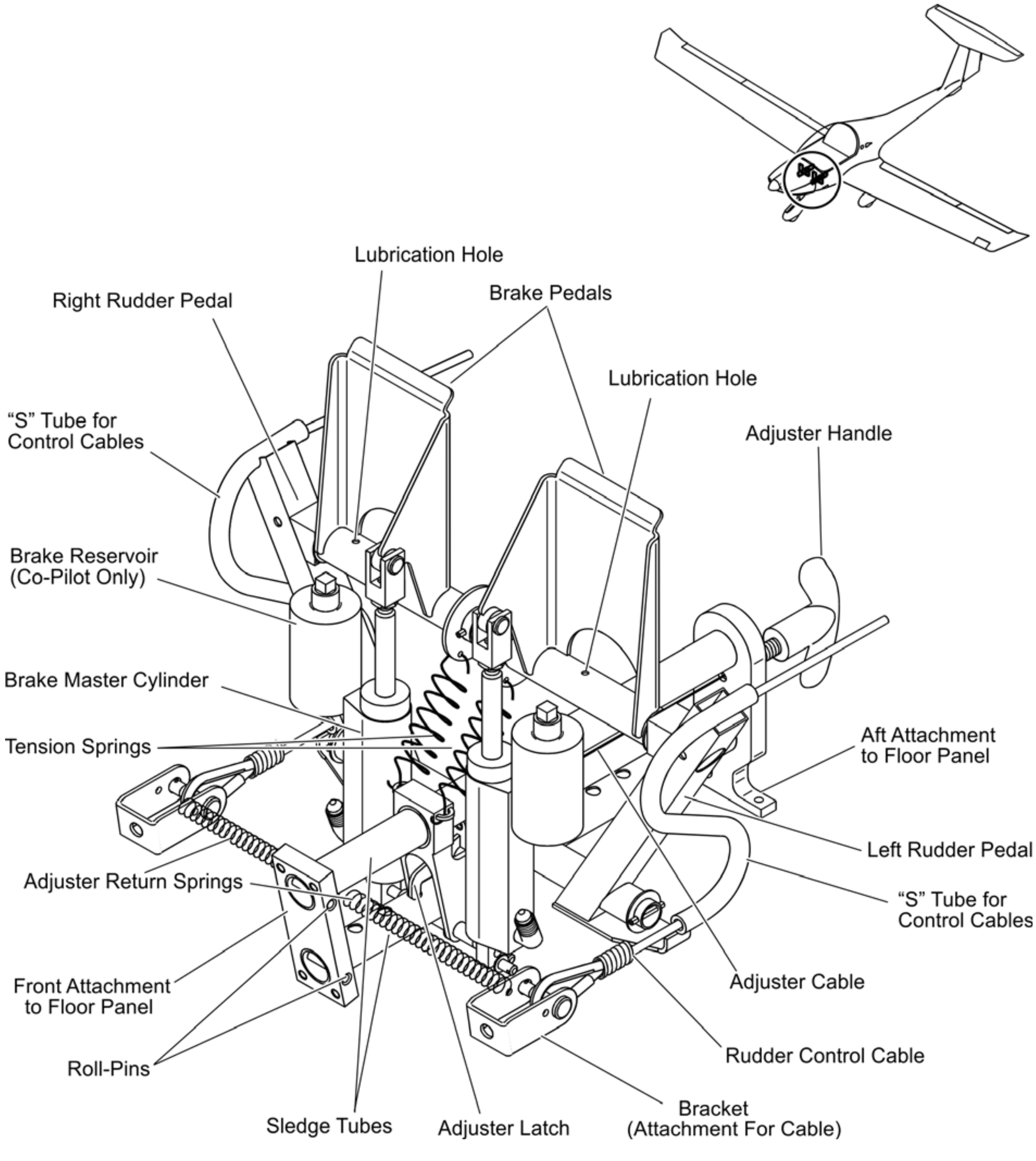


Figure 2: Rudder Pedal Assembly

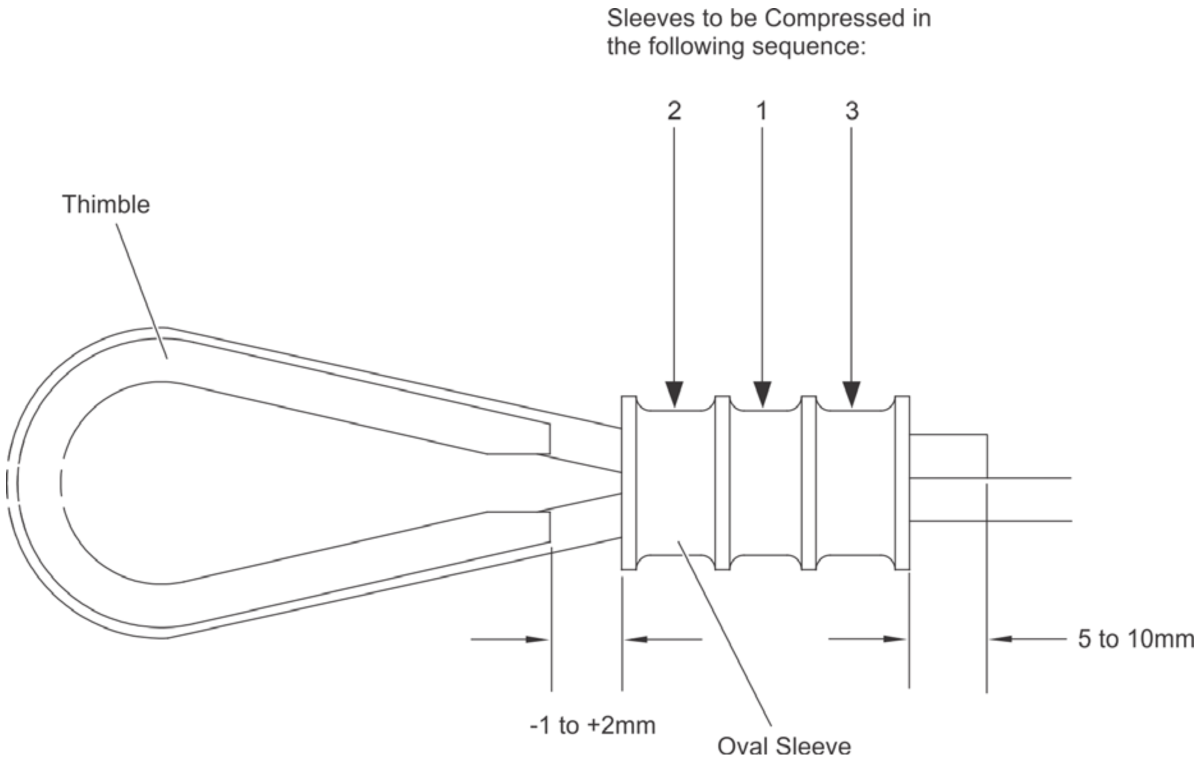


Figure 3: Thimble Installation

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Trouble-Shooting

1. General

This table explains how to troubleshoot the rudder control system. If you have the trouble detailed in the Trouble column, read across to the Possible Cause column and then do the repair given in the Repair column.

Trouble	Possible Cause	Repair
Airplane moves about its yaw axis.	Rudder cables out of adjustment.	Adjust the rudder cables.
	Fixed trim tab out of adjustment.	Adjust the fixed trim tab.
Rudder controls stiff/catch.	Bearings defective.	Replace the defective bearing.

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Maintenance Practices

1. General

The following maintenance practices describe how to do test procedures on the rudder control system and how to adjust the rudder control system. Refer to Section 55-40 to remove/install the rudder.

WARNING: WHEN YOU DO WORK ON THE AIRPLANE CONTROLS, MAKE SURE THAT THE AREA AROUND THE CONTROLS/CONTROL SURFACES ARE CLEAR OF PERSONNEL/EQUIPMENT. IF YOU DO NOT DO THIS, INJURY TO PERSONNEL AND DAMAGE TO CONTROL SURFACES CAN OCCUR.

WARNING: WHEN YOU COMPLETE WORK ON THE CONTROLS, MAKE SURE THAT YOU REMOVE ALL LOOSE ITEMS/TOOLS FROM THAT AREA. LOOSE ITEMS/TOOLS CAN PREVENT FULL MOVEMENT OF THE AIRPLANE CONTROLS. THIS CAN CAUSE DEATH OR INJURY TO PERSONS.

2. Rudder Control System Test for Correct Range of Movement

A. Equipment

Item	Quantity	Part Number
Protractor.	1	Commercial.

B. Rudder Control Test Procedure

	Detail Steps/Work Items	Key Items/References
(1)	Make a copy of the Control Adjustment Report. – Use it to record the measurements.	Refer to Section 06-00.
(2)	Set both rudder pedals fully forward.	
(3)	Set the rudder pedals central. – Make sure the rudder is in the neutral position.	The left pedal must align with the right pedal.
(4)	Set the rudder pedals to fully left. – The rudder must hit the stops at the rudder mounting bracket.	The rudder position must be between 26 - 28 degrees to the left, when measured from the neutral position.
(5)	Set the rudder pedals to fully right. – The rudder must hit the stops at the rudder mounting bracket.	The rudder position must be between 26 - 28 degrees to the right, when measured from the neutral position.
(6)	Make sure that the left/right rudder pedals are free to move when they are set in all of the adjustable positions.	

3. Rudder Control System Adjustments

If you cannot get the correct range of movement of the rudder control system, use this procedure to adjust the system.

A. Equipment

Item	Quantity	Part Number
Cable tension gauge.	1	Commercial.
Protractor.	1	Commercial.

B. Rudder Adjustment Procedure

	Detail Steps/Work Items	Key Items/References
(1)	Remove the following items for access: – Baggage compartment floor.	Refer to Section 25-10.
(2)	Set both rudder pedals fully forward.	
(3)	Set the rudder pedals central. – Make sure the rudder is in the neutral position.	The left pedal must align with the right pedal.
(4)	If necessary, adjust the length of the cables between the yoke and the rudder mounting bracket. – Remove the lock clip from the turnbuckles. – Adjust the turnbuckles to set the rudder to neutral. – Do a test for correct cable tension. – Tighten the turnbuckles and install the lock clip.	You can get access to the turnbuckles behind the fuel tank. The cable tension must be between 13.25 - 17.33 kg (29.21 - 38.20 lb). It is recommended to set cable tension near the high limit. Use a piece of safety lock wire to make sure the turnbuckles that you have adjusted are still safe.

	Detail Steps/Work Items	Key Items/References
(5)	Set the rudder pedals to fully left. – The rudder must hit the stops at the rudder mounting bracket.	The rudder position must be between 26 - 28 degrees to the left, when measured from the neutral position.
(6)	If necessary, adjust the rudder stop bolt on the left side of the rudder mounting plate: – Release the lock nut on the correct stop bolt. – Adjust the stop bolt to give the correct range of movement. – Tighten the lock nut on the stop bolt.	The rudder position must be between 26 - 28 degrees to the left, when measured from the neutral position.
(7)	Set the rudder pedals to fully right. – The rudder must hit the stops at the rudder lower mounting bracket.	The rudder position must be between 26- 28 degrees to the right, when measured from the neutral position.
(8)	If necessary, adjust the rudder stop bolt on the right side of the rudder mounting plate: – Release the lock nut on the correct stop bolt. – Adjust the stop bolt to give the correct range of movement. – Tighten the lock nut on the stop bolt.	The rudder position must be between 26 - 28 degrees to the right, when measured from the neutral position.
(9)	Do a check of the correct rudder range of movement.	Refer to Paragraph 2.
(10)	Do an inspection of all the controls that you have adjusted. – If necessary for your airworthiness authority, do a second inspection of the controls.	
(11)	Install the following items: – Baggage compartment floor.	Refer to Section 25-10.

4. Remove/Install the Rudder Control Cables

A. Equipment

Item	Quantity	Part Number
Cable tension gauge.	1	Commercial.
Swaging tool.	1	Commercial.

B. Remove the Cockpit Rudder Control Cables (From the Firewall to the Yoke)

	Detail Steps/Work Items	Key Items/References
(1)	Remove the following items for access: – Pilots' seats. – Baggage compartment floor. – Fuel tank.	 Refer to Section 25-10. Refer to Section 25-10. Refer to Section 28-10.
(2)	Remove the cable between the firewall and the yoke: – Remove the cotter pin and clevis pin that attaches the cable to the bracket at the firewall. – Remove the bolt that attaches the cable to the yoke. – Cut the eye end from the old cable at the firewall end. – Remove the old cable.	

C. Install the Rudder Control Cables (From the Firewall to the Yoke)

	Detail Steps/Work Items	Key Items/References
	WARNING: ONLY TRAINED AND AUTHORIZED PERSONS SHOULD INSTALL CABLE EYE-ENDS. IF THE EYE ENDS ARE NOT INSTALLED CORRECTLY, THE RUDDER CONTROLS CAN FAIL. THIS CAN CAUSE DEATH OR INJURY TO PERSONNEL.	
(1)	Push the control cable through the teflon tubes from the rear.	Refer to Figure 1.
(2)	Make sure the cable is in the correct position on the pulleys (for the outer cables only).	Refer to Figure 1.
(3)	Push the cable through the "S" tube on the rudder pedal assembly.	Refer to Figure 1.
(4)	Install the cable to the yoke:	
	– Install the bolt that attaches the cable to the yoke.	
	– Tighten the bolt.	Torque to 6.5 Nm (4.6 lbf-ft).
(5)	Install the new thimble and the oval sleeve on the cable at the firewall end. Do not swage the sleeve at this time.	
	– Attach the cable to the firewall bracket and adjust the cable length to have rudder pedals centered.	Make sure that the left pedal aligns with the right pedal.
	– Make sure that the rudder is in the neutral position during this operation.	Make sure that the rudder pedal levers are vertical when the rudder is in neutral.
(6)	Clamp the cable end by the oval sleeve to prevent thimble from shifting on the cable. Use the vise grip pliers with protective sleeves on the jaws to prevent damage to the cable.	

	Detail Steps/Work Items	Key Items/References
(7)	Disconnect the cable from the firewall bracket and swage the oval sleeve in accordance with AC 43.13-1B. – Inspect the cable eye end for correct assembly. – If necessary for your airworthiness authority, send a sample for the proof test.	Refer to Figure 3.
(8)	Install the cable to the bracket at the firewall: – Install the clevis pin that attaches the cable to the firewall bracket. – Install the cotter pin.	
(9)	Do a check of the rudder range of movement.	Refer to Paragraph 2.
(10)	Do an inspection of all the controls that you have adjusted. – If necessary for your airworthiness authority, do a second inspection of the controls.	
(11)	Install the following items: – Fuel tank. – Baggage compartment floor. – Pilots' seats.	 Refer to Section 28-10. Refer to Section 25-10. Refer to Section 25-10.

D. Remove the Aft Fuselage Rudder Control Cables (From the Yoke to the Rudder)

	Detail Steps/Work Items	Key Items/References
(1)	Remove the following items for access:	
	– Pilots' seats.	Refer to Section 25-10.
	– Baggage compartment floor.	Refer to Section 25-10.
	– Fuel tank.	Refer to Section 28-10.
	– Rudder.	Refer to Section 55-40.
(2)	Remove the cable between the rudder yoke and the rudder:	
	– Remove the bolt that attaches the turnbuckle to the rudder yoke.	
	– Remove the bolt that attaches the cable to the rudder lower mounting bracket.	
	– Cut the eye end from the old cable at the lower bracket end.	
	– Cut the eye end from the turnbuckle.	
	– Remove the old cable.	

E. Install the Aft Fuselage Rudder Control Cables (From the Yoke to the Rudder)

	Detail Steps/Work Items	Key Items/References
	WARNING: ONLY TRAINED AND AUTHORIZED PERSONS SHOULD INSTALL CABLE EYE-ENDS. IF THE EYE ENDS ARE NOT INSTALLED CORRECTLY, THE RUDDER CONTROLS CAN FAIL. THIS CAN CAUSE DEATH OR INJURY TO PERSONNEL.	
(1)	Push the control cable through the teflon tubes from the front.	Refer to Figure 1.

	Detail Steps/Work Items	Key Items/References
(2)	Attach the turnbuckle end of the cable to the yoke. – Set the turnbuckle to the middle of adjustment.	
(3)	Install the new thimble and the oval sleeve on the cable at the rudder lower mounting bracket. – Do not swage the sleeve at tis time. – Attach the cable to the rudder lower mounting bracket. – Adjust the cable tension to the middle of the value range specified.	Make sure that the left pedal aligns with the right pedal. Refer to Paragraph 3.
(4)	Clamp the cable end by the oval sleeve to prevent thimble from shifting on the cable. Use the vise grip pliers with protective sleeves on the jaws to prevent damage to the cable.	
(5)	Disconnect the control cable from the rudder lower mount bracket and swage the oval sleeve in accordance with AC 43.13-1B. – Inspect the cable eye end for correct assembly. – If necessary for your airworthiness authority, send a sample for the proof test.	Refer to Figure 3.
(6)	Install the cable to the rudder lower mounting bracket: – Install the bolt that attaches the cable to the lower mounting bracket – Tighten the bolt. – Lubricate the cable eyes.	Torque to 6.5 Nm (4.6 lbf-ft). Refer to Section 12-20.

	Detail Steps/Work Items	Key Items/References
(7)	Install the turnbuckle to the rudder yoke: – Install the bolt that attaches the turnbuckle to the rudder yoke. – Tighten the bolt.	 Torque to 6.5 Nm (4.6 lbf-ft).
(8)	Install the rudder.	Refer to Section 55-40.
(9)	Adjust both the rudder cables to give the correct tension	Refer to Paragraph 3.
(10)	Do a check of the rudder range of movement.	Refer to Paragraph 2.
(11)	Do an inspection of all the controls that you have adjusted. – If necessary for your airworthiness authority, do a second inspection of the controls.	
(12)	Install the following items: – Fuel tank. – Baggage compartment floor. – Pilots’ seats.	 Refer to Section 28-10. Refer to Section 25-10. Refer to Section 25-10.

Section 27-30
Flight Controls - Elevator

1. General

The DV 20 E airplane has the usual elevator flight controls. An elevator attached to the horizontal stabilizer gives longitudinal control. The two control sticks operate the elevator.

2. Description

Figure 1 shows the elevator controls in the fuselage.

Each pilot has a control stick that attaches to a torque tube assembly. The torque tube assembly has a lever which attaches to a short control rod. The short control rod attaches to a long control rod behind the aft control bulkhead. The aft control bulkhead has an UHMW bush for the short control rod.

The long control rod has two bearings. The half ring bulkhead and ring bulkhead #2 have push-rod guides. Each guide has three rollers.

The long control rod attaches to the bellcrank at the bottom of the vertical stabilizer. The bellcrank attaches to a vertical control rod in the vertical stabilizer. The vertical control rod connects to the elevator horn.

The vertical control rod in the vertical stabilizer has a spring assembly attached. The spring assembly connects to the trim motor. Refer to Section 27-31 for data about the trim system.

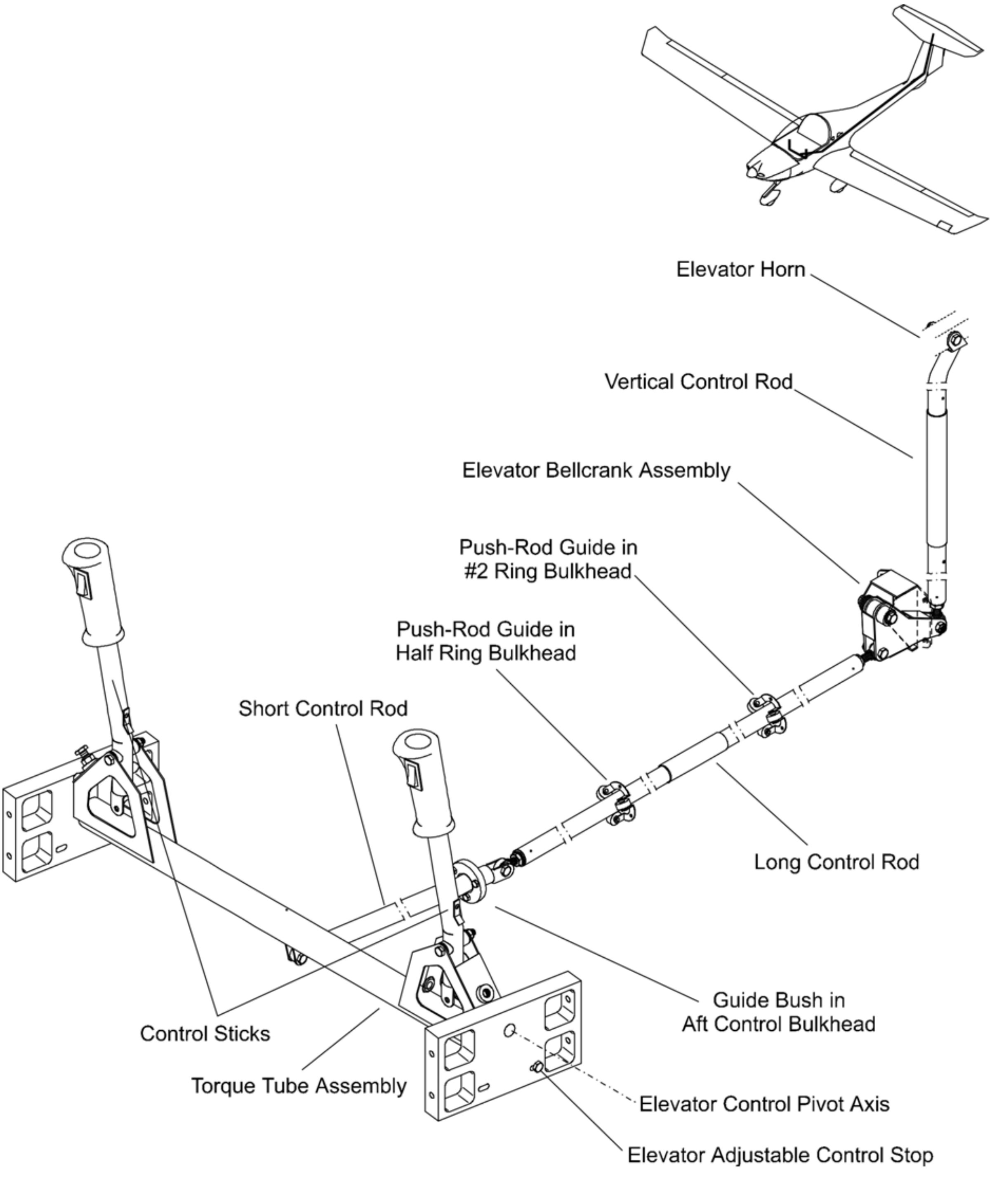

Figure 1: Elevator Controls

3. Operation

If you move the control stick forward:

– The torque tube assembly turns.

– The lever below the torque tube assembly pushes the short control rod aft.

– The short control rod pushes the long control rod aft.

– The long control rod pushes the bellcrank rearward.

– The bellcrank pushes the vertical control rod up.

– The vertical control rod moves the elevator horn.

– The elevator moves down.

If you move the control stick aft:

– The torque tube assembly turns.

– The short and long control rods move forward.

– The bellcrank pulls the vertical control rod down.

– The elevator moves up.

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Trouble-Shooting

1. General

This table explains how to troubleshoot the elevator control system. If you have the trouble detailed in the Trouble column read across to the Possible Cause column. Then do the repair given in the Repair column.

Trouble	Possible Cause	Repair
Control vibration in the air.	Too much backlash in the flight controls.	Examine the flight control system to isolate the problem. Replace the defective part.
Elevator controls stiff/catch.	Bearings defective.	Replace the defective eye end.

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Maintenance Practices

1. General

The following maintenance practices describe how to do test procedures on the elevator control system and how to adjust the elevator control system. Refer to Section 55-20 to remove/install the elevator.

WARNING: WHEN YOU DO WORK ON THE AIRPLANE CONTROLS, MAKE SURE THAT THE AREA AROUND THE CONTROLS/CONTROL SURFACES ARE CLEAR OF PERSONNEL/EQUIPMENT. IF YOU DO NOT DO THIS, INJURY TO PERSONNEL AND DAMAGE TO CONTROL SURFACES CAN OCCUR.

WARNING: WHEN YOU COMPLETE WORK ON THE CONTROLS, MAKE SURE THAT YOU REMOVE ALL LOOSE ITEMS/TOOLS FROM THAT AREA. LOOSE ITEMS/TOOLS CAN PREVENT FULL MOVEMENT OF THE AIRPLANE CONTROLS. THIS CAN CAUSE DEATH OR INJURY TO PERSONS.

2. Elevator Control System Test for Correct Range of Movement

A. Equipment

Item	Quantity	Part Number
Protractor.	1	Commercial.

B. Elevator Control Test Procedure

	Detail Steps/Work Items	Key Items/References
(1)	Make a copy of the Control Adjustment Report. – Use it to record the measurements.	Refer to Section 06-00.
(2)	Make sure the control stick is centered.	
	Note: Use a protractor to make all measurements at the elevator control surface. Make the measurement from the top surface of the horizontal stabilizer to the top surface of the elevator.	
(3)	Measure the angle between the top surface of the horizontal stabilizer and the top surface of the elevator.	The elevator must align with the horizontal stabilizer.
	WARNING: WHEN YOU DO WORK ON THE AIRPLANE CONTROLS, MAKE SURE THAT THE AREA AROUND THE CONTROLS/CONTROL SURFACES ARE CLEAR OF PERSONNEL/EQUIPMENT. IF YOU DO NOT DO THIS, INJURY TO PERSONNEL AND DAMAGE TO CONTROL SURFACES CAN OCCUR.	
(4)	Move the control stick fully forward and hold it against the stop.	
(5)	Measure the angle between the top surface of the horizontal stabilizer and the top surface of the elevator. – Record the measurement.	The elevator must be between 14 and 16 degrees down.
(6)	Move the control stick fully aft and hold it against the stop.	
(7)	Measure the angle between the top surface of the horizontal stabilizer and the top surface of the elevator. – Record the measurement.	The elevator must be between 24 and 26 degrees up.

3. Elevator Control System Adjustments

If you cannot get the correct range of movement of the elevator control system, use this procedure to adjust the system. Gust travel refers to the amount of travel remaining at the control surface with the control stick held against the cockpit stop.

WARNING: IF YOU DO AN ADJUSTMENT OF A CONTROL ROD, MAKE SURE THAT THE CONTROL ROD IS STILL IN SAFETY. IF YOU DO NOT DO THIS, THE CONTROL ROD CAN DISCONNECT. THIS CAN CAUSE DEATH OR INJURY TO PERSONNEL.

A. Equipment

Item	Quantity	Part Number
Protractor.	1	Commercial.

B. Elevator Control Adjustment Procedure

	Detail Steps/Work Items	Key Items/References
(1)	Remove the following items for access: – Pilots' seats. – Center fuselage access panels. – Rudder.	 Refer to Section 25-10 Refer to Section 52-40. Refer to Section 55-40.
(2)	Make sure the control stick is centered.	
	WARNING: WHEN YOU DO WORK ON THE AIRPLANE CONTROLS, MAKE SURE THAT THE AREA AROUND THE CONTROLS/CONTROL SURFACES ARE CLEAR OF PERSONNEL/EQUIPMENT. IF YOU DO NOT DO THIS, INJURY TO PERSONNEL AND DAMAGE TO CONTROL SURFACES CAN OCCUR.	
(3)	Do a check of the two elevator control rods that attach between the torque tube assembly and the bellcrank at the bottom of the vertical stabilizer.	Make sure that the bellcrank is at 90 degrees to the vertical stabilizer lower rib.

	Detail Steps/Work Items	Key Items/References
	WARNING: IF YOU DO AN ADJUSTMENT OF A CONTROL ROD, MAKE SURE THAT THE CONTROL ROD IS STILL IN SAFETY. IF YOU DO NOT DO THIS, THE CONTROL ROD CAN DISCONNECT. THIS CAN CAUSE DEATH OR INJURY TO PERSONS.	
(4)	If necessary, adjust the length of the elevator control rods.	
	– Release the bolts that hold the elevator control rods to the torque tube assembly and the bellcrank.	
	– Adjust the length of the control rods.	Use a piece of safety lock wire to make sure the elevator control rods that you have adjusted are still safe.
	– Install the bolts that hold the elevator control rods to the torque tube assembly and the bellcrank.	Torque to 6.5 Nm (4.6 lbf-ft).
(5)	Do a check of the elevator control rod from the bellcrank at the bottom of the vertical stabilizer to the elevator.	The elevator must be in the neutral position.
(6)	If necessary, adjust the length of the elevator control rods.	
	– Release the bolt that holds the elevator control rods to the bellcrank at the bottom of the vertical stabilizer	
	– Adjust the length of the control rods.	Use a piece of safety lock wire to make sure the elevator control rods that you have adjusted are still safe.
	– Install the bolt that holds the elevator control rods to the bellcrank at the bottom of the vertical stabilizer.	Torque to 6.5 Nm (4.6 lbf-ft).

Section 27-31

Flight Controls - Elevator Trim-Mechanical

1. General

The DV 20 E airplane has an elevator with an electrically-operated trim system. This lets you trim the airplane for different center of gravity positions. A switch on the control stick controls the elevator trim. An indicator tells the pilot the trim position. An electric actuator moves a spring system.

Control stick mounted trim switches are located on top of each control stick, aft of centre. The switches are positioned so that they can be easily operated by thumb. Forward movement of either switch gives nose down trimming and aft movement of the switch gives nose up trim. The trim switches control electrical relays that supply electrical power to the electric pitch trim motor. If the switches are operated in opposing directions at the same time the trim motor will not operate. Operation of the trim switches in the same direction and at the same time will cause the trim motor to operate in that direction.

2. Description

Figure 1 shows the elevator trim control system. The trim control system has the following parts:

- The switches are located on each of the control sticks. The switches are spring-loaded to the middle (off) position.

- A trim indicator located on the instrument panel. The indicator has a vertical row of lightemitting diodes.

- A spring-mount assembly which attaches to the vertical control rod for the elevator. The spring-mount assembly has 2 springs. The vertical control rod goes through the bore of the springs. The top of the top spring (and the bottom of the bottom spring) have mounts. Roll pins attach the mounts to the vertical control rod. A spacer bush between the springs has a groove for the fork assembly on the trim actuator.

- An electrical trim actuator. Two brackets attach the trim actuator to the aft face of the spar in the vertical stabilizer. A snubber attaches to the output rod of the trim actuator. A fork assembly on the snubber engages with the spring-mount on the vertical control rod for the elevator.

The trim system used on the DV 20 E airplane is not adjustable.

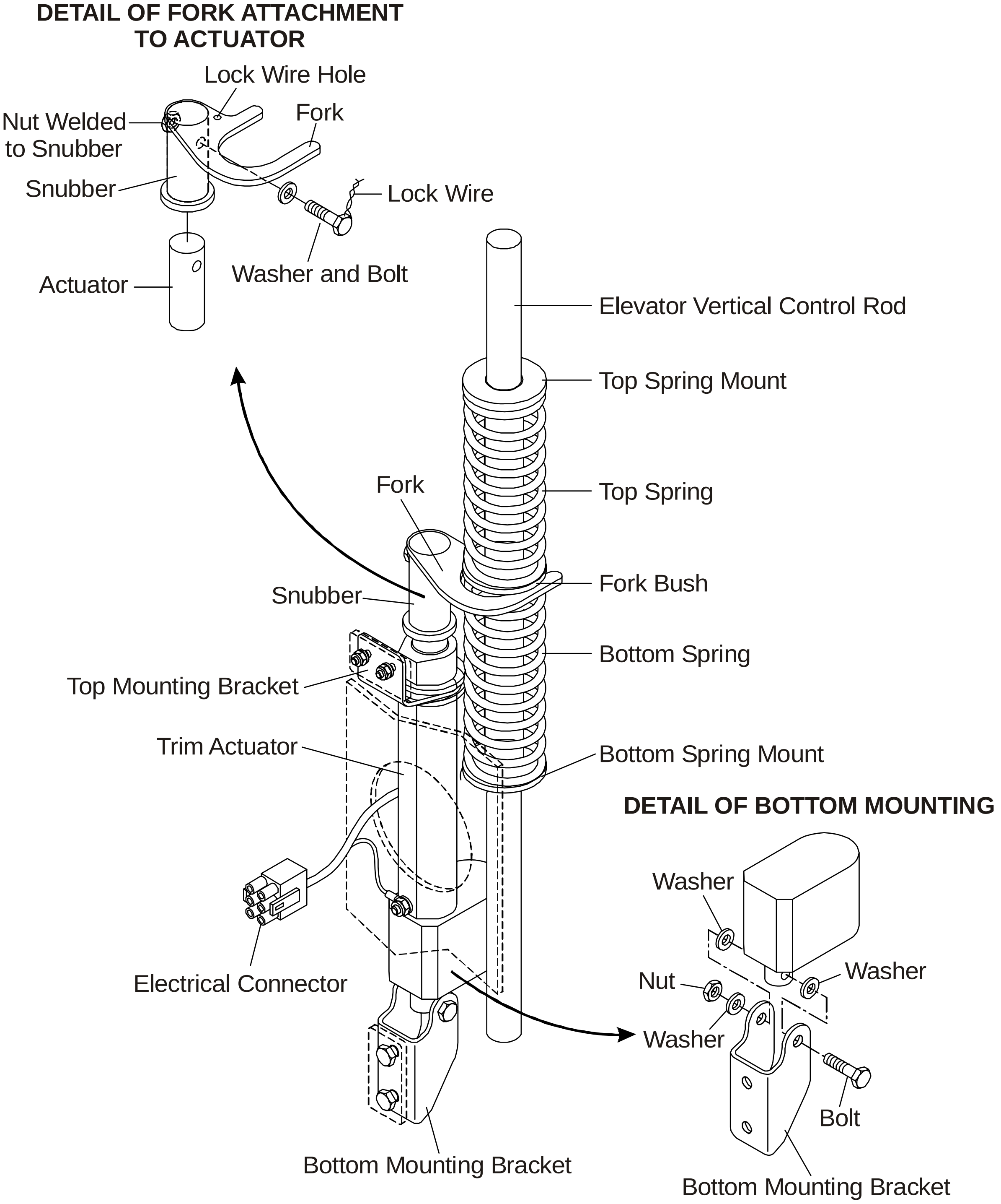

Figure 1: Elevator Trim Controls

3. Operation

If you push the front part of the trim switch with no load on the control column, the following happens:

- The actuator moves the fork assembly upwards.
- The fork assembly moves the spring-mount upwards. This compresses the top spring. It also extends the bottom spring. This gives an upwards force on the rod.
- The vertical control rod will move upwards until the 2 springs are equally compressed.
- The elevator moves down.
- The actuator will continue to move until:
  - You release the switch.
  - The actuator extends fully.

If you push the rear part of the trim switch with no load on the control column, the elevator will move up.

The pilot can set the elevator trim so that the spring load balances the aerodynamic load on the elevator.

The trim position indicator shows the position of the trim actuator.

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Trouble-Shooting

1. General

This table explains how to troubleshoot the elevator control trim system. If you have the trouble detailed in the Trouble column read across to the Possible Cause column. Then do the repair in the Repair column.

Trouble	Possible Cause	Repair
Trim system does not operate.	Circuit breaker not set.	Set the trim circuit breaker. Do a test for correct trim system operation. If the circuit breaker opens: – Do a short circuit test. – Do an electrical actuator friction test.
	Trim electric actuator defective.	Replace the trim electric actuator.
	Bearings defective.	Replace the defective bearings.
	Open circuit in the electrical control system.	Do a test for continuity in each wire of the control system. Repair/replace defective items.
	Trim switch defective.	Replace the trim switch.
Elevator trim moves too slowly. (Usual time for full travel 11 seconds).	Not enough actuator power.	Do a test for the correct electrical power at the actuator.
	Trim electric actuator defective.	Replace the trim electric actuator.

Trouble	Possible Cause	Repair
No (or incorrect) position indication.	Elevator trim position indicator out of adjustment.	Adjust elevator trim position indicator.
	Elevator trim position indicator defective.	Replace the elevator trim position indicator.
Loss of stick-centering.	Trim electric actuator defective.	Replace the trim electric actuator.
	Trim electric actuator disconnected.	Reconnect the trim electric actuator.
	Spring-mount assembly defective.	Replace the spring-mount assembly.

Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the elevator actuator. Refer to Section 55-20 to remove/install the elevator.

2. Remove/Install the Elevator Trim Actuator

Refer to Figure 1.

A. Remove the Elevator Trim Actuator

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the airplane battery.	Refer to Section 24-31.
(2)	Remove the rudder.	Refer to Section 55-40.
WARNING:	**WHEN YOU DO WORK ON THE AIRPLANE CONTROLS, MAKE SURE THAT THE AREA AROUND THE CONTROLS/CONTROL SURFACES ARE CLEAR OF PERSONNEL/EQUIPMENT. IF YOU DO NOT DO THIS, INJURY TO PERSONNEL AND DAMAGE TO CONTROL SURFACES CAN OCCUR.**	
(3)	Disconnect the bottom of the elevator vertical control rod at the elevator bellcrank. – Remove the nut bolt and two washers. – Move the control rod clear of the fork assembly.	
(4)	Get access through the hole in the vertical stabilizer and cut the Tie-wrap that holds the electrical harness of the elevator trim actuator. – Disconnect the electrical harness connector.	
(5)	Remove the nut, bolt and three washers that attach the elevator trim actuator to the lower mounting bracket.	

	Detail Steps/Work Items	Key Items/References
(6)	Cut the locking wire from the bolt that attaches the fork assembly to the elevator trim actuator. – Remove the bolt and washer. – Remove the fork assembly.	
(7)	Carefully move the elevator trim actuator down until it clears the upper mounting bracket. – Remove the elevator trim actuator.	

B. **Install the Elevator Actuator**

	Detail Steps/Work Items	Key Items/References
(1)	Put the fork assembly in the correct position.	Refer to Figure 1.
(2)	Carefully put the elevator trim actuator in the upper mounting bracket. – Make sure you align the actuator rod in the inner fork assembly. – Install the bolt and washer. – Lock the bolt with wire.	Refer to Figure 1. Torque to 6.5 Nm (4.6 lbf-ft).
(3)	Install the nut, the bolt and the three washers that attach the elevator trim actuator to the lower mounting bracket.	
(4)	Connect the electrical harness to the elevator trim actuator. – Get access through the hole in the vertical stabilizer and connect the electrical harness connector. – Install the tie-wrap that holds the electrical harness.	

	Detail Steps/Work Items	Key Items/References
	WARNING: WHEN YOU DO WORK ON THE AIRPLANE CONTROLS, MAKE SURE THAT THE AREA AROUND THE CONTROLS/CONTROL SURFACES ARE CLEAR OF PERSONNEL/EQUIPMENT. IF YOU DO NOT DO THIS, INJURY TO PERSONNEL AND DAMAGE TO CONTROL SURFACES CAN OCCUR.	
(5)	Install the bottom of the elevator vertical control rod to the elevator bellcrank. – Make sure you correctly align the fork assembly with the spring mount assembly. – Install the nut bolt and two washers.	 Refer to Figure 1. Torque to 6.5 Nm (4.6 lbf-ft).
(6)	Connect the airplane battery.	Refer to Section 24-31.
(7)	Do an operational check of the elevator trim control system.	
(8)	Do a test for correct, full and free movement of the elevator control system.	Refer to Section 27-30.
(9)	Install the rudder.	Refer to Section 55-40.

C. Adjust the Elevator Trim Position Indicator

	Detail Steps/Work Items	Key Items/References
(1)	Remove the instrument panel cover.	Refer to Section 25-10.
(2)	Remove the rudder.	Refer to Section 55-40.
	WARNING: WHEN YOU DO WORK ON THE AIRPLANE CONTROLS, MAKE SURE THAT THE AREA AROUND THE CONTROLS/CONTROL SURFACES ARE CLEAR OF PERSONNEL/EQUIPMENT. IF YOU DO NOT DO THIS, INJURY TO PERSONNEL AND DAMAGE TO CONTROL SURFACES CAN OCCUR.	
(3)	Using the elevator trim switch set the trim to full nose up.	

	Detail Steps/Work Items	Key Items/References
(4)	Mark the position of the trim actuator shaft in the nose up position.	
(5)	Using the elevator trim switch set the trim to full nose down.	
(6)	Mark the position of the trim actuator shaft in the nose down position.	
(7)	Measure the trim actuator travel between the marks for full nose up and full nose down and divide this measurement by two to get the midpoint of travel.	
(8)	Using the elevator trim switch set the trim actuator to the midpoint of travel.	
(9)	Use a small screwdriver to adjust the potentiometer on top of the trim position indicator.	The two middle light emitting diodes on the indicator must be lit.
(10)	Using the elevator trim switch set the trim to full nose up.	The top light emitting diode must be lit at full nose up trim.
(11)	Using the elevator trim switch set the trim to full nose down.	The bottom light emitting diode must be lit at full nose down trim.
(12)	Do an operational check of the elevator trim control system.	
(13)	Install the instrument panel cover.	Refer to Section 25-10.

Section 27-50
Flight Controls - Flaps

1. General

The DV 20 E airplane has slotted flaps for landing and take-off. An electric flap actuator moves the flaps. Refer to Section 57-50 for data about the flap structure.

A three-position toggle switch controls the flaps. The switch is in the center section of the instrument panel.

The flap position indicator has marks for CRUISE, T/O and LDG positions.

2. Description

Figure 1 shows the flap control system in the fuselage. Figure 2 shows the flap control system in the aft control bulkhead and wing.

A. Flap Actuator

An electric actuator operates the flaps. The electric actuator is under the left seat. A mounting bracket on the on the aft face of the T-panel holds the front of the actuator.

The electric actuator has an electric motor. The motor has a reduction gear which turns a spindle. The spindle operates a control rod. The control rod connects to a bellcrank attached to the aft control bulkhead.

A cam attached to the control rod operates five micro-switches. The micro-switches are part of the flaps electronic control circuit.

B. Control Rods and Bellcranks

The output lever of the bellcrank on the aft control bulkhead connects to two control rods. The two control rods connect to the flap bellcranks in the wings. Two short control rods attach to the flap horns.

A short rod connects to the input lever of the bellcrank on the aft control bulkhead. The rod goes through a hole in the aft control bulkhead. Large washers attach to the end of the rod. The washers make a stop for the up movement of the flaps. If there is an electrical fault, the stop protects the flaps from too much load.

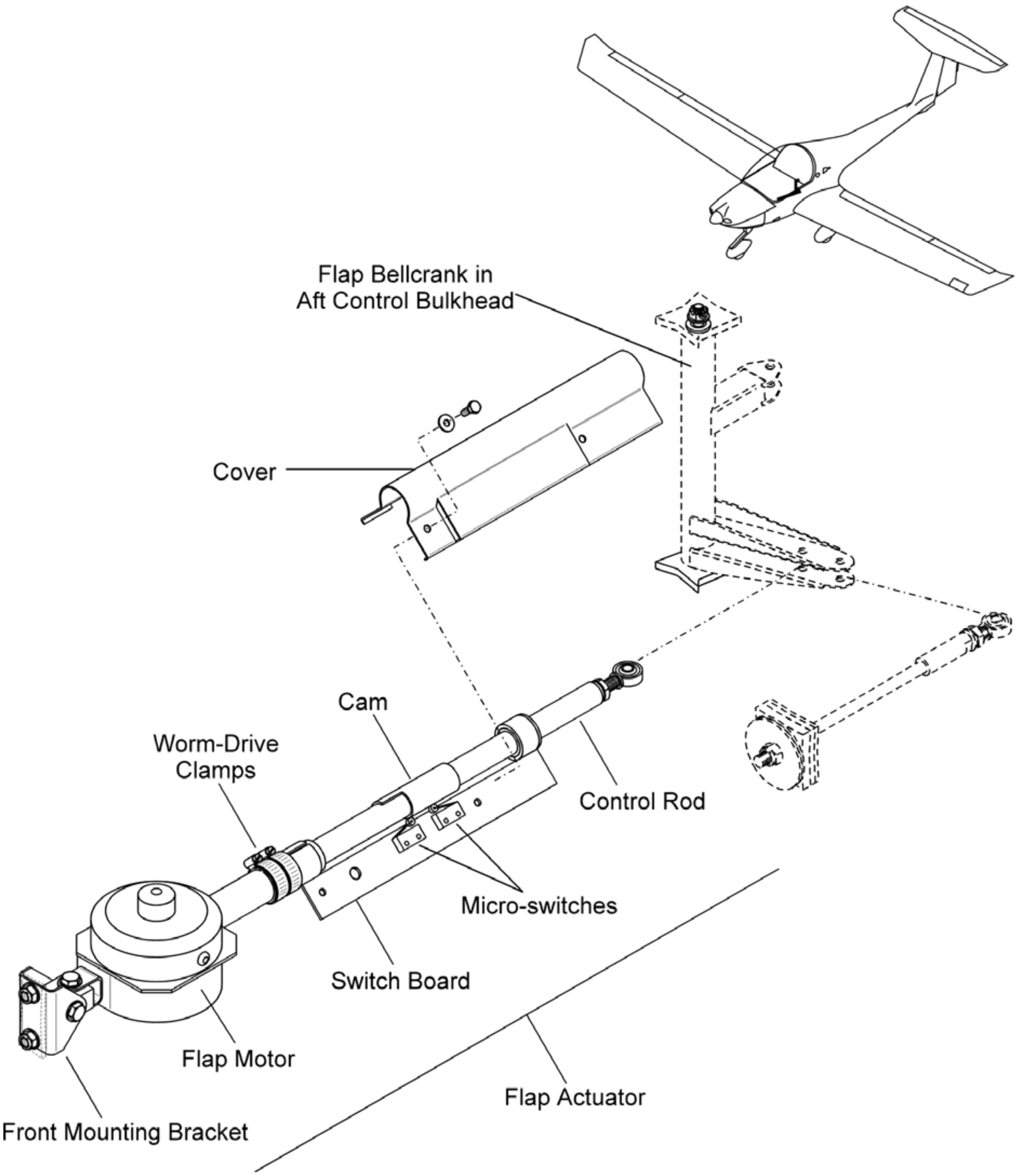

Figure 1: Flap Control System in the Fuselage

C. Flap Electrical Control

Figure 3 shows the flap electrical controls. The main bus supplies power for the flaps. A 5 A circuit breaker protects the circuit. Refer to Section 92 for the wiring diagram.

The flap electrical control system uses solid-state electronics. It has an electronic control unit and a switchboard. The electronic control unit is located on the instrument panel. The switch board attaches to the flap actuator.

The electronic control unit has a 3-position selector switch, solid-state logic circuits and a flap position indicator. The selector switch can be set to:

– CRUISE (fully up). 0 ±1°

– T/O (take-off). 15 ±1°

– LDG (landing). 45 ±1°

The logic circuits monitor the outputs from the selector switch and the micro-switches on the switch board. They control 4 power transistors. Two of the power transistors can connect the power supply to the flap motor. The other two can connect the motor to ground.

The flap position indicator has three bulbs. The top bulb lights when the flaps are in the CRUISE position. The middle bulb lights when the flaps are in the T/O position. The bottom bulb lights when the flaps are in the LDG position.

The switch board attaches to the body of the flap actuator with 2 worm-drive clamps. The switch board has 5 micro switches. Two screws attach each micro-switch to the switch board. You can adjust the position of the switch board with the worm-drive clamps. You can adjust each micro-switch with its attaching screws. The micro-switches have the following functions:

– Micro-switch 1 - LDG indication and T/O limit (from LDG position).

– Micro-switch 2 - CRUISE indication and T/O limit (from CRUISE position).

– Micro-switch 3 - LDG limit.

– Micro-switch 4 - T/O indication.

– Micro-switch 5 - CRUISE limit.

– Cable harnesses with multi-pin connectors connect the components.

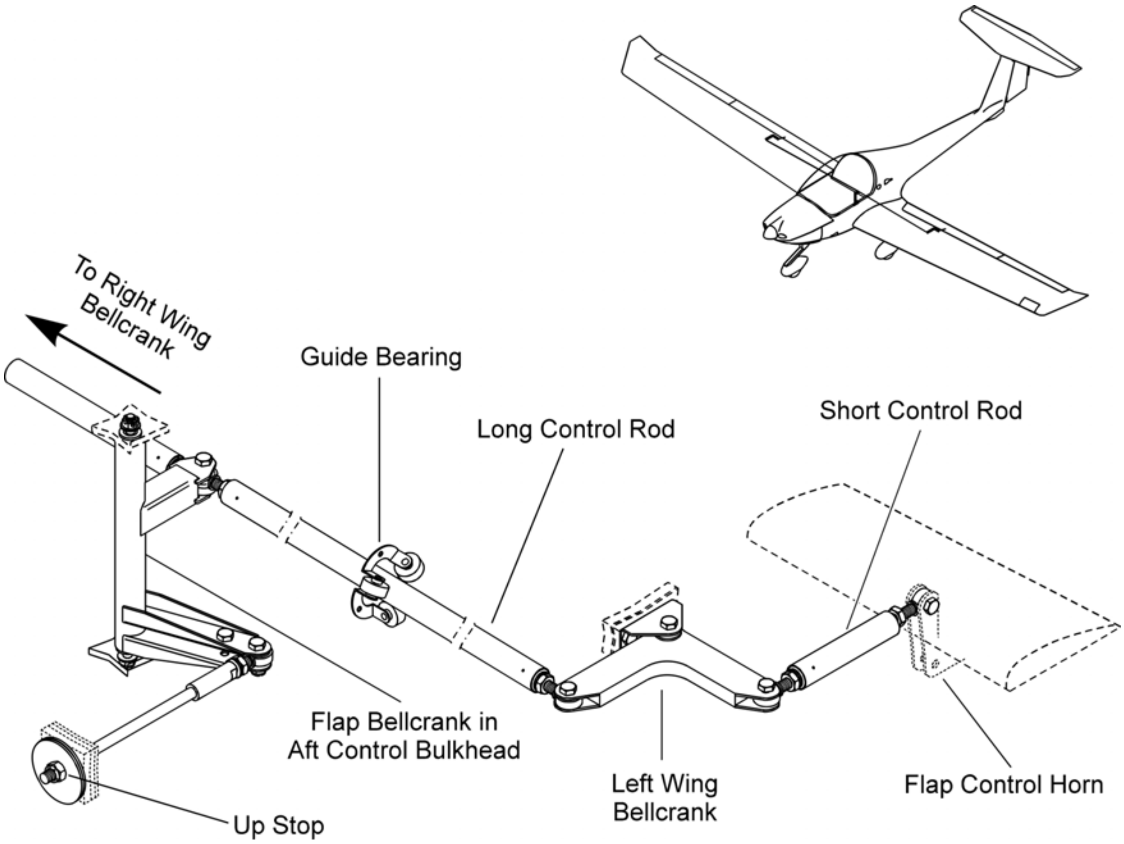

Figure 2: Flap Controls in the Aft Control Bulkhead and Wing

3. Operation

If you operate the flap selector switch the following happens:

- The switch energizes the related logic circuit.
- The logic circuit switches on the related transistors to supply power/ground to the flap motor.
- The flap motor turns the reduction gear and spindle. This moves the control rod towards the new set position.
- The control rod turns the bellcrank around its axis.
- The bellcrank moves the two control rods in the wings.
- The two control rods move the bellcranks in the left and right wing.
- The two short control rods move the flaps.

When the flaps come to the set position:

- The cam on the flap control rod operates the related position and indication micro-switches.
- The logic circuit switches off the related transistors to de-energize the motor.
- The flap position indicator shows the new flap position.

4. Fail Safe Operation

The flap control system has the following safety properties:

- If the CRUISE position micro-switch fails closed, the stop in the aft control bulkhead prevents damage to the flaps. The FLAP circuit-breaker opens.
- If the LDG position micro-switch fails closed, the actuator control rod contacts the end of the actuator body after about 5 mm (0.2 in) of movement. This prevents damage to the flaps. The FLAP circuit-breaker opens.

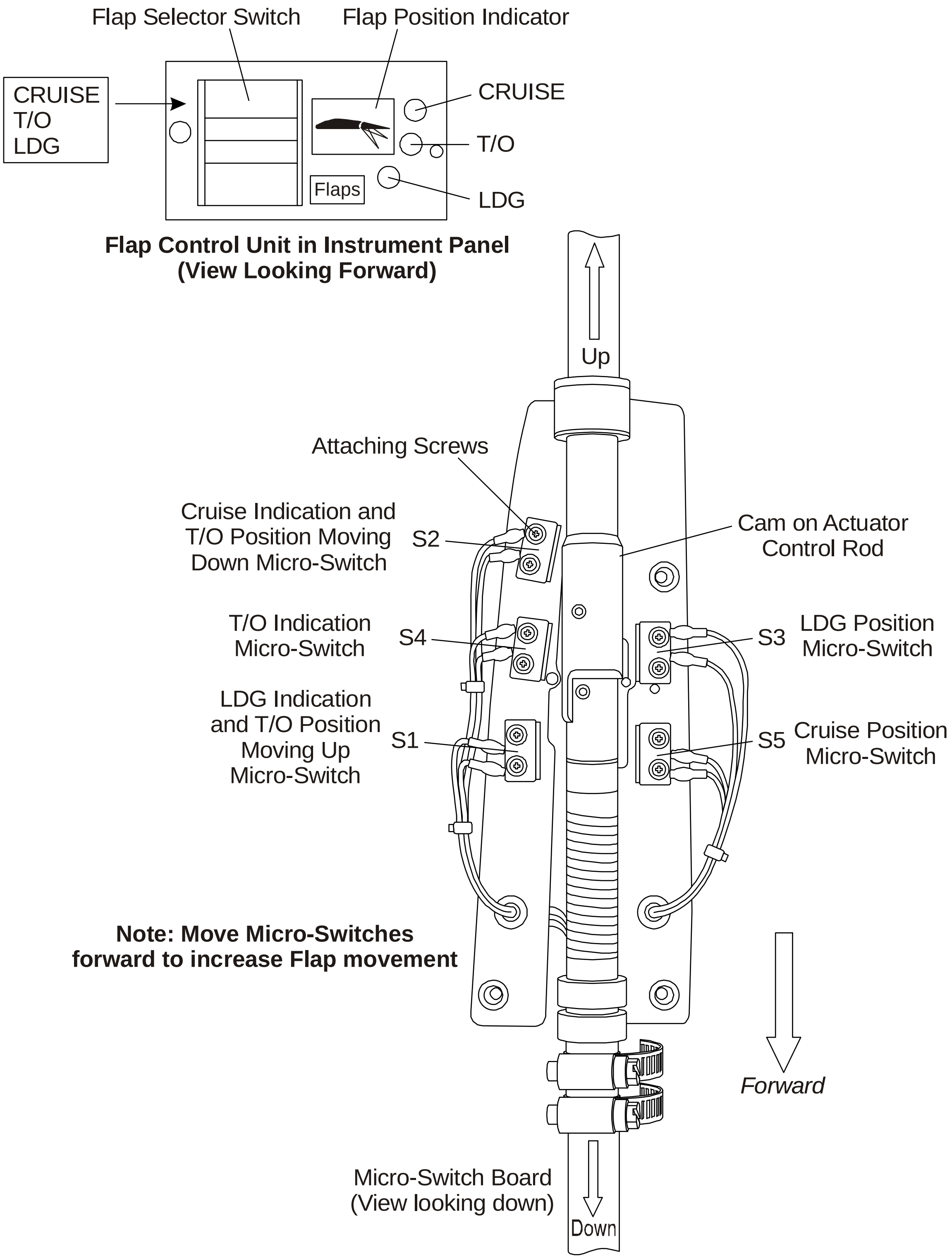

Figure 3: Flap Electrical Control System

Trouble-Shooting

1. General

This table explains how to troubleshoot the flap system. If you have the trouble detailed in the Trouble column read across to the Possible Cause column. Then do the repair in the Repair column.

Trouble	Possible Cause	Repair
Flaps do not operate.	Circuit breaker not set. Airplane electrical system voltage low. Flap selector switch defective.	Set the flap circuit breaker. Do a test of the airplane electrical system voltage. Replace the flap electronic control unit.
Flap circuit breaker will not stay closed.	Short to ground in the wires to the electrical control unit or the micro switches. Short to ground in the electrical control unit. Short to ground in a micro switch. Short to ground in a wire between a closed micro switch and the control unit.	Do an insulation test between each wire and ground. Repair or replace defective wires. Replace the electrical control unit. Replace the micro switch. Do an insulation test between each wire and ground. Repair or replace defective wires.
Flap circuit breaker opens when flap selector switch moved to any down position.	Short to ground in a motor supply wire.	Do an insulation test between each wire and ground. Repair or replace defective wires.
Flap circuit-breaker opens when flap selector switch moved to any up position.	Short to ground in a motor supply wire.	Do an insulation test between each wire and ground. Repair or replace defective wires.
Flap circuit-breaker opens when the flaps stop at the chosen position.	Short to ground in the wires to the electrical control unit from the related indication micro-switch.	Do an insulation test between each wire and ground. Repair or replace defective wires.

Trouble	Possible Cause	Repair
Flap circuit-breaker opens when the flaps have moved only a short distance from the CRUISE setting.	Short to ground in the wires to the electrical control unit from micro-switch 1.	Do an insulation test between each wire and ground. Repair or replace defective wires.
Flap circuit-breaker opens when the flaps have moved only a short distance from the LDG setting.	Short to ground in the wires to the electrical control unit from micro-switch 4.	Do an insulation test between each wire and ground. Repair or replace defective wires.
Flaps move slowly.	Airplane electrical system voltage low.	Do a test of the airplane electrical system voltage.
	Flap motor defective.	Do a test for 12V at the motor with flaps selected. If there is 12V at the motor. Replace the actuator.
	Defective flap actuator.	Examine the actuator. If you find damage, then replace the flap actuator.
Flaps do no not align with the wing trailing edge.	Flaps extended at too high airspeed.	Examine the flap system. Replace damaged parts. Adjust the system.

Trouble	Possible Cause	Repair
Flaps will not move to LDG position. Flaps move to T/O and CRUISE correctly.	Micro-switch 4 defective. Open circuit in the micro-switch 4 wiring.	Replace the micro-switch. Do a continuity test of the wiring. Repair or replace the defective wire.
Flaps will not move to CRUISE position. Flaps move to T/O and LDG correctly.	Micro-switch 1 defective. Open circuit in the micro-switch 1 wiring.	Replace the micro-switch. Do a continuity test of the wiring. Repair or replace the defective wire.
No LDG indication when the flaps are in the LDG position. Flaps will not move from LDG to T/O. Flaps move from LDG to CRUISE correctly.	Micro-switch 5 defective. Open circuit in the micro-switch 5 wiring.	Replace the micro-switch. Do a continuity test of the wiring. Repair or replace the defective wire.
No CRUISE indication when the flaps are in the CRUISE position. Flaps will not move from CRUISE to T/O. Flaps move from CRUISE to LDG correctly.	Micro-switch 2 defective. Open circuit in the micro-switch 2 wiring.	Replace the micro-switch. Do a continuity test of the wiring. Repair or replace the defective wire.
No T/O indication when the flaps are in the T/O position. Flaps move to all positions correctly.	Micro-switch 3 defective. Open circuit in the micro-switch 3 wiring.	Replace the micro-switch. Do a continuity test of the wiring. Repair or replace the defective wire.
Flap circuit-breaker opens at the end of down movement.	Micro-switch 4 defective.	Replace the micro-switch.
Flap circuit-breaker opens at the end of up movement.	Micro-switch 1 defective.	Replace the micro-switch.
LDG light stays on when the flaps are not in the LDG position. The other indications operate correctly.	Micro-switch 1 defective. Long side of cam making contact.	Replace the micro-switch. Rotate switch tray.

Trouble	Possible Cause	Repair
CRUISE light stays on when the flaps are not in the CRUISE position. The other indications operate correctly.	Long side of cam making contact.	Rotate switch tray.
T/O light stays on when the flaps are not in the T/O position. The other indications operate correctly.	Micro-switch 3 defective.	Replace the micro-switch.
Flaps move to LDG when T/O set from CRUISE.	Micro-switch 2 defective.	Replace the micro-switch.
Flaps move to CRUISE when T/O set from LDG.	Micro-switch 5 defective.	Replace the micro-switch.

Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the components of the flap system and how to test and adjust the system. Refer to Section 57-50 for data about removing and installing the flaps.

2. Remove/Install the Flap Actuator

Refer to Figures 1.

A. Remove the Flap Actuator

	Detail Steps/Work Items	Key Items/References
(1)	If possible, set the flaps to the LDG position.	
(2)	Disconnect the airplane battery.	Refer to Section 24-31.
(3)	Remove the pilot’s seat.	Refer to Section 25-10.
(4)	Disconnect the supply wires to the flap motor.	
(5)	Disconnect the control harness plug from the switch-board.	
(6)	Remove the access panels below the aft control bulkhead.	
(7)	Remove the bolt that attaches the actuator control rod to the bellcrank.	At the aft control bulkhead. Hold the flaps.
(8)	Lower the flaps by hand until the stop.	
(9)	Remove the bolt which attaches the actuator body to the forward mounting bracket.	
(10)	Remove the actuator from the airplane.	

B. Install the Flap Actuator

	Detail Steps/Work Items	Key Items/References
(1)	Put the flap actuator in position in the fuselage.	Make sure that the actuator is in the fully retracted position.
(2)	Install the bolt which attaches the actuator to the forward mounting.	
(3)	Install the bolt which attaches the actuator control rod to the bellcrank.	At the aft control bulkhead. Hold the flaps.
(4)	Connect the control harness plug for the switch-board.	
(5)	Connect the supply wires to the flap motor.	
(6)	Connect the airplane battery.	Refer to Section 24-31.
(7)	Do the adjustment test procedure.	See below.
(8)	Install the left pilot’s seat.	Refer to Section 25-10.
(9)	Install the access panels below the aft control bulkhead.	

3. Test the Flap Control System

A. Equipment

Item	Quantity	Part Number
Spring Scale	1	Commercial.
Angle Level	1	Commercial.

B. Procedure

NOTE: This procedure assumes that the flap controls are fully connected.

NOTE: Use the micro-switches to adjust the range of movement of both flaps. Use the short rods at the flap horns to adjust the angle of one flap against the other.

	Detail Steps/Work Items	Key Items/References
(1)	Open the FLAP circuit-breaker.	On the right side of the instrument panel.
(2)	Remove the left pilot’s seat.	Refer to Section 25-10.
(3)	Remove the access panels below the aft control bulkhead.	
(4)	Remove the cover from the flap actuator switch board.	
(5)	Loosen the 2 worm-drive clamps which hold the switch board to the actuator body.	
(6)	Set the ELECTRIC MASTER switch to ON.	
(7)	Set the flap selector switch to LDG.	
(8)	Close the FLAP circuit-breaker.	
(9)	Set the flap selector switch to T/O.	Let the flap actuator extend about 12 mm (1/2 in).
(10)	Set the ELECTRIC MASTER switch to OFF.	
(11)	Move the switch board to give approximately 5 mm (0.2 in) of actuator control rod movement from the fully closed position.	
(12)	Set the ELECTRIC MASTER switch to ON.	
(13)	Set the flap selector switch to LDG.	The actuator must stop approximately 5 mm (0.2 in) from the fully closed position.
(14)	Do items 9 to 13 as necessary to get the correct movement.	Approximately 5 mm (0.2 in) of actuator control rod movement from the fully closed position.
(15)	Set the ELECTRIC MASTER switch to OFF.	
(16)	Tighten the worm-drive clamps.	
(17)	Set the ELECTRIC MASTER switch to ON.	

	Detail Steps/Work Items	Key Items/References
(18)	Set the flap selector switch to CRUISE.	
(19)	If the flap circuit-breaker opens: – Set the ELECTRIC MASTER switch to OFF. – Increase the length of both short control rods by 1 turn at the flaps. – If necessary, Increase the length of the emergency up-stop rod.	Make sure that the rod-ends are in safety. Make sure that the rod-end is in safety.
(20)	Close the FLAP circuit-breaker.	
(21)	Set the ELECTRIC MASTER switch to ON.	
(22)	Set the flap selector switch to T/O.	
(23)	Do the items 18 to 22 again until the flaps stop correctly.	
(24)	Test the flap pre-load: – Make sure that both flaps contact the bumpers together. – Pull down on the flaps to just clear the flap bumpers.	If necessary, adjust the length of the short pushrod at the flap. Use a spring scale. The force must be 3 to 5 kg (6.7 to 11.2 lb).
(25)	If the flap pre-load is too low, decrease the length of both short control rods by 1 turn at the flaps.	
(26)	Do items 24 and 25 again until the flaps stop correctly.	
(27)	Put the angle level in position on the flap.	Record the angle.
(28)	Set the flap selector switch to LDG.	
(29)	When the flaps stop, measure the angle on the angle level.	The angle must be 44 to 46 degrees.

	Detail Steps/Work Items	Key Items/References
(30)	If necessary, adjust the angle with micro-switch 4: – Set the ELECTRIC MASTER switch to OFF. – Loosen the two attaching screws. – Move the switch a small distance. – Tighten the two attaching screws.	Refer to Figure 3. Move the switch forward to increase the angle.
(31)	Set the ELECTRIC MASTER switch to ON.	
(32)	Set the flap selector switch to T/O.	
(33)	Do the steps 28 to 32 again until the flaps stop correctly.	
(34)	When the flaps stop, measure the angle on the angle level.	The angle must be 14 to 16 degrees.
(35)	If necessary, adjust the angle with micro-switch 5: – Set the ELECTRIC MASTER switch to OFF. – Loosen the two attaching screws. – Move the switch a small distance. – Tighten the two attaching screws.	Refer to Figure 3. Move the switch forward to increase the angle.
(36)	Set the ELECTRIC MASTER switch to ON.	
(37)	Set the flap selector switch to T/O.	
(38)	Do the items 34 to 37 again until the flaps stop correctly.	
(39)	Set the flap selector switch to CRUISE.	
(40)	When the flaps stop, measure the angle on the angle level.	The angle must be +1 to -1 degree.

	Detail Steps/Work Items	Key Items/References
(41)	If necessary, adjust the angle with micro-switch 1: – Set the ELECTRIC MASTER switch to OFF. – Loosen the two attaching screws. – Move the switch a small distance. – Tighten the two attaching screws.	Refer to Figure 3. Move the switch forward to increase the angle.
(42)	Set the ELECTRIC MASTER switch to ON.	
(43)	Set the flap selector switch to T/O.	
(44)	Do the items 39 to 43 again until the flaps stop correctly.	
(45)	When the flaps stop, measure the angle on the angle level.	The angle must be 14 to 16 degrees.
(46)	If necessary, adjust the angle with micro-switch 2: – Set the ELECTRIC MASTER switch to OFF. – Loosen the two attaching screws. – Move the switch a small distance. – Tighten the two attaching screws.	Refer to Figure 1. Move the switch forward to increase the angle.
(47)	Set the ELECTRIC MASTER switch to ON.	
(48)	Set the flap selector switch to CRUISE.	
(49)	Set the flap selector switch to T/O.	
(50)	Do the items 45 to 49 again until the flaps stop correctly.	
(51)	Make sure that the T/O light on the flap position indicator is on.	

	Detail Steps/Work Items	Key Items/References
(52)	If necessary, adjust the angle with micro-switch 3: – Set the ELECTRIC MASTER switch to OFF. – Loosen the two attaching screws. – Move the switch a small distance. – Tighten the two attaching screws.	Refer to Figure 3. Move the switch forward to increase the angle.
(53)	Set the ELECTRIC MASTER switch to ON.	
(54)	Set the flap selector switch to LDG.	
(55)	When the flap stops at LDG: – Set the flap selector switch to T/O.	
(56)	When the flaps stop at T/O: – Make sure that the T/O light on the flap position indicator is on.	
(57)	If necessary, adjust the angle with micro-switch 3: – Set the ELECTRIC MASTER switch to OFF. – Loosen the two attaching screws. – Move the switch a small distance. – Tighten the two attaching screws.	Refer to Figure 3. If the position indication does not come on, move the switch forward.
(58)	Do items 51 to 57 again until the flap position indicates correctly at T/O on the way up and down.	
(59)	Set the flap selector switch to CRUISE.	
(60)	Set the ELECTRIC MASTER switch to OFF.	
(61)	Do a test of the flap pre-load.	

	Detail Steps/Work Items	Key Items/References
(62)	If necessary, adjust the emergency up-stop.	There must be a light load on the washers.
(63)	Remove the angle level.	
(64)	Install the cover on the switch board of the flap actuator.	
(65)	Do an inspection of the control connections which you disconnected. If necessary for your airworthiness authority, do a second inspection of the controls.	
(66)	Do a check for loose items in the cockpit and the area of the aft control bulkhead.	
(67)	Install the access panels below the fuselage.	
(68)	Install the left pilot's seat.	Refer to Section 25-10.

CHAPTER 28

FUEL

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TABLE OF CONTENTS

CHAPTER 28

FUEL

Section 28-10

Fuel Storage

Trouble-Shooting

Maintenance Practices

Section 28-20

Fuel Distribution

Trouble-Shooting

Maintenance Practices

Section 28-40

Fuel Indicating

Trouble-Shooting

Maintenance Practices

CHAPTER 28
FUEL

1. General

This chapter describes the general data about the airframe fuel system. Refer to the engine maintenance manuals for data about the engine fuel system.

2. Description

Figure 1 shows the fuel system schematic diagram. The DV 20 E airplane has the following fuel system components:

– A 24.5 US gallon (92.7 liters) fuel tank. The fuel tank is located in the fuselage behind the seats.

– A fuel shut-off valve. The fuel shut-off valve is located on the aft side of the firewall. The control lever for the shut-off valve is on the forward part of the center console.

– A maintenance shut-off valve. The maintenance shut-off valve lets you remove the filter screen from the gascolator or the electrical pump without draining the entire fuel tank. The maintenance shut-off valve is located below the fuel tank.

– A gascolator. The gascolator is located below the fuel tank. It has a 62 micron filter screen.

– A fuel line filter is located in the engine compartment.

– An electrical fuel pump unit. The electrical fuel pump unit (consists of 2 fuel pumps) is located below the fuel tank.

– A check valve. The check valve is located in the return line below the fuel tank.

– A spring loaded check valve. The spring loaded check valve is a bypass to the fuel inline filter.

– A fuel quantity sensor. The fuel quantity sensor is located in the top of the fuel tank.

– A fuel quantity gauge. The fuel quantity gauge is located on the right instrument panel.

– A fuel pressure sensor. The fuel pressure sensor is installed at the inlet of the fuel pressure regulator.

– A fuel pressure indicator. The fuel pressure indicator is on the engine instrument display.

– A fuel tank drain valve. The drain valve is located below the fuel tank and is spring loaded.

– Two maintenance drain taps. The low point of each supply and return pipe has a maintenance drain tap.

– Flexible fuel hoses.

– An Air-Fuel Separator with integrated orifice.

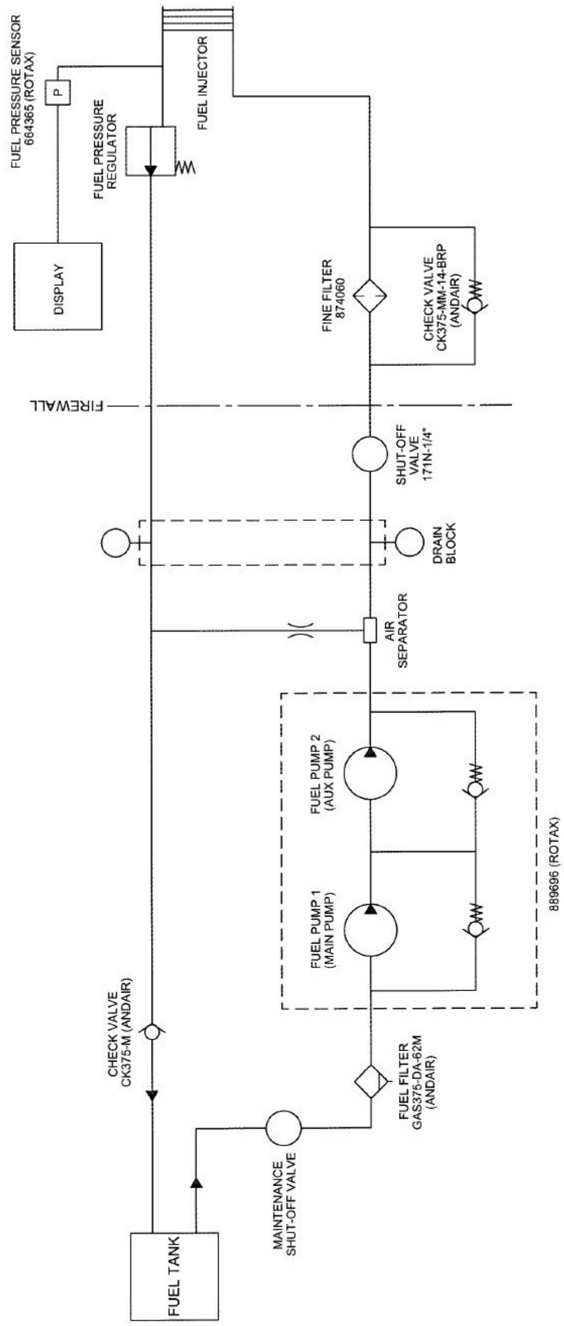

Figure 1: Fuel System Schematic

3. Operation

With the fuel shut-off valve set to OPEN, fuel flows from the fuel tank to the engine through the following components:

– Maintenance shut-off valve.

– Gascolator.

– Electrically driven fuel pumps.

– Air fuel separator.

– Maintenance drain tap in the supply line.

– Fuel shut-off valve.

– Fuel line filter.

Fuel returns from the engine to the fuel tank through the following components:

– Fuel return line.

– Maintenance drain tap in the return pipe.

– Check valve.

With the fuel shut-off valve set to CLOSED, fuel cannot flow to the engine.

CAUTION: LOCK THE MAINTENANCE SHUT-OFF VALVE OPEN WITH WIRE. IF YOU DO NOT LOCK THE VALVE OPEN IT MAY CLOSE IN FLIGHT. THIS WOULD CAUSE ENGINE FAILURE.

You can close the maintenance shut-off valve to do maintenance on the fuel system components below the fuel tank.

Section 28-10
Fuel Storage

1. General

This chapter describes in more detail the fuel tank installation.

2. Description

Figure 1 shows the fuel tank. The standard capacity aluminum tank can hold 24.5 US gal (92.7 liter) total fuel of which 22.2 US gal (84 liter) is usable fuel.

Baffles inside the tank prevent fuel slushing. An aluminum tube at the left hand side of the tank connects to the fuel filler. A vent pipe connects to the aluminum tube. The vent pipe goes down through the fuselage skin to the outside of the airplane. The fuel tank bonds electrically to the fuel ground connection.

The tank is located between the spar bridge and the B bulkhead. Pads on the spar bridge and B bulkhead positions the fuel tank. A steel band holds the tank in position. The baggage compartment floor panel covers the fuel tank.

The top of the tank has a mounting for the fuel quantity sensor. The bottom of the tank also has connections for:

– The fuel supply to the maintenance shut-off valve. The tank has one supply pipe. This connection has a hollow bolt with a finger filter. The bottom part of the hollow bolt makes a small stand-pipe. This makes a sump to prevent water (or other contaminants) from entering the fuel system.

– The fuel drain valve. The fuel drain valve connects to the lowest part of the tank. You can use the fuel-sampler cup to operate the drain valve. Push the extension tube upwards to operate the drain valve. Release it to close the valve. You can drain the tank fully using the drain valve.

– The fuel return pipe.

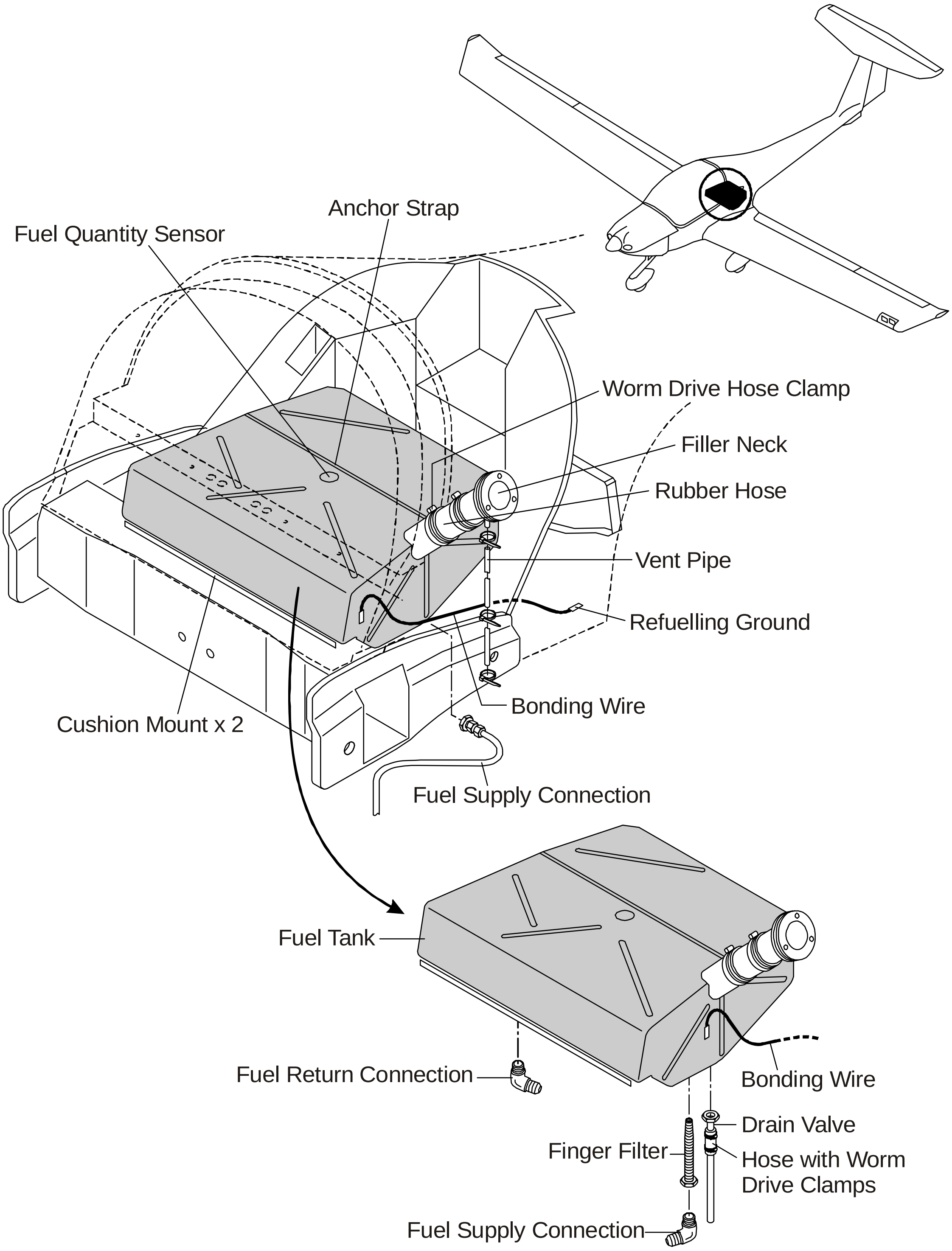

Figure 1: Fuel Tank Installation

Trouble-Shooting

1. General

This table explains how to troubleshoot the fuel storage system. If you find the trouble in column 1, do the repair given in column 3.

Trouble	Possible Cause	Repair
Smell of fuel in the airplane.	Fuel hose connection loose.	Tighten the connection.
	Fuel tank cracked.	Replace or repair the fuel tank.
	Fuel filler hose loose.	Tighten the connection.
Fuel tank filler-cap leaking.	Defective filler-cap seal.	Replace the seal.
Fuel tank connection leaking.	Defective drain valve seal.	Replace the seal.
	Damaged thread.	Replace or repair the fuel tank.
Fuel contamination.	Bulk fuel supply contaminated.	Remove and flush the fuel tank.
		Flush all fuel pipes.
		Clean or replace all filters.
NOTE: Most fuel contamination comes from poor quality control of the fuel before putting it in the airplane. Make sure that you use only clean fuel that meets the specifications as listed in the AFM.		

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Maintenance Practices

1. General

The following maintenance practices describe how to remove and install components and how to flush the fuel system. Refer to Chapter 28-00 for the system description and Chapter 28-40 for the fuel gauge installation.

Obey the usual safety precautions when you do work on the fuel system.

WARNING: DO NOT ALLOW HEAT OR FIRE NEAR FUEL. FUEL BURNS VIOLENTLY. THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

WARNING: DO NOT GET FUEL ON YOUR SKIN. FUEL CAN CAUSE SKIN DISEASE.

2. Remove/Install the Fuel Tank

A. Remove the Fuel Tank

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the airplane battery.	Refer to Chapter 24-31.
(2)	Disconnect any external electrical power from the airplane.	
(3)	Defuel the airplane.	Refer to Chapter 12-10.
(4)	Remove the baggage compartment floor.	Refer to Chapter 25-10.
(5)	Disconnect the fuel return hose.	
(6)	Disconnect the fuel drain valve.	
(7)	Disconnect the fuel supply hose.	
(8)	Release the rubber hose for the fuel filler: – Release the hose-clamps. – Pull the hose from the connection sleeve.	
(9)	Release the steel band which holds the tank.	
(10)	Disconnect the wires from the fuel quantity sensor.	

	Detail Steps/Work Items	Key Items/References
(11)	Remove the tank from the airplane: – Lift the back of the tank upwards and forwards. – Turn the tank upside-down as you remove it over the seat back.	Refer to Figure 2.

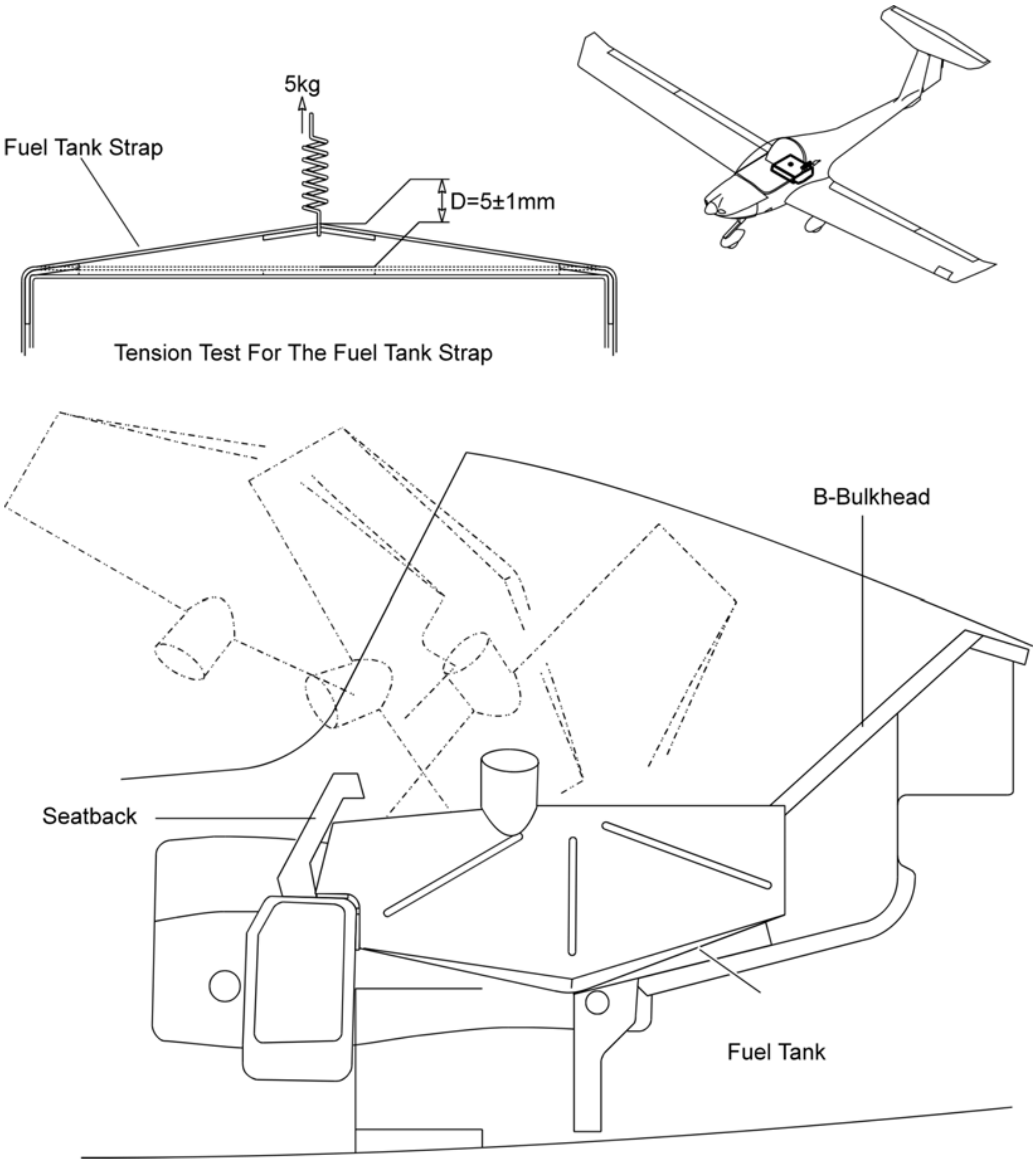

Figure 2: Remove/Install the Fuel Tank

B. Install the Fuel Tank

	Detail Steps/Work Items	Key Items/References
(1)	Make sure that the rubber pads are in position on the spar bridge and the B-bulkhead.	
(2)	Put the fuel tank in position in the airplane. – Hold the tank upside-down with the stepped edge facing aft. – Move the tank above the seat back. – Turn the tank so that the stepped edge goes down behind the seat back. – Keep turning the tank until it is the correct way up.	Refer to Figure 2.
(3)	Install the steel band which holds the tank: – Tighten the nuts at each end equally. – Pull upwards on the middle of the strap with a spring balance.	Refer to Figure 2. The movement of the strap must be 0.15 - 0.23 in at 11 lb load (5 ± 1 mm at 5 kg load).
(4)	Connect the wires to the fuel quantity sensor.	
(5)	Install the rubber hose for the fuel filler: – Put the hose in position on the connection sleeve. – Tighten the hose-clamps.	
(6)	Connect the pipe to the fuel drain valve.	
(7)	Connect the fuel return hose.	
(8)	Connect the fuel supply hose.	
(9)	Refuel the airplane.	
(10)	Examine the fuel tank installation.	Look especially for fuel leaks.

NOTE: If you find a leak from the tank (not from the connections), you must remove the tank for repair. Obey the regulations of your airworthiness authority when you repair fuel tanks.

	Detail Steps/Work Items	Key Items/References
(11)	Install the baggage compartment floor.	
(12)	Connect the battery.	Refer to Chapter 24-31.

3. Remove/Install the Fuel Filler Neck

A. Remove the Fuel Filler Neck

Refer to Figure 3.

	Detail Steps/Work Items	Key Items/References
(1)	On the airplane exterior, remove the six screws from the fuel cap surround.	The screws are screwed into self clinching nuts on the flange of the filler neck.
(2)	Remove the necessary floor covering from the baggage compartment.	
(3)	Inside the baggage compartment, pry the fuel filler neck and spacer free from the fuselage.	Make sure that the fuel cap surround stays in place.
(4)	Remove the spacer from the fuel filler neck assembly.	
(5)	Remove the bolt, two washers and locknut from the ground tab and remove the ground strap from the fuel filler neck.	
(6)	Remove the drain tube from the fuel filler neck.	
(7)	Loosen the hose-clamp at the fuel filler neck and pull the fuel filler neck from the hose.	
(8)	Remove the fuel filler neck.	

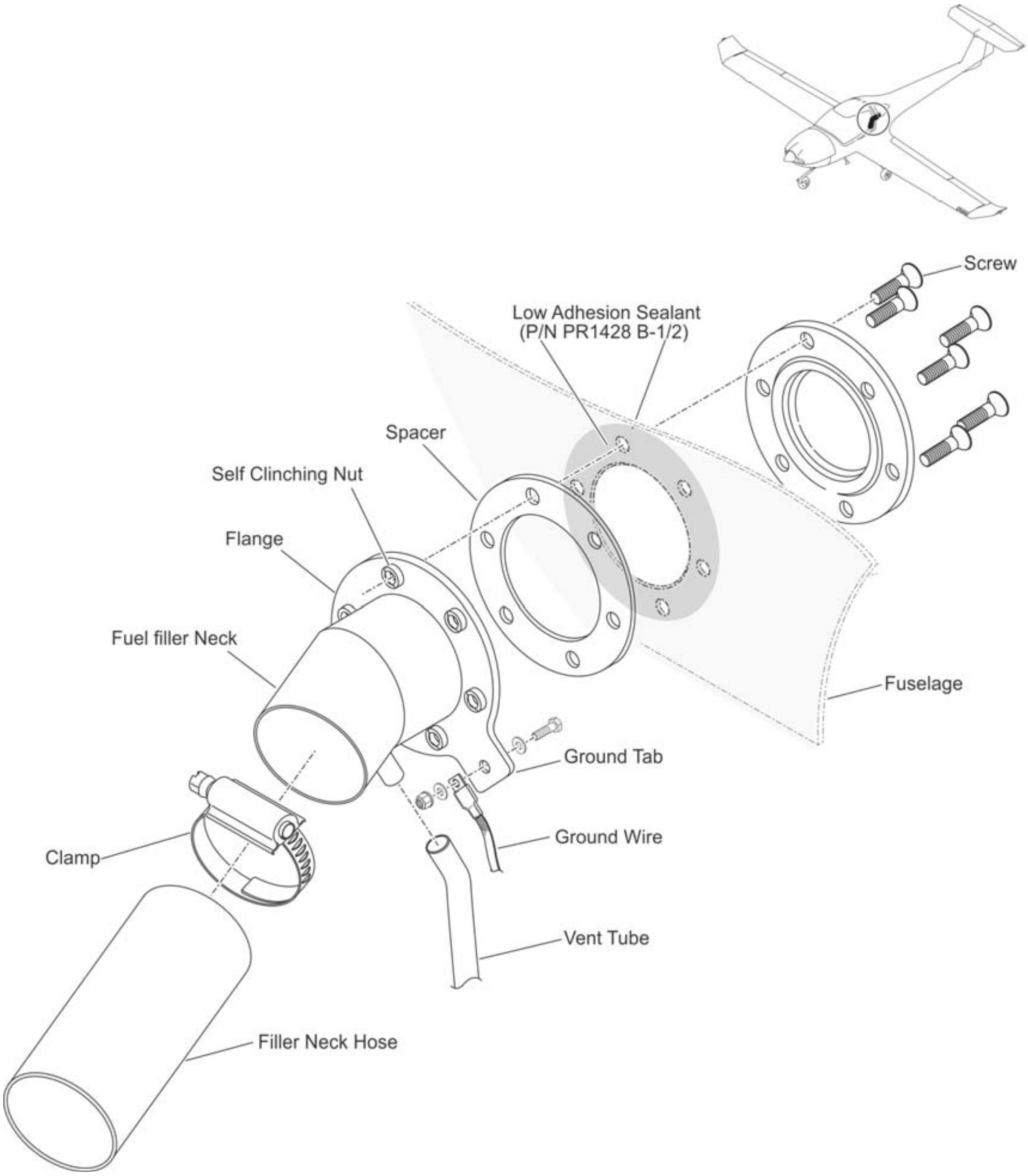

Figure 3: Fuel Filler Neck Removal/Installation

B. Install the Fuel Filler Neck

Refer to Figure 3.

	Detail Steps/Work Items	Key Items/References
(1)	Inside the baggage compartment, connect the hose to the fuel filler neck.	Do not tighten the hose-clamp immediately.
(2)	Connect the drain tube.	
(3)	Connect the ground strap to the ground tab with the bolt, two washers and locknut.	
(4)	Align and install the fuel filler neck assembly and spacer with low adhesion fuel compatible sealant (inner fuselage mating surfaces, and between the fuel filler spacer and filler neck).	Use PR1428 B-1/2 low adhesion sealant. NOTE: Replace the spacer if it is damaged.
(5)	On the airplane exterior, install and tighten the six screws on the fuel cap surround using Loctite 545.	The screws are screwed into self clinching nuts on the flange of the filler neck.
(6)	Tighten the hose-clamp at the fuel filler neck.	
(7)	Install the baggage compartment floor covering.	

4. Flush the Fuel System Procedure

This procedure describes how to flush the fuel feed pipe from the fuel tank to the engine bay.

Obey the usual safety precautions when you do work on the fuel system.

WARNING: DO NOT ALLOW HEAT OR FIRE NEAR FUEL. FUEL BURNS VIOLENTLY. THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

WARNING: DO NOT GET FUEL ON YOUR SKIN. FUEL CAN CAUSE SKIN DISEASE.

	Detail Steps/Work Items	**Key Items/References**
(1)	Remove the engine cowlings.	Refer to Chapter 71-10.
(2)	Make sure the airplane has sufficient fuel to do the test.	Approximately 4.5 Liters (1.2 US gallons) of fuel.
(3)	Put a fire extinguisher in position next to the airplane.	
(4)	Disconnect the fuel feed hose from the fuel fine filter in the engine compartment.	NOTE: Make sure to note the orientation of inline fuel filter.
(5)	Put the end of the fuel feed hose into a container.	Make sure the fuel feed hose and the container are connected to ground connections.
(6)	Set the ELECTRIC MASTER switch to ON. – Set the EMERGENCY FUEL PUMP switch to ON. – Let the fuel pump operate for sufficient time to pump approximately 4.5 liters (1.2 US gallons) into the container.	This will make sure that sufficient fuel has been flushed through the system.
(7)	Set the EMERGENCY FUEL PUMP switch to OFF.	
(8)	Attach the fuel feed hose to the fuel pump inlet. Tighten the fuel hose connector.	NOTE: Make sure that the inline fuel filter is installed correctly. Refer to step 4. Torque to 30.5 Nm (270 lbf-in).

	Detail Steps/Work Items	Key Items/References
(9)	Set the EMERGENCY FUEL PUMP switch to ON. – Do a leak check of the fuel feed hose connection. – Set the EMERGENCY FUEL PUMP switch to OFF. – Set the ELECTRIC MASTER switch to OFF.	
(10)	Install the engine cowlings.	Refer to Chapter 71-10.

5. Replace the Fuel Cap O-Rings

This procedure describes how to flush the fuel feed pipe from the fuel tank to the engine bay.

Obey the usual safety precautions when you do work on the fuel system.

WARNING: DO NOT ALLOW HEAT OR FIRE NEAR FUEL. FUEL BURNS VIOLENTLY. THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

WARNING: DO NOT GET FUEL ON YOUR SKIN. FUEL CAN CAUSE SKIN DISEASE.

	Detail Steps/Work Items	Key Items/References
(1)	Remove the fuel cap.	
(2)	Disassemble and clean the cap.	Insert the key before removing the lock.
(3)	Replace all items included in overhaul kit part number OHK3.	
(4)	Re-assemble cap.	During the reassembly of the cap, lubricate with Vaseline or light silicone crease.
(5)	Adjust the cap to provide a light but positive seal.	
(6)	Install the fuel cap.	

Section 28-20

Fuel Distribution

1. General

This chapter describes in more detail the fuel distribution system. Refer to the Rotax engine manuals for more data about the engine fuel system.

2. Description

Figure 1 shows the location of the fuel distribution system components in the airplane.

The fuel distribution system has the following components:

A. Maintenance shut-off valve.

The maintenance shut-off valve is located below the fuel tank. It attaches to the inlet port of the gascolator. The valve has 2 positions:

– Open: The valve connects the fuel tank to the gascolator inlet. You must lock the valve in this position with wire at all times when you operate the airplane.

– Closed: The valve stops fuel flow to the gascolator inlet. Use this position only to do maintenance on the fuel system. For example, when you clean the fuel filter.

B. Gascolator

The gascolator is located below the fuel tank on the left. It attaches to the B-bulkhead. The gascolator is a sediment trap. It also has a filter screen. You can release the bowl of the gascolator to clean the filter.

C. Electrical Fuel Pump Unit

The electrical fuel pump unit is located below the fuel tank. It attaches to a bracket at the bottom on the right. The main pump is switched on with the ENGINE MASTER switch. The emergency fuel pump switch is located on the instrument panel and activates the second fuel pump.

For maintenance purposes (e.g. ECU data readout) the main pump can be de-activated by pulling a circuit breaker on the RH bottom side of the instrument panel.

D. Maintenance Drain Taps

The maintenance drain taps are located on the fuselage inner skin below the spar bridge. They are at the lowest point in the fuel system. You can use the drain taps to drain water from the fuel pipes in the system. Use the drain valve in the fuel tank for the usual water drain check.

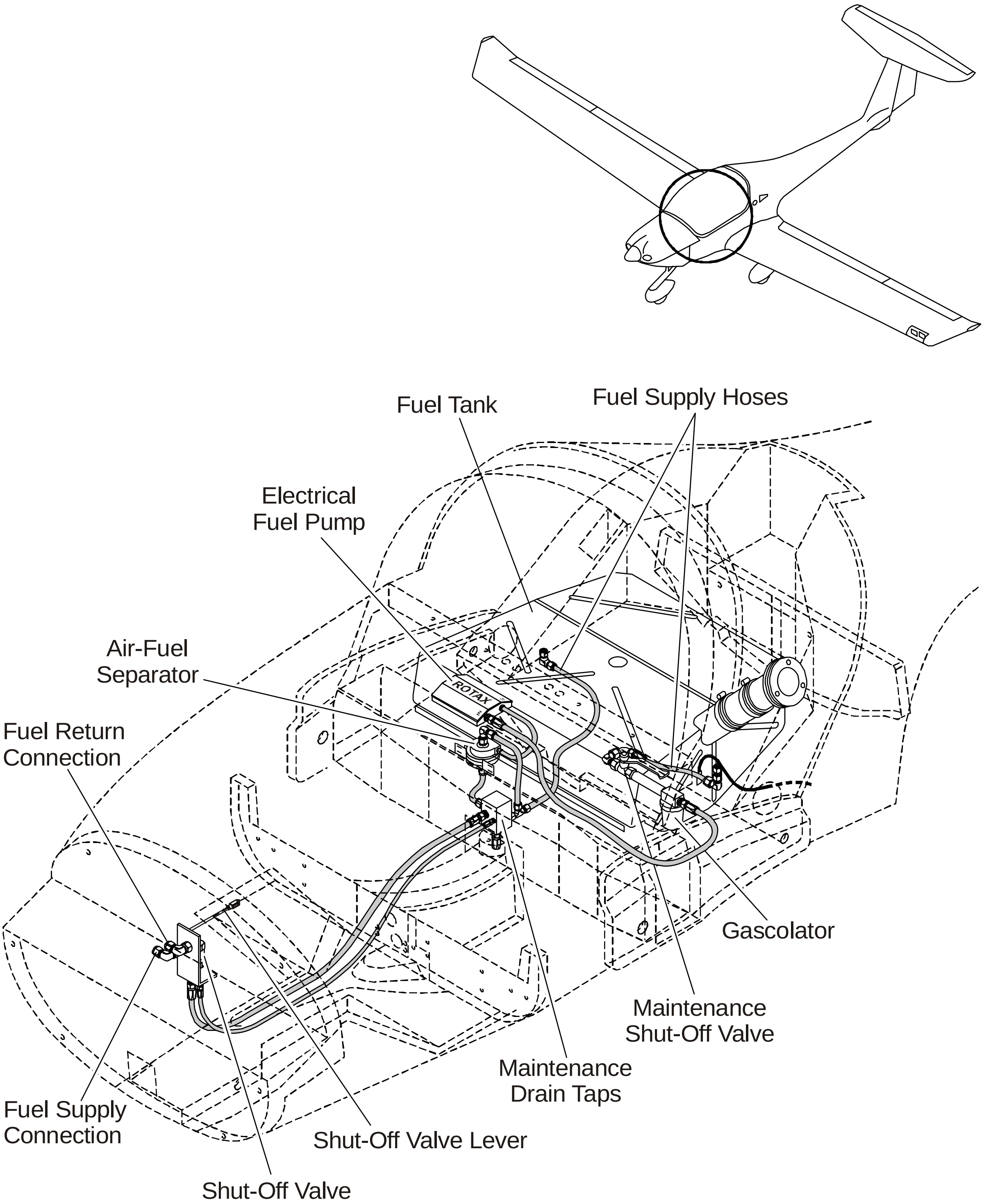

Figure 1: Fuel Distribution System

E. Air-Fuel-Separator

The air-fuel-separator is located in front of the fuel tank and assures via a return vent line, that air in the fuel line is separated prior to reaching the engine.

F. Fuel Shut-Off Valve

Figure 2 shows the Fuel shut-off valve. The fuel shut-off valve is located on the aft face of the firewall. It has a red-striped handle. The fuel shut-off valve can also be located on the center console. The valve has 2 positions:

– OPEN: The valve connects the electrical fuel pump outlet to the engine fuel system. This is the usual position when you operate the airplane.

– CLOSED: The valve stops all fuel flow to the engine.

G. Check Valve

A check valve is located beside the fuel tank on the left. It is in the fuel return pipe. The check valve prevents fuel vapor from the return pipe being sucked into the engine during engine start. You cannot adjust the check valve.

A Check valve is located parallel to each fuel pump in the fuel pump box and allows fuel flow when one pump is not operating.

A check valve is located parallel to the fuel fine filter. It opens when the fuel fine filter becomes clogged.

H. Fuel Hoses

Flexible fuel hoses made of 'Teflon' connect the components. The hoses have a protective metal sheath. The hoses have standard flared end-fittings.

I. Fuel Fine Filter

A fuel fine filter is located on the firewall in the engine compartment.

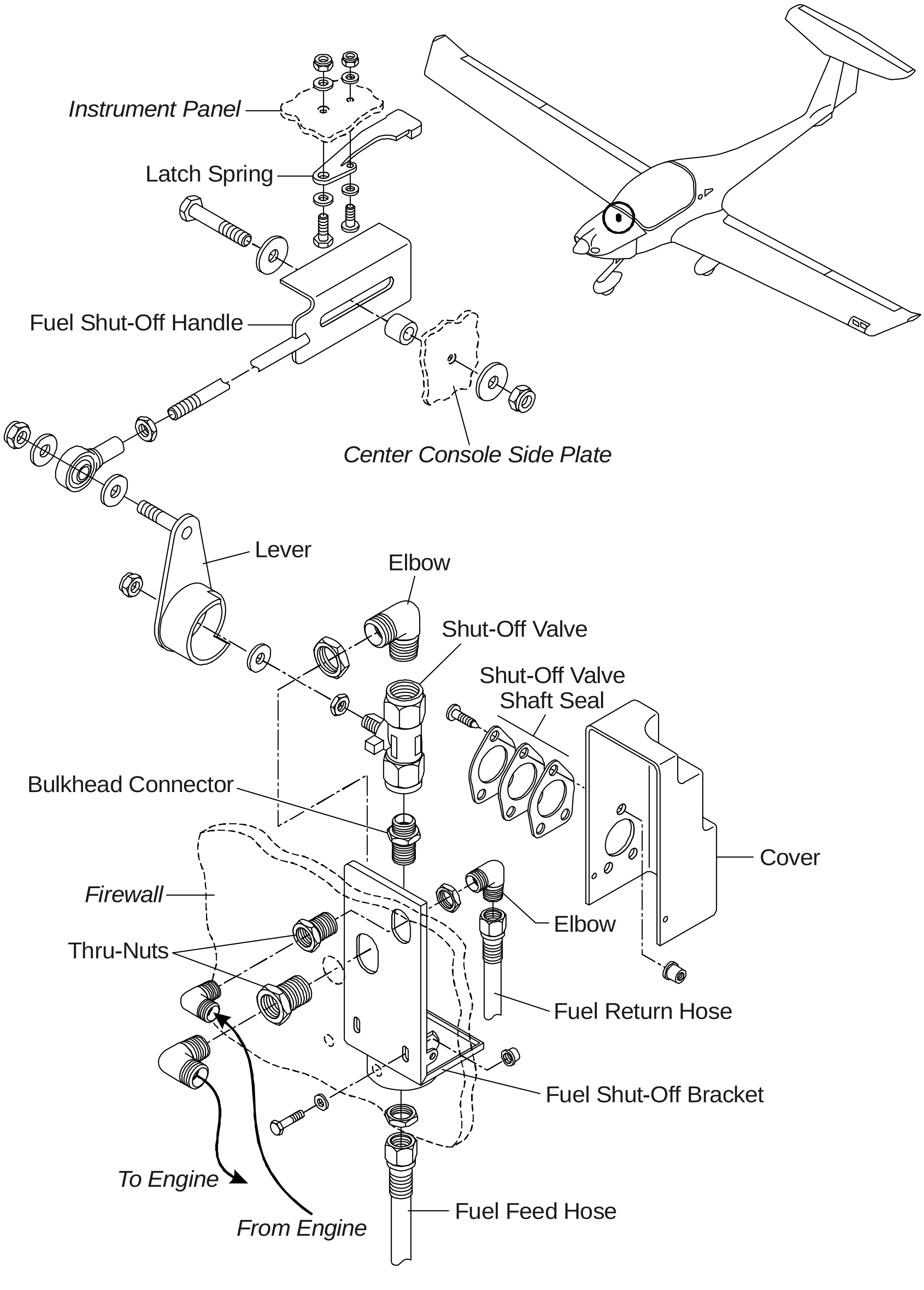

Figure 2: Fuel Shut-Off Valve

Trouble-Shooting

1. General

This table explains how to troubleshoot the fuel distribution system. If you find the trouble in column 1, do the repair given in column 3.

Trouble	Possible Cause	Repair
Smell of fuel in the airplane.	Fuel hose connection loose. Electrical fuel pump leaking. Gascolator leaking. Fuel shut-off valve leaking.	Tighten the connection Replace the fuel pump. Repair or replace the gascolator. Replace the fuel shut-off valve.
Low fuel pressure.	Blocked gascolator.	Clean the filters.
High fuel pressure.	Blocked fuel fine filter.	Replace the fine filter. Determine source of contamination.
Difficulty starting the engine.	Defective fuel pump.	Replace the fuel pump.

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Maintenance Practices

1. General

The following maintenance practices describe how to remove and install components. Refer to Chapter 28-00 for the system description.

Obey the usual safety precautions when you do work on the fuel system.

WARNING: DO NOT ALLOW HEAT OR FIRE NEAR FUEL. FUEL BURNS VIOLENTLY. THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.

WARNING: DO NOT GET FUEL ON YOUR SKIN. FUEL CAN CAUSE SKIN DISEASE.

2. Remove/Install the Electric Fuel Pump Unit

A. Remove the Electric Fuel Pump Unit

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the airplane battery.	Refer to Chapter 24-31.
(2)	Remove the fuel-tank access-panels from the bottom of the fuselage.	
(3)	Remove the fuel tank.	Refer to Chapter 28-10.
(4)	Disconnect the electrical connector for the fuel pump unit.	
(5)	Open the maintenance drain tap.	Use a container to catch the fuel.
(6)	Release the inlet pipe to the fuel pump unit.	Put the caps on the open connections.
(7)	Release the outlet pipe from the fuel pump unit.	Put the caps on the open connections.
(8)	Remove the four nuts that attach the fuel pump unit to the fuel pump bracket.	
(9)	Remove the fuel pump unit from the airplane.	
(10)	Make sure that the maintenance drain tap is closed.	

B. Install the Electric Fuel Pump Unit

	Detail Steps/Work Items	Key Items/References
(1)	Put the fuel pump unit in position in the airplane.	
(2)	Install the four nuts that attach the fuel pump unit to the fuel pump bracket.	Refer to Chapter 20 for torque value.
(3)	Connect the outlet pipe from the fuel pump unit.	
(4)	Connect the inlet pipe to the fuel pump unit.	
(5)	Connect the electrical connector for the fuel pump unit.	
(6)	Install the fuel tank.	Refer to Chapter 28-10.
(7)	Open the maintenance shut-off valve.	
(8)	Connect the battery.	Refer to Chapter 24-31.
(9)	Do a functional test of the electrical fuel pump unit.	
(10)	Examine the fuel pump unit installation.	Look especially for fuel leaks.
CAUTION: LOCK THE MAINTENANCE SHUT-OFF VALVE OPEN WITH WIRE. IF YOU DO NOT LOCK THE VALVE OPEN, IT MAY CLOSE IN FLIGHT. THIS WOULD CAUSE ENGINE FAILURE.		
(11)	Lock the maintenance valve open with wire.	Lock the maintenance valve lever to the gascolator.
(12)	Install the fuel-tank access-panels below the fuselage.	Refer to Chapter 24-31.

C. Clean the Filter Element in the Gascolator

	Detail Steps/Work Items	Key Items/References
(1)	Remove the fuel-tank access-panels from the bottom of the fuselage.	
(2)	Close the maintenance shut-off valve.	Cut the lock-wire.
(3)	Remove the bowl from the gascolator.	Cut the lock-wire. Turn lock ring clockwise.
(4)	Remove the filter element.	Turn filter assembly counter clockwise.
	WARNING: DO NOT ALLOW HEAT OR FIRE NEAR FUEL. FUEL BURNS VIOLENTLY. THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.	
(5)	Wash the filter element.	Use clean fuel.
(6)	Clean the inside of the gascolator bowl.	
(7)	Install the filter and the gascolator bowl.	Align the arrow on the bowl with the mark on the housing, rotate retaining ring counter clockwise.
	CAUTION: DO NOT OVERTIGHTEN THE KNURLED RETENTION NUT ON THE WIRE BAIL TYPE GASCOLATOR. SEPARATION OF THE GASCOLATOR BOWL MAY RESULT.	
(8)	Open the maintenance shut-off valve.	
(9)	Examine the gascolator installation.	Look especially for fuel leaks.
	CAUTION: LOCK THE MAINTENANCE SHUT-OFF VALVE OPEN WITH WIRE. IF YOU DO NOT LOCK THE VALVE OPEN, IT MAY CLOSE IN FLIGHT. THIS WOULD CAUSE ENGINE FAILURE.	
(10)	Lock the maintenance valve open with lock-wire.	
(11)	Lock the gascolator bowl retaining device.	Lockwire the ring to the gascolator housing.
(12)	Install the fuel-tank access-panels below the fuselage.	

3. Remove/Install the Fuel Shut-Off Valve

A. Remove the Fuel Shut-Off Valve

Refer to Figure 2.

	Detail Steps/Work Items	Key Items/References
(1)	Remove the top engine cowling.	Refer to Chapter 71-10.
(2)	Remove the fuel-tank access-panels from the bottom of the fuselage.	
(3)	Disconnect the airplane battery	Refer to Chapter 24-31.
(4)	Close the maintenance shut-off valve.	Cut the lock-wire.
	WARNING: DO NOT ALLOW HEAT OR FIRE NEAR FUEL. FUEL BURNS VIOLENTLY. THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT. **WARNING: DO NOT GET FUEL ON YOUR SKIN. FUEL CAN CAUSE SKIN DISEASE.**	
(5)	Drain the fuel lines: – Open the maintenance taps at the bottom of the fuselage.	Use a correct fuel container.
(6)	Remove the instrument panel.	
(7)	Disconnect the shut-off control rod from the fuel valve lever.	
(8)	Remove the cover from the fuel valve box.	Carefully break the adhesive fuel seal between the cover and the box.
(9)	Loosen the nut on the pipe elbow at the cockpit side of the firewall. Disconnect the fuel feed hose from the pipe elbow on the engine side of the firewall.	Put a cap on the fuel hose.
(10)	Remove the thru-nut from the firewall.	
(11)	Remove the shut-off valve from the bulkhead nut. – Turn the shut-off valve.	

	Detail Steps/Work Items	Key Items/References
(12)	Remove the fuel shut-off valve.	Put a cap on the fuel shut-off valve connections.

B. Install the Fuel Shut-Off Valve

	Detail Steps/Work Items	Key Items/References
(1)	Remove the two caps from the fuel shut-off valve. Put the fuel shut-off valve in position in the airplane.	
(2)	Install the shut-off valve to the bulkhead nut. – Turn the shut-off valve.	Apply Loctite 545 to the threads of the connector (from the third thread aft). Torque to 1.5 - 3 turns past finger tight.
(3)	Put the thru-nut through the firewall from the engine side.	
(4)	Install the elbow pipe nut to the thru-nut.	Torque to 1.5 - 3 turns past finger tight.
(5)	Remove the cap from the hose. Connect the fuel hose to the fuel valve at the engine side.	Apply Loctite 545 to the threads of the connector (from the third thread aft).
(6)	Tighten the valve stem packing nut to give a spring force of 15 to 30 N (3.4 to 6.8 lbf).	Measure perpendicular to the lever with the lever aligned with the valve axis.
(7)	Install the shut-off control rod to the fuel valve lever.	
(8)	Open the maintenance shut-off valve.	
(9)	Install the instrument panel.	Refer to Chapter 31-10.
(10)	Connect the battery.	Refer to Chapter 24-31.
(11)	Operate the electrical fuel pump.	
(12)	Examine the fuel shut-off valve installation.	Look especially for fuel leaks.
(13)	Examine the cover of the box for the fuel shut-off valve. If necessary remove the old sealant.	
(14)	Install the box cover.	Use sealant to specification PRC 1428.
CAUTION: LOCK THE MAINTENANCE SHUT-OFF VALVE OPEN WITH WIRE. IF YOU DO NOT LOCK THE VALVE OPEN, IT MAY CLOSE IN FLIGHT. THIS WOULD CAUSE ENGINE FAILURE.		

	Detail Steps/Work Items	Key Items/References
(15)	Lock the maintenance valve open with wire.	Lock the maintenance valve lever to the gascolator.
(16)	Install the fuel-tank access-panels below the fuselage.	
(17)	Install the top engine cowling.	Refer to Chapter 71-10.
(18)	Do the fuel shut-off valve functional test.	Refer to Chapter 28-20.

4. Functional Test of the Fuel Shut-Off Valve

	Detail Steps/Work Items	Key Items/References
(1)	Do an engine run up test: – Set the engine to IDLE RPM. – Set the fuel shut-off valve to OFF. – Make sure the engine stops.	For the engine run procedures, refer to the DV 20 E Airplane Flight Manual.
(2)	Set the fuel shut-off valve to OPEN. – Restart the engine. – Make sure that the engine operates correctly.	For the engine run procedures, refer to the DV 20 E Airplane Flight Manual.

Section 28-40
Fuel Indicating

1. General

The DV 20 E airplane has a fuel quantity indicating system. The fuel quantity indicating system has a capacitive sensor. The gauge on the instrument panel measures the current flowing through the sensor. The gauge is marked 0, 1/4, 1/2, 3/4 and 1/1.

2. Description

Figure 1 shows the location and installation of the components in the airplane.

The fuel quantity indication system has only two components. It has a fuel quantity sensor and a gauge.

The fuel quantity sensor is a located in the top of the fuel tank. It has a tube which goes close to the bottom of the fuel tank.

Five screws attach the sensor to the top of the fuel tank. A cork gasket makes a fuel-tight seal between the tank and the sensor. Two electrical wires connect to the sensor.

The fuel quantity gauge is on the right side of the instrument panel. The gauge gives a constant low-voltage supply to the fuel quantity sensor. The gauge measures the current flowing in the circuit to the sensor. You can adjust the gauge to give the correct zero indication.

The main bus supplies current for the system. When the float moves up or down, it changes the resistance of the circuit through the sensor. The current flowing in the system decreases as the resistance increases. The fuel quantity gauge uses the current to set the pointer.

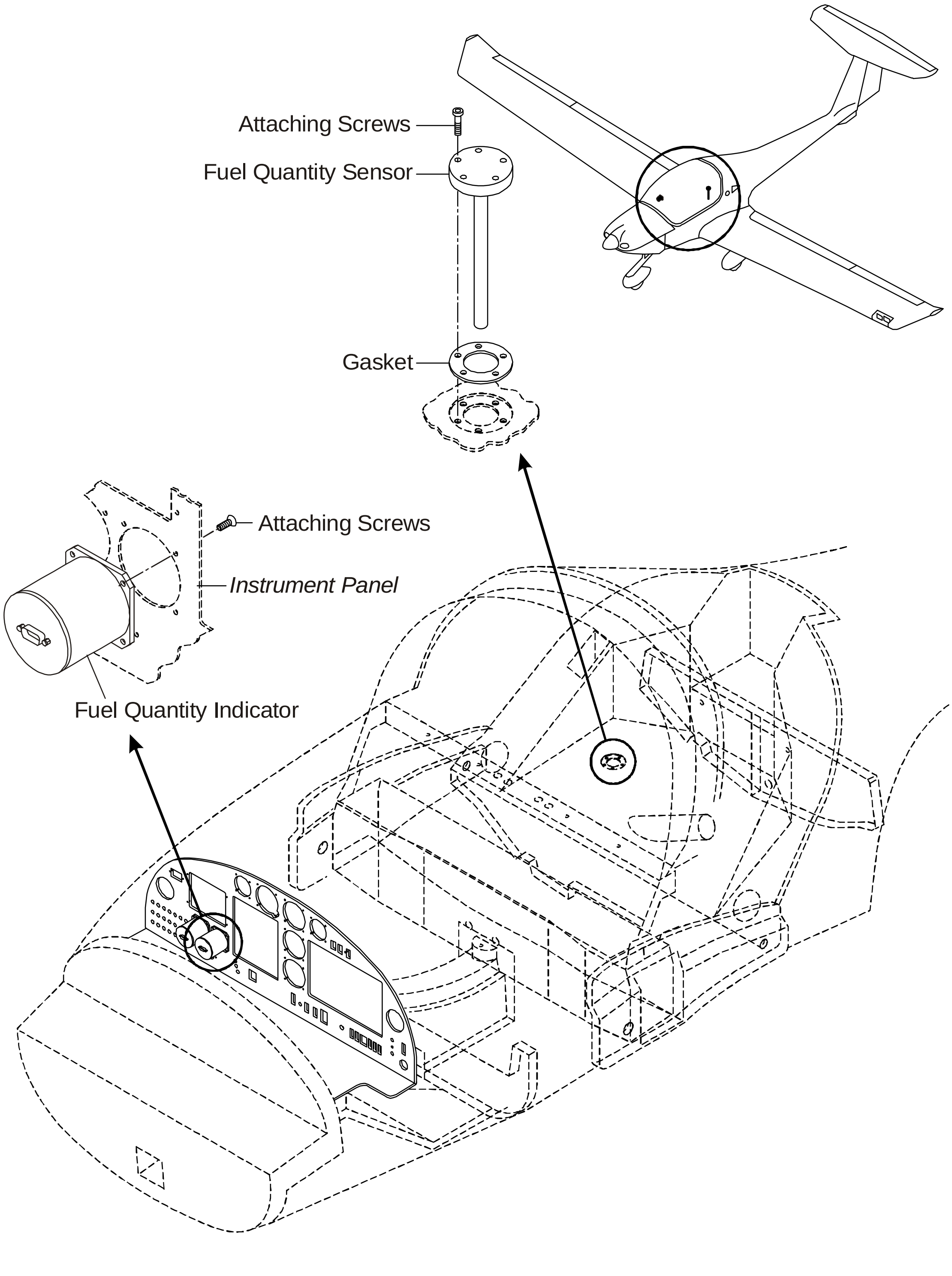

Figure 1: Location and Installation of the Fuel Indication Components

Trouble-Shooting

1. General

This table explains how to troubleshoot the fuel indicating system. If you find the trouble in column 1, do the repair given in column 3.

Trouble	Possible Cause	Repair
Fuel quantity indication incorrect.	Fuel quantity senor and gauge need calibration and adjustment	Follow the procedures in Section 28-40 Maintenance procedures item 3 and 4.
	Fuel quantity sensor defective.	Replace the quantity sensor.
	Fuel quantity gauge defective.	Replace the fuel quantity gauge.
	High resistance connection in the electrical wiring to the sensor.	Do a resistance test between the gauge and the sensor. Repair the defective connection.

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Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the components and how to calibrate the fuel quantity indication system. Refer to Chapter 28-00 for the system description.

2. Remove/Install the Fuel Quantity Sensor

A. Remove the Fuel Quantity Sensor

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the airplane battery.	Refer to Chapter 24-31.
(2)	Drain the fuel tank.	Refer to Chapter 12-10.
(3)	Remove the baggage compartment floor.	Refer to Chapter 25-10.
(4)	Release the electrical connections from the fuel quantity sensor.	Refer to Figure 1.
(5)	Remove the five screws that attach the fuel quantity sensor to the tank.	
WARNING:	**DO NOT ALLOW HEAT OR FIRE NEAR FUEL. FUEL BURNS VIOLENTLY. THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT.** **WARNING: DO NOT GET FUEL ON YOUR SKIN. FUEL CAN CAUSE SKIN DISEASE.**	
(6)	Remove the sensor. Discard the cork gasket.	

B. Install the Fuel Quantity Sensor

	Detail Steps/Work Items	Key Items/References
	WARNING: DO NOT ALLOW HEAT OR FIRE NEAR FUEL. FUEL BURNS VIOLENTLY. THIS CAN CAUSE INJURY TO PERSONS AND DAMAGE TO EQUIPMENT. **WARNING: DO NOT GET FUEL ON YOUR SKIN. FUEL CAN CAUSE SKIN DISEASE.**	
(1)	Remove the tape and transit pin from the new sensor.	
(2)	Put 'Sealube' on the cork gasket.	Use a new gasket.
(3)	Put the gasket in position on the sensor.	The holes for the screws are not equally spaced. There is only one correct position.
(4)	Put the sensor in position in the fuel tank.	The holes for the screws are not equally spaced. There is only one correct position.
(5)	Put 'Sealube' on the screws and install the screws.	Torque 20 - 30 lbf-in. (2.3 - 3.4 Nm)
(6)	Connect the electrical connectors.	
(7)	Connect the battery.	Refer to Chapter 24-31.
(8)	Check the calibration of the fuel quantity indication system.	
(9)	When the tank is full, look for leaks around the fuel quantity sensor.	
(10)	Install the baggage compartment floor.	Refer to Chapter 25-10.

3. Calibrate the Fuel Probe

NOTE: This calibration is only required if there is an error in the fuel quantity indication.

	Detail Steps/Work Items	Key Items/References
(1)	Remove the baggage compartment floor.	Refer to Chapter 25-10.
(2)	Empty Level Calibration: – Fill the tank with the unusable fuel quantity (9 liters / 2.4 USgal) – with all wires connected and power off, jump the yellow lead of the fuel probe to ground. – Switch the ELECTRIC MASTER ON and count 10 seconds. Then remove the jumper. – The fuel quantity indicator will fluctuate between empty and full then settle on empty.	
(3)	Full Level Calibration: – Fill the tank to full. – with all wires connected and power off, jump the yellow lead of the fuel probe to ground. – Switch the ELECTRIC MASTER ON and count 20 seconds. Then remove the jumper. – The fuel quantity indicator will fluctuate between empty and full then settle on full.	
(4)	Switch ELECTRIC MASTER to OFF.	
(5)	Install the baggage compartment floor.	Refer to Chapter 25-10.

4. Remove/Install the Fuel Quantity Gauge

A. Remove the Fuel Quantity Gauge

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the airplane battery.	Refer to Chapter 24-31.
(2)	Remove the instrument panel cover for access.	Refer to Chapter 25-10.
(3)	Disconnect the wires from the fuel quantity gauge.	
(4)	Remove the four attaching screws.	
(5)	Remove the fuel quantity gauge.	

B. Install the Fuel Quantity Gauge

	Detail Steps/Work Items	Key Items/References
(1)	Put the fuel quantity gauge in position in the instrument panel.	
(2)	Install the ring which attaches the quantity gauge.	
(3)	Install the four attaching screws to the front of the instrument panel.	
(4)	Connect the wires to the fuel quantity gauge.	Refer to Chapter 92 for wiring diagrams.
(5)	Connect the airplane battery.	Refer to Chapter 24-31. Connect the positive cable first.
(6)	Check the calibration of the fuel quantity gauge.	
(7)	Install the instrument panel cover.	Refer to Chapter 25-10.

CHAPTER 31

INDICATING SYSTEMS

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TABLE OF CONTENTS

CHAPTER 31

INDICATING SYSTEMS

Section 31-10

Instrument and Control Panels

Trouble-Shooting

Maintenance Practices

Section 31-20

Independent Instruments

Trouble-Shooting

Maintenance Practices

Section 31-50

Warning Systems

Trouble-Shooting

Maintenance Practices

Section 31-60

Garmin G500 Integrated Display System

Trouble-Shooting

Maintenance Practices

CHAPTER 31
INDICATING SYSTEMS

1. General

The DV 20 E airplane has the following indicating systems:

- An instrument panel: The instrument panel is made in one piece with a shelf. The shelf goes between the panel and the firewall.
- A control panel in the center console: This panel has the engine controls, fuel controls and parking brake. It has a forward part and an aft part.
- Independent instruments: The airplane has an hour meter, controlled with the ENGINE MASTER switch.
- Warning Lights (Red): The airplane has warning lights for canopy unlocked, starter relay engaged and low voltage.
- Caution light (Amber): The airplane has a caution light for indicating the connection of the airframe and engine electric system (EMU) and a caution light for the function of the external alternator (AWL).

This chapter does not describe about the indicators that belong to the systems. Refer to the related system for data. For example, refer to Chapter 77-00 for data about the engine indicators.

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Section 31-10
Instrument and Control Panels

1. General

The DV 20 E airplane has the following instrument and control panels:

– An instrument panel: The instrument panel is made in one piece with a shelf. The shelf goes between the panel and the firewall.

– A control panel in the center console: This panel has a forward cover and an aft cover. The forward cover has the cabin heat controls, parking brake and fuel controls. The aft cover has the engine controls.

Refer to the related AMM Chapter for data about the controls. For example, refer to Chapter 76-00 for data on the engine controls.

2. Description

A. Instrument Panel

Figure 1 shows the instrument panel.

The airplane has an aluminum alloy instrument panel. The panel has cut-outs for instruments and switches. A large cut-out in the middle of the panel has the avionic equipment. A bracket between the shelf and the avionic equipment rack makes the installation rigid.

The bottom of the panel bends up to make a shelf. The shelf has mountings for electrical equipment such as relays and multi-pin connectors. Each side of the shelf has a row of ground terminals. Large cut-out areas in the shelf allow cooling air to move past the instruments and out through holes in the instrument panel cover.

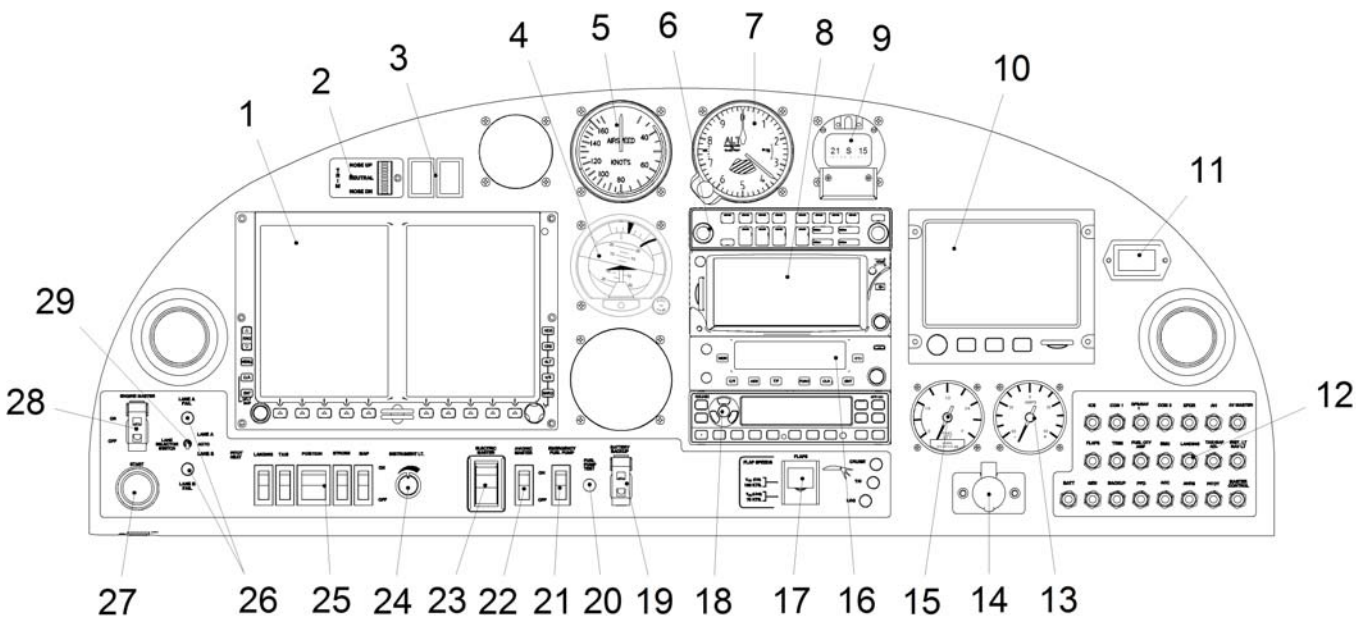

Figure 1: Instrument Panel

Note: Figure 1 shows the typical installation position for the equipment. The actual installation may vary due to the approved equipment version.

Major Instruments and Controls	
1 GDU 620 Display	16 COM #2
2 Trim Indicator	17 Flap controller
3 Warning / Caution Lights	18 Transponder
4 Backup artificial horizon	19 Battery Backup switch
5 Backup airspeed indicator	20 Fuel Pump Test button
6 Audio panel	21 Emergency Fuel Pump switch
7 Backup altitude indicator	22 Avionic Master switch
8 GPS/NAV/COM	23 Electric Master switch
9 Emergency compass	24 Instrument Light Dimmer
10 Engine Monitoring Unit	25 Light switches
11 Hourmeter	26 LANE A/B FAIL warning lights
12 Circuit breakers*	27 Start button
13 Ammeter	28 Engine Master switch
14 Accessory power plug	29 Lane Selector switch
15 Fuel quantity indicator	30 -

B. Control Panel

The control panel in the center console has two aluminum-alloy side-plates. Tubular spacers keep the side plates in position. Two square spacers hold the outer sheaths of the control cables.

Long bolts with spacers go through the side plates. The bolts make pivots for the control levers. The pivot for the engine control levers has a tension knob on the right side.

The forward cover of the control panel attaches to the center console below the instrument panel. It has two control levers for the cabin heat system and one for the parking brake. The left lever sets the cabin heat ON or OFF. The middle lever sends the air to the windscreen (DEFR) or the FLOOR. The right lever sets the parking brake ON or OFF.

The control lever for the fuel shut-off valve is on the right of the forward cover. It is ON when the control is pushed in and the latch is engaged. It is OFF when the control is pulled out.

The aft cover of the control panel attaches to the center console and to the forward cover. It has these engine controls towards the front:

– ALT AIR on the left side.

– THROTTLE in the center.

– PROPELLER on the right side.

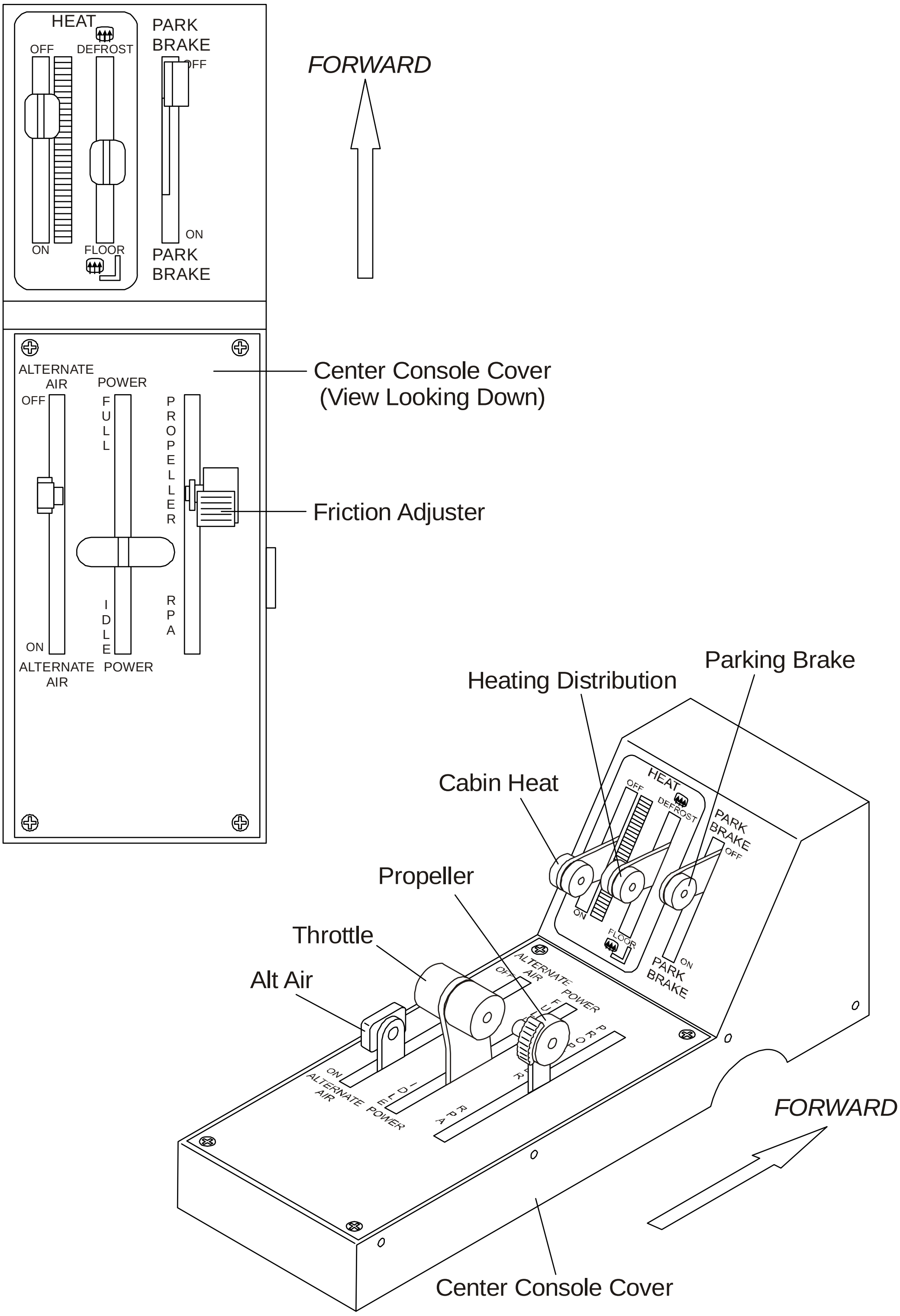

Figure 2: Control Panel in the Center Console

Trouble-Shooting

1. General

This table explains how to troubleshoot the instrument and control panels. If you find the trouble in column 1, do the repair given in column 3. Refer to the related AMM Chapter for other data on an instrument or switch.

Trouble	Possible Cause	Repair
Indication incorrect.	Sensor defective.	Replace the sensor.
	Indicator defective.	Replace the indicator.
	High resistance or open connection in the electrical wiring from the sensor.	Do resistance and continuity tests between the indicator and the sensor. Repair the defective connection or wire.

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Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the instrument and control panels. Refer to the related AMM Chapter for data about the indicators in other systems.

WARNING: MAKE SURE THAT THE ENGINE IS SAFE BEFORE YOU REMOVE THE INSTRUMENT PANEL. DISCONNECT THE SPARK PLUG LEADS. MAKE SURE THAT:

- THE ENGINE MASTER SWITCH IS IN THE "OFF" POSITION.

- THE ELECTRIC MASTER SWITCH IS IN THE "OFF" POSITION.

- THE BATTERY BACKUP SWITCH IS IN THE “OFF” POSITION.

- THE THROTTLE IS SET TO "IDLE".

2. Remove/Install the Control Panel

A. Remove the Control Panel

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the airplane battery.	Refer to Chapter 24-31.
(2)	Remove the two screws which hold the fiberglass cover.	
(3)	Remove the eight screws that hold the forward and aft covers.	
(4)	Remove the knobs on all of the controls except for the mixture.	
(5)	Move the aft cover up and aft to clear the control levers.	Make sure that the wires for the trim switch do not catch.
(6)	Lift the forward cover clear of the fuel shut-off valve shaft and then move it aft to clear the heating control levers.	

B. Install the Control Panel

	Detail Steps/Work Items	Key Items/References
(1)	Move the forward cover into position over the heating control levers.	
(2)	Move the aft cover forward and down into position around the control levers.	Make sure that the wires for the trim switch do not catch.
(3)	Install the knobs on the controls.	
(4)	Install the two screws in the fiberglass cover.	
(5)	Install the eight screws that hold the forward and aft covers.	
(6)	Connect the battery.	Refer to Chapter 24-31.

Section 31-20
Independent Instruments

1. General

The airplane has an engine operated hour meter which is in the instrument panel. Refer to Figure 1 in Section 31-10.

2. Description and Operation

A. Hour Meter (Hobbs Meter)

The engine-operated hour meter is at the top right of the instrument panel. It is an electro mechanical meter. The right window in the meter shows 1/10 of an hour. The other windows show hours, tens of hours and so on. The ENGINE MASTER switch operates the meter.

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Trouble-Shooting

1. General

This table explains how to troubleshoot the independent instruments. If you find the trouble in column 1, do the repair given in column 3.

Trouble	Possible Cause	Repair
Hour meter does not operate.	Hour meter defective.	Replace the hour meter.
	High resistance or open connection in the electrical wiring of the hour meter.	Do resistance and short-circuit tests between the meter and the Engine Master. Repair the defective connection or wire. Refer to Chapter 92 for wiring diagrams.
	Open fuse.	Check fuse.

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Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the independent instruments. Refer to Chapter 92 for wiring diagrams.

2. Remove/Install the Hour Meter

A. Remove the Hour Meter

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the airplane battery.	Refer to Chapter 24-31.
(2)	Remove the instrument panel cover.	Refer to Chapter 25-10.
(3)	Release the two faston connectors from the hour meter.	
(4)	Remove the two screws and the nuts that attach the hour meter.	
(5)	Remove the meter from the instrument panel.	

B. Install the Hour Meter

	Detail Steps/Work Items	Key Items/References
(1)	Put the meter in the instrument panel.	
(2)	Install the two attaching screws and the nuts.	
(3)	Connect the two faston connectors to the hour meter.	Refer to Chapter 92 for wiring diagrams.
(4)	Install the instrument panel cover.	Refer to Chapter 25-10.
(5)	Connect the airplane battery.	Refer to Chapter 24-31.

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Section 31-50
Warning Systems

1. General

The DV 20 E airplane has the following standard warnings:

– CANOPY warning.

– VOLTAGE warning.

– START warning.

– EMU caution.

– AWL caution

2. Description and Operation

Figure 1 shows the location of the warnings. The warnings are in two annunciator units at the top of the instrument panel. The left unit has the START (red) and the CANOPY (red) warnings. The right unit has the VOLTAGE (red) and EMU (amber) warnings.

Each warning unit has a test switch. Press the front of the unit to operate the test switch. (The ELECTRIC MASTER switch must be ON).

The main bus provides power to the VOLTAGE and CANOPY warnings through circuit-breakers. The VOLTAGE and CANOPY warnings operate when the related system provides a ground for the warning lamp.

The main bus provides power to the AWL caution. An inline fuse protects the circuit. The AWL operates when the alternator regulator of the external alternator provides a ground for the caution lamp.

The starter side of the starter relay supplies power for the START warning. An in-line fuse protects the circuit.

The START POWER relay or BATTERY BACKUP switch supply power and ground to the EMU caution lamp.

Refer to the related Chapters for data about the systems. Refer to Chapter 92 for wiring diagrams.

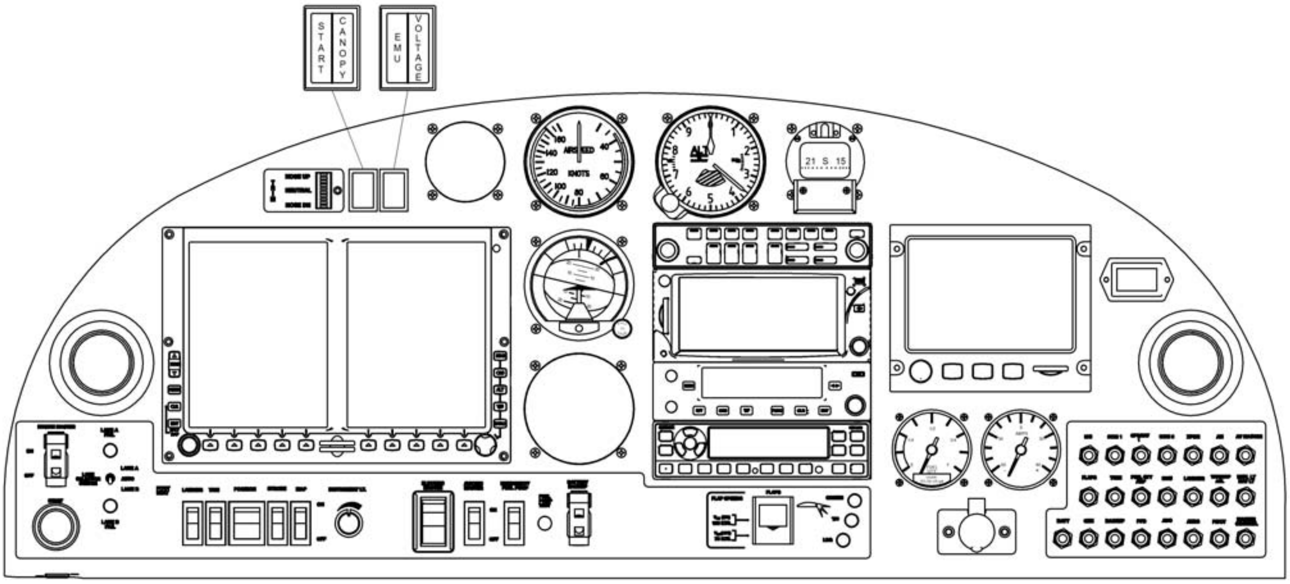

Figure 1: Warning and Cautions Locations

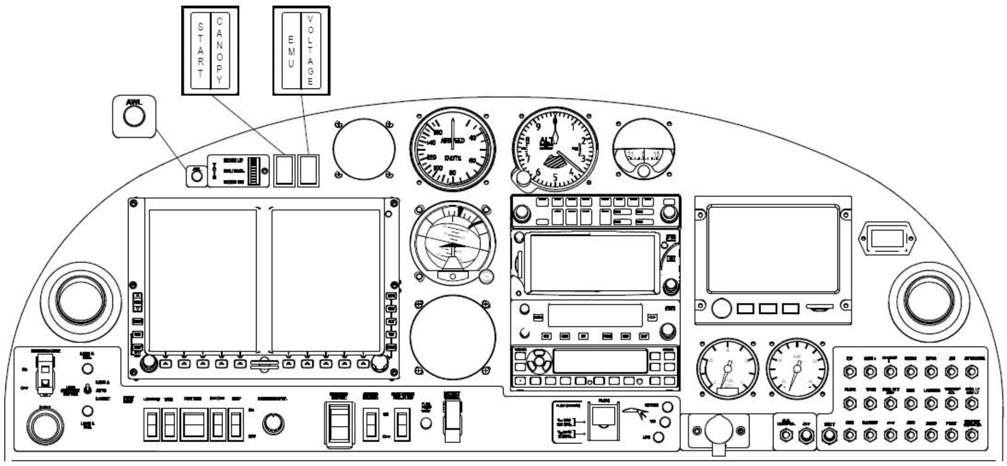

Figure 2: Warning and Cautions Location (if OÄM 20-245/b is installed)

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Trouble-Shooting

1. General

This table explains how to troubleshoot the warning systems. If you find the trouble in column 1, do the repair given in column 3.

Trouble	Possible Cause	Repair
Warning indication incorrect.	Warning lamp bulb failed.	Replace the warning bulb.
	Sensor defective.	Replace the sensor.
	High resistance or open connection in the electrical wiring from the sensor.	Do resistance and continuity tests between the indicator and the sensor. Repair the defective connection or wire.

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Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the annunciator units. Refer to AMM Chapter 92 for wiring diagrams.

2. Replace a Warning Lamp Bulb

	Detail Steps/Work Items	Key Items/References
(1)	Set the ELECTRIC MASTER, ENGINE MASTER and BATTERY BACKUP switches OFF.	
(2)	Pull the lens from the front of the annunciator unit.	
(3)	Carefully pull the PULL tab to remove the bulb.	
(4)	Carefully push the PULL tab to install the bulb.	
(5)	Push the lens onto the front of the annunciator unit.	
(6)	Do a test of the warning lamps: – Set the ELECTRIC MASTER switch to ON. – Push the front of each warning in turn. – Set the ELECTRIC MASTER switch to OFF.	With the canopy open. The VOLTAGE and CANOPY warnings and EMU caution must come on. Each warning must come on.

3. Remove/Install an Annunciator Unit

A. Remove an Annunciator Unit

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the airplane battery.	Refer to Chapter 24-31.
(2)	Remove the instrument panel cover.	Refer to Chapter 25-10.
(3)	Disconnect the wires from the annunciator unit.	
(4)	Release the spring clips that hold the annunciator unit.	
(5)	Remove the annunciator unit through the instrument panel into the cockpit.	

B. Install an Annunciator Unit

	Detail Steps/Work Items	Key Items/References
(1)	Put the annunciator unit in position in the instrument panel.	Make sure that the spring clips engage the panel.
(2)	Connect the wires to the unit.	Refer to Chapter 92.
(3)	Connect the airplane battery.	Refer to Chapter 24-31.
(4)	Do a test of the warning lamps: – Set the ELECTRIC MASTER switch to ON. – Push the front of each warning in turn. – Set the ELECTRIC MASTER switch to OFF.	With the canopy open. The VOLTAGE and CANOPY warnings and EMU caution must come on. Each warning must come on.
(5)	Install the instrument panel cover.	Refer to Chapter 25-10.

Section 31-60
Garmin G500 Integrated Display System

1. General

The DV 20 E has a Garmin G500 integrated display system. The system presents primary flight instrumentation, navigation and provides a moving map to the pilot through large format displays. Refer to Figure 1.

For more detailed data about this integrated display system, refer to the G500 Cockpit Reference Guide.

2. Description and Operation

The G500 system consists of:

– Garmin Display Unit (GDU) 620 (PFD/MFD).

– Garmin Data Computer (GDC) 74A [Air Data Computer (ADC)].

– Garmin Reference System (GRS) 77 [Attitude and Heading Reference System (AHRS)].

– Garmin Magnetometer Unit (GMU) 44.

– Garmin Temperature Probe (GTP) 59.

The standby instruments consist of an airspeed indicator, an altimeter, an artificial horizon and a emergency compass located at the top of the Instrument Panel (Refer to Figure 1).

A. GDU 620 Display

The GDU 620 is a Primary Flight Display (PFD) and a Multi Function Display (MFD) that is interfaced to the other LRUs of the system installed on the airplane. The GDU 620 provides the following operations:

- Display of attitude (pitch and roll), rate of turn, slip/skid, heading, airspeed, altitude, and vertical speed information.
- Display and control of the Horizontal Situation Indicator (HSI) and selected heading.
- Display of position and ground speed for use by the pilot/flight crew.
- Display of the stored navigation and map database for use by the pilot/flight crew.
- Interfacing with the following:
  - GPS sources.
  - NAV sources.

The GDU 620 has dual VGA (640 x 480 pixels) 6.5” diagonal LCD displays. The left side of the GDU is the Primary Flight Display (PFD) and the right side is the Multi-Function Display (MFD). The PFD shows primary flight information. The MFD shows navigation and flight plan information, and terrain. An external configuration module is used, so no configuration is required if the GDU 620 is replaced.

(1) Primary Flight Display (PFD)

The left side of the GDU 620 is the PFD. The PFD is a 6.5" liquid crystal display. The PFD shows the basic primary flight display plus a number of additional options that can be selected manually. Some other indications will be generated automatically for example, alert captions.

The PFD window displays the usual primary flight instruments in a standard 'T' configuration.

The basic flight instruments are:

Attitude Indicator (Artificial Horizon): The attitude indicator is located on the top of the display. The attitude indicator shows the pitch, roll and yaw situation of the airplane. If the attitude indicator fails the display marks the pitch attitude display area with a red 'X' and yellow text spelling out 'ATTITUDE FAIL'.

Airspeed Indicator (ASI): The airspeed indicator is on the top of the display and indicates the airspeed on a rolling number gauge using a moving tape. The airspeed indicator also displays speed ranges for different airplane configurations, airspeed trends and 'V' speeds. If the airspeed indicator fails the display marks the airspeed display area with a red 'X' and yellow text spelling out 'AIRSPEED FAIL'.

Altimeter: The altimeter is located at the top right of the display. The altimeter displays the airplane altitude in feet on a rolling number gauge using a moving tape. The altimeter also shows an altitude 'bug' at the selected altitude or the edge of the tape, whichever is closest to the current altitude. If the altitude indicator fails the display marks the tape display area with a red 'X' and yellow text spelling out 'ALTITUDE FAIL'.

TAS: True airspeed is digitally displayed in a small window below the airspeed indicator.

Barometric Pressure Indicator: The barometric pressure indicator is located immediately below the altitude indicator. The indicator shows the barometric pressure that has been set in either inches of mercury (Hg) or hectopascal number (hPa).

(2) Multi-Function Display (MFD)

The right side of the GDU 620 is the MFD. The MFD is a 6.5" liquid crystal display. The MFD provides detailed moving-map graphics of the airplane’s current position in relation to ground features, chart data, navaids, flight plan routings and more. Built-in terrain and the obstacles databases provide color-coding and other visual cues to graphically alert the pilot when proximity conflicts loom ahead.

B. GRS 77 Attitude and Heading Reference System (AHRS)

The GRS 77 is an attitude and heading reference unit, or AHRS, that provides airplane attitude and flight characteristics information to the GDU 620. The unit contains advanced tilt sensors, accelerometers, and rate sensors. In addition, the GRS 77 interfaces with both the GDC 74A air data computer and the GMU 44 magnetometer. The GRS 77 also utilizes GPS signals sent from the GPS/WAAS receiver. Actual attitude and heading information is sent using ARINC 429 digital interface to the GDU 620.

C. GDC 74A Air Data Computer (ADC)

The GDC 74A air data computer receives information from the pitot/static system and the GTP 59 outside air temperature (OAT) sensor. The GDC 74A is responsible for providing pressure altitude, airspeed, vertical speed, and OAT information to the G500 system. The GDC 74A provides data to the GDU 620 and GRS 77 using ARINC 429 digital interfaces. The GDC 74A also communicates maintenance and configuration information to the GDU 620 using an RS-232 interface.

D. GMU 44 Magnetometer

The GMU 44 magnetometer senses magnetic field information. Data is sent to the GRS 77 AHRS for processing to determine airplane magnetic heading. This unit receives power directly from the GRS 77 and communicates with the GRS 77 using an RS-485 digital interface.

E. Databases

The GDU 620 utilizes the following databases:

– Basemap Database.

– Navigation Database.

– Terrain and Airport Terrain Databases.

– Obstacles Database.

– IGRF (International Geomagnetic Reference Field) model.

With the exception of the Navigation database and IGRF model, which reside internal to the GDU 620, all databases are stored on a single SD memory card that is inserted into the bottom slot of the GDU 620. The following describe each database and how the databases are updated.

(1) Basemap Database

The basemap provides ground based references such as roads and bodies of water. The database is stored in internal memory of the GDU 620 display. The basemap does not have a scheduled update cycle and as such does not have an expiration date. The basemap database is updated very infrequently.

(2) Navigation Database

The Jeppesen Navigation Database provides the G500 system with the required information for displaying flight plan information. The GDU 620 utilizes a database stored on an SD memory data card for easy updating and replacement. The Navigation database may be updated by simply inserting an updated Navigation database update card into the top SD card slot in the front panel in the GDU 620. The actual database is downloaded into the unit, so the card can be removed after the update. Each card will only update one system. Alternately, the Navigation database may be updated by copying the database to the Garmin-supplied Supplemental Data card. It will be downloaded into the GDU 620 on first use, and the file can be left on the Supplemental Data card until the next update cycle. The navigation database on the GDU 620 database card is generated from current Jeppesen Sanderson data and converted to a format that is used by the GDU 620.

(3) Terrain and Airport Terrain Databases

The Terrain database is used to provide basic Terrain awareness functionality. There are two variants of the Terrain database – one lower-resolution Terrain database for terrain alerting, and one higher-resolution Terrain database for SVT (this higher-resolution database can also be used for terrain alerting, so only one Terrain database is required for any given installation). The Airport Terrain database provides higher resolution terrain information near most airports. The terrain databases are updated by removing the database card from the GDU 620, updating the databases on the card and reinserting the card in the lower card slot on the GDU 620 front panel. The Terrain databases can be downloaded via the internet and the card programmed using the supplied SD card reader.

(4) Obstacles Database

The obstacle database provides identification of known obstacles greater than 200 feet AGL. This database is also used with Terrain awareness functionality. The obstacle database is updated by removing the database card from the GDU 620, updating the database on the card and reinserting the card. The Obstacle database can be downloaded via the internet and the card programmed using the supplied SD card reader.

(5) IGRF Model

The IGRF model is contained in the GRS 77 and is only updated once every five years. The IGRF model is part of the Navigation Database. At system power-up, the IGRF models in the GRS 77 and in the Navigation Database are compared, and if the IGRF model in the GRS 77 is out of date, the user is prompted to update the IGRF model in the GRS 77. The prompt will appear after the G500 splash screen is acknowledged on the MFD.

Figure 1: Garmin G500 Integrated Display System

Trouble-Shooting

1. General

This table explains how to troubleshoot the GDU 620 display. If you find the trouble in column 1, do the repair given in column 3.

Trouble	Possible Cause	Repair
Unit does not power up - blank screen.	Improper wiring; circuit breaker open. Unit intensity turned down.	Make sure that the power is properly wired to the GDU 620 and the circuit breaker is closed. Make sure that the unit is not in manual intensity control mode with the intensity turned down.
All expected configuration pages are not displayed.	An installer unlock card is not inserted into the GDU 620.	Insert the installer unlock card P/N 010-00769-60 into the bottom slot of the GDU 620 and cycle power.
The GDC OAT probe type shows up as UNKNOWN.	The RS-232 connection to the GDC 74A is not working.	Make sure that the GDC 74A RS-232 connection to the GDU is properly wired, and that the GDC (ADC) 74A circuit breaker is closed.
When loading software, the LRU software is not being displayed on the SOFTWARE UPLOAD page.	The software loader card is installed in the bottom slot of the GDU 620. The software loader card contains no information.	Insert the loader card in the top slot and cycle power to the GDU. Repeat the process for making the software loader card.
Configuration errors are displayed on power-up, before the GDU enters normal mode.	The configuration module has not been updated.	Update the configuration module.
Data is not being received from an ARINC 429 device. (valid data is being received on the 429 input port as shown on the GDU 620 PORT MONITORING page)	ARINC 429 bus hi and low are swapped. Wrong device is connected to port on GDU 620.	Verify wiring. Use correct ports.

Trouble	Possible Cause	Repair
Data is not being received from an ARINC 429 device. (no data is being received on the 429 input port as shown on the GDU 620 PORT MONITORING page)	On the transmitting LRU, the ARINC 429 transmitter speed is not set correctly. Wiring is not correct.	Set the ARINC 429 transmitter speed to correct speed. Check for continuity/shorts and correct as required.

Maintenance Practices

1. General

The following maintenance procedures describe how to remove and install the following components of the Garmin G500 integrated display system. They do not describe how to maintain the components:

– GDU 620 Display.

– GDC 74A Air Data Computer (ADC).

– GRS 77 Attitude, Heading and Reference Unit (AHRS).

– GMU 44 Magnetometer.

– GTP 59 Temperature Probe.

For more data about maintaining the equipment, refer to the G500™ Avionics System Maintenance Manual, Document Number 190-00601-05. Refer to Chapter 92 for the Garmin G500 wiring diagram.

NOTE: Whenever removing or replacing units, remove power from the LRU by removing airplane power or opening the LRU circuit breaker.

2. Remove/Install the GDU 620 Display

A. Remove the the GDU 620 Display

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the airplane battery.	Refer to Chapter 24-31.
(2)	Open the PFD circuit-breaker.	7.5 A on electrical bus.
(3)	Remove the display unit: – Remove the six mounting screws that attach the display to the instrument panel. – Pull the GDU 620 display unit far enough out from the instrument panel to gain access to the three rear connectors. – Disconnect the three rear connectors. – Remove the GDU 620 display.	

B. Install the GDU 620 Display

	Detail Steps/Work Items	Key Items/References
(1)	Open the PFD circuit-breaker.	7.5 A on electrical bus.
(2)	Install the GDU 620 display unit: – Visually inspect the connectors to make sure that there are no bent or damaged pins. – Connect the three rear connectors to the display unit. – Place the GDU 620 display into place. – Install the six mounting screws that attach the display unit to the instrument panel.	Make sure that each slide lock is secured on both sides.
(3)	Close the PFD circuit-breaker.	
(4)	Connect the airplane battery.	Refer to Chapter 24-31.

	Detail Steps/Work Items	Key Items/References
(5)	Energize the GDU 620 in configuration mode.	Refer to Garmin G500 STC AML Installation Manual, Document No. 190-01102-06, latest revision.
(6)	Verify that the configurations settings match those recorded in the check out log.	
(7)	Energize the GDU 620 in normal mode.	
(8)	Verify that there are no red “X” and that no alerts are present.	If red ”X” or alerts are present, troubleshoot the system.

NOTE: The installation configuration settings are stored in the configuration module and will be retained when the GDU 620 display is replaced with a new unit. User settings, such as map orientation preferences, are stored internally and will be lost when the GDU 620 is replaced with a new unit.

NOTE: If the original GDU 620 display is reinstalled, then no software loading is required. This does not include units that were returned for repair as their software and configuration files are deleted during the repair process. No configuration is required. Verify that the configuration is correct using the previously completed checkout log.

NOTE: If the GDU 620 display is replaced with a new, repaired, or exchange unit then software must be loaded. No configuration is required.

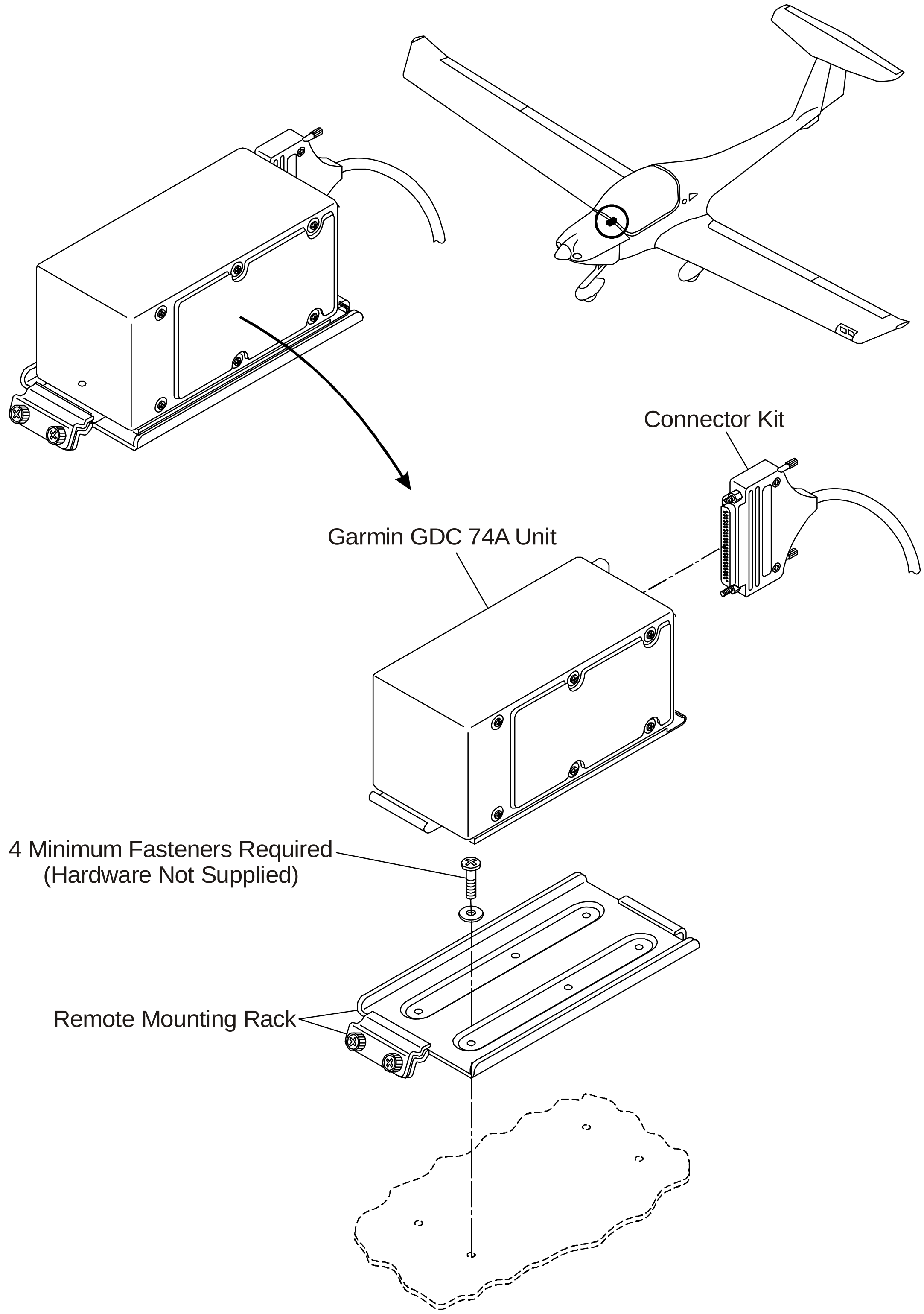

Figure 2: GDC 74A Air Data Computer (ADC) Installation

3. Remove/Install the GDC 74A Air Data Computer (ADC)

A. Remove the GDC 74A Air Data Computer (ADC)

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the airplane main battery.	Refer to Chapter 24-31.
(2)	Open the ADC circuit-breaker.	5 A electrical bus.
(3)	Remove the instrument panel cover.	
(4)	Disconnect the pitot/static plumbing from the rear of the unit.	
(5)	Disconnect the single connector.	
(6)	Remove the GDC 74A: – Loosen each thumbscrew on the holddown clamp and remove the clamp. – Carefully remove the unit from the mount.	

B. Install the GDC 74A Air Data Computer (ADC)

	Detail Steps/Work Items	Key Items/References
(1)	Place the GDC 74A unit in the mounting tray.	
(2)	Install the GDC 74A: – Position the locking clamp and install using the thumbscrews. – Connect the pitot/static plumbing. – Install the Pitot/Static tubes to the unit. – Visually inspect the connectors to make sure that there are no bent or damaged pins. – Connect the connector to GDC 74A.	Repair any damaged pin. Make sure that each side lock is secured on both sides.
(3)	Close the ADC circuit-breaker.	
(4)	Connect the airplane battery.	Refer to Chapter 24-31.

	Detail Steps/Work Items	Key Items/References
(5)	Energize the G500 system with GDU 620 in normal mode.	
(6)	Verify that the GDU 620 displays valid air data within approximately one minute.	
(7)	Verify that no unexpected alerts are present.	If alerts are present, troubleshoot the system.
(8)	Do pitot/static leak test and observe the airspeed, altitude, and vertical speed for proper operation.	Refer to Chapter 34-10.

4. Remove/Install the GRS77 Attitude, Heading and Reference Unit (AHRS)

A. Remove the GRS77 Attitude, Heading and Reference Unit (AHRS)

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the airplane battery.	Refer to Chapter 24-31.
(2)	Open the AHRS circuit-breaker.	5 amp electrical bus.
(3)	Open the access panel in the aft baggage compartment.	
(4)	Remove the GRS77: – Disconnect the GRS77 connector. – Remove the four thumbscrews that attach the GRS77 to the mounting plate. – Gently lift the GRS77 from the mounting plate.	If the supports for the mounting plate are removed, the GRS77 must be recalibrated.

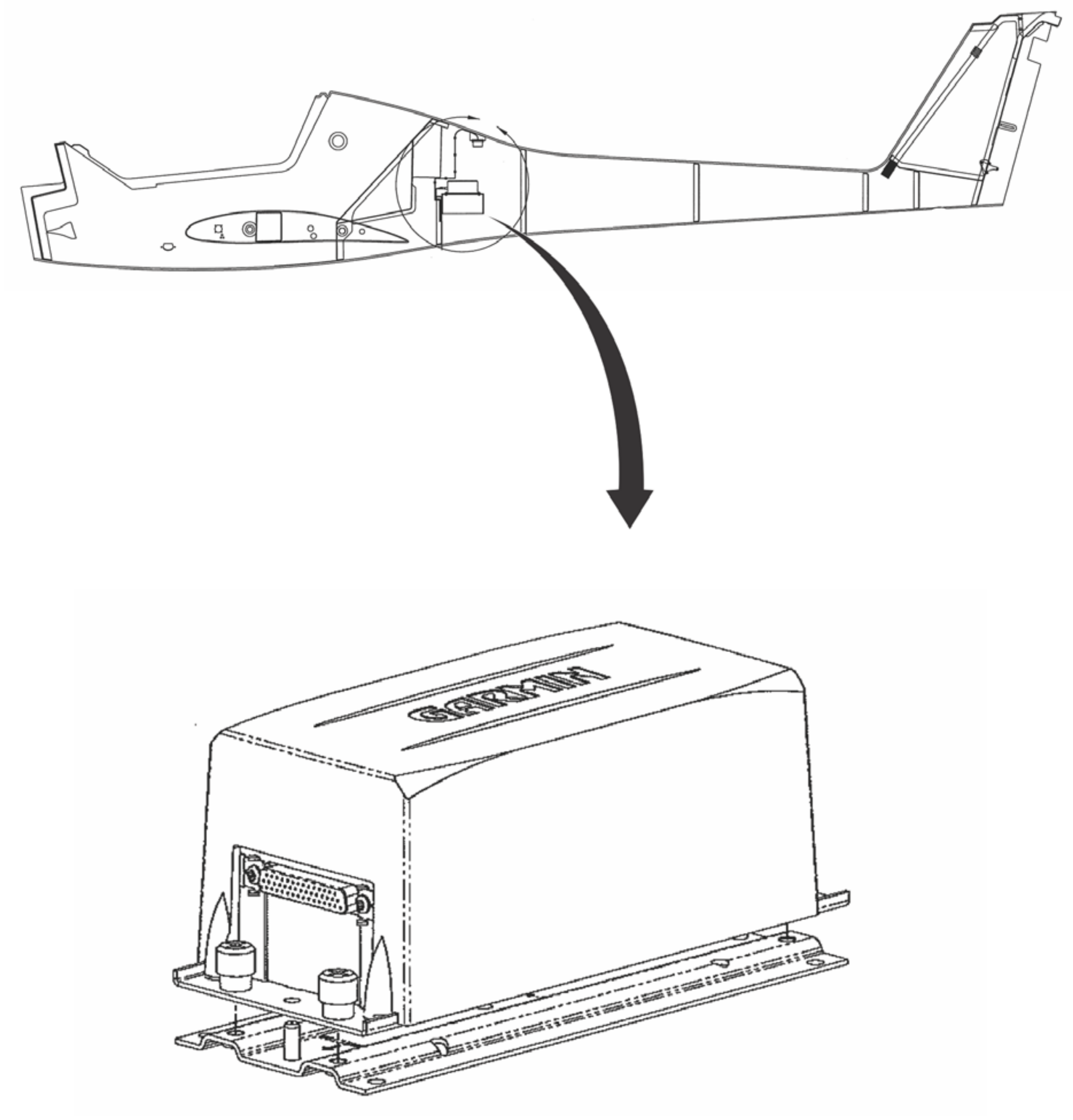

Figure 3: GRS 77 Attitude, Heading and Reference System (AHRS) Installation

B. Install the GRS77 Attitude, Heading and Reference Unit (AHRS)

	Detail Steps/Work Items	Key Items/References
(1)	Install the GRS77 unit:	
	– Place the GRS77 on the mounting plate.	Make sure that the orientation is correct.
	– Install the four thumbscrews that attach the GRS77 to the mounting plate.	Torque to 0.15 - 0.18 Nm (22 - 25 lbf-in).
	– Visually inspect the connectors to make sure that there are no bent or damaged pins.	Repair any damaged pin.
	– Connect the connector to GRS77.	Make sure that each side lock is secured on both sides.
(2)	Close the access panel in the aft baggage compartment.	
(3)	Close the AHRS circuit-breaker.	
(4)	Connect the airplane battery.	Refer to Chapter 24-31.
(5)	Energize the G500 system with GDU 620 in normal mode.	
(6)	Verify that the GDU 620 displays valid heading and attitude within approximately one minute.	Note that heading can remain invalid if the magnetometer is near a large metal structure such as a hanger wall or if the magnetometer is close to a large ground power cart.
(7)	Verify that no unexpected alerts are present.	If alerts are present, troubleshoot the system.

NOTE: If the original GRS 77 is reinstalled, then no software loading is required. This does not include units that were returned for repair as their software and configuration files are deleted during the repair testing process.

NOTE: If the GRS 77 Configuration Module is replaced, the GRS 77 must be re-calibrated.

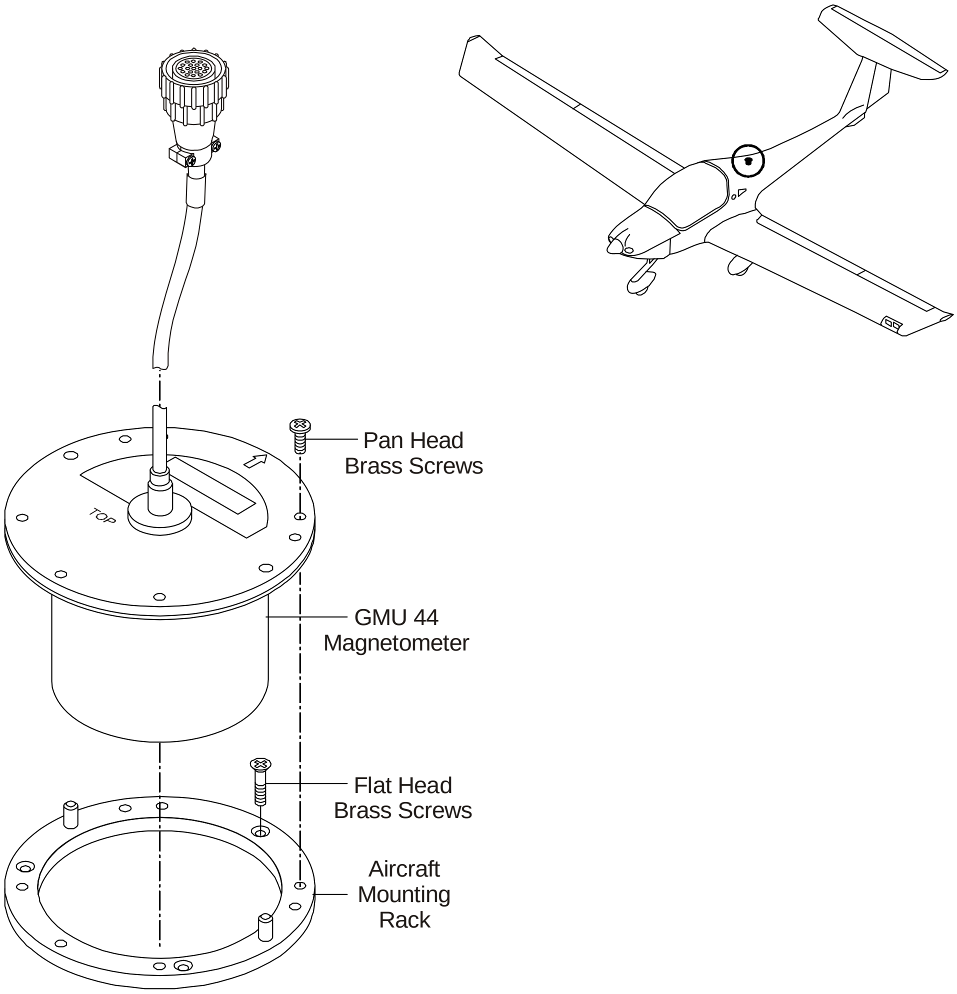

Figure 4: GMU 44 Magnetometer Assembly Installation

5. Remove/Install the GMU 44 Magnetometer

A. Remove the GMU 44 Magnetometer

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the airplane battery.	Refer to Chapter 24-31.
(2)	Open the AHRS circuit-breaker.	5 A electrical bus.
(3)	Open the access panel in the aft baggage compartment.	
(4)	Remove the GMU 44 magnetometer: – Gain access to the GMU 44 magnetometer. – Remove the three screws that attach the magnetometer to the mounting plate. – Carefully lift the GMU 44 from the plate. – Disconnect the wiring harness.	
(5)	Remove the GMU 44 magnetometer.	

B. Install the GMU 44 Magnetometer

	Detail Steps/Work Items	Key Items/References
(1)	Install the GMU 44 magnetometer: – Visually inspect the connector to make sure that there are no bent or damaged pins. – Connect the wiring harness to the GMU 44 magnetometer. – Lower the GMU 44 into the mounting plate. – Install the 3 screws that attach the GMU 44 magnetometer to the mounting plate.	 Repair any damaged pin. At the in-line connector.
(2)	Close the access panel in the aft baggage compartment.	
(3)	Close the AHRS circuit-breaker.	
(4)	Connect the airplane battery.	Refer to Chapter 24-31.

	Detail Steps/Work Items	Key Items/References
(5)	Energize the G500 system with GDU 620 in normal mode.	
(6)	Verify that the GDU 620 displays valid heading within approximately one minute.	Note that heading can remain invalid if the magnetometer is near a large metal structure such as a hanger wall or if the magnetometer is close to a large ground power cart.
(7)	Verify that no unexpected alerts are present.	If alerts are present, troubleshoot the system.

6. Remove/Install the Temperature Probe (GTP 59)

A. Remove the Temperature Probe (GTP 59)

	Detail Steps/Work Items	Key Items/References
(1)	Remove the nut and the washer that attach the GTP 59 temperature probe to the access panel.	
(2)	Remove the GTP 59 carefully from NACA.	

B. Install the Temperature Probe (GTP 59)

	Detail Steps/Work Items	Key Items/References
(1)	Place the GTP 59 temperature probe into position in the access panel.	
(2)	Install the washer and the nut that attach the GTP 59 temperature probe.	
(3)	Tighten the nut.	

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CHAPTER 32

LANDING GEAR

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TABLE OF CONTENTS

CHAPTER 32
LANDING GEAR

Section 32-10
Main Landing Gear

Trouble-Shooting

Maintenance Practices

Section 32-20
Nose Landing Gear

Trouble-Shooting

Maintenance Practices

Section 32-40

Wheels and Brakes

Trouble-Shooting

Maintenance Practices

CHAPTER 32
LANDING GEAR

1. General

The DV 20 E airplane has a fixed tricycle landing gear with a castoring nose wheel. This chapter gives you only the general description and operation.

Refer to Chapter 32-10 for trouble-shooting and maintenance practices for the main gear.

Refer to Chapter 32-20 for trouble-shooting and maintenance practices for the nose gear.

Refer to Chapter 32-40 for trouble-shooting and maintenance practices for the wheels and brakes.

2. Description and Operation

Flat section aluminum leaf-springs make the main gear struts. Two mountings attach each main gear strut to the spar bridge in the fuselage. The bottom of each strut has an aluminum axle and a mounting plate for the GFRP fairing.

The nose gear is a tubular strut. A strong pivot attaches it to the forward fuselage. An elastomer spring pack (elastomer pack) attaches the strut to the engine mount. A pivot at the bottom of the strut has a trailing fork for the wheel. It also holds the GFRP fairing.

Nose and main gear have single wheels with low pressure tires. Each main gear strut carries a disk brake. Toe-brake pedals on the rudder pedals operate the brakes. A parking brake valve allows the brakes to be set ON for parking.

The landing gear absorbs vertical loads (for example, landing loads). Each main gear strut is a leaf spring which deflects upwards as the load increases. The elastomer pack in the nose gear compresses as the load increases. In each case, the spring returns to the original position when the load is removed.

Pushing on both toe-brake pedals applies both disk brakes. The airplane will stop in a straight line.

Pushing on one toe-brake pedal only applies the brake on that side. The airplane will steer to that side.

Pull the parking brake knob fully aft. Then push on both brake pedals to apply the parking brake. Push the parking brake knob fully in to release the parking brake.

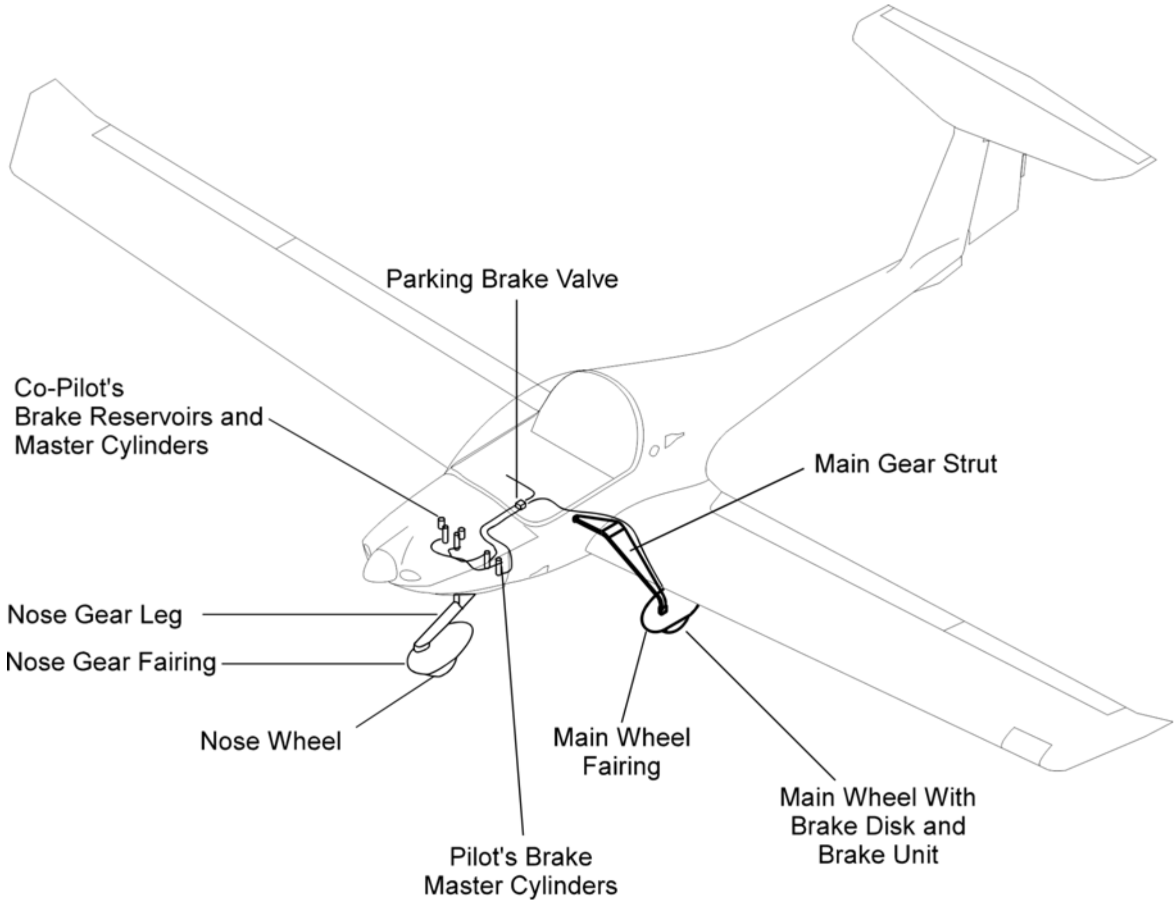

Figure 1: Location of Landing Gear Components

Section 32-10
Main Landing Gear

1. General

This chapter describes the data for the main landing gear. It gives you the trouble-shooting and maintenance practices. Refer to Chapter 32-40 for data for the main wheels and the brakes.

2. Description and Operation

Each main gear strut is an aluminum alloy leaf spring. Two strong mounts attach each spring to the spar bridge in the fuselage. Small panels with flexible centers seal the gap where each strut goes through the fuselage shell.

The inner mount is a large vertical bolt. The bolt goes through a metal block which attaches to a U-shaped bracket. The bracket goes under and around the spar bridge. Spring washers separate the top face of the spring from the block. A castle-nut pre-loads the spring washers.

The outer mount is an H-shaped bracket. The top arms of the H go fore and aft of the spar bridge. The leaf spring goes between the bottom arms of the H. A retaining bar holds the leaf spring in position. UHMW - polyethylene inserts go above and below the leaf spring to prevent chafing damage. Brass strips go each side of the leaf spring.

Four bolts at the outer end of each strut attach the following components:

– An aluminum axle.

– A brake torque-plate.

– A mount for the GFRP wheel fairing (optional).

When the airplane is on the ground, the inner end of the leaf spring pulls down on the inner mounting. The outer end pushes up against the outer mounting. When the airplane is flying, the inner end of the leaf spring pushes up on the inner mounting. And the outer end pulls down against the retaining bar of the outer mounting.

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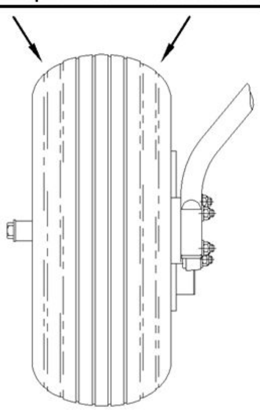
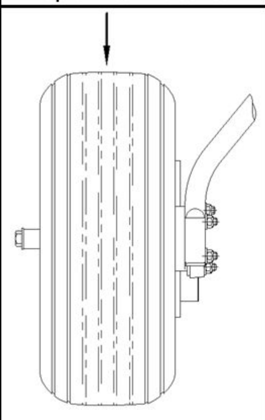
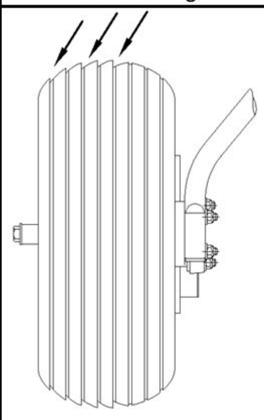
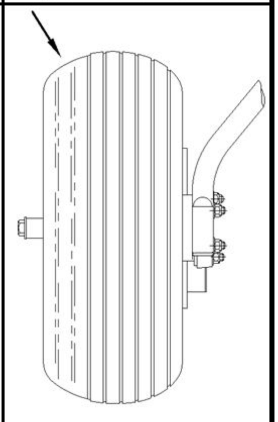
Trouble-Shooting

1. General

The tables below explain how to troubleshoot the main landing gear and MLG tires.

WARNING: YOU MUST DO A HARD LANDING CHECK AFTER A HARD LANDING. HARD LANDINGS CAN CAUSE DAMAGE TO THE STRUCTURE AS WELL AS THE LANDING GEAR.

Trouble	Possible Cause	Repair
Strut bent.	Hard landing.	Do a hard landing check. Refer to Chapter 05-50. Replace the strut.
Negative camber.	Strut bent, Hard landing.	Do a hard landing check. Refer to Chapter 05-50. Replace the strut.

Condition	Rapid Wear At Shoulders	Rapid Wear At Center	Feathered Edge	Rapid Wear On One Side
Effect				
Cause	Tire Under-Inflated	Tire Over-Inflated	Toe Misalignment	Camber Misalignment
Correction	Adjust Tire Pressure As Per Chapter 12-10 When Tires Are Cool		Adjust Toe Angle As Per Chapter 32-10	Adjust Camber Angle As Per Chapter 32-10
			Rotation Of MLG Tires Recommended To Increase Service Life	

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Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the components of the main landing gear. Refer to the manufacturer for further data.

2. Remove/Install the Main Landing Gear

A. Equipment

Item	Quantity	Part Number
Airplane jacks.	2	Commercial.
Tail Former.	1	

B. Remove the Main Landing Gear Strut

Refer to Figure 1 - 2.

	Detail Steps/Work Items	Key Items/References
(1)	Lift the airplane on jacks.	Refer to Chapter 07-10.
(2)	Remove the wheel fairing: – Remove the outer bolt. – Remove the two screws on the inner side.	If installed.
(3)	Remove the back-plate from the brake caliper.	Refer to Chapter 32-40.
(4)	Remove the wheel.	Refer to Chapter 32-40.
(5)	Release the brake caliper.	
(6)	Release the brake pipe from the strut.	Tie the brake caliper back. Do not stress the brake pipe.
(7)	Remove the four bolts that attach the axle. Remove the axle, torque-plate and fairing mount.	Only if you are going to install a different strut.
(8)	Disconnect the bonding cable from the strut.	
(9)	Remove the nut, the washers and the bolt at the inner mount attachment-bracket.	
(10)	Note the stacking arrangement of the inner mount attachment	Refer to Figure 1.

	Detail Steps/Work Items	Key Items/References
(11)	Remove the nuts and the washers, the retaining bar, the inserts and the brass strips at the outer mount attachment-bracket.	Hold the strut.
(12)	Note the location and thickness of UHMW inserts and brass strips at outer mount attachment.	
(13)	Remove the strut.	Move the strut outboard.

C. Install the Main Landing Gear Strut

Refer to Figure 1 - 2.

	Detail Steps/Work Items	Key Items/References
(1)	Examine the spar bridge in the area of the main gear mountings. Look especially for damage to the GFRP structure.	Refer to Chapter 51-10 for GFRP inspection procedures.
(2)	Install the retaining bar. Install the bolts, the washers and the nuts to hold the retaining bar to the outer mount attachment-bracket.	Leave the hardware loose.
(3)	Apply grease to the brass strips.	Use MIL-G-81322 grease.
(4)	Put the inserts and brass strips in position at the outer mount.	If same strut, inserts and brass strips are reinstalled, refer to Step 12 in paragraph 2.B. for the location and thickness of inserts and the brass strips at the outer mount attachment. Try to install brass strip P/N 22-3210-00-14 first. If it is too tight, use brass strip P/N 22-3210-00-19, or a combination of the two. Make sure that maximum of two brass strips in one location. Install symmetrically between LH and RH sides. If new parts are installed, select insert to achieve approximately 0.1 mm compression when assembled.

	Detail Steps/Work Items	Key Items/References
(5)	Put the strut in position.	Move it inboard through the fuselage slot. Make sure that the inserts and brass strips remain in proper location as they tend to slide inboard during the strut installation.
(6)	Apply grease to the concave and convex washers.	Use MIL-G-81322 grease.
(7)	Install the bolts, the washers and the nut at the inner mount attachment bracket.	Refer to Figure 1-2. If same strut is installed, refer to step 10 in paragraph 2.B. for parts arrangement. If new strut is installed shim inboard MLG strut to level airplane side to side by adding up to 2 plain washer between the belleville washers and the inner mount on the high side.
(8)	Tighten the nuts on the outer mount.	Torque to 15-20 Nm (132-177 lbf-in). Make sure that there is no gap between the retaining bar and the outer mount.
(9)	Tighten the nut on the inner bolt.	To give a height of the spring washers and 1 flat washer. (Distance from the strut to the outer mount: 5.55 ± 0.1 mm).
(10)	Connect the bonding cable to the strut.	If you install a bonding terminal on a new strut, remove the surface protection where the terminal will attach. Then varnish the area with NYCOTE 7-11.
(11)	Install the axle, the torque-plate and the fairing mount. Install the four bolts that attach the axle.	Only if you install a different strut. Torque to 13.6 - 15.8 Nm (120 - 140 lbf-in).
(12)	Attach the brake line to the strut.	
(13)	Install the brake caliper.	Refer to Chapter 32-40.
(14)	Install the wheel.	Refer to Chapter 32-40.
(15)	Install the back-plate to the brake caliper.	Refer to Chapter 32-40.

	Detail Steps/Work Items	Key Items/References
(16)	Install the wheel fairing:- Install the outer bolt – Install the two screws on the inner side.	Airplane with wheel fairing option only.
(17)	Lower the airplane with the jacks.	
(18)	Do a test for correct adjustment of the landing gear.	See Paragraph 4.

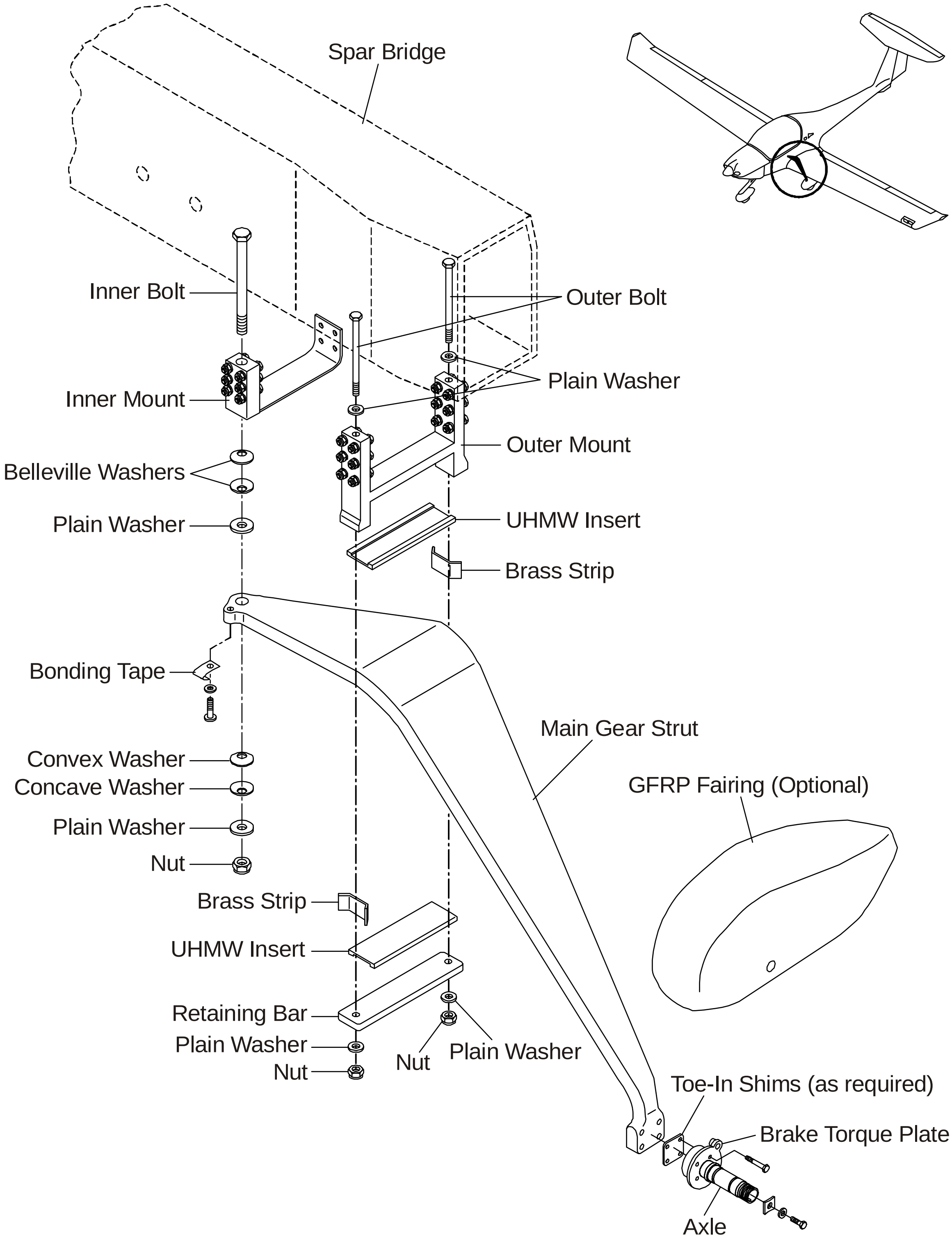

Figure 1: Main Landing Gear

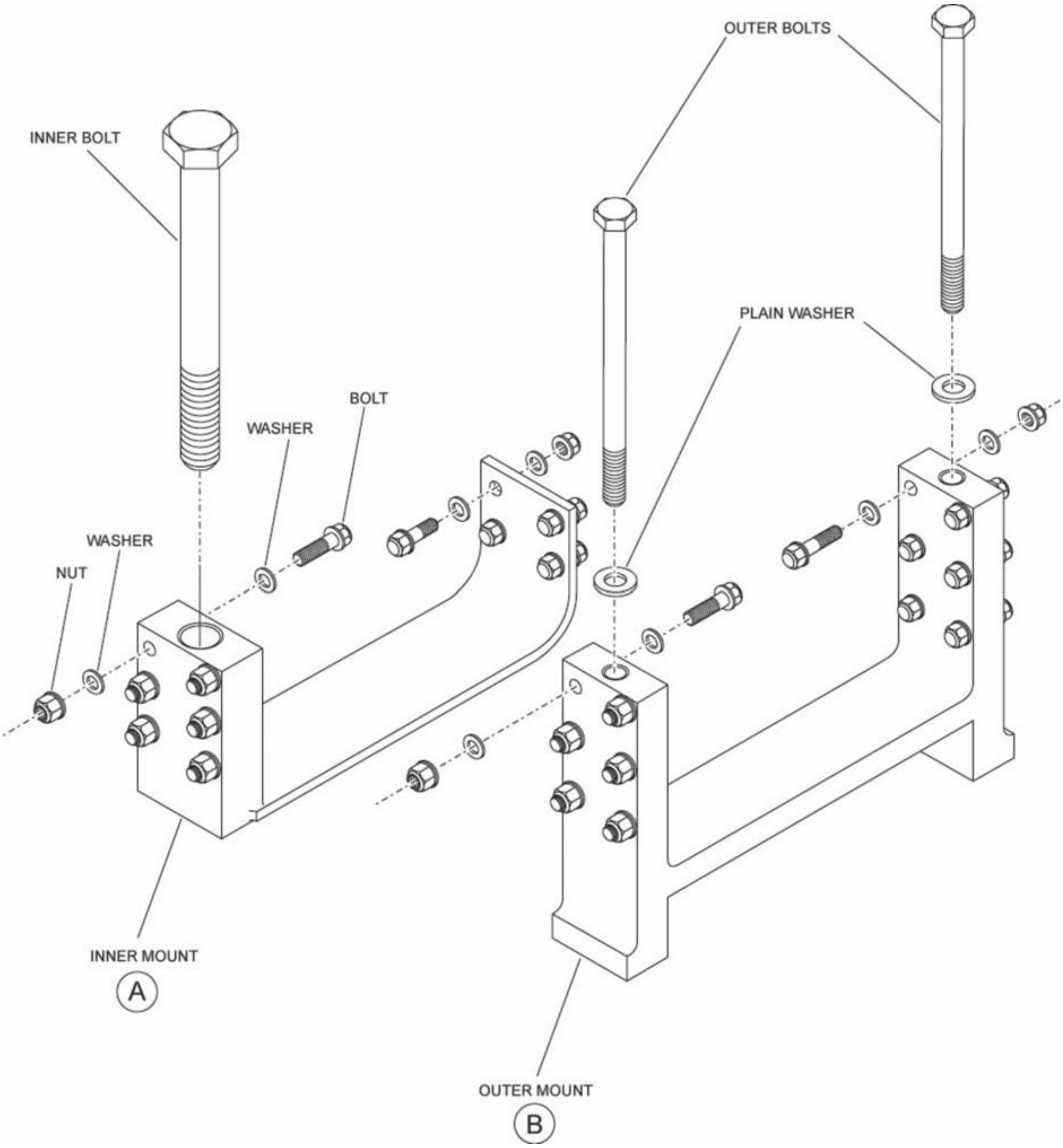

Figure 2: Main Landing Gear

3. Remove/Install the Hardware at the Inner and Outer Mounts of the Main Landing-Gear Strut

A. Equipment

Item	Quantity	Part Number
Airplane jacks.	2	Commercial.
Tail Former.	1	

B. Remove the Hardware from the Inner/Outer Mount of the Main Landing-Gear Strut

Refer to Figure 1 - 2.

	Detail Steps/Work Items	Key Items/References
(1)	Remove the applicable wing.	Refer to Chapter 57-10.
(2)	Remove the applicable main landing-gear strut.	
(3)	Remove the hardware from the inner mount of the main landing-gear strut, as follows:	
	Note: The inner mount is not removed. Note: The bolts for the forward side and rear side are different in length. The washers are installed on the bolt side and the nut side.	
	– Remove the nuts, bolts and washers at the forward side of the inner mount.	There are six nuts, six bolts and 12 washers.
	– Remove the nuts, the bolts and the washers at the rear side of the inner mount.	There are four nuts, four bolts and eight washers.
(4)	Make sure that the spar bridge, at the location of the inner mount, is not damaged.	Look especially for cracks, chips or delamination.
(5)	Replace the hardware.	Refer to the installation of the hardware

	Detail Steps/Work Items	Key Items/References
(6)	Remove the hardware from the outer mount of the main landing-gear strut, as follows:	
	NOTE: The outer mount is not removed. NOTE: The bolts for the forward side and rear side are the same in length. The washers are installed on the bolt side and the nut side.	
	– Remove the nuts, bolts and washers at the forward side of the outer mount.	There are six nuts, six bolts and 12 washers.
	– Remove the nuts, the bolts and the washers at the rear side of the outer mount.	There are six nuts, six bolts and 12 washers.
(7)	Make sure that the spar bridge, at the location of the outer mount, is not damaged.	Look especially for cracks, chips or delamination.
(8)	Replace the hardware.	Refer to the installation of the hardware.

C. Install the Hardware from the Inner/Outer Mount of the Main Landing-Gear Strut

Refer to Figure 1 - 2.

	Detail Steps/Work Items	Key Items/References
(1)	Install the hardware from the outer mount of the main landing-gear strut, as follows:	
	Note: The outer mount is bonded to the spar bridge. Note: The bolts for the forward side and rear side are the same in length. The washers are installed on the bolt side and the nut side.	
	– Install the bolts, the washers and the nuts at the rear side of the outer mount and spar bridge.	Apply Mastinox 6856K to the shank of each bolt only. Be careful to not get Mastinox on the threads of the bolt.
	– Torque the bolts to 5.6 - 7.9 Nm (50 -70 lbf-in).	
	– Install the bolts, the washers and the nuts at the forward side of the outer mount and spar bridge.	Apply Mastinox 6856K to the shank of each bolt only. Be careful to not get Mastinox on the threads of the bolt.
	– Torque the bolts to 5.6 - 7.9 Nm (50 -70 lbf-in).	

	Detail Steps/Work Items	Key Items/References
(2)	Install the hardware from the inner mount of the main landing-gear strut, as follows:	
	Note: The inner mount is bonded to the spar bridge. Note: The bolts for the forward side and rear side are the same in length. The washers are installed on the bolt side and the nut side.	
	– Install the bolts, the washers and the nuts at the rear side of the inner mount and spar bridge.	Apply Mastinox 6856K to the shank of each bolt only. Be careful to not get Mastinox on the threads of the bolt.
	– Torque the bolts to 5.6 - 7.9 Nm (50 -70 lbf-in).	
	– Install the bolts, the washers and the nuts at the forward side of the inner mount and spar bridge.	Apply Mastinox 6856K to the shank of each bolt only. Be careful to not get Mastinox on the threads of the bolt.
	– Torque the bolts to 5.6 - 7.9 Nm (50 -70 lbf-in).	
(3)	Install the main landing gear strut.	Refer to Chapter 32-10.
(4)	Install the wing.	Refer to Chapter 57-10.

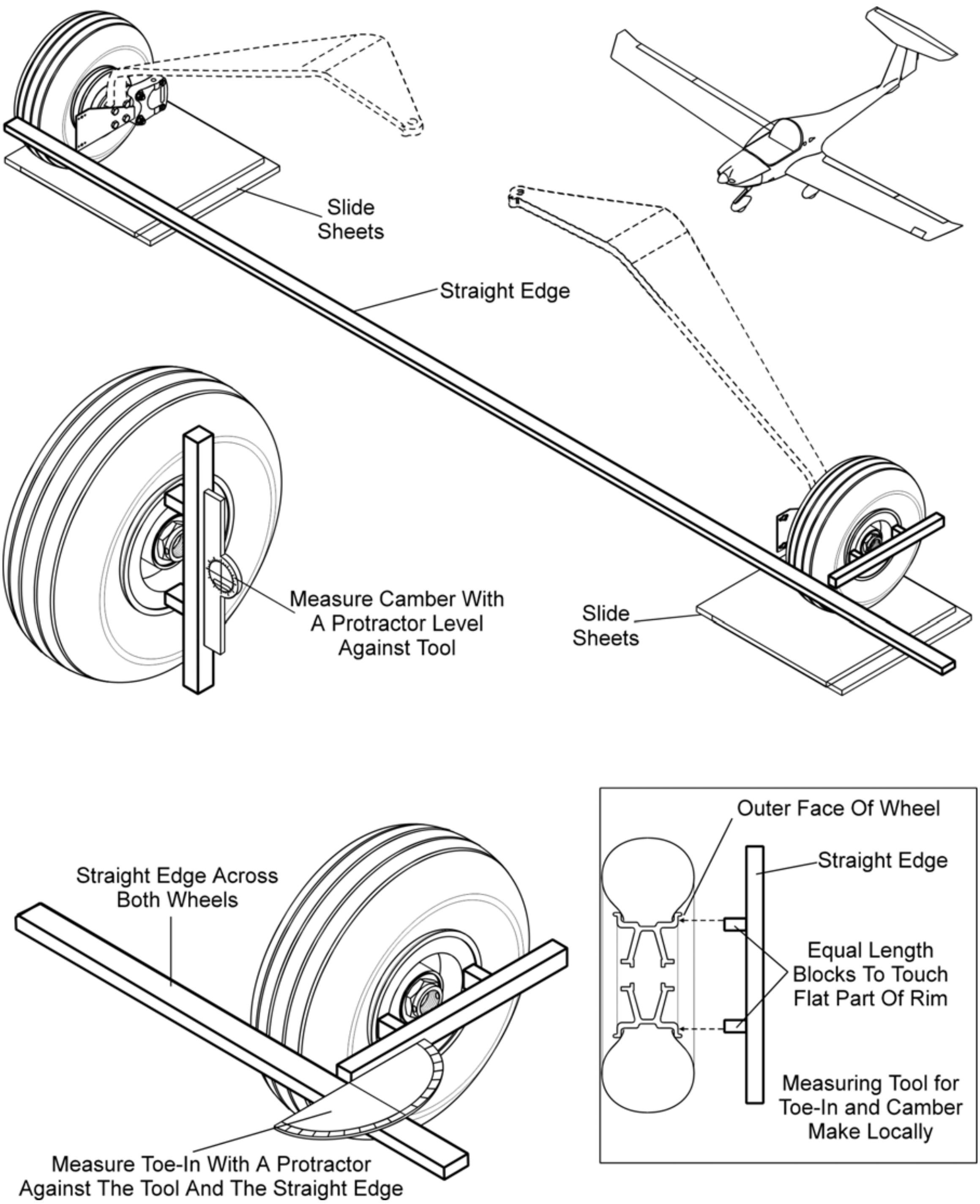

Figure 3: Measure Toe-In and Camber

4. Test/Adjust the Main Landing Gear

Do this work at the following times:

- After a hard landing.
- After any repair to the main landing gear which could affect alignment.

A. Equipment

Item	Quantity	Part Number
Slide Sheets - 2 per side.	4	Commercial.

B. Procedure

	Detail Steps/Work Items	Key Items/References
(1)	Make sure that the airplane is at the empty weight.	
(2)	Roll the main wheels onto the slide sheets.	
(3)	Measure the toe-in.	Refer to Figure 3.
(4)	Measure the camber.	Refer to Figure 3.
WARNING:	**USE ONLY THE SHIMS LISTED FOR THE PURPOSE IN THE AIRPLANE ILLUSTRATED PARTS CATALOG. OTHER SHIMS COULD CAUSE LANDING GEAR FAILURE.**	
(5)	If necessary, adjust the toe-in and/or camber.	Refer to Chapter 06-00 for limits. Maximum 2° shim per side (camber + toe). Refer to the illustrated parts catalog for the correct shims. Put shims between the strut and the axle. These change the angle between the axle and the airplane longitudinal or vertical axis.
(6)	Measure the wheel track.	Across the airplane from the outermost point on one axle to the outermost point on the other axle.
(7)	Roll the main wheels off the slide sheets.	

Section 32-20

Nose Landing Gear

1. General

This chapter describes the data for the nose landing gear. It gives you the trouble-shooting and maintenance practices. Refer to Chapter 32-40 for data for the nose wheel.

2. Description and Operation

The DV 20 E airplane has a fixed nose landing gear with a castoring wheel. The nose gear strut is a welded tubular-steel component. The aft upper end has a transverse tube which holds the main attachment journal-bearings. These journal-bearings allow the strut to move only up and down.

Forward and below the attachment bearing is a welded bracket which holds the bottom of the shock absorber assembly. The upper end of the shock absorber assembly attaches to the engine mount.

The forward bottom end of the nose gear strut has a near-vertical pivot for the nose-wheel fork. This lets the nose wheel caster. Stops limit the caster movement to ± 64 degrees.

When the airplane is on the ground, the shock absorber assembly pushes up against the engine mount. The journal-bearing pulls down against the front fuselage. When the airplane is flying, the shock absorber assembly pulls down against the engine mount and the journal-bearing pushes up against the front fuselage.

The journal bearing keeps the nose gear strut aligned fore and aft. A side load on the nose wheel causes it to caster. The stiffness (steering friction) of the nose-wheel fork pivot can be adjusted with the nose wheel fork mounting-screw. This prevents nose-wheel shimmy.

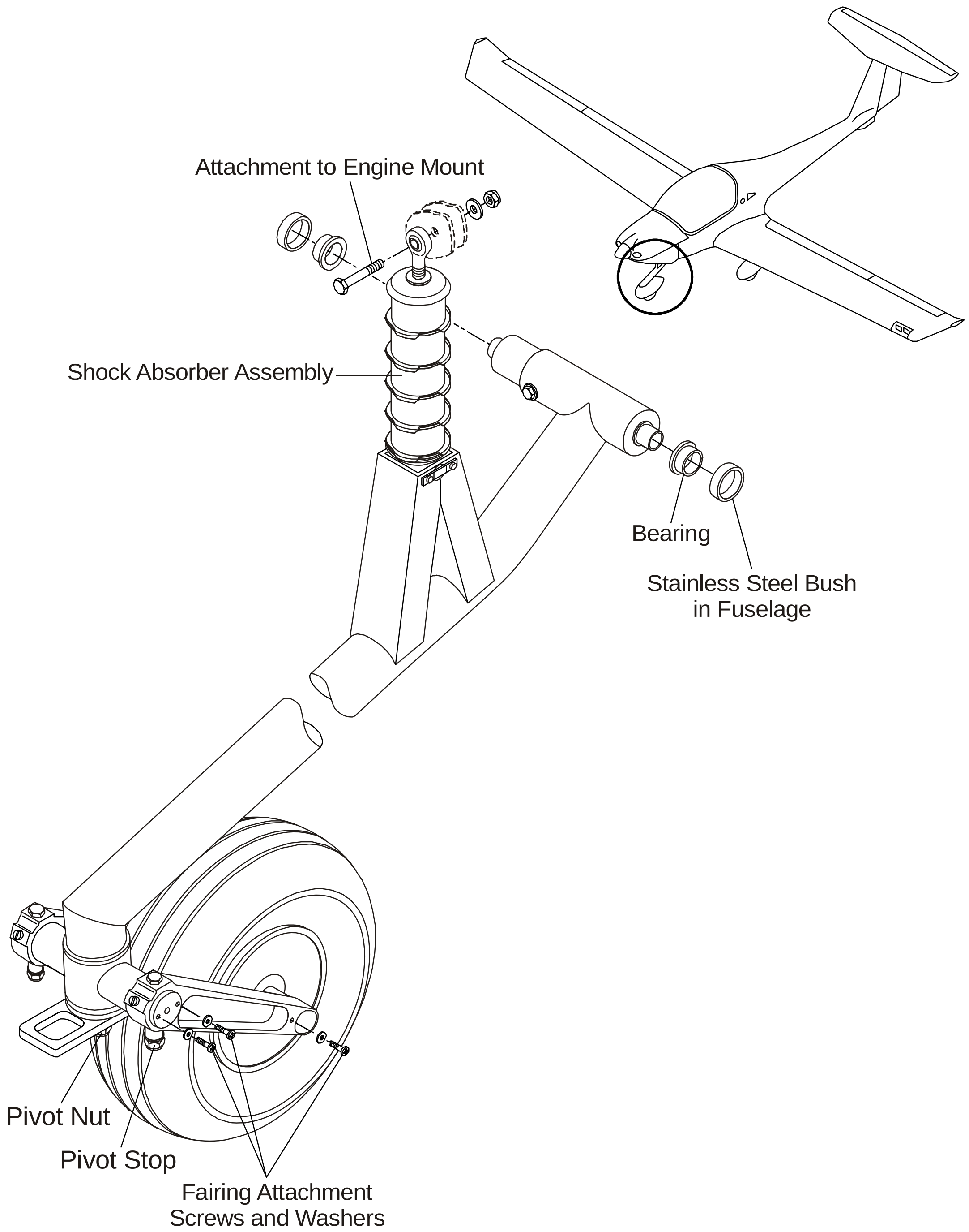

Figure 1: Nose Landing Gear

Trouble-Shooting

1. General

This table explains how to troubleshoot the nose landing gear. If you find the trouble given in Trouble column read across to the Possible Cause column. Then do the repair given in the Repair column.

WARNING: YOU MUST DO A HARD LANDING CHECK AFTER A HARD LANDING. HARD LANDINGS CAN CAUSE DAMAGE TO THE STRUCTURE AS WELL AS THE LANDING GEAR.

Trouble	Possible Cause	Repair
Strut bent.	Hard landing.	Do a hard landing check. Refer to Chapter 05-50. Replace the strut.
Nose-wheel shimmy.	Steering friction too low.	Adjust the nose-wheel fork mounting-screw.

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Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the components of the nose landing gear. Refer to the manufacturer for further data.

2. Remove/Install the Nose Landing Gear

A. Equipment

Refer to Chapter 07-10 for the equipment required for jacking the airplane.

B. Remove the Nose Landing Gear Strut

	Detail Steps/Work Items	Key Items/References
(1)	Jack the airplane.	Refer to Chapter 07-10.
(2)	Remove the engine cowling.	Refer to Chapter 71-10.
(3)	Disconnect the shock absorber assembly from the nose landing gear strut as follows: – Remove the rivets. Discard the rivets. – Remove the two clip retainers. – Remove the strut pins.	Refer to Figure 1 and 2. Use a slide hammer to remove the strut pins.
(4)	Remove the lock bolt from the journal assembly.	Refer to Figure 2.
(5)	Provide adequate support to the NLG strut and slide the large pivot inwards.	
WARNING:	**DO NOT STAND UNDER THE NOSE LANDING GEAR STRUT. THE ASSEMBLY IS HEAVY AND MAY CAUSE HARM AND INJURY TO PERSONNEL.**	
(6)	Release the journal assembly unit from the fuselage bearings.	
(7)	Carefully remove the nose gear strut from the airplane in a downward direction.	

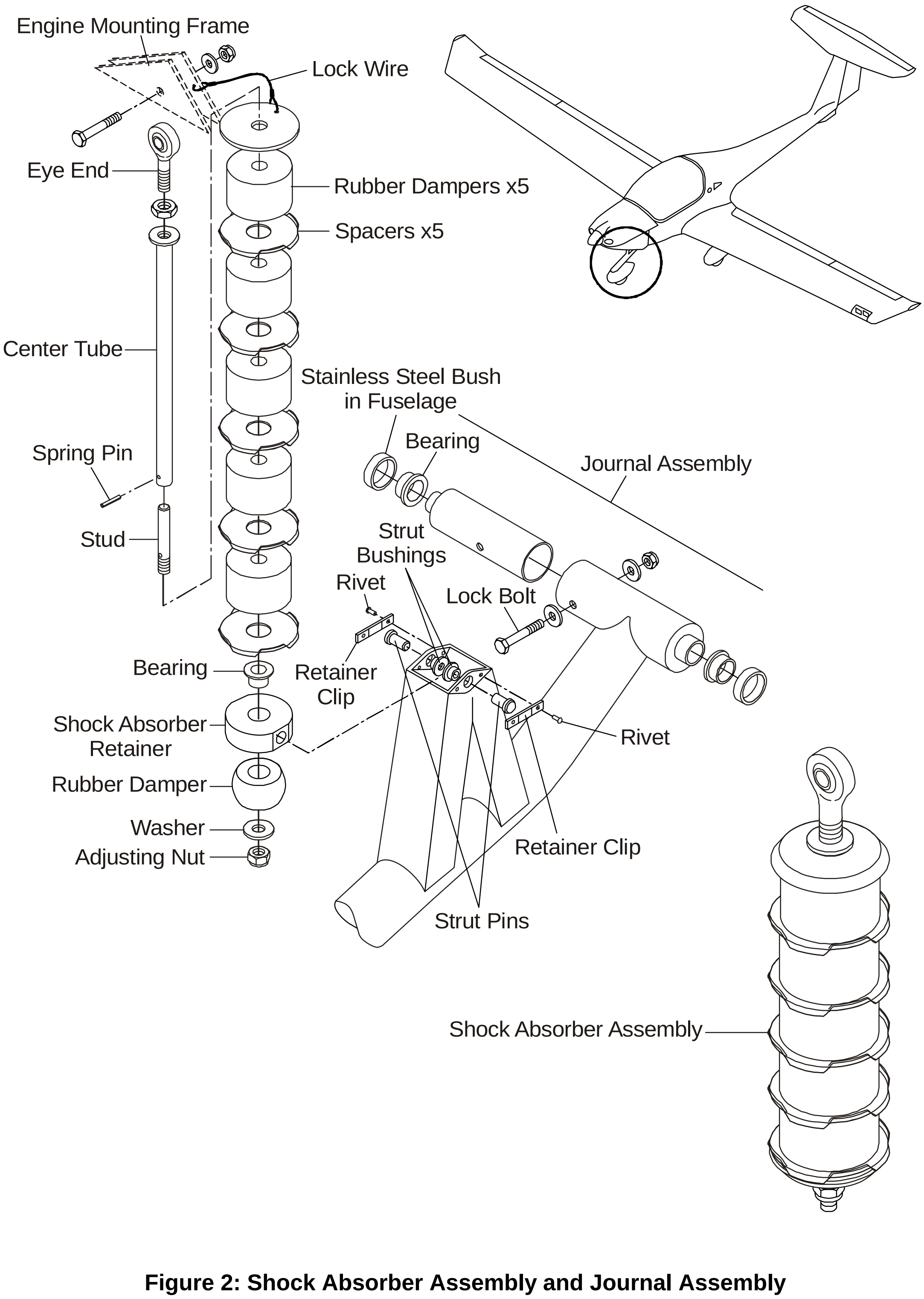

Figure 2: Shock Absorber Assembly and Journal Assembly

C. Install the Nose Landing Gear Strut

	Detail Steps/Work Items	Key Items/References
	WARNING: USE PROPER PERSONAL PROTECTIVE EQUIPMENT (PPE) WHEN HANDLING CORROSION PROTECTION AND GREASE. THESE CHEMICALS WHEN MAKE CONTACT MAY IRRITATE OR CAUSE DAMAGE TO SKIN.	
	Note: If Installing a new NLG Strut, Step 1 must be completed first. If installing the original NLG Strut proceed to step 2.	
(1)	Preparation of a new NLG Strut assembly:	
	– Install strut pivot into strut journal.	Use Loctite 680. Refer to Figure 3.
	– Install large pivot into strut journal.	A new large pivot must be used when a new NLG Strut is installed.
	– Put the NLG strut into position in the airplane from below.	
	– Slide out the large pivot from the journal to engage the bearings in the fuselage.	No lateral free play is allowed.
	– Drill a 2 mm (+/- 0.015 mm) hole in the large pivot through the pilot hole in the strut journal (one side only).	
	– Slide the large pivot inwards and remove the NLG strut.	
	– Secure the large pivot in the NLG Strut with a MS171466/468 spring pin inserted into the drilled hole.	
	– Drill a 7.9 mm hole through the strut journal and large pivot in order to install the lock bolt.	Hole location is 17mm (+/- 0.5 mm) from the edge of the strut journal and angled 50° (+/- 1°) from the center axis of the strut tube. Refer to Figure 3.
	– Remove and discard the spring pin. Remove the large pivot.	
	– Remove burrs and sharp edges from holes.	
	– Clean up strut journal and large pivot from foreign objects and any contaminates.	

	Detail Steps/Work Items	Key Items/References
(2)	Lubrication prior to final installation: – Liberally apply corrosion protection to the following items: – The inside of the journal assembly. – The shank of the lock bolt. – Apply a light coat of grease to the Teflon bearings and strut pivots.	 Use Type 5 lubricant. Refer to Chapter 12-20. Clean corrosion protection from the threads. Use Type 1 lubricant. Refer to Chapter 12-20.
(3)	Install the large pivot into the strut journal and put the nose gear strut in position in the airplane from below.	
(4)	Slide out the large pivot of the unit to engage the bearings in the fuselage.	Refer to Figure 2.
(5)	Install the lock bolt in the journal bearing unit.	
(6)	Install the shock absorber assembly to the nose landing gear strut as follows: – Apply a light corrosion protection on strut pins and clip retainers. – Install the shock absorber assembly using the strut pins. – Install the clip retainers and secure with rivets.	Refer to Figure 2. Use Mastinox (6856K). Clean corrosion protection excess. Use vinyl hammer to secure strut pins.
(7)	Adjust the nose wheel steering friction.	Refer to Paragraph 7.
(8)	Remove airplane from the jacks.	Refer to Chapter 07-10.
(9)	Install the engine cowling.	Refer to Chapter 71-10.

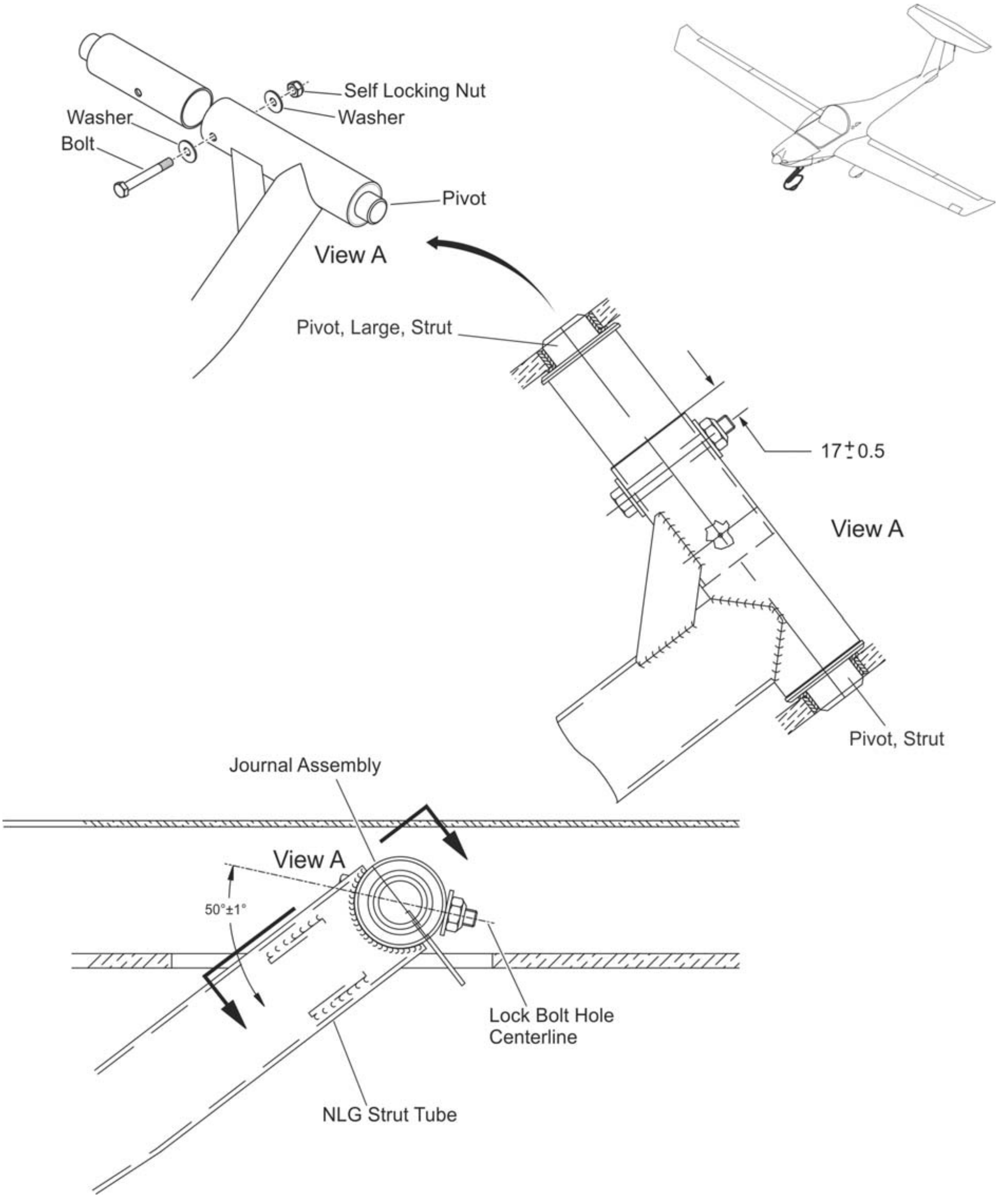

Figure 3: Lock Bolt Hole Centerline Position

3. Remove/Install the NLG Fork Assembly

A. Equipment

Refer to Chapter 07-10-00 for the equipment required for jacking the airplane.

B. Remove the NLG Fork Assembly

	Detail Steps/Work Items	Key Items/References
(1)	Jack the airplane.	Refer to Chapter 07-10.
(2)	Remove fairing if installed.	
(3)	Remove the cotter pin, castellated nut, washers, and spring disc.	Refer to Figure 5.
(4)	Remove the lower spacer, stop plate, thrust washer, and the bushings.	Inspect all parts and replace if necessary.
(5)	Remove the fork assembly from the pivot.	

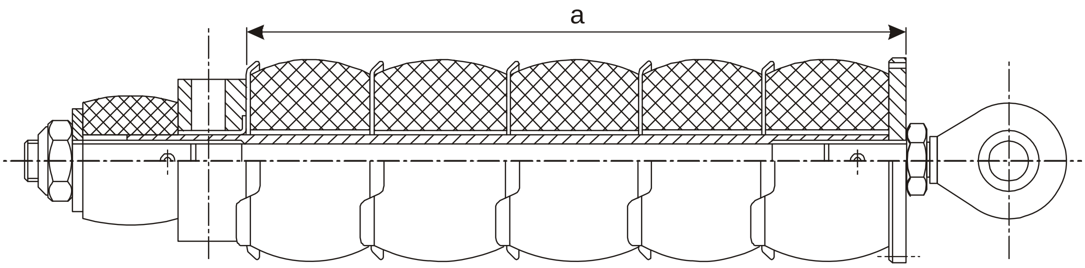

Figure 4: Elastomer Package

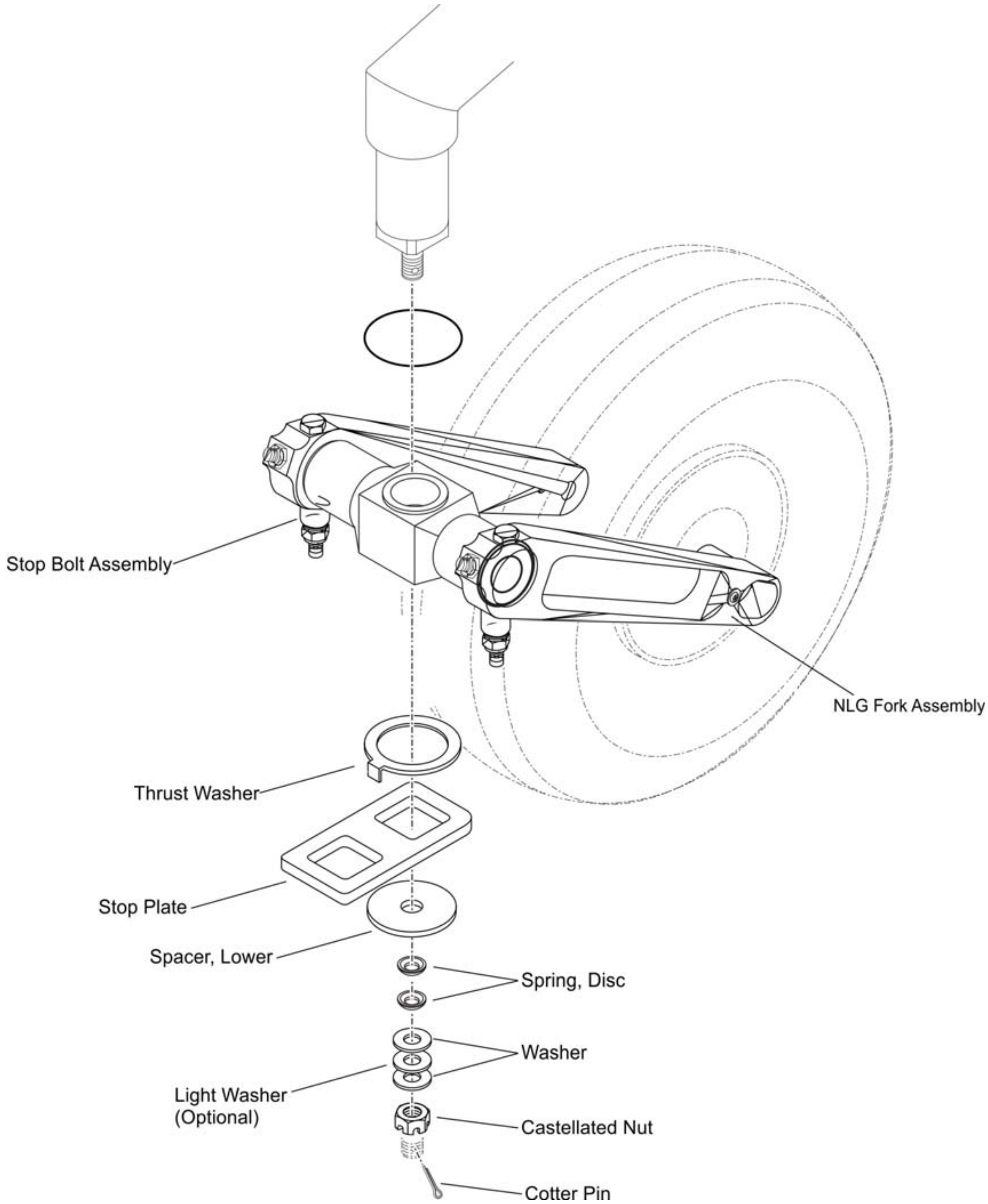

Figure 5: NLG Fork Installation

C. Install the NLG Fork Assembly

	Detail Steps/Work Items	Key Items/References
(1)	Apply grease to the bearing surfaces of the NLG strut axle.	Use MIL-C-81322 grease.
(2)	Apply CRC Corrosion shell or CRC SP-400 to the non-painted area at the stud end of the NLG strut axle except the bearing surface prior to assembly.	Do not apply grease to the surfaces. Make sure that you do not contaminate the tire or the fiberglass. Refer to Chapter 12-20.
(3)	Install the fork assembly on the NLG strut axle as follows: – Install the fork assembly onto NLG strut. – Install the thrust washer, the stop plate and the lower spacer. – Install the spring disc, the washers, and the Castellated nut. – Tightened the nut to achieve break out – force. – Install the cotter pin.	Refer to Figure 5. Make sure that both spring discs are installed with open side facing up. Refer to Paragraph 7.
(4)	Adjust the nose wheel steering friction.	Refer to Paragraph 7.
(5)	Apply CRC Corrosion shell or CRC SP-400 to the nut and the washers only on the stud end of the NLG strut axle.	Do not apply grease to the surfaces. Make sure that you do not contaminate the tire or the fiberglass. Refer to Chapter 12-20.
(6)	Install the fairings, if removed.	If fairing is not installed install the fairing attachment screws and washers as shown in Figure 1.
(7)	Remove airplane from the jacks.	Refer to Chapter 07-10.

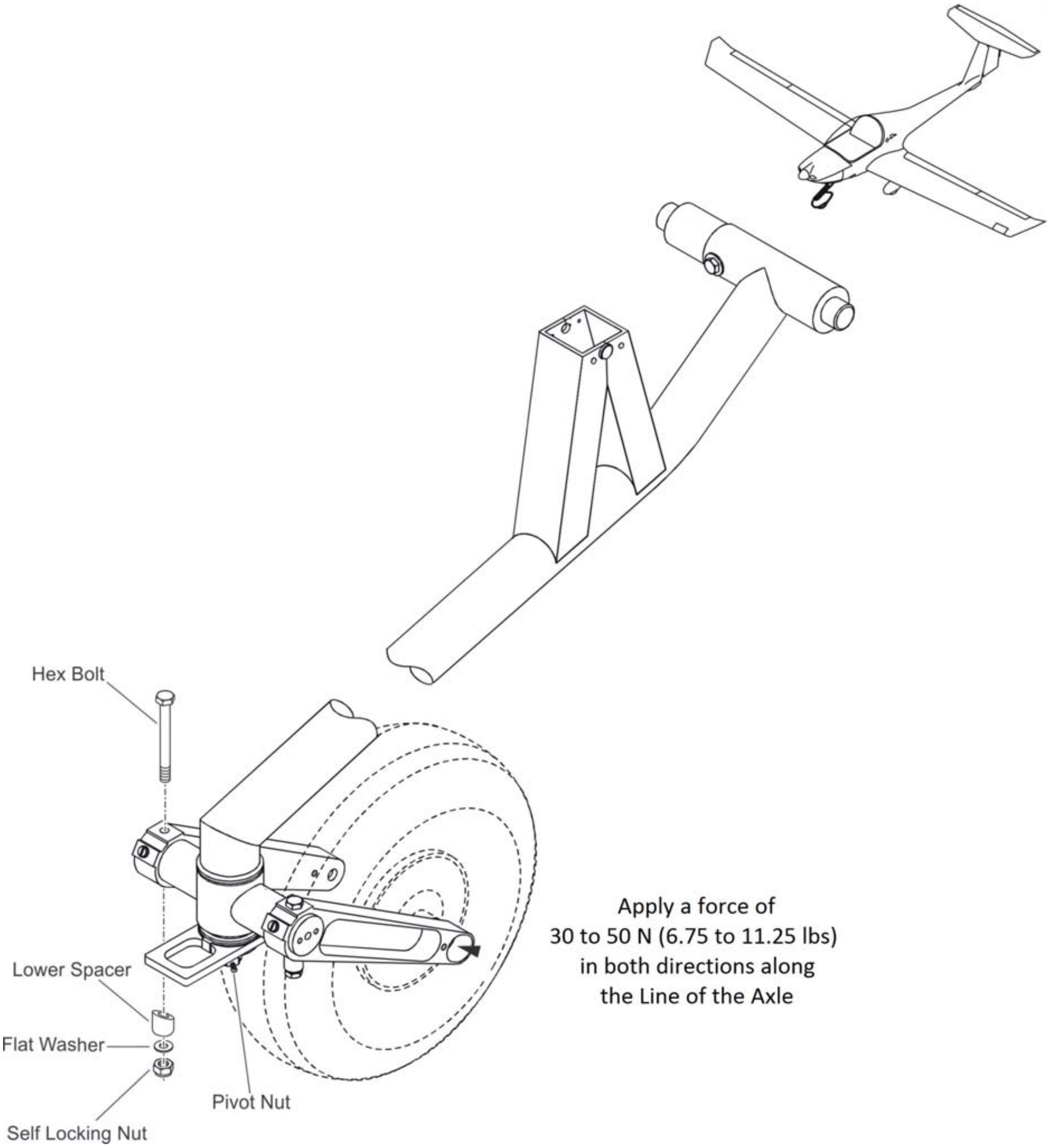

Figure 6: Adjust the Nose Wheel Steering Friction

4. Remove/Install the Shock Absorber Assembly

A. Equipment

Refer to Chapter 07-10 for the required equipment for jacking the airplane.

B. Remove the Shock Absorber Assembly

	Detail Steps/Work Items	Key Items/References
(1)	Jack the airplane	Refer to Chapter 07-10.
(2)	Remove the engine cowling.	Refer to Chapter 71-10.
	WARNING: SUPPORT THE NOSE LANDING GEAR PRIOR TO REMOVAL OF THE UNIT. FAILURE TO SUPPORT THE ASSEMBLY WILL DAMAGE THE EQUIPMENT AND MAY CAUSE HARM OR INJURY TO PERSONNEL.	
(3)	Disconnect the shock absorber assembly from the engine mount as follows: – Disconnect the lock-wire. – Remove the bolt, the washer, and the nut.	One person should hold the nose landing gear strut. Refer to Figure 2.
(4)	Remove shock absorber assembly from the nose landing gear strut as follows: – Remove the rivets. Discard the rivets. – Remove the two clip retainers. – Remove the strut pins.	Refer to Figure 2. Use a slide hammer to remove the strut pins.

C. Install the Shock Absorber Assembly

	Detail Steps/Work Items	Key Items/References
	WARNING: USE PROPER PERSONAL PROTECTIVE EQUIPMENT (PPE) WHEN HANDLING CORROSION PROTECTION AND GREASE. THESE CHEMICALS WHEN MAKE CONTACT MAY IRRITATE OR CAUSE DAMAGE TO SKIN.	
(1)	Install the shock absorber assembly to the nose landing gear strut as follows:	Refer to Figure 2.
	– Apply a light corrosion protection on strut pins and clip retainers.	Use Mastinox (6856K). Clean corrosion protection excess.
	– Install the shock absorber assembly using the strut pins.	Use vinyl hammer to secure strut pins.
	– Install the clip retainers and secure with rivets.	
(2)	Connect the shock absorber assembly to the engine mount as follows:	Use Type 5 lubricant Refer to Chapter 12-20. Clean corrosion protection from the threads.
	– Apply corrosion protection to bolt shank.	
	– Install the bolt, the washer, and the nut.	
	– Install the lock-wire.	
(3)	Remove airplane from jacks.	Refer to Chapter 07-10.
(4)	Install the engine cowling.	Refer to Chapter 71-10.

5. Replace the Shock Absorber Assembly Elements

You must replace cracked rubber damper

	Detail Steps/Work Items	Key Items/References
(1)	Remove the shock absorber assembly from the airplane.	Refer to paragraph 4.A and 4.B.
	WARNING: DO NOT STAND IN THE LINE OF THE SHOCK ABSORBER ASSEMBLY WHEN YOU REMOVE THE NUT. THE ASSEMBLY MAY EXPAND WITH A LOT OF FORCE. AND CAN CAUSE INJURY TO PERSONNEL.	
(2)	Disassemble the shock absorber assembly. – Remove the adjusting nut from the shock absorber assembly. – Remove the washer, and the rubber damper. – Remove the shock absorber retainer, nine spacers, and 10 rubber dampers.	If necessary, use heat to break the adhesive.
(3)	Replace rubber dampers and spacers as required.	
(4)	Reassemble the 10 rubber dampers, 9 spacers and shock absorber retainer in the reverse order removed.	
(5)	Install the washer and rubber damper.	
(6)	Install the adjusting nut.	
(7)	Adjust the shock absorber assembly.	Refer to Paragraph 6.
(8)	Install the shock absorber assembly on the airplane.	Refer to Paragraph 4C.

6. Adjust the Shock Absorber Assembly

When new elastomer elements are installed, dimension “a” (see Figure 4) should be 195 mm or 7.7 in with the nose wheel clear of the ground.

The preload on used elements is adjusted properly when rubber elements cannot be turned by moderate force of hand while the nose wheel is clear of the ground. With the elastomer package properly preloaded, dimension “a” must not be less than 185 mm or 7.3 in. Otherwise the rubber elements must be replaced.

7. Adjust the Nose Landing Steering Friction

Steering friction prevents nose wheel shimmy.

A. Equipment

Refer to Chapter 07-10 for the equipment required for jacking the airplane.

B. Procedure

	Detail Steps/Work Items	Key Items/References
(1)	Jack the airplane.	Refer to Chapter 07-10.
(2)	Remove the nose-wheel fairing.	
(3)	Inspect condition of belleville springs, washers, spacer and stop plate.	Replace as required.
(4)	Check the NLG friction by application of force to NLG wheel axle in both directions along the axle.	
(5)	If required, adjust the nose-wheel fork pivot nut: – Remove the cotter pin (if required). – Adjust the nut. – Install a new cotter pin.	The nose-wheel must just caster when you apply a force of 30 - 50 N (6.75 - 11.25 lb.) acting in the direction of the nose wheel axle. Refer to Figure 6. If the cotter pin hole and the nut castellation do not align after adjustment of steering friction install/remove one AN960-616L thin washer. Washer is optional and (if installed) located in between the two AN960-616 washers. It may be necessary to tighten the nut to the next castellation if alignment is not obtained. Refer to Figure 5.

	Detail Steps/Work Items	Key Items/References
(6)	Apply corrosion protection to the stud, nut and washers only.	Use CRC SP-400 or CRC Corrosion shell. Do not contaminate tire or fiberglass.
(7)	Install the nose-wheel fairing.	
(8)	Remove the trestle from the front fuselage.	
(9)	Remove the airplane from jacks.	Refer to Chapter 07-10.

8. Nose Wheel Balancing

Always have a new nose-wheel balanced before installation.

Section 32-40
Wheels and Brakes

1. General

This chapter describes the data for the main and nose wheels and for the brake system. It gives you the trouble-shooting and maintenance practices.

2. Description and Operation

A. Main Wheel

Figure 1 shows the wheels. The main wheel hub has two aluminum alloy halves. Three bolts hold the two halves together. The bolts also hold a brake disk to the inner half of the hub.

The wheel has a tire with an inner tube. Snap rings hold taper roller bearings and grease seals in each half of the hub. You can remove the bearings for maintenance. The outer half of the hub has a hole for the valve stem.

B. Nose Wheel

The nose has a similar construction to the main wheel. But it has sealed ball bearings.

C. Brake System

Figure 2 shows the brake system schematic diagram. The DV 20 E airplane has two separate brake systems. The pilots and co-pilots left rudder pedals operate the left system. It supplies pressure to the left brake caliper. The right rudder pedals operate the right brake caliper.

Figure 3 shows the brake master cylinder and reservoir installation. Each system has a brake fluid reservoir. The reservoir attaches to the master cylinder on the co-pilot's rudder pedal. The outlet from the master cylinder on the co-pilot's rudder pedal connects to the inlet of the master cylinder on the pilot's rudder pedal. The outlet of the master cylinder on the pilot's rudder pedals connects to the parking brake valve. The parking brake valve connects to the brake caliper.

Figure 4 shows the wheel brake assembly.

The parking brake valve shown in Figure 2 is located below the right seat. It contains 2 valves which can seal the brake pressure into the calipers. This keeps the brakes on. The pressure will reduce in time and the brakes will release. A serviceable parking brake valve will hold the brakes on for more than one day.

(1) Co-Pilot's Brake Operation

When you press on the co-pilot's right brake pedal, the following happens:

- The connection to the reservoir is cut off by the initial movement.
- Further movement pushes fluid past the piston on the pilot's master cylinder.
- The fluid flows through the parking brake valve to the right brake caliper.
- The fluid pushes the piston and the pressure plate against the brake disk.
- The reaction force on the caliper pulls the back plate against the brake disk.
- And the right brake is applied.

In the same way, when you press on the co-pilot's left brake pedal, the left brake is applied.

(2) Pilot’s Brake Operation

When you press on the pilot's right brake pedal, these things happen:

- The connection from the co-pilots master cylinder is cut off by the initial movement. (Note: Any hydraulic pressure from the co-pilot's master cylinder pushes on the back of the piston in the pilot's master cylinder. This increases the brake pressure).
- The fluid flows through the parking brake valve to the right brake caliper.
- The fluid pushes the piston and the pressure plate against the brake disk.
- The reaction force on the caliper pulls the back plate against the brake disk.
- And the right brake is applied.

In the same way, when you press on the pilot's left brake pedal, the left brake is applied.

Note: If one side of the system fails, one or both pilots can loose braking on that side. For example, a leak in the pipe between the co-pilot's and pilot's right master cylinders will cause a right brake failure for the co-pilot. The pilot's right brake will operate correctly. If the leak is between the pilots right master cylinder and the right brake caliper, both pilots will have right brake failure.

(3) Parking Brake Operation

To apply the parking brake:

– Press on both pedals.

– Pull the parking brake knob fully aft.

– Release your foot pressure on the pedals.

– If necessary, pump the brake pedals.

To release the parking brake, select control too off.

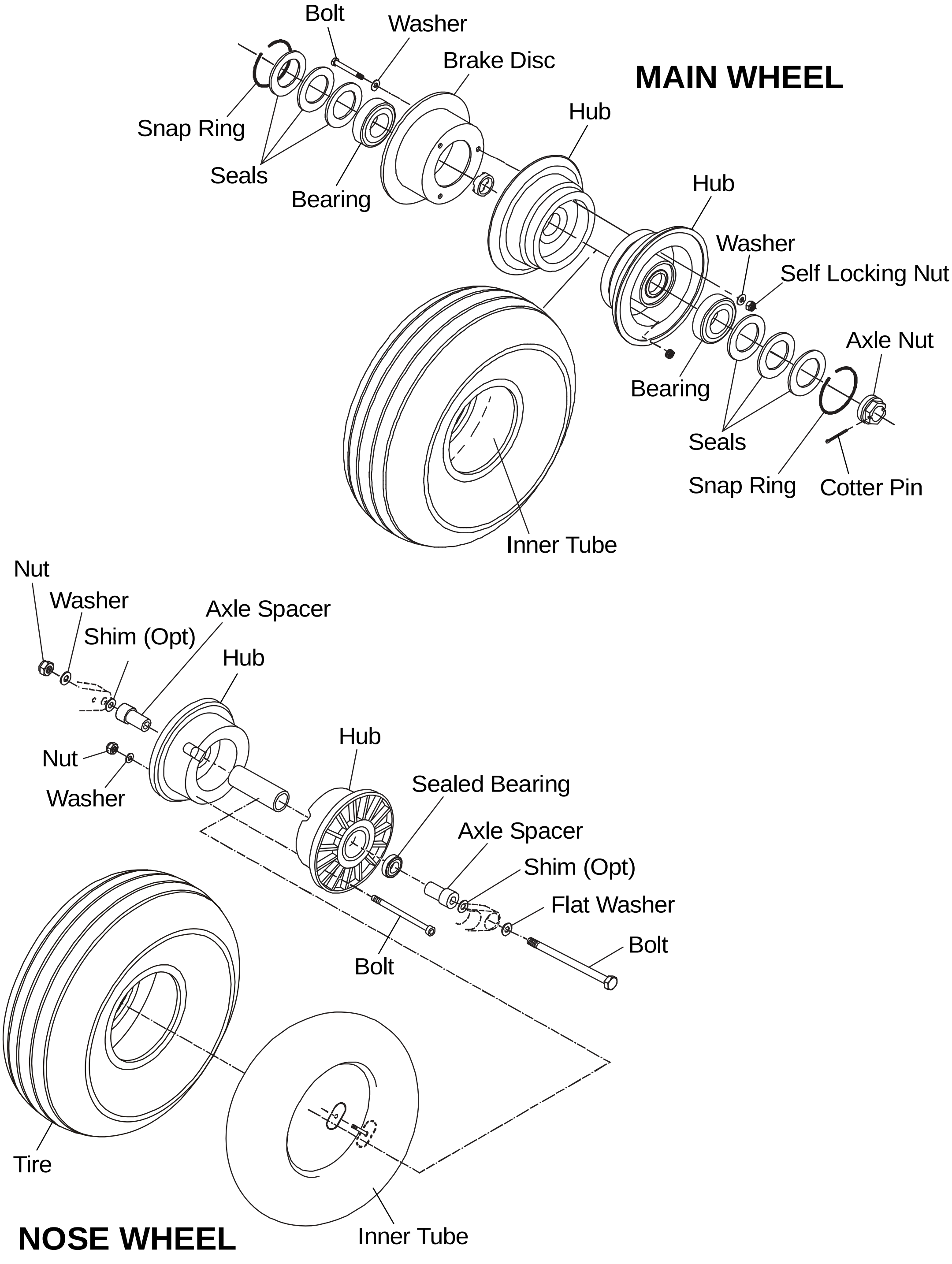

Figure 1: Main and Nose Wheel

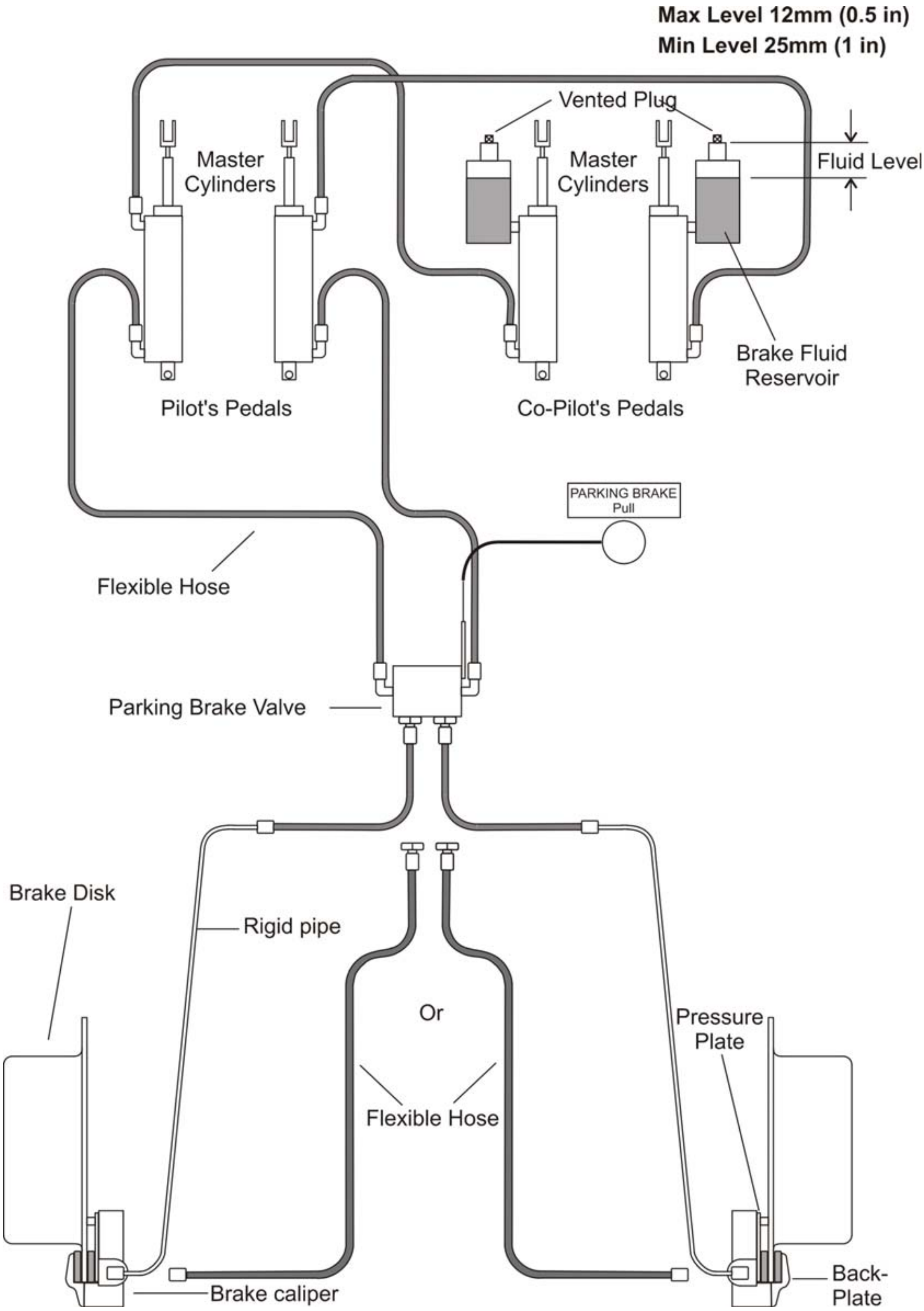

Figure 2: Brake System Schematic

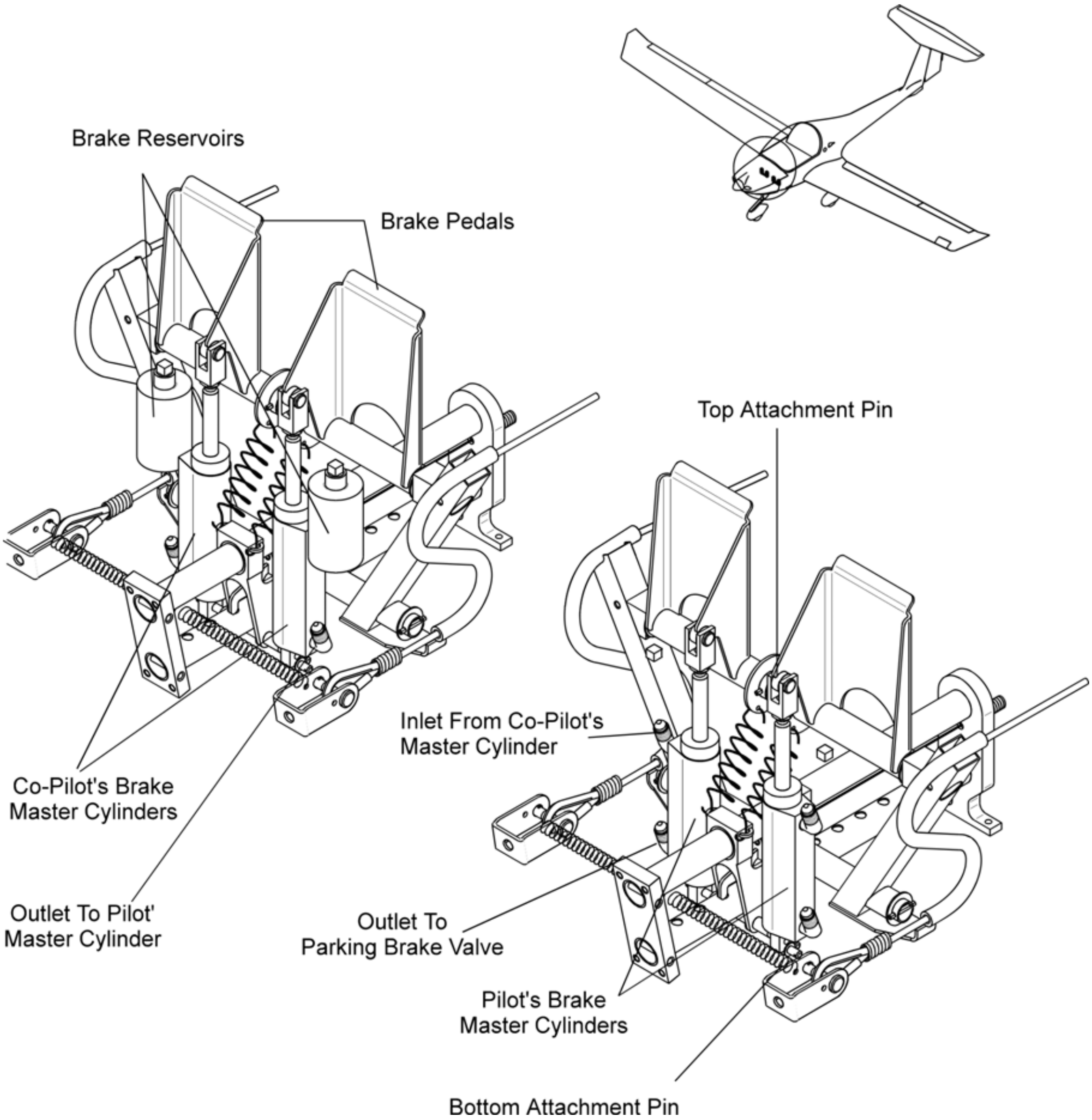

Figure 3: Brake Master Cylinder and Reservoir Installation

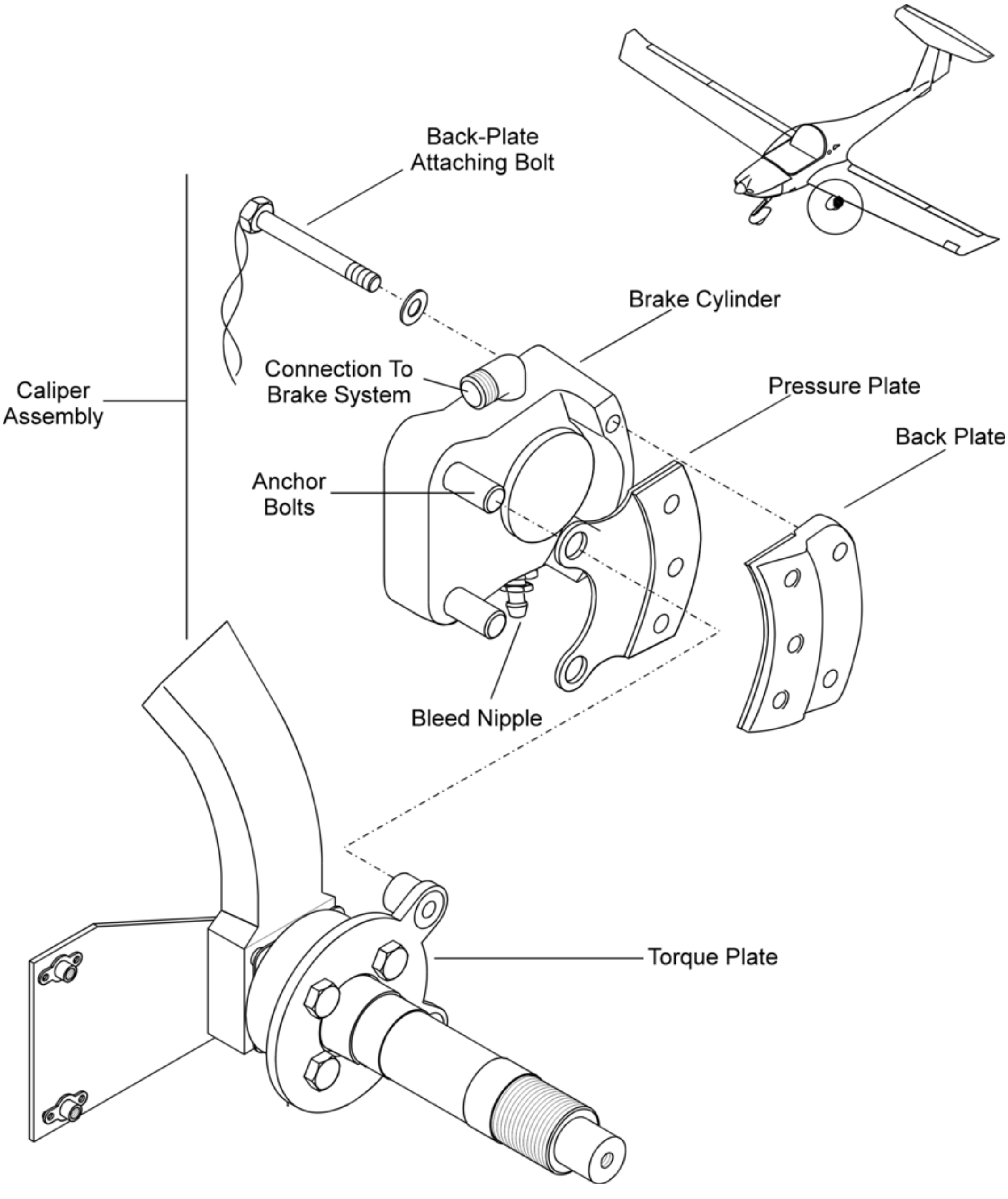

Figure 4: Wheel Brake Assembly

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Trouble-Shooting

1. General

If you find the trouble given in Trouble column read across to the Possible Cause column. Then do the repair given in the Repair column.

Trouble	Possible Cause	Repair
Too much tire wear.	Incorrect toe-in.	Adjust the toe-in. Refer to Chapter 32-10.
Too much axial play in a wheel.	Main wheel incorrectly adjusted. Defective wheel bearing.	Adjust the main wheel. Replace the wheel bearings.
Brake disk distorted.	Brakes applied too hard. Hard landing.	Replace the brake disk.
Brakes do not hold static engine run-up with the usual pedal force.	Too much light braking. Brake lining glaze worn away.	Condition the brake linings.
Brake(s) do not operate.	Brake fluid level low. Air in the brake system. Defective master cylinder. Defective caliper. Worn out brake linings. Leaking connector.	Fill the system with brake fluid. Bleed the brake system. Replace the master cylinder and then bleed the brake system. Replace the caliper and then bleed the brake system. Replace the brake linings and then bleed the brake system. Tighten (or replace) the connector and then bleed the brake system.

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Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the components and the conditioning procedure for the brake linings.

Refer to the manufacturer maintenance manual (refer to Section 05-00).

2. Remove/Install the Main Wheel

A. Equipment

Item	Quantity	Part Number
Airplane jacks.	2	Commercial.
Tail former.	1	

B. Remove the Main Wheel

	Detail Steps/Work Items	Key Items/References
(1)	Remove the wheel fairing: – Remove the outer bolt. – Remove the two screws on the inner side.	
(2)	Lift the airplane on jacks.	Refer to Chapter 07-10.
(3)	Remove the back-plate from the brake caliper.	Cut the locking wire.
	WARNING: DEFLATE THE WHEEL BEFORE THE AXLE NUT IS REMOVED. FAILURE TO DEFLATE THE TIRE BEFORE THE WHEEL REMOVAL COULD RESULT IN SEVERE INJURY TO PERSONNEL.	
(4)	Remove the axle nut.	Discard the cotter pin.
(5)	Pull the wheel from the axle.	

C. Install the Main Wheel

	Detail Steps/Work Items	Key Items/References
	WARNING: MAKE SURE THAT THE AIRPLANE IS SECURE AND STABLE BEFORE BEGINNING ANY WORK. WORKING UNDER AN IMPROPERLY STABILIZED AIRPLANE COULD CAUSE INJURY OR DEATH. **WARNING: INFLATION OF TIRE CAN BE EXTREMELY DANGEROUS AND IT IS RECOMMENDED THAT INFLATION BE PERFORMED IN AN INFLATION CAGE PRIOR TO INSTALLATION ON THE AIRPLANE.**	
(1)	Check the tire pressure.	If required, inflate the tire to the specified level.
(2)	Apply a light coating of the wheel bearing grease to the felt grease seals.	Make sure that the wheel bearings are installed and lubricated.
(3)	Apply a light coating of the wheel bearing grease to the axle bearings installation areas.	Use grease TYPE 1. Refer to Chapter 12-20.
(4)	Install the slotted ring or seal axle inner with wheel bearing grease between the slotted ring and the axle.	
	CAUTION: DO NOT MIX AVIATION WHEEL BEARING GREASE WITH EACH OTHER. IF USING OTHER APPROVED GREASE, COMPLETE REMOVAL OF CONTAINED GREASE AND BEARING CLEANING IS REQUIRED. REPLACEMENT OF PREVIOUSLY LUBRICATED FELT GREASE SEALS IS ALSO REQUIRED. (REFER TO CLEVELAND WHEELS AND BRAKES MANUAL AWBCMM0001 LATEST APPROVED REVISION).	
(5)	Put the wheel in position on the axle.	Make sure that the brake caliper is correctly engaged on the torque-plate.
	NOTE: Rotate the wheel by hand while you tighten the axle nut.	
(6)	Install the axle nut (axle-nut with spacer or the axle-nut assembly).	Torque to 12.2 Nm (9 lbf-ft).
(7)	Loosen the axle nut until it is just loose.	
(8)	Tighten the axle nut.	Torque to 4.5 - 6.8 Nm (3.4 - 4.5 lbf-ft).

	Detail Steps/Work Items	Key Items/References
(9)	Loosen the axle nut until one of the two holes in the axle aligns with the nut.	Do not loosen the nut more than 30 degrees. (Half of a flat).
(10)	Measure the end play in the hub assembly.	Wheel must rotate freely without perceptible play.
(11)	Install a new cotter-pin.	Bend the ends of the cotter pin against the axle nut. Check security of the wheel installation.
(12)	Lower the airplane with the jacks.	Refer to Chapter 07-10-00.
(13)	Install the back-plate to the brake caliper.	Torque to 8.5 - 9 Nm (75 - 80 lbf-in). Lock with wire.
(14)	Install the wheel fairing: – Install the two screws on the inner side. – Install the outer bolt.	

3. Remove/Install the Nose Wheel

A. Equipment

Item	Quantity	Part Number
Padded trestle.	1	Commercial.
Weight and strap.	1	Commercial.

B. Remove the Nose Wheel

	Detail Steps/Work Items	Key Items/References
(1)	Remove the wheel fairing: – Remove the six allen screws that attach the left half of the fairing to the right half. – Remove the LH and RH mounting screws. – Remove the fairing.	
(2)	Use weights to hold the rear fuselage down with the nose wheel clear of the ground.	Use a strap around the rear fuselage.
(3)	Put a padded trestle under the front fuselage just aft of the nose gear mounting.	
	WARNING: DEFLATE THE WHEEL BEFORE THE AXLE NUT IS REMOVED. FAILURE TO DEFLATE THE TIRE BEFORE THE WHEEL REMOVAL COULD RESULT IN SEVERE INJURY TO PERSONNEL.	
(4)	Remove the 7/16 nut from the axle bolt.	
(5)	Remove the axle bolt.	Hold the wheel.
(6)	Remove the wheel from the fork.	
(7)	Note the thickness and location of the shims installed between the wheel axle spacers and the fork assembly (if installed).	

C. Install the Nose Wheel

	Detail Steps/Work Items	Key Items/References
	WARNING: MAKE SURE THAT THE AIRPLANE IS SECURE AND STABLE BEFORE BEGINNING ANY WORK. WORKING UNDER AN IMPROPERLY STABILIZED AIRPLANE COULD CAUSE INJURY OR DEATH TO PERSONNEL. **WARNING: INFLATION OF TIRE CAN BE EXTREMELY DANGEROUS AND MAY CAUSE INJURY TO PERSONNEL. IT IS RECOMMENDED THAT INFLATION BE PERFORMED IN AN INFLATION CAGE PRIOR TO INSTALLATION ON THE AIRPLANE.**	
(1)	Check the tire pressure.	If required, inflate the tire to specified level.
(2)	Put the wheel in position in the fork.	
(3)	Install the axle shims between the wheel axle spacers and the fork assembly.	Select the shims thickness as required to fill the gap.
(4)	Divide shim installation evenly from side to side when possible to a maximum of 2 shims.	Maximum difference between sides is 0.25 mm (0.010 in). If the gap is less than 0.25 mm (0.010 in), no shim is required.
(5)	Install the axle bolt and 7/16 UNJF nut.	Standard Torque. Refer to Chapter 20-00. Put Mastinox 6856 K corrosion-inhibitor or LPS-3 on the shank of the bolt. Clean the corrosion inhibitor from the threads.
(6)	Turn the nose wheel. Make sure that the valve cap does not touch the fork.	Clearance 2 mm (0.08 in) minimum.
(7)	Remove the trestle from the front fuselage.	
(8)	Lower the nose wheel to the floor.	Remove the weights from the rear fuselage.

	Detail Steps/Work Items	Key Items/References
(9)	Install the wheel fairing (if applicable): – Put the two halves in position. – Install the LH and RH mounting screws. – Install the screws that hold the fairings. together.	

4. Remove/Install a Brake Master Cylinder

A. Remove a Brake Master Cylinder

	Detail Steps/Work Items	Key Items/References
	WARNING: DO NOT GET BRAKE FLUID ON YOU. BRAKE FLUID CAN CAUSE DISEASE. CAUTION: CLEAN UP SPILT BRAKE FLUID IMMEDIATELY. BRAKE FLUID CAN DAMAGE PAINT AND OTHER MATERIAL.	
(1)	Disconnect the brake pipe(s) from the brake master cylinder.	Catch the brake fluid. Refer to Figure 3. Put the caps on the connections.
(2)	Remove the top pivot pin: – Remove the cotter pin. – Remove the washer. – Remove the pivot pin.	
(3)	Remove the bottom pivot pin: – Remove the cotter pin. – Remove the washer. – Move the master cylinder sideways off the pivot pin.	
(4)	Lift the master cylinder from the rudder pedal assembly.	

B. Install a Brake Master Cylinder

	Detail Steps/Work Items	Key Items/References
(1)	Put the master cylinder in position on the bottom pivot pin.	Refer to Figure 3.
(2)	Attach the master cylinder to the bottom pivot pin: – Install the washer. – Install the cotter pin.	
(3)	Install the top pivot pin as follows: – Install the pivot pin. – Install the washer. – Install the cotter pin.	
(4)	Connect the brake pipe(s) to the brake master cylinder.	
(5)	Bleed the brake system.	Refer to Paragraph 7.
(6)	Do a function test of the brake system.	

5. Remove/Install a Brake Caliper

A. Remove a Brake Caliper

	Detail Steps/Work Items	Key Items/References
(1)	Remove the two bolts that hold the back-plate. Remove the back-plate. Cut the lock-wire.	
	WARNING: DO NOT GET BRAKE FLUID ON YOU. BRAKE FLUID CAN CAUSE DISEASE. CAUTION: CLEAN UP SPILT BRAKE FLUID IMMEDIATELY. BRAKE FLUID CAN DAMAGE PAINT AND OTHER MATERIAL.	
(2)	Disconnect the brake pipe or hose from the caliper.	Catch the brake fluid. Put the caps on the connections.
(3)	Remove the pressure plate and the caliper from the torque-plate.	

B. Install a Brake Caliper

	Detail Steps/Work Items	Key Items/References
(1)	Put the caliper and pressure plate in position on the torque-plate.	Use Loctite anti-seize compound 767 on the locating pins.
(2)	Connect the brake pipe or hose to the caliper.	
(3)	Put the back plate in position on the caliper.	
(4)	Install the two bolts which attach the back plate.	Torque to 8.5 - 9 Nm (75 - 80 lbf-in).
(5)	Lock the bolts with wire.	
(6)	Bleed the brake system.	Refer to Paragraph 7.

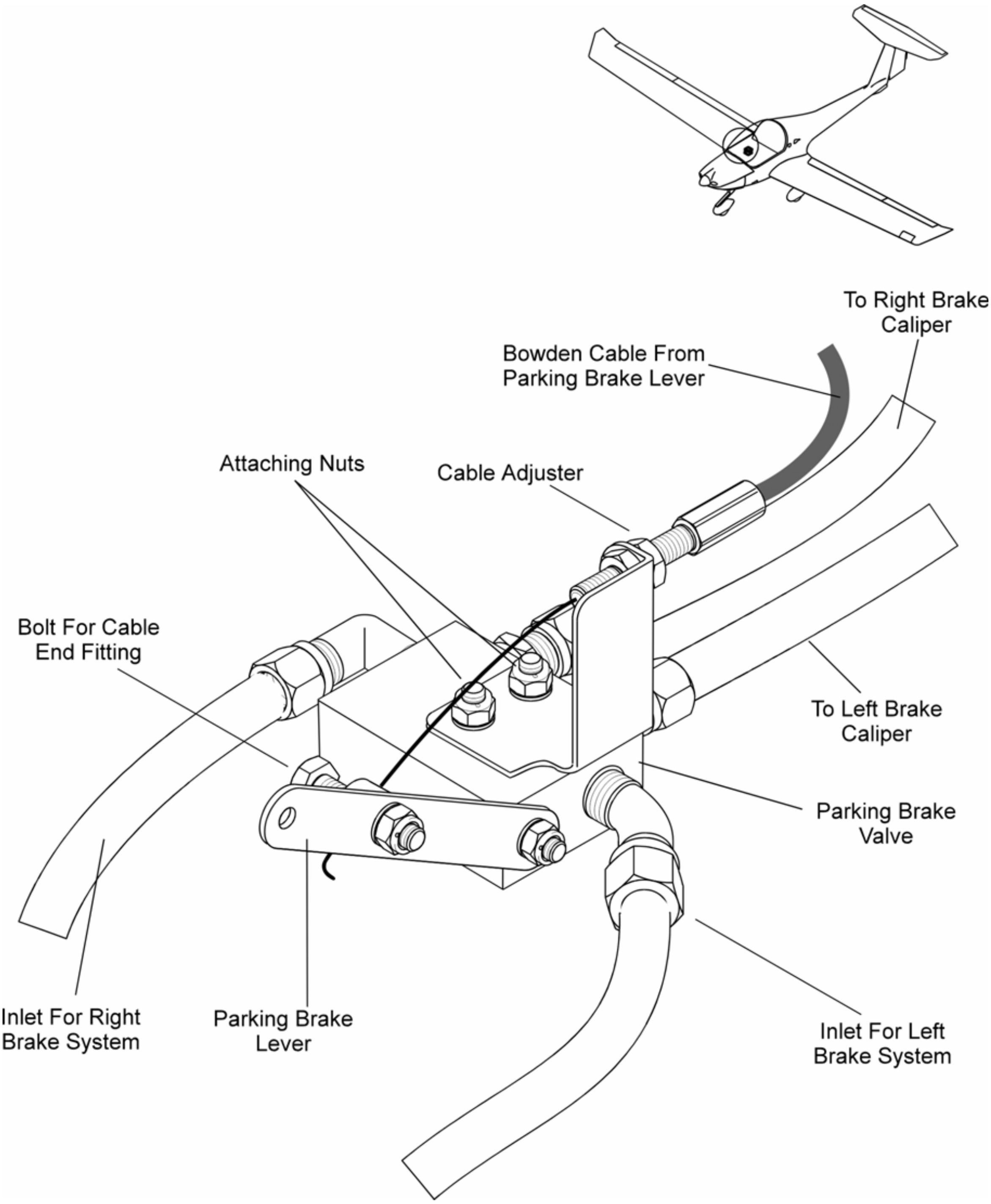

Figure 5: Parking Brake Valve Installation

6. Remove/Install the Parking Brake Valve

A. Remove the Parking Brake Valve

	Detail Steps/Work Items	Key Items/References
(1)	Remove the right pilot's seat.	Refer to Chapter 25-10-00.
(2)	Disconnect the bowden cable: – Loosen the bolt in the end fitting. – Pull the center wire from the end fitting.	Refer to Figure 5.
	WARNING: DO NOT GET BRAKE FLUID ON YOU. BRAKE FLUID CAN CAUSE DISEASE. CAUTION: CLEAN UP SPILT BRAKE FLUID IMMEDIATELY. BRAKE FLUID CAN DAMAGE PAINT AND OTHER MATERIAL.	
(3)	Disconnect the four brake pipes from the parking brake valve.	Catch the brake fluid. Put the caps on the connections.
(4)	Remove the nuts, the bolts and the washers that attach the parking brake valve.	
(5)	Remove the parking brake valve.	

B. Install the Parking Brake Valve

	Detail Steps/Work Items	Key Items/References
(1)	Put the parking brake valve in position.	
(2)	Install the nuts, the bolts and the washers that attach the parking brake valve.	Make sure that the bracket for the bowden cable is in position.
(3)	Connect the four brake pipes to the parking brake valve.	
(4)	Put center wire of the bowden cable through the end fitting on the parking brake lever. Tighten the bolt.	With the brake lever in the center console set to OFF, the lever on the parking brake valve must be fully forward.
(5)	Bleed the brake system.	Refer to Paragraph 7.
(6)	Do a function test of the parking brake: – Set the parking brake to ON. – Pump the foot brake pedals. – The brakes must stay on. – Set the parking brake to OFF. – The brakes must release.	
(7)	Install the right pilot’s seat.	Refer to Chapter 25-10.

7. Bleed the Brake System

A. Equipment

Item	Quantity	Part Number
Pressure bleed equipment with Aero Shell Fluid 41 (MIL-H-5606H) brake fluid.	1	Commercial.
Transparent overflow pipe and container.	1	Commercial.

B. Bleeding Procedure

Do this procedure for each brake system (left and right) as necessary.

	Detail Steps/Work Items	Key Items/References
(1)	Clean the area of the brake fluid reservoir cap.	
(2)	Remove the cap.	Use a strap around the rear fuselage.
	WARNING: DO NOT GET BRAKE FLUID ON YOU. BRAKE FLUID CAN CAUSE DISEASE. CAUTION: CLEAN UP SPILT BRAKE FLUID IMMEDIATELY. BRAKE FLUID CAN DAMAGE PAINT AND OTHER MATERIAL.	
(3)	Connect the transparent overflow pipe to the reservoir.	Put the free end of the pipe in a container.
(4)	Clean the area around the bleed nipple.	
(5)	Connect the pressure bleed equipment to the bleed nipple below the brake caliper.	Use only Aero Shell Fluid 41 (MIL-H-5606H) brake fluid.
(6)	Open the bleed nipple about ½ to 1 turn.	
(7)	Use the pressure bleed equipment to fill the brake system.	
(8)	Operate the parking brake ON and OFF 10 to 20 times to remove the air from the system.	Continue bleeding the system.
(9)	Operate the pilot's brake pedals many times to remove the air from the system.	Continue bleeding the system.
(10)	Operate the co-pilot's brake pedals many times to remove the air from the system.	Continue bleeding the system until no more air bubbles come from the reservoir.

	Detail Steps/Work Items	Key Items/References
(11)	Close the bleed nipple. Remove the pressure bleed equipment.	
(12)	Remove the overflow pipe and container.	
(13)	Measure the fluid level in the reservoir. If necessary, add or remove fluid.	The correct level is 12 mm (½ in) below the top of the filler hole. When the level is 25 mm (1.0 in) below the top of the filler hole you must add fluid to the correct level. Refer to Figure 2, Brake System Schematic.
(14)	Install the reservoir cap.	
(15)	Do a functional test of the brake system.	

8. Condition of the Brake Linings

The brake linings are a non-asbestos organic material. You must condition new brake linings. Conditioning gives a thin layer of glaze at the friction surface. Usual brake usage keeps the layer of glaze for the life of the brake lining.

Light brake use can wear off the glaze. This reduces brake performance. If the glaze wears off, do the conditioning procedure.

	Detail Steps/Work Items	Key Items/References
(1)	Taxi the airplane for 500 m (1500 ft) with 4000 RPM.	Use the brakes to keep the speed at 8 - 16 km/h (5 - 10 mph).
(2)	Let the brakes cool for 10-15 minutes.	
(3)	Apply the brakes. Do a high throttle run-up.	The brakes must hold with the usual pedal force.
(4)	If the brakes do not hold the static run-up, do steps 1 - 3 again as necessary.	

9. Wheels and Brakes Cleaning Procedures

Do the following inspection and cleaning procedures of the DV 20 E wheels and brakes.

A. Inspection

	Detail Steps/Work Items	Key Items/References
(1)	Remove the main wheel.	Refer to Paragraph 2.B.
CAUTION:	DO NOT MIX AVIATION WHEEL BEARING GREASES WITH EACH OTHER. IF USING OTHER APPROVED GREASE, COMPLETE REMOVAL OF CONTAINED GREASE AND BEARING CLEANING IS REQUIRED. REPLACEMENT OF PREVIOUSLY LUBRICATED FELT GREASE SEALS IS ALSO REQUIRED.	
(2)	Inspect bearings. Make sure there is enough grease on the bearing.	Apply grease on bearing. Use Mobil Aviation Grease SHC 100.
(3)	If felt grease seals are used, lightly coat all surfaces of the seals with bearing grease prior to installing.	
(4)	If rubber lip seals are used, lubricate the bearing seal bore with bearing grease.	
(5)	Install the main wheel.	Refer to Paragraph 2.C.

B. Cleaning

	Detail Steps/Work Items	Key Items/References
(1)	Remove the main wheel.	Refer to Paragraph 2.B.
	CAUTION: DO NOT USE HIGH PRESSURE SPRAY WASH EQUIPMENT. THE USE OF HIGH PRESSURE SPRAY WASH MAY INJECT SOAP SOLUTION AND WATER INTO BEARINGS AND OTHER INTERNAL CAVITIES RESULTING IN CORROSION AND REDUCED SERVICE LIFE.	
(2)	Hand wash wheels and brakes with a mild soap and water solution.	Rinse with low-pressure spray.
(3)	Install the main wheel.	Refer to Paragraph 2.C.

CHAPTER 33

LIGHTS

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TABLE OF CONTENTS

CHAPTER 33

LIGHTS

Section 33-20

Cockpit Lighting

Trouble-Shooting

Maintenance Practices

Section 33-40

Exterior Lights

Trouble-Shooting

Maintenance Practices

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CHAPTER 33
LIGHTS

1. General

This chapter describes about the cockpit and exterior lighting on the DV 20 E airplane. Chapter 33-20 describes about the cockpit lighting. Chapter 33-40 describes about the exterior lighting. Refer to Chapter 92 for wiring diagrams for the lighting systems.

2. Description

Figure 1 shows the location of the lights. The DV 20 E airplane has the following cockpit lights:

– General instrument panel lighting from two lights on the bottom face of the roll bar.

– A map light on the bottom face of the roll bar.

– Internal lighting for the standby instruments.

Some avionics equipment has internal lighting. Refer to the related chapter and the manufacturers' handbooks for the equipment in your airplane. The controls for the interior lights are on the instrument panel.

The DV 20 E airplane has the following exterior lights in one light-unit at each wing-tip:

– Left and right position lights. The front part of the assembly has red (left) or green (right) LEDs with clear lenses. The light can only be seen from the front and the side.

– Rear position lights. The aft part of each wing tip light unit has a clear lens with white LEDs. The lights can be seen only from the rear of the airplane.

– Strobe light. The middle part of each wing tip light unit has a clear lens. White LEDs provide a high-intensity flash. The strobe light can be seen from all directions.

The DV 20 E airplane has the following exterior lights in one housing in the leading edge of the left wing:

- Landing light: The landing light has a clear lens and a 35 Watt bulb. If OÄM 20-271 is installed, the DV 20 E has a LED landing light. It is located inboard in the housing.

- Taxi light: The taxi light has a optic lens and a 35 Watt bulb. If OÄM 20-271 is installed, the DV 20 E has a LED taxi light. It is located outboard in the housing.

The switches for the exterior lights are located together on the left instrument panel.

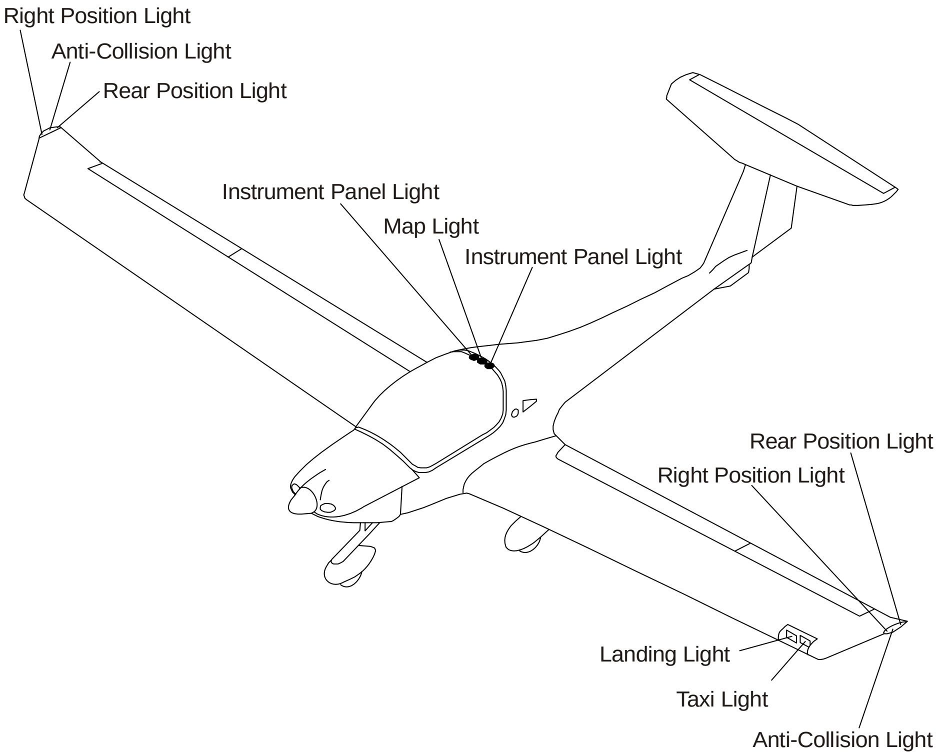

Figure 1: Cockpit and Exterior Lights

Section 33-20
Cockpit Lighting

1. General

This chapter describes about the cockpit lighting on the DV 20 E airplane. Refer to Chapter 92 for the cockpit lighting wiring diagrams.

2. Description

The DV 20 E airplane cockpit lighting systems:

– General instrument panel lighting from two lights on the bottom face of the roll bar.

– A map light on the bottom face of the roll bar.

– Internal lighting for the standby instruments.

Some avionics equipment has internal lighting. Refer to the related AMM Chapter and the manufacturers' handbooks for the equipment in your airplane.

A. General Instrument Panel Lighting

Two lights give general lighting to the instrument panel. They are located below the roll bar. Each light gives a flat beam. You can adjust the angle and direction of the beam. The combined switch/potentiometer controls the instrument panel lights as well as the lighting for the standby instruments.

B. Map Light

A map light gives lighting to the inside of the cockpit. The light is located below the roll bar between the instrument panel lights. You can adjust the angle and direction of the beam. The switch for the map light is located on the instrument panel.

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Trouble-Shooting

1. General

This table explains how to troubleshoot the cockpit lighting systems. If you have the trouble shown in the Trouble column read across to the Possible Cause column. Then do the repair given in the Repair column.

Trouble	Possible Cause	Repair
Instrument panel lighting does not operate.	Circuit-breaker not set.	Set the circuit-breaker.
	Defective instrument light switch/potentiometer.	Replace the switch/potentiometer.
	Defective lighting control module.	Check wiring and repair/replace lighting control module.
	Defective wiring.	Do a continuity test of the wiring. Repair/replace defective wiring. Refer to Chapter 92 for wiring diagrams.
Map light does not operate.	Circuit-breaker not set.	Set the circuit-breaker.
	Defective map light switch.	Replace the switch.
	Defective wiring.	Do a continuity test of the wiring. Repair/replace defective wiring. Refer to Chapter 92 for wiring diagrams.
Compass light does not operate.	Compass light bulb failed.	Replace the bulb.
	Defective wiring.	Do a continuity test of the wiring. Repair/replace defective wiring. Refer to Chapter 92 for wiring diagrams.

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Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the general instrument light and map light module. Refer to AMM Chapter 92 for details of the electrical wiring.

2. Remove/Install a Instrument Light/Map Light

A. Remove a Instrument Light/Map Light

	Detail Steps/Work Items	Key Items/References
(1)	Set the ELECTRIC MASTER switch to OFF.	
(2)	Remove the screws that attach the light to the fuselage.	
(3)	Hold the light and disconnect the wiring harness. – Remove the light.	

B. Install a Instrument Light/Map Light Module

	Detail Steps/Work Items	Key Items/References
(1)	Put the light in position and connect the wiring harness.	
(2)	Install the screws that attach the light to the fuselage.	
(3)	Set the ELECTRIC MASTER switch to ON. – Set the MAP switch to ON. Make sure that the map light comes on. – Rotate the INSTRUMENT LT. switch /potentiometer fully clockwise. Make sure that the two instrument lights come on. – Make sure the dimming control operates correctly. – If necessary, adjust the lights to align correctly.	The map light is in the center of the module. The two instrument lights are on the outboard of the module. Cover the canopy with a dark clean cover when you adjust the lights. Refer to Figure 1.

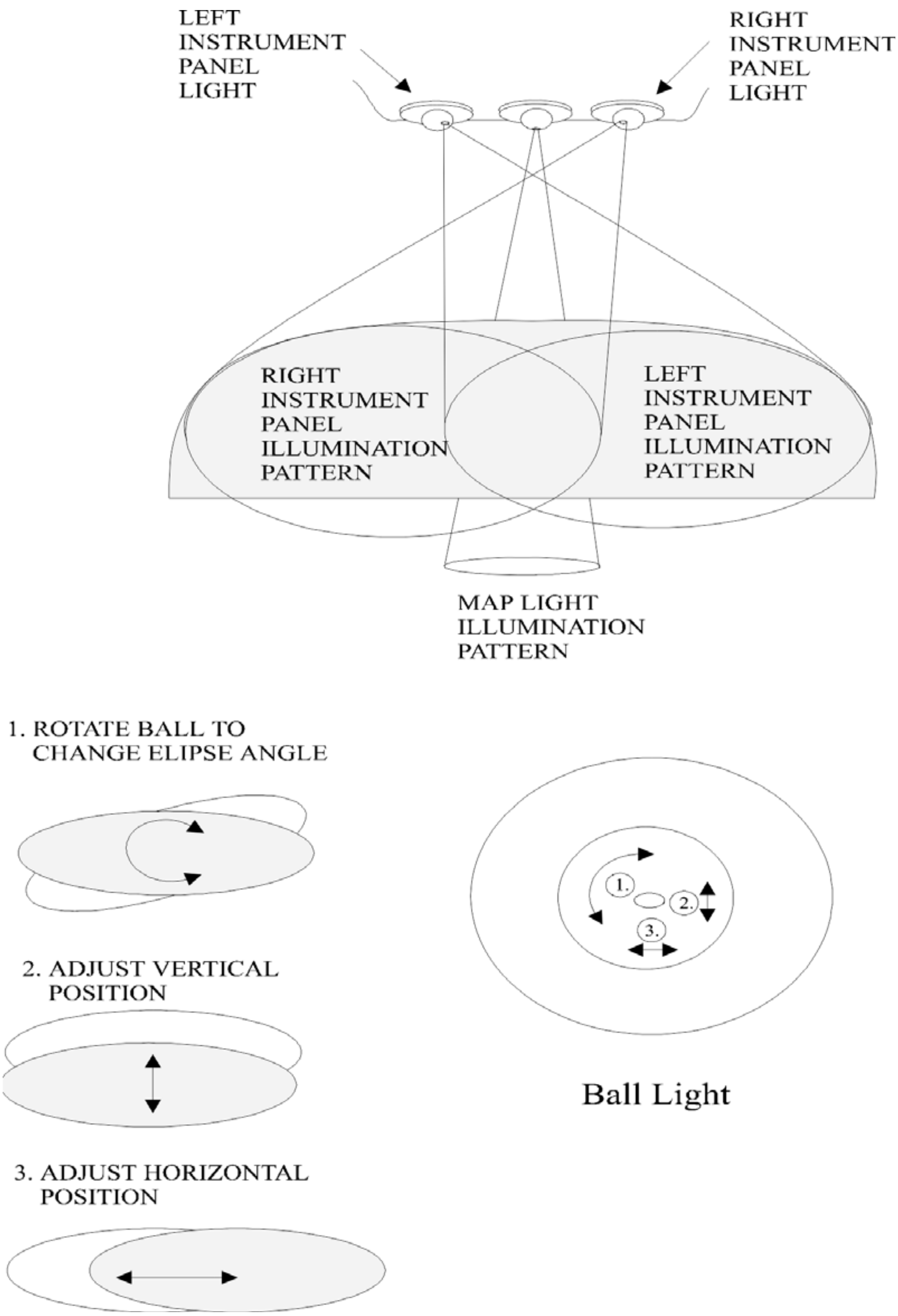

Figure 1: General Instrument Light/Map Light Adjustment

Section 33-40
Exterior Lights

1. General

This chapter describes about the exterior lights.

2. Description

The DV 20 E airplane has three exterior lights in one light-unit at each wing-tip. It also has landing and taxi lights in a housing in the left wing. Figure 1 shows the wing-tip light-unit.

A. Position Lights and Strobe Light (Anti-Collision Light - ACL)

The DV 20 E has left and right LED position and anti-collision light assemblies. The position and anti-collision lights are installed on a base plate covered by a clear lens. The LEDs provide the coloration. The forward position light is covered with red (left) or green (right) LEDs. The rear position light is designed with two white LEDs. The anti-collision light is designed with 24 white LEDs. If one of the LEDs fails, the unit must be replaced. The position lights and the anti-collision lights are controlled by separate switches and are protected by individual circuit breakers.

B. Landing Light

The landing light is located in a housing in the leading edge of the left wing. The landing light has a clear lens with a 35 Watt bulb. If OÄM 20-271 is installed, the DV 20 E is equipped with a LED landing light. It is located inboard in the housing. Figure 2 and 3 show the landing light. A switch on the left instrument panel controls the landing light.

C. Taxi Light

The taxi light is located in a housing in the leading edge of the left wing. The taxi light has a clear lens with a 35 Watt bulb. If OÄM 20-271 is installed, the DV 20 E is equipped with a LED taxi light. It is located outboard in the housing. Figure 2 and 3 show the taxiing light. A switch on the left instrument panel controls the taxi light.

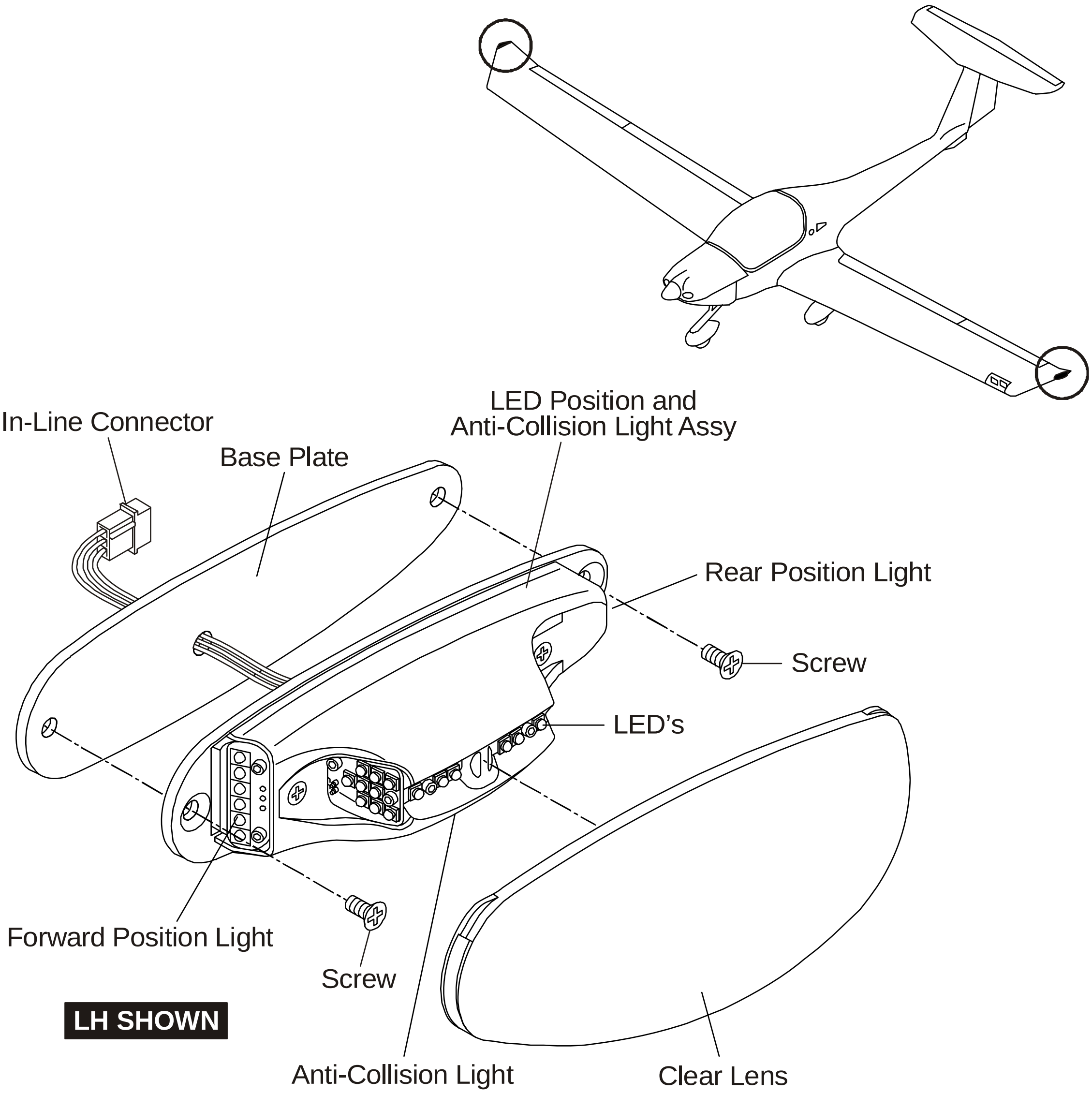

Figure 1: Wing-Tip Light-Unit

Trouble-Shooting

1. General

This table explains how to troubleshoot the exterior lighting systems. If you have the trouble shown in the Trouble column read across to the Possible Cause column. Then do the repair given in the Repair column.

Trouble	Possible Cause	Repair
Both position lights do not operate.	Circuit-breaker not set. Defective position light switch. Defective wiring in forward cockpit area.	Set the circuit-breaker. Replace the switch. Do a continuity test of the wiring. Repair/replace defective wiring. Refer to Chapter 92 for wiring diagrams.
One position light does not operate.	Defective light unit. Defective wiring.	Replace the light unit. Do a continuity test of the wiring. Repair/replace defective wiring. Refer to Chapter 92 for wiring diagrams.
Both ACLs do not operate.	Circuit-breaker not set. Defective switch. Defective wiring.	Set the circuit-breaker. Replace the switch. Do a continuity test of the wiring. Repair/replace defective wiring. Refer to Chapter 92 for wiring diagrams.
One ACL does not operate.	Defective light unit. Defective wiring.	Replace the light unit. Do a continuity test of the wiring. Repair/replace defective wiring. Refer to Chapter 92 for wiring diagrams.
ACL and position light do not operate on one side.	Connector at wing root disconnected.	Connect the connector.

Trouble	Possible Cause	Repair
Landing light/taxi light not working.	Defective light unit.	Replace the light unit.
	Circuit-breaker not set or defective.	Set/replace the circuit-breaker.
	Defective landing or taxiing light switch.	Replace the switch.
	Defective wiring in forward cockpit area.	Do a continuity test of the wiring. Repair/replace defective wiring. Refer to Chapter 92 for wiring diagrams.
	Loose connector next to the light.	Connect the connector correctly.

Maintenance Practices

1. General

The following maintenance practices describe how to:

- Remove and install the light units.
- Adjust the landing light and the taxi light.
- Remove/install components in the system.

Refer to Chapter 92 for details of the electrical wiring.

WARNING: DO NOT OPERATE THE ANTI-COLLISION LIGHTS WHEN PERSONS ARE CLOSE TO THE AIRPLANE AND DO NOT LOOK DIRECTLY AT THE LIGHT WHEN IT OPERATES. ANTI-COLLISION LIGHTS CAN CAUSE EYE DAMAGE.

2. Remove/Install the Taxi Light

A. Remove the Taxi Light

	Detail Steps/Work Items	Key Items/References
(1)	Set the ELECTRIC MASTER switch to OFF.	
(2)	Open the TAXI/MAP/ACL circuit breaker	
(3)	Remove the taxi/landing light cover from the wing. – Examine the white vinyl tape on the cover for damage. If necessary, replace the tape.	
(4)	Loosen the lock nuts and remove the screws that attach the taxi light to the wing.	The taxi light is the outboard assembly. Refer to Figure 2.
(5)	Hold the taxi light and carefully move the light out from the wing. – Disconnect the electrical connector from the rear of the taxi light. – Remove the taxi light.	

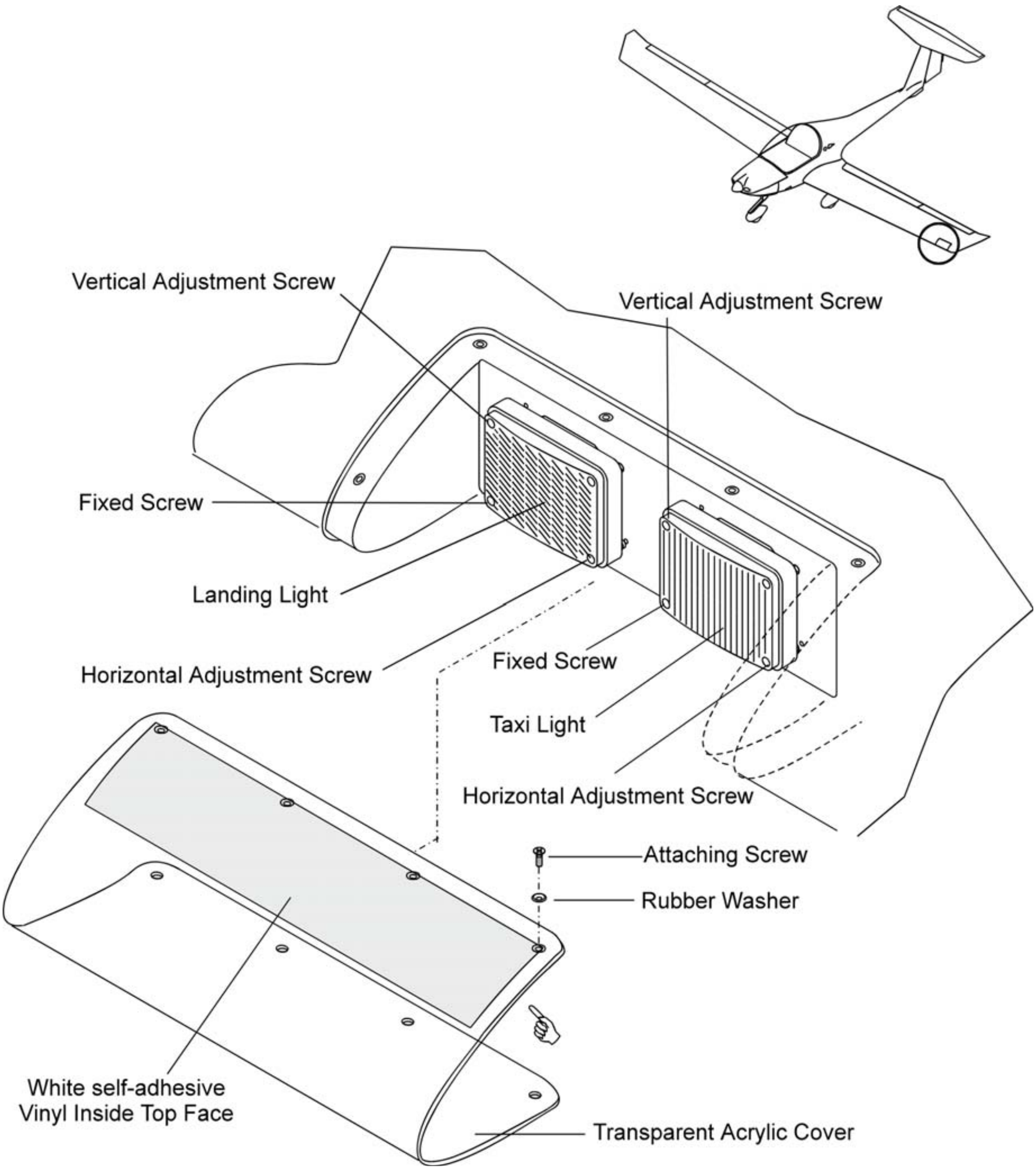

Figure 2: Landing and Taxi Light Installation (Sheet 1)

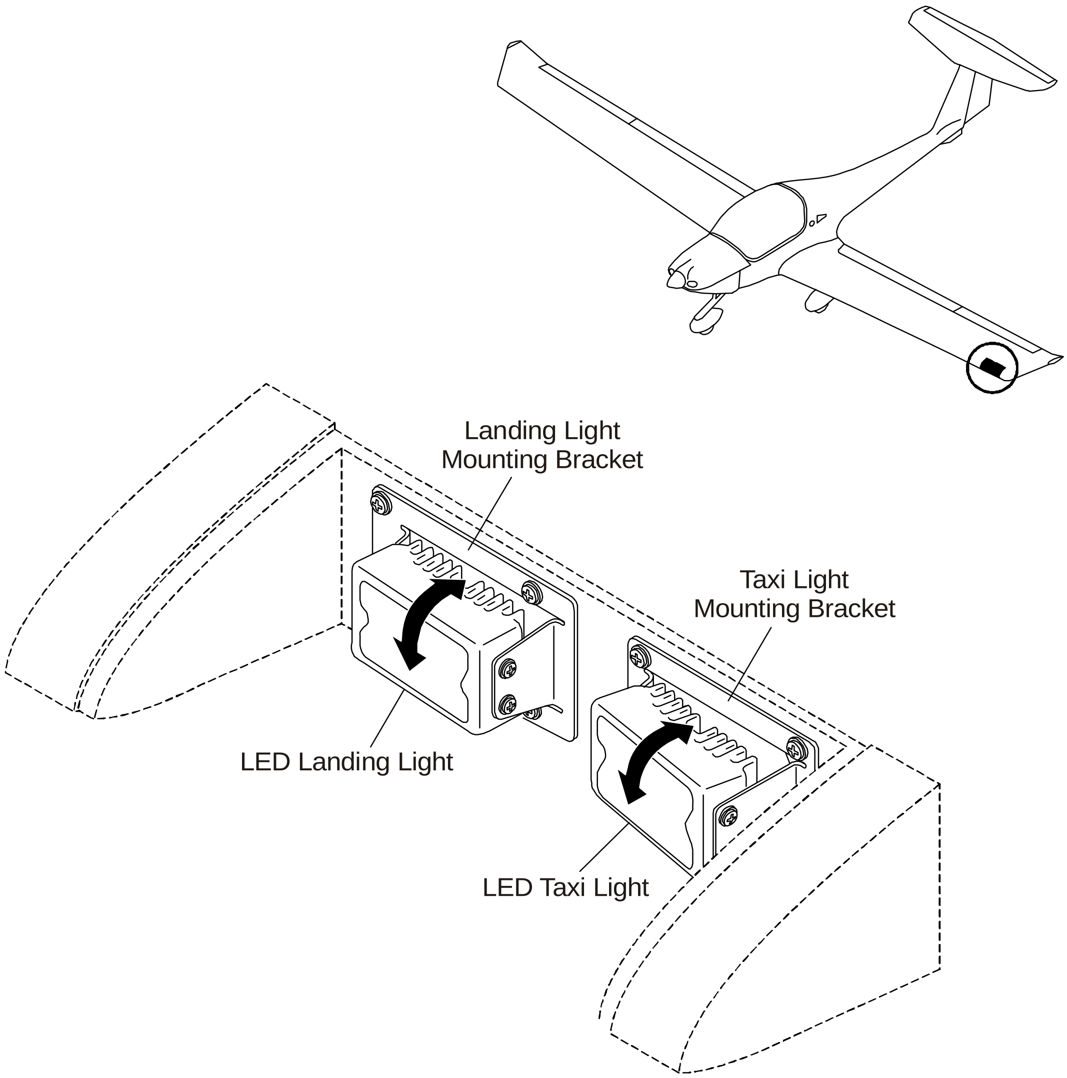

Figure 3: Landing and Taxi Light Installation LED Lights (if OÄM 20-271 is installed)

B. Install the Taxi Light

	Detail Steps/Work Items	Key Items/References
(1)	Make sure that the airplane is in the same configuration as in the removal task.	
(2)	Hold the taxi light in position at the leading edge of the left wing. – Connect the electrical connector to the rear of the taxi light.	
(3)	Install the attaching screws through the taxi light, with lock nuts installed behind the light.	Do not tighten the lock nuts at this time.
(4)	Install the taxi light assembly to the wing with the attaching screws.	Refer to Figure 4 for the alignment dimensions of the four screws.
(5)	When the alignment is complete, tighten the lock nuts of the four attaching screws behind the taxi light.	
(6)	Do an operational test of the taxi light: – Set the ELECTRIC MASTER switch to ON. – Close the TAXI/MAP/ACL circuit breaker – Set the TAXI light switch to ON.	Make sure that the taxi light comes on.
(7)	Set the TAXI light switch to OFF.	
(8)	Set the ELECTRIC MASTER switch to OFF.	
(9)	Install the taxi/landing light cover to the wing.	

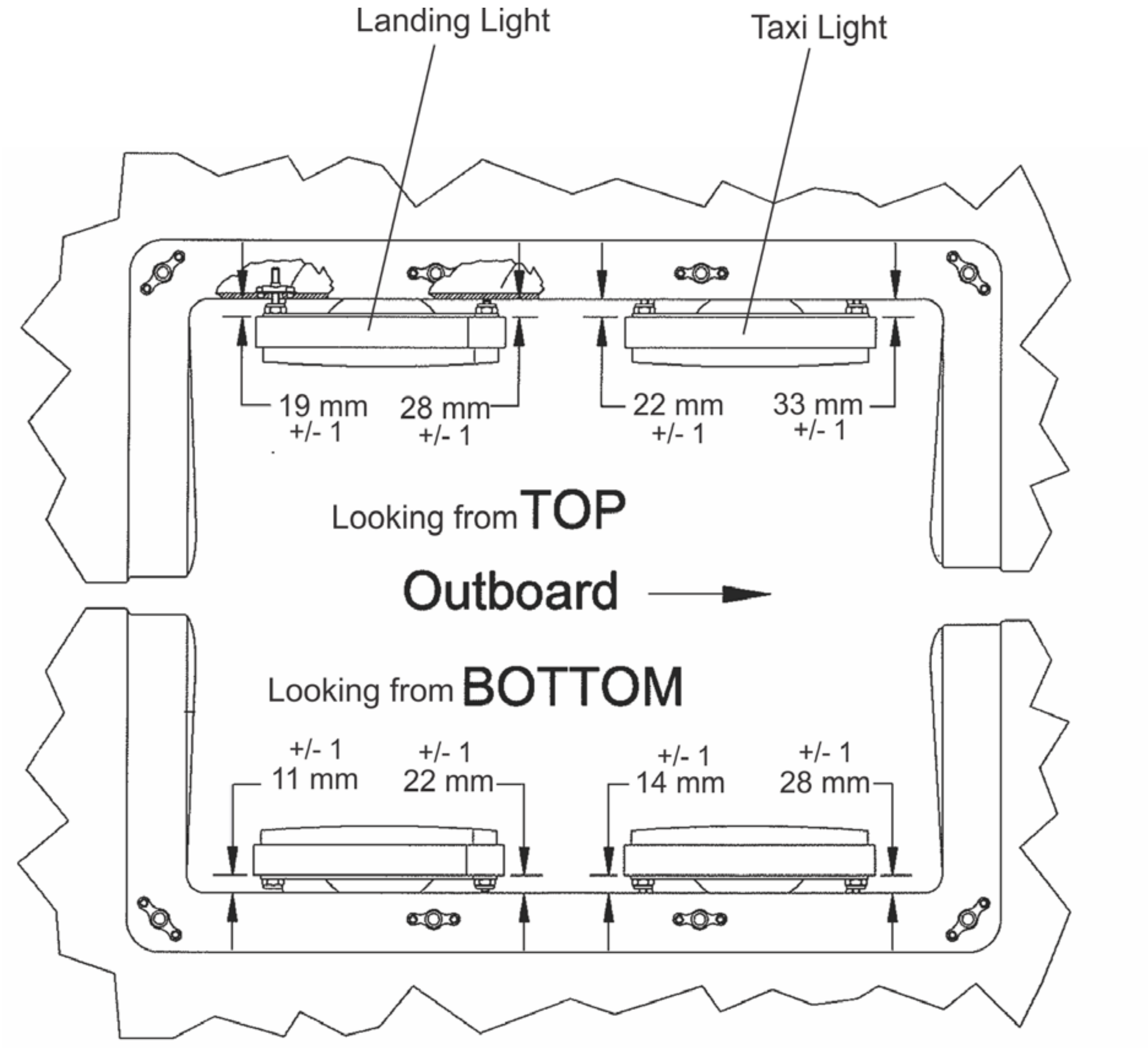

Figure 4: Landing and Taxi Light Installation (Sheet 2)

3. Remove/Install the Landing Light

A. Remove the Landing Light

	Detail Steps/Work Items	Key Items/References
(1)	Set the ELECTRIC MASTER switch to OFF.	
(2)	Open the LANDING circuit breaker.	
(3)	Remove the taxi/landing light cover from the wing. – Examine the white vinyl tape on the cover for damage. If necessary, replace the tape.	
(4)	Loosen the lock nuts and remove the screws that attach the landing light to the wing.	The landing light is the inboard assembly. Refer to Figure 2.
(5)	Hold the landing light and carefully move the light out from the wing. – Disconnect the electrical connector from the rear of the landing light. – Remove the landing light.	

B. Install the Landing Light

	Detail Steps/Work Items	Key Items/References
(1)	Make sure that the airplane is in the same configuration as in the removal task.	
(2)	Hold the landing light in position at the leading edge of the left wing. – Connect the electrical connector to the rear of the landing light.	
(3)	Install the attaching screws through the landing light, with lock nuts installed behind the light.	Do not tighten the lock nuts at this time.
(4)	Install the landing light assembly to the wing with the attaching screws.	Refer to Figure 4 for the alignment dimensions of the four screws.
(5)	When the alignment is complete, tighten the lock nuts of the four attaching screws behind the landing light.	
(6)	Do an operational test of the landing light: – Set the ELECTRIC MASTER switch to ON. – Close the LANDING circuit breaker. – Set the LANDING light switch to ON.	Make sure that the landing light comes on.
(7)	Set the LANDING light switch to OFF.	
(8)	Set the ELECTRIC MASTER switch to OFF.	
(9)	Install the taxi/landing light cover to the wing.	

4. Adjust the Position of the Taxi/Landing Light Beam

	Detail Steps/Work Items	Key Items/References
(1)	Set the ELECTRIC MASTER switch to OFF.	
(2)	Open the LANDING/ TAXI/MAP/ACL circuit-breakers.	
(3)	Remove the taxi/landing light cover from the wing. – Examine the white vinyl tape on the cover for damage. If necessary, replace the tape.	
(4)	Adjust the position of the light beam as follows: If OÄM 20-271 is NOT installed: – Loosen the four lock nuts behind the light. – Adjust the four attaching screws to the correct alignment dimensions. – When the alignment is complete, tighten the lock nuts of the four attaching screws behind the light. If OÄM 20-271 is installed: – Loosen the four lock nuts. – Adjust LED light to the correct alignment. – When the alignment is complete, tighten the lock nuts of the four attaching screws.	This procedure is applicable to the landing light and/or the taxi light. Refer to Figure 4 for the alignment dimensions of the four screws for the applicable light. Refer to Figure 3.
(5)	Do an operational test of the taxi/landing light: – Set the ELECTRIC MASTER switch to ON. – Close the LANDING/ TAXI/MAP/ACL circuit-breaker. – Set the TAXI/LANDING light switch to ON.	Make sure that the applicable light comes on.
(6)	Set the TAXI/LANDING light switch to OFF.	
(7)	Install the taxi/landing light cover to the wing.	

5. Remove/Install the Light Unit in the Wing Tip

A. Remove the Light Unit in the Wing Tip

	Detail Steps/Work Items	Key Items/References
(1)	Set the ELECTRIC MASTER switch to OFF.	
(2)	Remove the light unit cover from the wing tip.	Refer to Figure 1.
(3)	Remove the screws that attach the light unit to the wing tip. – Carefully move the light unit out from the wing tip. – Disconnect the two electrical connections from the rear of the light unit. – Remove the light unit.	

B. Install the Light Unit in the Wing Tip

	Detail Steps/Work Items	Key Items/References
(1)	Put the light unit in position at the wing tip. – Connect the two electrical connectors to the rear of the light unit.	
(2)	Install the screws that attach the light unit to the wing tip.	
(3)	Do an operational test of the position and anti-collision lights: – Set the ELECTRIC MASTER switch to ON. – Set the position/strobe light switches to ON.	
(4)	Set the ELECTRIC MASTER switch to OFF.	
(5)	Install the light unit cover.	

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CHAPTER 34

NAVIGATION

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TABLE OF CONTENTS

CHAPTER 34

NAVIGATION

Section 34-10

Flight Environment Data

Trouble-Shooting

Maintenance Practices

Section 34-20

Attitude and Direction

Trouble-Shooting

Maintenance Practices

Section 34-30

Landing and Taxiing Aids

Trouble-Shooting

Section 34-50

Dependent Position Determining

Trouble Shooting

Maintenance Practices

CHAPTER 34
NAVIGATION

1. General

The following chapters describe about the navigation systems:

- Chapter 34-10: Pitot-static and Outside Air Temperature (OAT).
- Chapter 34-20: Artificial horizon and magnetic compass.
- Chapter 34-30: Radio navigation instruments for landing such as the marker receiver.
- Chapter 34-50: Radio navigation instruments that give position data such as the transponder and Global Positioning Systems (GPS).

This chapter describes only the on-airplane data about the systems and components. Refer to the manufacturers’ handbooks for shop data.

Many different instruments and avionics can be installed as options. This chapter describes about the standard installation.

2. Description

A. Flight Environment Data

(1) Pitot Static System

The pitot-static system has the following components:

- A combined pitot-static probe below the left wing.
- Air Speed Indicators (ASI), integral of the Garmin G500 and backup.
- Altimeters, integral of the Garmin G500 and backup.

(2) OAT

The OAT indicator is integrated into the G500 system.

B. Attitude and Direction

The attitude and direction system has the following components:

– Magnetic compass.

– Backup artificial horizon.

C. Landing and Taxiing Aids

The audio control panel has a marker beacon receiver.

D. Dependent Position Determining

The dependent position determining system has the following components:

– VHF radio navigation aids (VOR/LOC).

– GPS.

– Transponder.

Section 34-10
Flight Environment Data

1. General

This chapter describes about the pitot-static system and OAT indicating system in the airplane. Refer to the manufacturer's handbook for shop data about an instrument or component.

2. Description

Figure 1 shows the pitot-static system component locations.

A. Pitot-Static System

The pitot-static system supplies pitot pressure and static pressure to the air data instruments. A pitot static probe mounted below the left wing senses pitot and static pressure.

The probe has an internal heater element.

Flexible hoses connect the pitot-static probe to the air data instruments. Pitot pipes are green. Static pipes are purple or blue. Push-fit plastic connectors connect the flexible pipes. T-pieces make pipe junctions. There are in-line bulkhead-connectors at the wing root.

Both pitot and static pipes have a water trap in the lowest part of the pipe run. T-pieces divide the pipe into 2 runs. The top run goes directly to the instruments. The bottom run forms a sump before re-joining the top run at a second T-piece. The water traps are below the left seat shell.

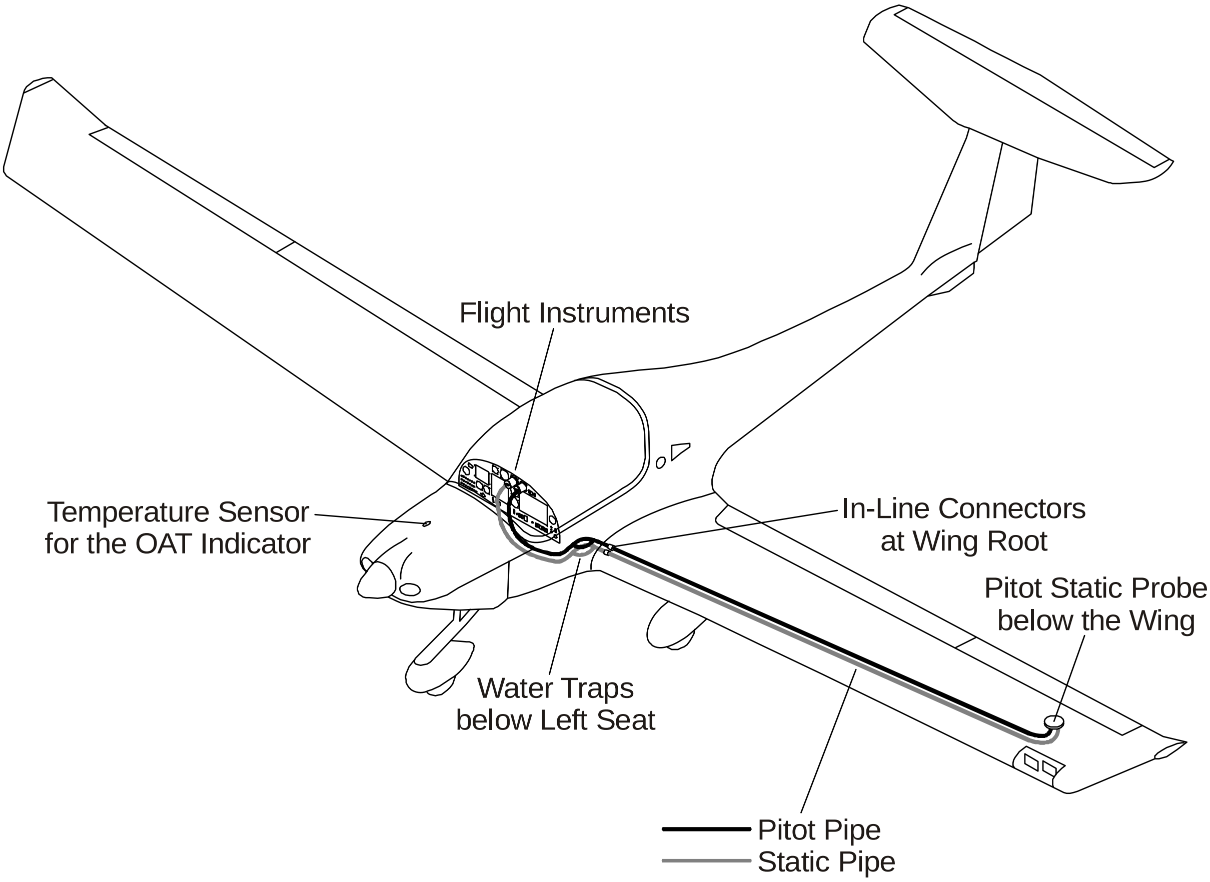

Figure 1: Flight Environment Data - Component Locations

Trouble-Shooting

1. General

This table explains how to troubleshoot the pitot-static and OAT systems. If you find the trouble in column 1, do the repair given in column 3.

A. Pitot-Static and OAT Systems

Trouble	Possible Cause	Repair
Altimeter lags or reads incorrectly.	Faulty indicator.	Replace the indicator.
VSI reads incorrectly.	Blocked or kinked static pipe. Water in the system.	Clear the hose. Drain the water.
Airspeed indicator reads low.	Faulty indicator. Blocked or kinked pitot hose. Water in the system.	Replace the indicator. Clear the hose. Drain the water.
Pitot heat does not operate.	PITOT circuit-breaker is open. PITOT circuit-breaker defective. Thermal limit switch is open-circuit (automatic reset defective). Pitot heat wiring is open circuit. Heater element defective.	Close the circuit-breaker. If the circuit breaker opens again, do a test for a short-circuit in the pitot heat wiring. Replace the circuit breaker. Replace thermal switch. Do a continuity test of the wiring. Repair/replace defective wiring. Replace the heater element.
OAT indication incorrect.	OAT sensor defective.	Replace the sensor.

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Maintenance Practices

1. General

The following maintenance practices describe how to remove, install and test the flight environment systems. Refer to the manufacturer's manuals for further data.

2. Remove/Install a Pitot-Static Instrument

A. Remove a Pitot-Static Instrument

	Detail Steps/Work Items	Key Items/References
(1)	Remove the instrument panel cover.	Refer to Chapter 25-10.
(2)	Disconnect the pitot/static hoses from the rear of the indicator.	
(3)	Remove the mounting screws.	Hold the instrument.
(4)	Remove the instrument from the panel.	

B. Install a Pitot-Static Instrument

	Detail Steps/Work Items	Key Items/References
(1)	Remove the port cover from the new instrument. Install it on the replacement instrument.	
(2)	Transfer the pitot/static fitting(s) to the new instrument.	
(3)	Put the instrument in position in the panel.	
(4)	Install the mounting screws.	
(5)	Connect the pitot/static hoses to the rear of the indicator.	
(6)	Do a low-range static leak test.	Refer to Paragraph 7.
(7)	Do a pitot-static leak test.	Refer to Paragraph 7.
(8)	Install the instrument panel cover.	Refer to Chapter 25-10.

3. Remove/Install the Pitot Probe

A. Remove the Pitot Probe

	Detail Steps/Work Items	Key Items/References
(1)	Remove the attaching screws for the probe from below the wing.	Hold the probe.
(2)	Move the probe down to give access to the connections.	
(3)	Disconnect the pitot and static hoses.	Identify the connections. Put the caps on the hoses.
(4)	Disconnect the bonding cable and electrical connector.	
(5)	Remove the pitot-static probe.	

B. Install the Pitot Probe

	Detail Steps/Work Items	Key Items/References
(1)	Hold the pitot-static probe close to the mounting below the wing.	
(2)	Connect the bonding cable and electrical connector.	
(3)	Connect the pitot and static hoses.	
(4)	Put the probe in position on the mounting.	
(5)	Install the attaching screws.	
(6)	Do a low-range static leak test.	Refer to Paragraph 7.
(7)	Do a pitot-static leak test.	Refer to Paragraph 7.
(8)	Put a cap on the pitot-static probe.	

4. Pitot and Static Leak Tests

Always do a pitot leak-test after you do maintenance on the pitot system. And always do a low-range static leak-test after you do maintenance on the static system.

CAUTION: OBEY THE FOLLOWING PRECAUTIONS WHEN YOU DO A PITOT OR STATIC LEAK TEST. IF YOU DO NOT OBEY THE PRECAUTIONS, YOU CAN DAMAGE THE AIR DATA INSTRUMENTS.

A. Test Precautions

- The pressure in the pitot system must be equal to (or greater than) the pressure in the static system.
- Reversal of the pitot and static pipes can cause damage to the air data instruments.
- The applied pressure (and rate of change of pressure) must not be greater than the design limits of the equipment under test.
- After doing the test, you must return the system to its usual operating conditions.

B. Equipment

Item	Quantity	Part Number
Pitot Static Probe Adapter.	1	Commercial.
Pitot Static Leak Tester.	1	Commercial.

C. Low Range Static Leak Test

	Detail Steps/Work Items	Key Items/References
(1)	Obey the precautions at the beginning of this subject.	
(2)	Connect the pitot-static leak-tester to the pitot-static probe.	
(3)	Apply a partial vacuum to the static port until you get a pressure altitude of 1000 ft above the ambient pressure altitude.	Note the altitude.
(4)	Let the pressure stabilize.	
(5)	Monitor the system pressure.	The pressure loss must not be more than 100 ft/min.
(6)	Compare the test-equipment altimeter and the airplane altimeter.	

Table 1: Altimeter Indication Error

Altitude	Permissible Error
Sea level.	±20 ft.
4,000 ft.	±35 ft.
8,000 ft.	±60 ft.
12,000 ft.	±90 ft.
16,000 ft.	±110 ft.
20,000 ft.	±130 ft.

D. Pitot Test

	Detail Steps/Work Items	Key Items/References
(1)	Obey the precautions at the beginning of this subject.	
(2)	Connect the pitot-static leak-tester to the pitot-static probe.	
(3)	Apply a pressure to the pitot port equal to 150 knots.	
(4)	Let the pressure stabilize.	
(5)	Monitor the system pressure.	The leak rate must not be more than 10 knots/min.
(6)	Compare the test equipment Airspeed Indicator (ASI) and the airplane ASI.	The indication error must be less than shown in Table 2 below.

Table 1: ASI Indication Error

Airspeed in Knots	Allowable Error in Knots
160	± 4
100	± 4
40	± 1.7

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Section 34-20
Attitude and Direction

1. General

This Section tells you about the attitude and direction systems with the Garmin G500 system installed. The main attitude and direction systems are integral with the Integrated Cockpit System (ICS). Refer to Section 31-40 for more data about the ICS.

The DV 20 E has the usual magnetic compass. The magnetic compass is installed in the instrument panel at the top, on the right-hand side. There is also an artificial horizon installed in the instrument panel, arranged centrally.

Refer to the manufacturer's manuals for data about these instruments.

2. Description and Operation

A. Magnetic Compass

The magnetic compass shows the heading of the airplane related to magnetic north. Fluid in the compass bowl gives damping. Each graduation on the compass is 5°. A compass deviation card attaches to the compass. Compensating magnets for compass adjustment are behind the deviation card holder.

You must do a test for correct operation of the compass (compass swing):

– After replacing a major component.

– After replacing the compass.

– After modification to the airplane.

B. Artificial Horizon

The Artificial Horizon incorporates a moving display that simulates the earth's horizon and provides the pilot with a real time visual indication of the airplane pitch and roll attitude relative to the indicator symbolic airplane.

The Artificial Horizon incorporates pitch and roll displays that are mechanically linked to a spinning mass gyroscope. The horizon bar moves behind the symbolic airplane. Precession error is corrected by the internal erection system or by pulling the "PULL TO CAGE" knob. A warning flag drops into view to indicate that the gyro motor is not receiving sufficient power to operate.

The Artificial Horizon employs an efficient electrically driven internal vertical gyroscope assembly incorporating a special air erection mechanism. This mechanism simultaneously erects the pitch and roll axes of the gyroscope. Movement of the airplane generates a reaction of the display that simulates the visual reference seen by the pilot when looking outside at the earth's true horizon line.

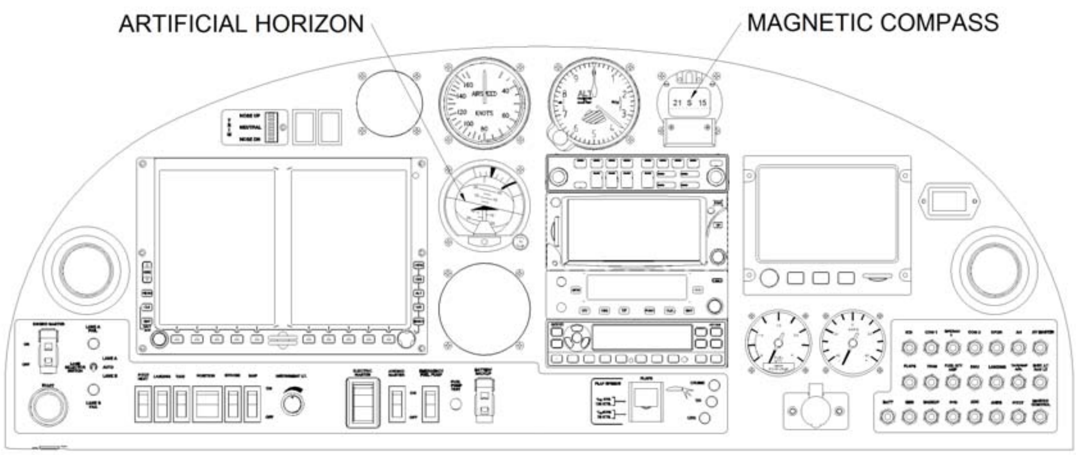

Figure 1: Instrument Panel Locations

Trouble-Shooting

1. General

Trouble	Possible Cause	Repair
Attitude indicator gyro operation not reliable.	Power supply wiring defective.	Do a test for the correct voltage at the instrument. Repair the power supply wiring/connector
	Ground connection defective.	Do a test for correct ground connection. Repair the ground wiring/connector.
	Instrument defective.	Replace the instrument.
Magnetic compass leaking fluid.	Defective compass housing.	Replace the compass.
Compass deviation more than 10°.	Residual magnetism of a metal component in the airplane.	Do a test for residual magnetism using a hand-held compass. If necessary, degauss the component.
	Defective compass.	Replace the compass.
	Compass out of calibration.	Do a compass swing. Refer to the Maintenance Practices in this Chapter.

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Maintenance Practices

1. General

The following maintenance practices describe how to:

– Remove and install the magnetic compass

– Test and adjust the magnetic compass (compass swing)

– Remove and install the backup artificial horizon indicator

Be very careful when you work on or move gyroscopic instruments. Make sure that the gyro stops turning before you start to remove the instrument. Use only the correct shock-proof container for shipping. Mark the container 'VERY FRAGILE' 'HANDLE LIKE RAW EGGS'.

2. Remove/Install the Magnetic Compass

A. Remove the Magnetic Compass

	Detail Steps/Work Items	Key Items/References
(1)	Remove the instrument panel cover.	Refer to Chapter 25-10.
(2)	Disconnect the lighting plug.	
(3)	Remove the mounting screws.	Hold the instrument.
(4)	Remove the compass from the panel.	

B. Install the Magnetic Compass

	Detail Steps/Work Items	Key Items/References
(1)	Put the compass in position in the instrument panel.	
(2)	Install the mounting screws.	
(3)	Connect the lighting plug.	
(4)	Install the instrument panel cover.	Refer to Chapter 25-10.
(5)	Do a compass swing.	

3. Test/Adjust the Magnetic Compass

You must do a test for correct operation of the compass (compass swing):

– After replacing a major component.

– After replacing the compass.

– After modification to the airplane.

CAUTION: USE ONLY NON-MAGNETIC TOOLS TO ADJUST THE COMPASS.

CAUTION: DO NOT WEAR OR CARRY METALIC MATERIAL (WATCHES, BRACELETS ETC) WHEN YOU ADJUST THE COMPENSATING MAGNETS OR OPERATE THE LAND COMPASS. METALIC MATERIAL CAN CAUSE ERRORS.

NOTE: If possible, use a compass swing area that has been tested for magnetic interference. In any case, use a level area which is away from steel structure, underground pipes, cable, reinforced concrete, other airplane and ground equipment.

A. Equipment

Item	Quantity	Part Number
Calibrated Land Compass.	1	Commercial.
0.060 in. 6-Spline Wrench.	1	Commercial.

B. Compass Swing

	Detail Steps/Work Items	Key Items/References
(1)	Adjust the compensating magnets in the compass to a neutral position.	
(2)	Start the engine. Set all electrical loads to ON.	Refer to the DV 20 E Airplane Flight Manual.
(3)	Use a calibrated and reliable land compass to confirm the airplane heading.	
(4)	Align the airplane to magnetic north.	Adjust the N-S compensator so that the compass indicates a heading of 0 degrees.
(5)	Align the airplane to magnetic east.	Adjust the E-W compensator so that the compass indicates a heading of 90 degrees.
(6)	Align the airplane to magnetic south.	Adjust the N-S compensator so that the compass indicates a heading of 180 degrees.
(7)	Align the airplane to magnetic west.	Adjust the E-W compensator so that the compass indicates a heading of 270 degrees.
(8)	Turn the airplane through 360 degrees. Record the deviation at each 30 degrees. Prepare a deviation table that shows the corrections that must be applied to each heading	If large deviations occur when you operate electrical equipment/systems, the deviation table must also show the corrections to apply at each 30 degrees heading when the system is operated.
(9)	Install the deviation table in the compass card holder below the compass.	

4. Remove/Install the Backup Artificial Horizon Indicator

A. Remove the Backup Artificial Horizon Indicator

	Detail Steps/Work Items	Key Items/References
(1)	Disconnect the battery.	Refer to Chapter 24-31.
(2)	Remove the instrument panel cover.	Refer to Chapter 25-10.
(3)	Disconnect the connector 3490-01 from the Artificial Horizon Indicator.	
(4)	Remove the three mounting screws that attach the Artificial Horizon Indicator.	Hold the instrument.
(5)	Remove the Artificial Horizon Indicator from the panel.	

B. Install the Backup Artificial Horizon Indicator

	Detail Steps/Work Items	Key Items/References
(1)	Place the Artificial Horizon Indicator in position in the instrument panel.	
(2)	Install the three mounting screws.	
(3)	Plug in connector 3490-01 into Artificial Horizon Indicator.	
(4)	Install the instrument panel cover.	Refer to Chapter 25-10.
(5)	Connect the airplane battery.	Refer to Chapter 24-31.
(6)	Do the functional test of the Artificial Horizon indicator as follows: – Switch the ELECTRIC MASTER to ON. – Make sure that the Gyro Warning flag (red) is pulled out-of-view. – Check the indicator internal lighting is working correctly. Turn INSTRUMENT LT knob ON and continue to adjust clockwise. – Pull the cage knob and confirm the indicators display levels out.	Make sure that the Artificial Horizon’s internal lighting turns on, and continues to get brighter.

Section 34-30
Landing and Taxiing Aids

1. General

The DV 20 E airplane has a Garmin GMA 340 Audio Panel\Marker receiver. Refer to Chapter 23-50 for data about the audio integration functions of the GMA 340.

The DV 20 E airplane has also localizer, and glideslope receivers installed. Refer to Chapter 34-50 and to the manufacturers manuals for data about the equipment installed.

Refer to Chapter 23-50 for maintenance practices to remove/install the GMA 340 audio panel.

2. Description and Operation

The GMA 340 is an audio selector panel. It also has a marker beacon receiver and a headphone isolation amplifier. The marker beacon receiver receives a 75 MHz carrier signal. The carrier signal is modulated with the following tones:

– Outer marker: 400 Hz.

– Middle marker: 1300 Hz.

– Airways marker: 3000 Hz.

Three colored lenses show when the airplane is over the related beacon. The lenses are marked A, O and M.

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Trouble-Shooting

1. General

This table explains how to troubleshoot the audio marker beacon receiver. If you find the trouble in column 1, do the repair given in column 3.

Trouble	Possible Cause	Repair
Test operates correctly but the marker does not operate.	Faulty marker receiver.	Replace the GMA 340.
	Poor co-ax connections.	Examine the co-ax connectors for condition and security.
	Faulty antenna.	Replace the antenna.
Test does not operate.	No power.	Do a power check. Do a continuity test of the ground and power wires.
	Circuit-breaker open or defective.	Close the circuit-breaker or replace the circuit-breaker.
	Faulty marker receiver.	Replace the GMA 340.

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Section 34-50
Dependent Position Determining

1. General

This chapter describes about the equipment that shows dependent position determining. The DV 20 E airplane has the following position determining systems:

– COM/NAV/GPS - Garmin GTN 650.

– Transponders - Garmin GTX 328/330.

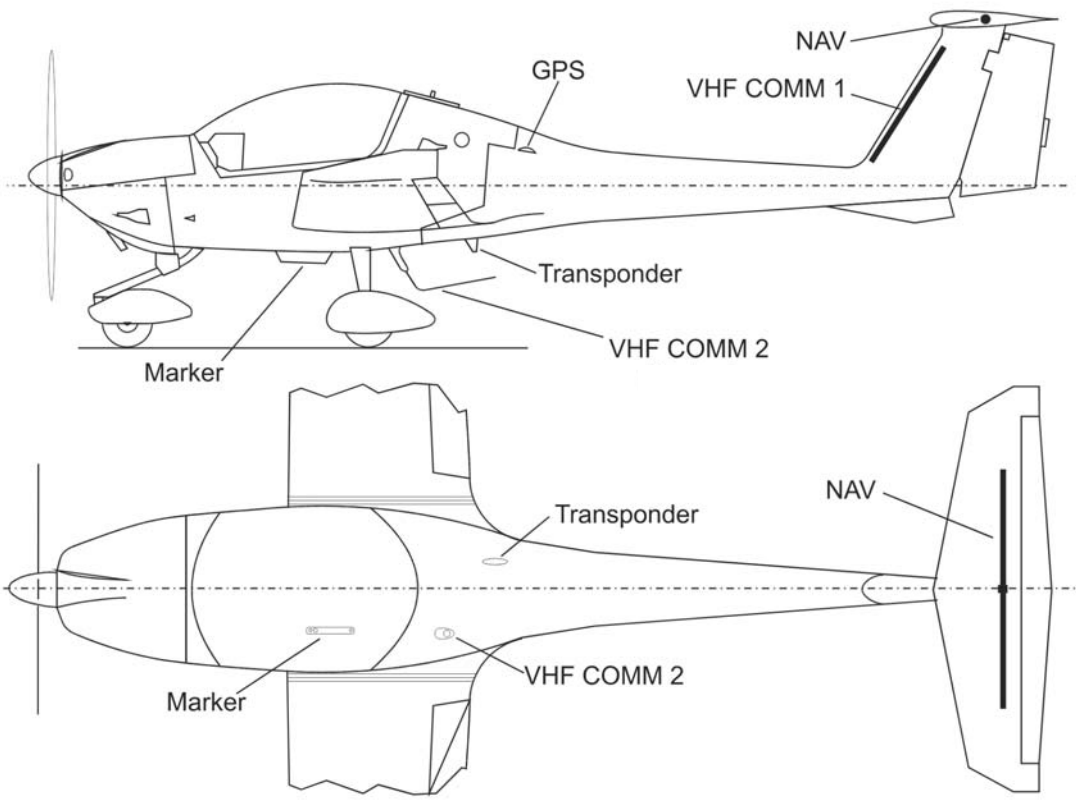

Figure 1: Antenna Locations

A. Garmin GTX 328/330 Transponder

(1) Description

The Garmin GTX 328/330 is a panel mounted Mode S Transponder.

The Garmin GTX 328 retains many of the GTX 330 features such as displaying outside air temperature, altitude monitoring, count up and count down timers (using a built-in digitized voice annunciator to alert the pilot when preset altitude limits have been exceeded or timer expiration), density altitude functions, and front-panel input for flight ID.

The GTX 328 has a solid-state design that uses less power, reduces heat emissions and eliminates warm-up time. The GTX-328 will not offer TIS, EHS or ADS-B functionality.

(2) Operation

The GTX 328/330 transponder is a radio transmitter and receiver that operates on radar frequencies, receiving ground radar or TCAS interrogations at 1030 MHz and transmitting a coded response of pulses to groundbased radar on a frequency of 1090 MHz. The GTX 328/330 is equipped with IDENT capability that activates the Special Position Identification (SPI) pulse for 18 seconds.

The GTX 328/330 replies to ATCRBS Mode A, Mode C and Mode S All-Call interrogation. Mode A replies consist of any one of 4,096 codes, which differ in the position and number of pulses transmitted. Mode C replies include framing pulses and encoded altitude. Mode S interrogations are selective. The Mode S transponders can respond to a single directed interrogation from the ground station or another airplane.

The GTX 328/330 is a Level 2 transponder, providing downlink of airplane information. Ground stations can interrogate Mode S Transponders individually using a 24-bit ICAO Mode S address, which is unique to the particular airplane. In addition, ground stations may interrogate a GTX 330 for its Transponder data capability and the airplane's Flight ID, which may be the registration number or other call sign. The GTX 330 makes the maximum airspeed capability available to TCAS systems on-board nearby airplane to aid in the determination of TCAS advisories.

Figure 2: GTX 328/330 Transponder Front Panel

The GTX 330 Transponder has the following functional controls:

Key	Function
OFF	Powers off the GTX 330. Pressing the STBY, ON or ALT key powers on the transponder displaying the last active identification code.
STBY	Selects the standby mode. When in standby mode the transponder will not reply to any interrogations. Pressing and holding the STBY key selects ground (GND) mode if Automated Airborne Determination is not otherwise selected from another source. When GND is annunciated, the transponder does not respond to ATCRBS interrogations but squitters and replies to discretely addressed Mode S interrogations.
ON	Selects Mode A and Mode S. In this mode, the transponder replies to Mode A and Mode C interrogations, as indicated by the Reply Symbol (“®”), but the replies do not include altitude information.
ALT	Selects Mode A, Mode C, and Mode S. In ALT mode, the transponder replies to identification and altitude as indicated by the Reply Symbol (“®”). Replies to altitude interrogations include the standard pressure altitude (29.92 inches Hg.) received from an external altitude source, which is not adjusted for barometric pressure. The ALT mode may be selected in airplane not equipped with an optional altitude encoder; however, the reply signal will not include altitude information.
NOTE: Any time the function switch is in the ON or ALT position the transponder becomes an active part of the Air Traffic Control Radar Beacon System (ATCRBS). The transponder also responds to interrogations from TCAS equipped airplane.	

Key	Function
IDENT	Pressing the IDENT key activates the Special Position Identification (SPI) Pulse for 18 seconds, identifying the transponder return from others on an air traffic controller's screen. During the IDENT period, the word 'IDENT' appears in the upper left corner of the display.
VFR	Sets the transponder code to the pre-programmed VFR code selected in Configuration mode (set to 7000 at the factory). Pressing the VFR key again will restore the previous identification code.
NOTE: The VFR key is on (functional) by default, but can be disabled in configuration mode.	
FUNC	Changes the page shown on the right side of the display. Display data includes Pressure Altitude, Flight Time, Count Up and Count Down timers. In the Configuration mode, steps through the function pages.
START/STOP	Starts and stops the Count Up, Count Down and Flight Time. In the Configuration mode, reverses through the function pages.
CRSR	Activates the change fields for the Count Down timer.
CLR	Resets the Count Up, Count Down and Flight timers. Returns cursor to fourth code digit up to five seconds after code entry is complete.
8	Reduces screen Contrast and Display Brightness. Enters the number eight into the Count Down timer.
9	Increases screen Contrast and Display Brightness. Enters the number nine into the Count Down timer.

B. GTN 650

The GTN 650 is a VHF communications transceiver and a GPS receiver. (Refer to Chapter 23-10 for COM functions). It also includes VOR/Localizer and glideslope receivers. It uses a Secure Digital (SD) card to load and store various types of data. For basic flight operations, the SD card is required for terrain, obstacle, and safe taxi database storage as well as Jeppesen aviation database updates.

The equipment can receive Comm signals from 118.00 MHz to 136.976 MHz in 25 KHz and 8.33 kHz increments. The display is a 600 by 266 pixel, 4.9 inch diagonal color LCD with touchscreen controls.

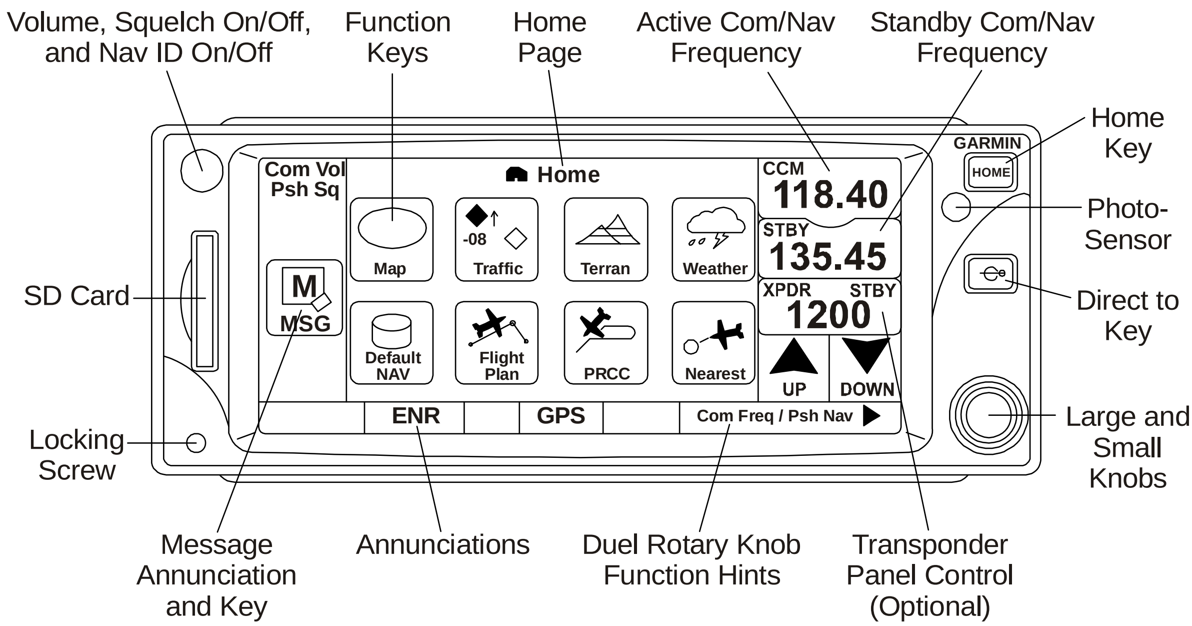

Figure 3: GTN 650 COM/NAV/GPS

The GTN 650 has the following controls:

(a) Left-Hand Knob

Volume / Squelch Knob - controls audio volume for the selected Com radio or Nav receiver and other volume levels for external audio input devices that are controlled via the GTN interface, if installed. Pressing the Volume knob momentarily will disable the automatic squelch control for the Com radio, when active.

(b) Right-Hand Keys and Knobs

HOME Key - displays the Home page, the main screen for accessing the GTN features. Pressing and holding the HOME key will open the Default Navigation page from any other page.

Direct-To Key - provides access to the direct-to function, which allows you to enter a waypoint and establishes a direct course to the selected destination.

Large and Small Concentric Knobs - used for data entry, such as in the Waypoint or Direct-To functions, and to set the frequencies for the communications transceiver or the VOR/Localizer in units so equipped.

To operate the unit set the ELECTRIC MASTER switch and AVIONICS MASTER switch to ON. The related circuit-breakers must be closed. Turn the COM power/Volume knob clockwise from the OFF position. The display will show the frequency last stored in the non-volatile memory. The INST. LT knob controls the brightness of the display.

Refer to the operators handbook provided with the equipment for additional information.

Trouble Shooting

1. General

This table explains how to troubleshoot the dependent position determining. If you find the trouble in column 1, do the repair given in column 3.

A. Transponder

Trouble	Possible Cause	Repair
ATC reports no reply. Transponder reply lamp flashes.	Low output power.	Examine the antenna connections. Replace the transponder.
ATC reports no reply. Transponder reply lamp does not flash.	Airplane out of radar range. Poor received signal. Faulty transponder.	Do a test at higher altitude. Examine the antenna connections. Replace the transponder
ATC reports mode A does not operate. Mode C operates correctly.	Faulty transponder.	Replace the transponder.

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Maintenance Practices

1. General

The following maintenance practices describe how to remove, install and adjust/test the components of the dependent position determining systems on the airplane. Refer to the manufacturer's component maintenance manuals for more data and shop data.

2. Remove/Install the GTX 328/330 Transponder

A. Remove the GTX 328/330 Transponder

	Detail Steps/Work Items	Key Items/References
(1)	Open the related circuit-breaker.	
(2)	Put a 3/32 allen wrench into the access hole for the locking screw in the front panel. Engage the screw.	
(3)	Turn the screw counter-clockwise until the unit disengages from the mounting rack.	
	CAUTION: DO NOT PULL ON THE KNOBS. DO NOT PRY THE FACE-PLATE. YOU CAN DAMAGE THE UNIT. CAUTION: DO NOT TOUCH THE CONNECTOR CARD AT THE REAR OF THE UNIT. THE ELECTROSTATIC CHARGE ON YOUR BODY CAN DAMAGE THE UNIT.	
(4)	Pull gently on the sides of the unit to remove it from the mounting rack.	
(5)	Install the protective covers on the rear connectors of the unit.	

B. Install the GTX 328/330 Transponder

	Detail Steps/Work Items	Key Items/References
(1)	Remove the protective covers from the rear connectors on the unit.	Looking at the bottom of the transponder, make sure that the front lobe of the locking mechanism is in a vertical position. This can be accomplished by using a 3/32 inch allen wrench through the face plate.
(2)	Insert the transponder slowly until the front lobe of the unit touches the mounting rack.	
(3)	Insert a 3/32 inch allen wrench into the hole in the front panel.	
CAUTION: DO NOT OVER-TIGHTEN THE LOCKING SCREW. YOU CAN DAMAGE THE LOCKING MECHANISM.		
(4)	Turn the locking screw clockwise until the screw stops.	
(5)	Close the circuit-breaker.	
(6)	Do an operational test.	

3. Remove/Install the Garmin GTN 650

Refer to Section 23-10.

CHAPTER 51

STANDARD PRACTICES AND STRUCTURES

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TABLE OF CONTENTS

CHAPTER 51

STANDARD PRACTICES AND STRUCTURE

Section 51-10

Investigation

Section 51-20

Repair Processes

Maintenance Practices

Section 51-30

Materials

Section 51-60

Control Surface Balancing

CHAPTER 51
STANDARD PRACTICES AND STRUCTURE

1. General

The DV 20 E airplane is a single-engine, low-wing monoplane of composite construction. It has a 'T' tail and a fixed tricycle landing gear with a nose wheel that can caster.

The fuselage has a glass fiber skin of semi-monocoque construction with bulkheads and stiffeners. The vertical stabilizer is part of the fuselage structure. It has a spar near the rudder hinge line and a full laminate skin. The horizontal stabilizer, elevator and rudder have GFRP skins with rigid foam cores. The ailerons and flaps have GFRP/CFRP skins with rigid foam cores.

The tapered cantilever wing has an I-spar. The spar caps are carbon fiber rovings. The wing skin is a sandwich of Glass Fiber Reinforced Plastic (GFRP) with a rigid foam core. Each wing attaches to the fuselage at three places.

The acrylic canopy has a frame made from carbon fiber laminate.

An epoxy filler with a polyurethane paint protects the airplane against moisture and ultraviolet rays.

2. Types of Structure

The DV 20 E is constructed from two main types of composite structure.

A. Glass Fiber Reinforced Plastic (GFRP)

GFRP is very thin glass fibers bonded together by resin. The glass fibers give most of the strength and the resin maintains the shape. The resin also bonds to other structural components such as other GFRP parts, metal attachment brackets or metal bushings.

The glass fibers are woven to make glass cloth. The orientation and weave of the glass in the cloth affects the structural strength of the cloth. A component can have many layers of cloth bonded together with resin. This is called lamination.

GFRP has very good properties. It is strong and flexible. It is very resistant to chemical attack and very little maintenance is necessary.

B. Carbon Fiber Reinforced Plastic (CFRP)

CFRP is very thin carbon fibers bonded together by resin. The carbon gives most of the strength and the resin maintains the shape. The resin also bonds to other structural components such as other CFRP parts, metal attachment brackets or metal bushings.

CFRP is very similar to GFRP. The main advantage of CFRP is that it is stronger and more rigid and lighter than GFRP.

3. Laminated Components

A laminated component has two or more layers of glass/carbon cloth. The direction of the fibers in the cloth is important for the properties for each layer. Extra layers are bonded to areas to give more strength.

4. Sandwich Structure

Many of the components in the DV 20 E have a sandwich of two skins and a core. GFRP make the skins and rigid plastic foam makes the core.

The skins must bond to the core of a sandwich structure completely. If the skins do not bond to the core the component can fail.

5. Bonded Components

A number of components can bond together to make a larger component. Special thick resin bonds these components together and fills the gap in a joint.

6. Repair Limitations

Repairs which are categorized as 'Class 1' in accordance with Section 51-10, Paragraph 2, may only be carried out in accordance with a repair scheme which has been approved by the manufacturer. Such repairs are not described in this Airplane Maintenance Manual.

7. Identification of Primary Structure

The primary structure of the DV 20 E consists of the following components:

A. Wing

- Spar.
- Ribs.
- Web at hinge line.
- Skin.
- Wing-fuselage connection.
- Ailerons.
- Wing flaps.

B. Fuselage

- Skin.
- Bulkheads and stiffeners.
- Rudder fin.
- Rudder.

C. Horizontal Tail

- Elevator fin.
- Elevator.
- Horizontal tail-vertical tail connection.

All other structural components are secondary structure.

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Section 51-10
Investigation

1. General

This Section tells you how to assess the class of the damage. It also tells you how to inspect glass fiber reinforced plastic (GFRP) and carbon fiber reinforced plastic (CFRP) composite structures. Damage assessment and repairs must be carried out by approved persons.

Refer to Section 51-00 for the types of structure used in the DV 20 E and for repair limitations. Refer to Section 51-20 for general repair procedures.

2. Damage Classification

Damage is divided into the classes described below. In doubtful cases (i.e., if you are not sure about the classification of a damage), you must contact the airplane manufacturer.

A. Class 1

– Major structural damage that requires the partial replacing of a structural component, or

– Damage to a large area, or

– Damage to a highly stressed component or part.

This type of damage restricts or voids airworthiness.

B. Class 2

Holes and cracks passing through both skins of a sandwich construction component. The core damage must be able to be covered by a 75 mm (3 in) diameter circle.

C. Class 3

Small holes or cracks in the outer skin where there is no internal damage to the component, the sandwich material, or the inner skin.

D. Class 4

Minor scratches, abrasions or similar damage which is not a crack or a puncture in the skin.

3. Types of Damage

There are two basic types of hidden failure in composite structures:

- Disbonding.
- Delamination.

Disbonding is the failure of a bond between two components. For example between the fuselage skin and a fuselage frame. Or between a composite component and a metal component. Or between a composite skin and a sandwich core material.

Delamination is the failure of the bond between layers of glass/carbon cloth in a component.

There are also two main types of cracks:

- Micro cracks which occur in the surface of the resin.
- Major cracks with broken fibers. Major cracks do not occur with normal flight loads or normal landing loads. You must repair major cracks.

4. Inspection Techniques

A. Examine Visually

Use this method to find all types of damage to composites. Use a bright light to examine visually the inside of a component. GFRP must be green or brown. If the GFRP has white areas, then it may be damaged. Look specially at areas where components bond to the GFRP.

CFRP must be black or black/brown. If the CFRP has white areas, then it may be damaged. Look specially at areas where components bond to the CFRP.

Look carefully at the outer surface of a component. If the paint has cracks or bubbles, then the composite may be damaged. Refer to Paragraph 5 in this Section.

Also look for dents. Look specially in areas where stones can hit the airplane below the fuselage and the wings. Look specially in the areas of the walkways.

B. Light Test

Use the light test to find delamination. Use this test on components which do not have rigid foam inside.

CAUTION: DO NOT LET THE COMPOSITE GET HOT. HEAT CAN CAUSE DAMAGE TO THE COMPOSITE.

Point a very bright light at the surface and look at the other side of the surface. Damage shows as a dark area. You can point the light from the inside of a component or from the outside of a component.

Note: You can use the light test on thick GFRP but it is difficult to use on CFRP.

C. Coin Tap Test

Use the coin tap test to find delamination and disbonding. Tap a coin on the laminate surface in the area you will test. The sound of the coin tapping on the surface of the laminate will change as you move the coin over damaged laminate.

Look specially at the area around the damage for secondary damage, which can remain undetected.

5. Further Inspection

If you find paint damage when you examine a composite structure then do this further inspection.

Find a way to see the inside of a structure or a component. If necessary, remove panels (or other components), or you can use remote viewing equipment. If you can see damage inside the component or structure you must do a repair.

Remove the paint coat in the area that you think is damaged. Remove the paint coat carefully, you must not damage the cloth under the paint coat.

Look carefully at the surface. If you find cracks in the composite you must repair the structure.

If you do not find cracks in the composite then do this test. Push the middle of the area to be tested with your thumb. If you can feel the skin hitting the core of a sandwich (or other layer/component), then the skin is disbonded and you must repair the structure.

In some cases you must cut inspection holes in the structure to do the test correctly. If you must cut inspection holes you must seek advice from Diamond Aircraft Industries.

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Section 51-20
Repair Processes

1. General

This Section tells you how to repair composite structures. Repairs must be carried out by approved persons. Refer to Section 51-00 for data about the types of structures. Refer to Section 51-10 for data about the classification of damage and inspection techniques. Refer to Section 51-30 for data about approved repair materials.

2. Center of Gravity Limits

When you repair an airplane, it is likely that you change the weight of the airplane and the center of gravity. The further the distance of a repair from the center of gravity, the greater the effect will be on the center of gravity. You must always weigh the airplane after a large repair and calculate the center of gravity. Refer to Section 08-10 for data about weighing the airplane.

3. Control Surface Balancing

When you repair a control surface it becomes heavier. Make an estimate of the new weight of the control surface after before you do a repair. If the control surface will be too heavy then do not repair it. You must install a new item.

When you repair a control surface and/or apply a new paint coat you must weigh and balance the control surface. Refer to Section 06-00 for data about weights and balance. Section 51-60 tells you how to balance a control surface.

WARNING: YOU MUST WEIGH AND BALANCE A CONTROL SURFACE AFTER REPAIR OR PAINTING. FAILURE TO BALANCE A CONTROL SURFACE MAY CAUSE THE AIRPLANE TO FAIL IN FLIGHT.

4. Drain/Vent Holes

You must keep all drain and vent holes in the structure of the DV 20 E open. If you close a drain or vent hole doing a repair you must make a new hole in the same position.

5. Holding the Component

You must hold a component in the correct position when you do a repair. If you do not hold a component correctly it may move when you do the repair and cause further damage. It can also change the airplane alignment.

Hold the component in a special device (jig/fixture) before you cut the repair area. If necessary, lift the airplane on jacks and level the airplane. Refer to Section 07-10 for data about jacking and Section 08-20 for data about leveling the airplane.

6. Safety Precautions

Most resins can cause skin disease. When you use resin/hardener use a protective barrier cream on your hands and exposed skin. You must always wear plastic gloves.

WARNING: DO NOT GET RESIN ON YOUR SKIN. RESIN CAN CAUSE SKIN DISEASE.

The resins, hardeners and solvents used for composite repairs are poisonous. You must not take food into the work area. Use a mask to protect your face and use eye-protection.

WARNING: DO NOT GET RESINS, HARDENERS OR SOLVENTS IN YOUR MOUTH OR IN YOUR EYES. THESE CHEMICALS CAN CAUSE DISEASE.

When you grind composites you make small particles of composite dust. These particles can irritate the skin and eyes. If you breathe these composite particles, they can cause lung disease.

When you grind composite you must always use a protective cream on your hands and on all exposed skin. Wear overalls which seal at the wrists, neck and ankles. You must always wear gloves and if necessary, change them often. Use a suitable mask to protect you face and lungs. Always wear safety goggles to protect your eyes.

If your skin comes into contact with composite dust, then wash it off with flowing water. Do not rub your skin while it has dust on it.

WARNING: DO NOT GET COMPOSITE DUST PARTICLES IN YOUR EYES, OR IN YOUR MOUTH, OR ON YOUR SKIN. THESE PARTICLES CAN CAUSE DISEASE.

7. Workshop Conditions

Keep the workshop clean and free from dust. Remove grinding dust as it occurs. The working area must not be affected by air draughts.

The temperature of the workshop should be maintained between 18 °C (65 °F) and 27 °C (77 °F) and must not fall below 15 °C (59 °F). The relative humidity during mixing, applying or curing resins must not be allowed to rise above 80 %.

Maintain the workshop temperature as near to 25 °C (77 °F) as possible during curing.

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Maintenance Practices

1. General

These Maintenance Practices tell you about composite repair processes and how to repair Class 2, 3 and 4 damage to the composite structure. Refer to Section 51-10 for data about damage classification. Class 1 damage may only be repaired in accordance with a repair scheme approved by the manufacturer. All repairs must be carried out by approved persons.

You must only use the materials approved by the manufacturer when repairing the airplane. Refer to Section 51-30 for data about approved materials.

Inspect the damaged area. Look specially at the adjacent structure. Damage can go a long way under the surface. Use the techniques given in Section 51-10.

You must take care to do the repair correctly. The outer shell of a composite structure is stressed. Failure of the structure can cause an accident.

2. Resin

You must use the correct quantity of mixed resin for the repair. Weigh all the cut cloth patches that you will use for the repair. The ratio for glass cloth to mixed resin is 100 : 70. For example, 100 grams of dry glass cloth require 70 grams of mixed resin. The ratio for carbon cloth to mixed resin is 100 : 100. For example, 100 grams of dry carbon cloth require 100 grams of mixed resin.

Measure the quantities of resin and hardener accurately (± 2% by weight). Mix the resin and hardener thoroughly before laminating, or adding fillers or other additives.

Always use clean containers for mixing resin and only mix as much resin as you can use within its pot life.

When using a large quantity of resin put it into a shallow container. This will increase the ratio of surface area to volume which will reduce the risk of an exothermic reaction and can improve pot life.

For parts made from self extinguishing resin use the same resin system for repair (refer to Section 51-30).

3. Glass and Carbon Cloth

CAUTION: Epoxy resin cures in an exothermal reaction. Depending on resin/hardener combination, and pot life of the combination, and working temperature the mixture can reach high temperatures. Do not use hot resin. Hot resin can inflame. Put it to a safe location until hardened.

You must always use the correct cloth for the repair. Refer to the lay-up drawing of the repair area for data about the type of cloths you must use. The lay-up drawing will tell you:

– The correct type of cloth.

– The fiber direction.

– The dimensions of the layer.

Make sure that the fibers in each layer of cloth point in the direction given in the lay-up drawing. This gives the correct strength to the laminate. Only use sharp shears or scissors to cut the cloth to size. Make sure that the fibers in the cut cloth point in the correct relative direction. Make sure that the fiber strands are not broken or damaged. The cloth must be free of any damage or contamination.

4. Core Material

You must always use the correct sandwich core for the repair. Refer to the lay-up drawing of the repair area for data about the type of core you must use.

Make sure that the core material is not damaged or contaminated.

Use a sharp knife to cut the core to the exact size for the repair. The edges of the cut must be clean so that the core will bond correctly. You can profile the core by cutting or sanding.

5. Laminating

A prescribed stack of resin impregnated cloth makes a laminate. A laminate which is used to repair an airplane becomes an integral part of the airplane structure once the laminate is hardened and fully cured.

You can make the laminate in place directly on the repair or you can make the laminate on a work table and then apply the wet laminate to the repair. When you make the laminate on a table:

– It is easier to do.

– It is easier to control and correct the laminating process.

– You can make sure that the cloth layers in the stack are correct before you apply the resin.

– You can make the repair neater.

– You do not have to work upside down.

A. Laminating in Place

	Detail Steps/Work Items	Key Items/References
(1)	Prepare the damaged area for laminating. Make sure that the repair is clean and free contamination.	Refer to the relevant repair procedure in this Section.
(2)	Prepare the layers of cloth that you will use.	Refer to the lay-up drawing.
(3)	Protect the area of the structure around the repair from contamination by the repair materials.	Use plastic/polythene sheet material held in place by self adhesive tape.

WARNING: DO NOT GET RESIN ON YOUR SKIN. RESIN CAN CAUSE SKIN DISEASE.

WARNING: DO NOT GET RESINS, HARDENERS OR SOLVENTS IN YOUR MOUTH OR IN YOUR EYES. THESE CHEMICALS CAN CAUSE DISEASE.

(4)	Apply a thin coat of resin to the repair.	
(5)	Apply the first layer of cloth to the repair and trim to the correct size.	Make sure that the fibers in the cloth point in the correct direction.
(6)	Use a roller, squeegee and a stipple brush to remove all trapped air. Make sure that the cloth is completely impregnated with resin. If necessary, add more resin.	
(7)	When the excess resin has been brought to the surface with the rolling and stippling process, apply the next layer of cloth. Trim the cloth to the correct size.	Make sure that the fibers in the cloth point in the correct direction.
(8)	Do steps 6 and 7 as necessary until all the layers of cloth are in place.	
(9)	Use the roller and squeegee to remove the excess resin.	
(10)	Put a layer of peel ply over the laminate.	
(11)	If necessary, apply a vacuum bag to the laminate.	Refer to the lay-up drawing and/or repair drawing.

B. Laminating on a Table

	Detail Steps/Work Items	Key Items/References
(1)	Prepare the damaged area for laminating. Make sure that the repair is clean and free from contamination.	Refer to the relevant repair procedure in this Section.
(2)	Protect the area of the structure around the repair from contamination by the repair materials.	Use plastic/polythene sheet material held in place by self adhesive tape.
(3)	Put a layer of clean transparent plastic / polyethylene sheet over the repair and hold it in place with self adhesive tape.	Colored sheet should be preferred.
(4)	Use an indelible felt marker to: – Trace onto the plastic sheet the extreme outline of the repair. – Trace onto the plastic sheet the contour lines of each layer of cloth in the structure.	The outer layer of the structure must be tapered to avoid stress risers and to give a good finish.
(5)	Remove the transparent sheet from the structure and place it upside down on a work table.	
	Note: The cloth layers are laid in reverse order when you laminate on a table. You must take care to put the cut cloth layers in the correct order and that the fibers in each cloth layer point in the correct direction.	
(6)	Cut the layers of cloth to fit the contour lines that you traced onto the transparent sheet.	
	WARNING: DO NOT GET RESIN ON YOUR SKIN. RESIN CAN CAUSE SKIN DISEASE. **WARNING: DO NOT GET RESINS, HARDENERS OR SOLVENTS IN YOUR MOUTH OR IN YOUR EYES. THESE CHEMICALS CAN CAUSE DISEASE.**	
(7)	Apply a thin coat of resin to the transparent sheet.	

	Detail Steps/Work Items	Key Items/References
(8)	Apply the first inner layer of cloth to the transparent sheet and trim to the correct size.	Make sure that the fibers in the cloth point in the correct direction.
(9)	Use a roller, squeegee and a stipple brush to remove all trapped air. Make sure that the cloth is completely impregnated with resin. If necessary, add more resin.	
(10)	When the excess resin has been brought to the surface with the rolling and stippling process, apply the next layer of cloth. Trim the cloth to the correct size.	Make sure that the fibers in the cloth point in the correct direction.
(11)	Do steps 9 and 10 as necessary until all the layers of cloth are in place.	
(12)	Apply a thin coat of resin to the area of the repair on the structure where you will attach the laminate patch.	
(13)	Put the laminate patch carefully into position on the structure using the transparent sheet.	Make sure that the fibers in the cloths point in the correct direction.
(14)	Carefully remove the transparent sheet from the laminate patch.	
(15)	Use a roller to make sure that the laminate patch is firmly in position and that any excess resin is removed from the repair laminate.	
(16)	Put a layer of peel ply over the laminate.	
(17)	If necessary, apply a vacuum bag to the laminate.	Refer to the lay-up drawing and/or repair drawing.

Table 1 - Bonding Paste Mixing Table

Material	Weight in Grams								
Mixed Resin	50	100	150	200	250	300	350	400	450
Cotton Flocks	6	11.5	17	23	29	34.5	40	46	52
Aerosil	1.4	2.8	4.2	5.5	6.9	8.3	9.7	11.1	12.5

6. Bonding Paste (Thickened Resin)

CAUTION: TO BOND PARTS MADE OR REPAIRED WITH SELF EXTINGUISHING RESIN, YOU MUST USE SELF EXTINGUISHING RESIN TO MIX THE BONDING PASTE (REFER TO SECTION 51-30).

Use bonding paste to bond GFRP/CFRP components together and in the repair of sandwich cores. Resin and thickening fillers make bonding paste. Table 1 gives you the proportions by weight of resin to thickening fillers. You can change the proportions of Aerosil and Microballoons relative to each other but you must keep the total weight of the Aerosil/Microballoon mix constant.

7. Curing

You must cure a composite structure to make it strong. If you do not cure a composite structure correctly it may fail. Curing is a two part process, pre-curing and post-curing. The following procedure gives a typical curing process.

	Detail Steps/Work Items	Key Items/References
(1)	Maintain the temperature of the repair at 20 °C to 25 °C (68 °F to 77 °F) for at least 24 hours to pre-cure the repair.	If you do not have an oven or a warming room you can make a temporary enclosure around the repair to trap the heat from a flame proof air heater.
	CAUTION: DO NOT ALLOW A TOO HIGH TEMPERATURE DURING THE CURE. A TOO HIGH TEMPERATURE CAN DAMAGE THE COMPOSITE STRUCTURE.	
(2)	After 24 hours raise the temperature of the repair to at least 65 °C (149 °F) for a minimum of 6 hours to complete the first stage of the post-cure.	Monitor the temperature every 15 minutes for the first hour and then hourly.
(3)	After a minimum of 6 hours raise the temperature of the repair to at least 80 °C (176 °F). Maintain this temperature for a minimum of 14 hours to complete the final post-cure.	The final stage post-cure time can be divided into sections but you must make sure that the repair has a minimum total of 14 hours at post-cure temperature.

8. Exterior Paint Finish

Refer to Chapter 04 for paint scheme limitations.

A. Painting a Repair Area

	Detail Steps/Work Items	Key Items/References
	WARNING: DO NOT GET ACETONE, FILLER, OR PAINT ON YOUR SKIN. ACETONE, FILLER, AND PAINT CAN CAUSE SKIN DISEASE. **WARNING: DO NOT BREATHE ACETONE, FILLER, OR PAINT FUMES. ACETONE, FILLER, AND PAINT FUMES CAN CAUSE DISEASE.** CAUTION: THERE MUST BE NO GREASE OR DUST ON THE REPAIR AREA. GREASE AND DUST PREVENT A GOOD BOND.	
(1)	Make sure that the area to be repaired is clean and free from any contaminants.	If necessary, use acetone and re-sand the area.
(2)	Apply 2 layers of HS filler to the repair area.	Obey the filler manufacturer's instructions.
(3)	Allow the HS filler to cure.	2 hours at 45 °C (113 °F).
(4)	Lightly sand the HS filler with 320 grit sanding paper.	
(5)	Make sure that the area to be repaired is clean and free from any contaminants.	If necessary, use acetone and re-sand the area.
(6)	Apply the coating paint.	Obey the paint manufacturer's instructions.
(7)	Allow the coating paint to dry.	90 minutes at 45 °C (113 °F), then 2 days at 20 °C (68 °F).

B. Class 4 Repairs

The repair of minor scratches, abrasions or similar damage which is not a crack or a puncture in the skin.

	Detail Steps/Work Items	Key Items/References
	WARNING: DO NOT GET ACETONE ON YOUR SKIN. ACETONE CAN CAUSE SKIN DISEASE. **WARNING: DO NOT BREATHE ACETONE FUMES. ACETONE FUMES CAN CAUSE DISEASE.**	
(1)	Sand the repair area with 150 grit sanding paper.	
(2)	Make sure that the area to be repaired is clean and free from any contaminants.	If necessary, use acetone.
(3)	Apply putty to the repair area to fill any damage.	Obey the putty manufacturer's instructions. Fill to the original contour of the structure.
(4)	Allow the putty to cure.	5 to 20 minutes.
(5)	Lightly sand the putty with 150 grit sanding paper.	
(6)	Apply filler(s) and paint coat.	Refer to Paragraph 8.

Table 2 - Material Specifications

WLB No. (German Aviation Standard)	Manufacturer and Type	Material	Weave	Weight per unit area [g/m^2]	Thick-ness [mm]	Scarf [mm]
8.4548.60	Interglas 92110	glass	2/2 twill	163	0.17	7
8.4551.60	Interglas 92125	glass	2/2 twill	280	0.30	12
8.4554.60	Interglas 92140	glass	2/2 twill	390	0.43	18
8.4520.6	Interglas 92145	glass	uni-directional	220	0.23	19
8.4525.60	Interglas 92146	glass	uni-directional	425	0.43	35
8.3520.80	Interglas 98141, Cramer CCC 452	carbon	2/2 twill	200	0.30	18
	Cramer CCC 459 Al	carbon with aluminum	2/2 twill	220	0.32	20
	SGL Sigratex KDU 1034	carbon	uni-directional tape	380	0.40	80

C. Class 3 Repairs

Small holes or cracks in the outer skin where there is no internal damage to the component, the sandwich material, or the inner skin.

<table>
<tr><th></th><th>Detail Steps/Work Items</th><th>Key Items/References</th></tr>
<tr><td>(1)</td><td>Make sure that the area around the damage is clean.</td><td></td></tr>
<tr><td>(2)</td><td>Carefully examine the area around the damage. Look specially for disbonding between the inner laminate layers and any core material.</td><td>Do a coin tap test to find the extent of any disbonding or delamination.</td></tr>
<tr><td>(3)</td><td>Remove damaged/loose laminate until the edges of the laminates bond together and to any core material.</td><td>Refer to Figure 1.
Use a sharp knife or grinding disk.</td></tr>
<tr><td>(4)</td><td>Scarf the edges of the repair area with a grinding disk or block.</td><td>Refer to Table 2 for data about the scarf size.</td></tr>
<tr><td>(5)</td><td>Count the layers of fabric that you will need to replace.</td><td>Refer to the lay-up drawing for the related structure for data about the cloth type and orientation.</td></tr>
<tr><td colspan="3">WARNING: DO NOT GET ACETONE ON YOUR SKIN. ACETONE CAN CAUSE SKIN DISEASE.

WARNING: DO NOT BREATHE ACETONE FUMES. ACETONE FUMES CAN CAUSE DISEASE.

CAUTION: THERE MUST BE NO GREASE OR DUST ON THE REPAIR AREA. GREASE AND DUST PREVENT A GOOD BOND.</td></tr>
<tr><td>(6)</td><td>Clean the area of the repair.</td><td>If you use acetone to remove any grease or dirt then you must re-sand the repair area.</td></tr>
</table>

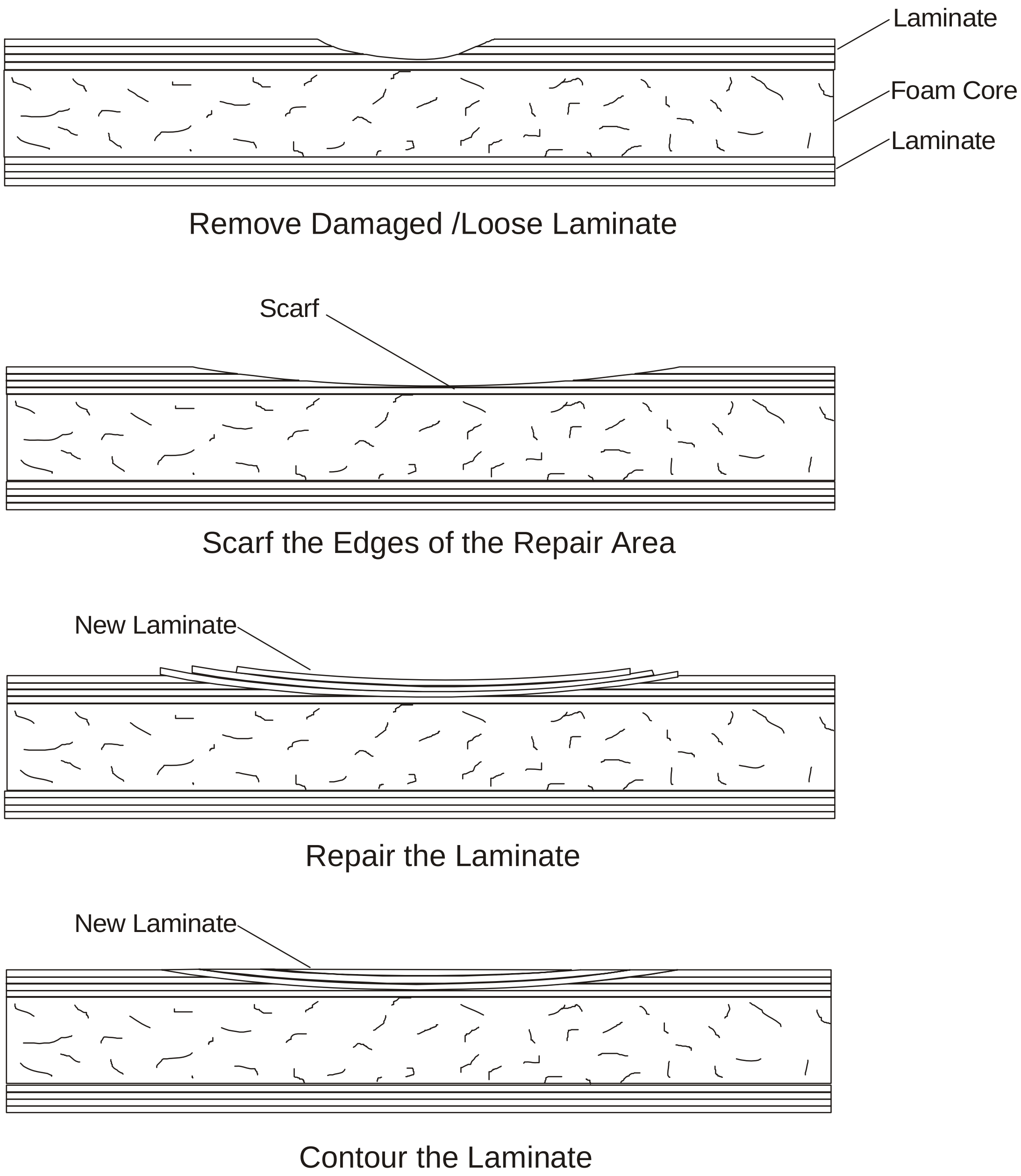

Figure 1: Typical Class 3 Repair

	Detail Steps/Work Items	Key Items/References
	WARNING: DO NOT GET RESIN ON YOUR SKIN. RESIN CAN CAUSE SKIN DISEASE. **WARNING: DO NOT GET RESINS, HARDENERS OR SOLVENTS IN YOUR MOUTH OR IN YOUR EYES. THESE CHEMICALS CAN CAUSE DISEASE.**	
(7)	Repair the laminate.	Use one of the 2 methods given in Paragraph 5.
(8)	Pre-cure the repair.	Refer to Paragraph 7.
(9)	Post-cure the repair.	Refer to Paragraph 7.
(10)	When the repair is fully post cured, remove the peel ply and sand smooth the surface of the repair.	
(11)	Contour the repair so that the final surface level of the repair is slightly lower than the original surrounding area.	Use 150 grit sanding paper. To allow for the paint coat.
(12)	Apply filler(s) and paint coat.	Refer to Paragraph 8.

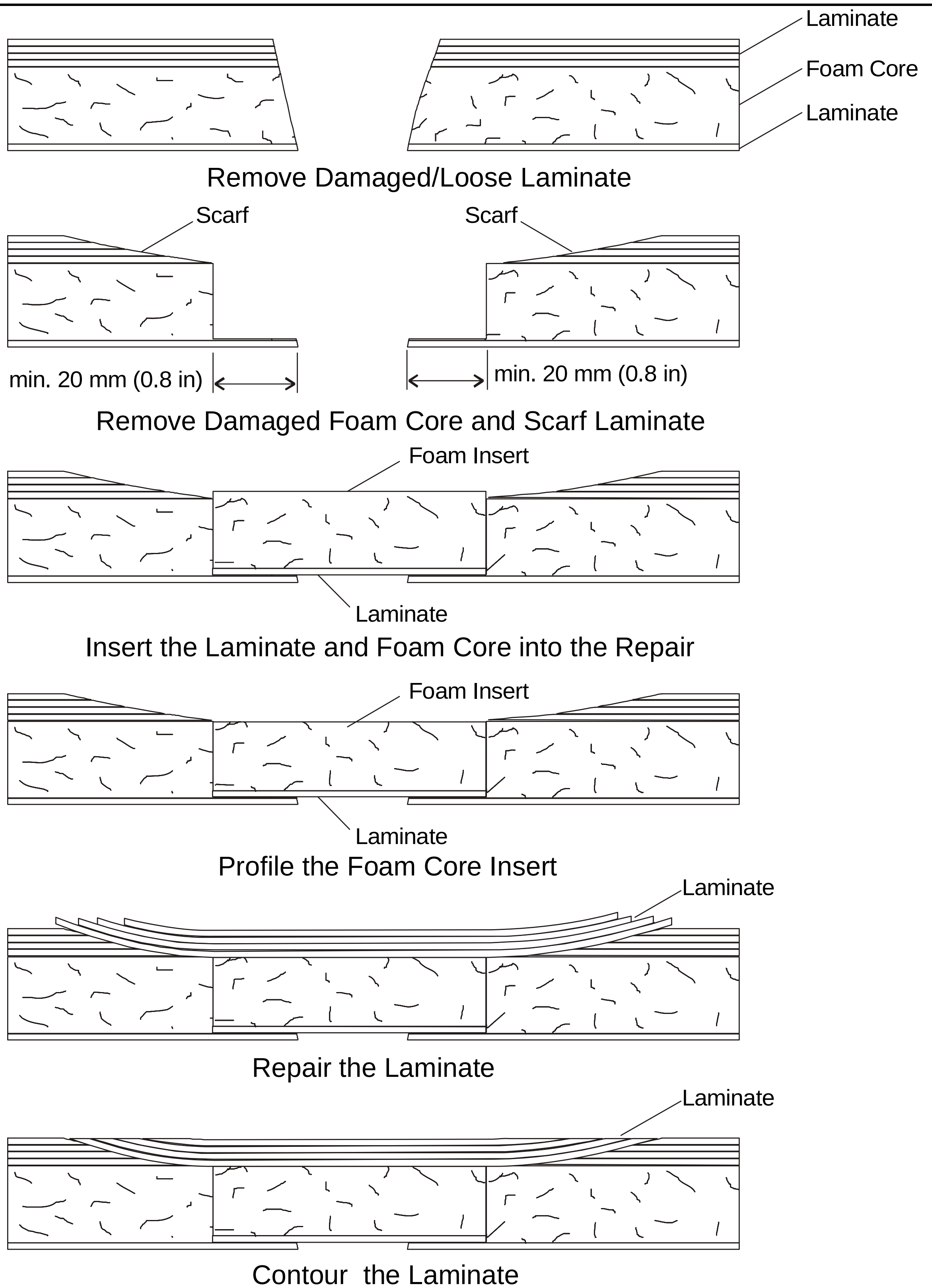

Figure 2: Typical Class 2 Repair

D. Class 2 Repairs

Holes and cracks passing through both skins of a sandwich construction component. The core damage must be able to be covered by a 75 mm (3 in) diameter circle.

<table>
<tr><th></th><th>Detail Steps/Work Items</th><th>Key Items/References</th></tr>
<tr><td>(1)</td><td>Make sure that the area around the damage is clean.</td><td></td></tr>
<tr><td>(2)</td><td>Carefully examine the area around the damage. Look specially for disbonding between the inner laminate layers and the foam core.</td><td>Do a coin tap test to find the extent of any disbonding or delamination.</td></tr>
<tr><td>(3)</td><td>Remove exterior laminate which is damaged or has become disbonded from the foam core. The edge of the laminate must bond to the foam core.</td><td>Refer to Figure 2.</td></tr>
<tr><td>(4)</td><td>Remove the damaged foam core.</td><td>Remove sufficient foam core to give a minimum of a 20 mm (0.8 in) edge around the outside of the damaged area. Refer to Figure 1.</td></tr>
<tr><td>(5)</td><td>Scarf the edges of the external laminate repair area with a grinding disk or block.</td><td>Refer to Table 2 for data about the scarf size.</td></tr>
<tr><td colspan="3">WARNING: DO NOT GET ACETONE ON YOUR SKIN. ACETONE CAN CAUSE SKIN DISEASE.

WARNING: DO NOT BREATHE ACETONE FUMES. ACETONE FUMES CAN CAUSE DISEASE.

CAUTION: THERE MUST BE NO GREASE OR DUST ON THE REPAIR AREA. GREASE AND DUST PREVENT A GOOD BOND.</td></tr>
<tr><td>(6)</td><td>Clean the area of the repair.</td><td>Use acetone only if any grease or dirt comes to the surface of the repair.</td></tr>
<tr><td>(7)</td><td>Cut and shape a piece of foam core to replace the damaged foam core that you removed in step 4.</td><td>Use a sharp knife to cut the foam.</td></tr>
<tr><td>(8)</td><td>Prepare the layers of cloth that you will need to laminate on the inner surface of the foam core.</td><td>Refer to the lay-up drawing for the related structure for data about the cloth type and orientation.</td></tr>
</table>

	Detail Steps/Work Items	Key Items/References
	WARNING: DO NOT GET RESIN ON YOUR SKIN. RESIN CAN CAUSE SKIN DISEASE. **WARNING: DO NOT GET RESINS, HARDENERS OR SOLVENTS IN YOUR MOUTH OR IN YOUR EYES. THESE CHEMICALS CAN CAUSE DISEASE.**	
(9)	Prepare the foam core for inserting in the repair: – Apply a thin coat of resin to the foam core. – Apply a coat of thickened resin to the foam core. – Laminate the inner layers of cloth onto the inner surface of the foam core. Make sure that the fibers in the cloth point in the correct direction.	 Refer to Paragraph 6. Use one of the 2 methods given in Paragraph 5.
(10)	Apply a thin coat of resin to the area to be repaired.	
(11)	Put the foam core and inner laminate into position in the repair.	
(12)	Pre-cure the repair.	Refer to Paragraph 7.
(13)	Use a sanding disk or block to contour the foam core to the correct shape.	Refer to Figure 2.
(14)	Clean the repair.	
(15)	Apply a coat of thickened resin to the foam core of the repair.	
(16)	Apply a thin coat of resin to the scarfed edges of the outer laminate of the repair.	
(17)	Repair the outer laminate.	Use one of the 2 methods given in Paragraph 5.
(18)	Pre-cure the repair.	Refer to Paragraph 7.
(19)	Post-cure the repair.	Refer to Paragraph 7.

	Detail Steps/Work Items	Key Items/References
(20)	When the repair is fully post cured, remove any peel ply and sand smooth the surface of the repair.	
(21)	Contour the repair so that the final surface level of the repair is slightly lower than the original surrounding area.	Use 150 grit sanding paper. To allow for the paint coat.
(22)	Apply filler(s) and paint coat.	Refer to Paragraph 8.

9. Repair of Fire Retardant Paint

The following maintenance practices describe how to do a repair of fire retardant paint of a cowling and the fuselage bottom aft of the engine.

NOTE: If the Fire Retardant Paint of a cowling must be repaired, remove the cowling from the airplane. Make sure that the outside of the cowling is protected against damage.

	Detail Steps/Work Items	Key Items/References
WARNING:	OBEY THE SAFETY PRECAUTIONS THAT FOLLOW WHEN YOU DO WORK WITH COMPOSITE MATERIALS: - DO THE WORK IN AN AREA THAT HAS A GOOD FLOW OF CLEAN AIR. - USE APPROVED EYE, MOUTH, AND BODY PROTECTION. SMALL PARTICLES CAN GO THROUGH USUAL CLOTHING. - DO NOT LET THE MATERIALS TOUCH YOUR EYES, MOUTH, OR SKIN. - IF IRRITATION OCCURS, GET MEDICAL AID IMMEDIATELY. - OBEY THE MANUFACTURER'S INSTRUCTIONS. - DO NOT USE CHEMICAL PAINT REMOVERS. TO REMOVE PAINT FROM COMPOSITES THAT HAVE RESIN, USE ABRASIVE MATERIALS. - DO NOT USE POWER TOOLS TO MAKE A SURFACE ROUGH.	
WARNING:	YOU CAN CAUSE INJURY TO PERSONS AND/OR DAMAGE TO EQUIPMENT IF ABOVE SAFETY PRECAUTIONS ARE NOT OBEYED.	

	Detail Steps/Work Items	Key Items/References
(1)	Prepare the area(s) for the application of the fire retardant paint, as follows: – If dirt or grease is present, wash the area with clean carbon tetrachloride or acetone. Wipe the area off immediately. – Abrade the surface with 280 grit sandpaper. – Remove the dust with a fully opened tack cloth. – Cover the area(s) that will not be painted. Use masking tape to hold the cover(s) in place.	Make sure that you do not damage the laminate. Only remove the transparent top coat and the fire resistant paint.

WARNING: OBEY THE SAFETY PRECAUTIONS THAT FOLLOW WHEN YOU USE PAINTS:

- **USE SAFETY GOGGLES.**
- **USE SAFETY CLOTHING.**
- **DO NOT LET PAINTS TOUCH YOUR SKIN, EYES, OR MOUTH**
- **PAINTS ARE POISONOUS**
- **IF IRRITATION OCCURS, GET MEDICAL AID**
- **DO THE WORK IN AN AREA THAT HAS A GOOD FLOW OF AIR**
- **DO THE WORK IN AN AREA THAT DOES NOT HAVE SPARKS, FLAME, OR HOT SURFACES.**
- **OBEY THE MANUFACTURER'S INSTRUCTIONS.**

WARNING: YOU CAN CAUSE INJURY TO PERSONS AND/OR DAMAGE TO EQUIPMENT IF ABOVE SAFETY PRECAUTIONS ARE NOT OBEYED

	Detail Steps/Work Items	Key Items/References
(2)	Apply the first coat of fire retardant paint with a splatter spray gun, a brush or a roller to a minimum thickness of 250 microns (0.010 in).	For approved materials and suppliers, refer to Chapter 51-30. Make sure that the painting is done in a dust free area.
(3)	Let the fire retardant paint dry, in a dust free area, for a minimum of four hours.	
(4)	Remove any dust that has collected with a fully opened tack cloth.	
(5)	After a minimum of four hours, apply the second coat of fire retardant paint with a splatter spray gun, a brush or a roller to a minimum thickness of 0.010 in (250 microns).	Make sure that the painting is done in a dust free area.
(6)	Let the fire resistant paint dry, in a dust free area, for a minimum of 24 hours.	
(7)	Before the transparent top coat is applied, remove any dust that has collected with a fully opened tack cloth.	
(8)	Apply the first coat of transparent top coat with a high pressure sprayer as an even cross coat.	For approved materials and suppliers, refer to Chapter 51-30. Make sure that the painting is done in a dust free area.
(9)	Allow it to dry for 30 to 45 minutes and apply the second coat.	
(10)	Apply the two cross coats to achieve the required thickness.	Film thickness: For the first coat: 25 microns For the second coat: 35 microns. Total thickness: 60 microns (0.002 in or 2.3 mil)
(11)	Let the transparent top coat dry, in a dust free area.	
(12)	Remove and discard the cover(s) and masking tape. Remove any dust that has collected with a fully opened tack cloth.	

	Detail Steps/Work Items	Key Items/References
(13)	Visually inspect the completed paint repair(s). Make sure that there are no defects, such as bubbles, pinholes, craters, chips, scratches or abrasions.	

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Section 51-30
Materials

1. General

You must only use approved materials from approved sources to repair the DV 20 E airplane.

Note: If the approved material for the repair work is not available please contact Diamond Aircraft Industries for information about alternative materials.

2. Approved Materials

A. Resin System

Resin : L 285
Hardener : H 286
Mixture : 100 parts resin and 40 ± 2 parts hardener (by weight)

Supplier : Hexion Speciality Chemicals Stuttgart GmbH
Am Ostkai 21/22
D-70327 Stuttgart, Germany
Phone : +49-711-323081
Fax : +49-711-3280041

B. Glass Fiber Cloth

WLB No. (German Aviation Standard)	Weave	Weight per Unit Area [g/m²]	Interglas Type	Porcher Type
8.4548.60	2/2 twill	163	92110	917
8.4551.60	2/2 twill	280	92125	3063
8.4554.60	2/2 twill	390	92140	1989
8.4520.6	UD	220	92145	
8.4525.60	UD	425	92146	

All cloth types consist of alkali free E-glass with I 550 or PT 55 finish and comply with LN 9169 (German aviation standard).

Supplier for Interglas fabric : Rudolf Usner GmbH
Am Ausferngenufer 4
A-5400 Hallein, Austria
Phone : +43-6245-81516
Fax : +43-6245-81516-40

Supplier for Porcher fabric : Porcher Industrietextilien GmbH
Holzgraben 13/15
D-52062 Aachen, Germany
Phone : +49-241-48225
Fax : +49-241-48229

C. Carbon Fiber Cloth

WLB No. (German Aviation Standard)	Weave	Mass per Unit Area [g/m²]	Interglas Type	Cramer Type	SGL Type
8.3520.80	2/2 twill	200	98141	CCC 452	
	UD tape	380			Sigratex KDU 1034

The cloth complies with LN 9169 (German aviation standard).

Supplier for Interglas fabric : Rudolf Usner GmbH (see above)

Supplier for Cramer fabric : CCC C. Cramer & Co
Postfach 2163
D-48616 Heek-Nienborg, Germany
Phone : +49-2568-9315-34
Fax : +49-2568-9315-93

Supplier for SGL tape : SGL Technik GmbH
Werner von Siemens-Str. 8
D-86405 Meitingen, Germany
Phone: +49-8271-832152
Fax: +49-8271-831427

D. Peel Ply

Type	: PA 20-63, compliant with LN 98690
Supplier	: Strübel Vertriebs GbR Herrlingerstr. 36/1 D-89081 Ulm, Germany Phone : +49-731-388577-1, -2 Fax : +49-731-9387353

E. Sandwich Core Material

Type	: PVC rigid foam Divinycell H 60
Thickness	: 3 mm, 6 mm, 8 mm
Supplier	: Conti Tech Kautschuk- und KunststoffvertriebsgesmbH Industriestr. 31 A-2353 Guntramsdorf, Austria Phone: +43-2236-49101-0 Fax: +43-2236-49101-49

Type	: Airex C70.55, Airex C71.55
Manufacturer	: Alcan
Supplier	: Polychem HandelsgesmbH Markt Allhau Nr. 463 A-7411 Markt Allhau, Austria Phone: +43-3356-20444 Fax: +43-3356-20445 E-Mail: chemie@polychem.at

F. Fillers for Resin

(1) Cotton Flakes FB1/035

Supplier	: Rudolf Usner GmbH (see above)

(2) Silcell 300

Supplier	: Joh. Klinglhuber & Söhne Handelsgesellschaft mbH Wallgasse 21 A-1060 Vienna, Austria Phone : +43-1-5974712-0 Fax : +43-1-5974712-16

(3) Aerosil 380

Supplier	: Polychem HandelsgesmbH Markt Allhau Nr. 463 A-7411 Markt Allhau, Austria Phone : +43-3356-20444 Fax : +43-3356-20445 E-Mail : chemie@polychem.at

G. Exterior Paint

(1) Putty

(a)

Putty	: Sikkens Polysoft
Manufacturer	: Akzo Nobel
Supplier	: Akzo Nobel Coatings GesmbH Baudißg. 10 A-1110 Vienna, Austria Phone : +43-1-7674488 Fax : +43-1-7674488-33

or (b)

Putty	: ICI P551-1052
Manufacturer	: ICI Paints, Berkshire, Great Britain
Supplier	: ICI Autocolor der PPG (Austria) Handels GmbH Rautenweg 15 A-1220 Vienna, Austria Phone : +43-1-2562704-53 Fax : +43-1-2562700-47

(2) HS Filler

Filler	: HS Filler ICI P565-889
Manufacturer	: ICI Paints, Berkshire, Great Britain
Supplier	: ICI Autocolor (see above)

(3) Coating Paint

(a) Durodur

Coating paint	: Durodur 3067-R916g; color: RAL 9016 (white) or DB 147 (white)
Manufacturer	: Morton International GmbH, Strullendorf, Germany
Supplier	: Lorenz Industrielacke (see above)

or

(b) ICI

Coating paint	: ICI Turbo Plus P488-1111; color RAL 9016 (white) or DB 147 (white)
Manufacturer	: ICI Paints, Berkshire, Great Britain
Supplier	: ICI Autocolor Bachstr. 75 A-5020 Salzburg, Austria Phone : +43-662-643681 Fax : +43-662-643686

H. Interior Paint

(1) Putty

(a)

Putty	: Sikkens Polysoft
Manufacturer	: Akzo Nobel
Supplier	: Akzo Nobel Coatings GesmbH (see above)

or (b)

Putty	: ICI P551-1052
Manufacturer	: ICI Paints, Berkshire, Great Britain
Supplier	: ICI Autocolor (see above)

(2) Coating Paint

Glare shield	: Nuvovern DS 10/1 + Nuvovern ACR
Instr. panel cover	: Nuvovern DS 10/1 + Nuvovern ACR
Other interior parts	: Nuvovern DS 10/1
Manufacturer	: Mäder Lacke AG, Killwangen, Switzerland
Supplier	: Walter Mäder GmbH Wiener Str. 99 A-2514 Traiskirchen, Austria Phone : +43-2252-53038 Fax : +43-2252-52297

I. Fire Retardant Paint

(1) Courtaulds

Fire retardant paint: Courtaulds Aerospace N 56582/T508 (white)

Finishing varnish : Courtaulds Aerospace 4232-0303

Hardener : Courtaulds Aerospace N 39/1327 (4:1)

Supplier : PRO-DeSoto Deutschland GmbH
Aerospace Coatings
Lauenburger Landstr. 11
D-21039 Börnsen, Germany
Phone : +49-40-742193-10
Fax : +49-40-742139-69

(2) Hensel

Fire retardant paint: Hensotherm 2 KS (white)

Coating paint : Hensotop 84 f

Supplier : Rudolf Hensel GmbH
Lack- und Farbenfabrik
Süderstraße 235
D-20537 Hamburg, Germany
Phone :+49-40-214093
Fax :+49-40-214783

(3) Desothane

(a)

Fire retardant paint: Desothane HS Buffable Clear Coat 9008B900D

Hardener : 9008B

or (b)

Fire retardant paint: Desothane HS Matt Clear Coat CA8720M0900C

Hardener : CA8000B

Manufacturer : PPG Aerospace

Supplier : PRC-Desoto International
Hein-Sass-Weg 29
D-21129 Hamburg-Finkenwerder, Germany

J. Acrylic Glass Cement

Acrylic glass cement : Polymerization cement Acrifix 92

Manufacturer : Röhm, Darmstadt, Germany

Supplier : Röhm Austria GmbH (see above)

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Section 51-60
Control Surface Balancing

1. General

This Section tells you how to weigh and measure the residual moment of the control surfaces.

For weights and residual moments refer to Chapter 06.

WARNING: YOU MUST WEIGH AND BALANCE A CONTROL SURFACE AFTER ANY WORK WHICH COULD AFFECT ITS WEIGHT OR ITS BALANCE. OUT OF BALANCE CONTROL SURFACES CAN FLUTTER AND CAUSE STRUCTURAL FAILURE.

Correct control surface balance is critical to flight safety. You must remove a control surface to weigh and balance it after:

– Any repair to the control surface.

– Painting the control surface.

– Any report of control vibration or flutter in flight.

You can use any convenient method to weigh a control surface. If you use anything to connect the control surface to the weighing device, (for example, a sling) you must weigh it separately. Then subtract its weight from the total value. For example, you use a rope sling to lift an aileron with a spring balance:

– Weight of the aileron and the rope sling	= 3.8 kg (8.3 lb)
– Weight of the rope sling	= 0.7 kg (1.5 lb)
– Weight of the aileron	= 3.8 kg (8.3 lb) - 0.7 kg (1.5 lb) = 3.1 kg (6.8 lb)

When you balance a control surface, the pivot angle of the control must be as shown in the Weights and Residual Moments Report.

We recommend that for balancing the flaps, aileron, elevator and elevator trim tab, you put a suitable size rod through the hinge bearings. Support the rod at two points to keep it horizontal.

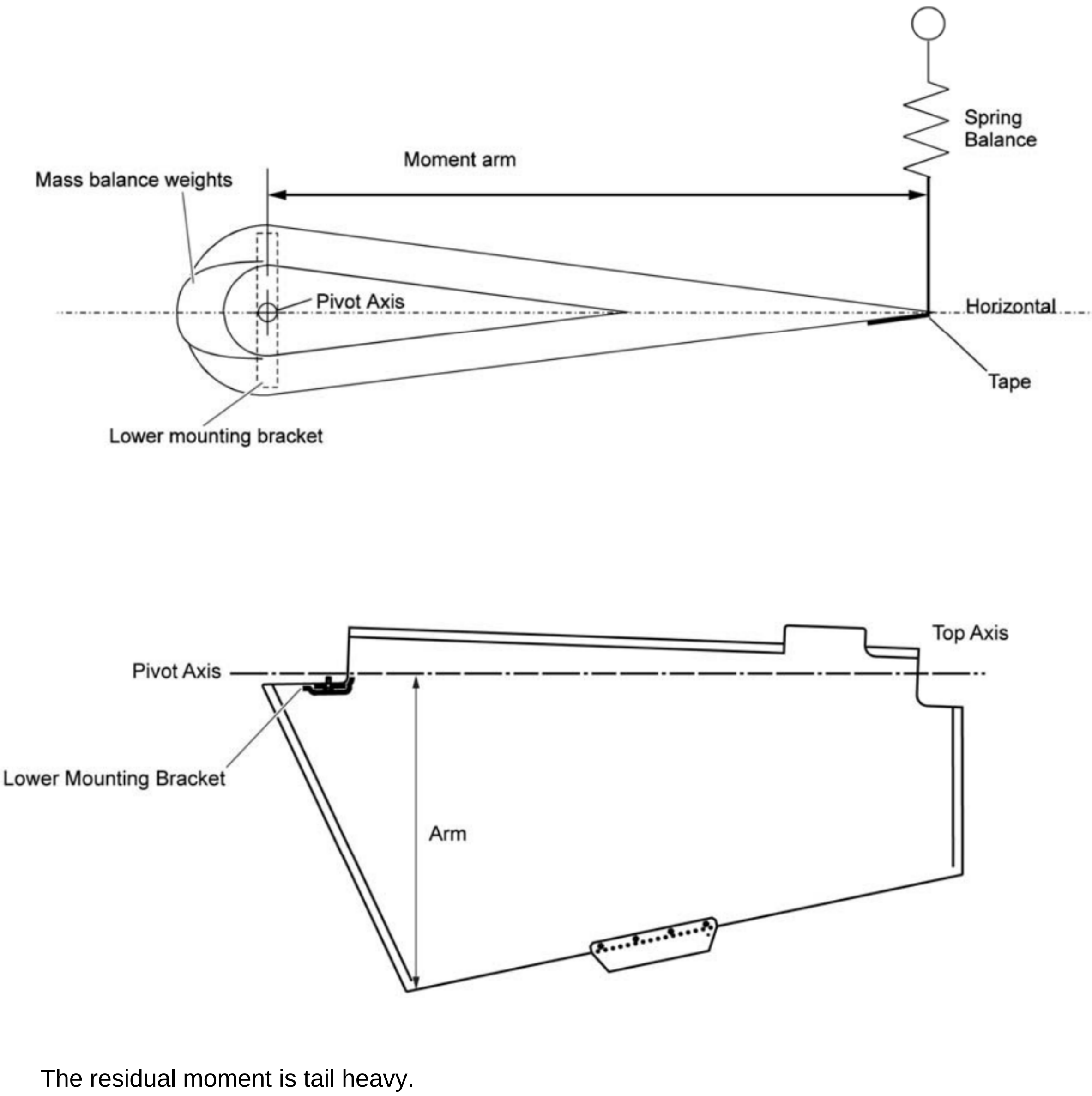
A. Rudder

To balance the rudder it must be supported at the top pivot pin and the bottom mounting bracket. The center line of the rudder must be horizontal.

Use any suitable method to support the rudder horizontally at the pivot axis.

The rudder must be able to rotate freely around the pivot axis.

Remove the stop bolts from the lower mounting bracket before weighing and balancing.



The residual moment is tail heavy.

Figure 1: Rudder Static Balance

B. Elevator

Use any suitable method to support the elevator horizontally at the pivot axis.

The elevator must be able to rotate freely around the pivot axis.

The balance includes the trim tab, trim tab control rod and horn.

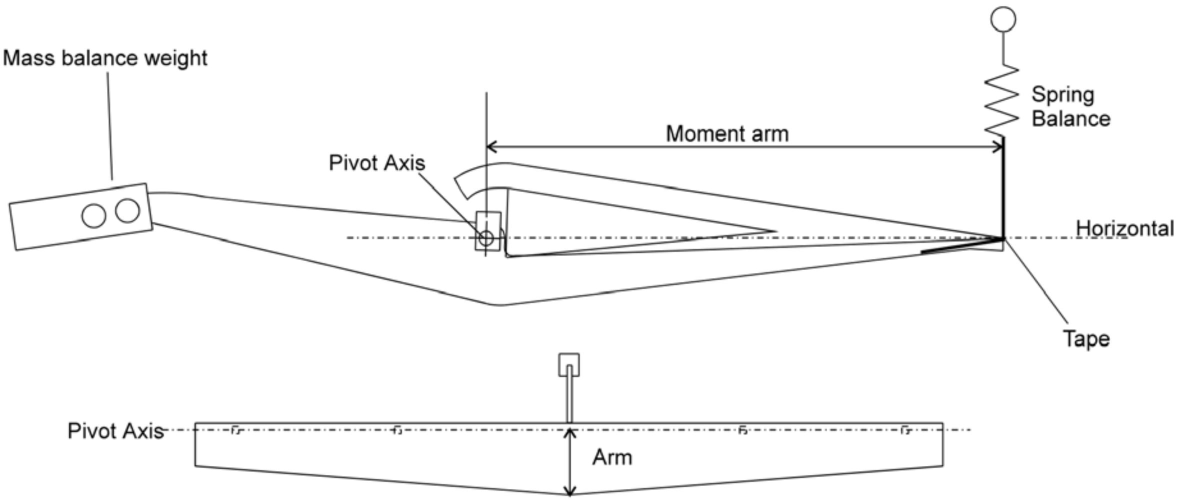


Figure 2: Elevator Static Balance

C. Aileron

Use any suitable method to support the aileron horizontally at the pivot axis.

The aileron must be able to rotate freely around the pivot axis.

The balance includes the horn, trim plate and hinges.

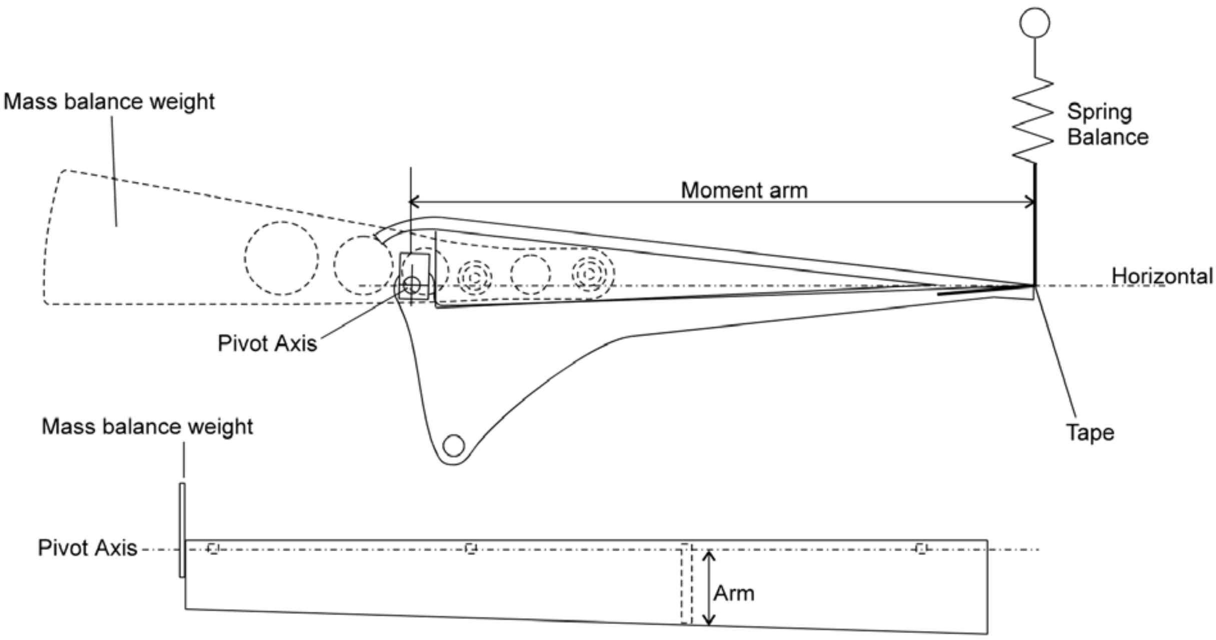


Figure 4: Aileron Static Balance

D. Flap

Use any suitable method to support the wing flap horizontally at the pivot axis.

The wing flap must be able to rotate freely around the pivot axis.

The balance includes the horn and hinges.

The residual moment is tail heavy.

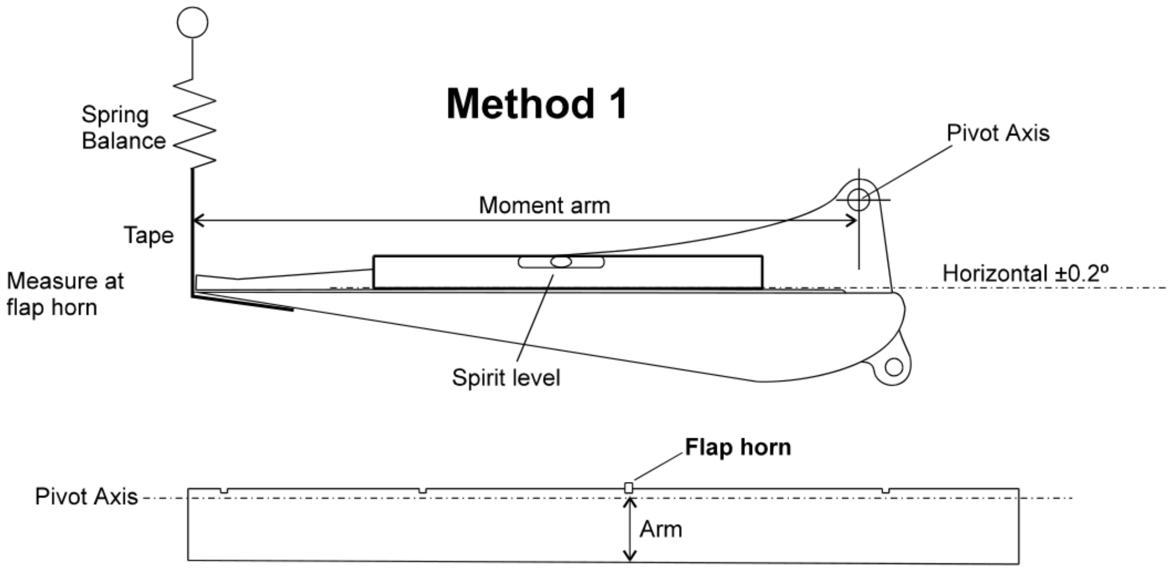


Figure 5: Wing Flap Static Balance

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CHAPTER 52

DOORS

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TABLE OF CONTENTS

CHAPTER 52

DOORS

Section 52-10

Canopy

Trouble-Shooting

Maintenance Practices

Section 52-40

Access Panels

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CHAPTER 52

DOORS

1. General

The DV 20 E airplane has two types of doors.

– The canopy which gives access to the cockpit.

– Access panels which give access to do maintenance.

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Section 52-10
Canopy

1. General

The DV 20 E airplane has a one-piece lifting canopy. It has a carbon-fiber reinforced plastic (CFRP) frame and one large acrylic glass. The canopy glass has two small emergency windows.

The canopy has a hinge at the back and a stabilizing rod on each side. The support arms have counterbalance springs to help operate the canopy.

A locking system locks the canopy closed. Two latch-levers operate the locking system. One lever is on the inside of the canopy on the left side. And one lever is on the inside of the canopy on the right side.

The canopy has a warning light system. The red warning light comes on when the canopy is not correctly locked. The warning light is on the instrument panel.

2. Description

A. Canopy Structure

Figure 1 shows the canopy. The canopy has a CFRP frame. A one-piece acrylic transparency attaches to the frame with screws and flexible adhesive. The transparency has two sliding side windows. The sliding side windows are on each side of the canopy and move in guide rails.

The canopy has a tubular rubber seal. The seal goes round the edge of the canopy frame. When the canopy is closed the seal touches the cockpit sill.

B. Canopy Hinges

The canopy attaches to the fuselage with three hinges. One hinge at the back of the canopy and one at each side. A large spring attaches between each side arm and the rear fuselage. The springs help balance the weight of the canopy.

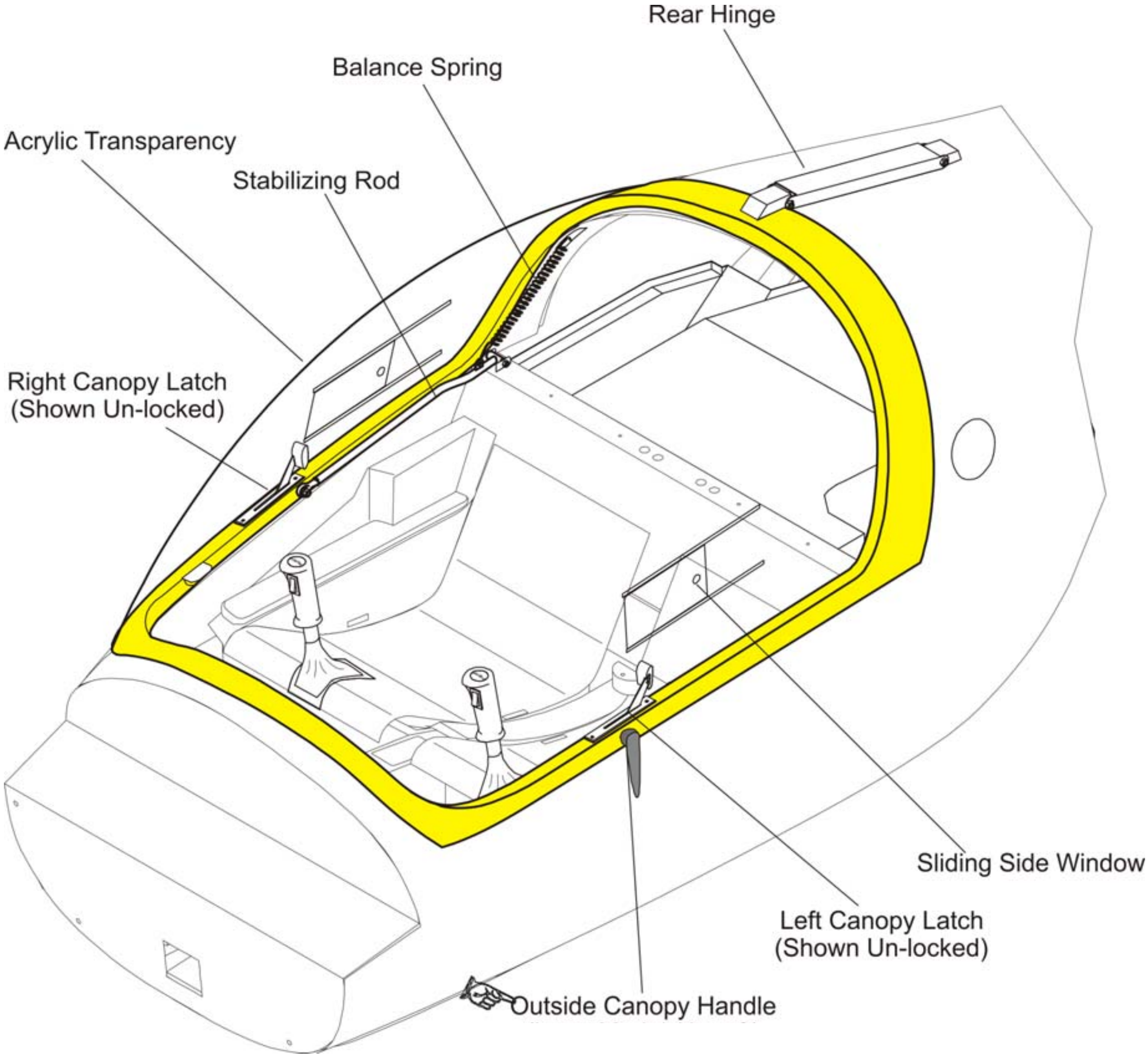

Figure 1: Canopy

C. Canopy Locking

A latch mechanism attaches to each side of the canopy. The latches are constructed as follows (Refer to Figure 2):

The single steel plate is attached to the canopy frame by four steel screws and separated from the frame by two steel shims and an FRP spacer at each end. The shaft of the external handle is inserted into a bushing permanently installed in the steel plate. The shaft has an "O"-ring seal that provides friction. The friction is not adjustable on aircraft with outside handles. The internal handle/hook is fastened to the external handle via three screws. A screw to limit the travel of the mechanism is also fastened to the steel plate.

A strike bearing attaches to each side of the fuselage next to the canopy rail. A ball bearing that turns on a stainless steel shaft makes the strike bearing. The strike bearing attaches to an aluminum block. The aluminum block attaches to the underside of the fuselage at the canopy rail. A micro-switch with a roller lever goes behind the bearing. The micro-switch will only operate when the hook completely engages the strike bearing.

The part of the hook that engages the strike bearing is shaped with a small ramp that ends to make a recess. As the grip is pushed forwards, the canopy is pulled downwards to compress the canopy seal. When the bearing drops into the recess the canopy is locked. The force necessary to open the canopy from this position will stop accidental operation. If the electrical power is set to on and both latches are not engaged, the red warning light on the instrument panel will come on.

D. Alignment Pins

A conical pin on each side of the canopy at the rear aligns the canopy when it is closed. The pins engage with conical alignment holes in the bottom of the canopy frame.

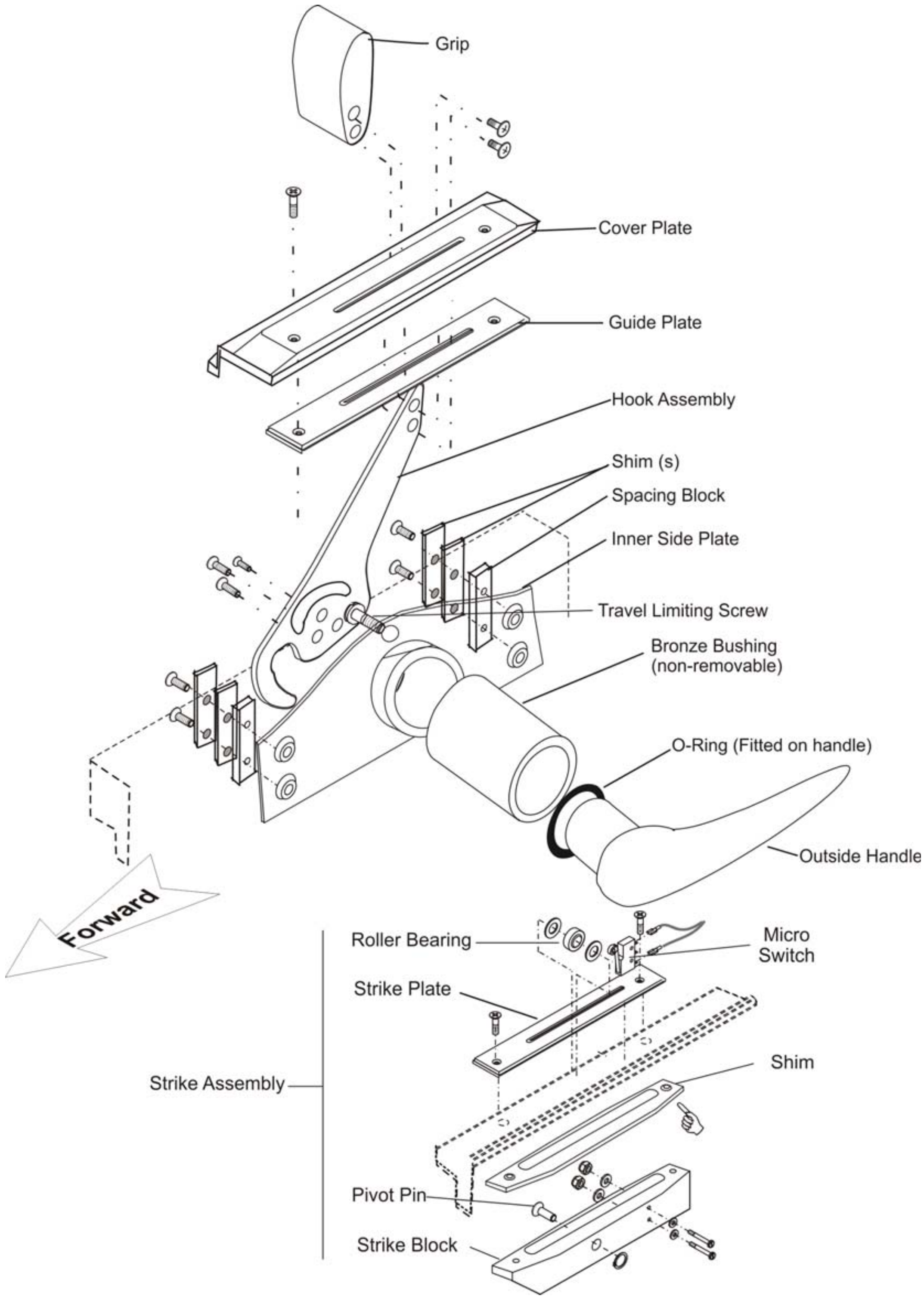

Figure 2 - Canopy Latch Installation

3. Operation

With the canopy lock set to open, the hook moves forward and disengages the strike bearing. The canopy can move up. You can access the canopy lock grips through the canopy sliding side windows externally.

A. Canopy Closed

These actions lock the canopy closed:

– Move the canopy fully down.

– Move both grips to the CLOSED position. (Both internal grips fully forward).

– The hook goes to the rear. It fully engages the strike bearing. It also operates the micro-switch. This pulls the canopy against the seals.

B. Canopy Open

These actions unlock the canopy:

– Move both grips to the OPEN position. (Both internal grips to the rear/aft).

– The hook moves forward and disengages the strike bearing.

– Push the canopy up.

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Trouble-Shooting

1. General

This table explains how to troubleshoot the canopy. If you have the trouble detailed in the Trouble column, read across to the Possible Cause column. Then do the repair given in the Repair column.

Trouble	Possible Cause	Repair
Canopy is hard to move.	Canopy frame damaged.	Replace the canopy.
Canopy unlock/lock grips hard to move.	Latch mechanism out of adjustment.	Adjust the latch mechanism.
Emergency side windows hard to move.	Emergency side window guides dirty or damaged.	Clean or replace the side window guides.
Canopy warning light does not operate correctly.	Canopy warning light out of adjustment.	Adjust the canopy warning light micro-switch.

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Maintenance Practices

1. General

The following Maintenance Practices describe how to remove and install the canopy and how to do a canopy latch force test/adjustment.

2. Remove/Install the Canopy

CAUTION: TWO PEOPLE WILL BE NEEDED TO REMOVE/INSTALL THE CANOPY. THE CANOPY WILL BE DAMAGED IF YOU DROP IT.

A. Remove the Canopy

	Detail Steps/Work Items	Key Items/References
(1)	Open the canopy.	
(2)	Remove the screws that attach the rear hinge to the rear of the canopy.	Hold the canopy.
(3)	Remove the rod end bearings from the stabilizing rods at the canopy frame.	
(4)	Lift the canopy clear of the airplane.	

B. Install the Canopy

	Detail Steps/Work Items	Key Items/References
(1)	Lift the canopy into position on the airplane. And hold the canopy open.	
(2)	Install the rod end bearings to the stabilizing rods at the canopy frame.	
(3)	Install the screws that attach the hinged tube to the rear of the canopy.	
(4)	Close the canopy and operate both canopy latches.	Make sure the canopy latch mechanism pulls the canopy fully closed.
(5)	Set the ELECTRIC MASTER switch to ON.	Make sure the canopy warning light goes out. If necessary, adjust the micro switches. (Refer to the micro-switch adjustment procedure).

3. Canopy Latch Force Test

A. Equipment

Item	Quantity	Part Number
Strap.	1	Commercial
Spring scale.	1	Commercial

B. Canopy Latch Force Test

	Detail Steps/Work Items	Key Items/References
(1)	Close the canopy.	
(2)	Set the ELECTRIC MASTER switch to ON.	
(3)	Make sure the canopy warning light goes off. – Set the ELECTRIC MASTER switch to OFF.	
(4)	Put a strap around the canopy grip at the top. Attach the spring scale to the strap. – Pull the spring scale straight aft and up at approximately 30 degrees. – Measure and record the force necessary to move the grip to the unlocked position. – If necessary, adjust the force required to move the grip.	 Force must be between 66 - 110 N (15 - 25 lbf). Refer to the adjustment procedure.
(5)	Do steps 1 through 4 for the other grip.	

4. Adjust the Canopy Latch Force

	Detail Steps/Work Items	Key Items/References
(1)	Release the screws which hold the strike block assembly to the fuselage.	Refer to Figure 2.
(2)	Lower the strike block assembly and install (or remove) shims as necessary to give the correct latch force.	Shim, strike, P/N 22-5600-00-15 and P/N 22-5600-00-18. Shims may be sanded to reduce their thickness.
(3)	Lift the strike block assembly into position.	Do not trap the cable for the canopy lock micro-switch.
(4)	Do a latch force test.	Refer to Paragraph 3.

5. Adjust the Canopy Warning Light Micro-Switch

	Detail Steps/Work Items	Key Items/References
(1)	Set the ELECTRIC MASTER switch to ON.	
(2)	Close the canopy.	Make sure both hooks are engaged past the detent.
(3)	Bend the micro-switch actuator in the necessary direction to operate the warning light correctly.	Both hooks must be engaged past the detent before the warning light goes out.
(4)	Open the canopy and close the canopy.	Make sure both hooks are engaged past the detent when the light goes off.
(5)	Make sure the canopy warning light operates correctly.	
(6)	Set the ELECTRIC MASTER switch to OFF.	

6. Remove/Install the Sliding Side Window

A. Remove the Sliding Side Window

	Detail Steps/Work Items	Key Items/References
(1)	Remove the air scoop lock as follows: – Remove the screw and the nut. – Remove the two thin washers and a nylon washer. – Remove the air scoop lock.	Refer to Figure 3.
(2)	Remove the clear and tinted sliding window air scoop as follows: – Remove the screw, the washer, and the nut from the sliding window air scoop hinge. – Remove the hinge. – Remove the clear/tinted sliding window air scoop.	Refer to Figure 3.
(3)	Remove the guide rails as follows: – Remove the nylon screws. – Remove the guide rails from the canopy window.	Refer to Figure 3.
(4)	Remove the sliding window as follows: – Remove the screws. – Remove the hinge block. – Remove the sliding window knob. – Remove the sliding window.	Refer to Figure 3.

B. Install the Sliding Side Window

	Detail Steps/Work Items	Key Items/References
(1)	Assemble the sliding window as follows: – Install the sliding window knob into the sliding window. – Install the hinge block using two screws.	Refer to Figure 3.
(2)	Install the sliding window with the guide rails.	
(3)	Secure the guide rails with eight nylon screws.	
(4)	If the sliding window installed does not include the clear/tinted sliding window air scoop and the air scoop lock, install as follows: – Install the hinge with the screw, the washer, and the nut. – Install the clear/tinted sliding window air scoop. – Install the air scoop lock with the screw, the nut, the two thin washers, and a nylon washer.	

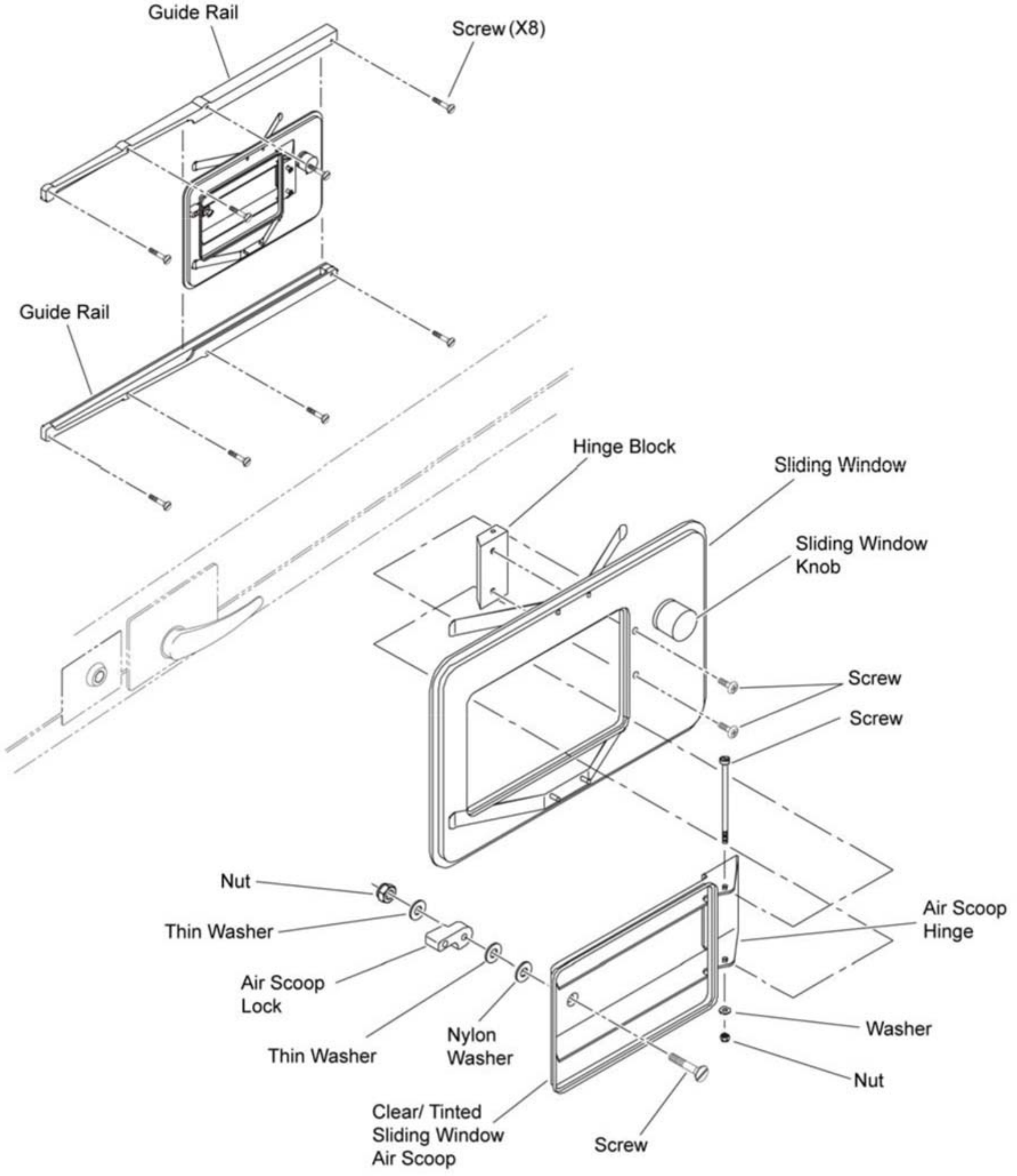

Figure 3: Sliding Window Assembly

Section 52-40
Access Panels

1. General

The DV 20 E airplane has a small number of access panels. The panels give access for maintenance. Most panels are GFRP moldings. Self-tapping screws or camlock (quick-release) fasteners hold the panels. Refer to Chapter 71-10 for data about the engine cowlings.

Figure 1 shows the access panel locations on the bottom of the airplane.

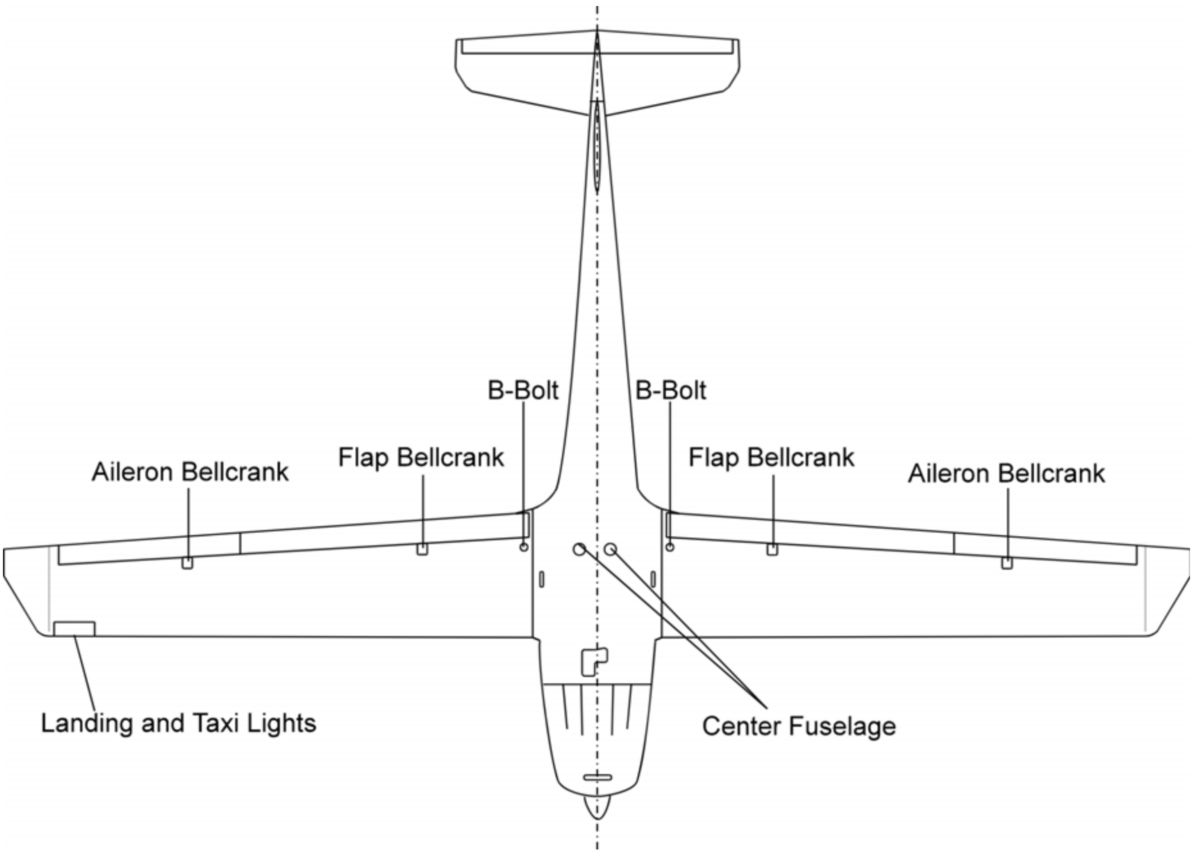

Figure 1: Access Panel Locations on the Bottom of the Airplane

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CHAPTER 53

FUSELAGE

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TABLE OF CONTENTS

CHAPTER 53

FUSELAGE

Section 53-10

Fuselage Structure

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CHAPTER 53
FUSELAGE

1. General

The DV 20 E airplane fuselage is a semi-monocoque structure. Two GFRP half-shells make the fuselage skin. GFRP frames and webs give strength and stiffness. Each half shell also makes the vertical stabilizer.

The fuselage shells have many layers of glass cloth. Some areas have more glass cloth than other areas. This gives more strength and stiffness where it is needed.

The frames and webs also have many layers of glass cloth. Some areas have layers of carbon fiber cloth to give extra strength. Some components also have inserts for attaching brackets or other components.

Chapter 53-10 gives the data for the fuselage structure.

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Section 53-10
Fuselage Structure

1. General

This Chapter describes the data about the fuselage structure. It also includes the vertical stabilizer. Refer to Chapter 51-00 for data about repair to the structure. The DV 20 E airplane has the following components in the fuselage structure:

– All of the main structural components are GFRP rigid moldings. Many layers of glass cloth bond together to make each molding. Some components have layers of carbon cloth or tape. This gives more strength and stiffness.

– Most components have rigid GFRP inserts. The inserts give strength and stiffness for attaching other components such as brackets for controls.

– Bonding paste (thickened resin) bonds each component to other components. Most components also bond to the fuselage shells.

2. Description

Figures 1 to 4 show the fuselage structure.

A. Fuselage Shells

Two GFRP shells make the outer skin of the fuselage. The shells transmit structural loads. The shells bond to each other at the top and bottom of the fuselage. Each shell has many layers of glass cloth. Some areas of the shell have more layers to give more strength and stiffness.

Thickened resin bonds all other structural components to the shells.

Many small components bond to the fuselage shells. These include:

– Air inlet and outlet ducts.

– Conduits for electrical wires, antenna cables and fuel pipes.

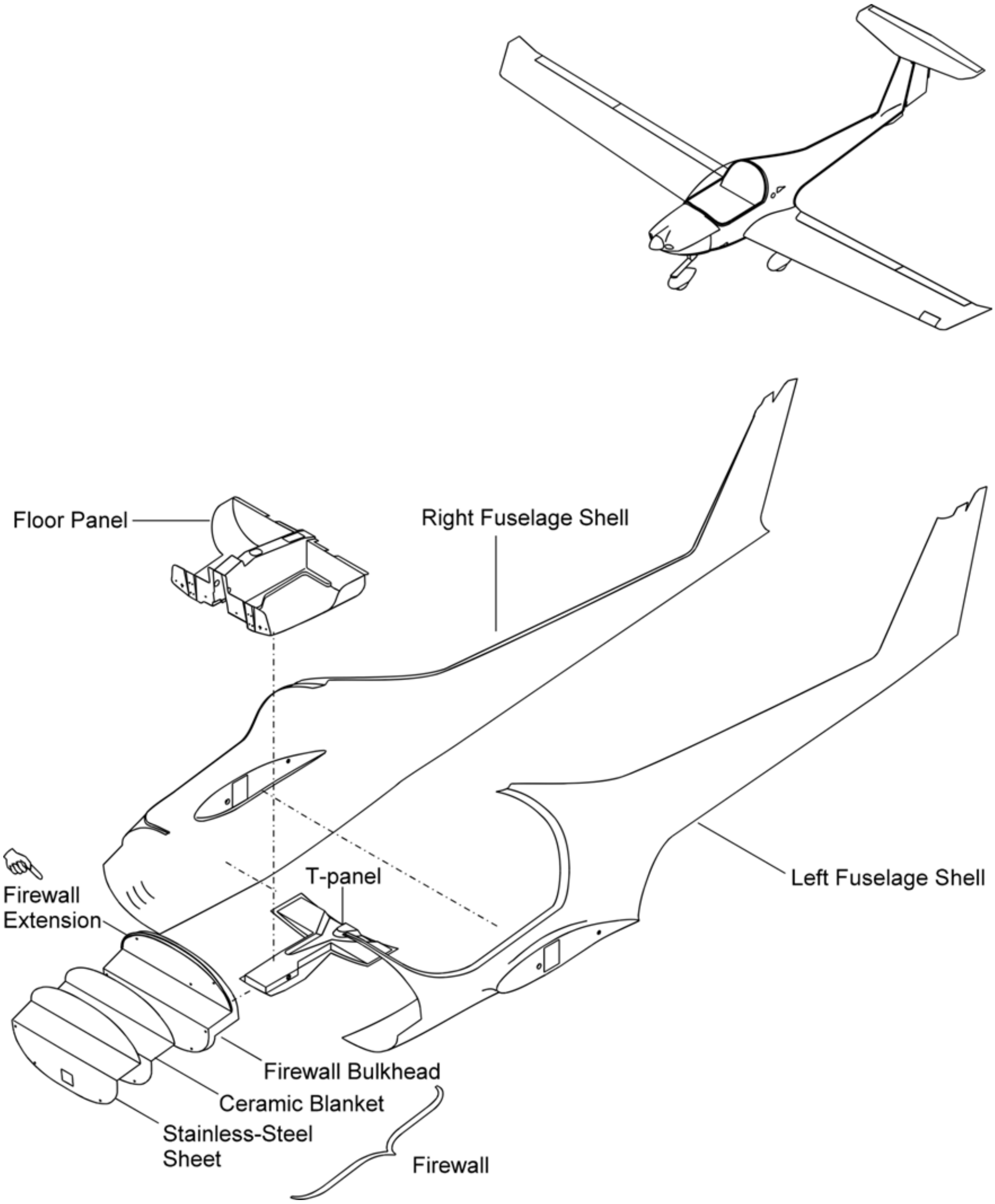


Figure 1 - Fuselage Shells and Front Fuselage Structure

B. Firewall

The firewall closes the front of the fuselage. It also holds the attachments for the engine mounting frame. It has holes for the different systems which connect to the engine.

The firewall is a rigid GFRP molding. A special adhesive bonds a fire-resistant ceramic blanket to the front face of the firewall. The adhesive also bonds a stainless-steel sheet to the front of the blanket. Components which go through the firewall also hold the stainless-steel sheet and blanket to the GFRP molding.

A GFRP extension bonds to the top of the firewall. It carries the seal for the engine cowling.

C. T-Panel

The T-panel bonds to the inner-bottom skin of the fuselage behind the firewall. It gives strength and stiffness to the front fuselage. It has mountings for the nose landing gear.

D. Floor

The floor is a rigid GFRP molding. It bonds to the inner-bottom skin of the fuselage shell behind the firewall. It goes over the T-panel. The center part of the floor makes the center console.

The rear part of the floor makes the front support for the pilot's seats. It also holds the front of the control stick support brackets. The rudder pedal assembly for each pilot attaches to the floor element.

E. Forward Control Bulkhead

The forward control bulkhead is a rigid GFRP molding. Rigid GFRP inserts make strong-points which hold the control components. The bulkhead bonds to the fuselage shell, the top of the T-panel and the center-tunnel. The control stick support brackets attach to the front face of the bulkhead.

F. Center Tunnel

The center tunnel is a rigid GFRP molding. An insert makes a strong-point which holds the front mounting for the flap actuator. A rigid GFRP insert holds the locking hook assembly for the main pins. The center tunnel bonds to the fuselage shells, the bulkhead, forward control and the spar bridge.

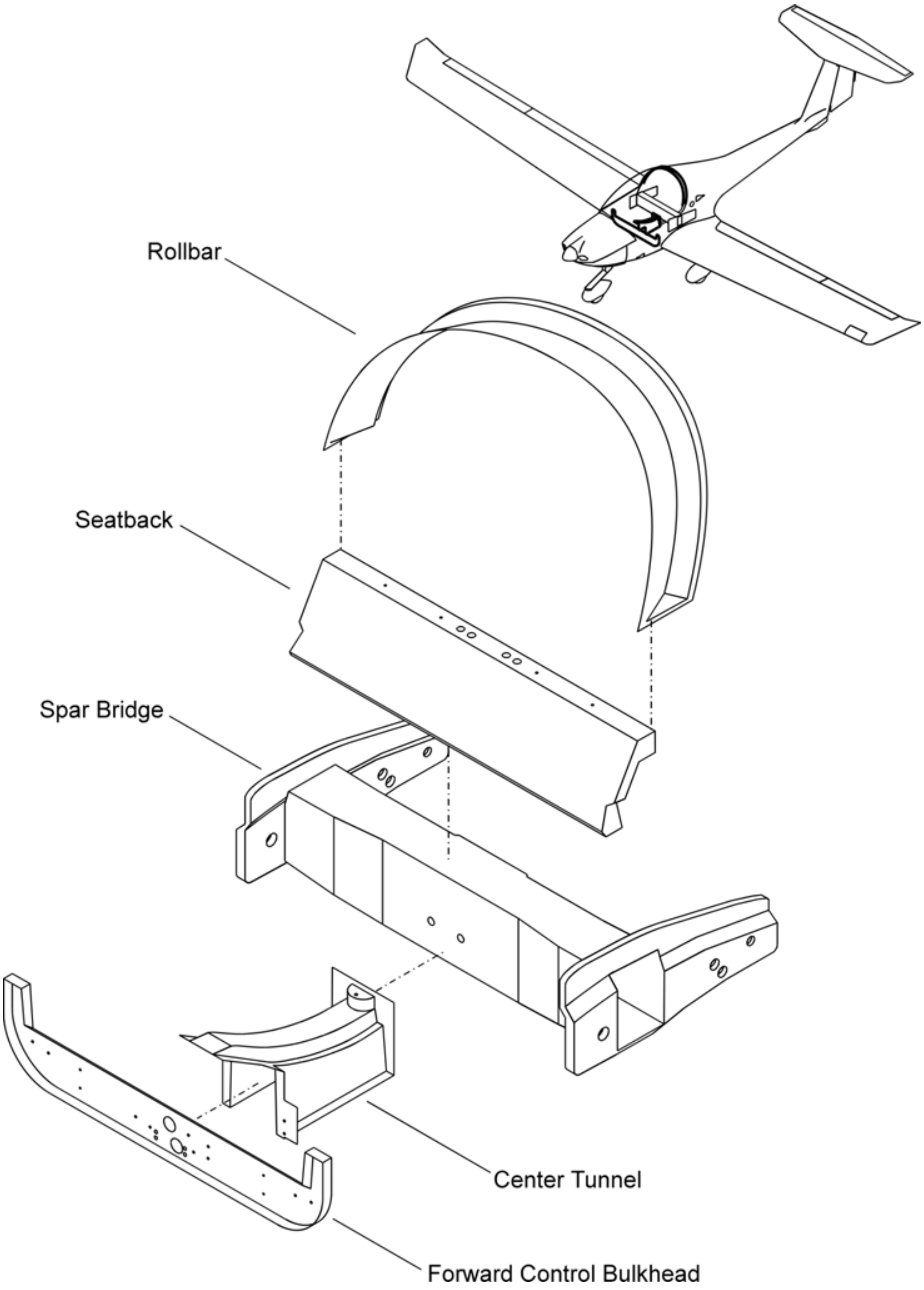


Figure 2 - Front Fuselage Structure

G. Spar Bridge

The spar bridge is a rigid GFRP box-section molding. It has layers of carbon cloth on the top and bottom faces. Each end is a strong web. Carbon cloth gives strength and stiffness to the webs. The webs bond to the spar bridge to the fuselage shells at the root rib area.

The center area of the spar bridge has 2 pairs of bushes for the wing main bolts. The webs hold the A and B bolt bushes for the wing attachment. The front face of the spar bridge has a large bracket for the inner end of the A-bolt. Bonding paste and 8 bolts attach each bracket to the spar bridge.

The spar bridge also has four attachments for the main landing gear. Refer to Chapter 32-10 for data about the landing gear attachments.

H. Seat Back

The seat back is a rigid GFRP molding. Carbon tape gives strength and stiffness to the top of the seat back. A rigid GFRP insert bonds inside the top of the seat back. The insert has strong-points for the pilot's safety belts.

The seat back bonds to the top face of the spar bridge. It also bonds to the fuselage shells.

I. Rollbar

The rollbar is a rigid GFRP molding. Carbon tape gives strength and stiffness to the rollbar. The rollbar bonds to the inner face of the fuselage shell around the rear cockpit cut-out.

J. Aft Control Bulkhead

The aft control bulkhead is a rigid GFRP molding. The middle part has top and bottom flanges which hold the control bellcranks. The bulkhead bonds to the aft face of the spar bridge. It also bonds to the fuselage shell.

K. B-bulkhead

The B-bulkhead is a large rigid GFRP molding. The main part of the bulkhead has a slope of about 45°. The middle of the bulkhead makes a box for the fuel tank.

L. Half bulkhead

The half bulkhead is a rigid GFRP molding. It bonds to the bottom of the fuselage shell just aft of the B-bulkhead. It has a guide bearing for the elevator control pushrod and holes for the rudder control cables. It has a cut-out on the right side for a cable conduit.

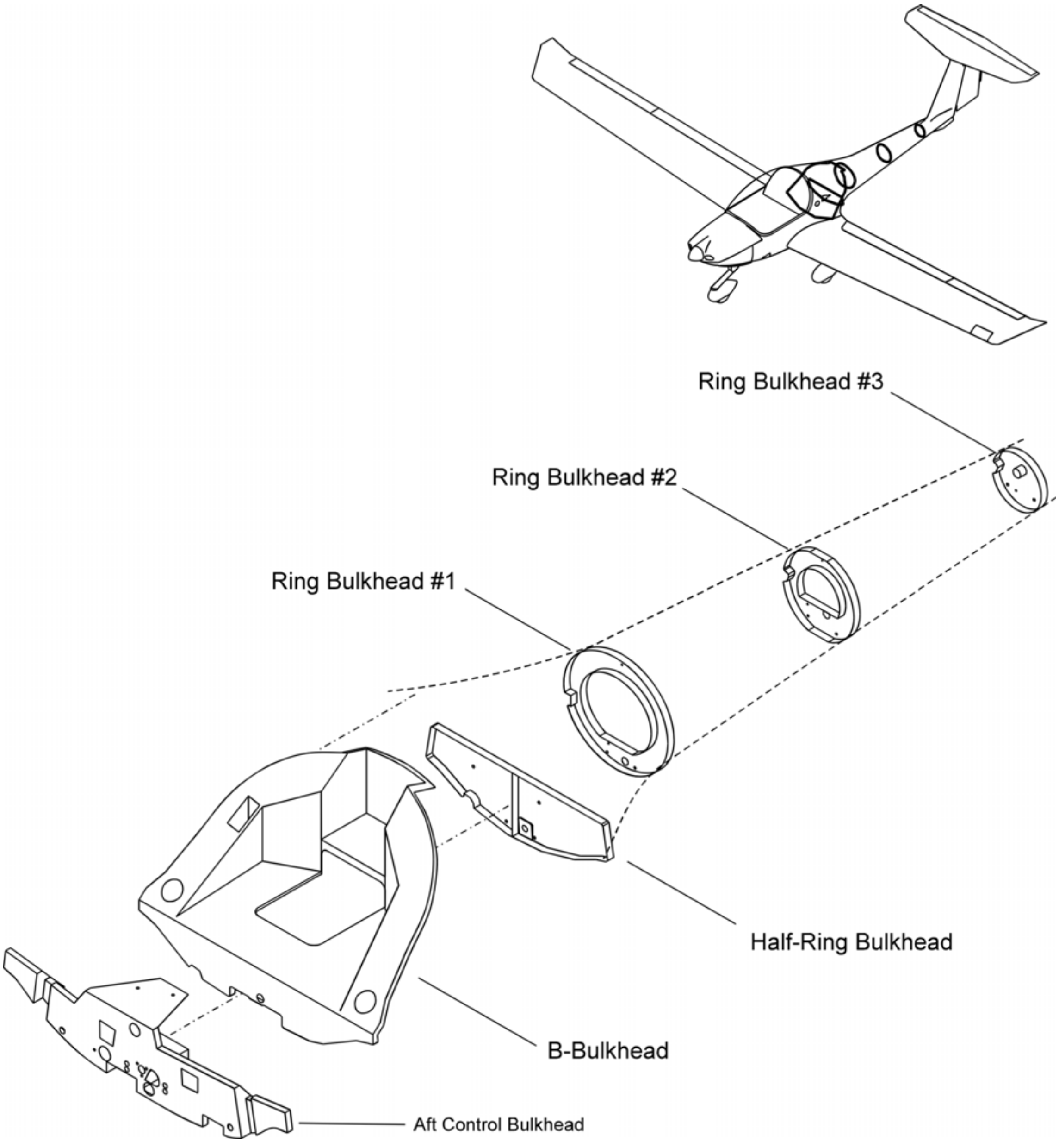


Figure 3 - Rear Fuselage Structure

M. Ring-Bulkhead #1

The ring bulkhead #1 is a rigid GFRP molding. It bonds to the fuselage shell just aft of the half bulkhead. It has holes for the elevator control pushrod and the rudder control cables. It has a cutout on the right side for a cable conduit.

N. Ring-Bulkhead #2

The ring bulkhead #2 is a rigid GFRP molding. It bonds to the fuselage shell half way along the rear fuselage. It has a guide bearing for the elevator control pushrod and holes for the rudder control cables. It has a cut-out on the right side for a cable conduit.

O. Ring-Bulkhead #3

The ring bulkhead #3 is a rigid GFRP molding. It bonds to the fuselage shell just forward of the vertical stabilizer. It has holes for the elevator control pushrod and the rudder control cables. It has a cut-out on the right side for a cable conduit.

P. Ring-Bulkhead #4

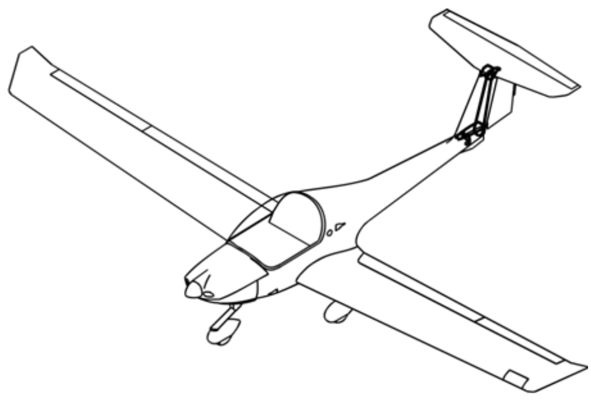
The ring bulkhead #4 is a rigid GFRP molding. It bonds to the fuselage shell below the vertical stabilizer. It has a very large cut-out for the elevator control pushrod, the rudder control cables and a cable conduit.

Q. Vertical Stabilizer Lower Rib

The vertical stabilizer lower rib is a rigid GFRP molding. It bonds to the fuselage shell at the bottom of the vertical stabilizer. It also bonds to the spar, vertical stabilizer. It has a large slot for the elevator control pushrod. It has a mount for the VHF antenna at the front.

R. Vertical Stabilizer Upper Rib

The vertical stabilizer upper rib is a rigid GFRP molding. It bonds to the fuselage shell at the top of the vertical stabilizer. It also bonds to the spar, vertical stabilizer. It has the mountings for the horizontal stabilizer.



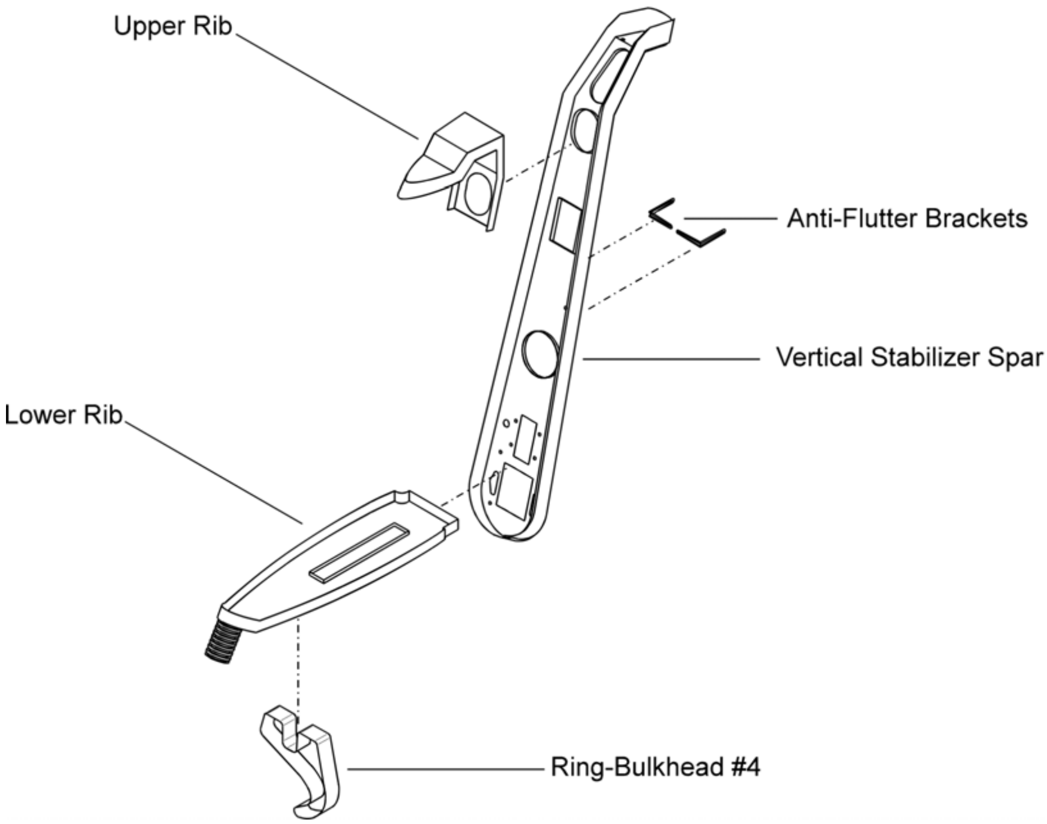


Figure 4 - Vertical Stabilizer Structure

S. Vertical Stabilizer Spar

The vertical stabilizer spar is a rigid GFRP molding. It bonds to the fuselage shell. It also bonds to the upper and vertical stabilizer lower ribs. The spar has mounting points for these components:

– The elevator bellcrank.

– The elevator trim actuator.

– The rudder top bearing.

– The rudder bottom bearing.

Two anti-flutter brackets bond to the skin and also half way up the spar. The brackets prevent the skin from vibrating in the airflow.

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CHAPTER 55

STABILIZERS

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TABLE OF CONTENTS

CHAPTER 55

STABILIZERS

Section 55-10

Horizontal Stabilizer

Maintenance Practices

Section 55-20

Elevator

Maintenance Practices

Section 55-30

Lower Fin

Maintenance Practices

Section 55-40

Rudder

Maintenance Practices

CHAPTER 55
STABILIZERS

1. General

The DV 20 E airplane has the usual stabilizers. The vertical stabilizer is part of the fuselage. The aft part of the left and right fuselage shells make the left and right shells of the vertical stabilizer. Refer to Chapter 53-10 for data on the fuselage structure.

The horizontal stabilizer has top and bottom shells. Each shell has GFRP skins with a rigid foam core. The horizontal stabilizer has a main spar. The main spar holds the attachment bracket. Center ribs fore and aft give strength to the center area. A trailing edge web holds the hinges for the elevator.

The elevator has top and bottom shells. Each shell has GFRP skins with a rigid foam core. The bottom shell also makes the leading edge spar. The hinges attach to the bottom shell. A large horn with the mass balance weight attaches to the bottom shell at the center.

The lower fin is a GFRP molding. Bolts attach the lower fin to the bottom of the fuselage.

The rudder has left and right shells. Each shell has GFRP skins with a rigid foam core. The shells bond together at a flange. The hinges attach to the top face of the rudder and a flat face near the bottom of the leading edge. The horn near the top makes the rudder mass balance.

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Section 55-10

Horizontal Stabilizer

1. General

The DV 20 E airplane has the usual horizontal stabilizer. The horizontal stabilizer attaches to the top of the vertical stabilizer. The elevator attaches to the trailing edge of the horizontal stabilizer. Refer to Chapter 55-20 for data about the elevator structure.

2. Description

The horizontal stabilizer has top and bottom shells. Each shell has GFRP skins with a rigid foam core. The top shell has no cut-outs. The bottom shell has a large cut-out at the rear for the elevator horn and mass balance. It also has two small triangular holes forward and aft of the front rib.

The horizontal stabilizer has a main spar. The spar has GFRP skins with a rigid foam core. It also has top and bottom flanges. The main spar bonds to the top and bottom shells with bonding paste.

The main spar has four holes for the mount plate. You can get access to the attachment bolts from below. The mount plate goes down through the large cut-out in the bottom shell. Four more holes in the bottom part of the mount plate attach to the vertical stabilizer top rib.

Fore and aft center ribs give strength to the center area. Both ribs are rigid GFRP moldings. They bond to the other components with bonding paste. The front rib has a triangular shape.

The aft rib has sides with bends and a top face which joins the sides. It closes the sides of the large cut-out in the bottom shell. The aft part has three holes on each side for the center hinge plates for the elevator.

Left and right trailing edge webs close the trailing edges of the top and bottom shells. The webs also hold the hinges for the elevator. Small holes in the bottom shell give access to the nuts which attach the hinges. The webs bond to the top and bottom shells and the aft rib with bonding paste.

A small GFRP rib at each side closes the elevator cut-out. The rib bonds to the other components with bonding paste.

A rigid GFRP fairing goes around the joint between the horizontal stabilizer and the vertical stabilizer. Four screws attach the fairing to the vertical stabilizer.

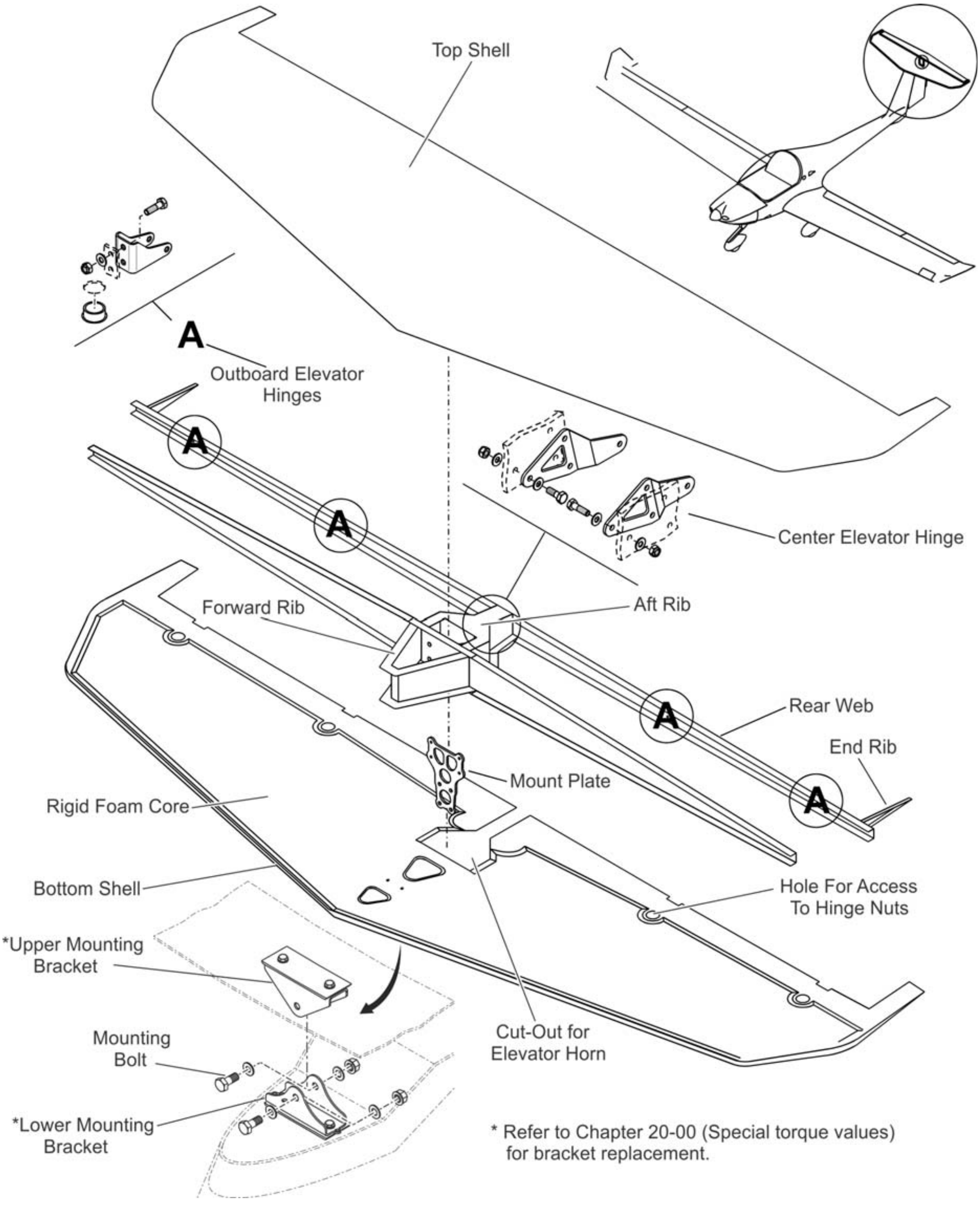

Figure 1: Horizontal Stabilizer Structure

Maintenance Practices

1. General

These Maintenance Practices tell you how to remove and install the horizontal stabilizer.

2. Remove/Install the Horizontal Stabilizer

A. Remove the Horizontal Stabilizer

Note: Two persons are needed to remove/install the horizontal stabilizer.

	Detail Steps/Work Items	Key Items/References
(1)	Remove the horizontal stabilizer fairing. – Remove the four screws.	
(2)	Remove the bolt that connects the elevator vertical control rod to the elevator horn.	
(3)	Remove the two bolts that connect the lower mounting bracket to the upper mounting bracket.	
(4)	Remove the four bolts that attach the horizontal stabilizer mount plate to the vertical stabilizer.	Hold the horizontal stabilizer.
(5)	Lift the horizontal stabilizer clear of the airplane.	Use 2 persons.

B. Install the Horizontal Stabilizer

	Detail Steps/Work Items	Key Items/References
(1)	Put the horizontal stabilizer in position on the vertical stabilizer.	Use 2 persons.
(2)	Install the four mounting plate attaching bolts.	Torque to 20.6 Nm (15.2 lbf-ft).
(3)	Install the two bolts that connect the lower mounting bracket to the upper mounting bracket.	Torque to 6.24 Nm (4.6 lbf-ft).
(4)	Install the bolt which connects the elevator vertical control rod to the elevator horn.	Torque to 1.7 Nm (1.2 lbf-ft). Make sure that the fork of the elevator trim actuator engages the spring mount on the control rod.
(5)	Do a test for correct, full and free movement of the elevator control. If necessary, adjust the elevator control.	Refer to Chapter 27-30.
(6)	Install the horizontal stabilizer fairing. – Install the four screws.	

Section 55-20

Elevator

1. General

The DV 20 E airplane has the usual elevator. The elevator attaches to the rear web of the horizontal stabilizer. Refer to Chapter 27-30 for data about the elevator controls.

2. Description

Figure 1 shows the elevator structure.

The elevator has top and bottom shells. Each shell has GFRP skins with a rigid foam core. The bottom shell also makes the leading edge spar. The top edge of the leading edge spar has a flange which goes forward. The shells bond together at this flange and at the trailing edge.

The hinges attach to the bottom shell. Each hinge is a small metal block with a bush. A bolt holds the block to the leading edge spar. A small hole in the bottom shell near each hinge gives access to the attachment.

A large horn attaches to the bottom shell at the center. The attaching bolts for the horn go into the elevator shells at the leading and trailing edges. The top shell has an access hole for the front bolt.

The horn has a hole with a bush for the elevator control rod. The front of the horn has the elevator mass balance weight.

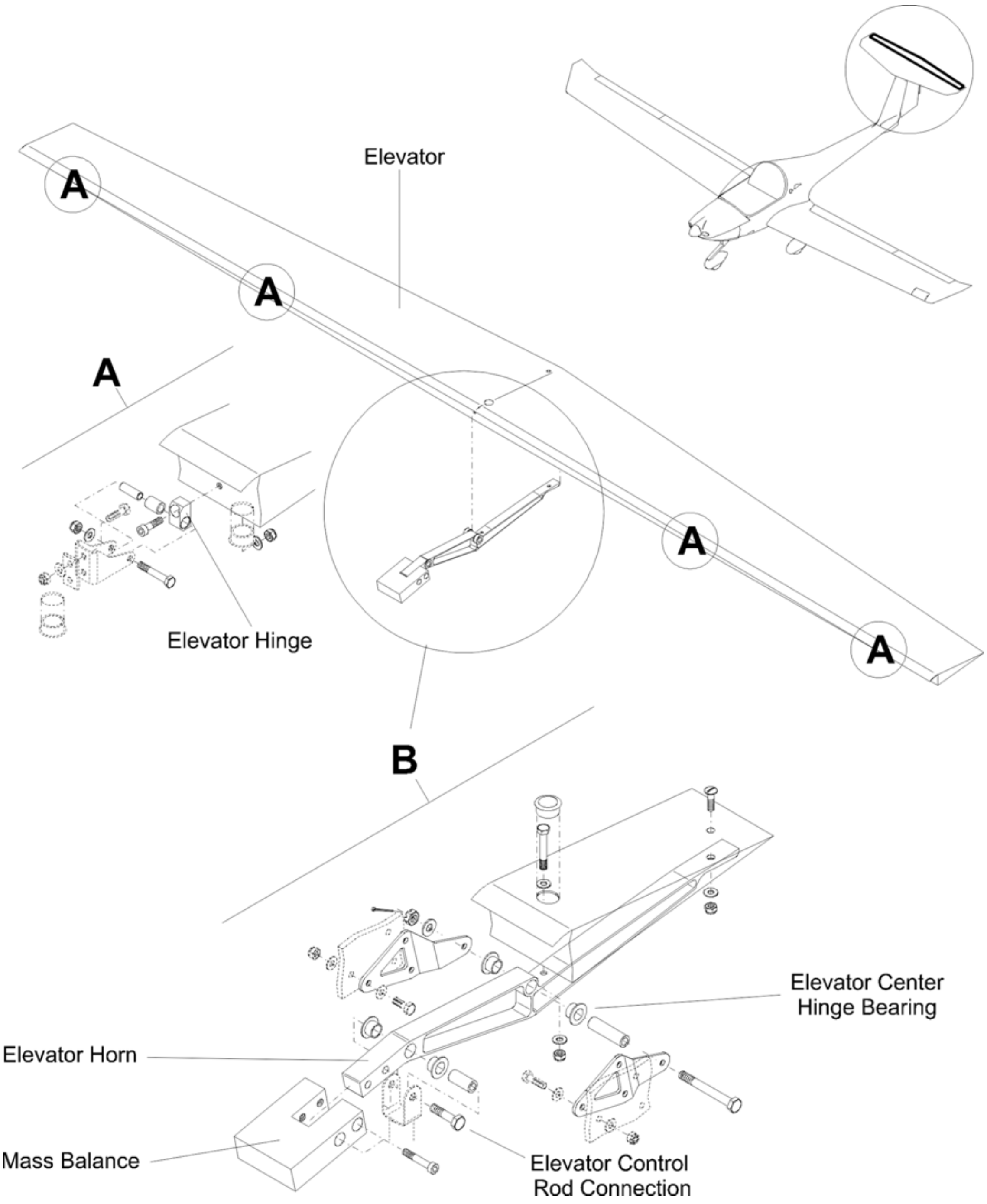

Figure 1: Elevator Structure

Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the elevator. Refer to Chapter 27-30 for adjustment data for the elevator control system.

2. Remove/Install the Elevator

A. Remove the Elevator

Note: Use 2 persons to remove/install the elevator. Or use control clamps to hold the elevator in position while you remove/install the attaching bolts.

	Detail Steps/Work Items	Key Items/References
(1)	Remove the horizontal stabilizer fairing. – Remove the four screws.	
(2)	Remove the bolt that connects the elevator vertical control rod to the elevator horn.	
(3)	Remove the five elevator hinge bolts.	Hold the elevator. There are two bolts outboard at each side and one center bolt through the control horn.
(4)	Lift the elevator clear of the airplane.	

B. Install the Elevator

	Detail Steps/Work Items	Key Items/References
(1)	Put the elevator in position on the horizontal stabilizer.	Use 2 persons.
(2)	Install the five hinge bolts.	There are two bolts outboard at each side and one center bolt through the control horn. Refer to Chapter 20 for standard torque values.
(3)	Install the bolt which connects the elevator vertical control rod to the elevator horn.	Make sure that the fork of the elevator trim actuator engages the spring mount on the control rod.
(4)	Do a test for correct, full and free movement of the elevator control. If necessary, adjust the elevator control.	Refer to Chapter 27-30.
(5)	Install the horizontal stabilizer fairing. – Install the four screws.	

Section 55-30
Lower Fin

1. General

The lower fin has three functions. It helps give directional stability. It makes a tail-bumper. It also has a tie-down point.

2. Description

Figure 1 shows the lower fin. The lower fin is a rigid GFRP molding. Five screws attach the lower fin to the bottom of the fuselage. The bottom aft corner has a hole for a tie-down rope. Some lower fins may be filled with ballast made up of lead shot and epoxy.

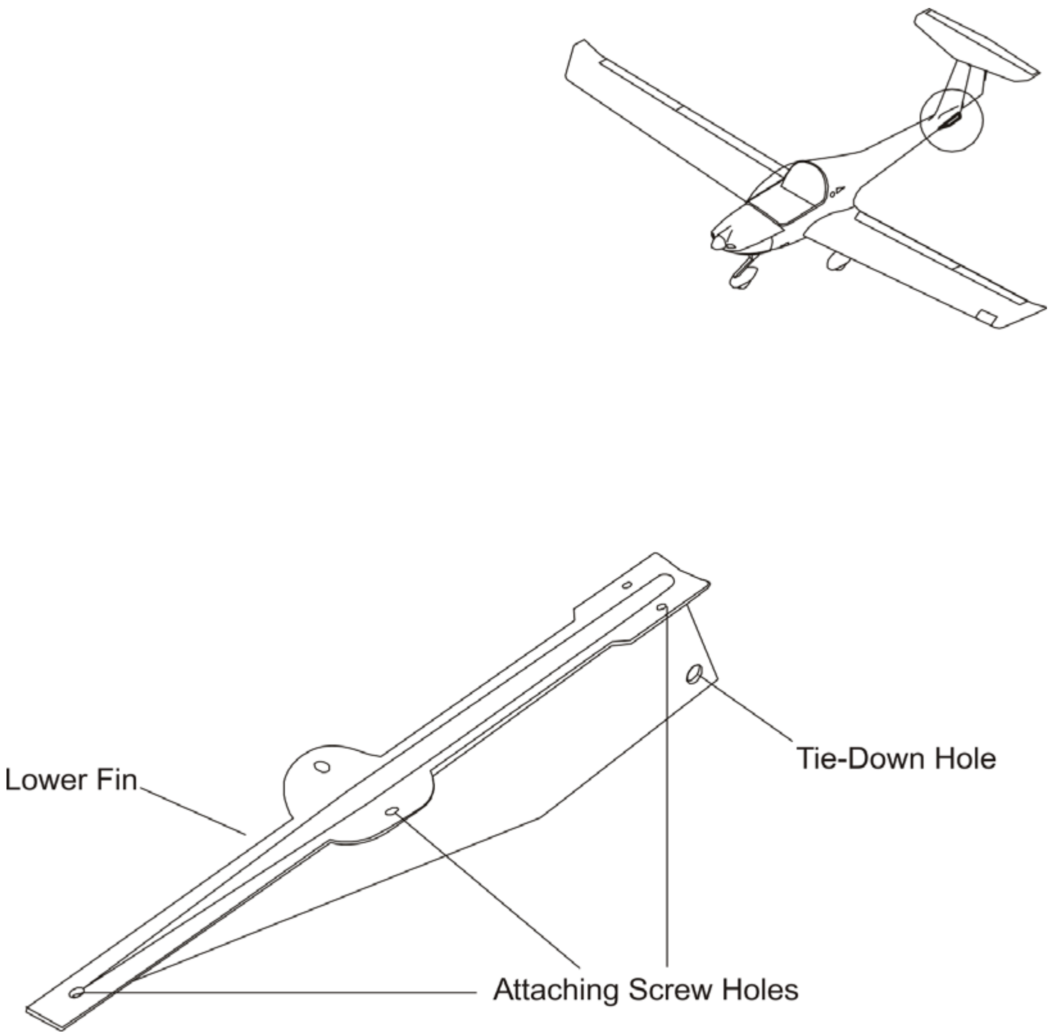

Figure 1: Lower Fin

Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the lower fin.

Note: If the lower fin is being replaced and the lower fin contains ballast:

- Measure weight of old lower fin;
- Add ballast to new lower fin to get same weight; and
- Use lead balls and epoxy.

Refer to Chapter 51.

2. Remove/Install the Lower Fin

A. Remove the Lower Fin

	Detail Steps/Work Items	Key Items/References
(1)	Remove the adhesive tape that seals the joint between the lower fin and the fuselage.	
(2)	Remove the five screws that attach the fin to the fuselage.	Hold the fin.
(3)	Remove the lower fin from the airplane.	

B. Install the Lower Fin

	Detail Steps/Work Items	Key Items/References
(1)	Put the lower fin in position under the rear fuselage.	
(2)	Install the five screws that attach the lower fin.	Seal the joint with Marine Sealant 3M 4000UV P/N 06586.

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Section 55-40
Rudder

1. General

The DV 20 E airplane has the usual rudder. The rudder attaches to the spar of the vertical stabilizer. Refer to Chapter 27-20 for data about the rudder controls.

2. Description

Figure 1 shows the rudder structure.

The rudder has left and right shells. Each shell has GFRP skins with a rigid foam core. The shells bond together all around with bonding paste.

The rudder has two pivots. The top pivot pin bonds to the top face of the shells near the leading edge. The top pivot has a bushing. This bushing is a sacrificial point and will require periodic replacement. The bottom pivot is part of the rudder support-bracket assembly. The rudder lower mounting plate (also part of the rudder support-bracket assembly) attaches to the bottom of the leading edge.

The rudder has a mass balance weight inside the top part of the leading edge. The mass balance weight is bonded to the rudder structure during manufacture.

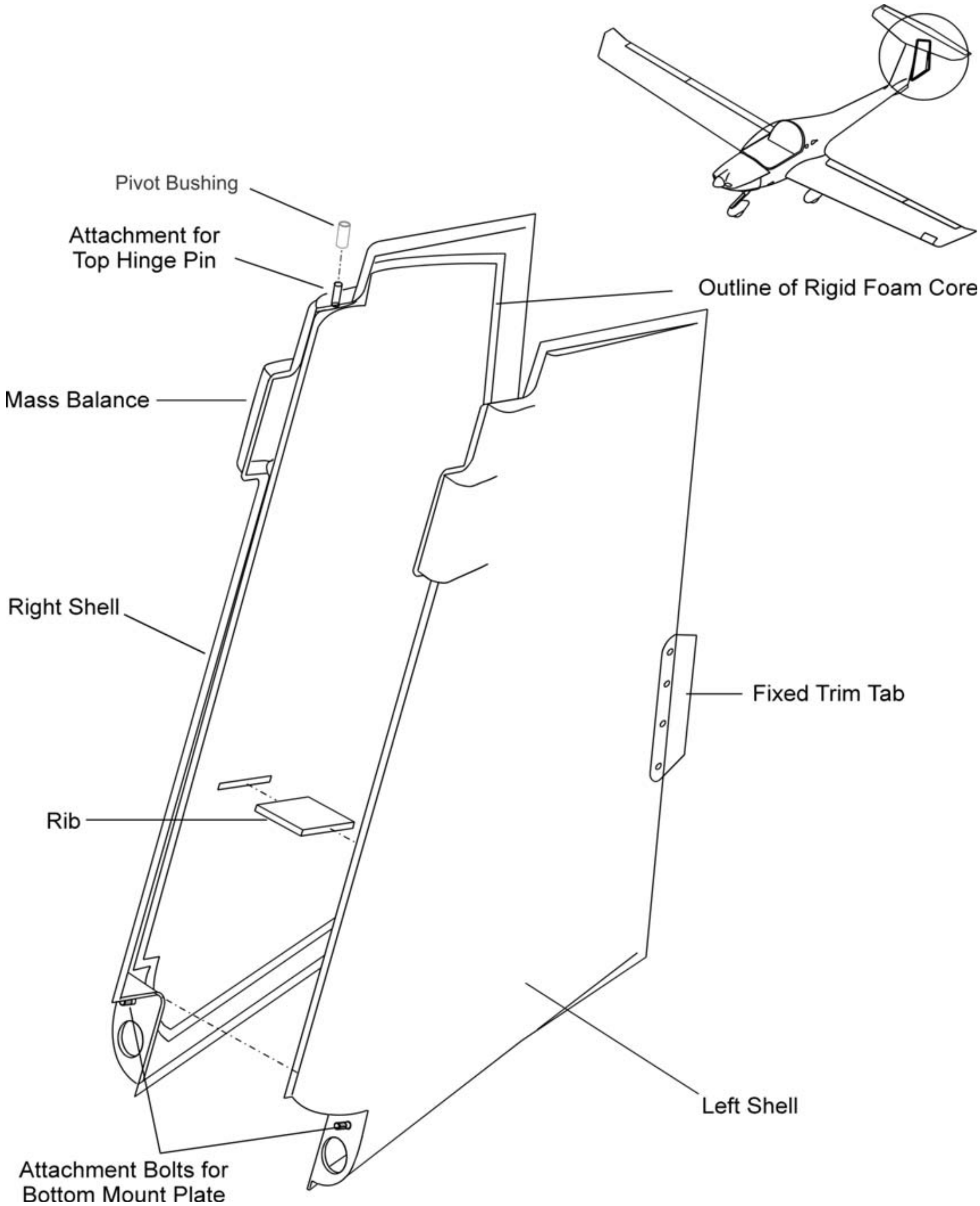

Figure 1: Rudder Assembly

Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the rudder. Refer to Chapter 27-30 for adjustment data for the rudder controls.

2. Remove/Install the Rudder

A. Remove the Rudder

Figure 2 shows the rudder installation.

Note: Use two persons to remove the rudder. Or use supports to hold the rudder in position while you remove/install the attaching bolts.

	Detail Steps/Work Items	Key Items/References
(1)	Remove the two nuts and the washers that attach the rudder to the lower mounting plate.	Hold the rudder.
(2)	Remove the rudder from the airplane.	Move the bottom of the rudder aft, then down to release the top pivot.
(3)	Inspect the bushing on the pivot rudder pin.	Make sure that the bushing is not loose or damaged. Remove and replace bushing when loose or damaged. Apply adhesive Loctite 680 to the replacement bushing and install. Make sure that the bushing is free of adhesive on the outside surface.

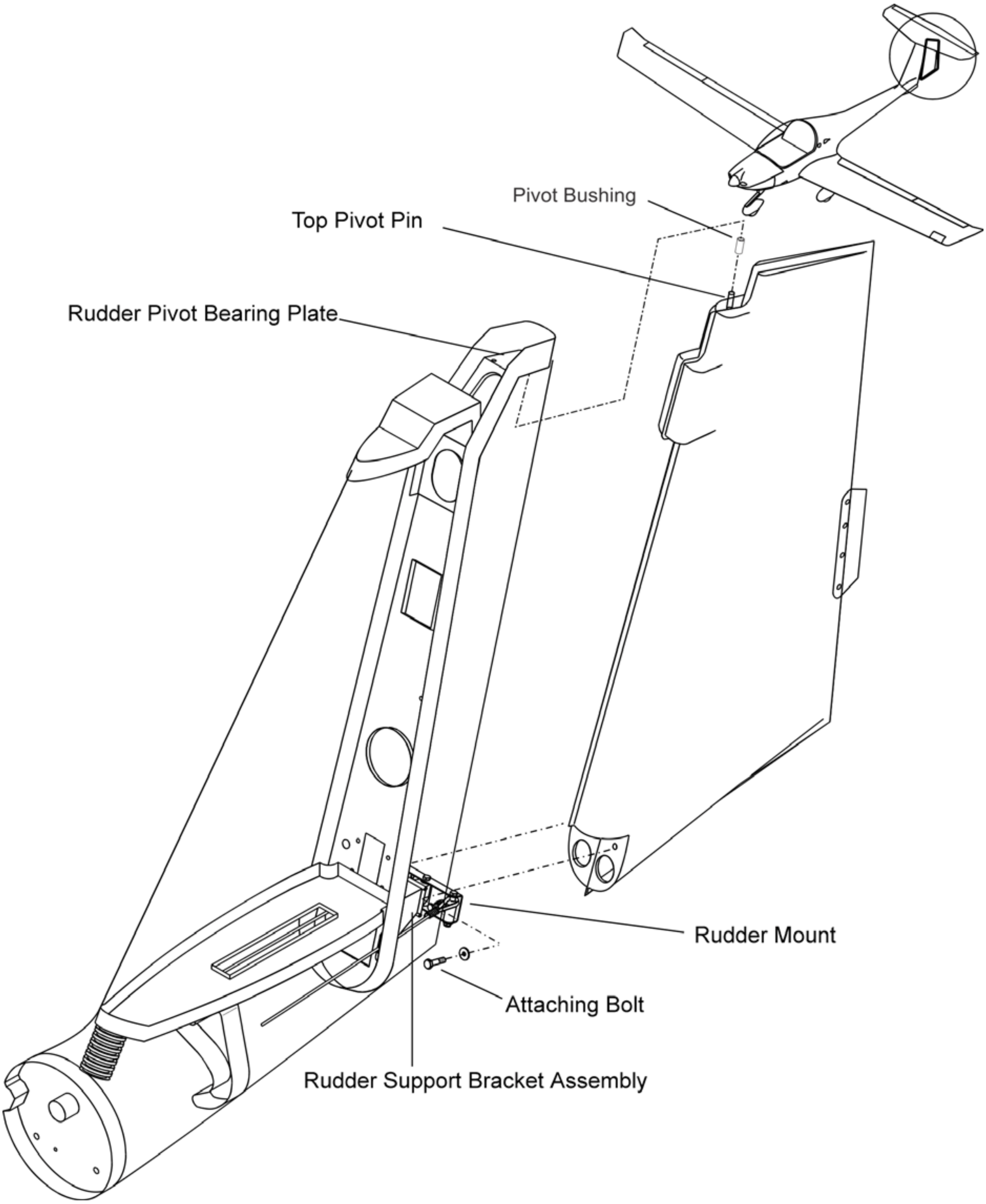

Figure 2: Rudder Installation

B. Install the Rudder

	Detail Steps/Work Items	Key Items/References
(1)	Put the rudder in position on the vertical stabilizer.	Make sure that the top pivot engages the rudder bearing plate.
(2)	Install the two nuts and washers that attach the rudder to the lower mounting plate.	Hold the rudder. Refer to Chapter 20 for standard torque values.
(3)	Do a test for correct, full and free movement of the rudder control. If necessary, adjust the rudder control.	Refer to Chapter 27-30.

3. Remove/Install the Top Pivot Bushing

A. Remove the Top Pivot Bushing

	Detail Steps/Work Items	Key Items/References
(1)	Remove the rudder from the airplane.	Move the bottom of the rudder aft, then down to release the top pivot. Refer to Chapter 55-40.
(2)	Clean/remove all lubrication from the top pivot.	
(3)	Apply a small amount of heat using an appropriate heat source (i.e. heat gun) to soften the retaining 680 Loctite.	
(4)	Apply a torsional force to the pivot bushing to break it feel from the pivot pin.	

B. Install the Top Pivot Bushing

	Detail Steps/Work Items	Key Items/References
(1)	Clean the surface of the pivot pin.	
(2)	Apply 680 Loctite to the pivot pin.	
(3)	Install the pivot bushing over the pivot pin.	
(4)	Clean all 680 Loctite from the outer bushing surface.	
(5)	Install the rudder to the airplane.	Refer to Chapter 55-40.

CHAPTER 56

WINDOWS

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TABLE OF CONTENTS

CHAPTER 56
WINDOWS

Section 56-10
Repair of the Canopy Glass

Section 56-11
Replacement of the Rear Window

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CHAPTER 56

WINDOWS

1. General

Information on the principal canopy repair is given in this chapter.

2. Description

The DV 20 E airplane has a one-piece lifting canopy. It has a carbon-fiber reinforced plastic (CFRP) frame and one large acrylic glass bubble. The canopy glass has two small emergency windows.

The canopy has a hinge at the back and a stabilizing rod on each side. The support arms have counterbalance springs to help operate the canopy.

A locking system locks the canopy closed. Latch-levers operate the locking system. The levers are located on the in- and outside on the right and left side.

In addition there is a rear window on each side aft of the canopy.

3. Removal and Installation

Refer to Chapter 52-10.

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Section 56-10
Repair of the Canopy Glass

1. Damage Limits

You must scrap the canopy glass when:

– The crack is more than 150 mm (6 in) long.

– There is a crack stop drill hole in the shaded area, as shown in Figure 2.

Otherwise you can use the following repair information. If in doubt, you must contact the airplane manufacturer.

2. Tools and Equipment

The following tools and equipment are required for the repair of the cockpit glass:

– High speed grinder.

– Drill.

– UV light (cold).

3. Materials

The following materials are required for the repair of the cockpit glass:

Item	Quantity	Part Number
Filler ACRYFIX 192.	A/R	Commercial.
Masking Tape.	A/R	Commercial.
Transparency polish (Micro - Gloss Liquid Abrasive).	A/R	Commercial.

NOTE: A UV-light (cold) is required to cure ACRYFIX 192.

4. Fillers

To compensate for the shrinkage of the fillers during the cure process, the filler must be applied proud of the transparency surface. As this is not possible when repairing a vertical crack in-situ, a strip of masking tape must be rolled up over the repair while simultaneously applying the filler. This procedure must be repeated until the filler sticks out of the glass surface.

5. Temporary Repair to the Canopy Glass

To prevent further propagation of cracks before a permanent repair is possible, stop-drill the ends of the crack with a 2.4 mm (0.1 in) diameter hole.

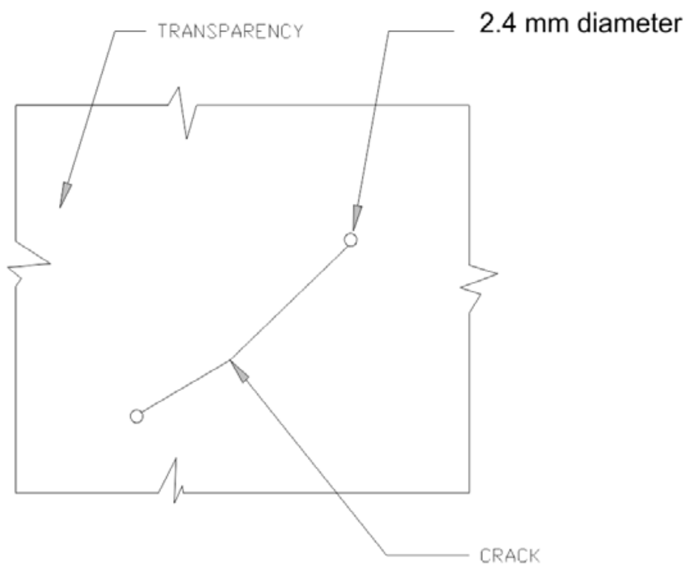


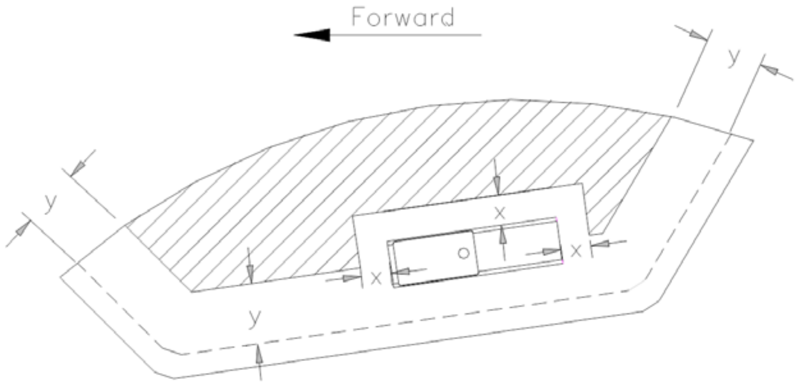
Figure 1: Temporary Repair

6. Permanent Repair to the Canopy Glass

To make a permanent repair, do the following standard procedure:

	Detail Steps/Work Items	Key Items/References
(1)	If necessary, remove the canopy for the repair. Put the canopy on a firm working surface with the crack horizontal.	Refer to Chapter 52-10.
(2)	If the canopy will stay on the airplane for the repair, put protective covers over the inside of the cockpit.	
(3)	Mask the area around the crack on the inner and outer surfaces of the canopy.	
(4)	Use a high-speed grinder to cut a groove along the crack on the outer surface of the glass.	Refer to Step 1 of Figure 3.
(5)	On the outer surface, countersink the temporary stop-drill holes.	Refer to Step 1 of Figure 4.

	Detail Steps/Work Items	Key Items/References
(6)	On the inner surface, seal-off the stop-drill holes with masking tape.	
(7)	Apply filler to the groove and stop-drill holes until the filler is proud of the glass surface. Leave the filler to cure.	Refer to Step 2 of Figures 3 and 4.
(8)	Use a high-speed grinder to cut a groove along the crack on the inner surface of the glass. Make sure that it cuts into the first layer of filler.	Refer to Step 3 of Figure 3.
(9)	On the inner surface, countersink the filler of the temporary stop-drill holes to a depth of approx. 1 mm (0.04 in).	Refer to Step 3 of Figure 4.
(10)	Apply filler to the groove and stop-drill holes until the filler is proud of the glass surface. Leave the filler to cure.	Refer to Step 4 of Figures 3 and 4.
(11)	Remove the masking tape from the surfaces of the canopy.	Refer to Step 5 of Figures 3 and 4.
(12)	Grind the filler to the contour of the glass surfaces and polish the repair with the recommended acrylic glass polish.	
(13)	If protective covers were used, remove them from the inside of the cockpit.	
(14)	If the canopy was removed for the repair, install the canopy.	Refer to Chapter 52-10.



Dimensions
x =   50 mm (2 in)
y = 100 mm (4 in)

No cracks are permitted in the shaded area.
The maximum crack length is 150 mm (6 in).

Figure 2: Crack Limits

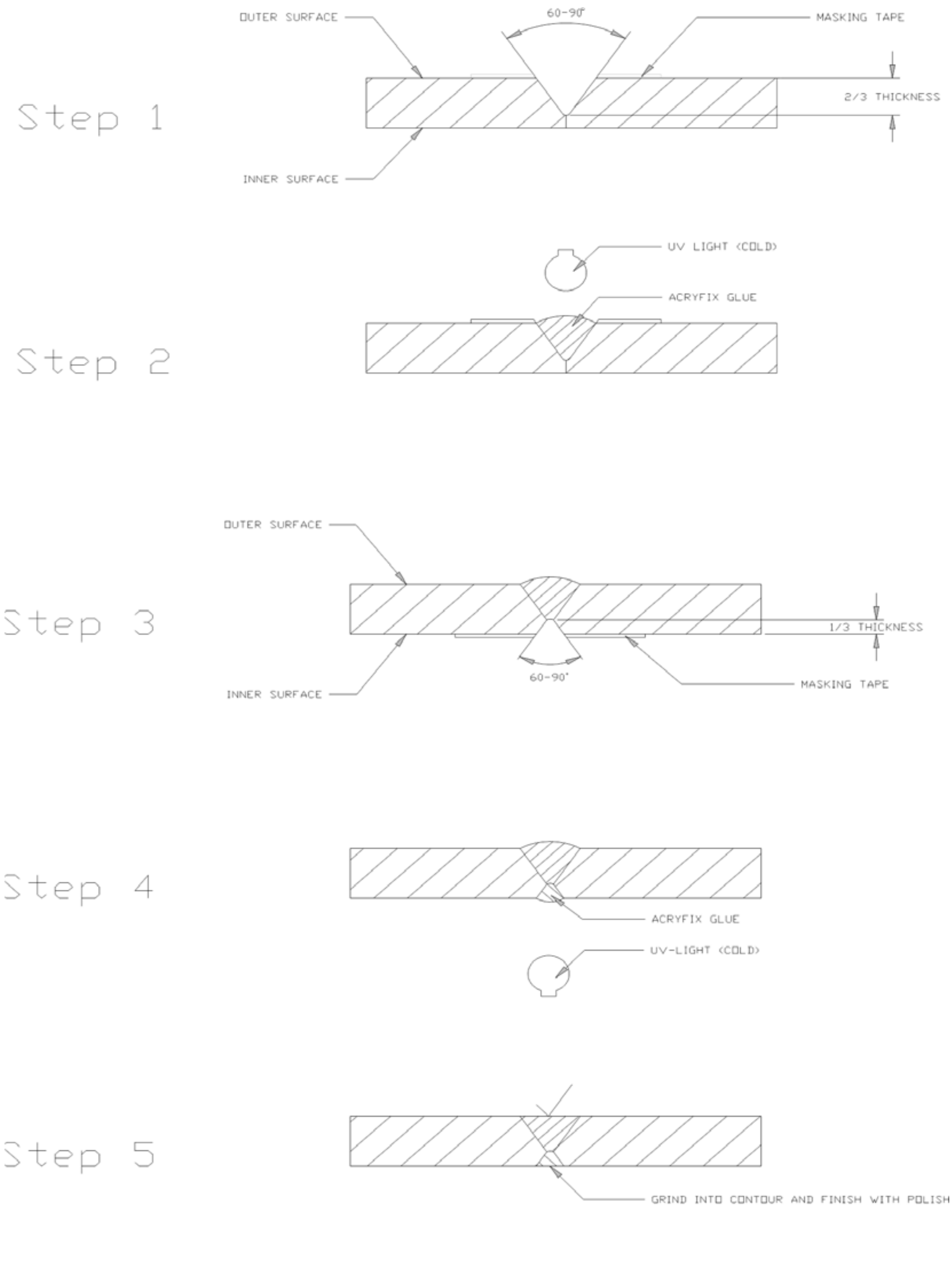


Figure 3: Crack Repairs

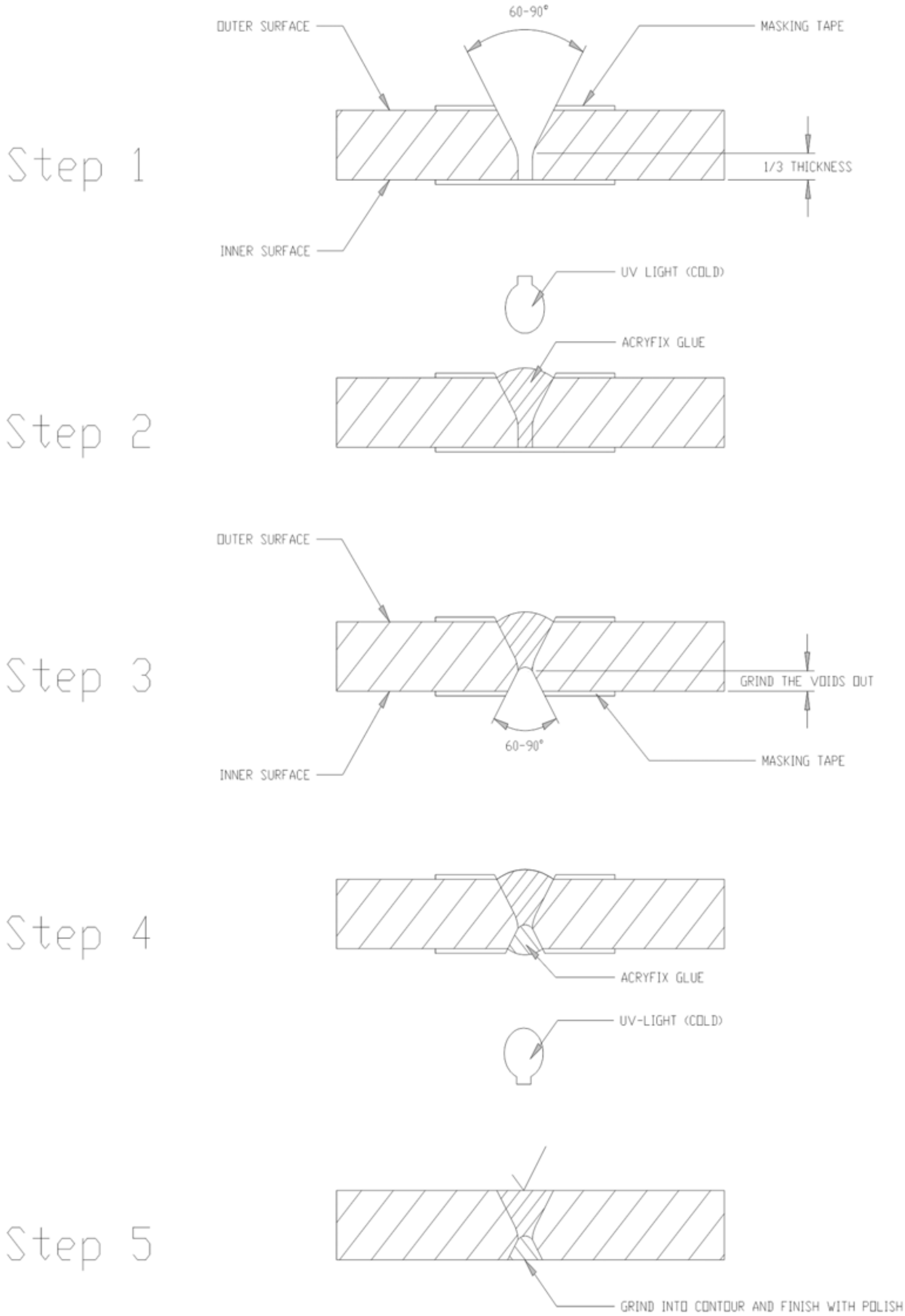


Figure 4: Store-Drill Hole Repair

Section 56-11

Replacement of the Rear Window

1. Damage Limits

The rear windows must be replaced when the crack is more than 50 mm (2 in) long and the windows are damaged. Follow the following replacement information or contact the airplane manufacturer, Diamond Aircraft Industries.

2. Tools and Equipment

The following tools and equipment are required for the replacement of the rear window:

– High speed grinder.

– Blade.

– Drill.

– Jigsaw.

– Chisel.

3. Materials

The following materials are required for the replacement of the rear window:

Item	Quantity	Part Number
Adhesive, – Terostat MS9380. – Loctite 495.	A/R	Commercial.
Black paintable acrylic caulking – PF224, black sealant.	A/R	Commercial.
Cleaner, Prekleeno 900.	A/R	Commercial.
Masking Tape low residue.	A/R	Commercial.
Sandpaper.	A/R	Commercial.
Tape Flash Braker I, II.	A/R	Commercial.

4. Replace a Window

	Detail Steps/Work Items	Key Items/References
CAUTION: WEAR MASK AND EYE PROTECTION WHEN GRINDING OUT EXISTING WINDOW. BE CAREFUL NOT TO DAMAGE THE SURROUNDING COMPOSITE STRUCTURE.		
(1)	Tape fuselage around the window with 51 mm (2.0 in) Tape Flash Braker II to protect the fuselage paint from scratches.	
(2)	Drill a hole in the window close to the frame, large enough to insert a jigsaw.	
(3)	Cut out window all around 20 mm (3/4 in) from inner edge of fuselage bonding flange.	
(4)	Separate the remaining acrylic from fuselage using a sharp blade or chisel and remove it.	Do not damage surrounding composite structure.
(5)	Carefully grind or sand away any remaining adhesive from the bonding flange on the fuselage.	Use extreme care not to damage the surrounding composite or the bonding flange.
CAUTION: KEEP BONDING SURFACES CLEAN FROM OIL, DIRT, AND OTHER CONTAMINANTS. CAUTION: WEAR GLOVES, RESPIRATOR, AND EYE PROTECTION WHEN HANDLING RESIN, CLEANER, AND ADHESIVE.		
(6)	Vacuum the frame and surrounding areas to remove any dust and debris.	
(7)	Glue small gum rubber shims (5 mm x 5 mm) using Loctite 495 around the circumference of the flange to bring the glass flush to the fuselage skin.	There are approximately 12 shims used on the right hand window and 14 shims used on the left hand window.
(8)	Pre-fit the acrylic window to the fuselage to make sure that it is correctly trimmed. There should be 3 mm (± 1 mm) gap between the edge of the glass and the edge of the recessed frame.	Refer to Figure 1.
(9)	Center the window vertically and horizontally to get even gaps all around.	

	Detail Steps/Work Items	Key Items/References
(10)	Put match marks on the window and fuselage at the front, rear, top and bottom to allow alignment during bonding.	
(11)	Remove all dust and debris from the bonding surfaces.	
(12)	Prepare bonding surface of the window and the fuselage by sanding with 320 grit paper. Clean with pre-cleano cleaner.	Use the wipe on wet/wipe off dry method.
(13)	Allow 20-30 minutes minimum for the cleaned areas to dry.	Allow longer dry times in cooler and/or humid conditions.
(14)	Inspect for proper cleaning.	Refer to Chapter 52-10.
(15)	Apply adhesive Terostat MS 9380 to the fuselage bonding flange. Apply one continuous bead.	Make sure that the bead cover most of the bonding flange.
(16)	Install the window on the fuselage immediately.	Pot lifetime for adhesive Terostat MS 9380 is 10 minutes.
(17)	Move the window to align the marks and to make the contour of the acrylic match that of the fuselage as closely as possible.	Avoid excess local pressure as this can lead to a wavy surface.
(18)	Inspect for voids and for proper bond line.	
(19)	Remove excess adhesive from gap between edge of acrylic and fuselage on the outside and at edge of bonding flange on the inside.	
(20)	Apply enough flash tape to the exterior to provide an even and constant pressure.	
(21)	Allow adhesive to cure for a minimum of 24 hours.	
(22)	Inspect the window for any unbonded and/or voided areas or waviness.	
(23)	Remove internal masking tape and external flashing tape.	
(24)	Using fresh low residue masking or flash tape, mask off window edges and fuselage edges around gap.	

	Detail Steps/Work Items	Key Items/References
(25)	Fill gap between window and fuselage with black paintable exterior acrylic caulk (PF224, black sealant)	Remove the excess black sealant with plastic scraper or spatula.
(26)	Allow the caulk to cure overnight.	
(27)	Remove masking or flash tape.	
(28)	Mask off fuselage and window in preparation for paint application. Paint to original line on fuselage and extend paint line to cover frame line on window. Refer to Figure 2.	Refer to Chapter 51-00.

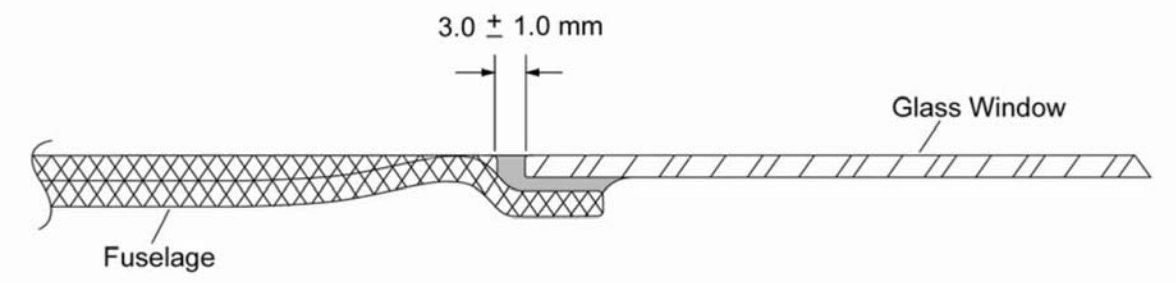


Figure 1: Acceptable Fuselage and Glass Window Gap

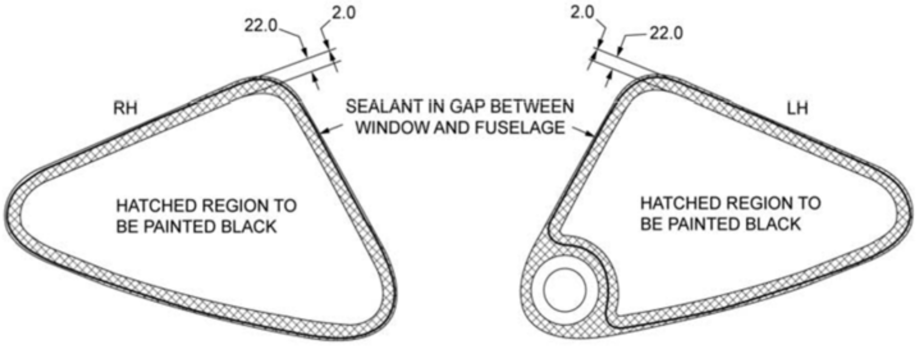


Figure 2: Paint Dimension on Glass Window

CHAPTER 57

WINGS

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TABLE OF CONTENTS

CHAPTER 57

WINGS

Section 57-10

Wing Structure

Maintenance Practices

Section 57-50

Flaps

Maintenance Practices

Section 57-60

Ailerons

Maintenance Practices

CHAPTER 57
WINGS

1. General

The DV 20 E airplane has cantilever wings. The wings are set low on the fuselage. Each wing has a flap inboard on the trailing edge. There is an aileron on the outboard trailing edge.

The wings are monocoque structure. Each wing has top and bottom shells. The shells have GFRP skins and a rigid foam core. Each wing has an I-section spar. Carbon fiber rovings make the spar caps. Each wing also has rigid GFRP ribs and webs.

Refer to Chapter 27 for data on the control systems for the flaps and ailerons. Refer to Chapter 51 for general repair data.

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Section 57-10
Wing Structure

1. General

The DV 20 E airplane has composite wings. The main spar has carbon fiber spar-caps. The wing shells have GFRP skins and a rigid foam core. Rigid GFRP moldings give strength to the structure. Some also hold control levers or bearings.

Refer to the following Chapters:

– Chapter 57-50 for the data about the flaps

– Chapter 57-60 for the data about the ailerons

– Chapter 27-00 for data about the control system.

2. Description

Figure 1 shows the wing structure. Bonding paste (thickened resin) bonds the wing components to each other. The wing has the following main parts:

A. Wing Shells

Each wing has top and bottom shells. Each shell has GFRP skins with a rigid foam core. The skins have many layers of glass cloth. Some areas have more layers to give more strength. In most cases, the fibers in the cloth lie at ±45° to the lateral axis.

The wing has an anti-vortex tip. The aft end of the wing tip has a mounting for the position light assembly.

The bottom shell of both wings has holes for access panels below the flap and aileron bellcranks. The bottom shell has a hole for an access panel below the B-bolt. This gives access to the B-bolt for removing the wings.

The outer leading edge of both shells in the left wing has a cut-out for the landing and taxi lamps.

A stall strip bonds to the leading edge of both wings at approximately 2/3 span.

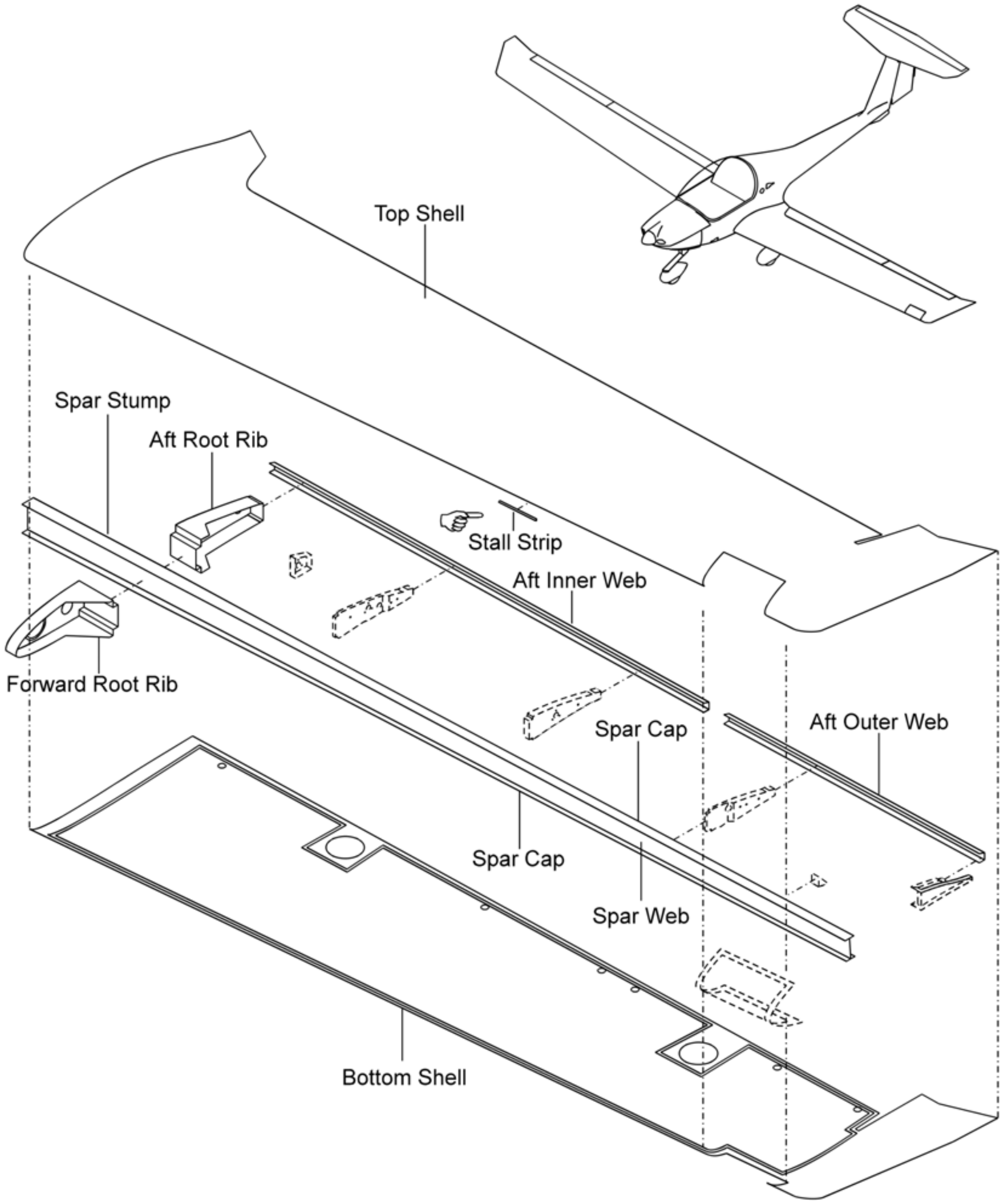

Figure 1: Wing Structure - Shells, Spar, Root Rib and Webs

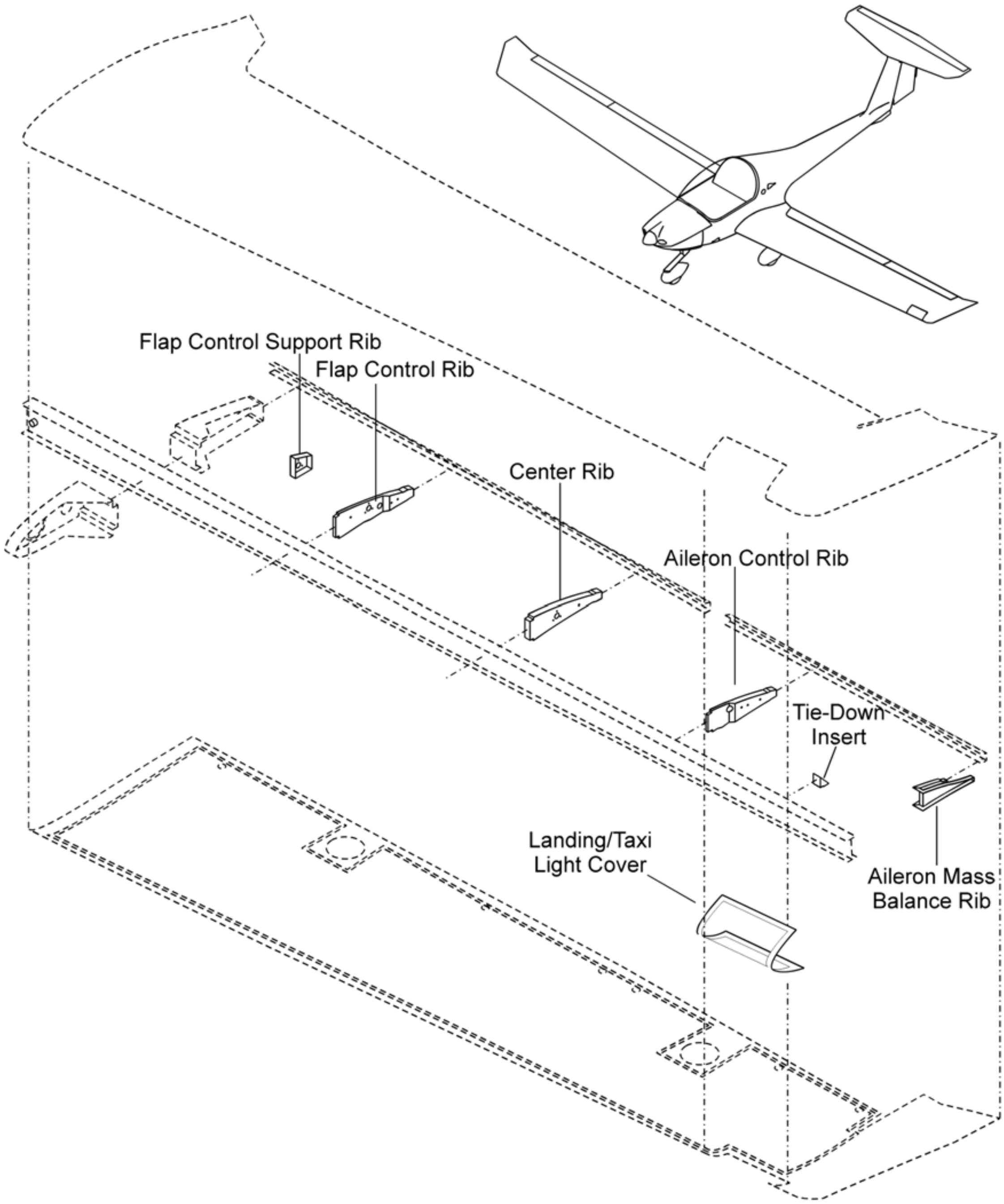

Figure 2: Wing Structure - Ribs

B. Spar

The wing has an I-beam spar. Carbon fiber rovings make the spar caps. The number of rovings decreases from the root to the tip.

The spar has a shear web. The web has GFRP skins and a rigid foam core. Glass cloth fillets attach the spar caps to the shear web.

The inboard end of the spar is a stump. Many layers of glass cloth transmit the wing bending loads into the spar stump. The inboard end of the spar stump goes into the spar bridge in the fuselage. The inboard end has a large metal bush for the wing main pin. The main pin transmits the wing bending loads into the spar bridge.

C. Root Rib

The root rib has a forward part and an aft part. Both parts are rigid GFRP moldings with many layers of glass cloth. Many layers of glass cloth bond both parts of the root rib to the spar.

The forward root rib has a bearing housing for the A-bolt. The A-bolt is a small distance in front of the spar. The A-bolt transmits lift loads into the fuselage structure.

The aft part of the root rib has a bearing housing for the B-bolt. The B-bolt transmits some lift loads and lateral loads into the fuselage structure.

D. Aft Inner Web

The Aft Inner Web closes the rear of the wing in front of the flap. It is a rigid GFRP molding. Three rigid GFRP inserts in the web make mountings for the flap hinge brackets. The web goes from the root rib to the outer end of the flap.

E. Aft Outer Web

The Aft Outer Web closes the rear of the wing in front of the aileron. It is a rigid GFRP molding. Three rigid GFRP inserts in the web make mountings for the aileron hinge brackets. The web goes from the outer end of the flap to the outer end of the aileron.

F. Flap Control Support Rib

This small rib is close to the root rib. It is a rigid GFRP molding. It has a guide bearing for the flap control rod.

G. Flap Control Rib

The flap control rib is located half way along the aft inner web. It is a rigid GFRP molding with an insert. It has the mounting for the flap control bellcrank. It bonds to the aft face of the spar, the top and bottom shells and the aft inner web. It has a guide bearing for the aileron control rod.

H. Center Rib

The center rib is located half way along the wing. It is a rigid GFRP molding. It has a guide bearing for the aileron control rod. It bonds to the aft face of the spar, the top and bottom shells and the aft inner web.

I. Aileron Control Rib

The aileron control rib is located half way along the aft outer web. It is a rigid GFRP molding with an insert. It has the mounting for the aileron control bellcrank. It bonds to the aft face of the spar, the top and bottom shells and the aft outer web.

J. Aileron Mass Balance Rib

The aileron mass balance rib makes a cut-out for the aileron mass balance at the outboard end of the aft rear web. It is a rigid GFRP molding.

K. Tie-Down Insert

The tie-down insert gives strength to the tie-down point in the bottom shell.

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Maintenance Practices

1. General

The following maintenance practices describe how to:

- Remove and install the wings. The procedure is simple. You need no special tools. Remove/Install the wing using 3 persons.

- Install a wing spar bushing to a new replacement wing.

2. Remove/Install the Wings

A. Equipment

Item	Quantity	Part Number
Wing trestles.	2	Commercial.
Wing stand.	2	Commercial.

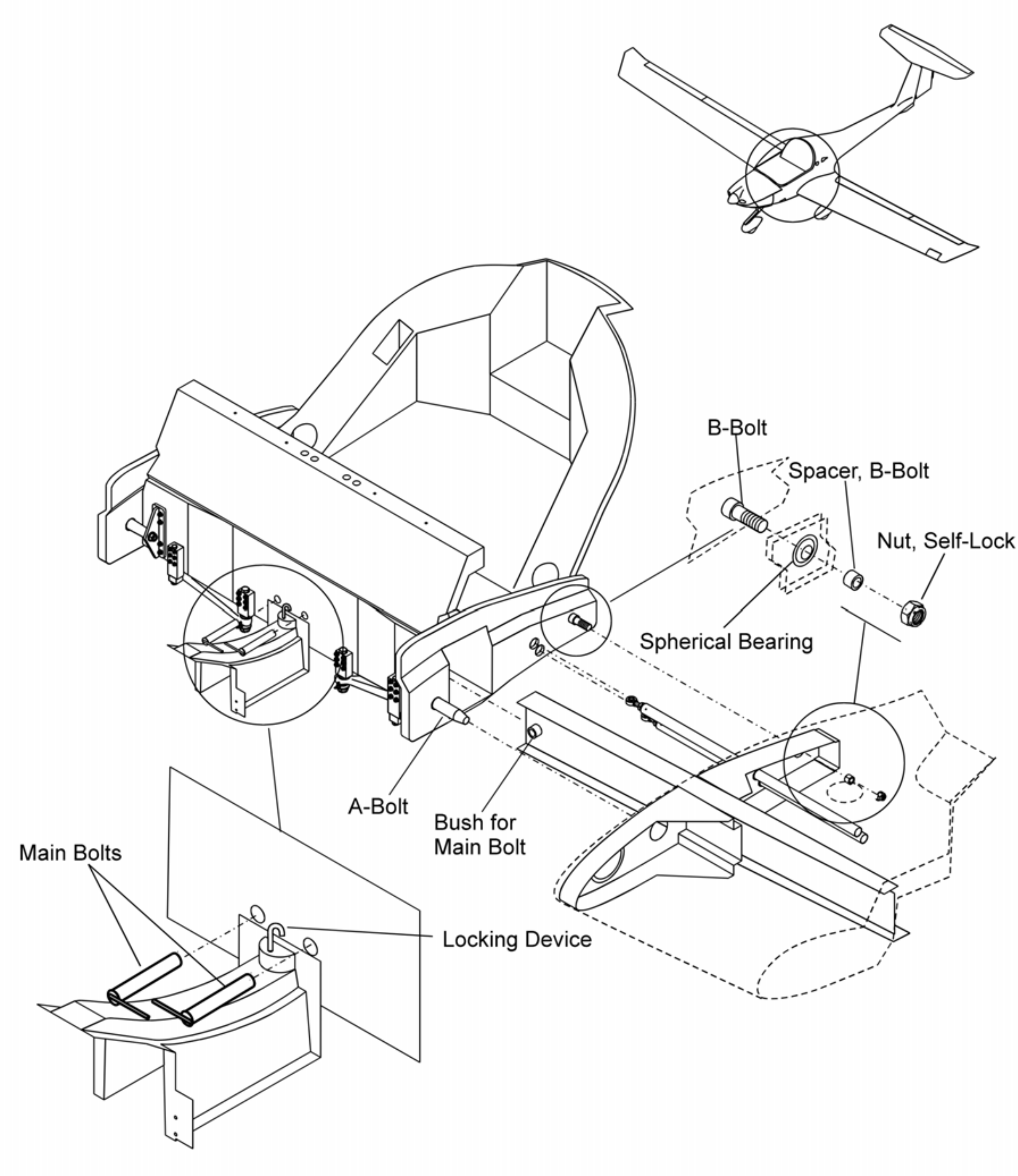

Figure 3: Wing Attachment Bolts

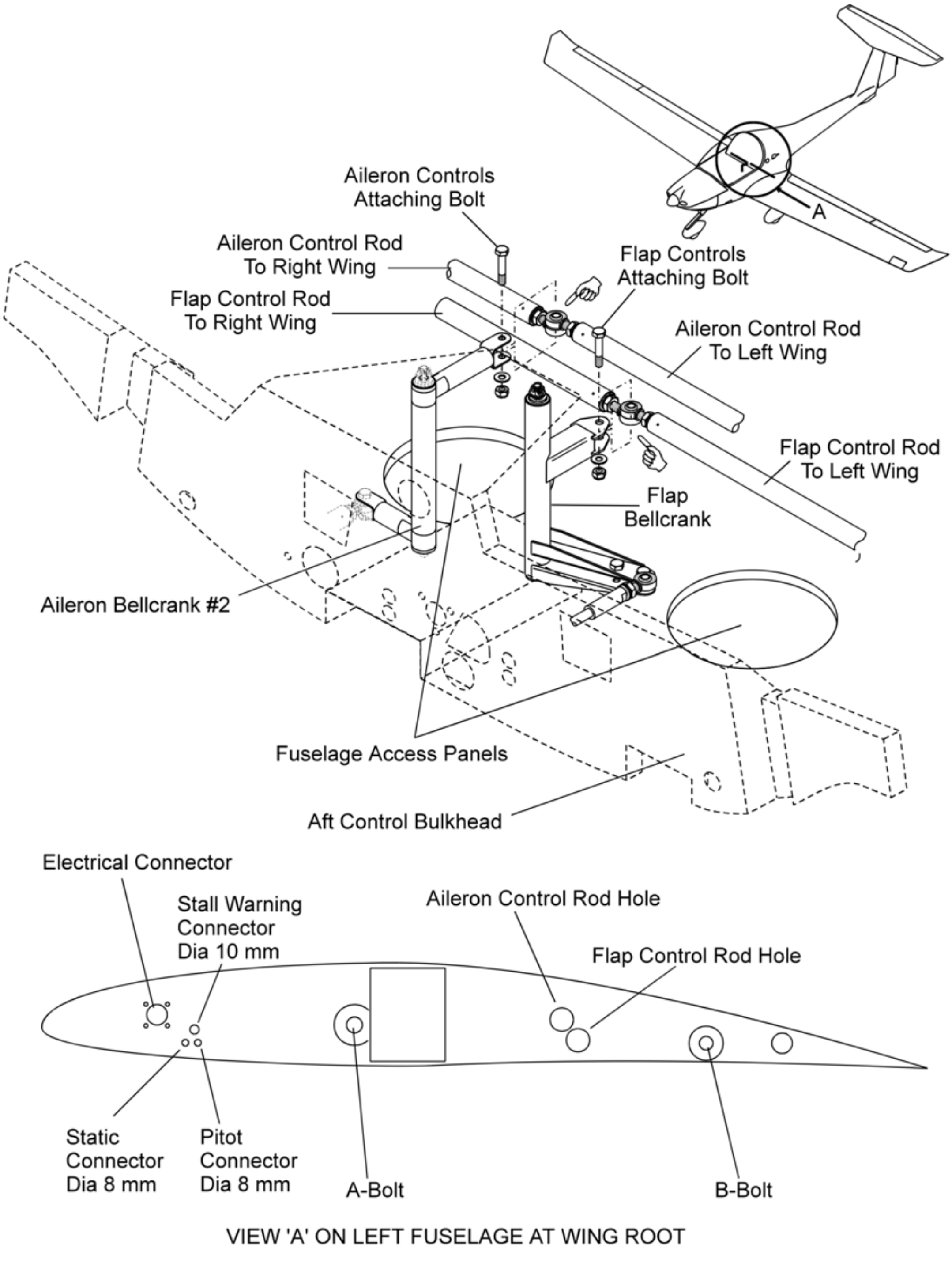

Figure 4: Wing Connections

B. Remove the Wings

	Detail Steps/Work Items	Key Items/References
(1)	Remove the following items for access: – Pilots' seats. – Access panels below the fuselage for the control connections. – Access panels below the wing roots for the B-bolts.	 Refer to Chapter 25-10. Refer to Chapter 52-40. Refer to Chapter 52-40.
(2)	Disconnect the aileron control rods at the bellcrank on the bulkhead, aft control.	Refer to Chapter 27-10. Through the panels below the fuselage.
(3)	Disconnect the flap control rods at the bellcrank on the bulkhead, aft control.	Refer to Chapter 27-50. Through the panels below the fuselage.
(4)	Put the trestles under the wings.	To touch the wing under the spar.
(5)	Remove the nut and spacer from the B-bolt.	
(6)	Release the locking device for the main bolts.	Pull it up against the spring. Then turn it 180°.
(7)	Take the weight of the wing.	One person at the wing tip.
(8)	Remove the main bolt.	If necessary, move the wing tip slightly up and down.
CAUTION:	DO NOT LIFT ON THE FLAP. ONLY LIFT ON THE WING STRUCTURE. OTHERWISE YOU MAY DAMAGE THE FLAP.	
(9)	Move the wing outboard a small distance.	To give access to the connections at the wing root. Use one person on the wing tip, one person at the wing-root leading-edge, and one person at the wing-root trailing edge.
(10)	Let the trestle hold the weight of the wing.	
(11)	Disconnect the electrical connector forward of the spar.	
(12)	Disconnect the stall-warning hose forward of the spar.	Left wing only. The hose is 10 mm (3/8 in) diameter. (Transparent Color)

	Detail Steps/Work Items	Key Items/References
(13)	Disconnect the pitot hose forward of the spar.	Left wing only. The hose is 8 mm (5/16 in) diameter. (Green Color)
(14)	Disconnect the static hose forward of the spar.	Left wing only. The hose is 8 mm (5/16 in) diameter. (Purple Color)
CAUTION: DO NOT LIFT ON THE FLAP. ONLY LIFT ON THE WING STRUCTURE. OTHERWISE YOU MAY DAMAGE THE FLAP.		
(15)	Move the wing away from the fuselage. Put the wing in the wing stand.	Use one person on the wing tip, one person at the wing-root leading-edge and one person at the wing-root trailing-edge.
(16)	If necessary, do this procedure again for the other wing.	

C. Install the Wings

	Detail Steps/Work Items	Key Items/References
	CAUTION: DO NOT GET GREASE ON THE THREADS OF THE B-BOLT. GREASE REDUCES THE FRICTION OF THE SELF-LOCKING NUT.	
(1)	Clean and lubricate the mounting bolts.	Refer to Chapter 12-20.
	CAUTION: DO NOT LIFT ON THE FLAP. ONLY LIFT ON THE WING STRUCTURE. OTHERWISE YOU MAY DAMAGE THE FLAP.	
(2)	Put the wing in position in the fuselage. Leave a gap for access to the system connections.	Use one person on the wing tip, one person at the wing-root leading-edge, and one person at the wing-root trailing-edge.
(3)	Hold the wing with a trestle.	To touch the wing under the spar.
(4)	Connect the static hose forward of the spar	Left wing only. The hose is 8 mm (5/16 in) diameter. (Purple Color)
(5)	Connect the Pitot hose forward of the spar.	Left wing only. The hose is 8 mm (5/16 in) diameter. (Green Color)
(6)	Connect the stall-warning hose forward of the spar.	Left wing only. The hose is 10 mm (3/8 in) diameter. (Transparent Color)
(7)	Connect the electrical connector forward of the spar.	
	CAUTION: DO NOT LIFT ON THE FLAP. ONLY LIFT ON THE WING STRUCTURE. OTHERWISE YOU MAY DAMAGE THE FLAP.	
(8)	Move the wing inboard fully.	Use one person on the wing tip, one person at the wing-root leading-edge, and one person at the wing-root trailing-edge.
(9)	Take the weight of the wing(s).	One person at each wing tip.
(10)	Install the main bolt.	If necessary, move the wing tip(s) in a circular motion

	Detail Steps/Work Items	Key Items/References
(11)	Install the spacer and nut on the B-bolt.	Torque to 14.8 lbf-ft (20 Nm).
(12)	Let the trestles hold the weight of the wing(s).	
(13)	Do this procedure again to install the other wing.	
(14)	Lock the handles of the main bolts with the locking device.	Pull it up against the spring. Then turn it to engage both of the handles.
(15)	Remove the trestles under the wings.	
(16)	Connect the flap control rods at the bellcrank on the bulkhead, aft control.	Refer to Chapter 27-50. Through the panels below the fuselage. Refer to Chapter 20 for standard torque values.
(17)	Connect the aileron control rods at the bellcrank on the bulkhead, aft control.	Refer to Chapter 27-10. Through the panels below the fuselage. Refer to Chapter 20 for standard torque values.
(18)	Do a check of the flap controls for correct connection and operation.	Obey the instructions of your airworthiness authority for control checks.
(19)	Do a check of the aileron controls for correct connection and operation.	Obey the instructions of your airworthiness authority for control checks.
(20)	Do a low-range static leak test.	Refer to Chapter 34-10.
(21)	Do a pitot leak test.	Refer to Chapter 34-10.
(22)	Install the following items: – Pilots' seats. – Access panels below the fuselage for the control connections. – Access panels below the wing roots for the B-bolts.	 Refer to Chapter 25-10. Refer to Chapter 52-40. Refer to Chapter 52-40.

3. Install a Wing Spar Bushing to a New Replacement Wing

	Detail Steps/Work Items	Key Items/References
(1)	Dry fit the bushing in the wing spar and install the wing temporarily.	Refer to Paragraph 2.C.
(2)	Make sure that there are no fit problems, sweep and dihedral tolerances are within the limits.	Refer to Figure 5.
(3)	Remove the wing and spar bushing.	Refer to Paragraph 2.B.
(4)	Lightly scuff the spar bonding area and the bushing outer surface with 120 grit sand paper or equivalent.	Do not cut into the composite of the spar.
(5)	Remove the dust and clean the bonding surfaces with acetone.	Do not let the acetone dry on composite surfaces. Wipe dry. Do not touch clean bonding surfaces with bare hands.
(6)	Mix resin.	Refer to Chapter 51-00.
(7)	Prepare thickened resin (paste).	
(8)	Wet surfaces to be bonded with a thin coat of mixed resin, not paste.	
(9)	Apply the paste to the outer surface of the bushing and the spar hole.	
(10)	Press the bushing into place.	
(11)	Remove any excess paste.	
Note:	Coat the wing pin with mold release wax or equivalent. This will aid in release if pin comes in contact with thickened resin.	
(12)	Install the wing.	Refer to Paragraph 2.C.
(13)	Make sure that the sweep and dihedral are within tolerance.	Refer to Figure 5.
(14)	Pre-cure the bushing at room temperature for 24 hours.	Post cure is required to obtain necessary structural properties of the resin/hardener.
(15)	When pre-cure is complete, remove the wing.	Refer to Paragraph 2.B.
(16)	Post cure at 60 ± 5 °C (140 ± 5 °F) for 15 hours.	Refer to Chapter 51-00.

	Detail Steps/Work Items	Key Items/References
(17)	Construct an enclosure to trap the heat using high temperature resistant materials or blankets.	
(18)	Use a heat source to heat the ambient air around the bushing installation.	Do not point the heat source directly at the composite material. This will result in damage.
(19)	Using a thermocouple probe(s) for temperature, adjust the heat source to maintain 60 ± 5 °C (140 ± 5 °F).	
	Note: Make sure that the airplane is monitored every 15 minutes during post cure to make sure that the temperature remains constant and for safety.	
(20)	Re-install the wing.	Refer to paragraph 2.C.

4. Bolt Play

A. Radial Play

The wing connection bolt values given in the table below must not be exceeded.

– A-bolt in spherical bearing	0.08 mm	0.003 in.
– B-bolt in spherical bearing	0.08 mm	0.003 in.
– Main bolt in spar stump bushing	0.125 mm	0.005 in.
– Main bolt in spar bridge bushing	0.08 mm	0.003 in.

To measure radial play, measure the diameter of the appropriate bolt and bearing/bushing. The difference between diameters must not exceed the values given in the above table.

B. Axial Play

Maximum admissible values:

– Spherical bearing for B-bolt	0.89 mm	0.035 in.

To measure axial play, the wing tip is to move forward, then back, the change in the gap between the fuselage and wing root rib (directly above the B-bolt), must not exceed the values stated in the above table.

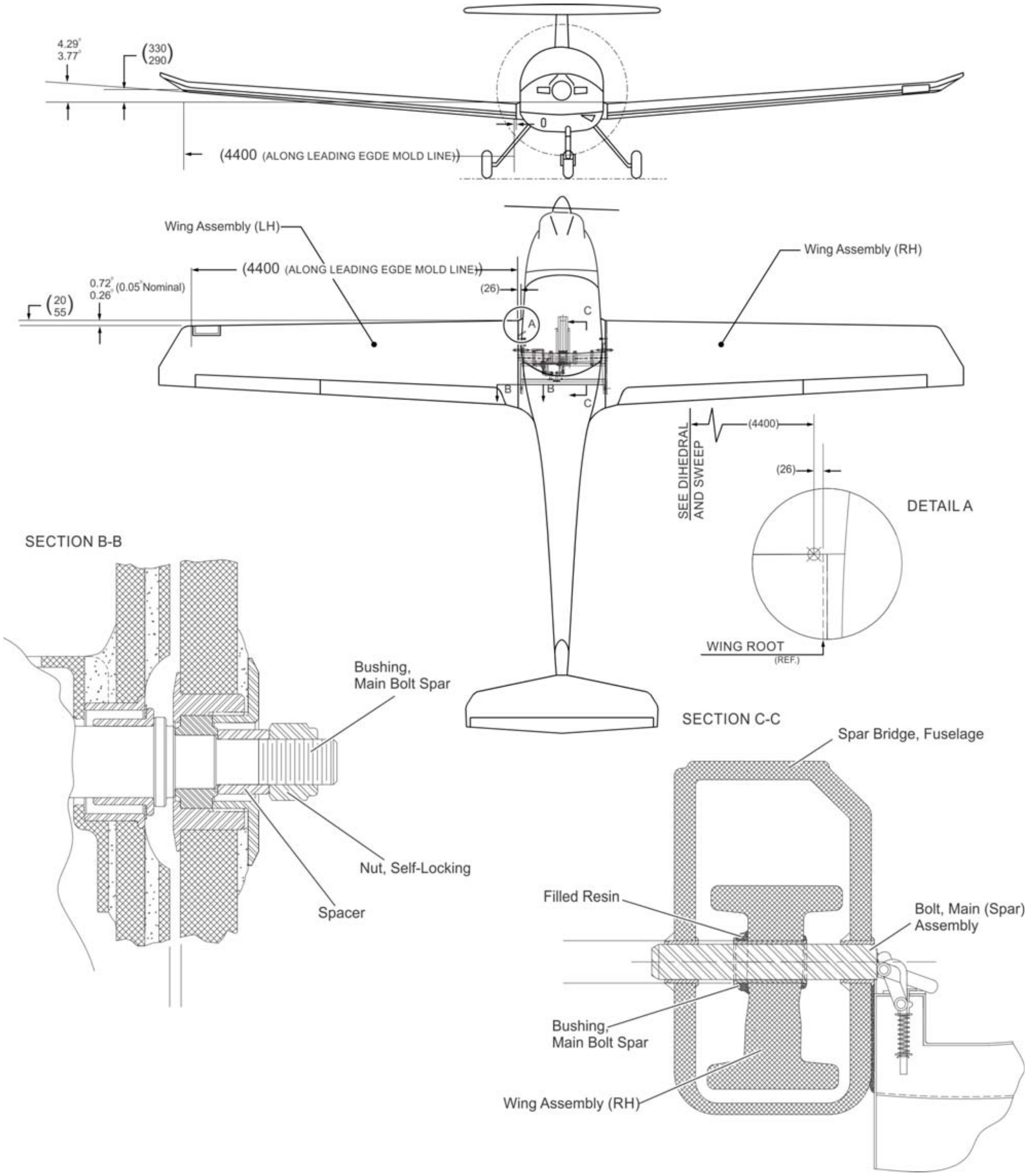

Figure 5: Installation of Spar Bushing to a New Replacement Wing (Sweep and Dihedral Tolerances)

Section 57-50
Flaps

1. General

This chapter describes about the flap structure. Refer to Chapter 27-50 for data about the flap control system. The flap hinge axis is below the wing. The flaps move back as they go down.

2. Description

Figure 1 shows the flap structure. Each flap has the following components:

A. Top Shell

The top shell has inner and outer GFRP skins. The skins bond to a rigid plastic foam core. Carbon cloth gives extra strength and stiffness in the outer skin.

B. Bottom Shell

The bottom shell has inner and outer GFRP skins. The skins bond to a rigid plastic foam core. Carbon cloth gives extra strength and stiffness in the outer skin.

C. End Ribs

The end ribs are rigid carbon moldings. They bond to the top and bottom shells.

D. Flap Horn

The flap horn is aluminum alloy. Bolts and nuts attach the flap horn to the flap.

E. Flap Hinges

Each flap has 3 hinges (and the flap horn). The flap hinges are stainless steel. Bolts attach the flap hinges to the flap.

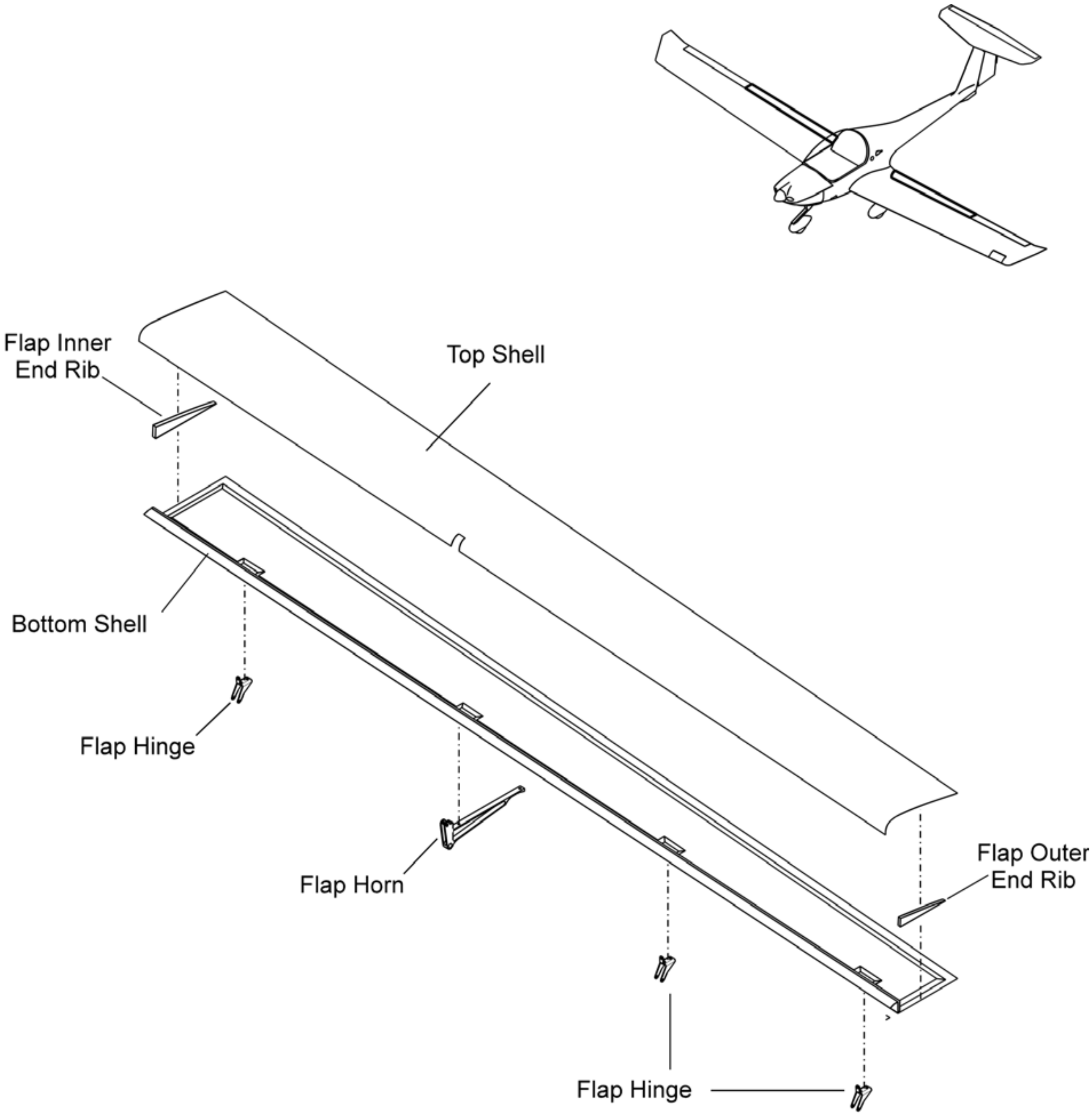

Figure 1: Flap Structure

Maintenance Practices

1. General

These Maintenance Practices tell you how to remove and install the flaps. Refer to Section 27-50 for the flap setting procedure.

2. Remove/Install a Flap

A. Remove the Flap

	Detail Steps/Work Items	Key Items/References
CAUTION: MAKE SURE THAT THE AREA UNDER THE FLAPS IS CLEAR BEFORE YOU MOVE THE FLAPS.		
(1)	Lower the flaps. – Set the ELECTRIC MASTER switch to ON – Set the flap selector to LDG – When the flaps stop moving: – Set the ELECTRIC MASTER switch to OFF.	
(2)	Remove the bolt which attaches the control rod to the flap horn.	Hold the flap.
(3)	Remove the pivot bolts from the hinges and the flap horn.	Hold the flap.
(4)	Remove the flap from the airplane.	

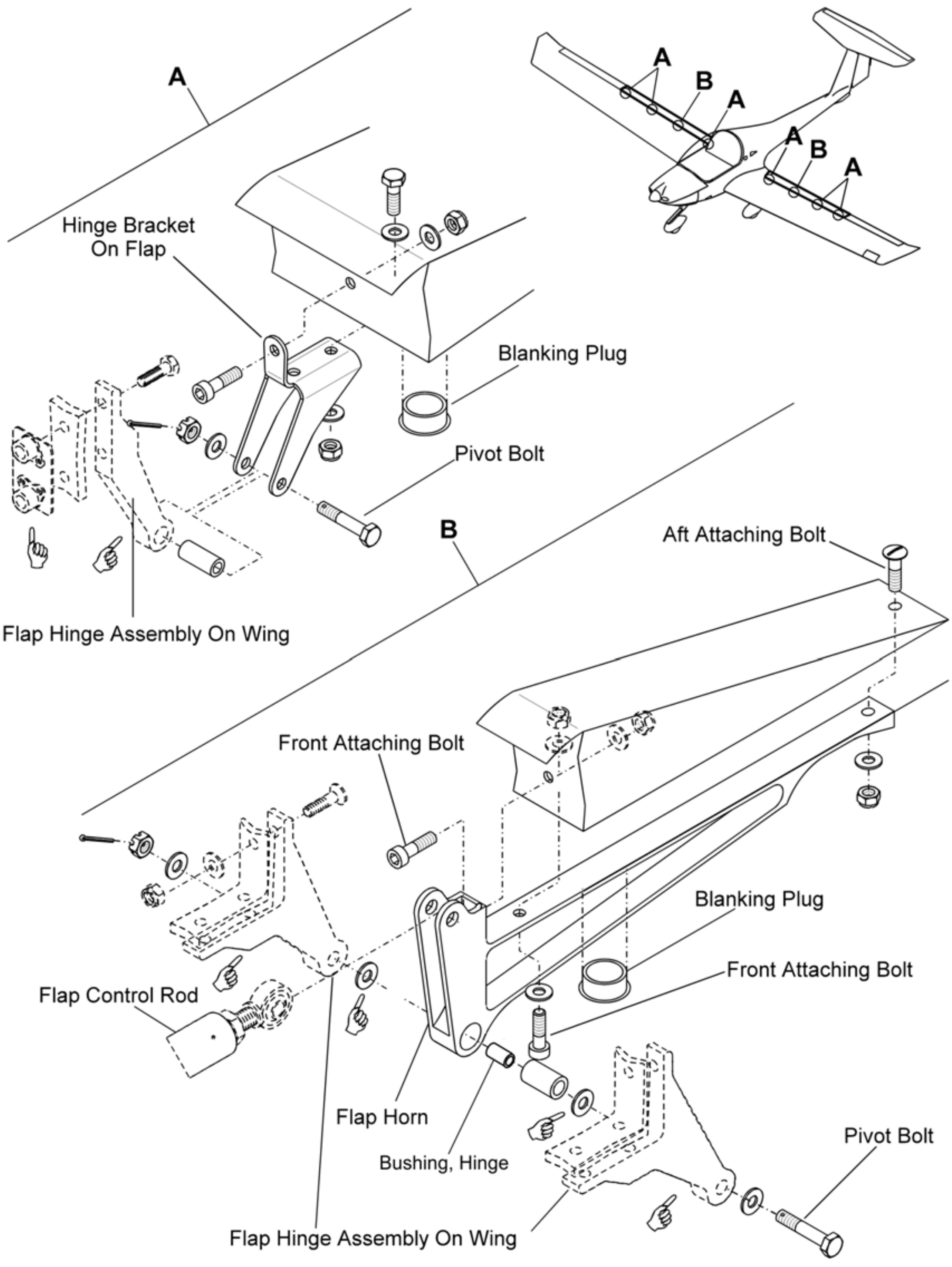

Figure 2: Flap Connections

B. Install the Flap

	Detail Steps/Work Items	Key Items/References
(1)	Put the flap in position on the airplane.	Hold the flap.
(2)	Install the pivot bolts in the hinges and the flap horn.	Hold the flap. Make sure that there is a gap of 3 - 5 mm (0.12 - 0.20 in) between the flap and the aileron.
(3)	Install the bolt which attaches the control rod to the flap horn.	
(4)	Install the bushing	Ream the bushing to Ø 9.525 (+0.010 and +0.050) after installation to fit properly.
(5)	Do a test for correct adjustment of the flaps.	Refer to Section 27-50.
(6)	Do an inspection of the flap controls which you disconnected or adjusted.	
(7)	If necessary for your airworthiness authority, do a second inspection of the flap controls.	

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Section 57-60
Ailerons

1. General

This chapter describes about the aileron structure. Refer to Chapter 27-10 for data about the aileron control system.

The aileron hinge axis is near the lower wing stern.

2. Description

Each aileron has the following components:

A. Top Shell

The top shell has inner and outer GFRP skins. The skins bond to a rigid plastic foam core. Carbon cloth gives extra strength and stiffness in the outer skin.

B. Bottom Shell

The bottom shell has inner and outer GFRP skins. The skins bond to a rigid plastic foam core. Carbon cloth gives extra strength and stiffness in the outer skin.

C. End Ribs

The end ribs are rigid carbon moldings. They bond to the top and bottom shells. The outer end rib has the mounting for the aileron mass-balance.

D. Aileron Horn

The aileron horn is aluminum alloy. Bolts and nuts attach the aileron horn to the bottom shell of the aileron. The horn also makes the middle hinge for the aileron.

E. Aileron Hinges

Each aileron has 3 hinges (and the aileron horn). The aileron hinges are small blocks of aluminum alloy. Bolts attach the aileron hinges to the aileron.

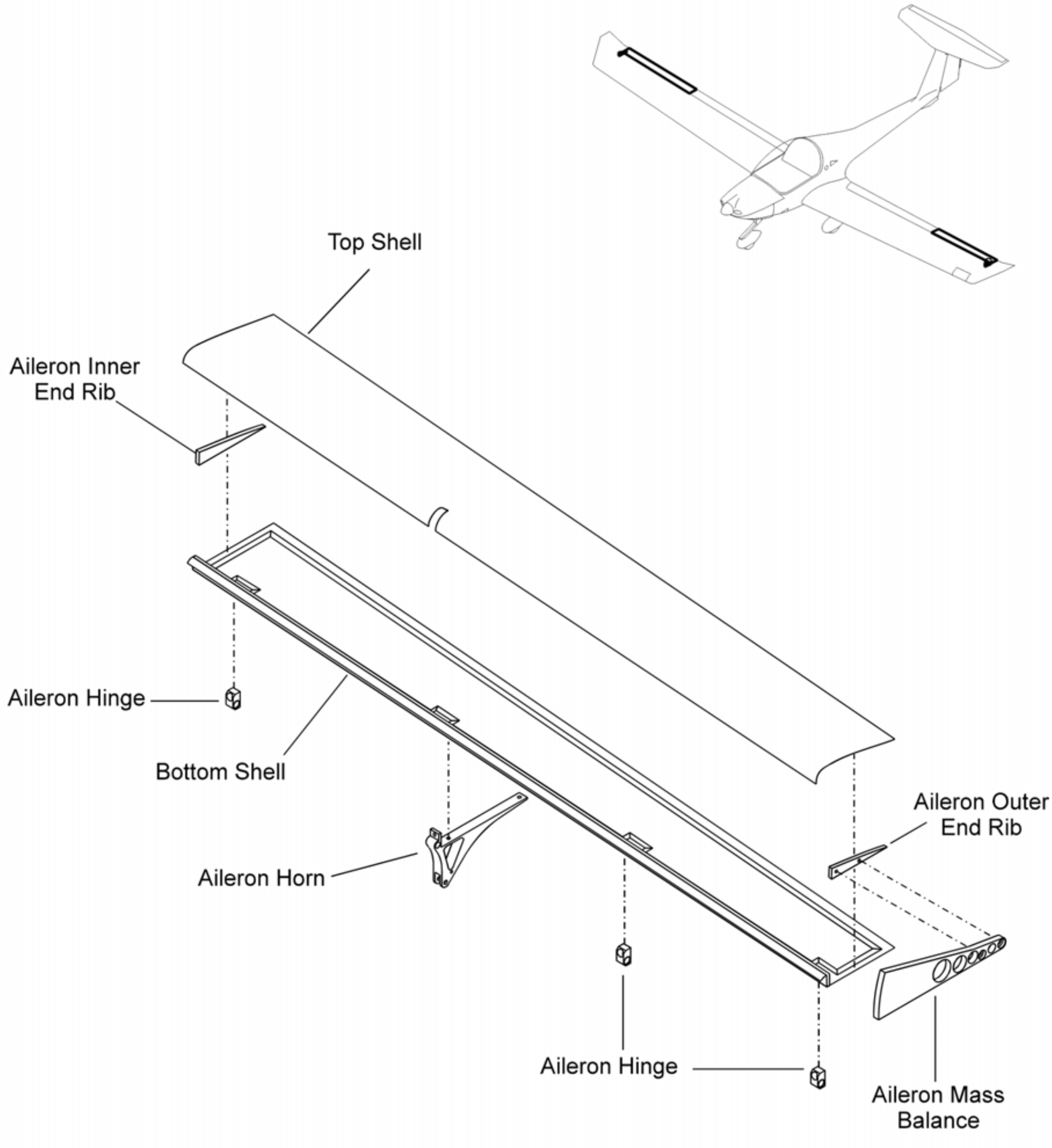

Figure 1: Aileron Structure

Maintenance Practices

1. General

The following maintenance practices describe how to remove and install the ailerons. Refer to Chapter 27-10 for data on adjusting the aileron controls.

2. Remove/Install the Aileron

A. Remove the Aileron

	Detail Steps/Work Items	Key Items/References
(1)	Remove the bolt which attaches the control rod to the aileron horn.	Hold the aileron.
(2)	Remove the pivot bolts from the hinges and the aileron horn.	Hold the aileron.
(3)	Remove the aileron from the airplane.	

B. Install an Aileron

	Detail Steps/Work Items	Key Items/References
(1)	Put the aileron in position on the airplane.	Hold the aileron.
(2)	Install the pivot bolts in the hinges and the aileron horn.	Hold the aileron. Make sure that there is a gap of 3 - 5 mm (0.12 - 0.20 in) between the flap and the aileron. Make sure that aileron axial play does not exceed 1 mm. If play exceeds 1 mm, install a washer (P/N NAS1149C0432R) at the control horn hinge to reduce the play. Washer may be installed on inboard or outboard side of the control horn as required for clearance.
(3)	Install the bolt that attaches the control rod to the flap horn.	
(4)	Do a test for correct adjustment of the ailerons.	Refer to Chapter 27-10
(5)	Do an inspection of the aileron controls that you disconnected or adjusted.	
(6)	If necessary for your airworthiness authority, do a second inspection of the aileron controls.	

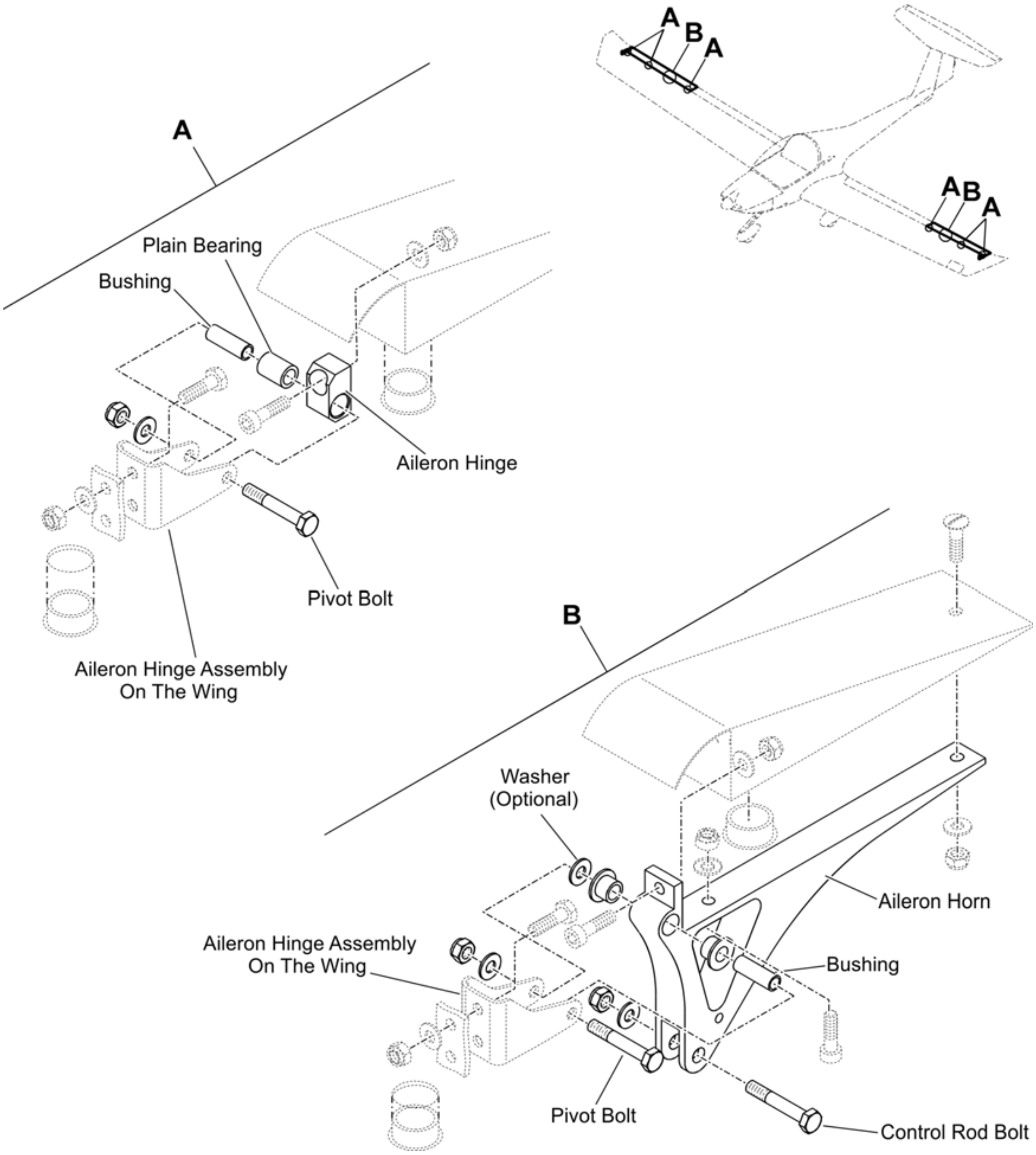

Figure 2: Aileron Installation

CHAPTER 61

PROPELLER

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TABLE OF CONTENTS

CHAPTER 61

PROPELLER

Section 61-10

Propeller Assembly

Trouble-Shooting

Maintenance Practices

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CHAPTER 61
PROPELLER

1. General

This Chapter describes the propeller installation of the DV 20 E. For more data on the propeller refer to the propeller manufacturer's manuals.

Note: Equipment which is certified for installation in the DV 20 E is listed in Section 6.5 of the Airplane Flight Manual. Such equipment may be installed in accordance with the Airplane Maintenance Manual.

Any equipment which is not listed in Section 6.5 of the Airplane Flight Manual is called "Additional Equipment". The installation of Additional Equipment is a modification which must be handled in accordance with national regulations or a Service Bulletin.

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Section 61-10
Propeller Assembly

1. General

The DV 20 E airplane has a mt-propeller MTV-21-A/175-05 hydraulically regulated 2-blade constant speed propeller installed. The propeller has wood composite blades with fiber-reinforced plastic coating and stainless steel edge cladding; in the region of the propeller hub the leading edge is coated with adhesive PU foil. These blades combine the lowest weight whilst minimizing vibration.

Low Pitch: 14.5° ± 0.2°

High Pitch: 30° ± 1°

2. Propeller Control

The propeller pitch control system consists of the mt-propeller P-850-12 governor. The pitch is set by the pilot via the propeller speed lever. To change the blade pitch angle gearbox oil is pumped into the propeller hub. Decreasing the oil pressure leads to a decrease of pitch and a higher RPM. Increasing the pressure leads to higher pitch and a lower RPM.

A. Ground Operation

CAUTION: OPERATION ON THE GROUND AT HIGH RPM SHOULD BE AVOIDED AS FAR AS POSSIBLE, AS THE BLADES COULD SUFFER STONE DAMAGE. FOR THIS REASON A SUITABLE SITE FOR ENGINE RUNS SHOULD BE SELECTED, WHERE THERE ARE NO LOOSE STONE OR SIMILAR ITEMS.

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Trouble-Shooting

1. General

The table below lists the defects you could have for the propeller. If you have the trouble detailed in the Trouble column read across to the Possible Cause column. Then do the repair in the Repair column.

Trouble	Possible Cause	Repair
Sluggish RPM.	Cold oil.	Allow engine to warm up sufficiently.
	Friction in pitch change mechanism.	Turn blades within angular play. If excessive friction is revealed, contact propeller manufacturer to inspect blade retention system.
Engine vibration.	Propeller out of balance.	Examine the propeller. If you find damage refer to the manufacturer's Owners Manual.
	Spinner out of balance.	Replace the spinner.
	Propeller mounting loose.	Tighten the mounting nuts to the correct torque. Refer to the manufacturer's Owners Manual. Use new nuts.
	Spinner attaching screws loose.	Tighten the attaching screws. Refer to the manufacturer's Owners Manual.
	Blade tracking not correct.	Refer to the manufacturer's Owners Manual.
Cracks in the blades.	Over-speed.	Refer to the manufacturer's Owners Manual.
Holes/nicks/dents in the blade.	Stone damage.	Repair/replace the propeller. Refer to the manufacturer's Owners Manual.

Trouble	Possible Cause	Repair
Surging RPM.	Trapped air in propeller piston.	Move propeller speed lever at least twice before flight at about 4000 RPM with a drop of about 1000 RPM.
	Oil sludge in system.	Contact repair station to clean oil lines in engine, cylinder, propeller and governor.
	Wrong speeder spring in governor.	Check governor designation.
	Speeder spring in governor too weak.	5 periods of surging with low amplitude are acceptable. If governor does not stabilize then, contact repair station.
	Improper pitch setting in propeller.	Check propeller pitch setting. Check static RPM.
	Abrupt movement of prop control or throttle control.	Move controls slowly and smoothly.
	Oscillation of tachometer.	Check tachometer and drive.
Differences in RPM during climb, cruise and descent without propeller speed control lever movement.	Up to ± 100 RPM are system inherent. If this value is exceeded:	
	Friction in propeller or governor.	Contact propeller manufacturer.
	Defective RPM indicator.	Replace.

Trouble	Possible Cause	Repair
Increasing RPM during normal operation without movement of propeller speed control lever.	Oil leakage which is visible outside. Pitch change due to leakage in internal oil system between governor and propeller. Internal leakage in propeller. Malfunction of governor drive or governor relieve valve.	Replace seals. Contact engine repair station. Oil transfer rings on propeller shaft may be defective, or supply of engine oil to governor may be insufficient. Contact propeller manufacturer. Contact repair station to replace governor.
RPM drop during normal operation without movement of propeller speed control lever.	Failure of governor speeder spring, or plunger stuck in governor. Defective propeller speed control bowden cable. Dirt in fuel system.	Contact repair station to replace governor. Repair or replace. Clean.
Pitch change extremely sluggish after movement of propeller speed control lever and/or RPM changes with airspeed and manifold pressure as in case of a fixed pitch propeller.	Clogged oil lines between governor and propeller. Oil sludge in cylinder of propeller pitch change mechanism. Defective pitch change mechanism in propeller. Corrosion in the blade bearings.	Contact repair station to have lines cleaned. NOTE: This kind of malfunction does not appear abruptly. The quality of the prop speed control function deteriorates slowly over a period of time. This condition should be detected during preflight inspections. Contact repair station to clean. See NOTE above. Contact propeller manufacturer. NOTE: This failure may occur suddenly. Contact repair station.

Trouble	Possible Cause	Repair
Oil leakage (may either be visible from outside or not).	Defective seals.	Replace.

Maintenance Practices

1. Install the Propeller

	Detail Steps/Work Items	Key Items/References
	NOTE: Propeller installation may only be done by authorized personnel and must be checked immediately after completion. Any maintenance must be performed in accordance with the propeller manufacturer’s documentation.	
(1)	Clean propeller and engine flange with gasoline or a similar substance.	The torque is transmitted through friction, therefore the flange surface must be clean.
(2)	Check O-rings. NOTE: Do not install additional O-Rings! Check position of O-Ring installed in propeller flange.	
(3)	Install spinner backplate. Install propeller, considering position relative to spinner backplate.	
(4)	Tighten nuts on flange uniformly in crosswise order. Proper torque: see propeller manual. Verify nuts and bolts are clean (do not lubricate) and turn easily on bolt threads.	
(5)	Check track of propeller blades approx. 10 cm (4 in) from the blade tips at the trailing edge. Maximum allowable value: 3 mm (0.12 in).	
(6)	Install spinner in accordance with the markings. Ensure sufficient guidance on guiding plate. Apply a light coat of motor oil to rubber before installing spinner. Torque of spinner mounting screws: 4 to 5 Nm (35.4 to 44.3 in.lbs.).	

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CHAPTER 71

POWER PLANT

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TABLE OF CONTENTS

CHAPTER 71

POWER PLANT

Trouble-Shooting

Maintenance Practices

Section 71-10

Cowling

Maintenance Practices

Section 71-20

Engine Mount

Maintenance Practices

Section 71-60

Air Intakes and Guides

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CHAPTER 71
POWER PLANT

1. General

This Chapter contains information about the Rotax 912 iSc3 Sport engine installation in the DV 20 E.

Refer to the DV 20 E Airplane Flight Manual for engine start/stop procedures.

Refer to these Chapters for data about other engine systems:

– Chapter 76. Engine controls.

– Chapter 77. Engine indicating.

– Chapter 78. Exhaust system.

– Chapter 79. Oil system.

Note: Equipment which is certified for installation in the DV 20 E is listed in Section 6.5 of the Airplane Flight Manual. Such equipment may be installed in accordance with the Airplane Maintenance Manual.

2. Description

The DV 20 E has a Rotax 912 iSc3 Sport engine installed, which has the following specifications:

– Four cylinder, four-stroke engine with dry sump forced lubrication.

– Horizontally opposed construction.

– Fuel injection system.

– Propeller speed reducing gear 1:2.43.

– Digital engine control.

Max. power:	73.5 kW (100 DIN-HP) at 5800 RPM at sea level and ISA
Max. continuous power:	72.0 kW (98.0 DIN-HP) at 5500 RPM at sea level and ISA
Displacement:	1352 cm^3 (82.5 in^3)

The indications for monitoring important engine parameters during operation are displayed on the engine instrument. The engine can only be operated with the ENGINE MASTER switch ON. The engine has an ECU (Electrical Engine Control Unit) which receives its electrical power from Generator 1 when the engine is running. For engine start, the ECU receives its electrical power from the battery.

The engine has a redundancy concept for generator failure. After failure of Generator 1, the ECU receives electrical power from Generator 2. After failure of both generators the ECU can receive electrical power from the battery by closing the Battery Backup switch.

In case of failure of any generator, the engine provides no more electric power to the airframe. Failure of a generator is recognized by the low voltage light and negative current indicated on the ammeter.

In case of failure of Generator 1 the LANE A/B FAIL lights are flashing. At failure of Generator 1 the ECU automatically switches one-time over to the Generator 2. A power drop for a fraction of a second could be noticed when switching.

In case of failure of Generator 2 the LANE A/B FAIL lights are not illuminated but the low voltage caution will be displayed.

For more detailed information refer to the engine maintenance and operation manual.

Trouble-Shooting

1. General

The table below lists the defects you could have with the power plant. It does not give trouble shooting data for the engine or the engine systems. Refer to the Operation Manual, latest revision for engine and engine system trouble-shooting.

WARNING: YOU MUST BE CAREFUL WHEN YOU DO POWER PLANT TROUBLE SHOOTING. OPERATION OF A DAMAGED ENGINE CAN CAUSE MORE DAMAGE TO THE ENGINE. THIS CAN CAUSE INJURY TO PERSONNEL.

If you have the trouble detailed in the Trouble column read across to the Possible Cause column. Then do the repair given in the Repair column.

Trouble	Possible Cause	Repair
Engine does not start.	Spark plug gap too wide.	Adjust gap to 0.5 mm (0.02 in) or replace plugs.
	Closed fuel shut off valve.	Open.
	Clogged fuel filter.	Clean or replace.
	Leaky fuel system.	Repair.
	No fuel in tank.	Replenish fuel.
	Ignition wires interchanged.	Observe firing order 1-4-2-3.
	Starter RPM too low, defective or empty battery.	Recharge or replace battery.
	Loose or defective ignition wire.	Check wire connections, replace if required.
	Spark plugs wet.	Thoroughly dry plugs inside and outside.

Trouble	Possible Cause	Repair
	Insufficient compression. Engine damage.	Check for loss of pressure; carry out repair if necessary. Inspect oil tank for metal particles; in case of presence, engine overhaul might be required.
Engine idles unsteadily after warm up, black exhaust gas.	Intake manifold leaky.	Tighten all connectors, replace defective parts.
Engine runs irregularly or misfires occasionally.	Spark plugs do not fire. Spark discharge over ignition wires. Defective ignition box. Clogged fuel filter.	Check plugs, clean inside and outside, adjust electrode gap; Replace plugs if necessary. Dry wet wires; replace defective wires. Have box repaired or replace box. Clean.

Trouble	Possible Cause	Repair
Engine runs too hot, oil temperature exceeds 140° C.	Too much oil remaining in crankcase.	Check oil return line for clogging; check engine for gas mixture leakage.
	Insufficient air stream to oil radiator.	Check for free air passage; clean.
	Insufficient oil supply.	Check oil level, replenish if necessary.
	Poor oil quality.	Change oil, use approved oil.
	Clogged oil filter.	Replace.
	Excessive piston blow-by.	Usual reason: worn or seized piston rings, overhaul required.
	Defective bearings.	If there are metal particles in the engine or oil tank - overhaul required.
	Defective oil temperature indicator.	Replace.
Engine performance unsatisfactory.	Defective ignition system.	Check ignition circuits; if defective replace.
	Too much oil in crankcase.	Check return line to oil tank for clogging (seals, covers etc.).
	Insufficient fuel supply.	Check fuel system.
	Non-approved fuel.	Refuel using approved fuel.
	Incorrect throttle lever adjustment.	Adjust.
	Leaky air intake.	Tighten connectors.

Trouble	Possible Cause	Repair
Low oil pressure.	Insufficient oil level.	Check oil level, replenish if required.
	Oil remains in engine and does not return to tank.	Check oil return line for clogging.
	Defective oil seal.	Replace.
	High oil temperature.	See “engine runs too hot”.
	Defective pressure control valve.	Check for foreign matter, check spring.
	No oil pressure, air in oil line.	Bleed oil line.
	Defective oil pressure indicator	Check sensor, instrument and wiring.
	Defective crankshaft bearings.	Engine overhaul required.
Excessive oil consumption.	Worn, broken or improperly installed piston rings.	Engine overhaul required.
	Poor oil quality.	Change oil, use approved oil type.
	Worn valve guides, poor condition of valve shaft seal.	Cylinder head repair required.
	Oil leaks.	Seal.

Trouble	Possible Cause	Repair
Knocking under load.	Octane rating of fuel too low. Spark plugs installed without sealing ring. Excessive residue in combustion chamber.	Use fuel with higher Octane rating. Ensure that there is one sealing ring on each spark plug. Remove cylinder heads, remove combustion residue, check oil consumption.
Engine hard to start at low temperatures.	Starting RPM too low. Low battery change. High oil pressure. Too low oil pressure after cold-start.	Preheat. Recharge or replace battery. In case of cold start, a reading of up to 7 bar does not indicate malfunction. Too much resistance in oil line at low temperatures; shut off engine, pre-heat motor oil.
High fuel pressure.	Fuel fine filter contaminated. Fuel pressure regulator defect.	Replace fuel fine filter. Replace fuel pressure regulator.

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Maintenance Practices

1. Remove/Install the Engine

A. Remove the Engine

Note: In many cases it is better to remove the engine together with the engine mount from the firewall. The following is a description of such task.

Warning: Before removing the engine, disconnect the battery.

	Detail Steps/Work Items	Key Items/References
(1)	Install the tail support.	Refer to Chapter 7.
	WARNING: MAKE SURE THAT THE ENGINE IS SAFE BEFORE YOU DO ANY WORK ON THE PROPELLER. IF THE ENGINE IS TURNED, THE PROPELLER CAN CAUSE INJURY OR DEATH.	
(2)	Remove upper and lower cowling.	
(3)	Disconnect nose wheel elastomer package assembly from engine mount.	
(4)	Disconnect ignition wires.	
(5)	Remove propeller.	
(6)	Disconnect battery (negative terminal first), remove battery.	
(7)	Disconnect fuel lines from firewall fitting.	
(8)	Disconnect the electrical connector on the firewall.	
(9)	Disconnect bowden cables for throttle, alternator air and cabin heat.	
(10)	Remove heating hose on the exhaust heat exchanger.	
(11)	Lift engine until the engine mount is without load. Remove lower and than upper engine mount attachment bolts and move airplane rearward.	
(12)	Remove exhaust, radiators, oil tank, ignition box, engine mount and auxiliary engine mounts.	

B. Install Engine

For installation of the engine reverse the engine removal sequence.

Section 71-10

Cowling

1. General

The engine cowling consists of two halves, with two inspection covers located on the upper half allowing access to the oil dipstick and the coolant equalizing reservoir. The covers are attached to the cowling by hinges and secured by rotary locks.

Both halves of the engine cowling are attached to the airframe by quick lock fasteners.

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Maintenance Practices

1. Remove/Install the Cowlings

A. Remove the Cowlings

	Detail Steps/Work Items	Key Items/References
	WARNING: MAKE SURE THAT THE ENGINE IS SAFE BEFORE YOU DO ANY WORK ON THE PROPELLER. IF THE ENGINE IS TURNED, THE PROPELLER CAN CAUSE INJURY OR DEATH.	
(1)	Loosen fasteners on upper engine cowling.	
(2)	Remove upper cowling.	
(3)	Loosen fasteners on lower engine cowling.	
(4)	Place propeller into horizontal position and remove cowling in forward direction.	

B. Install the Cowlings

For installation of the cowlings reverse the cowlings removal sequence.

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Section 71-20
Engine Mount

1. General

The engine is mounted to the airframe via the engine mount and the shock mounts. The mount consists of a welded steel tube frame which is mounted to the firewall using bolts and self locking nuts. The bolts must be re-torqued at the intervals specified in Chapter 5.

The shock mounts are located between the engine and the engine ring mount to reduce the vibration transmission from the engine to the airframe.

2. Description

The engine mount is electrically grounded to the firewall by a ground strap. The engine is attached to the engine mount with shock mounts, which consist of a rubber element and a spacer tube. The rubber elements are secured against twisting by pre-tension within the bushings.

Attached to the engine mount are different mounting brackets for oil, coolant radiators, oil tank, as well as mounting provisions for various cables and hoses.

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Maintenance Practices

1. Remove/Install the Engine Mount

A. Remove the Engine Mount

	Detail Steps/Work Items	Key Items/References
(1)	Remove bolts holding the engine mount.	
(2)	Remove engine mount from firewall.	

B. Install the Engine Mount

For installation of the engine mount reverse the removal sequence.

Note: For the correct torque refer to Chapter 20-00. Re-torque of the bolts is necessary at intervals given in Chapter 05.

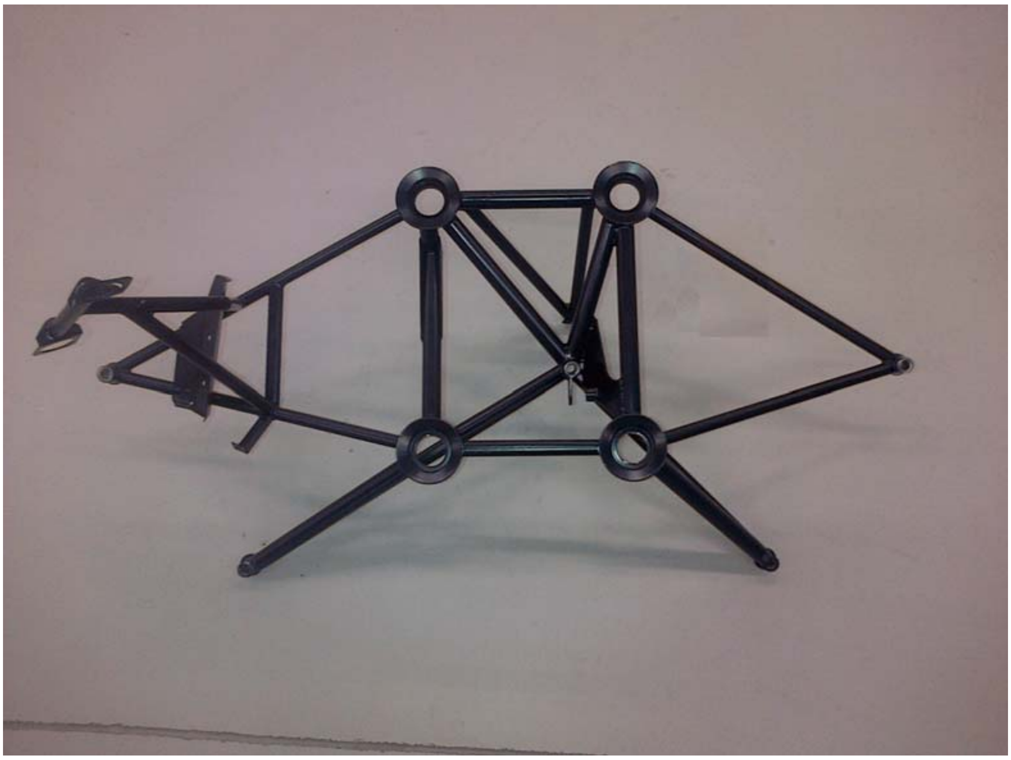

Figure 1: Engine Mount

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Section 71-60
Air Intakes and Guides

1. General

A ram air guide made of GFRP is installed on the engine to ensure optimal engine cooling.

2. Description

The air guide is designed to follow the contours of the engine block and cylinders. The exact fitting makes attachment screws unnecessary. The crossed over coolant hoses installed on the upper side of the engine secure the air guide.

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CHAPTER 75

LIQUID COOLING SYSTEM

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TABLE OF CONTENTS

CHAPTER 75

LIQUID COOLING SYSTEM

Maintenance Practices

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CHAPTER 75

LIQUID COOLING SYSTEM

1. General

This Section describes the liquid cooling system for the DV 20 E airplane. The Rotax 912 iSc3 Sport features liquid cooling of the cylinder heads and ram air cooling of the cylinders. The cooling system of the cylinder heads is a closed circuit with a dispatcher vessel (expansion tank) on top of the engine and an equalizing reservoir (overflow bottle).

An inspection hole in the right-hand side of the upper cowling provides access to the overflow bottle. A dipstick is used for checking its quantity of coolant.

The expansion tank is closed by a pressure cap with pressure relief valve and return valve. As the coolant heats up and expands, the pressure relief valve opens and the coolant flows via a hose to the overflow bottle at atmospheric pressure. As it cools down, the coolant is sucked back into the cooling circuit.

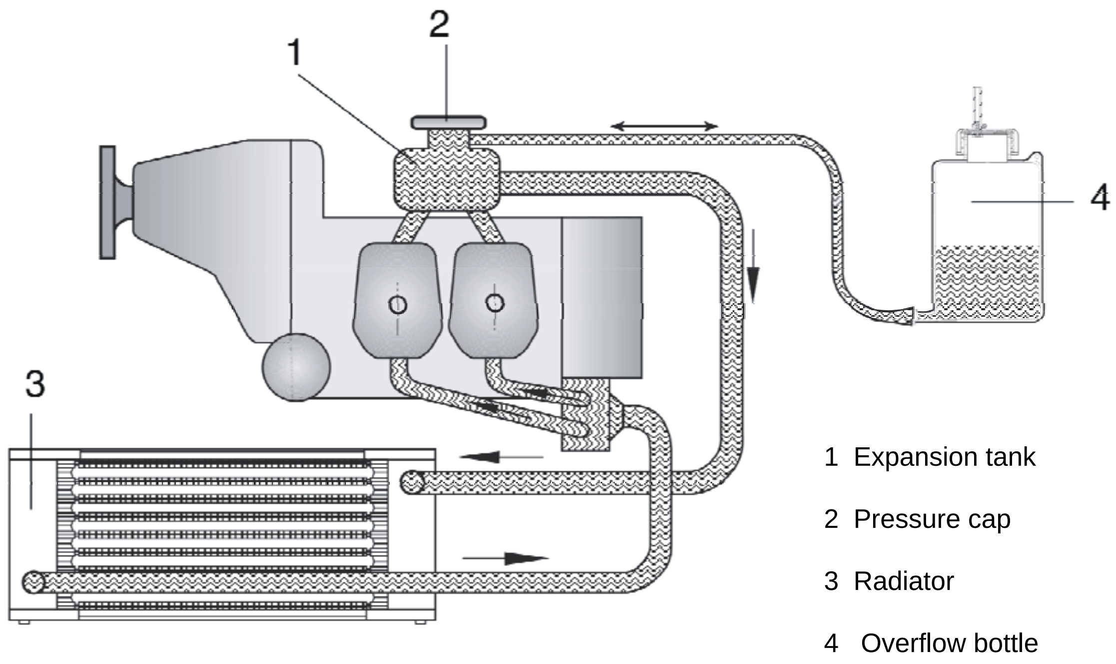

Figure 1: Cooling System

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Maintenance Practices

1. General

This Section describes the Maintenance Practices for the components in the liquid cooling system.

2. Remove and Install the Coolant Tank

	Detail Steps/Work Items	Key Items/References
(1)	Remove all hoses, connected to coolant tank.	
(2)	Remove coolant tank.	

For Installation, reverse the sequence.

3. Remove and Install the Radiator

	Detail Steps/Work Items	Key Items/References
	NOTE: Disconnecting the hoses to the radiator will cause coolant to leak out. An appropriate container should be used to store all coolant.	
(1)	Remove all hoses connected to radiator.	
(2)	Remove the 3 bolts connecting radiator to engine.	
(3)	Remove radiator.	

For Installation, reverse the sequence.

4. Remove and Install the Overflow Bottle

	Detail Steps/Work Items	Key Items/References
(1)	Remove all hoses connected to overflow bottle.	
(2)	Remove clamps securing overflow bottle.	

For Installation, reverse the sequence.

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CHAPTER 76

ENGINE CONTROLS

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TABLE OF CONTENTS

CHAPTER 76

ENGINE CONTROLS

Trouble-Shooting

Maintenance Practices

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CHAPTER 76
ENGINE CONTROLS

1. General

This Section describes the DV 20 E engine power controls.

The primary engine controls are the throttle lever and the propeller speed lever. Bowden cables are used for the transmission of control movements. The bowden cables are sealed with fire resistant compound where they pass through the fire wall.

2. Engine Controls

A. Throttle Lever

The throttle lever is used to set the desired manifold pressure.

Lever forward (MAX) = wide open throttle

Lever to rear (IDLE) = Idle

The separate ECU controls injected fuel quantity and ignition according to the selected manifold pressure and RPM. Operation of the throttle valve is controlled by the throttle lever which is located in the center console. The bowden cable is attached to the throttle lever by a clamp. The bowden cables are attached on the other end to the throttle valve using a clamp. The bowden cable jacket is attached on both ends to a bracket and are adjustable on the throttle valve side. The stop is located on the throttle valve. In case of a malfunctioning of the throttle valve operating mechanism, a spring will positions the throttle valve in the fully open position.

B. Propeller Speed Lever

To adjust the propeller RPM, the propeller speed lever located in the center console must be set. The movement of the lever is transferred to the control lever on the propeller governor via a bowden cable.

C. ELECTRIC MASTER

The ELECTRIC MASTER switch has two positions:

OFF disconnecting battery power

ON connecting battery power to the power distribution system

D. ENGINE MASTER

The engine can only be cranked with its ENGINE MASTER switched to ON. When activated, the ENGINE MASTER provides the power supply for the main fuel pump and the ECU. To shut down the engine the ENGINE MASTER is switched to OFF.

E. START button

Pressing the START button starts the engine.

F. LANE SELECTOR switch

There is a LANE SELECTOR switch. For normal operation the switch is set to AUTO. The engine is controlled by either LANE A or LANE B. In case of a failure of the active lane there should be an automatic switch-over to the other lane.

G. Alternate Air lever

In the event of power loss because of icing or blocking of the air filter, there is the possibility of drawing air from the engine compartment. The ALTERNATE AIR lever is located in the center console. To open the alternate air valve the lever is pulled to the rear. Normally, the alternate air source is closed with the lever in the forward position. The motion of the ALTERNATE AIR lever is transferred to the alternate air valve by a bowden cable.

H. Throttle Quadrant Friction Control

The levers for throttle, propeller speed, and alternate air can be arrested by turning the black knob on the right hand side of the center console in clockwise direction. The arresting is performed by a friction washers which is installed on the lever axis.

3. Electrical Engine Control Unit / ECU

A. Engine Control and Regulation

The electrical ECU controls the fuel injectors and ignition system according to the engine sensor information. The ECU monitors, controls and regulates all important parameters for engine operation.

Sensors installed are:

– Oil temperature (lubrication system engine).

– Oil pressure (lubrication system engine).

– Coolant temperature.

– Crankshaft RPM (twice).

– Manifold pressure (twice).

– Manifold air temperature (twice).

– Ambient air pressure.

– Ambient air temperature.

– ECU voltage.

In accordance with the received signals and a comparison with the programmed characteristic diagrams the necessary inputs are calculated and transmitted via signal lines to the engine:

– Signal for each of the 4 injection nozzles.

– Signal for the ignition system.

The electrical ECU consists of two lanes. A Lane Selector switch selects the operative lane by switching off the other lane. Normal position of the Lane Selector switch is AUTO.

A fault in one of the lanes is indicated by a flashing or illuminated LANE A FAIL or LANE B FAIL light.

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Trouble-Shooting

1. General

The table below lists the defects you could have with the engine control system. If you have the trouble detailed in the Trouble column read across to the Possible Cause column. Then do the repair given in the Repair column.

For all other engine control trouble, refer to the engine manufacturer.

Trouble	Possible Cause	Repair
Engine is not controllable.	Broken bowden cable.	Replace.
	Loose bowden cable connections.	Tighten.
	Jammed bowden cable.	Replace.
Engine does not reach take off RPM.	Throttle valve does not reach stop.	Adjust bowden cable.
	Propeller governor does not reach stop.	Adjust stop screw.
Poor action of friction brake in throttle quadrant.	Worn friction washers.	Replace.

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Maintenance Practices

1. Remove and Install an Throttle Control Bowden Cable

	Detail/Steps/ Work Items	Key Items/References
(1)	Remove engine cowlings.	
(2)	Remove throttle quadrant.	
(3)	Disconnect bowden cable clamps on the throttle valve.	
(4)	Disconnect bowden cable clamps on shift lever below instrument panel.	
(5)	Disconnect bowden cable jackets from brackets below instrument panel.	
(6)	Remove bowden cables by pulling rearward.	

For Installation reverse the sequence.

Figure 1: Throttle Control Bowden Cables

2. Adjustment of Throttle Control Bowden Cable

Make sure that the throttle valve touches the stops with the throttle lever in IDLE and FULL position.

3. Remove and Install an Alternate Air Bowden Cable

	Detail/Steps/ Work Items	Key Items/References
(1)	Remove engine cowlings.	
(2)	Remove throttle quadrant cover.	
(3)	Disconnect bowden cable from flap actuating lever on alternate air valve.	
(4)	Disconnect bowden cable from alternate air lever.	
(5)	Remove bowden cables by pulling rearward.	

For Installation reverse the sequence.

4. Adjustment of Alternate Air Bowden Cable

Make sure that the flap of the alternate air valve is closed when the alternate air lever is in its full forward position.

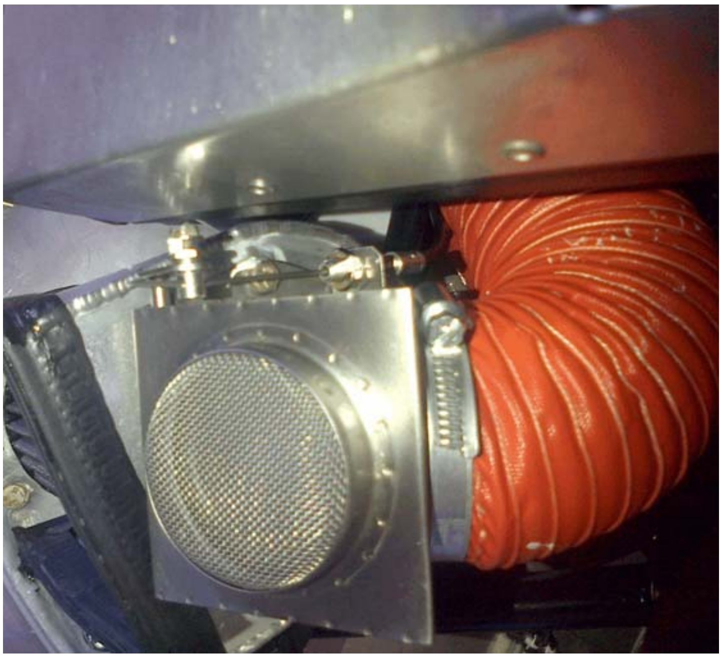

Figure 2: Flap Actuating Lever on Air Distribution Box

5. Remove and Install a Propeller Speed Control Bowden Cable

	Detail/Steps/ Work Items	Key Items/References
(1)	Remove engine cowlings.	
(2)	Disconnect bowden cable from propeller governor.	
(3)	Remove the throttle quadrant cover.	
(4)	Disconnect bowden cable from propeller speed control lever.	
(5)	Remove bowden cables by pulling rearward.	

For Installation reverse the sequence.

6. Adjustment of Propeller Speed Control Bowden Cable

Ensure that the lever on the governor reaches its stop in pull-direction when the propeller speed control lever is in full forward position.

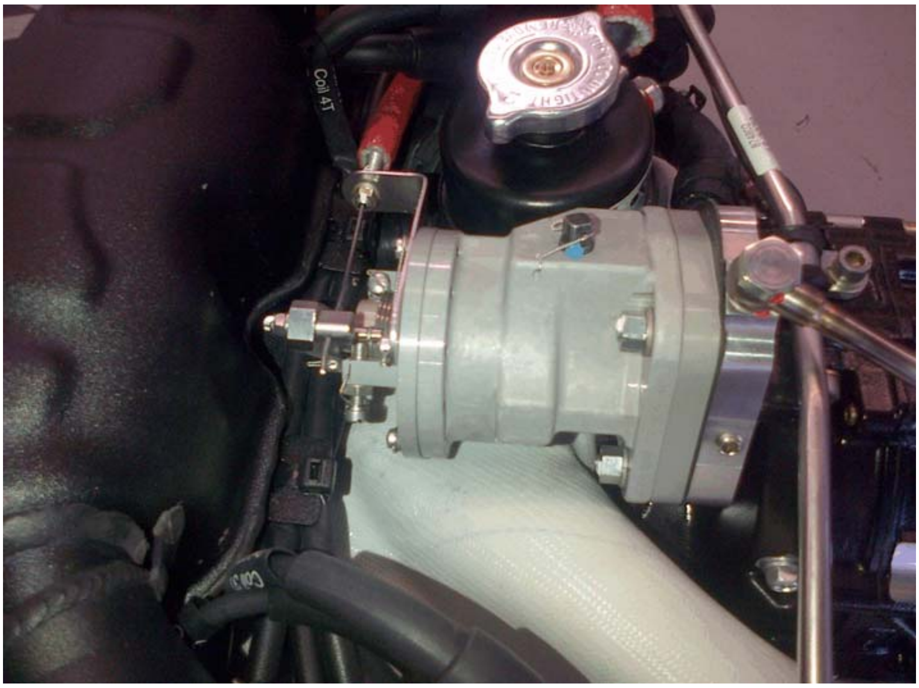

Figure 3: Lever on Propeller Governor

7. Remove and Install the Throttle Quadrant Friction Control

	Detail/Steps/ Work Items	Key Items/References
(1)	Remove rotary knob on RH side of center console.	
(2)	Remove washer springs and replace if required.	

For Installation reverse the sequence.

Figure 4: Throttle Quadrant

CHAPTER 77

ENGINE INDICATING

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TABLE OF CONTENTS

CHAPTER 77

ENGINE INDICATING

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CHAPTER 77

ENGINE INDICATING

1. General

This Section tells you about the engine indicating system for the DV 20 E airplane.

2. Engine Instruments

The engine instruments are displayed on the EMU 912 iS evo and a separate fuel quantity gauge. In addition the LANE A/B FAIL lights are located next to the LANE SELECTOR switch. The airframe electrical system current can be monitored on a separate ammeter.

A. LANE A/B FAIL Lights

The lights are either illuminated, flashing or not illuminated.

When the ECU is switched on the lights are illuminated for a few seconds until the internal test procedure is completed without faults. During that time is the ECU already functional.

After successful completion of the internal test procedure the lights are extinguished.

In case of an fault detected by ECU internal mechanisms the LANE A/B FAIL light is flashing or permanently illuminated depending of the nature of the fault.

When the LANE A/B FAIL light is flashing, the lane is still working and the engine control function has not been switched to the other lane.

When the LANE A/B FAIL light is illuminated permanently, the lanes engine control function is switched over to the other lane. The engine is now operated in the power modus with increased fuel consumption. Full engine power is still available.

Note: The engine manufacturer allows limited operation with one flashing LANE A/B FAIL light on the engine level. On the airplane level continued operation with one flashing LANE A/B FAIL light is not acceptable. Refer to Chapter 4.

B. Engine Instrument EMU 912 iS evo

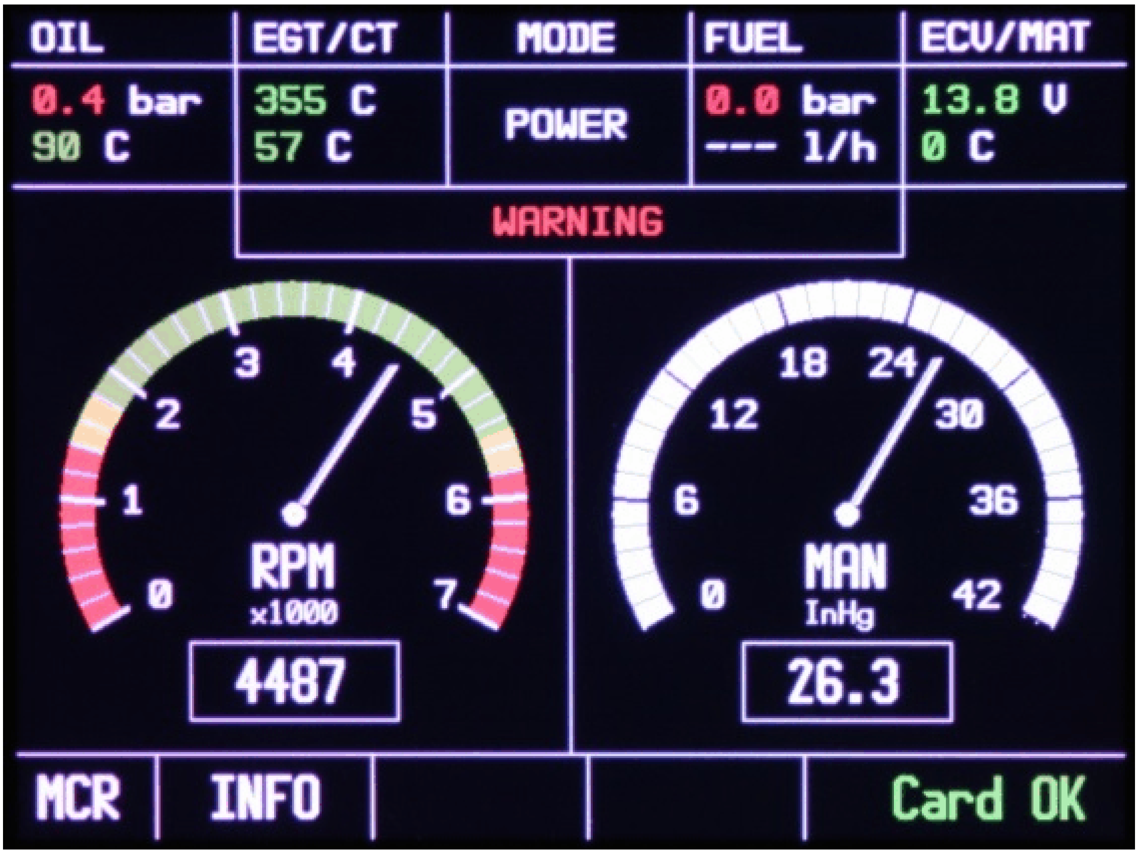

Figure 1: EMU Display - Main Page

The EMU displays all flight relevant engine parameters on the MAIN page. Engine parameters with operating limitations and caution ranges that are displayed as alphanumeric values are color-coded with green, amber and red.

On the INFO page more detailed information is provided including color-coded bars and drag indicators. The drag indicators are reset by pressing the ZERO button.

The brightness of the display can be adjusted by rotating the MCR button.

A SDHC-Card slot is available for engine data logging. These data can be used for troubleshooting.

During engine start the EMU connects the electrical systems of the airframe and the engine with the start power relay. The start power relay is activated as soon as the EMU is powered up and remains activated until the engine RPM reaches 1500/min for the first time. Then the relay is deactivated and is never activated again, until the EMU is turned off.

Designation	Indication	Unit
RPM	Engine RPM	1/min
MAN	Manifold pressure	inHG
OIL	Oil pressure	bar
	Oil temperature	°C
EGT	Exhaust gas temperature	°C
CT	Coolant temperature	°C
FUEL	Fuel pressure	bar
	Fuel consumption rate	l/h
ECV	ECU voltage	V
MAT	Manifold air temperature	°C
MODE	Engine operation mode	POWER/ECO
WARNING	Engine parameter(s) in red range	-
CAUTION	Engine parameter(s) in amber range	-
MCR	Master Caution Reset	-
INFO	INFO Subpage	-

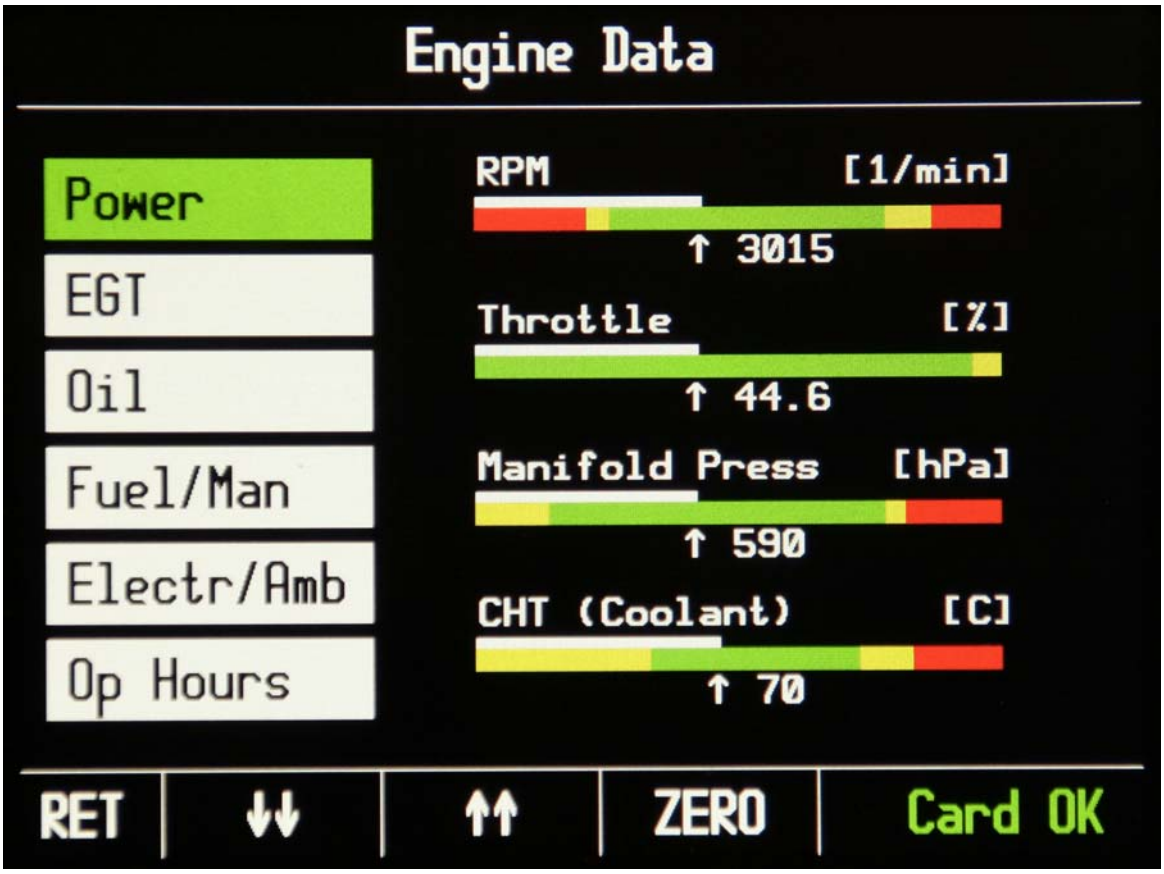

Figure 2: EMU Display - INFO Page

RET	Return to main page
↑↑	Page down
↓↓	Page Up
ZERO	Reset drag indicators

CHAPTER 78

EXHAUST

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TABLE OF CONTENTS

CHAPTER 78

EXHAUST

Trouble-Shooting

Maintenance Practices

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CHAPTER 78
EXHAUST

1. General

Each of the engine cylinders is equipped with an own exhaust pipe leading to the muffler below the engine.

To enable heat expansion of the exhaust system, the connections between muffler and pipes are moveable and secured with two springs each. The end pipe runs to the exterior of the airplane through the lower engine cowling on the left hand side. A jacket around the muffler serves as a heat exchanger for cabin heat.

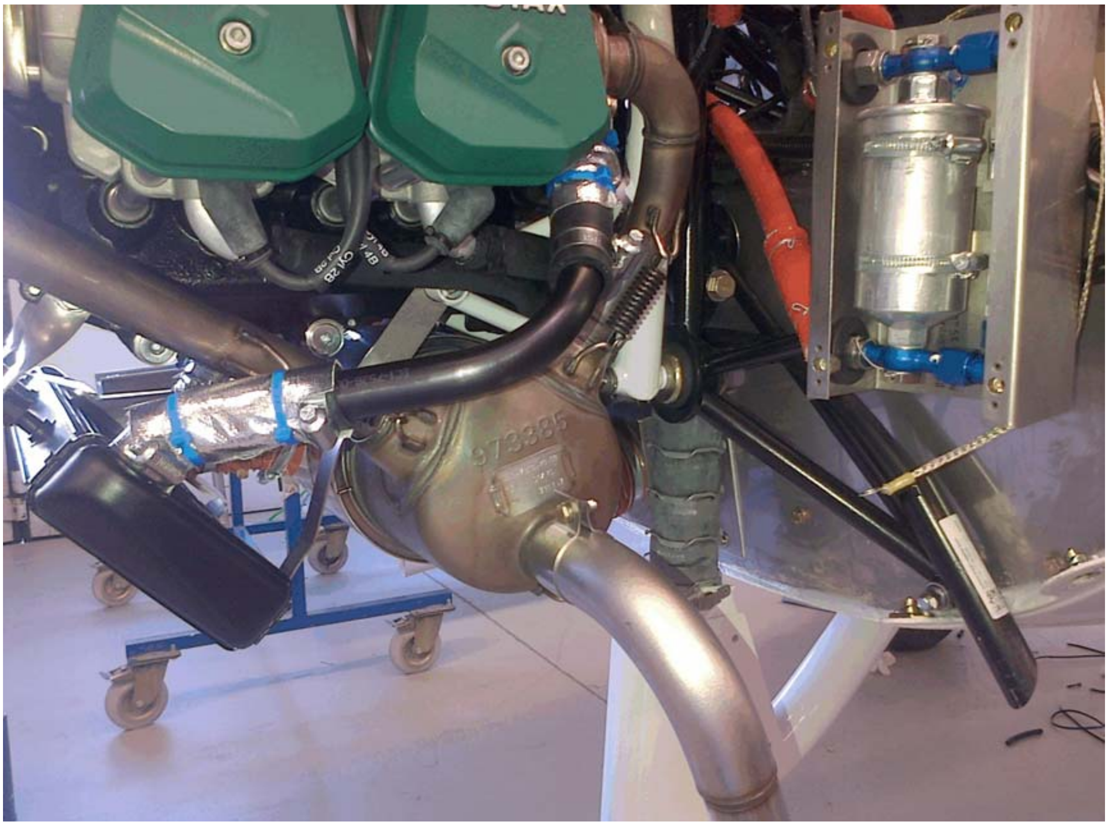

Figure 1: Exhaust System Installation

2. Description

Refer to Figure 1.

The exhaust pipes are fabricated of welded stainless steel. They run from the cylinders to the muffler below the engine. A heat exchanger surrounds the muffler. It heats fresh air collected from behind the coolant radiator. The heated air is directed to the cockpit by a hose.

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Trouble-Shooting

1. General

The table below lists the defects you could have with the exhaust system. If you have the trouble detailed in the Trouble column read across to the Possible Cause column. Then do the repair given in the Repair column.

Trouble	Possible Cause	Repair
Excessive engine noise.	Defective muffler or exhaust pipe.	Replace.
Cracks in muffler.	Locked up stress in muffler.	Weld or replace.
Exhaust gas in cockpit.	Cracks in muffler.	Weld or replace muffler.
Traces of exhaust gas on cylinder.	Defective gasket on cylinder or defective exhaust pipe. Bent flange.	Replace. Replace pipe.

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Maintenance Practices

1. General

This Maintenance Practice describes how to remove and install an engine exhaust pipe. Refer to Section 81-00 for data about the turbo-chargers.

2. Remove/Install the Exhaust System

WARNING: MAKE SURE THAT THE EXHAUST SYSTEM IS COOL BEFORE YOU TOUCH IT. THE EXHAUST SYSTEM CAN BE VERY HOT, THIS CAN CAUSE INJURY TO PERSONS.

	Detail Steps/Work Items	Key Items/References
WARNING: DO NOT STAND WITHIN THE DANGER AREA OF THE PROPELLER. IF THE ENGINE STARTS, THE PROPELLER CAN CAUSE DEATH OR INJURY TO PERSONS. **WARNING: YOU MUST MAKE SURE THAT THE ENGINE IS SAFE BEFORE YOU DO WORK ON THE ENGINE CONTROLS. IF THE PROPELLER TURNS IT CAN CAUSE INJURY TO PERSONS.**		
(1)	Disconnect air hoses from heat exchanger.	
(2)	Remove and discard nuts securing the exhaust pipes to the cylinder heads.	
(3)	Remove complete exhaust system from engine.	

For Installation reverse the sequence.

Use anti-seize compound on connections.

Install new lock nuts and ensure adequate clearance against rub from pipes to nearby components.

3. Inspection of Exhaust System

The inspection can be performed without removal of exhaust system components. To perform this test, loosen the mounting screws of the hose connection on the heat exchanger and inspect the muffler for cracks and corrosion.

The weld seams are especially susceptible to cracks through which dangerous carbon monoxide can enter the cabin.

If there is suspicion of leakage, the cabin should be checked for contamination using a gas-detector apparatus. The maximum permissible level of carbon monoxide contamination is 50 PPM (parts per million). In the event that there is no gas-detector apparatus available, the muffler should be closed off and checked by application of compressed air. The outside surface of the muffler should be coated with soap solution, which will show bubbles where cracks exist. Small cracks can be repaired by welding, while in the event that major damage has been found, the muffler should be replaced.

4. Inspection of Heat Exchanger

For inspection instruction, refer to Chapter 21.

CHAPTER 79

OIL COOLING

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TABLE OF CONTENTS

CHAPTER 79

OIL COOLING

SECTION 79-21

OIL RADIATOR

Trouble-Shooting

Maintenance Practices

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CHAPTER 79
OIL COOLING

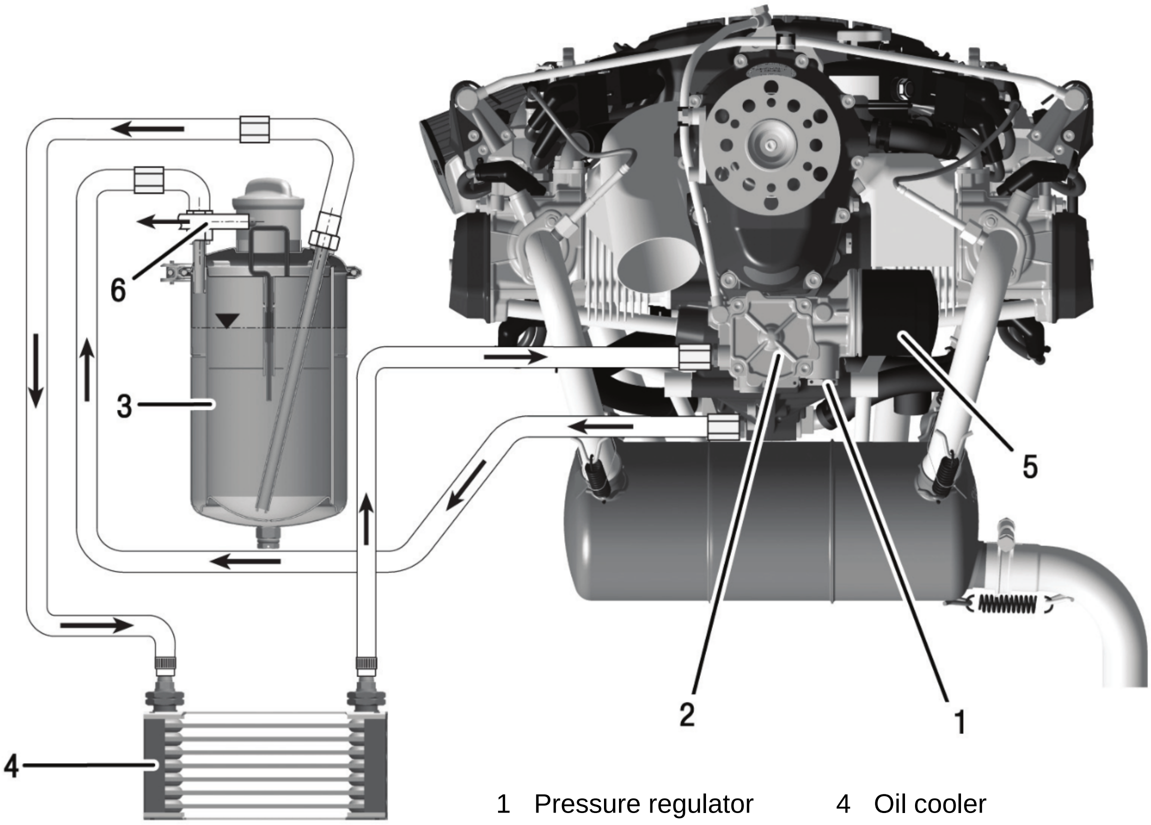
1. General

The Rotax 912 iSc3 Sport engine is fitted with a dry sump forced lubrication system with an oil pump and integrated pressure regulator.

2. Description

The Rotax 912 iSc3 Sport has a dry sump lubrication system. The camshaft driven oil pump has an integrated oil pressure regulator and oil pressure sensor.

The oil pump transports the oil from the oil tank through a radiator and the oil filter to the lubrication points of the engine (see Figure 1). Surplus oil accumulates at the bottom of the crankcase and is forced back to the oil tank by the piston blow by gases.



1	Pressure regulator	4	Oil cooler
2	Oil pump	5	Oil filter
3	Oil tank	6	Venting tube

Figure 1: Oil System

SECTION 79-21
OIL RADIATOR

1. General

The oil radiator is located on the lower right hand side of the engine, and is attached to the engine mount. The oil radiator has two threaded connection sleeves to which the oil lines are attached. The sleeves are also used to secure the radiator to the engine mount. Attached to the radiator is an air hose whose opening ends in the opening of the engine cowling.

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Trouble-Shooting

1. General

The table below lists the possible defects with the oil cooling system. If you have the trouble detailed in the Trouble column read across to the Possible Cause column. Then do the repair given in the Repair column.

Trouble	Possible Cause	Repair
Excessive oil temperature.	Damaged radiator fins. Inhibited air flow.	Replace radiator. Check for foreign objects.
Leaks in oil cooling system.	Defective hose connections or radiator.	Check connections and radiator.

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Maintenance Practices

1. Remove and Install an Oil Radiator

Refer to Figure 2.

	Detail Steps/Work Item	Key Items/References
(1)	Disconnect hose lines from radiator ports.	
(2)	Straighten locking plates on hose connectors.	
(3)	Remove mounting nuts.	
(4)	Remove oil radiator.	

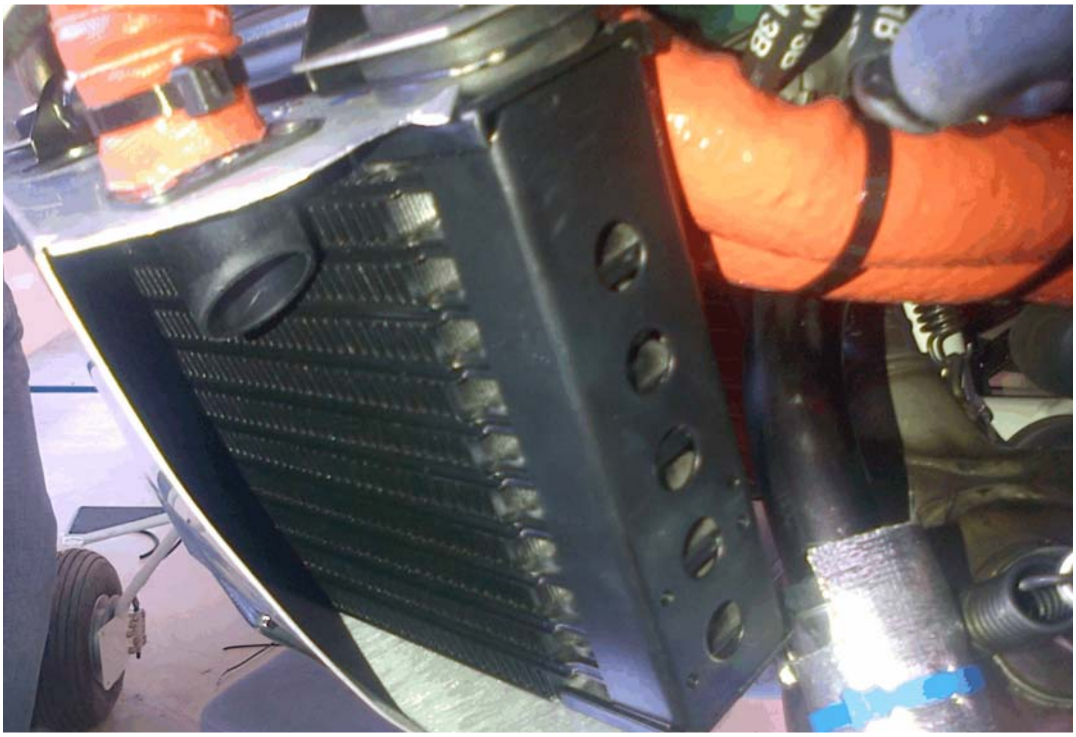

Figure 2: Oil Radiator

For Installation reverse the sequence.

NOTE: Use new locking plates.

NOTE: In the event that the engine has to be disassembled due to metal particles detected during oil filter change, the radiator must be flushed or replaced.

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CHAPTER 92

WIRING DIAGRAMS

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TABLE OF CONTENTS

CHAPTER 92

WIRING DIAGRAMS

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CHAPTER 92
WIRING DIAGRAMS

1. General

This Chapter contains the wiring diagrams for each system. The wiring diagrams use the ATA Chapter/Section numbering system.

Title	Drawing No.	Rev. No.	No. of Sheets
Schematic, Rotax 912iS Wiring	D21-9224-30-01_01	A	2
Schematic, Rotax 912iS Wiring	D21-9224-30-02		1
Schematic, External Power Connector Wiring	D21-9224-40-01	-	1
Schematic, Accessory Power Plug	D21-9224-60-01	-	1
Schematic, USB Charging Ports	D21-9224-60-02	-	1
Schematic, Flaps Wiring	D21-9227-50-00	-	1
Schematic, Pitot Heat Wiring	D21-9230-30-01	A	1
Schematic, Engine Instruments	D21-9231-10-01	-	1
Schematic, Hourmeter Wiring	D21-9231-20-01	-	1
Schematic, Annunciator Lights	D21-9231-50-01	B	1
Schematic, G500	D21-9231-60-01	A	5
Schematic, Dimming Regulator & Placards	D21-9233-10-07	-	1
Schematic, Exterior Lighting	D21-9233-40-01	-	1
Schematic, Backup Artificial Horizon Indicator	D21-9234-10-00	-	1

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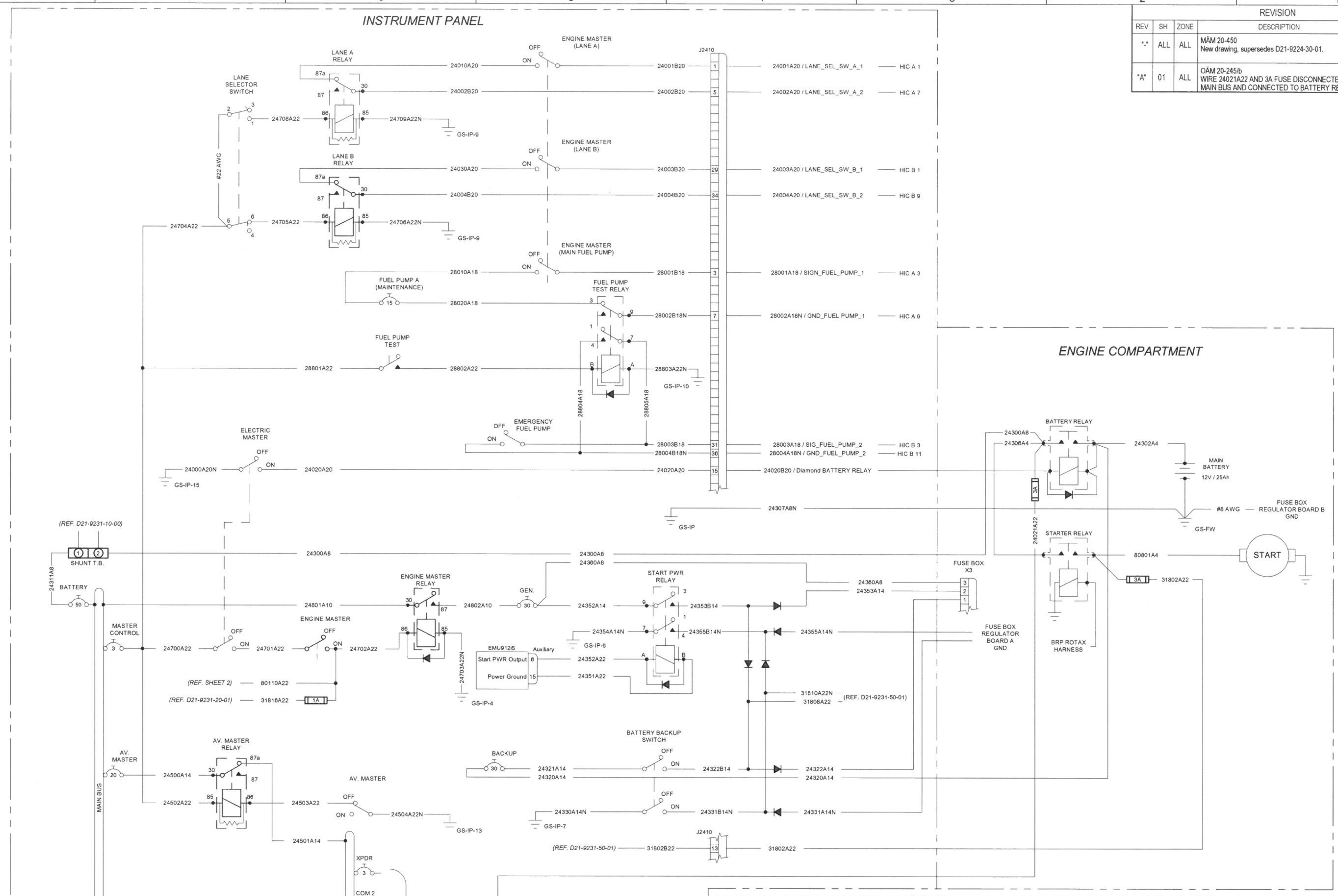

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	NAME / SIGN / DATE
DRAWN:	P.Lukic 17.09.2020
CHECKED:	M. Kowarsch 01 OCT 20
RELEASED:	M. Scheikl

PROJECT **DV 20 E**

TITLE

Schematic, Rotax 912iS Wiring

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CODE **710197** SCALE NTS SH **01** OF **02**

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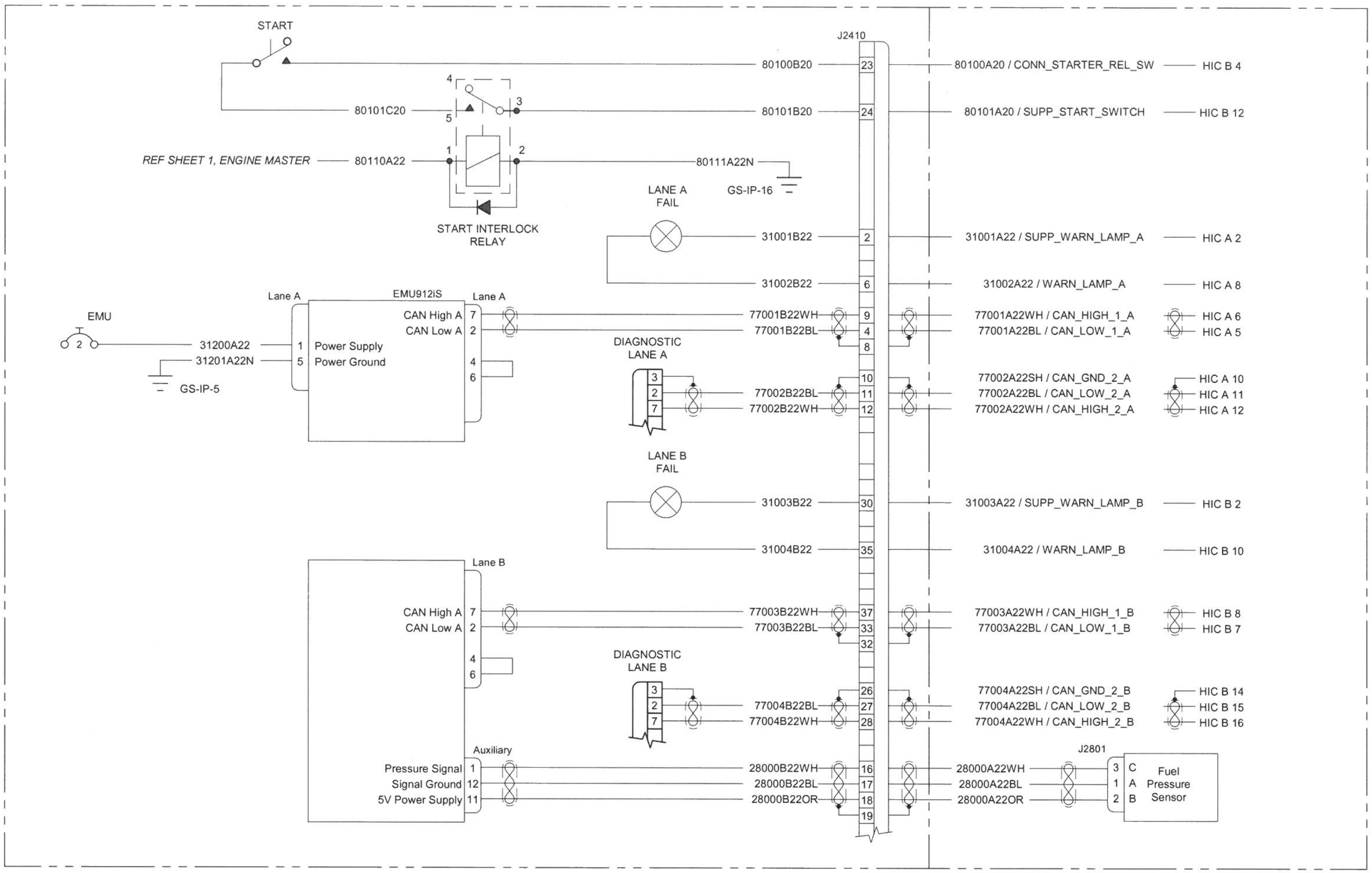

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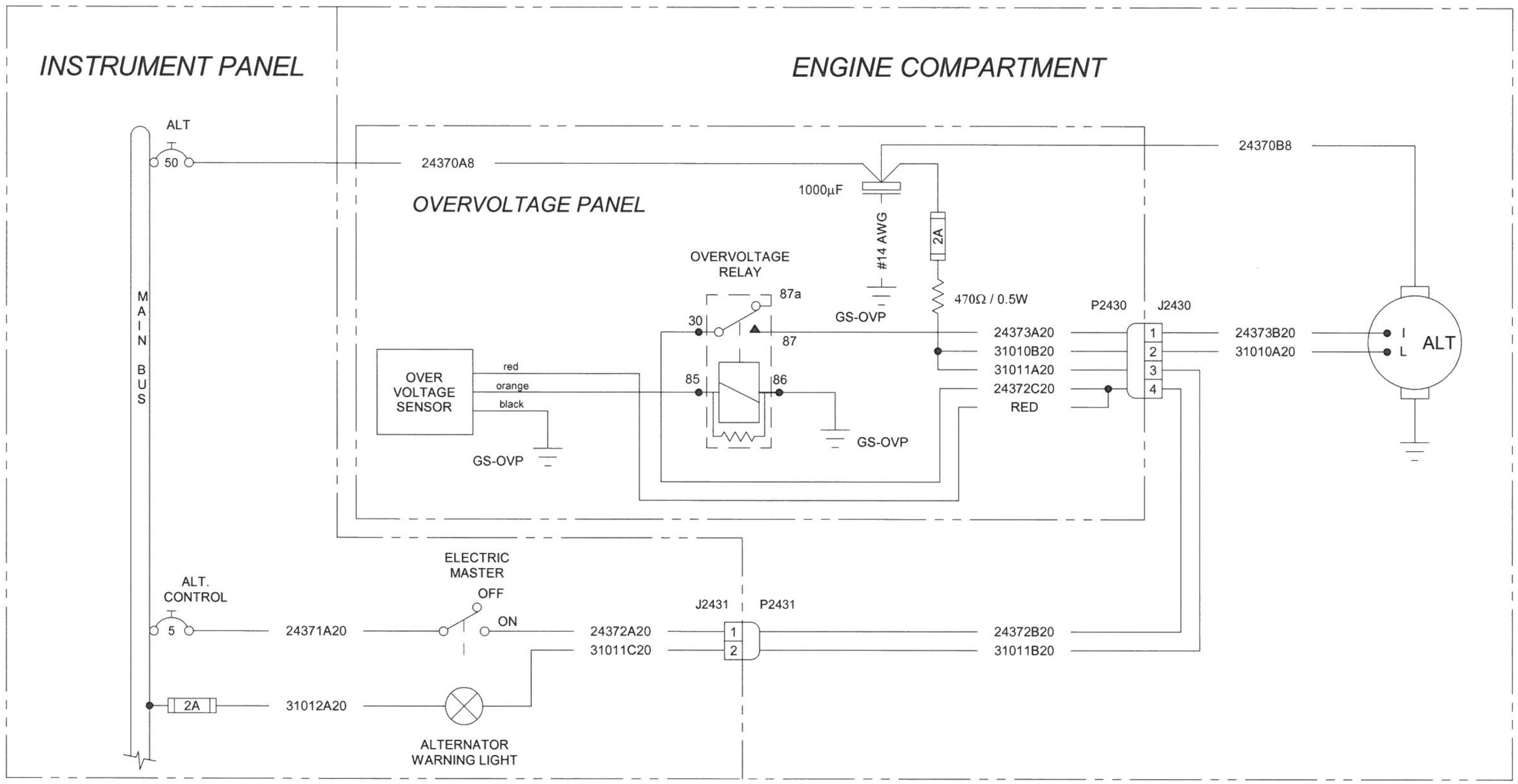

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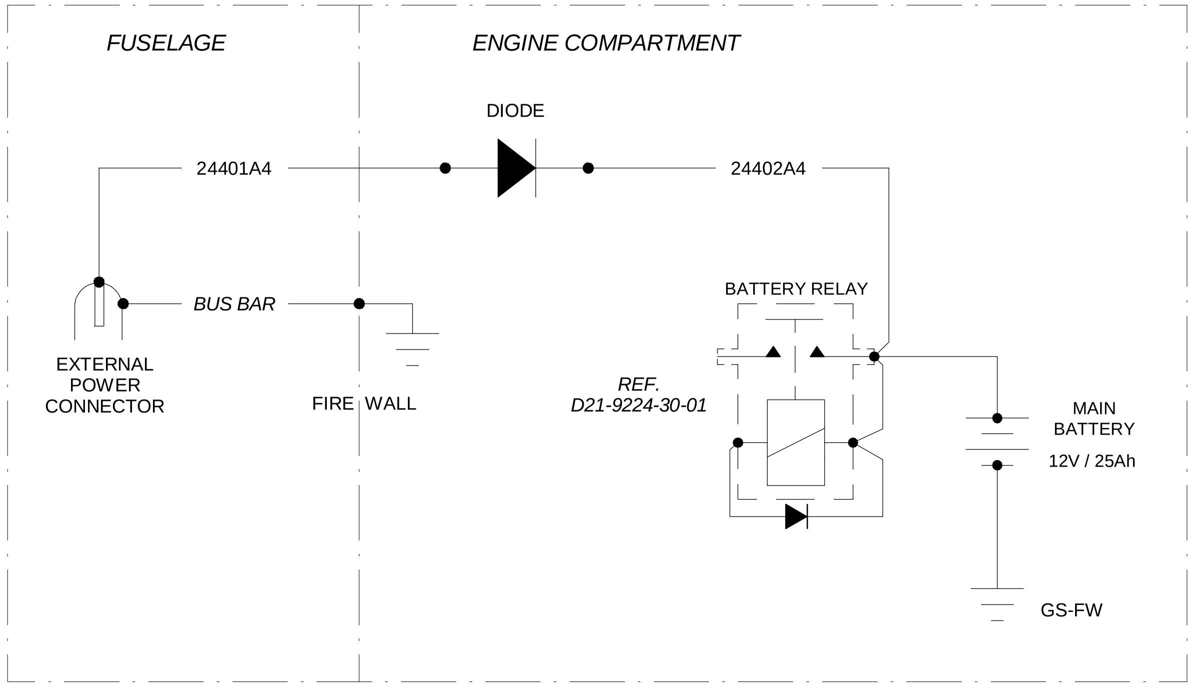

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TITLE
Schematic, External Power Connector Wiring

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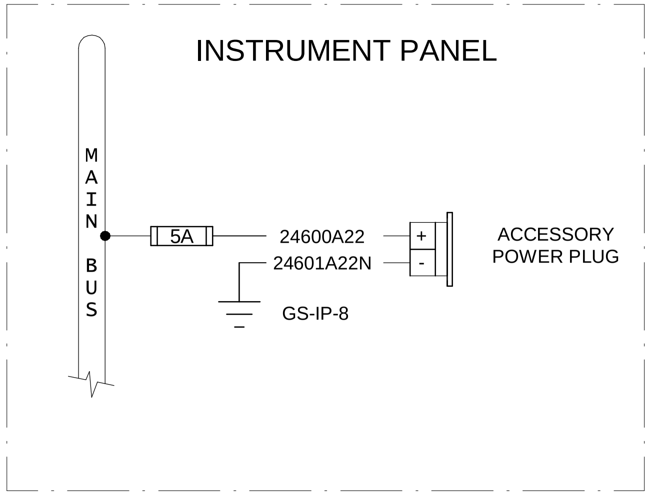

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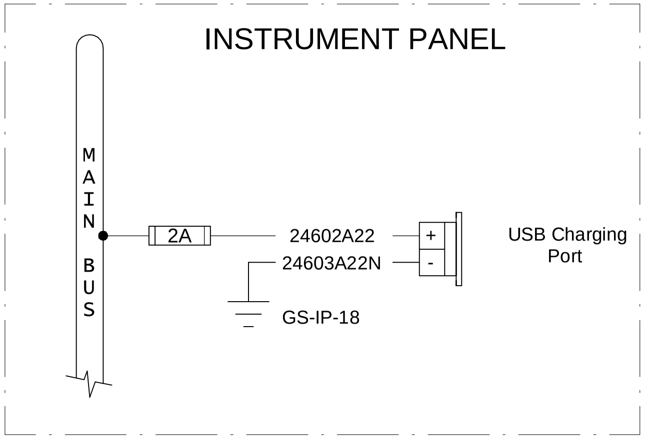

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PROJECT **DV 20 E**

TITLE
Schematic,
USB Charging Ports

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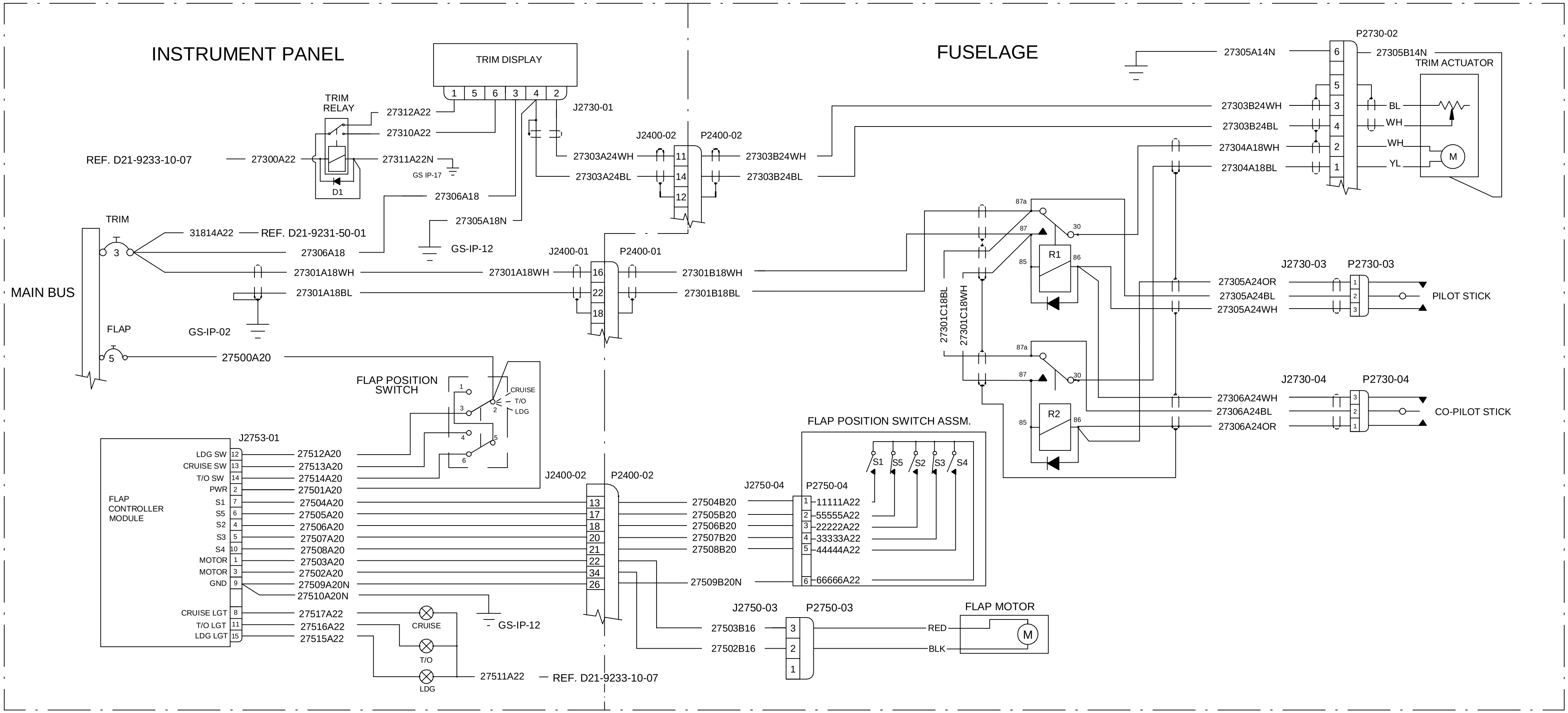

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PROJECT **DV 20 E**

TITLE
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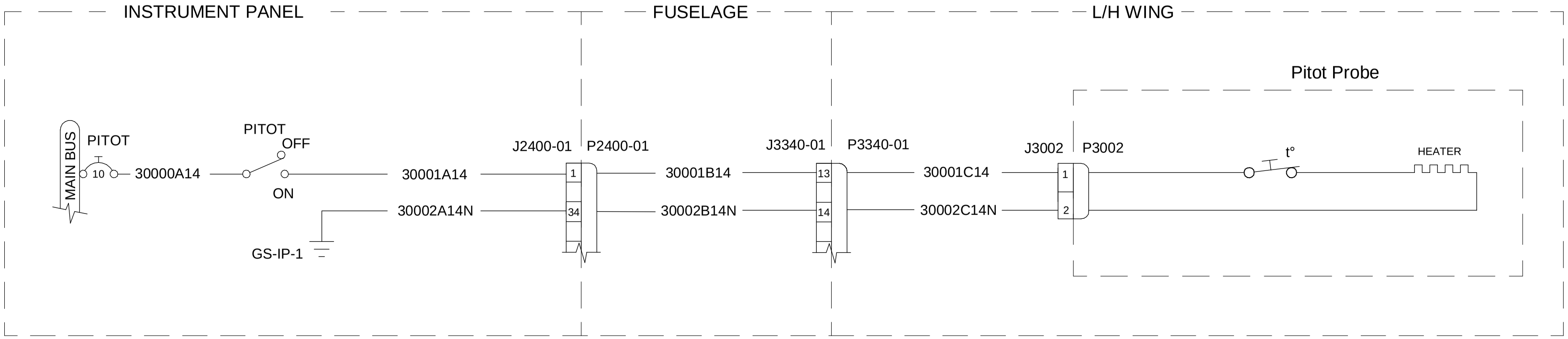

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PROJECT **DV 20 E**

TITLE

Schematic, Pitot Heat Wiring

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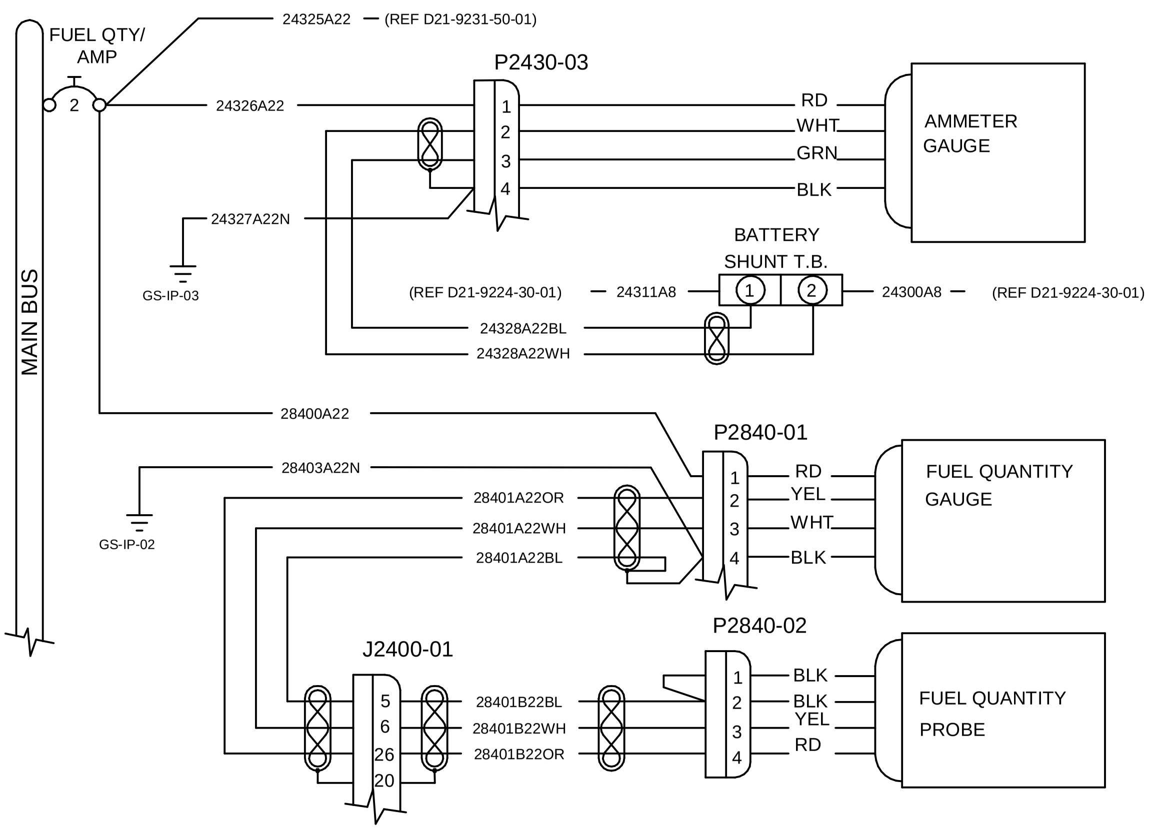

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PROJECT **DV 20 E**

TITLE

Schematic, Engine Instruments

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710197	NTS	**01**	**01**

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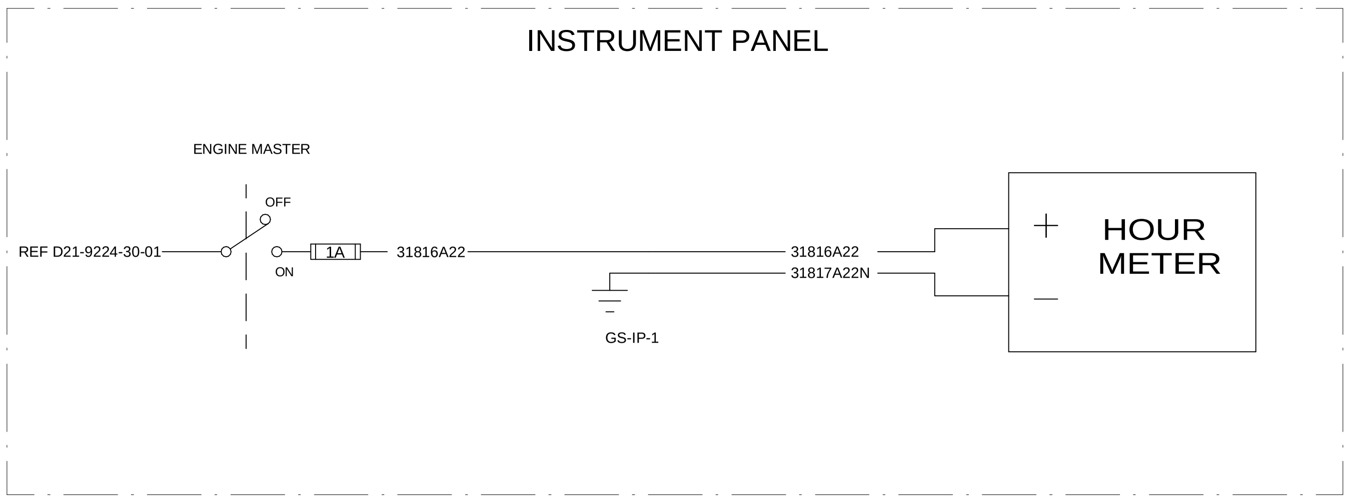

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PROJECT **DV 20 E**

TITLE

Schematic, Hourmeter Wiring

DWG.ORIG.	DWG.NO.	REV
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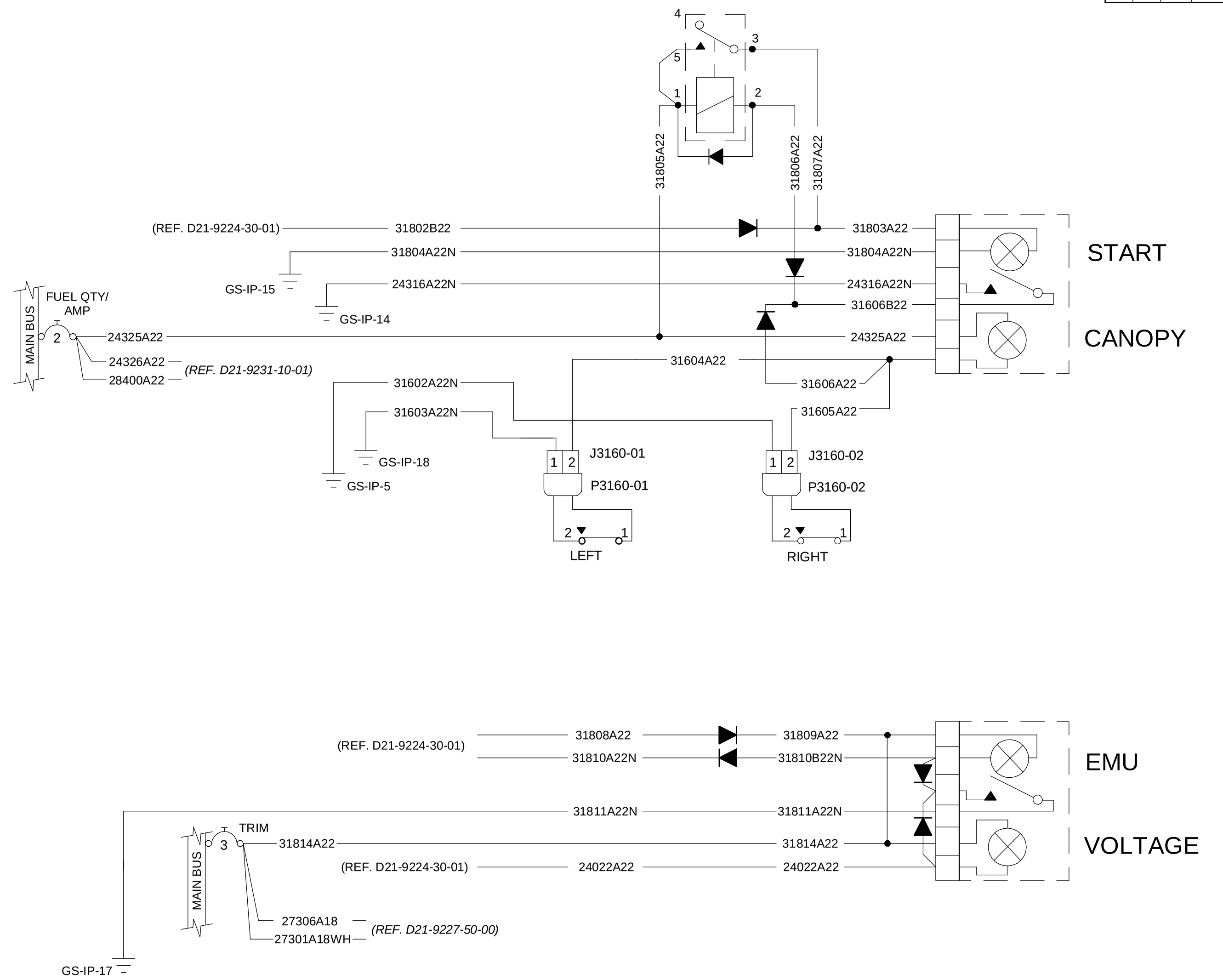
"A"	01	C-4	MÄM 20-408 Diode at "EMU" lamp (31810A22N / 31810B22N) added.	11.01.16
"B"	01	B/C-3 E/D-3	MÄM 20-407 2 Diodes at "EMU/ Voltage" Lamp Test button added. 1 Diode at "START/ CANOPY" Lamp Test button added.	20.01.16



DIMENSIONS **METRIC**	IDENTIFICATION MARKINGS **DP-S-17-00001**	Diamond Aircraft Industries GmbH	Diamond Aircraft Industries	N. A. Otto-Straße 5 A-2700 Wiener Neustadt
FIRST ANGLE PROJECTION	FORMAT **A2**	CLASSIFICATION: **NONE**	NAME / SIGN / DATE	PROJECT **DV 20 E**
IF NOT OTHERWISE SPECIFIED GEOMETRIC DIMENSIONING AND TOLERANCING ACC. TO **ISO 2768-mK**	3.2 FINISH IN MICRO-METER	INTERCHANGEABLE PART **NO**	DRAWN	TITLE **Schematic, Annunciator Lights**
DIMENSIONS IN **mm**		THIS DRAWING WAS PRODUCED USING SOFTWARE: **SOLID EDGE ST6**	CHECKED:	DWG.ORIG. **DAIA** DWG.NO. **D21-9231-50-01** REV **"B"**
		FILENAME **D21-9231-50-01b.dft**	RELEASED:	CODE **710197** SCALE NTS SH **01** OF **01**

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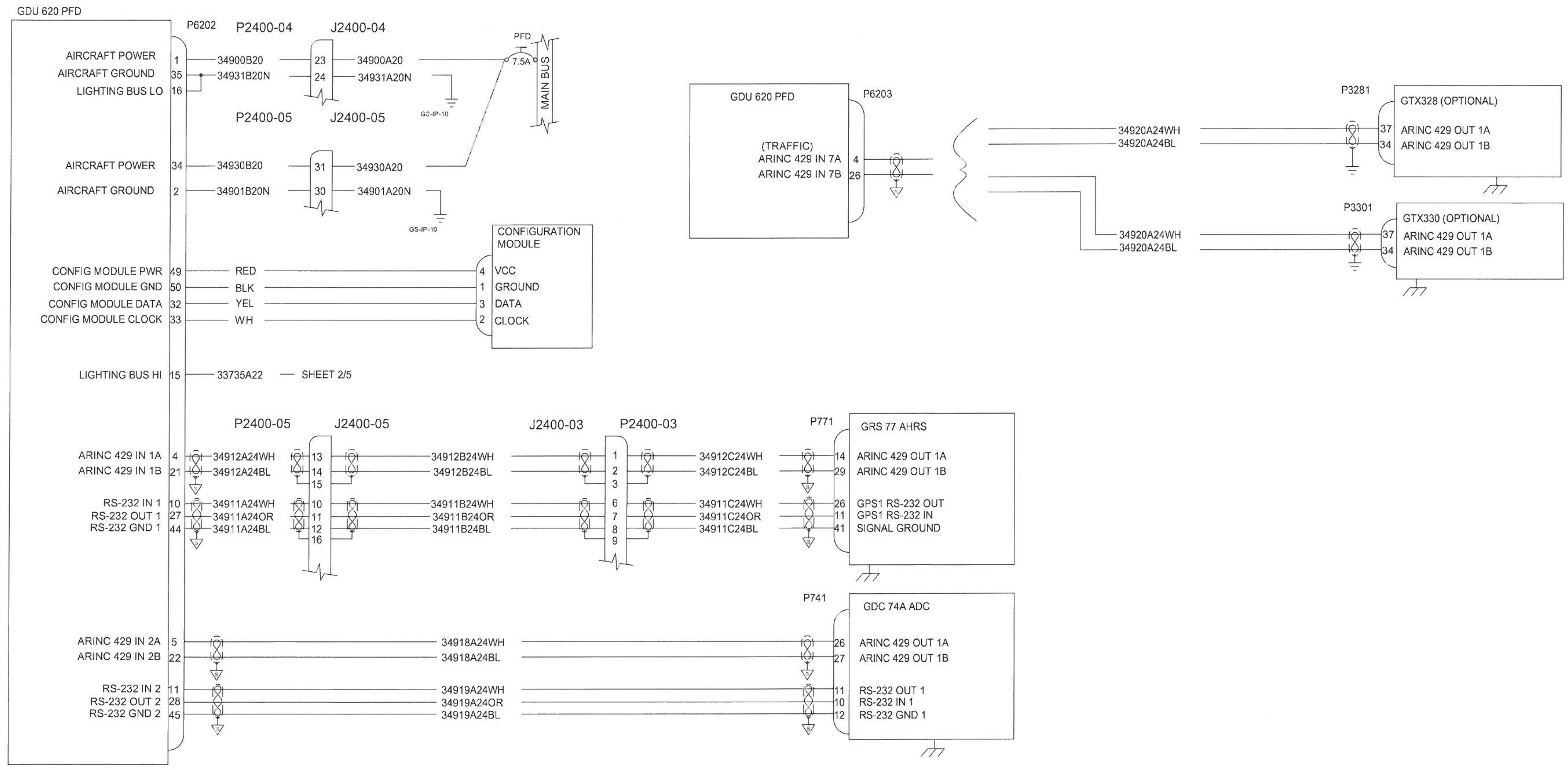
REVISION				
REV	SH	ZONE	DESCRIPTION	DATE
"-"	01	ALL	VÄM 20-002 NEW DRAWING, DOES NOT SUPERSEDE ANOTHER DRAWING.	14.09.2015
"a"	01	ALL	MÄM 20-407 FLAG NOTE 2 REMOVED.	09.02.16

NOTES

1. SYMBOL DESIGNATIONS

   S BACKSHELL GROUND



DIMENSIONS METRIC

FIRST ANGLE PROJECTION

FORMAT A2

IF NOT OTHERWISE SPECIFIED GEOMETRIC DIMENSIONING AND TOLERANCING ACC. TO **ISO 2768-mK**

DIMENSIONS IN **mm**

3.2 FINISH IN MICRO-METER

IDENTIFICATION MARKINGS **DP-S-17-00001**

CLASSIFICATION: **NONE**

INTERCHANGEABLE PART **NO**

THIS DRAWING WAS PRODUCED USING SOFTWARE: **SOLID EDGE ST6**

FILENAME **D21-9231-60-01**

Diamond Aircraft Industries GmbH

Diamond Aircraft Industries

N. A. Otto-Straße 5
A-2700 Wiener Neustadt

	NAME / SIGN / DATE
DRAWN:	C. Dvorak 08 FEB 16
CHECKED:	M. Kowarsch 18 MAR 16
RELEASED:	M. Volck 31 MAR 16

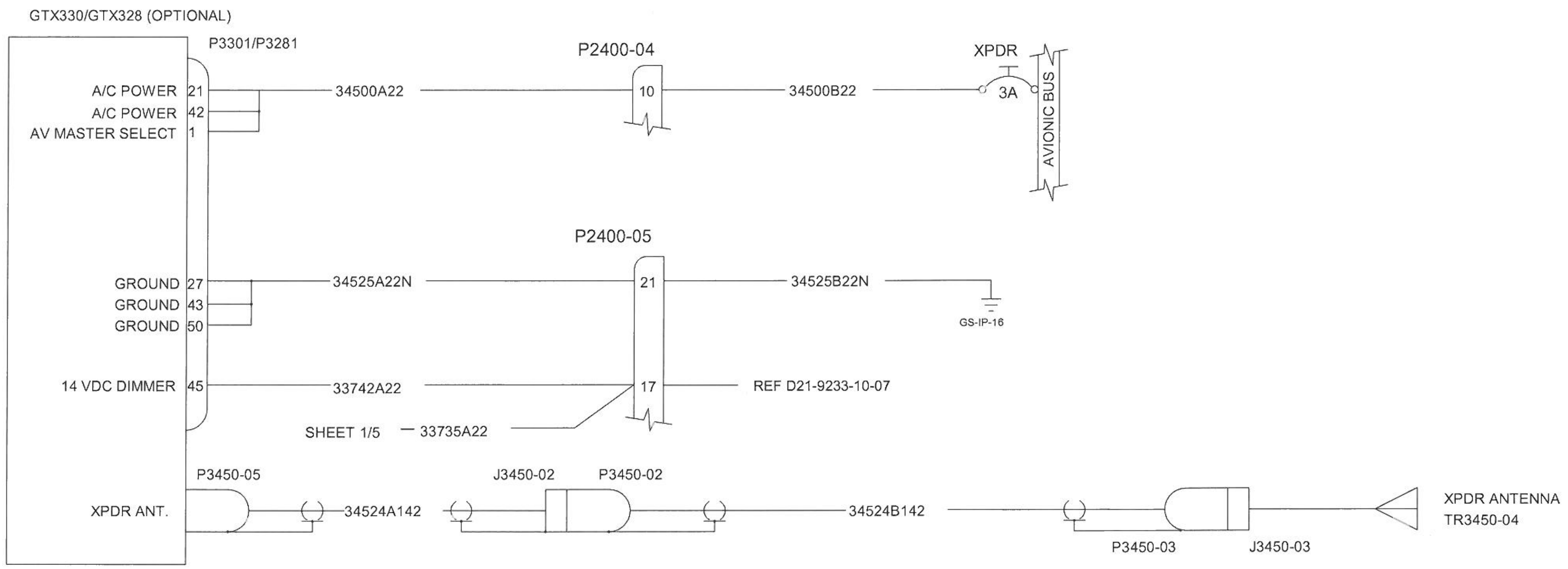
PROJECT **DV 20 E**

TITLE

Schematic, G500

DWG.ORIG. **DAIA** DWG.NO. **D21-9231-60-01** REV "a"

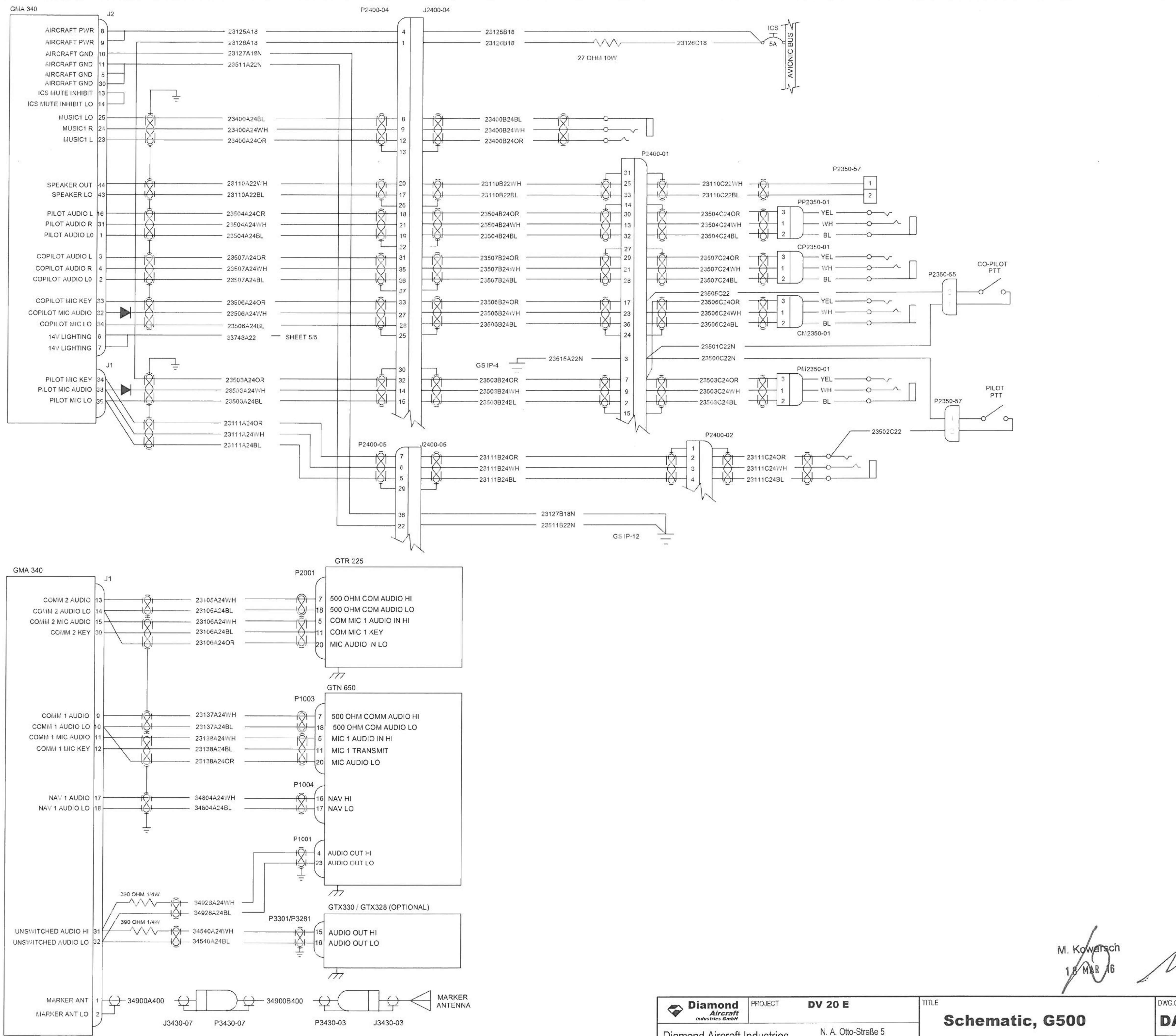
CODE **710197** SCALE SH **01** OF **05**



M. Kowarsch
18 MAR 16

M. Volck
31 MAR 16

Diamond Aircraft Industries GmbH	PROJECT DV 20 E	TITLE Schematic, G500	DWG.ORIG. DAIA	DWG.NO. D21-9231-60-01 — REV "a"
Diamond Aircraft Industries	N. A. Otto-Straße 5, A-2700 Wiener Neustadt		CODE 710197	SCALE NTS — SH 02 OF 05



Diamond Aircraft Industries GmbH	PROJECT DV 20 E	TITLE	DWG.ORIG. DAIA	DWG.NO. D21-9231-60-01 — REV "a"
Diamond Aircraft Industries	N. A. Otto-Straße 5, A-2700 Wiener Neustadt	Schematic, G500	CODE 710197	SCALE NTS — SH 03 OF 05

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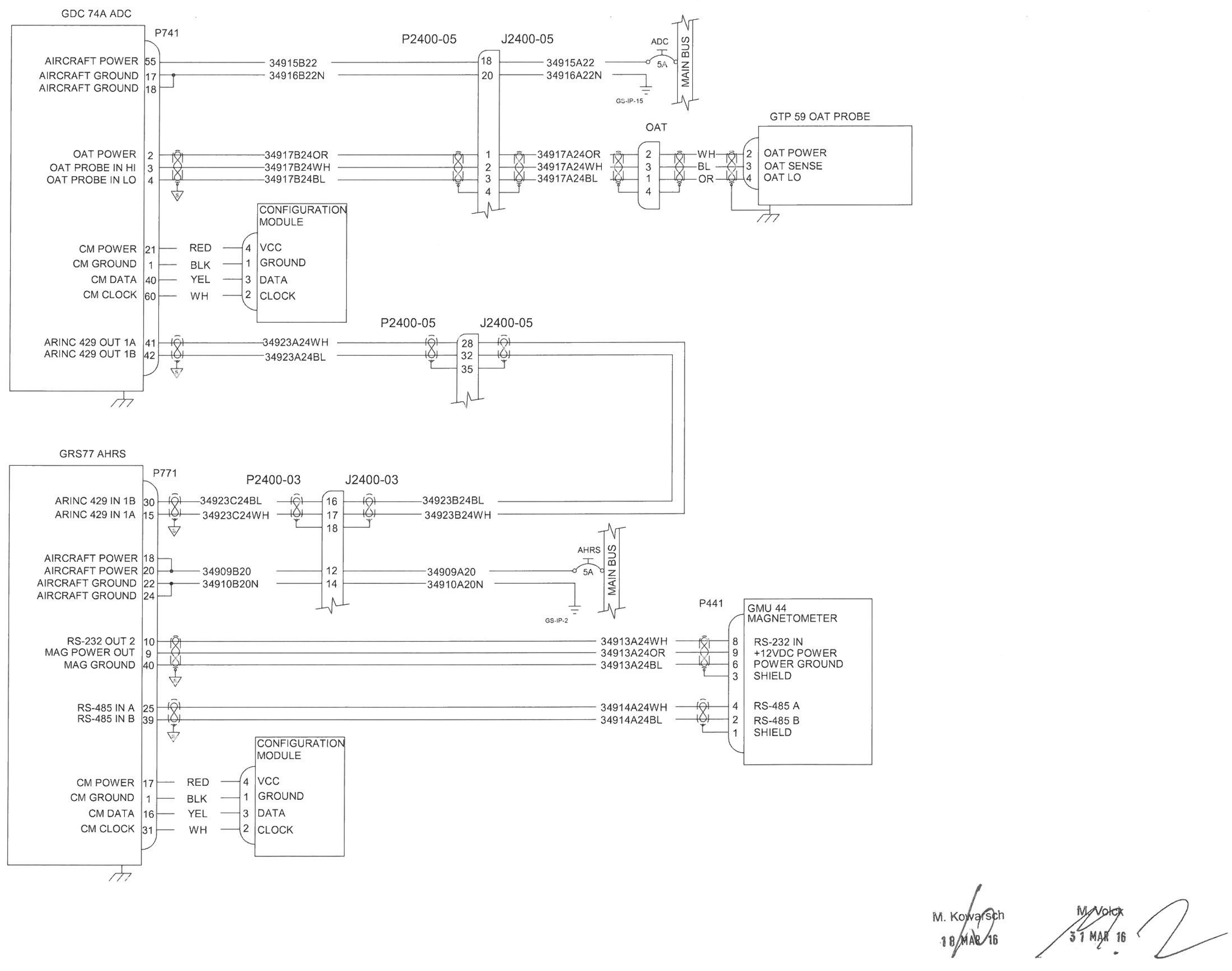

Diamond Aircraft Industries GmbH	PROJECT DV 20 E	TITLE Schematic, G500	DWG.ORIG. DAIA / DWG.NO. D21-9231-60-01 / REV "a"
Diamond Aircraft Industries	N. A. Otto-Straße 5, A-2700 Wiener Neustadt		CODE 710197 / SCALE NTS / SH 04 OF 05

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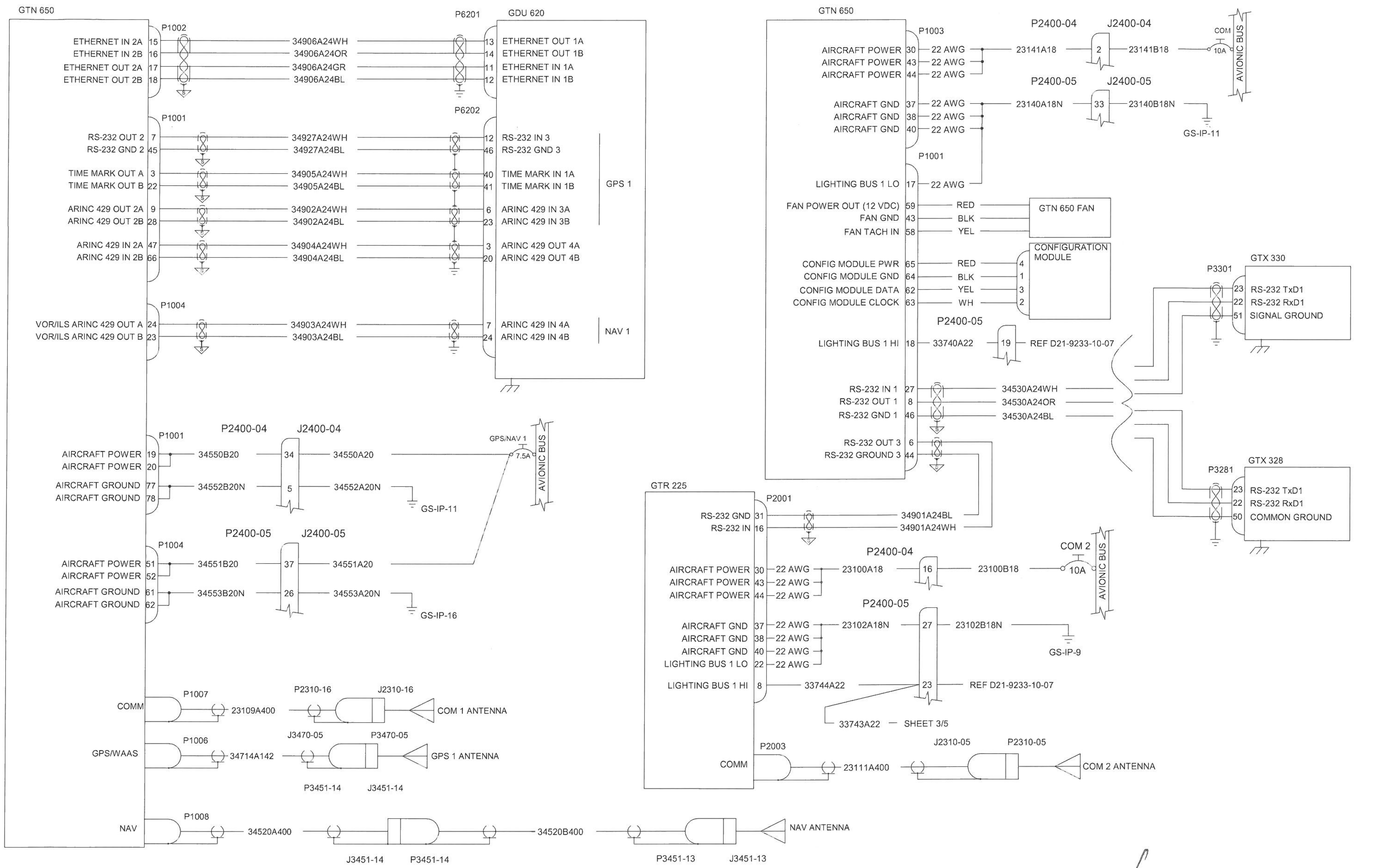

Diamond Aircraft Industries GmbH	PROJECT DV 20 E	TITLE	DWG.ORIG. DAIA
Diamond Aircraft Industries	N. A. Otto-Straße 5, A-2700 Wiener Neustadt	Schematic, G500	DWG.NO. D21-9231-60-01
			REV. "a"
			CODE 710197 · SCALE NTS · SH 05 OF 05

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REV	SH	ZONE	DESCRIPTION	DATE
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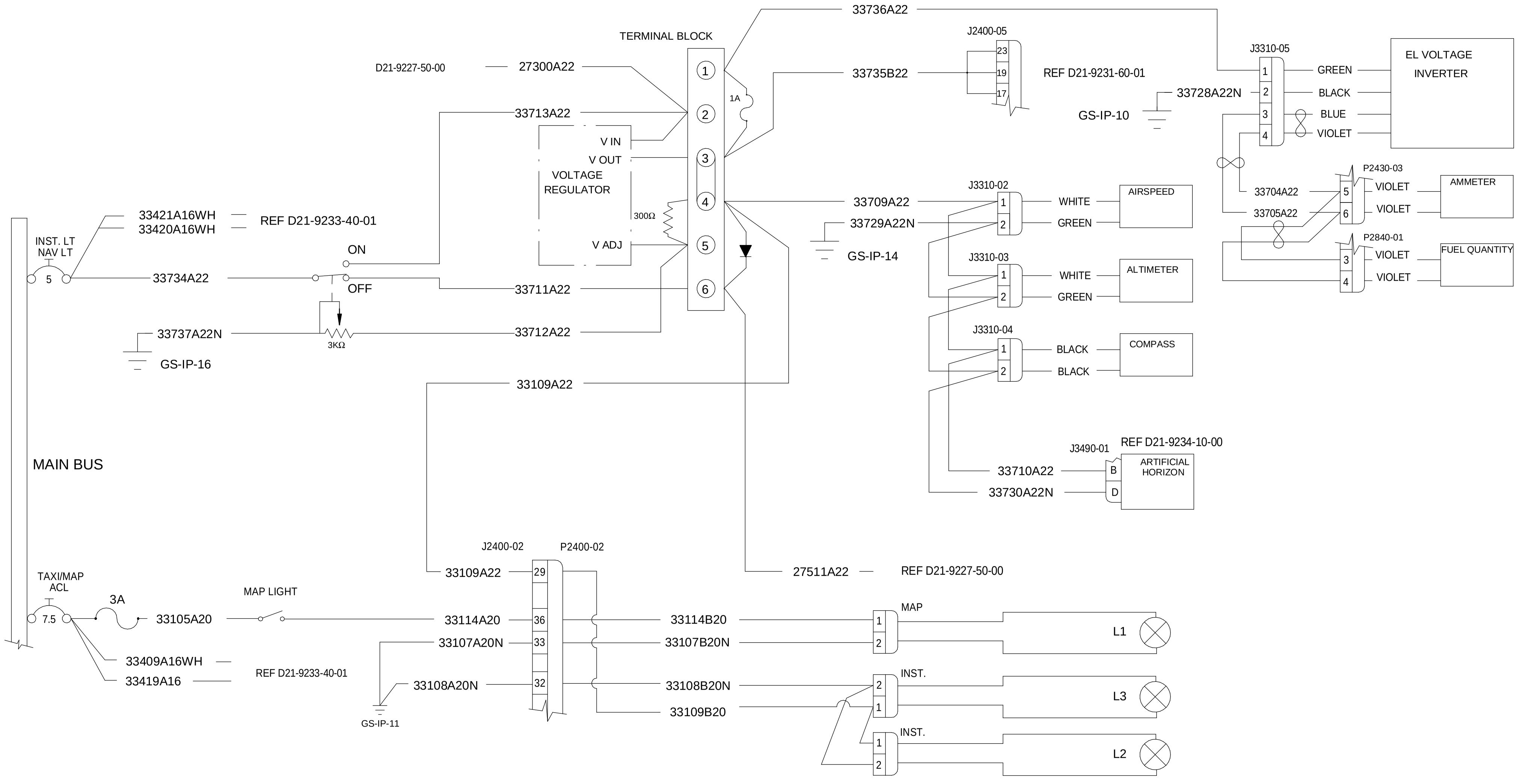
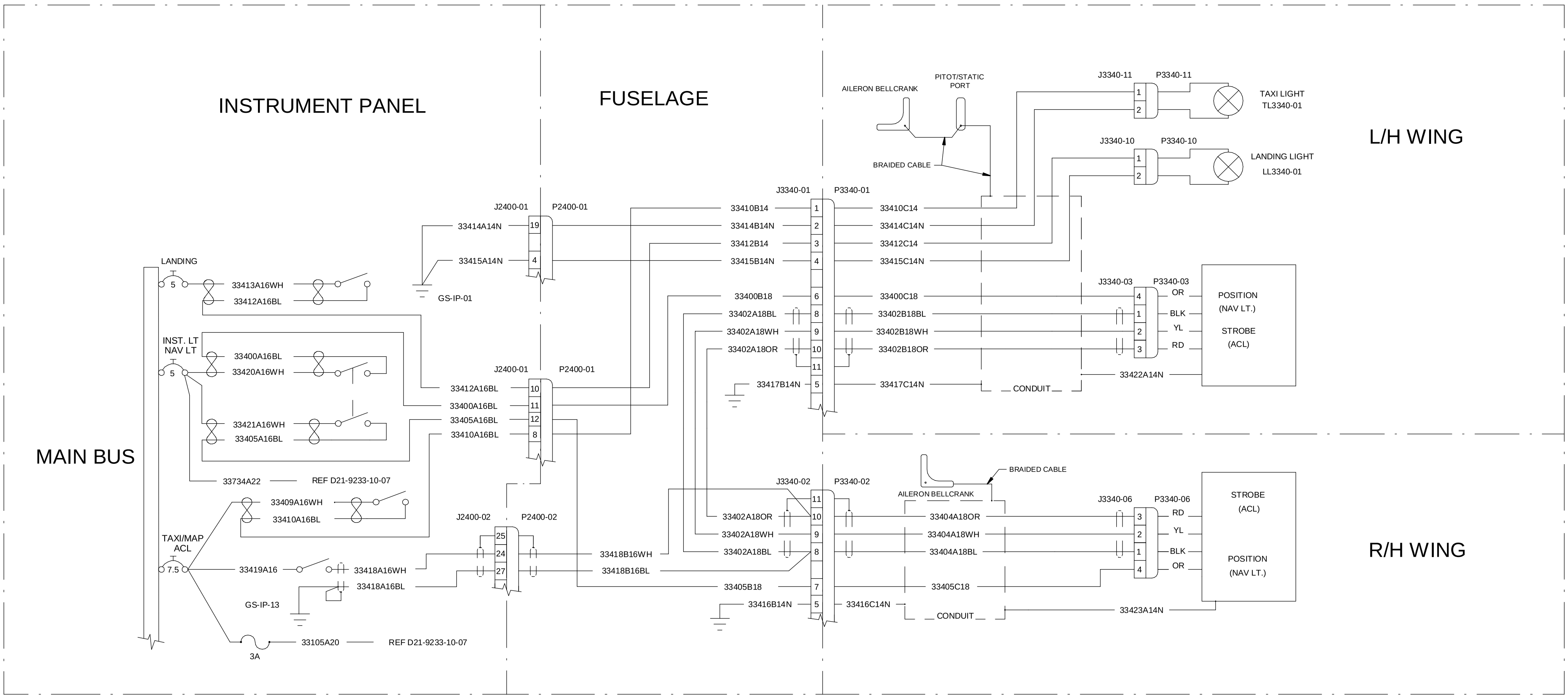


DIMENSIONS **METRIC**	IDENTIFICATION MARKINGS **DP-S-17-00001**	**Diamond Aircraft Industries GmbH** Diamond Aircraft Industries	N. A. Otto-Straße 5 A-2700 Wiener Neustadt
FIRST ANGLE PROJECTION	FORMAT **A2**	CLASSIFICATION: **NONE**	NAME / SIGN / DATE — DRAWN	PROJECT **DV 20 E**
IF NOT OTHERWISE SPECIFIED GEOMETRIC DIMENSIONING AND TOLERANCING ACC. TO **ISO 2768-mK**	3.2 FINISH IN MICRO-METER	INTERCHANGEABLE PART **NO**	CHECKED:	TITLE **Schematic, Dimming Regulator & Placards**
DIMENSIONS IN **mm**	THIS DRAWING WAS PRODUCED USING SOFTWARE **SOLID EDGE ST6**	FILENAME **D21-9233-10-07.dft**	RELEASED:	DWG.ORIG. **DAIA** DWG.NO. **D21-9233-10-07** REV "-"

CODE 710197 SCALE NTS SH 01 OF 01

REVISION				
REV	SH	ZONE	DESCRIPTION	DATE
"-"	01	ALL	VÄM 20-002 NEW DRAWING, DOES NOT SUPERSEDE ANOTHER DRAWING.	16.09.2015



DIMENSIONS **METRIC**	IDENTIFICATION MARKINGS **DP-S-17-00001**	**Diamond Aircraft Industries GmbH** Diamond Aircraft Industries	N. A. Otto-Straße 5 A-2700 Wiener Neustadt
FIRST ANGLE PROJECTION / FORMAT **A2**	CLASSIFICATION: **NONE**	NAME / SIGN / DATE	PROJECT **DV 20 E**
IF NOT OTHERWISE SPECIFIED GEOMETRIC DIMENSIONING AND TOLERANCING ACC. TO **ISO 2768-mK**	INTERCHANGEABLE PART **NO**	DRAWN	TITLE **Schematic, Exterior Lighting**
3.2 FINISH IN MICRO-METER	THIS DRAWING WAS PRODUCED USING SOFTWARE **SOLID EDGE ST6**	CHECKED:	DWG.ORIG. **DAIA** / DWG.NO. **D21-9233-40-01** / REV "-"
DIMENSIONS IN **mm**	FILENAME **D21-9233-40-01.dft**	RELEASED:	CODE **710197** SCALE NTS SH **01** OF **01**

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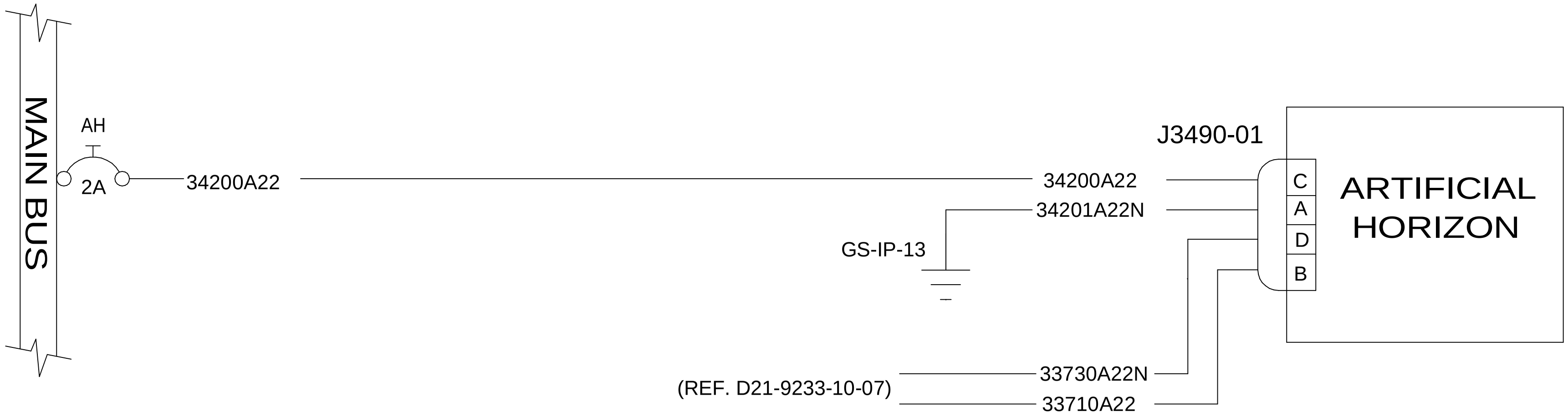
REVISION				
REV	SH	ZONE	DESCRIPTION	DATE
"-"	01	ALL	VÄM 22-002 NEW DRAWING, DOES NOT SUPERSEDE ANOTHER DRAWING.	03.11.15



DIMENSIONS **METRIC**	IDENTIFICATION MARKINGS **DP-S-17-00001**	**Diamond Aircraft Industries GmbH** Diamond Aircraft Industries — N. A. Otto-Straße 5, A-2700 Wiener Neustadt
FIRST ANGLE PROJECTION	CLASSIFICATION: **NONE**	PROJECT **DV 20 E**
FORMAT **A3**	INTERCHANGEABLE PART **NO**	TITLE **Schematic, Backup Artificial Horizon Indicator**
IF NOT OTHERWISE SPECIFIED GEOMETRIC DIMENSIONING AND TOLERANCING ACC. TO **ISO 2768-mK**	THIS DRAWING WAS PRODUCED USING SOFTWARE **SOLID EDGE ST6**	NAME / SIGN / DATE — DRAWN: / CHECKED: / RELEASED:
DIMENSIONS IN **mm**	FILENAME **D21-9234-10-00.dft**	DWG.ORIG. **DAIA** — DWG.NO. **D21-9234-10-00** — REV "-"
3.2 FINISH IN MICRO-METER		CODE **710197** SCALE NTS SH **01** OF **01**

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