CATERPILLAR 1G2

APPENDIX A

Procurement of Test Parts

The following suppliers are referenced throughout the procedure:

A.1 Asco Solenoid Valve—Part # 8266023

Asco

Florham Park, New Jersey 07932

A.2 Barco Venturi Meter—Part # BR12705-16-31

J. P. Bushnell

3436 Lindell Boulevard

St. Louis, Missouri

A.3 Labeco Oil Filter (#2418) and Element (#3105)

Labeco

156 E. Harrison

Mooresville, Indiana 46158

A.4 Spin On Oil Filter (SP 350) and Adapter (FRAM HPK-2)

Contact any Ford dealer.

A.5 Viking Oil Pump—Part # GX4154

Viking Pump Co.

Cedar Rapids, Iowa 50613

A.6 Dispersant Engine Cleaner (order by this name)

The Lubrizol Corporation

29400 Lakeland Boulevard

Cleveland, Ohio 44092 Attn: K. L. Gamiere

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A.7 CRC Manual #5 and Rating Aids.

Coordinating Research Council, Inc.

30 Rockefeller Plaza

New York, New York 10020

A.8 Hoke Check Valve—Part # 6253B

Tech Controls

4615 Gardendale, #1607

San Antonio, Texas

1-512-699-8293

A.9 Kid Flood Jet—1/8"

Spraying Systems Co.

North Avenue at Schmale Road

Wheaton, Illinois 60187

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APPENDIX B

Test Data Recording

A sample data log sheet for recording engine operating conditions is shown in Figure 23.

FIGURE 23

CATERPILLAR 1-G2 DATA LOG

Lab Oil Code:	Client Oil Code:	Fuel:	Date:	Page No:

Engine No.:	Stand No.:	Test No.:

	Initials	R												
	Time	R												
	Total Hours Run	R												
	Speed, RPM	1800 ± 10												
Load	Dyno Beam, Lbs.	R												
Load	Blower Boost, PSI	R												
Load	BHP	Approx. 42												
	Fuel Rate Sec.	See Fuel Board												
	Fuel Rack Setting	R												
	BTU Input/Min.	5850 ± 10												
Humidified Air	Grains Added	R												
Humidified Air	Flowmeter	R												
Humidified Air	Total Grains	120 – 130												
Temperatures	Water Out, °F	190 ± 5												
Temperatures	Water In, °F	R												
Temperatures	Oil to Bearings, °F	205 ± 5												
Temperatures	Inlet Air, °F	255 ± 5												
Temperatures	Exhaust, °F	1100 ± 50												
Temperatures	Oil Cooler Inlet, °F	R												
Temperatures	Fuel, °F	R												
Pressures	Oil to Bearings, PSI	R												
Pressures	Oil to Jet Nozzle, PSI	24 ± 2												
Pressures	Inlet Air, In. Hg. Abs.	53 ± 0.3												
Pressures	Exhaust, In. H_2O	8.5 ± 3.5												
Pressures	Fuel – On Test, PSI	20 ± 2												
Pressures	Fuel – Rate Meas., PSI	20 ± 2												
Pressures	Crankcase Vacuum, in. H_2O	1.0 ± 0.5												
	Oil Level	R												
	Crankcase Blowby, CFH	R												
	Coolant Water Flow, GPM	15.3 ± 1												
	Engine Shutdown	Place * In Square												

TWELVE HOUR OIL ADJUSTMENT/CHANGE

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APPENDIX C

Test Data Plotting

The following recorded data are plotted against engine hours after the run-in:

1. Fuel rate, btu/minute (kw)
2. Bhp (kW)
3. Temperature, water from cylinder head, °F (°C)
4. Temperature, water to cylinder block, °F (°C)
5. Temperature, oil to bearings, °F (°C)
6. Temperature, inlet air to engine, °F (°C)
7. Temperature, exhaust, °F (°C)
8. Pressure, exhaust, in H_2O (kPa)
9. Pressure, oil to bearings, psi (kPa)
10. Pressure, oil to jet cooling nozzle, psi (kPa)
11. Pressure, air to engine, in. Hg Abs. (kPa)
12. Blowby, ft^3/hr. (m^3/hr)
13. Total oil consumption (oil added less oil drained), lb (grams)
14. Specific oil consumption, lb/bhp-hr (g/kw-hr)
15. Humidity, gr/lb of dry air, (µ g/kg)
16. Crankcase vacuum, in. H_2O (kPa)

The plotted data show operating conditions recorded at each 5 hours of test time. In addition to the 5-hour points, readings that fall outside the test limits are plotted. Plot the total lubricating oil added and/or drained at the exact time of the addition and/or drain. Plot specific lubricating oil consumption in lb/bhp hour (g/kw hr) for each 120 hours. This plotting is done on two standard 8 1/2 x 11 in. (21.6 x 27.9 cm) sheets of graph paper. A full-size plot of both sheets is included in the report. Figure 24 shows a sample format of the Caterpillar operating data log.

FIGURE 24

STAND NO. STAND RUN NO. ENGINE NO.

OIL DATE FUEL

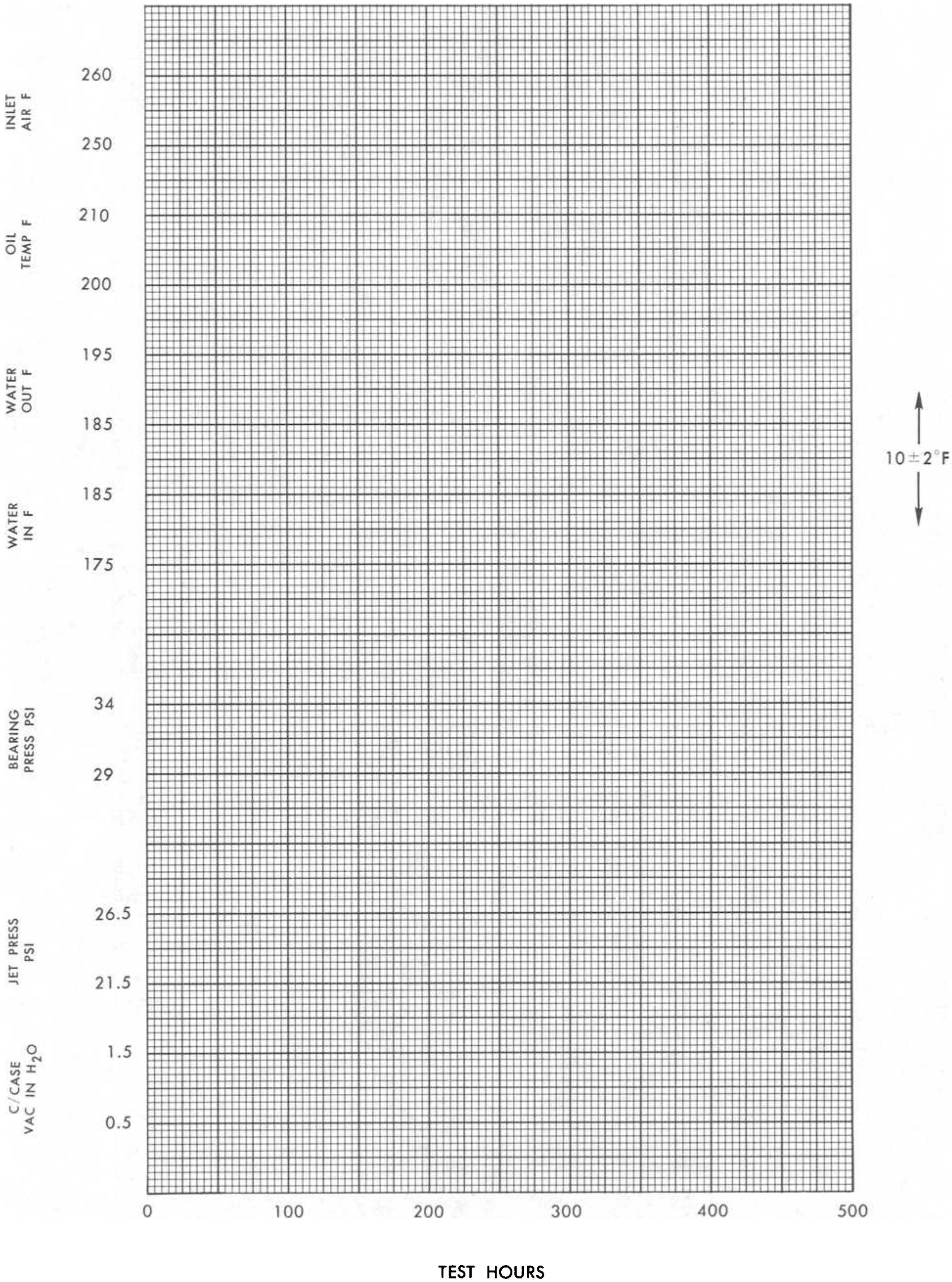
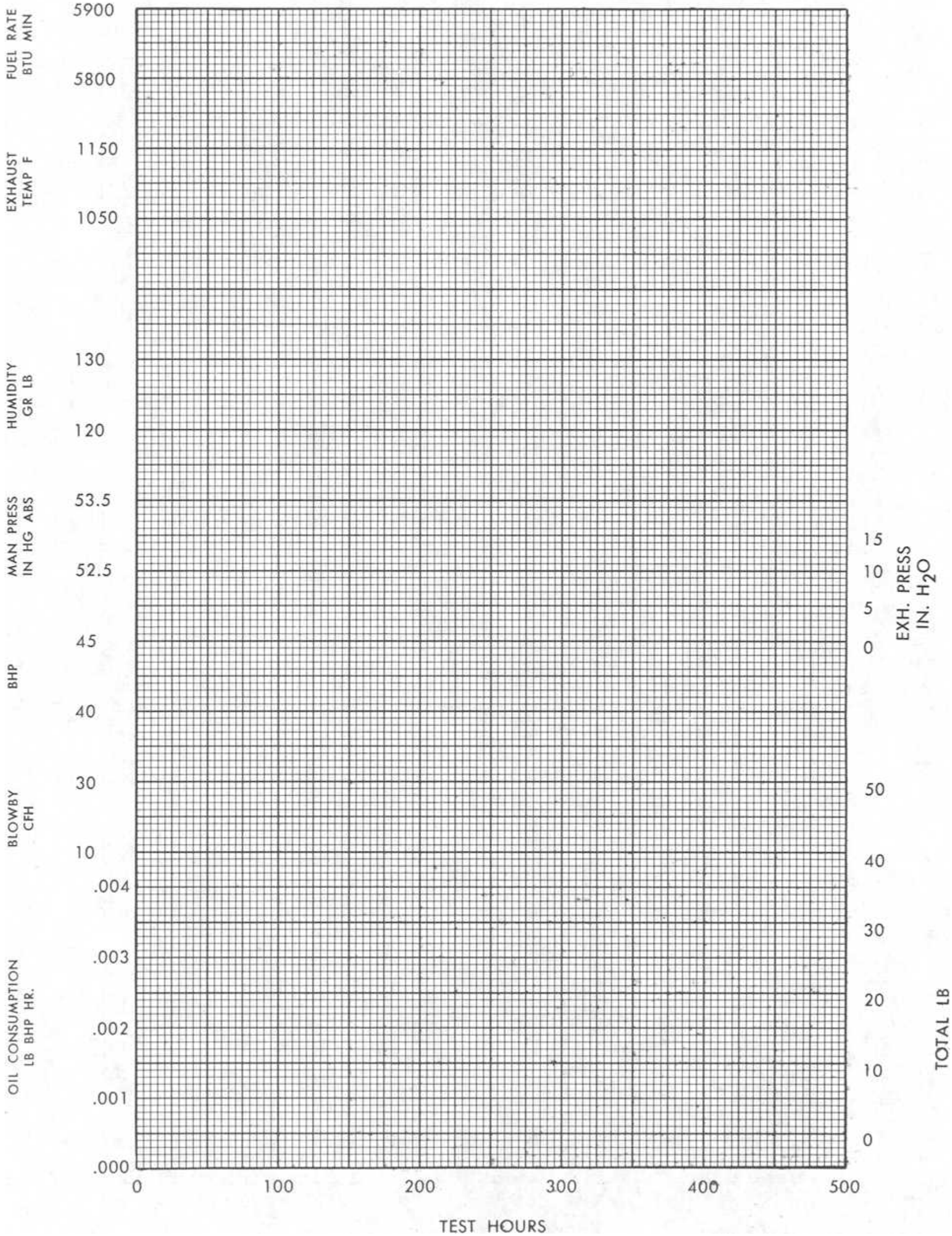


FIGURE 24 (CONT.)

STAND NO. STAND RUN NO. ENGINE NO.

OIL DATE FUEL



CATERPILLAR 1G2

APPENDIX D

Report Forms

The report forms shown in Figure 25 must be completed upon completion of the test.

FIGURE 25

1.0 TEST IDENTIFICATION

FTMS 791, Method	Laboratory		Oil Code
Stand No.	Stand Run No.	Engine No.	Fuel (Mfr. - Batch)
Date Started	Date Completed		Test Hours

2.0 REFERENCE TESTS

STAND LAST REFERENCE Stand No. Stand Run No.	Engine No.	Date Completed	Oil I.D.
	Test Rating WTD = , TGF =		Industry Average WTD = , TGF =
LAB LAST REFERENCE Stand No. Stand Run No.	Engine No.	Date Completed	Oil I.D.
	Test Rating WTD = , TGF =		Industry Average WTD = , TGF =

3.0 EVALUATION OF ENGINE PARTS

3.1 Piston Deposits (Groove Backs and Lands)

Dep. Type		Dep. Fct.	Grooves								Lands					
			No. 1		No. 2		No. 3		No. 4		No. 2		No. 3		No. 4	
			A,%	Dem.	A,%	Dem.	A,%	Dem.	A,%	Dem.	A,%	Dem.	A,%	Dem.	A,%	Dem.
Carbon	HC	1.000														
	MHC	0.750														
	MC	0.500														
	LC	0.250														
	VLC	0.150														
	Total															
Lacquer	BL	0.100														
	DBR	0.075														
	AL	0.050														
	LAL	0.025														
	VLA	0.010														
	RL	0.000														
	Total															
Clean																
Rating																
Location Factor				1		10		35		70		3.5		20		35
Weighted Rating																

Total Weighted Demerit	
Top Groove Filling, %	

FIGURE 25 (CONT.)

TEST NO. ________ OIL CODE ________ DATE ________

3.2 SUPPLEMENTAL PISTON DEPOSITS (GROOVE SIDES & RINGS)

DEPOSIT TYPE			CARBON			LACQUER					
			HC	MC	LC	BL	DBRL	AL	LAL	VLAL	RL
SKIRT											
UN-CROWN											
LINER ABOVE RING TRAVEL											
PISTON CROWN											
GROOVE TOP & BOTTOM	1	T									
		B									
	2	T									
		B									
	3	T									
		B									
	4	T									
		B									
TOP, BOTTOM & BACK OF RINGS	1	T									
		B									
		BK									
	2	T									
		B									
		BK									
	3	T									
		B									
		BK									
	4	T									
		B									
		BK									

3.3 ADDITIONAL DEPOSIT & CONDITION RATINGS

A. Piston Crown Scuffing (Nature and Quantity) ________

____

B. Amount and Nature of Deposits On Oil Ring Slots ________

____

C. Piston Skirt Condition (Not Including Deposits) ________

____

D. Liner Condition ________

____

FIGURE 25 (CONT.)

TEST NO. ____________ OIL CODE ____________ DATE ________

4.0 OPERATIONAL AND MEASUREMENT SUMMARY

OPERATING CONDITION	MIN	MAX	AVG
ENGINE SPEED, RPM			
ENGINE LOAD			
BHP			
BTU INPUT/MIN			
HUMIDITY, GRAINS/POUND			
TEMPERATURE, ^{o}F			
COOLANT JACKET OUTLET			
COOLANT JACKET INLET			
COOLANT JACKET Δ T			
OIL TO BEARINGS			
INLET AIR			
EXHAUST			
PRESSURES			
OIL TO BEARINGS, PSI			
OIL TO JET, PSI			
INLET AIR, IN. HG (ABS)			
EXHAUST BACKPRESS, IN. H_2O			
FUEL (ON TEST), PSI			
FUEL (RATE MEAS), PSI			
C' CASE VACUUM, IN. H_2O			
BLOWBY, CFH			
OIL CONSUMPTION, # / BHP-HR			
0-120			
120-240			
240-360			
360-480			
0-480			
AIR FUEL RATIO			
COMPRESSION RATIO			

MEASUREMENTS

RING GAP INCREASE

NO. 1	NO. 2	NO. 3	NO. 4

RING SIDE CLEARANCE

	BEFORE TEST		AFTER TEST	
	MIN	MAX	MIN	MAX
1				
2				
3				
4				

LINER WEAR STEP

LONGITUDINAL	TRANSVERSE

CONDITION OF RINGS

FACE
SHARPNESS
NO. TIGHT
NO. STUCK

REMARKS

FIGURE 25 (CONT.)

TEST NO ________________ OIL CODE: ________________ DATE: ________________

5.0 TEST LOST TIME AND INSPECTION

TEST HOURS	DATE	TIME DOWN	REMARKS
			Note: If no lost time state this fact.
			INSPECTION

6 0 TEST MODIFICATIONS AND COMMENTS

7.0 TEST CERTIFICATION

I do certify that this test was conducted in accordance with the procedure designated in Section 1.0 as amended by Information Letters dated ________________ except as modified in Section 6.0 above.

DATE ________________

____
Project Engineer

CATERPILLAR 1G2

APPENDIX E

Precision Data

Estimates of the standard deviation of 1G2 top groove fill (TGF) and weighted total demerits (WTD) for reference tests using oils REO 203 and REO 191 are shown below:

	TGF			WTD	
Ref. Oil	n	$\bar{x}$	σ *	$\bar{x}$	σ*
REO 203	34	69	12	169	49
REO 191	21	91	4	354	92

* Tests were run between March, 1976 and April, 1977.

Nomenclature: n = the number of test runs (observations)

$\bar{x}$ = the arithmetic mean or average

σ = an estimate of the true standard deviation in a finite set, any finite set is considered to be a sub-set from the infinite set.

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APPENDIX F

Test Fuel

The fuel used in the engine for the 1G2 Test Method has the characteristics shown below:

TEST	ASTM METHOD[1]	REQUIREMENT
Flash Point	D 93	100°F (37.8°C) min or legal limit
Pour Point	D 97	20°F (-7°C) max
Cloud Point	D 97	Report
Water and Sediment	D 1796	0.05% V max
Ramsbottom Carbon on 10% Residuum	D 524	0.20% W max
Ash	D 482	0.01% max
Distillation	D 86	IBP Report 10% Report 50% 500 - 530°F (260 - 277°C) 90% 580 - 620°F (304 - 327°C) EP 650 - 690°F (343 - 366°C)
Kinematic Viscosity at 100°F (37.8°C)	D 445	3.0-4.0cS(3.0-4.0 $\mu m^2/s$)
Total Sulfur (must be natural)	D 2622 (Alternates D 3120, D 1266)	0.370 - 0.430% W
Copper Corrosion	D 130	No. 2 max
Neutralization No., TAN-E	D 664	0.15 mg KOH/gm max
Cetane Number	D 613	45.0 - 51.0
Cetane Index	D 976	Report
API Gravity	D 287 (Alternate D 1298)	32- 35°
Cracked Stocks		None

[1] These designations refer to methods of test of the American Society for Testing and Materials in accordance with which the requirements specified are determined.

CATERPILLAR 1G2

3. For heat input, either the high or low heating value is used, but must be stated. When calculating the heating value, refer to the U.S. Department of Commerce Miscellaneous Publication No. 97. (The pertinent section of this publication is reproduced below.)

Gravity	**Heat of Combustion**	
Degrees A. P. I. at 60° F (15.6° C)	High Btu/lb (joule/kg)	Low Btu/lb (joule/kg)
30	19,420 (40.58)	18,250 (38.14)
31	19,450 (40.65)	18,280 (38.20)
32	19,490 (40.73)	18,310 (38.26)
33	19,520 (40.79)	18,300 (38.31)
34	19,560 (40.88)	18,360 (38.37)
35	19,590 (40.94)	18,390 (38.43)

CATERPILLAR 1G2

APPENDIX G

1Y38 Surge Chamber and Air Heater Assembly

This assembly is essentially a pressure vessel with internal electric heating elements. The general dimensions of the surge chamber are:

Volume	7.37 cubic feet
Inside Diameter.	21.00 inches
Inside Height	36.75 inches

If individual requirements or local building codes necessitate changes in the design, the following modifications are permissible:

1. Volume may vary from seven to eight cubic feet.
2. Inside diameter may vary from 19 to 23 inches.
3. Inside height will be a function of the volume and inside diameter selected.
4. Inlet and outlet fittings may be located anywhere except directly opposite each other.
5. The type and arrangement of heating controls may be determined by local conditions.
6. The chamber may be located in any of a number of positions relative to the engine as long as:
   (a) The length of the air transfer pipe is 30 ±0.5 inches from the face of the surge chamber mounting pad to the inlet port face of the cylinder head.
   (b) The air transfer pipe contains only one bend.
   (c) The one bend shall not exceed 90 degrees.
7. A stand may be constructed to raise the chamber to the proper height depending upon the engine arrangement and mounting.

Figures 26-42 present the bill of materials and drawings needed to manufacture the surge chamber and air heater assembly.

APPENDIX G (continued)

BILL OF MATERIAL

SURGE CHAMBER AND AIR HEATER ASSEMBLY

(All dimensions are in inches unless otherwise specified)

Item No.	Name	Caterpillar Tractor Co. Part No.	Description	No. Req'd	Ref. Fig.
1-1	Surge Chamber & Heater Assembly		See Figure 26	1	
1-2	Bolt	L1648	3/8 - 24 thd 2.50 long	1	
1-4	Thermostatic Switch		*	2	
1-5	Lockwasher	3B4506	Std. for .375 dia bolt	20	
1-6	Bolt	2A4996	3/8 - 24 thd 1.375 long	20	
1-7	Pressure Relief Valve		**	1	
1-8	Gasket		.0312 thick***	1	
1-9	Mounting Plate		20 x 12 x .0625 thick SAE 1020 steel	1	26
1-10	Spacer	8B7430	.750 OD .359 ID .531 thick SAE 1020 steel	4	
1-11	Bolt	L1590	1/4 - 28 thd 1.125 long	4	
1-12	Lockwasher	3B4504	Std. for .250 dia bolt	4	
1-13	Nut	1B4201	1/4 - 28 thd	4	
1-14	Electrical Junction Box		12 x 18 x 4 std pull box w/hinged cover	1	
1-15	Strip Heater		****	24	
1-16	Gasket		.0312 thick***	1	
2-1	Assembly		See Figure 27	1	
2-2	Top Ring		See Figure 28	1	
2-3	Bottom Plate		See Figure 29	1	
2-4	Strap – Surge Chamber		See Figure 30	2	
2-5	Hook		See Figure 31	2	As Ind.
2-6	Pad		See Figure 32	1	
3-1	Assembly		See Figure 33	1	
3-2	Top Cover		See Figure 34	1	
3-3	Inner Bracket		See Figure 35	1	
3-4	Outer Bracket		See Figure 36	1	
4-1	Terminal Assembly		See Figure 37	5	
4-2	Nut		7/16 - 14 thd SAE 73 brass	29	
4-3	Washer		Std. for .437 dia bolt	10	37
4-4	Insulator		1.250 OD .453 ID .187 thick Synthane	5	
4-5	Stud		7/16 - 14 thd 3 long brass	5	
4-6	Collar		See Figure 38	5	As Ind.
4-7	Insulator Assembly		See Figure 39	48	
4-8	Washer		.750 OD .265 ID .125 thick Mica	48	
4-9	Insulator		.500 OD .265 ID .0625 thick Synthane	48	
4-10	Insulator		1.687 x 1 x .0625 w/.265 hole Mica	48	39
4-11	Bolt		1/4 - 20 thd 1 long	48	
4-12	Washer		Std. for .250 dia bolt	48	
4-13	Nut		Std. for 1/4 - 20 thd	48	
4-14	Electric Cable Cover		See Figure 40	1	
4-15	Terminal Connector		See Figure 41	As Req'd	As Ind.
4-16	Lower Bracket Assembly		See Figure 42	1	

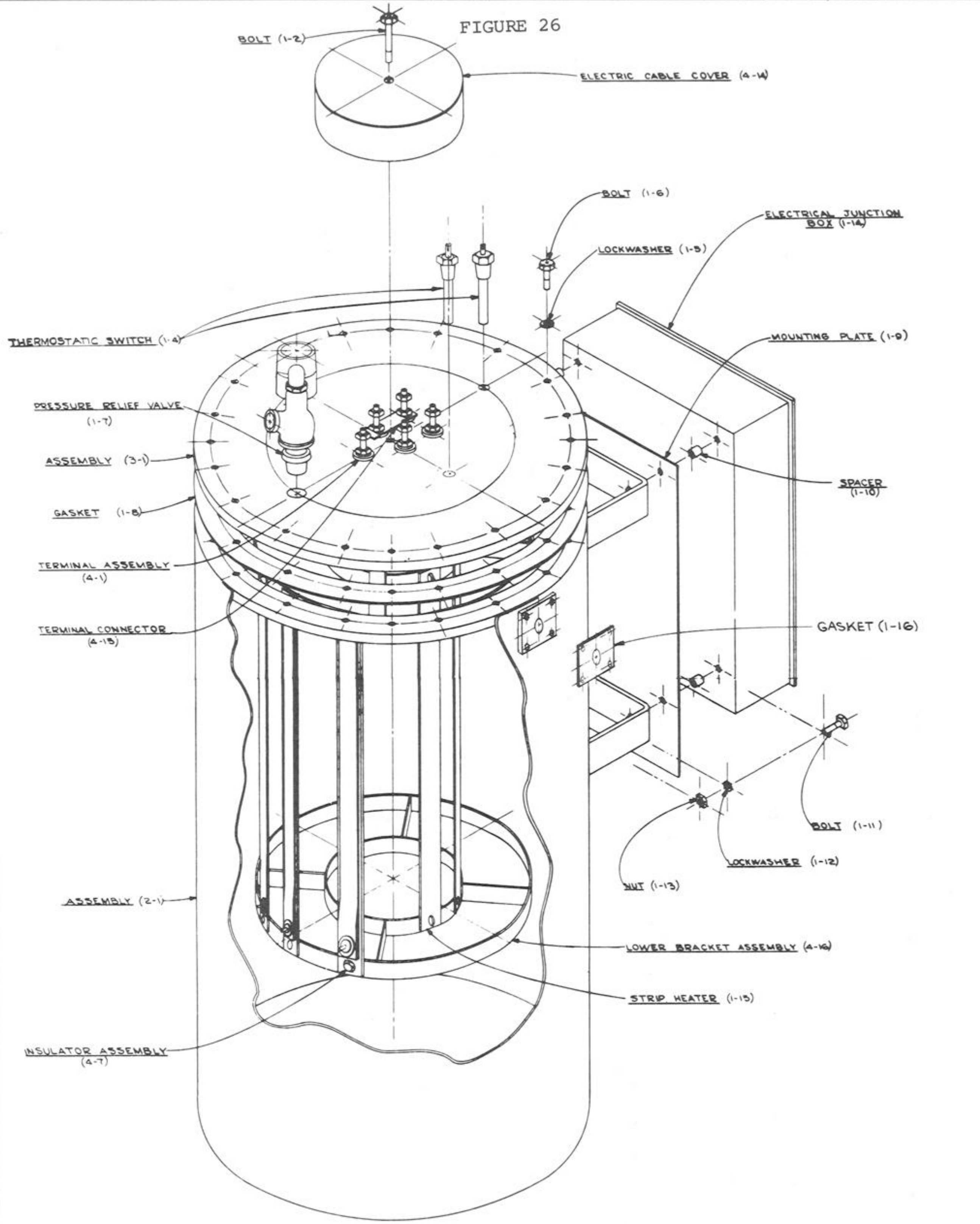
*40 F per turn – normally closed – contacts open with increase of temperature. Turning screw counter-clockwise causes contacts to open at a higher temperature.

**Set to "pop off" at 20.5 ±.5 psi.

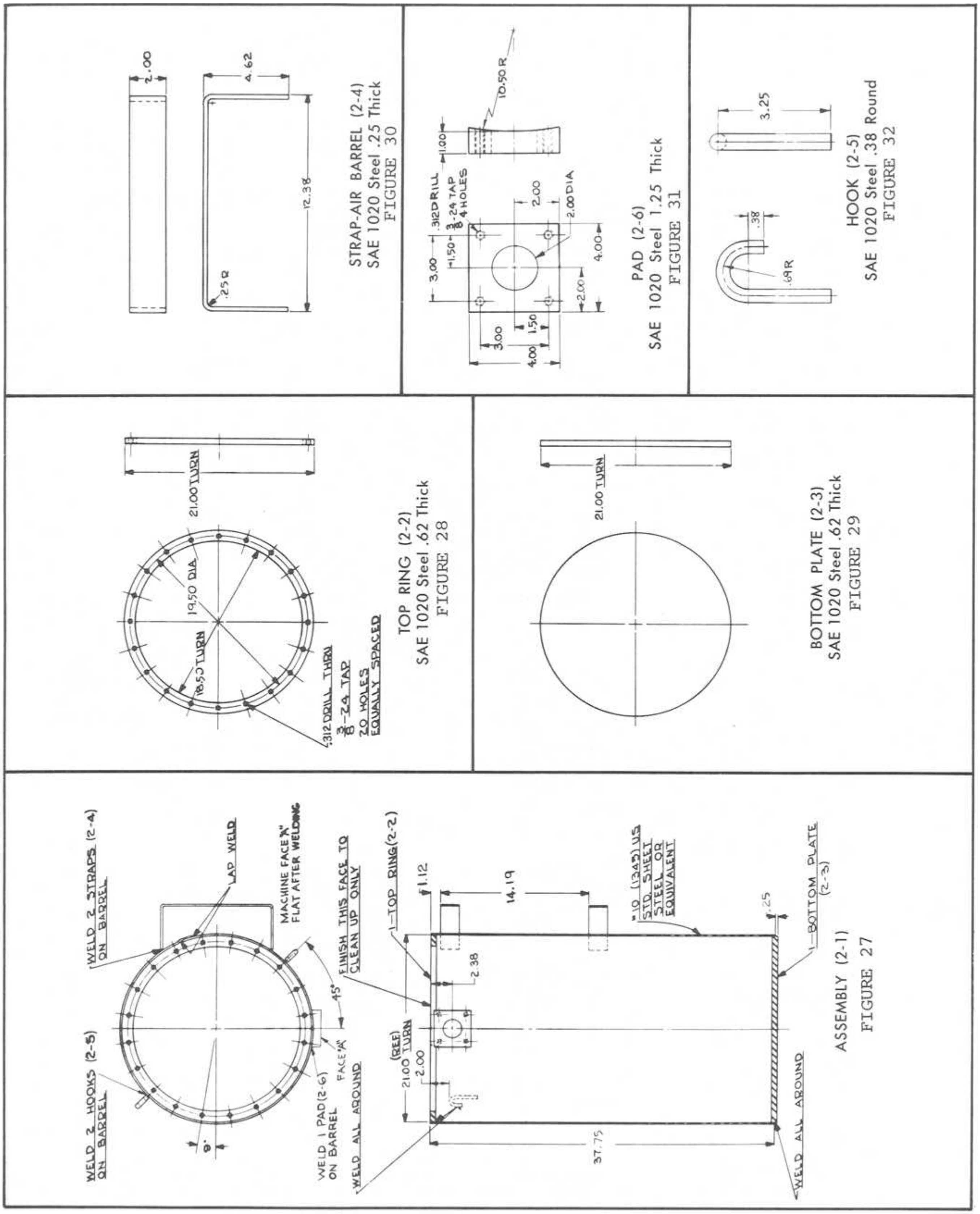
***Make gasket to fit top ring (2-2) and pad (2-6).

****Terminal on element goes to inside of barrel on inner rings and to outside of barrel on outer rings.

FIGURE 26



SURGE CHAMBER AND AIR HEATER ASSEMBLY (1-1)



STRAP-AIR BARREL (2-4)
SAE 1020 Steel .25 Thick
FIGURE 30

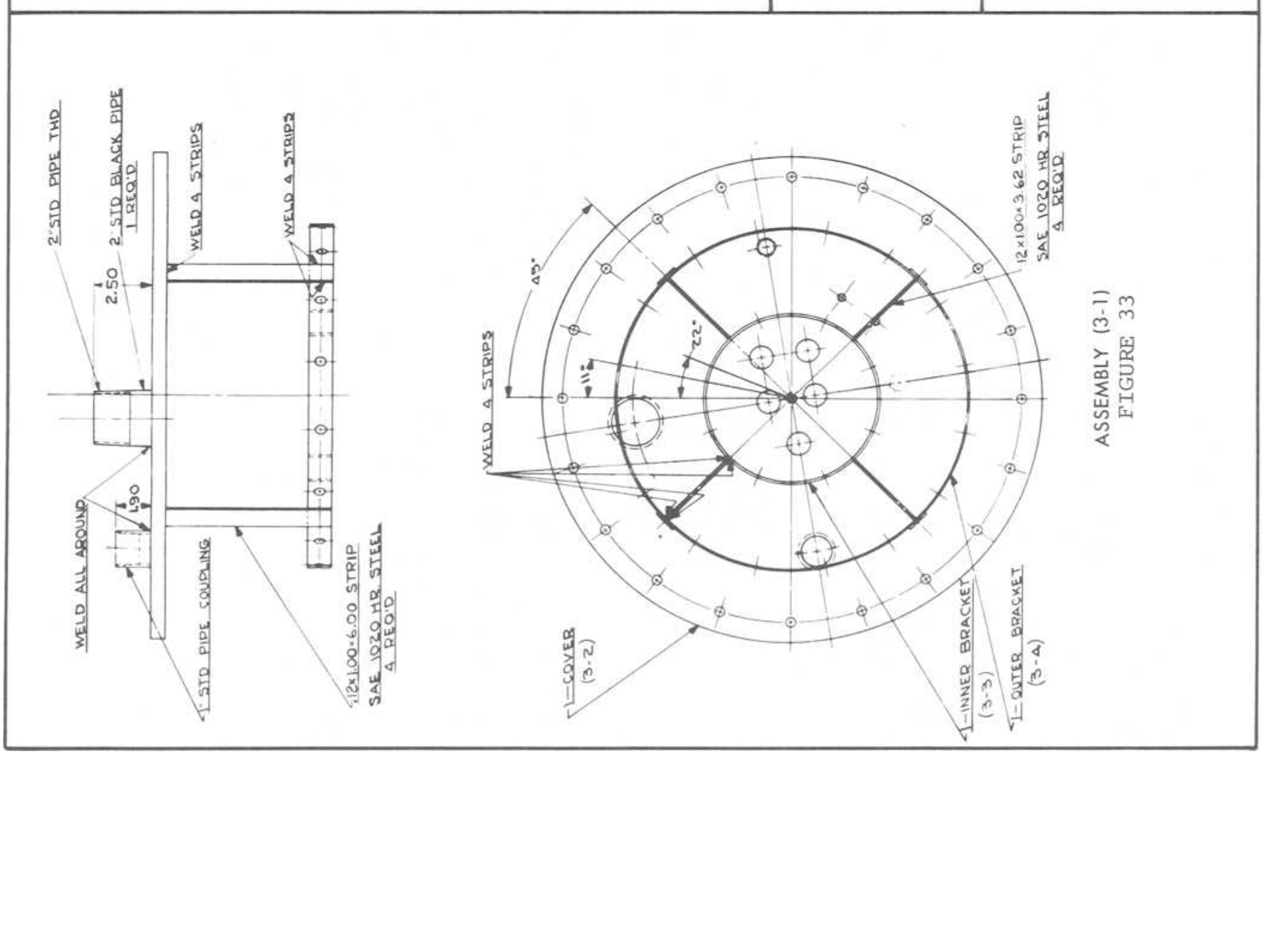
PAD (2-6)
SAE 1020 Steel 1.25 Thick
FIGURE 31

HOOK (2-5)
SAE 1020 Steel .38 Round
FIGURE 32

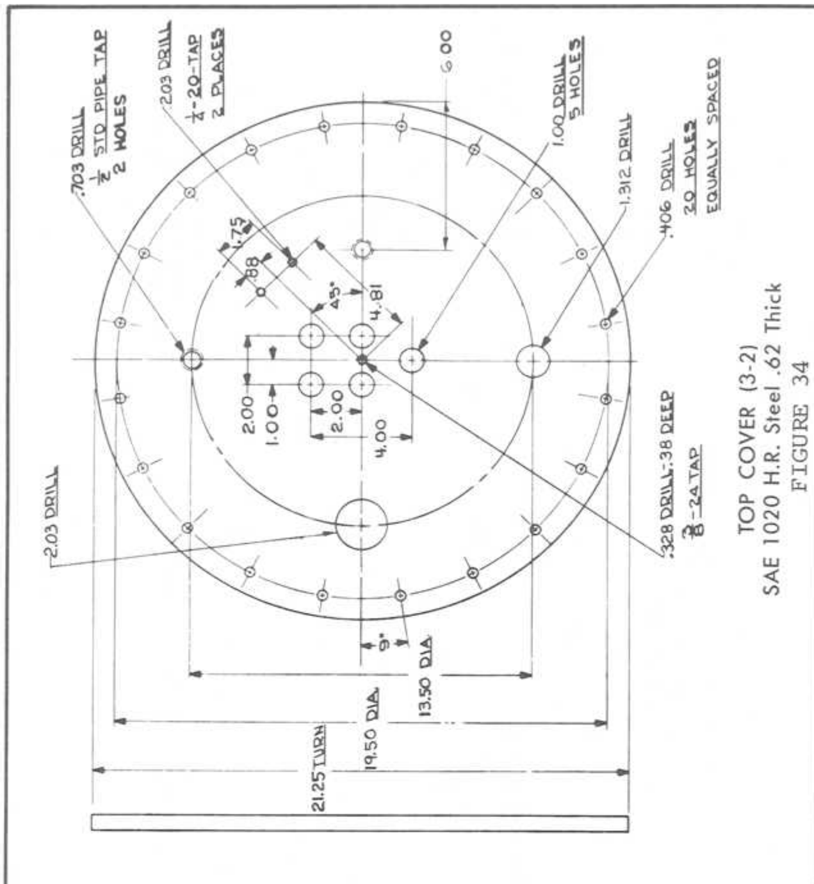
TOP RING (2-2)
SAE 1020 Steel .62 Thick
FIGURE 28

BOTTOM PLATE (2-3)
SAE 1020 Steel .62 Thick
FIGURE 29

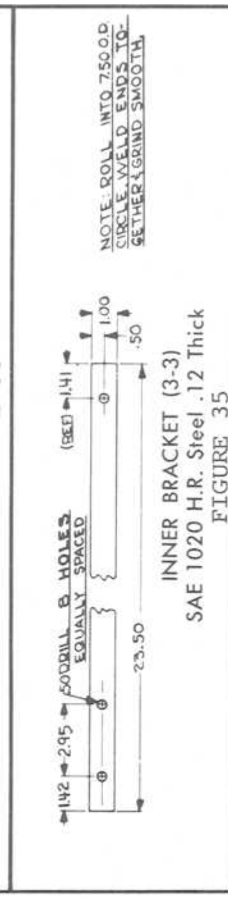
ASSEMBLY (2-1)
FIGURE 27



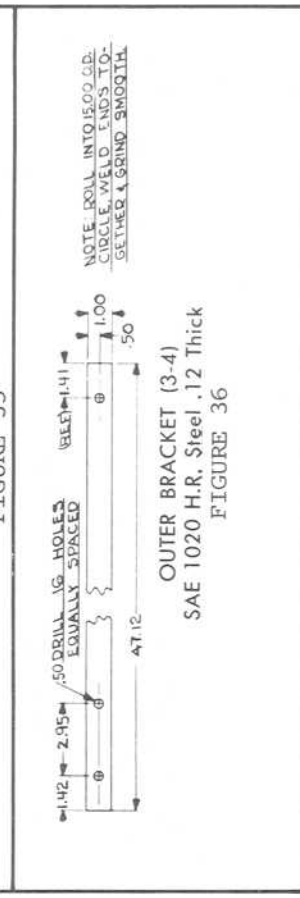
ASSEMBLY (3-1)
FIGURE 33



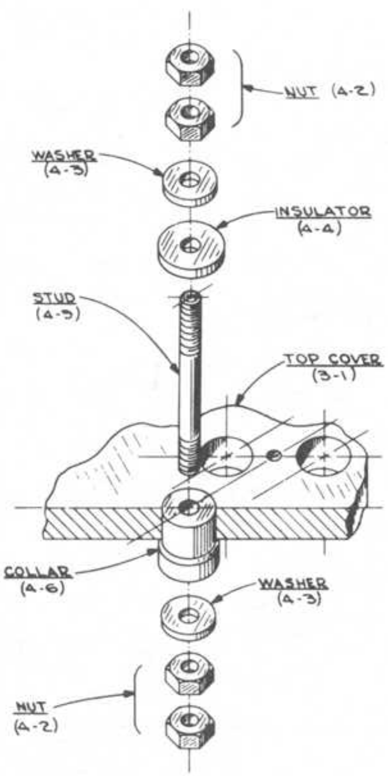
TOP COVER (3-2)
SAE 1020 H.R. Steel .62 Thick
FIGURE 34



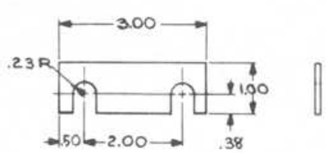
INNER BRACKET (3-3)
SAE 1020 H.R. Steel .12 Thick
FIGURE 35



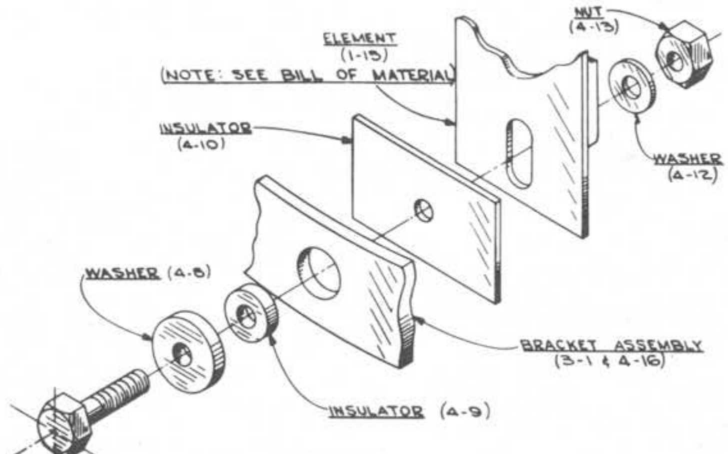
OUTER BRACKET (3-4)
SAE 1020 H.R. Steel .12 Thick
FIGURE 36



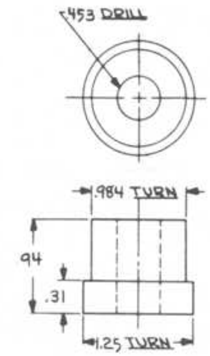
TERMINAL ASSEMBLY (4-1)
FIGURE 37



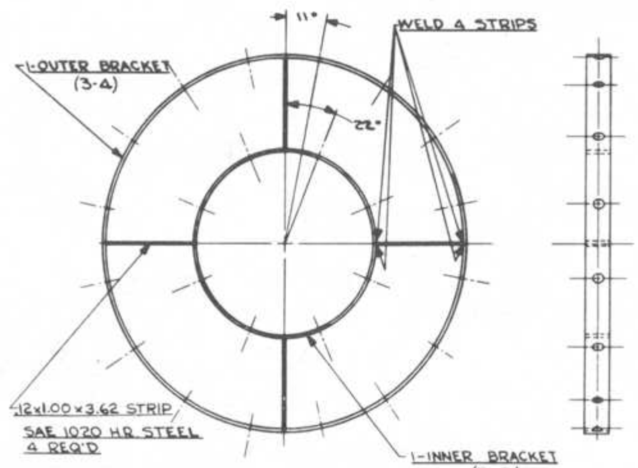
TERMINAL CONNECTOR (4-15)
Copper Bar Stock .12 Thick
FIGURE 41



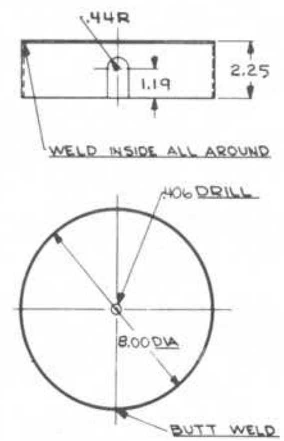
INSULATOR ASSEMBLY (4-7)
FIGURE 39



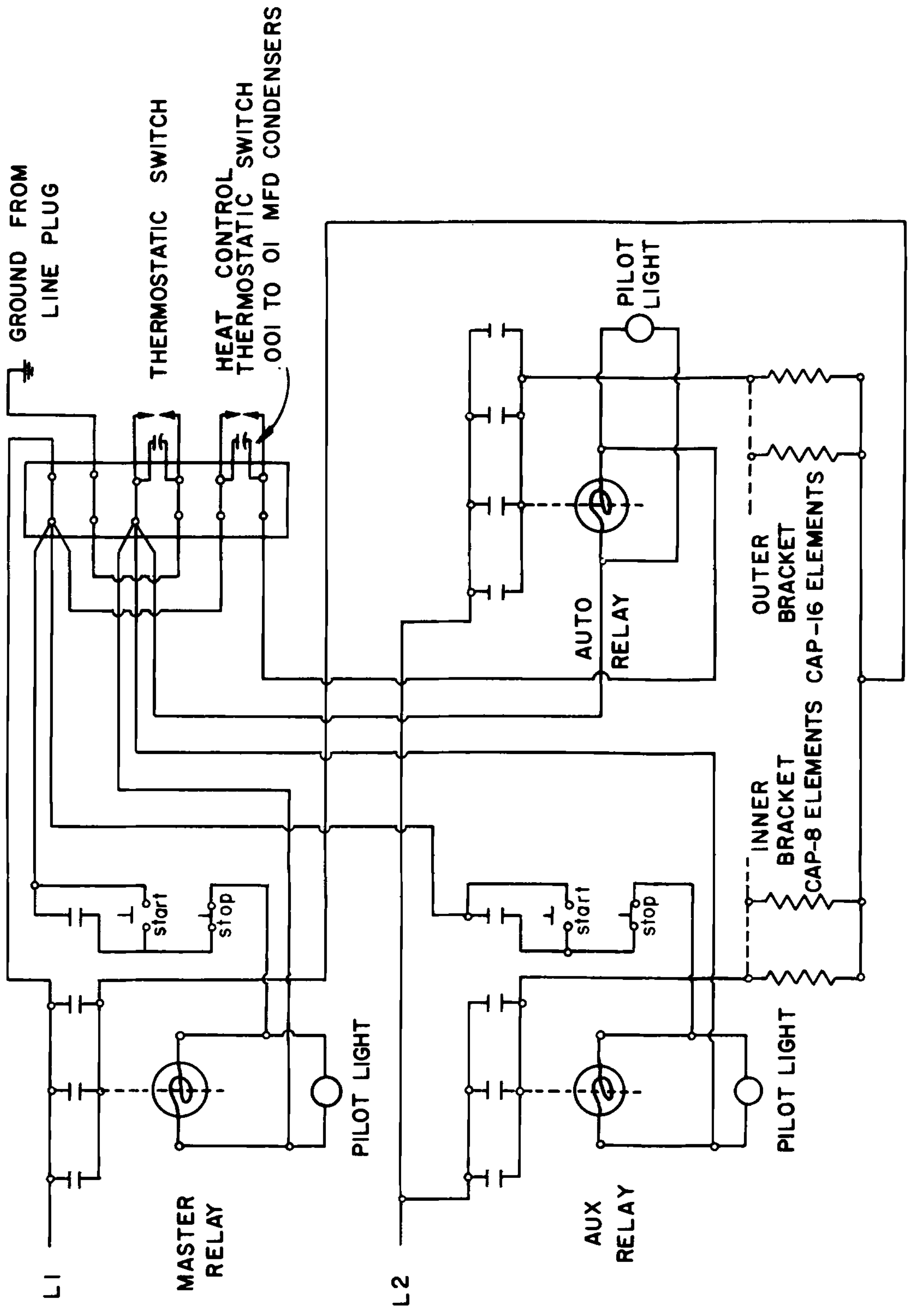
COLLAR (4-6)
Synthane
FIGURE 38



LOWER BRACKET ASSEMBLY (4-16)
FIGURE 42



ELECTRIC CABLE COVER (4-14)
SAE 1020 H.R. Steel .0478 Thick
FIGURE 40



WIRING DIAGRAM FOR 1Y38 SURGE CHAMBER AND AIR HEATER ASSEMBLY
FIGURE 41

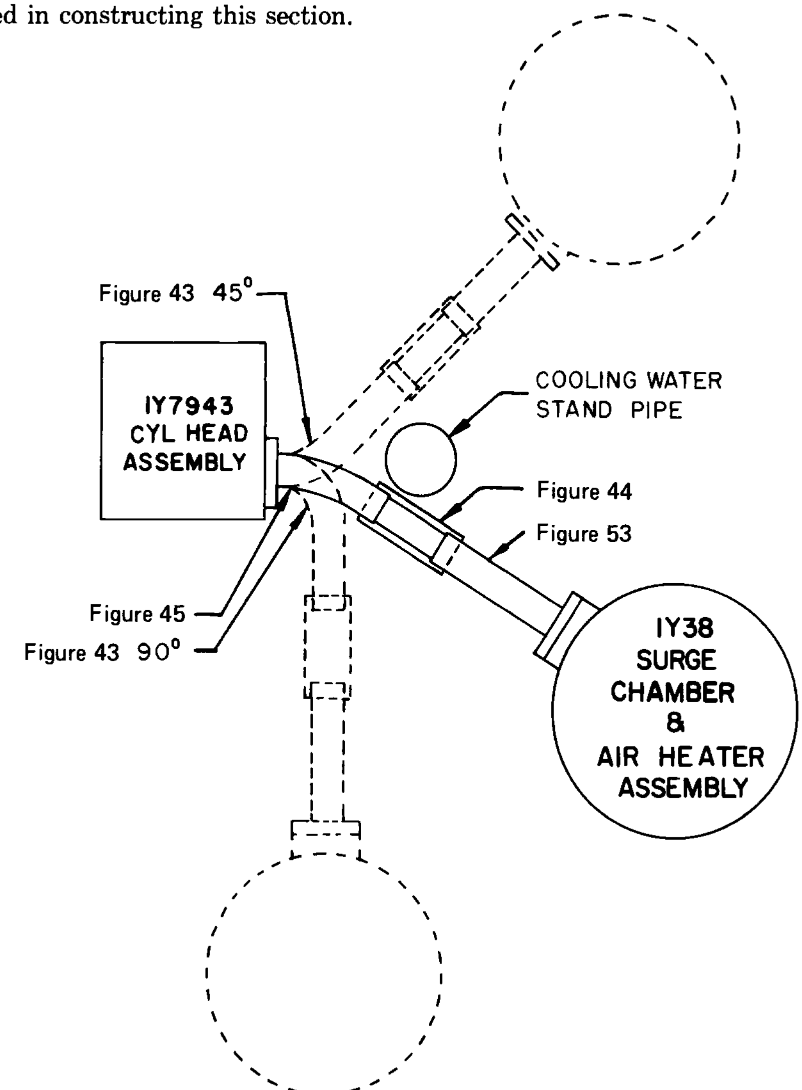
Air Transfer Pipe

The 1Y73 Engine Arrangement or the 1Y7500 Engine Arrangement modified with the 1Y7999 High Speed Change-Over Group requires an air transfer pipe as illustrated in Figures 42 - 48 and 53 - 55. It consists of two sections of two inch black iron pipe. The 1Y43 Flange, part of the section attached to the engine, is available as a standard part.

A slight bend may be made in one of the sections as long as the inner surface is not rippled and the inside circularity is not distorted. If a more pronounced bend is required a 45° or 90° standard welding pipe fitting, illustrated in Figure 43, is recommended. The centerline pipe distance of the temperature and pressure bosses from the flange face, shown in Figure 45, should be maintained regardless of pipe curvature in this area.

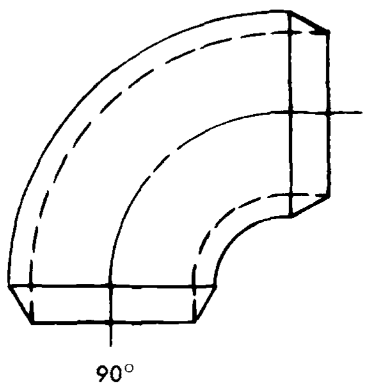
To isolate the surge chamber from engine vibration the two sections are connected with a length of rubber hose as shown in Figure 47. Any other suitable isolation device may be employed that has an inside diameter of 2.5 ± 0.5 inches and does not alter the total pipe length of 30 ± 0.5 inches.

The 1Y7500 Engine Arrangement modified with the 1Y7630 Supercharger Change-Over Group uses an air transfer pipe identical to the one just described except for the flange on the section attached to the engine. The 1Y217 Flange shown in Figure 52, available as a standard part, is used in constructing this section.



Alternate Air Transfer Pipe Arrangements

FIGURE 42



STANDARD 2 IN. WELDING FITTINGS
FIGURE 43

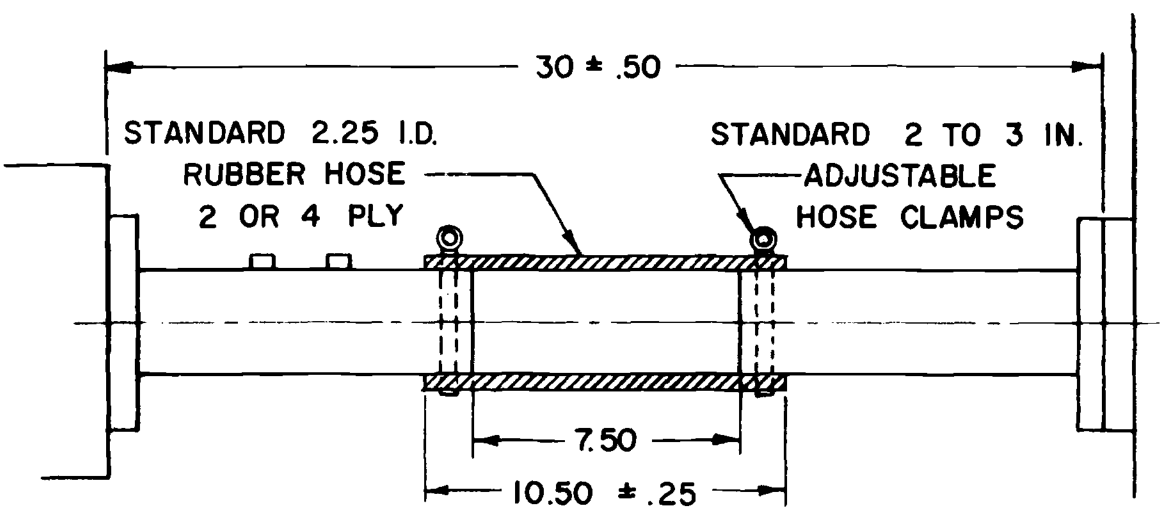
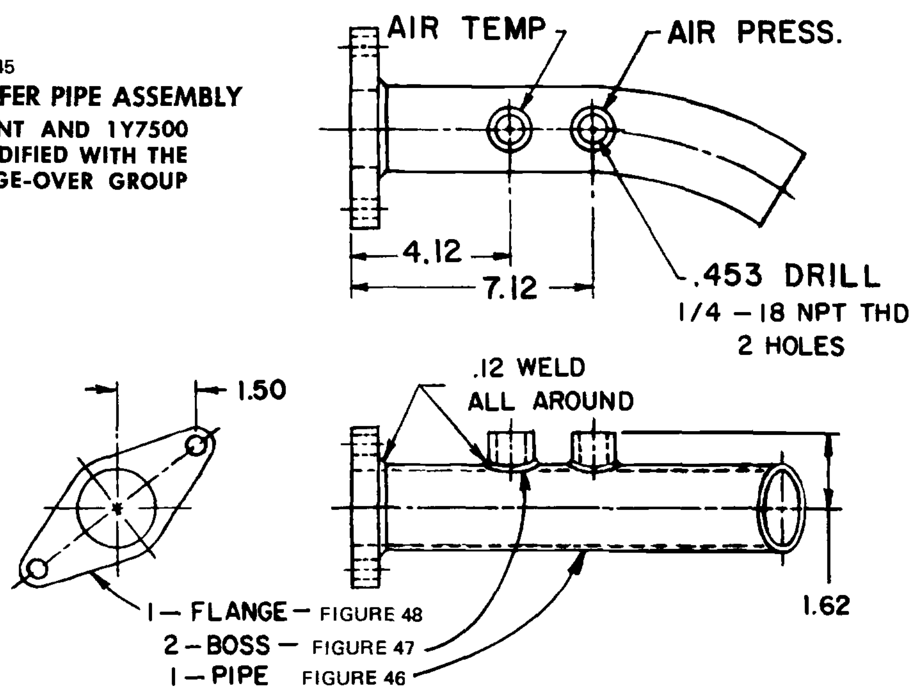
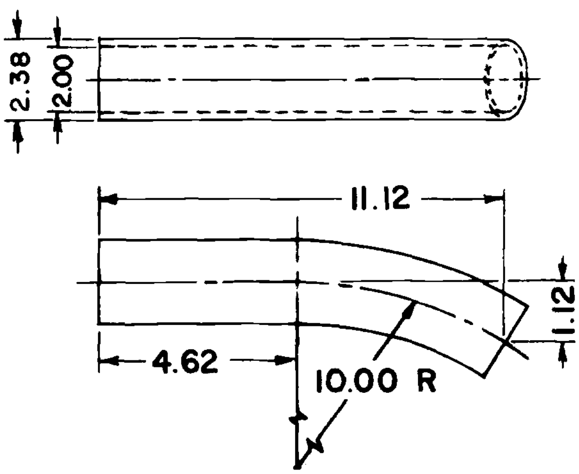


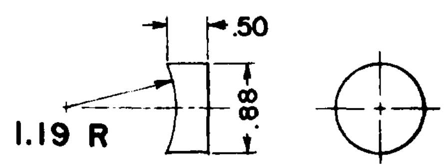
FIGURE 44
ISOLATION HOSE

FIGURE 45
ENGINE AIR TRANSFER PIPE ASSEMBLY
1Y73 ENGINE ARRANGEMENT AND 1Y7500 ENGINE ARRANGEMENT MODIFIED WITH THE 1Y7999 HIGH-SPEED CHANGE-OVER GROUP

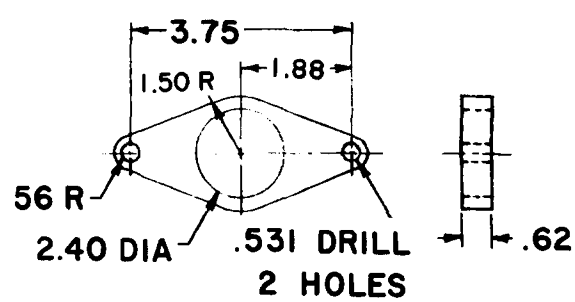




PIPE
2 IN. BLACK IRON
FIGURE 46



BOSS
SAE 1020 STEEL
FIGURE 47

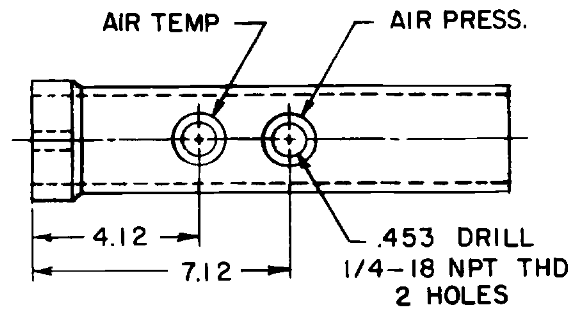


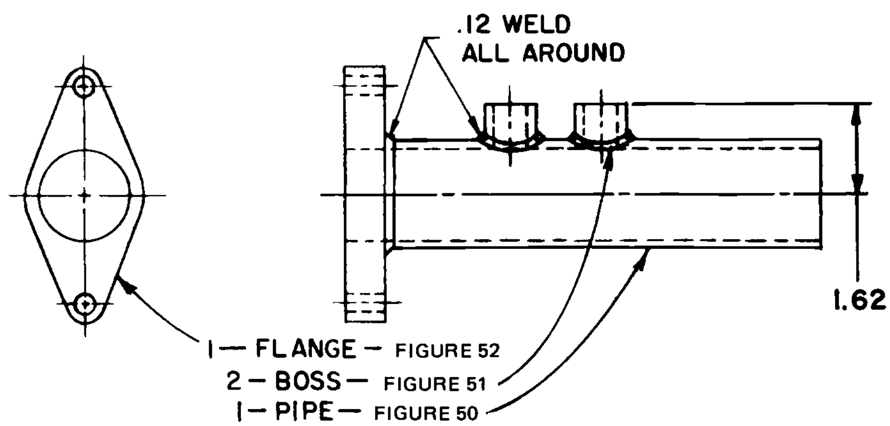
FLANGE
SAE 1020 STEEL
FIGURE 48

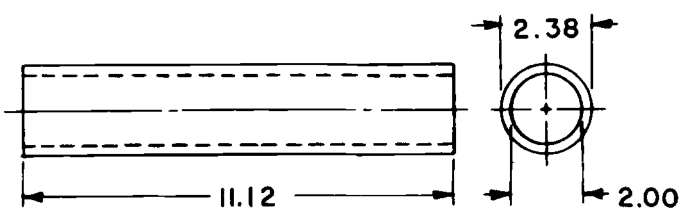
FIGURE 49

ENGINE AIR TRANSFER PIPE ASSEMBLY

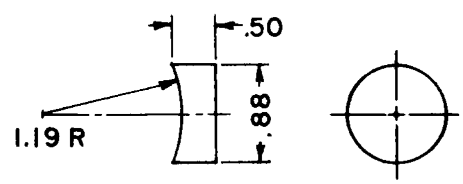
1Y7500 ENGINE ARRANGEMENT MODIFIED WITH THE 1Y7630 SUPERCHARGER CHANGE-OVER GROUP



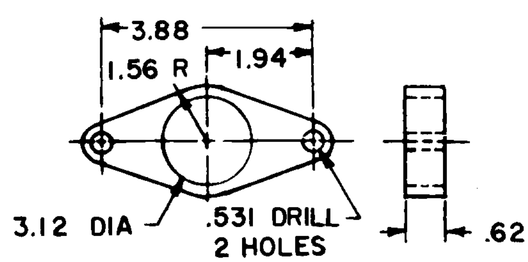




ITEM 12 — PIPE
2 IN. BLACK IRON
FIGURE 50



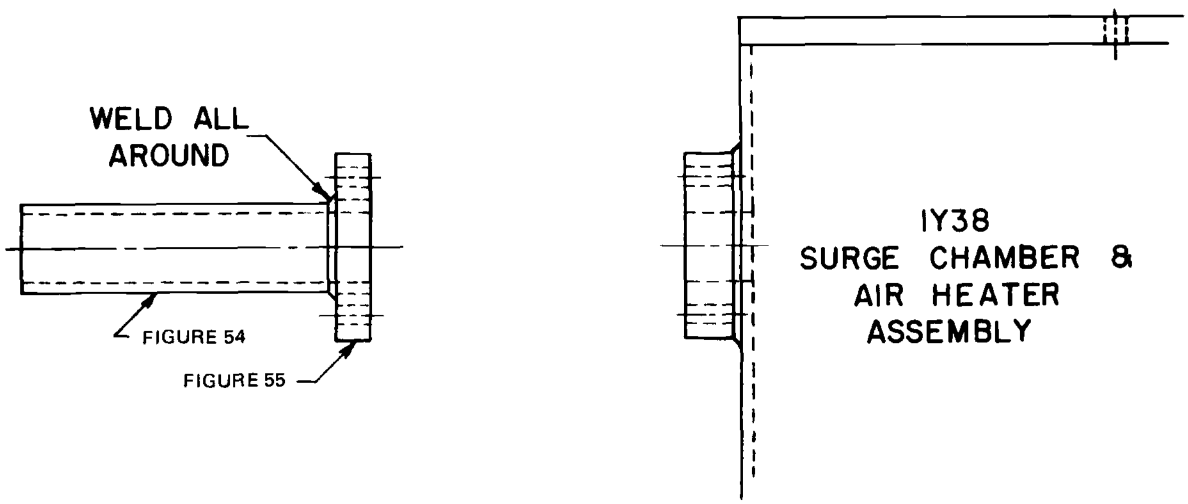
ITEM 13 — BOSS
SAE 1020 STEEL
FIGURE 51

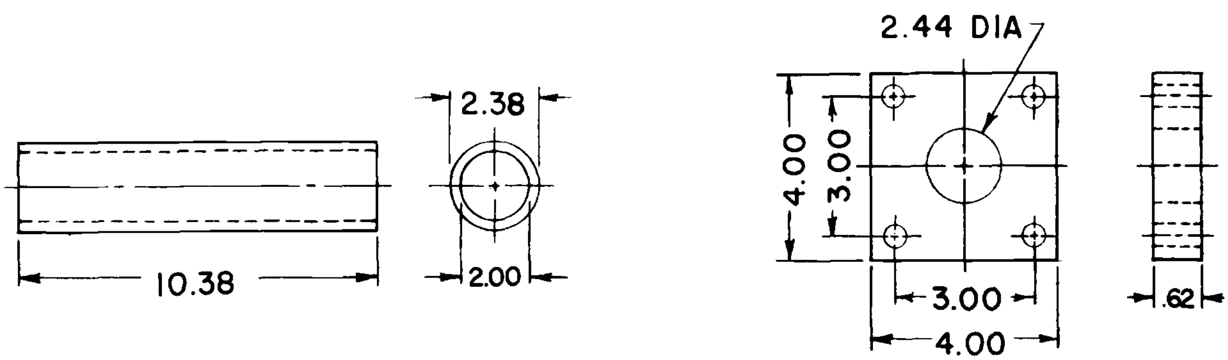


ITEM 14 — FLANGE
SAE 1020 STEEL
FIGURE 52

FIGURE 53
— SURGE CHAMBER OUTLET PIPE ASSEMBLY

1Y73 ENGINE ARRANGEMENT AND 1Y7500 ENGINE ARRANGEMENT MODIFIED WITH THE 1Y7999 HIGH-SPEED CHANGE-OVER GROUP





PIPE
2 IN. BLACK IRON
FIGURE 54

FLANGE
SAE 1020 STEEL
FIGURE 55

SAFETY

The operating of engine tests can expose personnel and facilities to a number of safety hazards. It is recommended that only personnel who are thoroughly trained and experienced in engine testing should undertake the design, installation and operation of engine test stands.

Each laboratory conducting engine tests should have their test installation inspected and approved by their Safety Department. Personnel working on the engines should be provided with the proper tools, be alert to common sense safety practices and avoid contact with moving and/or hot engine parts. Guards should be installed around all external moving or hot parts. When engines are operating at high speeds, heavy duty guards are required and personnel should be cautioned against working alongside the engine and coupling shaft. Barrier protection should be provided for personnel. All fuel, oil lines and electrical wiring should be property routed, guarded and kept in good order. Scraped knuckles, minor burns and cuts are common if proper safety precautions are not taken. Safety masks or glasses should always be worn by personnel working on the engines and no loose or flowing clothing should be worn near running engines.

The external parts of the engine and the floor area around the engines should be kept clean and free of oil and fuel spills. In addition, working areas should be free of all tripping hazards. In case of injury, no matter how slight, first aid attention should be applied at once and the incident reported. Personnel should be alert for leaking fuel or exhaust gas. Leaking fuel represents a fire hazards and exhaust gas fumes are noxious. Containers of oil or fuel cannot be permitted to accumulate in the testing area.

The test installation should be equipped with a fuel shut-off valve which is designed to automatically cut off the fuel supply to the engine when the engine is not running. A remote station for cutting off fuel from the test stand is recommended. Suitable interlocks should be provided so that engine is automatically shut down when any of the following events occur: engine or dynamometer loses field current, engine overspeeds, exhaust system fails, room ventilation fails or the fire protection system is activated. Consider an excessive vibration pickup interlock if equipment operates unattended. Fixed fire protection equipment should be provided and dry chemical fire extinguishers should be available at the test stands.

Many ASTM Tests use chemicals to flush engines between tests. Some of these chemicals require that personnel wear face masks, dust breathers and gloves as exothermic reactions are possible. Emergency showers and face rinse facilities should be provided when handling such materials.

GLOSSARY

Abrasive Wear	Progressive removal of material from a rubbing surface evidenced by lapping of the surface caused by fine particles carried in the lubricant, fuel, air, or embedded in the surface.
Adhesive Wear (or Galling)	Removal of material from a rubbing surface caused by seizing, scoring, or scuffing.
(a) Seizing	Sticking together of two surfaces characterized by the presence of small particles of material which have become welded to the surface.
(b) Scoring	Mechanical disturbance of a rubbing surface with definite surface roughness in line with motion characterized by the transfer of metal by dragging which results in progressive deterioration.
(c) Scuffing	Mechanical disturbance of a rubbing surface with no appreciable surface roughness.
Ash	Residue of combustion inorganic in nature.
Blowby	That portion of the combustion reactants and unburned air-fuel mixture which leak into the engine crankcase during operation of the engine.
Burning	Removal of metal from sealing surface to form leakage path.
Carbon	A firm, black, highly insoluble deposit composed primarily of organic residue and most readily definable by thickness or volume and texture. It is usually nonlustrous except when rubbed smooth between adjoining engine parts and found primarily on surfaces operating above engine bulk temperatures but below the ashing point.
Carbon Cutting	Removal of piston or cylinder material due to abrasion by carbonaceous deposits firmly adhering to a mating surface.
Corrosive Wear	Progressive removal of material from a rubbing surface caused by a combination of chemical attack and mechanical action.
Clogging	Restriction of a flow path due to the accumulation of debris along the flow path boundaries.
Corrosion	Any observed chemical attack on the metal parts. Rust is a special case of the corrosion of iron.
Demerit Rating	Definition of an engine condition in numerical terms on a scale from 0 representing a new part condition to 10 representing the arbitrary high level of condition which would be considered unsatisfactory for the party under consideration.

Glossary (continued)

Deposit	Material other than fuel or lubricant as such so affixed to an engine surface as to have finite volume under operating conditons and classifiable as sludge, lacquer, carbon, rust, etc.
Deposit Channelling	Removal of deposit material from sealing surface to form leakage path.
Erosion	Mechanical removal of material by impingement of high velocity fluid with or without entrained particles.
Fretting (also called Fretting Corrosion)	Wear occurring on mating surfaces due to slight relative motion resulting from dynamic stresses.
Indentation	Displacement of metal by plastic deformation to form a crater or dent.
Lacquer	A thin, hard, lustrous, oil insoluble deposit composed primarily of organic residue and most readily definable by color. It is not easily removed by wiping and resistant to saturated solvents such as petroleum naphtha, but soluble in other solvents such as benzene, chloroform, ketones, and similar compounds classed as "lacquer solvents." It may be variously colored, usually in grey, brown or amber hues.
Lifter, stuck	One that does not return to its original position by its own force upon removal from the engine.
Merit Rating	Definition of an engine condition in numerical terms on a scale from 10 representing a new part condition to 0 representing the arbitrary high level condition which would be considered unsatisfactory for the part under consideration.
Proudness	Ring protrusions caused by the buildup of carbon or lacquer deposits behind the ring or on the sides of the ring or groove.
Ring, free	One that falls of its own weight from side to side in its own groove.
Ring, stuck	One that is either partially or completely bound in its groove.
Ring, tight	One that offers resistance to movement in its groove, but which can be pressed into or out of the groove under finger pressure without springing back.
Ring Feathering	Metal drag from face of ring beyond ring side to form burred edge.
Rumble	An abnormal combustion phenomenon that is characterized by an audible throbbing sound resulting from crankshaft vibration.

Glossary (continued)

Rust	The chemical combination of oxygen with ferrous engine parts, including other iron complexes not removable by organic solvents.
Scaling	The deposition and growth of insolubles and oxides on cooling system walls.
Scoring	A condition resulting from metal to metal contact or foreign matter causing surface roughness in the direction of relative motion characterized by dragging and smearing of the material of one or both surfaces.
Scratching	Mechanical disturbance of a rubbing surface with definite surface roughness in line with motion. No progressive surface deterioration due to debris.
Scuffing	Adhesive wear which is the result of progressive removal of material from a rubbing surface caused by localized welding and subsequent fracture.
Sludge	A deposit composed of organic residue which may contain fuel, lubricant and/or water. Such deposits will be found on surfaces operating at bulk engine temperature and exposed to fuels and/or lubricants.
Spalling	Surface disintegration associated with loss of particles from surface and not associated with adhesion.
Varnish	A hard, dry, generally lustrous oil insoluble deposit which cannot be removed by wiping with a soft cloth.
Wear	The loss or relocation of material from two or more surfaces in relative motion.