TECHNICAL MANUAL

AVIATION UNIT
AND AVIATION INTERMEDIATE
MAINTENANCE MANUAL

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N6887191
NSN 2840-01-013-1339

This copy is a reprint which includes current pages from Changes 1 through 15.

HEADQUARTERS, DEPARTMENT OF THE ARMY
2 NOVEMBER 1977

CHANGE NO. 18

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 31 July 1995

Aviation Unit and Aviation Intermediate Maintenance Manual

Engine, Aircraft, Gas Turbine
Model T63-A-720 P/N 6887191
NSN 2840-01-013-1339

DISTRIBUTION STATEMENT A: Approved fur public release; distribution is unlimited.

TM 55-2840-241 -23,2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
i and ii	i and ii
2-5 and 2-6	2-5 and 2-6
4-9 through 4-10.1/(4-10.2 blank)	4-9 through 4-10.1/(4-10.2 blank)
4-16.1 and 4-16.2	4-16.1 and 4-16.2
- - - -	4-16.3/(4-16.4 blank)
5-3 and 5-4	5-3 and 5-4
- - - -	5-14.1/(5-14.2 blank)
5-15 and 5-16	5-15 and 5-16
5-16.1/(5-16.2 blank)	516.1/(5-16.2 blank)
5-19 through 5-20.1/(5-20.2 blank)	5-19 through 5-20.1/(5-20.2 blank)
7-1 and 7-2	7-1 and 7-2
B-9 and B-10	B-9 and B-10
Index 1 and Index 2	Index 1 and Index 2

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

DENNIS J. REIMER
General, United States Army
Chief of Staff

Official:

JOEL B. HUDSON
Acting Administrative Assistant to the
Secretary of the Army
00863

DISTRIBUTION:

To be distributed in accordance with DA Form 12-31-E, block no. 1802, requirements for TM 55-2840-241-23.

URGENT

TM 56-2840-241-23
C17

CHANGE

NO. 17

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 4 November 1994

Aviation Unit and Aviation Intermediate Maintenance Manual

Engine, Aircraft, Gas Turbine
Model T63-A-720 P/N 6887191
NSN 2640-01-013-1339

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
2-5 and 2-6	2-5 and 2-6
7-1 through 7-4	7-1 through 7-4
- - -	7-4.1/(7-4.2 blank)

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTION H. HAMILTON
Administrative Assistant to the Secretary of the Army
07025

DISTRIBUTION:

To be distributed in accordance with DA Form 12-31-E, block no. 1802, requirements for TM 55-2840241-23.

URGENT

CHANGE

NO. 16

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 15 OCTOBER 1993

AVIATION UNIT AND AVIATION INTERMEDIATE MAINTENANCE MANUAL

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339

DISTRIBUTION STATEMENT A: Approved for public release; distribution is unlimited.

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
1-1/(1-2 blank)	1-1/(1-2 blank)
2-1 through 2-4	2-1 through 2-4
3-1 and 3-2	3-1 and 3-2
3-5 and 3-6	3-5 and 3-6
4-7 and 4-8	4-7 and 4-8
4-13 and 4-14	4-13 and 4-14
4-16.1/(4-16.2 blank)	4-16.1 and 4-16.2
5-3 and 5-4	5-3 and 5-4
5-4.1/(5-4.2 blank)	5-4.1/(5-4.2 blank)
5-16.1/(5-16.2 blank)	5-16.1/(5-16.2 blank)
7-5 and 7-6	7-5 and 7-6
7-11 and 7-12	7-11 and 7-12
10-1 and 10-2	10-1 and 10-2
10-7 and 10-8	10-7 and 10-8
12-3 and 12-4	12-3 and 12-4
13-1 and 13-2	13-1 and 13-2
A-1/(A-2 blank)	A-1/(A-2 blank)

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

MILTON H. HAMILTON
Administrative Assistant to the
Secretary of the Army
05528

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31-E, block no. 1802, requirements for TM 55-2840-241-23.

CHANGE }
NO. 15 }

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 14 August 1991

AVIATION UNIT AND AVIATION INTERMEDIATE
MAINTENANCE MANUAL

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 68887191
NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
1-1/1-2	1-1/1-2
4-12.1 and 4-12.2	4-12.1 and 4-12.2
4-13 and 4-14	4-13 and 4-14
4-16.1/4-16.2	4-16.1/4-16.2
5-7 and 5-8	5-7 and 5-8
5-18.1/5-18.2	5-18.1/5-18.2
5-21 and 5-22	5-21 and 5-22
7-5 and 7-6	7-5 and 7-6
7-9 and 7-10	7-9 and 7-10
7-19 and 7-20	7-19 and 7-20
11-1 and 11-2	11-1 and 11-2
A-1/A-2	A-1/A-2

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

GORDON R. SULLIVAN
General, United States Army
Chief of Staff

Official:

PATRICIA P. HICKERSON
Colonel, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31-E, block no. 1802, AVUM and AVIM maintenance requirements for Engine, Gas Turbine, T63-A-720 (TM 55-2840-241-series).

CHANGE NO. 14

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 22 September 1988

AVIATION UNIT AND AVIATION INTERMEDIATE MAINTENANCE MANUAL

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 68887191
NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
A and B	A and B
i and ii	i and ii
1-1 and 1-2	1-1/1-2
	1-2.1/1-2.2
1-3 and 1-4	1-3 and 1-4
1-9 through 1-12	1-9 through 1-12
2-1 through 2-6	2-1 through 2-6
3-5 through 3-8	3-5 through 3-8
3-11 and 3-12	3-11 and 3-12
4-1 through 4-6	4-1 through 4-6
	4-6.1/4-6.2
4-7 and 4-8	4-7 and 4-8
	4-8.1/4-8.2
4-9 and 4-10	4-9 and 4-10
	4-10.1/4-10.2
4-11 and 4-12	4-11 and 4-12
	4-12.1 and 4-12.2
4-13 and 4-14	4-13 and 4-14
4-14.1 and 4-14.2	4-14.1 and 4-14.2
4-15 and 4-16	4-15 and 4-16
5-1 and 5-2	5-1 and 5-2
	5-2.1/5-2.2
5-3 and 5-4	5-3 and 5-4
5-4A/5-4B	5-4.1/5-4.2
5-7 through 5-10	5-7 through 5-10
5-10.1 through 5-10.4	5-10.1 through 5-10.4
5-11 through 5-16	5-11 through 5-16
5-16A/5-16B	5-16.1/5-16.2
5-17 and 5-18	5-17 and 5-18
5-18A	5-18.1/5-18.2
5-19 and 5-20	5-19 and 5-20
	5-20.1/5-20.2
5-21 and 5-22	5-21 and 5-22

C 14

Remove pages	Insert pages
5-27 and 5-28	5-27 and 5-28
	5-28.1/5-28.2
6-1 and 6-2	6-1 and 6-2
7-1 through 7-12	7-1 through 7-12
7-15 through 7-18	7-15 through 7-18
8-1/8-2	8-1/8-2
9-1 and 9-2	9-1 and 9-2
10-1 through 10-4	10-1 through 10-4
	10-4.1/10-4.2
10-5 and 10-6	10-5 and 10-6
	10-6.1/10-6.2
10-7 and 10-8	10-7 and 10-8
11-1 through 11-4	11-1 through 11-4
	11-5/11-6
12-3 and 12-4	12-3 and 12-4
A-l/A-2	A-1/A-2
B-1 and B-2	B-1 and B-2
B-7 and B-8	B-7 and B-8
B-11 and B-12	B-n and B-12
Index 1 through Index 6	Index 1 through Index 6

2. Retain these sheets in front of manual for reference purposes.

By Order of the Secretary of the Army:

CARL E. VUONO
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, AVUM and AVIM requirements for Engine, Gas Turbine, T63-A-720 (TM 55-284O-24l-series)

URGENT

TM 55-2840-241-23
C 13

CHANGE NO. 13

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 6 November 1987

Aviation Unit and Aviation Intermediate
Maintenance Manual

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
5-7 and 5-8	5-7 and 5-8

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

CARL E. VUONO,
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, AVUM and AVIM requirements for Engine, Gas Turbine, T63-A-720 (TM 55-2840-241 series).

URGENT

URGENT

TM 55-2840-241-23
C 12

CHANGE NO. 12

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 14 April 1987

Aviation Unit and Aviation Intermediate
Maintenance Manual

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
13-1 and 13-2	13-1 and 13-2

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, AVUM and AVIM maintenance requirements for Engine, Gas Turbine, T-63-A-720 (TM 55-2840-241 series).

URGENT

URGENT

NOTICE: THIS CHANGE HAS BEEN PRINTED AND DISTRIBUTED OUT OF SEQUENCE. IT SHOULD BE INSERTED IN THE MANUAL AND USED. UPON RECEIPT OF THE EARLIER SEQUENCED CHANGE INSURE A MORE CURRENT CHANGE PAGE IS NOT REPLACED WITH A LESS CURRENT PAGE.

TM 55-2840-241-23
C 11

CHANGE
NO. 11

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 12 December 1986

Aviation Unit and Aviation Intermediate
Maintenance Manual

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
i and ii	i and ii
5-3 and 5-4	5-3 and 5-4
5-9 and 5-10	5-9 and 5-10
5-10.1 through 5-10.3/5-10.4	5-10.1 through 5-10.4
5-11 through 5-14	5-11 through 5-14
10-3 and 10-4	10-3 and 10-4

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

R. L.DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational, Direct Support and General Support Maintenance requirements for Engine, Gas Turbine, T-63-A-720 (TM 55-2840-241 series).

URGENT

CHANGE
NO. 10

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 17 November 1986

Aviation Unit and Aviation Intermediate Maintenance Manual

ENGINE, AIRCRAFT, GAS TURBINE MODEL T63-A-720 P/N 6887191 NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

Remove pages	Insert pages
i and ii	i and ii
2-3 and 2-4	2-3 and 2-4
3-5 and 3-6	3-5 and 3-6
3-11 and 3-12	3-11 and 3-12
4-3 through 4-6	4-3 through 4-6
4-11 through 4-14	4-11 through 4-14
4-14A/4-14B	4-14.1 and 4-14.2
4-15 and 4-16	4-15 and 4-16
4-16A/4-16B	4-16.1/4-16.2
5-3 and 5-4	5-3 and 5-4
5-9 and 5-10	5-9 and 5-10
---	5-10.1 through 5-10.3/5-10.4
5-11 and 5-12	5-11 and 5-12
5-13 through 5-16	5-13 through 5-16
5-19 and 5-20	5-19 and 5-20
5-25 through 5-28	5-25 through 5-28
7-1 and 7-2	7-1 and 7-2
7-7 and 7-8	7-7 and 7-8
7-17 and 7-18	7-17 and 7-18
9-1 and 9-2	9-1 and 9-2
10-1 and 10-2	10-1 and 1O-2
10-7 and 10-8	10-7 and 10-8
12-1 through 12-4	12-1 through 12-4
13-1 and 13-2	13-1 and 13-2
B-13 and B-14	B-13 and B-14
Index 5 and Index 6	Index 5 and Index 6

2. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

R. L. DILWORTH
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational, Direct Support and General Support Maintenance requirements for Engine, Gas Turbine, T-63-A-720 (TM 55-2840-241-series).

CHANGE
No. 9

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 30 March 1984

Aviation Unit and Aviation Intermediate
Maintenance Manual

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove pages	Insert pages
Chapter 3	3-5 and 3-6	3-5 and 3-6
	3-11 and 3-12	3-11 and 3-12
Chapter 4	4-5 and 4-6	4-5 thru 4-6A/4-6B
	4-9 and 4-10	4-9 and 4-10
	4-13 thru 4-14A/4-14B	4-13 thru 4-14A/4-14B
	4-16A/4-16B	4-16A/4-16B
Chapter 5	5-3 and 5-4	5-3 and 5-3
	5-9 and 5-10	5-9 and 5-10
	5-25 and 5-26	5-25 and 5-26
Chapter 7	7-1 and 7-2	7-1 and 7-2
	7-7 and 7-8	7-7 and 7-8
Appendix B	B-3 and B-4	B-3 and B-4
	B-13 thru B-16	B-13 thru B-16

2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

JOHN A. WICKHAM, JR.
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational Maintenance requirements for OH-58 and OH-58C aircraft.

URGENT

TM 55-2840-241-23
C 8

CHANGE NO. 8

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 8 November 1982

Aviation Unit and Aviation Intermediate
Maintenance Manual

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339

TM 55-2840-241-23,2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove Pages	Insert Pages
Chapter 4	4-13 thru 4-16	4-13 thru 4-16
Chapter 12	12-1 and 12-2	12-1 and 12-2
Chapter 13	13-1/13-2	13-1/ 13-2

2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

E.C.MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational Maintenance Requirements for OH-58 and OH-58C aircraft.

URGENT

URGENT

TM 55-2840-241-23
C 7

CHANGE NO. 7

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 2 August 1982

Aviation Unit and Aviation Intermediate
Maintenance Manual

ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove Pages	Insert Pages
Chapter 4	4-13 and 4-14	4-13 and 4-14 4-16A/(4-16B blank)

2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Major General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational Maintenance Requirements for OH-58 and OH-58C aircraft.

CHANGE
No. 6

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 13 May 1982

Aviation Unit and Aviation Intermediate Maintenance Manual
ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove pages	Insert pages
Chapter 1	1-1 and 1-2	1-1 and 1-2
	1-13 and 1-14	1-13 and 1-14
Chapter 2	2-5 and 2-6	2-5 and 2-6
Chapter 3	3-5 and 3-6	3-5 and 3-6
	3-11 and 3-12	3-11 and 3-12
Chapter 4	4-13 thru 4-16	4-13 thru 4-16
Chapter 5	5-11 and 5-12	5-11 and 5-12
	5-16A/B	5-16A/B
	5-21 and 5-22	5-21 and 5-22
	5-25 thru 5-28	5-25 thru 5-28
Chapter 7	7-1 and 7-2	7-1 and 7-2
Chapter 10	10-1 thru 10-4	10-1 thru 10-4
Chapter 13	13-1/13-2	13-1/13-2

2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

ROBERT M. JOYCE
Brigadier General, United States Army
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational Maintenance Requirements for OH-58 and OH-58C Aircraft.

CHANGE
No. 5

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D.C., 26 June 1981

Aviation Unit and Aviation Intermediate Maintenance Manual
ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191

TM 55-2840-241-23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove pages	Insert pages
Chapter 2	2-5 and 2-6	2-5 and 2-6
Chapter 4	4-5 thru 4-8	4-5 thru 4–8
	4-11 thru 4-15/4-16	4-11 thru 4-16
Chapter 5	5-3 and 5-4	5-3 thru 5-4A/B
	5-9 and 5-10	5-9 and 5-10
	5-15 and 5-16	5-15 thru 5-16A/B
		5-18A/B
Chapter 7	7-1 thru 7-4	7-1 thru 7-4
Appendix B	B-1 and B-2	B-1 and B-2

2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

J. C. PENNINGT'ON
Major General, United States Army
The Adjutant General

DISTRIBUTION:

To be distributed in accordance with DA Form 12-31, Organizational Maintenance Requirements for OH-58 and OH-58C Aircraft.

CHANGE No. 4

**HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C.,** *14 January 1981*

**Aviation Unit and Aviation Intermediate Maintenance Manual
ENGINE, AIRCRAFT, GAS TURBINE
MODEL T63-A-720 P/N 6887191
NSN 2840-01-013-1339**

TM 55-2840-241 -23, 2 November 1977, is changed as follows:

1. Remove and insert pages as indicated below.

	Remove pages	Insert pages
Chapter 3	3-1 and 3-2	3-1 and 3-2
	3-5 and 3-6	3-5 and 3-6
Chapter 4	4-1 and 4-2	4-1 and 4-2
	4-13 thru 4-15/4-16	4-13 thru 4-15/4-16
Chapter 5	5-3 and 5-4	5-3 and 5-4
	5-9 thru 5-12 A/5-12B	5-9 thru 5-12A/5-12B
Chapter 7	7-1 and 7-2	7-1 and 7-2
Chapter 10	10-1 thru 10-4	10-1 thru 10-4
	10-7 and 10-8	10-7 and 10-8

2. New or changed text material is indicated by a vertical bar in the margin. An illustration change is indicated by a miniature pointing hand.

3. Retain this sheet in front of manual for reference purposes.

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Major *General, United States Army*
The Adjutant General

DISTRIBUTION:
To be distributed in accordance with DA Form 12-31, Organizational Maintenance Requirements for OH-58 and 0H-58C aircraft.

EXPLANATION OF WARNINGS, CAUTIONS AND NOTES:

WARNING

An operating procedure, practice, etc., which if not correctly followed, could result in personal injury or loss of life.

CAUTION

An operating procedure, practice, etc., which if not strictly observed, could result in damage to or destruction of equipment.

NOTE

Any operating procedure, condition, etc., which it is essential to highlight.

WARNING

DANGEROUS CHEMICALS

are used in this equipment. Skin rash may result from contact with lubricating fluids. Provide adequate ventilation when using solvents, fuels, or lubricating oil in a closed area.

WARNING

HIGH VOLTAGE

may be present in the igniter lead. Ensure that the ignition system has been off for at least five minutes before disconnecting the lead. Ground the lead to the engine using an insulated screwdriver to dissipate any energy stored in the exciter.

WARNING

SEVERE BURNS

may result from contact with the engine hot section. Ensure that the engine has had sufficient time to cool before attempting to perform maintenance on the hot section.

WARNING

EXPLOSIVE VAPORS

Prior to removing engine from container, make sure both sections of container are grounded and the container is opened in a well ventilated area.

WARNING

PRESSURIZED CONTAINER

Make sure that all air pressure has been released before loosening nuts and bolts on shipping container. If nuts are removed before pressure is released, internal pressure could blow off cover.

WARNING

COMPRESSED AIR

is dangerous when directed toward another person. The airstream or material blown by the airstream can cause injury, particularly to the eyes or face. Use goggles. Do not exceed 30 psi. Do not direct airstream toward yourself or another person.

WARNING

EXPLOSION

may occur if the aircraft is not adequately grounded when purging the fuel system.

WARNING

STARTING ENGINE

of the helicopter will be performed only by authorized personnel in accordance with AR 95-1.

WARNING

LUBRICATING OILS

contain materials hazardous to health. They irritate skin and cause burns. They can cause paralysis if swallowed. Prolonged contact with skin can cause irritation. Fire can result if exposed to heat or flame. Use only in areas with adequate ventilation. Wash hands thoroughly after handling.

WARNING

NOISE LEVELS

reached during ground runup of Army aircraft may cause permanent hearing loss. Maintenance personnel shall wear adequate hearing protection when working on aircraft engines in operation.

WARNING

HOISTING

heavy objects can result in injury or death if the following practices are not observed. Ensure that hoisting equipment is rated for weight of object to be lifted. Have a helper guide the hoisted object. Use guide lines if the object is hoisted overhead. Do not get under the object while it is suspended on the hoist.

TECHNICAL MANUAL
NO. 55-2840-241-23

HEADQUARTERS
DEPARTMENT OF THE ARMY
WASHINGTON, D. C., 2 November 1977

Aviation Unit and Aviation Intermediate
Maintenance Manual

ENGINE AIRCRAFT, GAS TURBINE. T63-A-720
NSN 2840-01-013-1339
P/N 6887191

LIST OF ILLUSTRATIONS

LIST OF TABLES

CHAPTER 1

INTRODUCTION

Section 1. GENERAL

1-1. Scope.

a. This manual is issued expressly for Aviation Unit Maintenance (AVUM) and Aviation Intermediate Maintenance (AVIM) activities. Its purpose is to familiarize maintenance personnel having limited technical training and experience with the maintenance functions to be performed on the Army Model T63-A-720 (Allison Gas Turbine Model 250-C20C) turboshaft engine. The study and use of this manual will enable maintenance personnel to perform the assigned functions with maximum efficiency. This manual provides all essential information to accomplish the three levels of maintenance on the complete engine, its components, and systems as prescribed in the Maintenance Allocation Chart (MAC). (Refer to Appendix B.)

CAUTION

Use only chrome plated steel or unplated steel tools for the disassembly or reassembly procedures described in this manual. The use of cadmium or zinc plated tools is not permitted since these platings are prone to chipping and flaking. Should these chips enter the engine they may contaminate the lubrication system, ultimately clogging the filters or produce intergranular attack on nickel or titanium base alloys at elevated temperatures.

1-2. Maintenance Forms and Records.

Maintenance forms, records, and reports which are to be used by maintenance personnel at all maintenance levels are listed in and prescribed by DA Pamphlet 738-751, Functional Users Manual for the Army Maintenance Management System - Aviation (TAMMS-A).

1-3. Reporting of Errors.

Report of errors, omissions, and recommendations for improving this publication by the individual user is encouraged. Reports shall be submitted on DA Form 2028 (Recommended Changes to Publication and Blank Forms) and forwarded directly to Commander, U.S. Army Aviation and Troop Command, ATTN: AMSAT-I-MP, 4300 Goodfellow Blvd., St. Louis, MO 63120-1798.

1-4. Destruction of Army Material to Prevent Enemy Use.

Procedures for destruction of Army materials to prevent enemy use are prescribed by TM 750-244-1-5.

Section II. DESCRIPTION

1-5. General

a. The T63-A-720 Series engine consists of a multi-stage, axial-centrifugal compressor, a single combustion chamber, a two-stage gas producer turbine, a free-two-stage power turbine, and a power and accessory gearbox. (See figure 1-1.)

b. The major engine systems are fuel and control, lubrication, ignition, anti-icing air, temperature measurement, and compressor acceleration bleed air.

c. Engine description includes a discussion of each major component and each major system.

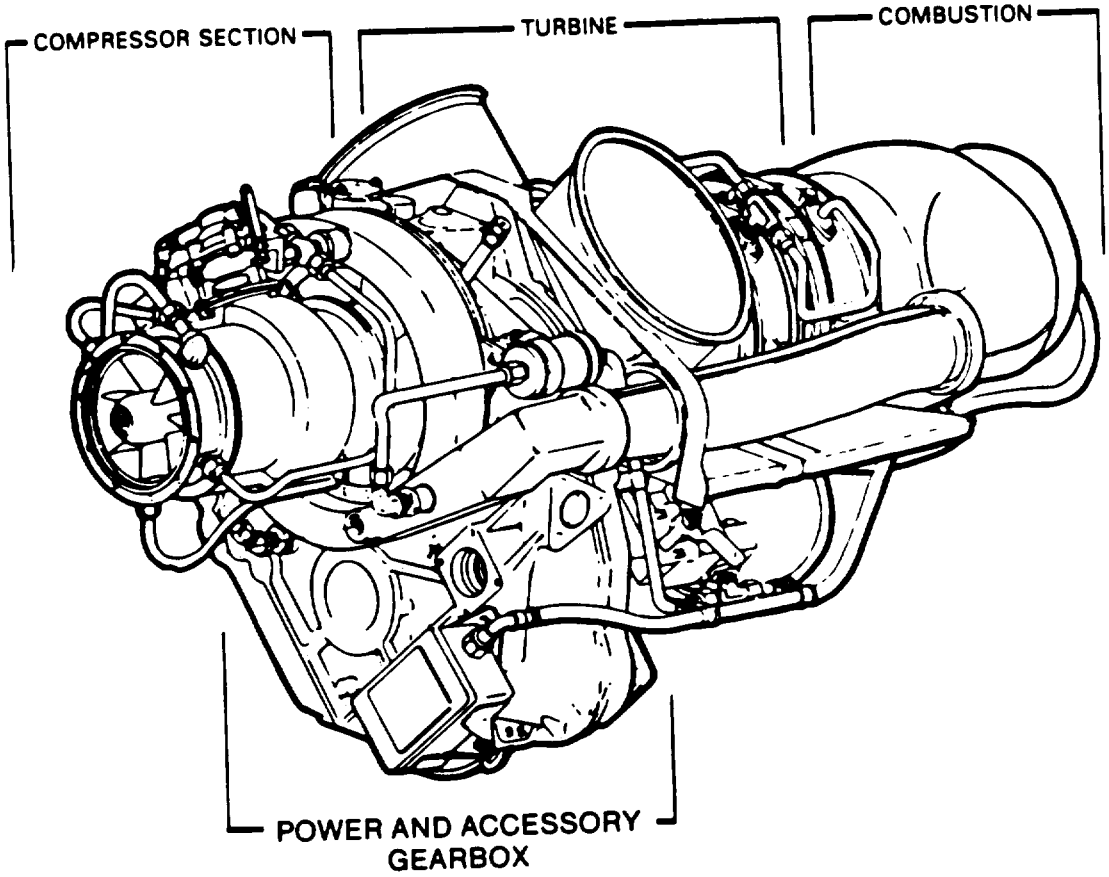
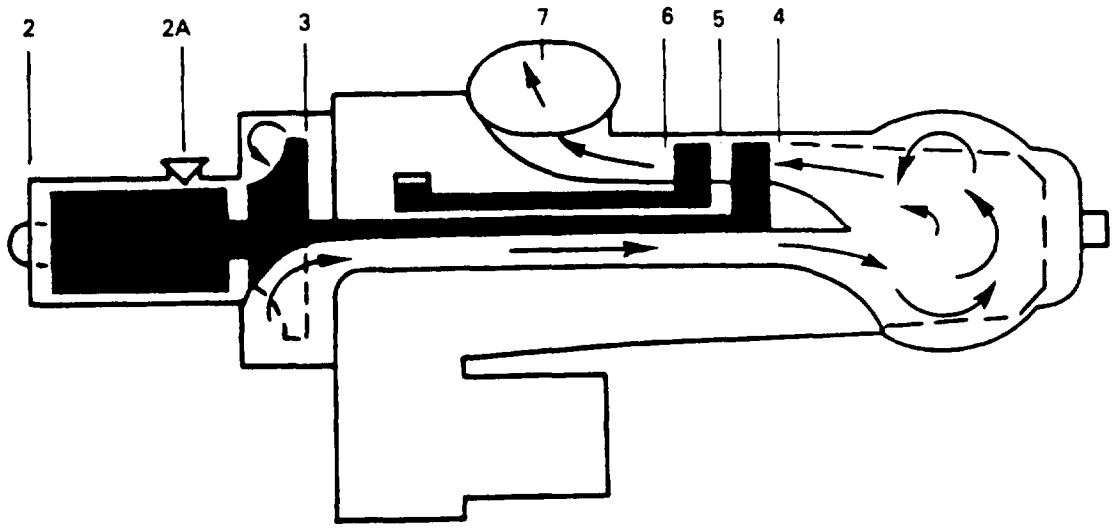


Figure 1-1. Left Side View of Engine (Typical)



2. ENGINE INLET
2A. FIFTH STAGE ACCELERATION BLEED PORT
3. COMPRESSOR DISCHARGE
4. GAS PRODUCER TURBINE INLET
5. GAS PRODUCER TURBINE OUTLET
6. POWER TURBINE DISCHARGE
7. ENGINE OUTLET

298995

Figure 1-2. Engine Airflow

1-6. Compressor.

a. The compressor assembly consists of a compressor front support, case assembly with stator vanes, rotor assembly with blades, centrifugal impeller, front diffuser assembly, rear diffuser assembly, and diffuser scroll. Air enters the compressor through the front support. (See figure 1-2.) Struts in the support guide the air and direct it in the proper direction into the first stage of the compressor rotor. The air is then compressed by six axial compressor stages and one centrifugal stage. As the air passes through the axial stages, it is alternately accelerated by the rotor blades and decelerated by the stator vanes. At the same time, it is compressed into an ever decreasing space. This results in an increase in both air pressure and temperature.

b. The sixth-stage compressor vanes direct the compressor air into the impeller. The impeller vanes centrifugally accelerate the air through an ever decreasing space to further increase the air pressure and temperature. It is then discharged across the diffuser vanes and directed into the diffuser scroll.

c. The diffuser scroll collect the compressor discharge flow at a constant velocity and directs it rearward through two ports (one on each side of the engine) to the combustion section. Each of the ports has turning vanes which direct the air rearward.

1-7. Combustion Section.

a. The combustion section consists of two compressor discharge air tubes (one on each side of the

engine), a combustion outer case and a combustion liner. A spark igniter and a fuel nozzle are installed in the rear of the outer combustion case.

b. Compressor discharge air is ducted from the diffuser scroll to the combustion outer case by the two compressor discharge air tubes. Air enters the single combustion liner at the rear through holes in the liner. The air is mixed with fuel sprayed from the fuel nozzle. The fuel-air mixture is then ignited in the combustion liner to provide combustion. Combustion gases move forward out of the combustion liner to the turbine.

1-8. Turbine.

a. The turbine consists of a gas producer turbine support, a power turbine support, a turbine and exhaust collector support, a two-stage gas producer turbine, and a two-stage power turbine. The turbine is mounted between the combustion section and the power and accessory gearbox. The two-stage gas producer turbine drives the compressor and accessory gear train. The two-stage power turbine furnishes the output power of the engine.

b. Combustion gases from the combustion section are expanded across the two stages of the gas producer turbine. Energy is extracted from the gas stream and converted to shaft torque to drive the compressor and gas producer gear train.

c. The combustion gases then move forward from the gas producer turbine and are expanded across the two stages of the power turbine. Additional energy is extracted from the gas stream and converted to shaft torque. This shaft torque is then transmitted through the power turbine gear train to the output shaft.

d. The expanded gas from the power turbine passes through the exhaust collector support and is exhausted upward through the twin ducts The small amount of energy remaining in the gas stream assists in scavenging the exhaust gases from the engine.

1-9. Power and Accessory Gearbox.

The main power and accessory drive gear trains are enclosed in a single gear case. The gear case serves as the structural support of the engine. All engine components, including the engine-mounted accessories, are attached to the case. At 100% engine speed, reduction gearing reduces power turbine speed from 33,290 to 6,016 rpm at the output drive pads. The power turbine gear train has a torquemeter to measure engine output torque. Accessories driven by the power turbine gear train are the power turbine tachometer-generator (N2) and the power turbine governor. The gas producer gear train drives the oil pump, fuel pump, gas producer fuel control, and tachometer-generator (N1). The gearbox has a spare accessory mounting pad which is driven by the gas producer gear train. During starting the starter-generator cranks the engine through the gas producer gear train. After completion of the starting cycle, the starter-generator functions as a generator.

1-10 Description of Engine Operation

a. The engine is a free turbine engine, that is, there is no mechanical connection betweem the gas producer turbine and the power turbine. The power turbine is gas coupled to the gas producer turbine by the combustion gases.

b. The helicopter uses a conventional control system. The collective pitch of the helicopter rotor establishes the power output demand on the engine. For all practical purposes, helicopter rotor speed is held constant by the engine and its control system.

c. The fuel control is connected to the twist grip on the pilot's and copilot's collective pitch sticks. The power turbine governor is interconnected to the collective pitch sticks through a coordinated system of bellcranks and linkages. Any change in collective pitch resets the governor to a new power demand. This demand is transmitted to the gas producer fuel control, which resets and varies the N1 speed of the gas producer turbine accordingly.

d. A motor-actuated speed trimming device is installed in the linkage between the collective pitch sticks and the power turbine governor lever. It is operated by a trim switch on pilots collective pitch stick, and allows engine output speed to be varied over a normal range of approximately 95 to 102% (5896 to 6196 rpm).

1-11. Fuel and Control System.

a. The gas producer fuel control is located schematically in the fuel system between the fuel pump assembly and the fuel nozzle. (See figure 1-3.) A power turbine governor, also a part of the control system, provides control intelligence to the gas producer fuel control.

b. The system controls engine power output by controlling gas producer speed. Gas producer speed levels are established by the action of the power turbine governor which senses power turbine speed. Power turbine speed is selected by the operator. The power required to maintain this speed is automatically maintained by power turbine governor action on the gas producer fuel control.

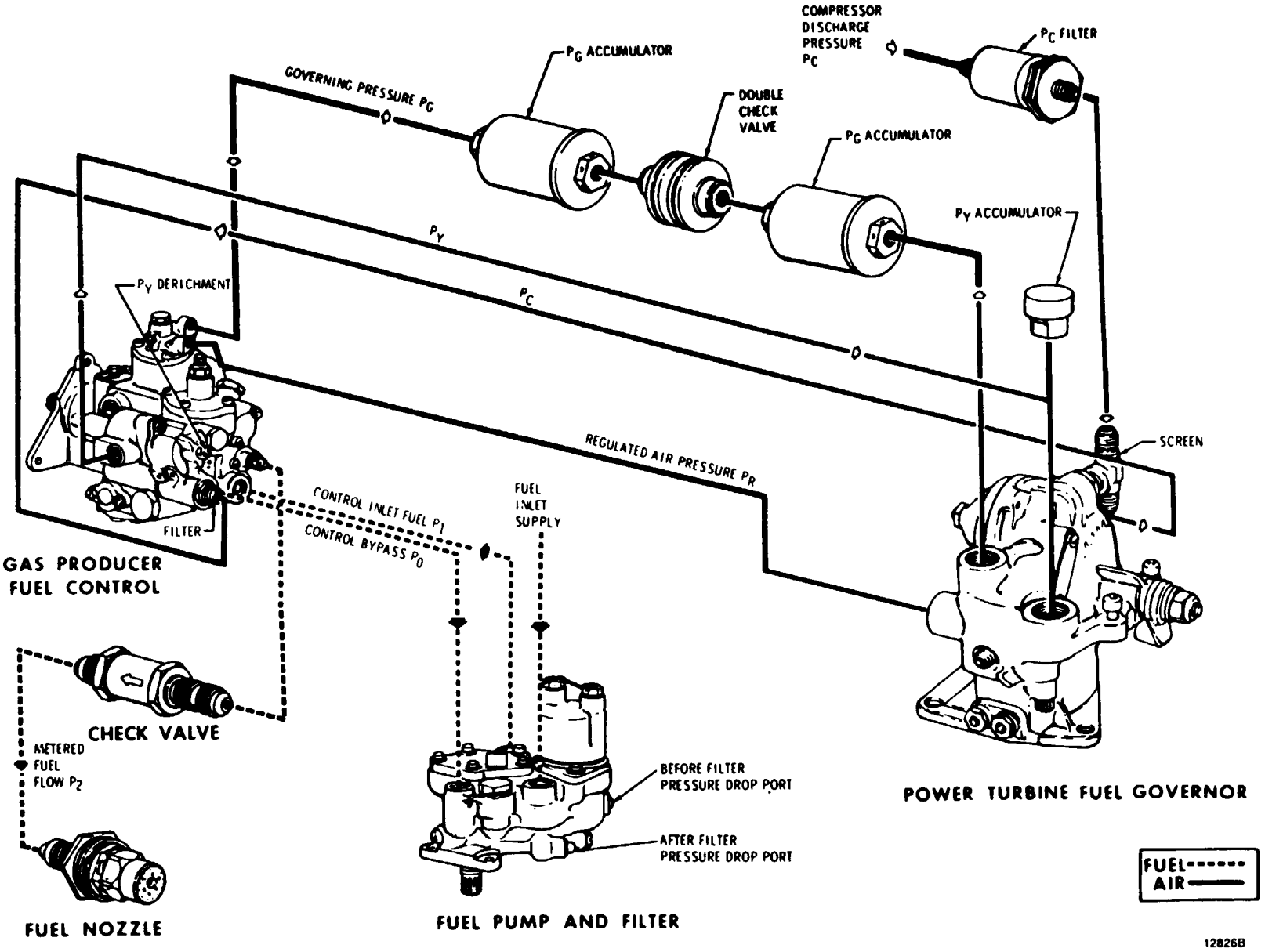


Figure 1-3. Fuel System Schematic

c. The power turbine governor lever schedules the governor requirements. The power turbine governor, in turn, schedules the gas producer speed to a changed power output to maintain output shaft speed.

d. Fuel flow for engine control depends on compressor discharge pressure (Pc), engine speed (gas producer—N1 and/or power turbine—N2), and lever angle. Fuel flow is a function of Pc as sensed in the fuel control. Variations of fuel flow schedules are obtained by modulating the Pc to Px and Py pressures in the control through the action of a bleed-down circuit actuated by the governors. (See figure 1-4.)

1-12. Gas Producer Fuel Control.

a. The gas producer fuel control has a bypass valve, metering valve, acceleration bellows, governing and enrichment bellows, manually operated cutoff valve, maximum pressure relief valve, torque tube seal and lever assembly, and a start derichment valve. The maximum pressure relief valve protects the system from excessive fuel pressure.

b. Fuel enters the control from the engine fuel pump and filter assembly and is delivered to the metering valve. The bypass valve maintains a constant pressure differential across the metering valve. Also, excess fuel is bypassed to the fuel pump and filter assembly through an external line connecting the pump bypass inlet to the bypass outlet port of the gas producer fuel control.

c. The metering valve is operated by lever action through movement of the governor and acceleration bellows, Metering valve area depends on valve travel, Before light -off and acceleration, the metering valve is set at a pre-determined open position by the accelerationbellows under the influence of ambient pressure (Pc at zero rpm).

d. The start derichment valve is open during light-off and acceleration to a set Pc. The open derichment valve vents Py pressure to atmosphere. Venting Py allows the governor bellows to move the metering valve against the minimum flow stop. At minimum flow the metering valve provides the required lean fuel schedule after light-off. As compressor rpm increases, the derichment valve is closed by Pc acting on the derichment bellows. When the derichment valve is closed, control of the metering valve is returned to the normal operating schedule.

e. During acceleration, the Px and Py pressures are equal to the modified compressor discharge pressure (Pc) up to the point where the speed enrichment orifice is opened by flyweight action. Opening the speed enrichment orifice bleeds Px pressure whil Py remains at a value equal to Pc. Under the influence of the Py minus Px pressure drop across the governor bellows, the metering valve moves toward the max imum flow stop where it increases fuel flow.

f. Gas producer speed is controlled by the gas producer fuel control governor. A set of flyweights operate the governor lever which controls the governor bellows (Py) bleed at the governing orifice. Flyweight operation of the governor lever is opposed by a variable spring load. The spring force is established by the throttle lever acting on a spring scheduling cam. Opening the governing orifice bleeds Py pressure and allows Px pressure to control the governor bellows. The Px influence on the bellows moves the metering valve toward minimum flow and at a position where metered flow is at steady state requirements.

g. The governor reset assembly in the gas producer fuel control limits or governs power turbine speed. Control of the reset assembly is derived from the power turbine governor. The power turbine governor also provides quick responding overspeed protect ion by bleeding governor servo (Py) pressure from the gas producer fuel control.

1-13. Power Turbine Governor.

a. Power turbine speed is scheduled by the power turbine governor lever and the power turbine speed scheduling cam. The cam sets a governor spring load which opposes a flyweight output. As the desired speed is approached, the flyweights operating against the governor spring move a link to open the power turbine governor orifice. The flyweights also open the overspeed bleed (Py) orifice but at a higher speed than the regular governor (Pg) orifice.

b. The governor orifice is downstream of a bleed supplied by a regulated air pressure (Pr). Opening the orifice results in a reduced pressure downstream of the bleed (Pg) as an inverse function of increasing speed. Regulated pressure (Pr) and governing pressure (Pg) are applied to opposite sides of a diaphragm in the governor reset section of the gas producer fuel control, The force generated by Pr minus Pg across the diaphragm acts on the gas producer power output link through the governor reset rod. This force supplements the weight force in the gas producer fuel governor to reset (reduce) the gas producer speed. Gas producer speed cannot exceed the gas producer fuel governor setting. The Pr minus Pg diaphragm is preloaded for establishing the active Pr minus Pg range. Pr pressure is supplied from engine Pc pressure by an air regulator valve.

c. The overspeed orifice bleeds Py pressure from the governing system of the gas producer fuel control. Bleeding Py pressure at the power turbine governor gives the fuel control system a rapid response to overspeed conditions.

1-14. Fuel Pump and Filter Assembly.

a. The fuel pump and filter assembly (figure 1-5) incorporates a single gear-type pumping element, a low pressure barrier filter, a filter bypass valve, and a bypass pressure regulating valve, Fuel enters the engine fuel system at the inlet port of the pump and passes through the low pressure filter before entering the gear element. The filter bypass valve allows fuel to bypass the filter element if it becomes clogged.

b. The bypass return flow from the fuel control u passed back to the inlet of the gear element through a pressure regulating valve which maintains the bypass flow pressure above inlet pressure, By means of passages leading to auxiliary filling ports on the periphery of the gear element, a portion of the bypass flow is used to fill the gear teeth when vapor-liquid conditions exist at the inlet to the gear element.

c. The 5 micron nominal 15 micron absolute, paper filter is located inside the fuel pump assembly upstream of the gear element. It is retained by a cast cover attached to the pump housing by two socket head cap screws. The cover is located on the aft side of the pump. To minimize fuel spillage during filter replacement, fuel may be drained through the lower of

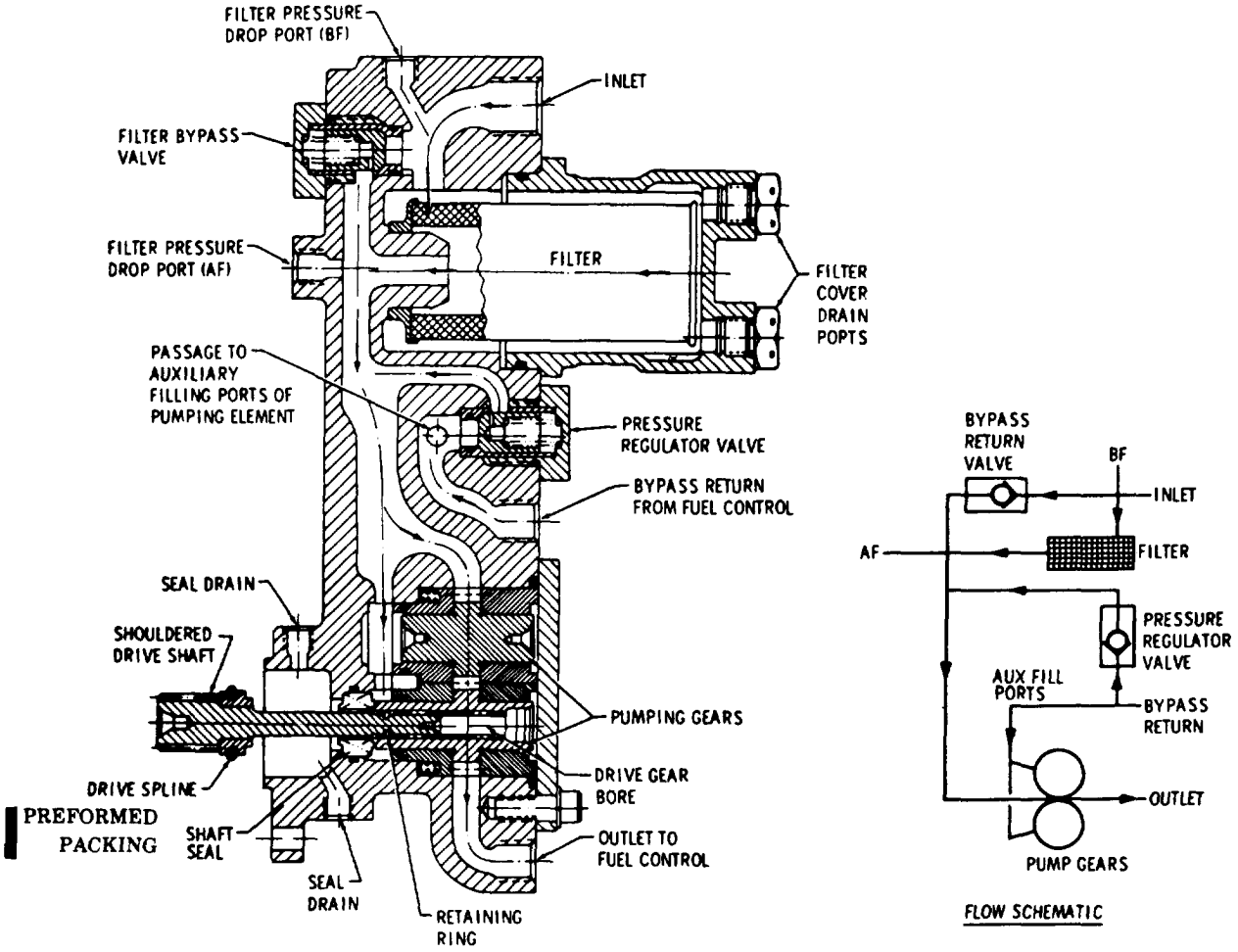


Figure 1-5. Fuel Pump and Filter Assembly

the two drain ports located on the aft face of the filter cover. Pressure taps are provided before and after (labeled BF and AF) the filter element to permit measurement of filter pressure drop if desired.

1-15. Double Check Valve.

The double check valve assembly is a mechanical device placed in the governing pressure (Pg) circuit between the power turbine governor and the main fuel control to dampen surges in the Pg pressure signal. (See figure 1-4.) It incorporates two individual, diaphragm operated valves within one unit. The valves are located in parallel with each other and open in opposite directions. Movement of air through the check valve assembly in either direction is permitted by one of the valves. However, when a stable signal is provided, a very small flow of air is experienced with the valve toward its closed position. Any pressure surges in the Pg signal will be dampened by spring loading on the valve.

1-16. Pc Air Filter.

The Pc air filter is a 10 micron filter located in the Pc air supply line leading from the diffuser scroll to the power turbine governor. It incorporates a permanent type, wire mesh, cleanable element. It prevents the governor and fuel control pneumatic components from being contaminated with foreign particles by filtering Pc air flow to the governor and control.

1-17. Fuel Check Valve.

The fuel check valve is located in the fuel line between the fuel control and the fuel nozzle. It has a cracking pressure of 22-28 psi and serves to prevent leakage of fuel through the fuel nozzle into the combustion chamber if the fuel cutoff valve is inadvertently opened or leaks while the engine is not operating.

1-18. Fuel Nozzle.

The fuel nozzle is a single-entry, dual-orifice type unit. It contains an integral valve for dividing primary and secondary flow. This fuel nozzle relies on the fuel check valve to provide fuel cutoff when the fuel manifold pressure falls below a pre-determined pressure, to keep fuel out of the combustion chamber at shutdown.

1-19. Lubrication System.

The lubrication system is a dry sump type with an external reservoir and heat exchanger. A gear type pressure and scavenge pump assembly is mounted within the power and accessory gearbox. (See figures 1-6 and 1-7.) The oil filter, filter bypass valve, and pressure regulating valve are in a unit which is located in the upper right-hand side of the power and accessory gearbox housing and are accessible from the top of the engine. A check valve is located between the housing and the filter unit. Indicating type magnetic chip detectors are installed at the bottom of the power and accessory gearbox, and at the engine oil outlet connection. All engine oil system lines and connections are internal with the exception of pressure and scavenge lines to the compressor front support, the gas producer turbine support, and the power turbine support.

1-20. Ignition System.

The engine ignition system consists of a low tension capacitor discharge ignition exciter, a spark igniter lead, and a shunted-surface gap spark igniter. The system receives its input power from a 14 to 29-volt, d-c power source.

1-21. Temperature Measurement System.

The temperature measurement system has four chromel-alumel single junction thermocouples in the gas producer turbine outlet (TOT) and a associated integral harness. The voltages of the four thermocouples are electrically averaged in the assembly and delivered by the assembly lead to an engine terminal block for attachment to the airframe temperature indicating system.

1-22. Anti-king System.

a. Anti-icing is provided for the compressor inlet guide vanes and front support hub by the use of compressor discharge air. The air is taken from a port at the twelve o'clock position on the front face of the diffuser scroll. An anti-icing air shutoff valve is installed in the port and is manually operated from the flight deck to control anti-icing airflow. Anti-icing air tubes direct the flow of air from the valve to fittings on each side of the compressor front support. The air is then routed through an annulus around the OD of the front support and through the inlet guide vanes and is discharged into the inlet air stream.

b. The approximate effects of anti-icing air flow on performance available to pilot at power levels above 40,000 N_1 (gas producer) speed are immediate and definite.

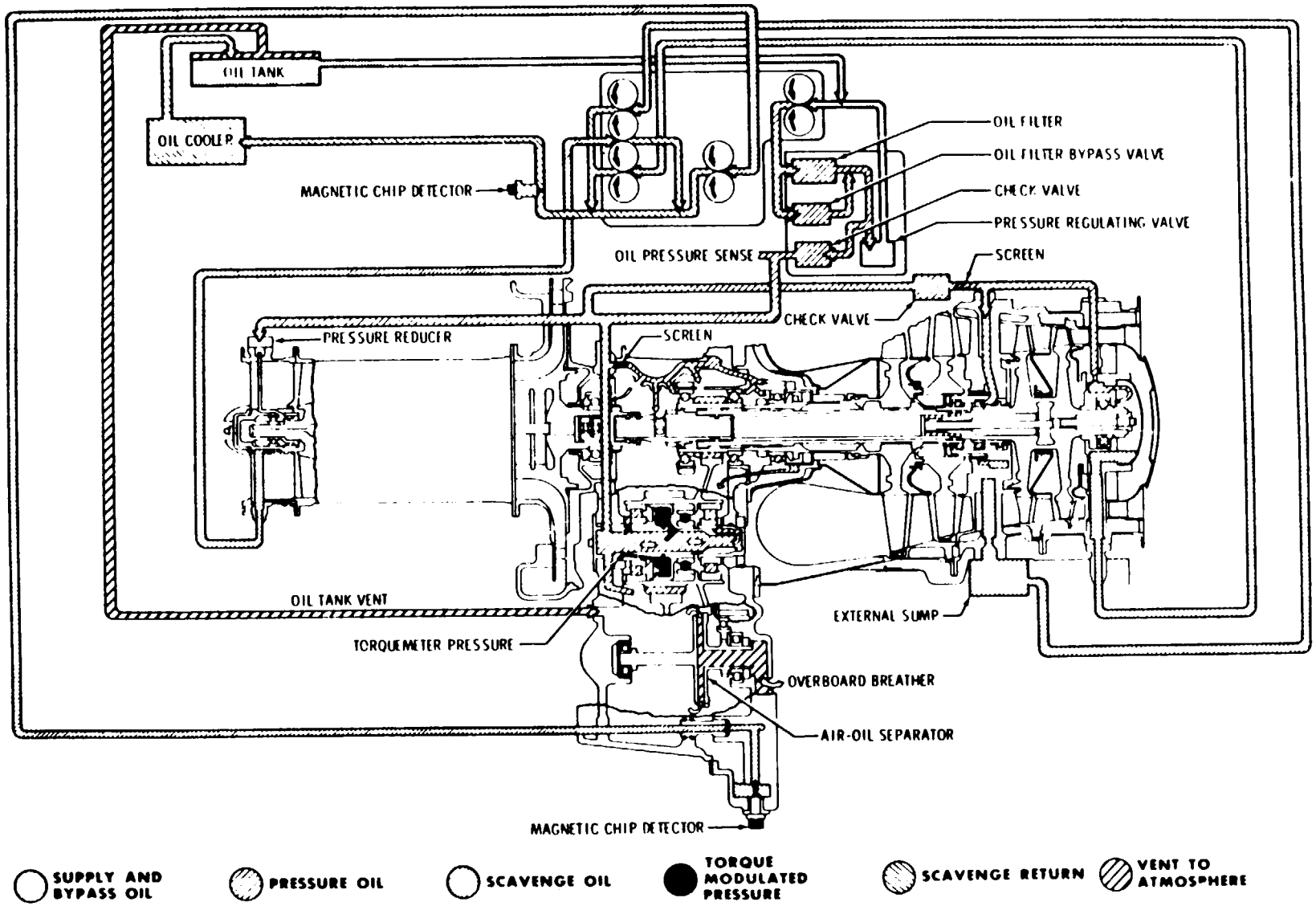


Figure 1-6. Engine Lubrication System Schematic

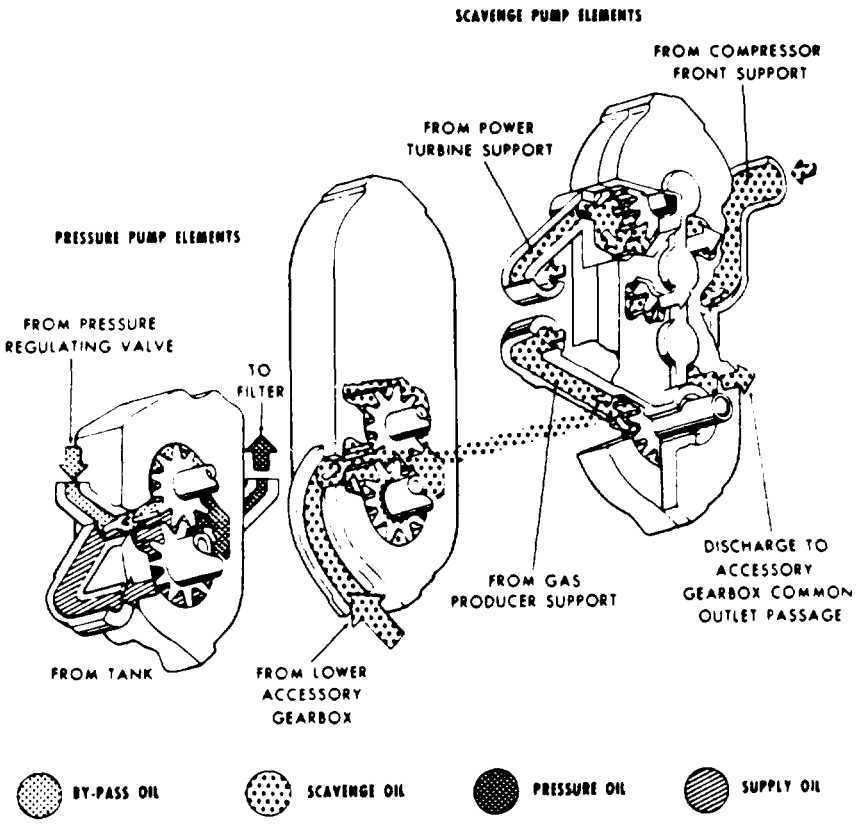


Figure 1-7. Oil Pump Schematic

1-23. Acceleration Bleed Air System.

a. The compressor bleed air system permits rapid engine response. The system has a compressor discharge pressure sending port on the scroll, tubing from the sensing port to the bleed valve, a compressor bleed valve (figure 1-8) and a bleed air manifold on the compressor case.

b. A slot in the compressor wall over the fifth stage blades compressor air into a manifold, which is an integral part of the compressor case. The manifold fore-s the mounting flange for the compressor bleed control valve when the compressor case halves are assembled.

c. Compressor discharge air pressure sensing for bleed control valve operation, is obtained at a sensing port on the compressor scroll. The bleed control valve is normally open; it is closed by compressor discharge pressure. See figure 1-9 for bleed control valve opening and closing speeds.

1-24. Air Bleed Extraction.

Two ports are provided on the diffuser scroll to supply compressor bleed air for aircraft systems. Bleed airflow is limited to four percent of total engine airflow.

1-25. Leading Particulars.

Engine leading particulars are listed in table 1-1. Performance ratings are listed in table 1-2.

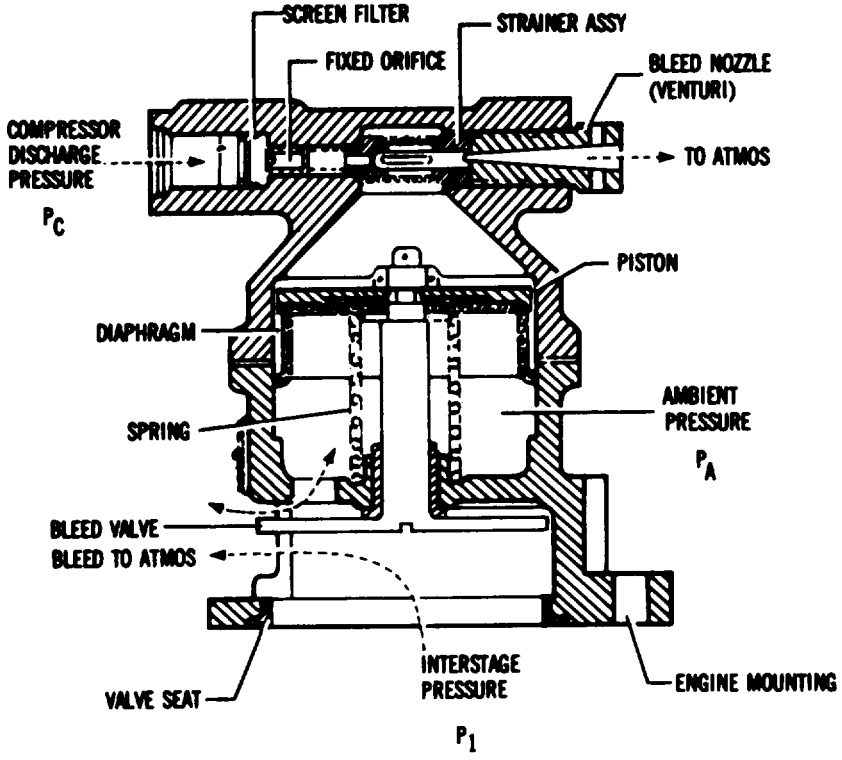


Figure 1-8. Compressor Bleed Control Valve

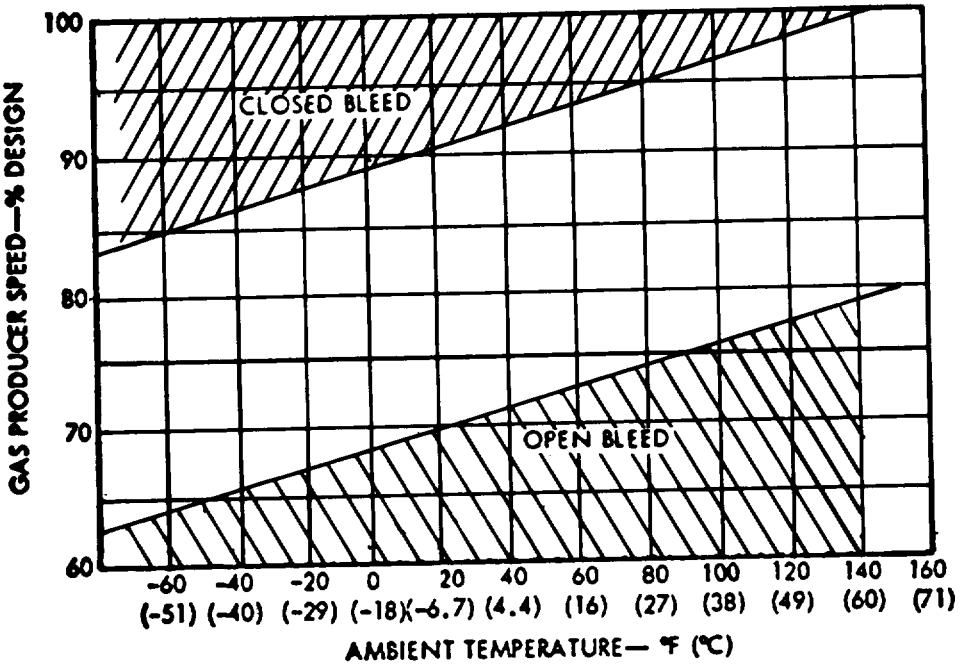


Figure 1-9. Compressor Bleed Control Valve Operation

Table 1-1. Leading Particulars

Dimensions:	
Length	40.7 inches
Height	23.2 inches
Width	.19.0 inches
Engine weight (dry)	158 pounds
Maximum oil consumption	0.05 gal/hr
Lubricating oil specifications	MIL-L-23699 or MIL-L-7808
Fuel specifications:	
Primary	MIL-T-5624 (JP-4)
Alternate	MIL-T-5624 (JP-5)
Emergency	MIL-G-5572
Design power output	420 shp
Ram power rating	.440 shp
Design speeds:	
Gas producer (Nl)	100% (50,970 rpm)
Power turbine (N2)	100% (33,290 rpm)
Power output shaft	100% (6,016 rpm)

Table 1-2. Performance Ratings (Standard Sea Level Static Conditions)

Ratings	Shaft HP	Gas Generator rpm (est)	output Shaft Speed rpm	Fuel Flow lb/hr (max)	Ram Power Rating Torque at Output Shaft ft-lb (max)	Measured Rated Gas Temp. °C (max)
Intermediate	420	53000	6016	273	384	810
Max Cont.	370	51200	6016	241	323	738
75% Max Cont.	278	48800	6016	197	323	——
50% Max Cont.	185	45880	6016	153	323	——
Ground Idle	35 (max)	33000	4500-6300	70 lbs/hr	——	**425 ±60**
Flight Idle	0	33000	5900-6480	70 lbs/hr	——	**415±60**

Intermediate power is the maximum power authorized and is limited to 30 minutes use.

Max Continuous is the highest power authorized for continuous operation.

CHAPTER 2

SPECIAL TOOLS, TEST EQUIPMENT, AND CONSUMABLE MATERIALS

Section I. SPECIAL TOOLS AND TEST EQUIPMENT

2-1. General.

A listing and illustration of special tools and test equipment is presented in this section. This listing provides a convenient reference for special tools and test equipment available to perform maintenance functions on the engine. It is primarily intended as a ready reference for maintenance personnel in determining what equipment is available. All tools and equipment are arranged alphabetically.

Table 2-1. Special Tools and Test Equipment

Figure	Nomenclature	Part Number
2-1	Adapter, Engine Turning	6799790 NSN 4920-00-923-3188
2-2	Bracket, Mounting, Compressor Vibration Pickup	6872539
2-3	Clamp, Loop	6799952 NSN 5340-00-945-0244
2-3	Clamp, Loop	6799953 NSN 5340-00-945-0242
2-4	Kit, Protector, Compressor Cleaning	6886204 NSN 4920-01-030-1011
None	Kit, Vibration Signal Source	171170-0104 (FSC 14028) NSN 4920-00-879-0331
2-5	Lift, Engine Assy	6796963 NSN 5120-00-924-7722
None	PC Gauge, Text Kit	15600H58-397 NSN 4920-01-334-4360
2-6	Puller Kit, Mechanical	6796941 NSN 5120-00-945-0186
2-7	Stand, Test, Engine, Modular	LTCT 10465-02 NSN 4920-00-167-9178
2-8	Stand, Turnover, Engine Assembly	6795579 NSN 4920-00-924-5726
None	Stop Watch	NSN 6645-00-250-4680
None	Wrench, Bristol	S1116 NSN 5120-00-224-2482
2-9	Wrench, Ground Idle	6798292 NSN 5120-00-763-7565

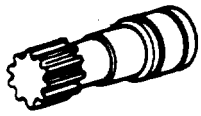


Figure 2-1. Engine Turning Adapter 6799790

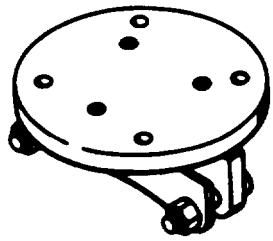


Figure 2-2. Compressor Vibration Pickup Mounting Bracket 6872539

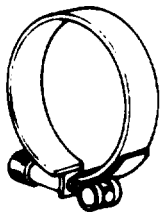


Figure 2-3. Loop Clamps 6799952 and 6799953

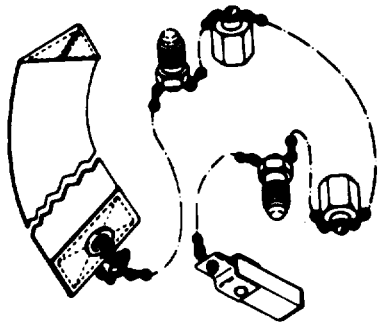


Figure 2-4. Compressor Protector Kit 6886204

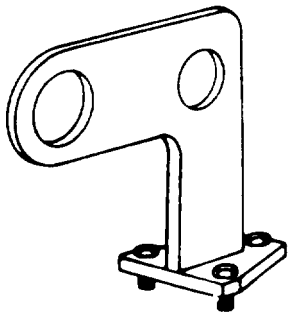


Figure 2-5. Engine Assembly Lift 6796963

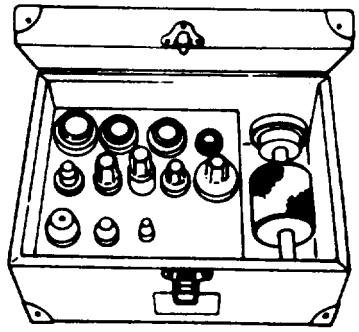


Figure 2-6. Mechanical Puller Kit 6796941

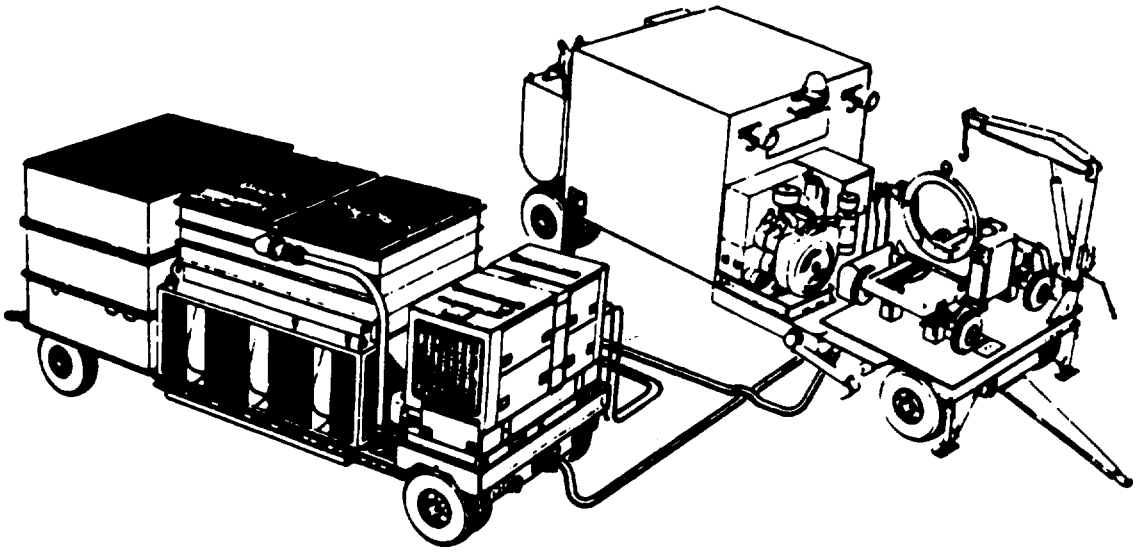


Figure 2-7. Modular Engine Test Stand LTCT10465-02

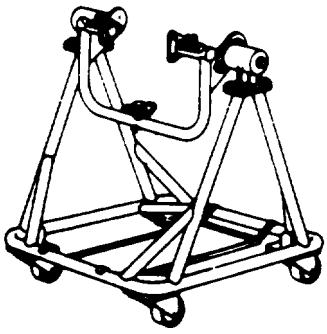


Figure 2-8. Engine Assembly Turnover Stand 6795579

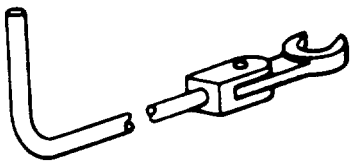


Figure 2-9. Ground Idle Wrench 6798292

Section II. CONSUMABLE MATERIALS

2-2. General

Table 2-2 presents a listing of the consumable materials required to maintain the engine. Consumable materials are supply items which are consumed in use or materials which lose their identity in an assembly.

Table 2-2. CONSUMABLE MATERIALS

ITEM NUMBER	LEVEL	NSN	DESCRIPTION	U/M
1	0	8520-00-228-0598	Liquid Soap Solution P-S-624, Type 1 (1Gal Can)	EA
2	0	8030-00-244-1298	Corrosion Preventive Compound MIL-C-16173 Grade 2(5 Gal can)	EA
3	0	6850-00-264-9038	D cleaning solvent P-D-680, Type 1	EA
3A	0	6850-00-274-5421	D cleaning solvent P-D-680, Type II	EA
4	0	8135-00-282-0565	Barrier Material (Water-vapor proof), MlL-B-l31, Class I (3X 600 ft)	EA
5	0	7510-00-074-5124	Tape, pressure sensitive adhesive PPP-T-60, Type IV (2 in. X 60 yds)	EA
6	0	7510-00-227-1444	Ink, stencil marking white. TT-1-1795 (1 qt can)	EA
7	0	9150-00-782-2627	Oil, Lubricating MIL-L-7808 (1 qt can)	EA
8	0	9150-00-985-7099	Oil, Lubricating MIL-L-23699 (1 qt can)	EA
9	0	6810-00-281-2762	Methlethylketone TT-M -261 (5 Gal Can)	EA
10	0	9505-00-596-5101	Lockwire 0.020-in. Dia. MS20995C20	EA

Table 2-2. CONSUMABLE MATERIALS (CONT.)

ITEM NUMBER	LEVEL	NSN	DESCRIPTION	U/M
11	0	6850-00-181-7139	Dehydrating Agent MIL-D-3464 (16 Unit bag)	EA
12	0	6850-00-209-7230	Corrosion Preventive Compound MIL-C-6529 Type 5 (Gal can)	EA
13	Deleted			
14	0	9150-00-944-8953	Grease Aircraft MIL-G-81322 (1 pound can)	EA
15	0	8030-00-209-8005	Compound. Antiseize IT-S-1732 (1 pound can)	EA
15.1	0	8030-00-778-4277	Compound Antiseize Ease-off 990	EA
16	0	6850-00-550-5565	Solvent. Turco 4181 MIL-C-16440	EA
17	0	6850-00-803-6420	Compound, Carbon Removal MIL-C-25107 (5 Gal pail)	EA
18	0	6850-00-597-1528	Compound, Cleaning Cresol Base (Turco formula 3097) or equivalent	EA
19	0	6850-00-209-7230	Rust Preventive MIL-C-6529 Type 3	EA
20	0	9150-00-223-8892	Oil MIL-L-15016	EA
21	0	6850-00-181-7594	Cleaner, Water Soluable (B and B 3100) (5 Gal pad)	EA
22	0	5350-00-246-0330	Abrasive Paper Grade 320	EA
23	0	5350-00-186-8856	Emery Cloth No. 400 Grit	EA
24	0	8010-00-831-5935	Paint Thinner (Saron Chem. Co.) Actithane H251	EA
25	0	8010-00-831-5934	Corrosion Resistant Paint Gray (Saran Chem. Co) Actithane WC100	EA
26	0	8030-00-105-0270	Antiseize Compound Never-Seez NSN165 (1 pound can)	EA
27	0	8030-00-209-8005	Antiseize Compound TT-S-1732	EA
28	0	6810-00-184-4796	Acetone	EA
29	0	3439-00-166-9584	Rod. Welding AMS5786	EA

Table 2-2 CONSUMABLE MATERIALS (CONT.)

ITEM NUMBER	LEVEL	NSN	DESCRIPTION	U/M
30	0	5350-00-224-7201	Abrasive Paper P-P-101	EA
31	0	9150-00-754-0064	Molykote (Lubri-Bond A)	EA
32	0	9505-00-293-4208	Lockwire 0.032 in. DIA MS20995C32	EA
33	0	9130-00-256-8613	Fuel MIL-T-5624 Grade JP-4	EA
34	0	6810-00-275-6010	Methanol (Grade A or B)	EA
35	0	6850-00-066-2333	Rustlick No. 606 (5 Gal can)	EA
36	0	8030-00-838-7789	WD 40 or equivalent (MIL-C-23411)	16 oz. spray can
37	0	9150-00-273-2388	Lubricating oil (for assembly and preservation only) MIL-L-6081. Grade 1010	EA
38	0	4710-00-087-1629	Tubing. Nonmetallic	EA
39	0	6850-00-372-8303	Cleaning Compound MIL-C-85704, Type II	5 Gal
40	0	6850-00-372-8304	Cleaning Compound MIL-C-85704, Type II	55 Gal
41	0	6850-00-370-5245	Cleaning Compound MIL-C-85704, Type IIA	5 Gal
42	0	6850-00-370-5244	Cleaning Compound MIL-C-85704, Type IIA	55 Gal

CHAPTER 3

PREPARATION FOR SERVICE, STORAGE, AND ENGINE HANDLING

Section I. PREPARATION FOR SERVICE AND STORAGE

3-1. General.

NOTE

The periodic preservation, storage, and activation of engines are prescribed in TM 55-1520-228-23.

This section provides procedures for the preservation, depreservation and storage of a complete en me assembly. It also contains procedures or the preservation and depreservation of the compressor, fuel pump, gas producer fuel control, and power turbine governor. Weight and dimension data for the shipping containers are shown in paragraph 3-14.

NOTE

All engine operation procedures will be accomplishshed in accordance with TM 5-1520-228-10.

3-2. Preservation Maintenance.

Preservation maintenance is not represervation, but is the regular inspection an replacement of the dehydrating agent. Allow engine awaiting installation to remain in the dehumidified shipping container as long as possible.

3-3. Inspection of Pressurized Containers.

Immediately upon receipt of an engine at an activity and every 90 days (or more frequently) thereafter check the relative humidity indicator and the internal pressure of the contamer in accordance with table 3-1.

NOTE

An all blue color in the humidity indicator indicates a safe condition. As moisture content inside the container increases, the indicator color willl change from blue to pink. An all ink condition is considered unsafe and indicates that the desiccant must be changed and the container repressurized.

a. If the humidity indicator indicates that the relative humidity is less than 40 percent and the internal pressure is more than 1 psig, no maintenance is necessary until the next regular inspection.

b. If the humidity indicator indicates that the relative humidity is less than 40 percent but the internal pressure is less than psig, the container shall be checked for leadage, using a soap solution (item 1, table 2-2) aat all closures. (Refer to TB 5-8100-200-24.) When leakage has been corrected, the container shall be repressurized to the value stated in table 3-1. Use clean dry compressed air. Record date of represurization and name of activity m appropriate section of engine historical record.

c. If the humidity indicator indicates the relative humidity to be 40 percent or more, an unsafe or corrosive condition exists. Comet as follows:

(1) Depressurize shipping container by opening air filling valve a front of container.

CAUTION

Do not disturb relief valve. Present pressure valve could be affected.

(2) Allow air pressure to return to zero.

(3) Remove capscrews and nuts that secure container halves together.

(4) Remove cover from container and inspect engine to determine its serviceability. Any presence of corrosion on the inlet or compressor housings, or on other visible exterior surfaces, or on the compressor or turbine blades or-vanes is cause to render the engine as unserviceable.

(5) If engine is found to be serviceable, remove it from container and place it in service or represerve it per paragraph 3-11.

(6) If unserviceable inspect and repair to a like-new corrosion free condition per apaplicable paragraphs within this manual as authorized by Maintenance Allocation Chart. If not repairable, ship engine to overhaul.

3-4. Removal of Engine From Shipping

WARNING

Prior to removing engine from container, make sure both sections of container are grounded and the container is opened in a well ventilated area. Electrical spark could occur.

NOTE

Before removing the engine from the shipping container, inspect for evidence of rough handling or tampering.

To remove the engine from the shipping and storage container, proceed as follows:

a. Loosen nut (17, figure 3-1) and open cover (19). Remove the engine records from the records receptacle.

b. Loosen two nuts (26) and open cover (31). Loosen air valve (32) and allow the container to depressurize.

WARNING

Make certain that all air pressure has been released before loosening nuts and bolts 1 and 37). If nuts are removed before pressure is released internal pressure could blow off cover.

c. Remove nuts (1) and bolts (37) from the container splitline and remove cover (2).

CAUTION

Ensure upper half of shipping container does not strike engine when removing cover. Damage to engine could occur.

d. Install engine assembly lift, tool No, 6796963 on the gearbox top mounting ad and attach a hoist. Raise the engine only enough to take the strain off the mounts.

e. Remove four nuts (7), washers (6), and bolts (4) from the engine side mounts. Remove two cotter pins (8 , pins (9), and adapters (5) from the engine side mounts.

f. Remove cotter pin (14) and pull out on pin assembly (13) until it disengages from the engine bottom mount.

g. Lift the engine assembly out of the shipping container. Remove the three engine mounting brackets (12) from the engine; these brackets are to remain with the shipping container. Install the three engine mounting brackets supplied with the en me turnover stand tool No. 6795579, on the engine. Install the engine m the turnover stand.

CAUTION

Do not use the shipping container mounting brackets in lieu of the turnover stand mounting brackets. Brackets are not interchangeable, damage to turnover stand could occur.

h. Place all loose shipping container hardware in the cloth bag supplied with the container. and place the bag m the bottom of the container.

i. Remove desiccant from desiccant basket.

j. Install gasket (3) on container base assembly (24).

k. Lower cover assembly (2) into place. Engage the forward end of the cover with the guide in in the closure flange of base assembly (24); then lower the aft end. Ensure that gasket (3) is properly seated.

1. Install thirty-two bolts 37) and nuts (1) in the closure flange. Bolts (3 shall be inserted from thhe bottom side of the closure flange. Tighten nuts (1) finger tight. Apply preservative to bolt threads (item 2, table 2-2).

3-5. Engine Depreservation.

a. Remove engine shipping caps, plugs, and covers from the engine as required (see figure 3-2.)

b. Remove the lockwire from the fuel control and governor stops and anti-lcmg air valve

c. Remove all barrier material and tape. Remove tape residue with solvent (item 3, table 2-2).

d. Remove any corrosion from the exterior surfaces of the engine and touch up paint as required. (Refer to paragraphs 7-25b and 7-29).

NOTE

Flushing of the engine fuel system is not required.

3-6. Inspection of Engine Dropped During Handling.

If the engine is dropped during handling, perform the following inspection and tests:

a. Inspect accessory drive gearbox for cracked flanges.

b. Inspect governor and tachometer drive for cracks, distortion, and bent shafts.

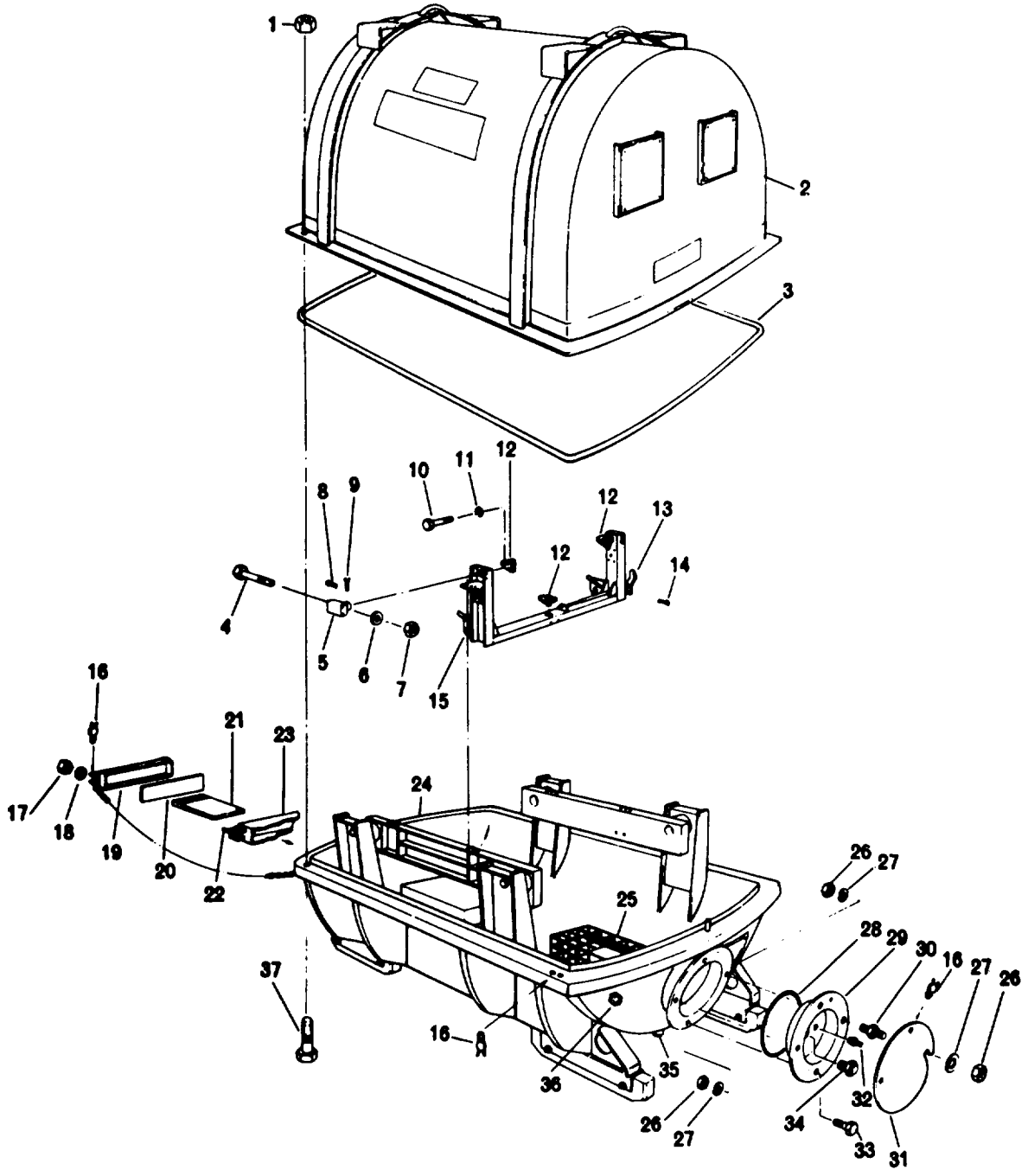
c. Inspect oil falter for damage.

d. Inspect fuel control assembly for cracked flanges.

e. Inspect engine mounting pads for cracks.

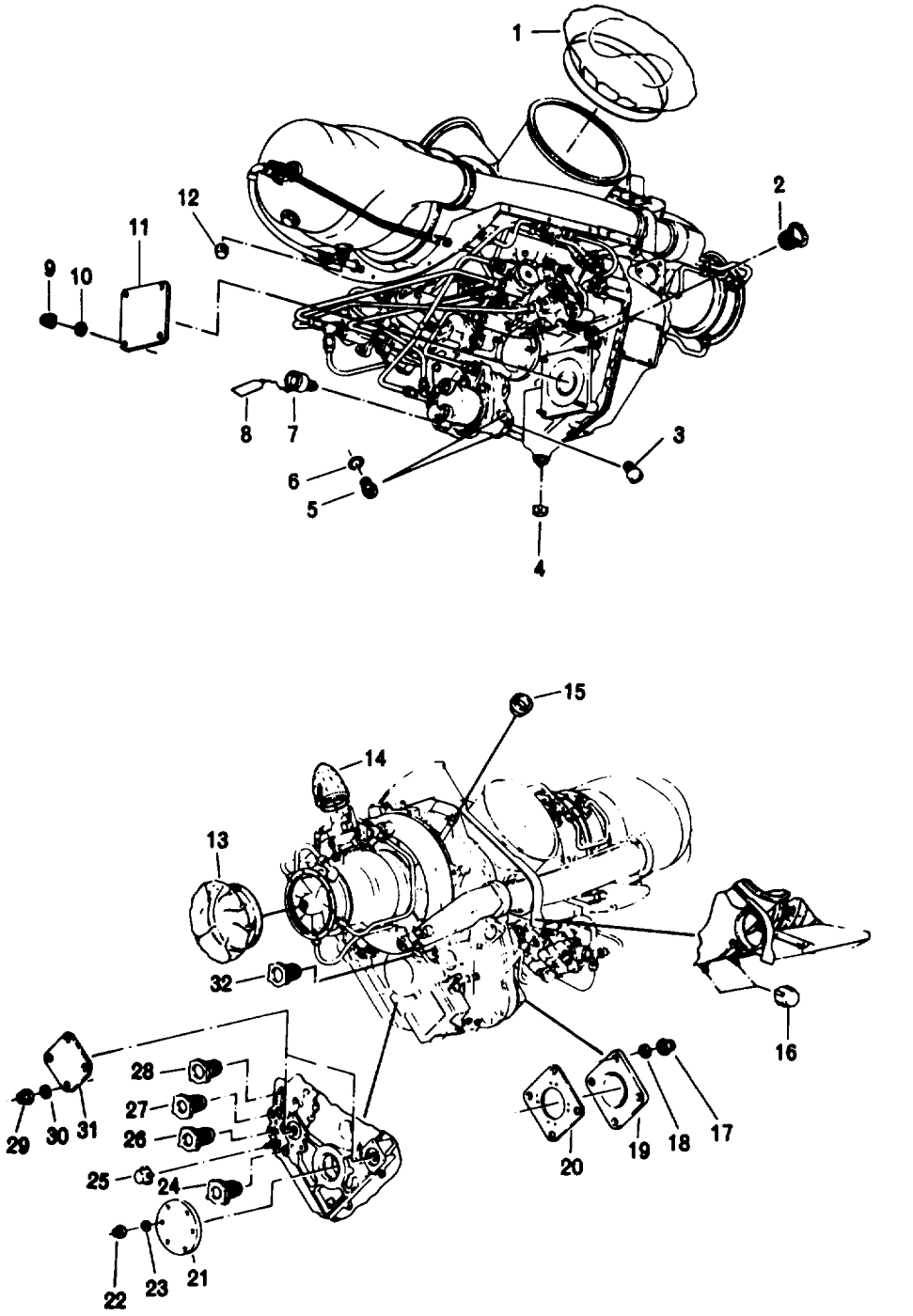
f. Check air, oil, and fuel hose connections for security.

g. Check all accessories for loose bolts, nuts, and connections.



1. Nut
2. Cover assy
3. Gasket
4. Bolt
5. Adapter
6. Washer
7. Nut
8. Cotter pin
9. Pin
10. Bolt
11. Washer
12. Bracket
13. Pin assy
14. Cotter pin
15. Yoke
16. Lead seal
17. Nut
18. Washer
19. Cover
20. Gasket
21. Envelope
22. Stud assy
23. Records receptacle
24. Base assy
25. Basket
26. Nut
27. Washer
28. Preformed packing
29. Service receptacle
30. Bolt
31. Cover
32. Air valve
33. Bolt
34. Relief valve
35. Drain plug
36. Humidity indicator
37. Bolt

Figure 3-1. Engine Shipping Container



1. Exhaust Cover (2)
2. Plug
3. Plug
4. Cap
5. Plug (2)
6. Preformed packing(2)
7. Plug
8. Tag
9. Nut (4)
10. Washer (4)
11. Generator Pad Cover
12. Cap
13. Inlet Cover
14. Bleed Valve Cover
15. Plug
16. Cap (2)
17. Nut (4)
18. Washer (4)
19. Accessory Pad Cover
20. Gasket
21. Output Pad Cover
22. Nut (6)
23. Washer (6)
24. Plug
25. Cap
26. Plug
27. Plug
28. Plug
29. Nut (4)
30. Washer (4)
31. Tach Pad Cover (2)
32. Plug

Figure 3-2. Engine Shipping Parts

h. If no visual damage is apparent, engine ma be operationally checked either in airframe or in mobile engine test unit. (Refer to Chapter 10.) Minimum test time is 30 minutes and shall include vibration check, coastdown noise check, and post-test mspection of oil falter and chip detectors for metal, lint, or other foreign material. Vibration levels must be within established limits. If no defects are noted, engine is considered serviceable.

i. If engine is unserviceable, it will be preserved in accordance with paragragh 3-8, paced in a metal reusable shipping and storage container (paragraph 3-11), and returned to an overhaul facility. Complete and attach necessary tags to engine; prepare necessary forms and records and place m records receptacle m accordance with paragraph 3-9.

3-7. Accident Engine Preservation.

NOTE

Do not treat an engine for. corrosion that has been involved m an accident where engine failure or malfunction is known or suspected to have been a factor. This engine must be held for shipment to an overhaul depot or designated in-investigation area and should not be treated for corrosion prevention.

a. Without disconnecting lines or fittings, make eve effort to prevent the remaining fuel and oil in the engine from leaking out.

b. Seal all openings with covers. (See figure 3-2.) If covers are not available, seal with barrier material (item 4, table 2-2) and secure with tape (item, table 2-2).

c. Plug all ports and cap all fittings. (See figure 3-2.)

d. Install engine in bottom half of metal reusable shipping and storage container in accordance with paragraph 3-11b. Ground engine to container to prevent a possible explosion of dangerous vapors which may be ignited by static electricity or a spark. Secure all loose metal components to the container with tape (item 5, table 2-2 to prevent possible spark during shipment.

3-8. Damaged, Cannilizd, or Failed Engine Preservation.

Inoperable engines that are idle because they require parts or maintenance shall be preserved in accordance with paragraph 3-7b, c and d and stored m a shipping container or in a clean, dry, area where the engine will be adequately protected from dirt, corrosion, and physic damage.

3-9. Forms, Records, Tags and Stenciling.

a. The forms, records, and reports that are to be used by maintenance personnel when preparing an engine or engine component for storage or shipment are listed in and prescribed by DA Pamphlet 738-751.

b. Authorized tags and the published, procedure for their completion is prescribed in TB 750-126. Additional pressurization tags may be applied to assist the maintenance officer in depreservation.

c. Stenciling, labeling and marking of contamers for storage and shipment ares shown in figures 3-3 and 3-5. Obliterate old markings that do not apply. Letters and numerals of stencils shall be in block letters 1/2 inch high., Use white stencil ink (item 6, table 2-2). For additional information on marking and stenciling refer to MIL-STD-l29.

3-10. Engine Preservation.

A serviceable engine that is being removed from an aircraft for the purpose of storage or return to the overhaul facility will be preserved prior to removal from the aircraft.

a. Ensure that the engine,. accessories, inlet duct, plenum chamber, and relet screens are clean and free from corrosion and foreign material. When external cleaning is necessary, clean with solvent (item 3, table 2-2). (Refer to TB 55-9150-200-24.)

b. Fill the engine oil tanks as necessary to normal operating level with standard operating oil (item 7, table 2-2). Start engine. If available, use external auxiliary power unit (APU).

c. Run at idle to ensure that the engine is operating satisfactorily. Accelerate to 100% N_2, collective full down. Operate engine for five minutes or until oil temperature reaches 88°C (191° F), whichever occurs first.

d. Idle engine for two minutes prior to shutting down engine.

e. Allow the engine to cool until the compressor is cool to the touch (bare hand); then preserve the compressor as follows:

(1) Disconnect the fuels stem pressure sensing (Pc) tube from the elbow at the diffuser scroll. Cap the tube and the elbow using compressor protector cleaning kit 6886204.

(2) Disconnect the bleed control valve pressure sensing (Pc) tube from the elbow at the diffuser scroll. Cap the tube and the elbow using compressor protector cleaning kit 6886204.

(3) Block the bleed control valve in the closed position using compressor protector cleaning kit 6886204.

(4) Retain the anti-ice valve in the closed position.

(5) Spray one-quarter pint of preservative item 35, table 2-.2) into the engine whde it is being motored with the starter and without ignition. Use a sprayer with a quick opening valve and a nozzle sized to spray one-quarter pint of preservative m 1 to 3 seconds. Hold sprayer 8 to 12 inches in front of the compressor. Allow the preservative to be drawn into the compressor while spray circular motion which covers the entire intake area. As an alternate method of application use an aerosol pressure-type spray can. Spray preservation from the can or 15 to 20 seconds whale the engine is being motored. Spray in a circular motion which covers the entire retake area.

CAUTION

Do not exceed 10% N_1 rpm motoring speed. Do not reject a solid stream of fluid into the compressor, proper compressor preservabon may not occur and damage to the compressor vanes could result.

(6) Reconnect the control system and bleed control valve pressure sensing. Tighten coupling nuts to 80-120 lb. in.

(7) Remove the wedge which was used to block the bleed control valve in the closed position.

f. Preserve the engine fuel system as follows:

(l) Disconnect the power input lead at the ignition exciter or pull the IGN ENG circuit breaker Reference TM 55-1520-228-10). Pull the boost pump circuit breaker.

(2) Disconnect the fuel line at the fuel pump inlet port and connect a source of lubricating oil (item 37, table 2-2). Cap the disconnected fuel line.

(3) Move the twist grip to the IDLE detent and motor the engine with the starter (use APU if available).

CAUTION

To prevent damage to the starter observe starter time restriction-35 seconds maximum when temperature is 90°F or (32°C) or above.

(4) Discontinue motoring when fuel-free oil flows from the combustion burner drain valve hose.

(5) Disconnect the source of lubricating oil and cap relet port of fuel pump.

(6) Reconnect the power lead to the ignition exciter or reset the IGN ENG circuit breaker. Reset the boost pump circuit breaker.

g. Install engine inlet and exhaust protective covers. If covers are not available, seal the openings with barrier material (item 4 table 2-2) and secure with tape (item 5, table 2-2).

h. Make all necessary entries to include the date and extent of engine reservation on the forms (DA Form 2408-13).

i. Remove engine accessories in accordance with Chapter 4 of TM 55-1520-228-23.

j. Clean the starter-generator drives lines with methylethylketone (item 9, table 2-2) as necessary to remove previously applied lubrcant. Coat all accessory drive splines and accessory drive pads which do not have accessories installed on them and engine oil shipping plugs (26, 27, 28, figure 3-2) with oil (item 7, table 2-2). Coat fuel inlet shipping plug (7) with oil (item 8, table 2-2). Install shipping plugs, covers, gaskets, washers and nuts.

k. Secure the gas producer fuel control stop in the cut-off Position. Secure the power turbine governor stop and anti-icing valve lever sufficiently tight to prevent movement. Lockwire (item 10, table 2-2) shall be used to secure the stops and lever.

1. Attach a tag (8) tome fuel inlet shipping plug (7) with the following reformation shown clearly on the tag: THIS FUEL SYSTEM HAS BEEN PREPARED FOR STORAGE BY FLUSHING WITH OIL CONFORMING TO SPECIFICATION MIL-L-6081, GRADE 1 0 1 0 .

m. Touch up paint where damaged in accordance with paragraphs 7-25b and 7-29. Do not expose touchup areas to engine fluids or cleaning solvents for a minimum period of 72 hours after application.

n. Tighten aluminum and plastic shipping caps an plugs finger tight; except, tighten caps (12 and 16, figure 3-2) on the combustor drain valve and exhaust collector drain to bottom of cap; then twist an additional 90-120 degrees.

o. Tighten threaded parts to standard torques.

p. Tighten nuts which secure plastic accesso covers as required to obtain a snug fit without out excessive cover indentation.

q. Cover the compressor bleed valve with cover (14).

a. Preparation of Container

(1) Loosen two nuts (26, figure 3-1) and pivot cover (31) around to expose air valve (32).

(2) Slowly loosen the air valve (31) to relieve pressure in the container.

WARNING

Personnel should stand clear of air valve when loosening to prevent personal injury.

(3) Remove thirty-two nuts (1) and bolts (37) from the closure flange and remove cover assembly (2).

(4) Remove two cotter pins (8) and pins (9) and remove engine side mounting brackets (12).

(5) Remove cotter pin (14) and slide pin assembly (13) out until it disengages from the engine lower mounting bracket (12). Remove the mounting bracket.

(6) Remove four nuts (7) washers (6), and bolts (4) and remove engine side mounting adapters (5).

(7) Inspect the container to determine that it is complete and serviceable. Particular attention should be given to the mounting brackets, bolts, nuts, pins and cotter pins in the engine suspension system. Replace parts which show signs of wear and/or damage.

b. Installation of Engine In Container

WARNING

The fuel system of all engines that are to be placed in containers (less accident-involved engines) will be thoroughly drained, purged, and preserved. All disconnected lines will be capped or plugged. Tape will not be used in lieu of caps or plugs.

(1) Suspend the engine from a hoist in the upright position (exhaust ducts up) using engine assembly lift, tool No. 6796963.

(2) Remove the three turnover stand mounting brackets and assemble three engine mounting brackets (12, figure 3-1) on the engine using nine bolts (10) and washers (11). Tighten bolts to 85-110 in. lbs. and lockwire (item 10, table 2-2).

CAUTION

Do not use the engine turnover stand mounting brackets in lieu of engine mounting brackets. Brackets are not interchangeable, damage to engine could occur.

CAUTION

Avoid sharp bends when coiling the thermocouple lead.

(2.1) Coil the thermocouple lead and secure it to the top of the turbine.

(3) Lower the engine into the container until the bottom mounting bracket (12) engages with the bottom mounting adapter.

(4) Align the pin holes and engage pin assembly (13). Secure with one cotter pin (14).

(5) Insert the two side mounting adapters (5) through the locating holes in yoke assembly (15) and engage with the two side mounting brackets (12). Secure with two pins (9) and cotter pins (8).

(6) Secure the two side mounting adapters (5) to the yoke assembly (15) with four bolts (4) washers (6) and nuts (7). Tighten nuts (7) firmly then loosen one complete turn.

(7) Release the engine weight from the hoist and remove the engine assembly lift, tool No. 679696, from the engine.

(8) Tighten four nuts (7) at the engine side mounts to 40.50 in. lb.

(9) Tie the cloth bag, used to store the engine mounting bolts (10) and washers (11), to desiccant basket (25) for future use.

(10) Place two bags of desiccant (item 11, table 2.2) into desiccant basket (25).

(11) Install gasket (3) on container base assembly (24).

(12) Lower cover assembly (2) into place over the engine. Engage the forward end of the cover with the guide pin in the closure flange of base assembly (24); then lower the aft end. Ensure that gasket (3) is properly seated.

(13) Install thirty-two bolts (37) and nuts (1) in the closure flange. Bolts (37) shall be inserted from the bottom side of the closure flange. Tighten nuts (1) finger tight.

(14) Tighten one nut (1) on each side of the container at the center and at each of the four comers to approximately 75 in. lb.

(15) Starting at the guide pin in the forward end of the closure flange and moving in a clockwise direction, final tighten nuts (1) to 150-165 in. lb.

c. Container Pressurization.

(1) Tighten the air valve (32, figure 3-l).

(2) Using a source of filtered, dry, compressed air, pressurize the container to the value shown in table 3-1.

(3) Check gasket (3), humidity indicator, packing (28), drain plug (35), air valve (32), and relief valve (34) for leaks by brushing a liquid soap solution (item 1, table 2-2) on all seams and closure points.

(4) If leaks are found, check torque on nuts (1) and bolts (30, 33). Replace gasket (3) and packing (28) if necessary.

CAUTION

Do not attempt to stop leaks by overtorquing nuts. Overtorquing may cause damage to container.

(5) Repeat steps (2) and (3) as required.

(6) Wipe off or flush away soap solution.

(7) Install cover (31) on bolts (30) and tighten nuts (26) to 15-25 in. lbs.

Table 3-1. Container Air Pressure vs Ambient Temperature

Temperature (%F)	Pressure (psig)	Temperature (%F)	Pressure (psig)
140	7.6	40	3.9
130	7.3	30	3.5
120	6.9	20	3.2
110	6.5	10	2.8
100	6.1	0	2.4
90	5.8	– 10	2.0
80	5.4	–20	1.7
70	5.0	–30	1.3
60	4.6	–40	0.9
50	4.3		

d. Engine Records Receptacle.

(1) Loosen two nuts (17, figure 3-1) and swing stud assembly (22) out of the slot in cover (19). Pivot the cover out of the way.

(2) Insert applicable engine records in envelope (21) and place in the engine records receptacle.

(3) Pivot cover (19) with gasket (20) into place over the receptacle opening and swing stud assembly (22) into the cover (19) slot.

(4) Secure the cover in place by tightening two nuts (17) to 30-45 in. lb.

e. Tamper-proof Security.

Container tamper-proof security is provided by five lead seals; two in the container closure flange, two in the records receptacle cover, and one in the service receptacle cover,

(1) Thread seal (16, figure 3-1) wire through the sealing holes in cover (31) and service receptacle (29). Seal the ends of the wire together with the attached lead seal.

(2) Seal both ends of the records receptacle cover (19) by threading seal wire (16) through the sealing holes in cover (19) and receptacle (23). Seal the ends of the wires together with the attached lead seals.

(3) Thread seal wire (16) through each set of sealing holes in the closure flange of base assembly (24) and cover assembly (2). Thread the wire down through one hole and up through the other hole. Secure the ends of the wires together with the attached lead seals. The sealing holes are located at the left front and right rear of container closure flange,

(4) Coat the exposed threads of bo]ts (30 and 37) and stud assembly (22) with corrosion preventive compound (item 2, table 2-2).

f. Container Stenciling.

Stenciling of the engine shipping container will be in accordance with paragraph 3-9 and figure 3-3.

3-12. Engine Container Internal Pressure and Humidity Check.

Check the internal pressure and humidity within 24 hours after the container is pressurized. Check the pressure and humidity immediately prior to shipment if the engine is to be shipped.

a. Internal Pressure Check. If the internal pressure is not within 0.5 psig of the value shown in table 3-1, repeat paragraph 3-11c(2) and (3).

b. Humidity Indicator Check. The humidity indicator (36, figure 3-1) is normally light blue in color. At 40± 3 percent relative humidity, the color will change to light lavender or lavender pink.

(1) the humidity indicator may be light lavender or lavender pink when the container is pressurized and should change to light blue within one to two hours. If it does not change to light blue, replace the indicator.

NOTE

The humidity indicator should change to light blue in an atmosphere of less than 37 percent relative humidity unless it has absorbed sufficient moisture to wash away or destroy its chemical properties.

(2) If the humidity indicator changes to light lavender or lavender pink after the container has been pressurized, open the container and inspect the engine for corrosion. Replace the desiccant (item 11, table 2-2.)

3-13. Removing Accessory from Shipping Container

NOTE

Before removing the accessory from the shipping container, inspect for evidence of rough handling or tampering.

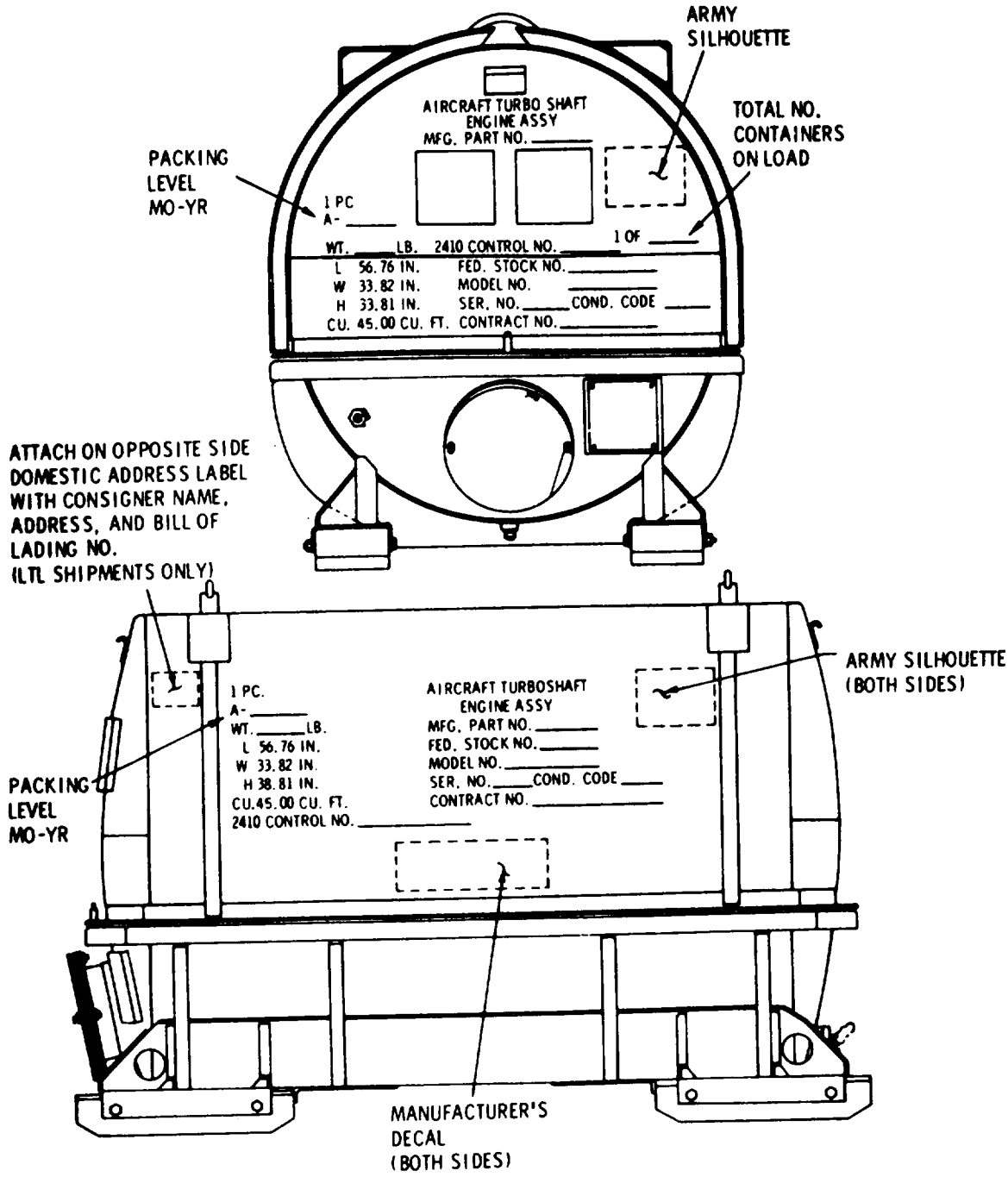


Figure 3-3. Engine Shipping Container Stenciling and Labeling

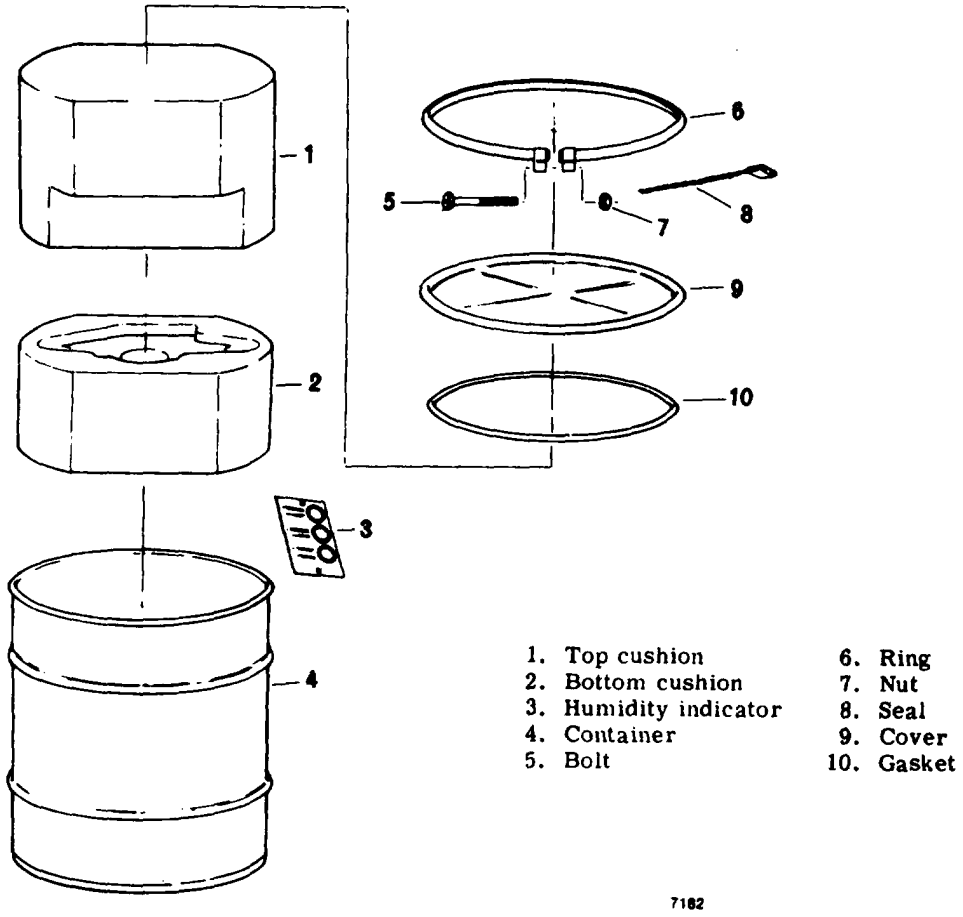


Figure 3-4. Accessories Shipping Container

a. Loosen nut (7, figure 3-4) and remove the ring (6), cover (9), and gasket (10).

b. Note the condition of the humidity indicator (3).

c. Remove the records and dehydrating agent from the voids on each side of the top cushion (1).

d. Remove top cushion (l).

e. Remove the accessory from the container.

f. Remove all shipping caps, plugs, and covers.

g. Place all shipping parts inside the shipping container (less desiccant) and replace the cover.

3-14. Shipping Container Dimensions and Weight.

The following lists the size, weight, and cubic displacement of the engine, fuel pump, gas producer fuel control, and the power turbine governor shipping and storage containers.

a. Engine Container
Length . . . . . 57 in.
Width . . . . . 34 in.
Height . . . . . 39 in.
Weight (with engine) . . . . . .600 lb.
Cubic Displacement . . . . . 45 cu ft

b. Fuel Pump and Filter Assembly Container
Height . . . . . l5 in.
Diameter . . . . . 14 in.
Weight (with fuel pump) . . . . . 24 lb.
Cubic Displacement . . . . . 1.3 cu ft

c. Gas Producer Fuel Control Container
Height . . . . . 12¾ in.
Diameter . . . . . l0½ in.
Weight (with fuel control) . . . . . 16 lb.
Cubic Displacement . . . . . 0.8 cu ft

d. Power Turbine Governor Container
Height . . . . . 12¾in.
Diameter . . . . . l0½in.
Weight (with governor) . . . . . .13 lb.
Cubic Displacement . . . . . 0.8 cu ft

3-15. Preparing Fuel Pump and Fitter Assembly for Storage and Shipment

NOTE

The procedure for removing the fuel pump and filter assembly from the metal shipping and storage container is prescribed in paragraph 3-13.

Prepare the fuel pump and filter assembly for storage, shipment, and installation in a metal shipping and storage container, MS63052-1, as follows:

a. Clean the exterior of the fuel pump with a clean cloth dampened with solvent (item 3, table 2-2). Air dry or wipe with a clean lint-free cloth. Blow out all crevices with dry, filtered, low-pressure compressed air.

b. Pump lubricating oil (item 37, table 2-2) into fuel inlet port until fuel-free oil flows from the outlet port. Drain excess oil from the fuel pump.

NOTE

If the engine fuel system was preserved in accordance with paragraph 3-10, subparagraph *b* above may be omitted.

c. Install shipping plugs in all ports to prevent entry of foreign material.

d. Coat external bare metal surfaces including the splines with corrosion preventive compound (item 12, table 2-2).

e. Attach a tag to the fuel pump stating: FUEL PUMP PRESERVED WITH LUBRICATING OIL, MIL-L-6081, GRADE 1010.

f. Attach a properly filled out DD FORM 1577-2 [Unserviceable-Repairable tag). Refer to paragraph 3-9 for additional information concerning tags.

g. Prepare DA FORM 2410 (Component Removal and Repair/Overhaul Record) according to TM 38-750 and place in a greaseproof envelope (Refer to paragraph 3-9).

h. Wrap the fuel pump with barrier material (Item 4, table 2-2) to prevent contact with the cushioning material and to prevent the loss of the corrosion preventive compound. Secure barrier material with pressure-sensitive tape (item 5, table 2-2).

i. Prepare the container for use as follows:

(1) Loosen nut (7, figure 3-4) and remove the ring (6), cover (9), gasket (10), and top cushion (1) from body (4).

(2) Check gasket (10) for damage or deterioration and replace if necessary.

(3) Check the container for cleanliness and general condition.

j. Install the fuel pump in the container as follows:

(1) Install the fuel pump upright in the container. Ensure that it is properly seated in the bottom cushion (2, figure 3-4).

(2) Install top cushion (1) in the container. Ensure that it is properly seated over the pump.

(3) Plate two bags of dehydrating agent (item 11, table 2-2) in the voids on each side of top cushion (1)--one bag per side.

(4) Place the fuel pump assembly records in one of the voids at the side of the top and bottom cushions. Tape the three-spot humidity indicator card (3) on the side of the top cushion.

(5) Place gasket (10) on cover (9). Install the cover on body (4) and secure with ring (6).

(6) Slowly tighten nut (7) while tapping on the locking ring until 65-75 in. lb torque is obtained. Secure the nut with wire seal (8).

k. Stencil the container in accordance with paragraph 3-9 and figure 3-5.

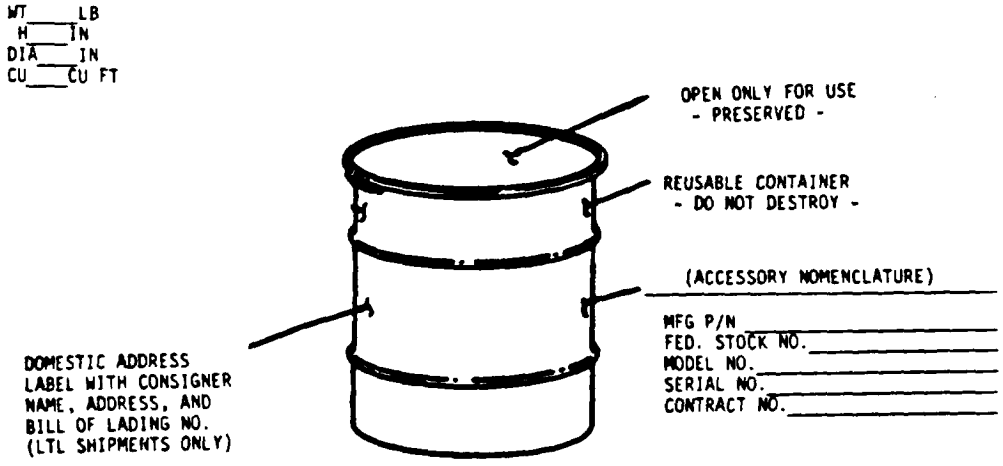


Figure 3-5. Accessories Shipping Container Stenciling

3-16. Preparing Gas Producer Fuel Control for Storage and Shipment.

NOTE

The procedure for removing the gas producer fuel control from the metal shipping and storage container is prescribed in paragraph 3-13.

Prepare the gas producer fuel control for storage, shipment, and installation in a metal shipping and storage container, MS 63048-1, as follows. The fuel control consists of an air section and a fuel section; each section must be treated separately when preparing the unit for storage and shipment.

CAUTION

Do not permit fuel or oil to enter the drive body cavity or any air pressure ports. Damage to fuel control could result.

a. Install shipping plugs in the compressor discharge pressure, governing pressure, Py air pressure, and regulated air pressure pork (See figure 3-6),

b. Drain residual fuel from the fuel control. Place the throttle lever against the maximum stop. Pump/pour lubricating oil (item 37, table 2-2) into the inlet port. When clean oil flows out of bypass and fuel outlet ports, remove the source of oil. Plug the inlet, bypass and outlet pork Reposition the throttle lever for shipping.

NOTE

If the engine fuel system was preserved in accordance with paragraph 3-10, subparagraph *b* above may be omitted.

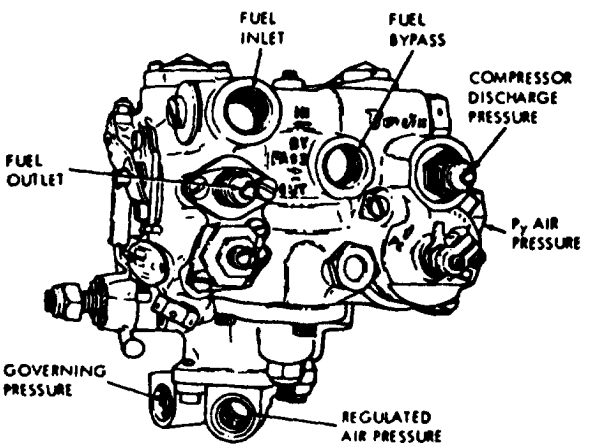


Figure 3-6. Gas Producerr Fuel Control Ports Identification

c. Clean the exterior of the fuel control with a clean cloth dampened with solvent (item 3, table 2-2). Air dry or wipe with a clean lint-free cloth. Blow out all crevices with dry, filtered, low-pressure compressed air.

d. Coat external bare metal surfaces including the splines with corrosion preventive compound (item 12, table 2-2).

e. Attach a tag to the fuel control stating FUEL CONTROL PRESERVED WITH LUBRICATING OIL, MIL-L-6081, GRADE 1010.

f. Attach a properly filled out DD Form 1577-2 (Unserviceable-Reparable tag). Refer to paragraph 3-9 for additional information concerning tags.

g. Prepare DA Form 2410 (Component Removal and Repair/Overhaul Record) according to TM 38-750 and place in a greaseproof envelope (Refer to paragraph 3-9).

h. Wrap the fuel control with barrier material (item 4, table 2-2) to prevent contact with the cushioning material and to prevent the loss of the corrosion preventive compound. Secure barrier material with pressure-sensitive tape (item 5, table 2-2).

i. Prepare the container for use in accordance with paragraph 3-15i.

j. Install the fuel control upright in the container in accordance with paragraph 3-15j.

k. Stencil the container in accordance with paragraph 3-9 and figure 3-5.

3-17. Preparing Power Turbine Governor for Storage and Shipment

NOTE

The procedure for removing the power turbine governor from the metal shipping and storage container is prescribed in paragraph 3-13.

Prepare the power turbine governor for storage, shipment, and installation in a metal shipping and storage container, MS 27684-2, as follows:

CAUTION

Use extreme care to prevent foreign material from entering the pneumatic tubes or the governor ports. Internal damage to the governor could result.

a. Install shipping plugs in all the ports to prevent entry of foreign material.

b. Clean the exterior of the governor with a clean cloth damp ened with solvent (item 3, table 2-2). Air

dry or wipe with a clean lint-free cloth. Blow out all crevices with dry, filtered, low-pressure compressed air.

c. Coat external bare metal surfaces including the splines with corrosion preventive compound (item 12, table 2-2).

d. Attach a properly filled out DD Form 1577-2 (Unserviceable-Reparable tag). Refer to paragraph 3-9 for additional information concerning tags.

e. Prepare DA Form 2410 (Component Removal and Repair/Overhaul Record) according to TM 38-750 and place in a greaseproof envelope. (Refer to paragraph 3-9.)

f. Wrap the governor with barrier material (item 4, table 2-2) to prevent contact with the cushioning material and to prevent the loss of the corrosion preventive compound. Secure barrier material with pressure-sensitive tape (item 5, table 2-2).

g. Prepare the container for use in accordance with paragraph 3- 15i.

h. Install the governor upright in the container in accordance with paragraph 3-15j.

i. Stencil the container in accordance with paragraph 3-9 and figure 3-5.

Section II. ENGINE HANDLING

3-18. Scope.

This section provides instructions for installation of the engine in the turnover stand and dismantling of the engine into major functional assemblies.

3-19. Installing Engine in Turnover Stand.

a. Install engine assembly lift, tool No. 6796963 on the gearbox top mounting pad and suspend the engine from a hoist.

NOTE

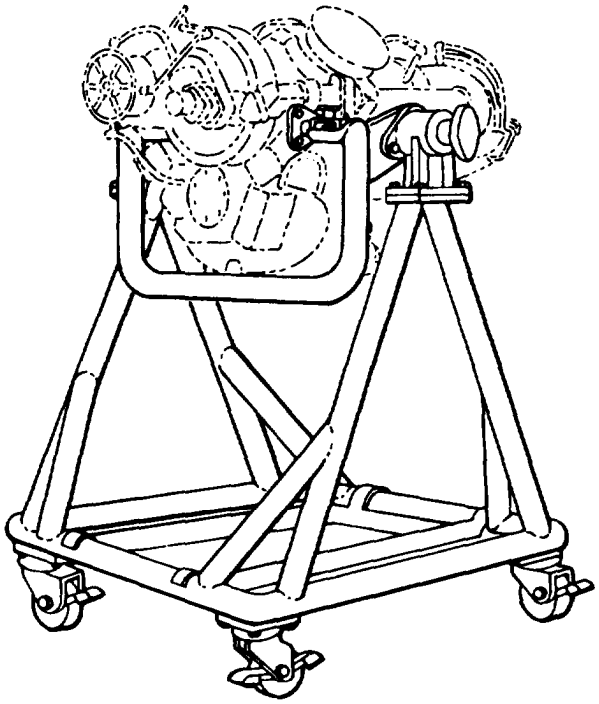
Do not use the shipping container or airframe mounting backets in lieu **of the** turnover stand mounting brackets.

b. Install the three turnover stand, tool No. 6795579, mounting brackets on the gearbox side and bottom mounting pads. (See figure 3-7.)

c. Lower the engine into the turnover stand. Ensure that the three mounting brackets installed on the gearbox engage the mounting bosses on the turnover stand,

d. Slide the two clamps at the gearbox side mounts in to engage the mounting brackets and tighten the hand knobs.

e. Remove the hoist and lifting tool.



2225A

Figure 3-7. Engine Assembly Turnover Stand No. 6795579

3-20. Dismantling Engine into Major Functional Assemblies

a. During dismantling, examine all major functional assemblies for serviceability. The condition of an assembly can often be better determined by examination during dismantling. Signs of scoring, burning, and excessive wear or the presence of metal particles are danger signals. Thorough inspection should be made immediately. Look for any indication of work incorrectly performed during previous maintenance or overhaul. Report any such indications to the local maintenance officer.

b. Care must be exercised to prevent the entrance of dirt and other foreign material into the engine. Whenever practicable, temporary covers should be used to seal all openings in the dismantled engine. All threads, splines, and pilot diameters should be protected against damage. Protective covers should be of a configuration that prohibits assembly with mating parts without removing the covers.

c. Unless parts of a particular engine are to be held for a special inspection discard all gaskets, lockwashers, preformed packings, diaphragms, and cotter pins as they are removed. These parts must not be mixed with new parts of similar type and must not be used again. Disposition of self-locking nuts shall be determined in accodance with minimum prevailing toque at reassembly.

WARNING

Prolonged contact with lubricating oil (item 7, table 2-2) may cause a skin rash. Those areas of skin and clothing that come in contact with lubricating oil should be thoroughly washed immediately. Enclosed areas where lubricating oil is used should be adequately ventilated to keep mist and fumes to a minimum.

CAUTION

Lubricating oil may soften paint upon contact. If lubricating oil is spilled on painted surfaces, these surfaces should be thoroughly washed.

d. Remove the magnetic drain plug from the bottom of the gearbox and allow oil to drain before the engine is rotated in the turnover stand.

3-21. Combustion Section Removal.

a. Disconnect the drain hose from the burner drain valve (14, figure 3-8).

b. Remove the lockwire, remove jam nut (16) and disengage bracket (15) from the engine.

WARNING

To prevent personnel injury due to electrical chock, ensure ignition system has been off for at least five minutes before disconnecting the igniter lead. Ground the lead to the engine using an insulated screwdriver to dissipate any energy stored in the exciter.

c. Disconnect the igniter lead (9) from the spark igniter (10).

d. Remove fuel hose (8) between the firewall shield and fuel nozzle (7).

e. If a new outer combustion case (6) is to be installed:

(1) Remove fuel nozzle (7) and spark igniter (10) from outer combustion case (6).

(2) Remove drain valve (14) and plug (12) the bottom of outer combution case (6), Diacard preformed packing (11, 13).

f. Remove the two retaining rings (17) from outer combustion case (6) and slide them forward on the discharge air tubes (18).

g. Remove 24 nuts (5), one clamp (4) and 24 bolts (1, 2) at the combustion case splitline.

h. Remove outer combustion case (6) and air tubes (18). Separate the air tubes from the outer combustion case.

i. Remove combustion liner (3) from the engine.

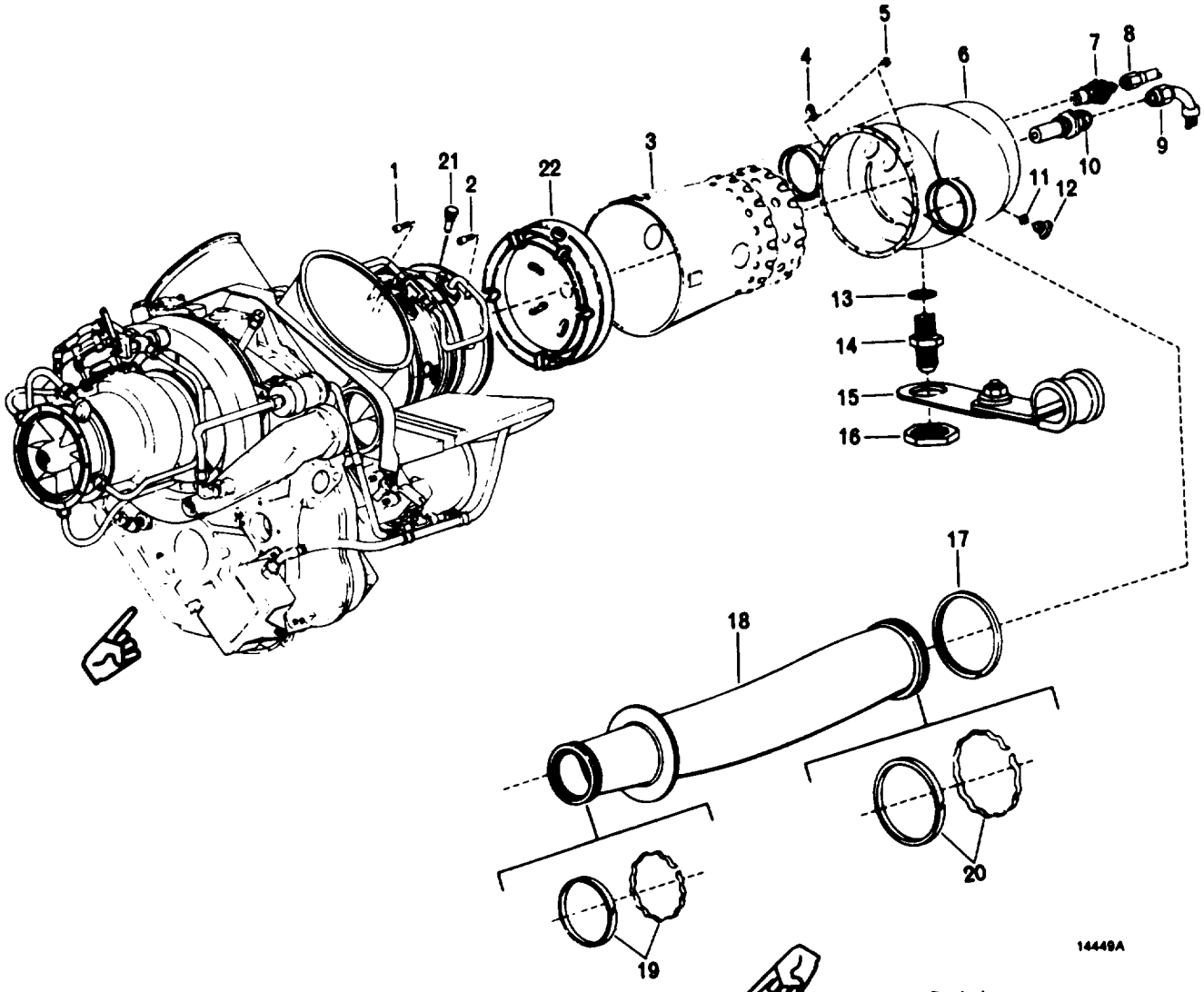
j. Remove seal rings (19) from the small ends of the air tubes.

k. Remove retaining rings (17) and seal rings (20) from the large ends of the air tubes.

NOTE

If a turbine overtemperature inspection is to be made, complete step *l.*

l. Remove lockwire and two positioning plugs (21). Lift off first stage turbine nozzle shield (22).



1. Bolt
2. Bolt (23)
3. Combustion liner
4. Clamp
5. Nut (24)
6. Outer combustion case
7. Fuel nozzle
8. Fuel hose
9. Igniter lead
10. Spark igniter
11. Preformed packing
12. Plug
13. O-ring
14. Drain valve
15. Bracket
16. Jam nut
17. Retaining ring
18. Compressor discharge air tube
19. Seal ring
20. Seal ring
21. Plug
22. First-stage nozzle shield

Figure 3-8. Combustion Section Removal

CHAPTER 4

TROUBLESHOOTING

4-1. General.

a. The troubleshooting procedures in this chapter are presented as a guide for locating and correcting malfunctions. **Use** of these procedures will reduce delays and maintenance down time and will minimize unnecessary replacement of engine components. Two basic assumptions have been made in preparing these procedures; (1) the correct operating procedures have been followed and (2) the problem is caused by a single failure or malfunction.

b. The troubleshooting procedures are organized under three basic heading; (1) Trouble, (2) Probable cause, and (3) Remedy.

c. The trouble as reported by the flight crew is the main point of the problem. Obtain as much information as possible from the flight crew and their report. In many cases, this information will define the problem completely, however, the malfunction should be confirmed by a ground run, providing there is no danger of possible engine damage occurring.

d. The probable cause lists the components which might cause the malfunction. The cockpit indications can often give a clue as to which of these components is causing the problem.

e. Caution must be exercised to avoid troubleshooting difficulties caused by false cockpit indications. In most cases, a false indication can be detected by checking it against other indications. For example, a TOT indication system malfunction should be suspected if TOT is high, low, or fluctuating with no change in fuel flow or torque.

f. The remedy lists the action to be taken to correct the malfunction.

g. It is not possible to list troubleshooting procedures for every malfunction which can occur There will be situations encountered for which there are no applicable procedure but the methods and principles used in the procedures are effective in all maintenance problems.

Table 4-1. Troubleshooting

Item	**Trouble**	Probable cause	Remedy
1	Engine fails to reach light off cranking speed.	a. Inadequate starter torque caused by low battery or defective starter-generator.	a(1). Check battery. a(2). Check for loose cables. a(3). Check starter-generator and replace if defective. (Refer to TM 55-1520-228-23.)
		b. B and C leads on starter-generator terminal block reversed.	b. Reverse B and C leads.
		c. N_1 binding.	c(1). Check inlet for foreign object damage. Rotate N_1 by hand and listen for abnormal noise. c(2). Replace engine. (Refer to TM 55-1520-228-23.)
2	Engine fails to light off — fuel vapor coming out of exhaust and no audible ignition operation.	a. Preservative oil fouling spark igniter.	a. Try a second start.
		b. Faulty circuit to ignition exciter.	b. Check input power to exciter. If no power, isolate defective component and correct fault.

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
2 (cont)		c. Failed spark igniter.	c. Replace igniter. (Refer to para 5-36.)
		d. Failed ignition exciter.	d. Replace exciter. (Refer to para 5-35.)
		e. Spark igniter firing intermittently.	e. Check input voltage to exciter, If voltage is low, check battery. If voltage is not low, replace exciter.
3	Engine fails to light off — vapor coming out of exhaust and ignition operation audible.	Water or other contaminants in fuel.	Check a sample of fuel from the bottom of the tank. If contaminated, defuel the tank (Refer to TM 55-1520-228-23). Disconnect fuel line at the fuel nozzle then flush the system with clean fuel. Install new filters in the fuel pump and fuel control.
4	Engine fails to light off — no fuel vapor coming out of exhaust.	a. No fuel in tanks.	a. Fill tanks with fuel.
		b. Insufficient fuel pressure to engine fuel pump.	b. Turn on aircraft boost pump.
		c. Gas producer fuel control in cutoff position.	c. Check linkage.
		d. Fuel pump inoperative.	d(1). Check pump for sheared drives or internal damage and replace as required. (Refer to para 5-9).
			d(2). Check for air leaks at pump
		e. Fuel nozzle valve stuck.	e. Replace nozzle. (Refer to para 5-15).
		f. Fuel nozzle orifice clogged.	f(1). Check fuel filter. (Refer to para 5-l0.)
			f(2). Replace nozzle. (Refer to para 5-15.)
		g. Air fuel lines.	g. Bleed system and try a second start.
		h. Fuel check valve stuck.	h. Replace check valve. (See Figure 5-2).
5	Engine lights off but will not accelerate to idle speed in 45 seconds.	a. Inadequate starter torque caused by low battery or defective starter-generator.	a. Check condition of battery and starter-generator to determine if sufficient N1 cranking speed is attainable.

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
5 (cont)		b. Air leaks in control air tubing.	b. Check air tubes and fittings for looseness or cracks. Replace or tighten tubes and fittings as required.
		c. Cracked accumulator(s).	c. Replace as required. (Refer to para 5-16.)
		d. Sticking double check valve.	d. Replace valve. (Refer to para 5-14.)
		e. Pc filter clogged.	e. Check and clean Pc air filter. (Refer to para 5-11.) Clogging may be caused by dirt, moisture or ice.
		f. Cracks in compressor discharge air tubes or outer combustion case.	f. Weld repair or replace parts as applicable.
		g. Compressor discharge air tube seal leaks.	g. Replace air tube seals. (Refer to para 3-21.1
		h. Insufficient fuel supply to gas producer fuel control.	h. Check fuel system to ensure all valves are open and pumps are operative.
		i. Insufficient fuel pressure to fuel pump.	i. Turn on aircraft boost pump,
		j. Anti-icing valve open and cabin heat on.	j. Close anti-icing valve and turn off cabin heat.
		k. Gas producer fuel control start derichment too lean.	k. Adjust start derichment. (Refer to para 5-12.)
		l. Gas producer fuel control by-pass valve stuck open.	l. Disconnect the fuel line at the fuel nozzle, flush system with clean fuel. If the same condition still exists, replace fuel control. (Refer to para 5-12.)
		m. Gas producer fuel control incorrectly adjusted or calibration has shifted.	m. Replace control. (Refer to para 5-12.)
		n. Fuel nozzle partially clogged with carbon.	n. Clean fuel nozzle. (Refer to para 5-15.)
		o. Fuel nozzle check valve stuck partially open.	o. Replace fuel nozzle. (Refer to para 5-15.)
		p. Faulty power turbine governor.	p. Replace governor. (Refer to para 5-13.)
		q. Dirty compressor.	q. Clean compressor and bleed valve. (Refer to para 7-3 and 7-7.)
		r. Foreign object damage or erosion to compressor.	r. Inspect compressor. (Refer to para 7-9 or 7-10,)
		s. Contaminated fuel control fuel filter.	s. Clean or replace the filter. (Refer to para 5-12.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
6	Acceleration temperature too high during start.	a. Insufficient time allowed for draining after an unsuccessful starting attempt.	a. Purge the engine by motoring with the gas producer lever and ignition switch in OFF for approximately 10 sec before attempting a second start.
		b. Reduced battery capacity. This can produce low cranking speed.	b. Recharge battery, replace battery. (Refer to TM 55-1520-228-23.)
		c. High residual TOT in excess of 150°C (302°F).	c. Motor engine with starter leaving gas producer lever and ignition OFF.
		d. Depreciated starter which is not capable of dry motoring gas producer (Nl) above 15 percent.	d. Replace starter. (Refer to TM 55-1520-228-23.)
		e. Gas producer lever (twist grip) in ground idle (start) position prior to and during starter engagement.	e. Review starting procedure.
		f. Dirty compressor.	f. Clean compressor and bleed valve. (Refer to para 7-3 and 7-7.)
		g. Fuel nozzle valve stuck full open.	g. Replace fuel nozzle. (Refer to para 5-15.)
		h. Excessive compressor air leaking.	h. Check for leaks. Be sure that anti-ice valve is fully closed.
		i. Bleed control valve stuck closed,	i. Replace bleed control valve. (Refer to para 5-33.)
		j. Gas producer fuel control incorrectly adjusted or calibration has shifted.	j. Inspect turbine and replace faulty control if start temperature exceeds 927°C (1700°F).
		k. Gas producer fuel control start derichment too rich.	k. Adjust start derichment. (Refer to para 5-12.)
		1. Engine fuel pump	1. Replace fuel pump.
		m. Fuel control not in cutoff.	m. Check rigging.
7	Acceleration temperature too low during starting.	a. Fuel control system air sensing lines leaking.	a. Check air lines and fittings for leaks.
		b. Gas producer fuel control start derichment too lean.	b. Adjust start derichment (Refer to para 5-12.)
		c. Gas producer fuel control incorrectly adjusted or calibration has shifted.	c. Replace control. (Refer to para 5-12.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
8	Engine speed cycles at idle.	a. Gas producer fuel control bypass valve not operating freely.	a. Disconnect the fuel line at the fuel nozzle; flush system with clean fuel. Replace the fuel control fuel filter. (Refer to para 5-12.) If the same condition still exists, replace control. (Refer to para 5-12.)
		b. Check rigging	b. Refer to para 5-12.
9	Engine unstable above idle speed.	a. Leak(s) in fuel system air tubes.	a. Correct leak(s), then test in accordance with para 5-8.
		b. Double check valve.	b. Replace double check valve.
		c. Contamination in the pneumatic section of the gas producer fuel control and power turbine governor.	c. Check Pg port in the governor and the Pc port in both control and governor. Replace control or governor if contaminated. (Refer to para 5-12 and 5-13.)
		d. Defective fuel control or governor.	d. Isolate the governor from the system by removing the tee fitting from the governor Pc port and capping the governor end of the tee. Plug the open governor port to prevent entry of dirt. Start the engine and carefully accelerate to 100% N2 and check stability. If the engine is unstable, replace the fuel control; if stable, replace the governor. (Refer to para 5-12 and 5-13.)
		e. Accumulator(s) leaking,	e. Replace accumulator(s).
		f. Contaminated fuel control/fuel filter.	f. Clean or replace the filter. (Refer to para 5-12.)
10	Idle speed too low.	8. Incorrect gas producer lever setting.	a. Check lever position and rigging. (Refer to para 5-12.)
		b. Malfunctioning tachometer.	b. Replace tachometer. (Refer to TM 55-1520-228-23.)
		c. Excessive generator load.	c. Reduce electrical load requirement.
		d. Dirty compressor.	d. Clean compressor and bleed valve. (Refer to para 7-3 and 7-7.)
		e. Gas producer fuel control idle adjustment incorrectly set.	e. Adjust idle setting, (Refer to para 5-12.)
		f. Air sensing lines leaking.	f. Check for leaks. Tighten coupling nuts as required.
		g. Accumulator leaking.	g. Check for cracks in sheet metal or braze. Replace accumulator if leaks are found. (Refer to para 5-16.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
11	Idle speed too high.	a. Incorrect gas producer lever setting.	a. Check lever position and rigging.
		b. Malfunctioning tachometer.	b. Replace tachometer. (Refer to TM 55-1520-228-23.)
		c. Gas producer fuel control idle adjustment incorrectly set.	c. Correct the setting. (Refer to para 5-12.)
		d. Contaminated fuel control.	d. Replace control. (Refer to para 5-12.)
12	Oil pressure drops off severely.	a. Oil supply low.	a. Check oil supply and refill as necessary.
		b. Oil pressure transmitter hose obstructed.	b. Clean or replace oil transmitter hose (Refer to TM 55-1520 -228-23.)
		c. Regulator valve sticking or broken spring.	c. Clean valve or replace spring. (Refer to para 5-26.)
		d. Defective oil pump.	d. Replace engine. (Refer to TM 55-1520 -228-23.)
		e. Oil pressure transmitter or indicator giving false indication.	e. Check transmitter or indicator and repair or replace if necessary. (Refer to TM 55-1520-228-23.)
13	Excessive oil pressure fluctuation,	a. Low oil supply.	a. Check oil supply and refill as necessary.
		b. Air in sensing line,	b. Bleed line.
		c. Faulty pressure regulating valve.	c. Replace the valve. (Refer to para 5-26.)
		d. Oil contamination foaming and foreign objects in tanks.	d. Drain oil, inspect oil tank for foreign objects and replace filter. (Refer to para 5-25.) Inspect magnetic chip detectors for metallic particles. (Refer to para 5-24.) Thoroughly flush with engine oil while motoring engine. Drain and refill with engine oil.
		e. Internally kinked or twisted engine oil inlet line.	e. Replace oil line. (Refer to TM 55-1520-228-23.)
14	Low oil pressure.	a. Low oil supply.	a. Check oil supply and refill as necessary.
		b. Oil leaks,	b. Check all piping and connections.
		c. Clogged oil filter.	c. Clean or replace oil filter. (Refer to para 5-25.)
		d. Oil pressure hose obstructed.	d. Clean or replace transmitter hose (Refer to TM 55-1520-228-23.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
14 (cont)		e. Gage indication inaccurate.	e. Check transmitter or indicator. Repair or replace if necessary. (Refer to TM 55-1520-228-23.)
		CAUTION **Do not attempt to adjust pressure regulating valve to compensate for step change in oil pressure. This condition indicates oil system problems other than the pressure regulating valve.**	
		f. Oil pressure not properly adjusted.	f. Adjust oil pressure regulating valve. (Refer to para 5-26.)
		g. Increase in oil pump internal clearances or sheared drive.	g. Replace engine. (Refer to TM 55-1520-228-23.)
		h. Oil contamination and foaming.	h. Drain oil and replace filter. (Refer to para 5-25.) Inspect magnetic chip detectors for metallic particles. (Refer to para 5-24.) Thoroughly flush with engine oil while motoring engine. Drain and refill with engine oil.
		i. Wear of filter housing due to vibration of filter inlet and filter bypass tubes.	i. Replace packings on the inlet and bypass tubes. Replace the filter housing as required. (Refer to para 5-27.)
15	High oil pressure.	a. Oil pressure gage and transmitter records inaccurately.	a. Check gage and transmitter.
		CAUTION **Do not attempt to adjust pressure regulating valve to compensate for step change in oil pressure. This condition indicates oil system problems other than the pressure regulating valve.**	
		b. Pressure regulating valve improperly adjusted.	b. Readjust oil pressure regulating valve. (Refer to para 5-26.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable Cause	Remedy
16	ENGINE OIL TEMPERATURE EXCEEDS 225° F (107°C) but remains less than 248°F (120°C) for a period not exceeding ten minutes WITHOUT ANY CHANGE IN NORMAL OIL PRESSURE.	Contaminated oil or oil cooler malfunction.	a. Drain and refill engine oil system. b. Inspect the magnetic drain plugs. c. Inspect oil filter and clean or replace as required. d. Check for carbon deposits (coking). e. Ground run engine for ten minutes. Obtain as high a power level as possible without lift-off (without exceeding maximum continuous rating). f. Reinspect the magnetic drain plugs. If the magnetic drain plugs are free of particles, reinspect after five hours of operation. g. If carbon particles are found, repeat the maintenance procedure.
17	IF ENGINE OIL TEMPERATURE EXCEEDS 225°F (107°C) but remains less than 248°F (120°C) for a period not exceeding 10 minutes WITH A CHANGE IN NORMAL OIL PRESSURE.	Contaminated oil or oil cooler malfunction.	a. Do not attempt to adjust the oil pressure regulating valve setting, replace the oil filter housing assembly. (Refer to paragraph 5-27.) b. Inspect and replace the oil filter. Check for carbon deposits (coking). c. Drain and refill engine oil system. d. Inspect magnetic drain plugs. e. Start engine and check oil pressure at 78.2% N_1 speed or above; if pressure is not within 90 to 130 psig, adjust oil pressure regulator valve as required. f. If correct oil pressure is obtained, perform steps d and e under ENGINE OIL TEMPERATURE EXCEEDS 225°F (107°C) WITHOUT ANY CHANGE IN NORMAL OIL PRESSURE. g. If correct oil pressure cannot be obtained by regulator valve adjustment, replace engine. (Refer to TM 55-1520-228-23.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable Cause	Remedy
18	OIL TEMPERATURE EXCEEDS 248°F 120°C) momentarily or 225°F (107°C) for a period exceeding 10 minutes.	Contaminated oil or oil cooler malfunction.	a. Test the engine oil temperature indicating system, m accordance with TM 55-l520-228-23. NOTE Check the engine oil cooler. b. Remove the engine oil temperature indicating system, in accordance with TM 55-1520-228-23. c. Tag the engine indicating that maximum allowable operating oil temperatures were exceeded. Give maximum temperate and elapsed time.
19	No response to oil pressure adjustment.	Defective pressure regulating valve.	Replace oil filter housing assembly. (Refer to paragraph 5-2.)
20	Oil consumption exceeds 0.05 gallon (0.19 litre or 6.5 oz) per hour, or 1 quart (0.9 litre) per five hours.	a. External oil leaks.	a. Check all fittings and connections.
		b. Oil leakage from power turbine oil bellows seal.	b. Replace engine. (Refer to TM 55-1520-228-23.)
		c. Leaking accessory oil seals as evidenced by oil draining from wee hole (on gas producer fuel control and power turbine governor) or from drain on fuel pump.	c. Replace defective seals. (Refer to paragraph 7-27.)
20.1	Oil Consumption exceeds one quart (0.9 litre) per hour.	a. Coking or carbon buildup in power turbine support.	a. Replace engine. (Refer to TM 55-1520-228-23.)
		b. Improper fit between power turbine inner and outer shafts.	b. Replace engine. (Refer to TM 55-1520-228-23.)
21	Oil spewing from diffuser vent orifice.	Orifice improperly sized.	Replace orifice with next smaller size. (Refer to paragraph 10-9.)
21.1	Oils wing at compressor bleed control valve.	No. 1 bearing seal failure.	Replace en inc. (Refer to TM 55-1520-228-23.)
22	Low power with high TOT.	a. Compressor foreign object damage. or excessive erosion.	a. Replace engine if damage exceeds limits. (Refer to paragraphs 7-9 or 7-l0.)
		b. Dirty Compressor.	b. Clean compressor. (Refer to paragraph 7-3.

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
22 (cont)		c. Compressor bleed valve has failed to close.	c(1). Check compressor discharge pressure sensing line for leaks and for security. c(2). Clean valve nozzle, filter, strainer and jet. (Refer to para 7-7.) c(3). Replace compressor bleed valve. (Refer to para 5-33.)
		d. Excessive air leaks.	d. Repair leaks.
		e. Leaking aircraft heat control valve.	e. Replace valve.
		f. Faulty TOT indicator.	f. Replace indicator. (Refer to TM 55-1520-228-23.)
		g. Faulty torquemeter indicating system.	g. Bleed gage line. Replace defective gage. (Refer to TM 55-1520-228 -23.)
		h. Anti-icing valve leaking,	h. Check linkage or replace valve. (Refer to para 5-32.)
		i. Leaking from deteriorated flexible portion of the aircraft heat tube assembly.	i. Replace tube assembly.
23	Low power with TOT below maximum limit.	a. Loose pneumatic tube fitting, cracked accumulator, or cracked pneumatic tube causing air leak in control system.	a. Pressurize the system to check for leaks. (Refer to para 5-8.)
		b. Gas producer control lever does not reach maximum speed adjustment stop.	b. Adjust linkage to the gas producer fuel control.
		c. Gas producer control lever maximum speed adjustment stop not properly set.	c. Correct the maximum speed adjustment setting. Adjust cw to increase N1 speed — one turn equals (approx.) 1%. (Refer to para 5-12.)
		d. Gas producer control calibration shifted.	d. Replace control. (Refer to para 5-12.)
		e. Fuel obstruction.	e. Check fuel system for obstruction. Flush/repair as necessary. (Refer to chapter 5.)
24	Low measured TOT at normal or high power.	a. Faulty TOT indicator.	a. Replace indicator. (Refer to TM 55-1520-228-23.)
		b. Loose thermocouple wire terminal.	b. Tighten terminal.
		c. Faulty TOT thermocouple assembly.	c. Replace engine. (Refer to TM 55-1520-228-23.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Prubable cause	Remedy
25	Engine N1 overspeed above maximum limits.	a. Faulty N1 tachometer, or indicator.	a. Replace tachometer generator or indicator. (Refer to TM 55-1520-228-23.)
		b. Gas producer fuel control not properly set.	b. Check position of max speed stop screw.
		c. Faulty gas producer fuel control.	c. Replace fuel control. (Refer to para 5-12.)
26	Engine N2 overspeeds.	a. Gas producer fuel control or power turbine governor linkage not properly set.	a. Check linkage for proper operation and adjustment. (Refer to para 5-12 and 5-13.)
		NOTE During ground run after overspeed incident, note the idle speed with the twist grip at 30 degree position. If idle speed is notmal, suspect the governor - if idle speed is high, suspect the gas producer fuel control as the family component.	
		b. Defective gas producer fuel control or power turbine governor.	b. Replace defective control or governor. (Refer to para 5-12 a 5-13).
		c. Faulty N2 tachometer, or indicator.	c. Replace tachometer generator or indicator. (Refer to TM 55-1520-228-23.)
27	Excessive echaust torching during start and transients.	a Fuel nozzle malfunction.	a. Replace fuel nozzle. (Refer to para 5-15.)
		b. Excessively rich gas producer fuel control.	b. Replace control. (Refer to para 5-12.)
		c. Leaking accessory bleed lines.	c. Repair or replace lines.
28	Slow to accelerate from idle to power.	a. Dirty compressor.	a. Clean Compressor. (Refer to para 7-3.)
		b. Foreign object damage; eroded blades, vanes, or plastic coating.	b(1). Replace the compressor case if damaged, or if erosion exceeds the acceptable limits. (Refer to Chapter 7.) b(2). If compressor assembly is damaged replace engine. (Refer to TM 55-1520-228-23.)
		c. Compressor case misaligned when installed.	c. If noise monitoring indicates rub, remove and reinstall the case. (Refer to para 8-2.)
		d. Loose pneumatic fittings.	d. Tighten a replace as required.
		e. Excessive generator load.	e. Reduce electrical load.
		f. Excessive compressor air leakage.	f. Check for leaks and repair.
		g. Bleed control valve malfunctioning.	g. Replace bleed control valve. (Refer to para 5-33.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
28 (cont)		h. Gas producer control acceleration schedule too lean.	h. Replace control. (Refer to para 5-12.)
		i. Excessive bypass flow from power turbine governor.	i. Replace governor. (Refer to para 5-13.)
		j. Dirty fuel control air circuit.	j. Replace fuel control. (Refer to para 5-12.)
29	Slow to accelerate to power while in flight.	a. Same as in preceding Trouble.	a. Correct as in preceding Trouble.
		b. Governor linkage incorrectly rigged.	b. Check rigging. Correct linkage as required. (Refer to para 5-13.)
30	TOT approximately 30°C lower than normal at idle.	Bleed control valve stuck closed.	Replace bleed control valve. (Refer to para 5-33.)
31	Engine power to the takeoff setting.	Aircraft gas producer linkage broken or disengaged.	Replace linkage or reconnect.
32	Compressor stall during starting or near idle speed. (Refer to TM 55-1520-228-10 for stall definition.)	a. Dirty compressor.	a. Clean compressor. (Refer to para 7-3.)
		b. Fuel nozzle has carbon buildup.	b. Inspect and clean fuel nozzle. (Refer to para 5-15)
		c. Bleed control valve stuck closed.	c. Replace bleed control valve. (Refer to para 5-33.)
		d. Excessively rich gas producer fuel control.	d. Replace gas producer fuel control. (Refer to para 5-12.)
33	Compressor stall during acceleration.	a. Fuel nozzle has carbon buildup.	a. Inspect and clean fuel nozzle. (Refer to pare 5-15)
		b. Bleed control valve has failed to open.	b. Replace bleed control valve. (Refer to para 5-33.)
		c. Excessively rich gas producer fuel control.	c. Replace gas producer fuel control. (Refer to para 5-12.)
		d. Compressor erosion.	d. Inspect compressor. Correct as required.
		e. Foreign object damage; eroded blades, vanes, or plastic coating.	e(1). Replace the compressor case if damaged, or if erosion exceeds the acceptable limits. (Refer to Chapter 7.)
			e(2). If compressor rotor assembly is damaged, replace engine. (Refer to TM 55-1520-228-23.)
		f. Compressor case misaligned when installed.	f. If noise monitoring indicates rub, remove and reinstall the case. (Refer to para 8-2.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
34	Compressor stall during low power operation.	a Fuel nozzle has carbon buildup.	a. Inspect and clean fuel nozzle. (Refer to para 5-15.)
		b. Bleed control valve has failed to open.	b. Replace bleed control valve. (Refer to para 5-33.)
		c. Foreign object damage; eroded blades, vanes, or plastic coating.	c(1). Replace the compressor case if damaged, or if erosion exceeds the acceptable limits. (Refer to Chapter 7.)
			c(2). If compressor rotor assembly is damaged, replace engine. (Refer to TM 55-1520-228-23.)
		d. Compressor case misaligned when installed.	d. If noise monitoring indicates rub, remove and reinstall the case. (Refer to para 8-2.)
35	Excessive fuel leaking from drains or weep holes.	a. Fuel pump drive shaft seal diaphragm ruptured or leaking.	a. Replace fuel pump. (Refer to para 5-9.)
		b. Gas producer fuel control failure.	b. Replace fuel control. (Refer to para 5-12.)
36	Faulty torquemeter indication.	a. Faulty torque indicating system.	a(1). Bleed air from line to gage.
			a(2). Replace gage. (Refer to TM 55-1520-228-23.)
			a(3). Clean or replace obstructed line to gage. (Refer to TM 55-1520-228-23.)
		b. Faulty engine torquemeter.	b. Replace engine. (Refer to TM 55-1520-228-23.)
37	Lack of anti-icing air.	a. Improper rigging.	a. Check rigging.
		b. Defective anti-icing air lines.	b. Check lines.
		c. Anti-icing air valve stuck closed.	c. Replace valve. (Refer to para 5-32.)
		d. Dirt collected in vane trailing Slot.	d. Remove anti-icing airlines at the compressor front support and blow through struts and out slots.
37.1	Severe N_1 oscillation (control system) at approximately the 40° throttle lever position.	PR-PG reset dump valve recycling.	Move throttle out of affected range.

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
38	Continuous exhaust smoking.	a. Compressor front bearing oil seal leaking.	a. Replace engine if oil consumption exceeds limit. (Refer to TM 55-1520-228-23.)
		b. Power turbine oil bellows seal leaking.	b. Replace engine.
		c. Internal turbine seals leaking.	c. Replace engine if oil consumption exceeds limit. (Refer to TM 55-1520-228-23.)
		d. Oil seepage past No. 5 bearing oil bellows seal into hot exhaust and collector.	d. After engine shutdown, check for puddling in bottom of exhaust collector. Replace engine if oil consumption exceeds limits. (Refer to TM 55-1520-228-23.)
		e. Residual oil in No. 6 and No. 7 bearing areas, depositing on hot turbine parts.	e. Replace engine. (Refer to TM 55-1520-228-23.)
		f. Oil leakage in aircraft scavenge oil check valve.	f. Replace scavenge oil check valve. (Refer to para 5-29.)
38.1	Heavy exhaust smoking.	Contamination or carbon buildup in the turbine.	Replace engine. (Refer to TM 55-1520-228-23.)
39	Compressor rear bearing labyrinth seal vent smoking.	Seal vent orifice improperly seated.	Replace vent orifice. (Refer to para 10-9.)
40	Exhaust smoking on shutdown or engine start. (Also refer to items 41 and 47.)	a. Turbine rear bearing sump and nut assembly leaking.	a. Replace engine if oil consumption exceeds limit. (Refer to TM 55-1520-228-23.)
		b. Faulty external oil check valve.	b. Clean valve (Refer to para 5-29.)
40.1	Exhaust smoking on shutdown, or engine start, accompanied by low power.	Excessive clearance of rotating knife seals located in No. 6 and No. 7 bearing areas.	Replace engine. (Refer to to TM 55-1520-228-23.)
41	Static oil leakage from burner drain valve. (Also refer to items 40 and 47.)	a. Faulty airframe check valve.	a. Replace valve. (Refer to TM 55-1520-228-23).
		b. Oil leakage from turbine or combustion section.	b(l). Remove and inspect the external check valve. (Refer to para 5-29.) b(2). Inspect for leakage from power turbine carbon face seal.

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
41.1	Exhaust duct emitting sparks.	a. Combustion liner damage.	a. Inspect, repair, replace combustion liner. (Refer to para 7-20.)
		b. Damage to turbine or compressor blade, vane, or seal.	b. Replace engine. (Refer to TM 55-1520-228-23.)
41.2	Excessive vibration.	a. Loose engine mounts.	a. Inspect, tighten mounts.
		b. Turbine wheel blade failure.	b. Replace engine. (Refer to TM 55-1520-228-23.)
		c. Foreign object damage, eroded vanes, blades, or plastic coating.	c. Replace engine. (Refer to TM 55-1520-228-23.)
		d. Bearing or lube oil pump failure.	d. Check magnetic inspection plugs for particles. If particles have accumulated, send engine for overhaul.
		e. Accessories failure, such as starter generator or fuel pump.	e. Replace accessory.
		f. Cause uncertain.	f. Replace engine if excessive vibration persists. (Refer to TM 55-1520-228-23.)
42	Deleted.		
43	Deleted.		
44	Deleted.		
45	After fire.	a. Oil leak.	a. See item 47.
		b. Burner drain valve line obstruction.	b. Check the drain lines. Clean or replace as necessary,
		c. Sticking burner drain valve.	c. Replace valve. (Refer to para 5-38.)
		d. Fuel nozzle valve stuck open.	d. Replace fuel nozzle. (Refer to para 5-15.)
		e. Gas producer fuel control cut-off valve not fully closed.	e. Check linkage or replace fuel control. (Refer to para 5-12.)
46	High temperature during shutdown. (Also refer to item 56.)	Fuel control shutoff valve not closed.	Check linkage to fuel control. Verify that twist grip was in the closed position.

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
47	Oil leakage during shutdown periods (smoking on shutdown.) (Also refer to items 40 and 41.)	a. Oil leakage from compressor forward bearing seal.	a. Replace engine. (Refer to TM 55-1520-228-23.)
		b. Oil leakage from turbine or combustion section.	b(1). Remove and inspect the external check valve. (Refer to para 5-29.) b(2). Inspect for leakage from power turbine carbon face seal.
48	Static oil leakage from power and accessory gearbox breather.	Internal check valve stuck.	(1). Clean or replace the internal check valve. (Refer to para 5-28.) (2). Remove filter housing and inspect housing and transfer tubes (2) mating surfaces. Check preformed packing on housing end of transfer tubes. Replace defective items. (Refer to para 5-27.)
49	Oil leaking from weep holes at gas producer fuel control and/or power turbine fuel governor.	Check engine oil seal.	Replace leaking seal. (Refer to para 7-27.)
50	Starter unable to rotate engine immediately after shutdown.	Turbine blade tip clearance.	If engine will rotate after cool-down, no corrective action required. If unable to rotate engine after cool-down, replace engine. (Refer to TM 55-1520-228-23.)
			CAUTION **Remove only one case half at a time. An alignment problem will be encountered if attempt is made to assemble both case halves at the same time.**
50.1	Starter unable to rotate engine (cold).	a. Binding of compressor.	a(1). Remove one compressor case half and determine if compressor rub is occurring because of accumulated dirt. Clean case halves. (Refer to para 7-5.) a(2). If compressor rub is caused by debonded plastic, replace compressor case halves. (Refer to para 8-2.)

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable cause	Remedy
50.1 (cont)		b. Deleted. c. Binding of gearbox.	b. Deleted. c. Replace engine. (Refer to TM 55-1520-228-23.)
51	Main rotor does not rotate by 30% N1.	a. Dirt or sand between fourth stage turbine wheel and shroud.	a. Blow out with compressed air.
		b. Turbine blade tip (N2) rub.	b. Shutdown. Repeat start procedure. If not rotating after third attempt, replace engine. (Refer to TM 55-1520-228-23.)
		c. Carbon formation around rotating labyrinth seals.	c. Shutdown. Ensure that the oil being used is MIL-L-7808F or G, or MIL-L-23699. Repeat start procedure. If not rotating after third attempt, replace engine. (Refer to TM 55-1520-228-23.)
52	Unable to obtain maximum N2 rpm.	a. Air leak in control air tubes.	a. Tighten tube fittings.
		b. Improper control rigging.	b. Check rigging.
		c. Faulty power turbine governor.	c. Replace governor. (Refer to para 5-13.)
		d. Fuel obstruction,	d. Inspect, flush and/or replace fuel lines in system. (Refer to Chapter 5.)
53	Engine tubing cracked or broken at the flare.	Excessive vibration.	Check the engine for possible vibration causes. (Refer to the vibration inspections in para 12-8.)
54	Power turbine governor and gas producer fuel control throttle shaft binding.	Corrosion buildup on shaft causing a tight fit in the throttle shaft bushing.	Apply (Item 36, Table 2-2) to the area shown in figure 4-3 and figure 4-4; a one second spray should be sufficient. Rotate shaft, back and forth, following spray to assure penetration. Repeat spray if necessary.
55	Power loss, N2 droop or flameout.	a. Improper rigging.	Refer to para 4-3.
		b. Cracks, scratches, and dents.	
		c. Improper sealing or sealing surfaces.	

Table 4-1. Troubleshooting (Continued)

Item	Trouble	Probable Cause	Remedy
56	Health Indicator Test (HIT)	a. Dirty compressor.	a. Clean compressor (Refer to Chapter 7.)
		b. Air leaks.	b. Check air tubing, connector, and heater hose. Make repairs as necessary.
		c. Compressor bleed air valve.	c. Replace compressor bleed air valve, if necessary. (Refer to paragraph 5-33.)
		d. FAT (Thermometer).	d. Replace thermometer if necessary. Refer to TM 55-1520-228-23.)
		e. TOT Indicator and System.	e. Make repairs, adjustments, or replacements as necessary. (Refer to TM 55-1520-228-23.)
		f. N_1, Tachometer and Generator.	f. Make repairs, adjustments, or replacements as necessary. (Refer to TM 55-1520-228-23.) (Refer to
		g. Dirty particle separator.	g. Clean particle separator. (Refer to TM 55-1520-228-23.)
		h. Hot start or faulty fuel nozzle spray pattern.	h.1. Perform hot end inspection. (Refer to Chapter 7.)
			h.2. Replace engine if necessary. (Refer to TM 55-1520-228-23.)
57	Bearing noise at compressor.	Bearing failure.	Replace engine. (Refer to TM 55-1520-228-23.)
58	Engine chip detector caution light illuminated.	Accumulation of engine metal.	Inspect magnetic chip detectors.
59	Engine undershoots ground idle setting during practice autorotation.	Dirty fuel control P_1-P_g valve.	Replace gas producer fuel control. (Refer to paragraph 5-12.)

4-2. Health Indicator Test (HIT).

The HIT is the method by which a pilot, in day-to-day flying,monitors the aircraft engine condition. This is accomplished by the pilot selecting an N_1 setting (%) based on the existing outside air temperature OAT) observed on the aircraft OAT gage. The TOT indicated at that N_1 setting must then relate to the indicted value (baseline TOT value) found on the HIT log. TOT variations from the baseline values are logged by the pilot on the appropriate HIT log. This log, is then used by maintenance personnel as an aid in monitoring engine health trend data.

CAUTION

Several readings less than the established baseline value minus indications) may be an indication of inaccuracies in the TOT, N_1, or OAT indicating systems or an erroneous baseline and should be investigated and corrected. (For example, a HIT indication of -15° could mean that the indicating systems may be displaying a lower value than the actual present value. Given this example, if the engine is operated at or near an N_1 or TOT limit, it may well be operating beyond limitations while indicating to the pilot operations within published limits.)

When a difference between an indicated TOT and baseline TOT is greater than ±20°C the pilot will make an entry on DA Form 2408-13 to notify the maintenance officer. A difference of ±40°C is cause for grounding the aircraft. Readings greater than the established baseline value (plus indications) are an indication of possible engine degradation, bleed air

problems, or an indicating system error. These conditions must be investigated and corrected before possible catastrophic degradation occurs. HIT checks which yield indications from 20-39 degrees variation from the baseline value do not immediately ground the aircraft. However, troubleshooting, diagnosis, and corrective action should be completed prior to further use of that aircraft for training/operations missions.

a. Establish new HIT Baseline TOT Values. New baseline values for HIT will be established when an engine has been replaced or when the airflow of an engine has been affected by any maintenance performed. Examples include:

(1) Replacement or repair of the compressor.

(2) Discharge tube/seals replacement.

(3) Installation of a new particle separator or replacement of swirl tubes.

(4) Replacement or repair of components in the combustion section to include liner, fuel nozzle, and thermocouple harness assembly.

NOTE

Prior to establishing new HIT Baseline Values, clean compressor and check the accuracy of the following instrument systems: TOT, OAT, and N_1.

NOTE

Under no circumstances will a new Baseline HIT be established without first successfully completing an Engine Performance Check and verifying proper engine operation/health.

NOTE

Perform HIT procedure with a fully charged electrical system. (Generator load less than 20 amps.)

(5) Perform normal engine run-up and cockpit procedures in accordance with the applicable -10 manual.

(6) Maintain N_2 at 100% and stabilize instruments.

(7) If generator load is greater than 20 amps, turn generator off.

(8) Turn off all bleed air.

(9) Turn aircraft into the wind and read free air temperature on cockpit OAT gage. If utilizing in-flight HIT checks fly straight and level 60 knots OGE and read free air temperature on cockpit OAT gage.

(10) Utilizing a blank HIT Baseline TOT worksheet, locate OAT in first column, nearest the free air temperature read on the cockpit OAT gage. Circle this OAT.

(11) Set N_1% at the value indicated in column two opposite this OAT. Allow TOT to stabilize.

(12) Read TOT from indicator. Record TOT beside the circled OAT.

(13) Apply the ΔTOT_A Correction Factor in column three adjacent to the circled OAT to indicated TOT and record the result in the open space in column four.

(14) Apply the ΔTOT_B Correction Factor in column five to the TOT in column four. Record results of calculations for each of the OAT/N_1 combinations shown in column six.

(15) Enter baseline information in the respective columns of the HIT TOT Log.

(16) The HIT TOT Log should be placed in the log book where pilots can utilize it in accordance with applicable - 10 manual directions. The HIT TOT Work Sheet should be retained with the engine Historical Records and discarded only after the completion of the next successive HIT TOT Baseline. The current HIT TOT Log and Work Sheet should accompany the Historical Records when the engine is removed for any reason.

b. Adjusting HIT TOT Baseline Values. Baseline TOT Values will be adjusted, rather than establishing a new baseline, when reverse flow fairings are removed/installed. An engine performance check is not required for a baseline adjustment.

(1) Perform three seccessive Health Indicator Test (HIT) Checks in accordance with HIT TOT Log instructions, immediately prior to and after reverse flow fairing inlet installation/removal.

(2) Adjust the baseline TOT values on the HIT TOT Log to reflect the difference in HIT.

(3) Check readings. For example:

(a) The HIT Check after installation of reverse flow fairings is three degrees C TOT higher than before the installation. Add three degrees to each of the Baseline TOT values of the original HIT Log and enter the adjusted TOT values on the Reverse Flow Inlet TOT Baseline Work Sheet.

c. Verification of Baseline HIT Values. When corrective action is taken to bring the HIT TOT Log values back in tolerance with Baseline TOT Values. I Refer to Table 4-1, Troubleshooting Procedure No. 56, Health Indicator Test (HIT)], verification of the Baseline TOT is required.

(1) Perform a normal HIT Check in accordance with instructions on the HIT Log.

(2) Compare actual HIT TOT value when Baseline HIT TOT value.

NOTE

If variations between actual TOT and Baseline TOT values are within acceptable tolerance. then the Baseline TOT Values are verified.

(3) If variations are not acceptable, perform an Engine Performance Check to ensure proper engine operation/health and establish a New Engine TOT Baseline.

HIT TOT WORKSHEET

Instructions to Maintenance Officer:

Aircraft S/N	______________
Engine S/N	______________
Aircraft Hrs	______________
Engine Hrs	______________

NOTE

HIT checks are performed with generator load less than 20 amps.

1. Maintain N2 at 100% and stabilize all instruments.
2. Face aircraft wind and turn off all bleed air.
3. Deleted.
4. With rotor turning, read free air temperature from cockpit OAT indicator.
5. Enter line 1 at OAT nearest free air temperature.
6. Set N1% at value indicated in line 2.
7. Read TOT from indicator.
8. Apply ΔTOT_A Correction Factor in line 3 to indicated TOT and record result in box in center of line 4.
9. Apply each of the ΔTOT_B Correction Factors in line 5 to the corrected TOT in line 4 and record the result in each of the blank spaces in line 6.
10. Enter Baseline information in the respective columns of the Engine HIT log.
11. Enter aircraft or engine hours and word "Baseline" in log section at bottom of Engine HIT Log.

Line 4: $\frac{TOT}{\theta}$ — (Record Corrected TOT here) →

1 OAT °C	2 N1%	3 ΔTOT_A	5 ΔTOT_B	6 Baseline TOT
-50	73.9	+188	188	
-48	74.2	+182	182	
-46	74.6	+176	176	
-44	74.9	+171	171	
-42	75.2	+165	165	
-40	75.6	+159	159	
-38	75.9	+153	153	
-36	76.2	+148	148	
-34	76.5	+142	142	
-32	76.8	+136	136	
-30	77.2	+130	130	
-28	77.5	+124	124	
-26	77.8	+119	119	
-24	78.1	+113	113	
-22	78.4	+107	107	
-20	78.7	+101	101	
-18	79.0	+95	95	
-16	79.4	+90	90	
-14	79.7	+84	84	
-12	80.0	+78	78	
-10	80.3	+72	72	
-8	80.6	+67	67	
-6	80.9	+61	61	
-4	81.2	+55	55	
-2	81.5	+49	49	
0	81.8	+43	43	
2	82.1	+38	38	
4	82.4	+32	32	
6	82.7	+26	26	
8	83.0	+20	20	
10	83.3	+15	-15	
12	83.6	+9	-9	
14	83.9	+3	-3	
15	84.0	+0	+0	
16	84.1	-3	+3	
18	84.4	-9	+9	
20	84.7	-15	+15	
22	85.0	-20	+20	
24	85.3	-26	+26	
26	85.6	-32	+32	
28	85.9	-38	+38	
30	86.2	-43	+43	
32	86.4	-49	+49	
34	86.7	-55	+55	
36	87.0	-61	+61	
38	87.3	-67	+67	
40	87.6	-72	+72	
42	87.8	-78	+78	
44	88.1	-84	+84	
46	88.4	-90	+90	
48	88.7	-95	+95	
50	89.0	-101	+101	

Figure 4-1. OH-58C HIT TOT Work Sheet.

OH-58C HIT TOT LOG

Aircraft S/N																									
OAT °C	-50	-48	-46	-44	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	-4	-2
N1%	73.9	74.2	74.6	74.9	75.2	75.6	75.9	76.2	76.5	76.8	77.2	77.5	77.8	78.1	78.4	78.7	79.0	79.4	79.7	80.0	80.3	80.6	80.9	81.2	81.5
Baseline TOT																									

Engine S/N																												
OAT °C	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46	48	50		
N1%	81.8	82.1	82.4	82.7	83.0	83.3	83.6	83.9	84.1	84.4	84.7	85.0	85.3	85.6	85.9	86.2	86.4	86.7	87.0	87.3	87.6	87.8	88.1	88.4	88.7	89.0		
Baseline TOT																												

Instructions.

NOTE

HIT checks are performed with generator load less than 20 amps.

1. Maintain N2 at 100% and stabilize all instruments.
2. Face aircraft into wind and turn off all bleed air.
3. Deleted.
4. With rotor turning, read free air temperature from cockpit OAT indicator.
5. EnterOAT line at value nearest to free air temperature read on OAT indicator.
6. Set N1 at value indicated in N1% line. Allow TOT to stabilize.
7. Read TOT from indicator.
8. Compare this TOT with value recorded in line labeled Baseline TOT and N1% utilized.
9. Record aircraft or engine hours and difference (±) between indicated TOT and Baseline TOT in log section below.
10. If difference between indicated TOT and Baseline TOT is: A. ± 20°C or greater - enter on DA Form 2408-13.
    B. ± 40°C or greater - Aircraft should not be flown until cause for excessive TOT is determined. Enter on DA 2408-13.

Acft or Eng Hrs (-13)	Difference from Baseline TOT(±)	Acft or Eng Hrs (-13)	Difference from Baseline TOT(±)	Acft or Eng Hrs (-13)	Difference from Baseline TOT(±)	Acft or Eng Hrs (-13)	Difference from Baseline TOT(±)	Acft or Eng Hrs (-13)	Difference from Baseline TOT(±)

Figure 4-2. OH-58C HIT TOT Log

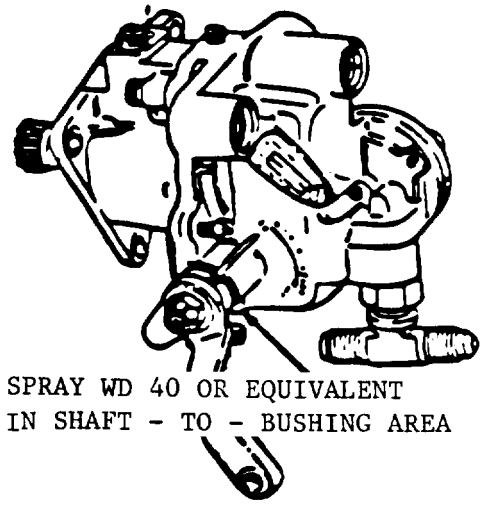


Figure 4-3 Bendix Governor

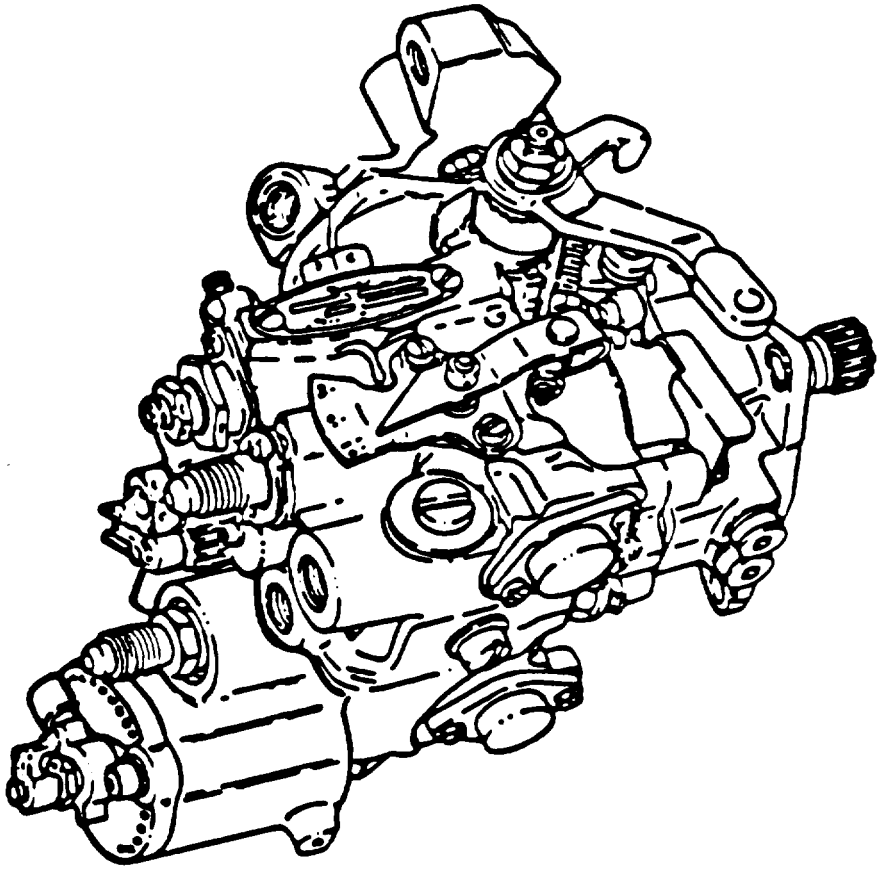


Figure 4-4. Bendix Fuel Control

4-3. Power Loss N_2 Droop or Flameout Parameter Maintenance Check Procedures.

Check maintenance procedures for OH-58 aircraft when a power loss, N_2 droop, or flameout occurs. N_2 droop may occur during a normal flight maneuver requiring a rapid increase in power (i.e., rapid collective and or tail rotor inputs, high G turn, steep turn). If N_2 droop occurs but low RPM warning is not activated and N_2 recovers to 100 percent on OH-58C, and further N_2 droop is not experienced, no maintenance action is required.

NOTE

For all maintenance actions notes below, pneumatic line fittings are to be torqued to specified values utilizing a torque wrench. All lines are to be installed so that there is no preload or deformation of the line in accordance with applicable TM's.

a. When a power loss, N2 droop, or flameout occurs (in parameters other than those established in paragraph above), check/inspect to determine the reason/reasons in accordance with the troubleshooting charts in table 4-1.

b. If a reason/reasons for power degradation cannot be established using the procedures specified in paragraph above, request assistance from AVIM Maintenance and proceed with the maintenance actions noted in paragraphs (1) through (5) below. If this is a second occurrence of power degradation on this aircraft/engine and the maintenance actions listed below have been complied within the last 100 flying hours, replace the engine.

(1) Check engine controls for proper rigging. Check throttle angle on fuel control at idle detent for the pilot's and co-pilot's twist grip. Maximum allowable variation between the pilot's and co-pilot's twist grip is 5/64-inch as measured on the fuel control sector. Re-rig controls if not within specifications per TM 55-1520-228-23 and per this TM for OH-58C aircraft.

(2) Remove engine fuel and pneumatic lines. Replace engine fuel filter P/N 6895177, NSN 2915-01-040-2607 on OH-58C aircraft. Inspect fittings and lines for cracks, scratches, dents and improper seating on sealing surfaces. Inspect lines and fittings for contamination. Clean all lines per applicable TM's. Inspect lines for chafing, check compressor bleed valve. Correct any discrepancies. Inspect and clean PC filter p/N 687458, NSN 2945-00-231-8065 (OH-58C only). On OH-58C replace fuel nozzle P/N 6890917, NSN 2915-01-039-4730 and check valve P/N 6895171, NSN 4820-01-045-0205. Reinstall pneumatic lines and filter. Leak check pneumatic system in accordance with TM 55-2840-241-23. Check comprssor bleed valve for proper operation.

(3) Remove all hoses, fittings and valves including fuel shutoff valve from the fuel boost pump to the engine. Clean and inspect all for damage and restrictions. Reinstall or replace as applicable. Bleed the fuel system in accordance with the appropriate TM. With aircraft fuel shutoff valve open, start boost pump and check all accessible fuel lines, connections, and fittings outside the fuel cell for leakage. Inspect and lubricate starter generator splines. Check calibration of dual tachometer (N_2 and rotor RPM).

(4) Check main and tail rotor systems for proper rigging and pitch angle, and re-rig as necessary.

(5) Start engine and perform deceleration check. If deceleration check is not in limits, replace fuel control P/N 6895672, NSN 2915-01-034-4671; N_2 governor P/N 6895673, NSN 2915-01-034-4317 and double check valve P/N 6876557, NSN 4820-01-047-2796 on OH-58C aircraft. Repeat deceleration check, if satisfactory, perform test flight in accordance with established procedures.

c. Aircraft are restricted from NOE contour, low level, and night flight for 10 hours after completion of the preceding procedures and must be flown at an altitude to allow safe autorotation as defined in TM 55-1520-228-10 or TM 55-1520-235-10 charts. After completion of the 10-hour restriction, repeat deceleration check. If satisfactory, perform test flight in accordance with established procedures. No further flight restrictions are imposed.

d. After completion of power loss, N_2 droop, or flame out parameter maintenance check procedures, make an entry on engine DA Form 2408-15 citing date the inspection was performed and engine hours at the time inspection was performed.

4-4. Engine Performance Check. See applicable aircraft Maintenance Test Flight Manual (MTF).

4-5. OH-58 T63-A-720 Engine Compressor Health Cheek Procedures.

a. General Information. The following procedures are to be used as a troubleshooting aid in determining compressor health when an engine fails the health check. A baseline is required with this procedure. Recommend that the baseline be done after the engine compressor health check. A new baseline will have to be established if the N_1 indicating system or the aircraft rigging has been changed or if a different gage is used.

CAUTION

Do not operate engine above idle speed with gage installed or damage to gage will result.

NOTE

Ensure engine de-ice and bleed air heater are off prior to performing check.

b. Compressor Health Check Procedure:

(1) Remove line from scroll to external P_C filter and replace with a locally manufactured line with a tee fitting designed to accommodate a 0-30 PSI pressure gage (figures 4-5 thru 4-6). Gage needs to withstand approximately 400°F.

(2) Start engine and stabilize at flight idle (62-64 percent).

(3) Record air pressure reading (approximately 15-16 psi for OH-58C).

(4) Compare gage reading with baseline reading.

(a) Readings 1 to 2 psi low indicate a slightly dirty or eroded compressor.

(b) Reading 1 1/2 to 3 1/2 psi low indicate a dirty or eroded compressor.

(c) Reading 3 1/2 psi or lower, check for compressor air leak or possible compressor erosion/damage

c. This check should be performed on a 500 hour interval and the results annotated on the 2408-19-1. Turbine Engine Analysis Check Record, along with the N_1 speed and the part and serial numbers of the gage used.

Subcomponents of P.C Gage Test Kit			
Item No	National Stock Number	Item Name and Part Number	Qty Req*
1	4730-00-013-6970	Elbow, Tube to Hose MS27060-4C (96906)	3
2	4730-00-889-2474	Adapter, Straight Tube MS27053-4C (96906)	3
3	4720-00-857-1732	Hose, Nonmetallic MIL-H-27267-4 (81349)	5 ft.
4	4730-00-804-9310	Tee, Tube MS24390-4 (96906)	1
5	4730-00-277-5736	Coupling, Pipe BF-4 (16166)	4
6	4730-00-266-0533	Adapter, Straight MS35869-22 (96906)	1
7	6685-00-088-1548	Gage, Pressure 047738 (61349)	1
*Quantity Required for Each End- Item/System			

Figure 4-5. Subcomponents of PC. Gage Test Kit.

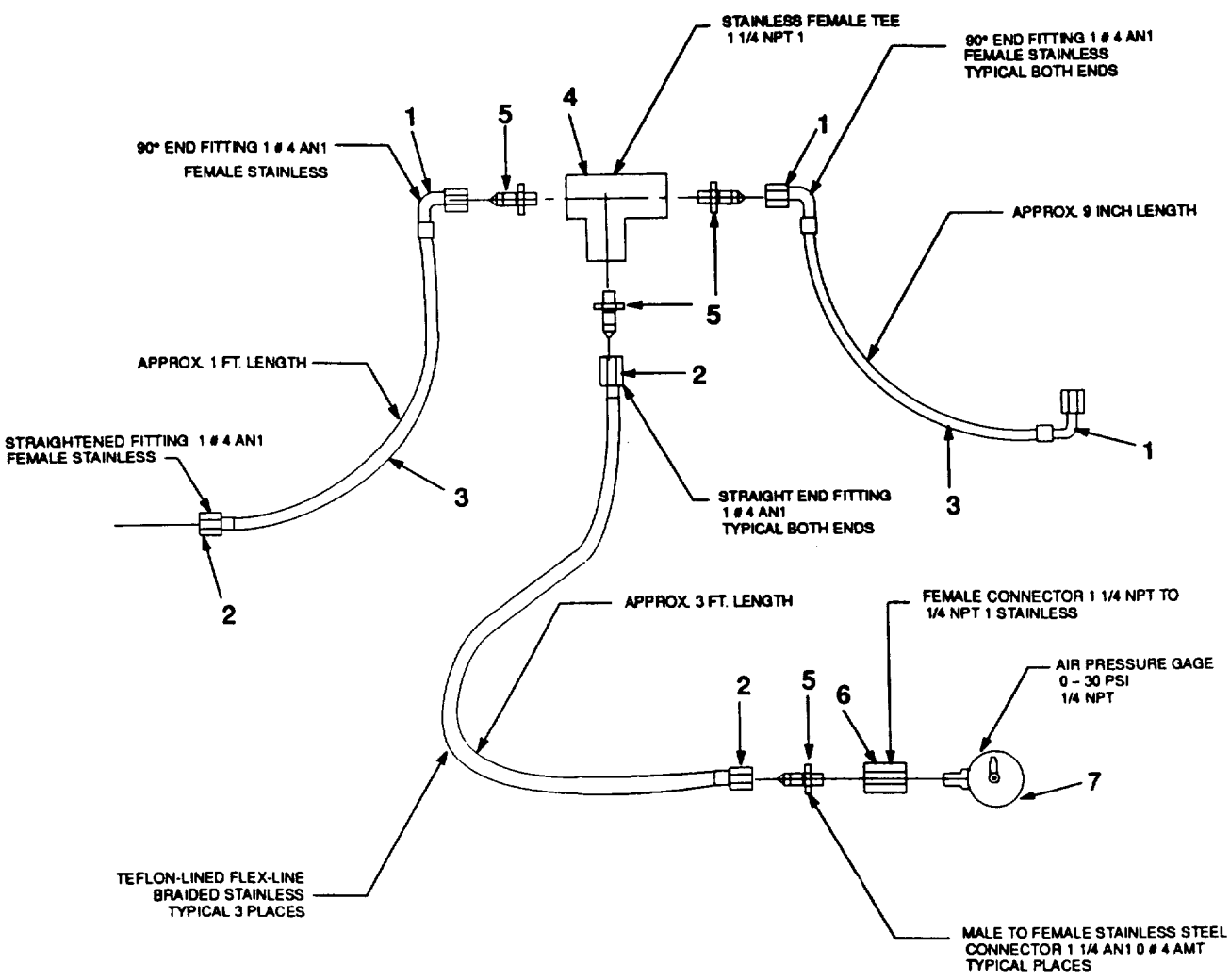


Figure 4-6. P.C. Gage Set-Up

CHAPTER 5

ACCESSORIES SERVICING

Section 1. GENERAL

5-1. Scope.

This section is intended to be used by Aviation Unit and Aviation Intermediate Maintenance personnel to perform accessories maintenance with maximum efficiency. Maintenance functions are grouped into sections by systems. Each section includes detailed instructions for removal, installation, adjustment, lubrication, and minor servicing of the individual components of the system.

5-2. General Practices and Precautions.

When performing maintenance on the engine. the following practices and precautions must be observed.

WARNING

Prolonged contact with lubricating oil, (item 7, table 2-2) may cause a skin rash. Those areas of skin and clothing that come into contact with lubricating oil should be thoroughly washed immediately. Areas in which lubricating oil is used should be adequately ventilated to keep mist and fumes to a minimum.

NOTE

Lubricating oil may soften paint upon contact. If lubricating oil is spilled on painted surfaces. these surfaces should be thoroughly washed.

a. Protect engine from dust and inclement weather. When possible, perform maintenance in a sheltered area.

b. On removal of engine components, exercise care to prevent dirt and other foreign matter from entering the engine. Caps, plugs, or temporary covers shall be used to close all openings. Do not use tape to cover fuel and oil openings. Tape adhesive is soluble in fuel or oil and can cause contamination.

c. When the gas producer fuel control power turbine governor, check valve, or accumulator are removed from the engine, use extreme care to prevent foreign materials from entering the pneumatic lines or the ports of the components.

d. Always use a backup wrench on fittings when removing or installing tubing.

e. Before removing ignition components. disconnect the input power lead at the ignition exciter.

f. Carefully inspect the condition of all replacement parts before installation.

g. Never attempt to rotate the gear trains and rotors using a speed wrench at the tachometer drive pads. Side loads on the speed wrench could crack the tachometer drive shaft. Rotate the gas producer gear train and rotor using the 6799790 turning adapter at the fuel control, fuel pump. starter generator, or spare accessory drive pad. Rotate the power turbine gear train and rotor using the 6799790 turning adapter at the power turbine governor drive pad.

5-3. Hardware.

Use 0.020 in. diameter stainless steel lockwire (item 10, table 2-21 where lockwire size is not specified. Double strand lockwire all drilled bolts, plugs, and screws. except those locked with self-locking nuts or lockwashers. Lockwire bolts in pairs where possible. When reassembling, be sure to safety wherever lockwire was removed.

CAUTION

To prevent possible failure, do not use zinc lockwire. Do not reuse lockwire, cotter pins, ring seals, lip seals, composition gaskets, and split or tab washers.

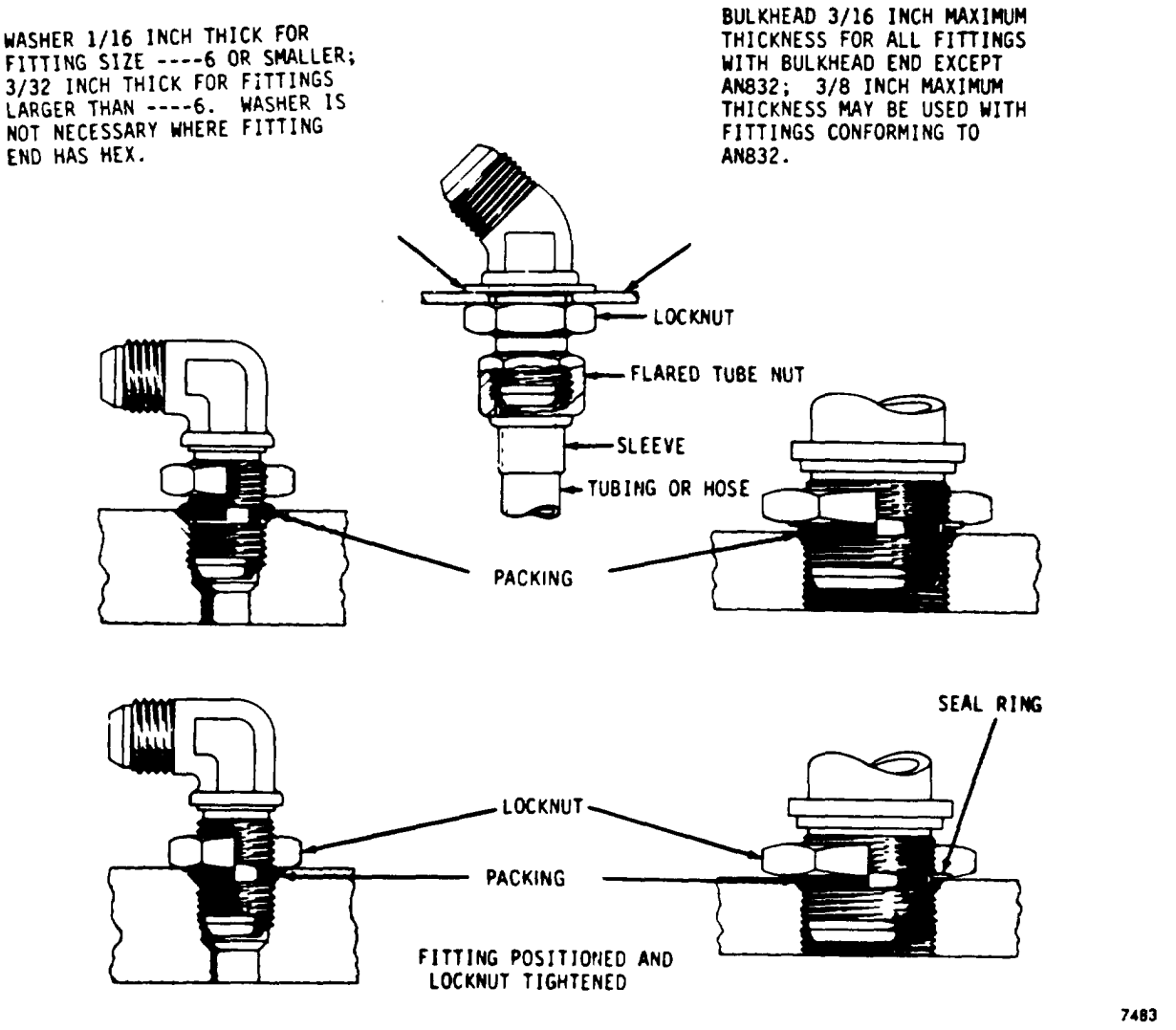


Figure 5-1. Universal Fittings

5-4. Universal Fittings.

a. Use this procedure to install universal fittings with backup rings. (see figure 5-1).

(1) Install the nut on the fitting and run it back until the counterbore of the nut aligns with the upper inner corner of the seal groove.

(2) Lubricate seals used on oil, anti-icing, and bleed air tube fittings with lubricating oil (item 7, table 2-2). Lubricate seals used on fuel tube fittings with lubricating oil (item 8,table 2-2). DO NOT lubricate seals used on fuel system control air tube fittings. Install the seal on the fitting.

(3) Work the backup ring into the counterore of the nut.

(4) Turn the nut down until the seal is pushed firmly against the lower threaded section of the fitting.

(5) Install the fitting into the boss, making certain the nut turns with the fitting, until the seal touches the boss. Then tighten the fitting one and one-half turns more.

(6) Put a wrench on the nut to prevent its turnning, and position the fitting by turning it not more than one turn.

(7) Hold the fitting in its position and tighten the nut against the boss.

b. Use this procedure to install universal fittings without backup rings. (See figure 5-1.)

(1) Run the nut on the fitting end back until the washer face is aligned with the upper inner comer of the seal groove.

(2) Lubricate seals used on oil, anti-icing, and bleed air tube fittings with lubricating oil (item 7, table 2-2). Lubricate seals used on fuel tube fittings with lubricating oil (item 8, table 2-2). DO NOT lubricate seals used on fuel system control air tube fittings. Place the seal in the seal groove.

(3) Screw the fitting into the boss until the seal barely touches the boss.

(4) Turn the fitting and nut together until the nut touches the boss.

(5) Put a wrench on the nut to prevent its turning, and position the fitting by turning it in up to 270° or unscrewing it up to 90°.

(6) Hold the fitting in its proper position and tighten the nut against the boss.

5-4.1. Airframe/Engine Interface Connection.

Refer to table 5-1 for the recommended torque values of airframe fittings installed into the engine at the airframe and engine interface.

Table 5-1. Recommended Torque for Airframe/ Engine Interface Connections.

Thread Size	Torque	
	lb in.	N m
().375-24	25-40	2.8-4.5
0.4375-20	40-65	4.5-7.3
0.500-20	60-80	6.8-9.0
0.750-16	150-200	17-23
0.875-14	200-350	23-40
1.0625-12	300-500	34-56

5-5. Rigid Tube Installation.

WARNING

Failure of engine pneumatic or fuel tubes due to faulty maintenance practice could cause flameout, power loss, or overspeed. The practice of tightening lock nuts with tube assemblies installed can cause tube damage and failure of the tube assembly.

a. Tube assemblies must fit and be aligned with the mating flare tube fittings to the degree that at both ends of the assembly the flares shall uniformly seat in a free state on the cones of the mating fittings. The fit shall be without distortion or stretching of the tube assembly and to the degree that the nuts can be fully engaged up to the final one-half turn with light finger pressure.

b. In the event a tube does not align with the mating fittings, reposition the mating fittings to the degree that proper alignment may be attained. Final tightening of these fittings must be accomplished before the tube assembly is connected.

c. If proper alignment cannot be attained by repositioning mating flare tube fittings, bend the tube sufficiently to provide alignment in the free state as specified. Accomplish all bending with the tube removed from the engine. Adjustment of the fit may be accomplished by bending by hand at principal bends. In the event the tube cannot be bent by hand, the tube must be clamped in a fixture or device which will not scratch, indent, crimp, or mark the surface of the tube during the bending operation. The flattened effect of the cross section of the tube as a result of the reforming operation must not exceed 15 percent of the tube OD.

d. When proper free-state alignment is attained complete the tubing installation by simultaneously securing the coupling nuts and tightening them to proper torque. Always use a backup wrench on the tube fittings when tightening the tube coupling nuts.

e. When a component to which rigid tube assemblies are attached is replaced, remove all interfering tube assemblies to permit easy removal and reinstallation of the component. This precaution will prevent subsequent damage to the tube assemblies.

WARNING

The fuel/air discharge is irritating and highly flammable. Mechanics must take suitable measures to protect their eyes and prevent fire. Aircraft must be properly grounded before working on the Fuel/air system.

WARNING

Failure to properly install, align, and tighten fuel fittings and tubes could result in an engine failure.

5-6. General.

Fuel system servicing includes removal and installation of the fuel pump, gas reducer fuel control, power turbine governor, fuel nozzle, and double check valve. In addition it includes fuel filter replacement, cleaning the fuel nozzle and adjusting the gas producer fuel control.

5-7. Bleeding the Fuel System.

Maintenance of the fuel system can result in air entrapment m the fuel, lines and subsequent false tarts. Following maintenance, purge the air from the fuel system as follows:

a. Disconnect the input lead to the ignition exciter.

b. Disconnect the fuel hose at the fuel nozzle and place the open end in a suitable container.

c. Loosen the line to the inlet side of the fuel check valve. Move the twist grip to the idle detent and motor engine until fuel appears at the inlet side of the check valve. Move the twist grip to the closed position. Reconnect the fuel line to the inlet side of the fuel check valve.

d. Move the twist grip to the idle detent and motor engine until a solid stream of the fuel flows from the disconnected fuel line. Move the twist grip to the closed position.

e. Reconnect the fuel hose to the fuel nozzle. Reconnect the input lead to the ignition exciter.

5-8. Fuel System Pneumatic Leak Check.

If any fuel system control air tubing (i.e., P_r, P_g, P_y or P_c from tee fitting on governor to fuel control) is removed or disturbed during maintenance, check the control air tubing or leaks as follows:

a. Disconnect the pressure sensing (P_c) line from the pressure probe elbow m the diffuser scroll.

b. Apply 50-80 psi filtered air or nitrogen to the P_c line. Ai will immediately escape from the pressure regulating air valve port on the power turbine governor.

c. Use a liquid soap solution item 1 table 2-2) to check the air tubes for leakage. Cover and parting surfaces on the fuel control and governor which produce a slight bubbling of power soap solution do not represent a leak of sufficient magnitude to warrant concem.. These leaks were present during original calibration and were compensated for at that time.

d. Reduce the pressure to 20-22 psi (0.14-1.54 kg sqcm) and check the governor diaphragm for leakage. No leakage is acceptable. If leakage is noted from the governor diaphragm, remove the safe wire from the screws, back off screws and then torque to 8-11 inch lbs. Let screws rest for 20 minutes and retorque to same value. If after this is completed, the governor diaphragm still leaks, replace governor.

e. Reconnect the P_c tube. Tighten coupling nuts to 80-120 in. lb. Hold the P_c filter whale tightening the couplingnut. During aircraft run UP, use the soap solution to verify no leakage around the-reconnected P_c line prior to fight. Rinse the soap and water solution from the engine after the check is completed.

5-9. Fuel Pump.

a. Removal.

(1) Disconnect the before-filter and after-filter pressure lines (25 and 27, figure 5-2) and the seal drain line (26) from the fuel pump (24).

(2). Disconnect the fuel supply hose at pump relet (23).

(3) Remove fuel tubes (3 and 4) between the fuel urn and control. It will not be necessary tools disturb the clamping arrangement between the tubes.

(4) Remove the three self-locking nuts 29, figure 5-3) and washers (30) which secure the fuel pump (31) to the gearbox. Remove the pump from the mounting studs.

5 Remove and discard mounting flange gasket (32) and preformed packing (33).

(6) If a new pump is to be installed, remove the tube fittings and keep them for installation in the new pump. Discard preformed packing.

b. Installation.

(1) If a new pump is to be installed, transfer the tube fitting from the removed pump to the new pump. Use new preformed packings lubricated with oil (item 8, table 2-2). Tighten fittings in the inlet, discharge and bypass ports to 75-100 in. lb. Tighten fittings in the before-filter, after-filter, an seal drain ports to 55-80 in. lb.

(2) Lubricate new preformed packing (33, figure 5-3 with oil (item 7 or 8, table 2-2) and install on the pump drive.

(3) Coat fuel pump drives lines with lubricating oil (item 7, table 2-2).

(4) Install the pump with new gasket (32) on the mounting pads studs.

5) Secure the pump with three washers (30\ and self-locking nuts (29). lighten the nuts to 70-85 in. lb.

(6) Install fuel tubes (3 and 4, figure 5-2) between the fuel pump and control. Tighten the tube coupling nuts to 150-200 in. lb.

(7) Connect the fuel supply hose at the urn inlet (23). Tighten coupling nut to 150-200 in. lb.

(8) Connect the before-filter, after-filter, and seal dram (25, 26 and 27) hoses. Tighten coupling nuts to 80-120 in. lb.

(9) Bleed fuel system. (Refer to paragraph 5-7.)

NOTE

On the first start after the fuel pump has been changed, return the gas producer level to fuel cut-off and motor the engine for about 10 seconds if a false start occurs or if a start is not completed within 45 seconds.

c. Testing. Following installation of the fuel pump, test the engine as outlined in Chapter

5-10. Fuel Filter.

WARNING

The fuel/air discharge is irritating and highly flammable. Mechanics must take suitable measures to protect their eyes and prevent fire.

The fuel filter is a 5-micron nominal, 15 micron absolute, paper element located inside the fuel pump. It is retained by a flanged cover on the rear of the pump. Replace the element as follows:

CAUTION

When there is evidence that fuel filter bypassing has occured, the fuel filter in the gas produced fuel control must also be cleaned or replaced. Contamination will be evident due to the fuel pump filter being by-passed (Refer to paragraph 5-12j.)

a. Place a container under the pump assembly as some fuel spillage is likely. Remove the two screws (1, figure 5-4) and washers (2) retaining the cover (4) to the housing.

b. Remove the cover and element (6). Discard preformed packings (5,7) and the contaminated filter element. If the element is a tight fit, remove by pulling straight out. Twisting may cause the element end cap to tear off.

c. Clean the filter cover with a ray of solvent (item 3, table 2-2) or with a cl-soaked cloth.

d. Be sure the element preformed packing (7) is in place then install the element (6) in the housing. Install the cover with new preformed packing (5). Tighten cover screws (1) to 95-105 in. lb.

NOTE

Lockwire is not required if filter cover screws are retained by self locking inserts.

e. Puree as follows:

WARNING

The fuel/air discharge is irritating and highly flammable. Mechanics must take suitable measures to protect their eyes and prevent fire. protect their eyes and prevent fire. plug (figure 5-4, item 3.)

(1) Remove the safety wire from the upper bleed port plug (figure 5-4, item 3.)

(2) Provide a shop rag to deflect the fuel spray.

(3) Turn on the aircraft boost pump.

(4) Loosen the upperdrain port plug (6) (approximately 1/2 turn) until a solid stream of fuel is emitted and then retighten to 34-45 in. lbs.

(5) Turn off the fuel pump.

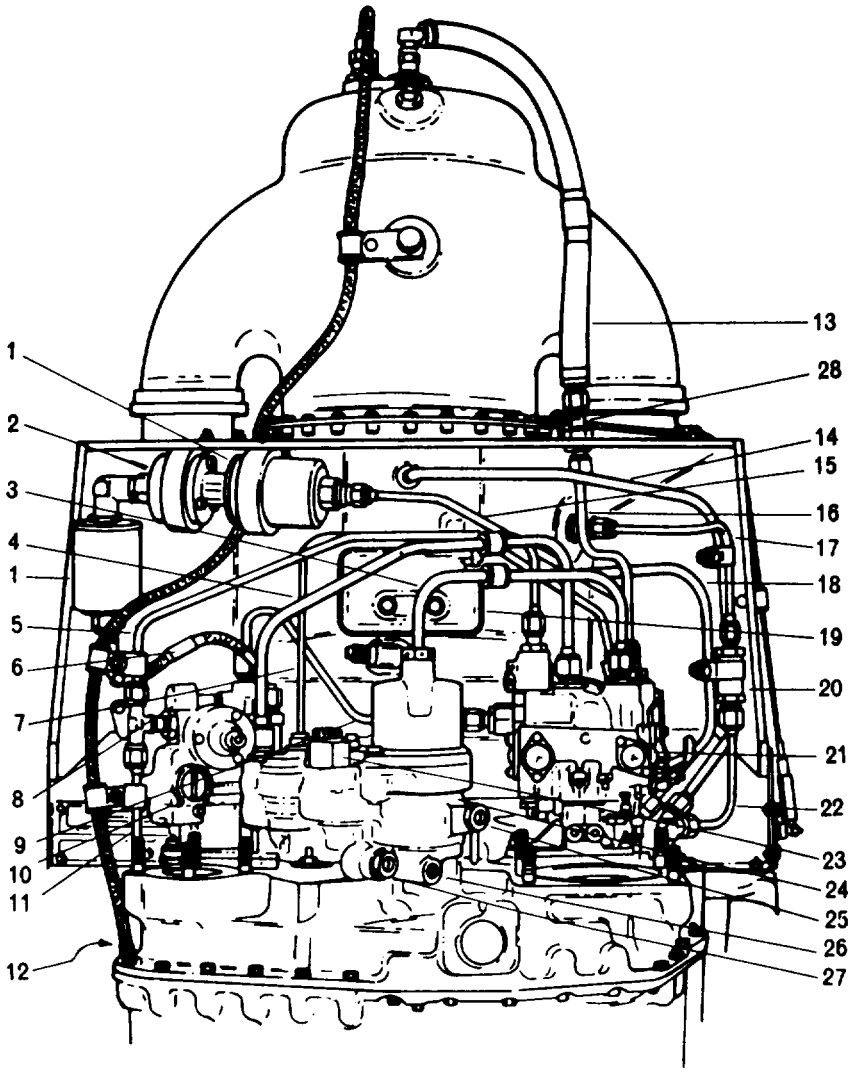
(6) Remove any fuel that may have been spilled in the engine compartment and re-safety the upper bleed port.

5-11. P_C Filter.

a. Removal.

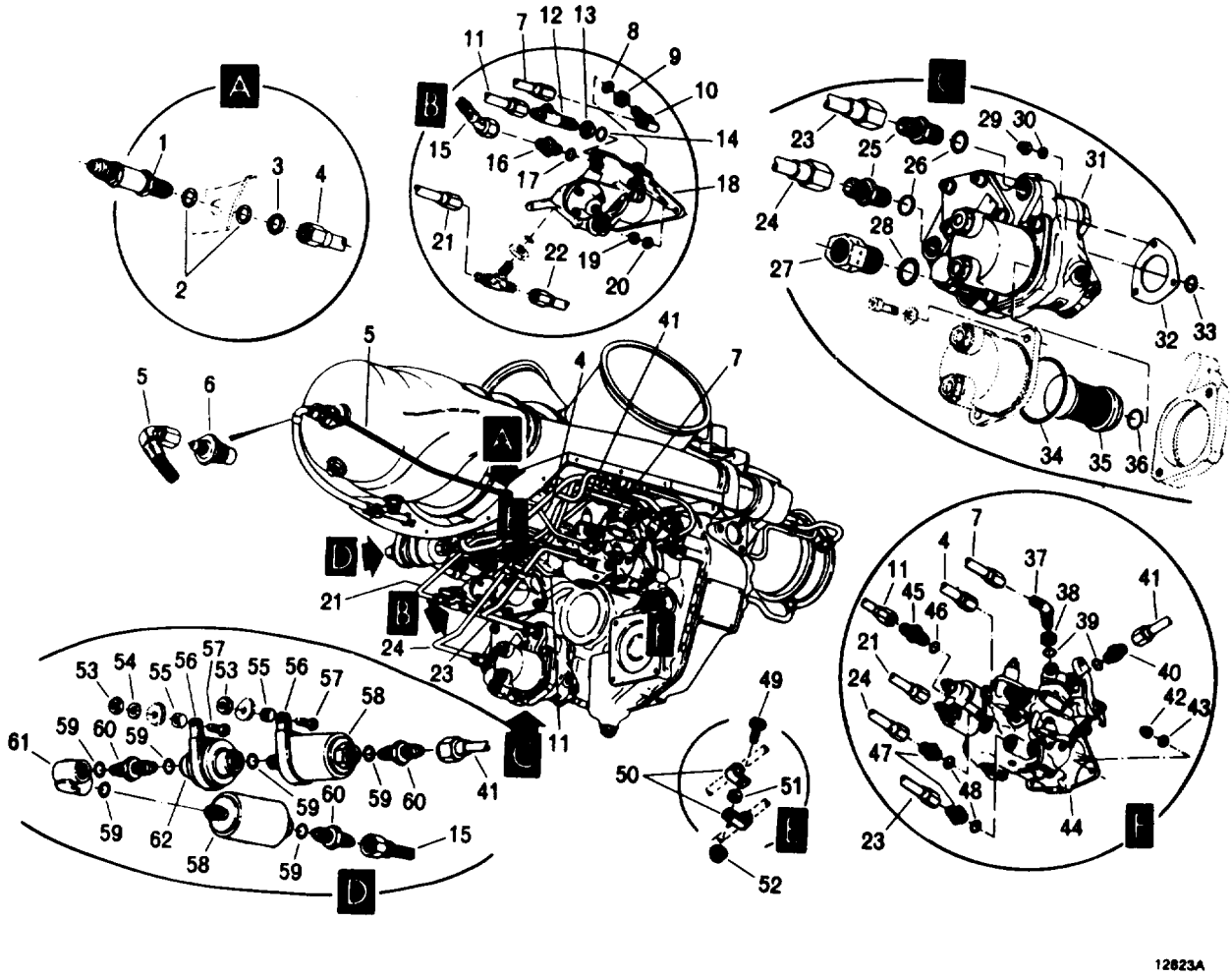
(1) Disconnect air tubes (22, 78, figure 5-3) from both ends of filter (69). Hold the falter while loosening the coupling nuts.

(2) Remove nut (64) and bolt (63) securing falter clamp (65) to filter mounting bracket. Remove the filter and separate the clamp from the filter.



1. Pg accumulator (2)
2. Double check valve
3. Fuel control-to-pump fuel tube
4. Pump-to-control fuel tube
5. Governor-to-fuel control air tube
6. Governor-to. accumulator air hose
7. Fuel control-to-regulator air tube
8. Py accumulator
9. Control-to-governor Py air tube
10. Power turbine governor
11. Pc filter-to-governor air tube
12. Pc air filter
13. Firewall shield-to-fuel nozzle fuel hose
14. Gasifier turbine scavenge oil tube
15. Fuel control-to-accumulator air tube
16. Fuel control-to-firewall shield fuel tube
17. Check valve-to-firewall shield pressure oil tube
18. External sump scavenge oil tube
19. External scavenge oil sump
20. Lube oil check valve
21. Gas producer fuel control
22. Gearbox-to-check valve pressure oil tube
23. Fuel supply inlet port
24. Fuel pump
25. After-filter pressure port
26. Fuel pump seal drain
27. Before-filter pressure port
28. Fuel check valve

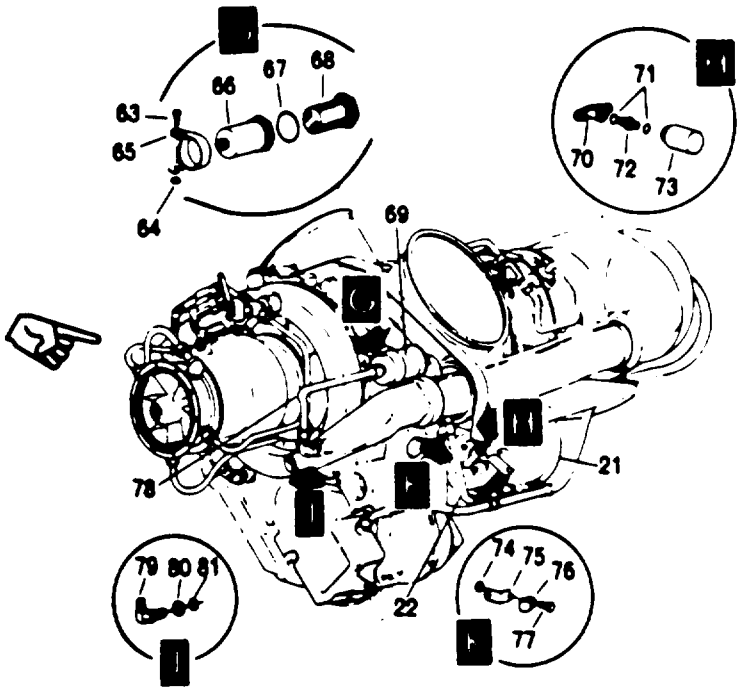
Figure 5-2. Fuel, Oil, and Air Tubing



1. Fuel check valve
2. Washer (2)
3. Nut
4. Fuel control-to-firewall shield tube
5. Firewall shield-to-fuel nozzle hose
6. Fuel nozzle
7. Fuel control-to-governor tube
8. Reformed packing
9. Nut
10. Elbow
11. Fuel control-to-governor Py tube
12. Tee
13. Nut
14. Preformed packing
15. Accumulator-to-governor hose
16. Reducer
17. Preformed packing
18. Governor
19. Nut (3)
20. Washer (3)
21. Governor-to-fuel control tube
22. Pc filter-to-governor tube
23. Fuel control-to-pump tube
24. Fuel pump-to-fuel control tube
25. Union (2)
26. Preformed packing
27. Bushing
28. Preformed packing

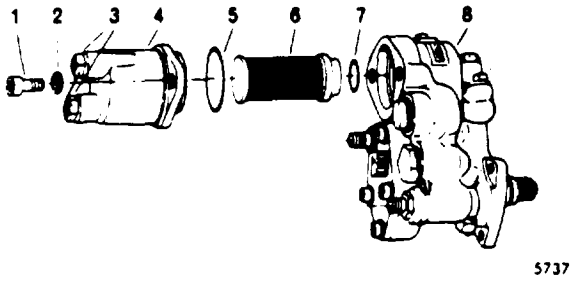
Figure 5-3. Fuel System Components
(Sheet 1 of 2)

29. Nut (3)
30. Washer (3)
31. Fuel pump
32. Gasket
33. Preformed packing
34. Preformed packing
35. Filter element
36. O-ring
37. Elbow
38. Nut
39. Preformed packing
40. Union
41. Fuel control-to-accumulator tube
42. Nut (3)
43. Washer (3)
44. Fuel control
45. Union
46. Preformed packing
47. Union (2)
48. Preformed packing (2)
49. Bolt
50. Clamp (2)
51. Spacer
52. Nut
53. Nut (2)
54. Washer
55. Spacer (2)
56. Clamp (2)
57. Bolt (2)
58. Accumulator (2)
59. Preformed packing
60. Union (3)
61. Elbow
62. Double check valve
63. Bolt
64. Nut
65. Clamp
66. Housing
67. Metallic O-ring seal
68. Filter element
69. Pc filter
70. Tee
71. Preformed packing
72. Union



73. Accumulator (0.7 cubic in.)
74. Nut
75. Bracket
76. Clamp
77. Bolt
78. Scroll-to-Pc filter tube
79. Pressure probe elbow
80. Nut
81. Preformed packing

Figure 5-3. Fuel System Components
(Sheet 2 of 2)



1. Screw (2)
2. Washer (2)
3. Plug (2)
4. Filter cover
5. Preformed packing
6. Filter element
7. Preformed packing
8. Fuel pump

Figure 5-4. Fuel Filter Replacement

b. Disassembly. Remove lockwire and separate filter element (68) and metallic O-ring seal (67) from filter housing (66). When a vise is used in [he disassembly, place the element hex (68) in the vise and usc the wrench on the hex of housing (66).

c. Cleaning. Clean the filter assembly (68) ultrasonically if equipment is available. If ultrasonic equipment is not available, clean the filter as follows:

(1) Cap the outlet fitting of the filter element with a clean metal cap (AN 820-4 or equivalent).

(2) Wash the filter assembly with solvent and a soft bristle brush.

(3) Dry the filter element with the metal cap removed. Use low pressure air directed from the outside to the inside of the element.

CAUTION

Do not use a cloth to dry the filter element. Lint from cloth could cause contamination.

d. Inspection. Inspect the filter assembly for dirt or damage. Replace unserviceable filters.

e. Assembly. Apply high temperature lubricant (item 14, table 2-2) lightly to the element (68) threads. Assemble the metallic O-ring seal (67) and housing (66) over the filter element. Tighten to 60-65 in. lb. and secure with lockwire.

f. Installation.

(1) Assemble clamp (65) on filter (69) and secure it to the filter mounting bracket with bolt (63) and nut (64). Tighten nut to 35-40 in lb. Check to ensure that the arrow on the filter is pointing rearward.

(2) Attach air tubes (22, 78) on both ends of the filter. Hold the filter while tightening the coupling nuts to 80-120 in. lb.

5-12. Gas Producer Fuel Control.

a. Removal.

NOTE

Before replacing the fuel control to correct an engine malfunction, ensure that the pneumatic tubes and fittings are not leaking and that the double check valve is functioning properly. A malfunction which appears to be a fuel control malfunction may be caused by erroneous pressures.

(1) Remove the self-locking nut and remove the lever from the fuel control.

(2) Remove fuel tubes (3 and 4, figure 5-2) between the fuel pump (24) and control (21). It will not be necessary to disturb the clamping arrangement between the tubes.

(3) Remove the fuel tube (16) between the control and fireshield.

(4) Remove air tube (5) between the control and governor.

(5) Remove air tube (7) between the control and governor.

(6) Remove air tube (15) between the control and accumulator.

(7) Remove air tube (9) between the control and governor.

(8) Remove three self-locking nuts and washers (42 and 43, figure 5-3) which secure the control to the gearbox. Carefully remove the control from the mounting studs.

b. Deleted.

c. Installation.

CAUTION

When removing or installing fittings in the fuel control, be careful not to cause a load on the drive shaft. Damage to the fuel control could occure.

(1) If a new fuel control is to be installed, transfer the tube fittings from the removed control to the new control. Use new preformed packing. Lubricate preformed packing on fuel tube fittings with oil (item 8, table 2-2). Do not lubricate preformed packing on air tube fittings. Tighten the unions to 75-110 in. lb. Do not tighten jam nuts.

(2) Check the max flow stop setting and adjust if required. (Refer to paragraph 5-12h.)

(3) Coat the fuel control drive shaft splines with lubricant (item 14, table 2-2), the studs with anti-seize compound (item 15, table 2-2), and fuel tube fittings with oil (item 8, table 2-2).

(4) Install the fuel control on the mounting pad studs. Make certain the fuel control drive splines are properly engaged in the gearbox drive splines; the fuel control must be flush against the gearbox mounting pad. Secure the control with three washers (43, figure 5-3) and self-locking nuts (42). Tighten the nuts to 70-85 in. lb.

(5) Install air tube (9, figure 5-2) between the fuel control and governor. Tighten coupling nuts to 80-120 in. lb.

(6) Install air tube (15) between the control and accumulator. Tighten coupling nuts to 80-120 in. lb. Tighten the jam nut on the tube fitting to 55-80 in. lb.

(7) Install air tube (7) between the control and governor. Tighten coupling nuts to 80-120 in. lb. Tighten the jam nut on the tube fitting to 55-80 in. lb.

(8) Install fuel tube (16) between the control and fireshield. Tighten coupling nuts to 80-120 in. lb,

(9) Install air tube (5) between the control and governor. Tighten coupling nuts to 80-120 in. lb.

(10) Install fuel tubes (3 and 4) between the fuel pump and control. Tighten coupling nuts to 150-200 in. lb.

(11) Assemble the lever on the control and secure with a self-locking nut. Position the lever in accordance with the Rigging Check. (Refer to paragraphs 5-12d.) Tighten the nut to 40-50 in. lb. (Overtorquing causes binding of the lever shaft.)

(12) Check the pneumatic tubes for leaks. (Refer to paragraph 5-8.)

(13) Bleed the fuel system. (Refer to paragraph 5-7.)

(14) Test the engine as outlined in Chapter 10 and make the following adjustments if required.

(a) Idle speed. (Refer to paragraph 5-12e.)

(b) Start derichment. (Refer to paragraph 5-12g.)

(c) Start acceleration - AVIM. (Refer to paragraph 5-12g.)

(15) Make appropriate entry relative to fuel control replacement in the engine log.

d. Rigging Check.

CAUTION

Do not adjust the minimum stop to compensate for aircraft rigging difficulties. The minimum stop is set on a flow bench and is not a field adjustment.

NOTE

For N1 rigging procedures, refer to TM 55-1520-228-23.

Check the rigging of the gas producer fuel control after a deceleration check has revealed the deceleration time to be less than the allowable minimum. This check is also required after installation of a fuel control or any component of the rigging system. Make the rigging check with the engine shut down using the following procedure.

(1) Check to ensure that sufficient travel is provided to allow physical contact with the gas producer minimum stop at or before the full closed position of the twist grip.

(2) Check the travel to the opposite end. Physical contact must be made with the gas producer maximum stop at or before the full open position of the twist grip.

(3) Looseness encountered in the rigging must be minimized by replacement of worn items and/or accuracy of the rigging. Looseness that cannot be removed must be within the limits indicated in figure 5-5. Check the looseness as follows:

(a) Start with the twist grip at the full open position then rotate the grip to the IDLE position. The pointer must beat the 30 degree mark.

NOTE

The pointer must be exactly at the 30 degree mark for initial rigging setup or when rigging is being adjusted.

(b) Start with the twist grip at the full closed position then rotate the grip to the IDLE position. The pointer must be no more than 5/64 in. below the 30 degree mark.

NOTE

Make rigging adjustments using the pilot's twist grip. If the copilot's collective is installed recheck the linkage movement using the copilots twist grip. The pointer in IDLE position. using the copilots twist grip. must be within 5 64 inch of the 30 position from within the full open or full closed position and idle speed must be no lower than idle speed obtained using the pilot's twist grip.

NOTE

Dual control installation requires an idle speed check from the copilot's side also. Idle speed must repeat every time.

NOTE

Perform the entire idle speed check whenever fuel control rigging or idle speed is adjusted.

e. Idle Speed Check. Roll twist grip to full open position then to idle detent, Mark (pencil) the precise position of pointer tip on the fuel control quadrant with twist grip in IDLE position. Release the idle detent on twist grip. Very slowly roll twist grip in direction of cut off just enough to obtain perceptible movement of pointer tip (approximately the width of the pencil mark). Index the twist grip at this position. Very slowly roll the twist grip in the direction of increased power from IDLE position just enough to obtain perceptible movement of the pointer tip (approximately the width of the pencil mark I. Index the twist grip at this position. Move the pointer to exactly the 30 degree mark, Index the twist grip at this position. Start the engine and let N1 stabilize in IDLE position. Very slowly roll the twist grip to index mark in direction of cutoff. If N1 idle speed decreases take the following corrective action.

(1) If the pointer is at or above the 30 degree mark, rerig aircraft linkage to move pointer tip to a point just below 30 degree mark.

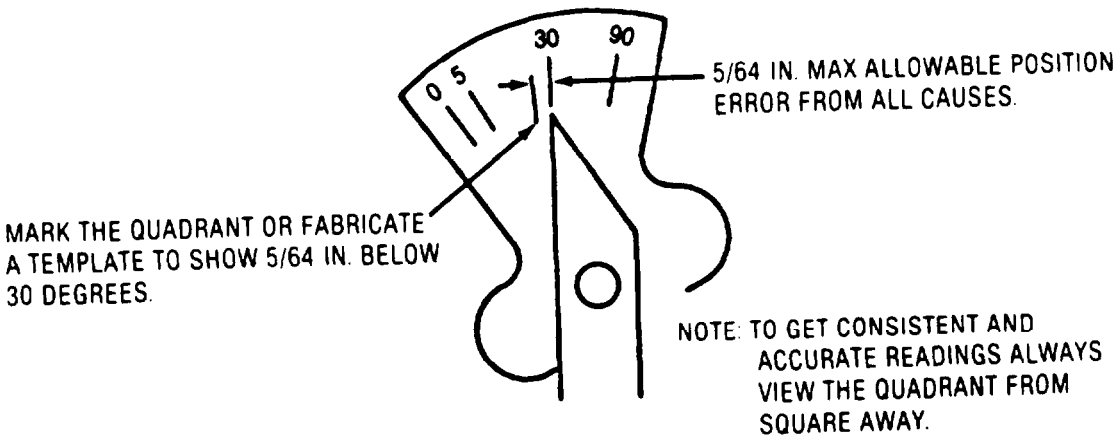


Figure 5-5. Fuel Control Quadrant and Pointer

(2) If pointer is more than 5/64 in. (2.0 mm) below 30 degree mark, rerig aircraft linkage to move pointer closer to the 30 degree mark.

(3) If N1 idle speed did not change, very slowly roll the twist grip to index mark in the direction of increased power. No increase in N1 speed is permitted before fuel control pointer indicates 30 degree as indicated on twist grip index mark.

(4) When the rigging is correct, change the idle speed adjustment screw to obtain a 62-64% N 1 speed adjustment with generator switch off. Set the idle speed at approximately 63% N1 to allow for seasonal temperature changes. (See figure 5-6). Using wrench 6798292, turn the screw counterclockwise to decrease N1 speed. A 1/8 turn adjustment changes engine speed approximately 5%. If Nl speed does not respond to the idle speed screw adjustment, the rigging is establishing idle speed. Rerig is required. If N1 speed does respond to the idle speed screw, make the 62-64% N1 speed setting. An engine performance check is not required if the rigging has not been adjusted.

f. Maximum Speed Stop. (See figure 5-6.) Adjust screw clockwise to increase or counterclockwise to decrease N1 speed. Do not exceed 105% N1. Check rigging to assure arm contacts max speed stop with twist grip (both sticks).

NOTE

Maximum speed stop screw should be turned in increments of one turn maximum One turn equals approximately l% N1 speed.

NOTE

If the allowable limit of one of the three main indicators (torque, temperature or N1 speed) cannot be reached in flight. readjust the max speed stop screw. Do not exceed existing torque. temperature or N1 limits.

NOTE

An engine performance check is required after adjusting maximum speed stop screw (refer to applicable Aircraft Maintenance Test Flight Manual). An EPC is required after adjustlng max speed stop screw or adjustment of fuel control rigging.

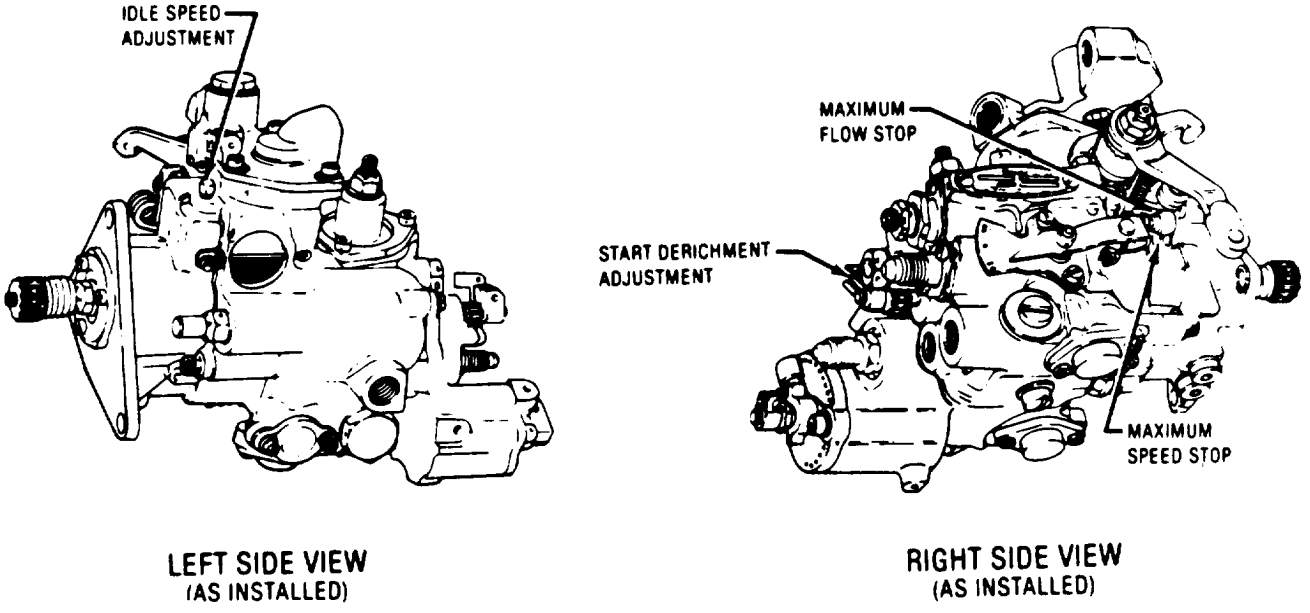


Figure 5-6. Gas Producer Fuel Control Adjustments

g. Engine Starting Characteristics Adjustments. (Refer to fig. 5-6.1). There are two fuel control adjustments which can be used to change the starting characteristics of the engine. These adjustments are a starting derichment adjustment in addition to a start acceleration adjustment, which is on some engines. The conditions, which can be improved by these adjustments, are indicated in Table 5-1.

(1) Start-Derichment Adjustment. (Refer to fig. 5-6.1). The start-derichment (derich) adjustment can be used to correct lean (slow) start or rich (hot) start conditions. This adjustment is effective below 33% Nl speed. For slow starts at Nl speeds between 35% and 55% Nl speed, refer to Start/Acceleration Fuel Flow Adjustment, subparagraph (2). (Refer to table 5-l).

NOTE

The start derichment adjustment on the latest modified fuel control has a wider angular range than earlier models (200° in Place of 100°). Neutral position for the latest control is 7 dots/70° from the counterclockwise stop. Neutral on controls prior to this is a 4 dots/40° counterclockwise. The effective start derichment speed range is between 20% and 33% N1. Also, turning the adjustment to the clockwise stop closes the Py vent which deactivates the start derichment.

NOTE

To accurately determine the proper adjustment, conditions under which the adjustments are made should be consistent, i.e., a fully charged aircraft battery, the same residual TOT and the same lightoff speed.

(a) For low temperature with slow starts at 20-33% N1 speed, adjust the start-derichment as follows:

1 Remove lockwire securing adjustment locknut to Pc filter-fitting.

CAUTION

Do not disturb the pointer-to-shaft sealed wire at any time. This is an overhaul function only.

2 Loosen the adjustment locknut.

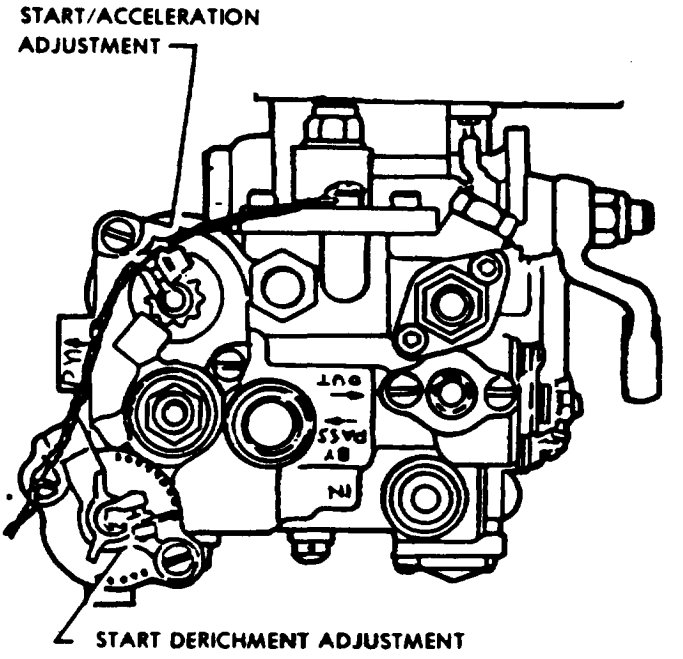


Figure 5-6.1. Start/Acceleration and Start Derichment Adjustments.

CAUTION

During attempted start, TOT must be closely monitored to prevent overtemperature operation. Record overtemperature in the Engine Log.

3 Make adjustment using an Allen wrench. Turn clockwise to enrich the starting fuel flow to improve stagnated starts, cold weather starts, or high altitude ground starts. Make adjustment in 10° maximum increments (dots are 10° apart) and tighten locknut to 20-25 lb in. (2.3-2.8 Nm) after each setting. Check the starting peak TOT after each setting until satisfactory starts are made.

4 When desired adjustment is obtained, secure lockout to Pc filter-fitting with lockwire.

CAUTION

Monitor TOT closely after start-derichment adjustment to be sure overtemperature limits are not exceeded.

Table 5-1.1 Adjustments to Improve Starting.

Condition	Recommended Adjustments
Excessive lightoff temperature — over 810°C (1490°F) with momentary peak of one second max at 927°C (1700°F) for a period not to exceed 10 seconds. N1 speed below 20%.	Adjust start/acceleration counterclockwise. If any additional correction is necessary, adjust start-derichment counterclockwise. (Refer to subparagraphs (1) and (2) for procedures.)
Low lightoff temperature — lightoff temperature below 550°C (1022°F) with Nl speed below 20% and slow acceleration.	Adjust start/acceleration clockwise. (Refer to subparagraph (2) for procedure.)
High rapid temperature rise with N1 speed at 25-30 %.	Adjust start/derichment counterclockwise. If any additional correction is necessary adjust start/acceleration counterclockwise. (Refer to subparagraphs (1) and (2) for procedures.)
Low lightoff temperature with slow start — lightoff temperature below approximately 550°C (1022°F) with starting time approaching 60 seconds (or more) and N 1 speed hesitation at 20-33%.	Adjust start-derichment clockwise. If additional correction is necessary, adjust start acceleration clockwise. (Refer to subparagraphs (1) and (2) for procedures.)
High lightoff temperature — over 810°C (1490°F) with a momentary peak of one second max at 927°C (1700°F) for a period not to exceed 10 seconds and N1 speed at 35-557.	Adjust start/acceleration counterclockwise. (Refer to subparagraph (2) for procedures.)
Low lightoff temperature with slow-to-hung starts—lightoff temperature below approximately 550°C (1022°F) with starting time approaching 60 seconds (or more) and N1 speed hesitation at 35-55%.	Adjust start/acceleration clockwise. (Refer to subparagraph (2) for procedure.)

(b) Rich (hot) starts may be caused by delayed ignition, or premature opening of the throttle. However, hot starts due to high fuel flow are normally caused by the fuel control. When the fuel control is suspected, make an adjustment of the start-derich setting as follows:

1 Remove lockwire and loosen adjustment locknut. (Refer to fig. 5-6.1).

2 Make adjustment, using an Allen wrench. Turn counterclockwise to lean-out the fuel flow. Make adjustment in 10° maximum decrements (dots are 10° apart) and tighten locknut after each setting. Check starting peak TOT after each setting until satisfactory starts are made.

3 When desired adjustment is obtained, secure locknut to P_c filter-fitting with lockwire.

(2) Start/Acceleration Fuel Flow Adjustment AVIM (Applicable to the Latest Modified Fuel Controls). The start/acceleration fuel flow schedule adjustment maintains the gas producer fuel control starting schedule within acceptable limits during normal service life.

(a) To optimize engine starting, the start-derichment adjustment should be made in conjunction with the start/acceleration adjustment. (Refer to table 5-1.1 and figure 5-6.2).

(b) Remove lockwire and make start/acceleration fuel flow adjustment as follows:

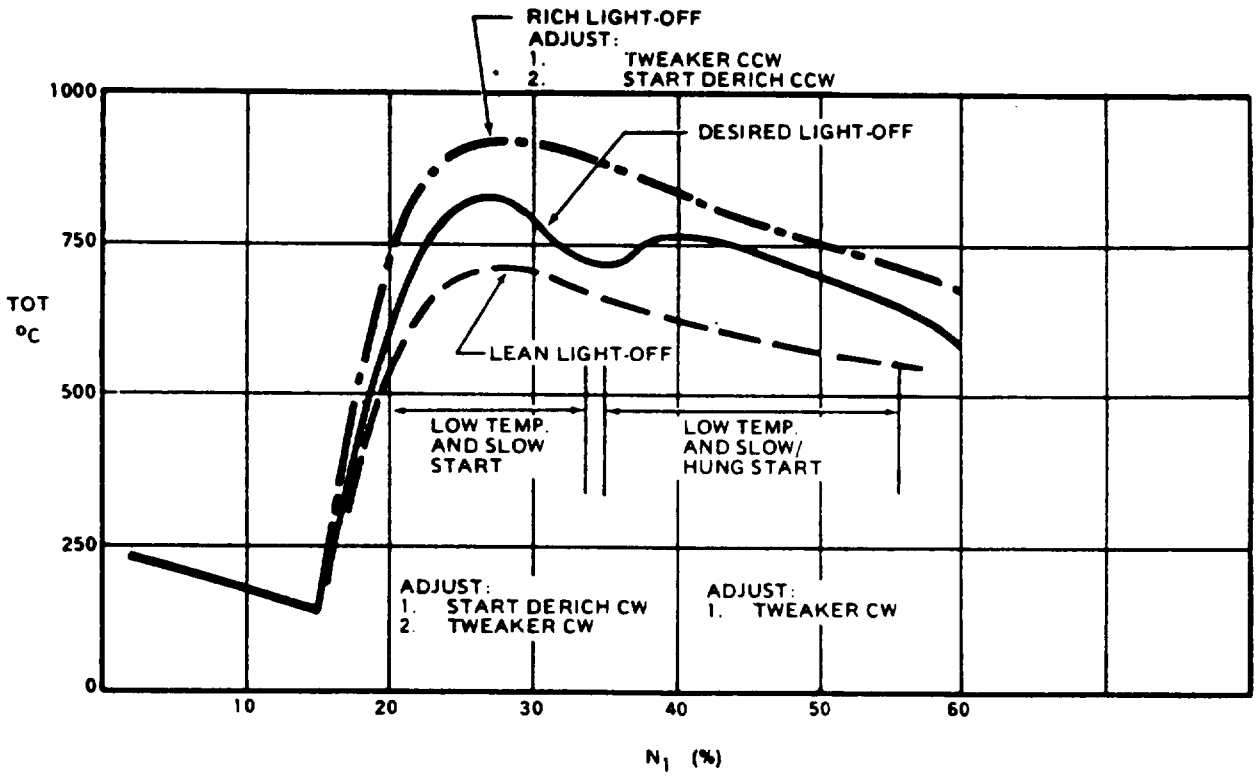


Figure 5-6.2. Start-Derich and Start-Accel (Tweaker) Adjustments

CAUTION

Do not use start/accleration adjustment to correct normal maintenance items such as misrigging, air leaks, fuel leaks, faulty fuel nozzle, ignition problems, starter-generator systems problems, etc. Do not use the start acceleration adjustment exclusively to improve engine starting. Excessive clockwise settings before encountering over-temperature results in a single high peak TOT over a wide speed range for a large part of the starting time. Use start-derich adjustment with start/acceleration adjustment to optimize engine darting.

NOTE

To accurately determine proper adjustment, conditions under which the adjustments are made should be consistent, i.e., a fully charged aircraft battery, the same residual TOT and the same lightoff speed.

There are eight positions for the adjuster (the neutral position is three clicks from the counterclockwise stop). Detent grooves hold the adjuster in the selected one of these positions without the need of a jam nut.

NOTE

A required adjustment of more than two clicks clockwise is an indication that the fuel control is not the cause of the problem.

1 For low lightoff temperature or slow/hung starts, turn the adjuster clockwise. Make adjustment in changes of one detent (click) at a time.

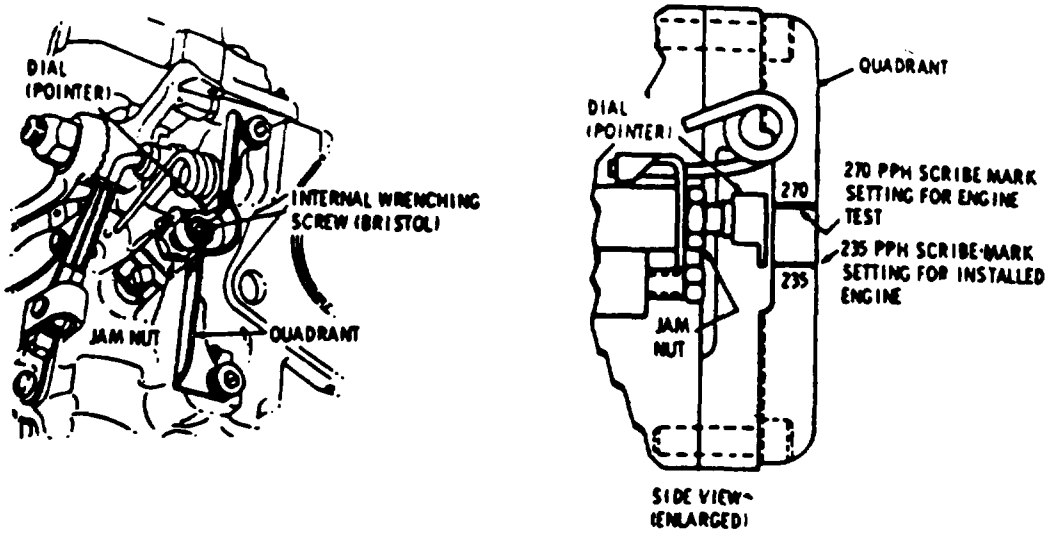


Figure 5-7. Fuel Control Max Flow Stop Adjustment

CAUTION

An over adjustment of the start/acceleration clockwise setting can cause overtemperature starts or compressor surge.

NOTE

If adjuster is positioned to the full clockwise stop and low lightoff temperatures or slow/hung starts are still encountered; ensure there are not pneumatic leaks. (Refer to para. 5-8.)

2 For excessive lightoff temperature starts, turn the adjuster counterclockwise. Make the adjustment in changes of one detent [click) at a time.

CAUTION

An over adjustment of the start/acceleration counterclockwise setting can cause an increase in starting time and possibly a hung start.

3 When the final start/acceleration adjuster position is established, lockwire the pointer in accordance with figure 5-6.1.

4 Check idle speed and deceleration time after the final start setting is determined. (Refer to para. 5-12e and para. 5-12i.)

NOTE

An engine performance check is required for this adjustment.

CAUTION

Monitor TOT closely after start-derichment adjustment to be sure overtemperature limits are not exceeded.

h. Max Fuel Flow Stop Adjustment. This adjustment is required to avoid exceeding the maximum power limit on the OH58C aircraft. The fuel control is bench calibrated to max flows of 235 and 270 pph with the pointer position at these flows scribe marked on the quadrant. The pointer should be set at the 235 pph scribe mark. Make the adjustment as follows:

(1) Remove the lockwire from the jam nut. (See figure 5-7).

(2) Loosen the jam nut while holding the pointer in position with an S1116 Bristol wrench in the internal wrenching *screw.*

(3) Turn the pointer with the Bristol wrench to the 235 scribe mark. Turn in a clockwise direction.

CAUTION

Throttle balance spring must be in proper position to insure adequate clearance for the throttle lever before tightening jam nut.

(4) Hold the pointer at 235 with the wrench while tightening the jam nut to 20-25 in. lb. Secure nut with lockwire.

NOTE

Fuel controls shipped from the manufacturer are set at the 270 pph scribe mark. Fuel controls on new or overhauled engines should be set at the 235 pph scribe mark. Controls which are set at the 270 pph scribe marl: must be reset to the 235 pph scribe mark.

i. Deceleration Check. Ground check the fuel control system and associated linkage by performing a deceleration check. This check is applicable only when using alternate fuels and must be performed before the engine has had time to cool down.

NOTE

JP-5 fuel is designated as the Army alternate fuel to be used in the T63-A-720. No deceleration time restrictions are imposed on the engine when the Army primary fuel (JP-4) is used.

NOTE

Perform each step in the sequence listed. Recheck the deceleration rate after each step to determine if there is a need for further correction. Replace the fuel control if the deceleration rate is still unsatisfactory after all steps have been completed,

(1) Turn the generator switch off.

(2) Rotate the twist grip to full open, hold collective at flat pitch and stabilize N2 at exactly 100% (trim as required) for approximately 15 seconds.

WARNING

During rapid throttle movements, make appropriate anti-torque pedal corrections to prevent aircraft from turning on loose or slick surfaces.

(3) Snap the twist grip to the IDLE position. Simultaneously start a time count using a stop watch. Stop the time as the N1 needle passes through 65%. The minimum allowable time is two seconds.

NOTE

Practice and/or retakes may be required before proficiency is obtained in timing the deceleration.

(4) If deceleration time is less than the time allowed make two more checks to confirm the time. If the confirmed deceleration time is less than the allowable minimum perform a rigging check. (Refer to paragraph 5-12d.).

(5) Repeat the deceleration check. If the deceleration time is leas than the allowable minimum perform an idle speed check. (Refer to paragraph 5-12e.).

(6) Repeat the deceleration check. If deceleration time is less than the allowable minimum, replace the fuel control.

j. Cleaning Gas Producer Fuel Control Fuel Filter. Remove, clean and reinstall the fuel control fuel filter assembly as follows. (See figure 5-8.).

(1) Thoroughly clean exterior of fuel control in the area of the plug to prevent contaminants from getting into the port after it is opened.

(2) Remove lockwire and remove plug (l), spring (3), and filter assembly (4). Discard preformed packing (2).

(3) Remove retaining clip (7), spring pin (6), and separate washer (10), spring (9), and strainer (8) from filter assembly (4).

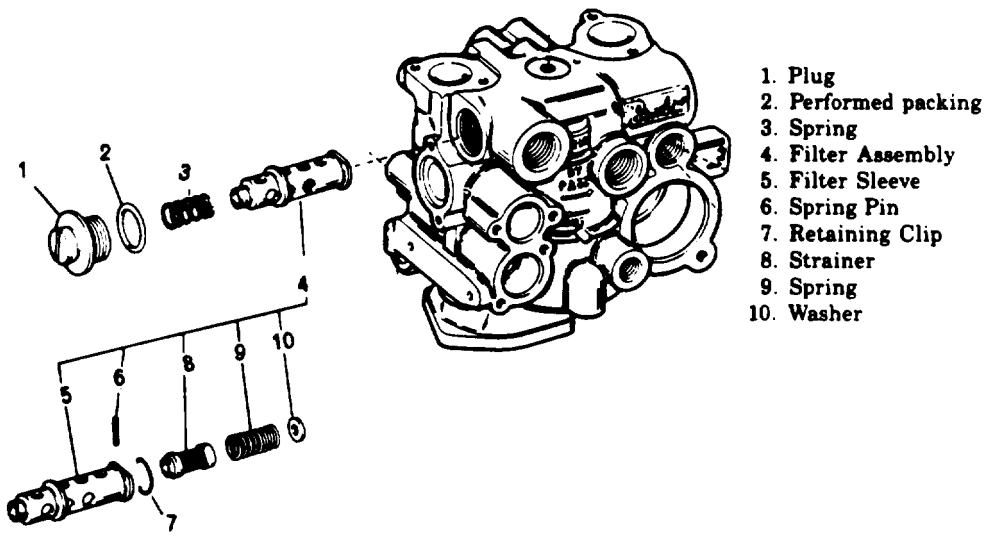


Figure 5-8. Fuel Control Fuel Filter

of the strainer. Repeat the procedure if visual inspection with a bright light shows that the interior of the drainer is not entirely free of contaminates.

CAUTION

Be cure strainer (8) is installed as shown in figure 5-8. Open end of strainer toward the outside of the control, away from the spring. Do not install backwards.

(5) Install drainer (8), spring (9), and washer (10) in filter sleeve (5). Secure components in the filter sleeve with spring pin (6) and retaining clip (7).

CAUTION

Use extreme care to insure that the pneumatic lines and fittings are not leaking. Erroneous pressures will cause fuel control malfunction.

(6) Lightly lubricate a new preformed packing (2) with engine fuel and place it on plug (1). Install filter assembly (4), spring (3) and plug (1) in fuel control.

CAUTION

Do not attempt to open a clogged screen with a sharp instrument.

(4) Clean filter assembly parts ultrasonically if equipment is available. If equipment is not available, agitate parts in solvent (item 3. table 2-2). Dry parts using clean shop air regulated to approximately 15 psig. Air pressure should be applied to the exterior of the strainer. Repeat the procedure if visual inspection with a bright light shows that the interior of the strainer is not entirely free of contaminates.

CAUTION

Be sure strainer (8) is installed as shown in figure 5-8. Open end of strainer toward the outside of the control, away from the spring. Do not install backwards.

(5) Install strainer (8), spring (9), and washer (10) in filter sleeve (5). Secure components in the filter sleeve with spring pin (6) and retaining clip (7).

CAUTION

Use extreme care to insure that the pneumatic lines and fittings are not leaking. Erroneous pressures will cause fuel control malfunction.

(6) Lightly lubricate a new preformed packing (2) with engine fuel and place it on plug (1). Install filter assembly (4), spring (3) and plug (1) in fuel control. Tighten the plug 65-70 in. lb and lockwire (item 10, table 2-2).

5-13. Power Turbine Governor.

a. Removal.

NOTE

Before replacing the power turbine governor to correct an engine malfunction, ensure that the pneumatic tubes and fittings are not leaking and the double check valve is functioning properly. A malfunction which appears to be a governor malfunction may be caused by erroneous pressures.

(1) Remove the self-locking nut and remove the lever from the governor (10, figure 5-2).

(2) Remove air tube (11) between the P_c filter (12) and governor tee.

(3) Remove air tube (5) between the governor tee and fuel control.

(4) Remove air tube (7) between the governor and fuel control.

(5) Remove air hose (6) between the governor and accumulator (1).

(6) Remove air tube (9) between the governor and control.

(7) Remove three self-locking nuts (19. figure 5-3) and washers (20) securing the governor to the gearbox. Remove the governor from the mounting studs.

b. Deleted

c. Installation.

(1) If a new governor is to be installed. transfer the union and Py accumulator. Use new preformed packing. Do not lubricate. Tighten union 75-110 in. lb. Tighten Py accumulator to 75-110 in. lb.

(2) Coat the governor drive shaft splines with lubricant (item 14, table 2-2) and the studs with anti-seize compound (item 15, table 2-21. Do not lubricate tube fittings.

(3) Install the governor on the mounting pad studs. Make certain the governor drive splines are properly engaged in the gearbox drive splines: the governor must be flush against the gearbox mounting pad. Secure the governor with three washers (20. figure 5-3) and self-locking nuts (19). Tighten the nuts to 70-85 in. lb.

(4) Install air tube (9, figure 5-2) between the control and the governor. Tighten the coupling nuts to 80-120 in. lb.

(5) Install air hose (6) between the governor and accumulator (1). Tighten the coupling nuts to 80-120 in. lb.

(6) Install air tube (7) between the governor and control. Tighten the coupling nuts to 80-120 in. lb. Tighten elbow jam nut to 55-80 in. lb.

(7) Install air tube (5) between the governor tee and the control. Tighten coupling nuts to 80-120 in. lb. Tighten the tee jam nut to 55-80 in. lb.

(8) Install air tube (11) between P_c filter (12) and governor tee. Tighten the coupling nuts to 80-120 in. lb.

(9) Perform a fuel system pneumatic leak check. (Refer to paragraph 5-8.)

(10) Install the governor lever on the governor shaft and position approximately 90 degrees to the centerline of the indicator on the stop assembly. Secure the lever with the self-locking nut. Tighten the nut to 40-50 in. lb. (Overtorquing will cause binding of the lever shaft.)

(11) Adjust the aircraft linkage as outlined in the applicable Aircraft Maintenance Manual.

(12) Test the engine as outlined in Chapter 10.

(13) Make appropriate entry relative to governor replacement in the engine log.

5-14. Double Check Valve

a. Removal.

CAUTION

Do not torque through the double check valve or accumulators, internal damage could result, use adjacent hexagonal surfaces for turning. When the double check valve or accumulators are removed, use extreme **care to prevent foreign materials from entering the pneumatic lines, valve, or accumulators.**

(1) Hold union (60, figure 5-3) and disconnect air hose (15) from accumulator (58).

(2) Hold elbow (61) and remove left accumulator (58). Discard preformed packing (59).

(3) Remove nut (53), washer (54), spacer (55), and bolt (57) securing clamp (56) to the firewall shield. Remove the clamp from the check valve.

(4) Hold right accumulator (58) and remove double check valve (62). Remove elbow (61) and union (60) from the double check valve. Discard preformed packing (59).

b. Inspection. Inspect general condition of valve and check associated tubing for cracked coupling nuts and chafed surfaces.

Installation.

(1) Install elbow (61, figure 5-3) and union (60) with new preformed packing (59) in double check valve (62). Tighten the elbow and union to 55-80 in. lb.

(2) Place a new preformed packing on right accumulator (58). Do not lubricate the preformed packing. Screw check valve (62) onto the accumulator. Hold accumulator (58) with a backup wrench and tighten the check valve by turning on the narrow hexagonal surface adjacent to the accumulator. Tighten to 40-65 in. lb.

(3) Install clamp (56) on the double check valve. Attach clamp to firewall shield with bolt (57), spacer (55), washer (54), and nut (53). Tighten the nut to 35-40 in. lb.

(4) Place a new preformed packing on left accumulator (58). Do not lubricate the O-ring. Screw the accumulator into elbow (61). Hold elbow (61) with a backup wrench and tighten the accumulator by turning on the narrow hexagonal surface adjacent to the elbow. Tighten to 55-80 in. lb.

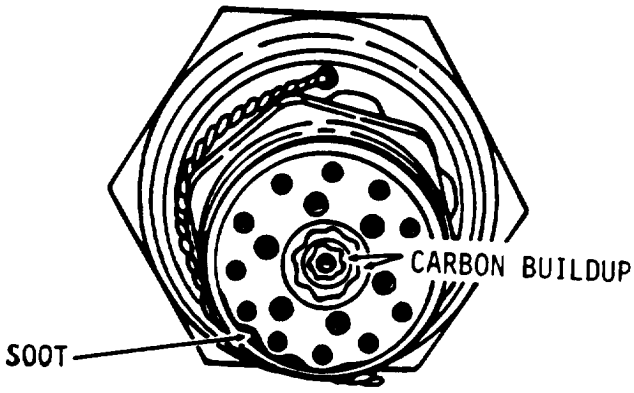


Figure 5-9. Carbon Buildup on Fuel Nozzle

(5) Connect air hose (15) to the accumulator and tighten to 80-120 in. lb.

(6) Perform a fuel system pneumatic leak check. (Refer to paragraph 5-8.).

5-15. Fuel Nozzle.

a. Removal.

(1) Disconnect the fuel hose at the fuel nozzle (6, figure 5-3).

CAUTION

Care must he taken when removing the nozzle from the outer combustion case to prevent damage to the nozzle spray tip. If the spray tip is damaged, the nozzle must be replaced.

(2) Remove the lockwire and unscrew the nozzle from the outer combustion case. Carefully extract the nozzle from the combustion case.

NOTE

To preclude the possibility of the combustion chamber becoming misaligned, do not remove the fuel nozzle and the spark igniter at the same time.

b. Cleaning.

(1) Check for carbon deposits on the spray tip. Figure 5-9 shows the condition of a typical fuel nozzle removed from an operational engine. A nozzle in this condition should be cleaned, if possible, before being reinstalled.

CAUTION

Use extreme care to prevent damaging the mirror finish and edge of the spray tip. If finish or spray tip is damaged, the nozzle must be replaced.

(2) Suspend the fuel nozzle vertically with the tip immersed approximately 1/8 in. in carbon removal compound (item 17, table 2-2, or equivalent). Soak the tip as long as necessary (minimum one hour) to remove all carbon. After carbon removal flush the nozzle inside and out using solvent (item 3, table 2-2) or clean JP-4. Dry with a soft lint-free cloth.

(3) Clean the air shroud face with a clean cloth; aair holes must be open. Ensure that loosened carbon does not enter the spray tip.

c. Inspection.

(1) Visually inspect for damaged mirror finish or edge of spray tip. Replace damaged nozzles.

(2) Visually inspect for carbon lodged in the spray tip. Flow fuel through the nozzle and replace if carbon cannot be flushed out.

d. Installation.

NOTE

Do not lubricate the nozzle threads.

(1) Carefully install the nozzle in the outer combustion case and tighten to 200-300 in. lb. Lock-wire (item 10, table 2-2) the nozzle to the spark igniter.

(2) Connect the fuel hose to the nozzle. Hold the fuel hose to prevent twisting and tighten the coupling nut to 80-120 in. lb.

5-16. Accumulator

The PY accumulator, union, and associated "O" rings are removed from the power turbine governor tee. A plug and "O" ring are then installed in the tee.

Accomplishment Instructions:

a. Remove power turbine governor (PTG) from the engine.

b. Inspect PY port on PTG.

c. If PY port is found acceptable, remove the PY accumulator and union as follows:

NOTE

Do not change orientation of governor tee.

(1) Place a torque reaction wrench on the governor tee to prevent damage to the PY port casting area while removing the accumulator and union.

(2) Remove the 6876775 accumulator from the governor tee (see figure 5-9.1) and discard the accumulator.

(3) Remove the AN815-4J (AN815 4K) union and packings from the governor tee (see Figure 5-9.1). Discard the packings. The union may be retained as surplus hardware for later use elsewhere.

(4) Install an MS9015-04 plug in the governor tee using a new AS3084-04 packing (see Figure 5-9.2).

(5) Torque plug to 55-80 lb in and secure with .020 lockwire. Use a torque reaction wrench on the fitting

(6) Install the serviceable governor. Torque governor attaching nuts to 75-80 lbs in.

(7) Reinstall all tubing. Ensure reinstalled tubes are in serviceable condition. Rigid tube alignment is very important. Torque values are shown in Table 5-1.2

Table 5-1.2. Torque Limits for Steel Couplings on Steel Fittings

Dash No.	Tubing OO Inches	Wrench Size	Torque	
			LB IN.	N M
-2	0.125	3/8	35-40	3.95-4.52
-3	0.187	7/16	64-100	7.34-11.30
-4	0.250	9/16	80-120	9.04-13.56
-5	0.312	5/8	150-200	16.95-22.60
-6	0.373	11/16	200-250	22.60-28.25
-8	0.500	7/8	325-400	36.72-45.19
-10	0.625	1	415-575	53.66-64.96
-12	0.750	1 1/4	660-780	74.57-88.12
-16	1.000	1 1/2	720-960	81.35-108.46
-20	1.250	2	1200-1500	135.58-169.47

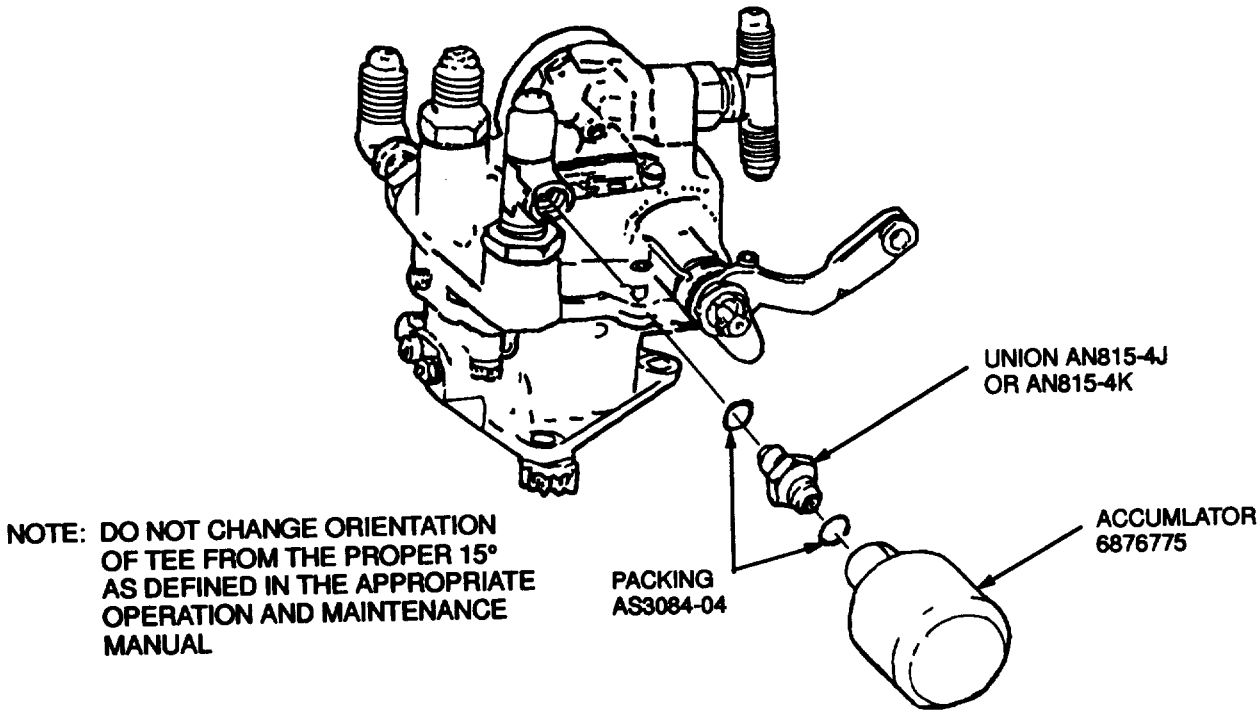


Figure 5-9.1. Removal of Accumulator and Union

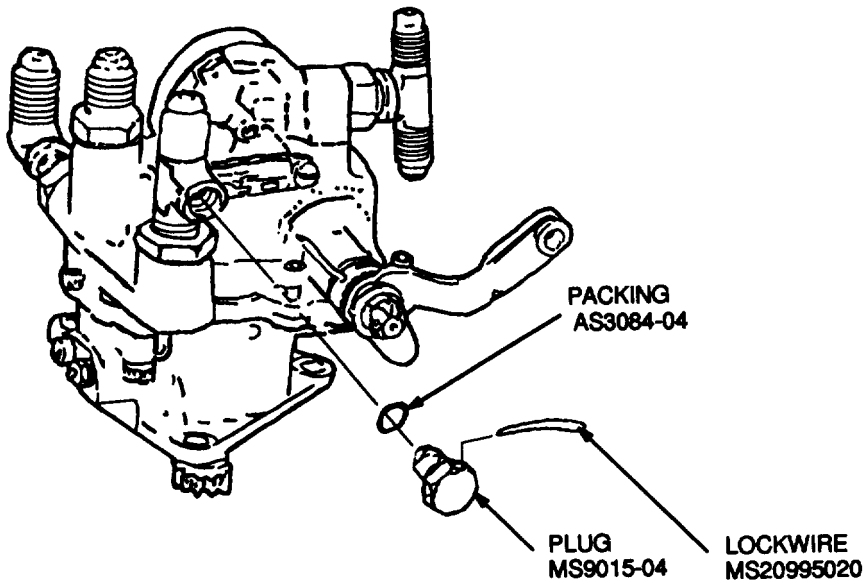


Figure 5-9.2. Installation of PIN MS9015-04 Plug

5-17. Fuel System Tubes.

a. Removal. Observe the following precautions when removing tubes.

(1) When loosening a coupling nut, always use a backup wrench on the mating fitting to prevent the fitting from turning.

(2) Always use the proper size wrench to prevent rounding off the hex corners.

(3) Attach the wrench to the fitting or coupling nut in a manner that will prevent crushing of the fitting or coupling nut.

(4) Never use a pipe wrench, pliers, or vise grips on a coupling nut or fitting.

b. Cleaning. Flush tubes with solvent (item 3, table 2-2) and blow dry.

c. Inspection. Inspect and reject tubes for the following damage.

(1) Kinks or dents which could obstruct fuel flow. Dents are allowable up to 0.015 in.

(2) Cracked or broken tubes or coupling nuts.

(3) Cross-threaded, crushed, or otherwise damaged coupling nuts.

(4) Chafing within clamp areas in excess of 0.010 in. deep. Chafing is not allowed at or near the flared tubing end.

(5) Nicks which exceed 0.010 in. deep.

d. Installation.

(1) Observe the precautions listed in removal when installing the fuel tubes.

(2) Tighten No. 4 size coupling nuts 80 to 120 in. lb. and No. 5 size coupling nuts 150 to 200 in. lb.

(3) Rigid steel tubing must align with its mating fittings in the free state such that both coupling nuts will engage two full threads of their mating fittings with light finger pressure. The tube must not be stretched during final tightening of the coupling nuts. Adjustments may be made by bending the tube at the principal bend or bends. All bending must be accomplished with the tube removed from the engine. Flattening effects as a result of reforming shall not exceed 15 percent of the tube OD.

5-17.1 Fuel Check Valve.

a. Removal.

(1) Disconnect Fire Shield to Fuel Nozzle Hose (5, Figure 5-3) from fuel nozzle (6) and fuel check valve (1).

(2) Disconnect fuel control-to-firewall shield tube (4) from Fuel Check Valve (1).

(3) Remove nut (3) washer (2) and check valve (1) from the firewall shield.

b. Inspection.

Visually inspect general condition of valve and check associated tubing for cracked or broken tubes or coupling nuts.

c. Installation.

(1) Install the check valve (1) and washer (2) in the fireshield. Install from the aft side with arrow pointing rearward. Secure the valve with washer (2) and nut (3). Tighten 55-80 in. lb.

(2) Install fuel control to check valve tube (4) an fuel nozzle to check valve hose (5). Tighten coupling muts to 80-120 in. lb.

Section III. LUBRICATION SYSTEM

WARNING

Failure to properly install, align and tighten oil fittings and tubes could result in an engine failure.

5-18. Scope.

Lubrication system servicing includes cleaning and inspecting the magnetic chip detectors and oil pressure regulator, changing the system oil, cleaning the oil filter, removing and installing the oil filter housing, oil pressure reducer, and lube oil check valves. In adition, it includes adjusting the oil pressure regulating valve and the scavenge oil flow check.

5-19. Use of Oils.

NOTE

It is not advisable to mix MIL-L-7808 and ML-L-23699 oils except in cases of emergency. If it becomes necessary, the system must be flushed within 6 hours of operation. (Refer to paragraph 5-21.)

NOTE

Nearly all present day lube oils contain antifoam additives which can settle to the bottom of the container. Thoroughly shake (agitate) the container prior to adding oil to the system either at an oil change or during routine servicing.

a. Use of MIL-L-23699 oil is authorized and directed for ambient temperatures abouve minus 25°F.

b. Use of MIL-L-7808 oil is specified for operation in ambient temperatures below minus 25°F. This oil may also be used when MIL-L-23699 oil is not available.

5-20. Oil Change Procedure.

Drain and refill the lubrication system after each 200 hours of engine operations as follows:

a. Drain the oil tank.

b. Remove the magnetic chip detector from the bottom of the gearbox and drain residual oil. (Refer to paragraph 5-24.)

Remove and clean or replace the oil filter, (Refer to paragraph 5-25.)

d. Refill the oil tank with engine oil (item 7 or 8, table 2-2).

e. Remove and clean the magnetic chip detector on the forwardside of the gearbox (refer to paragraph 5-24). While both magnetic plugs are removed, motor the engine with the starter and permit a small amount of oil (1 or 2 ounces) to flow from the openings in the gearbox. This will assist in rinsing the gearbox of carbon particles. Reinstall the cleaned magnetic plugs.

f. Refer to figure 5-10.1, Loosen clamp nut, then fittings and remove the line going to the "T" fittings that feeds oil to the number six and seven bearing. Pressure Oil Tube 6871470. Remove the small oil screen, 6840476 (Pressure Oil Fittings Screen Assembly). Motor the engine with the starter and permit a small amount of oil (1 or 2 ounces) to come out the end of the oil tube. Clean and reinstall the screen and tube assembly. Tighten pressure oil tube coupling nuts to 80 to 120 in. lb. Tighten clamp nuts to 35 to 40 in. lb.

g. Motor the engine with the starter until positive oil pressure indication is obtained. Do not exceed starter limitations.

h. After all work is completed make a ground run, check for leaks and monitor oil pressure for the first five minutes of engine operation. Check and reservice the oil tank to the proper level.

5-21. Oil Changeover Procedure.

When changing over from MIL-L-7808 oil to MIL-L-23699 oil or vice versa, proceed as follows:

a. Drain the oil tank, system components and piping, and engine gearbox as completely as possible.

Remove and clean or replace the oil filter. (Refer to paragraph 5-25.)

c. Remove, inspect, and clean the magnetic chip detectors.

d. Fill the oil tank with the desired lubricating oil (item 7 or 8, table 2-2).

e. Motor the engine to pump oil through the system. Check the tank oil level and add oil as required. Repeat the motoring cycle until the tank oil level does not change.

f. Run the engine for 30 minutes to one hour and shut down.

g. Inspect and clean or replace the oil filter.

(1) If the filter was heavily contaminated, accomplish steps h through 1.

(2) If the filter was not heavily contaminated, accomplish steps *j* through *l.*

h. Drain the oil from the engine oil system. (Refer to paragraph 5-20.)

i. Fill the oil tank with the desired oil and release the engine for service.

j. After five hours operation, inspect and clean or replace the oil filter.

k. After 15 hours operation since oil change, inspect and clean or replace the oil filter.

l. Revert to normal schedule of inspection of oil filter.

5-22. Mixing of Engine Oils.

Do not mix MIL-L-7808 and MIL-L-23699 oil except in an emergency. If mixing is necessary, flush the system within six hours of engine operation, (Refer to paragraph 5-21.)

5-23. 0i1 Tubing and Fittings.

The tubes used in the oil system are rigid stainless steel assemblies incorporating permanent fittings.

a. Inspect oil tubes for kinks, uniformity of diameter, breaks, and freedom from interference with adjoining structure or other components. Replace defective oil tubes.

b. Inspect fittings and hardware for cracks, crossed threads, obstructions in openings, burrs, or other damage. Replace all damaged fittings. Replace all seals, packings, and lockwire when they are removed from a unit.

c. Tighten No. 4 size coupling nuts to 80-120 in. lb and No. 5 size coupling nuts to 150-200 in. lb.

5-24. Magnetic Chip Detectors.

Each chip detector consists of a magnetic plug with a single pin electrical receptacle. The threaded plug portion of the chip detector includes a terminal shaft and. pole piece separated from a magnet in the plug body by insulators. When ferrous metal particles are sufficient in size of accumulation to bridge the gap between the pole piece and the magnet, an electrical (ground) circuit between the chip detector and the ENG CHIP DET indicator light is completed.

a. Removal. Remove lockwire and unscrew magnetic chip detector. Some oil spilling is likely. Remove preformed packing from plug and discard preformed packing.

NOTE

When removing chip detector, care should be taken not to contaminate detector.

b. Inspection.

(1) Visually check each plug for metal accumulation.

(2) Flakes of magnetic material of 1/16 in. or more diameter are indications of an incipient failure and are cause for engine removal. (See figure 5-10.)

(3) Fuzz or hair-like magnetic particles can normally be found on the magnetic plug and are not cause for engine replacement. (See figure 5-10.)

c. Cleaning. Wipe chip detectors with a clean, lint-free cloth.

d. Installation. Install a new preformed packing lubricated with oil (item 7, table 2-2) on magnetic plug. Install magnetic plug; tighten to 60-80 in. lb and lockwire.

e. Testing—Chip Detector and Circuitry.

(1) Place BATT-OFF switch to OFF and apply external power.

(2) Remove chip detector.

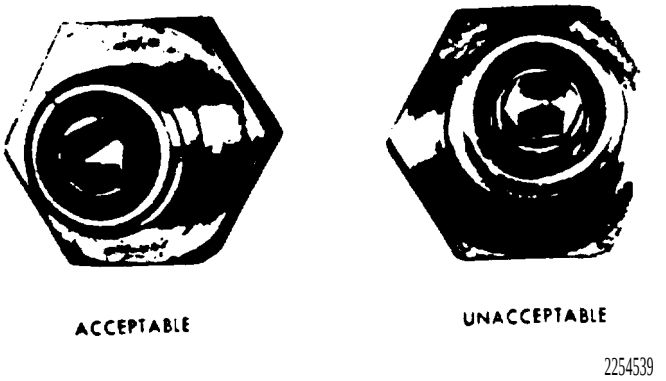


Figure 5-10. Particle Accumulation on Magnetic Chip Detector

(3) Connect the electrical lead to the chip detector and ground the case of the chip detector to the engine.

(4) Using a screwdriver, short across the gap between the pole piece and the magnet and observe ENC. CHIP DET indicator light. If light is on, circuit and detector test good.

(5) If ENC. CHIP DET indicator light does not illuminate, check that case is grounded to engine. If light is still not observed, remove electrical connector from chip detector and ground connector to engine. ENC. CHIP DET indicator light should illuminate. If light does illuminate replace chip detector; if light does not illuminate, check circuits for continuity and replace defective parts.

(6) Reinstall chip detector.

(7) Reinstall electrical connector to chip detector.

(8) With engine running, check the magnetic chip detector light; the light should be out.

5-25 Oil Filter.

a. Removal.

(1) Remove the nuts (1, figure 5-11) and washers (2). Remove cap (3) with preformed packing (4) from housing (9) located on top of engine.

(2) Use a clean suction gun or another suitable device to remove the puddled oil from within the filter housing (9) before removing the filter element (5). Do not damage the filter element. Examine sediment for evidence of metal particles.

(3) Remove the filter element (5) and preformed packing (6). Discard the preformed packing.

(4) Install the cap (3) with preformed packing on housing to prevent dirt from entering the housing.

b. Cleaning.

NOTE

- Use ultrasonic cleaning equipment if available.
- Some engine bearings have silver-plated separators, If minute silver particles are found in the engine oil filter, clean and reinstall the filter. Minute silver particles are due to normal bearing wear and are not cause for corrective action.

(1) Agitate filter element in solvent (item 3, table 2-2) until clean.

(2) Air dry filter element.

(3) Thoroughly clean the oil filter cavity of all residual oil and/or sludge prior to the installation of a cleaned or new filter element. If metal particles are present remove and examine magnetic plugs in gear case.

c. Installation.

(1) Remove cap (3, figure 5-11) with preformed packing from housing. Discard preformed packing. Clean cap with a clean lint-free cloth. Install new preformed packing (4) lubricated with engine oil (item 7 or 8, table 2-2) on filter cap.

(2) Install new preformed packing (6) and cleaned filter element (5) in filter housing (9).

(3) Install filter cap (3).

(4) Tighten nuts (1) which secure filter cap to housing to 40-45 in. lb.

d. Testing. After the filter element has been cleaned or replaced, run the engine for a short duration and check the splitline for leaks.

5-26. Oil Pressure Regulator.

NOTE

Do not remove the pressure regulator unless the oil pressure cannot be adjusted within limits.

a. Removal. Remove lockwire and turn guide (14, figure 5-11) out of housing (9). Remove spring (17) and poppet (18) from the housing. Discard preformed packing (16).

b. Installation.

(1) Lubricate preformed packing (16) with oil (item 7 or 8, table 2-2) and place on guide (14).

(2) Install poppet (18), spring (17), and guide (14) in housing (9). Turn the guide in until it bottoms; then back it out 5 ½ turns.

(3) Adjust the regulating valve as outlined in step e.

c. Inspection.

(1) Check the external condition of the regulator; ensure that the regulator is lockwired. If the regulator is not lockwired, check the adjustment as outlined in step *e.*

(2) If oil pressure cannot be adjusted within limits, remove the regulator. Check for a broken spring (17) or evidence of poppet (18) sticking. Check for damage or wear on the poppet seating surface.

d. Testing.

NOTE

Oil pressure limits apply to an engine that is at normal operating temperature.

(1) With the engine running at ground idle, check that the oil pressure is 50 psig minimum.

(2) With the engine operating at maximum speed, check that the oil pressure is within limits. (Refer to table 10-1.)

e. Adjustment.

NOTE

Any adjustment made to the oil pressure regulator should be verified by a calibrated direct-reading pressure gage connected at the oil pressure sensing port on the front of the gearbox.

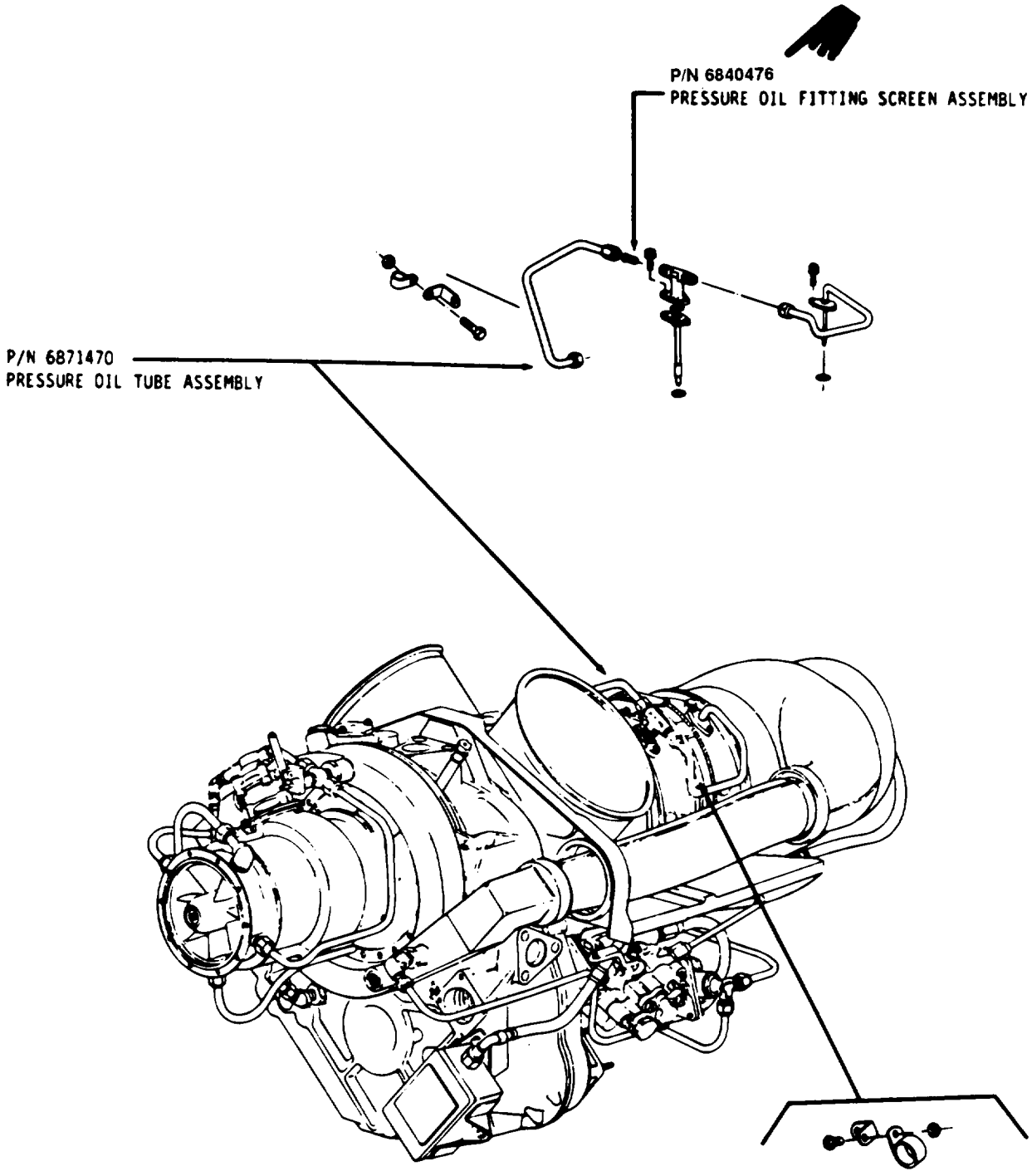
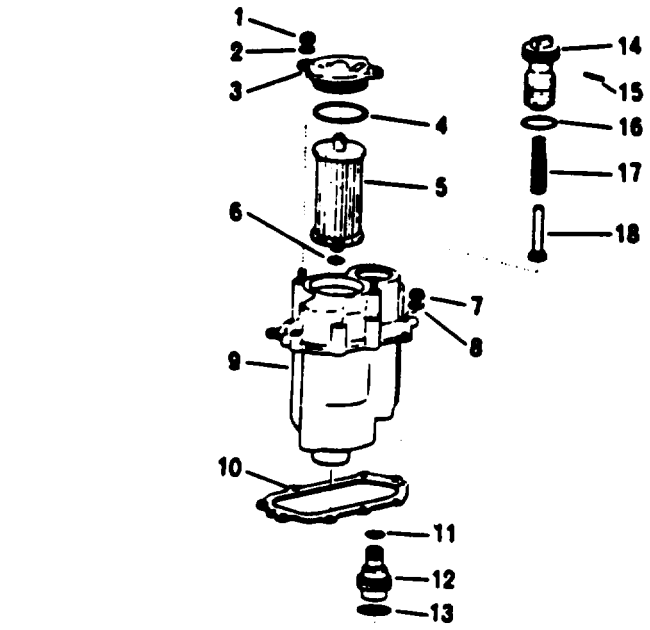


Figure 5-10.1 Pressure Oil Tube and Pressure Oil Filtering Screen

1. Nut (2)
2. Washer (2)
3. Cap
4. O-ring (2)
5. Oil filter
6. O-ring
7. Nut (8)
8. Washer (8)
9. Housing
10. Gasket
11. O-ring
12. Check valve
13. O-ring
14. Guide
15. Pin
16. O-ring
17. Spring
18. Valve poppet
19. O-ring
20. O-ring
21. Oil tube
22. Oil tube



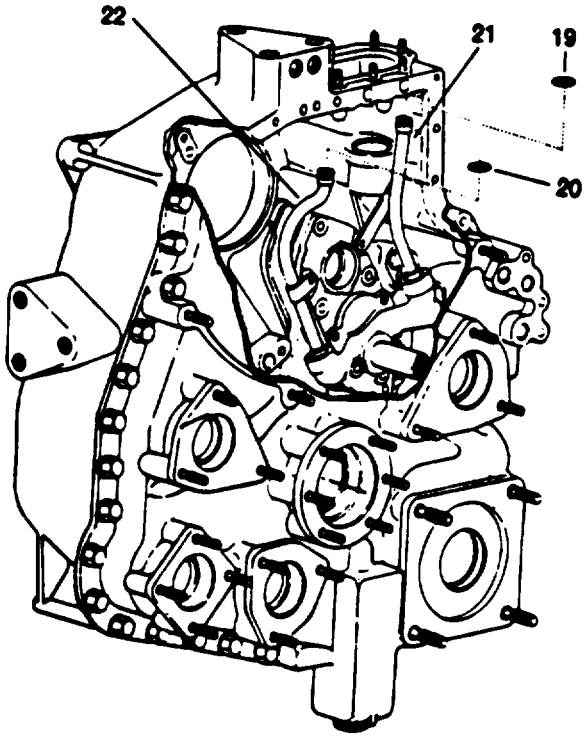


Figure 5-11. Oil Filter, Housing, Check Valve, and Regulator Value

(1) Remove th lockwire from the pressure regulator.

(2) Using a wrench, turn guide (14) clockwise to increase pressure; counterclockwise to decrease. Adjust the regulator until oil pressure is within limits of step d. One turn will change oil pressure approximately 13 psig.

NOTE

An approximate starting adjustment can be made by bottoming guide (14); then backing out 5 1/2 turns.

(3) Lockwire guide (14) after adjustment to prevent movement in either direction.

5-27. Oil Filter Housing

a. Removal.

(1) Remove eight self-locking nuts (7, figure 5-11) and washer (8).

(2) Lift housing (9) out of the gearbox. Discard gasket (10).

(3) Remove check valve (12). Discard preformed packing (11 and 13).

(4) Remove preformed packing (19 and 20) from oil tubes (21 and 22) and discard preformed packing.

b. Installation.

(1) Lubricate new preformed packing (19 and 20) with oil (item 7 or 8, table 2-2) and install on oil tubes (21 and 22).

(2) Lubricate new preformed packing (11 and 13) with oil (item 7 or 8, table 2-2) and install on check valve (12). Install the check valve in the gearbox.

(3) Place new gasket (10) in the gearbox.

(4) Insert housing (9) into the gearbox and engage the mounting studs. Ensure that the housing is mated with oil tubes (21 and 22) and with check valve (12).

(5) Retain the oil filter housing with eight washer (8) and self-locking nuts (7). Tighten the nuts to 35-40 in. lb.

5-28. Internal Oil Check Valve

The internal oil check valve (12, figure 5-11) is located under the oil filter housing (9), inside the gearbox. It serves to prevent oil from draining out of the oil tank and into the gearbox while the engine is shut down.

a. Removal. (Refer to paragraph 5-27a.)

b. Cleaning. Clean the internal check valve by flushing with solvent (item 3, table 2-2) and air dry.

c. Installation. (Refer to paragraph 5-27b.)

5-29. External Oil Check Valve.

The external oil check valve (4, figure 5-12) is located in the oil supply tube to the turbine. It serves to prevent oil from draining into the turbine bearing cavities while the engine is shut down.

a. Removal.

(1) Remove self-locking nut (5) and bolt (1) that secure clamps (2 and 3) together.

(2) Loosen the two oil tube coupling nuts and remove check valve (4) from the engine.

b. Cleaning. Clean the external check valve by flushing with solvent (item 3, table 2-2) and air dry.

c. Deleted.

d. Installation.

CAUTION

To prevent oil starvation of turbine bearings, be sure the check valve is installed with the end marked "OUT" and the arrow pointing toward the rear of the engine.

(1) Install check valve (4) on the pressure oil tube with the hex end marked "OUT" and the arrow pointing toward the rear of the engine. Tighten the coupling nuts to 80-120 in. lb.

(2) Secure clamps (2 and 3) together with bolt (1) and nut (5). Tighten the nut to 35-40 in. lb.

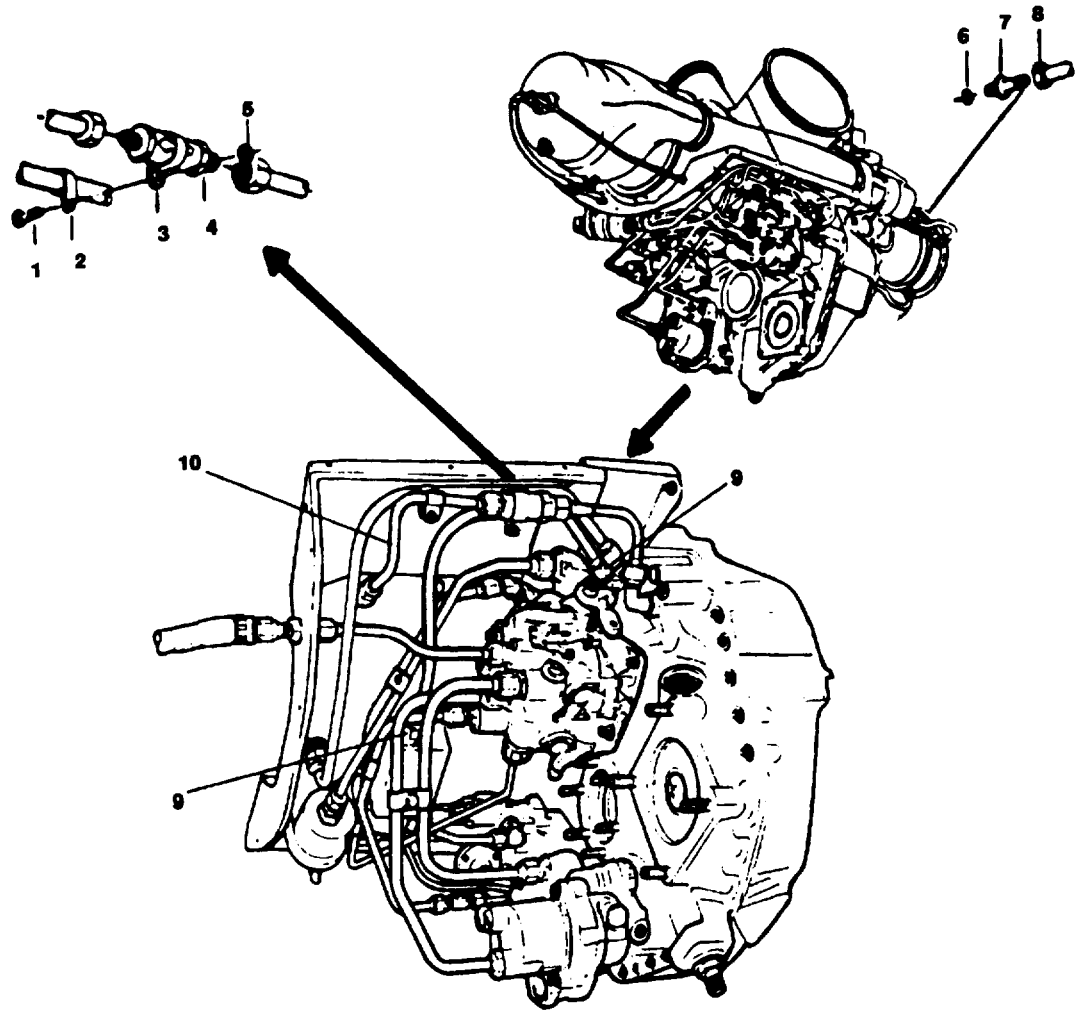
5-30. External Sump Pump.

a. Removal.

Remove two bolts (14) holding the scavenge oil external sump (15) to the firewall shield. Remove sump. Discard preformed packing (6).

b. Installation.

Install preformed packing (16) in the seal groove of the power turbine support scavenge oil opening. Apply a light coat of sealer (Permatex 1372W, NSN 8030-00-599-7753) over the preformed packing. Position sump (15) on the firewall shield. Apply Never Seez (item 26, table 2-2) to two bolts (14) and install. Tighten bolt to 35-40 in-lbs and secure with lockwire (item 10, table 2-2).



1. Bolt
2. Clamp
3. Clamp
4. Check Valve
5. Nut
6. Preformed packing
7. Oil pressure reducer
8. Oil tube
9. Tube nuts
10. Tube

Figure 5-12. External Oil Check Valve

5-30.1 Oil Pressure Reducer.

a. Removal.

(1) Disconnect the oil tube (8, figure 5-12) from the oil pressure reducer (7).

(2) Remove the oil pressure reducer from the compressor front support. Discard preformed packing (6) and oil pressure reducer (7).

b. Installation.

(1) Lubricate new preformed packing (6) with oil (item 7, table 2-2) and place on new oil pressure reducer (7).

(2) Install the oil pressure reducer on the compressor front support and tighten to 50-75 in. lb.

(3) Connect the oil tube (8) to oil pressure reducer and tighten coupling nut to 65-100 in. lb.

5-30.2 Scavenge Oil Flow Check.

a. Measure the quantity of oil flow from the power turbine support scavenge oil external sump. To ensure consistency, make the measurement during the following conditions:

(1) Engine oil temper-not cooler than 10°C (50°F) or hotter than normal operating temperatures.

(2) Use external power source to ensure N_1 rotation of 16% (TM 55-1520-228-23).

(3) Remove the extend sump to gear box scavenge oil tube by loosening tube nuts (9) and tube (10).

At the external sump and fitting, connect clear tube (item 38, table 2-2) to oil sump scavenge fitting to direct oil flow.

(4) Open ignition circuit breakers and make a preliminary rotation of the engine to 15 seconds to ensure that the oil lines and external sump are full of oil and there is oil flow.

b. With ignition circuit breakers open, rotate engine for exactly 15 seconds. At least 16% N1 speed must be achieved. Collect and measure oil flow during the 15 seconds of rotation period and during coast down until engine stops. It is not necessary to collect and measure minor drips.

c. A flow of less than 90 cc (3 oz.) indicates a significant restriction of the oil nozzle and/or passages and is cause for engine removal.

NOTE

Cleaning of lubrication system internal components should only be done at Depot Level Maintenance.

d. Remove oil drain tube.

e. Install the oil scavenge tube to the external sump. Tighten coupling nuts (9) to 150-200 inch lbs.

f. *Pilot:* Check run engine to determine presence of oil leakage at power turbine support pressure and scavenge oil system components.

Section IV. ANTI-ICING AND BLEED AIR SYSTEMS

WARNING

Failure to properly install, align, and tighten air fittings and tubes could result in an engine failure.

5-31. Scope.

Anti-icing and bleed air systems servicing includes replacing and testing the compressor bleed valve and anti-icing air valve. In addition, it includes anti-icing valve repair.

5-32. Anti-icing Air Valve.

a. Removal.

(1) Disconnect air tubes (23 and 26, figure 5-13) at the anti-icing air valve (29). Disconnect the air tubes at the compressor front support only if necessary.

(2) Disconnect the aircraft linkage from the valve lever.

(3) Remove lockwire, loosen jam nut (24), and unscrew the valve from the diffuser scroll. Discard preformed packing (25).

b. Testing.

(1) Apply 100 psig air pressure to the Valve Inlet with a 0.025 inch orifice installed between the air source and the valve inlet after installing gauges to monitor the pressure on both sides of the orifice.

(2) Apply 3.75 pounds maximum force to hold the lever in the closed position.

(3) Allow air pressure on both sides of the orifice to stabilize, maintaining pressure at the orifice inlet at 100 psig.

(4) If the valve leakage is excessive such that the pressure downstream of the orifice decreases, replace the valve and retest.

c. Anti-icing Valve Poppet Seat Replacement. Replace the Teflon poppet seat of the anti-icing valve as follows:

(1) Remove the cotter pin (17, figure 5-13), washer (16), and pin (14). Detach the actuating lever (13) from the valve. Discard the cotter pin.

(2) Remove the lockwire and unscrew the poppet guide (15) from the valve body (22). Separate the poppet (18) from the body.

(3) Remove the screw (21) and separate the poppet seat (20) from the poppet.

(4) Clean valve component in cleaning solvent (3, table 2-2).

(5) Inspect valve components per table 5-2.

(6) Install the replacement poppet seat (20). Retain the seat with screw (21). Stake the screw securely. (See figure 5-14.)

(7) Insert the poppet and seat into the valve body (22, figure 5-13) and screw the poppet guide (15) onto the body. Tighten the coupling nut to 65-75 in. lb. Do not lockwire at this time.

(8) Align the actuating lever (13) with the hole in the poppet guide (notch in the lever toward the guide) and insert the pin (14). Secure the pin with washer (16) and new cotter pin (17).

(9) Recheck the valve for leakage. Replace valve assembly if leakage is still excessive.

d. Installation.

(1) Place new preformed packing (25) with backed-off jam nut (24) on anti-icing valve (29). Apply antiseize compound (item 15, table 2-2) lightly to the threads and install the valve in the diffuser scroll. Do not tighten jam nut (24).

(2) Connect air tubes (23 and 26) to the valve. Tighten the coupling nuts to 150-200 in. lb. Tighten jam nut (24) to 100-150 in. lb. and lockwire (item 10, table 2-2).

(3) Loosen poppet guide (15) and position lever (13) parallel with the vertical centerline of the engine. Tighten the poppet guide to 65-75 in. lb. and lockwire (item 10, table 2-2).

5-33. Compressor Bleed Valve.

a. Testing. Test the compressor bleed valve while installed on the engine. Turn off all bleed air.

(1) Pilot and observer use helmets and extension cord to passenger communication box.

(2) Observer use flashlight to view operation of the bleed valve.

(3) Run up engine to 100% N2 and observe compressor bleed valve operation. Valve should not be fully closed.

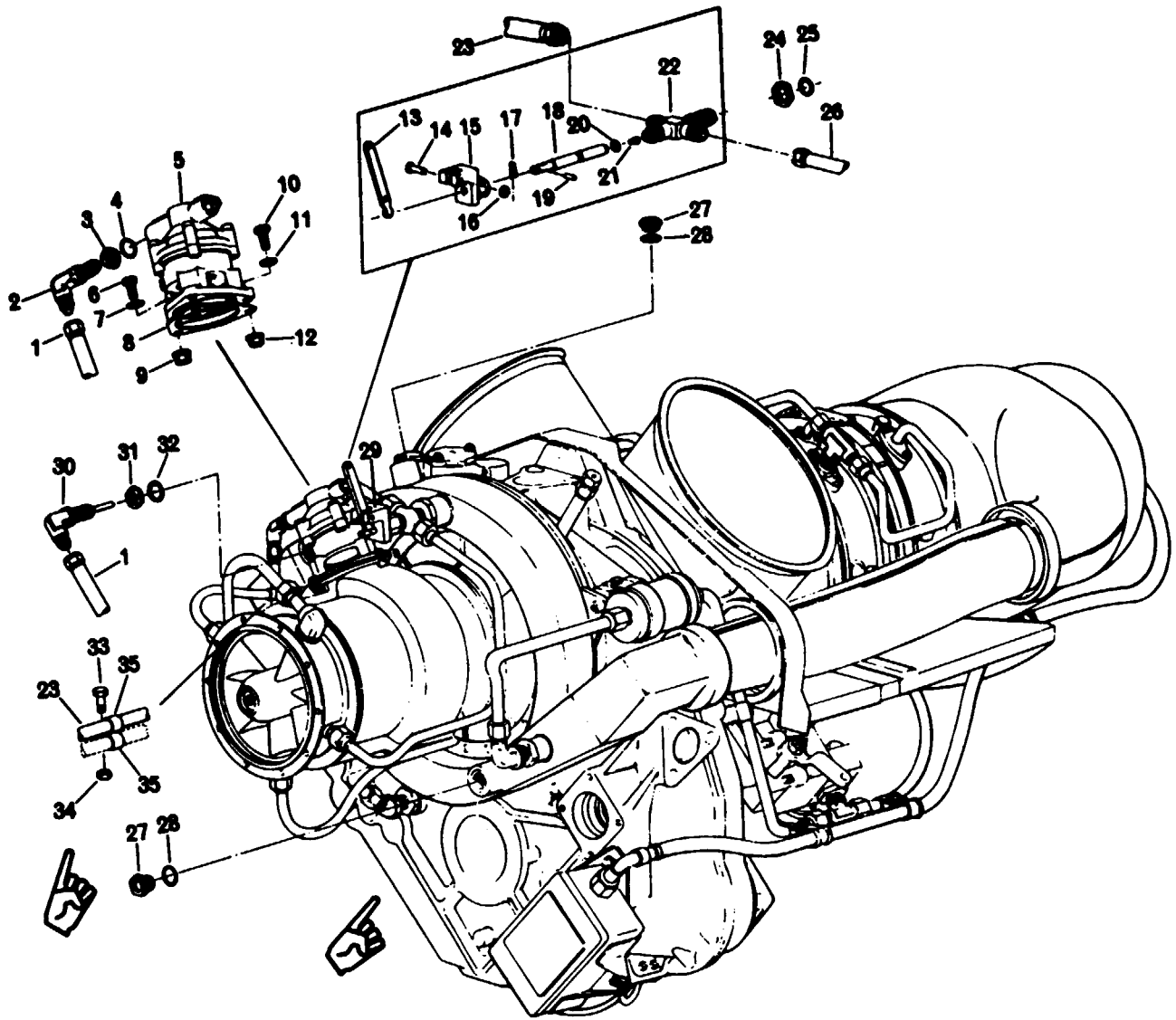
(4) Apply collective until valve is fully closed.

NOTE

It may be necessary to increase aircraft gross weight to accomplish run-up. If passengers are used to increase gross weight, ensure that seat belts are fastened for all occupants.

WARNING

Do not have personnel stand on aircraft skid tubes to increase gross weight.



1. Air Sensing Tube
2. Elbow
3. Nut
4. Preformed Packing
5. Bleed Valve
6. Bolt (2)
7. Washer (2)
8. Gasket
9. Nut (2)
10. Bolt
11. Washer
12. Nut
13. Lever
14. Pin
15. Poppet Guide
16. Washer
17. Pin
18. Poppet
19. Pin
20. Poppet Seat
21. Screw
22. Valve Body
23. Anti-icing Tube (RH)
24. Nut
25. Preformed Packing
26. Anti-icing Tube (LH)
27. Plug (2)
28. Preformed Packing (2)
29. Anti-icing Valve
30. Pressure Probe Elbow
31. Nut
32. Preformed Packing
33. Bolt
34. Nut
35. Clamp (2)

Figure 5-13. Engine Air Systems (Anti-icing and Bleed Air)

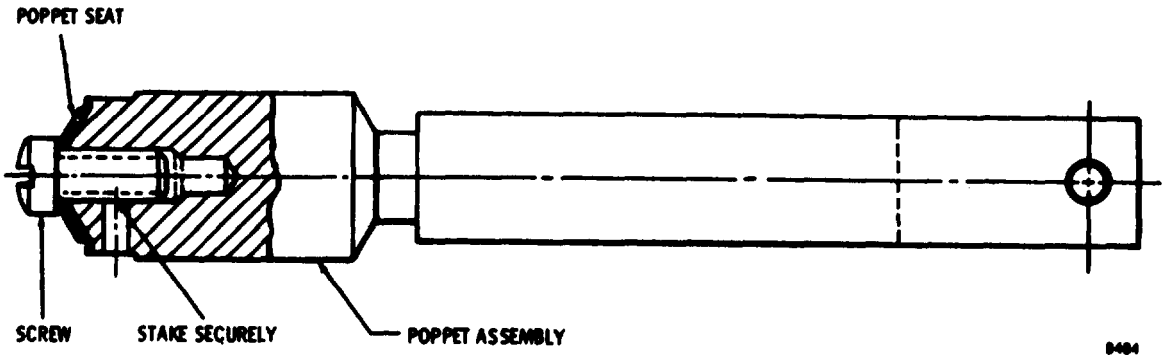


Figure 5-14. Anti-icing Valve Poppet Seat Replacement

Table 5-2. Anti-icing Air Valve Inspection and Repair

Item	Condition	Serviceable Limit	Repairable Limit	Disposition
1	Lever wear at poppet mating surface (creating flat).	Max flat length of 1/16 in.		Repair by grinding rounded end in accordance with figure 5-15 or replace lever.
2	Wear at hole for airframe linkage.	Remaining wall thickness not less than 0.040 in.		Repair or replace lever.
3	Nicks or scratches in flared tube sealing surfaces of valve body.	None.		Repair or replace valve body.
4	Stripped or crossed threads on valve body or coupling nut of the poppet guide.	None.	Max of one damaged thread per connection.	Chase threads.
5	Poppet wear.	Max wear step of 0.005 in.		Replace poppet.
6	Poppet seat damage or wear (excessive valve leakage).	None.		Replace seat.

(5) With the engine at 100% N2 and the compressor bleed valve closed, set the friction lock on collective and rotate the twist grip to flight idle and let N1 stabilize. The bleed valve should be fully open.

(6) Slowly rotate the twist grip toward open. Record the N1 speed at which the compressor bleed valve starts to close.

(7) Continue rotating the twist grip and record N1 speed at which the compressor bleed valve is fully closed.

(8) Compare the recorded N1 speeds for figure 1-9. Clean the compressor bleed valve (refer to para 7-7) if range of figure 1-9 is not met and retest. Replace the bleed valve if it does not operate within the range on figure 1-9.

c. Installation.

(1) Install compressor bleed valve (5) and new gasket (8) on mounting flange. Retain with three nuts (9, 12), bolts (6, 10) and washers (7, 11).

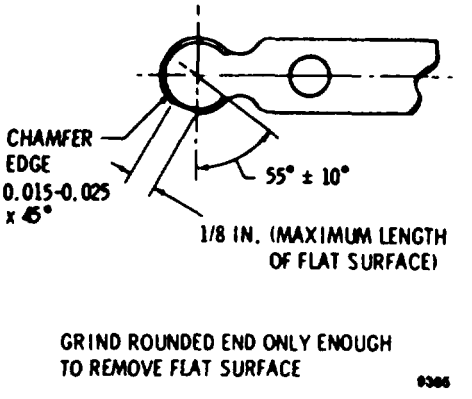


Figure 5-15. Anti-icing Valve Lever Repair

b. Removal.

(1) Disconnect the compressor discharge pressure sensing tube (1, figure 5-13) at compressor bleed valve (5). (Disconnect tube at the diffuser scroll pressure probe elbow only if necessary.)

(2) Remove three nuts (9, 12), bolts (6, 10) and washers (7, 11); remove valve (5) and gasket (8). Discard the gasket.

(3) If valve is to be replaced, remove lockwire, loosen jam nut (3) and unscrew elbow (2) from the bleed valve. Discard preformed packing (4).

Apply antiseize compound (item 15, table 2-2) to the bolts. The 1/4-28 bolt goes in the left hole (looking forward). Tighten nut on 1/4-28 bolt to 70-85 in. lb. and the other two nuts to 35-40 in. lb.

(2) Lubricate preformed packing (4) with oil (item 7, table 2-2) and place on elbow (2). Install the elbow in the bleed valve. Do not tighten the jam nut.

(3) Attach compressor discharge pressure sensing tube (1) to valve elbow (2). Tighten coupling nut to 80-120 in. lb. Tighten jam nut (3) to 55-80 in. lb.

Section V. IGNITION SYSTEM

5-34. Scope

Ignition system servicing includes replacing and testing the ignition exciter, spark igniter and igniter lead.

5-35. Ignition Exciter.

a. Removal.

WARNING

To prevent personnel injury due to electrical shock, ensure ignition system has been off at least five minutes before disconnecting any leads. Ground leads to engine using an insulated screwdriver.

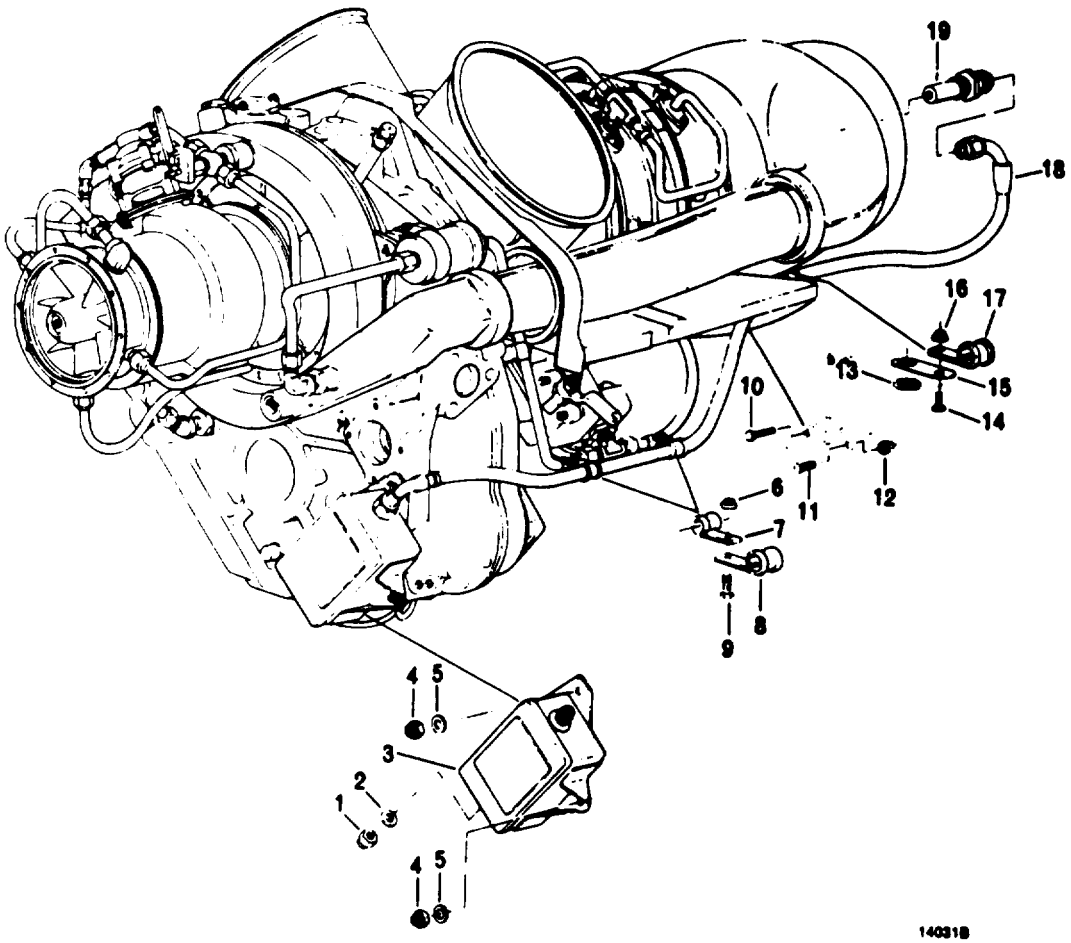
(1) Remove nut (1, figure 5-16) and washer (2) and disconnect power input lead from the exciter (3).

(2) Disconnect igniter lead (18) from the exciter.

(3) Remove three nuts (4) and washers (5) securing exciter (3) to the gearbox housing. Remove the exciter.

b. Inspection.

(1) Visually inspect for general condition of exciter, input power terminal, and igniter lead connector. Nicks, dents, etc. are acceptable if damage does not extend through the case or cover, Bent or misaligned electrical connector is acceptable if the connector base is not excessively distorted, bulged, or cracked. The connector ends must assemble properly with no evidence of internal damage.



1. Nut
2. Washer
3. Exciter
4. Nut (3)
5. Washer(3)
6. Nut (2)
7. Clamp (2)
8. Clamp (2)
9. Bolt (2)
10. Bolt
11. Bolt
12. Nut (2)
13. Nut
14. Bolt
15. Bracket
16. Nut
17. Clamp
18. Igniter lead
19. Spark Igniher

Figure 5-16. Ignition System

(2) Connect a known satisfactory igniter lead and spark igniter of type used on engine to the ignition exciter.

CAUTION

Do not energize ignition exciter if spark igniter and lead are disconnected. Damage to exciter could occur.

(9) Apply 28 volts dc to the input terminal of the ignition exciter using a minimum wire size of 16 gauge. Observe firing. If a repetitive spark rate of lees than six sparked per second is observed replace the ignition exciter.

CAUTION

Do not operate the exciter for more than 4 minutes in any 30 minute period. Damage to exciter could occur.

c. Installation.

(1) Install serviceable exciter on the engine and secure with three nuts (4) and washers (5). Tighten nuts (4) to 30-40 in. lb.

(2) Attach igniter lead (18) to the exciter. Tighten coupling nut to 50-70 in. lb.

(3) Attach power input lead to the exciter input terminal. Secure with washer (2) and nut (1). Tighten nut to 8-12 in. lb.

5-36. Spark Igniter

a. Removal.

WARNING

To prevent personnel injury due to electrical shock ensure ignition system has been off for at least five minutes before removing igniter to dissipate all energy stored in condenser. Ground igniter lead to engine using an insulated screwdriver.

(1) Disconnect igniter lead (18, figure 5-16) at igniter (19). Prevent lead from twisting while removing nut.

(2) Separate lead from igniter by pulling straight out without any rotational motion.

(3) Remove lock wire and unscrew igniter (19).

CAUTION

The igniter connector well must be kept dry and free from foreign material. Damage to igniter and igniter load could result.

b. Cleaning.

(1) Clean igniter connector well with a clean dry cloth. Do not wash with solvent.

CAUTION

Under no circumstances, wire brush, sand blast, vapor blast, or scrape the igniter. Any of these cleaning methods can damage the semi-conductor.

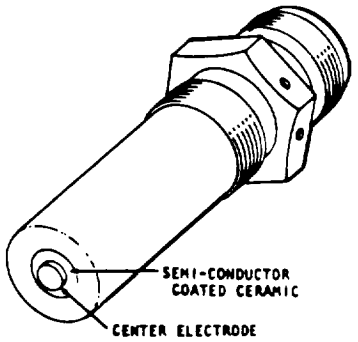
(2) Normal soot or carbon formation on the tip is not detrimental to igniter operation and need not be removed. If cleaning is desired, wipe the metal tip with a soft dry cloth.

(3) Remove any sizable carbon deposits with a blunt non-metallic instrument. Be careful not to damage the semi-conductor material.

c. Inspection.

(1) Inspect center electrode; replace igniter if electrode is loose (See figure 5-17.)

(2) Inspect ceramic for cracks; if any cracks are visible through carbon coating, replace ignite.



4364A

Figure 5-17. Spark Igniter

d. Testing.

(1) With a good exciter and igniter lead, check igniter operation before installing in engine.

(2) Apply 28 volts dc to the exciter; observe the rate of firing. Normal operation is six sparks per second minimum.

(3) Replace igniter if it fails to fire or fires intermittently.

e. Installation.

(1) Apply a light coat of antiseize compound (item 15, table 2-2) to the threads and install serviced or new igniter; tighten to 150-200 in. lb. and lockwire (item 10, table 2-2) to fuel nozzle.

(2) Connect igniter lead; tighten to 70-90 in. lb.

5-37. Spark Igniter Lead.

a. Removal.

WARNING

To prevent personnel injury due to electrical shock ensure ignition system has been off for at least five minutes before disconnecting igniter lead. Ground lead to engine using an insulated screwdriver.

(1) Remove the lead (18, figure 5-16) from the ignition exciter (3) and the spark igniter (19).

(2) Remove bolts (9) and nuts (6) securing clamps (7 and 8) together.

(3) Remove bolt (14) and nut (16) securing clamp (17) to bracket (15).

(4) Remove two bolts (10 and 11) and nuts (12) securing the lead to the fireshield. Remove the lead.

NOTE

Bolt (10) also secures the accumulator bracket and spacer to the fireshield.

b. Inspection.

(1) Inspect the outer part of the lead for braid damage; replace lead if there are more than five broken strands in any localized area, the braided conduit is punctured, or discolored and brittle from extreme heat.

(2} Inspect terminals of lead to ensure all parts are intact and no pitting is evident; replace lead if any part is missing or pitting is present.

c. Installation

(1) Insert the igniter lead (18) through the hold in the fireshield. Secure the lead to the fireshield with bolt (11) and nut (12). Secure accumulator clamp, spacer, and igniter lead with bolt (10) and nut (12). Tighten the nuts to 35-40 in. lb.

(2) Connect the igniter lead to the ignition exciter (3) and tighten the coupling nut to 50-70 in. lb.

(3) Connect the igniter lead to the spark igniter (19) and tighten the coupling nut to 70-90 in. lb.

(4) Secure the lead to the air tubing at the power turbine governor with four clamps (7 and 8), two bolts (9) and nuts (6). Tighten the nuts to 35-40 in. lb.

(5) Secure the igniter lead to bracket (15) with clamp (17), bolt (14) and nut (16). Tighten the nut to 35-40 in. lb.

d. Ignition System Check. The following procedure can be used to check the operation of the ignition system.

NOTE

To preclude the possibility of the combustion chamber becoming misalined, do not remove the fuel nozzle and the spark igniter at the same time.

(1) Remove the spark igniter lead (18) from the spark igniter.

(2) Remove the spark igniter (19).

CAUTION

To prevent damage to the igniter, when assembling or disassembling a lead and an igniter which is not installed on the engine, turn the lead nut and not the spark igniter.

(3) Attach the spark igniter lead to the spark igniter.

(4) Apply 28 volts dc across the ignition exciter. Observe or listen for spark.

(5) Install spark igniter and spark igniter lead on the engine. Tighten the spark igniter to 150-200 in. lb. and lockwire to the fuel nozzle. Tighten the lead to 70-90 in. lb.

Section VI. MISCELLANEOUS ACCESSORIES

5-38. Burner Drain Valve.

a. Removal.

NOTE

Use a wrench on the drain valve boss to offset torque when removing or installing the valve.

(1) Remove lockwire and remove nut (16, figure 3-8) from the drain valve (14). Disengage bracket (15) and remove the drain valve from the outer combustion case. Discard preformed packing (13).

b. Cleaning.

(1) Soak the valve in solvent (item 16, table 2-2).

(2) Flush the valve with petroleum solvent (item 3, table 2-2). Pass solvent through the valve to ensure that it is open.

(3) Blow dry with clean compressed air.

c. Testing.

Test the valve to ensure that it closes by applying air pressure (8 psig maximum) to the valve inlet or test as described in paragraph 5-38 *d* (2).

d. Installation.

(1) Lubricate new preformed packing (13) with oil (item 7 or 8, table 2-2) and place on drain valve (14). Install the drain valve in the outer combustion case

and tighten to 120-140 in. lb. Apply antiseize compound (item 15, table 2-2) to the threads on the outer end of the drain valve and install bracket (15) and nut (16). Tighten the nut to 55-80 in. lb. and lockwire (item 32, table 2-2).

(2) Start the engine and check to ensure that the valve is closed. Replace the valve if it fails to close.

(3) Attach the drain hose to the valve.

5-39. Thermocouple Terminal Assembly.

a. Removal.

(1) Remove the two nuts securing the thermocouple leads to the terminal assembly.

(2) Remove the two nuts and bolts securing the terminal assembly to the exhaust collector.

b. Installation.

(1) Position the terminal assembly on the exhaust collector with the large terminal to the top and secure with two bolts and self-locking nuts. Tighten the nuts to 35-40 in. lb.

(2) Attach the alumel leads to the top post on the terminal assembly and secure with the No. 10-32 alumel nut. Tighten the nut to 17-25 in. lb.

(3) Attach the chrome] leads to the bottom post on the terminal assembly and secure with the No. 8-32 chromel nut. Tighten the nut to 17-25 in. lb.

CHAPTER 6

ENGINE DISASSEMBLY

6-1. Scope.

This chapter provide sequential disassembly procedures for major functional assemblies. Procedures are provided for disassembly only to the extent necessary for Aviation Unit and Aviation Intermediate Maintenance activities to perform cleaning, inspection, repair, and/or replacement of provisioned parts in accordance with the Maintenance Allocation Chart and TM 55-2840-241-23P.

6-2. Compressor Case Half Removal.

One compressor case half may be removed to inspect the rotor blades, stator vanes, plastic coating, and front support welds. (Refer to paragraphs 7-9 thru 7-12.) Removal of the compressor case half is authorized only as a last resort to determine the cause of low engine performance when foreign object damaged (FOD) is suspected or when sand erosion is suspected. Before removing the case half ensure that low engine performance is not caused by a defective compressor bleed valve or anti-icing valve, leaking scroll-to-rear diffuser or compressor discharge air tube seals, or a dirty compressor. REMOVAL OF THE COMPRESSOR CASE HALF TO PERFORM ROUTINE PERIODIC INSPECTIONS IS NOT PERMITTED.

CAUTION

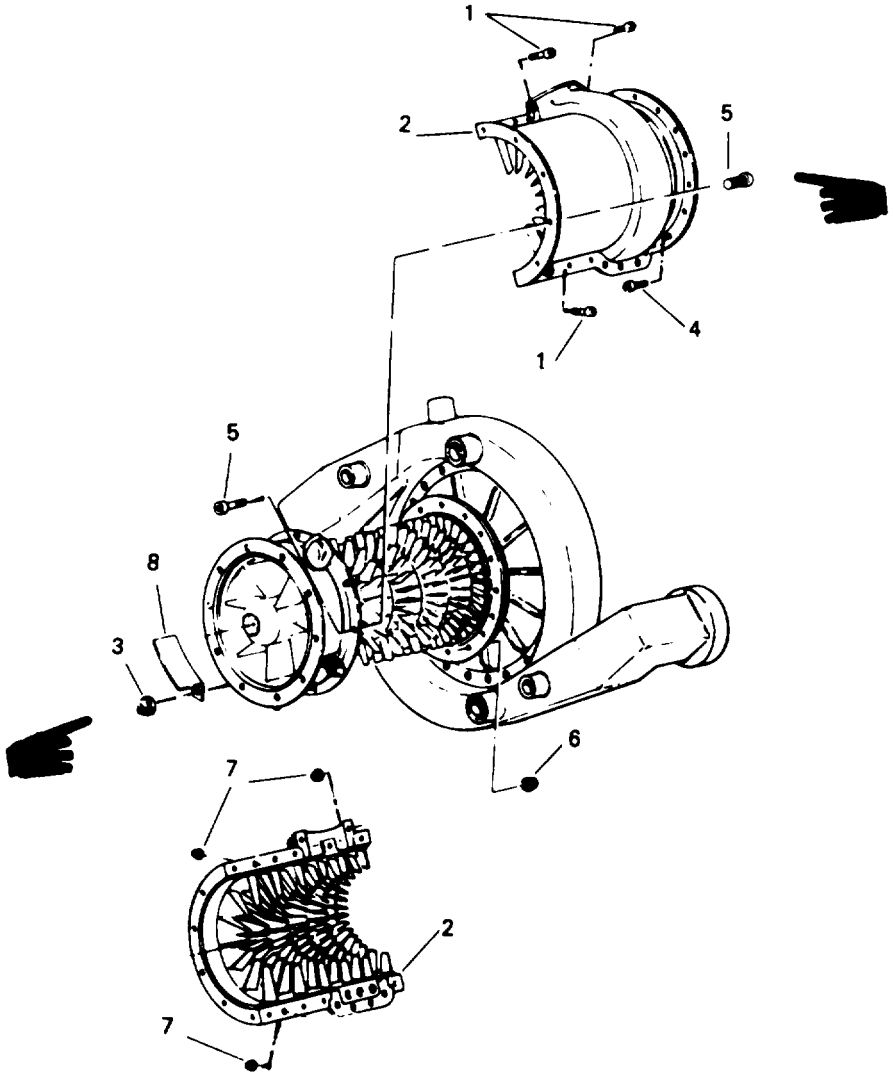
Remove only one case half at a time. DO NOT remove both case halves at the same time. Ensure that the removed case half is properly reinstalled and that the bolts are tightened to the required torque values before any of the bolts on the other case half are loosened. Misalignment of the compressor could result if both case halves were removed simultaneously. (Refer to paragraph 8-2.)

a. Remove the compressor bleed valve. (Refer to paragraph 5-33.)

b. Remove the anti-icing air tubes (23, 26, figure 5-13) between the anti-icing air valve and the compressor front support.

c. Mark the location of nameplate (8, figure 6-1) when the applicable compressor case half-to-front support bolts (5) are to be removed. This is to ensure that the nameplate will be returned to the same location at assembly.

d. Remove one compressor case half (2) by removing 16 horizontal splitline nuts (7) and bolts (1), five case half-to-front support nuts (3) and bolts (5), and eight case half-to-front diffuser nuts (6) and bolts (4). Lift the case half straight out.



1. BOLT (16)
2. COMPRESSOR CASE HALF
3. NUT (10)
4. BOLT (16)
5. BOLT (10)
6. NUT (16)
7. NUT (16)
8. NAMEPLATE

Figure 6-1. Compressor Case Assembly

CHAPTER 7

CLEANING, INSPECTION AND REPAIR

Section I. CLEANING

7-1. General.

Use care in separating metals for cleaning. Observe the following general cleaning precautions.

WARNING

Petroleum solvent vapors are toxic. Provide adequate ventilation for personnel using it.

a. Petroleum solvent (item 3, table 2-2) is the cleaning solvent recommended for nonferrous parts (clean" ers for steel will damage nonferrous parts.) Do not use rust preventives on magnesium and aluminum parts.

b. Clean aluminum-coated steel parts with carbon removal compound (item 17, table 2-2). Rinse the part with water and dry with an air blast.

c. Clean steel parts with cresol base cleaning compound (item 18, table 2-2). Rinse the part thoroughly with hot water. Coat parts with a compound of one part rust preventive (item 19. table 2-2) and the parts oil (item 20, table 2-2).

7-2. Cleaning Engine Exterior Surfaces

Flush or spray wash external surfaces with petroleum solvent (item 3A, table 2-2) to remove grease. oil. and dirt. Ensure that all openings are plugged or covered before cleaning.

CAUTION

Engine thermocouples should never be saturated or sprayed with cleaning solvents Liquid cleaning solvents will penetrate the porous magnesium oxide insulation. Engine heat will vaporize the solvents leaving a residue containing carbon which causes a low resistance to ground.

7-3. Compressor Cleaning to Restore Lost Performance.

CAUTION

Allow the engine to cool for a minimum of 45 minutes prior to spraying the compressor. Mandatory cooling period is required to prevent warpage to internal engine components.

Buildup of dirt in the compressor can result in a serious loss of engine power and performance. Lost performance may be restored by flushing the installed engine with a water/solvent solution as follows:

WARNING

Methanol is flammable; it should not be used if the ambient temperature is above 4°C (40°F), its vapor is harmful; it could be fatal or cause blindness if swallowed. Keep it away from open flame and avoid prolonged breathing of the vapor.

NOTE

Once the cleaning procedure is started, it must be carried through to completion without delay. At ambient temperatures below 4" C (40°F) and above -29°C (-20°F), use a 40 percent Methanol (item 34. table 2-2),60 percent water mixture, in place of fresh water. The temperature of the wash solution should not be below 4°C (40°F), ideally it should be between 21-26°CC (70-80°F). To avoid spraying concentrated Methanol. which is combustible. mix the solution thoroughly.

NOTE

B&B 3100 (MIL-C-85704, Type I is the primary cleaner for Army turbine engines and remains an approved cleaner for locales where environmental restrictions permit. Engine cleaners that conform to MIL-C-85704. Type II and Type IIA are also acceptable engine cleaners and meet EPA environmental requirements. Continue use of B & B 3100 where not restricted. Where restrictions apply use MIL-C-85704. Type II and Type IIA cleaners. Approved Type II and Type IIA cleaners shall be used in accordamce with the existing washing procedure. Type IIA cleaners do not require dilution with water. Both types of cleaners are less effectzive than Type I cleaners. Therefore more frequent engine washes may be required to achieve satisfactory results.

a. Prepare two to four quarts of cleaning solution consisting of one part cleaning compound (items 39, 40, 41, 42, table 2-2) to four parts of clean water (distilled if available).

CAUTION

Do not substitute petroleum base solvent or jet fuels for recommended cleaning compound. Damage to compressor plastic lining could result.

b. Retain the anti-icing air valve in the closed position.

c. Inspect P_c tube at scroll and filter ends for cracks and fretting wear. Closely check the areas covered by the floating ferrules and the flared ends. Inspect the scroll for cracks at the junction with P_c elbow.

d. Disconnect the control air and compressor bleed valve pressure sensing tubes at the diffuser scroll pressure probes. Cap both pressure probes and plug all open sensing lines. Block the compressor bleed valve in the closed position using the compressor protector cleaning kit, tool No. 68886204. (See figure 2-4.) Refer to TM 55-1520-228-23 for airframe bleed air operated systems.

e. Remove the burner drain valve (14, figure 3-8) from the bottom drain port on the outer combustion case.

f. Deactivate the ignition system by diconnecting the power lead to the ignition exciter or pull engine ignition circuit breaker.

CAUTION

Do not exceed 10% N1 motoring speed during the cleaning and rinsing cycles to prevent possible blade damage and assure adequate rinse/cleaning at the base of the blades. Do not inject a solid stream of fluid into the compressor. Damage to compressor could occur.

g. Spray cleaning solution into the compressor inlet using a low pressure type sprayer equipped with a quick opening valve while motoring the engine without ignition. Start injection 3 seconds prior to starter engagement and inject the solution at the rate of one quart in 9 to 11 seconds until 2 to 4 quarts (1.9 - 3.8) have been utilized. Maintain motoring speed below 10% for the duration of the injection. Disengage the starter if N1 speed is attained. Repeat the injection cycle as cecessary until the compressor is clean.

h. Within 15 minutes after injection of the cleaning solution, spray clean water (distilled preferred) into compressor. Use methanol water mixture if ambient temperature is below 4°C (40°F). Start injection 3 seconds prior to starter engagement and inject steam or water at the rate of one pint to one quart in 5 to 10 seconds. Disengage the starter before N1 speed accelerates above 10°.

i. Remove the compressor protector cleaning kit and reconnect the control and compressor bleed valve sensing tubes. Tighten the coupling nuts to 80 - 120 in. lb.

j. Reconnect the power lead to the ignition exciter or reset the IGN ENG circuit breaker.

k. Apply antiseize compound (item 15, table 2-2) to the threads and install burner drain valve (14, figure 3-8) with new preformed packing (13) in the bottom drain port of the outer combustion case. Tighten the drain valve to 120 - 140 in. lb. Apply antiseize compound (itm 15, table 2-2) to the threads on the outer end of the drain valve. Secure clamp and bracket assembly (15) to the drain valve with jam nut (16). Tighten the jam nut to 55-80 in. lb. and secure with lockwire (item 32, table 2-2).

l. Start and operate the engine for a minimum of five minutes. Operate the engine anti-icing system to purge solution from the compressor front support. Also, operate any aircraft systems which use compressor bleed air. Complete the engine drying run within 15 minutes after cleaning and rinsing. Using the soap solution, maintenance operation check (MOC) is required to verify that the reconnected P_c line and bleed valve line do not leak.

NOTE

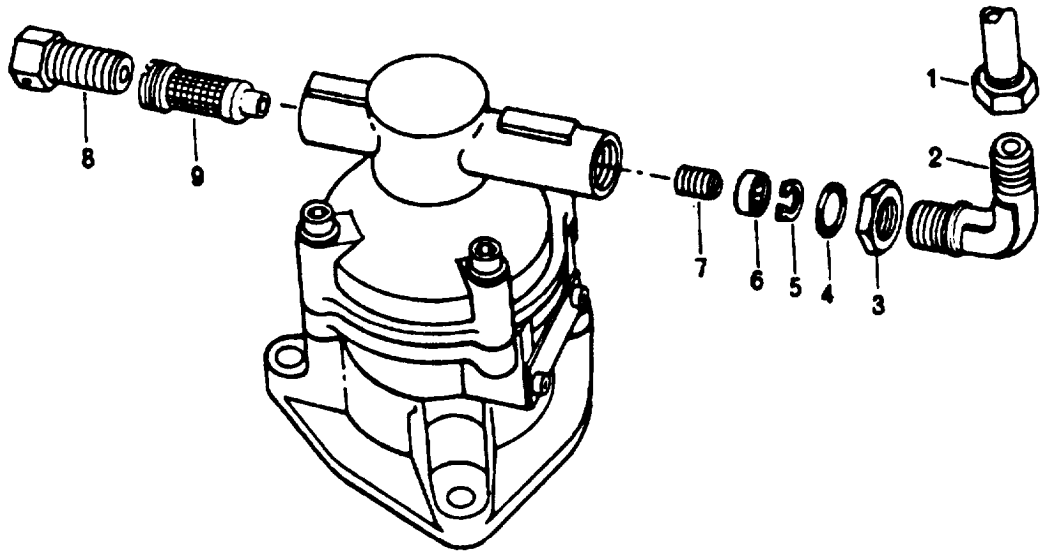
An EPC and torsional oscillation check is not required for routine 50 hour engine flushes unless poor engine performance is noted.

7-4. Compressor Rinsing to Remove Salt Water Contamination.

CAUTION

Allow the engine to cool for a minimum of 45 minutes prior to spraying the compressor. Mandatory cooling period is required to prevent warpage to internal engine components.

The compressor shall be rinsed if operated within 200 miles of volcanic activity or operated within 10 miles of salt water and on all engines operated below 1000 feet (304.8m) over salt water shall overgo cleaning according to the following procedure after shutdown following the last flight of the day. Use the procedure in paragraph 7-3 with the following additions.



1. Air Sensing Tube
2. Elbow
3. Jam Nut
4. Preformed Packing
5. Internal Retaining Ring
6. Filter
7. Jet
8. Nozzle
9. Strainer

Figure 7-1. Compressor Bleed Valve Jet and Nozzle Removal

a. Use only clean water for rinsing solution.

b. Block the compressor bleed valve in the closed position using the compessor cleaning kit, tool no. 6886204. It is not necessary to remove any lines.

7-5. Cleaning Compressor Case Half.

CAUTION

Do not immerse the compressor case half in liquid cleaning solvents. Damage to the compressor plastic lining could result.

a. Place the compressor case half on end and spray with solvent (item 3. table 2-2). Blow dry immediately with clean, compressed air.

NOTE

B&B 3100 (MIL-C-85704, Type I) is the primary cleaner for Army turbine engines and remains an approved cleaner for locales where environmental restrictions permit. Engine cleaners that conform to MIL-C-85704, Type II and Type IIA are also acceptable engine cleaners and meet EPA environmental requirements. Continue use of B & B 3100 where not restricted. Where restrictions apply use MIL-C-85704, Type II and Type IIA cleaners. Approved Type II and Type IIA cleaners shall be used in accordance with the existing washing procedure, Type IIA cleaners do not require dilution with water. Both types of cleaners are less effective than Type I cleaners. Therefore more frequent engine washes may be required to achieve satisfactory results.

b. If there is any contamination remaining on the vanes, clean with a tooth brush and a solution consisting of one part cleaning compound (items 39,40,41,42, table 2-2) to four parts clean water (distilled if available). Flush with clean water and blow dry immediately with clean compressed air.

7-6. Cleaning Compressor Rotor Blades.

NOTE

B&B 3100 (MIL-C-85704, Type I) is the primary cleaner for Army turbine engines and remains an approved cleaner for locales where environmental Restrictions permit. Engine cleaners that conform to MIL-C-85704, Type II and Type IIA are also acceptable engine cleaners and meet EPA environmental requirements. Continue use of B & B 3100 where not restricted where restrictions apply use MIL-C-85704, Type II and Type 11A cleaners. Approved Type II and Type IIA cleaners shall be used in accordance with the existing wash-

ing procedure. Type HA cleaners do not require dilution with water. Both types of cleaners are less effective than Type I cleaners. Therefore more frequent engine washes may be required to achieve satisfactory results.

a. With one compressor case half removed, clean contamination from the blades using a tooth brush and a solution of one part cleaning compound (items 39,40, 41,42, table 2-2).

b. Flush with clean water and blow dry with clean compressed air.

7-7. Compressor Bleed Valve Cleaning.

a. Remove the air sensing line (l, figure 7-l) from the compressor bleed valve elbow (2).

b. Remove the elbow from the bleed valve, Discard preformed packing (4).

c. Remove internal retaining ring (5) and separate fillter (6) from the compressor bleed valve. Replace the retaining ring before assembly if it is damaged during the removal operation.

d. Using a screwdriver, remove jet (7) from the compressor bleed valve.

e. Clip the lockwire, then remove nozzle (8) and strainer (9) from the compressor bleed valve.

f. Clean the nozzle, falter, strainer, and jet ultrasonically if equipment is available. If ultrasonic equipment is not available, agitate the parts in a clean container of solvent (item 3, table 2-2). Use a soft bristle brush to clean exposed surfaces. Insert a sewing thread through the jet hole. Slide the jet back and forth on the thread to remove film. Clean the nozzle in the same manner.

CAUTION

Do not blow the jet dry. The small jet can be easily lost or damaged.

NOTE

If the jet must be replaced, return the compressor bleed valve to overhaul for part replacement and recalibration of the valve assembly.

g. Inspect the jet and the nozzle using a flashlight. Place the part on the center of the lens so the light can be seen through the hole. Reclean the part if any particles or coating can be seen.

CAUTION

Do not use a probe to remove particles lodged in the jet or nozzle. Damage to the jet or nozzle could result.

h. Install jet (7) in the compressor bleed valve. Tighten to 8-12 in. lb.

i. Place filter (6) in the compressor bleed valve (skirt end first). Secure with internal retaining ring (5).

j. Install strainer (9) and nozzle (8) in the compressor bleed valve. Tighten to 35-45 in. lb. and secure with lockwire (item 10, table 2-2).

k. Lubricate preformed packing (4) with oil (item 7 or 8. table 2-2) and install it with elbow (2) on the compressor bleed valve. Do not tighten the elbow jam nut (3) at this time.

l. Position the elbow as required and install air sensing line (l). Tighten the coupling nut to 80-120 in. lb. Tighten elbow jam nut (3) to 55-80 in. lb.

Section II. INSPECTION

7-8. Scope.

This section provides instructions for complete inspection of engine parts within the scope of the Maintenance Allocation Chart. Service limits and standards are presented to determine when parts should be repaired or replaced.

7-9. Compressor Rotor and Blade Inspection.

Visually inspect the compressor rotor and blades for the following conditions. Replace the engine if any of the limits are exceeded.

CAUTION

Honing stone shall he used for any blending. Use of a file may relieve stresses purposely placed in new or overhauled compressor blades, weakening blades and risking premature failure.

NOTE

This inspection requires removal of a compressor case half and shall be performed only for the reasons stated in paragraph 6-2. It is not

possible to fully describe all of the damage conditions that could be incurred; therefore, if possible to fully describe all of the damage conditions that could be incurred; therefore, if damage is within rework limits, but there is reasonable doubt about the strength of the reworked blade as compared to a new blade, replace the engine. Light polishing to remove minor nicks, where blade dimensions are basically unchanged, is permissible on the other 2/3 of the blade.

Blend and polish blades or vanes in a longitudinal direction only with the rework forming a smooth blend with the basic airfoil. The number of blades or vanes which maybe reworked is not limited. Other than restriction to the outer 2/3 of the blade, the limiting factor of blade or vane rework is engine performance. Any reduction of blade or vane area will decrease the efficiency of the compressor and the performance of the engine. Remove as little material as possible. No sharp edges, burrs, cracks or tears are acceptable.

a. Inspect for cracked or missing compressor blades - none are permitted.

b. Inspect the compressor rotor blades and wheel hubs for evidence of corrosion. Corrosion must be removed by lending and polishing. (Refer to paragraph 7-24.) Replace the engine if pitting in any area of the blade forjs a definite line, pitting exceeds the blend limits, or if pitting in the inner 1/3 of blade.

c. Inspect the compressor rotor blades and wheel hubs for nicks, dents and scratches in areas other than the blade leading and trailing edges. All damage and imperfections must be blended out. (Refer to paragraph 7-24 *c* and *d.)* Blended areas must not exceed the limits shown on figure 7-12.

d. Inspect for nicks, dents, and erosion on the blade leading and trailing edges and at the blade tip. All damage and imperfictions must be blended out. (Refer to paragraph 7-24a and b.) Blended leading and trailing edges and chamfered blade tips must not exceed the limits shown on figures 7-10 and 7-11.

e. Inspect the blade tips and leading edges for evidence of loose plastic rub on all blades in a given stage. Loose plastic rub is a result of the compressor case plastic lining coming loose and displacing inward, wearing away portions of all blades in a given stage. Loose plastic rub is evidenced as a chamfer at the leading edge tip or an undercut of the blade leading edge. (See figure 7-2.) replace the engine if rub is indicated.

f. Inspect the blade tips for heat discoloration on one or more blades. heat discoloration is caused by severe blade rub on the compressor case plastic lining which occurs when the wheels shift off center due to an unbalance condition. Replace the engine if heat discoloration is detected.

7-10. Compressor Stator Vane Inspection.

Visually inspect the compressor stator vanes for the following conditions. Replace both compressor case halves if any of the limits are exceeded.

NOTE

This inspection requires removal of a compressor case half and shall be performed only for the reasons stated in paragraph 6-2.

a. Inspect for cracked or missing stator vanes - none are permitted.

b. Inspect the vane tips for evidence of rub. Rub is indicated by smeared metal on the vane tip associated with a burr on the convex side or by heat discoloration on the vane. Replace the engine if rub is indicated.

c. Inspect for evidence of corrosion on the vanes. Pitting in any. area of the vane that forms a definite line is not acceptable. Replace the compressor case if pitting exceeds blend limits. (Refer to paragraph 7-25a.)

c. Inspect for erosion on the airfoil leading and training edges. Replace the compressor case if the limits of figure 7-3 are exceeded.

e. Inspect for nicks, and dents on the vane leading and trading edges. All damage and imperfections must be blended out. (Refer to paragraph 7-25a.) Blended leading and trailing edges must not exceed the limits shown on figure 7-13.

f. Inspect for nicks and dents on the vane airfoil surface. All damage and imperfections must be blended out. (Refer to paragraph 7-25a.) Blended areas must be within the limits shown on figure 7-13.

g. Inspect for bent vanes. Straighten vanes that are bent on the inner thee-fourths of the vane. Vanes that are bent on the outer one-fourth are not acceptable.

7-11. Compressor Plastic Coating Inspection.

Visually inspect the compressor case plastic coating or the following conditions. Replace both compressor case halves if any of the limits are exceeded.

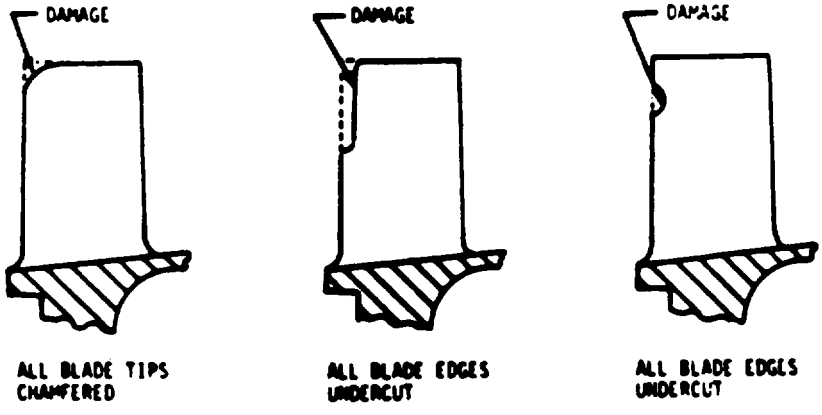
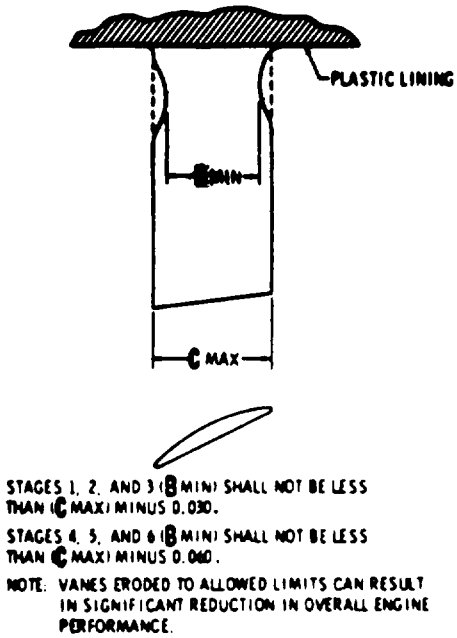


Figure 7-2. Compressor Blade Damage Caused by Rub



NOTE

This inspection requires removal of a compressor case half and shall be performed only for the reasons stated in paragraph 6-2.

a. Cracks are acceptable without limitation as to length and quantity provided the plastic is secure bonded to the case, except cracks along the horizontal splitline m excess of 1/2 inch are unacceptable.

b. Debonded, missing, or loose plastic in the vane row areas only is acceptable provided that no more than 50 percent in stages 5 and 6 or 25 percent in stages 1 through 4 are missing. Any raised or loose plastic in the vane row areas shall be removed.

c. Raised or debonded plastic in the blade path areas is not acceptable. Circumferential cracks at the front or rear of the blade path can cause an arc segment of the plastic to raise when at normal operating temperatures and cause plastic wear in line with the leading or trailing edge of the blade tips. A groove worn in the plastic adjacent to a circumferential crack is evidence of debonding in the blade path.

d. Erosion of the plastic coating is acceptable unless bare metal is visible.

7-12. Compressor Front Support Inspection.

Visually inspect the compressor front support. Replace the engine if any of the following conditions are found.

. a. Any cracks in the parent metal or braze joints.

b. Gradual dents exceeding 1/16 in. deep, or acute dents exceeding 1/32 m. deep. No punctures allowed.

c. Weld failures at the trailing edge spacers, as viewed from the rear with the compressor case half removed.

d. Vane erosion to the extent that reduction of skin thickness is a parent and/or trading edge slots are restricted.

e. Bullet nose dents with nicks or scratches on dome over 0.020 in. deep after stone blending and fine abrasive paper polishing.

7-13. Diffuser Scroll Inspection.

Visually inspect. the installed diffuser scroll for the following conditions. Replace the engine tithe damage cannot be reps.u-ed.

a. Inspect for visible cracks. Replace the engine if cracks are found.

NOTE

The turning vanes and air tube inserts may be inspected only when the combustion section is removed.

b. Check the turning vanes in the outlet ports for evidence of damage. Damage is indicative of impeller vane tip or shroud failure. Replace the engine.

c. Inspect the diffuser scroll discharge air tube inserts for wear and looseness. If wear in the ID of the insert exceeds 0.010 in. depth or there is evidence that the insert has been pulled out of the scroll, replace the engine.

7-13.1. Diffuser Vent Tube.

Visually inspect for cracks, bends, and dents. No cracks, dents or bends are pernutted. Replace vent tube.

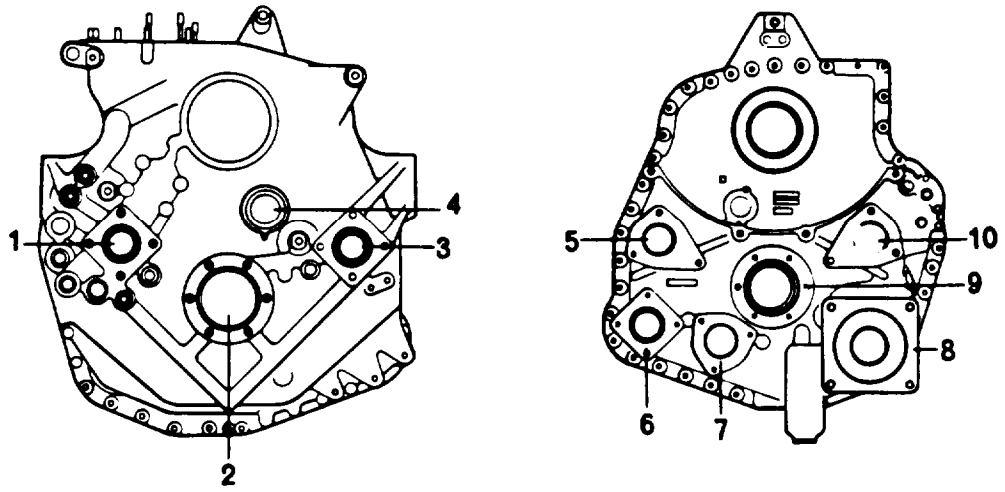
Inspect the tube for movement. None is permitted. Remove and replace tube.

7-14. Gearbox Inspection.

Visually inspect the exterior of the gearbox for the following conditions.

a. Check for cracks in the gearbox housing and cover, especially m stress areas; engine mounts, accessory pads, and at the splitline. If cracks are found, replace the engine.

b. Check for oil leaks. If area below seal at any accessory or power takeoff pad (figure 7-4) is dripping, replace the seal assembly. (Refer to paragraph 7-27.)



1213/1214

1. Gas producer tachometer-generator.
2. Power takeoff
3. Power turbine tachometer generator
4. Torquemeter spanner nut
5. Power turbine fuel govenor
6. Spare (not used)
7. Fuel pump
8. Starter-generator
9. Power takeoff
10. Gas producer fuel control

Figure 7-4. Gearbox Accessory Pad Locations

c. If any gearbox-mounted accessory is removed, visually inspect the gearbox studs for security, worn areas, and damaged threads. Replace loose, damaged, or worn studs. (Refer to paragraph 7-28.)

d. Check for damaged paint surfaces. Repair damaged paint per paragraph 7-29.

7-15. Thermocouple Assembly Inspection.

When erroneous indications are suspected, ensure that the indicating system is functioning properly. Perform a TOT gage calibration check and a total TOT circuit resistance check. (Refer to TM 55-4920-244-15 and TM 55-1520-228-23.) If no discrepancies are noted, check the thermocouple system as follows. Do not remove the thermocouple assembly from the engine.

a. Visually inspect the thermocouple assembly for broken leads, loose terminals, and other visible damage.

b. Disconnect the leads from the terminal assembly mounted on the right-hand side of the exhaust collector.

c. Check the internal resistance of the thermocouple harness at the terminal block on the right-hand side of the exhaust collector. Resistance shall be 0.55 to 0.65 ohms.

d. Reconnect the leads to the terminal assembly.

7-16. Exhaust Collector Support Inspection.

Visually inspect the exhaust collector support for cracks. Cracks are not repairable, replace the engine.

7-17. Outer Combustion Case Inspection.

Visually inspect for cracks and dents in sheet metal surfaces and wear in the air tube bosses. Replace the outer combustion case if the repairable limits are exceeded.

a. Check for cracks in the outer shell. Replace the outer combustion case if nonrepairable cracks are found. (See figure 7-5.) Weld all repairable cracks. (Refer to paragraph 7-30.)

b. Check for cracks in the liner (inner basket). Weld repair cracks three inches or less in length and a minimum of one inch apart. (Refer to paragraph 7-30.) Replace the outer combustion case if cracks are greater than three inches in length, cracks are less than one inch apart, or there are more than two cracks.

c. Check for dents in the outer shell. Replace the outer combustion case if dents are more than 1/8in. deep. (See figure 7-6.)

d. Check for wear in the air tube bosses. Replace the outer combustion case if wear is greater than 0.004 in. deep or out of round more than 0.004 in. (measure from adjacent unworn area.) (See figure 7-7.)

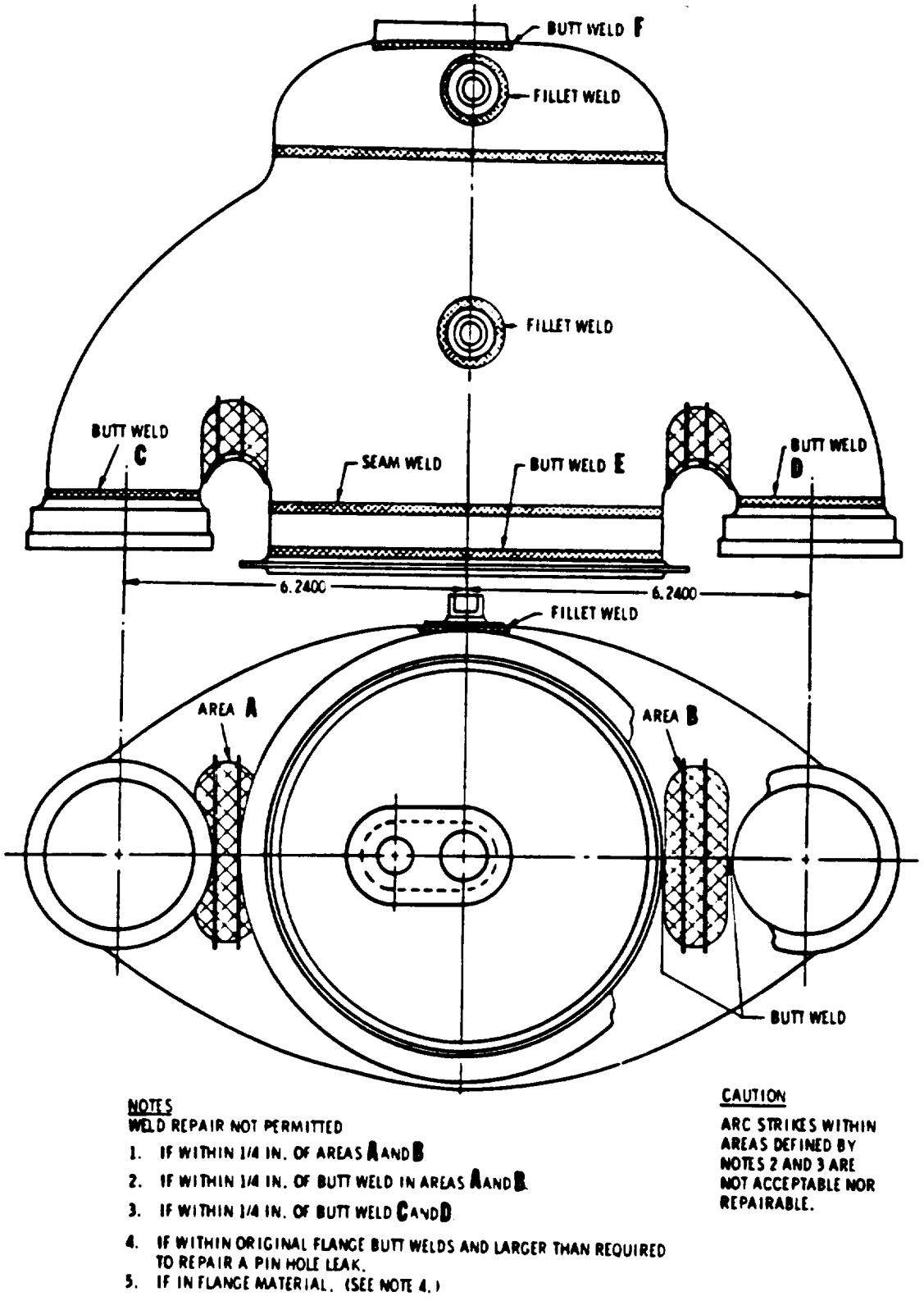


Figure 7-5. Outer Combustion Case Inspection

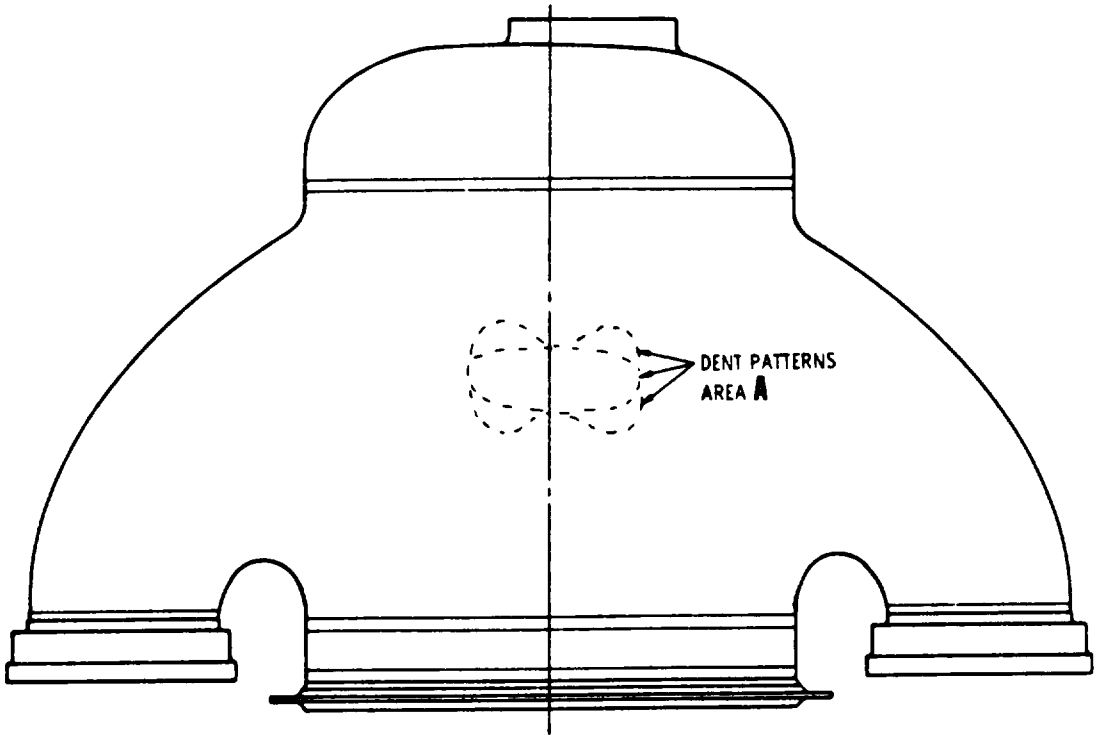


Figure 7-6. Dent Limits—Top of Outer Combustion Case

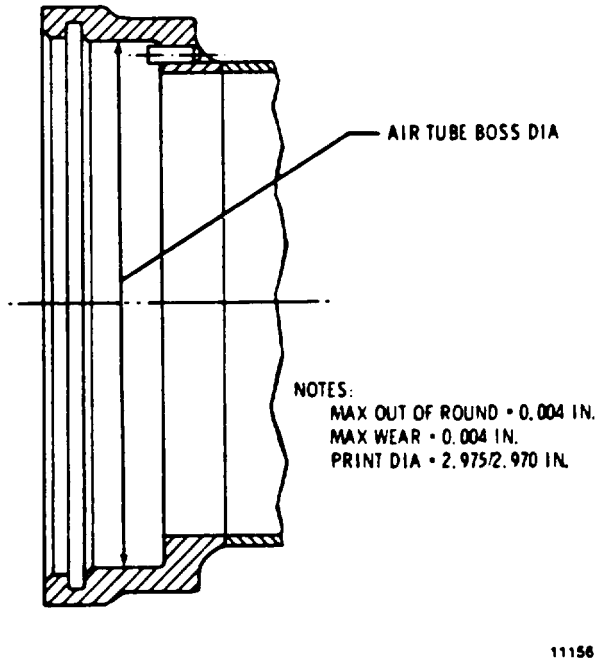


Figure 7-7. Outer Combustion Case Air Tube Boss

7-18. Compressor Discharge Air Tubes Inspection.

Visually inspect for cracks or dents in the sheet metal surfaces and wear in the seal ring grooves. Replace the air tube if repairable limits are exceeded.

a. Check for cracks in the sheet metal surface, Weld repair cracks which are three inches or less in length and do not extend into the brazed joints at the end flanges. (Refer to paragraph 7-31.) Replace the air tube if cracks are longer than three inches or extend into the brazed joint.

b. Check for dents in the sheet metal surfaces. Replace the air tube if:

(1) Any dent is greater than 1/8 in. deep.

(2) There are more than three dents up to 1/8 in. deep m areas not affected by weld joints.

(3) Any dent is greater than 1-1/2 in. in diameter.

c. Tubes with dents within allowable limits will be allowed to continue to operate without straightening or reforming.

NOTE

Dents should be round with no evidence of a sharp bottom. As a rule of thumb, a dent 1/8 in. deep should be a minimum of 1/2 in. in diameter.

7-19. Compressor Discharge Air Tube Seal Ring Inspection.

Replace compressor discharge air tube seal rings which exhibit fretting, excessive wear, or distortion. Replace two-piece seals when the spherical radius on the OD is worn flat all the way across.

7-20. Combustion Liner Inspection.

Inspect the combustion liner as outlined in table 7-1.

Table 7-1. Combustion Liner Inspection

Item	Inspection and method	Serviceable limits	Repairable limits	Corrective action
1	Pulled or broken spot-welds at liner step (See fig. 7-8.) (Visual)	Not more than three adjacent welds, or total of six.	Not more than four adjacent spotwelds or 40 percent of total per step.	Weld repair. (Refer to paragraph 7-32a.)
2	Handling damage. (See fig. 7-8.)			
	a. Mashed-out-of-round. (Visual)	None permitted.	Able to straighten to concentricity limits.	Straighten and re-form.
	b. Dented. (Visual)	None permitted.	Any dent that remains within the area shown on figure 7-8 and does not cause thin-out of metal. Straightened dents must meet concentricity limits.	Straighten and re-form.
3	Localized high temp-perature distortion indicated by warping or rippling of the liner surface and is normally accompanied by discol-oring (burning) of the area. (Visual)	Warpage less than 3/16 in. deep over an area 1 in. in diameter and remaining within the area shown on figure 7-8.	Not repairable.	Replace liner.

Table 7-1. Combustion Liner Inspection (Continued)

Item	Inspection and Method	Serviceable Limits	Repairable Limits	Corrective action
4	Burning in area of reliefs slots. (See figure 7-8.) (Visual)	Rear edge burned less than 1/16 in. or both comers burned less than 1/4 in. along relief slot.	Not repairable.	Replace liner.
5	Crack on outside of liner. (See figure 7-8.) (Visual)	None permitted.	Any number as long as crack length does not exceed limits shown in figure 7-8. Not repairable if crack cannot be completely welded an or weld obstructs cooling air passage.	Weld repair. (Refer to paragraph 7-32b.)
6	Crack in tab end inside liner.(ke figure 7-8.)	No cracks greater than 1/4 in. long and no more than two cracks per tab.	Not repairable.	Replace liner.
7	Cracks at two adjacent relief slots progressing toward same hole. (See figure 7-8.) (Visual)	Not permitted.	Not repairable.	Replace liner.
8	Crack in relief slots at combustion liner stem. (See figure 7-8.) (Visual)	Any number 3/16 in. or less in length.	Any number 1/2 in. or less in length.	Weld repair. (Refer to paragraph 7-32b.)
9	Crack in double lip area. (See figure 7-8.)	None permitted. (Visual)	Not more than 3 in. long.	Weld repair. (Refer to paragraph 7-32b.)
9.1	Cracks in relief slots.	Maximum of 3/16 in. length.	Not repairable.	Replace liner.
10	Crack in igniter ferrule attaching weld. (See figure 7-8.) (Visual)	None permitted.	Crack does not exceed 1/4 in. long.	Weld repair. (Refer to paragraph 7-32c.)
11	Roughened igniter ferrule ID. (See figure 7-8.) (Visual)	None permitted.	ID does not exceed 0.560 in. after polishing.	Polish ID. (Refer to paragraph 7-32d.)
12	Worn or distorted (out-of-round) igniter ferrule. (See figure 7-8.) (Visual)	Wall thickness is not less than 0.020 in. and/or ID does not exceed 0.560 in.	Not repairable.	Replace liner.
13	Crack in fuel nozzle ferrule attaching weld. (See figure 7-8. (Visual)	None permitted.	Crack does not exceed 1/4 in. long.	Weld repair. (Refer to paragraph 7-32c.)

Table 7-1. Combustion Liner Inspection (Continued)

Item	Inspection and Method	Serviceable Limits	Repairable Limits	Corrective action
14	Roughened fuel nozzle ferrule ID. (See figure 7-8.) (Visual)	None permitted.	ID does not exceed 0.670 in. after polishing.	Polish ID. (Refer to paragraph 7-32d.)
15	Worn or distorted (out-of-round) fuel nozzle ferrule. (See figure 7-8.) (Visual)	ID does not exceed 0.670 in.	Not repairable.	Replace liner.
16	Dome louvers bent closed or restricted by carbon. (Visual)	0.060-0.065 in. uniform opening.	Not applicable.	Lightly wire brush to remove carbon. Reposition louvers by bending to proper opening.
17	Burned louvers. (See figure 7-9.) (Visual)	Does not exceed limits of figure 7-9.	Not repairable.	Replace liner.

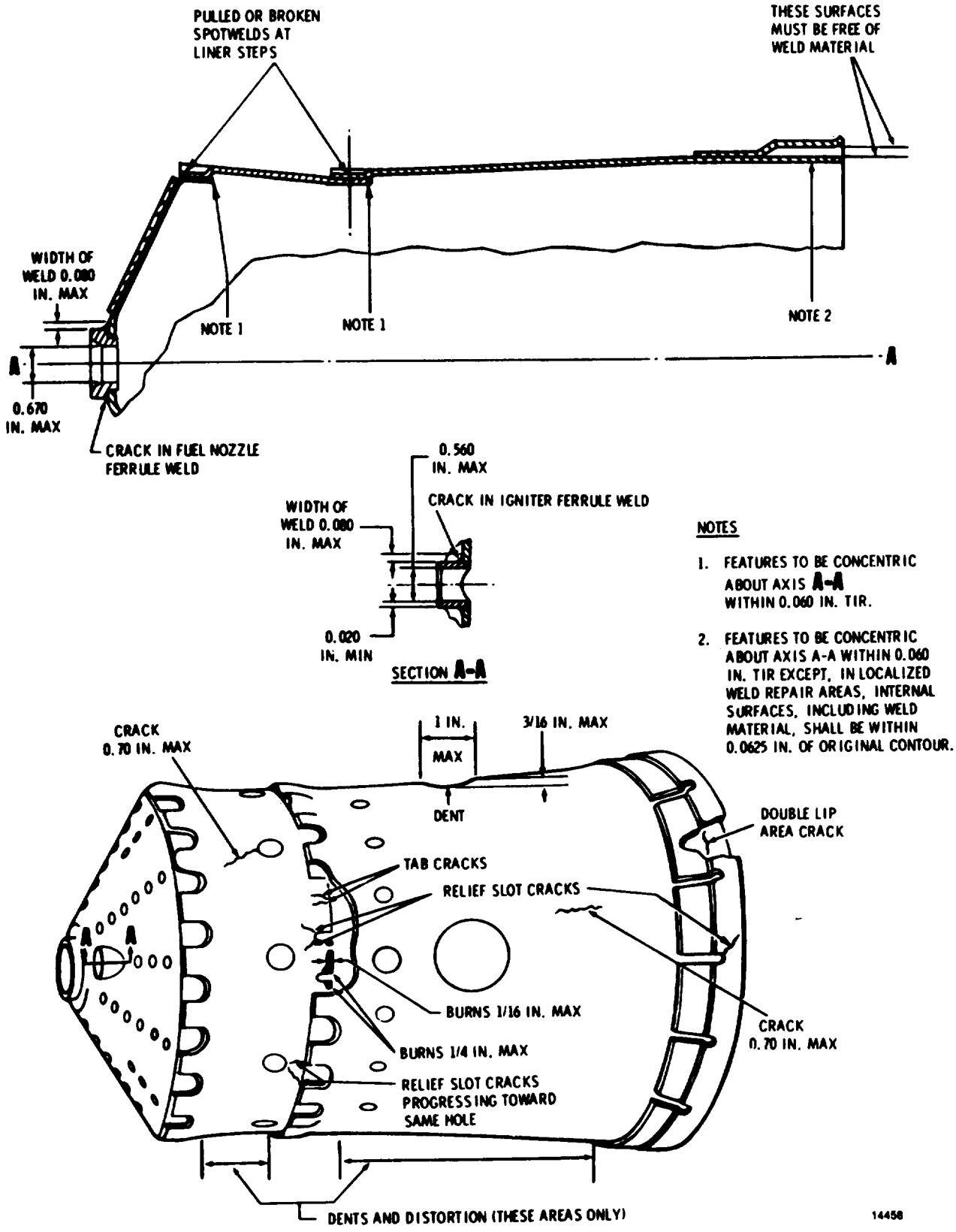


Figure 7-8. Combustion Liner Inspection

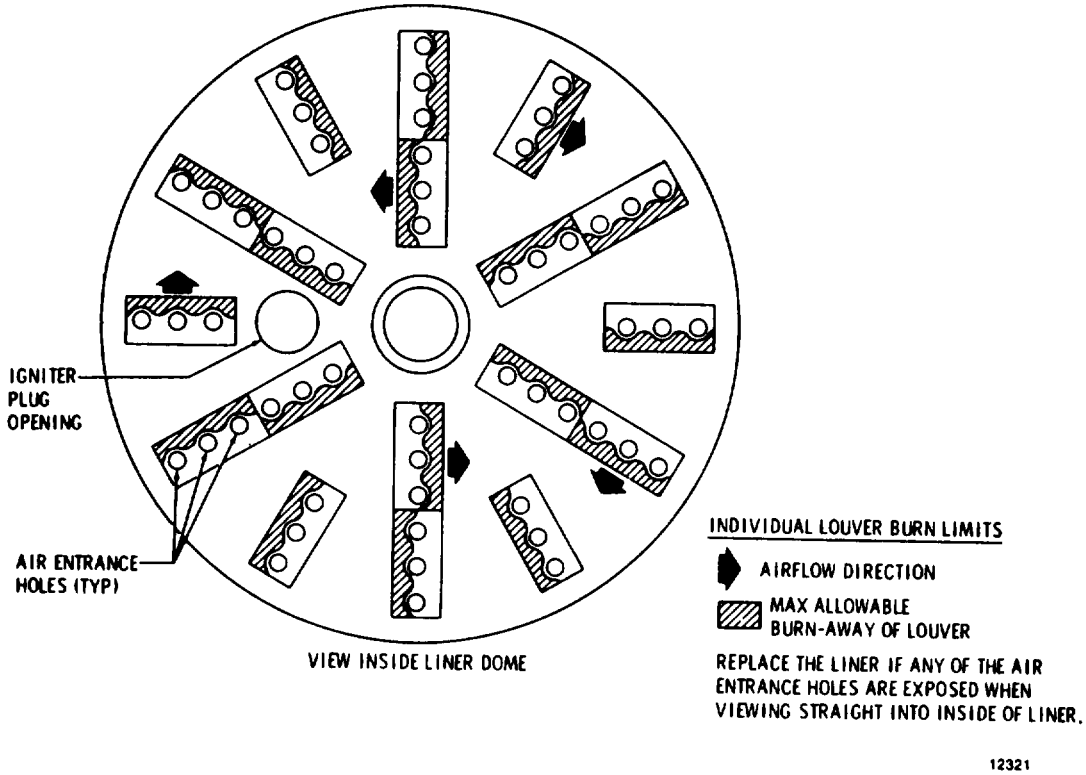


Figure 7-9. Inspection of Combustion Liner Dome Louvers

7-21. Turbine First-stage Blades Inspection.

Inspect the N1 turbine first-stage blades whenever a turbine overtemperature inspection is performed. (Refer to paragraph 12-2.)

7-22. Turbine First-stage Nozzle and Shield Inspection.

Inspect the turbine first-stage nozzle and shield whenever a turbine overtemperature inspection is performed. (Refer to paragraph 12-2.)

Section III. REPAIR

7-23. Scope.

This section provides instructions for accomplishing complete and detailed maintenance on the engine within the scope of the Maintenance Allocation Chart. Each subassembly or part is treated as a separate unit in the discussion of repair procedures.

7-24. Compressor Rotor and Blades.

CAUTION

Blade rework is limited to the outer 2/3 of the blade. Vane rework is limited to the inner 3/4 of the vane.

Repair of the compressor rotor and blades consists of blending and polishing to remove nicks, dents, scratches, corrosion, or erosion from the blades, blade fillets and wheel hubs. Where blending is recommended, use a medium grit stone. Where polishing is recommended, use a fine grit stone or abrasive paper (item 22, table 2-2), Blend and polish blades in a longitudinal direction only with the repair forming a smooth blend with the basic airfoil. No sharp edges, burrs, cracks, or tears are acceptable after blending. The number of blades or vanes which maybe reworked is not limited. The limiting factor of blade or vane rework is engine performance. Any reduction of blade or vane area will decrease the efficiency of the compressor and the performance of the engine. Remove as little material as possible.

a. Leading and Trailing Edge Damage. Blend and polish to remove damage on the outer 2/3 of the blade. Replace engine when: (1) the limits of figure 7-10 are exceeded or (2) there is edge damage in the lower 1/3 of the blade.

b. Tip Damage. Blend and polish to remove tip damage. Replace engine when: (1) more than 1/3 (1/6 on each side) of the original blade width requires rework or (2) rework extends within the inner 4/5 of the blade length. (See figure 7-11.)

c. Surface Damage. Blend and polish to remove surface damage. Replace the engine when any of the limits of figure 7-12 are exceeded.

d. Corrosion. Blend and polish to remove all corrosion caused pits by blending to limits defined for damage. Replace the engine when: (1) pitting in any area of the blade forms a definite line or (2) pit size or location exceeds blend limits. (See figure 7-10, 7-11, and 7-12.)

e. Erosion. Replace the engine when erosion of a blade tip results in a blade chord width less than the acceptable chord blend limits. (See figure 7-12.)

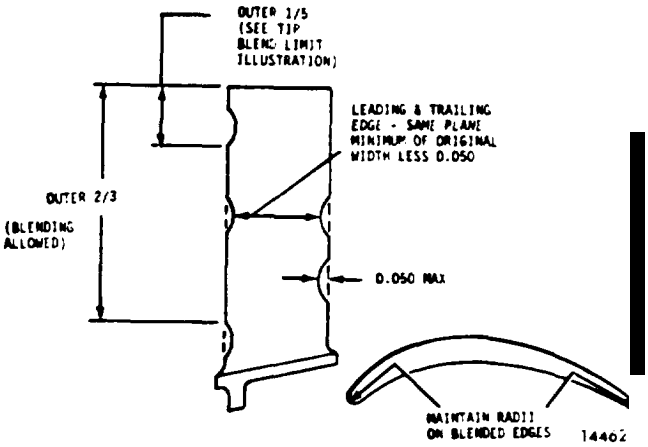


Figure 7-10. Compressor Rotor Blade Leading and Trailing Edge Blend Limits

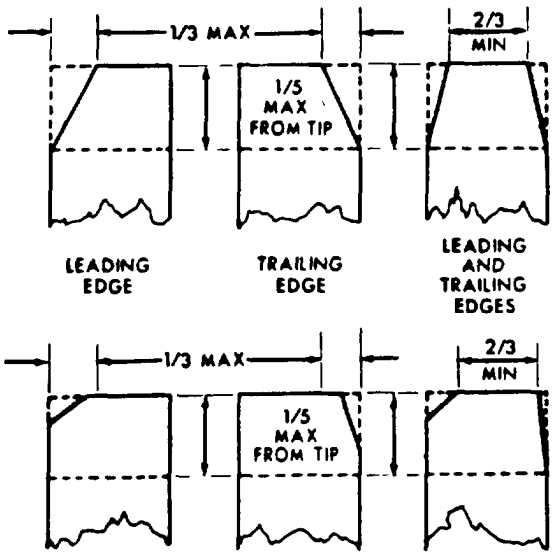
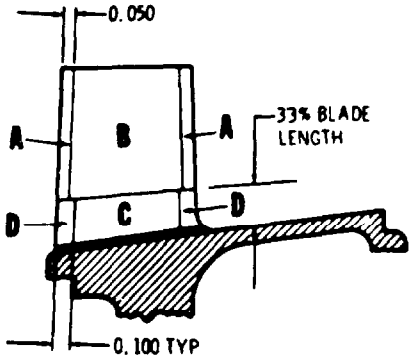
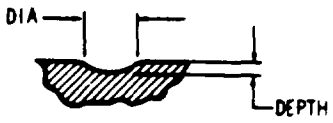


Figure 7-11. Compressor Rotor Blade Tip Blend Limits



VIEW 1. DEFINITION OF BLADE AND WHEEL SURFACES



VIEW 2. ROUND EDGE, ROUND BOTTOM IMPERFECTIONS

AREA	SURFACE BLENDING LIMIT FOR REMOVAL OF CORROSION PITS, NICKS AND DENTS
A	LEADING AND TRAILING EDGE RADII MUST BE MAINTAINED. (SEE LE AND TE BLEND LIMIT ILLUSTRATION FOR REWORK LIMIT.)
B	0.020 MAX DEPTH; BUT NOT EXCEEDING 1/3 OF BLADE THICKNESS.
C, D	ON THE CONVEX SIDE OF C AND THE CONCAVE SIDE OF D, POLISH ONLY. NO MEASUREABLE METAL REMOVAL.
C, D	ON THE CONCAVE SIDE OF C AND THE CONVEX SIDE OF D, 0.010 MAX DEPTH.

NOTE: ROUND EDGE, ROUND BOTTOM INDENTS (SEE VIEW 2) CAN OCCUR IN THE ORIGINAL AS-CAST SURFACE; THESE ARE NOT CORROSION PITS. IF THE INDENT CANNOT BE WIPED CLEAN (DARK SPOT REMAINS IN INDENT), BLEND THE INDENT AS A CORROSION PIT.

14461

Figure 7-12. Compressor Blade Surface Blending Limits

7-25. Compressor Case.

Repair of the compressor case consists of blending and polishing to remove nicks, dents, corrosion, and erosion from the stator vanes. Where blending is recommended, use a medium grit stone. Where polishing is recommended, use a fine grit stone or abrasive paper (item 22, table 2-2). Blend and polish vanes in a longitudinal direction only with the repair forming a smooth blend with the basic airfoil. No sharp edges, burrs, cracks, or tears are acceptable after blending.

NOTE

It is impossible to fully describe all damage conditions that can be encountered. If damage is within the repair limits of figure 7-13 but there is reasonable doubt about the strength of the blended vanes, replace the compressor case. Unlimited light polishing to remove minor damage where vane dimensions are basically unchanged, is permissible on any part of the vane.

a. Vane Damage. Replace the compressor case if any vanes are cracked or broken off or show evidence of tip rub on the rotor spacer. Blend limits for the vanes are as follows:

(1) *Leading and Trailing Edge Damage.* Replace the compressor case if damage to the leading and trailing edge cannot be blended out without reducing the total width of the vane more than the limits given in figure 7-13. Replace the compressor case when after blending, the vane total width is reduced more than the limits given in figure 7-13 or there are sharp edges, burrs, cracks or tears after blending.

(2) *Surface Damage.* (See figure 7-13.) Blend and polish surface damage on the vanes. Replace the compressor case when: (1) the blending depth exceeds 1/2 of the vane thickness or (2) cracking is detected on the vane surface.

(3) *Erosion.* Replace the compressor case when vane erosion at a specified stage results in a vane chord width less than the acceptable chord width (B). (See figure 7-3.)

(4) *Corrosion.* Blend and polish to remove corrosion pitting. Replace the compressor case when pitting in any area of the vane forma a definite line or blending exceeds same limits as given for blades, (See figure 7-12.)

b. Compressor Case Painting. The compressor case external surface is painted with gray, corrosion resistant paint. Repair damaged paint on the external surface of the compressor case as follows:

(1) Abrade the damaged area and localized surrounding area with emery cloth (item 23, table 2-2).

(2) Wipe abraded area with paint thinner (item 24, table 2-2).

(3) Apply gray corrosion resistant paint (item 25, table 2-2) to the abraded area.

(4) Air dry at least one hour before handling.

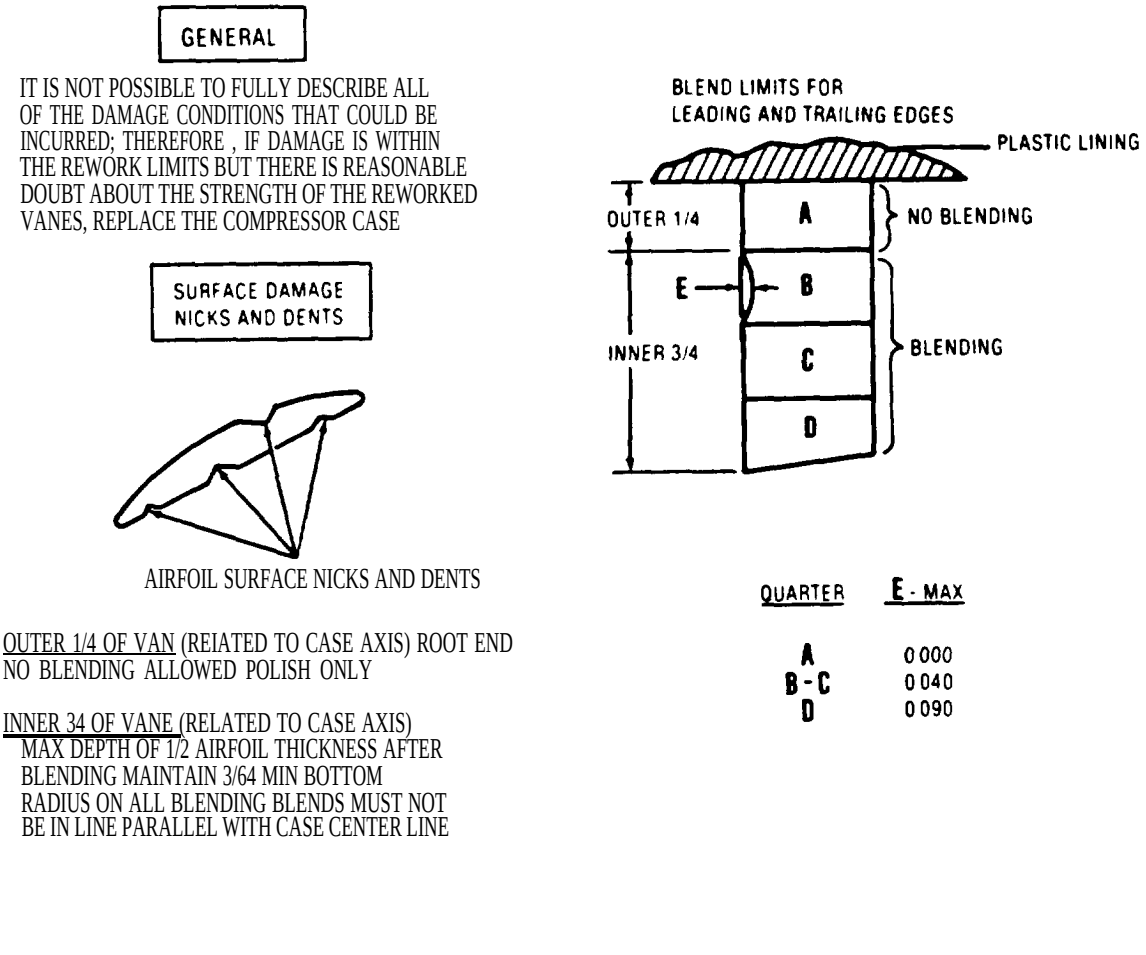
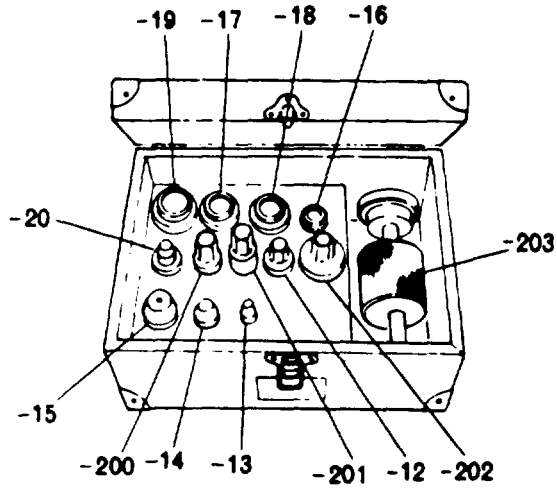


Figure 7-13. Compressor Stator Vane Blend Limits



DETAIL	NAME AND APPLICATION
6796941-200	PULLER—TACHOMETER
-201	PULLER—FUEL PUMP, ACCESSORY DRIVE, FUEL CONTROL, GOVERNOR, AND STARTER
-202	PULLER—POWER TAKEOFF
-203	HANDLE ASSEMBLY
-12	PULLER—IDLER GEARS
-13	GUIDE—TACHOMETER
-14	GUIDE—FUEL PUMP, ACCESSORY DRIVE, FUEL CONTROL, GOVERNOR, AND STARTER
-15	GUIDE—HELICAL POWER TRAIN DRIVE
-16	INSTALLATION TOOL—TACHOMETER
-17	INSTALLATION TOOL—FUEL PUMP, SPARE, FUEL CONTROL AND GOVERNOR
-18	INSTALLATION TOOL—STARTER
-19	INSTALLATION TOOL—POWER TAKEOFF
-20	INSTALLATION TOOL—GAS PRODUCER GEAR TRAIN IDLER SPUR GEAR

Figure 7-14. Seal Puller Kit

7-26. Diffuser Scroll.

WARNING

The diffuser scroll contains Magnesium Thorium (MG-TH) alloy. Maintenance is to be performed as outlined in the Nuclear Regulatory Commission Source Material License Number STB-1433 issued to USAAVSCOM.

Air Tube Insert Blend Repair. Using abrasive paper (item 30, table 2-2) blend and polish wear in the ID of the air tube inserts which does not exceed 0.010 in. depth. Blend and polish wear step as necessary to ensure freedom of movement of the air tube seals and to ensure that the sealing properties will not be impaired.

7-27. Gearbox External Seals Replacement.

CAUTION

To prevent damage to the gearbox housing, do not pry between the seal cavity in the gearbox housing and the seal. Be careful not to contaminate the shaft bearing or damage the gearshaft.

a. Remove the accessory or drive from the gearbox pad.

b. Remove defective seals using seal puller kit, tool No. 6796941 as follows: (See figure 7-14.)

(1) Use-201 detail to remove seals (1, figure 7-15).

(2) Use-202 detail to remove seals (2).

(3) Use-200 detail to remove seals (3).

c. Discard removed seals.

d. Apply grease (item 14, table 2-2) to the seal lip to aid installation. Carefully drive the new seal into place using seal kit, tool No. 6796941 as follows: (See figure 7-14.)

(1) Use-17 detail to install seals (1, figure 7-15) at the fuel pump, spare accessory, fuel control, and governor pads.

(2) Use-18 detail to install seal (1) at the starter-generator pad.

(3) Use-19 detail to install seals (2) at the power takeoff pads.

(4) Use-16 detail to install seals (3) at the tachometer pads.

e. Reinstall the **accessory** or drive on the gearbox pad.

7-28. Gearbox External Stud Replacement.

a. Remove and discard damaged stud.

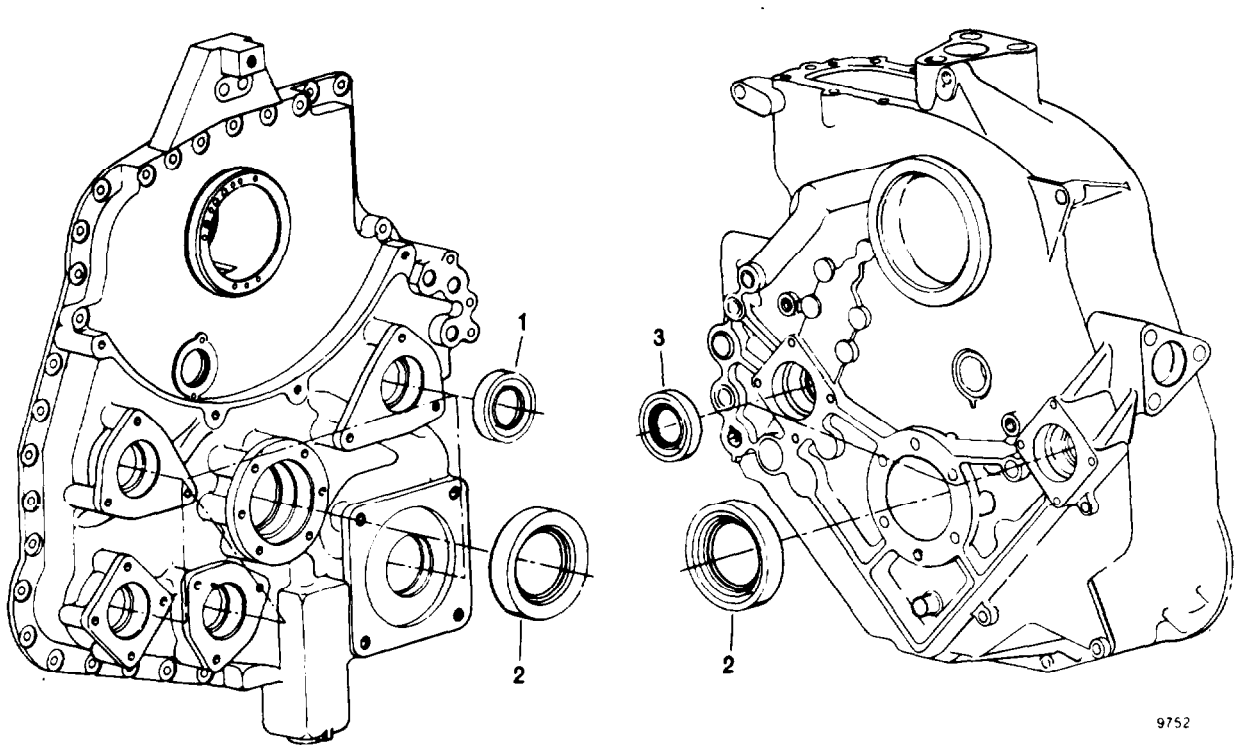
b. Clean and retap stud hole threads only when condition of hole threads restrains stud installation. Use the same size tap. (See figure 7-16.)

CAUTION

Keep the amount of compound used in a blind hole to a minimum to eliminate the possibility of cracking the casting.

c. Apply antiseize compound (item 27, table 2-2) to the stud threads and to the stud hole threads.

d. Install the stud and tighten to obtain the torque and setting height specified on figure 7-16. Oversize replacement studs may be used when necessary.



1. Accessory pad seals
2. Power takeoff pad seals
3. Tachometer pad seals

Figure 7-15. Gearbox External Seals

7-29. Gearbox Housing and Cover Painting.

Repair damaged paint on the external surfaces of the gearbox housing and cover as follows:

a. Clean the damaged area with a clean cloth saturated with solvent (item 3, table 2-2).

b. Using emery cloth (item 23, table 2-2), abrade an area slightly larger than the damaged area. Feather the edges of the abraded area.

c. Clean the area as in step a and dry using a blast of clean compressed air.

d. Chrome pickle the cleaned area per TM 55-1500-344-23.

e. Wipe the abraded area with paint thinner (item 24, table 2-2).

f. Apply medium gray corrosion resistant paint (item 25, table 2-2) to the abraded area.

g. Air dry at least one hour before handling. Heat may be applied with a heat lamp to speed up curing; however, do not exceed 300°F. Approximately 20 minutes will be required for the heat cure.

7-30. Outer Combustion Case Weld Repair.

Weld repair cracks in the outer combustion case as follows: (See figure 7-5.)

a. Remove surface contamination using a stainless steel wire brush.

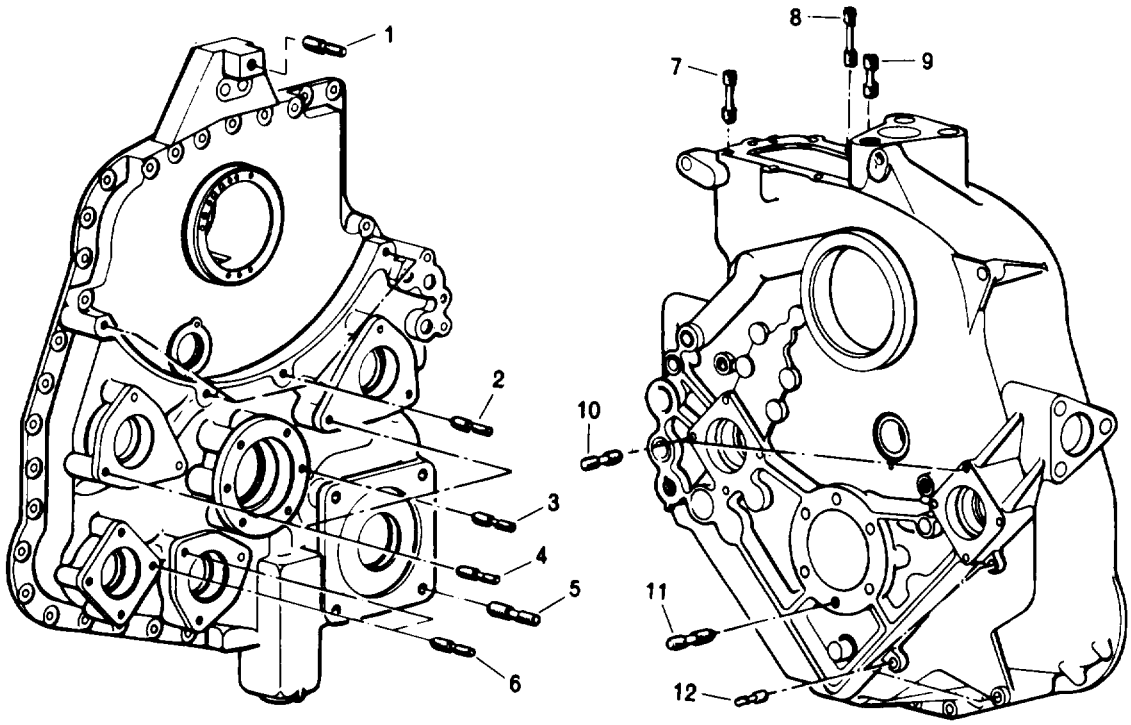
b. Clean the area with acetone (item 28, table 2-2) using a clean cloth for the application.

c. Weld cracks using inert gas arc and class 6 weld rod (item 29, table 2-2). Apply 1/8 in. wide stringer bead using medium heat input. Cool each bead with a wet cloth immediately. Do not apply another bead until cool enough to touch by hand.

d. Inspect the weld for undercut, cracking, and discontinuities. There must be not evidence of undercutting and cracking.

7-31. Compressor Discharge Air Tube Weld Repair.

Weld repair cracks in the compressor discharge air tubes as follows:



REF NO.	THREAD SIZE	THREAD TYPE	SETTING TORQUE (LB IN.)	SETTING HEIGHT (IN.)
1	3/8-16	UNJC-3B	105-210	0.66-0.70
2	5/16-18	UNJC-3B	50-100	0.60-0.64
3	5/16-18	UNJC-3B	50-100	0.91-0.95
4	5/16-18	UNJC-3B	50-100	0.60-0.64
5	3/8-16	UNJC-3B	105-210	0.89-0.93
6	5/16-18	UNJC-3B	50-100	0.85-0.89
7	1/4-20	UNC-3B	20-40	0.54-0.58
8	1/4-20	UNC-3B	20-40	1.17-1.21
9	1/4-20	UNC-3B	20-40	0.79-0.83
10	5/16-18	UNC-3B	50-100	0.62-0.66
11	5/16-18	UNC-3B	50-100	0.62-0.66
12	1/4-20	UNC-3B	20-40	0.42-0.46

9739

Figure 7-16. Gearbox External Stud Data

a. Remove surface contamination using a stainless steel brush.

b. Clean the area with acetone (item 28, table 2-2) using a clean cloth for the application.

c. Weld cracks using inert gee arc and class 6 weld rod (item 29, table 2-2).

d. Do not grind weld unless weld material extends into air path. Thin-out of material from welding or grinding is not permitted.

7-32. Combuston Liner Repair.

a. Pulled or Broken Spotwelds. Weld repair pulled or broken spotwelds in the liner steps as follows: (See figure 7-8.)

(1) Drill a 3/16-in. diameter hole through the outer liner section only.

(2) Remove surface contamination using a stainless steel wire brush.

(3) Clean the area with acetone (item 28, table 2-2) using a clean cloth for the application.

(4) Press the liner sections together and plugweld using inert gas arc with class 6 weld rod (item 29, table 2-2). Weld material must not extend into air openings. Do not grind the weld unless weld material blocks air entry.

b. Cracks in Liner Surface, Relief Slots, and Double Lip Area. Weld repair cracks as follows:

(1) Remove surface contamination using a stainless steel wire brush.

(2) Clean the area with acetone (item 28, table 2-2) using a clean cloth for the application.

(3) Weld cracks using inert gas arc with clean 6 weld rod (item 29, table 2-2). Weld material must not obstruct cooling air passage. Do not grind weld unless weld material obstructs cooling air passage.

c. Cracks in Igniter and Fuel Nozzle Ferrule Attaching Welds. Repair cracks in the attaching (fillet) weld as follows:

(1) Remove surface contamination using a stainless steel wire brush.

(2) Clean the area with acetone (item 28, table 2-2) using a clean cloth for the application.

(3) Weld cracks using insert gas arc. Use class 6 weld rod (item 29, table 2-2) on the igniter ferrule. Use class 12 weld rod (item 29, table 2-2) on the fuel nozzle ferrule.

d. Fuel Nozzle and Igniter Ferrule ID Roughness. Remove roughened or galled surfaces in the ID of the fuel nozzle and igniter ferrules by polishing with emery cloth (item 23, table 2-2). Polish as required to remove all surface roughness. Check to ensure that the ID, after polishing, does not exceed the limit specified in table 7-1.

CHAPTER 8
ASSEMBLY OF SUBASSEMBLIES

8-1. Scope.

This chapter presents step-by-step procedures for reassembly of component parts into major functional assemblies from the level of disassembly permitted by the Maintenance Allocation Chart.

CAUTION

Use only chrome plated steel or unplated steel tools for the assembly procedures described in this manual. The use of cadmium or zinc plated tools is not permitted since these platings are prone to chipping and flaking. Should these chips enter the engine, they may contaminate the lubrication system, ultimately clogging the filters or produce intergranular attack on nickel or titanium base alloys at elevated temperatures.

8-2. Compressor Case Half Installation.

CAUTION

The compressor case halves are a matched set and shall not be intermixed. If the removed case half cannot be repaired to a serviceable condition, replace both case halves. Remove only one case half at a time. Do not remove both case halves at the same time. Misalignment of the compressor could result if both case halves were removed simultaneously.

a. Position the compressor case half in place on the compressor.

b. Install eight bolts (1, figure 6-1) and nuts (7) in each horizontal splitline. Bolts at positions two and seven are pilot bolts. Tighten nuts on the pilot bolts to 10-15 in. lb. plus locknut drag; then tighten the remaining nuts.

NOTE

To determine locknut drag, run the nut up snug; then back off one-half turn. The torque required to first turn the loosened nut is locknut drag.

c. Install the eight case-to-front diffuser bolts (4) and nuts (6). Tighten the nuts to 10-15 in. lb. plus locknut drag.

d. Install nameplate (8) (if applicable) and the five case-to-front support bolts (5) and nuts (3). Tighten the nuts to 10-15 in. lb. plus locknut drag.

CAUTION

Do not attempt to rotate the compressor using a speed wrench at the tachometer drive pad. Side loads on the speed wrench could crack the tachometer drive shaft.

e. Turn the compressor rotor using the 6799790 engine turning adapter (figure 2-1) at the starter generator pad (figure 7-4). The rotor and gear train should turn freely with no evidence of interference or blade tip rub (evidenced by feel or noise).

f. Install the compressor bleed valve. (Refer to paragraph 5-33.)

g. Install anti-icing air tubes (23, 26, figure 5-13.) Tighten the coupling nuts to 150-200 in. lb.

CHAPTER 9

FINAL ENGINE ASSEMBLY

9-1. Scope

This chapter provides instruction for installing major engine assemblies and components on the engine while it is installed in the airframe or in the 6795579 engine assembly turnover stand. (See figure 2-8.)

CAUTION

Use only chrome plated steel or unplated steel tools for the assembly procedures described in this manual. The use of cadmium or zinc plated tools is not permitted since these platings are prone to chipping and flaking. Should these chips enter the engine, they may contaminate the lubrication system, ultimately clogging the filters or produce intergranular attack on nickel or titanium base alloys at elevated temperatures.

9-2. Combustion Section Installation.

Install the combustion section on the engine while the engine is installed in the airframe or while it is installed in turnover stand, tool No. 6795579. (See figure 2-8.) If the turnover stand is used, rotate the engine in the stand to a vertical position with the compressor on the bottom.

a. Install the first stage nozzle shield (22, figure 3-8).

(1) Apply anti seize compound (item 15, table 2-2), and install two positioning plugs (21). Tighten to 100-150 in. lb. and secure with lockwire (item 10, table 2-2).

b. Place the combustion liner (3) over the first-stage turbine nozzle shield with the igniter plug opening at the nine o'clock position (as viewed from the rear of the engine).

c. Slip the retaining rings (17) over the large ends of the compressor discharge air tubes (18).

d. Apply lubricant (item 31, table 2-2) to the seal ring assemblies (19 and 20) if they do not incorporate a previously applied bonded lubricant. Install the individual components of the seal assemblies (19 and 20) on the compressor discharge air tubes (18). On the small end of air tubes (18), position the ring gaps 180 degrees apart with the gap of the seal rings to the outboard side of tubes (18). On the large end of air tubes (18), position the ring gaps 180 degrees apart with the gap of the seal rings to the inboard side of tubes (18).

e. Insert the left-hand compressor discharge air tube (18) through the firewall. Compress the seal ring with the compressor discharge air tube-to-compressor scroll installation clamp, tool No. 6799953. (See figure 2-3.) Mate the air tube (18) with the compressor scroll; then, remove the installation clamp.

f. Install the right-hand compressor discharge air tube (18) in the same manner used for installing the left-hand tube.

g. Compress the seal rings at the large end of air tubes (18) with the compressor discharge air tube-to-outer combustion case installation clamps, tool No. 6799952. (See figure 2-3.) Then, place the outer combustion case (6) over combustion liner (3) while mating case (6) to compressor discharge air tubes (18). Case (6) is properly indexed when the drain port is at the bottom of the engine. Also, check to ensure that the igniter plug hole in outer combustion case (6) aligns with the igniter plug hole in combustion liner (3) before inserting attaching bolts.

h. Coat the threads of the 24 outer combustion case attaching bolts (1,2) lightly with antiseize compound (item 15, table 2-2). Secure the outer combustion case (6) to the gas producer turbine support with the 24 bolts (1,2) and nuts (5). The half-inch length bolt is used to secure the thermocouple harness clamp (4) on the rear side of the splitline flange at bolt position 6 (viewed from the rear of the engine with 1 at top center). Tighten nuts (5) to 20-30 in. lb. Remove the

installation clamps. Secure compressor discharge air tubes (18) to outer combustion case (6) with retaining rings (17).

i. If removed, install the following in outer combustion case (6):

(1) Apply antiseize compound (item 15, table 2-2) to the threads; then install burner drain valve (14) and plug (12) with new preformed packing (11 and 13). Tighten the drain valve and the plug to 120-140 in. lb and lockwire.

(2) Install the fuel nozzle (7). Apply antiseize compound to the fuel nozzle threads. Tighten the fuel nozzle to 200-300 in. lb.

(3) Install the spark igniter (10). Apply antiseize compound to the spark igniter threads. Tighten the spark igniter (10) to 150-200 in. lb. and secure to the fuel nozzle (7) with lockwire (item 10, table 2-2).

j. Install the fireshield-to-fuel nozzle hose (8). Tighten the coupling nuts to 80-120 in. lb.

k. Attach the spark igniter lead (9) to the spark igniter (10). Tighten coupling nut to 70-90 in. lb. Apply antiseize compound (item 15, table 2-2) lightly to the threads of the drain valve (14). Clamp the igniter lead (9) to the drain valve using clamp and bracket assembly (15). Secure the clamp and bracket using a jam nut (16). Tighten jam nut (16) to 55-80 in. lb.

l. Attach the drain hose to the burner drain valve of the airframe installed engine.

m. Make appropriate entry relative to combustion section replacement in the Engine Log.

9-3. Test Run.

Test run the engine after combustion section replacement. (Refer to Chapter 10.)

CHAPTER 10

FINAL ENGINE TEST

10-1. Scope.

This chapter provides instructions for conducting fuctional tests following repair or replacement of parts.

10-2. Preparation for Test.

Engine testing maybe accomplished with the engine installed in the airframe or on a mobile engine test stand.

a. Engine Installation in Airframe. Install the engine in the airframe as outlined in the applicable aircraft maintenance manual TM 55-1520-228-23.

b. Engine Installation on Test Stand. Install the engine on the mobile engine test stand, Part No. LTCT10465-02 (NSN 4920-00-167-9178), as outlined in TM 55-4920-328-13.

10-3. Instrumentation Requirements.

Engine testing may be accomplished using no more than standard aircraft instrumentation to monitor the following parameters.

a. Turbine Outlet Temperature (0-1000°C)

b. Output Shaft Torque (0-110 psi)

c. Oil Pressure (0-150 psi)

d. Gas Producer (N_1) Speed (0-110%)

e. Power Turbine (N_2 Speed (0-120%)

10-4. Engine Motoring Procedure.

a. Engine Installed in Airframe.

(1) Disconnect the power input lead from the ignition exciter or pull IGN ENG circuit breaker.

(2) Ensure that the throttle (twist grip) is in the FUEL CUTOFF position.

(3) Ensure that the collective pitch control is at the minimum position.

(4) Press and hold the starter-ignition button to motor the engine. Release the button to stop motoring.

b. Engine Installed on Test Stand.

(1) Prepare the test stand for operation as outlined in TM 55-4920-328-13.

(2) Place the N_1 throttle lever to the zero degree position as indicated on the throttle position indicator.

(3) Place the governor lever to the minimum lever.

NOTE

Do not press the ignition switch.

CAUTION

Ensure that lubricating oil is available at the engine oil inlet port. Damage to the engine could result if lubricating oil was not available at the oil inlet port at the start of the motoring procedure.

(4) Press the start switch to motor the engine. Press the start switch a second time to stop motoring.

10-5. Engine Operating Procedures.

NOTE

Refer to applicable TM 55-1520-228-10 for starting, operating, and shutdown procedures when the engine is to be tested in the airframe.

The following operating procedures apply when the engine is installed on the test stand.

a. Starting.

(1) Prepare the test stand for operation as outlined in TM 55-4920-328-13.

CAUTION

To prevent fuel starvation at engine start and to prevent engine damage due to lack of lubricating oil at engine start, ensure that fuel and lubrication oil are available at the engine fuel and oil inlet ports.

(2) Place the N_1 throttle lever to the zero degree position as indicated on the throttle position indicator.

(3) Place the governor lever to the minimum position.

CAUTION

Abort the start if any of the following conditions occur:

1. Time from starter ON to idle speed exceeds one minute. Investigate and correct cause before attempting another start.

2. Engine oil pressure does not start to increase by the time gas producer rotor speed (N_1) reaches 20%speed. Investigate and correct cause before attempting another start.

3. No indication of power turbine rotor speed (N_2) by the time gas producer rotor speed (N_1) reaches 30%speed. Investigate and correct cause if malfunction was of test stand origin. Reject engine if malfunction was of engine origin.

4. Indicated TOT exceeds 1490°F (810°C) for more than 10 seconds with a momentary peak of one second at 1700°F(927°C). Refer to table 12-1.

5. Indicated TOT exceeds 1700°F (927°C) or remains at 1700°F (927°C) for more than one second. Refer to table 12-1.

(4) Simultaneously press the start switch ignition switch, and timer start switch.

CAUTION

Do not advance the N_1 throttle lever above the 0° position fuel cutoff) until the proper cranking speed is attained. An over-temperature start or an explosive lightoff may occur.

(5) When N_1 speed reaches the value listed below, advance the N_1 throttle lever to 30 degree position (idle). If there is no immediate TOT indication retard the throttle lever to the 0°position (fuel cutoff). Investigate to determine the cause for no lightoff.

Ambient temperature	N_1 speed
7 to 54°C (45 to 130°F)	15%
-18 to 7°C (0 to 44°F)	13%
-54 to -18°C (-65 to -l°F)	12%

(6) At 58% N_1 speed, press the start switch , and ignition switch to cut off starter and Ignition.

(7) The engine. should continue to accelerate and stabilize at 62-64% N_1 speed (idle).

(8) Oil pressure should beat least 50 psi.

NOTE

During cold weather, oil pressure up to 150 psi is permissible. Operate at idle until normal pressure limits can be maintained.

b. Operating.

(1) Idle. Idle is the same setting as for starting and is established with the governor lever at the minimum position and the N_1 throttle lever at the idle (30°) opposition. Other determining factors are:

N_1 speed= 62 to 64%
N_2 speed = 75 to 105%
GPTOT = Determine from figure 10-1
Torque pressure = 0 to 11 psi

(2) Flight autorotation. Flight autorotation is established with governor lever m the minimum position and the N_1throttle lever at any position between idle (30°) and maximum (90). Other determining factors are:

N_1 speed - 63% (estimated)
N_2 speed -98 to 108% normal (See table 10-1 for exception)
GPTOT - Determine from figure 10-1
Torque pressure -0 to 5 psi

(3) Take off. Takeoff is established with the N_1 throttle lever at maximum (90°), the governor lever positioned to produce 100% N_2

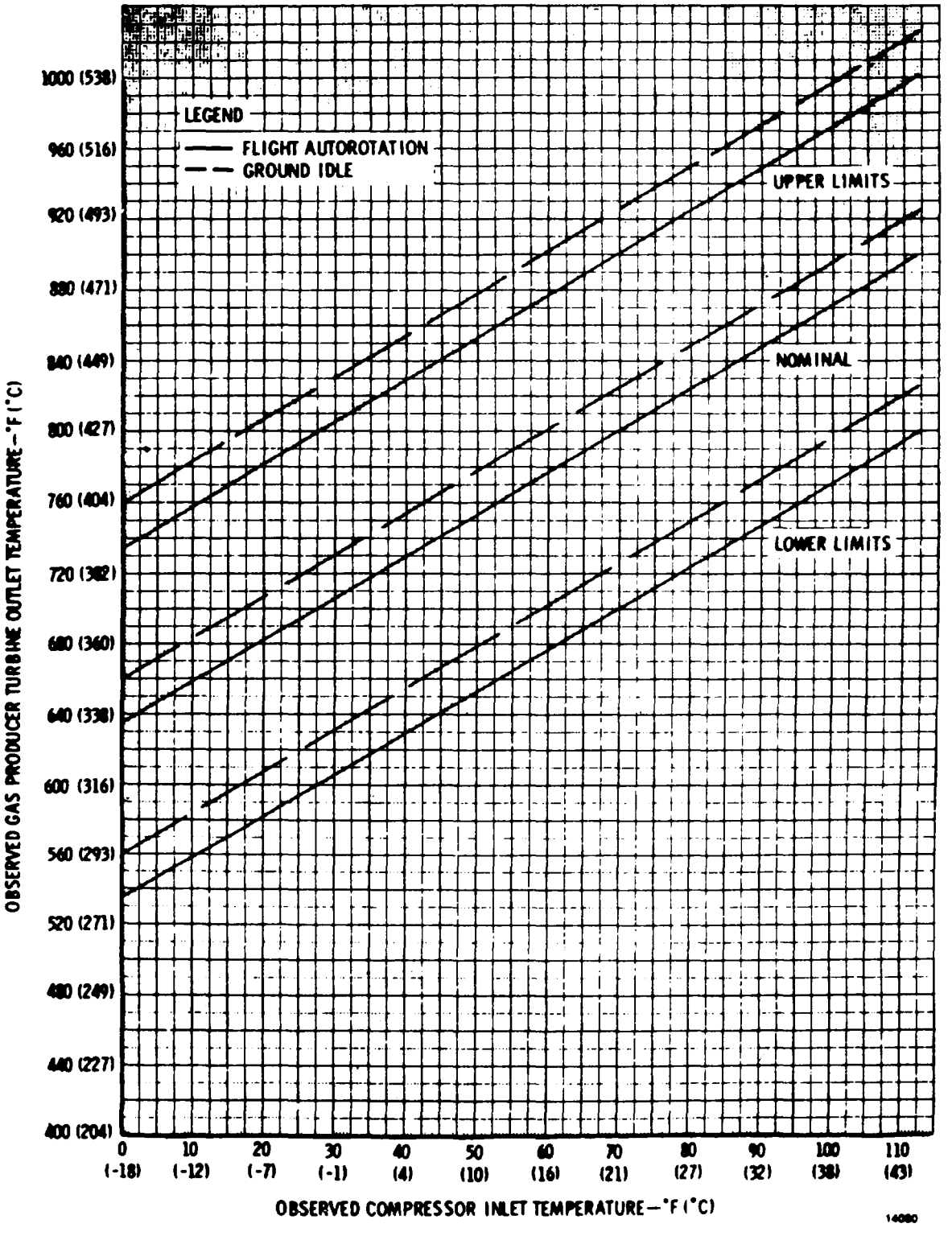


Figure 10-1. Idle and Flight Autorotation GPTOT Limits

c. Normal Shutdown.

(1) Place the N1 throttle lever to the ground idle (30°) position and the governor lever to the minimum position.

(2) Stabilize at idle for two minutes.

(3) Move the N1 throttle lever to the fuel cutoff (0°) position.

(4) Shut down the test stand es outlined in TM 55-4920-328-13.

d. Emergency Shutdown.

(1) Press the instrument power off switch and move the N1 throttle lever to the fuel cutoff (0°) position.

(2) If time permits, position the teat eat switches and controls as outlined in TM 55-4920-328-13.

10-6. Operating Parameters.

Observe the engine operating parameters (limits) in table 10-1 during all phases of engine testing.

Table 10-1. Operating Limits

Item	Limit	Remarks
N1 speed		
Rated	100%	
Maximum continuous	*105%	
Maximum transient	*106%	Permitted for 15 seconds maximum.
N2 speed		
Rated	100%	
Maximum continuous		See note.
Takeoff	*101%	
Flight autorotation	*105%	
Maximum transient		See note.
Takeoff	*103%	Permitted for 15 seconds maximum.
Flight autorotation	*110%	Permitted for 15 seconds maximum.

NOTE

Maximum continuous and maximum transient speeds vary linearly from flight autorotation to takeoff. (Refer to fig. 10-1.1.) Send the engine to repair/overhaul if limit is exceeded.

*Send the engine to repair/overhaul if limit is exceeded.

Output Shaft Torque Limit

Torque lb ft	Pressure PSI	Percent OH-58C	Time Limit
393	109	146*	10 sec
384	104	144*	30 min
323	88	120	continuous

* Not readable on OH-58C Torquemeter instrument.

GPTOT		
Maximum takeoff	1490° F (810° C)	Permitted for 30 minutes maximum.
Maximum continuous	1360° F (738° C)	Permitted for continuous operation.
Maximum transient	1490-1550° F (810-843° C)	Permitted for 6 seconds maximum.
Maximum starting	1490-1700° F (810-927° C)	Permitted for 10 seconds maximum.

NOTE

If temperature limits are exceeded, Inspect the turbine as outlined in Chapter 12.

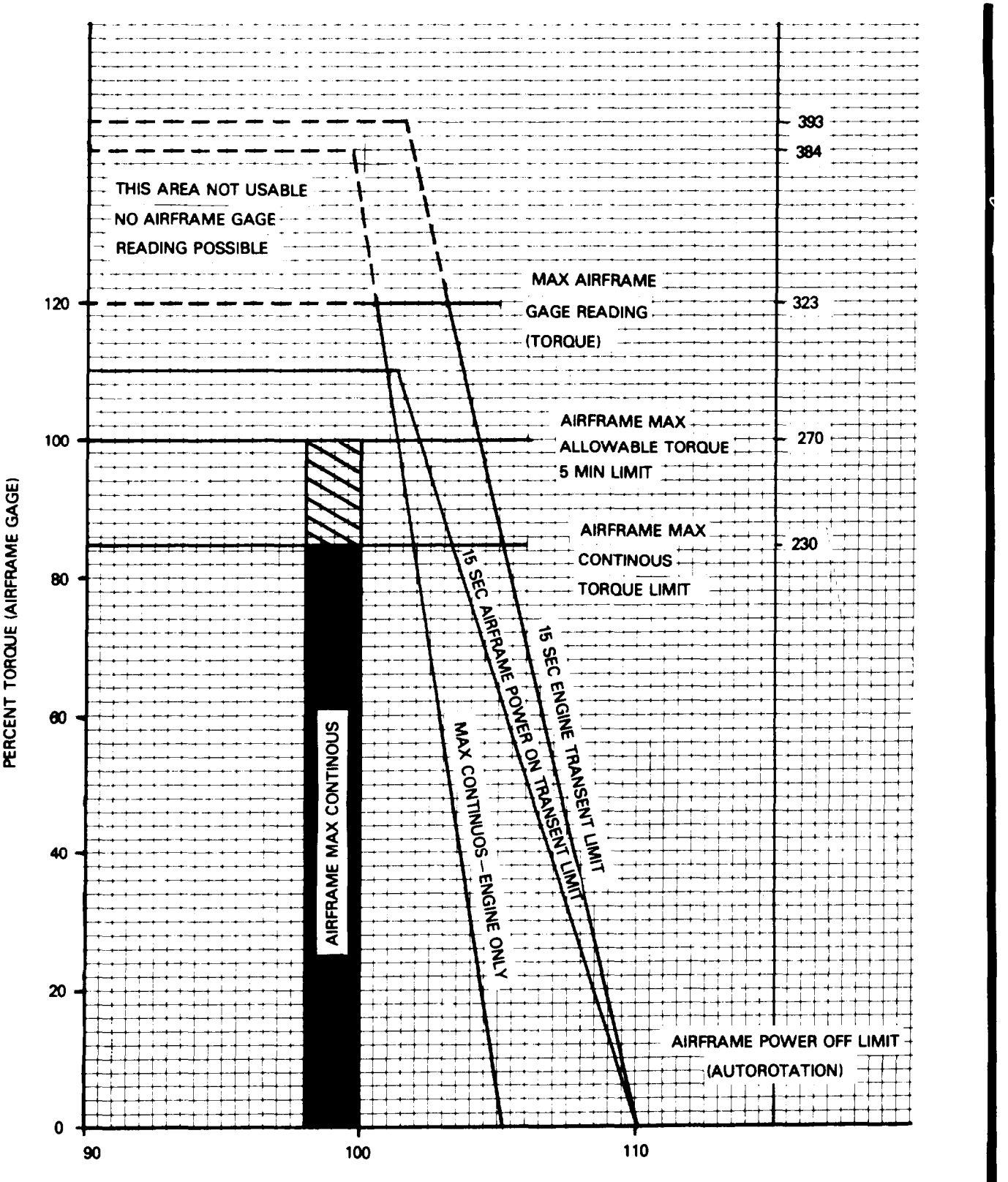


Figure 10-1.1 Maximum Allowable N2 Speed

Table 10-1. Operating Limits (Continued)

Item	Limit		Remarks
Maximum vibration (200 cps filter)	*Test Stand*	*Airframe*	
Transient			
Compressor	1.2 inch/second	2.0 inch/second	If limits are exceeded shut down immediately. Investigate to determine cause.
Turbine	1.8 inch/second	3.0 inch/second	
Gearbox	1.0 inch/second	1.7 inch/second	
Steady state			
Compressor	0.6 inch/second	0.9 inch/second	
Turbine	0.9 inch/second	1.5 inch/second	
Gearbox	0.5 inch/second	0.8 inch/second	
	NOTE Vibration test required after initial installation of engine in aircraft or when excessive vibration is suspected (refer to paragraph 12-8).		
Oil pressure			
During start	Increasing pressure by the time 20% N1 is reached		Abort start is pressure does not start increasing.
Idle to 78% N1	50 psig minimum		
78-89% N1	90-130 psig		
90% N1 and above	115-130 psig		
	NOTE Oil pressure limits are based on an oil inlet temperature of 180-225°F (82- 107°C).		
Oil temperature			
For starting	-65°F minimum (-54°C)		
For operation above idle*	35°F minimum (2°C)		Operate at idle until within limits
Normal range	180-200°F (82-93°C)		
Maximum	225°F maximum (107°C)		Reduce power to maintain limits.
	NOTE During cold weather operations, 150 psig engine oil pressure is permitted following engine start. When the 130 psig limit is exceeded, operate engine at idle RPM until normal engine oil pressure is obtained. When engine oil pressure is within normal limits, engine may be operated within full range of temperature limits (-54 to 107°C) without regard to engine oil temperature markings.		

* For test cell only.

10-7. Test Requirements.

a. Table 10-2 lists the test requirements following repair or replacement of an engine component or accessory. Parts removed to gain access to other parts or areas shall invoke the same test requirements, in accordance with the table of test requirements, as parts repaired or replaced to correct deficiencies or malfunctions. In the event that more than one test requirement is invoked, the most severe shall apply.

b. Setting numbers listed in the functional test column of table 10-2 refer to the setting numbers in the functional test schedule (table 10-3).

c. The following test points should be utilized for vibration testing of an engine when installed in a aircraft.

(1) Steady state data points:

(a) Throttle full open, 100% N2, flat pitch, stabilize for 30 seconds, record reading.

(b) Throttle full open, 100% N2, increase collective until skids are light, stabilize for 30 seconds, record reading.

(2) Transient datapoint:

(a) Throttle at idle, flat pitch, increase throttle to full open, 100% N2, record the peak reading.

(b) Throttle full open, 100% N2, flat pitch, increase collective until skids are light, record the peak reading.

Table 10-2. Test Requirements

Item	Parts replaced or repaired	Functional test	Remarks
1	Gearbox seals	Settings 3 thru 6	Check for leaks.
2	Oil pressure reducer	Settings 1 thru 6	Ensure oil pressure is within limits of table 10-1.
3	Lube oil check valve	Settings 1 thru 6	Ensure oil pressure is within limits of table 10-1.
4	Oil filter housing and associated valves	Settings 3 thru 6	Adjust oil pressure regulating valve. (Refer to paragraph 5-26.) Ensure oil pressure within limits of table 10-1.
5	Spark igniter	Settings l and 2	Ensure satisfactory start.
6	Ignition exciter	Settings 1 and 2	Ensure satisfactory start.
7	Compressor bleed valve	Settings 3 thru 6	Ensure valve operates within limits of figure 1-9.
8	Fuel control	Settings 1 thru 6	Make fuel control adjustments as required. (Refer to paragraph 5-12.) Ensure engine operates within limits of table 10-1.
9	Governor	Settings 1 thru 6	Ensure engine operates within limits of table 10-1.
10	Fuel pump	Settings 1 thru 6	Ensure engine operates within limits of table 10-1.
11	Compressor rotor	Settings 1 thru 6	Ensure engine operates within limits of table 10-1.
12	Compressor case	Settings l thru 6	Ensure engine operates within limits of table 10-1.
13	Combustion liner	Settings 3 thru 6	Ensure engine operates within limits of table 10-1.
14	Combustion outer case	Settings 3 thru 6	Ensure engine operates within limits of table 10-1.
15	Compressor discharge air tube(s)	settings 3 thru 6	Ensure engine operates within limits of table 10-1.
16	Double check valve	Settings 3 thru 6	Check for leaks.
17	Fuel filter element	Settings l and 2	Check for leaks.
18	Oil filter element	Settings 1 and 2	Check for leaks.
19	Fuel, oil, and air piping	Settings 1 and 2	Check for leaks.
20	Pc air filter	Settings l and 2	Check for leaks.

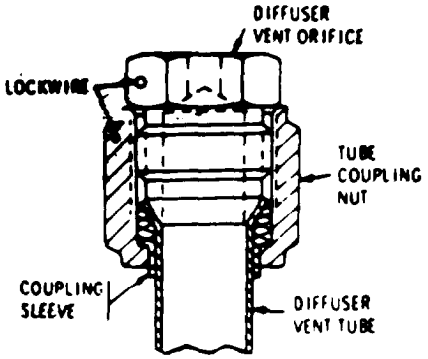


Figure 10-2. Diffuser Vent Orifice Installation

10-8. Functional Test Schedule.

Table 10-3 lists the power settings and sequence of events for performing an engine functional test run. Perform the applicable portions of the test as outlined in table 10-2. The engine must operate within the limits specified in table 10-1.

10-9. Diffuser Vent Orifice Selection.

If the compressor shows evidence of oil leaks e or smoking at the diffuser vent tube, select a new orifice as follows:

a. Clean the area around the orifice.

b. Perform settings 7 through 10 of the test run schedule in tab e 10-3.

c. After the test run, inspect the area around the orifice. If there is any evidence of smoking or spewing from the vent, reduce the orifice size by installing the next lower dash number orifice. (See figure 10-2.) Secure the orifice with lockwire (item 32, table 2-2).

d. Repeat the run, inspection, and orifice replacement until no evidence of spewing or smoking is present.

10-9.1. Diffuser Vent Tube Requirement

a. Remove lockwire, loosen coupling nut and separate the diffuser vent orifice from the diffuser vent tube. (See figure 10-2.)

b. Remove the bolt, washer and clamp. Separate the diffuser vent tube from the rear diffuser.

c. Install the diffuser vent orifice in the diffuser vent tube. Secure vent tube with bolt, washer and clam . Secure coupling nut to vent orifice with lockwire (item 32, table 2-2).

10-10. Fuel Requirements.

The fuel used for testing shall conform to item 33, table 2-2. The fuel supply system shall be capable of supplying 350 pounds per hour flow over the range of 5 to 45 psig inlet pressure. A sufficient number of 5 micron #200 mesh screen) filter elements shall be provided to adequately falter the fuel and allow the required flow rate.

10-11. Lubricating Oil Requirements.

The engine lubricating oil used for testing shall conform to items 7 or 8, table 2-2.The oil supply system shall be capable of maintaining oil inlet pressure within 0-1.8 psig and oil inlet temperature within the range of 180 to 225°F. A suffcient number of 25 micron filters shall be provided to adequately filter the scavenge oil.

10-12. Electrical Supply Requirements.

a. The ignition exciter requires a d-c power supply of 28 volts (4 amps minimum).

b. The starter requires a source of external power capable of 350 to 400 amperes, and 28 volts is recommended for starting the engine however, limits of 300 to 750 amperes and 28 volts are allowable for starting the engine.

10-13. Drainage Requirements.

When the engine is to be tested onn the test stand, drain bottles shall be provided to collect drainage from the burner drain valve, fuel pump seal drain, firewall shield drain and exhaust collector drain. Combine drainage shall not exceed 2 cc/minute, except fuel pump seal drainage shall not exceed 0.5 cc/minute, of this total.

10-14. Preservation Requirements.

Engines which are not scheduled for immediate installation into the airframe shall be preserved as outlined in Chapter 3.

Table 10-3. Functional Test Schedule

Setting No.	Condition	Time (Minutes)	N_1 Speed (%)	N_2 Speed (%)	GPTOT °F (°C)	Torque Press (psi)	Note Ref
1	Start engine (accelerate to idle)	5 max	62 to 64		See fig. 10-1	0-11	A
2	Shut down						
3	Start engine (accelerate to idle)		62 to 64		See fig. 10-1	0-11	B
4	Takeoff	2		100	1490 (810)	100	C
5	Idle	2	62 to 64		See fig. 10-1	0-11	D
6	Shut down						
7	Start engine (accelerate to idle)		62 to 64		See fig. 10-1	0-11	
8	Takeoff	5		100	1490 (810)	100	G
9	Idle	2	62 to 64		See fig. 10-1	0-11	H
10	Shut down						

NOTES

A Observe engine for abnormal conditions such as vibration, noise, or leakage.

B Make idle speed and start derichment adjustments if required. (Refer to paragraph 5-12.) Adjust oil pressure regulator if required. (Refer to paragraph 5-26.)

C If the engine is being tested in the airframe, limit collective to just short of lift-off.

D Check operation of the anti-icing valve.

E Give the engine a thorough visual inspection after shutdown. Repeat the check run if any repairs are necessary as a result o the run or the inspection.

F The check run is complete after setting No. 6 unless blend repair has been performed on the compressor rotor or case. To check engine performance, continue to the completion of the listed check run settings.

G If the engine is being tested in the airframe, make a test flight in accordance with TM 55-1520-228-MTF and TM 55-1500-328-25 and observe published operating limits.

H Check the diffuser vent orifice. Repeat settings 7 through 10 until the proper orifice size is determined. (Refer to paragraph 10-9).

CHAPTER 11

TORQUES AND DIMENSIONAL LIMITS

Section I. TORQUE VALUES

11-1. General.

Table 11-1 lists torque values for bolts, screws, studs, flared tubing, tube fittings, flexible hose connectors, etc. and are presented as a specific value tor each individual application. The torque values are listed in numerical order by figure reference number.

Table 11-1. Torque Values

Ref. No.	Fig. No.	Description	Minimum (in. lb)	Maximum (in. lb)
1	3-1	Shipping Container Closure Flange Nuts	150	165
7	3-1	Shipping Container Mounting Adapter Nut	40	50
10	3-1	Shipping Container Mounting Bracket Bolts	85	110
17	3-1	Shipping Container Records Receptacle Nuts	30	45
26	3-1	Shipping Container Service Receptacle Nuts	15	25
7	3-4	Accessory Shipping Container Locking Ring Nut	65	75
5	3-8	Outer Combustion Case Splitline Nuts	20	30
12	3-8	Combustion Case Drain Plug	120	140
14	3-8	Burner Drain Valve	120	140
16	3-8	Igniter Lead-to-Combustion Case Bracket Nut	55	80
3	5-2	Control-to-Pump Fuel Tube		
		Fittings	75	110
		Coupling Nuts	150	200
4	5-2	Pump-to-Control Fuel Tube		
		Fittings	75	110
		Coupling Nuts	150	200
5	5-2	Governor-to-Control Air Tube		
		Fitting (in control)	75	110
		Coupling Nuts	80	120
6	5-2	Governor-to-Accumulator Air Hose		
		Fitting (in governor)	75	110
		Coupling Nuts	80	120
7	5-2	Control-to-Regulator Air Tube		
		Fitting Jam Nuts	55	80
		Coupling Nuts	80	120
9	5-2	Control-to-Governor Py Air Tube		
		Fitting (in control)	75	110
		Coupling Nuts	80	120
11	5-2	Pc Filter-to-Governor Air Tube		
		Fitting Jam Nuts	55	80
		Coupling Nuts	80	120

Table 11-1. Torque Values (Continued)

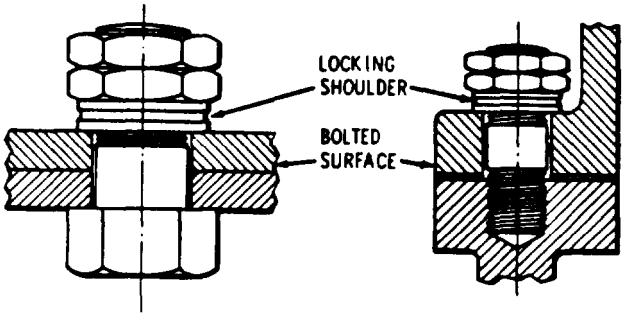
Ref. No.	Fig. No.	Description	Minimum (in. lb.)	Maximum (in. lb.)
13	5-2	Firewall Shield-to-Fuel Nozzle Hose Coupling Nuts	80	120
14	5-2	Gas Turbine Scavenge Oil Tube		
		Fitting Jam Nut	75	110
		Coupling Nuts	150	200
15	5-2	Accumulator-to-Control Air Tube		
		Fitting Jam Nuts	55	80
		Coupling Nuts	80	120
16	5-2	Control-to-Firewall Shield Fuel Tube		
		Fireshield Fitting Jam Nut	55	80
		Coupling Nuts	80	120
17	5-2	Check Valve-to-Turbine Pressure Oil Tube		
		Fitting Jam Nut	75	110
		Coupling Nuts	150	200
18	5-2	External Sump Scavenge Oil Tube		
		Fitting Jam Nut	75	110
		Coupling Nuts	150	200
22	5-2	Gearbox-to-Check Valve Pressure Oil Tube		
		Fitting Jam Nut	75	110
		Coupling Nuts	80	120
23	5-2	Fuel Supply Hose		
		Fitting	75	110
		Coupling Nut	150	200
25	5-2	After Filter Pressure Hose		
		Fitting	55	80
		Coupling Nut	80	120
26	5-2	Fuel Pump Seal Drain Hose		
		Fitting	55	80
		Coupling Nut	80	120
27	5-2	Before Filter Pressure Hose		
		Fitting	55	80
		Coupling Nut	80	120
6	5-3	Fuel Nozzle	200	300
	5-3	Power Turbine Governor Mounting Flange Nuts	70	85
19	5-3	Fuel Pump Mounting Flange Nuts	70	85
29	5-3	Gas Producer Fuel Control Mounting Flange Nuts	70	85
53	5-3	Accumulator and Check Valve Clamp Attaching Nuts	35	40
58	5-3	Pg Accumulators-to-Check Valve	40	65
59	5-3	Check Valve-to-Accumulator Elbow	55	80
60	5-3	Accumulator-to-Air Tube Unions	55	80
60	5-3	Elbow-to-Check Valve Union	55	80
64	5-3	Pc Filter Clamp Attaching Nuts	35	40
72	5-3	Py Accumulator-to-Governor Union	55	80
73	5-3	Py Accumulator	55	80
80	5-3	Pressure Probe Elbow Jam Nuts	55	80
8	5-4	Fuel Filter Cover Screws	95	105
1	5-8	Fuel Control Fuel Filter Plug	65	70
None	None	Fuel Control and Governor Lever Shaft Nuts	40	60
None	5-10	Magnetic Chip Detectors	60	80

Table 11-1. Torque Values (Continued)

Ref. No.	Fig. No.	Description	Minimum (in. lb.)	Maximum (in. lb.)
1	5-11	Oil Filter Cap Nuts	40	45
7	5-11	Oil Filter Housing Mounting Flange Nuts	35	40
5	5-12	External Oil Check Valve Clamp Nuts	35	40
7	5-12	Oil Pressure Reducer	50	75
8	5-12	Compressor Front Support Pressure Oil Tube		
		Fitting	50	75
		Coupling Nuts	65	100
1,3,31	5-13	Scroll-to-Bleed Valve Air Tube		
		Fitting Jam Nuts	55	80
		Coupling Nuts	80	120
9,12	5-13	Bleed Valve Mounting Flange Nuts		
		1/4-28 Nut	70	85
		10-32 Nuts	35	40
15	5-13	Anti-Icing Valve Poppet Guide	65	75
23	5-13	Anti-Icing Air Tube (RH) Coupling Nuts	150	200
24	5-13	Anti-Icing Valve Jam Nut	100	150
26	5-13	Anti-Icing Air Tube (LH) Coupling Nuts	150	200
1	5-16	Ignition Exciter Input Lead Nut	8	12
4	5-16	Ignition Exciter Mounting Nuts	30	40
6,16	5-16	Igniter Lead Clamp Nuts	35	40
12	5-16	Igniter Lead-to-Fireshield Attaching Nuts	35	40
13	5-16	Igniter Lead-to-Combustion Case Mounting		
		Bracket Nut	55	80
18	5-16	Igniter Lead Coupling Nuts		
		Lead-to-Exciter	50	70
		Lead-to-Igniter	70	90
19	5-16	Spark Igniter	150	200
None	None	Thermocouple Terminal Assembly Mounting Nuts	35	40
None	None	Thermocouple Leads-to-Terminal Assembly Nuts		
		No. 8-32 Nut	17	25
		No. 10-32 Nut	17	25
3	6-1	Compressor Case-to-Front Support Nuts	10	15
6	6-1	Compressor Case-to-Front Diffuser Nuts	10	15
7	6-1	Compressor Case Horizontal Splitline Nuts	10	15
7	7-1	Compressor Bleed Valve Jet	8	12
8	7-1	Compressor Bleed Valve Nozzle	35	45
1	7-16	Turbine-to-Gearbox Mounting Stud (Upper)	105	210
2	7-16	Turbine-to-Gearbox Mounting Studs (Lower)	50	100
3	7-16	Rear Power Takeoff Pad Studs	50	100
4	7-16	Fuel Control and Governor Pad Studs	50	100
5	7-16	Starter-Generator Pad Studs	105	210
6	7-16	Fuel Pump and Spare Accessory Pad Studs	50	100
7	7-16	Oil Filter Housing Mounting Studs (Short Studs)	20	40
8	7-16	Oil Filter Housing Mounting Studs (Long Studs)	20	40
9	7-16	Oil Filter Housing Mounting Studs (Medium Length Stud)	20	40
10	7-16	Tachometer Pad Studs	50	100
11	7-16	Front Power Takeoff Pad Studs	50	100
12	7-16	Ignition Exciter Mounting Studs	20	40

Table 11-1.1 Minimum Prevailing Torque for Used Locknuts.

Fine Thread Series			Coarse Thread Series		
Nut Size	*Minimum Torque lb. in.*	*(N·m)*	*Nut Size*	*Minimum Torque lb. in.*	*(N·m)*
8-36	0.7	0.08	8-32	0.7	0.08
10-32	1	0.11	10-24	1	0.11
1/4-28	2	0.23	1/4-20	2	0.23
5/16-24	3	0.34	5/16-18	3	0.34
3/8-24	5	0.56	3/8-16	5	0.56
7/16-20	8	0.90	7/16-14	8	0.90
1/2-20	10	1.1	1/2-13	10	1.1
9/16-18	13	1.5	9/16-12	14	1.6
5/8-18	18	2.0	5/8-11	20	2.3
3/4-16	27	3.1	3/4-10	27	3.1
7/8-14	40	4.5	7/8-9	40	4.5
1-12	55	6.2	1/8	51	5.8
1 1/8 — 12	73	8.3	1 1/8 — 8	68	7.7
1 1/4 — 12	94	10.6	1 1/4 — 8	88	9.9



11155

Figure 11-1. Typical Locknut Installation

Section II. DIMENSIONAL LIMITS

11-2. General.

This section provides limits for determining and maintaining proper relationship between mating parts within an assembly. Table 11-2 includes all clearantes, backlashes, plays, runouts, etc., arranged in numerical order by figure reference number.

Table 11-2. Dimensional Limits

Ref. No.	Fig. No.	Description	Minimum (in.)	Maximum (in.)
3	7-16	Rear Power Takeoff Pad Studs Setting Height	0.91	0.95
4	7-16	Fuel Control and Governor Pad Studs Setting Height	0.60	0.64
5	7-16	Starter-Generator Pad Studs Setting Height	0.89	0.93
6	7-16	Fuel Pump and Spare Accessory Pad Studs Setting Height	0.85	0.89
7,8,9	7-16	Oil Filter Housing Mounting Studs Setting Height		
		Short Studs	0.54	0.58
		Medium Length Studs	0.79	0.83
		Long Studs	1.17	1.21
10	7-16	Tachometer Pad Studs Setting Height	0.62	0.66
11	7-16	Front Power Takeoff Pad Studs Setting Height	0.62	0.66
12	7-16	Ignition Exciter Mounting Studs Setting Height	0.42	0.46

CHAPTER 12

SPECIAL INSPECTIONS

Section I. ENGINE HOT END

12-1. Scope.

This section presents special instructions to be performed on the turbine when the engine has experienced operation beyond allowable temperature limits. Tables 12-1 and 12-2 list the various overtemperature conditions for starting and power transients and the maintenance action required for each.

Table 12-1. Overtemperature During Start

Temperature range	Time	Maintenance action
810-927°C (1490-1700°F)	Over 10 seconds	Inspect turbine.*
Over 927-999°C (1700-1830°F)	Anytime	Inspect Turbine.*
Over 999°C (1830°F)	Anytime	Remove engine for depot maintenance or overhaul.

NOTE

1. Refer to item 6, table 4-1 when start temperature consistently exceeds 843° C (1550° F).
2. The time-at-temperature limits are not additive and may be repeated without restrictions.

*Refer to Turbine Overtemperature Inspection paragraph 12-2.

Table 12-2. Overtemperature During Power Transients

Temperature range	Time	Maintenance action
810-843° C (1490-1550° F)	Over 6 seconds	Inspect turbine*
843-927° C (1550-1700° F)	Anytime	Inspect turbine*
Over 927° C (1700° F)	Anytime	Remove engine for depot maintenance or overhaul.

NOTE

The time-at-temperature limits are not additive and may be repeated without restrictions.

*Refer to Turbine Overtemperatures Inspection paragraph 12-2.

12-2. Turbine Overtemperature Inspection.

NOTE

This inspection may be performed with the engine installed in the airframe.

a. Remove the combustion section. (Refer to paragraph 3-21.)

NOTE

Removal of the first-stage turbine nozzle from the turbine is not authorized.

b. Inspect the first-stage turbine nozzle and shield as outlined in table 12-3. (See figure 12-1.)

c. Visually inspect the N1 turbine first-stage blades. Replace the engine if any of the following conditions exist:
(1) Damaged inner 1/3 of blade.
(2) Blade broken off.
(3) Cracked blade.
(4) Melted blade.

d. Inspect the combustion liner. (Refer to table 7-l.)

Table 12-3. First-Stage Turbine Nozzleand Shield Inspection

Item	Condition	Serviceable limits
First-Stage Nozzle		
1	Axial cracks in vane airfoil.	Leading edge¼ in. maximum; trailing edge 5/16 in maximum. a. No two cracks in same plane. b. Adjacent cracks ¼ in. apart. c. Adjacent cracks not progressing toward each other.
2	Nicked or dented leading and trailing edge. Warped or burned trailing edge only.	Leading edge 1/16 in. maximum; trailing edge 1/8 in. maximum.
3	Fillet cracks–inner and outer hand.	Leading edge ¼ in. maximum; trailing edge 1/8 in. maximum.
4	Outer band cracks–leading and trailing edges.	Visible portion of crack extends 3/16 in. maximum axially into the band and not in line with crack on opposite edge.
5	Inner band cracks–leading and trailing edges.	Leading edge-visible portion of crack extends 3/16 in. maximum axially into the band and not in line with trailing edge cracks. Trailing edge-extending through inner band to sheet metal detail.
First-Stage Nozzle Shield		
6	Cracks around spotwelds on heat shield.	Cracks are acceptable provided the length of the crack is not greater than 50 percent of the distance around the weld.

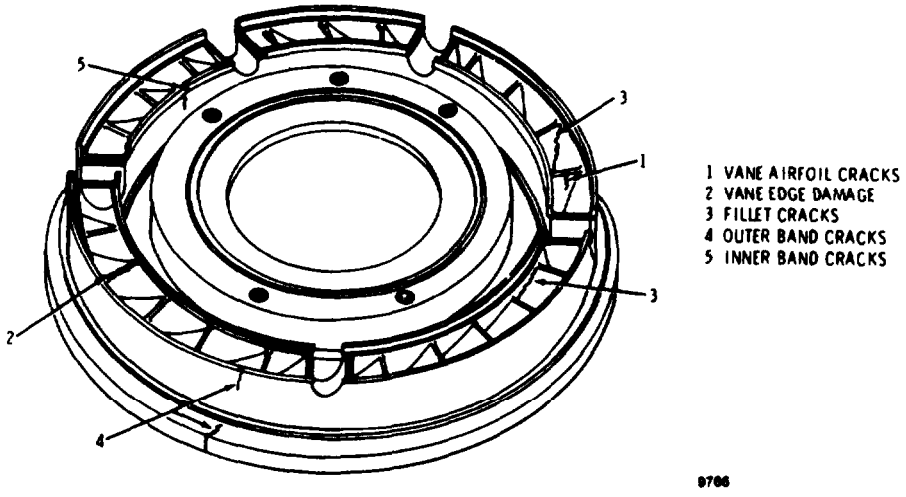


Figure 12-1. Typical First-stage Turbine Nozzle

Section II. COMPRESSOR

12-3. Scope.

This section presents special inspections to be performed on the engine when damage has been sustained due to operation under abnormal conditions or operation in severe climatic conditions.

12-4. Snow and Ice Ingestion Inspection.

This inspection must be performed following an inflight flameout in ice producing weather or anytime snow and ice ingestion is suspected. Inspect the compressor or snow, ice, or water damage as follows:

a. Obtain access to the compressor inlet but do not disassemble any engine parts.

b. Inspect the compressor front support vanes and first-stage rotor blades. Replace the engine if any mechanical damage, bending, or distortion is detected.

12-5. Compressor Inlet Blockage Inspection.

Replace the engine if it has been operated with inlet air restricted due to foreign objects or materials which have become lodged in the compressor relet. Tag the replaced engine to show that the cause of removal was inlet air blockage. Conditions which constitute blockage are as follows:

a. Foreign objects or materials found in inlet during inspection of the aircraft when not in operation. If it can be determined that the blackage was not there during the last operation of the engine, remove the foreign object or material and leave the engine in service.

b. Power loss encountered following a restriction at the compressor inlet area while the engine is in operation. Blockage in flight can usually be verified by inspection after landing (blockage still exists). However, some blockage may be followed by ingestion before inspection can take place. Objects or materials which were large enough to have stopped at the inlet guide vanes before ingestion should be considered to have caused compressor inlet blockage.

12-6. Foreign Object Damage (FOD) Inspection.

Power loss associated with an increase in engine vibration can often be attributed to foreign object damage. Inspect for foreign object damage as follows:

a. Obtain access to the compressor inlet but do not disassemble any engine parts.

b. Inspect the compressor front support vanes and first-stage rotor blades and vanes for FOD.

c. If the inspection in step b is inconclusive, remove one compressor case half and check for FOD. (Refer to paragraph 6-2.)

d. If the compressor FOD is not detected, remove the combustion section (paragraph 3-21) and check the turbine first-stage vanes and blades for FOD.

e. If compressor or turbine FOD is detected, replace the engine.

12-7. Erosion Inspection.

If the engine is frequently subject to sand and dirt ingestion, compressor erosion inspection is recommended. (Refer to paragraphs 7-10 and 7-11.)

12-8. Vibration Inspection.

NOTE

Perform engine vibration test after initial installation of engine in aircraft, after removal of combustion case, when excessive engine vibration is suspected; or when any maintenance has been performed that may effect engine to transmission alignment. The engine vibration test requirement shall apply to all engines installed, reinstalled, new, overhauled, same or different.

In engine. vibration is encountered determine the origin of the vibration as follows and repair or replace the engine as applicable.

a. Install vibration monitoring kit, tool No. 171170-0104, in accordance with TM 55-4920-243-15.

b. Run the engine and check for vibration in excess of the limits specified in table 10-1. Note the origin of the vibration.

c. If the compressor, turbine, or gearbox vibration limits are exceeded, replace the engine.

Section III. ABNORMAL FLIGHT MANEUVER INSPECTION

12-9. Hard Landing Inspection.

a. Replace the engine if landing forces exceed 10 g. Use the airframe condition to determine if the 10g force limit has been exceeded. If the airframe landing skids and cross tubes are deformed to a degree that the fuselage touches (or shows evidence of having touched) the ground, the 10g limit has been exceeded.

b. If the conditions of step a do not apply, make an inspection of the engine for damage as follows

(1) Check gearbox housing and flanges for cracks.

(2) Inspect magnetic chip detectors for metal particle accumulation.

(3) Check engine mounting pads for cracks.

(4) Check air, oil, and fuel tube connections for tightness and leaks.

(5) Check all engine accessories for cracked flanges, loose bolts and nuts, connections, and general condition.

(6) Install vibration monitoring kit, tool No. 171170-0104, in accordance with TM 55-4920-243-15, and operate the engine on the ground for 30 minutes. Check for vibration in excess of the limits specified in table 10-1.

(7) Shut down and check the magnetic chip detectors for metal particles.

12-10. Sudden Stoppage Inspection.

The following inspections must be accomplished whenever the main rotor or tail rotor strikes a stationary object.

a. Inspect the engine mounts for cracks and security. If stoppage was severe enough to fracture an engine mount, send the engine to overhaul.

b. Check the magnetic chip detectors for metal particles.

c. Inspect the compressor blades and vanes for foreign object damage.

d. Inspect the engine inlet for foreign objects.

e. Motor the engine and check for unusual noise.

f. Install vibration monitoring kit, tool No. 171170-0104, in accordance with TM 55-4920-243-15 and operate the engine on the ground for 30 minutes. Check that vibration is within limits specified in table 10-1.

g. Shut down and check the magnetic chip detectors for metal particles.

h. Reinspect the magnetic chip detectors after eight hours of engine operation.

CHAPTER 13

OVERHAUL INTERVAL AND RETIREMENT SCHEDULE

13-1. General.

Table 13-1 lists those items which have an established operating interval before they are overhauled or retired from service.

NOTE

TM 55-1500-328-25 should be referred to concerning mutilation/destruction of items, when they have reached the established life expectancy (finite life), before the items are forwarded for property disposal.

Table 13-1. Overhaul and Retirement Interval

Overhaul Interval (hr)	Retirement Interval (hr)	Item	Part Number
1800		Double Check Valve	6876557
1800		Engine	6887191
1800		Fuel Pump	6876721 (024918-104)
1800		Fuel Pump	6895172 (024918-106)
1800		Fuel Pump	6895653 (024918-107)
1800		Fuel Pump	23003114 (5002395)
1800		Fuel Pump	6896844 (386500-4)
1800		Fuel Pump	6899253 (386500-5)
1800		Bleed Valve	6889815
1800		Bleed Valve	6896348
1800		Bleed Valve	6899115
1800		Bleed Valve	23053176
1800		Fuel Control	6895672 (2524632-3)
1800		Fuel Control	6898894 (2524632-6)
2000		Fuel Control	23007860 (2524911-2)
2000		Fuel Control	23007857 (2524644-21)
2000		Fuel Control	23007869 (2524644-24)
2000		Fuel Control	2524911-2

Table 13-1. Overhaul and Retirement Interval - (Cont.)

Overhaul Interval (hr)	Retirement Interval (hr)	Item	Part Number
2000		Fuel Control	2524911-3
1800		Fuel Nozzle	6890917
1800		Governor	6895673 (2524589-2)
1800		Governor	6898888 (2524589-5)
1800		Governor	23005489 (2524589-3)
1800		Governor	23006274 (2524912-1)
2000		Governor	23007877 (2524912-2)
2000		Governor	23007865 (2524769-l0)
2000		Governor	23007506 (2524769-11)
2000		Governor	2524912-2 (23005489)
2000		Governor	2524912-3
1800		Compressor	6890570
	3600	Impeller	6876873
1800		Gearbox	6879863
		Turbine	6898739 6887635
1800		Turbine	23038244
	1800	First-Stage Wheel	6886407
	1800	Second-Stage Wheel	6898782 6877092
	4550	Third-Stage Wheel	23001967 6899373
	4550	Fourth-Stage Wheel	6891594 6853279

APPENDIX A

REFERENCES

AR 750-22	Maintenance of Supplies and Equipment, Army Oil Analysis Program
AS 478	Identification Marking Methods
MIL-M-3171	Magnesium Alloy, Processes for Pretreatment and Prevention of Corrosion on
MIL-STD-129	Marking for Shipment and Storage
TB 55-8100-200-24	Maintenance of Specialized Reusable Containers for Aircraft Equipment
TB 55-9150-200-24	Engine and Transmission Oils, Fuels, and Additives for Army Aircraft
TB 750-126	Use of Material Condition Tags and Labels on Army Aeronautical and Air Delivery Equipment
DA Pamphlet 738-751	Functional Users Manual for the Army Maintenance Management System-Aviation (TAMMS-A)
TM 1-1500-204-23	General Aircraft Maintenance Manual
TM 55-1500-328-25	Aeronautical Equipment, Maintenance Management Policies and Procedures
TM 55-1500-344-23	Aircraft Weapons System Cleaning and Corrosion Control
TM 55-1520-228-MTF	OH-58A Maintenance Test Flight
TM 55-1520-228-10	Operator's Manual: Army Model OH-58A Helicopter
TM 55-1520-228-23	AVUM and AVIM Maintenance Manual, Army Model OH-58A Helicopter
TM 55-4920-243-15	Operrator, Organizational, DS, GS, and Depot Maintenance Manual: Vibration Monitoring Kit
TM 55-4920-244-14	Tester, Exhaust Gas Temperature, Model BH 112JA36
TM 55-4920-328-13	Operator's, Organizational, DS, and GS Maintenance Manual for Engine Test System (LTCT 10465-02, NSN 4920-00-167-9178)
TM 750-244-1-5	Procedures for the Destruction of Aircraft and Associated Equipment to Prevent Enemy Use

☆ U.S. GOVERNMENT PRINTING OFFICE: 1993-555-028/80426

APPENDIX B
MAINTENANCE ALLOCATION CHART
Section I. INTRODUCTION

B-1. Maintenance Allocation Chart

a. This Maintenance Allocation Chart (MAC) assigns maintenance functions in accordance with the Three Levels of Maintenance concept for army aircraft. These maintenance levels, Aviation Unit Maintenance (AVUM); Aviation Intermediate Maintenance (AVIM) and Depot Maintenance are depicted on the MAC as:

AVUM which corresponds to the O Code in the RPSTL

AVIM which corresponds to an F Code in the RPSTL

DEPOT which corresponds to a D Code in the RPSTL

b. The maintenance to be performed below depot and in the field is described as follows:

(1) Aviation Unit Maintenance (AVUM) activities will be staffed and equipped to perform high frequency "On-Aircraft" maintenance tasks required to retain or return aircraft to a serviceable condition. The maintenance capability of the AVUM will be governed by the Maintenance Allocation Chart (MAC) and limited by the amount and complexity of ground support equipment (GSE), facilities required, and number of spaces and critical skills available. The range and quantity of authorized spare modules/components will be consistent with the mobility requirements dictated by the air mobility concept. (Assignments of maintenance tasks to divisional company size aviation units will consider the overall maintenance capability of the division, the requirement to conserve personnel and equipment resources and air mobility requirements.)

(a) Company size Aviation Units perform those tasks which consist primarily of preventive maintenance and maintenance repair and replacement functions associated with sustaining a high level of aircraft operational readiness. Perform maintenance inspections and servicing to include preflight, daily, intermediate, periodic and special inspections as authorized by the MAC or higher headquarters. Identify the cause of equipment/system malfunctions using applicable technical manual troubleshooting instructions, built-in-test equipment (BITE), installed aircraft instruments, or easy to use/interpret diagnostic/fault isolation devices (TMDE). Replace worn or damaged modules/components which do not require complex adjustments or system alignment and which can be removed/installed with available skills, tools and equipment. Perform operational and continuity checks and make minor repairs to the electrical system. Inspect, service and make operational capacity and pressure checks to hydraulic systems. Perform servicing, functional adjustments, and minor repair/replacement to the flight control, propulsion, power train and fuel systems. Accomplish airframe repair which does not require extensive disassembly, jigging, or alignment. The manufacture of airframe parts will be limited to those items which can be fabricated with tools and equipment found in current air mobile tools and shop sets. Evacuate unserviceable modules/components and end items beyond the repair capability of AVUM to the supporting AVIM.

(b) Less than Company Size Aviation Units: Aviation elements organic to brigade, group, battalion, headquarters and detachment size units are normally small and have less than ten aircraft assigned. Maintenance tasks performed by these units will be those which can be accomplished by the aircraft crew chief or assigned aircraft repairman and will normally be limited to preventive maintenance, inspections, servicing, spot painting, stop drilling, application of nonstress patches, minor adjustments, module/component fault diagnosis and replacement of selected modules/components, Repair functions will normally be accomplished by the supporting AVIM unit.

(2) Aviation Intermediate Maintenance (AVIM) provides mobile, responsible "One Stop" maintenance support. (Maintenance functions which are not conducive to sustaining air mobility will be assigned to depot maintenance). Performs all maintenance functions authorized to be done at AVUM. Repair of equipment for return to user will emphasize support or operational readiness requirements. Authorized maintenance includes replacement and repair of modules/components and items which can be accomplished efficiently with avail-

able skills, tools, and equipment. Established the Direct Exchange (DX) program for AVUM unite by repairing selected items for return to stock when such repairs cannot be accomplished at the AVUM level. Inspects, troubleshoots, tests, diagnoses, repairs, adjusts, calibrates, and aligns aircraft system modules/components. AVIM units will have capability to determine the serviceability of specified modules/components removed prior to the expiration of the Time Between Overhaul (TBO) or finite life. Module/component disassembly and repair will support the DX program and will normally be limited to task requiring cleaning and the replacement of seals, fittings and items of common hardware, Airframe repair and fabrication of parts will be limited to those maintenance tasks which can be performed with available tools and test equipment. Unserviceable reparable modules/components and end items which are beyond the capability of AVIM to repair will be evacuated to Depot Maintenance. This level will perform aircraft weight and balance inspections and other special inspections which exceed AVUM capability. Provides quick response maintenance support, including aircraft recovery and air evacuation on-the-job training, and technical assistance through the use of mobile maintenance contact teams. Maintain authorized operational readiness float aircraft. Provides collection and classification services for serviceable/unserviceable material. Operates a cannibalization activity in accordance with AR 750-50. (The aircraft maintenance company within the maintenance battalion of a division will perform AVIM functions consistent with air mobility requirements and conservation of personnel and equipment resources. Additional intermediate maintenance support will be provided by the supporting nondivisional AVIM unit).

B-2. Use of the Maintenance Allocation Chart

a. The Maintenance Allocation Chart assigns maintenance functions based on past experience and the following consideration:

(1) Skills available.

(2) Time required.

(3) Tools and test equipment required and/or available.

b. The assigned levels of maintenance authorized to perform a maintenance functions is indicated.

c. A maintenance function assigned to a lower maintenance level to be performed at any higher maintenance level.

d. A maintenance function that cannot be performed at the assigned level of maintenance for any reason may be evacuated to the next higher maintenance organization. Higher maintenance levels will perform the maintenance functions of lower maintenance levels when required or directed by the appropriate commander.

e. The assignment of a maintenance function will not be construed as authorization to carry the associated repair parts in stock. Information to requisition or otherwise secure the necessary repair parts will be specified in the Repair Parts, and Special Tools List.

f. Normally there will be no deviation from the assigned level of maintenance, In cases of operational necessity, maintenance functions assigned to a higher maintenance level may, on a one-time basis and at the request of the lower maintenance level, be specifically authorized by the maintenance officer of the higher level of maintenance to which the functions is assigned. The special tools, equipment, etc. required by the lower level of maintenance to perform this function will be furnished by the maintenance level to which the function is assigned. This transfer of a maintenance function to a lower maintenance level does not relieve the higher maintenance level of the responsibility of the function. The higher level of maintenance has the authority to determine:

(1) If the lower level is capable of performing the work.

(2) If the lower level will require assistance or technical supervision and on-site inspection.

(3) If the authorization will be granted.

g. Maintenance of the US Army Communications and Electronics Material Readiness Command equipment will be performed by designated US Army CERCOM personnel.

h. Changes to the Maintenance Allocation Chart will be based on continuing evaluation and analysis by responsible technical personnel and on reports received from field activities.

B-3. Definitions.

Maintenance functions. Maintenance functions will be limited to and defined as follows:

a. Inspect. To determine the serviceability of an item by comparing its physical, mechnical and/or electrical characteristics with established standards through examination.

b. Test. To verify serviceability and detect incipient failure by measuring the mechanical or electrical characteristics of an item and comparing those characteristics with the prescribed standards.

c. Service. Operations required periodically to keep an item in proper operating condition, i.e. to clean (decontaminate), to preserve, to drain, to paint, or to replenish fuel, lubricants, hydraulic fluids, or compressed air supplies.

d. Adjust. To maintain, within prescribed limits, by bringing into proper or exact position, or by setting the operating characteristics to specified parameter.

e. Align. To adjust specified variable elements of an item to bring about optimum or desired performance.

f. Calibrate. To determine and cause corrections to be made or to be adjusted on instruments or test, measuring and diagnostic equipment used in precision measurement. Consists of comparisons of two instruments, one of which is a certified standard of known accuracy to detect and adjust any discrepancy in the accuracy of the instrument being compared.

g. Intall. The act of emplacing, seating or fixing into position an item, part, or module (component or assembly) in a manner to allow the proper functioning of an equipment or system.

h. Replace. The act of substituting a serviceable like type part, subassembly or module, (component or assembly) for an unserviceable counterpart.

i. Repair. The application of maintenance services or other maintenance actions to restore serviceability to an item by correcting specific damage, fault, malfunctions or failure in a part, subassembly, module (component or assembly), end item, or system.

j. Overhaul. That maintenance effort (service/action) necessary to restore an item to a completely serviceable/operational condition as prescribed by the maintenance standard (i.e. DMWR) in the appropriate technical publication. Overhaul is normally the highest degree of maintenance performed by the Army. Overhaul does not normally return an item to like new condition.

k. Rebuild. Consists of those cervices/actions necessary for the restoration of unserviceable equipment to a like new condition in accordance with original manufacturing standards. Rebuild is the highest degree of materiel maintenance applied to Army equipment. The rebuild operation includes the act of returning to zero, those age measurements (hours/miles, etc.) considered in classifying Army equipments/components.

B-4. Standard Groups

The standard groupings shown below are used, as applicable, throughout this MAC. Maintenance manuals and RPSTLS will reflect these standard groupings as individual chapters with sections in each chapter relative to the individual complete systems, subsystems, modules, components, assemblies, or specific parts noted.

B-5. Symbols

The letters “AVUM, AVIM and Depot” as placed on the Maintenance Allocation Chart, indicate the level of Maintenance responsible for performing the particular maintenance function based upon assigned skills, tools and test equipment and time required to accomplish maintenance.

GROUP NUMBER	DESCRIPTION
0400	ENGINE SYSTEM
0401	ENGINE GENERAL Servicing, handling, inspection requirements, lubrication charts, overhaul and retirement schedules. External lines and hoses, (As applicable).
0402	COMPRESSOR SECTION Rotor, blades, vanes, impeller, stators, inlet guide vanes, main frame, particle separator, bleed valve, bearings, seals, external lines and hoses.
0403	COMBUSTION SECTION Liners, nozzles, stators, rotor seals, couplings, blades.
0404	POWER-TURBINE Nozzles, rotors, blades, exit guide vanes, exhaust frame, drive shaft, bearings, seals, external lines and hoses.
0405	ACCESSORY GEAR BOX Input/and output gears, seals, chips detector, housings, drive shaft bearings, seals.
0406	FUEL SYSTEM Fuel Control, fuel boost pump, governor, fuel filter assembly, sequence valve. Fuel manifold, fuel nozzle, external lines and hoses.
0407	ELECTRICAL SYSTEM Electrical control units, exciters, thermocouple, ignition harness, electrical cables, history recorders, torque overspeed sensor, NP sensor, alternate stator, blowers.
0408	OIL SYSTEM Tanks, oil, filter, oil coder, lube and scavenge pumps, oil filter bypass sensor, external lines and hoses.
04100	MISCELLANEOUS EQUIPMENT

B-6. Work Times.

The symbol -.- identifies the lowest level of Maintenance authorized to perform a maintenance function and indicates that work time figures are being developed and will be entered at a later date. When developed this time will appear: for example as, 0.1 and also indicates the lowest level of authorized maintenance.

B-7. Tools and Test Equipment (Section III)

Special tools, test, and support equipment required to& maintenance functions are listed with a reference number to permit cross-referencing to column 6 in the MAC. In addition, the maintenance category authorized to use the device is listed along with the item National Stock Number and, if applicable, the number to aid in identifying the tool/device.

B-8. Remarks (Section IV)

Column 6 of the MAC contains alphabetic reference codes which are explained in Section IV of this appendix.

Section II. MAINTENANCE ALLOCATION CHART

NOMENCLATURE OF END ITEMS: **ENGINE AIRCRAFT TURBOSHAFT MODEL T63-A-720**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY AVUM	AVIM	DEPOT	(6) TOOLS AND EQUIPMENT	(6) REMARKS
		NOTE ***The AVUM Maintenance functions identified herein are restriced to Company size units. These units are authorized SC 4920-99-CL-A92 (AVUM NO. 2) Tool Set and have 10 or more Aircraft assigned. Refer to paragraph 5-16(1)(a) and (b).***					
0400	ENGINE SYSTEM						
0401	TURBINE ENGINE	INSPECT	---			1	
		TEST	---			1,6,11	**A**
				---		1,6,11 16	**B**
		SERVICE	---			1,5	**C**
		INSTALL	---			1,2,14	**D**
		REPLACE	---			1,2,14, 17	**D**
		REPAIR	---			1,2	
		OVERHAUL			---		
0402	COMPRESSOR SECTION						
040201	COMPRESSOR ASSEMBLY	INSPECT	---			1	
		SERVICE	---			1,5	**C**
		INSTALL			---		
		REPLACE			---		
		REPAIR	---			1	
040202	INLET WIDE VANES	INSPECT	---			1	
040203	COMPRESSOR CASE HALVES	INSPECT	---			1	
		SERVICE	---			1,5	**C**

Section II. MAINTENANCE ALLOCATION CHART (CONT.)

NOMENCLATURE OF END ITEMS **ENGINE AIRCRAFT TURBOSHAFT MODEL T63-A-720**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY AVUM	AVIM	DEPOT	(5) TOOLS AND EQUIPMENT	(6) REMARKS
		INSTALL	---			1,2,10	
		REPLACE	---			1,2,10	
		REPAIR	---			1	E
040204	ROTOR ASSEMBLY	INSPECT	---			1	
		SERVICE	---			1,5	C
		INSTALL			---		
		REPLACE			---		
		REPAIR	---			1	E
040205	ANTI-ICE VALVE	INSPECT	---			1	
		TEST	---			1,3	
		INSTALL	---			1,2	
		REPLACE	---			1,2	
		REPAIR	---			1,2	
040206	DIFFUSER SCROLL	INSPECT	---			1	
		INSTALL			---		
		REPLACE			---		
		REPAIR	---			1	
040207	DIFFUSER VENT ORIFICE AND VENT TUBE	INSPECT	---			1	
		INSTALL	---			1,2	
		REPLACE	---			1,2	
040208	COMPRESSOR BLEED VALVE	INSPECT	---			1	
		TEST	---			1	
		SERVICE	---			1	

Section II. MAINTENANCE ALLOCATION CHART (CONT.)

NOMENCLATURE OF END ITEMS **ENGINE AIRCRAFT TURBOSHAFT MODEL T63-A-720**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY AVUM	AVIM	DEPOT	(5) TOOLS AND EQUIPMENT	(6) REMARKS
		INSTALL	---			1,2	
		REPLACE	---			1,2	
040209	OIL PRESSURE REDUCER	INSPECT	---			1	
		INSTALL	---			1,2	
		REPLACE	---			1,2	
0403	COMBUSTION SECTION						
040301	OUTER CASE	INSPECT	---			1	
		INSTALL	---			1	
		REPLACE	---			1,2	
		REPAIR		---		1,2 4	F
040302	COMBUSTION LINER	INSPECT	---			1	
		INSTALL	---			1,2	
		REPLACE	---			1,2	
		REPAIR		---		1,3,4,9	F
040303	DISCHARGE AIR TUBES	INSPECT	---			1	
		INSTALL	---			1,2,12, 13	
		REPLACE	---			1,2,12, 13	
		REPAIR		---		1,4	F
0404	TURBINE SECTION						
040401	TURBINE ASSEMBLY	INSPECT	---			1	
		INSTALL			---		
		REPLACE			---		
		REPAIR			---		

Section II. MAINTENANCE ALLOCATION CHART (CONT.)

NOMENCLATURE OF END ITEMS: ENGINE AIRCRAFT TURBOSHAFT MODEL T63-A-720

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY AVUM	AVIM	DEPOT	(5) TOOLS AND EQUIPMENT	(6) REMARKS
040402	FIRST STAGE NOZZLE	INSPECT	---			1	
040403	FIRST STAGE NOZZLE SHIELD	INSPECT	---			1	
040404	FIRST STAGE TURBINE BLADES	INSPECT	---			1	
040405	BURNER DRAIN VALVE	INSPECT	---			1	
		TEST	---			1,3	
		SERVICE	---			1	
		INSTALL	---			1,2	
		REPLACE	---			1,2	
0405	ACCESSORY GEARBOX						
040501	EXTERNAL SEALS	INSPECT	---			1	
		INSTALL		---		1,15	
		REPLACE		---		1,16	
040502	EXTERNAL STUDS	INSPECT	---			1	
		INSTALL		---		1,2,3,8	
		REPLACE		---		1,2,3,8	
040503	MAGNETIC CHIP DETECTOR	INSPECT	---			1	
		TEST	---			1	
		SERVICE	---			1	
		INSTALL	---			1,2	
		REPLACE	---			1,2	

Section II. MAINTENANCE ALLOCATION CHART (CONT.)

NOMENCLATURE OF END ITEMS: ENGINE AIRCRAFT TURBOSHAFT MODEL T63-A-720

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY AVUM	AVIM	DEPOT	(5) TOOLS AND EQUIPMENT	(6) REMARKS
0406	FUEL SYSTEM						
040601	FUEL CONTROL	INSPECT	-			1	
		TEST	-			1,18	
		SERVICE	-			1	
		ADJUST		-		1,2,19, 20	
		INSTALL	-			1,2	
		REPLACE	-			1,2	
		REPAIR	-			1,2	
		OVERHAUL			-		
040602	FUEL CONTROL FUEL FILTER	INSPECT	-			1	
		SERVICE	-			1	
		INSTALL	-			1,2	
		REPLACE	-			1,2	
040603	GOVERNOR	INSPECT	-			1	
		TEST	-			1,3	
		INSTALL	-			1,2	
		REPLACE	-			1,2	
040604	FUEL PUMP	INSPECT	-			1	
		INSTALL	-			1,2	
		REPLACE	-			1,2	
		REPAIR	-			1,2	
		OVERHAUL			-		

Section II. MAINTENANCE ALLOCATION CHART (CONT.)

NOMENCLATURE OF END ITEMS **ENGINE AIRCRAFT TURBOSHAFT MODEL T63-A-720**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY AVUM	AVIM	DEPOT	(5) TOOLS AND EQUIPMENT	(6) REMARKS
040605	FUEL FILTER	INSPECT	---			1	
		SERVICE	---			1	
		INSTALL	---			1,2	
		REPLACE	---			1,2	
040606	FUEL NOZZLE	INSPECT	---			1	
		SERVICE	---			1,2	
		INSTALL	---			1,2	
		REPLACE	---			1,2	
040607	DOUBLE CHECK VALVE	INSPECT	---			1	
		INSTALL	---			1,2	
		REPLACE	---			1,2	
040608	ACCUMULATORS	INSPECT	---			1	
		TEST	---			1,3	
		SERVICE	---			1	
		INSTALL	---			1,2	
		REPLACE	---			1,2	
040609	FUEL CHECK VALVE	INSPECT	---			1	
		INSTALL	---			1,2	
		REPLACE	---			1,2	
040610	PC AIR FILTER ASSEMBLY	INSPECT	---			1	
		SERVICE	---			1	

Section II. MAINTENANCE ALLOCATION CHART (CONT.)

NOMENCLATURE OF END ITEMS **ENGINE AIRCRAFT TURBOSHAFT MODEL T63-A-720**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY AVUM	AVIM	DEPOT	(5) TOOLS AND EQUIPMENT	(6) REMARKS
		INSTALL	---			1,2	
		REPLACE	---			1,2	
		REPAIR	---			1	
040611	EXTERNAL LINES AND HOSES	INSPECT	---			1	
		INSTALL	---			1,2	
		REPLACE	---			1,2	
0407	ELECTRICAL SYSTEM						
040701	EXCITER ASSEMBLY	INSPECT	---			1	
		TEST	---			1	
		INSTALL	---			1,2	
		REPLACE	---			1,2	
040702	SPARK IGNITER	INSPECT	---			1	
		TEST	---			1	
		SERVICE	---			1	
		INSTALL	---			1,2	
		REPLACE	---			1,2	
040703	SPARK IGNITER LEAD	INSPECT	---			1	
		INSTALL	---			1,2	
		REPLACE	---			1,2	
040704	THERMOCOUPLE ASSEMBLY	INSPECT	---			1	
		TEST	---			1,7	
		REPLACE	---				

Section II. MAINTENANCE ALLOCATION CHART (Cont.)

NOMENCLATURE OF END ITEMS

ENGINE AIRCRAFT TURBOSHAFT
MODEL T63-A-720

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY AVUM	AVIM	DEPOT	(5) TOOLS AND EQUIPMENT	(6) REMARKS
040705	THERMOCOUPLE TERMINAL ASSEMBLY	INSPECT	—.—			1	
		INSTALL	—.—			1,2	
		REPLACE	—.—			1,2	
0408	OIL SYSTEM						
040801	OIL FILTER HOUSING	INSPECT	—.—			1	
		INSTALL	—.—			1,2	
		REPLACE	—.—			1,2	
040802	OIL FILTER	INSPECT	—.—			1	
		SERVICE	—.—			1	
		INSTALL	—.—			1,2	
		REPLACE	—.—			1,2	
		REPAIR	—.—			1,2	
040803	OIL PRESSURE REGULATOR	INSPECT	—.—			1	
		TEST	—.—			1	
		ADJUST	—.—			1	
		INSTALL	—.—			1,2	
		REPLACE	—.—			1,2	
040804	INTERNAL OIL CHECK VALVE	INSPECT	—.—			1	
		SERVICE	—.—			1	
		INSTALL	—.—			1,2	
		REPLACE	—.—			1,2	
040805	EXTERNAL OIL CHECK VALVE	INSPECT	—.—			1	
		SERVICE	—.—			1	
		INSTALL	—.—			1,2	

Section II. MAINTENANCE ALLOCATION CHART (CONT.)

NOMENCLATURE OF END ITEMS **ENGINE AIRCRAFT TURBOSHAFT MODEL T68-A-720)**

(1) GROUP NUMBER	(2) COMPONENT/ASSEMBLY	(3) MAINTENANCE FUNCTION	(4) MAINTENANCE CATEGORY AVUM	AVIM	DEPOT	(5) TOOLS AND EQUIPMENT	(6) REMARKS
		REPLACE	—.—			1,2	
040806	EXTERNAL LINES AND FITTINGS	INSPECT	—.—			1	
		INSTALL	—.—			1	
		REPLACE	—.—			1	
04100	MISCELLANEOUS EQUIPMENT						
041001	FAT THERMOMETER	INSTALL	—.—				
		TEST	—.—			1,2	
		REPLACE					
041002	TOT GAGE	INSTALL	—.—				
		TEST	—.—			1,2	
		REPLACE				21	
041003	TACHOMETER	INSTALL				1,2	
		TEST	—.—			21	
		REPLACE					

Section III. TOOL AND TEST EQUIPMENT REQUIREMENTS

NOMENCLATURE OF END ITEMS

ENGINE AIRCRAFT TURBOSHAFT
MODEL T63-A-720

TOOL OR TEST EQUIPMENT REFERENCE CODE	MAINTENANCE CATEGORY	NOMENCLATURE	NATIONAL/NATO STOCK NUMBER	TOOL NUMBER
1	AVUM	TOOL KIT, ENGINE REPAIRMANS	5180003234944	SC518099CLA07
2	AVUM	TOOL SET, AVUM SET NO. 2	4920005670476	SC92099CLA92
3	AVIM	SHOP SET, AVIM TURBINE ENGINE	4920002243684	SC492092CLA91 ENTAM
4	AVIM	SHOP SET, AVIM WELDING, AVIM WELDING	4920001635093	SC492099CLAWEAM
5	AVUM	KIT, PROTECTOR COMPRESSOR CLEANING	4920010301011	6886204
6	AVUM	KIT, VIBRATION SIGNAL SOURCE	4920008790331	171170-0104
7	AVUM	TOOL KIT, ELECTRICAL REPAIRMANS	5180003234915	SC518099CLA06
8	AVIM	SHOP SET, AVIM MACHINE SHOP	4920004059279	SC492099CLA91 MAAM
9	AVIM	SHOP SET, AVIM SHEET METAL	4920001665505	SC492099CLA91 SMAM
10	AVIM	ADAPTER, ENGINE TURNING	4920009233188	6799790
11	AVUM	BRACKET, MOUNTING COMPRESSOR VIBRATION PICKUP	4920000301022	6872539
12	AVUM	CLAMP, LOOP	5340009450244	6799952
13	AVUM	CLAMP, LOOP	5340009450242	6799953
14	AVUM	LIFT, ENGINE ASSEMBLY	5120009247722	6796963
15	AVIM	PULLER, KIT MECHANICAL	5120009450186	6796941
16	AVIM	STAND TEST, ENGINE MODULAR	4920001679178	LTCT10465-02
17	AVUM	STAND, ENGINE TURNOVER	4920009245726	6795579
18	AVUM	STOP WATCH	6645002504680	10531878
19	AVUM	WRENCH, BRISTOL	5120002242482	S 1l1
20	AVUM	WRENCH, GROUND IDLE	5120007637565	6798292
21	AVUM	JET-CAL ANALYSER	4920006735514	BH-112-JA-36

Section IV. REMARKS
T63-A-720 TURBOSHAFT

REFERENCE CODE	REMARK/NOTES
A	Functional Test at AVUM - Engine in Airframe
B	Functional Test at AVIM - Engine in METS
C	Water/Solvent Solution Wash
D	Reference TM 55-1520-228-23
E	Blend Repair Only
F	Weld Repair

ALPHABETICAL INDEX

*U.S. GOVERNMENT OFFICE: 1996-733-163/40011

☆ U.S. GOVERNMENT PRINTING OFFICE: 1993-342-421/80380

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM (PRINT YOUR UNIT'S COMPLETE ADDRESS)
CDR, 1st Br, 65th ADA
ATTN: SP4 J. Brown
Key West, FL 33040

DATE SENT
10 Jun 79

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 9-1430-550-34-1	7 Sep 72 .	Unit of Radar Set AN/MPQ-50 Tested at the HFC

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARAGRAPH	FIGURE NO	TABLE NO
9-19		9-5	
21-2	step 1C	21-2	

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

"B" Ready Relay K11 is shown with two #9 contacts. That contact which is wired to pin 8 of relay K16 should be changed to contact #10.

Reads: Multimeter B indicates 600 K ohms to 9000 K ohms.

Change to read: Multimeter B indicates 600 K ohms minimum.

Reason: Circuit being checked could measure infinity. Multimeter can read above 9000 K ohms and still be correct.

SAMPLE

PRINTED NAME, GRADE OR TITLE AND TELEPHONE NUMBER
SP4 J.T. Brown, Jr.

SIGN HERE
SP4 James Brown, Jr.

DA FORM 2 JUL 79 2028-2 REPLACES DA FORM 2028-2 1 APR 76 WHICH WILL BE USED UNTIL EXHAUSTED

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS.

TEAR ALONG PERFORATED LINE

REVERSE OF DA FORM 2028-2 Reverse of DRSTS-M Overprint 2, 1 Nov 80

TEAR ALONG PERFORATED LINE

FILL IN YOUR UNITS ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

_____

_____

OFFICIAL BUSINESS

COMMANDER
U.S. ARMY AVIATION AND TROOP COMMAND
ATTN: AMSAT-I-MP
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120-1798

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 55-2840-241-23	2 NOV 77	AVUM & AVIM MAINTENANCE MANUAL ENGINE, AIRCRAFT, GAS TURBINE

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARAGRAPH	FIGURE NO	TABLE NO

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER

SIGN HERE

DA, FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS

REVERSE OF DA FORM 2028-2 Reverse of DRSTS-M Overprint 2, 1 Nov 80

TEAR ALONG PERFORATED LINE

FILL IN YOUR UNITS ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

COMMANDER
U.S. ARMY AVIATION AND TROOP COMMAND
ATTN: AMSAT-I-MP
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120-1798

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 55-2840-241-23	2 NOV 77	AVUM & AVIM MAINTENANCE MANUAL ENGINE, AIRCRAFT, GAS TURBINE

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARA-GRAPH	FIGURE NO	TABLE NO

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER

SIGN HERE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS

REVERSE OF DA FORM 2028-2 Reverse of DRSTS-M Overprint 2, 1 Nov 80

TEAR ALONG PERFORATED LINE

FILL IN YOUR UNITS ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

COMMANDER
U.S. ARMY AVIATION AND TROOP COMMAND
ATTN: AMSAT-I-MP
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120-1798

RECOMMENDED CHANGES TO EQUIPMENT TECHNICAL PUBLICATIONS

SOMETHING WRONG WITH THIS PUBLICATION?

FROM: (PRINT YOUR UNIT'S COMPLETE ADDRESS)

DATE SENT

PUBLICATION NUMBER	PUBLICATION DATE	PUBLICATION TITLE
TM 55-2840-241-23	2 NOV 77	AVUM & AVIM MAINTENANCE MANUAL ENGINE, AIRCRAFT, GAS TURBINE

BE EXACT PIN-POINT WHERE IT IS

PAGE NO	PARAGRAPH	FIGURE NO	TABLE NO

IN THIS SPACE TELL WHAT IS WRONG AND WHAT SHOULD BE DONE ABOUT IT:

PRINTED NAME GRADE OR TITLE AND TELEPHONE NUMBER

SIGN HERE

DA FORM 1 JUL 79 2028-2

PREVIOUS EDITIONS ARE OBSOLETE

P.S.--IF YOUR OUTFIT WANTS TO KNOW ABOUT YOUR RECOMMENDATION MAKE A CARBON COPY OF THIS AND GIVE IT TO YOUR HEADQUARTERS

REVERSE OF DA FORM 2028-2 Reverse of DRSTS-M Overprint 2, 1 Nov 80

TEAR ALONG PERFORATED LINE

FILL IN YOUR UNITS ADDRESS

FOLD BACK

DEPARTMENT OF THE ARMY

OFFICIAL BUSINESS

COMMANDER
U.S. ARMY AVIATION AND TROOP COMMAND
ATTN: AMSAT-I-MP
4300 GOODFELLOW BOULEVARD
ST. LOUIS, MO 63120-1798

PIN: 033211-016