SOLID ROCKET PLANT

TECHNICAL INTERFACE CONTROL DOCUMENT

Little Joe II

Algol Propulsion System

Contracts NAS 9-452 and -456

Report 0667-TICD-1 1 July 1963

AEROJET GENERAL TIRE GENERAL

1 July 1963

Little Joe II

Algol Propulsion System

Technical Interface Control Document

Report 0667-TICD-1

Contract NAS 9-452 (General Dynamics)
and
Contract NAS 9-456 (Aerojet-General)

National Aeronautics and Space Administration
Manned Spacecraft Center
Houston, Texas

Approved: _____
Little Joe II
GD/Convair Program Manager

Approved: _____
Little Joe II
AGC Program Manager

Table of Contents

SECTION I GENERAL

1.0 PURPOSE

This document delineates the design and operational interfaces between the Aerojet-General (AGC) Algol ID Mod 1 and Mod 2 rocket motors and the General Dynamics/Convair (GD/C) Little Joe II booster vehicle. Authority for origination of this document is in accordance with the statement of work pursuant to the applicable AGC contract with NASA-MSC. All details of design and operational interfaces shall be consistent with this document. This document shall define the responsibilities and methods to be used by both contractors and NASA to ensure that the integrated system of motors, booster vehicle, facilities, and GSE are compatible. The intent of this document is to provide consistent data with which the cognizant engineering personnel in each agency can analyze their own problem areas. This is a working document that will be continuously updated as necessary to define and control the design and operational interfaces as agreed to mutually by AGC, GD/C, and NASA.

2.0 ADMINISTRATION

2.1 Effectivity

The two organizations for which this Technical Interface Control Document (TICD) is a primary guide are the Aerojet-General Corporation (AGC), under Contract NAS 9-456, and General Dynamics/Convair (GD/C), under Contract NAS 9-492. The basic document will be submitted to the NASA for concurrence when the two contractors mutually agree to the format and contents of the basic document. Subsequently, all remaining undefined interfaces and changes will be negotiated in accordance with the procedures prescribed hereinafter.

2.2 Control

Aerojet-General will assume the responsibilities as the originating agency for the basic TICD, and therefore will maintain, revise, and reissue the document or parts thereof periodically, and the complete document at least quarterly until consummation of the effective contract. NASA will provide a list of authorized TICD recipients.

3.0 TICD REVISION

3.1 Changes and/or additions will be negotiated between the contractors at the appropriate technical level. Changes found to be technically acceptable and that do not affect the respective contracts will be implemented on approval. Changes and/or additions that are technically acceptable but affect one or both of the respective contracts will not be implemented until contractual approval is obtained. When agreement on a change cannot be reached between contractors, NASA-MSC direction will be required for disposition of the change.

3.2 Initiation

3.2.1 A change may be initiated by either contractor or NASA-MSC by preparation of a TICD Change Sheet (Exhibit A) and submission to the other agency(ies) for review and/or approval.

3.2.2 The initiating agency will identify itself by inserting the word, "initiator," under its approval block on the TICD Change Sheet.

3.3 Review and Approval

3.3.1 Normally it is expected that the TICD Change Sheet will be prepared and submitted to the other contractor for review and approval.

3.3.1.1 Certain changes may require technical discussions to resolve any differences or misunderstanding before the change is approved or disapproved. These discussions will take place during the Technical Interchange Meeting (see Paragraph 4.1.1).

3.3.1.2 TICD Change Sheets requiring technical-interchange-meeting action will be prepared by AGC and distributed to the other agencies in advance of the meetings for study. AGC will present a reproducible master at the meeting for approval signatures.

3.3.2 Both contractors must approve the TICD Change Sheets prior to incorporation into the TICD. NASA-MSC approval is required on, but not limited to, any changes reflecting contractual commitments prior to incorporation into the TICD.

3.4 Authorized Signature

3.4.1 TICD Change Sheets reflecting a contractual change will require each agency's appointed program contract officer's signature.

3.4.2 Approval of all TICD Change Sheets will rest with the respective program managers or their duly assigned delegate.

3.5 Serialization

3.5.1 The approved Change Sheet(s) will be serialized by AGC, and the affected pages in the basic TICD will be revised and assigned an associated Change Letter alluding to the TICD Change Sheet serial number.

3.6 Distribution

3.6.1 TICD Change Sheets will be distributed by AGC to all holders of the TICD document as soon as practicable after approval.

3.6.2 A revised page and Change Letter index sheet accompanied by the revised TICD Errata Sheet(s) will be issued as a follow-up package to the TICD Change Sheet(s). Issue of this package will be paced by the intervening publication time.

4.0 COORDINATION AND COMMUNICATION

4.1 Coordination

4.1.1 Technical Interchange Meetings - Technical Interchange Meetings will be held between AGC and GD/C on an as-requested basis. Meeting dates, locations, and agenda will be agreed on by the contractors. All requests for technical interchange meetings must be forwarded to National Aeronautics and Space Administration, Apollo Spacecraft Project Office, Manned Spacecraft Center, Houston 1, Texas, for approval.

4.2 Communications messages used as a basis for commitments shall be addressed to the individual indicated herein:

Program Manager:

GD/Convair - J. B. Hurt (3 copies)
S. J. Harris, Contract Administration

Aerojet-General - H. E. Halligan (3 copies)

D. A. Loomis, Contract Administration

NASA/MSC - W. W. Petynia

G. J. Mehailescu, Contracting Officer

4.2.1 Formal written communications shall be handled as in Paragraph 4.2 above.

EXHIBIT A

NASA LITTLE JOE II
ALGOL PROPULSION SYSTEM
TECHNICAL INTERFACE CONTROL
CHANGE SHEET

SERIAL NO. _____
SHEET _____ OF _____
PHYSICAL _____
FUNCTIONAL/ENVIRONMENT _____
OPERATION _____
DOCUMENT _____

STATEMENT OF ACTION:

DOES THIS ACTION ITEM AFFECT:

COSTS _____
SCHEDULES _____

ACTION INITIATED
DATE: _____
ACTION COMPLETED
DATE: _____

GD/CONVAIR APPROVAL	AEROJET-GENERAL APPROVAL	NASA/MSC APPROVAI
_____	_____	_____
DATED _____	DATED _____	DATED _____
ORIGINATOR _____	ORIGINATOR _____	ORIGINATOR _____

Page_____

Revision N/A

Date 1-30-63

SECTION II

INTERFACE CONTROL SPECIFICATIONS
TECHNICAL INTERFACE CONTROL DOCUMENT
(TICD)

LITTLE JOE II
ALGOL PROPULSION SYSTEM

ALGOL ID, MOD I AND MOD II

PROJECT APPROVAL:

GD/CONVAIR

_____

Date_____

PROJECT APPROVAL:

Aerojet-General

_____

Date_____

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Section II

Table of Contents (cont.)

Section II

A. INTRODUCTION

The data presented herein depicts the three basic interface areas between the Algol ID Mod 2 propulsion system and the Little Joe II vehicle. These interfaces are categorized as physical, functional, environmental, and operational. Section E contains that interface information required for incorporation of the Algol ID Mod 1 Propulsion System into the Little Joe II Vehicle.

A.1 LAUNCH VEHICLE DESCRIPTION

For clarification, the Algol ID Mod 1 has a nozzle that is canted by use of a micrometer assembly during vehicle assembly. The Algol ID Mod 2 has a straight, nonmovable nozzle.

The Little Joe II launch vehicle is a fin-stabilized airframe that has solid-fuel rocket motors as its source of propulsion power. The propulsion system consists of Thiokol Recruit and/or Aerojet Algol motors and their igniters and exhaust nozzles. In addition to the propulsion system, the vehicle incorporates the airborne portions of a command destruct system to terminate thrust of the rocket motors at any time during the powered portion of a flight, and a measurement system with sensors that operate in conjunction with the payload telemetry system. An electrical system contains all components for supply, conversion, distribution, and control of electrical power as required for the vehicle systems. Most of the components for the systems are located in an equipment area between vehicle stations 0.0 and 34.75, forward of the Algol motors. Three access doors spaced around the body provide access to the equipment area, and a crawlway permits movement of personnel within this area.

The airframe is a cylindrical structure with a truncated-form corrugated skin and four stabilizing fins. The body is in two sections, with three main bulkheads: two in the aft body and one in the forward body. One of the bulkheads in the aft body supports the aft attach fittings of the fins and absorbs motor thrust, and the other bulkhead in the aft body supports the forward attach fittings of the fins. The bulkhead in the forward body supports the forward ends of the sustaining rocket motors. A mating ring at vehicle station 0.0 interfaces the Spacecraft Service Module; mating rings at vehicle station 227.0 interface the two body sections. The aft body rests on the launcher pads and pins.

B. PHYSICAL INTERFACES

1. Motor-to-Vehicle Installation and Assembly:

The Interface Control Drawing, AGC Dwg 368281, describes the overall physical envelope of the Algol ID Mod 2 Propulsion System. It further provides a reference to all AGC and GD/C drawings that provide the applicable detail information required to describe the actual physical mating surfaces, their mode of attachment,

and/or attachment devices. Prior to its release, the TICD will have been coordinated with GD/C for their review and inclusion of all GD/C-applicable reference drawings.

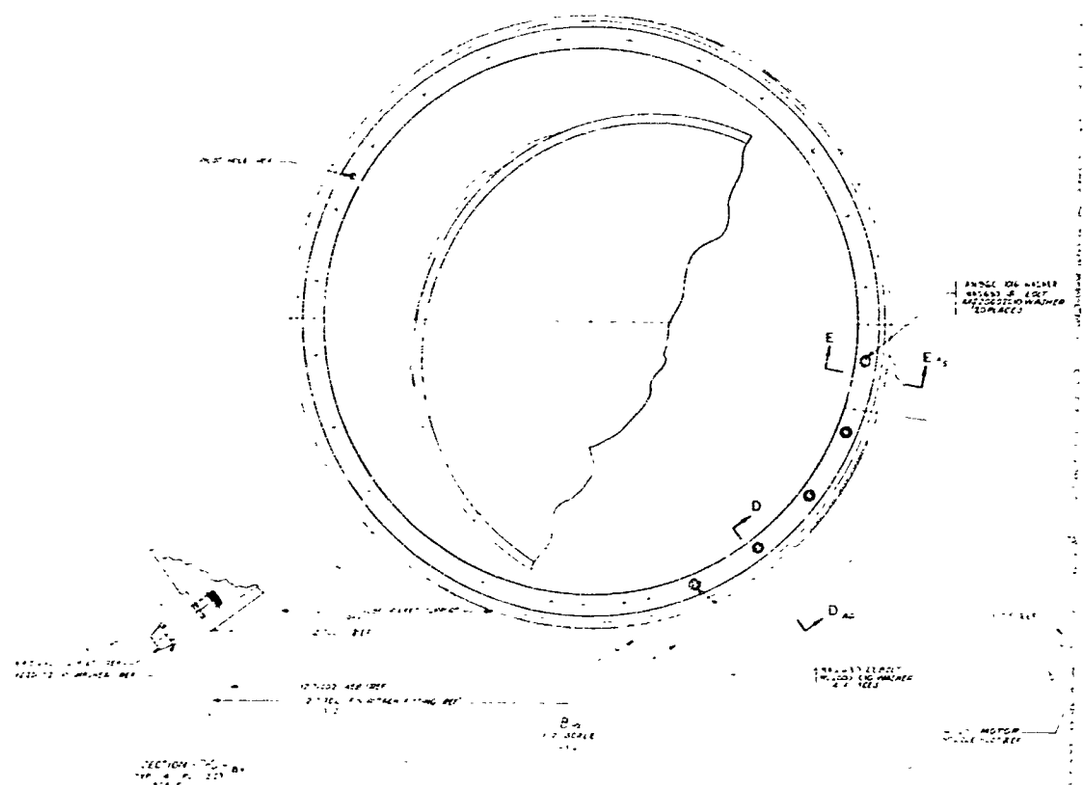
The following physical interfaces will be found on ICD 368281; corresponding interfaces for Algol ID Mod 1 will be found on ICD 367926.

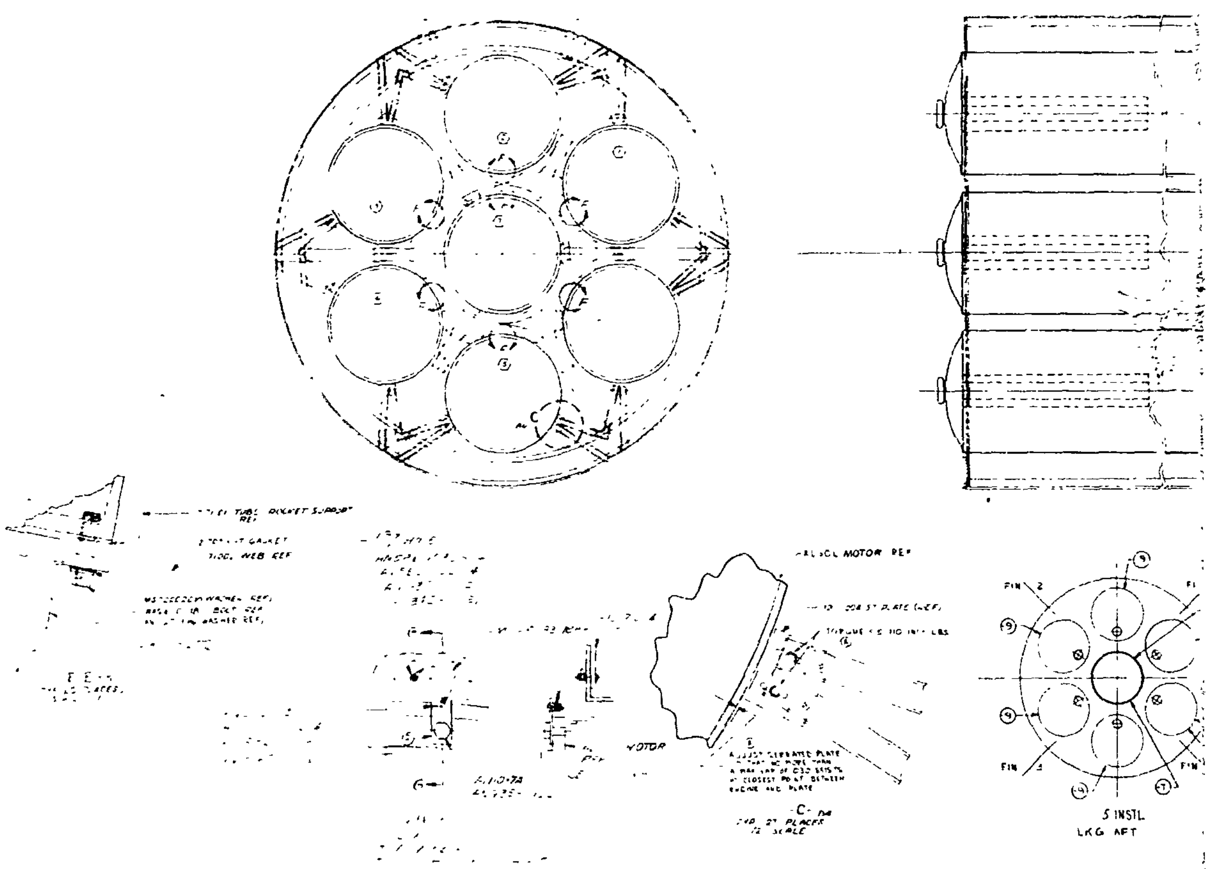
a. Motor-to-vehicle mounting

b. Chamber-pressure-transducer-to-igniter adapter

c. Grain-temperature monitor thermocouple electrical connector (ground monitoring only)

d. Ignition-system electrical connector

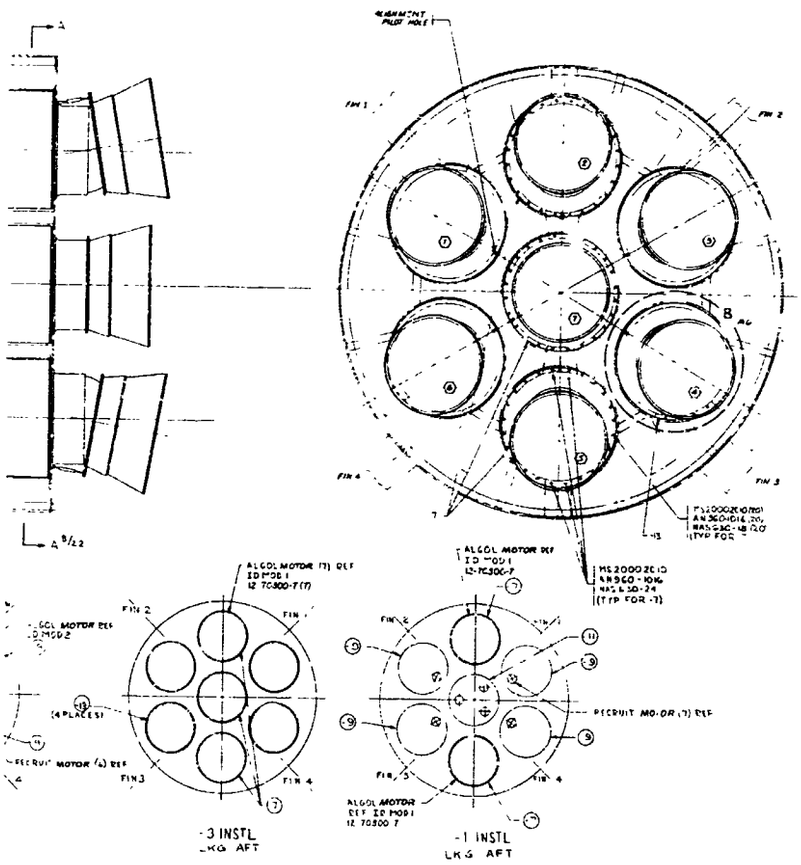

E
E
D
D



11 FOR BOLT TORQUE VALUES
OBTAIN FRICTION TORQUE VALUE OF BOLT BEFORE THREAD ENGAGEMENT, ADD THIS VALUE TO TORQUE VALUES BELOW TO OBTAIN TOTAL TORQUE VALUE REQD
5/16 BOLTS ~100 TO 140 IN LBS 3/8 BOLTS 1100 TO 1300 IN LBS
TORQUE 5/8 NUTS TO 660 TO 780 IN LBS.

[12] TORQUE [illegible] CLAMP TO 125-150 IN LBS
[13] ①, ②, ETC INDICATE MOTOR POSITION NUMBER

NOTE: END USE OF THIS DWG IS FOR REFERENCE ONLY TO SHOW THE ALGOL MOTOR INSTALLATION INTO THE GD/CONVAIR LITTLE JOE II VEHICLE CONFIGURATI[ON] THIS DWG HAS BEEN REPRODUCED FROM AND IS COMPATIBLE WITH GD/CONVAIR DWG 12-25001 CHG PLEASE REFER TO GD/CONVAIR DWG 12-25001 (LATEST CHG) FOR COMPLETE INSTALLATION DETAILS.



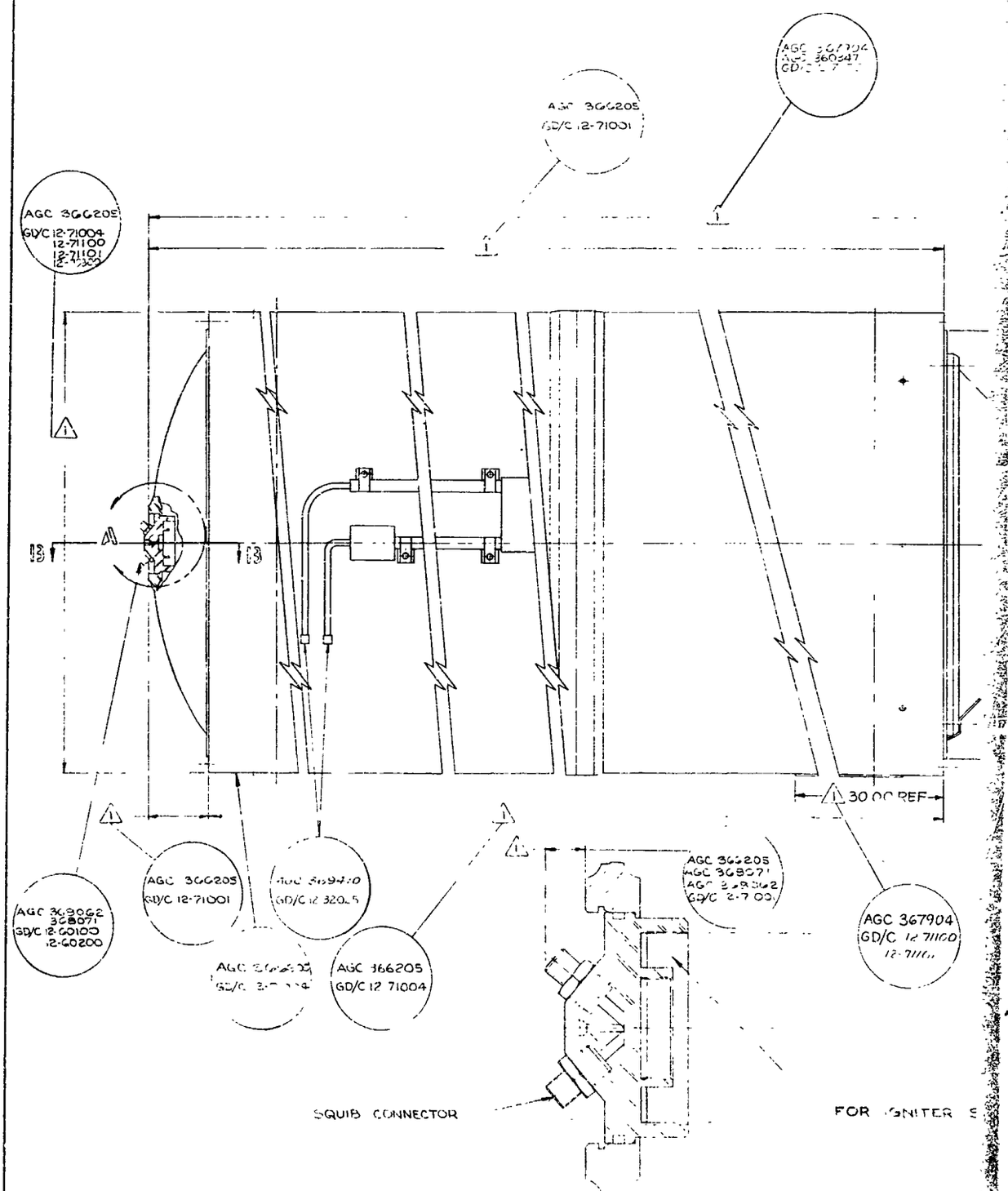
INTERFACE CONTROL DRAWING

FRAZIER		AEROJET-GENERAL CORPORATION SOLID ROCKET PLANT SACRAMENTO CALIFORNIA
		TITLE: ALGOL MOTOR INSTALLATION IN LITTLE JOE II VEHICLE
		CODE IDENT NO 13310 · DWG SIZE J · DWG NO 380663
		SCALE — · SHEET

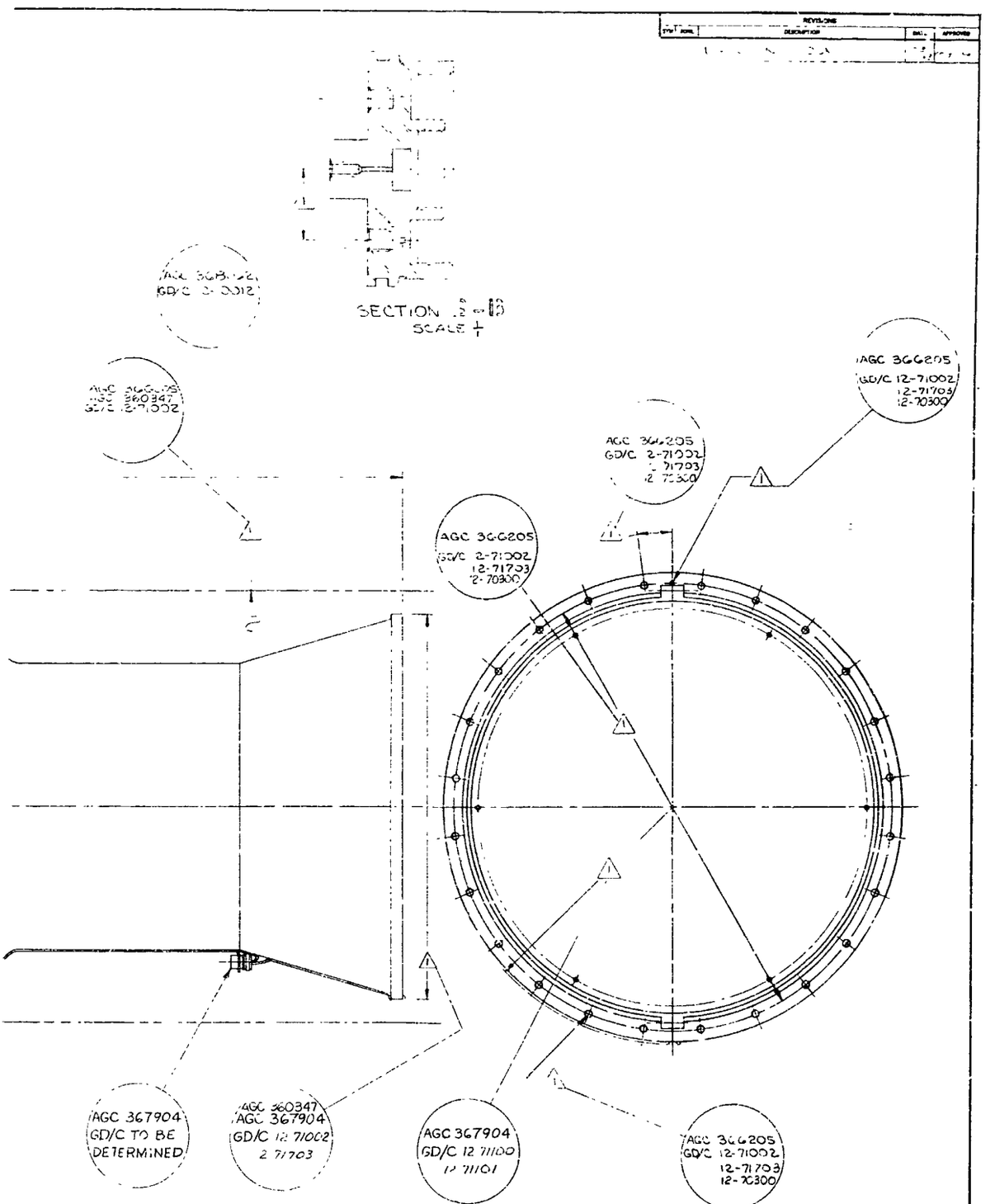
WS.

2.

NOTES: 1. THESE DIMENSIONS PER DWGS INDICATED IN CIRCLE.



DETAIL B
SCALE 1



SEE AGC 360345

INTERFACE CONTROL DRAWING

LIST OF MATERIALS

Aerojet General CORPORATION — SOLID ROCKET PLANT SACRAMENTO, CALIFORNIA

ENVELOPE, ALGOL ID, MOD 2

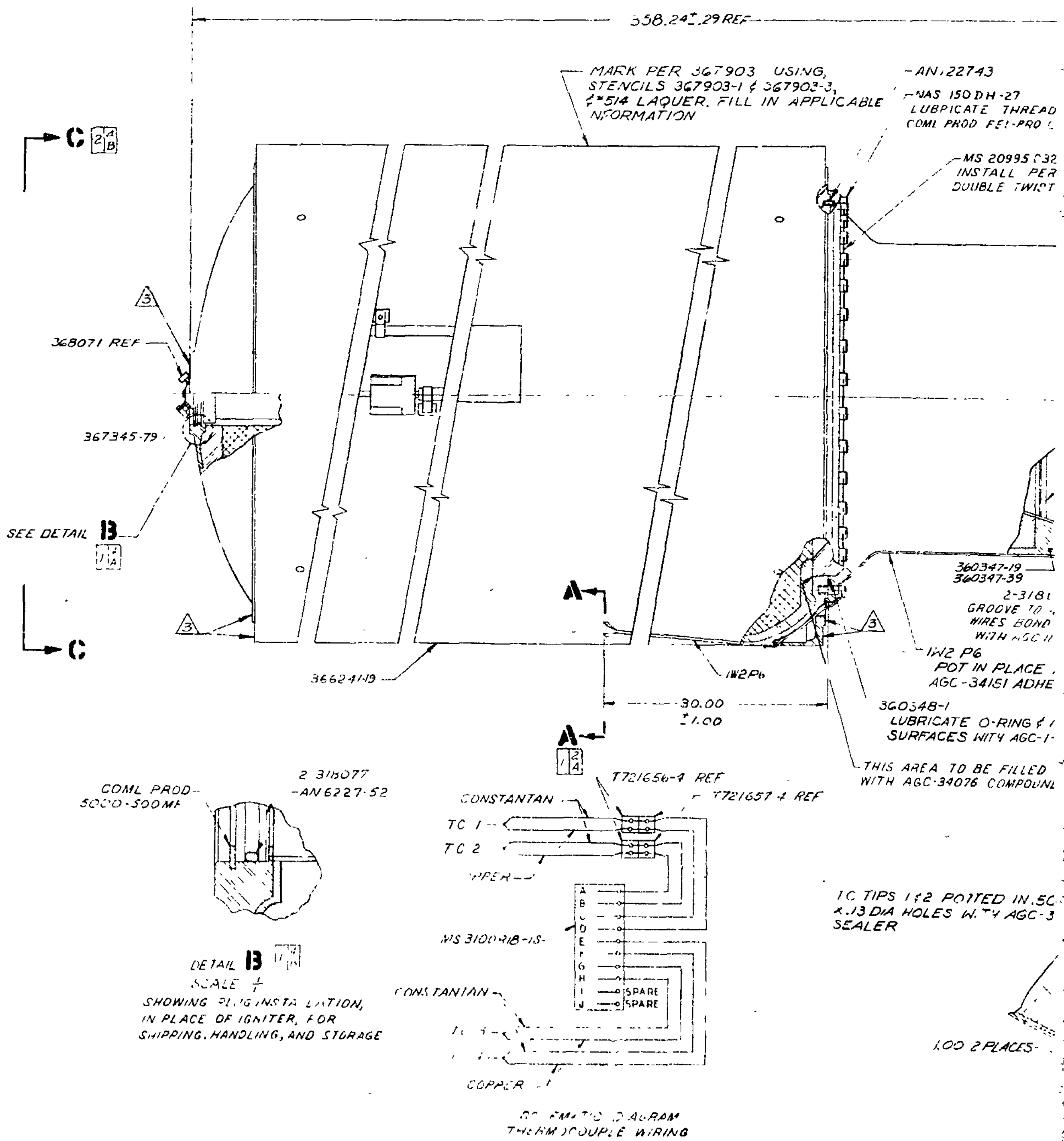
CODE IDENT NO. 13310 | SIZE E | DWG NO. 368281

SCALE | SHEET 1 OF 1

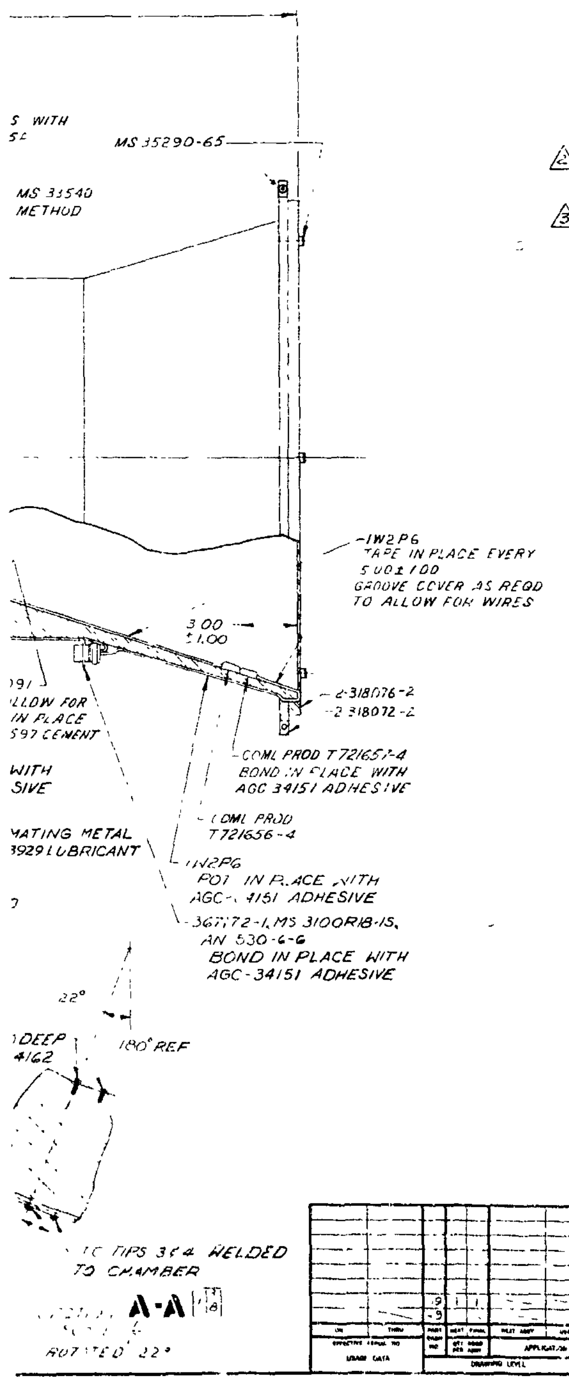
NOTES: 1 PACKAGING, PACKING, AND MARKING FOR OUT-OF-PLANT SHIPPING PER PPD SHEET NO. 3795.

2 REPAINT MOTOR ASSY AS REQUIRED WITH LACQUER NO. 511 INSIGNIA WHITE.

3 APPLY CORROSION PREVENTIVE PER MIL-C-16173 GR 4, TO BARE STEEL SURFACES INDICATED.



SYM	ZONE	DESCRIPTION	DATE	APPROVED
A		SEE A CHG DCN, ADDED SH 2	4-14-63	[illegible]



-29	-19	-9	SYM	CODE IDENT NO.	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL	SPECIFICATION	UNIT WT	ZONE	FIND NO
AR	AR			13165	FEL-PRO-C5A	LUBRICANT			1	3C	
AR	AR			09128	IW2P6	WIRE			1	2B	
2	2			09128	T721657-4	JACK			1	2B	
2	2			09128	T721656-4	PLUG			1	2B	
1	1			19136	5000-500MF	RING			1	4	
AR	AR					CEMENT, SYNTHETIC		AGC-11597	1	3B	
AR	AR					ADHESIVE, TYPE I		AGC-34151	1	2B	
AR	AR					LUBRICANT		AGC-13929	1	3B	
AR	AR					SEALING COMPOUND	CLASS 2	AGC-34076	1	3B	
AR	AR					SEALER		AGC-34162	1	3A	
△2 AR	AR					LACQUER, #511 INSIGNIA WHITE		MIL-L-7178			
AR	AR					LACQUER, #514 INSTRUMENT BLACK		MIL-L-6805	1	3C	
△3 AR	AR					CORROSION PREVENTIVE	GRADE 4	MIL-C-16173			
AR	AR					TAPE, TYPE I		UU-T-106	1	2B	
36	36				NAS 150 DH-27	BOLT			1	3B	
24	24				MS35335-19	WASHER, LOCK			2	1C	
8	8				MS 35290-65	SCREW			1	2C	
1	1				MS 3100R 18-1S	CONNECTOR			1	2B	
AR	AR				MS 20995-C32	LOCKWIRE			1	3C	
1	1				AN122743	PIN			1	3C	
1	1				AN 6227-52	PACKING, O-RING			1	4A	
4	4				AN 530-6-6	SCREW			1	2A	
24	24				MS35224-76	SCREW			2	1C	
24	24			13309	512669-1	CLAMP, DESTRUCT			2	2C	
24	24			13309	512668-1	BLOCK			2	2C	
1					360347-39	NOZZLE ASSY			1	3	
1	1				367903-3	STENCIL			1	3C	
1	1				367903-1	STENCIL			1	3C	
1	1				367345-79	IGNITER ASSY			1	4B	
1	1				367172-1	BRACKET			1	2B	
2	2			13309	369410-1	DESTRUCT UNIT			2	1C	
1	1				366241-19	CHAMBER ASSY			1	4B	
1	1				360348-1	O-RING			1	B	
	1	REMOVED			36034719	NOZZLE ASSY			1	3B	
1	1				2-318091	SEAL			1	3B	
1	1				2 318077	PLUG			1	4A	
1	1				2 3180162	COVER			1	2B	
2	2				2 3180722	CLAMP			1	2B	

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
DECIMAL TOLERANCE XX ± .03 XXX ± .010 — ANGULAR TOLERANCE ±1°30'
DO NOT SCALE DRAWING

TREATMENT

FINISH

RELEASE DATE 1-28-63

DRAWN	L.E. RICH	10-17-62
CHECKED	D BLO	1-24-63
DESIGN	[illegible]	1-15-63
PROJECT	A.J KOOREY	1-22-63
STRESS	[illegible]	1-25-63
MATERIALS		
PRODUCTION		
DESIGN ACTIVITY APPD		
CUSTOMER		

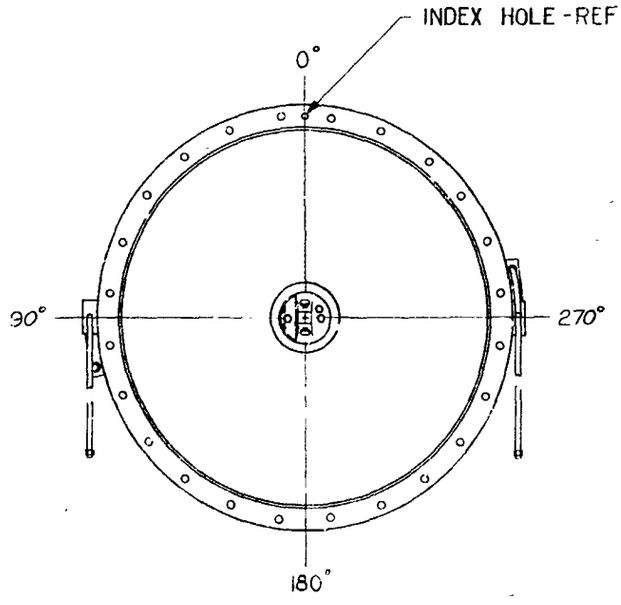
Aerojet-General CORPORATION — SOLID ROCKET PLANT, SACRAMENTO, CALIFORNIA

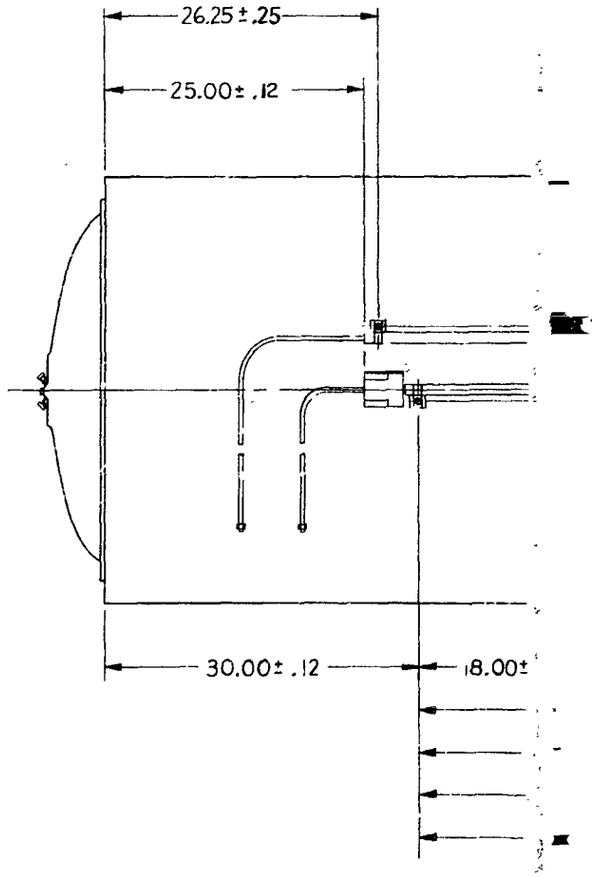
TITLE: MOTOR ASSEMBLY ALGOL ID, MOD 2

CODE IDENT NO 13310 | DWG SIZE E | DWG NO. 367904

SCALE 1/4 | SIMILAR TO 367421 | SHEET 1 OF 2

NOTES:

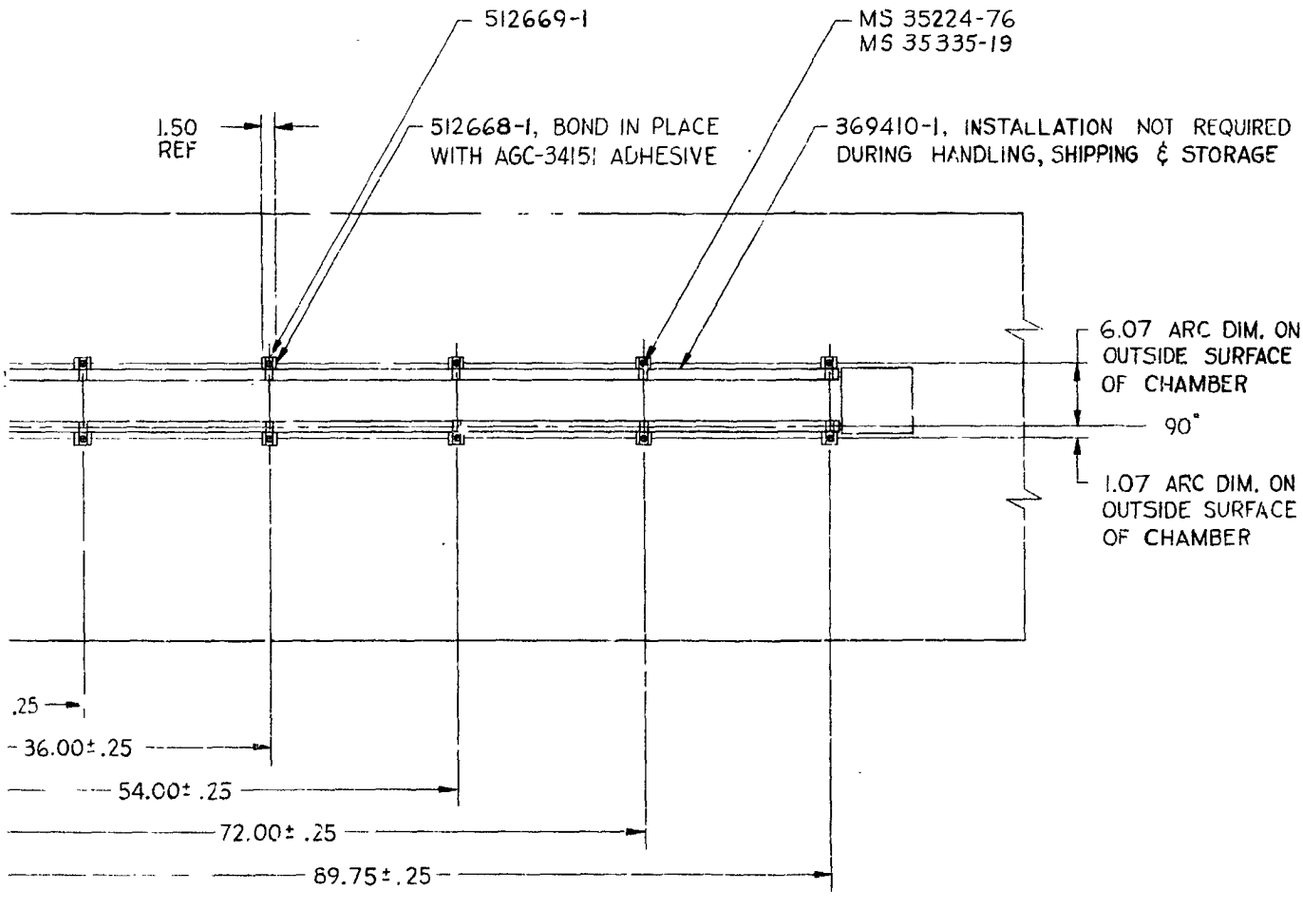




VIEW C-C [1|4C]

SCALE 1/8

REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
A				



DESTRUCT UNIT
2 PLACES, 180° APART

QTY REQD	SYM	CODE IDENT NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL	SPECIFICATION	UNIT WT.	ZONE	FIND NO.

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
DECIMAL TOLERANCE ANGULAR TOLERANCE
XX ± .03 ± 1° 30'
XXX ± .005
DO NOT SCALE DRAWING

TREATMENT

FINISH

RELEASE DATE 1-28-63

	NAME	DATE
DRAWN	L. E. RICH	10-17-62
CHECKED	D. RAHL	1-24-63
DESIGN	J. HASKINS	1-10-62
PROJECT	A.J. KOOREY	1-22-63
STRESS	M FLIEGER	1-22-63
MATERIALS		
PRODUCTION		
DESIGN ACTIVITY APPD		
CUSTOMER		

Aerojet-General CORPORATION
SOLID ROCKET PLANT
SACRAMENTO, CALIFORNIA

TITLE
MOTOR ASSEMBLY
ALGOL ID, MOD 2

CODE IDENT NO.	DWG SIZE	DWG NO.
13310	D	367904

SCALE 1/4 SIMILAR TO 367421 SHEET 2

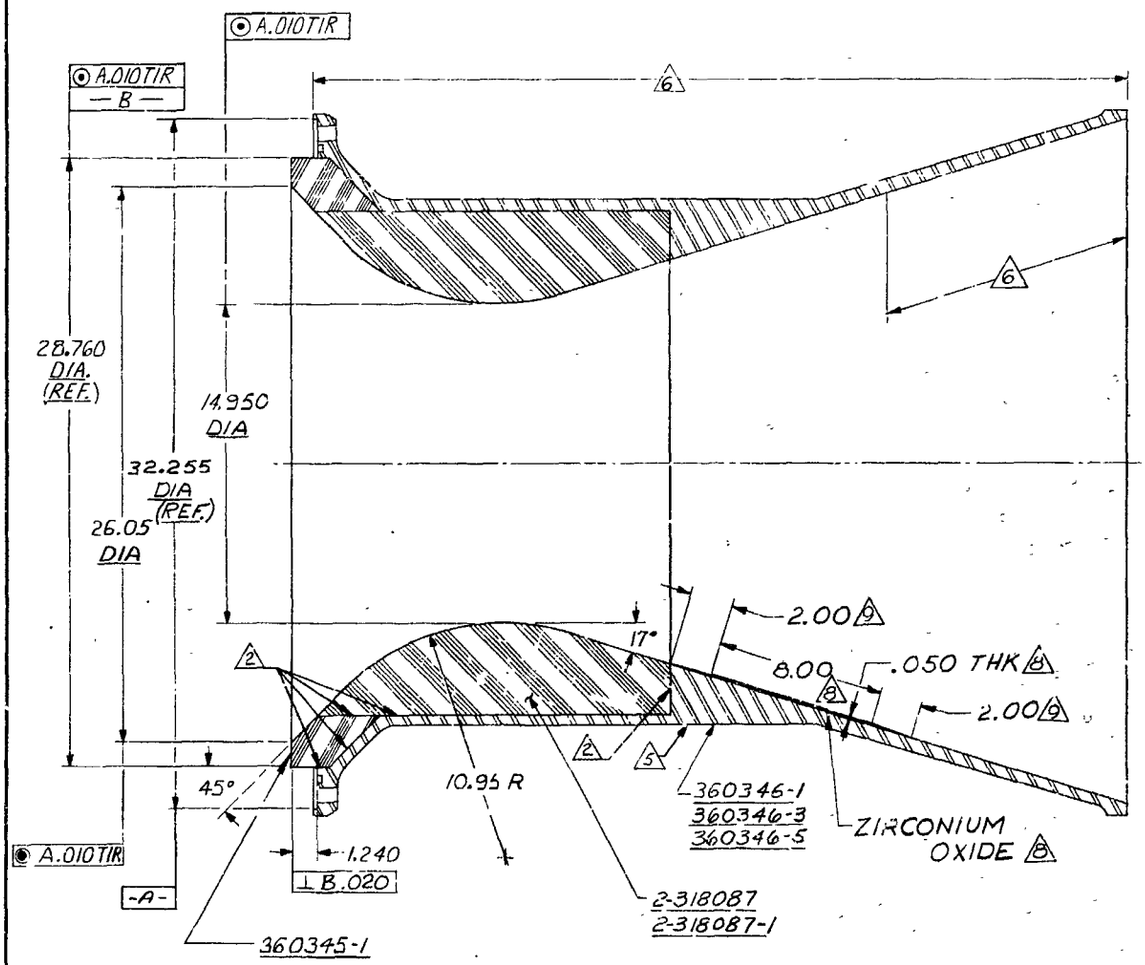
ON	THRU
EFFECTIVE SERIAL #	
USAGE DATA	

PART DASH NO.	NEXT QTY REQD PER ASSY	FINAL	NEXT ASSY	USED ON
			APPLICATION	

DRAWING LEVEL 1

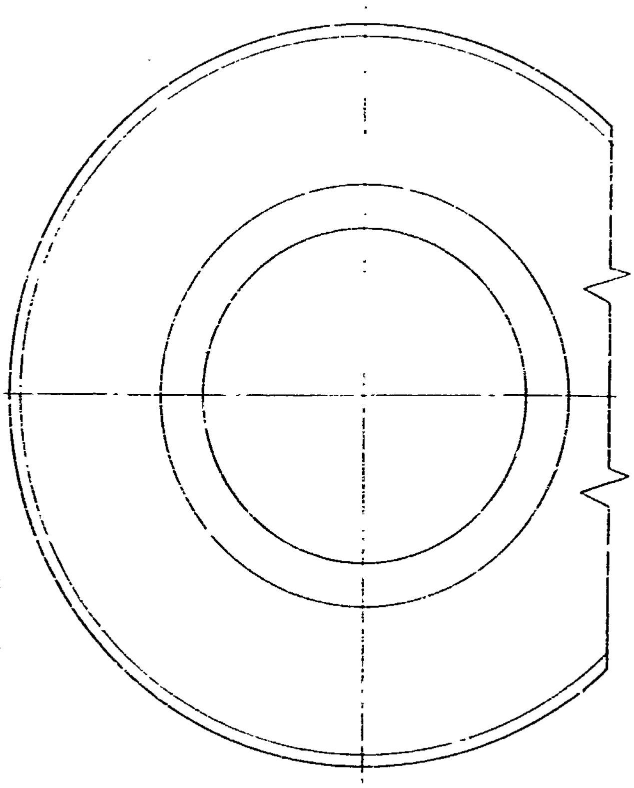
0667-02 104628

367904



9 TAPER ZIRCONIUM OXIDE FROM .050 THK TO BASE METAL OVER THIS DISTANCE.
8 MATERIAL & PROCESS PER AGC-36071 EXCEPT ITEMS (a), (b), & (c) OF PARAGRAPH 4.12.3. DO NOT UNDERCUT BASE METAL.
7. POSITIONAL TOLERANCE SYMBOLS PER MIL-STD-8.
6 PAINT NOTED SURFACES WITH LACQUER, #511 INSIGNIA WHITE PER MIL-L-7178.
5 IDENTIFY PER MIL-STD-130 WITH PART NO. & SERIAL NO. BY STEEL STAMP.
4. TOUCH UP PRIMED SURFACES WITH PRIMER PER AGC-36072.
3. APPLY CORROSION PREVENTIVE PER AGC-36234 TO ALL METAL SURFACES NOT PRIMED AFTER BONDING.
2 PREPARE BONDING SURFACES PER AGC-13842, METHOD-C. BOND 360345-1 INSULATOR & 2-318087 INSERT IN PLACE USING A MIXTURE OF:
100 PARTS BY WEIGHT OF ADHESIVE PER AGC-10758, TYPE III,
75 PARTS BY WEIGHT OF INERT FILLER PER AGC-34013;
6 PARTS BY WEIGHT DIETHYLENE-TRIAMINE PER AGC-10935;
CURE 4 HOURS MINIMUM AT 180°F.
1. REMOVED

SYM	DESCRIPTION	DATE	BY	APPD
A	DWG REVISED-ITEMS 1 THRU 6 INC EO 708931- ITEM 7 INC EO 70.939: ITEM 8 INC EO 701940. INC DCN DATED 1-7-63	1-7-63	EW	
\	SEE RECORD CHG DCN DATED 4-2-63	4-2-63	DF	



-39	-29	-19	-9	PART NO.	DESCRIPTION	MATERIAL	SPECIFICATION	ZONE
AR	AR	AR	AR	———	INERT FILLER	AGC-34049		
AR	AR	AR	AR	———	ZINC CHROMATE PRIMER	MIL-P-8585 COLOR-Y		
AR	AR	AR	AR	———	ZIRCONIUM OXIDE	△8		
AR	AR	AR	AR	———	LACQUER, #511 INSIGNIA WHITE	MIL-L-7178		
AR	AR	AR	AR	———	CORROSION PREVENTIVE	MIL-C-16173 GRADE 3		
AR	AR	AR	AR	———	ADHESIVE.	AGC-10758 TYPE III		
AR	AR	AR	AR	———	DIETHYLENE-TRIAMINE	AGC-10835		
1				360346-5	HOUSING			3 B
	1			360346-3	HOUSING			3 B
1	1	1		2-318087-1	INSERT			3 B
		1	1	360346-1	HOUSING			3 B
1	1	1	1	360345-1	INSULATOR			4 B
			1	2-318087	INSERT			3 3

QTY REQD PER ASSY — LIST OF MATERIALS

360347

COPY ___ A

AEROJET	GOVERNMENT
AGC-36071	MIL-STD-130
AGC-13842	MIL-STD-B

APPLICABLE SPECIFICATIONS

PART DASH NO.	NEXT	FINAL	NEXT ASSY	MODEL NO.
-39	1	1	367904-19	MOD II
-29	1	1	367904-19	MOD II
-19	1	1	367904-19	
-9	1	1	360351-3	33KS 120,000

QTY REQD PER ASSY — APPLICATION

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
DECIMAL TOLERANCE .XX ± .03 .XXX ± .010 — ANGULAR TOLERANCE ± 1° 0'
SURFACE ROUGHNESS PER MIL-STD-10
DO NOT SCALE DRAWING
TREATMENT
FINISH

DRAWN	RICH	5-24-61
CHECK		6-20-61
DESIGN		6-7-61
PROJECT		6-19-61
STRESS		6-19-61
MATL		
PRODUCTION		
CUSTOMER		

TITLE: NOZZLE ASSY

Aerojet-General CORPORATION SACRAMENTO, CALIFORNIA

SIMILAR TO — SCALE 1/4 — CA 1000 — DWG SIZE D — DWG TYPE 1 — DWG NO. 360347
RELEASE DATE 6-21-61 — CODE IDENT NO. 70143 — SHEET

NOTES:

1. [illegible] BE ALL RADII AND SHARP EDGES EQUIVALENT TO .005/.020 UNLESS OTHERWISE NOTED.
2. INTERPRET MARKING IN ACCORDANCE WITH STANDARD PRACTICES, MIL-STD-7032.
3. REMOVED.
4. THREADS PER NBS HANDBOOK H28.
5. [illegible] IS DEFINED AS A STRAIGHT LINE CONNECTING THE CENTERS OF [illegible] AND [illegible].
6. PURCHASE & INSPECT ALL FORGING MATERIAL PER AGC-36058, CLASS 4, PRIOR TO ASSY AND MACHINING.
7. SURFACE ROUGHNESS TO BE 63 UNLESS OTHERWISE SPECIFIED.
8. REMOVED.
9. ▲ DENOTES AN IN-PROCESS DIMENSION. DO NOT FINAL INSPECT.
10. RATE OF CHANGE OF CONTOUR NOT TO EXCEED .030 INCH/INCH.
11. ALL GRIND MARKS ON GIRTH WELDS TO BE CIRCUMFERENTIAL IN DIRECTION.
12. -21 TUBES MAY BE MADE FROM 2 TO 6 SECTIONS, GIRTH WELDED TOGETHER AND LONGITUDINALLY SEAM WELDED AS SHOWN. ADJACENT LONGITUDINAL WELDS SHALL BE STAGGERED RADIALLY 180 ± 30°. GIRTH WELDS ON PRESSURE VESSEL SHALL BE LIMITED TO NOT MORE THAN 10, EXCLUDING POST HEAT TREAT CENTER WELD.
13. TIG WELD PER AGC-36073/1.
14. MISMATCH OF -5 RINGS .030 MAX. MISMATCH OF ALL OTHER CYLINDRICAL PARTS .010 MAX.
15. PERMISSIBLE CROWN ON WELDS: .040/.005 ON INSIDE SURFACES .060/.020 ON OUTSIDE SURFACES EXCEPT FOR 2.50 INCHES AT BOTH ENDS OF -21 TUBE SECTIONS WHERE CROWN ON OUTSIDE OF LONGITUDINAL WELDS IS TO BE .060/.005.
16. RADIOGRAPHIC INSPECT WELDS PER AGC-36065. INTERPRET PER AGC-13860, TABLE 1, CLASS 1.
17. RADIOGRAPHIC INSPECT WELD PER AGC-36065. INTERPRET PER AGC-13860, TABLE 1, CLASS 4.
18. HEAT TREAT FORWARD AND AFT CHAMBER SECTIONS PER MIL-H-6875 TO 180,000 PSI MINIMUM ULTIMATE TENSILE STRENGTH IN THE CHAMBER SIDE WALL SECTION (.112 THICK). PHYSICAL PROPERTIES ARE TO BE DETERMINED BY AVERAGING THE TENSILE PROPERTIES OF AT LEAST 3 TENSILE TEST COUPONS REPRESENTING EACH -21 TUBE SECTION.
19. AFTER HEAT TREAT PER 18, PREHEAT 250°-300°F AND POST HEAT 150°-300°F FOR 10 MINUTES. WELD PER NOTE 13.
20. INDEX HOLE "A" AND "B" TO BE RADIALLY ALIGNED WITHIN .030.
21. HOLES MAY BE DRILLED USING DRILL FIXTURES PREPARED FROM AGC MASTER GAGE NO. T-800742.
22. HOLES MAY BE DRILLED USING DRILL FIXTURES PREPARED FROM AGC MASTER GAGE NO. T-800747.
23. SANDBLAST INTERIOR SURFACES PER AGC-36237.
24. AFTER SANDBLASTING, HYDROSTATIC PROOF TEST TO 725-750 PSIG AND HOLD FOR 3 MINUTES. REDUCE PRESSURE TO 0 PSIG. RATE OF PRESSURE RISE TO BE 200-400 PSIG PER MINUTE.
25. GROWTH DUE TO HYDROTEST SHALL NOT EXCEED 0.2% OF THIS DIMENSION.
26. MAGNETIC PARTICLE INSPECT PER AGC-36235 AFTER HYDROTEST.
27. REMOVED.
28. APPLY ONE COAT MIL-P-8585, COLOR Y, ZINC CHROMATE PRIMER AND A MIN OF ONE COAT MIL-L-7178, #511, INSIGNIA WHITE LACQUER TO ALL OUTSIDE SURFACES EXCEPT THOSE MARKED 40, AND 38.
29. ALL INSIDE SKIRT SURFACES MUST BE FULLY PRIMED AND PAINTED PER 28.
30. APPLY CORROSION PREVENTIVE COMPOUND PER AGC-36234.
31. REMOVED.
32. GRIND ALL WELDS ON O.D. OF CHAMBER FLUSH IN THIS AREA.
33. REFER TO 367926 ENVELOPE, ALGOL ID, MOD 1, FOR INTERFACE INFORMATION.
34. THIS POSITIONAL TOLERANCE DOES NOT APPLY TO -5 RINGS.
35. DO NOT RADIOGRAPHICALLY INSPECT THESE WELDS.
36. DO NOT PAINT AREAS NOTED.
37. CLASSIFICATION OF CHARACTERISTICS ARE DESCRIBED ON A SEPARATE DOCUMENT NO. 366205.

REVISIONS

SYM	ZONE	DESCRIPTION	DATE	APPROVED
[illegible]		[illegible] 205 [illegible]		

QTY -19	QTY -5	SYM	CODE IDENT NO	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL	SPECIFICATION	UNIT WT	ZONE	FIND NO.
28 AR					LACQUER NO 511 INSIGNIA WHITE		MIL-L-7178			
28 AR					PRIMER ZINC CHROMATE		MIL-P 8585 COLOR Y			
30 AR					CORROSION PREVENTIVE COMPOUND		MIL-C 16173 GR 3			
AR					WIRE, FILLER		AGC-34013			
2				-[illegible]3	FLANGE, SKIRT	4130 STL FORGE	MIL-S 6758 COND D3		2 3A	
12 AR				-[illegible]	TUBE	4130 STL SHEET	MIL-S 18729 COND N		2 3A	
1				-17	SKIRT, AFT	4130 STL SHEET	MIL-S 18729 COND N		2 2A	
1				-15	SKIRT, FWD	4130 STL SHEET	MIL-S 18729 COND N		2 3A	
1				-13	CLOSURE, FWD	4130 STL PLATE			2 4B	
1				-11	CLOSURE AFT	4130 ST. FORGE	MIL-S 6758 COND D3		2 2D	
	REMOVED			-7	REMOVED					
2				5	RING	4130 ST. FORGE	MIL-S 6758 COND D3		2 3A	
				-3	REMOVED					
1				1	IGNITER BOSS				2 4B	

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ANGULAR TOLERANCE ± 2°0'
DO NOT SCALE DRAWING

TREATMENT: 12

FINISH: 28

RELEASE DATE

DRAWN	H. WESCOTT	8-7-62
CHECKED	MALONEY	8-21-62
DESIGN	[illegible]KIND	8-16-62
PROJECT	H.J. STOREY	8-16-62
STRESS	H. PFLEGER	8-20-62
MATERIALS		
PRODUCTION	[illegible]	5-2-63
DESIGN ACTIVITY APPD		
CUSTOMER		

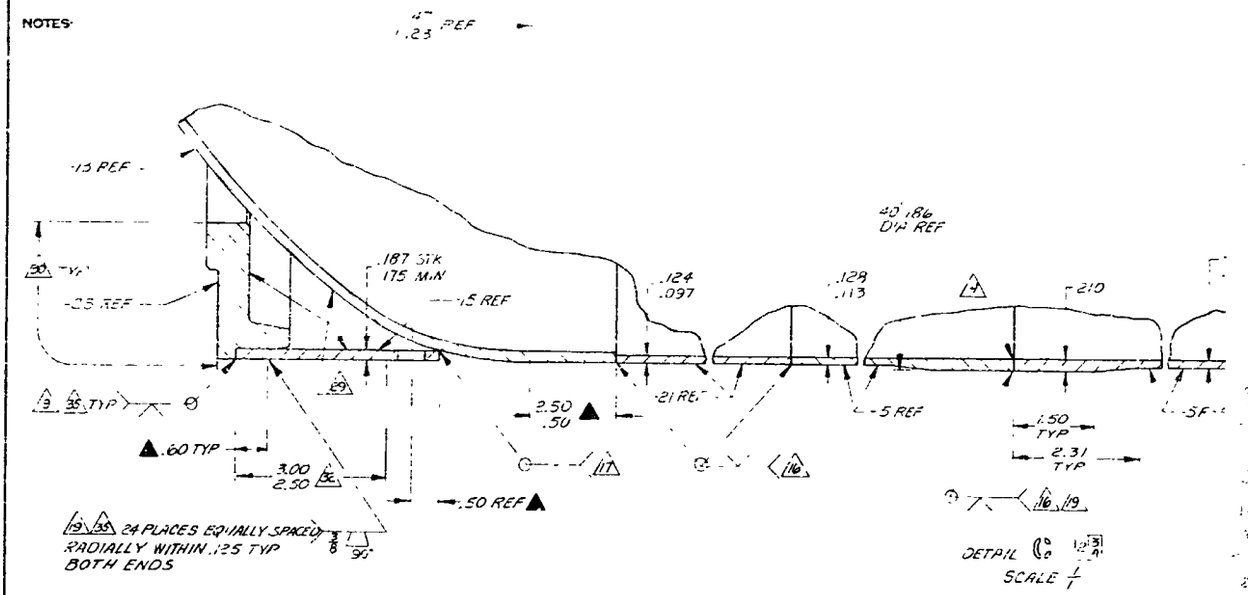
Aerojet-General CORPORATION
SOLID ROCKET PLANT
SACRAMENTO, CALIFORNIA

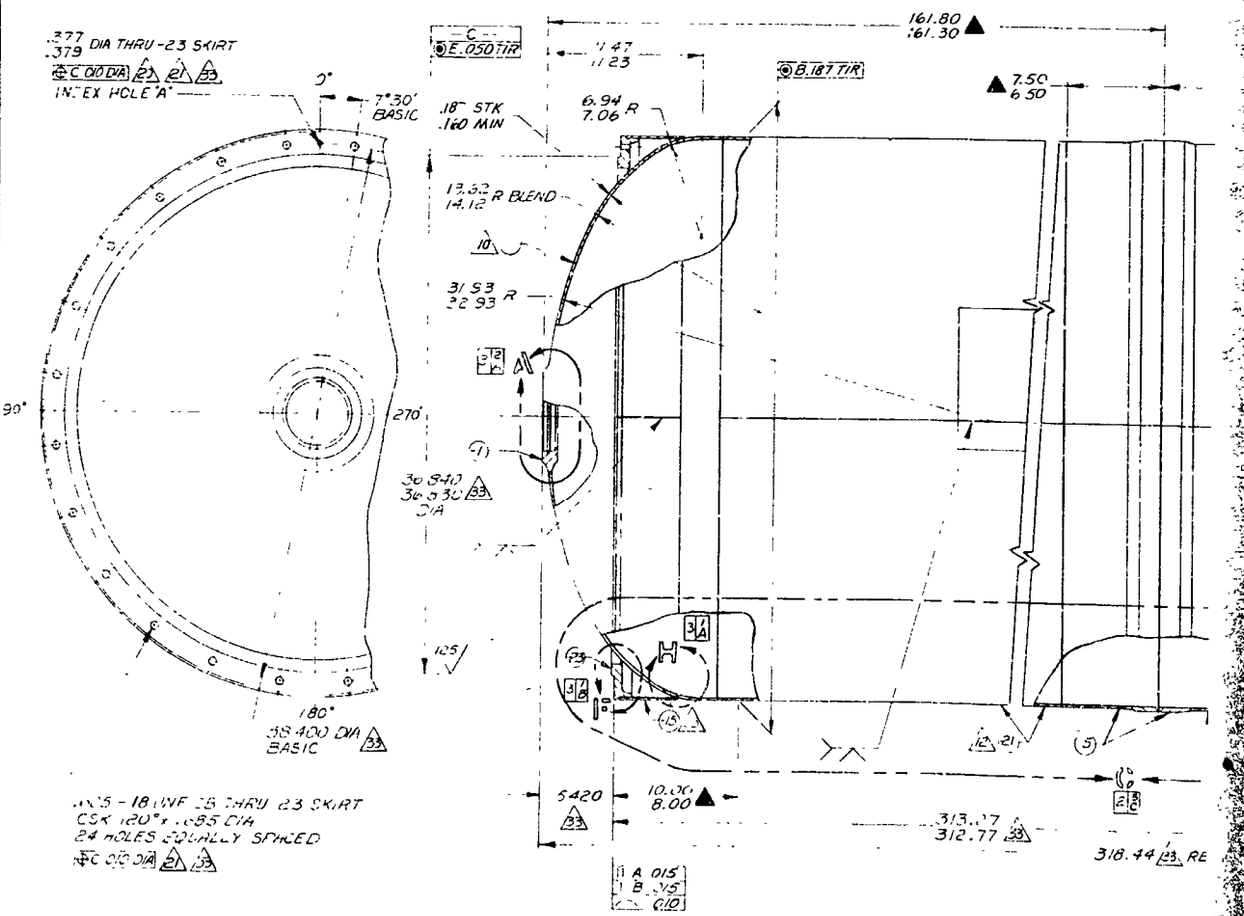
TITLE: CHAMBER ASSY

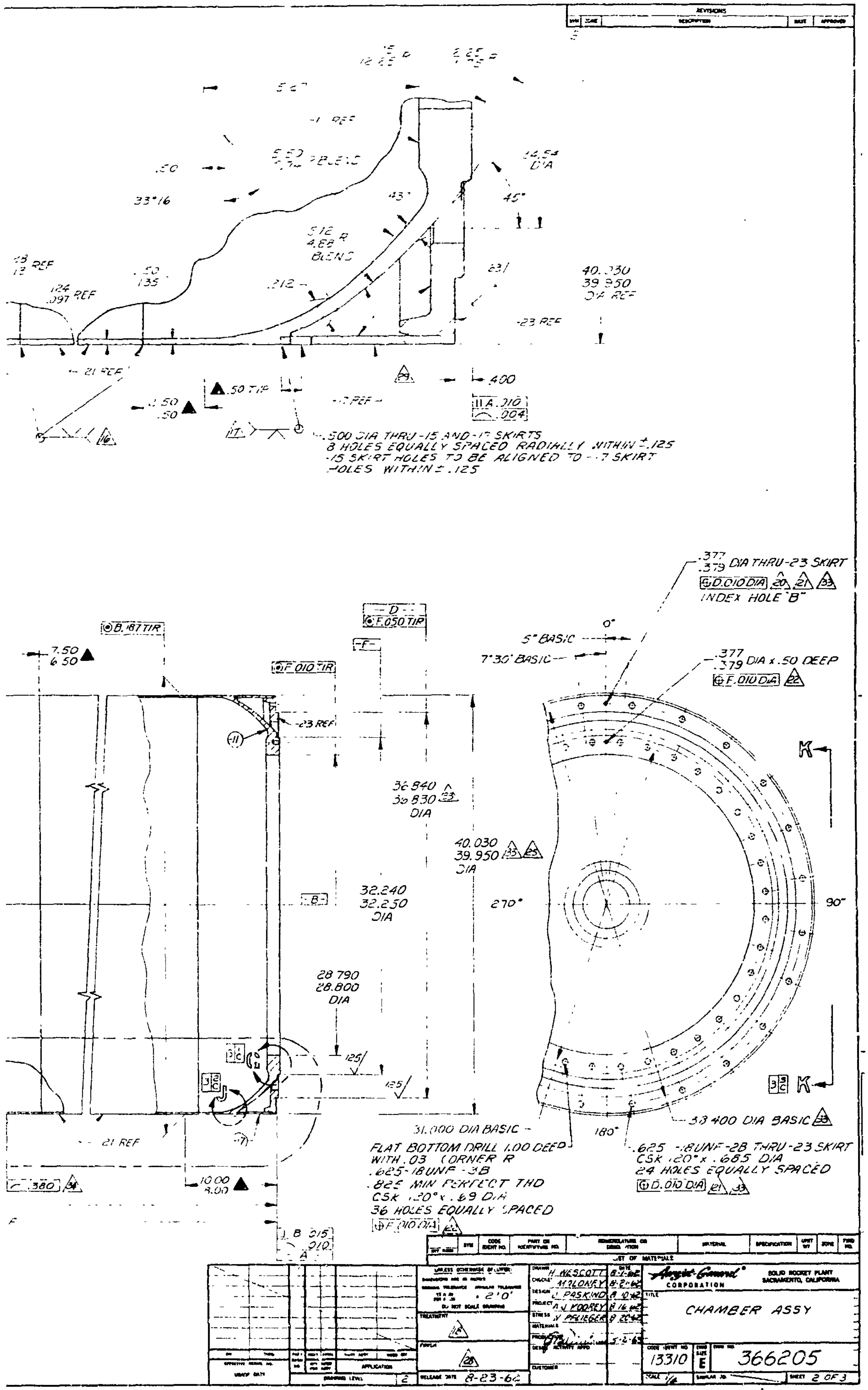
CODE IDENT NO. 13310 | DWG SIZE E | DWG NO. 366205

SCALE 1/4 | SIMILAR TO | SHEET 1 OF 3

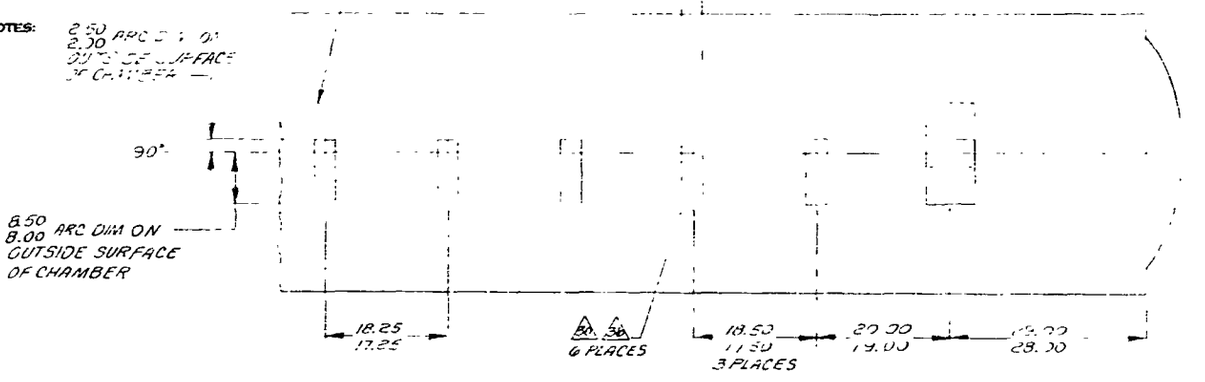
NOTES:


.13 REF
.187 STK
.175 MIN
.15 REF
.124
.097
.129
.113
40.186
DIA REF
.210
.03 REF
.60 TYP
3.00
2.50
.50 REF
2.50
.50
.21 REF
.5 REF
1.50
TYP
2.31
TYP
24 PLACES EQUALLY SPACED
RADIALLY WITHIN .125 TYP
BOTH ENDS
DETAIL
SCALE 1/1

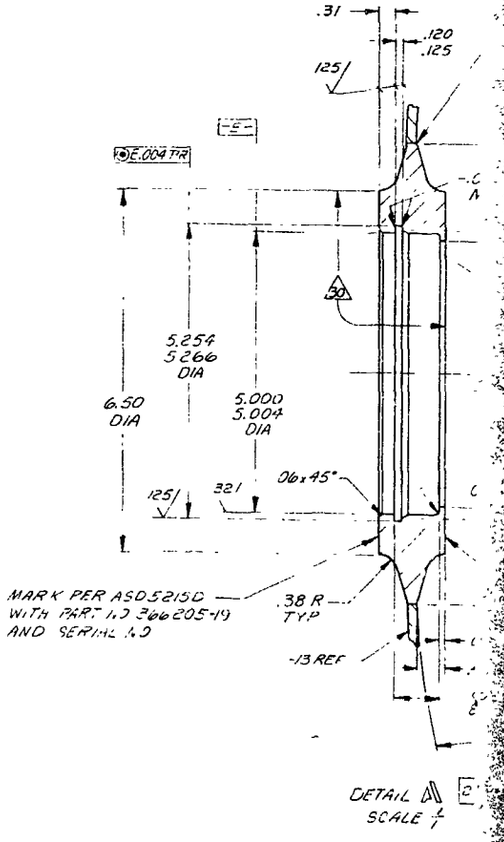

.377
.379 DIA THRU -23 SKIRT
C 00 DIA
INDEX HOLE 'A'
0°
7°30'
BASIC
90°
270°
180°
38.400 DIA
BASIC
.18 STK
.160 MIN
6.94
7.06 R
13.62
14.12 R BLEND
31.93
32.93 R
30.840
30.930 DIA
.125
E .050 TIR
B .187 TIR
161.80
161.30
1.47
1.23
7.50
6.50
5.420
10.00
8.00
313.07
312.77
318.44 REF
.1365 - 18 UNF 2B THRU -23 SKIRT
CSK 120° x .185 DIA
24 HOLES EQUALLY SPACED
C 00 DIA


REVISIONS
.500 DIA THRU -15 AND -17 SKIRTS
8 HOLES EQUALLY SPACED RADIALLY WITHIN ±.125
-15 SKIRT HOLES TO BE ALIGNED TO -17 SKIRT
HOLES WITHIN ±.125
.377
.379 DIA THRU -23 SKIRT
INDEX HOLE "B"
5° BASIC
7°30' BASIC
.377
.379 DIA x .50 DEEP
36.840
36.830
DIA
40.030
39.950
DIA
32.240
32.250
DIA
28.790
28.800
DIA
270°
90°
180°
31.000 DIA BASIC
38.400 DIA BASIC
FLAT BOTTOM DRILL 1.00 DEEP
WITH .03 CORNER R
.625-18UNF-3B
.825 MIN PERFECT THD
CSK 120° x .69 DIA
36 HOLES EQUALLY SPACED
.625-18UNF-2B THRU -23 SKIRT
CSK 120° x .685 DIA
24 HOLES EQUALLY SPACED
21 REF
LIST OF MATERIALS
Aerojet-General CORPORATION
SOLID ROCKET PLANT
SACRAMENTO, CALIFORNIA
CHAMBER ASSY
13310
E
366205
SHEET 2 OF 3
RELEASE DATE 8-23-62

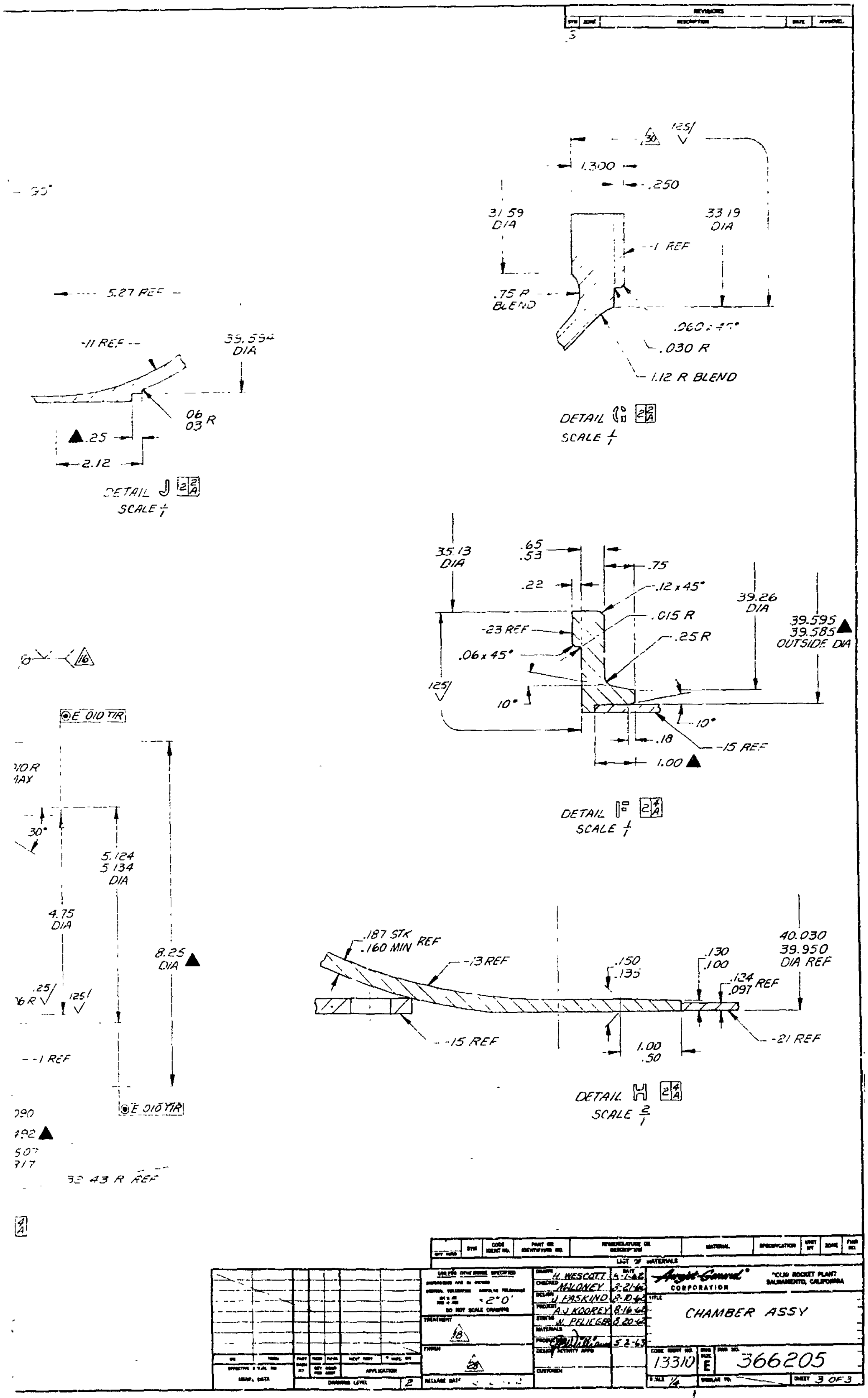
NOTES:



VIEW K-K [2] [A]
SCALE 1/8
2 PLACES 180° APART



DETAIL [A] [2]
SCALE 1/1


5.27 REF
-11 REF
39.594 DIA
06 03 R
.25
2.12
DETAIL J 2/A
SCALE 1/1
1.300
.250
31.59 DIA
33.19 DIA
-1 REF
.75 R BLEND
.060 x 45°
.030 R
1.12 R BLEND
DETAIL G 2/A
SCALE 1/1
35.13 DIA
.65 .53
.22
.75
.12 x 45°
.015 R
.25 R
-23 REF
.06 x 45°
39.26 DIA
39.595 39.585 OUTSIDE DIA
10°
.18
-15 REF
1.00
DETAIL F 2/A
SCALE 1/1
.187 STK .160 MIN REF
-13 REF
.150 .135
.130 .100
.124 .097 REF
40.030 39.950 DIA REF
-15 REF
-21 REF
1.00 .50
DETAIL H 2/A
SCALE 2/1
E .010 TIR
30°
5.124 5.134 DIA
4.75 DIA
8.25 DIA
-1 REF
32.43 R REF
LIST OF MATERIALS
H. WESCOTT
MALONEY
J. PASKIND
A.J. KOOREY
N. PELLEGER
Aerojet-General CORPORATION
SOLID ROCKET PLANT SACRAMENTO, CALIFORNIA
CHAMBER ASSY
13310
E
366205
SCALE 1/4
SHEET 3 OF 3

NOTES

1 REMOVED.

2 REMOVED.

3 APPLY ADHESIVE PER 4 TO THREADS OR MATING SURFACES IMMEDIATELY BEFORE ASSEMBLY.

4 ADHESIVE IS TO CONSIST OF 9 ± 1 PARTS DIETHYLENETRIAMINE TO 100 PARTS EPOXY RESIN. PARTS BY WEIGHT.

5 SEPARATE EACH ROW OF CLO PELLETS OR ALCLO GRAINS WITH ONE AS1382-53 CUSHION.

6 LOAD CAVITY WITH 2 ± .1 GRAMS INITIATOR CHARGE CONSISTING OF EQUAL PARTS BY WEIGHT OF AGC-32014 PYROTECHNIC POWDER AND AGC-34154 IGNITION POWDER. OMIT VEGETABLE OIL FROM AGC-32014 PYROTECHNIC POWDER.

7 REMOVED

8 QUANTITY REQUIRED 3000 ± 10 GRAMS.

9 PACKAGING, PACKING, MARKING AND SHIPPING PER PPD SHEET NO. 3456.

10 MARK TAG PER ASD 5215F WITH SQUIB RESISTANCE.

11 VENDOR ITEM, SEE SPEC CONTROL DRAWING.

12 REMOVED.

13 REMOVED.

14 APPLY ADHESIVE PER 4 TO 369581-9 RETAINER ASSY SUPPORTS PRIOR TO INSTALLATION.

15 REMOVED

16 SCRIBE 4 MARKS AFTER ASSY, .50 LONG X .01 WIDE X .020 DEEP ON FORWARD FACE OF 368062-1. SCRIBE MARKS TO BE IN LINE WITH EACH OF THE 4 HOLES IN 368101-19.

17 APPLY SEALING COMPOUND PER MIL-S-7916 TO THREADS ON 368071 IMMEDIATELY BEFORE ASSY.

18 TORQUE TO 6 ± 1 FT LBS.

19 TORQUE TO 50/70 INCH LBS.

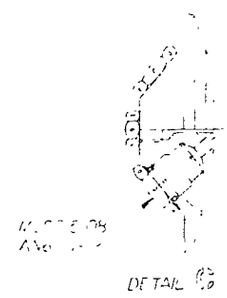
20 APPLY TAPE NO. 950 TO SURFACES INDICATED.

21 BOND AS1609-13011-13 TO 367343-29 WITH ADHESIVE PER 4.

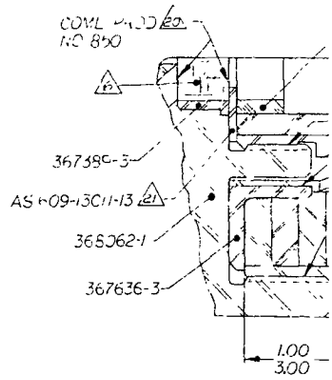
22 CLEAN MATING SURFACES PER AGC-46350 LEVEL H. APPLY NRL-1795 INSULATION AND CURE AT AMBIENT TEMPERATURE FOR 4 HRS.

23 MAINTAIN FIRM PELLET PACKING.

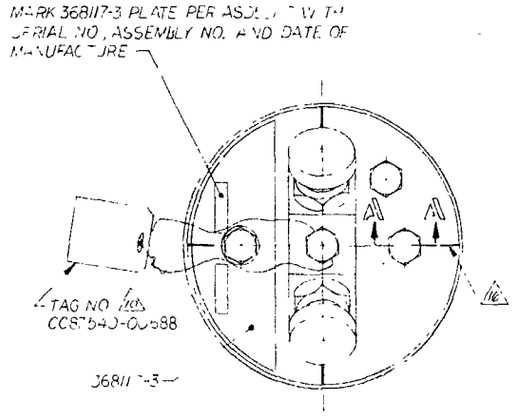
24 CLASSIFICATION OF CHARACTERISTICS ARE DESCRIBED ON A SEPARATE DOCUMENT 367345.

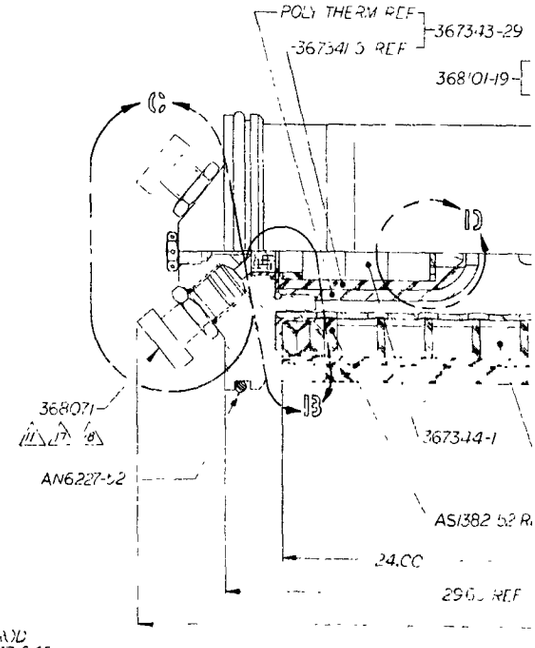


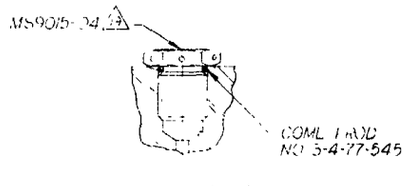
DETAIL

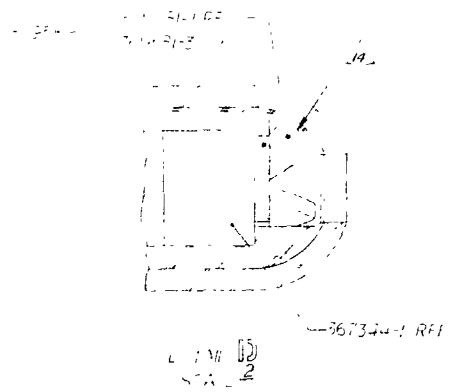


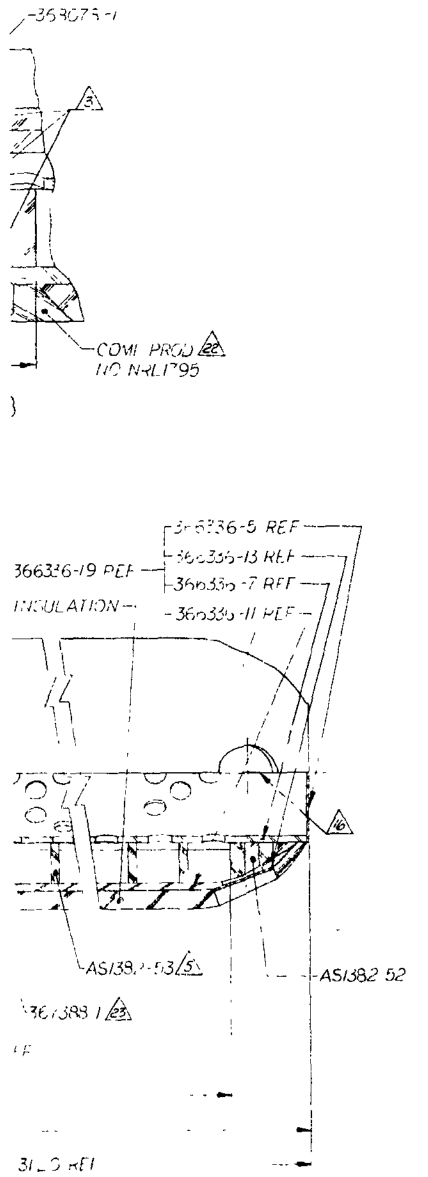
DETAIL
SCALE 2/1











Note	Qty Reqd	Code Ident No.	Part or Identifying No.	Nomenclature or Description	Material	Specification	Unit Wt	Zone
17	AR			SEALING COMPOUND		MIL-S-7916		
4	AR			DIETHYLENETRIAMINE		MIL-D-50025		
4	AR			RESIN, TYPE III		AGC-10758		
6	AR			POWDER, IGNITION		AGC-34154		
6	AR			POWDER, PYROTECHNIC		AGC-32014		
	4	13259	3-4 77-545	O RING			1	3A
22	AR		NRL-1795	INSULATION: INSULATION TECHNOLOGY INC CARMICHAEL CALIF			1	2C
20	AR	76381	850	TAPE			1	3C
	1	13310	CC87540-00688	TAG, IGNITER (AGC-3-109-099)			1	4B
	2		AN6227-12	PACKING O RING			1	3D
	1		AN6227-52	PACKING 'O' RING			1	3A
	1		MS9015-04	PLUG			1	4A
	2		MS9015-08	PLUG			1	3D
	1		AS1609-13C11-13	WASHER FLAT			1	3C
	AR		AS1382-53	CUSHION			1	2A
	AR		AS1382-52	CUSHION			1	2A
	1		369581-9	RETAINER, ASSY			1	2D
	1		368117-3	PLATE, IDENTIFICATION			1	4A
	1		368101-19	CHAMBER, INSULATED			1	3B
	1		368078-1	RETAINER, BOOSTER GRAIN			1	2C
11	2		368071	SQUIB			1	3A
	1		368062-1	ADAPTER			1	3C
	1		367636-3	RETAINER, CHAMBER			1	3C
	1		367389-3	INSULATOR			1	3C
8	1		367338-1	GRAIN, ALCLO			1	2A
	3		367344-1	GRAIN, ALCLO, BOOSTER			1	3A
	1		367343-29	CHAMBER, BOOSTER			1	3B

REMOVED REMOVED REMOVED REMOVED REMOVED REMOVED REMOVED

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. DO NOT SCALE DRAWING

DRAWN J. GLORIOSO 9-21-62
CHECKED D. RAHL 10-29-62
DESIGN J. GULLIVA 10-15-62
PROJECT L. PASKIND 10-17-62
STRESS S. RIKOPELLO 10-15-62
DESIGN ACTIVITY APPR. J. PASKIND 5-15-63

Aerojet-General CORPORATION — SOLID ROCKET PLANT SACRAMENTO, CALIFORNIA

TITLE: IGNITER ASSEMBLY

CODE IDENT NO. 13310 | DWG SIZE E | DWG NO. 367345

RELEASE DATE 10-29-62

NEXT ASSY: 367???-9 MOD II; 367906 MOD II

APPLICATION | USAGE DATA | DRAWING LEVEL 2

NOTES 1 REMOVE ALL BURRS AND SHARP EDGES.

2 INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS PRESCRIBED BY MIL-D-70327.

3 SURFACE ROUGHNESS TO BE 125 UNLESS OTHERWISE SPECIFIED.

4 HEAT TREAT TO 200,000 - 220,000 PSI ULTIMATE TENSILE STRENGTH PER MIL-H-6875.

5 MAGNETIC PARTICLE INSPECT PER MIL-I-6868 AFTER HYDROTEST. NO DEFECTS ALLOWED.

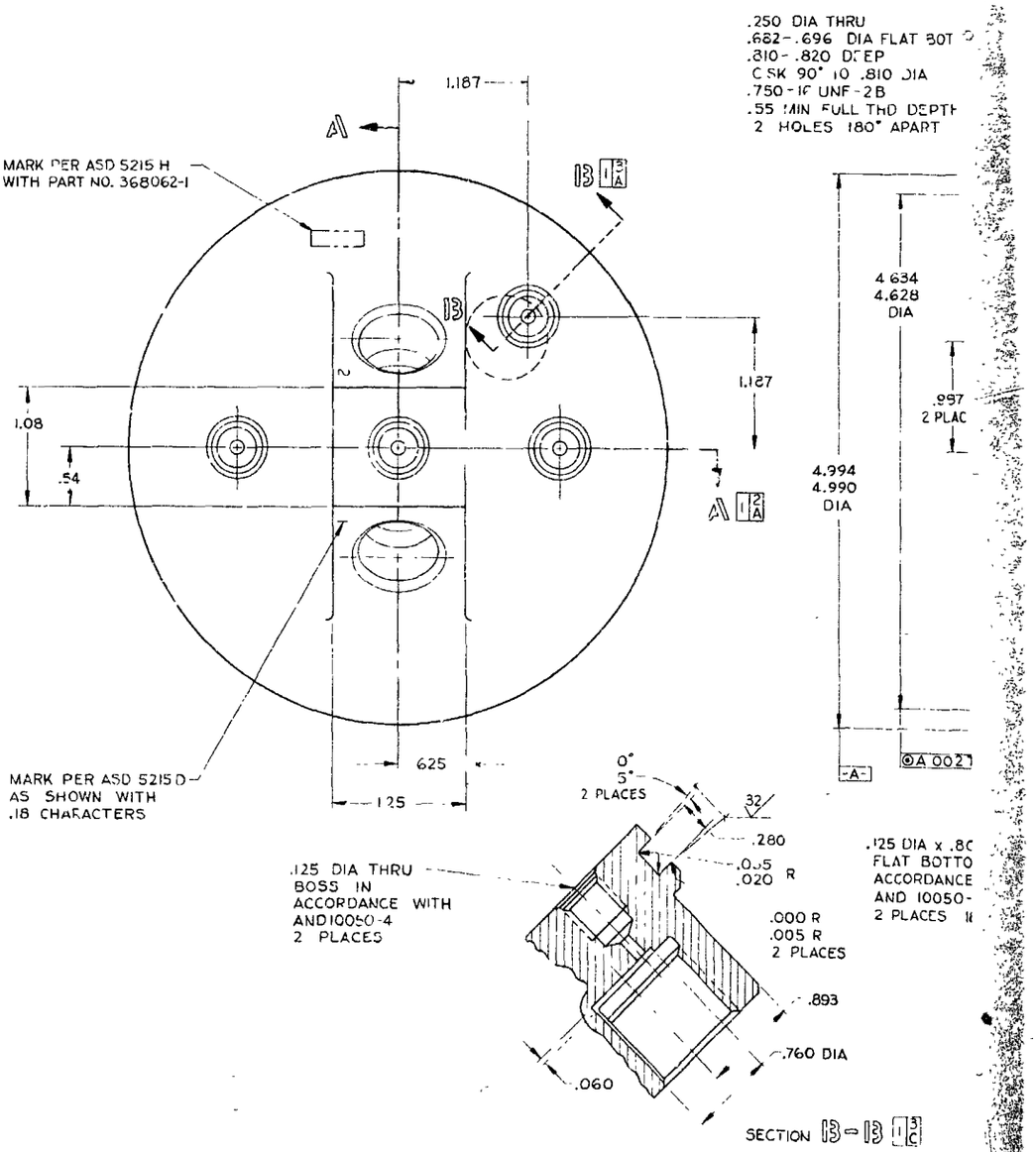
6 ALL DIMENSIONS APPLY AFTER PLATING.

7 HYDROSTATIC PROOF TEST SURFACES INDICATED TO 10,000 PSIG MINIMUM USING OIL, PER AGC-36140/3. HOLD FOR 3 ONE-MINUTE CYCLES. NO DEFECTS PERMISSIBLE.

8 THREADS PER NBS HANDBOOK H-28.

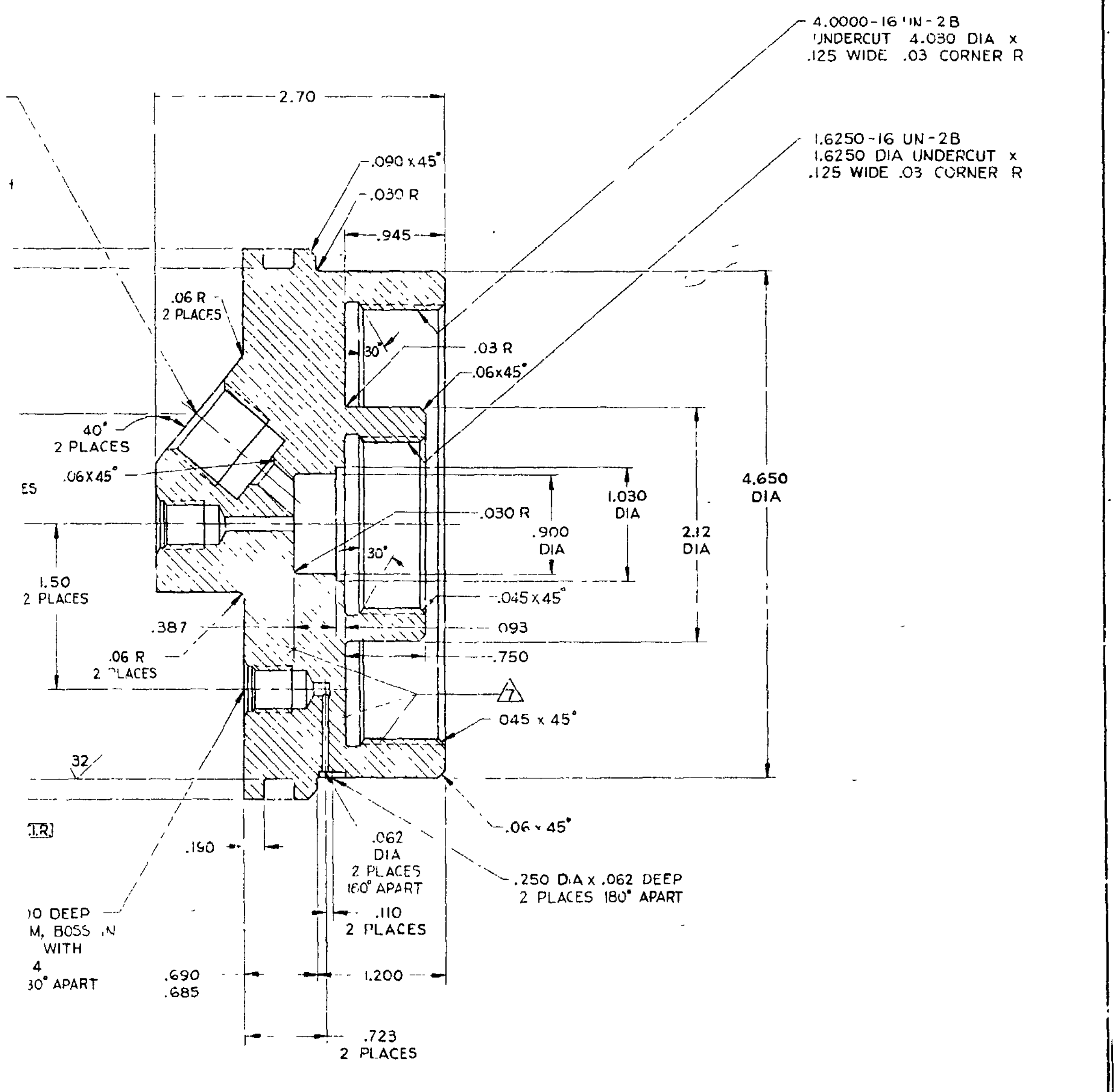
9 CLASSIFICATION OF CHARACTERISTICS ARE DESCRIBED ON A SEPARATE DOCUMENT NO. 368062.

10 ALL CORNER RADII TO BE .005 - .015 UNLESS OTHERWISE SPECIFIED.



REVISIONS

SYM	ZONE	DESCRIPTION	DATE	APPROVED
		... ER...IL FE ...ACES 368062		
		... G. DW... ...VEL WAS 1 SEE B CHG DCN		



SECTION A-A

QTY REQD		SYM	CODE IDENT NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL	SPECIFICATION	UNIT WT	ZONE	FIND NO.
				-1		4340 STL COND D2	MIL-S-5000			

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED
DO NOT SCALE DRAWING

TREATMENT 4

FINISH QQ-P-416 CL 2 TYPE II 6

RELEASE DATE 11-14-62

		DATE
DRAWN	J J GLORIOSO	11-6-62
CHECKED	D PAHL	11-19-62
DESIGN	D L NACHBAR	11-12-62
PROJECT	J Q TABOR JR	11-19-62
STRESS	KRIKPULO	11-12-62
MATERIALS		
PROJECT		5-31-63
DESIGN ACTIVITY APPD	J PASKIND	4-21-63
CUSTOMER		

Aerojet-General CORPORATION
SOLID ROCKET PLANT
SACRAMENTO, CALIFORNIA

TITLE ADAPTER, IGNITER

CODE IDENT NO. 13310 | SIZE E | DWG NO. 368062

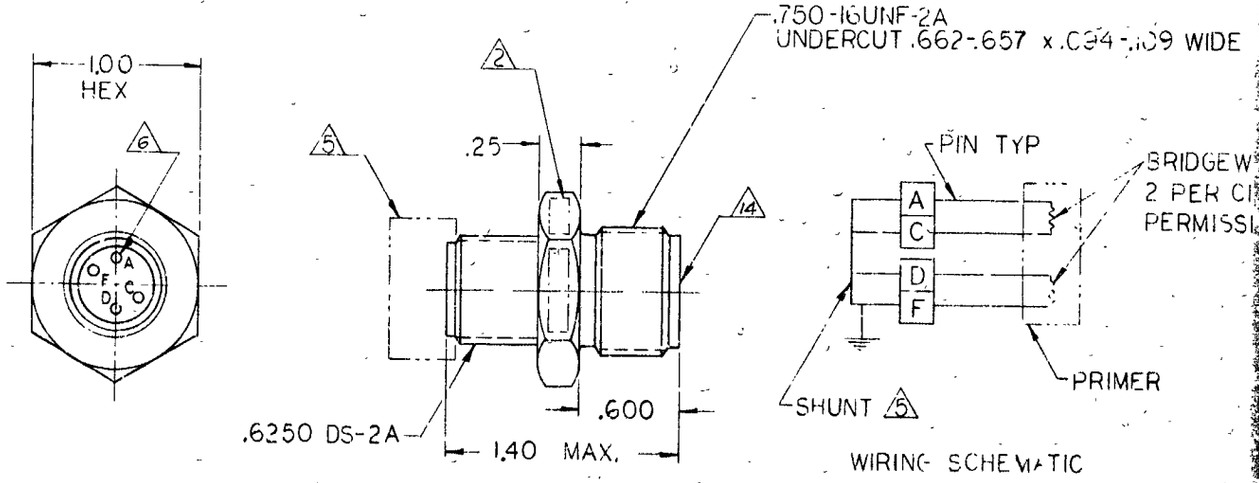
SCALE 2/1 | SHEET

-1						-1		367345-...	
PART DASH NO.	ACT. WEIGHT	CALC APPD							

USAGE DATA | APPLICATION | DRAWING LEVEL 2

NOTES:

1. REMOVE ALL BURRS AND SHARP EDGES.
2. IDENTIFY WITH VENDOR PART NO., AGC SPECIFICATION CONTROL DRAWING NUMBER 368071 AND SERIAL NO. PER ASD 52150.
3. INTERPRET DRAWING IN ACCORDANCE WITH THE STANDARDS PRESCRIBED BY MIL-D-70327.
4. SURFACE ROUGHNESS 125/ UNLESS OTHERWISE SPECIFIED.
5. SHUNT TO INSURE GROUNDING FROM PIN TO PIN AND ALL PINS TO CASE. MAXIMUM SHUNT RESISTANCE TO BE ONE-TENTH OF MINIMUM BRIDGEWIRE RESISTANCE. METAL FOIL SHUNTS NOT PERMISSIBLE.
6. BRIDGEWIRE PIN SPACING TO BE ACCOMPLISHED BY USING A CONNECTOR WHICH MATES WITH BENDIX PC06-10-6S CONNECTOR. PINS TO BE LETTERED CLOCKWISE WITH PIN A AT INDEX POINT OF CONNECTOR. PINS B AND E TO BE REMOVED. BRIDGEWIRES TO BE ATTACHED BETWEEN PINS A-C AND D-F.
7. THE INTEGRITY OF THE BRIDGEWIRE WELD SHALL BE DETERMINED BY MICROSCOPIC EXAMINATION, ELECTRICAL TEST, AND BRIDGEWIRE PULL TEST.
8. THE BRIDGEWIRE SHALL BE COVERED BY THE PRIME COMPOSITION WHICH IN TURN SHALL BE PREVENTED FROM MIGRATING FROM CONTACT WHEN BRIDGEWIRE IS UNDER VIBRATION. THE USE OF PRIMER OR IGNITION COMPOSITION IN THE FORM OF A BEAD OR PAINTED ON THE BRIDGEWIRE SHALL NOT BE ACCEPTABLE.
9. DETONATING MATERIALS ARE NOT PERMISSIBLE FOR USE AS A PRIMER CHARGE.
10. SQUIBS SHALL BE SHIPPED IN A MOISTURE PROOF CONTAINER CAPABLE OF BEING VAPOR SEALED. INDICATING DESICCANT PER MIL-D-3464 SHALL BE PLACED IN EACH CONTAINER, PRIOR TO SHIPMENT. CONTAINERS SHALL BE CLEARLY MARKED PER MIL-STD-129 WITH PART NUMBER, LOT NUMBER, AND DATE OF MANUFACTURE.
11. ALL DELIVERED LOTS OF ORDNANCE ITEMS OR COMPONENTS WILL CONTAIN PYROTECHNIC MATERIALS MANUFACTURED FROM A SINGLE BATCH.
12. CHANGING TYPE OF MATERIAL AND/OR METHOD OF CONSTRUCTION SHALL NOT BE PERMITTED WITHIN A LOT.
13. ALL VENDOR DETAIL DRAWINGS AND SUBSEQUENT CHANGES SHALL BE REVIEWED BY COGNIZANT AGC ENGINEERING PERSONNEL PRIOR TO MANUFACTURE OF PARTS.
14. NO SHRAPNEL PERMISSIBLE FROM CLOSURE. CLOSURE MAY BE SCORED TO EFFECT PETAL OPENING OR MAY BE CONSUMABLE.
15. CLASSIFICATION OF CHARACTERISTICS ARE DESCRIBED ON A SEPARATE DOCUMENT NO.368071.



REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
A		SEE A CHANGE DCN		
		SEE RECORD DCN DATED 5-6-63, DWG LEVEL WAS "1"	5-9-63	

NO FIRE DESIGN CAPABILITY

1. NO FIRE CURRENT EACH BRIDGEWIRE CIRCUIT 1.0 AMP MIN. 5 MINUTES MIN.
2. NO FIRE WATTAGE EACH BRIDGEWIRE CIRCUIT 1.0 WATT MIN. 5 MINUTES MIN.
3. NO FIRE VOLTAGE, PIN TO CASE 1000 V AC RMS MINIMUM.
4. STATIC DISCHARGE OF 0.01 JOULE FROM A 0.04 MICRO FARAD CAPACITOR APPLIED FROM SHUNTED LEADS TO CASE.

FUNCTIONAL DESIGN CAPABILITY

A. 100% FIRING CURRENT EACH BRIDGEWIRE CIRCUIT 4.5 AMPS.
B. RESISTANCE EACH BRIDGEWIRE CIRCUIT 0.5 OHMS MINIMUM.
C. ALTITUDE CAPABILITY SEA LEVEL TO 200.000 FT.
D. MIN AUTO IGNITION TEMP 350°F FOR 8 HOURS.

PHYSICAL DATA

1. SQUIB SEAL SHALL BE GLASS OR CERAMIC TO METAL.
2. INITIATOR CHARGE TO CONSIST OF .600 ± .01 GRAMS OF EQUAL PARTS BY WEIGHT OF IGNITION POWDER PER AGC-34154 AND PYROTECHNIC POWDER A 35 MI, PER AGC-32014.
3. DUAL BRIDGEWIRE CIRCUITS.
4. CLOSURE TO BE RESISTANCE WELDED PER MIL-W-6858 CLASS B OR SOFT SOLDERED PER MIL-S-6872.
5. CONNECTOR END MATES WITH BENDIX PC 06-10-6S STRAIGHT PLUG.
6. SQUIB CASE TO BE B-1113/C-1213 PER QQ-S-633, CD HEX., CADMIUM PLATED PER QQ-P-416, TYPE 1, CLASS 1.
7. PRESSURE TEST GLASS TO METAL SEAL WITH DRY N_2 FOR 10 SECONDS AT 10,000 PSIG PRIOR TO PLATING. TEST FOR LEAKS WITH LEAK TEST COMPOUND, TYPE 1 PER MIL-L-25567. NO LEAKAGE PERMITTED. UNITS WILL BE ACCEPTED ON AN INDIVIDUAL BASIS.

SPECIFICATION CONTROL DRAWING

IRES
RCUIT
BLE

QTY REQD	SYM	CODE IDENT NO.	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL	SPECIFICATION	UNIT WT.	ZONE	FIND NO.

LIST OF MATERIALS

PART DASH NO.	QTY REQD PER ASSY (NEXT)	QTY REQD PER ASSY (FINAL)	NEXT ASSY	USED ON
	2	2	367345-79	

APPLICATION

EFFECTIVE SERIAL NO. ON / THRU — USAGE DATA

DRAWING LEVEL 2

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
DECIMAL TOLERANCE .XX ± .XX .XXX ± .XXX — ANGULAR TOLERANCE ± —
DO NOT SCALE DRAWING

TREATMENT

FINISH

RELEASE DATE 11-13-62

		DATE
DRAWN	I. E. RICH	11-9-62
CHECKED		11-13-62
DESIGN	Q. Tabor Jr	11-13-62
PROJECT	A J	11-13-62
STRESS		
MATERIALS		
PRODUCTION		3-14-63
DESIGN ACTIVITY APPD		
CUSTOMER		

Aerojet-General CORPORATION — SOLID ROCKET PLANT SACRAMENTO, CALIFORNIA

TITLE SQUIB, ELECTRIC

CODE IDENT NO. 13310 | DWG SIZE D | DWG NO. 368071

SCALE 2/1 | SIMILAR TO 366554 | SHEET

0667-02

368071

C. FUNCTIONAL/ENVIRONMENTAL CHARACTERISTICS

The following sections define all the logistic and performance data applicable to handling of the motor and use of the motor for performance of a mission: the motor and component weights, motor weight distribution, environmental capabilities, and performance characteristics.

The limited number of samples that have been measured renders the establishment of performance parameters beyond a cursory one-sigma limit statistically unreliable.

C.1. GENERAL MOTOR CHARACTERISTICS

The following information will be replaced with data derived from the Aerojet-General Corporation computer program as soon as it becomes available.

Specific motor characteristics and predicted performance curves will be available in the individual motor log books of delivered units.

C-1. PERFORMANCE DEFINITIONS

1.0 Definition of times as shown on Figure #1

1.1 (t-1) Fire Switch

1.2 (t-3) Point at which the tangent to the ascending pressure curve intersects the zero pressure line. Further definition will be furnished after first test.

1.3 (t-3) 90% of initial maxim- pressure rise (not max pressure).

1.4 (t-4) Point at which the bisector of the angle, formed by lines tangent to the "level" and descending portion of the pressure curve, intersects the pressure curve.

1.5 (t-5) Point at which, the line tangent to the descending portion of the pressure curve, intersects the zero pressure line. (Draw tangent parallel to line through points at 20% and 80% of max. pressure).

2.0 Reduction requirements (to be tabulated on the Test Data Sheet)

2.1 Ignition delay (t_d): Interval between points t-1 and t-2

2.2 Ignition Interval (t_i): Interval between time points t-2 and t-3

2.3 Web Burning time (t_b): Interval between time points t-3 and t-4

2.4 Total Duration (t_t): Interval between time points t-2 and t-5

2.5 Average Pressure ($\bar{P}_c$), Total Duration

$$\bar{P}_c = \frac{\int_{t-5}^{t-2} P dt_t}{t_t}$$

2.6 Average Web Burning Pressure ($\bar{P}_{cb}$)

$$\bar{P}_{cb} = \frac{\int_{t-4}^{t-3} P dt_b}{t_b}$$

2.7 Average Thrust ($\bar{F}$), Total Duration

$$\bar{F} = \frac{\int_{t-5}^{t-2} F dt_t}{t_t}$$

2.8 Average Thrust, Web Burning ($\bar{F}_b$)

$$\bar{F}_b = \frac{\int_{t=4}^{t=3} F\,dt_b}{t_b}$$

2.9 Total Impulse (I_t)

$$I_t = \int_{t=5}^{t=2} F\,dt_t$$

2.10 Specific Impulse (I_{sp}), Total Overall, Measured

$$Isp = \frac{I_t}{W_p \text{ (Total propellant wt.)}}$$

2.11 Web Burning Impulse, (I_b)

$$I_b = \int_{t=4}^{t=3} F\,dt_b$$

2.12 Coefficient of Thrust, (C_f)

$$C_f = \frac{\bar{F}}{P_c\ A_t(\text{avg.})}$$

2.13 Characteristic Velocity, (C*)

$$C^* = \frac{I_{sp}(g)}{C_f}$$

2.14 Mass Flow Rate, ($\overset{o}{W}$)

$$\overset{o}{W} = \frac{W_p \text{ (Total propellant wt.)}}{t_t}$$

2.15 Propellant Burning Rate, (r_b), Average

$$r_b = \frac{\text{Web Thickness (in.)}}{t_b}$$

2.16 Mass Flow Coefficient, (C_w)

$$C_w = \frac{\overset{o}{W}}{P_c\ A_t(\text{avg})}$$

2.17 Force Vector Angle θ_v

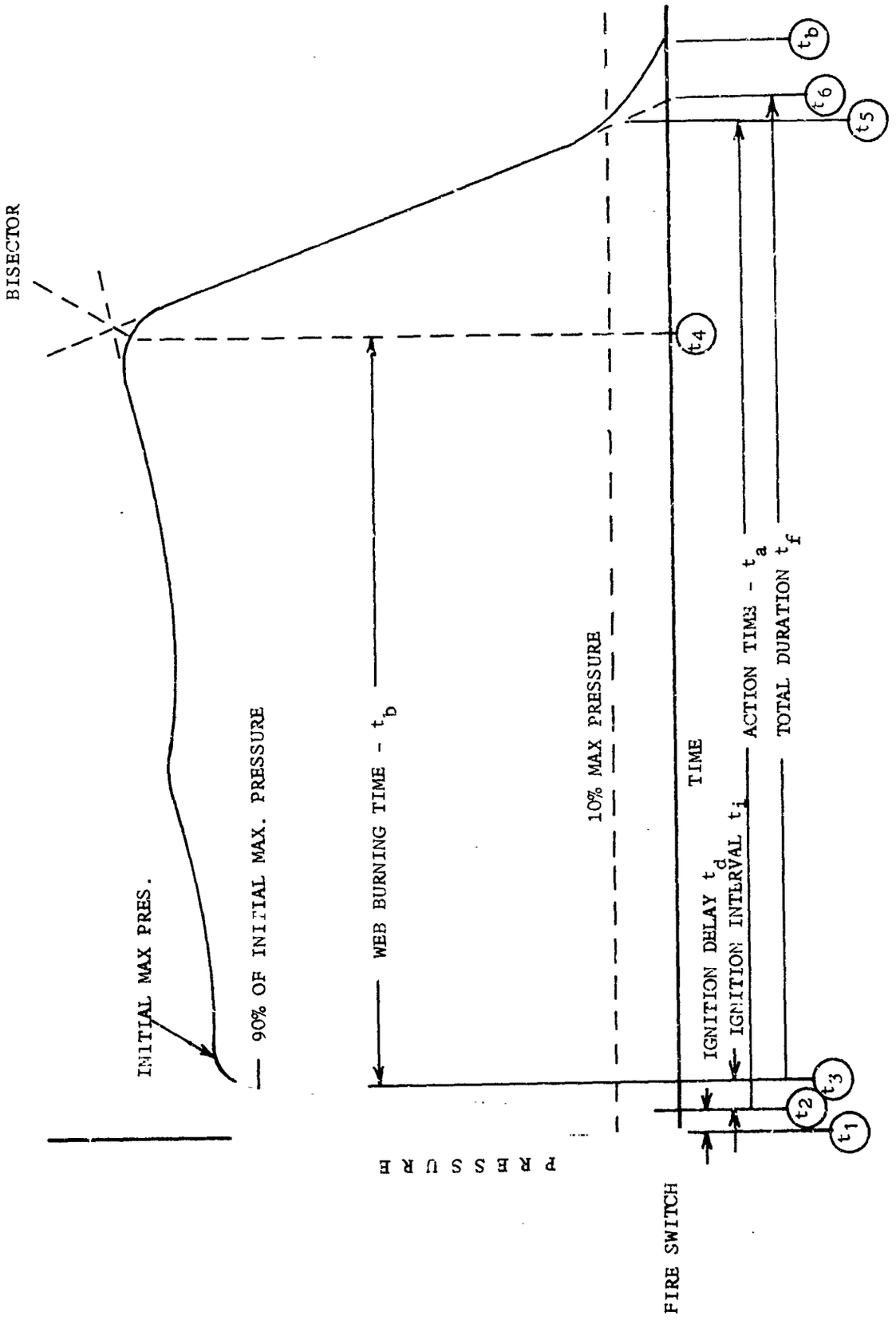
$$\theta_v = \tan^{-1} \frac{\bar{F}_z K}{\bar{F}_y}$$

$\bar{F}_z$ = Average measured aft side force during total duration

$\bar{F}_y$ = Average measured axial force during total duration

K = 0.976. This is determined from the moments to the throat center vs. aft side force take outpoint.

2.18 Absolute pressures must be used for all reduction.


BISECTOR
INITIAL MAX PRES.
90% OF INITIAL MAX. PRESSURE
WEB BURNING TIME - t_b
10% MAX PRESSURE
IGNITION DELAY t_d
IGNITION INTERVAL t_i
ACTION TIME - t_a
TOTAL DURATION t_f
TIME
PRESSURE
FIRE SWITCH
t_1
t_2
t_3
t_4
t_5
t_6
t_b

C-2
GENERAL MOTOR CHARACTERISTICS

	Algol ID Mod 2 Design	ALGOL I[a]			
		Design	Mean Value Measured[b]	σ(One Standard Deviation)[b]	Motors Measured
Loaded motor weight,* lbm	22,152	--	--	47	19
Propellant weight,* lbm	19,000	18,988	18,986	51	20
Inert parts weight,* lbm	3,130****	--	--	28	19
C_w (total burning time), lbm/lbf sec	.00642	.00642	--	.00007	5
Nozzle expansion ratio (A_e/A_t)	4.64	4.64	--	--	--
Throat area,* sq in.	175.33	175.33	--	--	--
Propellant weight fraction (W_p/W_m)***	0.858	--	--	.0014	19
Overall length,** in. chamber diameter, in.	357.61	357.61	--	--	--

* Individual motor "actual" values will be obtained during motor processing and will be included in motor log book.

** Measured from forward face of igniter boss to aft face of nozzle seal (nozzle in 0-degree-cant position).

*** W_p = propellant weight; W_m = loaded-motor weight.

**** Does not include igniter weight.

a. Data is shown for various models of the basic Algol motor. Design values are quoted for the ID configuration, and most nearly represent the Mod 2 and Mod 1 versions.

b. Mean measured values and standard deviations include variation due to temperature effects over a range extending from +30 to +50°F. All data was measured under sea-level conditions and E = 4.64.

Mean value measured = $\frac{\Sigma x}{n}$; x = value measured, n = number of samples.

$\sigma = \sqrt{\frac{\Sigma D1}{n-1}}$; D = deviation of value measured from mean value $\left(\frac{\Sigma x}{n}\right)$.

C-3

MOTOR BALLISTIC CHARACTERISTICS

	Algol ID Mod 2 Design	Algol I[a] Design	Mean[b] Value Measured	One Standard Deviation	Motors Measured
Average thrust (web),* lbf	102,227	102,227	104,310	2,905	5
Average thrust (total),* lbf	96,650	96,650	98,060	3,038	5
Maximum Thrust,* lbf	115,000	115,000	--	--	--
Impulse (web),* lbf-sec	3,671,675	3,671,675	3,713,405	95,000	4
Impulse (total),* lbf-sec	4,070,598	4,070,598	4,077,802	17,720	4
Specific impulse (overall)* lbf-sec/lbm (actual)	214.4	214.4	214.4	1.14	5
Average pressure (web), psia	427.8	427.8	429	7.0	5
Average pressure (total), psia	400.6	400.6	406	8.8	5
Maximum pressure, psia	450.0	450.0	--	--	--
Propellant type	ANP-2639 AF	ANP-2639 AF			
π_k, %/°F	0.19	0.19	--	--	--
Ignition delay, sec	0.083	0.083	0.100	0.027	5
Ignition interval, sec	0.051	0.051	0.058	0.004	5
Web burning time, sec	35.9	35.9	36.06	0.65	4
Total burning time, sec	42.1	42.1	41.29	1.76	4
Burning rate, in./sec	0.254	0.254	0.254	0.008	5
Weight flow rate, lbm/sec	450.8	450.8	457	14.0	5
C_f (total burning time)	1.376	1.376	1.38	0.013	5
CG loaded (calculated) **	167.3	--	--	0.30	18
CG empty (calculated) **	220.8	--	--	0.84	19

a. Delivered along thrust axis, nozzle in 0-degree-cant position.

b. Inches aft of front face of igniter boss.

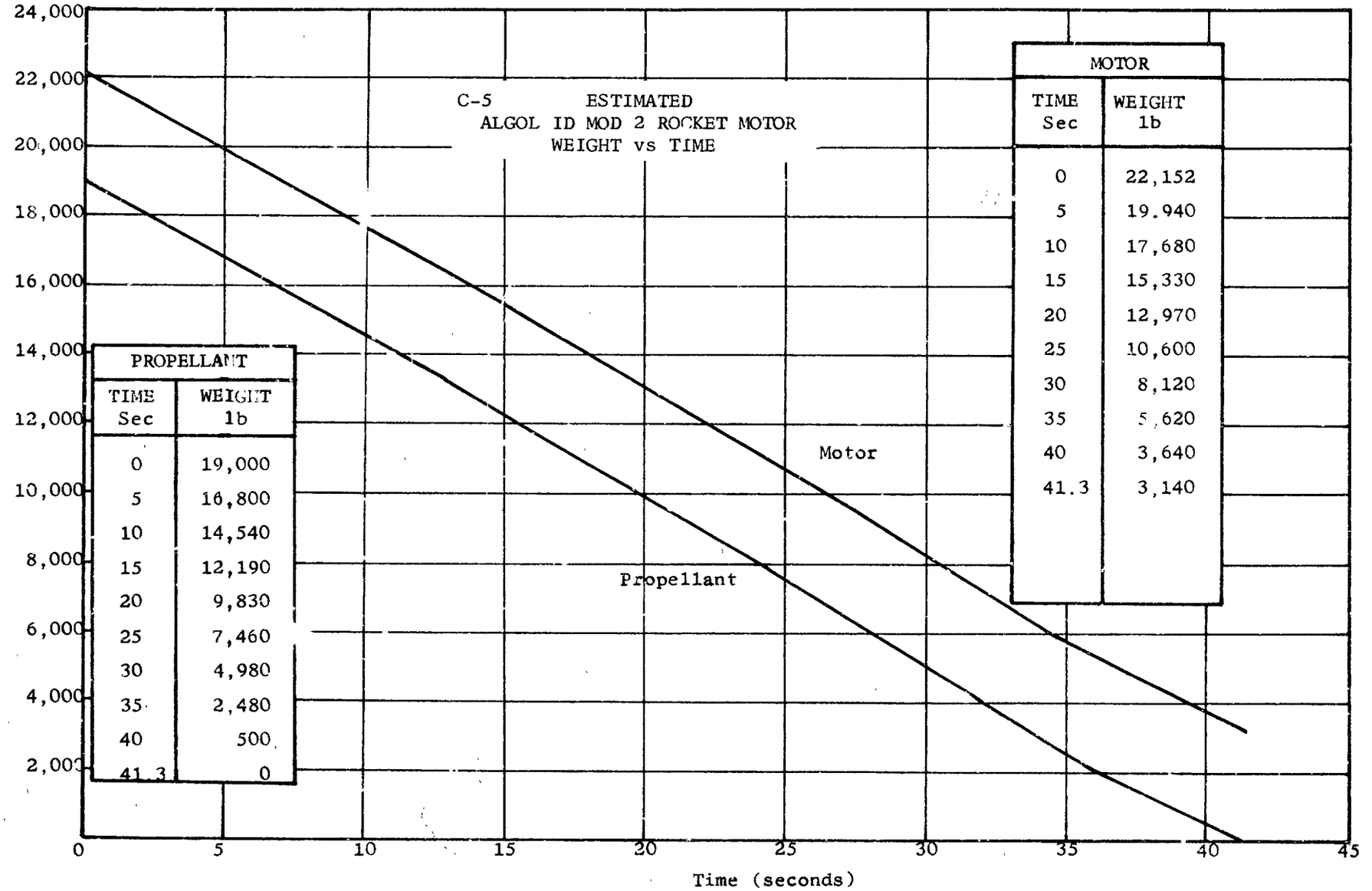
C-4 MOTOR WEIGHT SUMMARY

1. Algol ID Mod 2

		Weight, lb	Center of Gravity, in.
366205	Chamber assy	1640	167.0
366206	Insulation fwd	28	2.3
366206	Insulation aft	38	313.0
366346	Boot fwd	30	5.0
366346	Boot aft	41	315.0
366347	Chamber lining	300	180.0
360346	Nozzle housing	736	337.5
360345	Insulator	41	319.3
318087	Throat	222	327.5
	Closure bolts	6	318.8
366242	Destruct assy	30	3.7
318091	Weather seal	1	335.7
	Paint misc	17	221.5
Total Empty Motor		3130	221.48
366241	Propellant	19,000	158.59
367345	Igniter	22	12.0
Total Loaded Motor **		22,152	167.33

* Center-of-Gravity) reference plane is forward face of igniter boss.

C-5 ESTIMATED
ALGOL ID MOD 2 ROCKET MOTOR
WEIGHT vs TIME



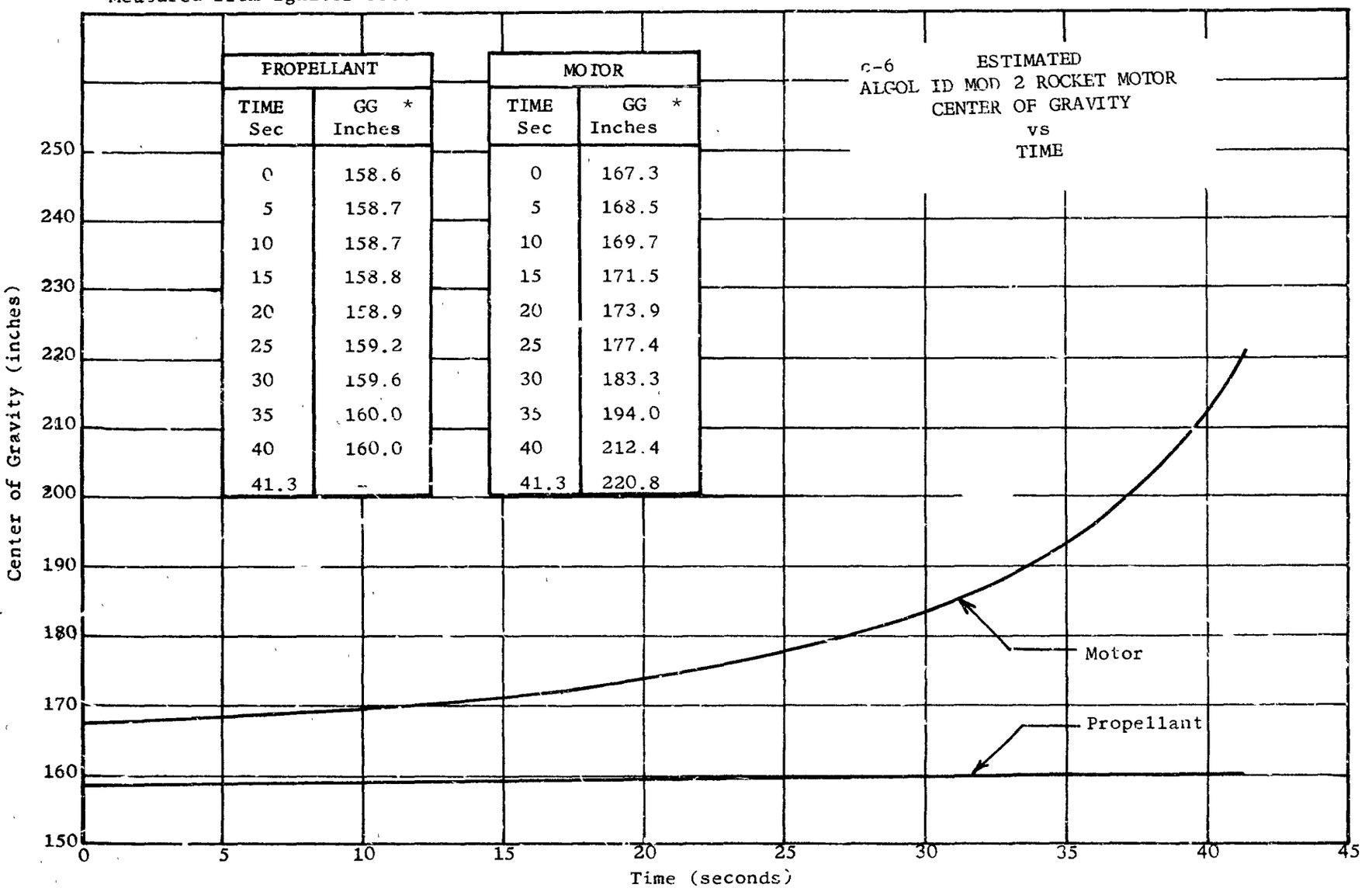
MOTOR	
TIME Sec	WEIGHT lb
0	22,152
5	19.940
10	17,680
15	15,330
20	12,970
25	10,600
30	8,120
35	5,620
40	3,640
41.3	3,140

PROPELLANT	
TIME Sec	WEIGHT lb
0	19,000
5	16,800
10	14,540
15	12,190
20	9,830
25	7,460
30	4,980
35	2,480
40	500
41.3	0

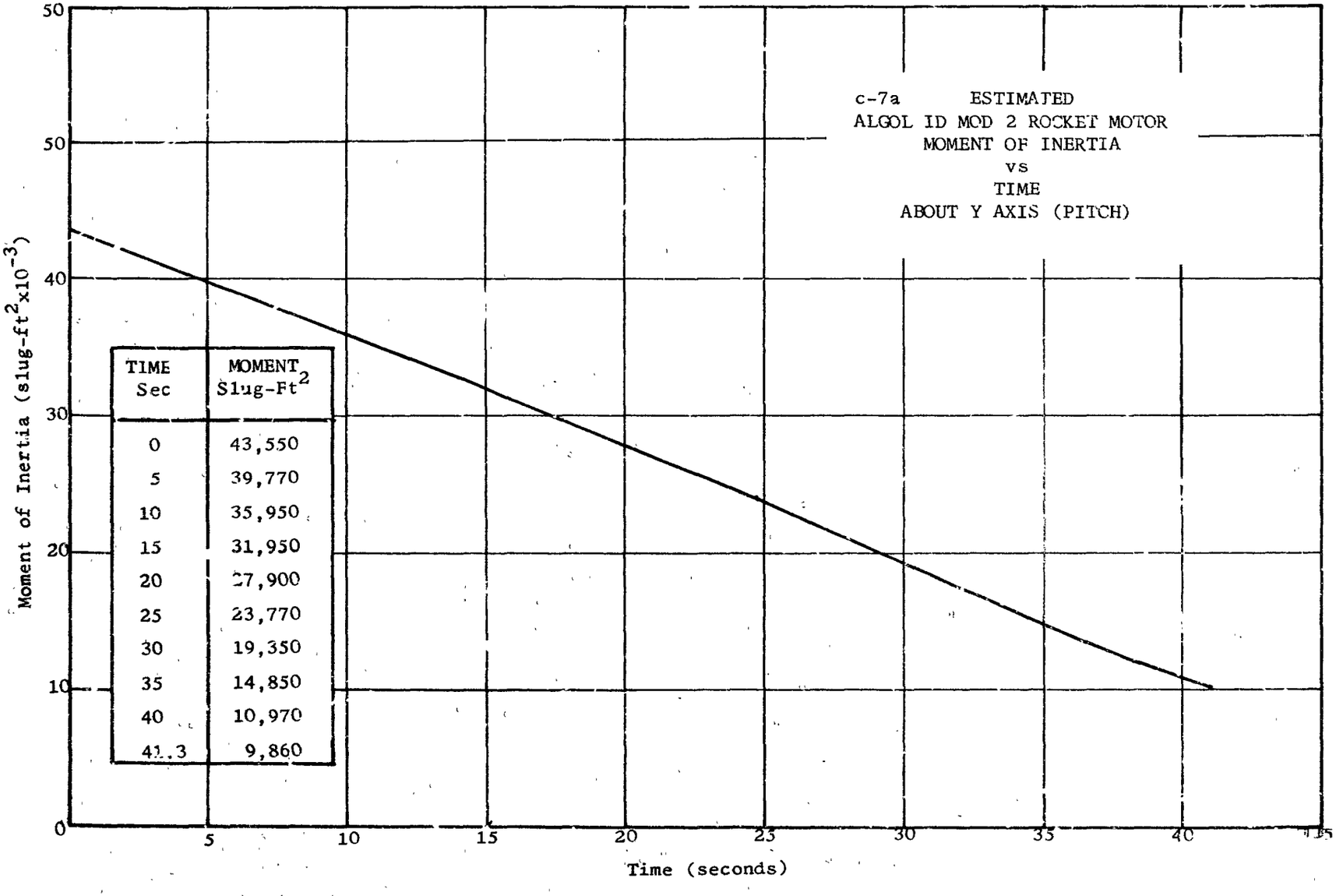
* Measured from igniter boss

c-6 ESTIMATED
ALGOL ID MOD 2 ROCKET MOTOR
CENTER OF GRAVITY
vs
TIME

PROPELLANT		MOTOR	
TIME Sec	GG * Inches	TIME Sec	GG * Inches
0	158.6	0	167.3
5	158.7	5	168.5
10	158.7	10	169.7
15	158.8	15	171.5
20	158.9	20	173.9
25	159.2	25	177.4
30	159.6	30	183.3
35	160.0	35	194.0
40	160.0	40	212.4
41.3	-	41.3	220.8

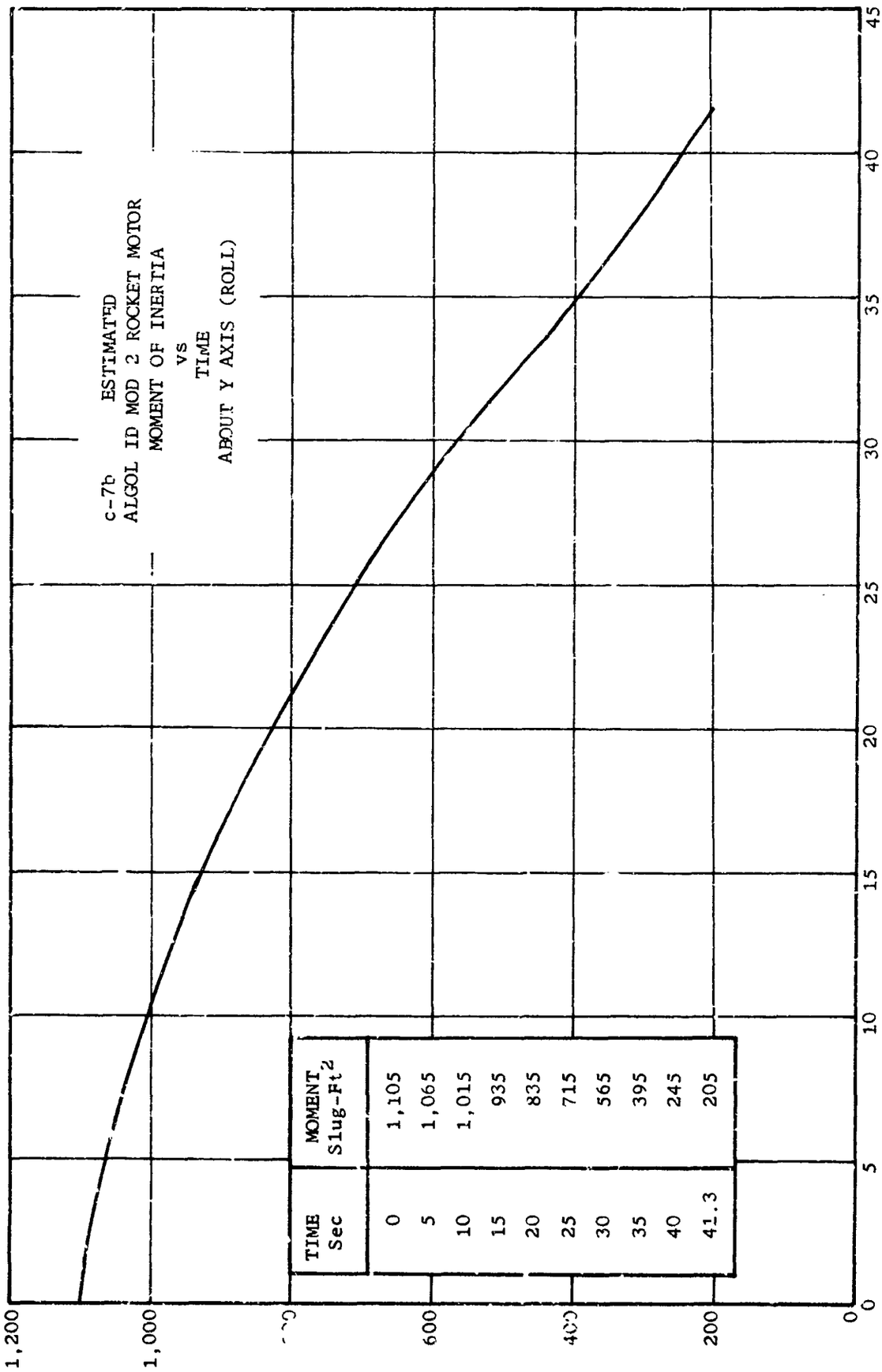


c-7a ESTIMATED
ALGOL ID MOD 2 ROCKET MOTOR
MOMENT OF INERTIA
vs
TIME
ABOUT Y AXIS (PITCH)



TIME Sec	MOMENT Slug-Ft^2
0	43,550
5	39,770
10	35,950
15	31,950
20	27,900
25	23,770
30	19,350
35	14,850
40	10,970
41.3	9,860

c-7b
ESTIMATED
ALGOL ID MOD 2 ROCKET MOTOR
MOMENT OF INERTIA
vs
TIME
ABOUT Y AXIS (ROLL)



TIME Sec	MOMENT, Slug-Ft²
0	1,105
5	1,065
10	1,015
15	935
20	835
25	715
30	565
35	395
40	245
41.3	205

C-8. MOTOR-PERFORMANCE CURVE

(Will be prepared from ballistic tests).

NOTE: Must show correction factor or procedure to bring sea-level curve to altitude (no ambient pressure) performance.

C-9 BASE HEATING

Results of static firing of two Little Joe motors--one with 0-degree-nozzle cant and one with a full 14-degree-nozzle cant--has established a negligible base-heating factor:

a. Rise in temperature measured at eight points on the nozzle exit-cone and closure sections reflected a maximum temperature rise above ambient of 25°F.

Short-term temperature rises due to reflected heat waves and exhaust gases resulting from launch-pad reflection at launch cannot be measured within the scope of the static-test program. The nozzle weather seal and boot has been designed to prevent any predictable reflected heat and exhaust gases from damaging motor components.

EXHAUST-GAS PROPERTIES

(ANP-2639AF Propellant)

Thermal conductivity	$K = .157$ Btu/hr-ft^2-°F
Specific heat	$\bar{C}_p = .481$ Btu/lb-°F
Viscosity	$\mu = .396 \times 10^{-4}$ lb/ft sec
Density	$\rho = .000125$ g/cc

C-11 ICC CLASSIFICATIONS

a. The Algol 1D rocket motor is marked for shipment and storage as a jet thrust unit (JATO) Class B explosive in compliance with Interstate Commerce Commission regulations.

b. The Algol igniter for Little Joe II motors is marked and shipped as a jet thrust unit (JATO) Class A explosive in compliance with Interstate Commerce Commission regulations.

c. Destruct package classification is to be determined.

C-12 STORAGE AND OPERATING TEMPERATURE LIMITS

Item	Value
Storage time, yr	
Rocket Motor	2
Igniter	2
Storage Temperature, °F	
Rocket Motor	+ 30 to + 100
Igniter	+ 30 to + 100
FIRING TEMPERATURE, °F	+ 50 to + 90
Max radial temperature gradient	40
Max axial temperature gradient	10

C-13 GRAIN TEMPERATURE VS TIME

a. Grain temperature versus time is presented graphically.

C-14 HANDLING AND FLIGHT ACCELERATION LIMITS

a. The motor shall be capable of sustaining acceleration loads in the following directions without failure or loss of ability to produce the specified motor performance:

Direction	Acceleration, g
Longitudinal	10
Transverse	4

D. GROUND SUPPORT AND MOTOR OPERATIONAL INTERFACES

1. Interfaces with Aerojet-General-supplied Ground Support Equipment consist of cranes for unloading the motor transport trailer, storage space with

floor-load capability to support motor and cradle, cranes to load and unload transport and erection dolly, crane to hydraset connections, pressure fitting for motor leak-check plug on Algol ID Mod 1, use of igniter installation tool for Algol ID Mods 1 and 2 pliers to compress igniter O ring, and igniter pressure transducers, and a harness for destruct package.

2. Operational interfaces with the Algol motor consist of lubrication for the igniter O ring, wrench for nozzle-cant adjustment on the Algol ID Mod 1, and bonding agent for port covers on the nozzle boot of Algol ID Mod 1.

3. Specific detailed operational instructions will be provided in the motor handling-procedures manual and Ground Support Equipment operating manuals.

4. Figures 1 through 8 depict a pictorial concept of equipment with dimensions where applicable.

IV D

FIGURE 7

DESTRUCT PACKAGE INTERFACE

(SYSTEM IN DESIGN)

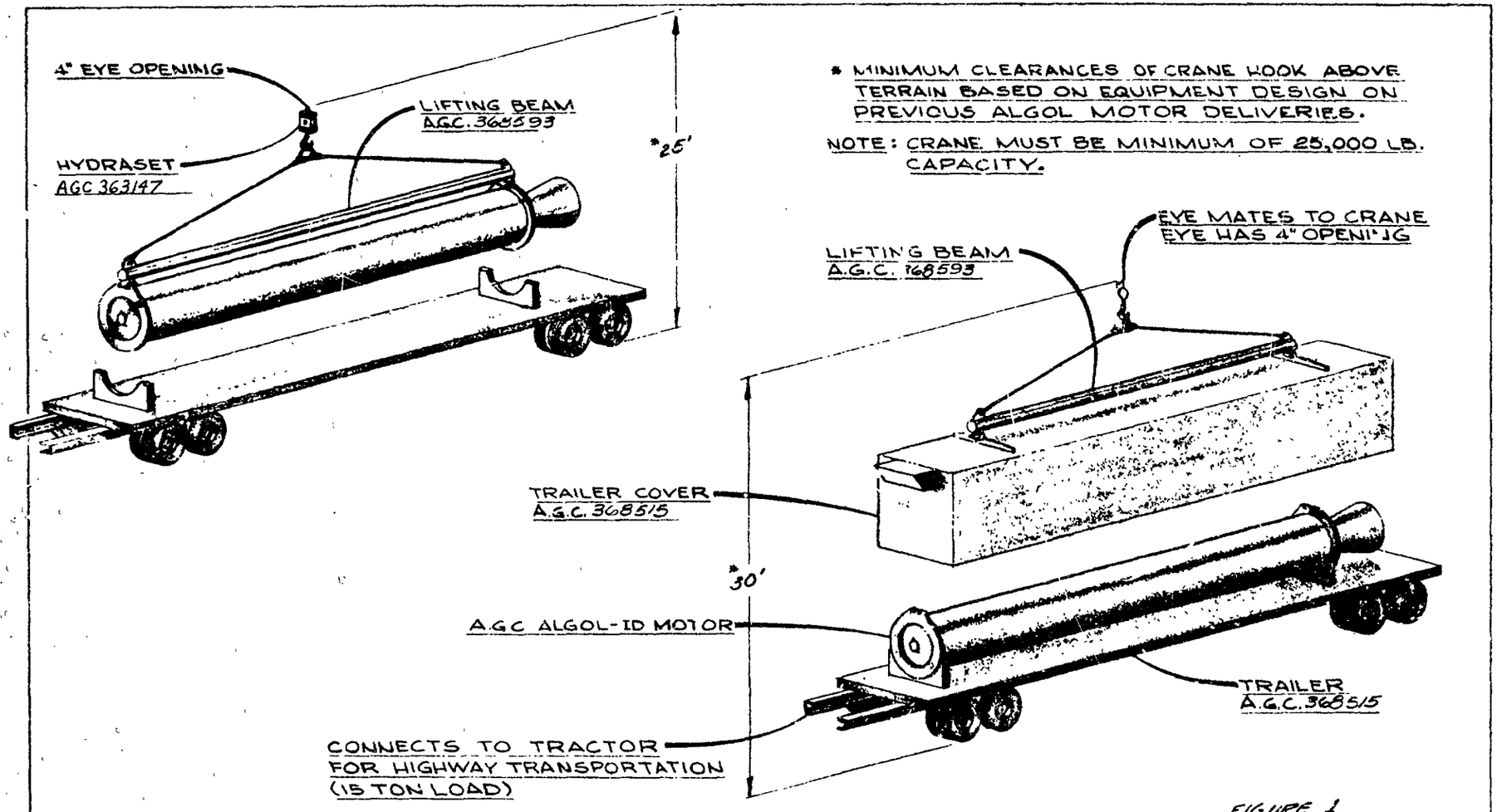


FIGURE 1

TRANSTAINER OFF LOADING

R. MASUI
12-5-62

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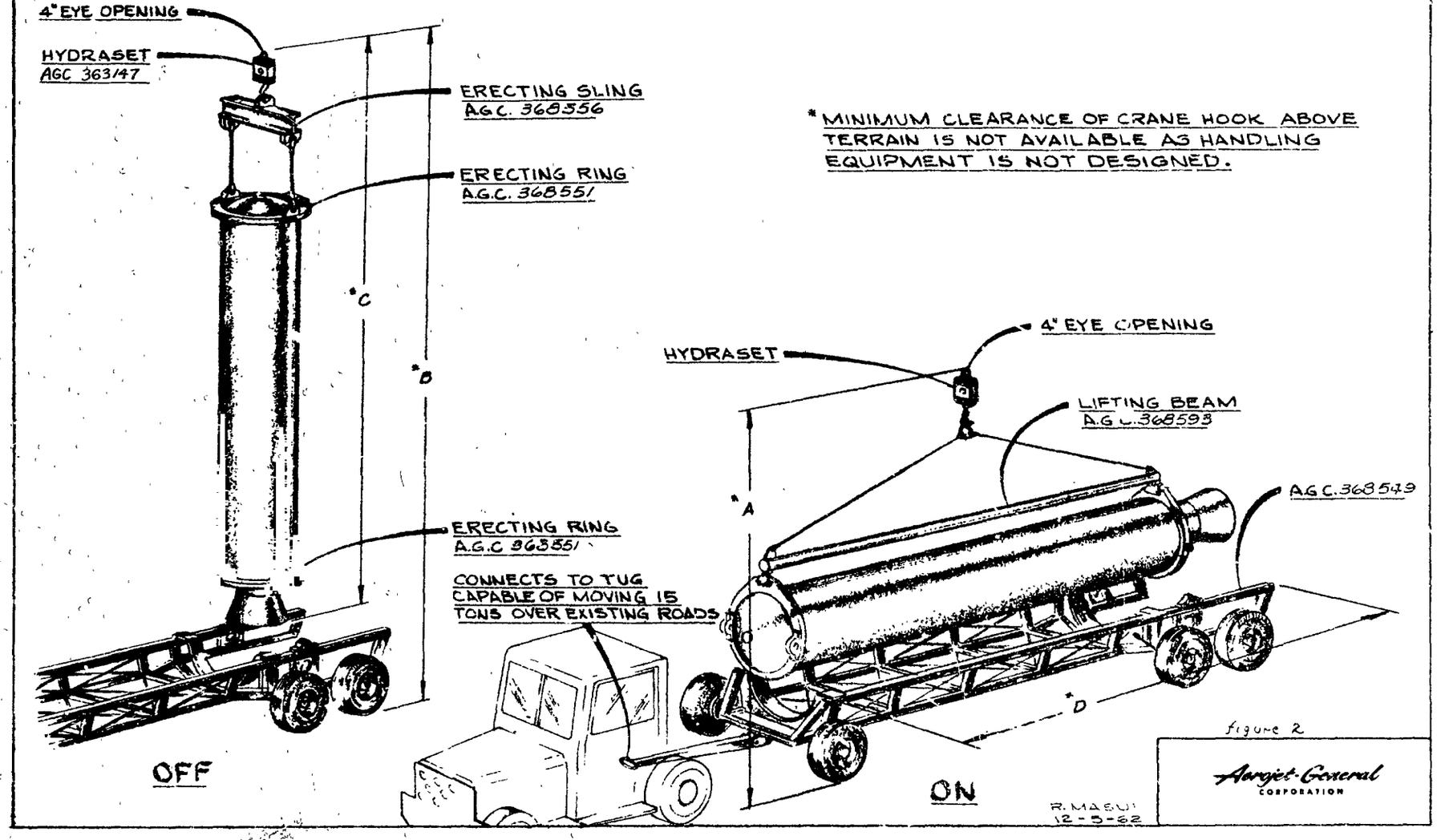
TRANSPORT-ERECTOR ON & OFF LOADING

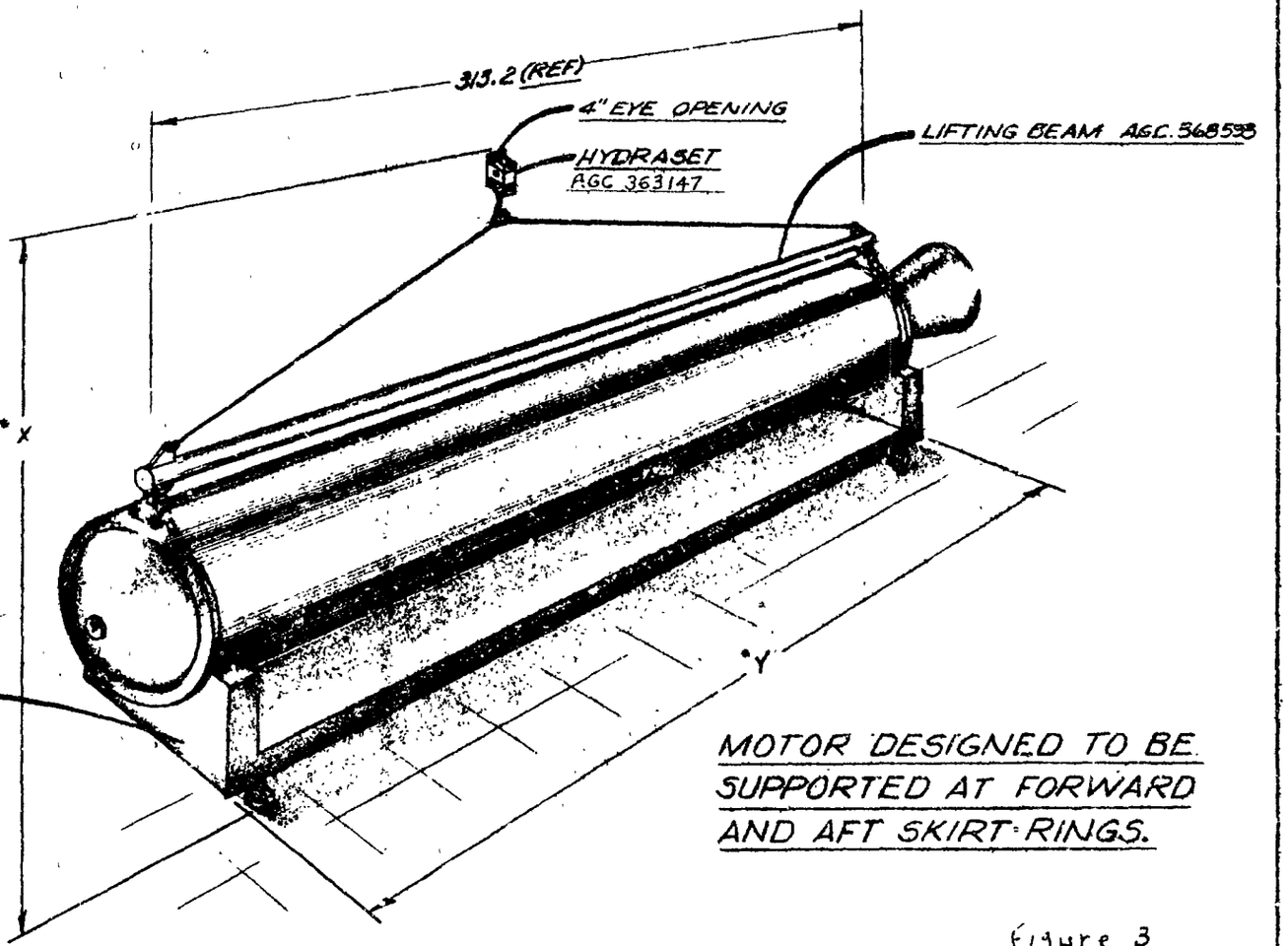


R. MASUI
12-5-62

Figure 2

Aerojet-General
CORPORATION

STORAGE



MOTOR DESIGNED TO BE SUPPORTED AT FORWARD AND AFT SKIRT RINGS.

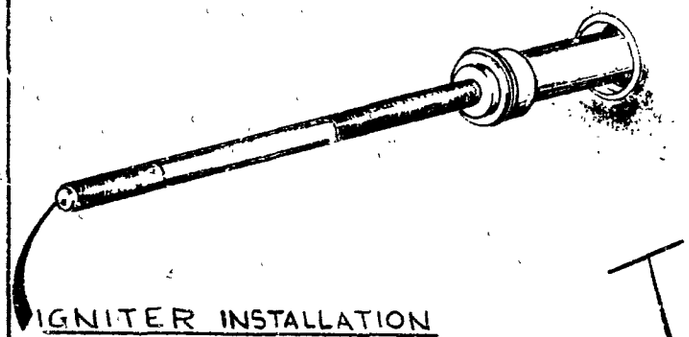
Figure 3

*DIMENSIONS TO BE PROVIDED UPON COMPLETION OF EQUIPMENT DESIGN.

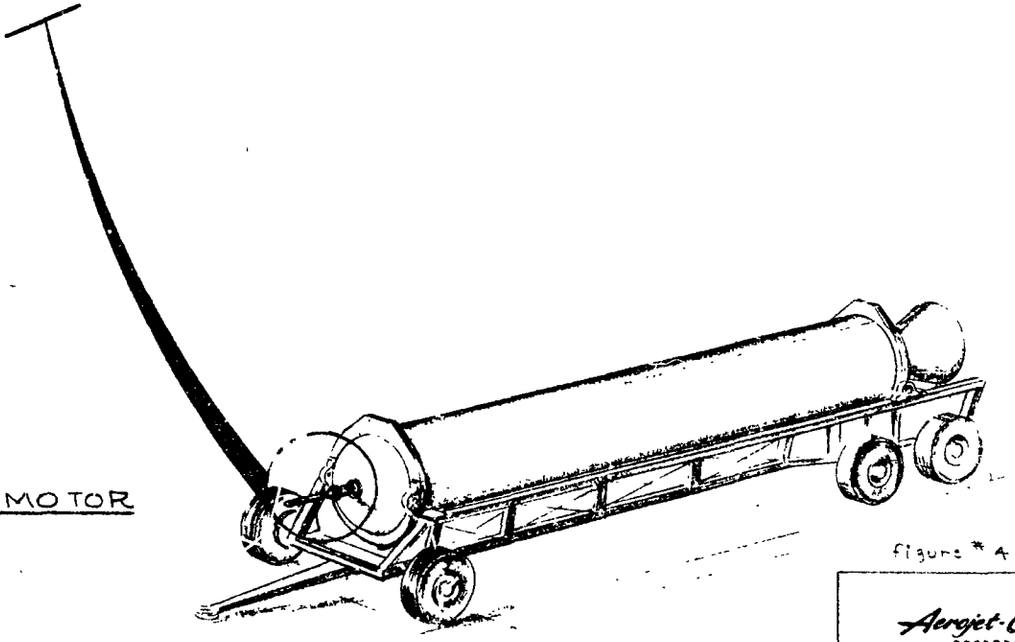
R. MASUI 12-7-62

Aerojet-General Corporation

IGNITER INSTALLATION



IGNITER INSTALLATION
TOOL 368553



INSTALLATION OF IGNITER WITH MOTOR IN HORIZONTAL POSITION.

figure # 4

Hal Sorenson 2-12-63

Aerojet-General
CORPORATION

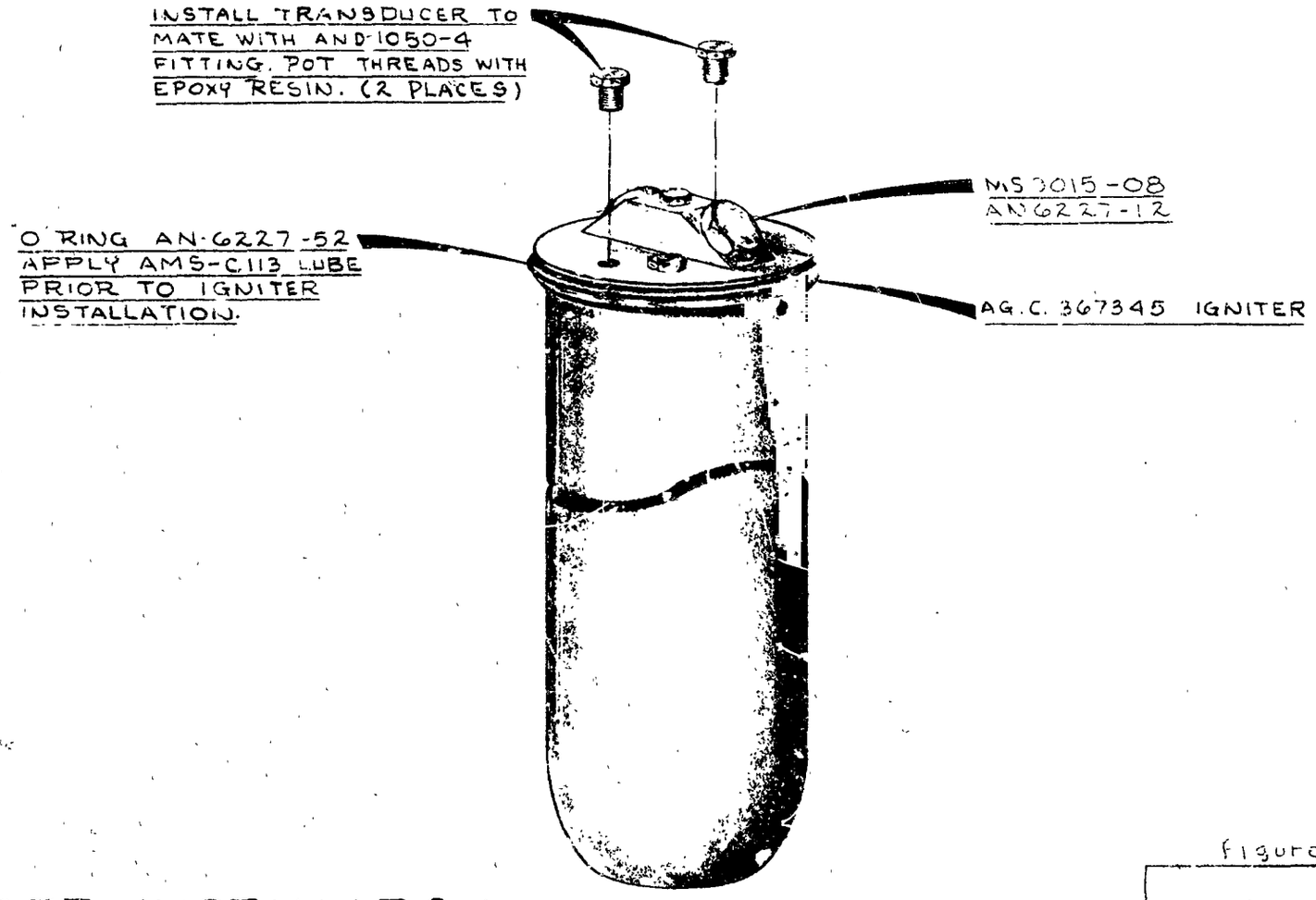


Figure 5

IGNITER INSTALLATION

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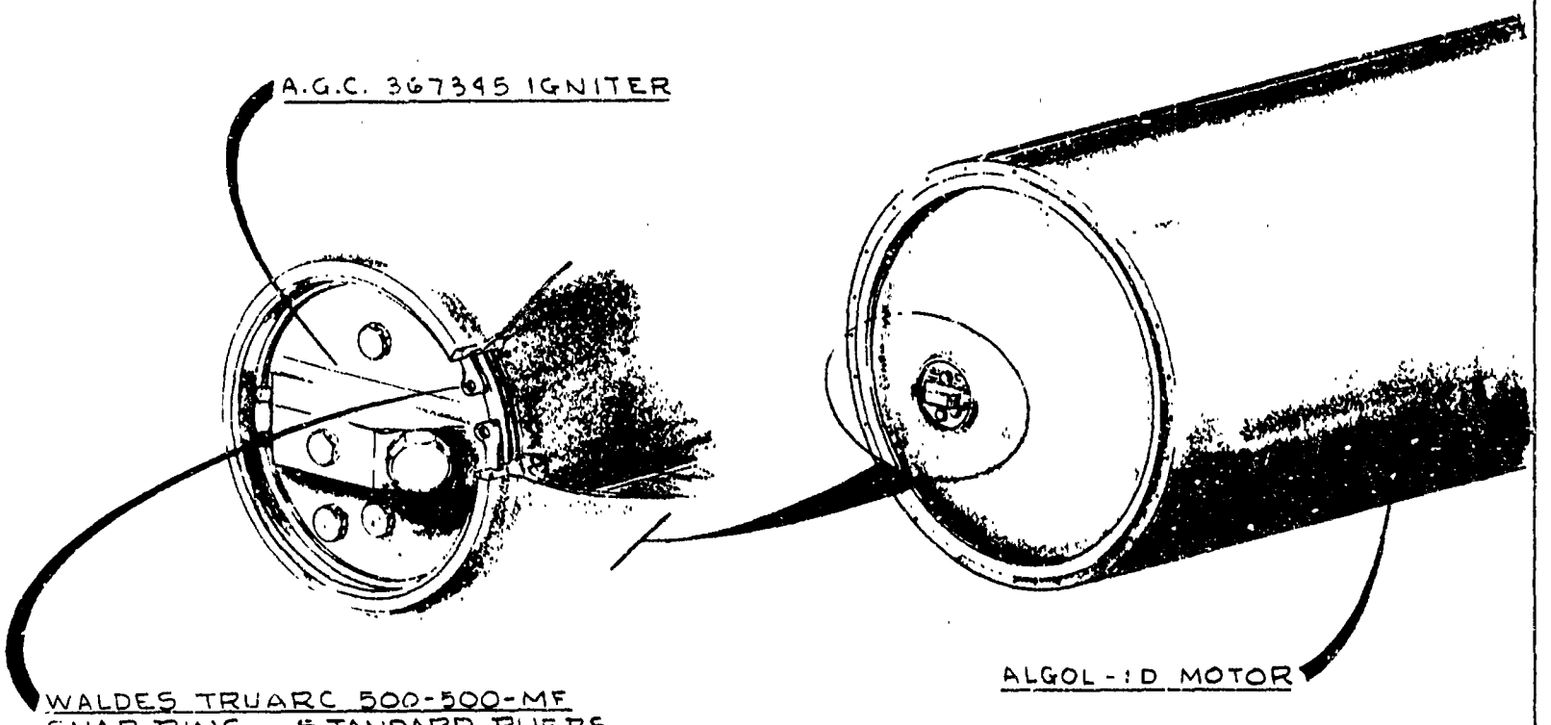
12-3-62

Aerojet-General CORPORATION



WALDES TRUARC 500-500-MF
SNAP RING. STANDARD PLIERS
#7 FOR INTERNAL SNAR RING
ARE REQUIRED.

Figure 6

IGNITER INSTALLATION

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12-4-62

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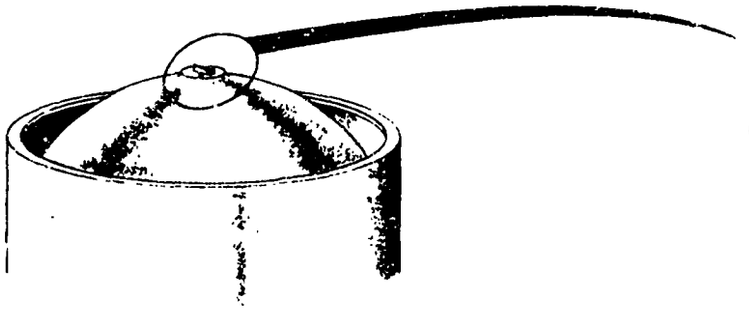
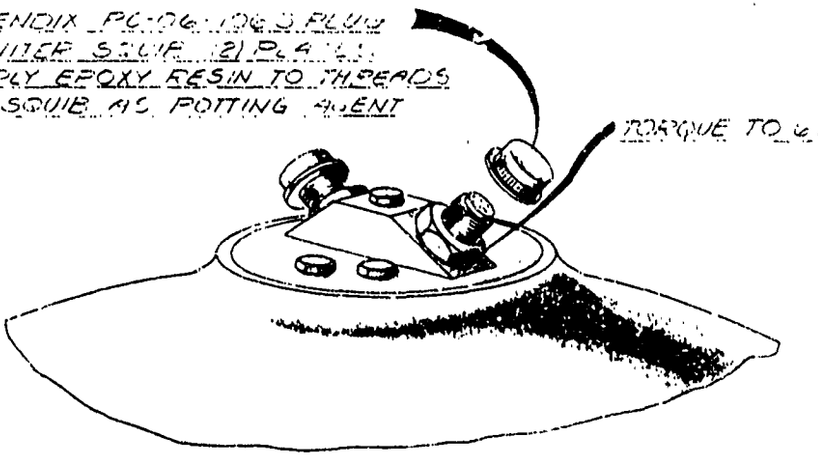
SQUIB INSTALLATION





BENDIX PC-06-106-3 PLUG
IGNITER SQUIB (2) REQ'D.
APPLY EPOXY RESIN TO THREADS
OF SQUIB AS POTTING AGENT

TORQUE TO 6 FT/LBS.

SQUIBS TO BE INSTALLED WITH
MOTOR IN VERTICAL POSITION

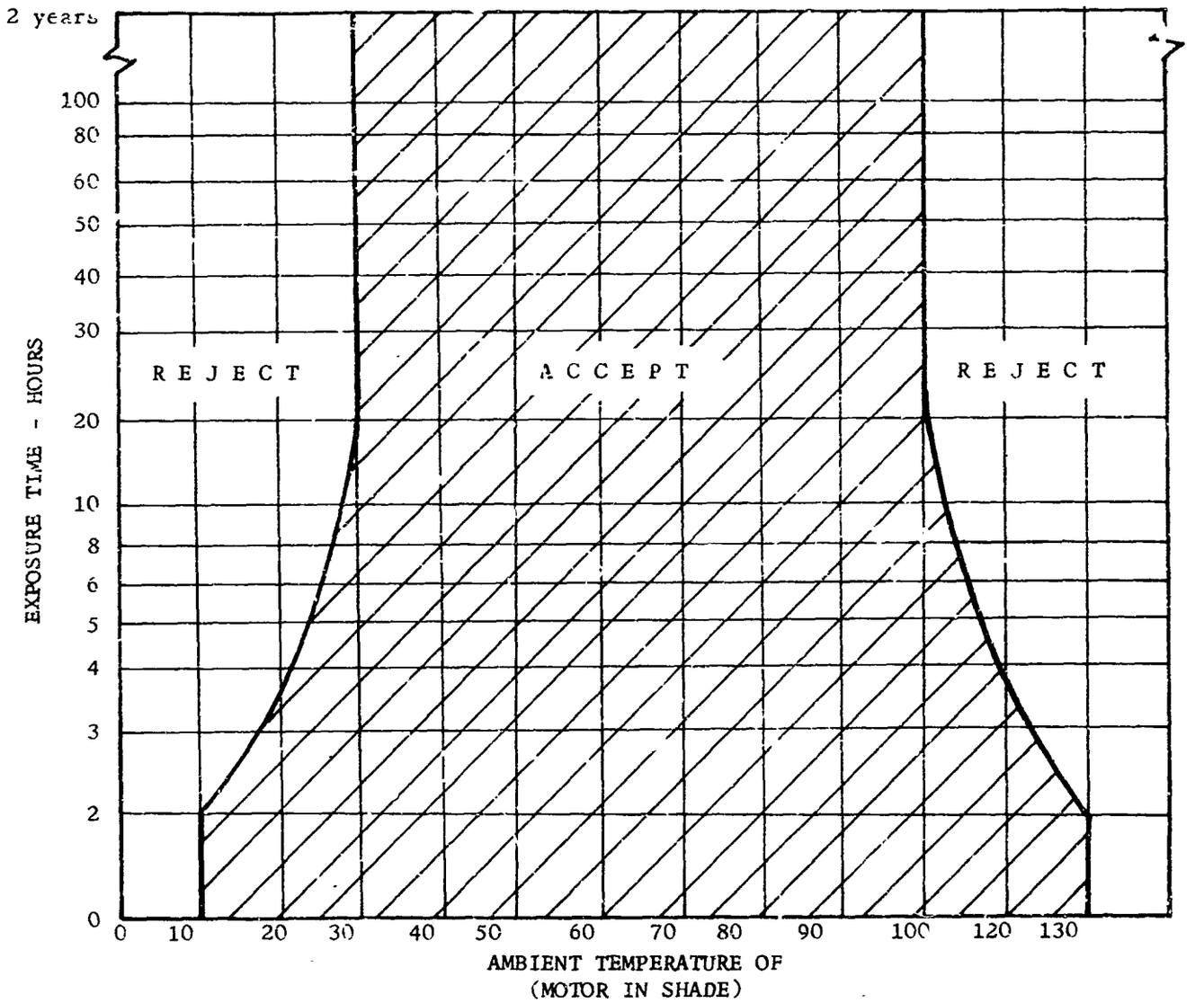
IGNITER SQUIB 28 VOLT

FIGURE 8

J.R.S 2-12-63

Aerojet-General
CORPORATION

C-13 TIME - TEMPERATURE STORAGE LIMITS FOR LITTLE JOE II MOTORS



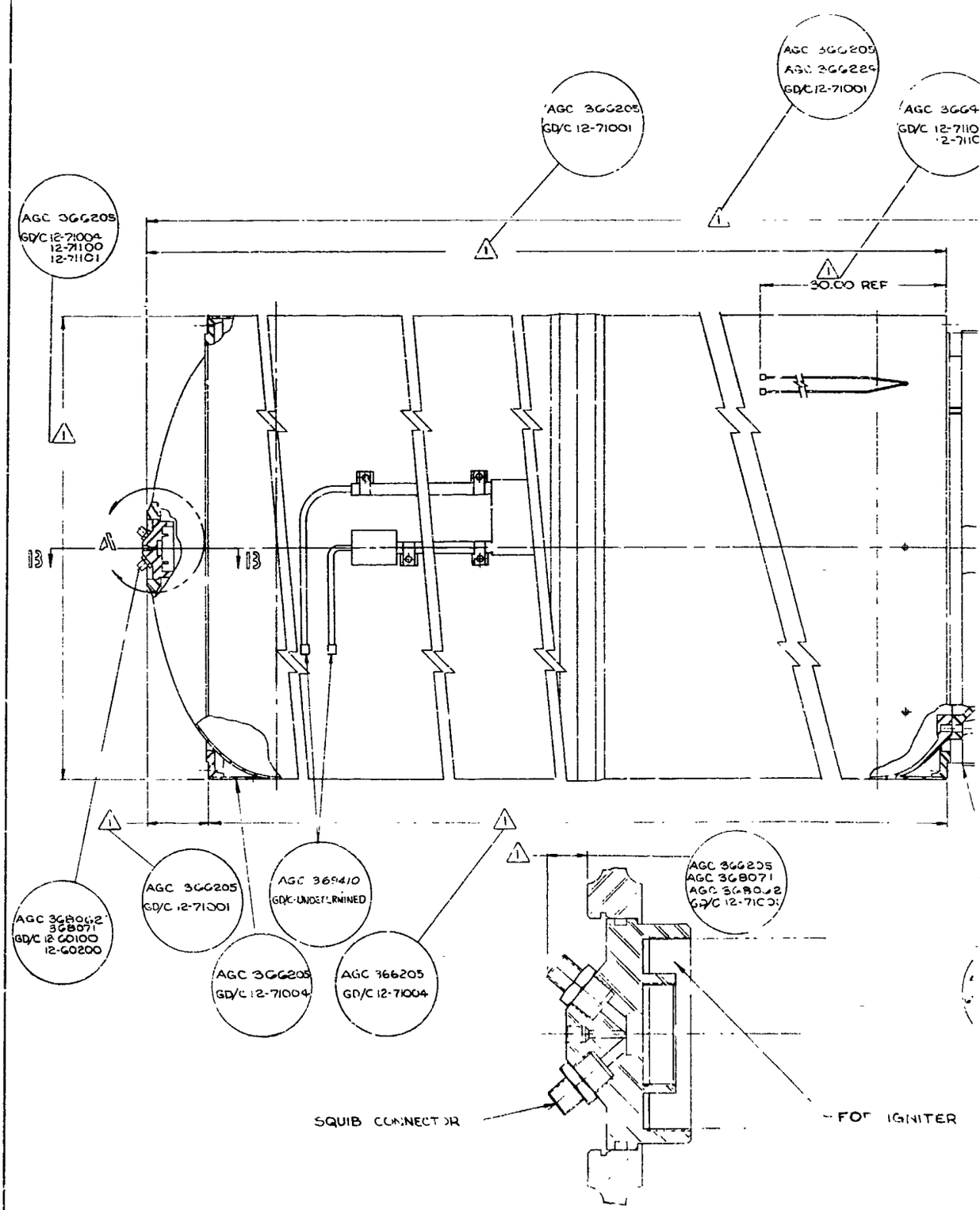
The motor can be exposed to the temperature extremes shown for the corresponding times for any number of cycles provided it is reconditioned to a temperature within the acceptable temperature limits shown between cycles.

E. INTERFACES PECULIAR TO ALGOL ID MOD I

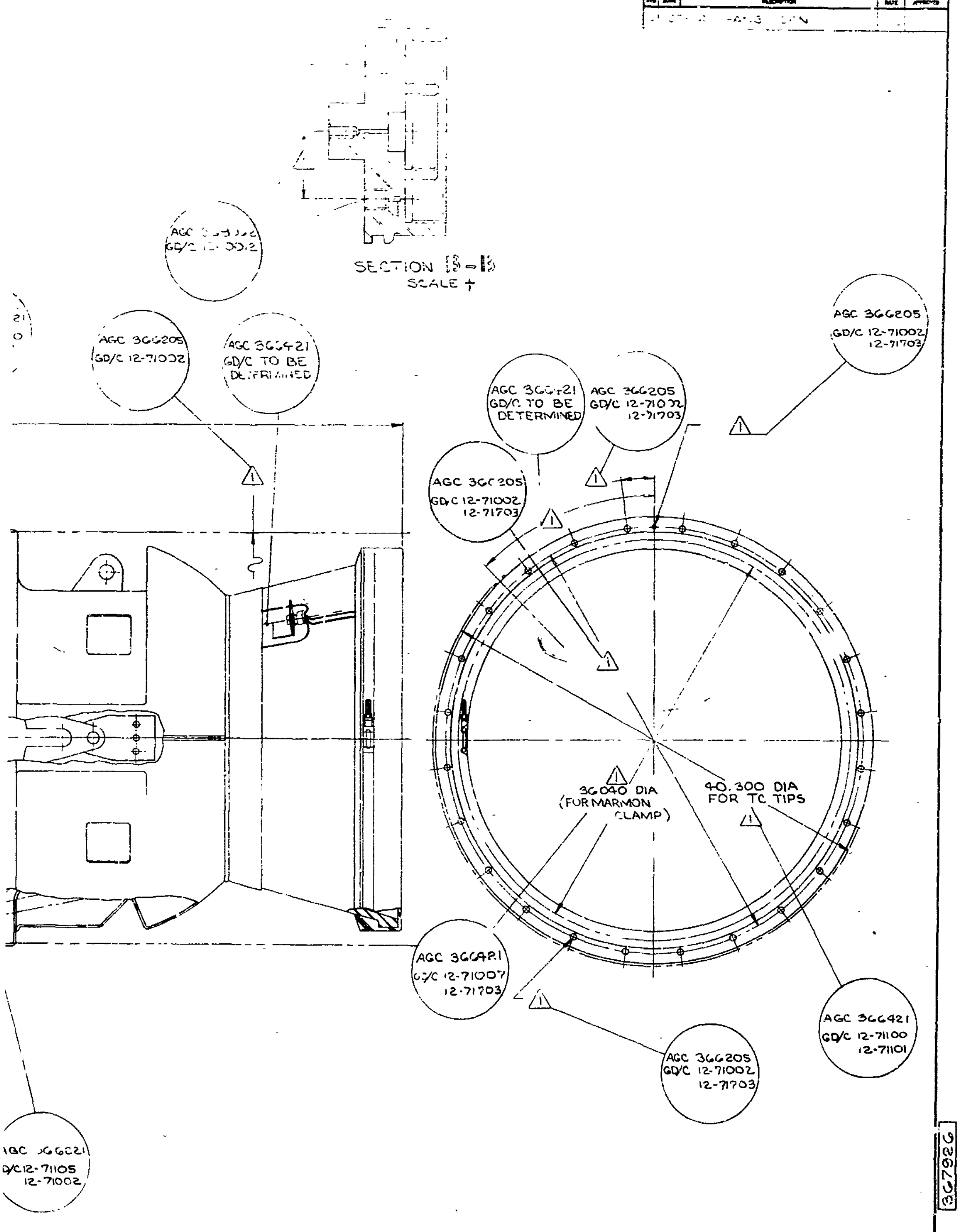
The data presented herein depicts the basic interfaces between the Algol ID Mod 1 motor and the Little Joe II vehicle where those interface requirements are not applicable to the Algol ID Mod 2 motor.

E-1	Motor to vehicle drawing
E-2	General motor characteristics
E-3	Motor ballistic characteristics
E-4	Weight summary
E-5	Curve of motor and propellant weight vs time
E-6	Curve of center of gravity vs time
E-7	Curve of moment of inertia vs time
E-8	Motor operation interfaces

NOTES: ⚠1 THESE DIMENSIONS REF [illegible]
INDICATED IN CIRCLE.



DETAIL
SCALE 1



SEE AGC 367345

INTERFACE CONTROL DRAWING

LIST OF MATERIALS

Aerojet-General CORPORATION
SOLID ROCKET PLANT
SACRAMENTO, CALIFORNIA

ENVELOPE,
ALGOL ID, MOD 1

13310 E 367926

NOTES:

1. FILL THIS AREA WITH AGC-34076 CLASS 2 SEALING COMPOUND WHEN NOZZLE IS INSTALLED.
2. LUBRICATE MATING METAL SURFACES OF 366241-19 & 366224-29, ALSO 360348-1 PRIOR TO ASSY, WITH AGC-13929 LUBRICANT.
3. LUBRICATE THREADS OF NAS 150DH-27 BOLTS AND EAB 22-10-16 BOLTS WITH FEL-PRO C-5A LUBRICANT.
4. TORQUE NAS 150DH-27 BOLTS & EAB 22-10-16 BOLTS TO 100-110 FT LB.
5. INSTALL LOCKWIRE PER MS33540, DOUBLE TWIST METHOD.
6. REPAINT AS REQUIRED WITH MIL-L-7178, NO. 511 LACQUER (INSIGNIA WHITE).
7. BOND 366221-19 TO 366224-29 IN AREAS SHOWN WITH AGC-34151 ADHESIVE.
8. BOND 366430-1 TO 366221-19 WITH AGC-34151 ADHESIVE AFTER FINAL CANT ANGLE ADJUSTMENT.
9. PRESSURE CHECK MOTOR ASSEMBLY AT 50 PSIG WITH AIR OR NITROGEN. NO LEAKAGE PERMITTED AT IGNITER O-RING, CLOSURE O-RING OR NOZZLE O-RING. THE IGNITER MAY BE REPLACED WITH A SIMULATOR PLUG.
10. STENCIL MOTOR PER DRAWING 367253 USING MIL-L-6605 LACQUER NO. 514 (INSTRUMENT BL CK).
11. INSTALL 2-318077-1 PLUG IN PLACE OF 367345-79 IGNITER FOR SHIPPING HANDLING & STORAGE.
12. APPLY AGC-34076 SEALING COMPOUND TO 620C-100-3400SH CLAMP & LIFTING LUG AFTER FINAL PRESSURE CHECK.
13. BOND 367172-1 TO 366224-29 USING AGC-34151 ADHESIVE.
14. COVER HOLES IN 366221-19 WITH AGC-34101 RUBBER & BOND WITH AGC-34151 ADHESIVE AFTER FINAL PRESSURE CHECK, BEFORE FIRING.
15. TAPE INSIDE THERMOCOUPLE WIRES TO MOTOR EVERY 5 INCHES.
16. PO, THERMOCOUPLE WIRES TO T721656-4 & T721657-4 USING AGC-34102 SEALING COMPOUND.
17. POT OUTSIDE THERMOCOUPLE WIRES WITH AGC-34151 ADHESIVE.
18. POT T721657-4 JACKS WITH AGC-34151 ADHESIVE.
19. DESTRUCT UNIT MAY BE REMOVED FOR SHIPPING, HANDLING & STORAGE.
20. PACKAGING, PACKING & MARKING FOR OUT-OF-PLANT SHIPPING PER PPD SHEET NO. 3794.
21. BOND 512668-1 PART IN PLACE WITH AGC-34151 ADHESIVE. PROTECT THREADS FROM ADHESIVE.
22. APPLY MIL-C-16173 GR 4 CORROSION PREVENTIVE PER AGC-36234 TO BARE STEEL SURFACES INDICATED.
23. CLASSIFICATION OF CHARACTERISTICS ARE DESCRIBED ON A SEPARATE DOCUMENT NO. 366421.
24. BOND 380568-1 TO 366244-1 USING AGC-34151 ADHESIVE.

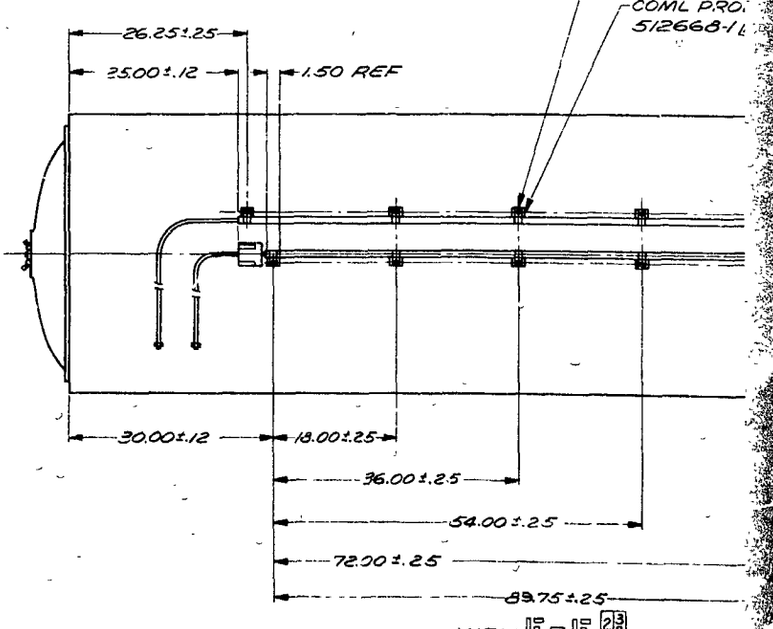
COML PROD
T721656-4
2 PLACES

TC1 CONSTANTAN / COPPER
TC2 CONSTANTAN / COPPER
TC3 CONSTANTAN / COPPER
TC4 CONSTANTAN / COPPER

SCHEMATIC ... THERMOCOUPL...

COML PROD
512668-1

COML PROD
512668-1



VIEW 1 5/8 - 1 5/8 2 3/8
SCALE: 1/2
2 PLACES, 180° APART

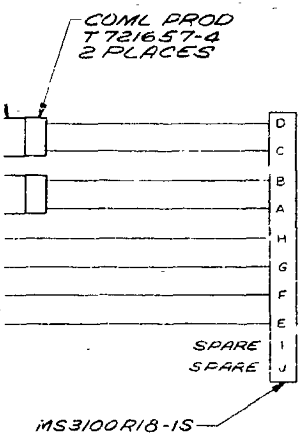
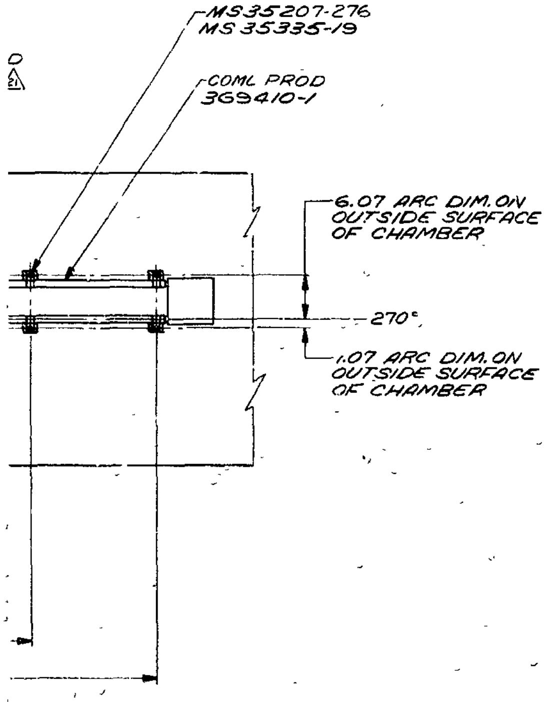


DIAGRAM
E WIRING



REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
C		REDRAWN WITH ADDITIONAL CHANGES, REPLACES 366421B. DRAWING WAS 1 LEVEL, SEE "C" CHANGE DCN		

	-19	-9	SYM	CODE IDENT NO	PART OR IDENTIFYING NO	NOMENCLATURE OR DESCRIPTION	MATERIAL	SPECIFICATION	UNIT WT	ZONE	FIND NO.
22	AR					CORROSION PREVENTIVE, GRADE 4		MIL-C-16173			
	AR					LACQUER, NO. 514 INSTRUMENT BLACK		MIL-L-6805			
	AR					LACQUER, NO. 511 INSIGNIA WHITE		MIL-L-7178			
	AR					LUBRICANT		AGC-13929			
	AR					ADHESIVE, TYPE I		AGC-34151			
	AR					COMPOUND, SEALING, CLASS 2		AGC-34076			
	AR					SEALING COMPOUND CLASS 2		AGC-34162			
14	AR					RUBBER .187 THICK		AGC-34161			
15	AR					TAPE, MASKING: .75 WIDE TYPE I		UU-T-106			
	2			03680	HI PSI EWB 22-10H-16	BOLT				2 4A	
	AR			73165	FEL-PRO -C5A	LUBRICANT					
	1			98625	620C-100 -3400 SH	CLAMP				2 1B	
	1			79136	5000-500-MF	RETAINING RING				2 3D	
	AR			99195	GG-22-DT	WIRE				2 2C	
	2			09128	T721657-4	JACK				2 1D	
	2			09128	T721656-4	PLUG				2 1D	
	24			13309	512669-1	CLAMP				1 3B	
	24			13309	512668-1	BLOCK				1 3B	
19	2			13309	369410-1	DESTRUCT UNIT				1 2B	
	AR	REMOVED			MS20995 C32	WIRE, LOCK				2 2B	
	24				MS35335 -19	WASHER, LOCK				1 2B	
	24				MS35207 -276	SCREW				1 2B	
	1				MS3100R 18-1S	CONNECTOR RECEPTACLE				2 2D	
	54				NAS150 DH-27	BOLT				2 2A	
	1				AN122 743	PIN				2 2C	
	1				AN6227 -52	PACKING				2 3D	
	4				AN530 -6-6	SCREW, TAPPING				2 2C	
	2				380568-1	CHECK VALVE				2 1B	
	1				3?734579	IGNITER ASSY				2 4C	
	1				367172-1	BRACKET				2 2D	
	1				366430-1	INSULATOR, MICROMETER				2 2A	
	1				366244-1	SEAL				2 1L	
	1				365241-19	CHAMBER & GRAIN ASSY				2 3A	
	1				36?22429	NOZZLE ASSY				2 2C	
	1				366221-3	BOOT				2 2B	
	1				360348-1	PACKING				2 3A	
	1				2-318077-1	PLUG				2 3D	

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
DECIMAL TOLERANCE ANGULAR TOLERANCE
DO NOT SCALE DRAWING
TREATMENT
FINISH

DRAWN	H. WESCOTT	7-26-62
CHECKED	D. RAHL	1-4-63
DESIGN	L. FASKINO	9-2?-62
PROJECT	A. J. MORREY	1-22-63
STRESS	PFLIEGER	1-26-63
MATERIALS		
PRODUCTION		6-12-63

Aerojet-General CORPORATION
SOLID ROCKET PLANT SACRAMENTO, CALIFORNIA

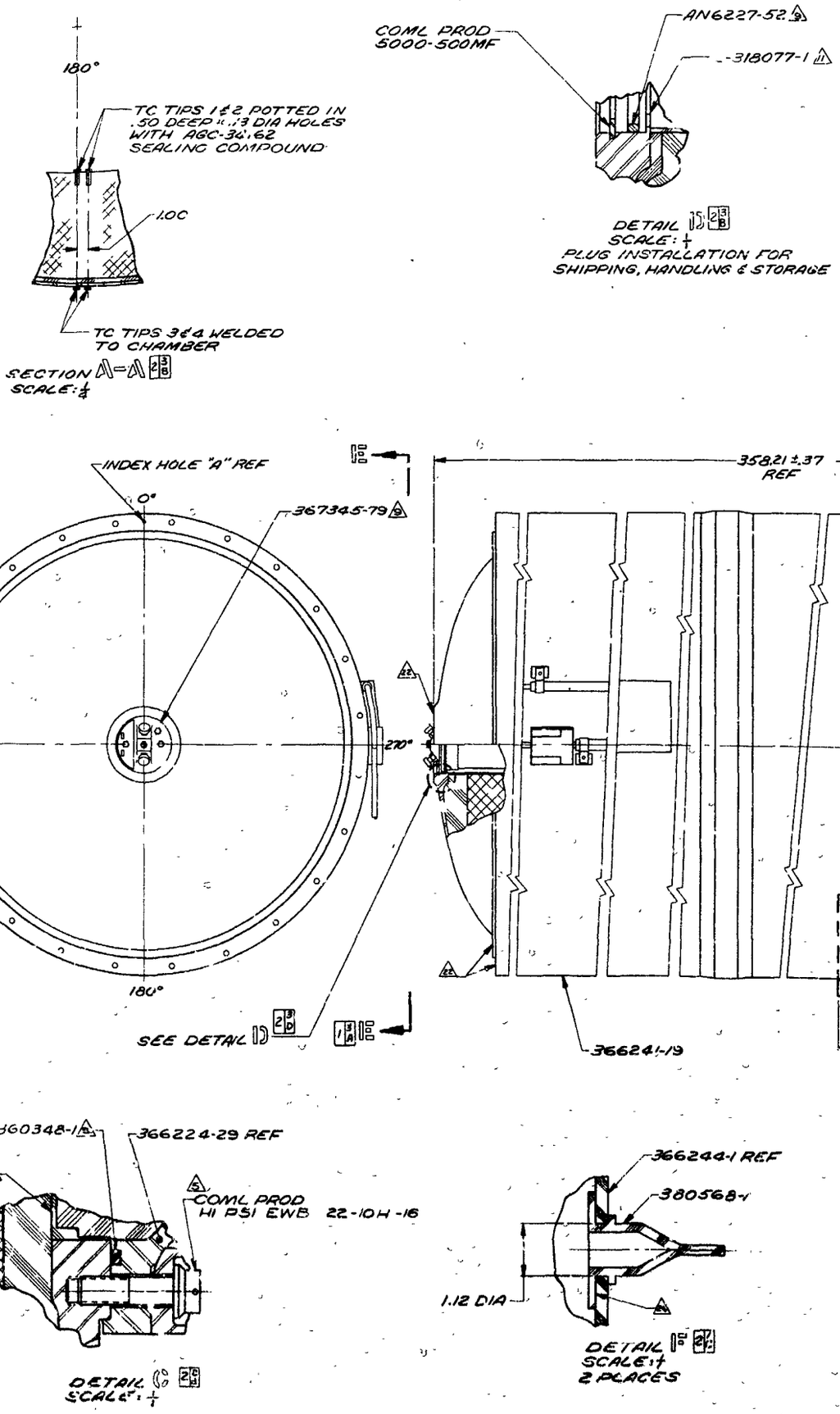
TITLE
MOTOR ASSY
ALGOL ID MOD I

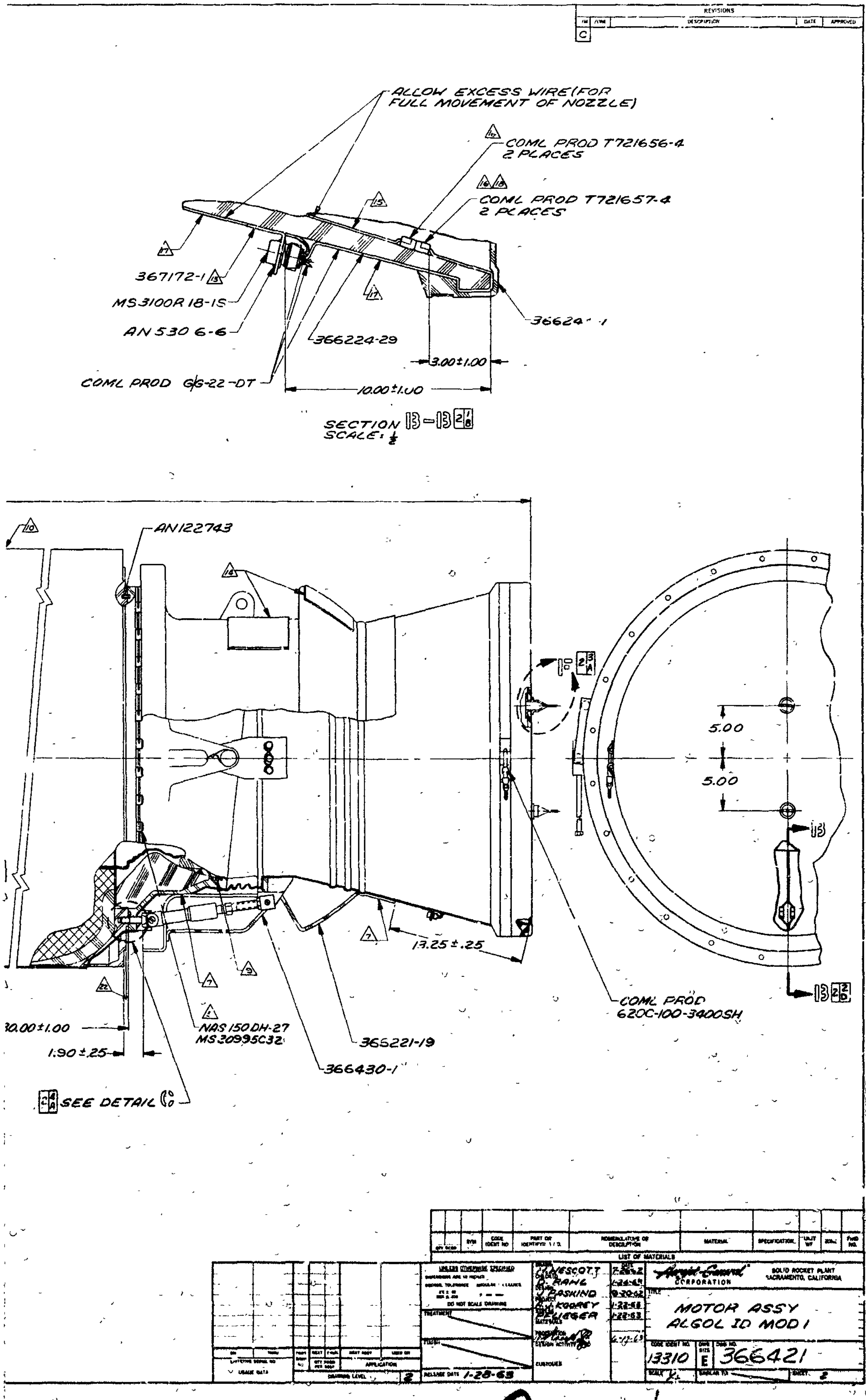
CODE IDENT NO 13310 | SIZE E | DWG NO. 366421

SCALE 1/4 | SHEET 1 OF 2

RELEASE DATE 1-28-63

-19 | -9 | DRAWING LEVEL 2


180°
TC TIPS 1 & 2 POTTED IN .50 DEEP x .13 DIA HOLES WITH AGC-3 & 62 SEALING COMPOUND
1.00
TC TIPS 3 & 4 WELDED TO CHAMBER
SECTION A-A
SCALE: 1/4
COML PROD 5000-500MF
AN6227-52
-318077-1
DETAIL D
SCALE: 1
PLUG INSTALLATION FOR SHIPPING, HANDLING & STORAGE
INDEX HOLE "A" REF
0°
367345-79
90°
270°
180°
358.21 ± .37 REF
SEE DETAIL D
366241-19
360348-1
366224-29 REF
COML PROD HI PSI EWB 22-10H-16
DETAIL C
SCALE: 1
366244-1 REF
380568-1
1.12 DIA
DETAIL E
SCALE: 1
2 PLACES


REVISIONS
C
ALLOW EXCESS WIRE (FOR FULL MOVEMENT OF NOZZLE)
COML PROD T721656-4 2 PLACES
COML PROD T721657-4 2 PLACES
367172-1
MS3100R 18-1S
AN 530 6-6
366224-29
COML PROD G/G-22-DT
3.00±1.00
10.00±1.00
SECTION B-B
SCALE: ½
AN122743
5.00
5.00
13.25±.25
COML PROD 620C-100-3400SH
NAS 150 DH-27
MS 20995C32
365221-19
366430-1
30.00±1.00
1.90±.25
SEE DETAIL
LIST OF MATERIALS
UNLESS OTHERWISE SPECIFIED
DO NOT SCALE DRAWING
TREATMENT
FINISH
APPLICATION
USAGE DATA
DRAWING LEVEL 2
RELEASE DATE 1-28-63
CUSTOMER
DESIGN ACTIVITY
WESCOTT
RAHL
PASKIND
KOOREY
PFLIEGER
Aerojet-General CORPORATION
SOLID ROCKET PLANT SACRAMENTO, CALIFORNIA
MOTOR ASSY
ALGOL ID MOD I
13310
E
366421
SHEET 2

NOTES:

1. REMOVE ALL BURRS AND SHARP EDGES EQUIVALENT TO 1000 MICRO-INCH UNLESS OTHERWISE NOTED.
2. INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS PRESCRIBED BY MIL-STD-10327.
3. REMOVED.
4. THREADS PER NBS HANDBOOK H28.
5. [illegible] IS DEFINED AS A STRAIGHT LINE CONNECTING THE CENTERS OF [illegible] AND [illegible].
6. ULTRASONIC INSPECT ALL PLATE AND MATERIAL PER MIL-I-6870B, CLASS 4, PRIOR TO ASSY AND MACHINING.
7. SURFACE ROUGHNESS TO BE 125 UNLESS OTHERWISE SPECIFIED.
8. REMOVED.
9. ▲ DENOTES AN IN-PROCESS DIMENSION. DO NOT FINAL INSPECT.
10. RATE OF CHANGE OF CONTOUR NOT TO EXCEED .030 INCH/INCH.
11. ALL GRIND MARKS ON GIRTH WELDS TO BE CIRCUMFERENTIAL IN DIRECTION.
12. -21 TUBES MAY BE MADE FROM 2 TO 6 SECTIONS, GIRTH WELDED TOGETHER AND LONGITUDINALLY SEAM WELDED AS SHOWN. ADJACENT LONGITUDINAL WELDS SHALL BE STAGGERED RADIALLY 180 ± 30°. GIRTH WELDS ON PRESSURE VESSEL SHALL BE LIMITED TO NOT MORE THAN 10, EXCLUDING POST HEAT TREAT CENTER WELD.
13. TIG WELD PER AGC 36073/1.
14. MISMATCH OF -5 RINGS .020 MAX. MISMATCH OF ALL OTHER CYLINDRICAL PARTS .010 MAX.
15. PERMISSIBLE CROWN ON WELDS: .040/.005 ON INSIDE SURFACES, .060/.020 ON OUTSIDE SURFACES EXCEPT FOR 2.50 INCHES AT BOTH ENDS OF -21 TUBE SECTIONS WHERE CROWN ON OUTSIDE OF LONGITUDINAL WELDS IS TO BE .060/.005.
16. RADIOGRAPHIC INSPECT WELDS PER AGC-36065. INTERPRET PER AGC-13860, TABLE 1, CLASS 1.
17. RADIOGRAPHIC INSPECT WELD PER AGC-36065. INTERPRET PER AGC-13860, TABLE 1, CLASS 4.
18. HEAT TREAT FORWARD AND AFT CHAMBER SECTIONS PER MIL-H-6875 TO 160,000 PSI MINIMUM ULTIMATE TENSILE STRENGTH IN THE CHAMBER SIDE WALL SECTION (.112 THICK). PHYSICAL PROPERTIES ARE TO BE DETERMINED BY AVERAGING THE TENSILE PROPERTIES OF AT LEAST 3 TENSILE TEST COUPONS REPRESENTING EACH -21 TUBE SECTION.
19. AFTER HEAT TREAT PER (18), PREHEAT 250°-300°F AND POST HEAT 150°-300°F FOR 10 MINUTES. WELD PER NOTE 13.
20. INDEX HOLE "A" AND "B" TO BE RADIALLY ALIGNED WITHIN .030.
21. HOLES MAY BE DRILLED USING DRILL FIXTURES PREPARED FROM AGC MASTER GAGE NO. T-800742.
22. HOLES MAY BE DRILLED USING DRILL FIXTURES PREPARED FROM AGC MASTER GAGE NO. T-800747.
23. SANDBLAST INTERIOR SURFACES PER AGC-36237.
24. AFTER SANDBLASTING, HYDROSTATIC PROOF TEST TO 725-750 PSIG AND HOLD FOR 3 MINUTES. REDUCE PRESSURE TO 0 PSIG. RATE OF PRESSURE RISE TO BE 200-400 PSIG PER MINUTE.
25. GROWTH DUE TO HYDROTEST SHALL NOT EXCEED 0.2% OF THIS DIMENSION.
26. MAGNETIC PARTICLE INSPECT PER AGC-36235 AFTER HYDROTEST.
27. REMOVED.
28. APPLY ONE COAT MIL-P-8585, COLOR Y, ZINC CHROMATE PRIMER AND A MIN OF ONE COAT MIL-L-7178, #511, INSIGNIA WHITE LACQUER TO ALL OUTSIDE SURFACES EXCEPT THOSE MARKED (20), AND (30).
29. ALL INSIDE SKIRT SURFACES MUST BE FULLY PRIMED AND PAINTED PER (28)
30. APPLY CORROSION PREVENTIVE COMPOUND PER AGC-36234.
31. REMOVED.
32. GRIND ALL WELDS ON O.D. OF CHAMBER FLUSH IN THIS AREA.
33. REFER TO 367926 ENVELOPE, ALGOL ID, MOD 1, FOR INTERFACE INFORMATION.
34. THIS POSITIONAL TOLERANCE DOES NOT APPLY TO -5 RINGS.
35. DO NOT RADIOGRAPHICALLY INSPECT THESE WELDS.
36. DO NOT PAINT AREAS NOTED.
37. CLASSIFICATION OF CHARACTERISTICS ARE DESCRIBED ON A SEPARATE DOCUMENT NO. 366205.

QTY REQD (-19)	QTY REQD (-9)	ITEM	CODE IDENT NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL	SPECIFICATION	UNIT WT	ZONE	FIND NO.
28 AR					LACQUER NO. 511 INSIGNIA WHITE		MIL-L-7178			
28 AR					PRIMER ZINC CHROMATE		MIL-P 8585 COLOR Y			
30 AR					CORROSION PREVENTIVE COMPOUND		MIL-C 16173 GR 3			
AR					WIRE, FILLER		AGC-34013			
2				-23	FLANGE, SKIRT	4130 STL FORGE	MIL-S 6758 COND D3		2 3A	
12 AR				-21	TUBE	4130 STL SHEET	MIL-S 18729 COND N		2 3A	
1				-17	SKIRT, AFT				2 2A	
1				-15	SKIRT, FWD				2 3A	
1				-13	CLOSURE, FWD	4130 STL PLATE			2 4B	
1				-11	CLOSURE AFT	4130 STL FORGE	MIL-S 6758 COND D3		2 2A	
	REMOVED			-7	REMOVED					
2				-5	RING				2 3A	
				-3	REMOVED					
1				-1	IGNITER BOSS				2 4B	

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. DECIMAL TOLERANCE .XX ± .03 .XXX ± .010 ANGULAR TOLERANCE ± 2°0'. DO NOT SCALE DRAWING

TREATMENT

FINISH

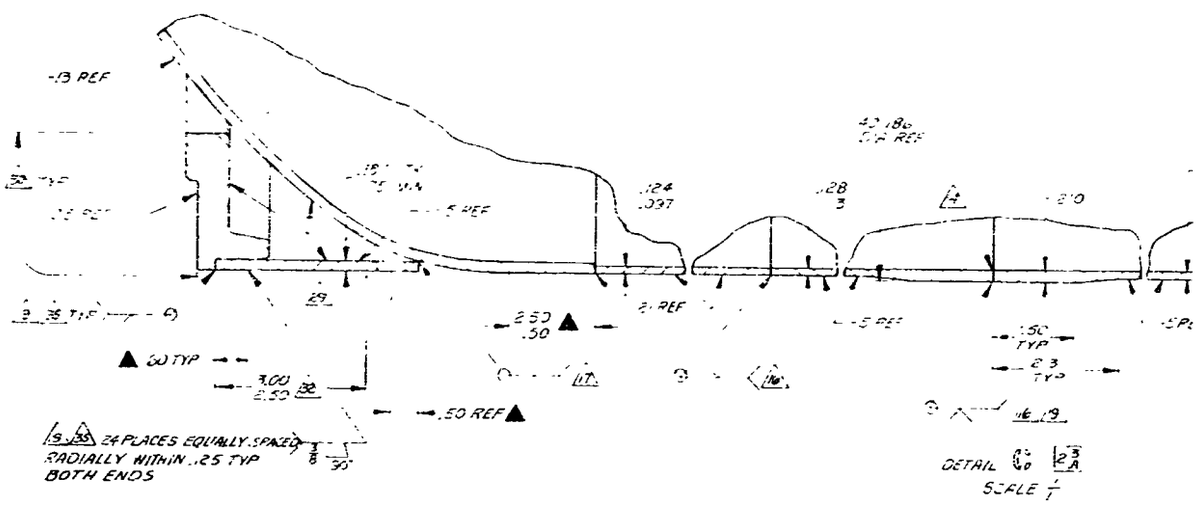
DRAWN	H. WESCOTT	8-1-62
CHECKED	MALONEY	8-21-62
DESIGN	J. FASKIND	8-10-62
PROJECT	J. J. LACEY	8-16-62
STRESS	W. PFLIEGER	8-20-62
MATERIALS		
PRODUCT	A. W. Williams	5-2-63
DESIGN ACTIVITY APPD		
CUSTOMER		

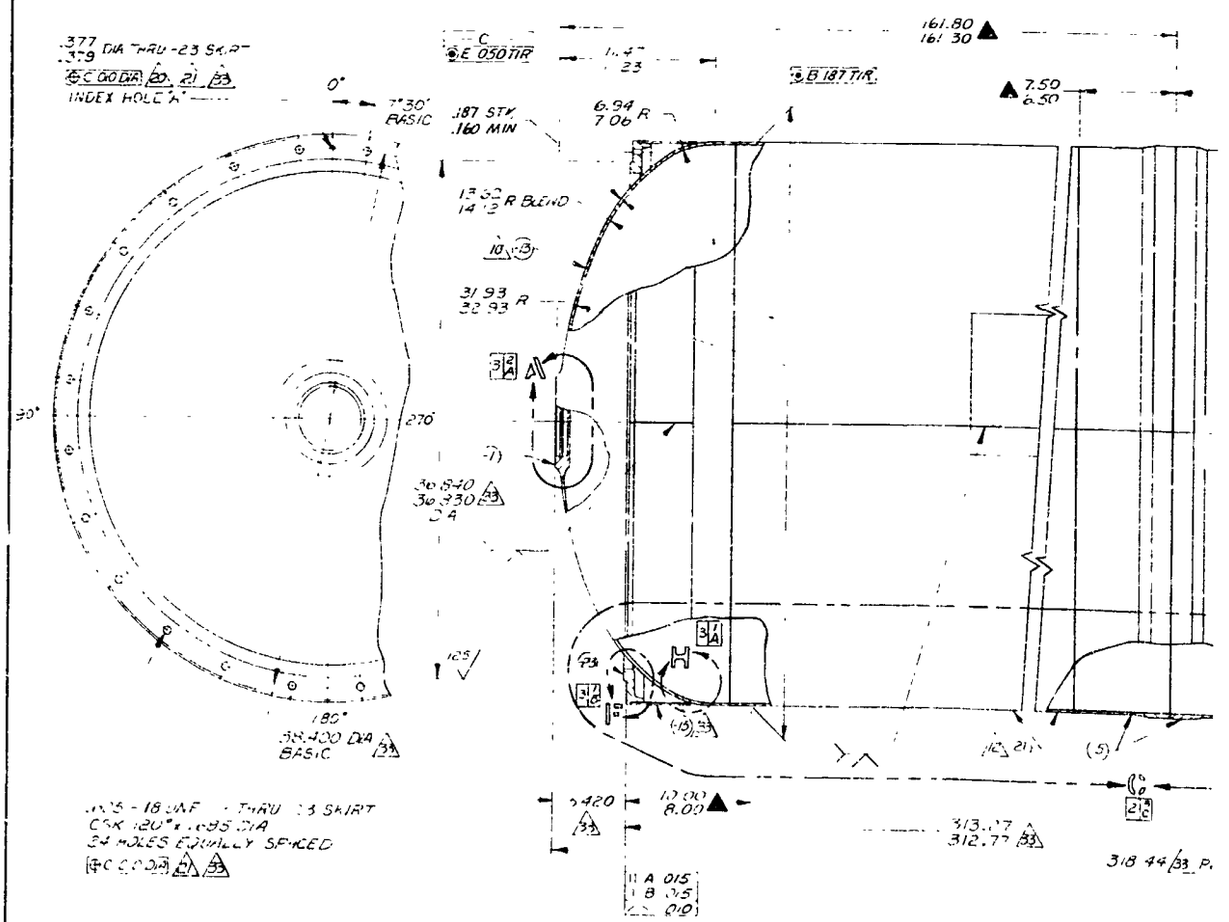
Aerojet-General CORPORATION — SOLID ROCKET PLANT, SACRAMENTO, CALIFORNIA

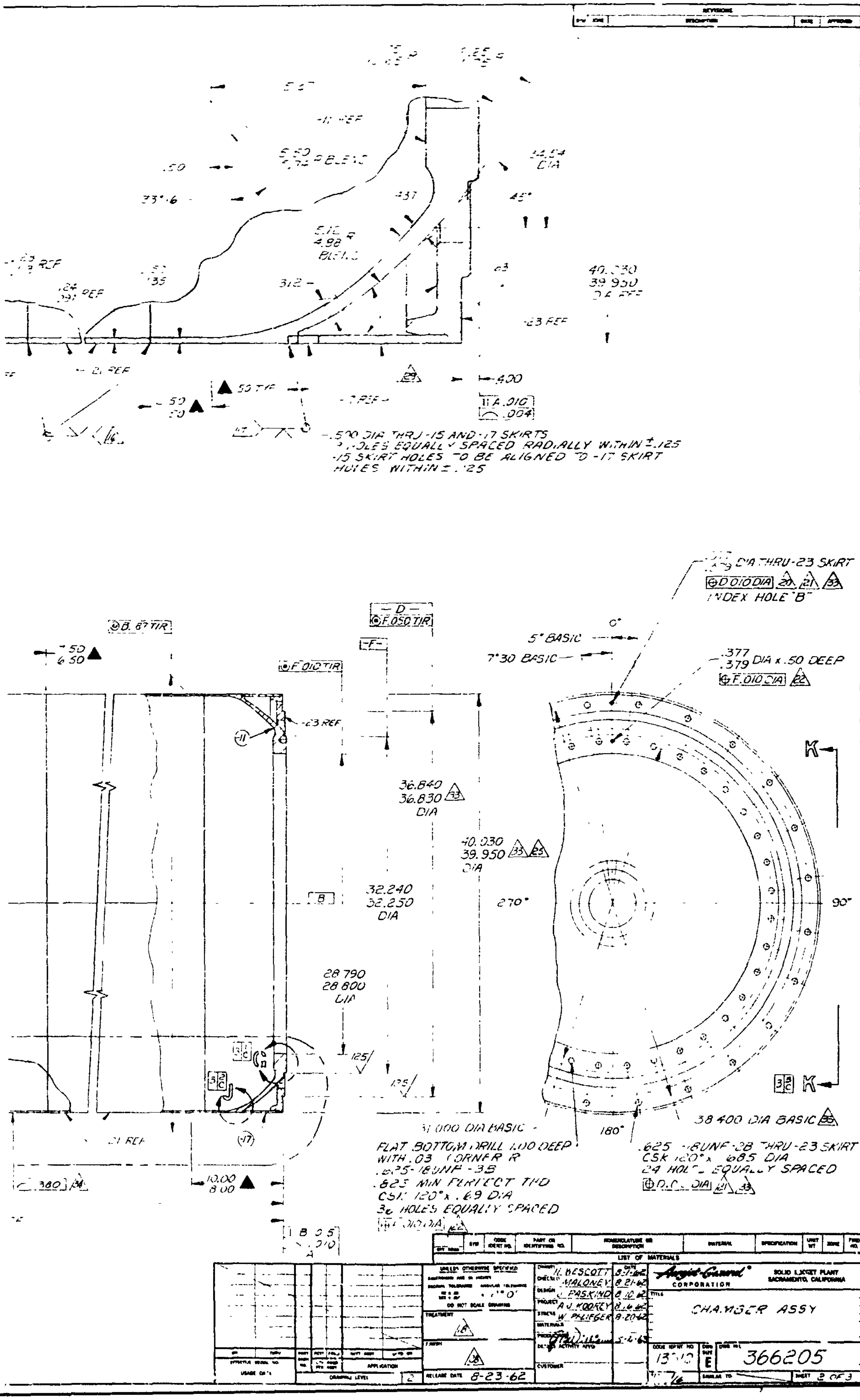
TITLE: CHAMBER ASSY

CODE IDENT NO. 13310 — SIZE E — DWG NO. 366205

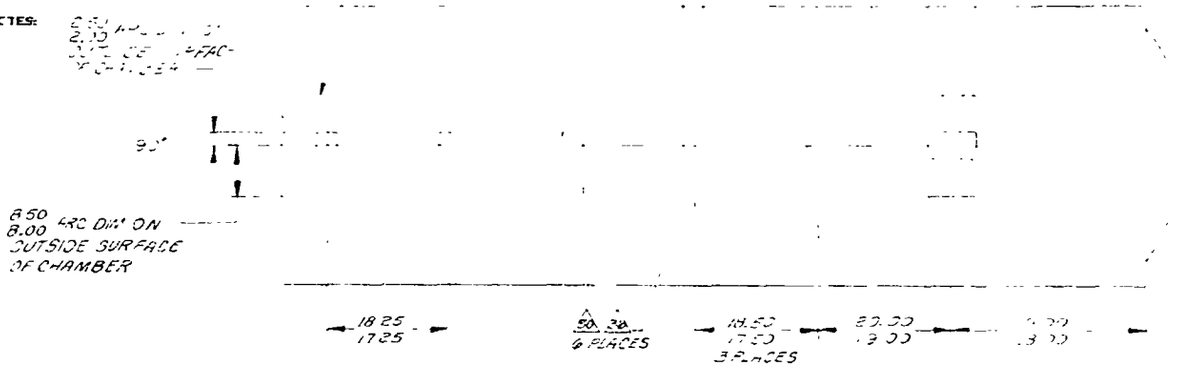
NOTES:


.13 REF
.124
.037
.128
3
2.50
.50
.50 REF
.50 TYP
2.3 TYP
24 PLACES EQUALLY SPACED RADIALLY WITHIN .25 TYP BOTH ENDS
DETAIL
SCALE 1/1

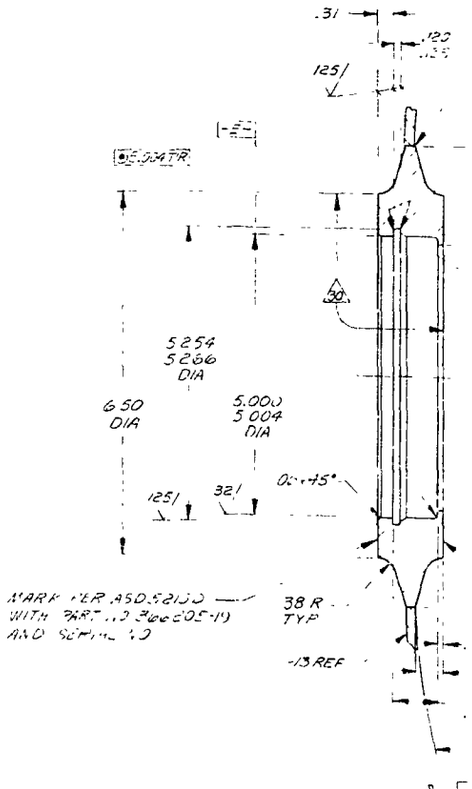

.377 DIA THRU -23 SKIRT
.379
INDEX HOLE 'A'
0°
30° BASIC
.187 STK
.160 MIN
6.94
7.06 R
13.32
14.12 R BLEND
3.93
32.93 R
90°
270°
180°
38.400 DIA BASIC
161.80
161.30
7.50
6.50
.420
10.00
8.00
313.07
312.77
318.44
.375 - 18 UNF - THRU -23 SKIRT
CSK 120° x .685 DIA
24 HOLES EQUALLY SPACED


REVISIONS
.500 DIA THRU -15 AND -17 SKIRTS
HOLES EQUALLY SPACED RADIALLY WITHIN ±.125
-15 SKIRT HOLES TO BE ALIGNED TO -17 SKIRT HOLES WITHIN ±.125
40.030
39.950
.400
DIA THRU -23 SKIRT
INDEX HOLE "B"
5° BASIC
7°30 BASIC
.377
.379 DIA x .50 DEEP
36.840
36.830
DIA
40.030
39.950
DIA
32.240
32.250
DIA
28.790
28.800
DIA
270°
90°
180°
38.400 DIA BASIC
FLAT BOTTOM DRILL 1.00 DEEP
WITH .03 CORNER R
.625-18UNF-3B
.625 MIN PERFECT THD
CSK 120° x .69 DIA
36 HOLES EQUALLY SPACED
.625-18UNF-2B THRU -23 SKIRT
CSK 120° x .685 DIA
24 HOLES EQUALLY SPACED
LIST OF MATERIALS
Aerojet-General CORPORATION
SOLID ROCKET PLANT
SACRAMENTO, CALIFORNIA
CHAMBER ASSY
366205
RELEASE DATE 8-23-62
SHEET 3 OF 3

NOTES:

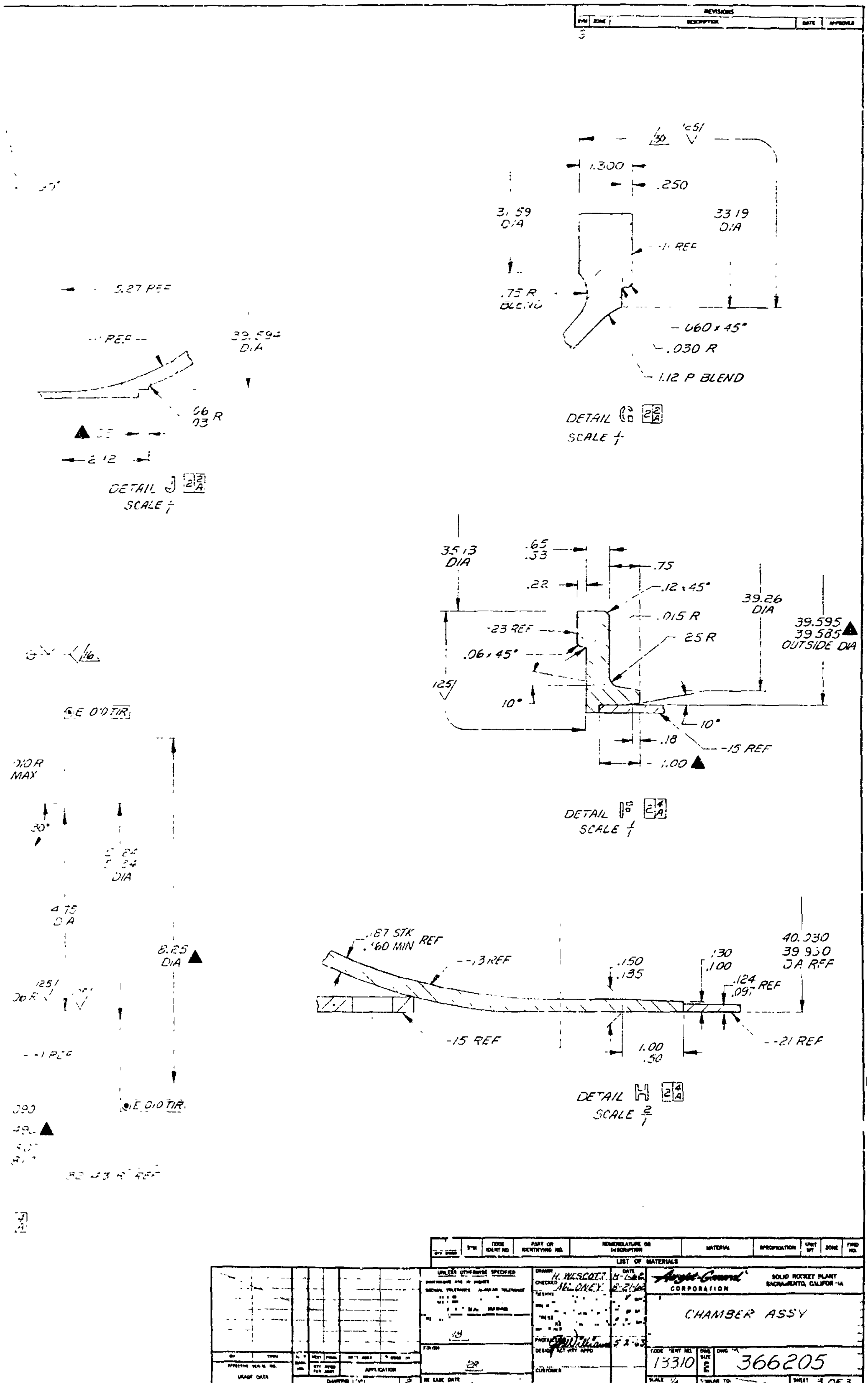


VIEW K
SCALE 1/2
6 PLACES 60° APART



MARKER ASD.52100
WITH PART NO 366205-19
AND SERIAL NO

DETAIL A
SCALE 1/1


REVISIONS
DETAIL G
SCALE 1/1
1.300
.250
33.19 DIA
.75 R BLEND
.060 x 45°
.030 R
1.12 R BLEND
DETAIL J
5.27 REF
39.594 DIA
.06 R
.03 R
DETAIL F
SCALE 1/1
35.13 DIA
.65
.33
.75
.22
.12 x 45°
.015 R
39.26 DIA
39.595
39.585
OUTSIDE DIA
.23 REF
.06 x 45°
.25 R
10°
.18
.15 REF
1.00
DETAIL H
SCALE 2/1
.87 STK
.60 MIN REF
.150
.135
.130
.100
40.030
39.930
DIA REF
.124
.097 REF
.15 REF
.21 REF
1.00
.50
.010 R MAX
30°
4.75 DIA
8.25 DIA
LIST OF MATERIALS
H. WESCOTT
MALONEY
Aerojet-General CORPORATION
SOLID ROCKET PLANT SACRAMENTO, CALIFORNIA
CHAMBER ASSY
13310
E
366205
SHEET 3 OF 3

NOTES: 1 REMOVED.

2 FILL THIS AREA, INCLUDING BOTH O-RING AND WIPER GROOVES, WITH MIL-I-8660 INSULATING AND SEALING COMPOUND.

3 APPLY ANTI-SEIZE COMPOUND TO ALL THREADS, EXCEPT 21.

4 LUBRICATE PINS AND BEARINGS WITH MIL-G-7711 GREASE.

5 ASSEMBLE 366213-19 AND 366214-9 SO THAT THE INDICATED SURFACES ARE CONCENTRIC WITHIN ± .001. INSURE THAT BOTH MATING SURFACES OF 366223-1 ARE FLUSH WITH 366213-19. INSTALL SCREWS AND TIGHTEN PER 9. DOWEL 366223-1 IN PLACE.

6 INSTALL 366216-9 LEAD SCREW, WITH THIMBLE, ENGAGED EQUALLY AT BOTH ENDS. ADJUST 366213-19 TO 6° POSITION BY ESTABLISHING A UNIFORM GAP BETWEEN INDICATED SURFACES OF 366213-19 AND 366214-9 WITHIN ± .001. ADJUST THIMBLE TO 6° POSITION AND TIGHTEN SET SCREWS.

7 POT SCREW HEADS WITH AGC-10758 AND MIL-P-50025. PROCESS PER AGC-36180.

8 TORQUE TO 60 IN LB.

9 TORQUE TO 1600 IN LB.

10 TORQUE TO 200 IN LB.

11 INSTALL LOCK WIRE PER MS 33540.

12 REMOVED.

13 REMOVED.

14 PROOF TEST NOZZLE WITH AIR OR NITROGEN AT BOTH THE 0° AND 14° POSITIONS. RATE OF PRESSURE BUILDUP TO BE 100 PSI PER MINUTE. HOLD AT 350 ± 5 PSIG FOR 2 ± .1 MINUTES. DROP TO 285 ± 5 PSIG, HOLD FOR 5 ± .1 MINUTES. PERMISSIBLE PRESSURE DECLINE IS 15 PSIG MAXIMUM. DROP PRESSURE TO 50 ± 5 PSIG AND LEAK CHECK WITH SOAP WATER. NO LEAKAGE ALLOWED. THE GAP BETWEEN 366213-19 AND 366214-9 TO BE FILLED WITH MIL-I-8660 COMPOUND AT THE START OF EACH TEST TO PREVENT SOAP WATER FROM ENTERING GAP.

15 REMOVED

16 REMOVED

17 REMOVED

18 TOUCH UP PRIMED SURFACES WITH MIL-P-8585 PRIMER PER AGC-36072.

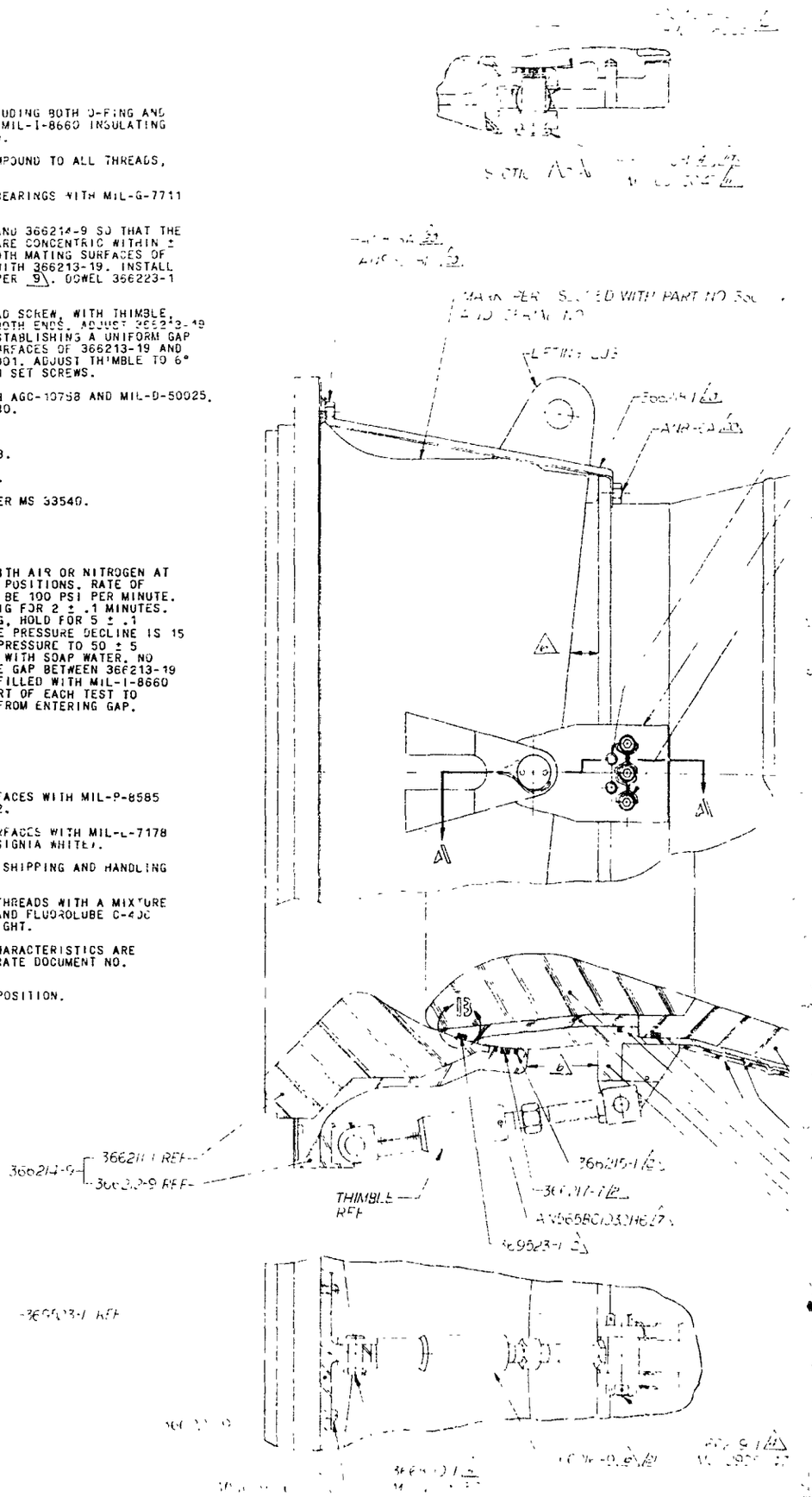
19 TOUCH UP PAINTED SURFACES WITH MIL-L-7178 LACQUER NO. 511 (INSIGNIA WHITE).

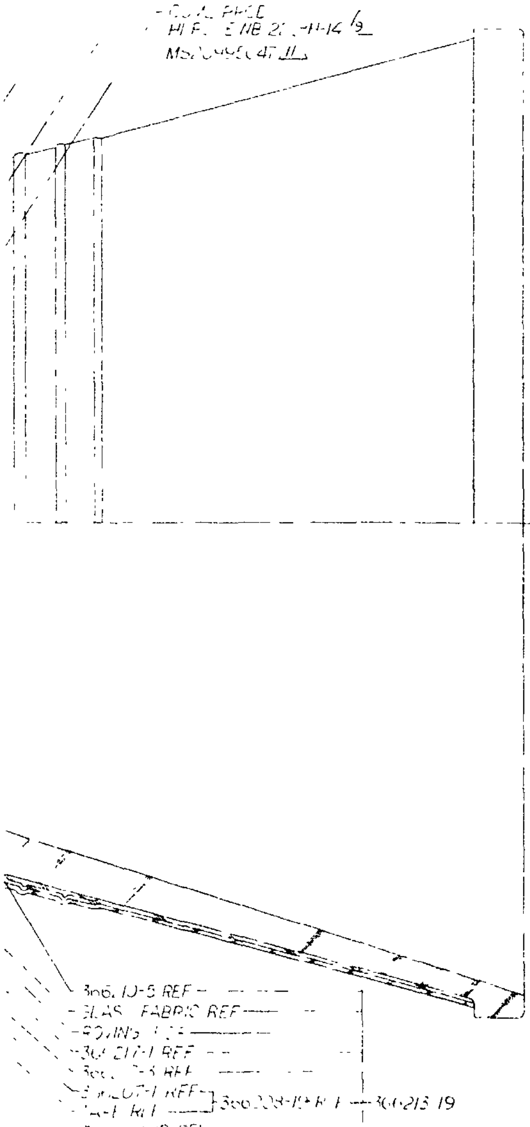
20 THESE PARTS ARE FOR SHIPPING AND HANDLING ONLY.

21 LUBRICATE 366216-9 THREADS WITH A MIXTURE OF MOLYKOTE POWDER AND FLUOROLUBE C-40C 50 ± 10% EACH BY WEIGHT.

22 CLASSIFICATION OF CHARACTERISTICS ARE DESCRIBED ON A SEPARATE DOCUMENT NO. 366224.

23 NOZZLE SHOWN IN 0° POSITION.





Note	QTY -29	-19	-9	SYM	CODE IDENT NO	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL	SPECIFICATION	UNIT WT	ZONE	FIND NO.
7	AR						DIETHYLENETRIAMINE		MIL-D-50025			
7	AR						RESIN TYPE I		AGC-10758			
18	AR						PRIMER COATING, COLOR Y		MIL-P-8585			
19	AR						LACQUER, COLOR NO 511		MIL-L-7178			
2	7						INSULATING AND SEALING COMPOUND		MIL-I-8660			
3	AR						ANTI-SEIZE COMPOUND		MIL-A-907			
4	AR						GREASE		MIL-G-7711			
21	AR				94499		MOLYKOTE POWDER, TYPE Z					
21	AR				91764	C-406	FLUOROLUBE					
	2				81376	BFCN-16003	BEARING			1	3D	
	6				56878	HIPSIENB 22-84-14	BOLT			1	2C	
	2					MS16997-63	SCREW			1	3A	
11	AR					MS20995C47	WIRE LOCK					
	1					MS24665-370	PIN, COTTER			1	3A	
20	6					AN960-816	WASHER			1	3D	
	2					AN565R C1032H6	SET SCREW			1	3A	
7	6					AN8-6A	BOLT			1	3D	
	4					AN 122173	PIN-DOWEL			1	2D	
	1					369523-1	RING, BAFFLE			1	3A	
	1					366800-1	PIN, STRAIGHT			1	3A	
	2					366223-1	TRUNNION			1	2D	
	1					366222-9	BRACKET			1	4H	
	2					366220-1	PIN NOZZLE			1	3D	
	2					366219-1	BOLT			1	3A	
20	3					366218-1	SUPPORT			1	3C	
	1					366217-7	PACKING			1	3A	
		REMOVED	REMOVED			366216-9	MICROMETER ASSY			1	3A	
	1					366215-1	RING			1	3B	
	1					366214-9	CLOSURE ASSY			1	4B	
	1					366213-19	THROAT AND EXIT CONE ASSY			1	2A	

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES
DECIMAL TOLERANCE — ANGULAR TOLERANCE
DO NOT SCALE DRAWING

DRAWN	H BONE	6-62
CHECKED	T. L. MALONEY	6-10-62
DESIGN	J. PISKIND	7-9-62
PROJECT	A. J. KOOREY	8-3-62
STRESS	W. D. PFLUEGER	8-3-62
DESIGN ACTIVITY		6-18-62

Aerojet-General CORPORATION
SOLID ROCKET PLANT SACRAMENTO, CALIFORNIA

TITLE: NOZZLE ASSY

CODE IDENT NO 13310 | SIZE E | DWG NO 366224

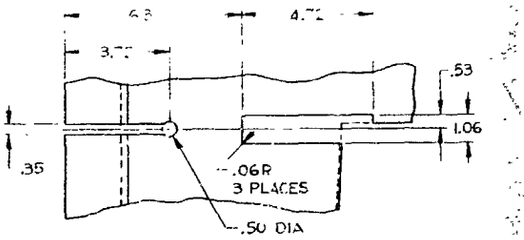
RELEASE DATE 6 13 62

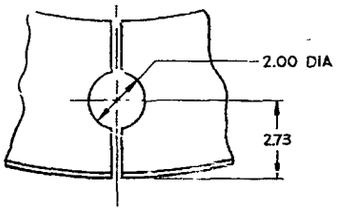
NOTES: 1 PROCESS -3 AND -5 PARTS PER AGC-36330

2 REMOVED.

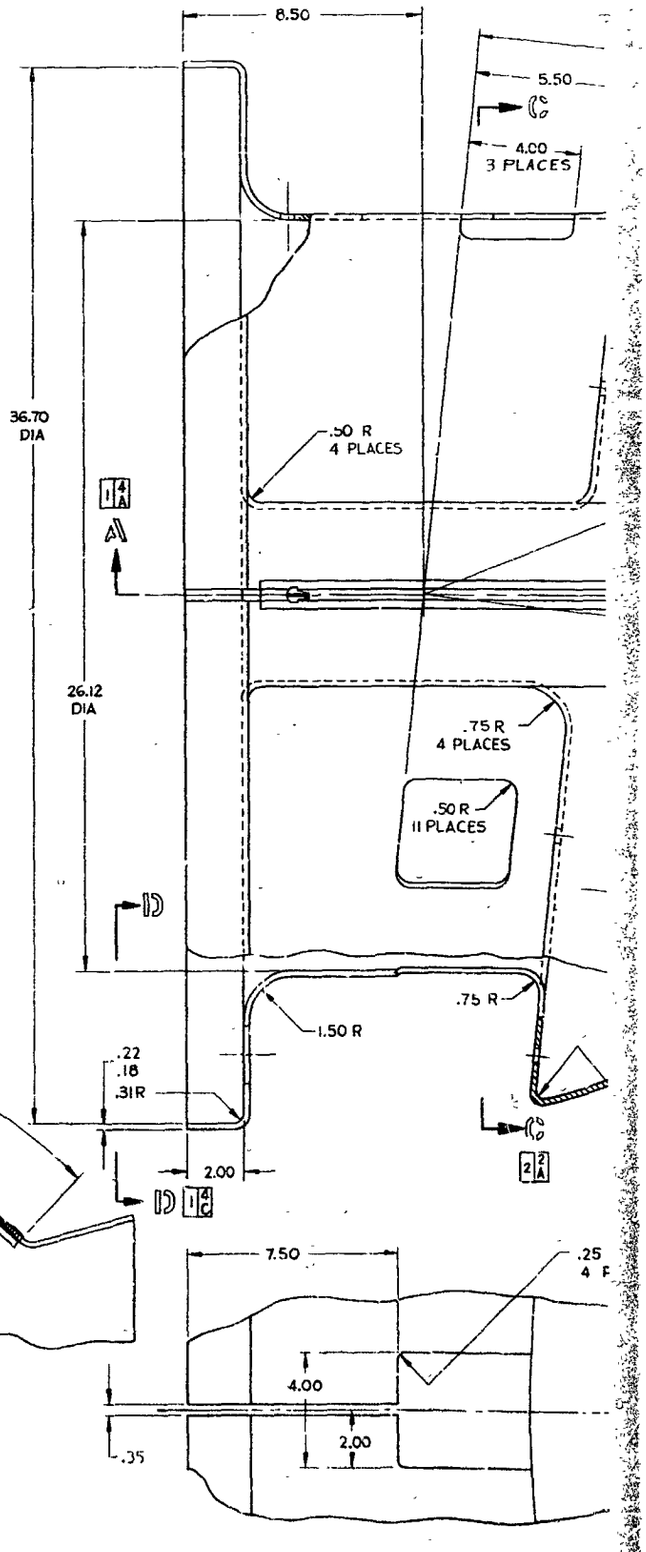
3 AFTER CURING -3 AND -5, BOND ZIPPER NO. 410 USING A-12 ADHESIVE.

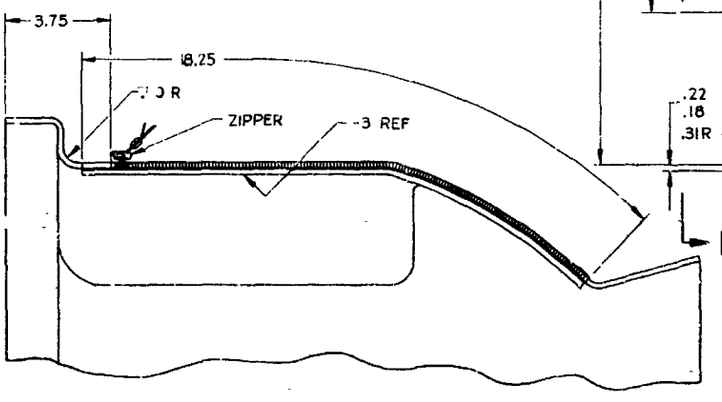
4 CLASSIFICATION OF CHARACTERISTICS ARE DESCRIBED ON A SEPARATE DOCUMENT NO. 366221.





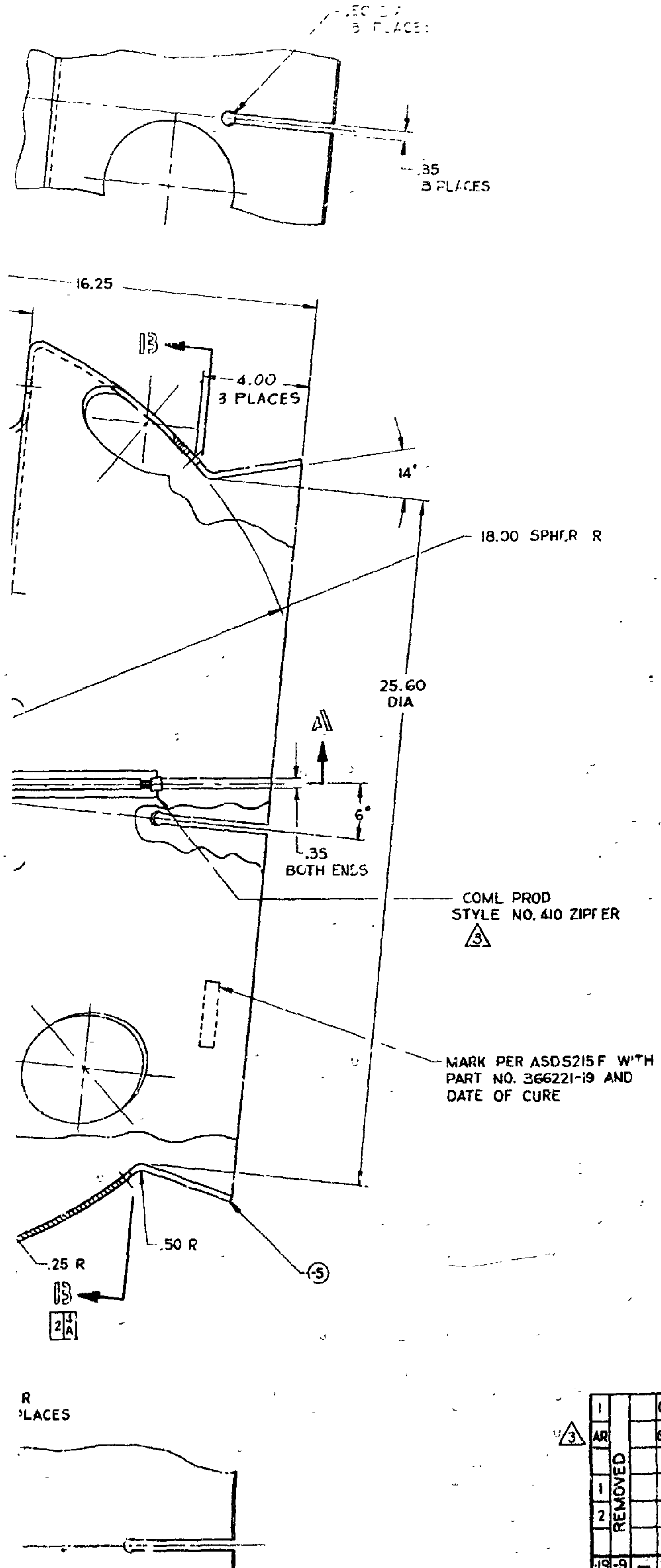
VIEW D-D [1] [3] A





SECTION A-A [1] [3] C

REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
C		[illegible] REPLACES 366221 C [illegible] DWG LEVEL WAS I	[illegible]	[illegible]
		[illegible] PRECED CHG DCN DATED 5-27-63	[illegible]	[illegible]



QTY -19	QTY -9	SYM	CODE IDENT NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL	SPECIFICATION	UNIT WT.	ZONE	FIND NO.
1			03481	STYLE NO. 410	ZIPPER - HYCAR RUBBER 18.25 LONG				1	2B
AR		3	89262		ADHESIVE, A-12					
	REMOVED									
1				-5	BODY		AGC-34161		1	2B
2				-3	STRIP		AGC-34161		2	1C
				-1	REMOVED					

LIST OF MATERIALS

DRAWN	L. E. RICH 9-5-63
CHECKED	W.H. PAMELL 9-20-63
	J. PASKIND 9-19-63
	A.V. KOREY 9-26-63
	HELICKER 9-26-63
	6-17-63

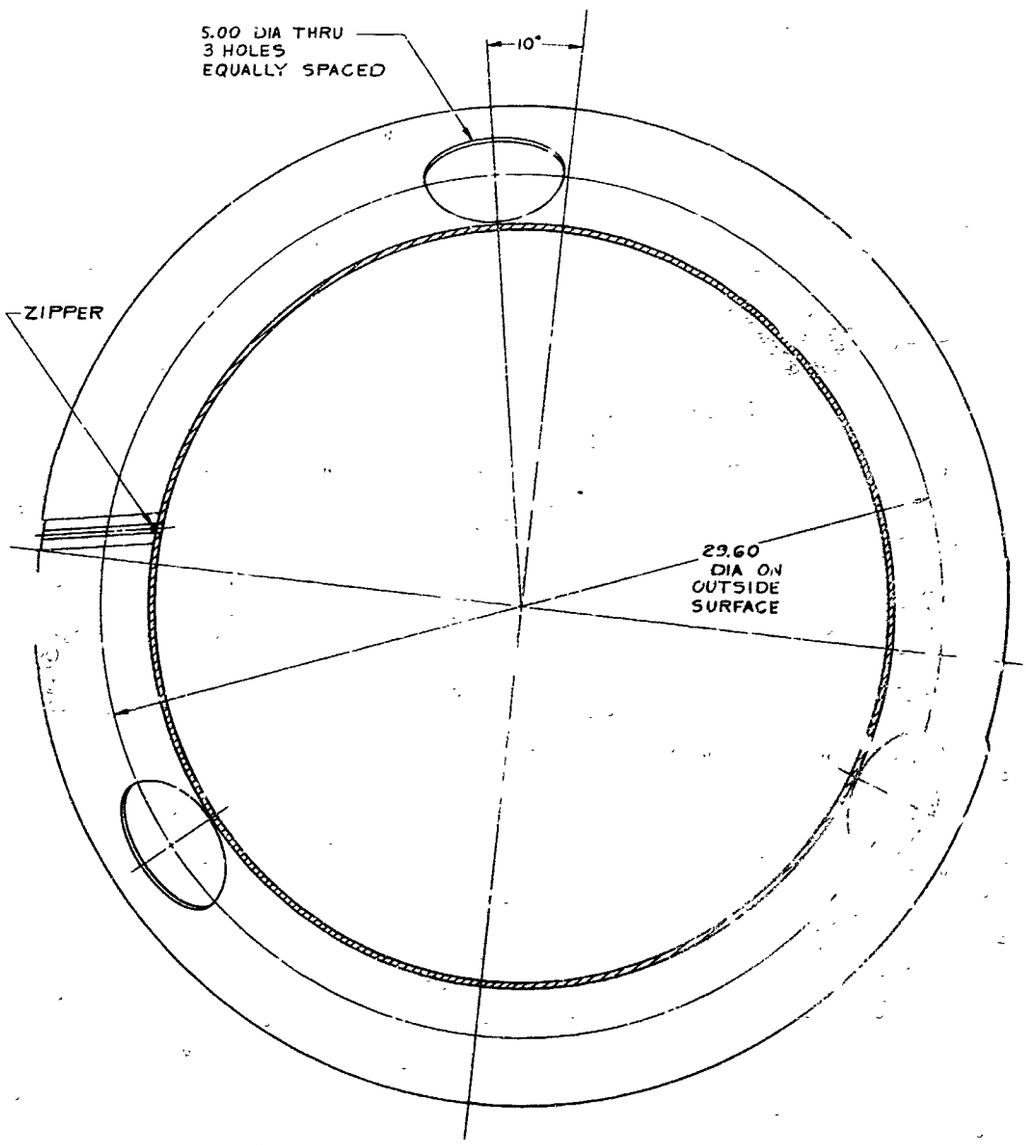
Aerojet-General CORPORATION — SOLID ROCKET PLANT, SACRAMENTO, CALIFORNIA

BOOT, INSULATOR

CODE IDENT NO. 13310 | SIZE F | DWG NO. 366221

-19		28.0		-19	1	1 366421-19
PART NO.	ACT. WEIGHT	CALC				

366221



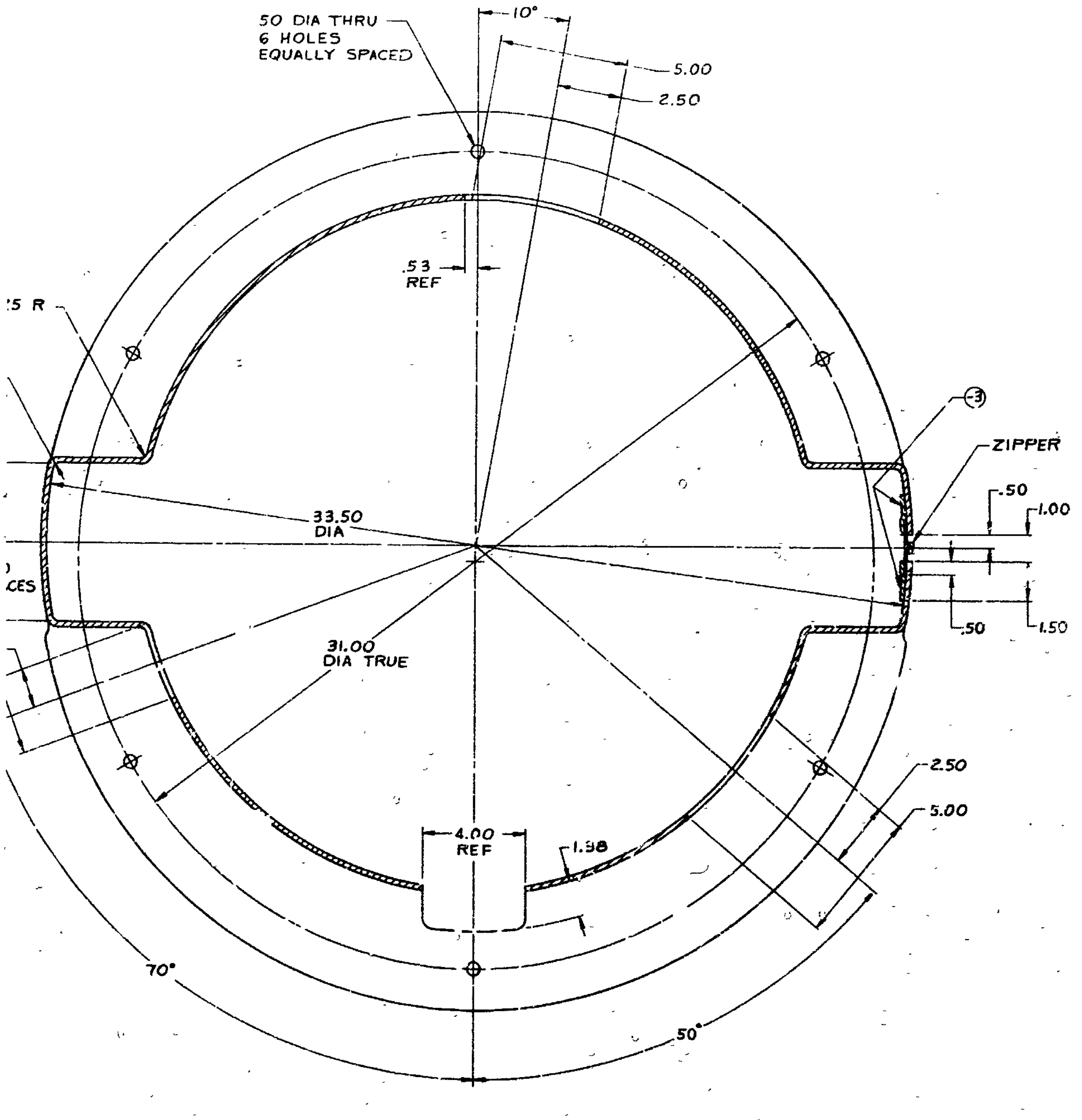
SECTION 13 - 13

.25 R

6.00
2 PLACES

3.00
2 PLA

1.50
3.00



SECTION C-C

LIST OF MATERIALS

DRAWN	E. RICH
CHECKED	W. H. PENNELL 9-28-62
	J. PASKIND 9-16-62
	J. J. ROONEY 9-26-62
	PFLIEGER 9-28-62

AEROJET-GENERAL CORPORATION — SOLID ROCKET PLANT, SACRAMENTO, CALIFORNIA

BOOT, INSULATOR

13310 | F | 366221

366221

NOTES:

1 REMOVED.

2 REMOVED.

⚠3 APPLY ADHESIVE PER ⚠4 TO THREADS & MATING SURFACES IMMEDIATELY BEFORE ASSEMBLY.

⚠4 ADHESIVE IS TO CONSIST OF 8 ± 1 PARTS DIETHYLENETRIAMINE TO 100 PARTS EPOXY RESIN. PARTS BY WEIGHT.

⚠5 SEPARATE EACH ROW OF ALCLO PELLETS OR ALCLO GRAINS WITH ONE AS1382-53 CUSHION.

⚠6 LOAD CAVITY WITH 2 ± .1 GRAMS INITIATOR CHARGE CONSISTING OF EQUAL PARTS BY WEIGHT OF AGC-32014 PYROTECHNIC POWDER AND AGC-34154 IGNITION POWDER. OMIT VEGETABLE OIL FROM AGC-32014 PYROTECHNIC POWDER.

7 REMOVED

⚠8 QUANTITY REQUIRED 3000 ± 10 GRAMS.

9 PACKAGING, PACKING, MARKING AND SHIPPING PER PPS SHEET NO. 3456.

⚠10 MARK TAG PER ASD 5215F WITH SQUIB RESISTANCE.

⚠11 VENDOR ITEM, SEE SPEC CONTROL DRAWING.

12 REMOVED.

13 REMOVED.

⚠14 APPLY ADHESIVE PER ⚠4 TO 369581-9 RETAINER ASSY SUPPORTS PRIOR TO INSTALLATION.

15 REMOVED

⚠16 SCRIBE 4 MARKS AFTER ASSY, .50 LONG X .01 WIDE X .020 DEEP ON FORWARD FACE OF 368062-1. SCRIBE MARKS TO BE IN LINE WITH EACH OF THE 4 HOLES IN 368101-19.

⚠17 APPLY SEALING COMPOUND PER MIL-S-7916 TO THREADS ON 368071 IMMEDIATELY BEFORE ASSY.

⚠18 TORQUE TO 6 ± 1 FT LBS.

⚠19 TORQUE TO 50/70 INCH LBS.

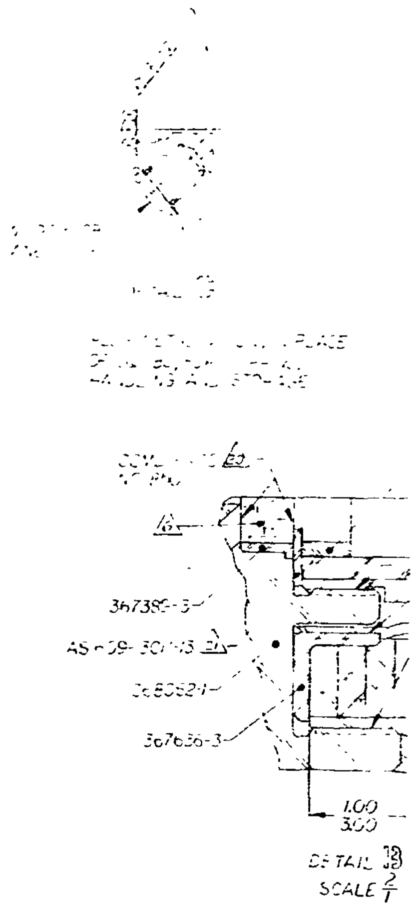
⚠20 APPLY TAPE NO. 850 TO SURFACES INDICATED.

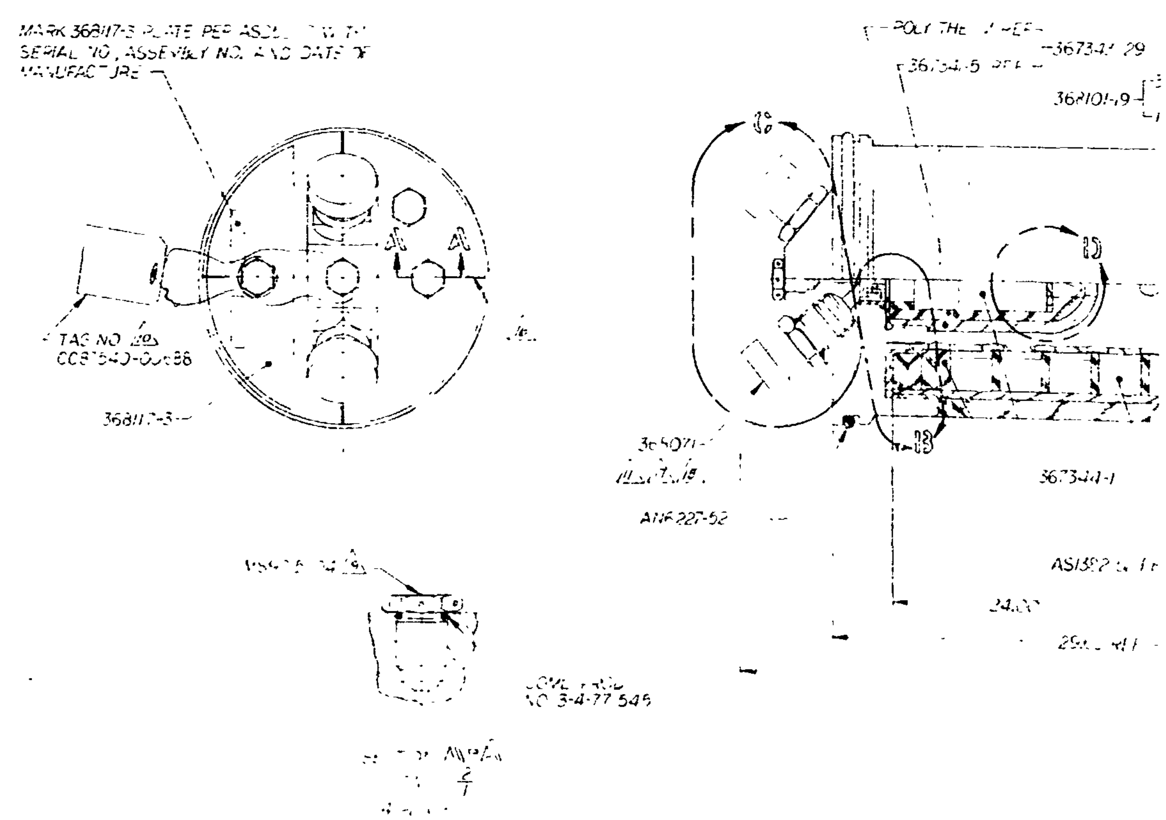
⚠21 BOND AS1609-13C11-13 TO 367343-29 WITH ADHESIVE PER ⚠4.

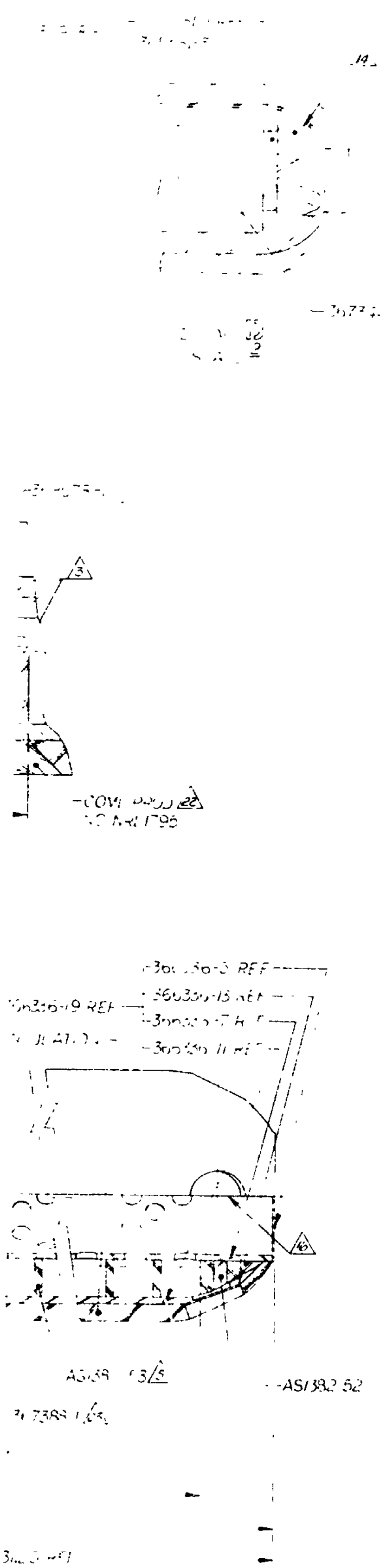
⚠22 CLEAN MATING SURFACES PER AGC-46350 LEVEL H. APPLY NRL-1795 INSULATION AND CURE AT AMBIENT TEMPERATURE FOR 4 HRS.

⚠23 MAINTAIN FIRM PELLET PACKING.

24 CLASSIFICATION OF CHARACTERISTICS ARE DESCRIBED ON A SEPARATE DOCUMENT 367345.







REVISIONS

REPLACES ... DGN

Note	Qty	Code Ident No.	Part or Identifying No.	Nomenclature or Description	Specification	Unit Wt	Zone
11	AR			SEALING COMPOUND	MIL-S-7916		
4	AR			DIETHYLENETRIAMINE	MIL-D-50025		
4	AR			RESIN, TYPE III	AGC-10756		
6	AR			POWDER, IGNITION	AGC-34154		
6	AR			POWDER, PYROTECHNIC	AGC-33014		
	4	83259	3-4 ... 545	O RING		1	3A
22	AR		NPC-1795	INSULATION: INSULATION TECHNOLOGY INC. CARMICHAEL CALIF		1	2C
20	AR	76381	850	TAPE		1	3C
	1	13310	2C81540-00088	TAG, IGNITER (AGC-5-109-099)		1	4B
	2		AN6227-12	PACKING O RING		1	3D
	1		AN6227-52	PACKING "O" RING		1	3A
	4		MS9015-04	PLUG		1	4A
	2		MS9015-08	PLUG		1	3C
	1		AS1609-13C11-13	WASHER, FLAT		1	3C
	AR		AS1382-53	CUSHION		1	2A
	AR		AS1382-52	CUSHION		1	2A
	1		369581-9	RETAINER, ASSY		1	2D
	1		368..7-3	PLATE, IDENTIFICATION		1	4A
	1		368101-19	CHAMBER, INSULATED		1	3B
	1		368078-1	RETAINER, BOOSTER GRAIN		1	2C
11	2		368071	SQUIB		1	3A
	1		368062-1	ADAPTER		1	3C
	1		367636-3	RETAINER, CHAMBER		1	3C
	1		367389-3	INSULATOR		1	3C
8			367388-1	GRAIN, ALCLO		1	2A
	3		367344-1	GRAIN, ALCLO, BOOSTER		1	3A
	1		367343-29	CHAMBER, BOOSTER		1	3B

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED

DO NOT SCALE DRAWING

DRAWN	... LORIOSO	...
CHECKED	D. BAHL	10-29-62
DESIGN	...	10-15-62
PROJECT	... HASKINS	...
STRESS	... KIKOPULO	10-15-62
	...	5-31-63
	J. ...	5-13-63

AEROJET-GENERAL CORPORATION

SOLID ROCKET PLANT SACRAMENTO, CALIFORNIA

TITLE: IGNITER ASSEMBLY

CODE IDENT NO.	SIZE	DWG NO.
13310	E	367345

SCALE 1/1

RELEASE DATE 10-29-62

NOTES: 1 REMOVE ALL BURRS AND SHARP EDGES.

2 INTERPRET DRAWING IN ACCORDANCE WITH STANDARDS PRESCRIBED BY MIL-D-70327.

3 SURFACE ROUGHNESS TO BE 125 UNLESS OTHERWISE SPECIFIED.

4 HEAT TREAT TO 200,000 - 220,000 PSI ULTIMATE TENSILE STRENGTH PER MIL-H-6875.

5 MAGNETIC PARTICLE INSPECT PER MIL-I-6868 AFTER HYDROTEST. NO DEFECTS ALLOWED.

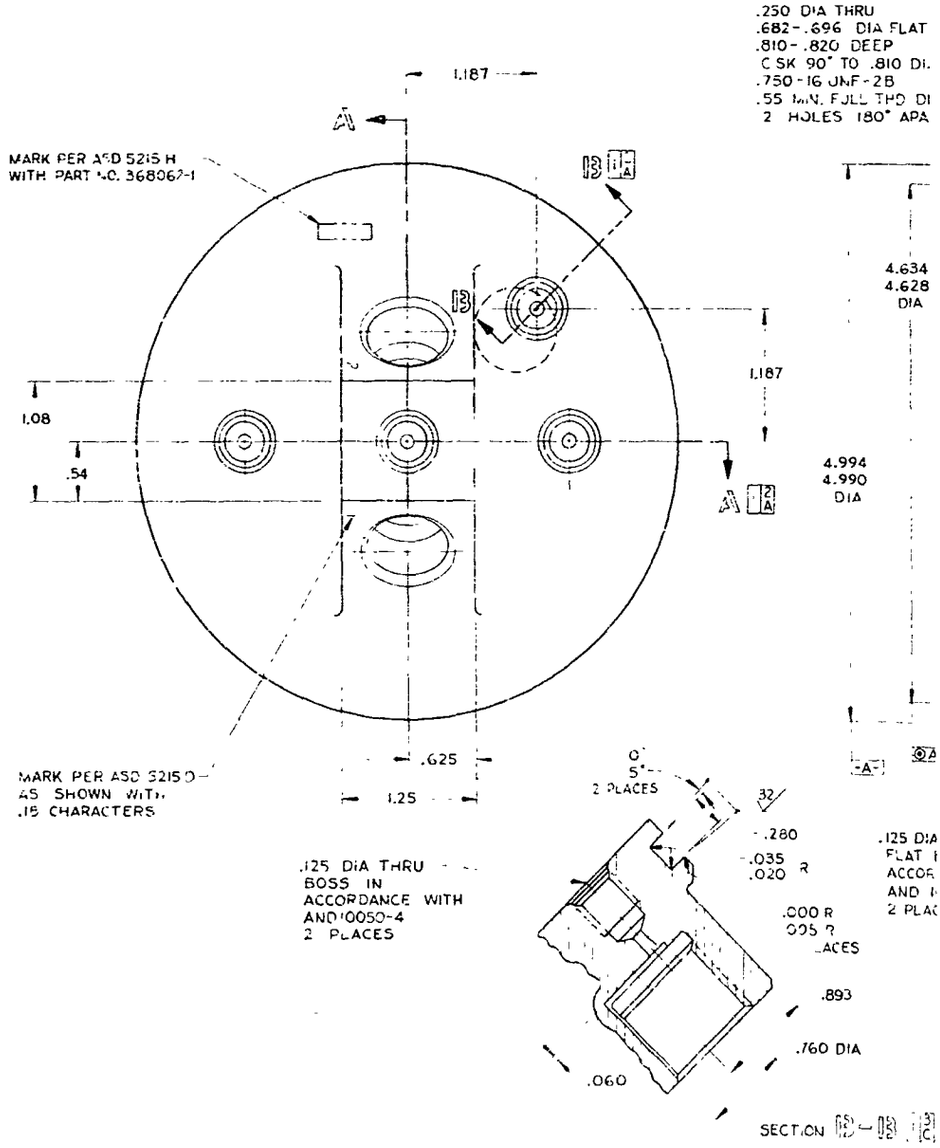
6 ALL DIMENSIONS APPLY AFTER PLATING.

7 HYDROSTATIC PROOF TEST SURFACES INDICATED TO 10,000 PSIG MINIMUM USING OIL, PER AGU-28140/3. HOLD FOR 3 ONE-MINUTE CYCLES. NO DEFECTS PERMISSIBLE.

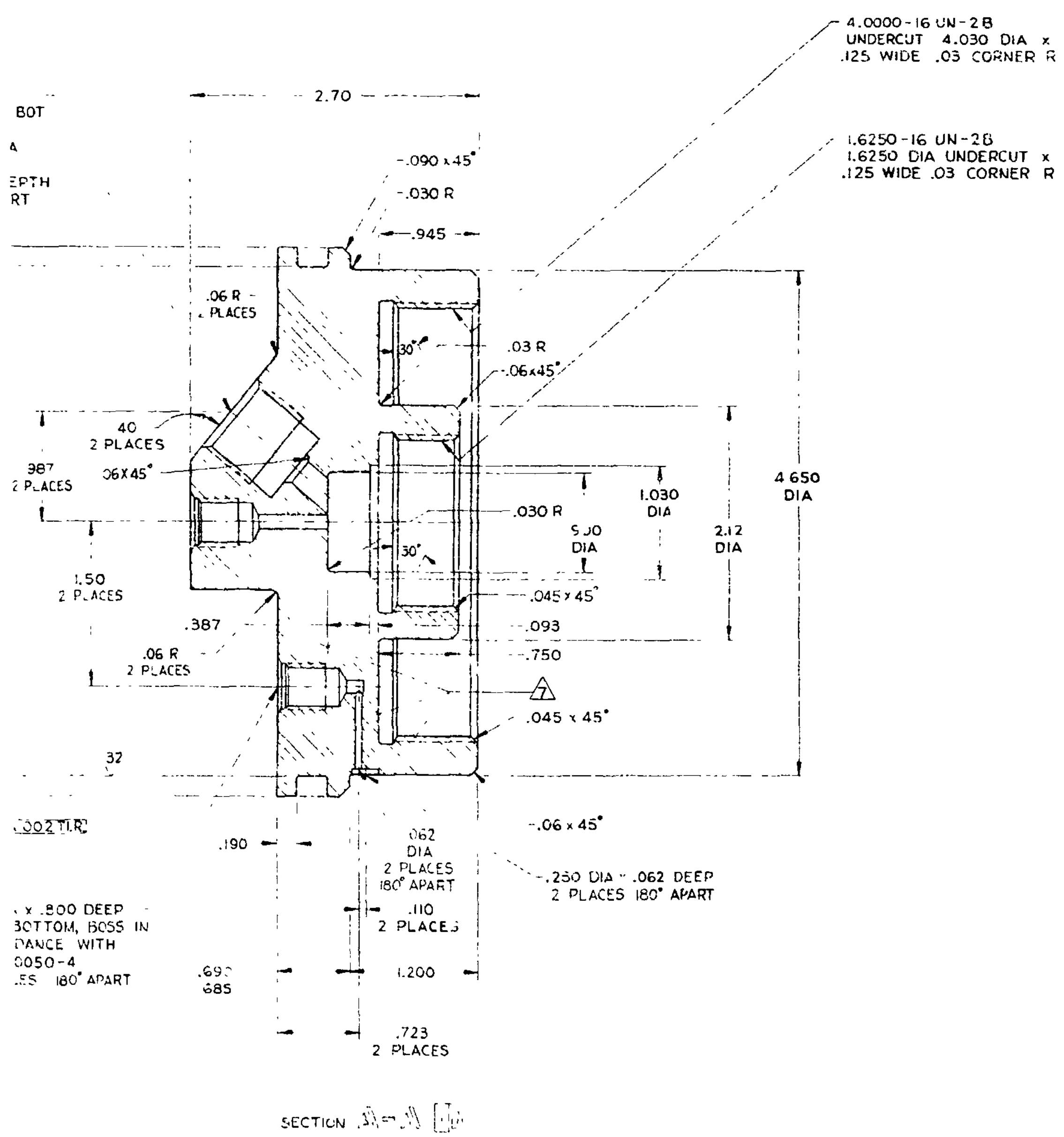
8 THREADS PER NBS HANDBOOK H-28.

9 CLASSIFICATION OF CHARACTERISTICS ARE DESCRIBED ON A SEPARATE DOCUMENT NO. 368062.

10 ALL CORNER RADII TO BE .005 - .015 UNLESS OTHERWISE SPECIFIED.



REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
		...ER... REPLACES 368062		
		... LEVEL WAS 1 SEE B CHG DCN		



-1		1340 STL COND D2	MIL-S-5000
PART IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL	SPECIFICATION

LIST OF MATERIALS

UNLESS OTHERWISE SPECIFIED

TREATMENT 4

FINISH QC P-416 CL 2 TYPE II 6

RELEASE DATE 11-14-62

DRAWN J. GLORIOSO 10-8-62; CHECKED R. RAHL; DESIGN ... HACKBAR; PROJECT ... TAFSR JR; STRESS ... ; MATERIALS ...; DESIGN ACTIVITY APPR ... J. CASHINO 5-21-63

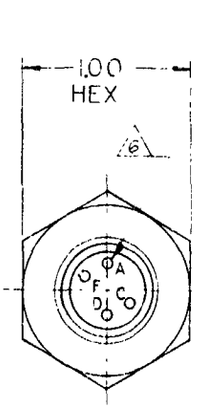
Aerojet-General Corporation — SOLID ROCKET PLANT, SACRAMENTO, CALIFORNIA

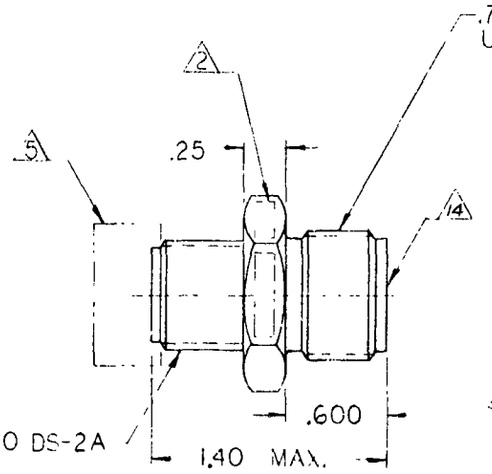
TITLE: ADAPTER, IGNITER

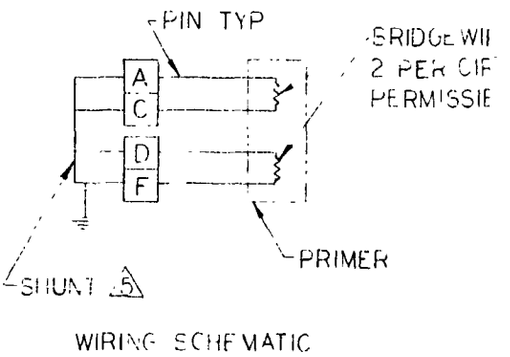
CODE IDENT NO 13310 | SIZE E | DWG NO 368062

NOTES:

1. REMOVE ALL BURRS AND SHARP EDGES.
2. IDENTIFY WITH VENDOR PART NO., AGC SPECIFICATION CONTROL DRAWING NUMBER 368071 AND SERIAL NO. PER ASD 5215C.
3. INTERPRET DRAWING IN ACCORDANCE WITH THE STANDARDS PRESCRIBED BY MIL-D-70327.
4. SURFACE ROUGHNESS 125/ UNLESS OTHERWISE SPECIFIED.
5. SHUNT TO INSURE GROUNDING FROM PIN TO PIN AND ALL PINS TO CASE. MAXIMUM SHUNT RESISTANCE TO BE ONE-TENTH OF MINIMUM BRIDGEWIRE RESISTANCE. METAL FOIL SHUNTS NOT PERMISSIBLE.
6. BRIDGEWIRE PIN SPACING TO BE ACCOMPLISHED BY USING A CONNECTOR WHICH MATES WITH BENDIX PC06-10-6S CONNECTOR. PINS TO BE LETTERED CLOCKWISE WITH PIN A AT INDEX POINT OF CONNECTOR. PINS B AND E TO BE REMOVED. BRIDGEWIRES TO BE ATTACHED BETWEEN PINS A-C AND D-F.
7. THE INTEGRITY OF THE BRIDGEWIRE WELD SHALL BE DETERMINED BY MICROSCOPIC EXAMINATION, ELECTRICAL TEST, AND BRIDGEWIRE PULL TEST.
8. THE BRIDGEWIRE SHALL BE COVERED BY THE PRIME COMPOSITION WHICH IN TURN SHALL BE PREVENTED FROM MIGRATING FROM CONTACT WHEN BRIDGEWIRE IS UNDER VIBRATION. THE USE OF PRIMER OR IGNITION COMPOSITION IN THE FORM OF A BEAD OR PAINTED ON THE BRIDGEWIRE SHALL NOT BE ACCEPTABLE.
9. DETONATING MATERIALS ARE NOT PERMISSIBLE FOR USE AS A PRIMER CHARGE.
10. SQUIBS SHALL BE SHIPPED IN A MOISTURE PROOF CONTAINER CAPABLE OF BEING VAPOR SEALED. INDICATING DESICCANT PER MIL-D-3464 SHALL BE PLACED IN EACH CONTAINER, PRIOR TO SHIPMENT. CONTAINERS SHALL BE CLEARLY MARKED PER MIL-STD-129 WITH PART NUMBER, LOT NUMBER, AND DATE OF MANUFACTURE.
11. ALL DELIVERED LOTS OF ORDNANCE ITEMS OR COMPONENTS WILL CONTAIN PYROTECHNIC MATERIALS MANUFACTURED FROM A SINGLE BATCH.
12. CHANGING TYPE OF MATERIAL AND/OR METHOD OF CONSTRUCTION SHALL NOT BE PERMITTED WITHIN A LOT.
13. ALL VENDOR DETAIL DRAWINGS AND SUBSEQUENT CHANGES SHALL BE REVIEWED BY COGNIZANT AGC ENGINEERING PERSONNEL PRIOR TO MANUFACTURE OF PARTS.
14. NO SHRAPNEL PERMISSIBLE FROM CLOSURE. CLOSURE MAY BE + SCORED TO EFFECT PETAL OPENING OR MAY BE CONSUMABLE.
15. CLASSIFICATION OF CHARACTERISTICS ARE DESCRIBED ON A SEPARATE DOCUMENT NO.368071.







WIRING SCHEMATIC

REVISIONS				
SYM	ZONE	DESCRIPTION	DATE	APPROVED
A		SEE A CHANGE DCN	12-6-62	J.N. Kay
		SEE RECORD DCN DATED 5-6-63, DWG LEVEL WAS "1"	5-9-63	L. Watson

NO FIRE DESIGN CAPABILITY

1. NO FIRE CURRENT EACH BRIDGEWIRE CIRCUIT 1.0 AMP MIN. 5 MINUTES MIN.
2. NO FIRE WATTAGE EACH BRIDGEWIRE CIRCUIT 1.0 WATT MIN. 5 MINUTES MIN.
3. NO FIRE VOLTAGE, PIN TO CASE 1000 V AC RMS MINIMUM.
4. STATIC DISCHARGE OF 0.01 JOULE FROM A 0.04 MICRO FARAD CAPACITOR APPLIED FROM SHUNTED LEADS TO CASE.

FUNCTIONAL DESIGN CAPABILITY

A. 100% FIRING CURRENT EACH BRIDGEWIRE CIRCUIT 4.5 AMPS.
B. RESISTANCE EACH BRIDGEWIRE CIRCUIT 0.5 OHMS MINIMUM.
C. ALTITUDE CAPABILITY SEA LEVEL TO 200,000 FT.
D. MIN AUTO IGNITION TEMP 350°F FOR 8 HOURS.

PHYSICAL DATA

1. SQUIB SEAL SHALL BE GLASS OR CERAMIC TO METAL.
2. INITIATOR CHARGE TO CONSIST OF .600 ± .01 GRAMS OF EQUAL PARTS BY WEIGHT OF IGNITION POWDER PER AGC-34154 AND PYROTECHNIC POWDER A 35 MI, PER AGC-32014.
3. DUAL BRIDGEWIRE CIRCUITS.
4. CLOSURE TO BE RESISTANCE WELDED PER MIL-W-6858 CLASS B OR SOFT SOLDERED PER MIL-S-6872.
5. CONNECTOR END MATES WITH BENDIX PC 06-10-6S STRAIGHT PLUG.
6. SQUIB CASE TO BE B-1113/C-1213 PER QQ-S-633, CL HEX., CADMIUM PLATED PER QQ-P-416, TYPE 1, CLASS 1.
7. PRESSURE TEST GLASS TO METAL SEAL WITH DRY N_2 FOR 10 SECONDS AT 10,000 PSIG PRIOR TO PLATING. TEST FOR LEAKS WITH LEAK TEST COMPOUND, TYPE I PER MIL-L-25567. NO LEAKAGE PERMITTED. UNITS WILL BE ACCEPTED ON AN INDIVIDUAL BASIS.

368071

SPECIFICATION CONTROL DRAWING

RES
RCUIT
BLE

QTY REQD	SYM	CODE IDENT NO.	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	MATERIAL	SPECIFICATION	UNIT WT.	ZONE	FIND NO.

LIST OF MATERIALS

				2	2	367345-79	
ON	THRU	PART DASH NO.	NEXT ASSY	FINAL	NEXT ASSY	USED ON	
EFFECTIVE SERIAL NO.			QTY REQD PER ASSY		APPLICATION		
USAGE DATA		DRAWING LEVEL			2		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
DECIMAL TOLERANCE ANGULAR TOLERANCE
XX ± .03 XXX ± .010 ± — —
DO NOT SCALE DRAWING

TREATMENT

FINISH

RELEASE DATE 11-13-62

		DATE
DRAWN	L E RICH	11-9-62
CHECKED	J.N. Kay	11-13-62
DESIGN	S/C J.Q. Talbot Jr	11-13-62
PROJECT	A.J. Woolley	11-13-62
STRESS		11-13-62
MATERIALS		
PRODUCTION		5/6/63
DESIGN ACTIVITY APPD		
CUSTOMER		

Aerojet-General CORPORATION
SOLID ROCKET PLANT
SACRAMENTO, CALIFORNIA

TITLE: SQUIB, ELECTRIC

CODE IDENT NO.	DWG SIZE	DWG NO.
13310	D	368071

SCALE 2/1 | SIMILAR TO 366554 | SHEET

E-2. GENERAL MOTOR CHARACTERISTICS

The following information will be replaced with data derived from the AGC Computer Program as soon as it becomes available.

Specific motor characteristics and predicted performance curves will be available in the individual log books of delivered units.

E-2
GENERAL MOTOR CHARACTERISTICS

	Algol ID Mod 1 Design	ALGOL I[a] Design	Mean[b] Value Measured	σ(One[b] Standard Deviation)	Motors Measured
Loaded motor weight,*	22,000	--	--	47	19
Propellant weight,*	19,000	18,988	18,986	51	20
Inert-parts weight,* lbm	2,978****	--	--	28	19
C_w (total burning time), lbm/lbf - sec	.00642	.00642	--	.00007	5
Nozzle expansion ratio (A_e/A_t)	4.64	4.64	--	--	--
Throat area,* sq. in.	175.33	175.33	--	--	--
Propellant weight fraction (W_p/W_m)***	0.863	--	.0014	.0014	19
Overall length,** in.	358.58	358.58	---	--	--
Chamber diameter, in.	40.00	40.00	--	--	--

* Individual motor actual values will be obtained during motor processing and will be included in motor log book.

** Measured from fwd face of igniter boss to aft face of nozzle seal (nozzle in 0-degree-cant position).

*** W_p = propellant weight; W_m = loaded motor weight.

**** Does not include igniter weight.

a. Data is shown for various models of the basic Algol motor. Design values are quoted for the ID configuration, and most nearly represent the Mod 2 and Mod 1 versions.

b. Mean measured values and standard deviations include variation due to temperature effects over a range extending from + 30 to +50°F. All data was measured under sea-level conditions and E = 4.64.

Mean value measured = $\frac{\Sigma x}{n}$; x = value measured, n = number of samples.

$\sigma = \sqrt{\frac{\Sigma D^2}{n-1}}$; D = Deviation of value measured from mean value ($\frac{\Sigma x}{n}$)

E-3

MOTOR BALLISTIC CHARACTERISTICS

	Algol ID Mod 1 Design	Algol I[a] Design	Mean[b] Value Measured	One[b] Standard Deviation	Motors Measured
Average thrust* (web), lbf	102,227	102,227	104,310	2,905	5
Average thrust* (total), lbf	96,650	96,650	98,060	3,038	5
Maximum thrust,* lbf	115,000	115,000	--	--	--
Impulse* (web), lbf-sec	3,671,675	3,671,675	3,713,405	95,000	4
Impulse* (total), lbf-sec	4,070,598	4,070,598	4,077,802	17,720	4
Specific impulse* (overall) lbf-sec/lbm (actual)	214.4	214.4	214.4	1.14	5
Average pressure (web), psia	427.8	427.8	429	7.0	5
Average pressure (total), psia	400.6	400.6	406	8.8	5
Maximum pressure, psia	450.0	450.0	--	--	--
Propellant type	ANP-2639AF	ANP-2639AF			
π_k, %/°F	0.19	0.19	--	--	--
Ignition delay, sec	0.083	0.083	0.100	0.027	5
Ignition interval, sec	0.051	0.051	0.058	0.004	5
Web burning time, sec	35.9	35.9	36.06	0.65	4
Total burning time, sec	42.1	42.1	41.29	1.76	4
Burning rate, in./sec	0.254	0.254	0.254	0.008	5
Weight flow rate, lbm/sec	450.8	450.8	457	14.0	5
C_f (total burning time)	1.376	1.376	1.38	0.013	5
CG loaded** (calculated)	166.1	--	--	0.30	18
CG empty** (calculated)	214.2	--	--	0.84	19

* Delivered along thrust axis, nozzle in 0-degree-cant position.

** Inches aft of front face of igniter boss.

E-4 WEIGHT SUMMARY

The attached two data sheets depict the weight summary for the Algol ID Mod 1 for nozzle cant positions of 0 and 14 degrees, which are the minimum and maximum cant angles, respectively.

E-4a

LITTLE JOE II PROPULSION SYSTEM
MOTOR WEIGHT AND CENTER OF GRAVITY
NOZZLE AT 14° POSITION

PAGE II-26
REVISION N/A
DATE 1-30-63

Dwg	Item	Weight, lb	$\bar{X}$*	$\bar{Z}$**
366205	Chamber assy	1,640	167.0	0
366206	Insulation, fwd	28	2.3	0
366206	Insulation, aft	38	313.0	0
366346	Boot, fwd	30	[illegible].0	0
366346	Boot, aft	41	315.0	0
366347	Chamber lining	300	180.0	0
366224	Nozzle assy (14 degrees, up)	802	330.7	1.1
	Closure bolts	6	318.8	0
366430	Nozzle boot	25	328.3	0
	Destruct system	30	4.0	0
366244	Weather seal	23	356.7	0
	Paint, misc	15	214.8	0
Total, empty motor		2,978	214.84	0.30
366241	Propellant	19,000	158.59	0
	Igniter	22	12.0	0
Total, loaded motor		22,000	166.07	.04

* Distance from forward face of igniter boss.
** Distance from motor center line.

E-4b

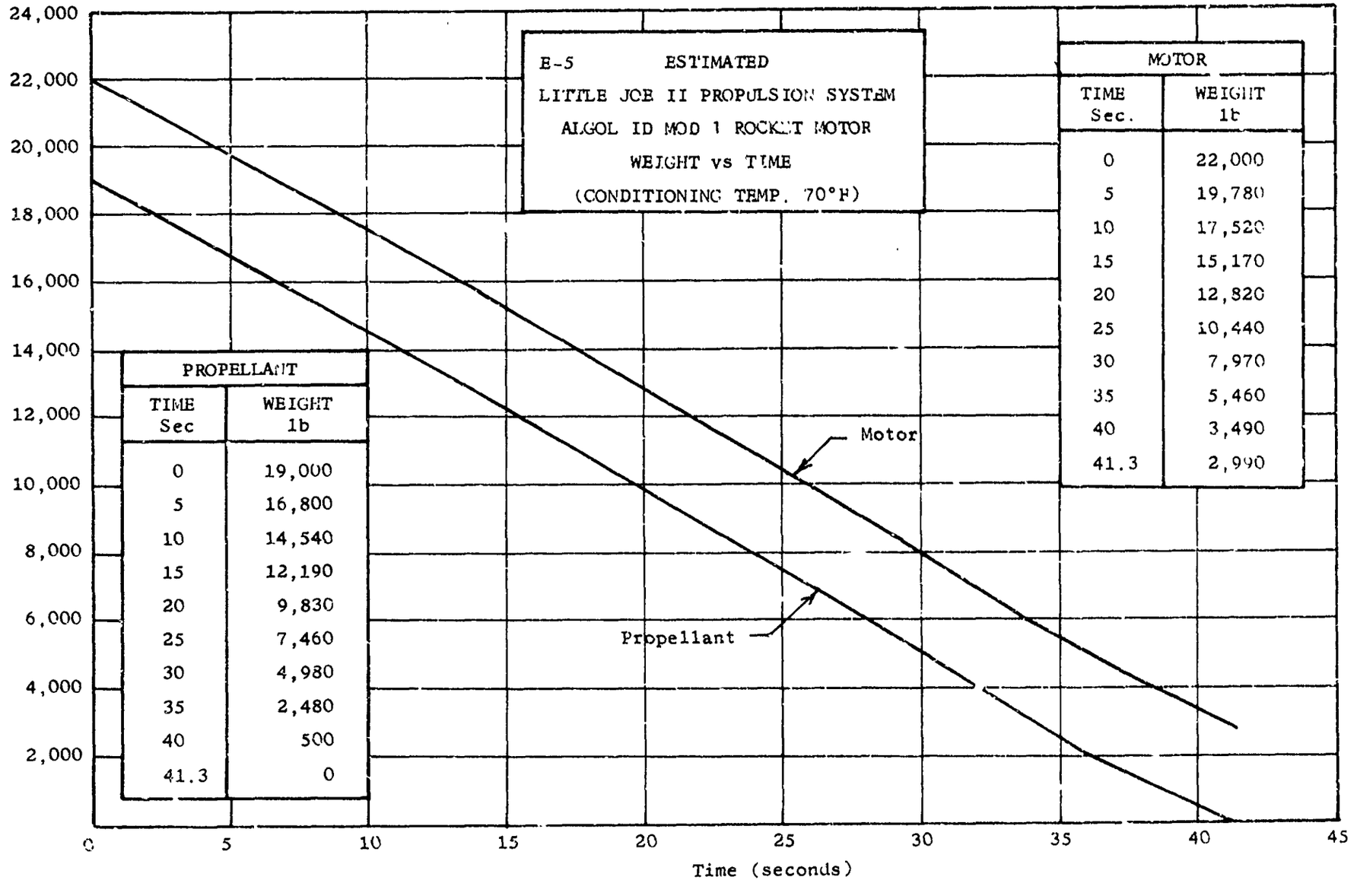
LITTLE JOE II PROPULSION SYSTEM
MOTOR WEIGHT AND CENTER OF GRAVITY
NOZZLE AT 0° POSITION

PAGE II-27
REVISION N/A
DATE 1-30-63

Dwg	Item	Weight, lb	$\bar{X}$*	$\bar{Z}$**
266205	Chamber Assy	1,640	167.0	0
266206	Insulation, fwd	28	2.3	0
366206	Insulation, aft	38	313.0	0
366346	Boot, fwd	30	5.0	0
366346	Boot, aft	41	315.0	0
366347	Chamber lining	300	180.0	0
366224	Nozzle Assy 0°	802	330.8	.03
	Closure bolts	6	318.8	0
366430	Nozzle boot	25	328.3	0
	Destruct system	30	4.0	0
366244	Weather seal	23	356.7	0
	Paint, Misc.	15	214.9	0
Total, empty motor		2,978	214.87	.01
366241	Propellant	19.000	158.59	0
	Igniter	22	12.0	0
Total, loaded motor		22,000	166.08	0

* Distance from forward face if igniter boss.
** Distance from motor center line.

September 17, 1962



PROPELLANT	
TIME Sec	WEIGHT lb
0	19,000
5	16,800
10	14,540
15	12,190
20	9,830
25	7,460
30	4,980
35	2,480
40	500
41.3	0

MOTOR	
TIME Sec.	WEIGHT lb
0	22,000
5	19,780
10	17,520
15	15,170
20	12,820
25	10,440
30	7,970
35	5,460
40	3,490
41.3	2,990

* Measured from igniter boss

September 17, 1962

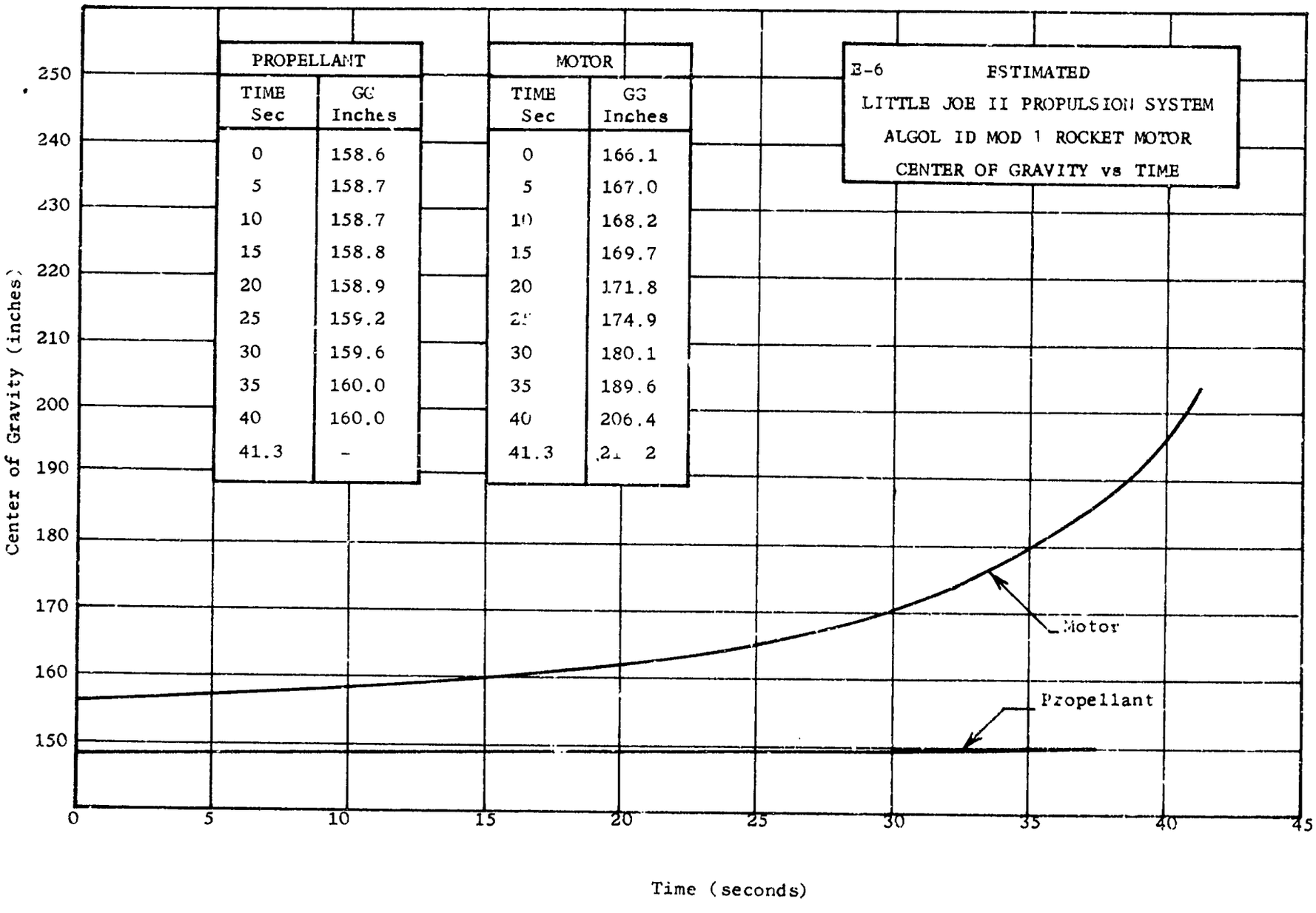
E-6 ESTIMATED

LITTLE JOE II PROPULSION SYSTEM

ALGOL ID MOD 1 ROCKET MOTOR

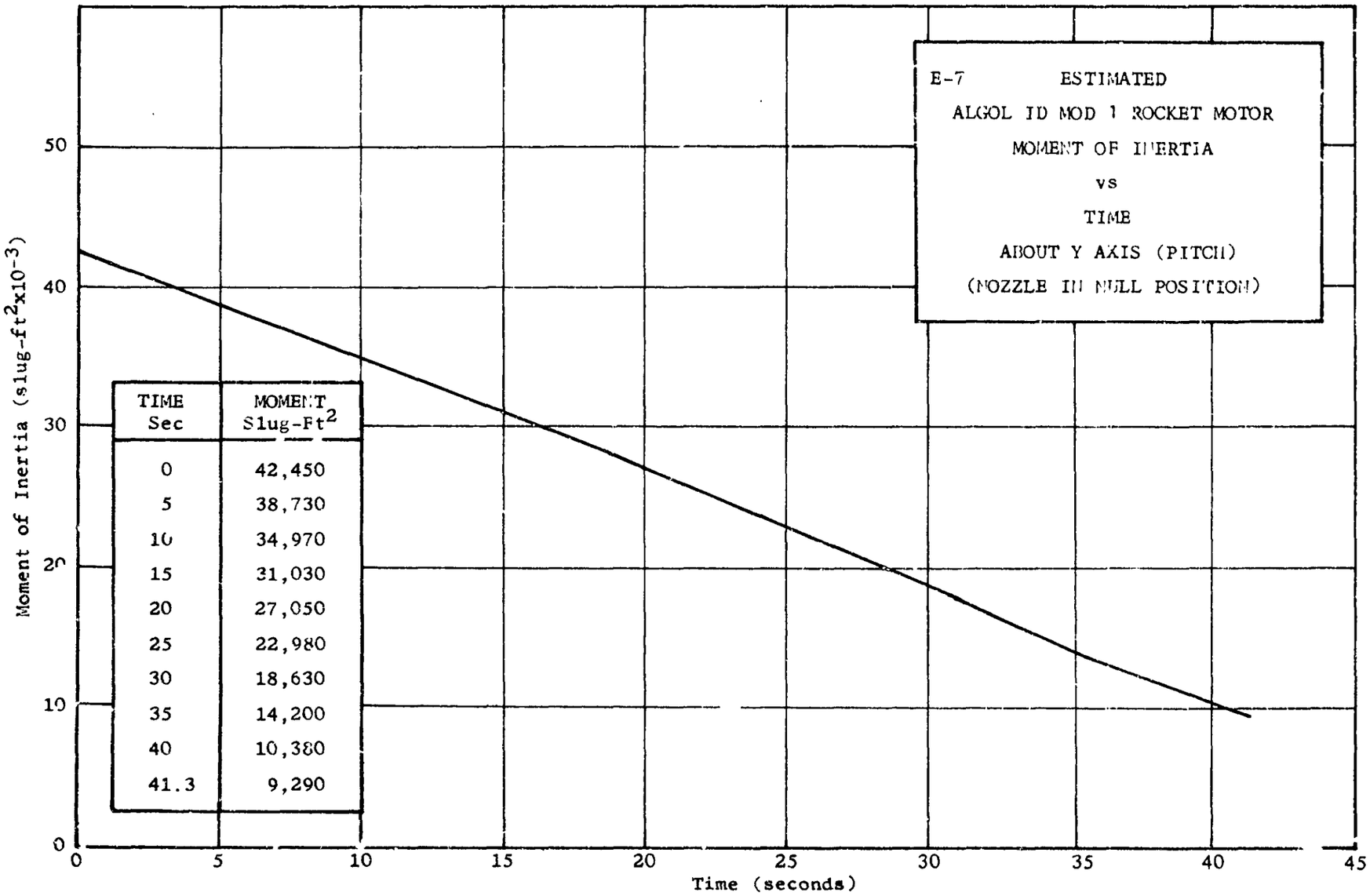
CENTER OF GRAVITY vs TIME

PROPELLANT		MOTOR	
TIME Sec	GG Inches	TIME Sec	GG Inches
0	158.6	0	166.1
5	158.7	5	167.0
10	158.7	10	168.2
15	158.8	15	169.7
20	158.9	20	171.8
25	159.2	25	174.9
30	159.6	30	180.1
35	160.0	35	189.6
40	160.0	40	206.4
41.3	-	41.3	21 2



E-7 ESTIMATED
ALGOL IID MOD 1 ROCKET MOTOR
MOMENT OF INERTIA
vs
TIME
ABOUT Y AXIS (PITCH)
(NOZZLE IN NULL POSITION)

TIME Sec	MOMENT Slug-Ft^2
0	42,450
5	38,730
10	34,970
15	31,030
20	27,050
25	22,980
30	18,630
35	14,200
40	10,380
41.3	9,290



E-7

ESTIMATED

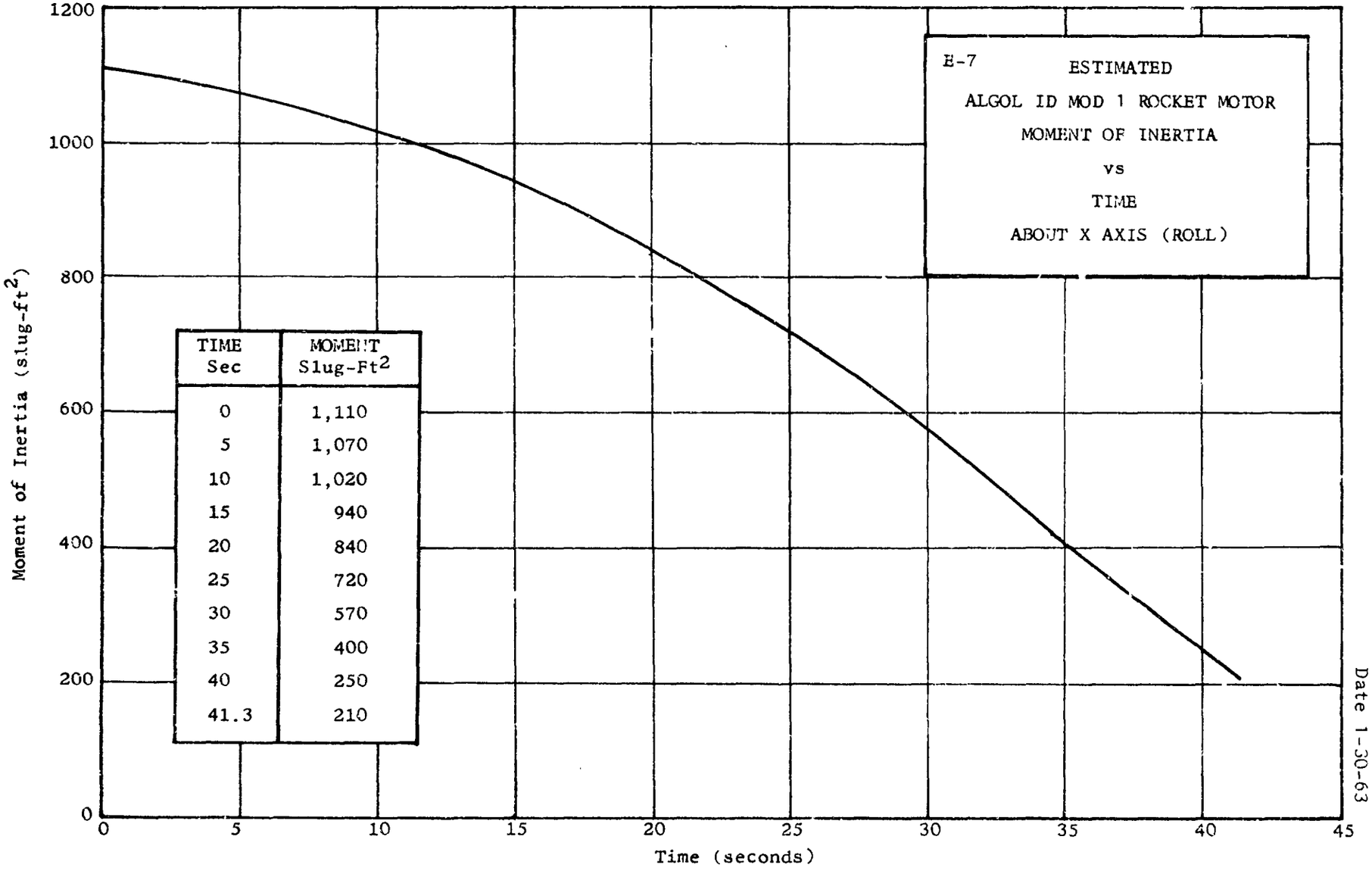
ALGOL ID MOD 1 ROCKET MOTOR

MOMENT OF INERTIA

vs

TIME

ABOUT X AXIS (ROLL)



TIME Sec	MOMENT Slug-Ft²
0	1,110
5	1,070
10	1,020
15	940
20	840
25	720
30	570
35	400
40	250
41.3	210

E-9 MOTOR-OPERATION INTERFACES

a. Because of the use of a ground-adjustable canted nozzle on the Algol ID Mod 1 motor, the requirements for prelaunch leak check, igniter installation with the motor horizontal, and adjustment of the nozzle prior to launch are additional interface functions beyond the operation of the Algol ID Mod 2 motor.

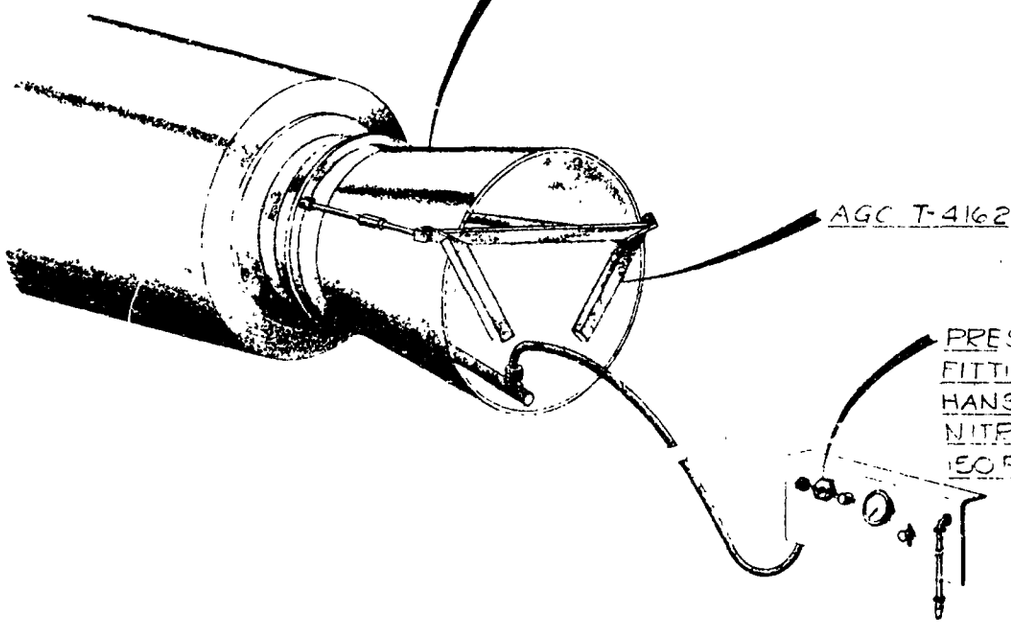
(1) An igniter-installation tool is required to balance the igniter during installation with the motor in the horizontal position.

(2) A motor leak-check nozzle plug is required, which attaches to a pressure source for leak checking the motor in the vertical position, with the nozzle canted.

(3) An adjustment wrench is required to turn the hex nut on the nozzle adjustment mechanism.

b. Presentations of interface areas are shown in Figures 9 and 10.

MOTOR LEAK CHECK (ALGOL ID MOD I)



PRESSURE REGULATOR
FITTING TO PRESSURE REGULATOR MATES WITH HANSEN SERIES 5000 #52 PLUG.
NITROGEN SOURCE OF 75 PSI MINIMUM AND 150 PSI MAXIMUM REQUIRED.

Figure 9

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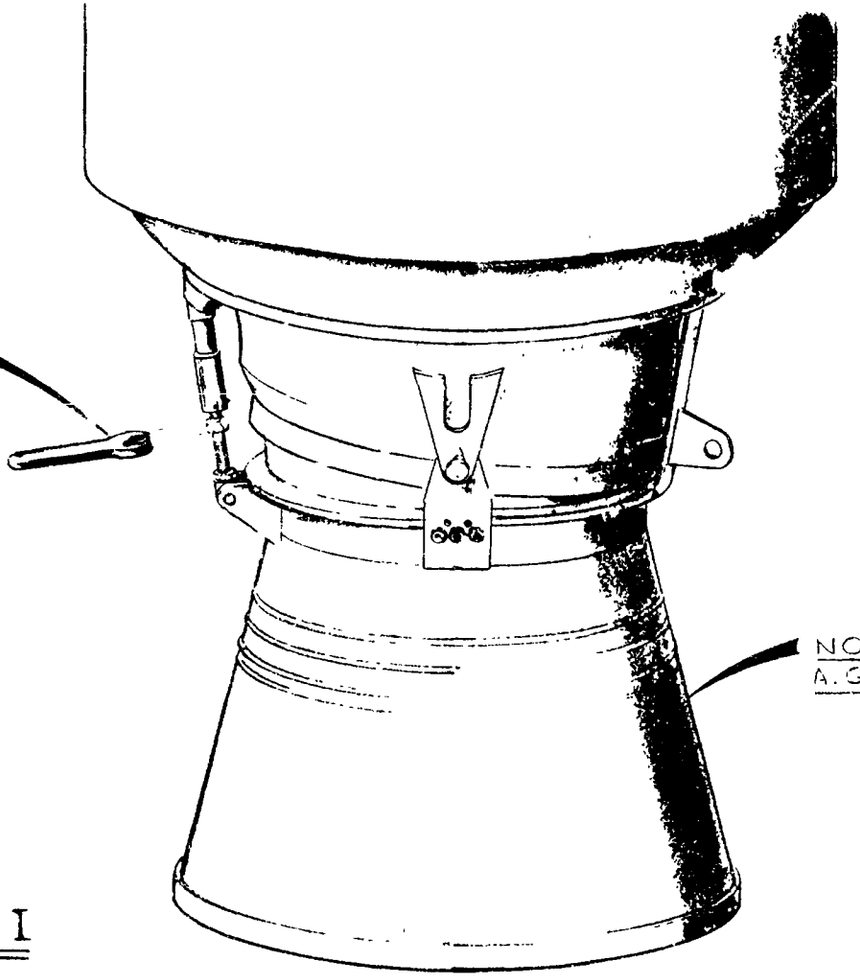
Jack Stayton 12-5-62



1 1/16 INCH OPEN END WRENCH TO TIGHTEN LOCK N.J.T.

NOZZLE
A.G.C. 366224

ALGOL-ID MOD. I

NOZZLE ADJUSTMANT

Fig. 10
Hal Sorenson
11-29-62

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