

QCX
AVRO
CF105
WS
R-
2

UNCLASSIFIED
CONFIDENTIAL

ARROW WEAPON SYSTEM
CO-ORDINATING CONTRACTOR
REPORT No. 2
CO-ORDINATION OF ARROW PROGRAM
STATEMENT OF WORK

UNLIMITED



AVRO AIRCRAFT LIMITED

FILE IN VAULT

NRC - CISTI
J. H. PARKIN
BRANCH

MAY 15 1995

ANNEXE
J. H. PARKIN
CNRC - ICIST

SECURITY WARNING
UNCLASSIFIED

UNLIMITED

This document is classified "CONFIDENTIAL" and is intended solely for the use of the recipient and such persons as have been delegated to use it in the course of their duty and may only be used in connection with work performed for or on behalf of Her Majesty's Canadian Government.

The unauthorized retention or destruction of this document or disclosure of its contents to any unauthorized person is forbidden.

Failure to comply with any of the above instructions is an infraction of the Official Secrets Act.

Any unauthorized person obtaining possession of this document, by finding or otherwise, must forward it, together with his name and address, in a registered envelope, to the Arrow Weapon System Co-ordinator, Avro Aircraft Limited, Malton, Ontario, Canada.

This is copy number**31**.....

Issued to

Date



National Research Council Canada / Conseil national de recherches Canada

Canada Institute for Scientific and Technical Information
J.H. Parkin Branch

Institut canadien de l'information scientifique et technique
Annexa J.H. Parkin

Report No.: QCX Auro CP105 WS R - 2

Has been: ☐ Downgraded to: As per letter 1463 (AC) 95/0043

☒ De-Classified

By: (Name)

(Dept)

Date: JAN 8 96

B.J. Petzinger
Deputy Coordinator
Access to Information and Privacy

Signature

CO-ORDI

ISSUED: M. A.
Arro
Co-o

ARROW WEAPON SYSTEM
CO-ORDINATING CONTRACTOR

UNLIMITED

REPORT NO. 2

21 MAY 1958

CO-ORDINATING OF ARROW PROGRAM STATEMENT OF WORK

ISSUED: W. R. Stephens
Arrow Weapon System
Co-ordinator

APPROVED: J. A. Morley
Vice-President
Sales & Service



UNCLASSIFIED
CONFIDENTIAL

INDEX

UNLIMITED

Summary

Attendance at Meeting Sessions

- 1.0 Status of AVRO Statement of Work for the ARROW Program
- 2.0 Co-ordination with Associate Contractors
- 3.0 Responsibility Charts
- 4.0 Recommendations
 - 4.1 Canadair Airborne Data Recording Equipment
 - 4.2 Orenda Responsibility for Iroquois Ground Support Equipment
 - 4.3 Orenda Responsibility for ARROW Weapon System Support
 - 4.4 Radio Corporation of America Responsibility for ARROW Weapon System Support
 - 4.5 Canadair Limited Responsibility for ARROW Weapon System Support
 - 4.6 Ground Support Equipment Model Specifications
- 5.0 Conclusions

Appendices

- A - Responsibility Chart - Contractor ARROW Aircraft
- B - Responsibility Chart - RCAF ARROW Aircraft
- C - Responsibility Chart - Other aircraft
- D - Support Responsibility Chart - Other ARROW Weapon System Activities



CONFIDENTIAL
UNCLASSIFIED

SUMMARY

Avro Aircraft Limited is preparing a Statement of Work covering its responsibilities in the ARROW Program for negotiation with the Department of Defence Production. The document includes AVRO's associate and co-ordinating contractor activities from the inception of the ARROW project through 1960. Many items are interrelated with the programs of the other ARROW Weapon System Associate Contractors (RCA, Canadair Limited and Orenda Engines Limited).

A meeting to co-ordinate these aspects was held at AVRO with representatives of the other three companies on 30 April and 1 May 1958. The meeting reached agreement on the division of responsibilities and duties in the areas where two or more of the contractors are involved. Changes to the AVRO Work Statement were made where necessary for clarification and compatibility.

The other Associate Contractors undertook to negotiate Statements of Work with DDP for their own programs which would be compatible with the division of responsibility agreed upon at the meeting. AVRO, as ARROW Weapon System Co-ordinating Contractor, undertook to recommend to the RCAF and DDP the changes in contractual coverage and/or instructions which are currently in effect with the other Associate Contractors in order to implement the agreements reached at the meeting. These recommendations are presented in this report.



CONFIDENTIAL

ATTENDANCE AT MEETING SESSIONS

Name	April 30		May 1	Representing
	am	pm	am	
Mr. W.R. Stephens (Chairman)	x	x	x	) Avro Aircraft Limited
Mr. I. M. Liss	x	x	x	) AWSC Department
Mr. D.W. Muggeridge (Secretary)	x	x	x	)
Mr. C.V. Lindow	x			) Avro Aircraft Limited
Mr. R. Adey	x	x		) Engineering Division
Mr. J.K. Scott	x	x	x	)
Mr. S.E. Harper		x		)
Mr. A. Buley			x	)
Mr. W.G. Eves	x	x	x	) Avro Aircraft Limited Manufacturing Division
Mr. J.R. Douglas	x	x	x	) Avro Aircraft Limited
Mr. P.E. Adams	x	x	x	) Contracts Department
Mr. R.D. Richmond	x	x	x	) Canadair Limited
Mr. R. Raven	x	x	x	)
Mr. W.S. Geddes	x	x	x	)
Mr. D.J. Caple	x	x	x	) Orenda Engines Limited
Mr. A.L. Sutton	x	x	x	)
Mr. A.W. Smallwood	x	x	x	)
Mr. E.W. Sheridan	x	x	x	) Radio Corporation of
Mr. D.E. Shumaker	x	x	x	) America
Mr. E.A. Williams	x	x	x	)

The following attended as observers:

S/L N.E. McCuaig

RCAF Technical Services
Detachments, AVRO.

Mr. C.A. Hore

DDP Representative, AVRO.



1.0 STATUS OF AVRO STATEMENT OF WORK FOR THE ARROW PROGRAM

Issue 1 of the Avro Aircraft Limited Statement of Work for the ARROW program was issued on 7 April 1958. Lists of changes amending Issue 1 were issued under reference AWSC 4-4/96 on 18 April 1958 and AWSC 4-4/120 on 29 April 1958. This Statement of Work reflects the Associate Contractor method of procurement established for the ARROW Weapon System by the Canadian Government. Avro Aircraft Limited is the Associate Contractor for the ARROW airframe with installed Government Supplied Materiel, and is also the Co-ordinating Contractor for the ARROW Weapon System. In the latter role, AVRO is responsible for co-ordination of the ARROW Weapon System activities of the other Associate Contractors, namely:

Orenda Engines Limited	(Iroquois Engine)
Radio Corporation of America	(ASTRA I Electronic System)
Canadair Limited	(Sparrow 2 Guided Missile)

The document includes both AVRO's Associate Contractor and its Co-ordinating Contractor responsibilities. It covers the entire ARROW program from its inception through 31 December 1960, with the exception of assistance or participation in RCAF Phase 4 through Phase 8 evaluation. This was omitted because AVRO's responsibilities for this activity have not yet been defined in adequate detail for contractual action.

2.0 CO-ORDINATION WITH ASSOCIATE CONTRACTORS

Prior to finalization of the AVRO Statement of Work and its submission for contractual negotiation with the Canadian Government, AVRO distributed



2.0 (Cont'd)

information copies of issue 1, together with the two relevant change lists, to the Royal Canadian Air Force, the Department of Defence Production and to all the other Associate Contractors.

A meeting of the ARROW Weapon System Associate Contractor Co-ordinating Committee was then called by AVRO to discuss the areas of the Statement of Work which affected the other Associate Contractors. Both RCAF and DDP were invited to send representatives as observers. The objectives of this meeting were:

1. To ensure that all known tasks in these areas had been taken into consideration.
2. To arrive at agreement among the various contractors on the allocation of responsibilities for interrelated work.
3. To determine the Government action which would have to take place with respect to the contractual arrangements with the other associates in order to implement item 2 above.

3.0 RESPONSIBILITY CHARTS

To facilitate the discussion, charts showing the responsibilities of the various contractors in condensed form were employed, dealing with the following areas of joint responsibility:

Contractor ARROW Aircraft

RCAF ARROW Aircraft



3.0 (Cont'd)

Other aircraft

Support Responsibilities - Other ARROW
weapon system activities

These charts, revised to incorporate the agreements and recommendations of the meeting, are included in this report as Appendices A, B, C and D.

Other detailed discussions dealt with the statements of support required from the other associate contractors and with Part 8 of the Statement of Work, which includes AVRO support to the other companies.

4.0 RECOMMENDATIONS

The representatives of the visiting contractors agreed that they would submit Statements of Work for their own ARROW Weapon System activities which would be compatible with the agreements reached at the meeting. Implementation of the agreed allocation of responsibility would require changes to existing contractual arrangements or instructions. Recommendations for these changes are presented below.

- 4.1 Canadair airborne data recording equipment. With the exception of Canadair, all the associate contractors intend to supply, modify and maintain the airborne recording instrumentation in the aircraft allocated to them. Canadair is willing to do this but has been advised by DDP that AVRO is to supply the recording instrumentation for Canadair ARROW aircraft. It is recommended that Canadair Limited be authorized to supply, as well as to modify and maintain, its own airborne recording instrumentation and so be consistent with the other



4.1 (Cont'd)

Associate Contractors and with the AVRO Statement of Work.

4.2 Orenda responsibility for Iroquois ground support equipment.

Associate Contractor flight operations at Malton will require support from Orenda Engines Limited, including provision of Iroquois engine ground support equipment other than certain items of engine handling equipment to be supplied by AVRO. Orenda requires contractual coverage for the provision of this ground support equipment, including field-type run-up stand and check-out facilities with noise silencing.

4.3 Orenda responsibility for ARROW Weapon System support.

Orenda Engines Limited requires additional contractual coverage in order to meet its obligations for support of the ARROW Weapon System, including:

- (a) Operation of Iroquois maintenance facilities at Malton and Cold Lake to support all Associate Contractors programs, including the provision of maintenance services and spares for the engine and the engine ground support equipment.
- (b) Technical assistance to AVRO in obtaining RCAF acceptance of ARROW 2 aircraft.
- (c) Compiling Personnel Requirements Data (PRD) for the Iroquois engine.
- (d) Design and fabrication of system trainers for the Iroquois engine.

Orenda Engines Limited has initiated action to secure contractual coverage for its support activities; action on this must be expedited in



4.3 (Cont'd)

order that Orenda can meet its obligations in phase with the rest of the program.

4.4 Radio Corporation of America Responsibility for ARROW Weapon System Support

4.4.1 RCA's present contractual obligation for technical assistance to other Associate Contractors is limited to the provision of field representatives, and support required by the aircraft manufacturer in securing satisfactory operation of pre-production Partial ASTRA and ASTRA I electronic systems in aircraft up to the acceptance of the aircraft by the RCAF.

Additional contractual coverage is required by RCA to support the programs of the other Associate Contractors, including:

- (a) Continuing technical support needed for the maintenance of systems in ARROW aircraft used by all the other Associate Contractors, after the RCAF has accepted the aircraft and turned them over to the contractors.
- (b) Maintenance facilities support, comprising:
 - (i) Provision, maintenance and operation of ASTRA maintenance facilities at Malton to serve all Associate Contractors' requirements. (The maintenance equipment itself is Government-furnished to RCA).
 - (ii) Maintenance and operation of ASTRA maintenance



4.4.1 (Cont'd)

facilities at Cold Lake to serve all Associate Contractors' requirements.

(iii) Provision of maintenance services and spares for both ASTRA systems and ASTRA ground support equipment to serve all Associate Contractors' requirements at Malton and Cold Lake.

4.4.2 No uniform procedure appears to exist for the provision of spares for ASTRA components originating in Canada (e. g. AN/ARC-552) and those originating in the United States. It is recommended that arrangements be made for stocks of all ASTRA spares, whether the equipment involved is of Canadian or U.S. origin, to be provided to RCA for support of ASTRA systems in ARROW aircraft assigned to all Associate Contractors.

4.4.3 RCA requires contractual coverage for work involved in compiling ASTRA Personnel Requirements Data (PRD) and for design and construction of ASTRA system trainers.

4.5 Canadair Limited Responsibility for ARROW Weapon System Support

Canadair requires contractual coverage for compilation of PRD documents and for design and construction of Sparrow system trainers.

Canadair requires contractual coverage for provision of facilities and services to train other Associate Contractors' personnel on the Sparrow 2 Mk 1 missile. Both RCA and AVRO require such training.



4.5 (Cont'd)

Canadair requires contractual coverage for engineering services and materiel to support RCA ASTRA-Sparrow compatibility tests.

Canadair should be made responsible for provision of Sparrow 2 missile spares required to support the programs of all the Associate Contractors. In particular, this should include spares for U. S.-made missiles and the incorporation of modifications to U. S.-made missiles to bring them to uniform and adequate modification status.

4.6 Ground Support Equipment Model Specifications

The present RCAF definitions of model specifications for the ARROW Weapon System include only one specification for ground support equipment. Presumably this would have to be assembled by the Co-ordinating Contractor from contributions by all the Associate Contractors. This arrangement is considered needlessly unwieldy. It is recommended that each major sub-system (airframe, electronic system, engine and missile) should have its own model specification for ground support equipment prepared by the Associate Contractor responsible for the relevant sub-system. The Co-ordinating Contractor's responsibility would then be to co-ordinate these and ensure compatibility in the same way as is done for the sub-system model specifications.

5.0 CONCLUSIONS

AVRO's Statement of Work (Issue 1) for the ARROW program includes coverage of the Associate and Co-ordinating Contractor activities in which interrelated responsibilities of more than one Associate Contractor are



5.0 (Cont'd)

involved. It has been based on the principle that each Associate Contractor will include the services and support that it is to provide to the other Associates or to the combined program in its own Statement of Work.

Discussions among all the Associate Contractors have resulted in agreement on the allocation of responsibilities. However, many aspects of this agreement cannot be implemented without additional contractual coverage being provided to the Associate Contractors for the extra work involved in making their contributions to the combined effort. This additional authorization and funding is believed to be already late for meeting RCAF requirements with respect to Personnel Requirements Data.

Other Government action is required to set up electronic system spares supply through RCA for support of Associate Contractor aircraft and to change existing requirements to permit separate model specifications to be provided for the Ground Support Equipment for each major sub-system of the ARROW Weapon System.

APPENDIX 'A'

RESPONSIBILITY CHART - CONTRACTOR ARROW AIRCRAFTCONFIDENTIALLegend:

A = AVRO
GSE = GROUND SUPPORT EQUIPMENT

C = CANADAIR
O = ORENDA
a = AFTER

F = RCAF
R = RCA
b = BEFORE

G = GOVERNMENT
W = DEMONSTRATION

ITEM	AIRCRAFT											
	25201	25202	25203	25204 & 25205	25206	25207	25208	25209	25210	25211 & 25212	25213 & 25214	25215
BEFORE/AFTER ACCEPTANCE	-	-	-	-	-	-	-	-	-	-	-	-
PRIMARY USER	A	A	A	R	A	O	A	R	A	C	W	A
SECONDARY USER	-	R	C	-	-	-	-	C	C	-	A	-
MAINTAIN AIRFRAME - MALTON	A	A	A	A	A	A	A	A	A	A	A	A
OPERATE TEST PROGRAM - MALTON	A	A	A	R	A	A	A	R	A	-	A	-
MAINTAIN AIRFRAME - COLD LAKE	-	-	-	-	-	-	-	-	-	A	A	-
OPERATE - COLD LAKE	-	-	-	-	-	-	-	-	-	C	A	-
FUEL - MALTON	A	A	A	A	A	A	A	A	A	A	A	A
FUEL - COLD LAKE	-	-	-	-	-	-	-	-	-	F	F	-
MOD AIRFRAME FOR TEST	A	A	A	A	A	A	A	A	A	A	A	A
INSTRUMENTATION INSTALL- ATION DESIGN & INSTALLATION	A	A	A	A	A	O/A	A	A	A	A	A	A
INSTRUMENT OR INST/ WEAPON PACK SUPPLY	A	A	A	A	A	A	A	A	A	A	A	A
INSTRUMENTATION SPECIF- ICATION	A	A/R	A/C	R	A	O	A	R/C	A/C	C	A	A
ASSIST INSTRUMENTATION MOD & MAINTAIN	-	-	-	A	-	A	-	A	-	A	-	-
AIRFRAME INSTRUMENTATION SUPPLY MOD & MAINTAIN	A	A	A	A	A	A	A	A	A	A	A	A
RECORDING INSTRUMENTATION SUPPLY MOD & MAINTAIN	A	A	A	R	A	O	A	R	A	C	A	A

ITEM	AIRCRAFT											
	25201	25202	25203	25204 & 25205	25206	25207	25208	25209	25210	25211 & 25212	25213 & 25214	25215
HANGAR (MALTON)	A	A	A	*A	A	A	A	*A	A	A	A	A
SUPPLY AIRFRAME GSE - MALTON	A	A	A	A	A	A	A	A	A	A	A	A
SUPPLY AIRFRAME GSE - COLD LAKE	-	-	-	-	-	-	-	-	-	F	F	-
SUPPLY ELECTRONICS GSE - MALTON	A	A/R	A	*G/R	*G/R	*G/R	*G/R	*G/R	*G/R	*G/R	*G/R	*G/R
SUPPLY ELECTRONICS GSE - COLD LAKE	-	-	-	-	-	-	-	-	-	F	F	-
SUPPLY MISSILE GSE - MALTON	-	-	C/A	C/A	-	-	-	C/A	C/A	C/A	C/A	-
SUPPLY MISSILE GSE - COLD LAKE	-	-	-	-	-	-	-	-	-	F	F	-
SUPPLY ENGINE GSE - MALTON	A	A	A	A	O/A	O/A	O/A	O/A	O/A	O/A	O/A	O/A
SUPPLY ENGINE GSE - COLD LAKE	-	-	-	-	-	-	-	-	-	F	F	-
CHECK OUT & MAINTAIN MISSILE & MISSILE GSE	-	-	C	C	-	-	-	C	C	C	C	-
MAINTAIN ENGINE & ENGINE GSE	A	A	A	A	O/A	O/A	O/A	O/A	O/A	O/A	O/A	O/A
MAINTAIN ELECTRONICS & ELECTRONICS GSE	A	A/R	A	R	R	R	R	R	R	R	R	R
ASSIST MAINTAIN ELECTRONICS	-	-/A	-	A	-	-	-	A	-	-	-	-
FIRST LINE ASTRA ELECTRONICS MAINTENANCE	-	-/A	-	R	A/R	A/R	A/R	R	A/R	R	A/R	A/R
LAB. TEST EQUIPMENT - MALTON	A	A	A	A/G/R	A/G/R	A/G/R	A/G/R	A/G/R	A/G/R	A/G/R	A/G/R	A/G/R
GROUND TELEMETERING - MALTON	A	A	A	-	A	A	A	-	-	A	A	A
GROUND TELEMETERING - POINT PETRE	-	-	C	-	-	-	-	-	-	-	-	-
GROUND TELEMETERING - COLD LAKE	-	-	-	-	-	-	-	-	-	F	F	-

* Subject to change depending on RCA Facilities arrangements at Malton

CONFIDENTIAL

ITEM	AIRCRAFT											
	25201	25202	25203	25204 & 25205	25206	25207	25208	25209	25210	25211 & 25212	25213 & 25214	25215
INSTALL AIRFRAME MOD KITS	A	A	A	A	A	A	A	A	A	A	A	A
AIRCREW	A	A	A	R	A	O	A	R/C	A/C	C	A	A
AIRFRAME REPAIR & OVERHAUL	A	A	A	A	A	A	A	A	A	A	A	A
MILTON DATA REDUCTION SERVICE	A	A	A/C	A	A	O	A	A	A	-	A	A
GOLD LAKE DATA REDUCTION SERVICE	-	-	-	-	-	-	-	-	-	F/C	F	-
SUPPLY GCI & GROUND STATION DATA LINK	-	-	-	F/R	-	-	-	F/R	F	-	F	-
OPERATE GSI & GROUND STATION DATA LINK	-	-	-	F/R	-	-	-	F/R	F	-	F	-

RESPONSIBILITY CHART - RCAF ARROW AIRCRAFT

Legend:

GSE = GROUND SUPPORT EQUIPMENT

F = RCAF

G = GOVERNMENT

0 = ORENDA

$$R = RCA$$

W = DEMONSTRATION

a = AFTER

b = BEFORE

[illegible]

CONFIDENTIAL

ITEM	AIRCRAFT									
	25216 and 25217	25218 and 25219	25220 thru 25225	25226 and 25227	25228 thru 25233					
HANGAR (MALTON)	A	WORK	A	WORK	A	WORK	A	WORK	A	WORK
SUPPLY AIRFRAME GSE - MALTON	A	WORK	A	WORK	A	WORK	A	WORK	A	WORK
SUPPLY AIRFRAME GSE - COLD LAKE	-	OF	-	OF	-	OF	-	OF	-	OF
SUPPLY ELECTRONICS GSE - MALTON	*G/R	*G/R	*G/R	*G/R	G/R					
SUPPLY ELECTRONICS GSE - COLD LAKE	-	STATEMENT	-	STATEMENT	-	STATEMENT	-	STATEMENT	-	STATEMENT
SUPPLY MISSILE GSE - MALTON	-	C/A	-	C/A	C/A					
SUPPLY MISSILE GSE - COLD LAKE	-	-	-	-	-					
SUPPLY ENGINE GSE - MALTON	O/A	O/A	O/A	O/A	O/A					
SUPPLY ENGINE GSE - COLD LAKE	-	-	-	-	-					
CHECK OUT & MAINTAIN MISSILE & MISSILE GSE	-	C	-	C	C					
MAINTAIN ENGINE & ENGINE GSE	O/A	O/A	O/A	O/A	O/A					
MAINTAIN ELECTRONICS & ELECTRONICS GSE	R	R	R	R	R					
ASSIST MAINTAIN ELECTRONICS	-	-	-	-	-					
FIRST LINE ASTRA ELECTRONICS MAINTENANCE	A/R	A/R	A/R	A/R	A/R					
LAB. TEST EQUIPMENT - MALTON	A/G/R	A/G/R	A/G/R	A/G/R	A/G/R					
GROUND TELEMETERING - MALTON	-	-	-	-	-					
GROUND TELEMETERING - POINT PETRE	-	-	-	-	-					
GROUND TELEMETERING - COLD LAKE	-	-	-	-	-					
	NOT	NOT	NOT	NOT	NOT					

* Subject to change depending on RCA facilities arrangements at Malton

CONFIDENTIAL

ITEM	AIRCRAFT							
	25216 and 25217	25218 and 25219	25220 thru 25225	25226 and 25227	25228 thru 25233			
INSTALL AIRFRAME MOD KITS	A	A	A	A	A			
AIRCREW	A/F	A/F	A/F	A/F	A/F			
AIRFRAME REPAIR & OVERHAUL	A	A	A	A	A			
MALTON DATA REDUCTION SERVICE	-	-	-	-	-			
COLD LAKE DATA REDUCTION SERVICE	-	-	-	-	-			
SUPPLY GCI & GROUND STATION DATA LINK	-	-	-	-	-			
OPERATE GCI & GROUND STATION DATA LINK	-	-	-	-	-			
	NOT COVERED BY THIS STATEMENT OF WORK	NOT COVERED BY THIS STATEMENT OF WORK	NOT COVERED BY THIS STATEMENT OF WORK	NOT COVERED BY THIS STATEMENT OF WORK	NOT COVERED BY THIS STATEMENT OF WORK			

RESPONSIBILITY CHART - OTHER AIRCRAFTCONFIDENTIALLegend:

A	AVRO	C	CANADAIR	F	RCAF	G	GOVERNMENT
GSE	GROUND SUPPORT EQUIPMENT	O	ORENDA	R	RCA	W	DEMONSTRATION
		a	AFTER	b	BEFORE		

ITEM	AIRCRAFT			
	CF-100 Mk. 5	2 SABRE 6's	2 CF-100s	2 F-101Bs
BEFORE/AFTER ACCEPTANCE	-	-	-	-
PRIMARY USER	A	A	R	R
SECONDARY USER	C/O	O	-	-
MAINTAIN AIRFRAME - MALTON	A	A	A	A
OPERATE TEST PROGRAM - MALTON	A	A	R	R
MAINTAIN AIRFRAME - COLD LAKE	-	-	-	-
OPERATE - COLD LAKE	-	-	-	-
FUEL - MALTON	A	A	A	A
FUEL - COLD LAKE	-	-	-	-
MOD AIRFRAME FOR TEST	A	A	R	R
INSTRUMENTATION INSTALLATION DESIGN & INSTALLATION	-	-	-	R
INSTRUMENT OR INST/WEAPON PACK SUPPLY	-	-	-	-
INSTRUMENTATION SPECIFICATION	-	-	-	R
ASSIST INSTRUMENTATION MOD & MAINTAIN	-	-	-	-
AIRFRAME INSTRUMENTATION SUPPLY MOD & MAINTAIN	-	-	-	-
RECORDING INSTRUMENTATION SUPPLY MOD & MAINTAIN	-	-	-	R

CONFIDENTIAL

ITEM	AIRCRAFT			
	CF-100 Mk.5	2 SABRE 6's	2 CF- 100s	2 F-101Bs
HANGAR (MALTON)	A	A	A	A
SUPPLY AIRFRAME GSE - MALTON	A	G/A	A	G/R
SUPPLY AIRFRAME GSE - COLD LAKE	-	-	-	-
SUPPLY ELECTRONICS GSE - MALTON	A	A	A/R	G/R
SUPPLY ELECTRONICS GSE - COLD LAKE	-	-	-	-
SUPPLY MISSILE GSE - MALTON	-	-	-	C/A
SUPPLY MISSILE GSE - COLD LAKE	-	-	-	-
SUPPLY ENGINE GSE - MALTON	A	A	A	G/R
SUPPLY ENGINE GSE - COLD LAKE	-	-	-	-
CHECK OUT & MAINTAIN MISSILE & MISSILE GSE	-	-	-	C
MAINTAIN ENGINE & ENGINE GSE	A	A	A	A
MAINTAIN ELECTRONICS & ELECTRONICS GSE	A	A	A	R
ASSIST MAINTAIN ELECTRONICS	-	-	-	A
FIRST LINE ASTRA ELECTRONICS MAINTENANCE	-	-	-	R
LAB. TEST EQUIPMENT - MALTON	-	-	-	R
GROUND TELEMETERING - MALTON	-	-	-	-
GROUND TELEMETERING - POINT PETRE	-	-	-	-
GROUND TELEMETERING - COLD LAKE	-	-	-	-

CONFIDENTIAL

ITEM	AIRCRAFT			
	CF-100 Mk. 5	2 SABRE 6's	2 CF- 100s	2 F-101Bs
INSTALL AIRFRAME MOD. KITS	A	A	A	A
AIRCREW	A	A	R	R
AIRFRAME REPAIR & OVERHAUL	G	G	G	G
MALTON DATA REDUCTION SERVICE	-	-	-	A
GOLD LAKE DATA REDUCTION SERVICE	-	-	-	-
SUPPLY GCI & GROUND STATION DATA LINK	-	-	-	F/R
OPERATE GCI & GROUND STATION DATA LINK	-	-	-	F/R

SUPPORT RESPONSIBILITY CHART
OTHER ARROW WEAPON SYSTEM ACTIVITIES

APPENDIX 'D'

CONFIDENTIAL

Statement of Work Item	Description	C-L	RCA	OEL	AVRO
1.2.3) 1.2.4)	Provision of available ASTRA, Iroquois and Sparrow data and model specifications for preparation of ARROW 2 model specifications	X	X	X	
1.2.5	Provision of available data and model specifications for ARROW 2 ground support equipment model specification co-ordination	X	X	X	
1.4) 1.5)	Assistance with evaluation of sub-system model specs and changes thereto	X	X	X	
5.4	Collaboration in providing GSE and technical briefings for ARROW 2 GSE evaluation	X	X	X	
7.4	Collaboration in ASTRA/ARROW studies (Appendix 12 of Statement of Work)		X		X
7.11) 7.12) 7.13) 7.14)	Collaboration and supply of data for studies of weapon system performance, air base requirements and supporting facilities etc.	X	X	X	
7.15	Provision of available technical progress reports for analysis	X	X	X	
7.17	Provision of available GSM defect data reports	X	X	X	
7.18) 7.19) 7.20)	Conduct studies - Collaboration in and supply of data for studies of weapon system effectiveness, growth potential, and flight/tactical trainer	X	X	X	X
7.21	Supply of available physical progress reports for analysis	X	X	X	
7.23	Study of semi-submerged Sparrow 2 carriage	X			X
8.1.6	Provision of office, storage, lab facilities for RCA at Malton				X
8.1.8	Training of RCA aircrew and ground crew - Provision of crews for training		X		X
8.2.4	Provision of office and storage facilities for Orenda at Malton				X
8.2.5	Training of Orenda aircrew and ground crew - Provision of crews for training			X	X

CONFIDENTIAL

Statement of Work Item	Description	C-L	RCA	OEL	AVRO
8.3.5	Provision of office, laboratory and storage facilities for Canadair at Malton				X
8.3.8	Training of Canadair aircrew and ground crew - Provision of crews for training	X			X
8.5.1	Collaboration and assistance in planning the weapon system demonstration	X	X	X	X
8.5.4	(a) Technical co-ordination of demonstration - Assistance to and liaison with co-ordinating contractor	X	X	X	X
10.2	Design of certain items of ground support equipment for handling other associate contractors' equipment				X
10.10	Co-ordination of GSE of associate contractors - Supply of data to, and liaison with, co-ordinating contractor	X	X	X	X
10.11	Co-ordination of system and GSE trainers of associate contractors - Supply of data to, and liaison with, co-ordinating contractor	X	X	X	X
12.3	Provision of facilities for other associates' crews at Malton - Provision of crews	X	X	X	X
12.4	Provision of personnel for training on ASTRA, Iroquois and Sparrow - Provision of training for AVRO personnel	X	X	X	X
12.5	Master Statement of Work for AWS; review of associates' Statements of Work to ascertain compatibility and co-ordinate changes - Provision of data to, and liaison with, co-ordinating contractor	X	X	X	X
12.6	Master phasing schedule for AWS; review of associates' schedules to determine compatibility; monitor progress - Provision of data to, and liaison with, co-ordinating contractor	X	X	X	X
12.7	Study of support recommendations and co-ordination into unified plan - Provision of assistance and data to co-ordinating contractor	X	X	X	X

CONFIDENTIAL

Statement of Work Item	Description	C-L	RCA	OEL	AVRO
12.8	Master component requirement schedule - Provision of data to, and liaison with, co-ordinating contractor	X	X	X	
12.9	Co-ordination of assesment of reliability statistics - Provision of data to, and liaison with, co-ordinating contractor	X	X	X	X
12.10	Assessment of data control systems of associates - Provision of information to, and lisison with, co-ordinating contractor	X	X	X	X
12.11	Continuous co-ordination and liaison with A/AWS and other associates - Provision of information to, and liaison with, co-ordinating contractor	X	X	X	X



CONFIDENTIAL

ARROW 1

MAINTENANCE INSTRUCTIONS

J.75 ENGINE BUILD-UP

REPORT NO. 71/MAINT 25/5

DECEMBER 1958

Prepared: J. B. Brumfit
J. Brumfit
Maintenance Engineering
Group

Approved: Ron D. Reid
Section Chief, Maintenance
& Reliability

Authorized: J. W. Ames
J. W. Ames
Chief of Equipment
Design

ENGINEERING DIVISION

AVRO AIRCRAFT LIMITED, MALTON, ONTARIO



CONFIDENTIAL

71/MAINT 25/5

TABLE OF CONTENTS

<u>CHAPTER</u>	<u>PARA.</u>	<u>SUBJECT</u>	<u>PAGE</u>
10		ENGINE CAN - LOWER ATTACHMENTS	14
11		CENTRE FITTING - REAR ENGINE MOUNT	14
12		ENGINE AIR BLEED ASSEMBLY - INBOARD	14
13		ENGINE AIR BLEED ASSEMBLY - OUTBOARD	14
14		AIR CONDITIONING SYSTEM	14
15		AIR EJECTOR CONTROL VALVE AND NOZZLE ASSEMBLY	15
16		ENGINE INPUT GEARBOX	15
17		ENGINE BEVEL GEARBOX	16
18		ENGINE STARTER	16
19		ENGINE OIL SYSTEM	18
20		FUEL SYSTEM	18
21		OIL PIPE BREATHER INSTALLATION	18
22		ADAPTOR RING	
23		CONSTANT SPEED DRIVE	18
24		ALTERNATOR	19
25		NOSE FAIRING	19
26		HEAT EXCHANGER DUCT	19
27		INSTALLATION OF PRESSURE RATIO TRANS- DUCER PIPING	19
28		ENGINE ELECTRICAL SERVICES	19
29		ENGINE CONTROLS	20
30		ENGINE SHROUD	20
31		FAIRING - INBOARD	20



CONFIDENTIAL
71/MAINT 25/5

TABLE OF CONTENTS

<u>CHAPTER</u>	<u>PARA.</u>	<u>SUBJECT</u>	<u>PAGE</u>
32		FAIRING - OUTBOARD	20
33		PRATT & WHITNEY REMOVED EQUIPMENT	20
34		LIST OF DRAWINGS DETAILING P5 POWER PLANT BUILD-UP PROCEDURES	22

ILLUSTRATIONS

Figure 1	Power Plant Build-up - LH Side of RH Power Plant	23
Figure 2	Power Plant Build-up - RH Side of RH Power Plant	24
Figure 3	Engine Mobile Work Stand	25
Figure 4	Rear View of Flange G	26
Figure 5	Rear View of Flange F	27
Figure 6	View of Assembled Rod Assembly Part No. 339616	28
Figure 7	View of Assembled Rod Assembly Part No. 339615	29
Figure 8	View of Assembled Rod Assembly Part No. 339614	30
Figure 9	View of Assembled Rod Assembly Part No. 339617	31
Figure 10	Rear View of Flange C	32
Figure 11	View of Left Side Anti-Icing System	33
Figure 12	View of Assembled Actuator	34
Figure 13	View of Junction Box to Anti-Icing Valve Cable	35
Figure 14	View of Junction Box to Anti-Icing Valve Cable	36
Figure 15	Rear View of Flange B	37
Figure 16	Rear View of Flange D	38
Figure 17	Rear View of Flange E	39
Figure 18	View of PWA 10143 Drift	40
Figure 19	View of Assembled Front Accessory Section	41
Figure 20	View of Assembled Lug Weldment	42
Figure 21	Side View of Assembled Lug Weldment	43



CONFIDENTIAL

7/MAINT 25/5

1. INTRODUCTION

- 1.1 This report defines the work and materials required to build up a Pratt & Whitney Model J75-P-5 Engine to an Arrow 1 Power Plant.
- 1.2 When changing from power plant to engine status for shipment to overhaul or for storage facility, the equipment removal will be the reverse of that given for installation, unless otherwise stated.
- 1.3 It is imperative that when a power plant is reduced to engine status, all the Pratt & Whitney equipment that was removed to fit Arrow power plant equipment is replaced, unless otherwise stated.
- 1.4 This instruction does not cover the special instrumentation requirements for monitoring power plant performance, etc.

2. GROUND EQUIPMENT

- 2.1 Crane (10,000 lb. lifting capacity).
- 2.2 Chain or cable sling to remove the top halves of the engine and afterburner container.
- 2.3 Engine Sling (Avro Ref. No. 140)
- 2.4 J75 Engine Service Stand (Avro Ref. No. 137)
- 2.5 Afterburner Adaptor's (Avro Ref. No. 141B)
- 2.6 Afterburner Front Duct Lifting Brackets (PWA Tool No. 10229)
- 2.7 Afterburner Sling (Avro Ref. No. 141A)
- 2.8 Torque Wrench (0-200 inch lbs.)
- 2.9 Torque Wrench (0-2400 inch lbs.)
- 2.10 Drift (PWA Tool No. 10143)

3. REMOVING AN ENGINE FROM A CONTAINER

- 3.1 Remove the air filler valve core to release the air pressure within the container.



CONFIDENTIAL

71/MAINT 25/5

CAUTION

The air pressure must be relieved before dismantling the container. A minimum of ten minutes is required for all the air to be released after the valve core is removed.

3.2 Attach a chain or a cable sling to the stacking pedestals in the top half of the engine container where the marking "LIFT HERE, TOP" appears. Remove the nuts, washers and bolts securing the top and bottom halves of the container together. Carefully raise the top half of the container straight up until it is clear of the engine.

3.3 Attach the lifting eye assembly to the top of the compressor intermediate case:

Part No's	Housing eye - 7-1095-185
	Lifting eye - 7-1095-175
	Bushings (2) - 7-1095-177
	Pin-Special - 7-1095-179
	Washer - AN 960-1016L
	Pin - MS 171595

3.4 Attach the engine sling (7-2700-38) to the front lifting eye and at the 3 and 9 o'clock positions of the rear engine cradle.

3.5 Attach a crane of 10,000 lb. lifting capacity to the engine sling and take up the slack chain.

3.6 Remove the four front engine-to-container mounting bolts and the two rear engine cradle-to-container bolts.

3.7 Lift the engine up out of the container.

3.8 Remove the front shipping mounts.

3.9 Install the front mounting plates, torque the bolts to 450-500 inch lbs. and wirelock with wire (AN 995 C 47).

Part No's	LH Engine inboard mounting plate - 7-1095-947
	LH Engine outboard mounting plate - 7-1095-921
	RH Engine inboard mounting plate - 7-1095-948
	RH Engine outboard mounting plate - 7-1095-922
	LH and RH inboard mounting plate bolts - CSB-1000-D22- (3 off)
	- CSB-1000-D23- (3 off)
	LH and RH outboard mounting plate bolts - CSB-1000-D23- (6 off)



- 3.10 Install the J75 engine service stand front mount adaptor (7-2700-1107) to the front outboard mount.
- 3.11 Lower the engine into the J75 engine service stand and fit the temporary support brackets to the turbine case flange.
- 3.12 Remove the engine sling from the rear engine cradle.
- 3.13 Remove the rear engine cradle.
- 3.14 Fit bolts temporarily to the 10 and 2 o'clock portion of the turbine case flange and attach the engine sling to these bolts.
- 3.15 Take up the slack on the engine sling with the crane, remove the engine-to-mobile stand attachment brackets and lift the engine up with the crane.
- 3.16 Install the rear mounting brackets and torque the bracket attachment bolts to 125-170 inch lbs. Lubricate the bolts with 3 GP-802 (MIL-C-5544) before installation.

Part No's	Bracket assembly	-	7-1095-857	-	2	per engine
	Attachment bolts	-	MS 20035-4	-	4	" "
	Bushings	-	7-1095-709	-	4	" "
	Washers	-	AN960-C1016	-	4	" "
	Nuts	-	AN320-C5	-	4	" "
	Cotter pins	-	AN381-2-12	-	4	" "

- 3.17 Install the spherical bearing and struts. Lubricate the spherical bearing with MIL-L-7866 and oil base and lubricate the attachment bolts with 3GP802 (MIL-C-5544) before installation. Torque the bolt to 2300-2500 inch lbs.

Part No's	Strut, inboard	7-1095-17
	Strut, outboard	7-1095-23
	Bearing, spherical	7-1095-21 - 2 per engine
	Sleeve	7-1095-37 - 2 " "
	Bolt, special	CSB-1000S-3 2 " "
	Nut, castellated	AN-310c12 - 2 " "
	Washer	NAS 143 12C 2 " "
	Cotter pins	AN 381-4-24 2 " "

- 3.18 Installation details for procedures called up in para's 3.16 and 3.17 are shown on drawing 7-1095-1371/2.
- 3.19 Lower the engine into the service stand and secure the attachments.



REMOVING AN AFTERBURNER FROM A CONTAINER

- 4.1 Remove the air filler valve core to release the air pressure within the container.

CAUTION

The air pressure must be relieved before disassembling the container. A minimum of ten minutes is required for the air to be released after the valve core is removed.

- 4.2 Attach a chain or cable sling to the stacking pedestals in the top half of the afterburner container where the marking "LIFT HERE, TOP" appears. Remove the nuts, washers and bolts securing the top and bottom halves of the container together. Carefully raise the top half of the container straight up until it is clear of the afterburner.

- 4.3 Attach the afterburner adaptors (7-2700-25) to the 3 and 9 o'clock positions on the duct-to-nozzle flange.

Part No's	Attachment bolts	AN 5-11A-	14 off
	Washers	AN960-516-	14 off
	Nuts	AN315-5-	14 off

- 4.4 Remove the container-to-afterburner bulkhead fastening bolts.

Fit an additional sling to the afterburner bulkhead.

- 4.5 Using two hoists, lift the afterburner assembly together with the bulkhead, clear of the container and lower to the floor level with the bulkhead resting on the floor.

- 4.6 Support the afterburner assembly on a stand, making sure that none of the piping etc., will be damaged.

- 4.7 Remove the bolts securing the front and rear afterburner ducts together and separate these two units.

- 4.8 Bolt the two afterburner front duct lifting brackets (PWA Tool No. 10229) to the rear flange of the duct at the 3 and 9 o'clock positions.



CONFIDENTIAL

71/MAINT 25/5

- 4.9 Attach the afterburner sling (7-2700-24) to the crane and to the spools of the brackets.
- 4.10 Lift the front duct to a horizontal position and remove the front cone section.
- 4.11 Install the front cone section on the engine.
- 4.12 Position the gasket (255912) in the recesses on the front flange of the afterburner front duct.
- 4.13 Position the front flange of the duct to the rear flange of the turbine exhaust case, aligning the off-set holes.
- 4.14 Secure the two flanges together with the 96 bolts (25591) and torque to a value of 125-170 inch lbs.
- 4.15 Reaching inside the rear cone, bolt it to the front cone and torque to a value of 125-170 inch lbs. (MS9035-08 - 24 off).
- 4.16 Remove the two afterburner front duct lifting brackets.
- 4.17 Attach the afterburner sling to the bracket spools on the afterburner duct-to-nozzle flange.
- 4.18 Lift the afterburner rear duct and nozzle assemble.
- 4.19 Position the front flange of the rear duct to the rear flange of the front duct.
- 4.20 Install the four sectioned seal shrouds and bolts. Torque the bolts to a value of 125-170 inch lbs.
- 4.21 Connect the afterburner nozzle air supply lines, torque the nuts to a value of 600-900 inch lbs., and wirelock with wire (AN995 NC 32).
- 4.22 Connect the afterburner fuel supply line to the afterburner fuel manifold, torque the "B" nut to 2200-2400 inch lbs., and wirelock with wire (AN 995 NC 40).

PRATT & WHITNEY SUPPLIED EQUIPMENT AND INSTALLATION INSTRUCTIONS

The following instructions relate to the Pratt & Whitney supplied equipment that is provided to equip the power plants for use in Arrow 1 Aircraft.



CONFIDENTIAL

71/MAINT 25/5

PRATT & WHITNEY SUPPLIED EQUIPMENT AND INSTALLATION INSTRUCTIONS
(Cont.)

5.1 Changes on Flange G (Figure 4)

On Flange G, make the following changes:

- 5.1.1 Install three combustion chamber, fireseal, stabilizing rod brackets (339627) and replace the nine bolts (341799) with nine bolts.
- 5.1.2 Install a combustion chamber, fireseal, stabilizing rod bracket (339628) and replace the three bolts (341799) with three bolts (339624) .

5.2 Changes on Flange F (Figure 5)

On Flange F, make the following changes:

- 5.2.1 Install a combustion chamber lower fireseal reinforcing Bracket (300502). Replace the two bolts (MS-9035-14) with two bolts (MS-9035-16).
- 5.2.2 Install a combustion chamber, lower fireseal, reinforcing bracket (300489). Replace the two bolts (MS-9035-15) with two bolts (MS-9035-17).
- 5.2.3 Install a combustion chamber, lower fireseal, reinforcing bracket (300490). Replace three bolts (MS-9035-14) with three bolts (MS9035-18).
- 5.2.4 Install a combustion chamber, lower fireseal, reinforcing bracket (300489). Replace the bolt (MS-9035-15) with bolts (MS-9035-16) and (MS-9035-17) respectively.

NOTE

It may be necessary to lower the fireseal to fit the brackets in.

5.3 Installation of the Combustion Chamber, Fireseal, Stabilizing Rod Assembly (Part No. 339616 -Figure 6)

- 5.3.1 Attach two combustion chamber, fireseal, reinforcing plates to the combustion chamber lower fireseal reinforcing bracket (300502) - installed in Para. 2.1, with a bolt (300500) and a nut (109189, 270404 or 237717).



CONFIDENTIAL

71/MAINT 25/5

- 5.3.2 Secure one end of the rod assembly to the two plates with a bolt (339625) and locknut (237717 or 270404).
- 5.3.3 Secure the other end of the rod assembly to the combustion chamber fireseal, stabilizing rod bracket (339627 - installed on flange G in Para. 1.1), with a bolt (300500) and a nut (237717, 109189 or 270404).

5.4 Installation of the Combustion Chamber, Fireseal, Stabilizing Rod Assembly (Part. No. 339615 - Figure 7).

- 5.4.1 Attach two combustion chamber, lower fireseal, reinforcing plates (300475) to the combustion chamber, lower fireseal, reinforcing bracket (300489 - installed in Para. 2.1.), with a bolt (300500) and a nut (237717, 109189 or 270404).
- 5.4.2 Secure one end of the rod assembly to the two plates with a bolt (339625) and a locknut (303506).
- 5.4.3 Secure the other end of the rod assembly to the combustion chamber, fireseal, stabilizing rod bracket (339627 - installed on Flange G in para. 1.1) with a bolt (339625) and a locknut (303506).

5.5 Installation of the Combustion Chamber, Fireseal, Stabilizing Rod Assembly (Part No. 339614 - Figure 8)

- 5.5.1 Attach the two combustion chamber, lower fireseal, reinforcing plates (300495) to the combustion chamber, lower fireseal, reinforcing bracket (300490 - installed in Para. 2.3), with a bolt (300500) and a nut (237717, 109189 or 270404).
- 5.5.2 Secure one end of the rod assembly to the two plates with a bolt (339626) and a locknut (303506).
- 5.5.3 Secure the other end of the rod assembly to the combustion chamber, fireseal, stabilizing rod bracket (339628 - installed on Flange G in Para. 1.2), with a bolt (339626) and a locknut (303506).

5.6 Installation of the Combustion Chamber, Fireseal, Stabilizing Rod Assembly (Part No. 339617 - Figure 9)

- 5.6.1 Attach two combustion chamber, lower fireseal, reinforcing plates (300491) to the combustion chamber lower fireseal reinforcing bracket (300489 - installed in Para. 2.1), with a bolt (300500) and a nut (237717, 109189 or 270404).



- 5.6.2 Secure one end of the rod assembly to the two plates with a bolt (339625) and a locknut (303506).
- 5.6.3 Secure the other end of the rod assembly to the combustion chamber, fireseal, stabilizing rod bracket (339627 - installed on Flange G in Para. 1.1), with a bolt (339625) and a locknut (303506).

5.7 Relocation of the Junction Box (Part No. 288239- Figure 10)

- 5.7.1 On Flange C, relocate the junction box (RH) complete, in accordance with Figure 10. Utilize the existing bolts, washers and locknuts.
- 5.7.2 When the anti-icing system is to be located on the RH side of the engine, use a junction box-to-anti-icing valve (RH) cable (337182). No clipping arrangement is necessary.
- 5.7.3 When the anti-icing system is to be located on the LH side of the engine, use a junction box-to-anti-icing valve (LH) cable (334977). The installation of this cable and its clipping arrangement is further described in Chapter 10 of these instructions.

5.8 Incorporation of LH Anti-icing System

(To be used only when the engine is installed in the LH side of the airframe).

Remove the RH anti-icing tube assemblies as follows:

- 5.8.1 Remove the junction box-to-anti-icing valve cable (328075).
- 5.8.2 Remove the anti-icing, air tubes front elbow (331061) and the three bolts (215377) and three washers (176823) which secure it.
- 5.8.3 Remove the anti-icing, front tube assembly (331060), the four bolts (310950), the gasket (318458) the four washers (176823) and the four locknuts (303506).
- 5.8.4 Remove the anti-icing, shut-off valve, actuator (346733), the four bolts (215377), the two gaskets (318458), the spacer (275612) and the four Washers (176823).



- 5.8.5 On Flange D, at approximately the 3 o'clock position, remove the tube clip assembly (310631), the screw and a locknut (157042 or 233347). This clip assembly supports the anti-icing rear tube assembly. Also remove the two anti-icing, air tube clips (333140), the packing (332640), the two screws (92938), and the two locknuts (157042 or 233347) and the anti-icing, rear tube bracket (332641).
- 5.8.6 Remove the anti-icing, rear tube assembly (332637), the anti-icing, air tubes elbow weldment (310423) and the three bolts (221410) and gasket (224856).

NOTE

When complying with the above instructions, exercise care in retaining the removed parts since they will be re-used in the instructions that follow.

- 5.8.7 Cover the two openings to the engine with the corresponding plates on the other side of the engine, which must be removed to permit installation of the LH anti-icing system.
- 5.8.8 Install the LH anti-icing system on the engine, utilizing the parts removed from the RH side.
- 5.8.9 Rework the de-icing valve pipe flange as detailed in drawing 7-1095-1407.
- 5.8.10 Lubricate the bolts securing the anti-icing, air tube elbow weldment to the compressor casing with 3GP-802 (MIL-C-5544) before installation.
- 5.8.11 Lockwire the mounting bolts with wire (AN 995C20).
- 5.8.12 Rework the RH de-icing valve pipe flange as detailed in drawing 7-1095-1407.

5.9 Replacement of the Junction Box-to-Anti-Icing Valve Cable

(For use only when the anti-icing system is relocated from the RH to the LH side of the engine).

- 5.9.1 The junction box-to-anti-icing valve cable (328075) has already been removed from the engine in accordance with the instructions in Para. 5.8.



- 5.9.2 Connect one end of the new cable (334977) to the junction box (288239, relocated as detailed in Para. 5.7).
- 5.9.3 Connect the other end of the cable to the anti-icing, shut-off valve, actuator.
- 5.9.4 Clip the cable to the engine as shown in Figures 13 and 14.

5.10 Installation of the Annular, Fireseal, Mounting Bracket on Flange B (Figure 15)

- 5.10.1 Install the annular, fireseal, mounting bracket assembly (332793). Replace the two bolts (317232) with two bolts (317233).
- 5.10.2 Install six annular, fire seal, mounting bracket assemblies (285380). Replace the twelve bolts (317232) with twelve bolts (317233).
- 5.10.3 Install a RH annular, fireseal, mounting bracket assembly (351950). Replace the two bolts (317232) with two bolts (317233).
- 5.10.4 Install a LH annular, fireseal mounting bracket assembly (332795). Replace the two bolts (317232) with two bolts (317233).
- 5.10.5 Install five annular, fireseal, mounting bracket assemblies (285382). Replace the ten bolts (317232) with ten bolts (317233).

5.11 Installation of the Annular, Fireseal, Mounting Brackets on Flange D. (Figure 16)

On Flange D, install eight annular, fireseal, mounting brackets (285378). Replace the sixteen bolts (306416) with sixteen bolts (223854).

5.12 Installation of the Annular, Fireseal, Mounting Brackets on Flange E (Figure 17)

- 5.12.1 Install two airbleed, manifold, front support brackets (332797). Utilize the bolts already in position.
- 5.12.2 Install four annular, fireseal, mounting brackets (285378). Utilize the bolts already in position.



5.13 Incorporation of the Ground Handling Lug Weldment (Figure 20)

This lug weldment is fitted to the power plant to provide a means of attaching the ground handling equipment for inserting and withdrawing the power plant from the aircraft engine bay.

- 5.13.1 On flange K at the 6 o'clock position, install the ground handling lug weldment (306615). Replace the three bolts (231307) with three bolts (265670).

CAUTION

This lug weldment is designed to take fore and aft loads only and is not suitable for withstanding any vertical loads. However, the weldment will withstand loads applied from 15° maximum below horizontal, as shown in Figure 21.

5.14 Modification of the Front Accessory Section

This modification is supplied by Pratt & Whitney and provides a power take-off to drive a constant speed unit and alternator.

- 5.14.1 Remove the cover plate (237920), 12 locknuts (157147 or 234534), 12 washers (AN 112584) and gasket (216462).
- 5.14.2 Remove the support assembly (278523) 20 bolts (216461) and washers (AN 122583).
- 5.14.3 Withdraw the shaft assembly (216457) from the engine with the support assembly leaving the scavenge pump transfer tube on the engine.

NOTE

A certain amount of oil will spill when carrying out the above operation. Care should be exercised in preventing this oil from entering the engine air inlet.

- 5.14.4 Place the support assembly on a clean surface beside the new support assembly kit.
- 5.14.5 Remove the scavenge pump gear drive (216454) cotter pin (AS 123775) and locknut (AN150436).
- 5.14.6 Remove the scavenge pump assembly (304573), 2 washers (AN122582) and 3 castle nuts (AN121552).

NOTE

Do not disturb the strainer assembly (404570) when removing the scavenge pump from the support assembly.

- 5.14.7 Assemble the scavenge pump and gear drive to the new support assemble (348366)



- 5.14.8 Remove the lockring (216464) from the shaft assembly (216457).
- 5.14.9 Pull the complete shaft assembly from the old support assembly.
- 5.14.10 Install the complete shaft assembly into the new support assembly and install the lockring (216464).
- 5.14.11 From the old assembly remove the jet nozzle (216468) the strainer (216469), 2 washers (AN122582) and 2 screws (AN115856).
- 5.14.12 On the new support assembly, install the jet nozzle (348371) and use the existing screws and washers removed from old assembly. Lockwire the screws. (Strainer (216469) not used).
- 5.14.13 Remove the oil pressure transfer tube (237112) from the old assembly and use the existing seal, if serviceable. Install it on the new transfer tube (348368) from the kit.
- 5.14.14 Install the strainer (348367) from the kit and transfer tube with the seals, into the new support assembly.

NOTE

When the transfer tube assembly installation is completed, blow in air to see that there is no obstruction in the oil passage from the transfer tube to the nozzle.

- 5.14.15 Assemble the scavenge pump and pump drive gear to the new support assembly.
- 5.14.16 Assemble the new support assembly to the engine, making sure that the seal (196448) around the compressor support assembly is in place. Mate the transfer tubes and the shaft assembly splines to the engine.
- 5.14.17 Assemble the plug (169410) and seal (AN123971) from the kit to the hole in the new support assembly.
- 5.14.18 With an arbor, press assemble the seal (271598) with a Pratt & Whitney drift (10143 - See Figure 18). Obtain the seal and housing from the kit.
- 5.14.19 Assemble the rubber seal (AN123996) to the housing and attach the housing assembly to the new support assembly with 6 washers (AN122582) and 6 screws (AN115856) which are obtained from the kit.



- 5.14.20 Lockwire the screws in pairs. Also lockwire the plug (169410) to the nearest housing assembly attachment screw.
- 5.14.21 Assemble a gasket (216462) and a cover (237920) to the support assembly with 12 washers (AN 122584) and 12 nuts (157147 or 234534).

INSTALLATION OF BRACKET - LH ENGINE

- 6.1 Remove the accessory drive cover plate (AN 100-41).
- 6.2 Do not disturb the gasket (AN4047-1) unless damaged on removal of the cover plate.
- 6.3 Install the cover plate assembly (7-1095-1189).
- 6.4 Torque the mounting nuts to 225-300 inch lbs.
- 6.5 Install the bracket (7-1095-1177) as detailed in drawing 7-1095-1187.

INSTALLATION OF BRACKET - RH ENGINE

- 7.1 Remove the accessory drive cover plate (AN100041).
- 7.2 Do not disturb the gasket (AN 4047-1) unless damaged on removal of the cover plate.
- 7.3 Install the cover plate and bracket assembly as detailed on drawing 7-1095-1687.
- 7.4 Torque the cover plate mounting nuts to 225-300 inch lbs.

INSTALLATION OF BRACKET 7-1095-1205

Install this bracket assembly as detailed in drawings 7-1095-143 (LH Engine) and 7-1095-144 (RH Engine).

ADDITIONS TO POWER PLANT STRUCTURE

Install brackets (7-1095-1421 - 5 off) and serated plates (7-1095-167 - 2 off) as detailed in drawing 7-1095-1407.



CONFIDENTIAL
71/MAINT 25/5

ENGINE CAN - LOWER ATTACHMENTS

Install the lower engine can attachment struts and brackets as detailed in drawing 7-1095-1381.

CENTRE FITTING - REAR ENGINE MOUNT

- 11.1 Install the block (7-1095-1385) as detailed in drawing 7-1095-1383.
- 11.2 Lubricate the bolt threads with MIL-C-5544 before installation.
- 11.3 Torque the bolts to 400-450 inch lbs.

ENGINE AIRBLEED ASSEMBLY - INBOARD

- 12.1 Remove the shipping cover (P11040) from the air bleed valve.
- 12.2 Install the air bleed assembly (7-1095-741 and the baffle assembly (7-1095-747 as detailed on drawing 7-1095-7.

ENGINE AIRBLEED ASSEMBLY - OUTBOARD

- 13.1 Remove the shipping cover (P11040) from the air bleed valve.
- 13.2 Install nozzle assemblies 7-1095-797 (LH Engine) and 7-1095-798 - RH Engine as detailed on drawing 7-1095-5 (LH Engine) and 7-1095-6 (RH Engine).

AIR CONDITIONING SYSTEM

- 14.1 Remove the diffuser case covers (300753 - 2 off) bolts (221410 - 12 off) and gasket (261643 - 2 off) .
- 14.2 Install the manifold and air shut off valve as detailed in drawings 7-2295-3 (LH Engine) and 7-2295-4 (RH Engine).
- 14.3 Lubricate all bolt threads in this area with MIL-C-5544, before installation.
- 14.4 Torque the bolts attaching the manifold flange to the diffuser casing to 125-170 inch lbs.

NOTE

Record the serial number of the air shut-off valve in the appropriate power plant log book.



CONFIDENTIAL

71/MAINT 25/5

AIR EJECTOR CONTROL VALVE AND NOZZLE ASSEMBLY

- 15.1 Install bracket (7-1895-181) and valve 7-1895-41 as detailed in drawing 7-1895-179.
- 15.2 Install tube assembly (7-1895-177) as detailed in drawing 7-1895-179.
- 15.3 Install tube assembly (7-1895-175 as detailed in drawing 7-1895-179).
- 15.4 Lubricate all bolt threads with MIL-C-5544 before installation.

NOTE

Record the serial number of the air ejector control valve in the appropriate power plant log book.

ENGINE INPUT GEARBOX

- 16.1 Remove the shipping covers (AN 100041), washers (AN 122584) and nuts (270406).
- 16.2 Do not disturb the gasket (AN 4047-1) unless damaged on removal of the shipping cover.
- 16.3 Lightly smear the splined drive with grease (3-GP-683A, MIL-G-3278) and install the input gearbox as shown on drawing 7-2995-21 (LH Engine) and 7-2995-22 (RH Engine).
- 16.4 Torque the mounting nuts to 225-300 inch lbs.

NOTE

Before installation of the input gearbox, remove the blanking cap at the oil inlet connection, drain out any fluid in the unit and prime with 1/2 pint of lubricating oil (MIL-L-7808). Recap when the priming operation is completed.

NOTE

Record the serial number of the input gearbox in the appropriate power plant log book.



CONFIDENTIAL

71/MAINT 25/5

ENGINE BEVEL GEARBOX

- 17.1 Lightly smear the splined drive of the bevel gearbox LH (7-2925-5) and RH (7-2925-6) with grease (3-GP-683A, MIL-G-3278).
- 17.2 Install the bevel gearbox as detailed in drawing 7-2995-21 (LH Engine) and 7-2995-22 (RH Engine).
- 17.3 Torque the mounting nuts to 225-300 inch lbs.

NOTE

Before installation of the bevel gearbox, remove the blanking cap at the oil inlet connection, drain out any fluid in the unit and prime with 1/2 pint of lubricating oil (MIL-L-7808).

Recap when the priming operation is completed.

- 17.4 Install the bevel gear box oil lines as detailed in drawings 7-2995-117 (LH Engine) and 7-2995-118 (RH Engine).

NOTE

Record the serial number of the bevel gearbox in the appropriate power plant log book.

ENGINE STARTER

- 18.1 Lightly smear the splined drive of the engine starter (7-2995-6) with grease (3-GP-683A, MIL-G-3278).
- 18.2 Install the engine starter as detailed in drawings 7-2995-21 (LH Engine) 7-2995-22 (RH Engine).
- 18.3 Torque the mounting nuts to 225-300 inch lbs.

NUTS

1. Before installation of the engine starter, drain out the inhibiting fluid and fill up with lubricating oil as detailed in Maintenance Instructions - Report No. 71/Maint 00/3-1, Structural Lubrication.
2. Record the serial number of the starter in the appropriate power plant log book.



CONFIDENTIAL

71/MAINT 25/5

ENGINE OIL SYSTEM

- 19.1 Remove plugs (MS9015-12 and MS9015-08) from the top LH side of the engine oil tank.
- 19.2 Install the engine oil filler pipes and hardware as detailed in drawing 7-1095-1301.
- 19.3 Install the engine oil tank drain pipe and hardware as detailed in drawing 7-2995-1301.
- 19.4 Remove the engine gearbox drain plug (MS9015-06) and install the drain valve (Koehler A/C Products 8051-2-65) as detailed in drawings 7-2995-3 (LH Engine) and 7-2995-4 (RH Engine)

NOTE

There is a possibility that while removing the N2 gearbox drain plug (MS9015-06), the bushing (315793) will turn with it and damage the screen that is attached to the bushing. When removing and replacing the drain plug or the drain valve, the bushing must be held to prevent rotation.

- 19.5 On the LH engine only, remove oil cooler (346841) and replace with a new unit (346852).
- 19.6 Install the engine oil line elbow as detailed in drawings 7-2995-72 (RH Engine).
- 19.7 Install the engine oil line as detailed in drawing 7-2995-97.

FUEL SYSTEM

- 20.1 Remove the FCU fuel inlet shipping cover (P11300) and gasket (P11854).
- 20.2 Install the fuel inlet lines and elbows as detailed in drawings 7-1695-3 (LH Engine) and 7-1695-4 (RH Engine).
- 20.3 Install afterburner fuel drain as detailed in drawings 7-1695-3 (LH Engine) and 7-1695-4 (RH Engine).
- 20.4 Install the waste fuel drain lines as detailed in drawing 7-1695-91.



CONFIDENTIAL

71/MAINT 25/5

OIL PIPE BREATHER INSTALLATION

- 21.1 Remove the shipping cover (P11952) from the oil breather pressure valve.
- 21.2 Install the breather oil pipe (7-1095-1241) as detailed in drawings 7-1095-1245 (LH Engine) and 7-1095-1244 (RH Engine).

ADAPTOR RING

- 22.1 Remove the engine air inlet shipping cover (P11858) from the air intake.
- 22.2 Install the adaptor ring as detailed in drawing 7-1095-1433.
- 22.3 Torque the mounting bolts to 65 - 85 inch lbs.

CONSTANT SPEED DRIVE

- 23.1 Lightly smear the splined shaft of the constant speed drive unit (7-2995-175) with grease (3-GP-683A, MIL-G-3278).
- 23.2 Install the constant speed drive unit in conjunction with the reinforcing can assembly (7-1095-1595) as detailed on drawing 7-2995-155.
- 23.3 Torque the mounting nuts to 225-300 inch lbs.

NOTE

Before installation of the constant speed drive, remove the sump drain plug, drain out any fluid in the unit and prime with 1/2 pint of lubricating oil (MIL-L-7808).

Fit the drain plug when the priming operation is completed.

- 23.4 Install the constant speed drive oil lines as detailed in drawing 7-2995-155.

NOTE

Record the serial number of the constant speed drive unit in the appropriate power plant log book.



CONFIDENTIAL
71/MAINT 25/5

ALTERNATOR

- 24.1 Lightly smear the splined drive of the alternator (7-1125-11) with grease (3-GP-683A, MIL-G-3278).
- 24.2 Install the alternator as detailed in drawing 7-1195-41.
- 24.3 Connect the alternator electrical wiring as detailed on drawing 7-1100-3, Sht. 2.

NOTE

Record the serial number of the alternator in the appropriate power plant log book.

NOSE FAIRING

- 25.1 Lightly smear the "O" ring (38606) on the compressor front bearing support and the "O" ring (196448) on the front accessory drives support with Petrolatum Jelly (VVP236).
- 25.2 Install the back plate assembly (7-1095-443) as detailed on drawing 7-1095-357.
- 25.3 Torque the mounting nuts to 65-85 inch lbs.
- 25.4 Install the RH nose fairing strut as detailed on drawing 7-1095-1701.
- 25.5 Install the LH nose fairing strut as detailed on drawing 7-1095-527.
- 25.6 Install the nose section assembly (7-1095-1545) as detailed on drawing 7-1095-357.

HEAT EXCHANGER DUCT

Install the duct (7-1095-791) as detailed on drawings 7-1095-1371 (LH Engine) and 7-1095-1372 (RH Engine).

INSTALLATION OF PRESSURE RATIO TRANSDUCER PIPING

- 27.1 Install Pt₂ probes and piping as detailed on drawing 7-1895-151 (LH Engine) and 7-1895-152 (RH Engine).
- 27.2 Install the Pt₇ piping as detailed on drawings 7-1895-151 (LH Engine) and 7-1895-152 (RH Engine).

ENGINE ELECTRICAL SERVICES

- 28.1 Install the fire detection wiring and hardware as detailed on drawing 7-1195-43.



CONFIDENTIAL
71/MAINT 25/5

28.2 Install wiring and hardware as detailed on drawing 7-1195-41.

ENGINE CONTROLS

Install the engine control drive coupling as detailed on drawings 7-1495-1 (LH Engine) and 7-1495-2 (RH Engine).

ENGINE SHROUD

Install the engine shroud can assembly as detailed in drawing 7-1095-697, Sht. 1 and 2 and drawing 7-1095-1381.

NOTE

1. Before installing the engine shroud, ensure that pipe unions etc., are tight and secure.
2. Loose elastic fitting nuts in some locations are not considered detrimental on engines received from the manufacturer. No tightening should be done unless leaks are encountered, since further tightening only serves to aggravate the problem of shredding the seals and collapsing the tubes.

FAIRING INBOARD

Install the inboard fairing as detailed on drawings 7-1095-591 (LH Engine) and 7-1095-592 (RH Engine).

FAIRING - OUTBOARD

Install the outboard fairing as detailed on drawings 7-1095-611 (LH Engine) and 7-1095-612 (RH Engine).

PRATT & WHITNEY REMOVED EQUIPMENT

- 33.1 This is a list of equipment that is removed from the J75-P5 engine when building up an Arrow 1 power plant.
- 33.2 On removal from the engine this equipment should be packaged and held in the stores until the engine is required to be sent to an overhaul or storage facility.



CONFIDENTIAL

71/MAINT 25/5

<u>PART NO.</u>	<u>PART NAME</u>	<u>QUANTITY</u>
30753	Diffuser Case Cover	2
221410	Bolts	12
AN100041	Engine Gearbox Shipping Covers	2
AN122584	Engine Gearbox Shipping Covers	12
270406	Locknuts	12
MS9015-12	Oil Tank Plug	1
MS9015-8	Oil Tank Plug	1
MS9015-6	Gearbox Oil Drain Plug	1
346852	Oil Cooler - LH Engine Only	1
P11858	Air Inlet Shipping Cover	1
AN101106	Bolts	10
AN122582	Washers	10
P11040	Air Bleed Cover	2
P11300	FCU Fuel Inlet Shipping Cover	1
8641	Bolts	6
AN122583	Washers	6
P11040	Accessory Drive Cover	1
P11952	Oil Breather Valve Shipping Cover	1
328075	Cable - Junction Box to Anti-Icing Valve	1
P12223	Turbine Exhaust Shipping Cover	1
302819	Bolts	12
AN122583	Washers	12
P10543	Plug - Shipping Closure	2
P7064	Cap " "	2
P6772	Plug " "	2
P6627	Cap " "	1
P6625	Plug " "	1
P10310	Plug Shipping Closure	1
278523	Front Accessory Support Assembly	1
216468	Oil Jet Nozzle	1
216469	Oil Strainer	1
237112	Oil Transfer Tube	12
341799	Bolts	6
MS9035-14	Bolts	3
MS9035-15	Bolts	4
176823	Washers	4
215377	Bolts	26
317232	Bolts	16
306416	Bolts	1
312178	Tube Assembly - Main Oil Pump Cooler	1
	Lower	3
231307	Bolts	



CONFIDENTIAL

71/MAINT 25/2

LIST OF DRAWINGS DETAILING P5 POWER PLANT BUILD-UP PROCEDURES

7-1095-5/6	Engine Airbleed Assembly - Outboard
7-1095-7	Engine Airbleed Assembly - Inboard
7-1095-143/144	Installation of Bracket
7-1095-357	Nose Fairing and back plate Assembly
7-1095-527	Installation of the LH Nose Fairing Strut
7-1095-591/592	Installation of the Fairing - Inboard
7-1095-611/612	Installation of the Fairing - Outboard
7-1095-697 Sht 1 & 2	Installation of the Engine Shroud
7-1095-1187	Installation of Bracket - LH Engine
7-1095-1243/1244	Installation of Engine Oil Breather Piping
7-1095-1301	Installation of Engine Oil Filler Piping
7-1095-1371/1372	Installation of Engine Mounts and Heater Exchanger Duct
7-1095-1381	Engine Can - Lower Attachements
7-1095-1383	Installation of the Centre Fitting - Rear Engine Mount
7-1095-1407	Additions to Power Plant Structure
7-1095-1687	Installation of Bracket - RH Engine
7-1095-1701	Installation of the RH Nose Fairing Strut
7-1100-3 Sht. 2	Alternator Wiring Connections
7-1195-11	Installation of the Alternator
7-1195-41	Wiring Arrangement and Clipping
7-1195-43	Installation of the Fire Detection Wiring
7-1495-1/2	Engine Controls
7-1695-3/4	Installation of the Fuel Inlet Pipes and After- burner Drain
7-1695-91	Installation of waste fuel drains
7-1895-151/152	Installation of the Pressure Ratio Transducer Piping
7-1895-179	Installation of the Ejector Tube Assembly
7-1895-181	Installation of the Ejector Control Valve Bracket
7-2295-3/4	Installation of the Manifold and Shut-off Valve
7-2995-3/4	Installation of the Engine Gearbox Drain Plug
7-2995-21/22	Installation of the Input Gearbox, Bevel Gearbox and Starter
7-2995-71/72	Installation of the Engine Oil Line Elbow
7-2995-97	Installation of the Engine Oil Line
7-2995-117/118	Installation of the Input Gearbox and Bevel Gearbox Oil Lines
7-2995-129	Installation of the Oil Tank Drain Pipe
7-2995-155	Installation of the Constant Speed Unit and Oil Lines

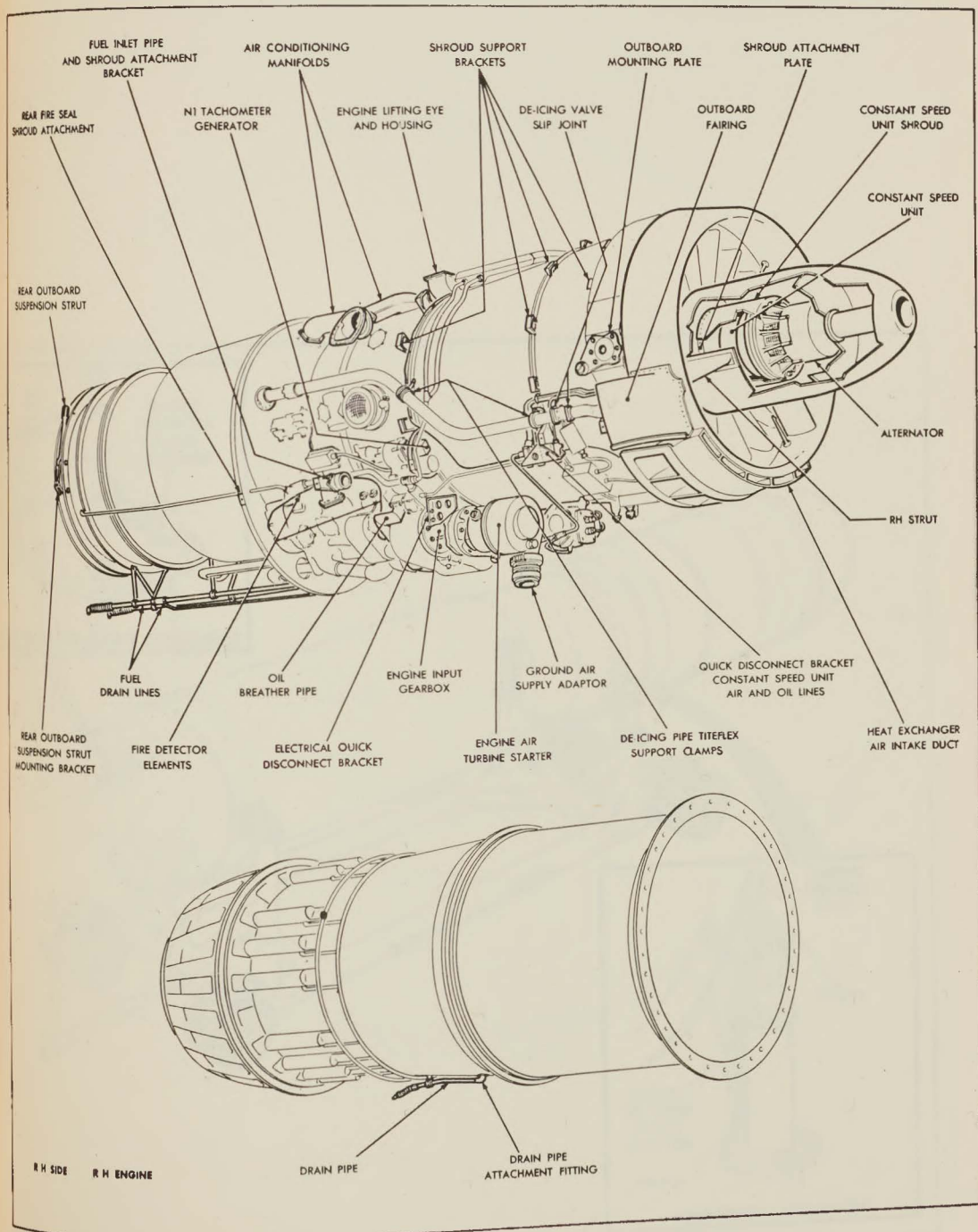


FIG.2 ENGINE BUILD UP - RH SIDE OF RH ENGINE

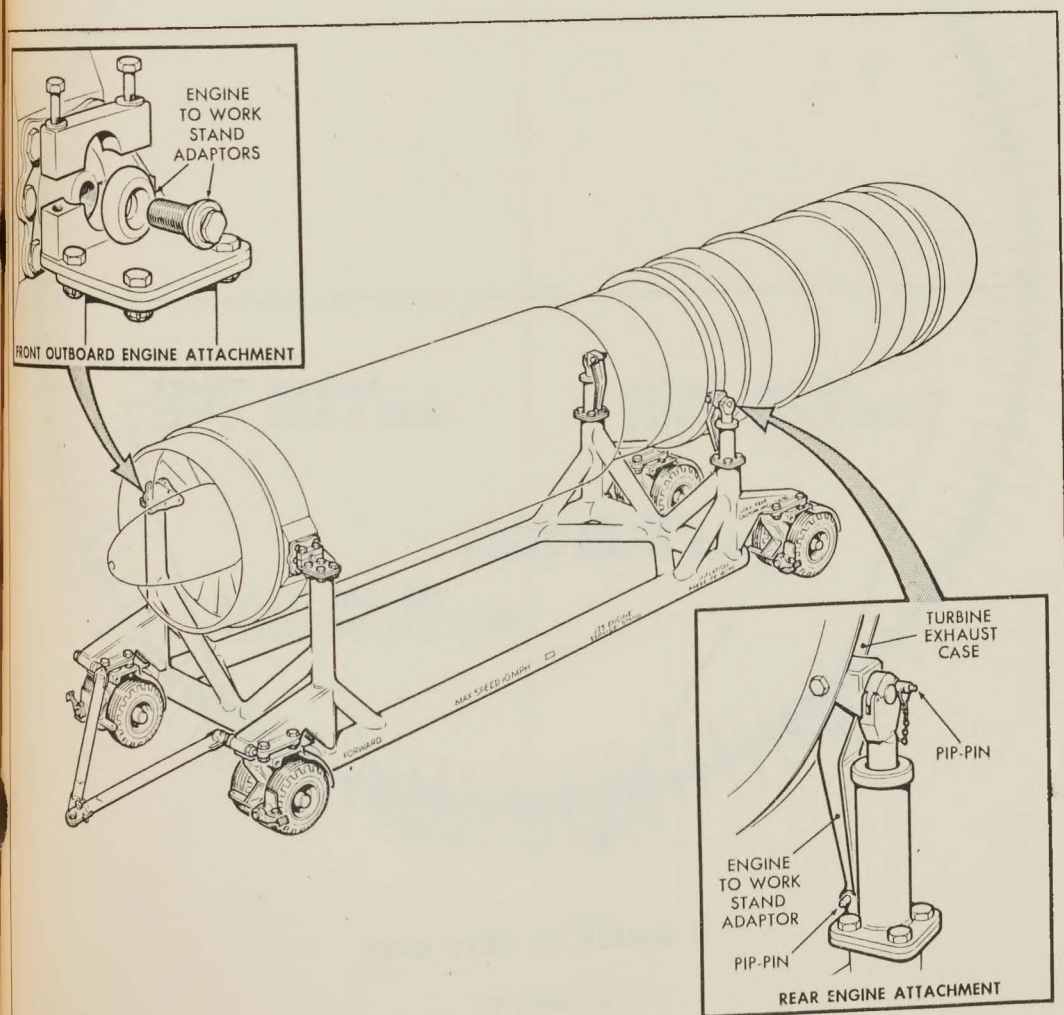
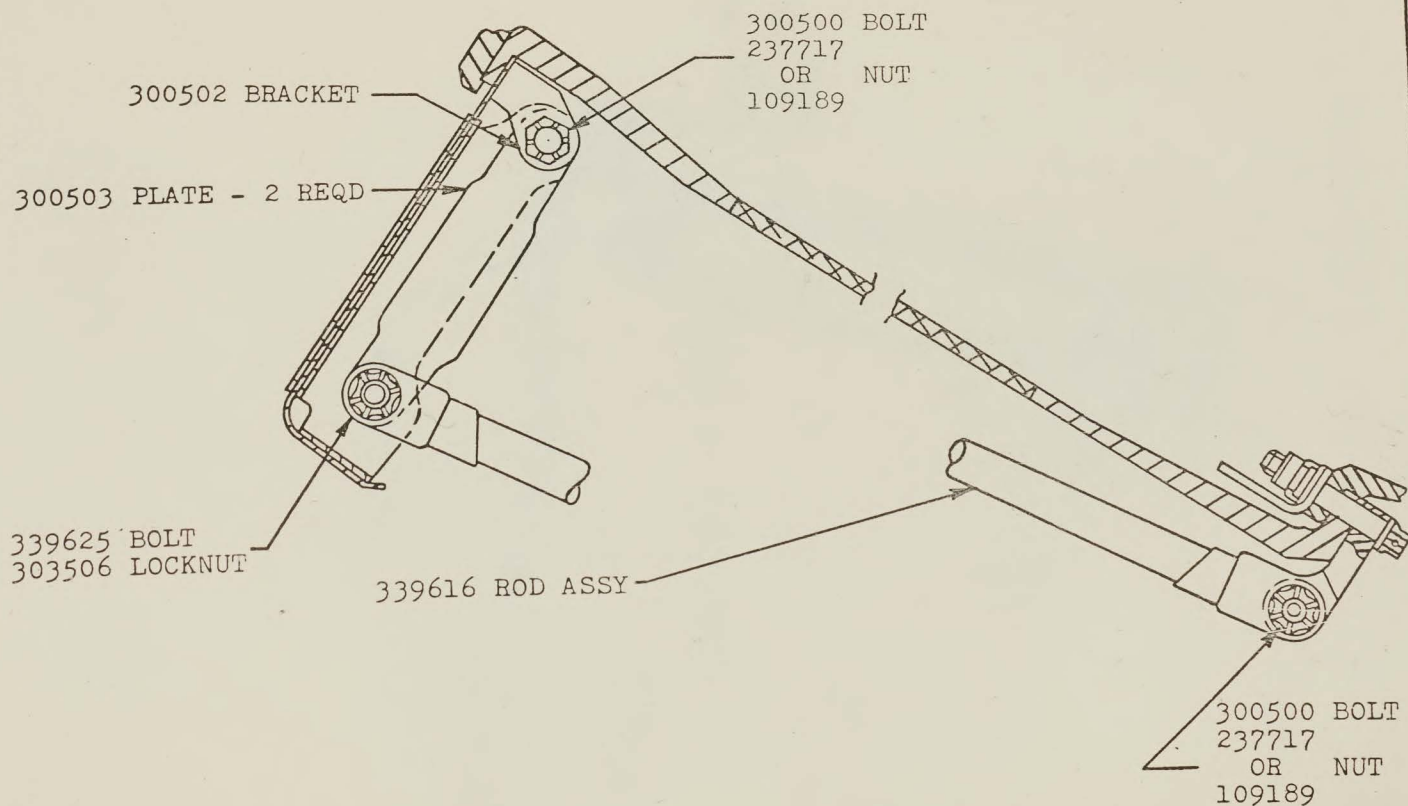
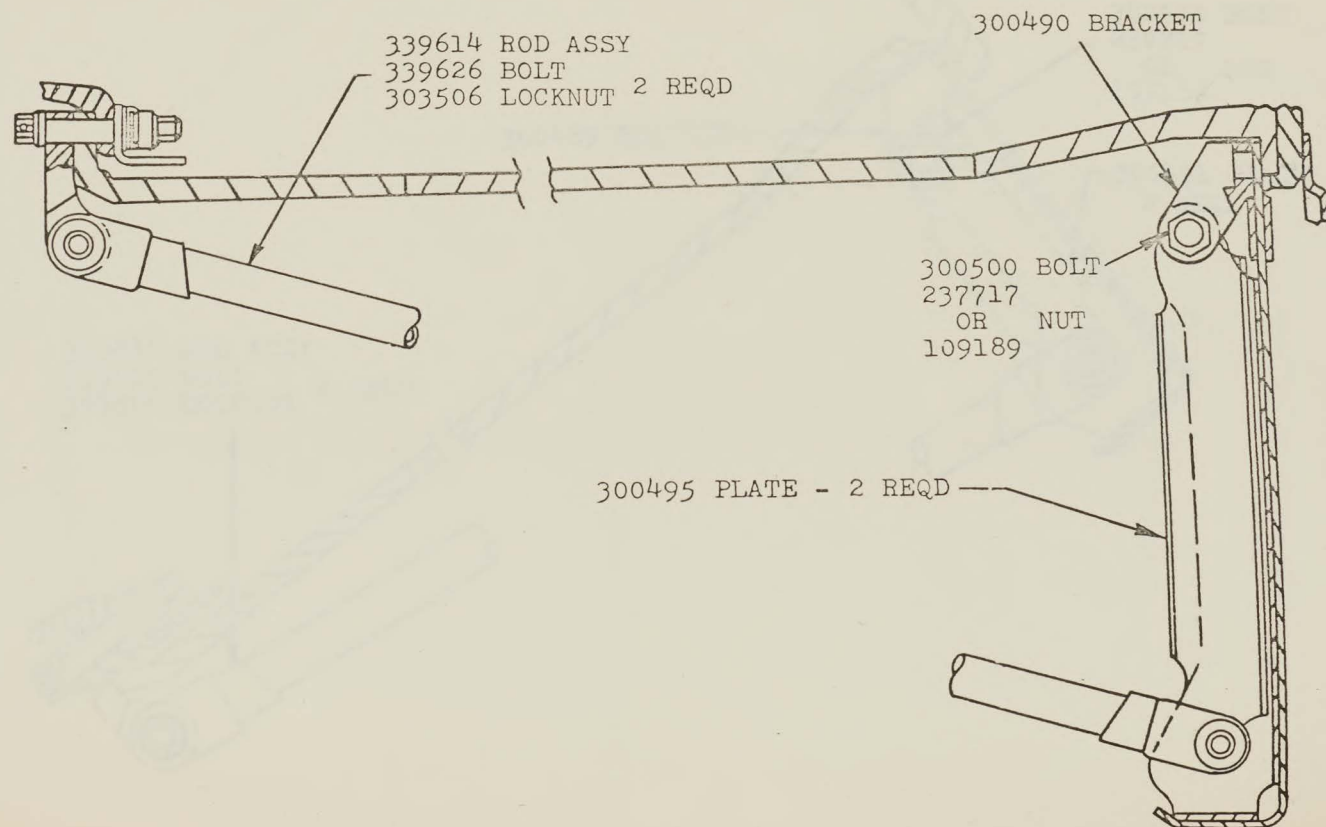


FIG.3 ENGINE MOBILE WORK STAND

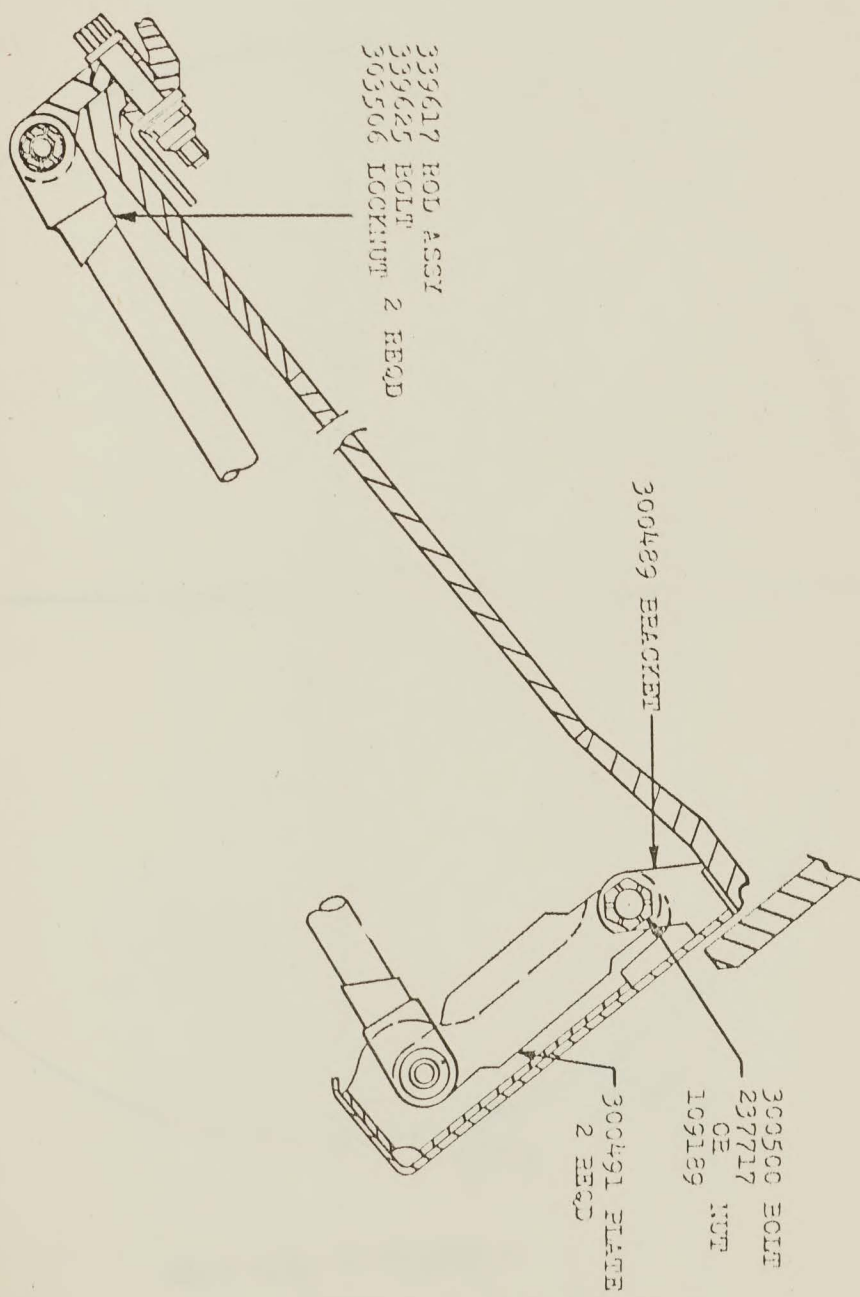


VIEW OF ASSEMBLED ROD ASSEMBLY, PART NO. 339616
FIGURE 6



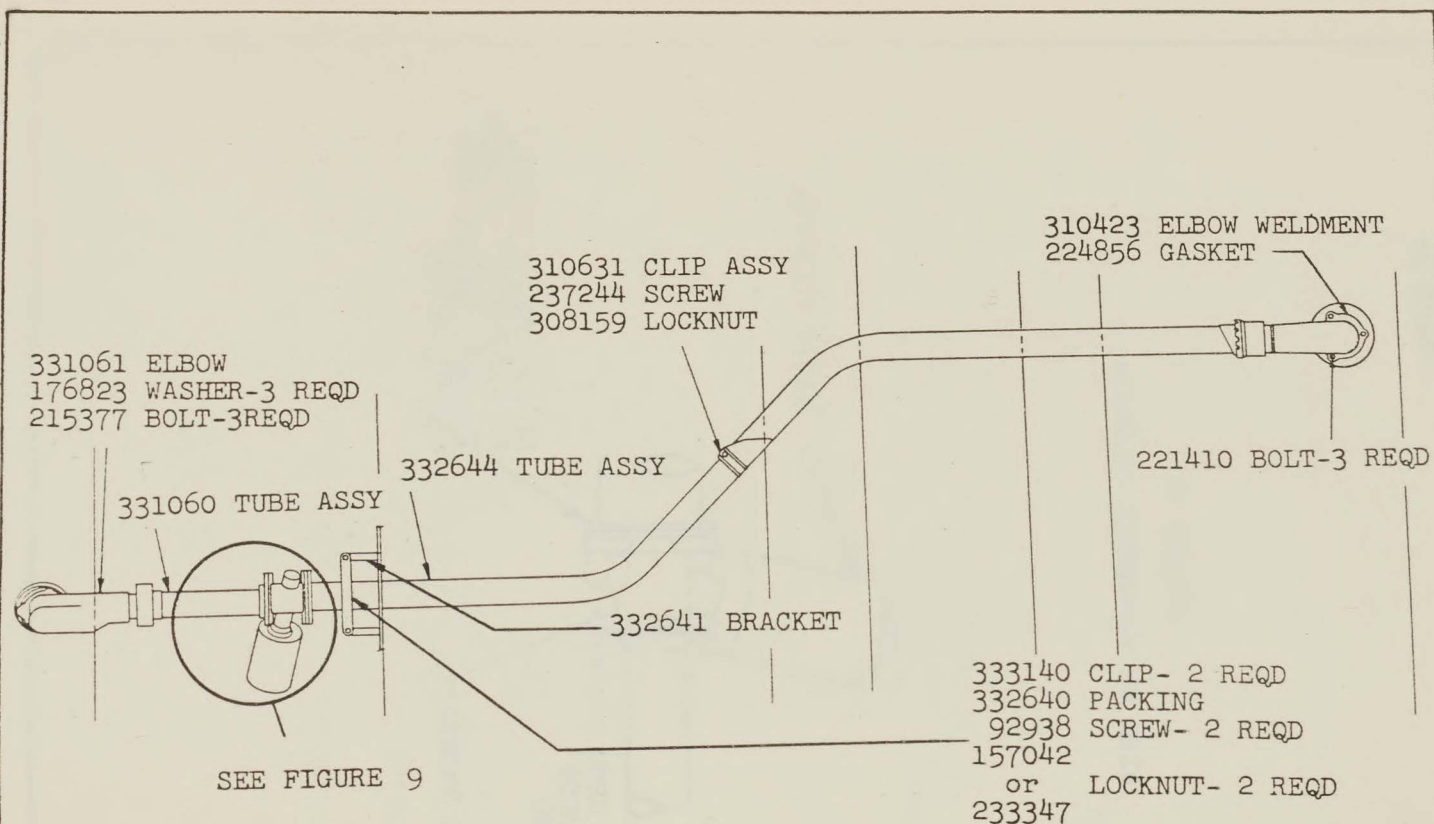
VIEW OF ASSEMBLED ROD ASSEMBLY, PART NO. 339614

FIGURE 8



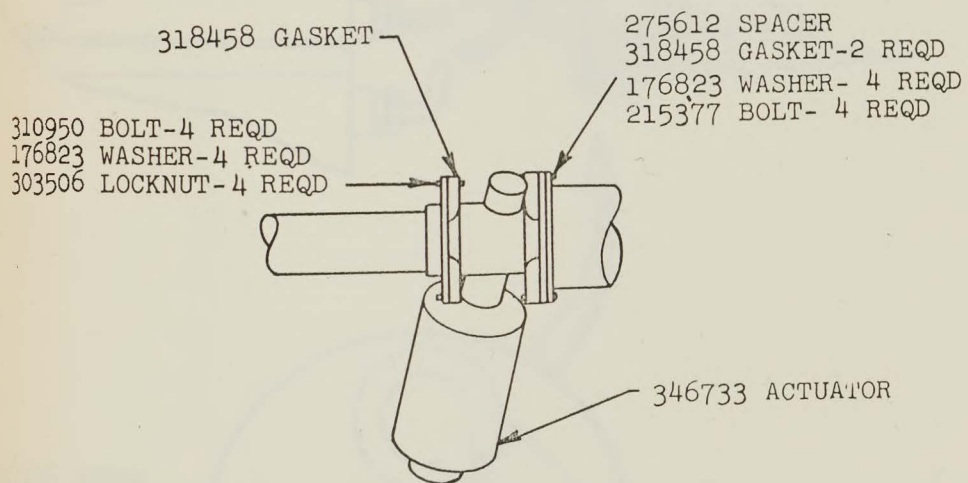
VIEW OF ASSEMBLED ROD ASSEMBLY, PART NO. 339617

FIGURE 9



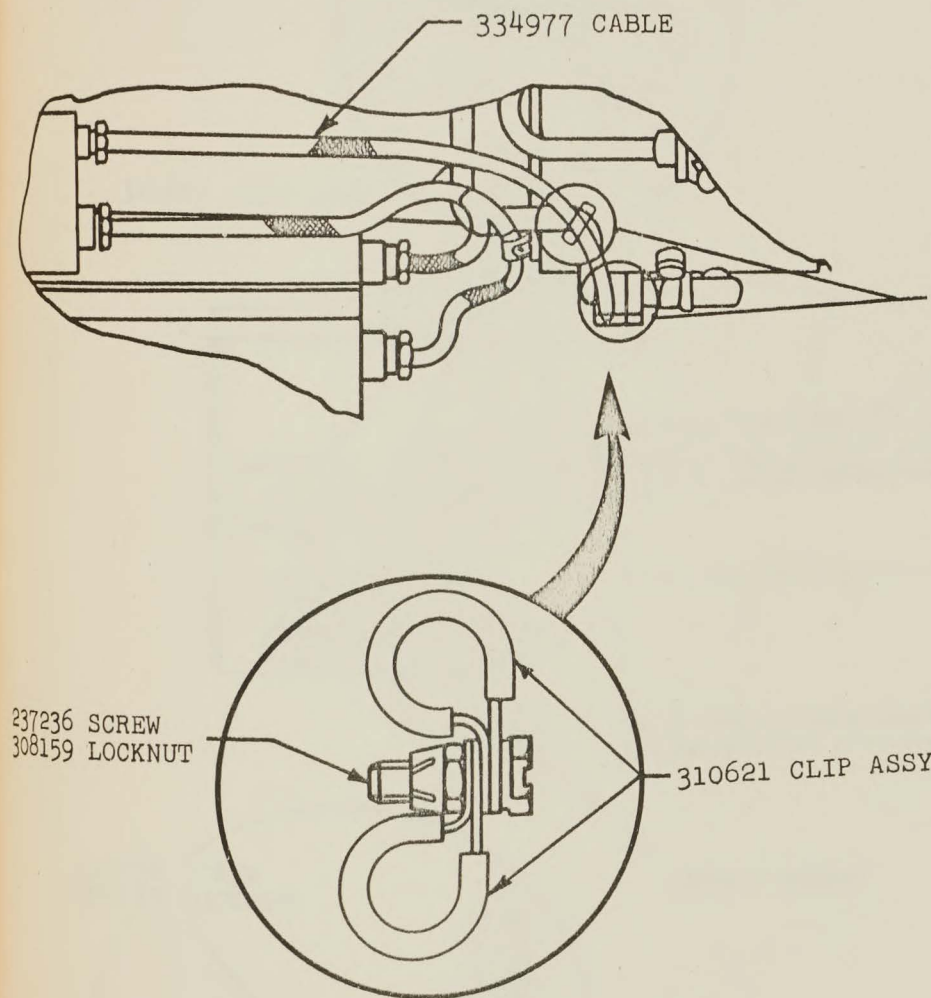
VIEW OF LEFT SIDE ANTI-ICING SYSTEM

FIGURE 11



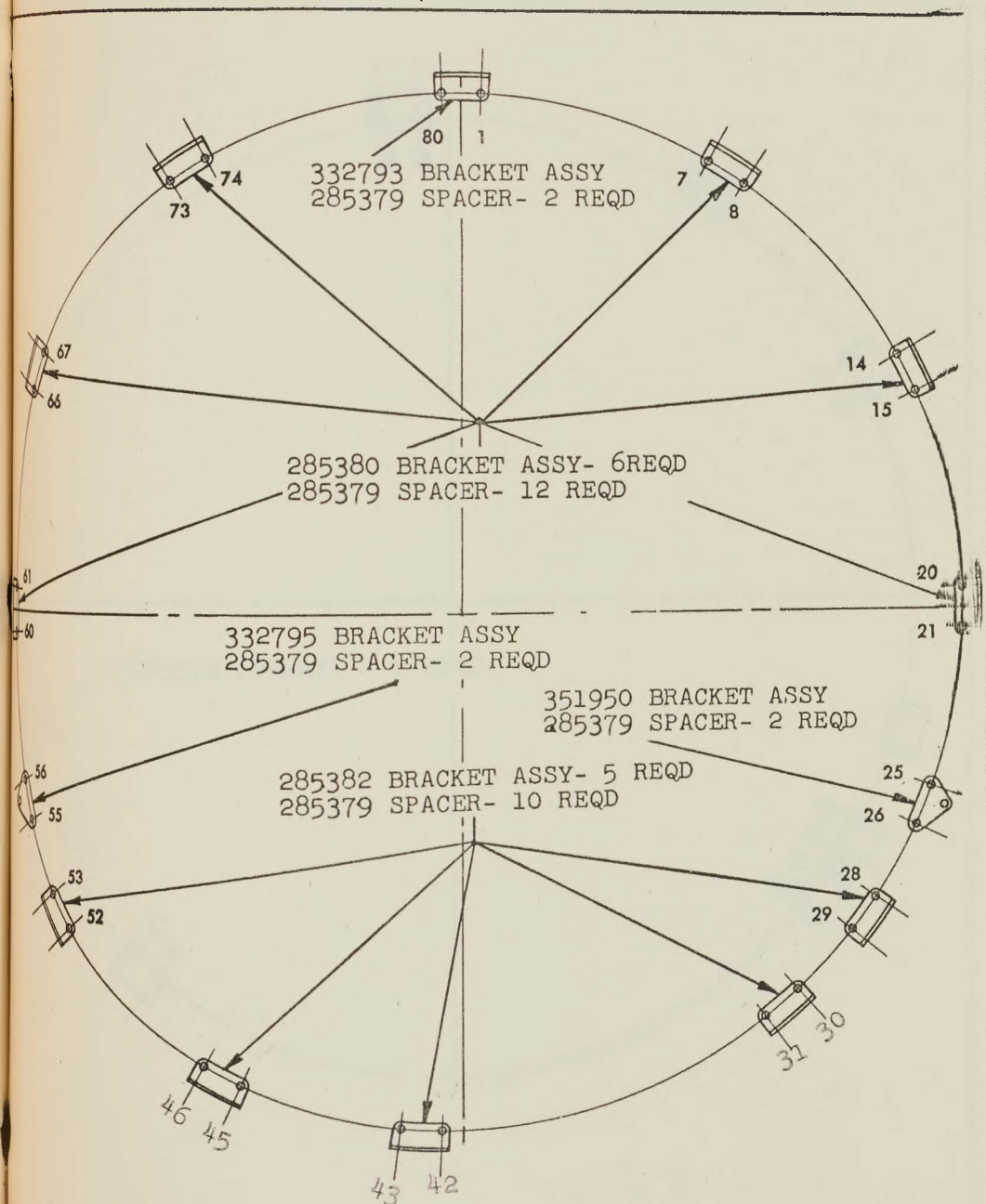
VIEW OF ASSEMBLED ACTUATOR

FIGURE 12

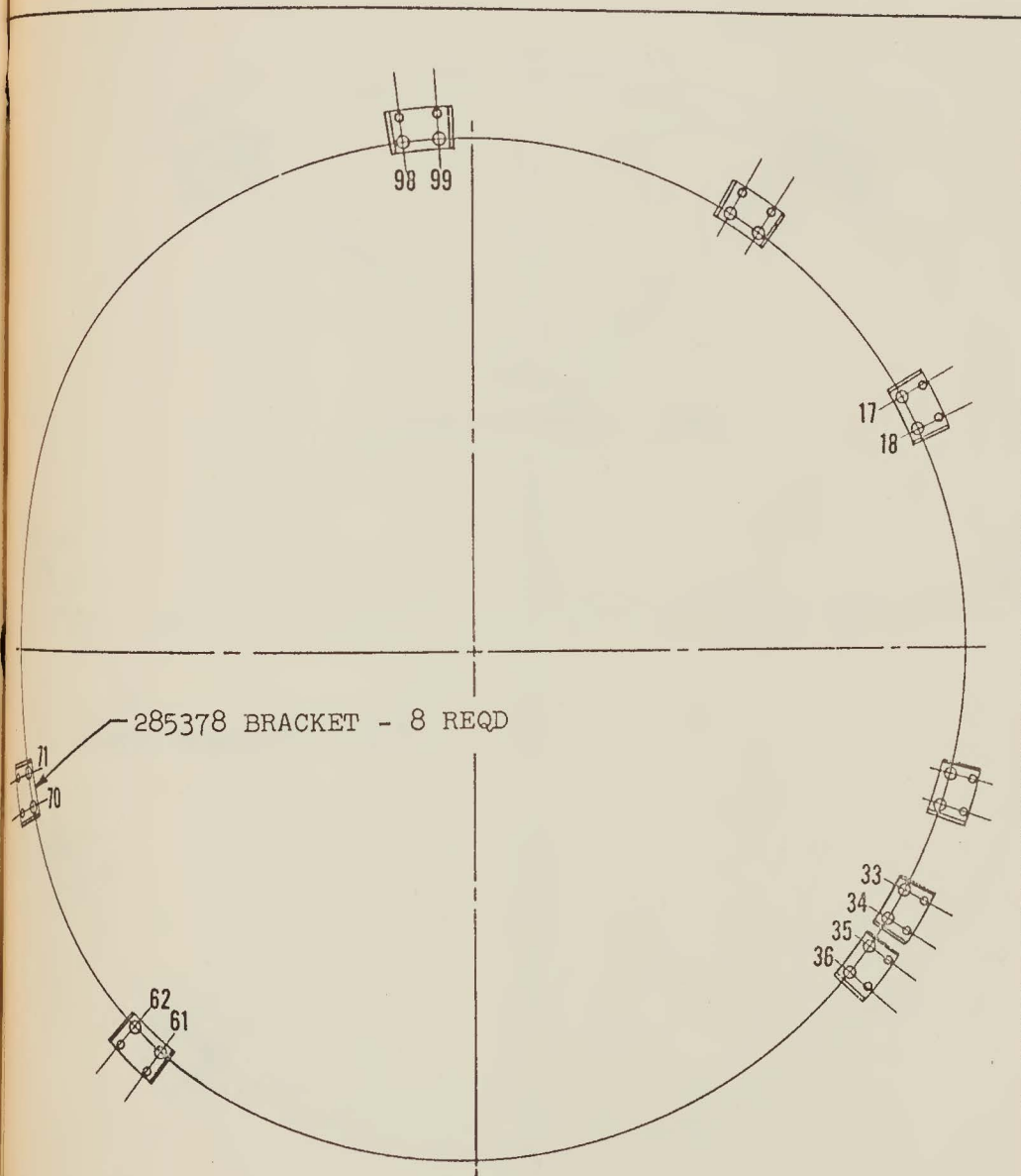


VIEW OF JUNCTION BOX TO ANTI-ICING VALVE CABLE

FIGURE 13

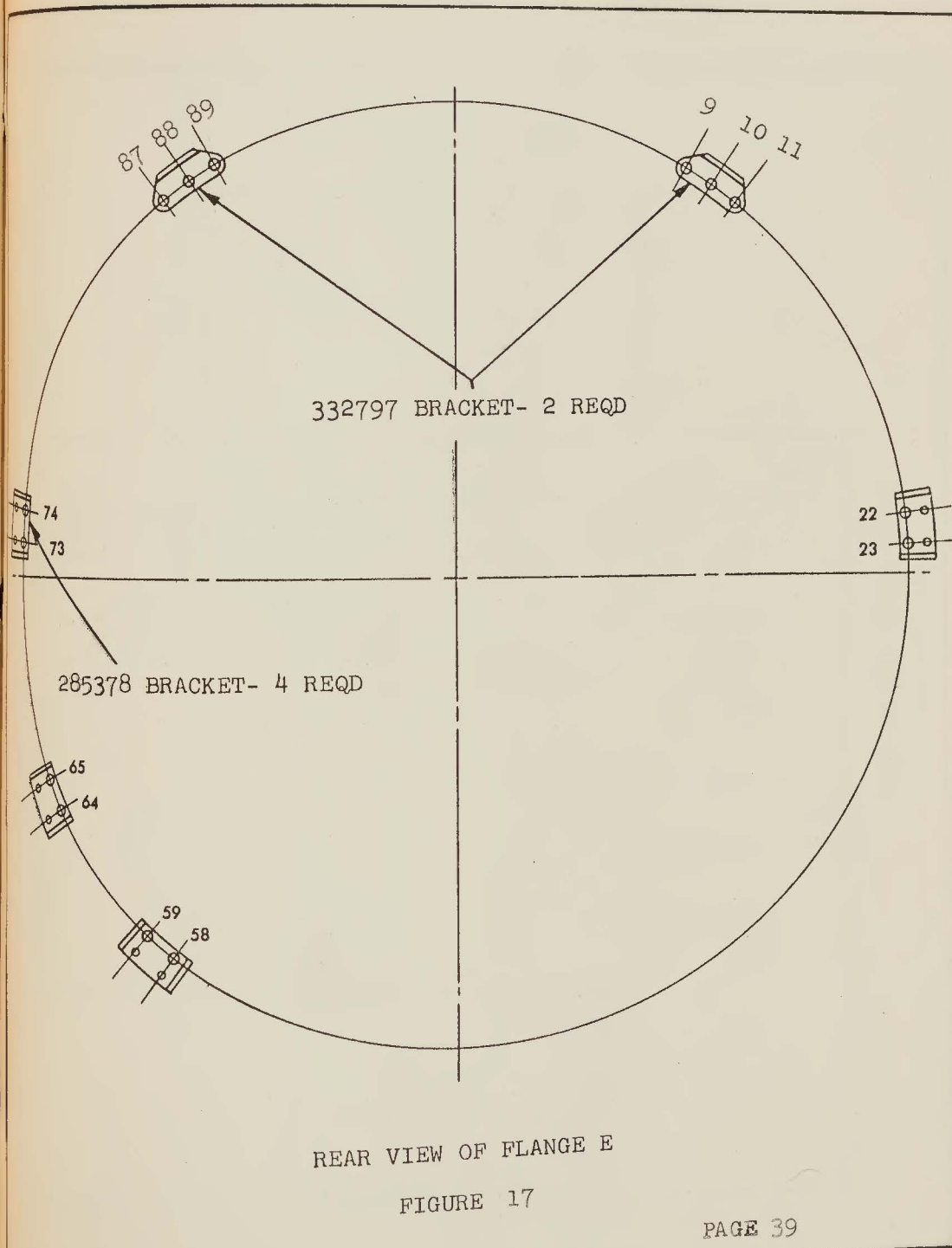


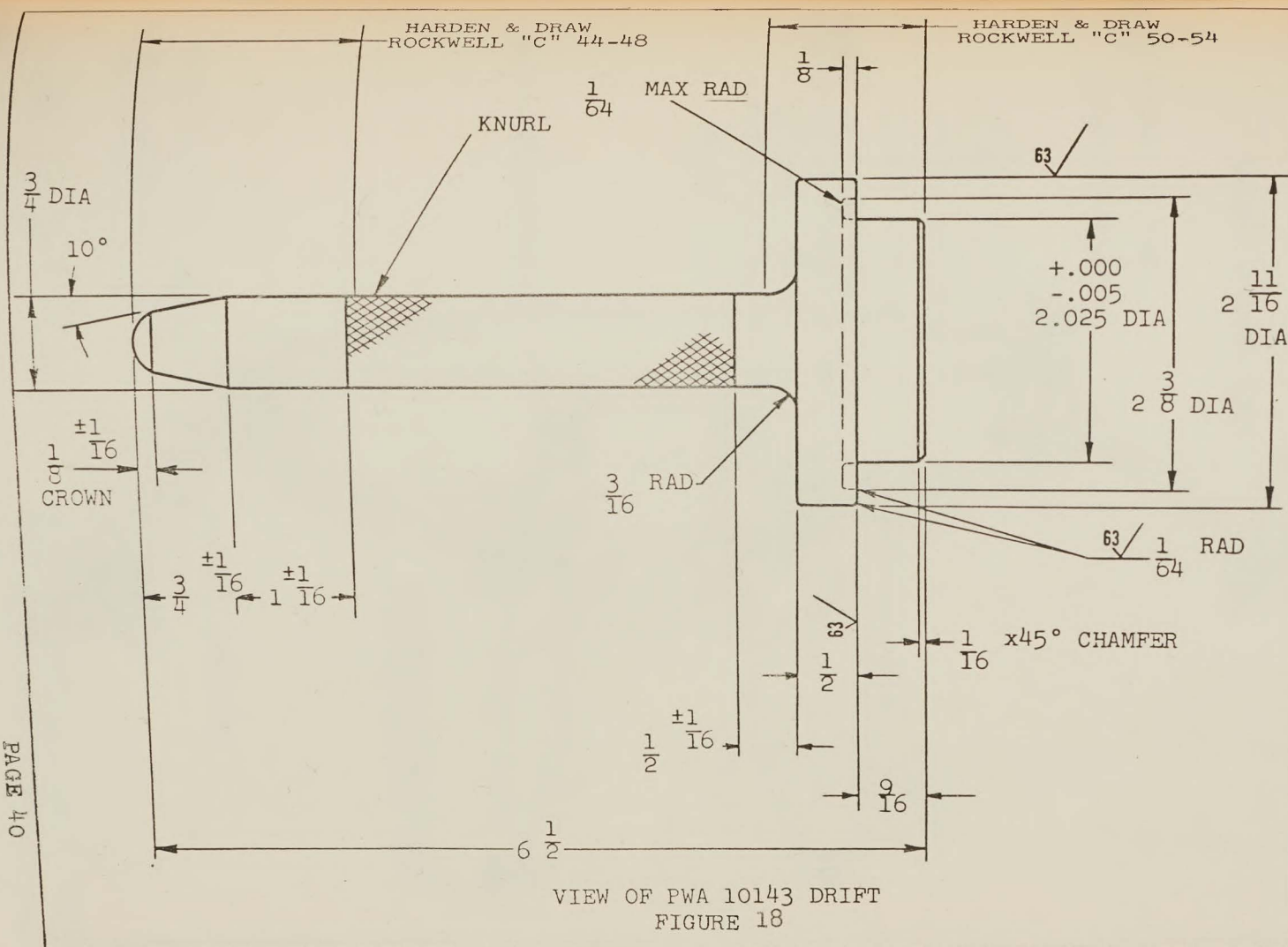
REAR VIEW OF FLANGE B
FIGURE 15

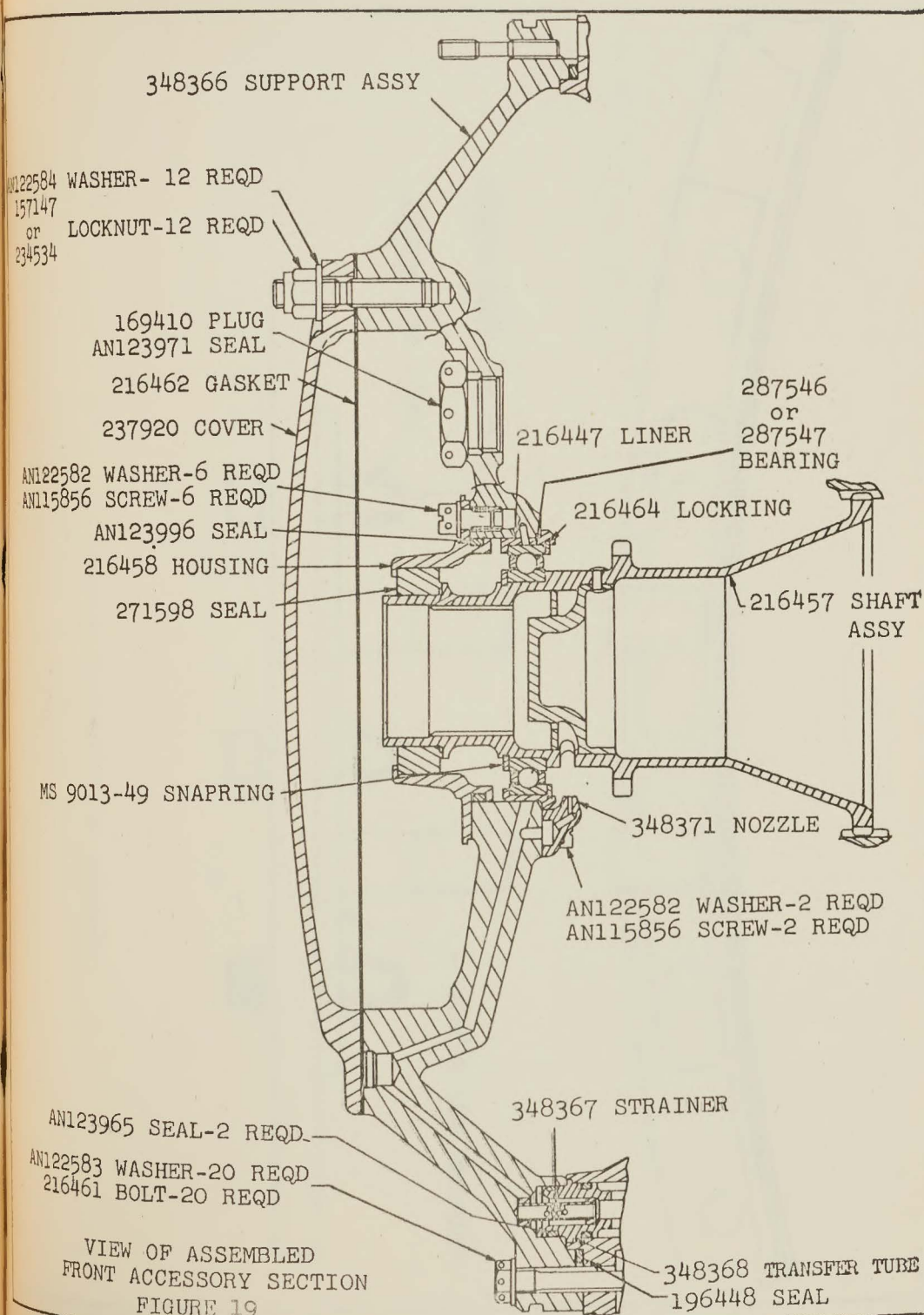


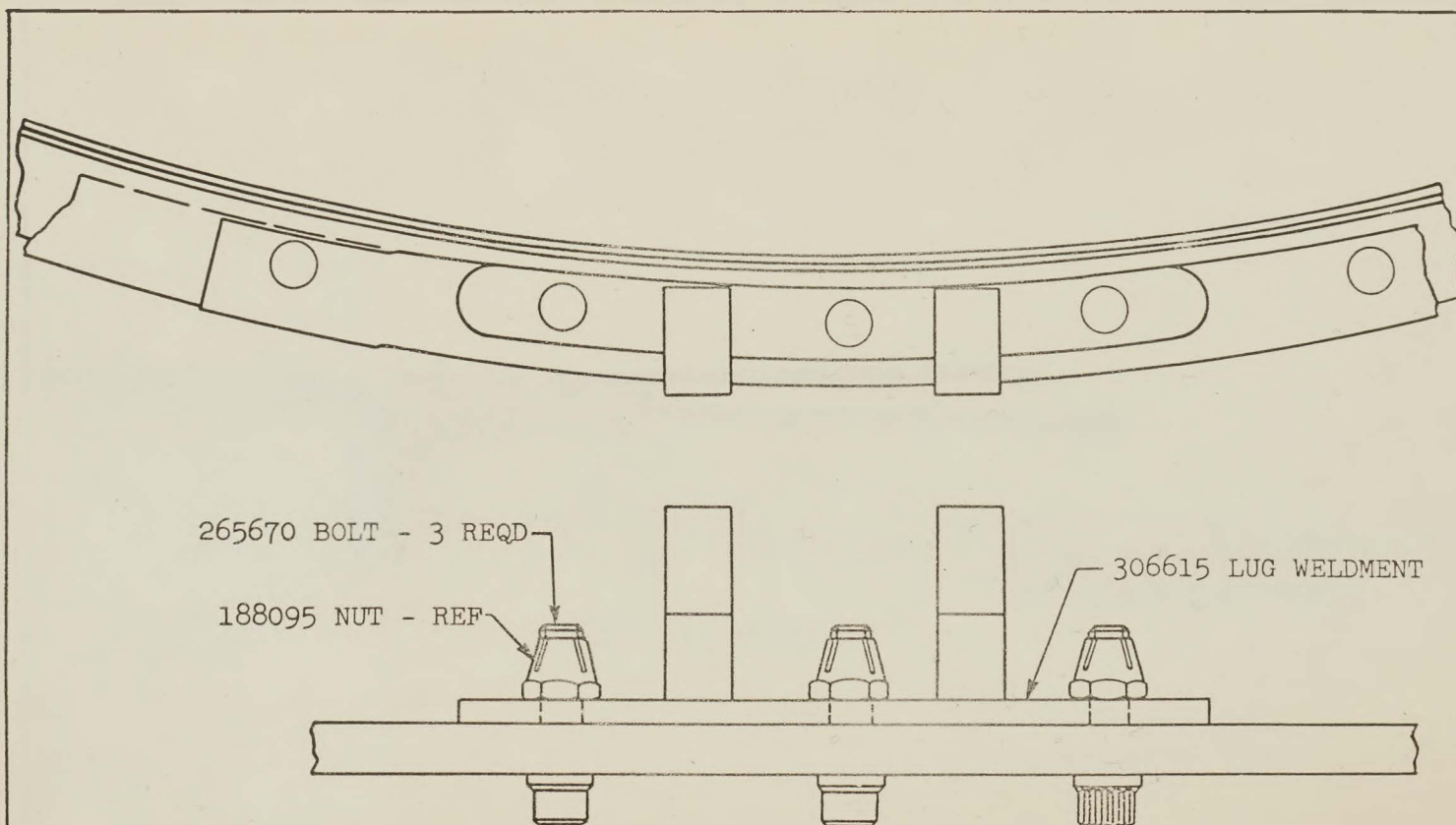
REAR VIEW OF FLANGE D

FIGURE 16



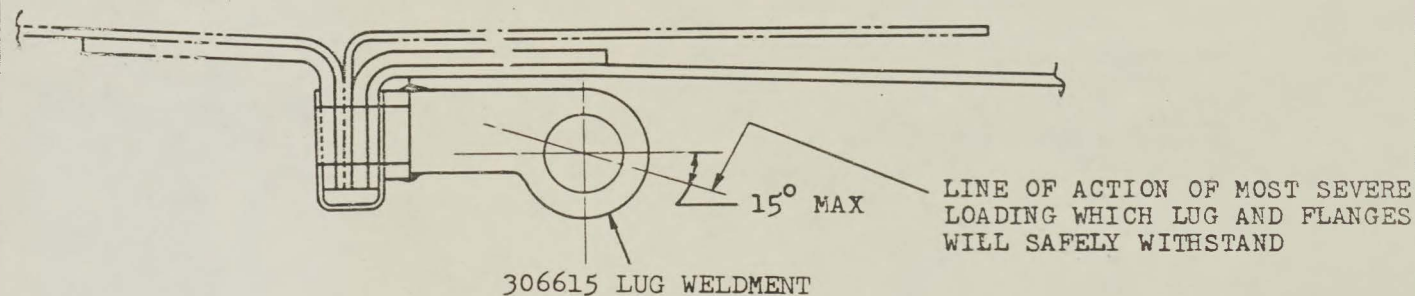






VIEW OF ASSEMBLED LUG WELDMENT

FIGURE 20



SIDE VIEW OF ASSEMBLED LUG WELDMENT

FIGURE 21

