SA S92A-RFM-000
SA S92A-RFM-002
SA S92A-RFM-003
SA S92A-RFM-004
SA S92A-RFM-005
SA S92A-RFM-006

FAA APPROVED

ROTORCRAFT

FLIGHT MANUAL

SUPPLEMENT

NO. 45

REVISION NO. 2

SIKORSKY

MODEL

S-92A

PART 1

AMS 7.1 OR 8.0 WITH MGB OIL OUT WARNING, PUMP FAILURE INDICATING SYSTEM, MAIN GEAR BOX AUTO BYPASS, AND M XMSN PRESS SWITCH CIRCUIT BREAKER

This supplement supersedes and replaces Supplement No. 45, dated July 30, 2012 and Supplement No. 45 Revision 1 dated September 21, 2016

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Approved by:

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ODA-800001-NE

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INTRODUCTION

This supplement must be attached to the applicable Sikorsky S-92 FAA Approved Rotorcraft Flight Manual (RFM) when the helicopter is equipped with the following:

- Avionics Management System (AMS) version 7.1 or 8.0 with MGB OIL OUT warning activated
- Pump failure indicating system
- Main gear box (MGB) auto bypass
- M XMSN PRESS SWITCH circuit breaker

The information contained herein supplements the basic RFM. For limitations and procedures not addressed in this and applicable supplements, consult the basic RFM.

The contents of this revision represent a major change. Relevant information from FAA Approved RFM Supplements Nos. 3, 6, 7 and 9 have been incorporated to allow properly configured operators to supersede those supplements. Additionally, main gear box emergency procedures have been revised to provide additional clarity and ease of use.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

PART 1

LOG OF TEMPORARY REVISIONS

TEMPORARY REVISION NUMBER	ISSUE DATE	REISSUE DATE	INCORPORATED/SUPERSEDED	
			BY REV NO	ISSUE DATE
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LOG OF TEMPORARY REVISIONS

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PART 1

LOG OF REVISIONS

The revision date is shown at the bottom of each revised page. A vertical bar on the outer margin indicates the latest revised portion of each page.

REVISION NO.	PAGES REVISED	REMARKS	DATE	FAA APPROVED
1	All	Reissues all pages for FAA approval. Incorporates Temporary Revision No. 1. Incorporates Section I Operating Limitations for Flight Management System from Supplement No. 09. Incorporates Section III Emergency Procedures for Engine Control System Malfunctions from Supplement No. 03 and Supplement No. 09. Incorporates 7.5 Gearbox Chip from Supplement No. 06. Incorporates 7.7 Tail/Intermediate Oil Low, 7.8 Tail/Intermediate Oil Hot/Chip, 7.9 Swashplate Temperature from Supplement No. 03. Adds emergency procedures for Main Transmission Pressure Switch Circuit Breaker. Revises emergency procedures in Sections 7.1 MGB Oil Out, 7.2 MGB Oil Press Warning, 7.3 MGB Oil Pressure Caution, 7.4 MGB Oil Hot Caution, 7.14 MGB Caution System Fault, 7.15 MGB Oil Pressure Caution System Fault. Incorporates 13.0 Fires from Supplement No. 06. Revises "None" to "No change" in Section IV.	9/21/16 for Nicholas C. Petruzzi MANAGER, BOSTON AIRCRAFT CERTIFICATION OFFICE, ANE-150	

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LOG OF REVISIONS (Cont)

REVISION NO.	PAGES REVISED	REMARKS	DATE	FAA APPROVED
2	All	Reissues all pages. Revised Section II Normal Procedures COCKPIT EQUIPMENT CHECKS adding additional battery power on EICAS messages. Renumbered Section III Emergency Procedures FADEC FAULT to 3.14. and added No Dispatch EICAS messages. Deleted Emergency Procedures paragraph 3.15 Engine Throttle Not In Fly. Added Emergency Procedures 7.16 Limit Exceeded from Supplement No. 06. Revised Emergency Procedures 8.6 Dual DC Converter and Backup Converter Failure symptoms.	APR 2 [illegible] 2017 MANAGER, BOSTON AIRCRAFT CERTIFICATION OFFICE, ANE-150	

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ACTIVE TEMPORARY REVISIONS

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PART 1, SECTION I

OPERATING LIMITATIONS

The text that follows supersedes any prior version of the FLIGHT MANAGEMENT SYSTEM (FMS) section from the basic manual.

FLIGHT MANAGEMENT SYSTEM (FMS)

FMS OPERATIONAL APPROVALS

The UNS-1Esp and UNS-1EspW Flight Management Systems (FMS) have been demonstrated capable of, and been shown to meet the requirements for the following operations:

1. VFR/IFR enroute, terminal and instrument approach (GPS stand-alone and GPS overlay VOR, VOR-DME, NDB, and RNAV) operation within the U.S. National Airspace System using the WGS-84 coordinate reference datum. Satellite navigation is based upon use of only the Global Positioning System (GPS) operated by the United States.

2. RNP5/BRNAV, provided it is receiving usable navigation information from one or more of the following:

    a. GPS.

    b. One VOR/DME or multiple DMEs.

3. Vertical Navigation (VNAV) Enroute, Terminal, and Approach operations, provided the FMS is receiving usable navigation information.

    NOTE

    Use of P-ILS mode is authorized to provide vertical guidance during GPS based instrument approaches.

4. Use of Barometric VNAV to conduct RNAV instrument approach procedures published with a VNAV Decision Altitude (LNAV/VNAV minimums).

5. LNAV MDA, LNAV/VNAV DA, and LPV DA instrument approach procedures using FMS vertical guidance when equipped with dual UNS-1EspW.

FMS OPERATING LIMITATIONS

General

1. The software status stated in the UNS-1Esp Pilot's Guide, Report No. 2423sv802/902, dated 16 September 2003, or later approved revision, must match that displayed on the equipment. The software status stated in the UNS-1EspW Pilot's Guide, Report No. 2423v1000/1100, dated 08/29/07, or later approved revision, must match that displayed on the equipment.

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2. When latitude/longitude transferred from the internal database (IDB) is displayed on the CDU, the pilot will ensure that it is a reasonable position for the requested identifier.

3. The internal database (IDB) must be updated to the latest revision every 28 days; updating to be accomplished with the Universal Avionics update disk or equivalent.

4. The fuel management mode is for advisory purposes only and it does not replace the aircraft primary fuel flow and fuel quantity systems.

5. When operating north of 73 degrees north latitude or south of 60 degrees south latitude the pilot must manually insert magnetic variation.

6. When the air data input is lost to the FMS, the pilot must manually insert TAS and Altitude information every ten minutes.

7. IFR En Route and Terminal navigation are prohibited unless the pilot verifies the currency of the data base or verifies each selected Waypoint for accuracy by reference to current approved data.

8. Other navigation equipment appropriate to the ground facilities along the intended route must be installed and operable, as required by the operating rules applicable to the specific type of operation (i.e., VOR, DME, etc.).

FMS LNAV OPERATION

1. Navigation shall not be predicated upon the UNS-1Esp or UNS-1EspW during periods of dead reckoning (DR).

2. Following a period of dead reckoning, position should be verified by visually sighting ground reference points and/or by using other navigation equipment such as NDB, VOR, DME, or radar fix.

3. The use of manually inserted runway coordinates is limited to VFR operations.

FMS VNAV OPERATIONS

1. If VNAV is to be used for approach, use of enroute VNAV must be discontinued within 10 nm of the FAF. When the approach mode is activated, as indicated by a green APP on the PFD, VNAV may be armed for the approach.

2. Pilot and co-pilot altimeters are the primary altitude reference during all VNAV operations.

FMS APPROACHES

1. Instrument approaches must be accomplished in accordance with approved instrument approach procedures that are retrieved from the FMS navigation data base. The FMS database must incorporate the current update cycle.

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NOTE

Not all published approaches are in the FMS database. The flight crew must ensure that the planned approach is in the database.

2. When using FMS guidance for conducting instrument approach procedures that do not include "GPS" or "RNAV" in the title of the published procedure, unless otherwise authorized by local authority, the flight crew must verify that the procedure-specified navaid and associated avionics are operational.

3. If an "INTEG" message is displayed on the PFD during an approach, navigation predicated on GPS should be discontinued.

4. Instrument approaches must be conducted in the approach mode of operation prior to the FAF as indicated by a green APP on the PFD.

5. RAIM must be available at the final approach fix in order to accomplish GPS based non-precision approaches. When RAIM is not available, "INTEG" will be displayed on the PFD and "NO GPS RAIM @ FAF" or "NO GPS @ MAP" messages will be displayed on the UNS-1 CDU.

6. The appropriate GPS Level of Service (LOS) must be available for WAAS approaches. If the current LOS does not match that required for the selected approach, the "CHECK LOS" alert will be displayed on the PFD.

7. Operations requiring WAAS require dual UNS-1EspW.

8. ILS, LOC, LOC-BC, LDA, SDF, and MLS approaches based on the UNS-1Esp or UNS-1EspW are not authorized.

9. The UNS-1Esp or UNS-1EspW is approved for FMS VFR approaches as a VFR pilot aid only.

10. Unless GPS approaches are approved for alternate airports by applicable operating rules, airports selected as alternates must be served by an approach based on other than GPS navigation. The aircraft must have operational equipment capable of using that navigation aid, and the required navigation aid must be operational.

The maximum approach gradient for airspeeds above 65 KIAS is 4 degrees. The maximum approach gradient for airspeeds at or below 65 KIAS is 7 degrees.

PLACARDS

The following placard **is installed** on the cockpit instrument panel when the main gear box pump failure indicating system is installed:

"MGB PUMP FAILURE INDICATING SYSTEM INSTALLED"

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PART 1, SECTION II

NORMAL PROCEDURES

BEFORE STARTING ENGINES

1. Seat and pedals – ADJUST.
2. Shoulder harness locks – CHECK.
3. Parking brake – SET.
4. Pilot and copilot emergency egress handles – Full forward and safetied.
5. Center console switches – SET.
    a. REVERSION CONTROL panel – SET.
        1) AHRS – NORM.
        2) DCU – NORM.
        3) ADC – NORM.
    b. NO. 1 RADIO GUARD – NORMAL.
    c. OEI TRAIN – OFF.
    d. TNG IDLE – Centered.
    e. Weather radar – OFF.
    f. LDG GEAR handle – DN.
    g. EMER DN – UP.
    h. Backup attitude indicator – Cage.
6. Collective stick switches – SET.
    a. SRCHLT – OFF.
7. Side consoles – SET.
    a. COMPASS – SLAVED.
    b. Audio panels – SET.
8. Overhead console – SET.
    a. Rotor brake – OFF.
    b. **FLOAT** LIFE RAFTS – SAFE.
    c. **FLOAT** LIFE RAFT TEST – NORM.

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d. **FLOAT** LIFE RAFTS JETT – OFF, cover closed and saftied.

e. **FLOAT** FLOTATION – SAFE.

f. **FLOAT** FLOTATION TEST – NORM.

g. ECS CONT PANEL:

1) CABIN and COCKPIT – OFF.

h. EMERG LTS – OFF.

i. INT LTS – As required.

j. COCKPIT LIGHTS – As required.

k. FIRE DET TEST – NORM.

l. FIRE EXTG TEST – NORM.

m. MGB OIL BYP – AUTO.

n. CVR/FDR – OFF.

o. RAMP – OFF.

p. GND PUMP – OFF.

q. SERVO BST – ON.

r. SERVO – BOTH.

s. NO. 1 and NO. 2 ENG IGN – AUTO.

t. FUEL PRIME – AUTO.

u. FIRE EXTG – OFF.

v. AIR SRCE HEAT/START – ENG.

w. APU CTRL – OFF.

x. APU GEN – OFF.

y. BATT – OFF.

z. AC EXT PWR – OFF.

aa. DC CONV BACKUP – NORM.

bb. DC CONV NO. 1 and NO. 2 – ON.

cc. AC GEN NO. 1 and NO. 2 – OFF.

dd. **CARGO HOOK** CARGO HOOK switch – SAFE.

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ee. **HOIST** RSQ HST switch – OFF.

ff. VIB CTRL – OFF.

gg. DC EXT PWR – OFF.

hh. Throttles – STOP.

ii. FUEL NO. 1 and NO. 2 – As required (XFD first flight of day).

jj. **FLOAT** AUX FLOTATION – SAFE.

kk. PITOT HT STBY – OFF.

ll. PITOT HT CPLT and PLT – OFF.

mm. WDSHLD WIPER – OFF.

nn. WDSHLD WASH – OFF.

oo. ANTI-ICE WDSHLD CPLT and PLT – OFF.

pp. ANTI-ICE ENGINE NO. 1 and NO. 2 – OFF.

qq. EXT LIGHTS – As required.

9. Circuit breakers – IN.

COCKPIT EQUIPMENT CHECKS

Items marked with an (*) are through flight checks.

1. *BATT – ON.

NOTE

On battery power, a series of cautions will illuminate to include the **MGB OIL HOT, DC CONV 1 FAIL, DC CONV 2 FAIL, BACKUP CONV OFF, AUTOPILOT 1 FAIL, AUTOPILOT 2 FAIL, MGB MAN COOL, RACK 1 FAN FAIL, RACK 2 FAN FAIL, DEICE SYS FAIL, HYD FAN FAIL, CHIP SYS FAULT, BATT CHARGE FAIL, COCKPIT SEC FAN** and **ROTOR BRAKE** cautions. These are normal indications and do not signify a system malfunction.

2. *AC EXT PWR – As required.

3. FIRE DET – TEST.

If AC EXT PWR is not used:

a. INBD – Note illumination of APU and both engine FIRE/ARMED pushbuttons, and the pilot's **FIRE** warning light.

b. NORM.

If AC EXT PWR is used:

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a. INBD – Note illumination of APU and both engine FIRE/ARMED pushbuttons, and the FIRE warning lights, plus annunciation of the "FIRE ENGINE ONE," "FIRE ENGINE TWO" and "FIRE APU" aural alerts.

b. NORM – Allow all lights and aural alerts to clear.

c. OUTB – Note illumination of both engine FIRE/ARMED pushbuttons and the FIRE warning lights, plus annunciation of the "FIRE ENGINE ONE" and "FIRE ENGINE TWO" aural alerts.

d. SMOKE – Note SMOKE IN BAGGAGE warning light on the EICAS page plus annunciation of the "SMOKE IN BAGGAGE" audio alert.

e. NORM.

4. *AIR SRCE HEAT/START – ENG.

NOTE

Wait at least 15 seconds between turning the battery on and starting the APU to allow time for the APU GCU preflight test.

5. *APU CTRL – ON.

6. *APU GEN – ON.

CAUTION

When operating a Color Multifunction Display (CMFD) at a very low selected LUM setting, bright ambient light may impair legibility of the MFD.

7. *CMFDs – ON and adjusted.

8. *Pilot and copilot Radio Tuning Units (RTUs) – ON and SET.

9. *FMS – ON.

10. *Pilot and copilot COMPASS – SLAVED and SET.

NOTE

The flotation system test will be accomplished once per day if over water flight is anticipated. It will be performed by the flight crew if not accomplished by maintenance personnel.

11. FLOAT Flotation system – Test.

12. *ECS – As required.

13. FIRE DET – TEST (if AC EXT PWR not used).

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a. INBD – Note illumination of APU FIRE and both engine FIRE/ARMED pushbuttons, and the FIRE warning lights, plus annunciation of the "FIRE ENGINE ONE," "FIRE ENGINE TWO" and "FIRE APU" aural alerts.

b. NORM – Allow all lights and aural alerts to clear.

c. OUTB – Note illumination of both engine FIRE/ARMED pushbuttons and the FIRE warning lights, plus annunciation of the "FIRE ENGINE ONE" and "FIRE ENGINE TWO" aural alerts.

d. SMOKE – Note SMOKE IN BAGGAGE warning light on the EICAS page plus annunciation of the "SMOKE IN BAGGAGE" aural alert.

e. NORM.

NOTE

Pushing the P/B LAMP switch to TEST will test the pilot and copilot master warning panel and warning lights, the landing gear unlocked light, the ELB panel, the backup attitude indicator test light and associated AFCS control panel lights, fire detector test status lights, and the fire bottle arming pushbuttons.

14. P/B LAMP – TEST.

15. Hydraulic GND PUMP – ON.

NOTE

Prior to conducting control checks, note the position of the flight controls and return them to approximately the same position before turning off the ground pump. This will prevent transfer of hydraulic fluid between system reservoirs.

NOTE

The full flight control check should be accomplished prior to the first flight of the day. On subsequent flights, the pilot should slowly move the cyclic, collective and pedals through complete range of motion, checking for freedom of movement and no binding. This check can be done with either or both sets of servos selected.

16. *Flight controls – CHECK.

NOTE

If the OAT is -17°C or less, the cold weather flight control warm-up procedure must be completed.

a. Cold weather control procedure – Complete (if required).

b. SERVO – NO 1.

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c. Slowly move the cyclic, collective and pedals through complete range of motion, checking for freedom of movement and no binding.

d. SERVO – NO 2.

e. Repeat step c.

f. SERVO BST – OFF.

g. Confirm full range of control movement with increased force and no binding.

h. SERVO BST – ON.

i. SERVO – BOTH.

17. AFCS – CHECK.

NOTE

The Preflight Built In Test (PFBIT) will be accomplished once per day. It will be performed by the fight crew if not accomplished by maintenance personnel.

a. Center all flight controls.

b. SAS 1 and SAS 2 – ON.

c. AP 1 and AP 2 – ON.

d. Rotor brake – ON.

e. Turn off, then engage YAW, CYCLIC and COLL TRIM.

f. AFCS RESET – Press and hold for 2 seconds.

g. AFCS MODE SEL panel – TEST.

h. PFLT – Press and hold for at least 0.5 seconds, but no more than 2 seconds.

i. Follow instructions on the AFCS MODE SEL panel while PFBIT is running.

j. AP PWR RESET – Depress AP 1 and AP 2 buttons.

18. Hydraulic LEAK TEST – CHECK.

a. Rotor brake – ON.

b. Select LDI on the HEALTH → STATUS page (if LDI prompt is not available, line down to HYDRAULICS).

c. Confirm LDI PASS indication.

19. GND PUMP – OFF.

20. *YAW, CYCLIC and COLL TRIM – ON.

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21. *SAS 1 and 2 – ON/PRI.

22. *AP 1 and 2 – ON/ATT.

23. *BU ATT IND PWR – TEST then ARM.

24. Main gear box pressure system – CHECK.

CAUTION

Do not take off if if any of the following conditions occur during this static test:

Red dashes are shown in place of a main gear box pressure indication

or

MGB OIL PRES and MGB OIL OUT warnings do not illuminate

or

MGB PUMP 1 FAIL and MGB PUMP 2 FAIL cautions do not illuminate.

or

either MGB OIL PRES or MGB SENSOR FAIL caution illuminates.

NOTE

If the main gear box last jet pressure switch fails, the **MGB OIL PRES** and **MGB SENSOR FAIL** cautions will replace the **MGB OIL PRES** and **MGB OIL OUT** warnings.

a. EICAS page – Select SHOW OBE.

b. Confirm main gear box oil pressure gauge indicates 0 psi.

c. Confirm **MGB OIL PRES** and **MGB OIL OUT** warnings are illuminated.

d. Confirm **MGB PUMP 1 FAIL** and **MGB PUMP 2 FAIL** cautions are illuminated.

e. EICAS page – Select HIDE OBE.

25. **CARGO HOOK** Cargo hook preflight – Accomplish if cargo hook operations are planned.

26. **HOIST** Hoist preflight – Accomplish if hoist operations are planned.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

ROTOR ENGAGEMENT AND ENGINE RUN-UP

1. *Flight controls – HOLD.

CAUTION

If engine starts were made with the rotor brake ON, remain at 50 to 54% N_r for a minimum of 1 minute prior to advancing throttles to FLY.

2. *Rotor brake – RELEASE, if set.
3. *Hydraulic system 1 and 2 pressure – GREEN by 40% N_r.
4. *Throttles – Adjust N_r to 54%.
5. *Engine and main gear box oil pressure – GREEN.

NOTE

Allow engine and main gear box oil pressure to reach normal operating limits before run-up to FLY. The engines will not respond to throttle movement until N_p is at least 24%.

6. *Throttles – FLY.
7. *Droop stops – Check out by 70% N_r.

NOTE

To provide a smoother transition from APU generator power to main generator power, turn AC GEN NO. 2 on, wait at least 1 second, and then turn AC GEN NO. 1 on.

8. *AC GEN NO. 2 – ON.
9. *AC GEN NO. 1 – ON.
10. *AC and DC EXT PWR – OFF, cable removed.
11. *APU CTRL – OFF.
12. *GND PUMP – OFF.
13. *AIR SRCE HEAT/START – ENG.
14. *VIB CTRL – ON.
15. *NO. 1 and NO. 2 FUEL – DIRECT.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

PART 1, SECTION III

EMERGENCY PROCEDURES

3.0 ENGINE CONTROL SYSTEM MALFUNCTIONS

3.14 FADEC FAULT

A FADEC fault caution identifies a fault or combination of faults in the affected FADEC. These faults alone will not affect engine operation. The caution notifies the pilot that a level of sensor redundancy has been lost.

Symptom:

FADEC 1 FAULT or **FADEC 2 FAULT** or **FADEC 1 NO DSPTCH** or **FADEC 2 NO DSPTCH**

Action:

In Flight:

1. Continue the flight and correct prior to next flight.

On the ground:

1. Correct prior to flight.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

7.0 GEAR BOX MALFUNCTIONS

The main gear box temperature and pressure gauges, along with the main gear box chip detection system, provide the pilot with information to diagnose and take corrective action in the event of a main gear box malfunction. An accessory/input hot indication requires retarding the affected engine to IDLE to remove power from that module. An imminent transmission failure would necessitate that the helicopter land immediately. Indications of low oil pressure, between 45 - 5 psi or high oil temperature, greater than 130°C, dictate that the helicopter should land as soon as possible. Low main gear box oil pressure can be caused by an oil leak or a pump failure. Oil leaks can occur either in the gear box housings or the external cooler. Different scenarios are discussed below.

IMMINENT TRANSMISSION FAILURE

After presentation of a main gear box oil pressure warning or caution, any one of the following symptoms are indicative of an imminent transmission failure: **MGB OIL OUT** warning, an increase in power required to maintain a constant collective setting and airspeed, yaw kicks, loss of two hydraulic pumps, or unusual noise or vibrations.

If an imminent failure is suspected, the primary consideration is to land the aircraft before the failure progresses to a gear box seizure or loss of drive to the main or tail rotor. The descent should be made at a reduced power setting but with at least 15% torque to ensure that the engines continue to drive the transmission. Avoid rapid or frequent power changes. A running landing is preferred since it requires less power and smaller power changes. A no-hover landing should be performed if a running landing area is not available.

OIL LEAK IN COOLING CIRCUIT

The main gear box bypass system is designed to contain leaks in the external cooler. Indication of a leak in the oil cooling circuit will be an **MGB OIL PRES** caution followed by an **MGB OIL PRES** warning. In the event of a leak in the external oil cooler, the automatic bypass system is designed to activate the bypass valve when pressure falls below 35 psi, which will capture sufficient oil to allow continued flight. With the oil cooler in bypass, main gear box pressure should stabilize above 5 psi and main gear box oil temperature will increase into the red zone. Unless accompanied by an **MGB PUMP 1 FAIL** or **MGB PUMP 2 FAIL** caution indication, the switch shall be left in the AUTO or BYP position.

OIL LEAK IN MAIN GEAR BOX HOUSING

WARNING

A total loss of main gear box oil pressure may result in main gear box failure in less than 10 minutes. If the MGB OIL OUT warning illuminates, land immediately.

Oil leaks in the gear box housings will not be contained by the bypass system and can lead to a rapid total loss of lubrication oil. The **MGB OIL OUT** warning, coupled with pressure below 5 psi, may be the only indications of a total oil loss.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

MAIN GEAR BOX LUBRICATION PUMP FAILURES

CAUTION

High oil temperatures or loss of lubrication may result in loss of the main generators. The APU should be started so that the APU generator will be immediately available.

NOTE

High oil temperature may cause the paint on the gear box to smoke or emit fumes, which may be noticeable in the cabin or cockpit.

NOTE

A loss of main gear box oil may result in the mechanical failure of a hydraulic pump drive.

NOTE

The main gear box oil temperature sensors are "wet bulb" systems, which require some presence of oil to indicate properly. When main gear box oil pressure is completely lost, main gear box temperature indications are not reliable.

NOTE

The **MGB OIL OUT** warning illuminates ("GEAR BOX OIL OUT" aural alert) when the oil pressure at the manifold falls below 5 psi and the last jet pressure switch falls below 24 psi.

NOTE

The **MGB OIL PRES** caution illuminates in flight when gear box pressure at the manifold falls below **45** psi or pressure at the last jet pressure switch falls below 24 psi. The **MGB OIL PRES** warning illuminates ("GEAR BOX PRESSURE" aural alert) when oil pressure at the manifold falls below **35** psi and pressure at the last jet pressure switch falls below 24 psi. If the **MGB OIL PRES** warning illuminates, the **MGB OIL PRES** caution will not be illuminated.

A pump failure is indicated by an **MGB PUMP 1 FAIL** or **MGB PUMP 2 FAIL** caution and will lead to oil pressure between 5 and 10 psi. A main gear box pump failure will also cause the auto bypass system to activate. A main gear box pump failure may result in high temperatures in the corresponding accessory and input modules (indicated by an **ACC/INPUT 1 HOT** or **ACC/INPUT 2 HOT** caution). If possible, the pilot should retard the engine on the affected side to IDLE and maintain a pitch attitude above 2° nose up to reduce heating due to churning oil. For a single pump failure, the pilot should redirect oil through the oil cooler by selecting MAN COOL in order to avoid excessive high oil temperatures.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

NOTE

Due to variability in potential oil leak rates and leak locations, and the relationship between pressure and temperature, combinations of warnings and cautions such as **MGB OIL OUT**, **MGB OIL PRESS**, **MGB OIL PRESS**, **MGB OIL HOT**, **MGB OIL BYPASS**, **INPUT/ACC 1/2 HOT** or **MGB PUMP 1/2 FAIL** may be indicated. Execute the emergency procedures according to the warnings, cautions and oil pressure/temperature indications listed as **Symptoms** first. Then diagnose the additional information executing the subsequent emergency procedure as appropriate.

7.1 MAIN GEAR BOX OIL OUT

WARNING

A total loss of main gear box oil pressure may result in main gear box failure in less than 10 minutes. If the MGB OIL OUT warning illuminates, land immediately.

Symptom:

MGB OIL OUT

"GEAR BOX OIL OUT" aural alert

AND MGB oil pressure below 5 psi on the EICAS page

Action:

1. **Land immediately.**

If time and altitude permit:

2. APU CTRL – ON.
3. APU GEN – ON.
4. Ditching checklist – Execute, if applicable.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

7.2 MGB OIL PRESS WARNING

WARNING

A total loss of main gear box oil pressure may result in main gear box failure in less than 10 minutes. If the MGB OIL OUT warning illuminates, land immediately.

Symptom:

MGB OIL PRESS

"GEARBOX PRESSURE" aural alert

MGB oil Pressure below 35 psi on the EICAS page

Action:

1. Descend to a minimum safe altitude while reducing airspeed below 100 KIAS. If conditions permit, descend below 500 feet above the water/terrain. Maintain airspeed between 80 and 100 KIAS until committed to land.
2. APU CTRL – ON.
3. APU GEN – ON.

If **MGB OIL BYPASS** is not illuminated:

4. MGB OIL BYP switch – BYP.

If **INPUT/ACC 1/2 HOT** and/or **MGB PUMP 1/2 FAIL** caution(s) also illuminate(s):

5. Throttle (affected engine) – IDLE, unless dual engine power is required for continued safe flight.
6. Adjust airspeed between 80 and 100 KIAS.
7. If practical, maintain pitch attitude above 2° nose up.

If **ALL** of the following symptoms exist:

MGB PUMP 1 FAIL or **MGB PUMP 2 FAIL** caution

MGB OIL BYPASS caution

MGB oil pressure is 7 psi or greater:

8. MGB OIL BYP – MAN COOL.
9. Land as soon as possible. If required, use dual engine power for landing.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

If **ANY** of the following symptoms of an imminent gear box failure exist:

MGB OIL OUT warning **AND** MGB oil pressure is below 5 psi on the EICAS page

Increased power required at constant collective setting and airspeed

Yaw kicks

Unusual noise or vibrations

Loss of two hydraulic pumps

10. **Land immediately**. If required, use dual engine power for landing.

If time and altitude permit:

11. Ditching checklist – Execute, if applicable.

7.3 MAIN GEAR BOX OIL PRESSURE CAUTION

WARNING

A total loss of main gear box oil pressure may result in main gear box failure in less than 10 minutes. If the MGB OIL OUT warning illuminates, land immediately.

Symptom:

MGB OIL PRESS

MGB oil pressure between 45-35 psi on the EICAS page

Actions:

1. APU CTRL – ON.
2. APU GEN – ON.

If **INPUT/ACC 1 HOT** or **INPUT/ACC 2 HOT** or **MGB PUMP 1 FAIL** or **MGB PUMP 2 FAIL** are illuminated:

3. Follow the 7.6 INPUT/ACCESSORY HOT OR MAIN GEAR BOX PUMP FAIL procedure.

4. Land as soon as possible.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

If **ANY** of the following symptoms of an imminent gear box failure exist:

MGB OIL OUT warning **AND** MGB oil pressure is below 5 psi on the EICAS page

Increased power required at constant collective setting and airspeed

Yaw kicks

Unusual noise or vibrations

Loss of two hydraulic pumps

5. **Land immediately**. If required, use dual engine power for landing.

If time and altitude permit:

6. Ditching checklist – Execute, if applicable.

7.4 MAIN GEAR BOX OIL HOT CAUTION

WARNING

A total loss of main gear box oil pressure may result in main gear box failure in less than 10 minutes. If the MGB OIL OUT warning illuminates, land immediately.

Symptoms:

MGB OIL HOT

MGB oil temperature above 130°C indicated on the EICAS page

Actions:

1. APU CTRL – ON.
2. APU GEN – ON.
3. Confirm MGB OIL BYP switch – AUTO.

If **INPUT/ACC 1 HOT** or **INPUT/ACC 2 HOT** or **MGB PUMP 1 FAIL** or **MGB PUMP 2 FAIL** are illuminated:

4. Follow the 7.6 INPUT/ACCESSORY HOT OR MAIN GEAR BOX PUMP FAIL procedure.

5. Land as soon as possible.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

If **ANY** of the following symptoms of an imminent gear box failure exist:

MGB OIL OUT warning **AND** MGB oil pressure is below 5 psi on the EICAS page

Increased power required at constant collective setting and airspeed

Yaw kicks

Unusual noise or vibrations

Loss of two hydraulic pumps

6. **Land immediately**. If required, use dual engine power for landing.

If time and altitude permit:

7. Ditching checklist – Execute, if applicable.

7.5 GEAR BOX CHIP

Symptom:

MGB CHIP or **ACC 1 CHIP** or **ACC 2 CHIP** or **INPUT 1 CHIP** or **INPUT 2 CHIP**

Action:

If one caution is illuminated:

1. Land as soon as practical.

If two or more cautions are illuminated:

2. Land as soon as possible.

7.6 INPUT/ACCESSORY HOT OR MAIN GEAR BOX PUMP FAIL

WARNING

If accompanied by any of the following: MGB OIL OUT or MGB OIL PRES warning or MGB OIL PRES, MGB OIL HOT or MGB OIL BYPASS caution, execute the appropriate MGB emergency procedure.

Symptom:

INPUT/ACC 1 HOT or **INPUT/ACC 2 HOT** or **MGB PUMP 1 FAIL** or **MGB PUMP 2 FAIL**

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

Action:

1. Throttle (affected engine) – IDLE, unless dual engine power is required for continued safe flight.
2. Adjust airspeed between 80 and 100 KIAS.
3. If practical, maintain pitch attitude above 2° nose up.
4. APU CTRL – ON.
5. APU GEN – ON.
6. Land as soon as possible. If required, use dual engine power for landing.

If **ANY** of the following symptoms of an imminent gear box failure exist:

MGB OIL OUT warning **AND** MGB oil pressure is below 5 psi on the EICAS page

Increased power required at constant collective setting and airspeed

Yaw kicks

Unusual noise or vibrations

Loss of two hydraulic pumps

7. **Land immediately**. If required, use dual engine power for landing.

If time and altitude permit:

8. Ditching checklist – Execute, if applicable.

7.7 TAIL/INTERMEDIATE OIL LOW

Symptom:

IGB OIL LEVEL or **TGB OIL LEVEL** prior to engine start.

NOTE

The **IGB OIL LEVEL** or **TGB OIL LEVEL** cautions are intended to alert the aircrew to an under-serviced gearbox prior to engine start. The internal tail and intermediate gearbox oil level sensors are only active when the rotors are not turning.

Action:

Do not start the engines until the appropriate gearbox has been serviced.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

7.8 TAIL/INTERMEDIATE OIL HOT/CHIP

Symptom:

TGB HOT or **IGB HOT** or **TGB CHIP** or **IGB CHIP**

Action:

1. Reduce airspeed to 80 KIAS.
2. Land as soon as possible.

If accompanied by loud/unusual noises, pedal kicks, high vibration or the combination of both CHIP and HOT cautions:

3. **Land immediately**.

7.9 SWASHPLATE TEMPERATURE

Symptom:

S/P TEMP DETECT

Action:

1. Land as soon as practical.

Symptom:

S/P TEMP LIMIT

"SWASHPLATE TEMPERATURE" aural alert.

Action:

1. Land as soon as possible.

If accompanied by secondary indications such as restricted control motion, unusual noises or vibrations:

2. **Land immediately**.

7.10 AUTOMATIC BYPASS TEST FAIL

Symptom:

BYPASS TEST FAIL

Action:

1. Advance throttles to FLY.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

2. MGB BYP switch – BYPASS.

3. MGB BYP switch – AUTO.

If **BYPASS TEST FAIL** illuminates again:

4. Correct prior to flight.

If **BYPASS TEST FAIL** does not illuminate:

4. Continue flight.

7.11 MAIN GEAR BOX MANUAL COOL

Symptom:

MGB MAN COOL

Action:

If MGB MAN COOL selected due to main gear box pump failure:

1. No additional action is required.

If MGB MAN COOL inadvertently selected:

2. MGB BYP switch – AUTO.

7.12 MAIN GEAR BOX OIL COOLER IN BYPASS

Symptom:

MGB OIL BYPASS

Action:

If MGB pressure is less than 45 psi indicated on the EICAS page:

1. Confirm MGB BYP switch – AUTO.

2. Monitor MBG oil pressure and temperature on the EICAS page.

If additional MGB warnings or cautions illuminate:

3. Execute the appropriate MGB emergency procedure.

NOTE

Abnormal flight conditions, such as severe turbulence or a low G pushover may result in momentarily low main gear box oil pressure and inadvertently activate the automatic bypass system.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

NOTE

The **MGB OIL BYPASS** caution will latch if activated by the auto bypass system. To unlatch the caution, the MGB BYP switch should be placed in MAN COOL and then back to AUTO to arm the system.

If MGB pressure is greater than 45 psi **AND** an abnormal flight condition can be identified:

4. MGB BYP switch – MAN COOL.
5. MGB BYP switch – AUTO.

If the **MGB OIL BYPASS** caution activates without an abnormal flight condition:

6. Remain in AUTO.

7.13 MAIN GEAR BOX SENSOR FAILURE

Symptom:

MGB SENSOR FAIL

Action:

Correct prior to flight.

7.14 MGB CAUTION SYSTEM FAULT

An electrical short in certain components or wiring will cause the M XMSN OIL WARN circuit breaker to pop. When this breaker pops, **MGB PUMP 1 FAIL**, **MGB PUMP 2 FAIL**, **MGB OIL HOT** and **MGB MAN COOL** EICAS cautions will erroneously illuminate.

The best indication of MGB health is the analog and digital indications of MGB pressure and temperature on the EICAS page. The pilot should continue to monitor EICAS indications of MGB pressure and temperature.

WARNING

If the MGB OIL PRES warning is illuminated, MGB oil temperature exceeds 130° or MGB oil pressure drops below 35 psi, follow the 7.2 MGB OIL PRESS WARNING procedure.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

Symptom:

All of the following cautions illuminate:

MGB PUMP 1 FAIL

MGB PUMP 2 FAIL

MGB OIL HOT

MGB MAN COOL

Action:

1. Monitor EICAS analog and digital display of MGB oil pressure and temperature.
2. Land as soon as practical.

7.15 MGB OIL PRESSURE CAUTION SYSTEM FAULT

An electrical short in the last jet switch or wiring will cause the M XMSN PRESS SWITCH circuit breaker to pop causing the **MGB OIL PRES** and **MGB OIL BYPASS** cautions to illuminate and the MGB bypass valve to go into the bypass condition.

WARNING

If the MGB OIL PRES warning is illuminated, MGB oil temperature exceeds 130° or MGB oil pressure drops below 35 psi, follow the 7.2 MGB OIL PRESS WARNING procedure.

Symptom:

The following cautions illuminate:

MGB OIL PRES

MGB OIL BYPASS

Rising MGB oil temperature.

A 5 to 10 psi drop in MGB oil pressure on EICAS page.

Action:

1. MGB BYP switch – MAN COOL.
2. Monitor EICAS analog and digital display of MGB oil pressure and temperature.
3. Land as soon as practical.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

7.16 LIMIT EXCEEDED

The limit exceeded caution illuminates when dual or single engine blow away power is activated exceeding a gearbox torque limit.

Symptom:

LIMIT EXCEEDED

Action:

1. Land as soon as practical.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

8.0 ELECTRICAL SYSTEM MALFUNCTIONS

8.6 DUAL DC CONVERTER AND BACKUP CONVERTER FAILURE

Symptom:

DC CONV 1 FAIL and **DC CONV 2 FAIL** and

BACKUP CONV OFF

NOTE

With only battery power, a series of cautions will illuminate to include the **MGB OIL HOT, AUTOPILOT 1 FAIL, AUTOPILOT 2 FAIL, AFCS DGRD, HYD FAN FAIL, RACK 1 FAN FAIL, RACK 2 FAN FAIL, INLT1 A-ICE FAIL, INLT2 A-ICE FAIL, DCU MISCOMPARE, AVC FAIL, CHIP SYS FAULT, MGB PUMP 1 FAIL, MGB PUMP 2 FAIL, MGB MAN COOL, MGB OIL PRES, COCKPIT SEC FAN, DEICE SYS FAIL,** and **BATT CHARGE FAIL** cautions. These are normal indications and do not signify a system malfunction.

Confirming:

Loss of all DC primary and essential busses, to include loss of copilot displays.

Action:

1. DC CONV NO 1 and NO 2 – RESET/OFF then ON.

If both converters are recovered:

2. Continue the flight.

If one converter is recovered:

3. Land as soon as practical.

If converters are not recovered:

CAUTION

Normal and emergency extension of the landing gear is not possible without electrical power. When operating on battery power only, the landing gear should be lowered before battery power is depleted.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

NOTE

With the loss of both main DC converters, the battery will not recharge. The battery utility, battery and battery hold up buses will be powered by the battery.

4. LDG GEAR – DN.

5. Land as soon as possible.

This Document contains technical data subject to EAR. See WARNING and classifications on first page.

13.0 FIRES

13.4 CABIN OR COCKPIT FIRE

Symptom:

SMOKE IN CABIN

Smoke or flames in the cockpit or cabin

NOTE

The **SMOKE IN CABIN** EICAS warning will only be present when the cabin smoke detector is installed.

Action:

1. Begin descent.
2. ECS CONT PANEL:
    a. COCKPIT – VENT.

    If cabin is occupied:

    b. CABIN – VENT.

    If cabin is not occupied:

    c. CABIN – OFF.
3. Fight fire with portable fire extinguisher.
4. Land as soon as possible.

If fire persists:

5. Land immediately.

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This Document contains technical data subject to EAR. See WARNING and classifications on first page.

PART 1, SECTION IV

PERFORMANCE DATA

No change.

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