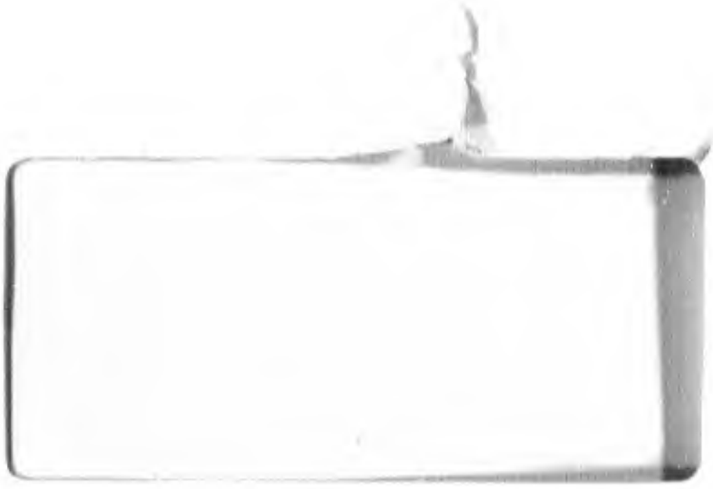


Briggs

PIONEERS IN MODERN OIL FILTRATION

THE BRIGGS FILTRATION COMPANY
RIVER ROAD, WASHINGTON 16, D. C.

(5) National Scientific Labs., Inc., Washington, D.

(9) FINAL REPORT.

(6) WATER AND SOLIDS REMOVAL PERFORMANCE
PBFS-6-50-2V FILTER/SEPARATOR
MOTOR GASOLINE FUEL - 50 GPM.

(15) CONTRACT DA 19-129 QM-1458

Test conducted at the Briggs Research & Development Laboratory, Washington, D. C.

Test dates 20, 21, and 22 June, 1960

Clifford H. May
Director of Research
July 7, 1960

TABLE OF CONTENTS

SUMMARY

The PBFS-6H-50-2V Filter Separator met the water and solids removal performance requirement of MIL-F-8508 A ~~in tests conducted at the Briggs Laboratory~~. The subject evaluation was conducted at a flow rate of 50 GPM with Motor (~~Esso~~) Gasoline. The subject tests were conducted in compliance with Contract DA 19-129-QM-1458 of Quartermaster Corps, Research & Development Laboratories at Natick, Massachusetts.

Object of Test:

Contract DA 19-129-QM-1458 states as follows: "The contractor shall design, fabricate, test, and deliver to the Government, portable petroleum dispensing kits, electric drive, for tract vehicles...". In accordance and as a part of the test on the petroleum dispensing kit, the ensuing report covers the filter separator performance test on the PBFS-6-50-V2 filter separator, as well as the flow test and electrical readings taken from the tests.

Description of PBFS-6H-50 Filter Separator:

The PBFS-6H-50 filter separator is basically a single stage horizontal unit, having an overall length of approximately 36" and a diameter of approximately 12".

The dispensing kit consists of a centrifugal pump and motor in which the pump impeller is submerged in a fuel well just below the inlet to the filter separator. The pump is driven by 28 volt d. c. motor and is capable of delivering 50 GPM of aviation gasoline fuel through the filter separator. On the inlet side of the filter separator the dispensing kit contains a 4-way four port aluminum valve which is designed to direct flow from the fueling tanker to engine supply or from the storage tank to the tanker. The entire dispensing kit assembly is mounted on a steel base and includes a utility box for the storage of accessories.

The filter separator itself contains three filter - coalescer elements, which are 28" in length and approximately 3-3/4" in diameter and with a flow direction from the inside to the outside. The model A-1826 element was used for the official qualification testing. This element is made of a molded fiber glass tube with dual densities. Each of the three elements is surrounded by 100 mesh Teflon coated screen spaced radially approximately 1/2" from the outside diameter of the elements. This screen is designed to collect the coalesced water droplets and direct them to the water collection sump at the rear of the filter separator vessel. The vessel itself is equipped with a sight window which enables the operator to detect the water collection and to drain water manually. The inlet to the filter separator case is located at the foreward end of the vessel and the inner chamber is accessable by means of removable head with a victaulic coupling. The vessel outlet is located in the main body of the filter separator vessel at the foreward end and on top of the filter separator. With the submerged centrifugal pump the entire pump pressure is applied to the submerged chamber where the fuel is forced upward through a slot opening into the inlet chamber of the filter separator.

The solids are collected inside of the filtering media and as previously mentioned, the coalesced water droplets are collected outside of the filtering media in the 100 mesh Teflon coated separating membrane from whence it is directed to the vessel sump.

Test Equipment and Procedures:

The PBFS-6-50-V2 filter separator was evaluated in the test facilities as shown in the attached sketch. Power was made available to the d. c. motor by means of a 28 volt d. c. generator - converter unit. In order to maintain the 50 GPM flow rate to the filter separator and test system, the motor voltage had to be held constant at approximately 30 volts as the differential pressure built up by the solids retention in filter separator elements created a heavier load on the motor. In all of the tests conducted on the subject dispensing kit, the average required for the d. c. motor was recorded at each sampling interval.

Two sets of tests were conducted, both using the procedures under MIL-F-8508 A. The first set of tests were conducted with the Briggs Model A-1056 element which is 14" in length and is composed of pre-densified 2" fiber glass discs. This is the standard Briggs type element which has been supplied for several years to the U. S. Air Force, U. S. Navy etc.; since the Model A-1056 element is 14" in length, 2 of these elements were used per canister.

The filter/separator kit was also qualified with our latest element development which is a one-piece molded fiber glass tube. This element was our part #A-1826 which was 28" in length and which, therefore, required only three such elements per unit. This latest fiber glass element development is a definite improvement over our present elements and the A-1015 which was used in the original test.

For some time now we have been developing an improved fiber glass element to replace the present fiber glass elements we manufacture.

This research program has been directed to accomplish the following purposes:

1. To reduce the cost of the present element

2. To improve the performance of the present elements

Considerable success has been obtained from this improved element program in that two of our newer elements have now been successfully qualified for use by the Navy.

Under MIL-F-8508 A the first test conducted in the procedure consists of a 2 hour blank run and pressure drop calibration test. These runs were conducted at a main fuel temperature of approximately 80° F. and are designed to establish the initial contaminant level in the filter separator test system by analyzing a series of 8 effluent samples taken every 15 minutes over a 2 hour test period. Also, during this test the pressure drop is recorded at various flow rates from 10 to 50 GPM in order to establish the pressure differential per unit of flow through the filter separator case.

Following the blank run and pressure drop tests, a 0.5% water run with 272 mg/gal of AC dust was conducted on each type of element as previously described. This test is conducted for a 2 hour period during which time the pressure differential cannot exceed 15 psi. Effluent samples are taken every 15 minutes for millipore solids analysis and for water analysis by the centrifuge method.. At each 15 minute interval the pressure differential fuel temperature, inlet pressure, and the motor amperage were recorded. Following the 0.5% water run a new set of elements was installed and a 3.0% water run conducted with the same solids add rate of 272 mil/gal. The effluent samples and the other data is recorded on this test in the same manner as the 0.5% water run.

The first 2 hour test cycle consisting of the blank run and the pressure drop requirement is conducted with uncontaminated fuel with the 8 effluent samples being averaged for solids content. This average is then used as a correction factor for the effluent samples of the 0.5% and 3.0% water run. The effluent samples were analyzed in accordance with paragraph 4.5.6.4.3 of MIL-F-8508 A with the exception that the effluent solids content was determined by the latest method of millipore analysis. The procedure specified by MIL-F-8508 A requires centrifuging for solids and water. However, the later military specifications are all requiring a more accurate millipore filter method for determining solids content. Since this method is more accurate and less time consuming, it was used for the official analysis rather than the centrifuge method of MIL-F-8508 A.

MODEL # PBFS-6-50-V2 FILTER SEPARATOR

MOTOR GASOLINE

Blank run and pressure drop calibration with the A-1826 elements

Time	Flow GPM	Press. Diff. " Hg.	Fuel Temp. °F	Sample #	Effluent Solids Content mg/l	Motor Amperage
0845	10	.10	75			
0900	10	.10	76	1	1.89	25
0902	20	.20	76			
0915	20	.20	77	2	1.20	28
0916	30	.30	77			
0930	30	.30	77	3	9.88	30.5
0931	40	.40	77			
0945	40	.40	78	4	1.26	33.2
0946	50	.50	78			
1000	50	.55	79	5	1.29	35.0
1015	50	.60	79	6	1.11	35.0
1030	50	.60	79	7	1.03	35.0
1045	50	.65	80	8	1.05	35.0
					9.71 = Total	

1.1 mg/liter = Average effluent solids content

MODEL # PBFS-6-50-V2

0.5% Water Run with 272 mg/gal of A. C. Dust - Fuel - Motor Gasoline

Time	Flow GPM	Press. Diff. " Hg.	Fuel Temp. °F	Sample #	Effluent Solids Content mg/l	Effluent Water Content mg/l	Motor Amperage
1300	50	0.9	84			0.0	
1302	50	2.0	84	30	.85	0.0	
1315	50	3.5	80	31	1.10	0.0	35
1330	50	4.8	80			0.0	35.2
1345	50	6.7	80	32	.15	0.0	35.5
1400	50	7.2	80			0.0	35.7
1415	50	8.0	80	33	.30	0.0	36.2
1430	50	8.5	80			0.0	36.5
1445	50	9.3	80	34	.30	0.0	36.5
1500	50	10.2	80	35	.25	0.0	36.5
				Total	= 3.15 mg/liter		
				Average	= .45 mg/liter		

This test was conducted with 3 of the Model #A-1826 molded fiber glass tube elements

Note: This average solids content is less than that of the Blank Run. Therefore, it is unnecessary to apply a correction factor.

MODEL # PBFS-6H-50 FILTER SEPARATOR

3.0% Water and 272 mg/gal of A. C. Dust

Time	Flow GPM	Press. Diff. " Hg.	Fuel Temp. oF	Sample #	Effluent Solids Content mg/l	Effluent Water Content
0930	50	.50	80			0.0
0932	50	1.7	80	21	1.32	0.0
0945	50	3.20	80	22	.746	0.0
1000	50	4.25	79	23	.886	0.0
1015	50	4.90	80	24	.638	0.0
1030	50	5.90	81	25	.738	0.0
1045	50	7.10	81	26	1.09	0.0
1100	50	8.60	82	27	.821	0.0
1115	50	9.80	82	28	.685	0.0
1130	50	11.60	82	29	.580	0.0
				Total	6.504	

Solids Content .722 mg/l
Solids uncorrected from Blank Run

This test was conducted with 3 of the Briggs Model A-1826 elements which are molded fiber glass tubes 28" in length.

MODEL # PBFS-6H-50 FILTER SEPARATOR

3.0% Water with 272 mg/gal A. C. Dust

Time	Flow GPM	Press. Diff. " Hg.	Fuel Temp. °F	Sample #	Effluent Solids Content mg/l	Motor Amperage
1330	50	.6	80	9	3.16	
1332	50	1.3	81	10	1.57	31
1345	50	2.9	84	11	1.70	32.2
1400	50	3.5	83	12	1.28	33
1415	50	4.1	83	13	1.36	33.2
1430	50	4.8	82	14	1.18	33.2
1445	50	5.7	82	15	1.26	33.8
1500	50	6.7	81	16	1.23	34.2
1515	50	8.1	81	17	1.31	34.9
1530	50	10.4	80.5			35.2
				Total	14.05	
				Average	1.56 solids uncorrected	

This test was conducted with 6 of the Model A-1056 elements - regular Esso gasoline.

Discussion of Test Results:

Mr. John Perry of the Quartermaster Research & Engineering Center, Natick, Massachusetts, visited the Briggs Plant on the 16th of June, 1960 and witnessed the test on the 3% water and 272 mg/gal AC Dust using the Briggs Model A-1056 element. At that time the Model A-1056 element was shown to Mr. Perry along with the later Briggs Model A-1826 molded fiber glass tube element. It was explained to Mr. Perry that we would like to try this type of molded fiber glass element in the PBFS-6-50-2V unit as we believe we could meet the requirements of MIL-F-8508 A with this element and that it would represent a savings in cost as well as improved performance over the Standard Briggs A-1056 element. Mr. Perry stated that this would be satisfactory with him if we made three of the Model A-1826 elements and tested them in accordance with 8508 A and reported our results to his office. This explains the reason for conducting the MIL-F-8508 A test with two different types of elements. It is the intention of the Briggs Filtration Co. to incorporate the Model A-1826 molded fiber glass tube element as the standard which will be used with the subject filter separator.

At the beginning of the blank run and pressure drop test considerable difficulty was experienced with contaminant being picked up from the 2" hose which was to be used with the Petroleum Dispensing unit. It was learned upon investigation that the hose which had been supplied to the Briggs Filtration Co. did not conform with the federal specification ZZ-H-471 A, which is required by the subject contract. The hose was initially used and contained a neoprene lining rather than a Buna N lining as is required by specification ZZ-H-471 A. This deficiency was corrected by ordering replacement hose directly from the factory which contained the Buna N lining. Upon replacing the hose the fuel samples cleared up and the test could proceed in accordance with MIL-F-8508 A. Both the 3% water run and the .5% water run (combined contaminant runs) indicate from the pressure drop vs. time graphs that the ultimate life period of the PBFS-6-50-V2 is considerably greater than that required by MIL-F-8508 A. At the same time that the filter separator was being evaluated a new pressure differential gauge manufactured by the Rochester Gauge Co. was evaluated along with the unit. This gauge indicates a red changeout indicator at 8.5 psi. The 8.5 psi differential pressure changeout provides a safety factor of approximately 2 to 1.

Conclusions:

It is concluded that Briggs Model PBFS-6-50-V2 filter separator satisfactorily met solids and water removal performance requirements of MIL-8508 A with motor gasoline. The pump and ~~generator~~ motor installed will satisfactorily deliver 50 gpm fuel flow rate to subject unit at a voltage of approximately 32 volts and an amperage of 36.2 amps.

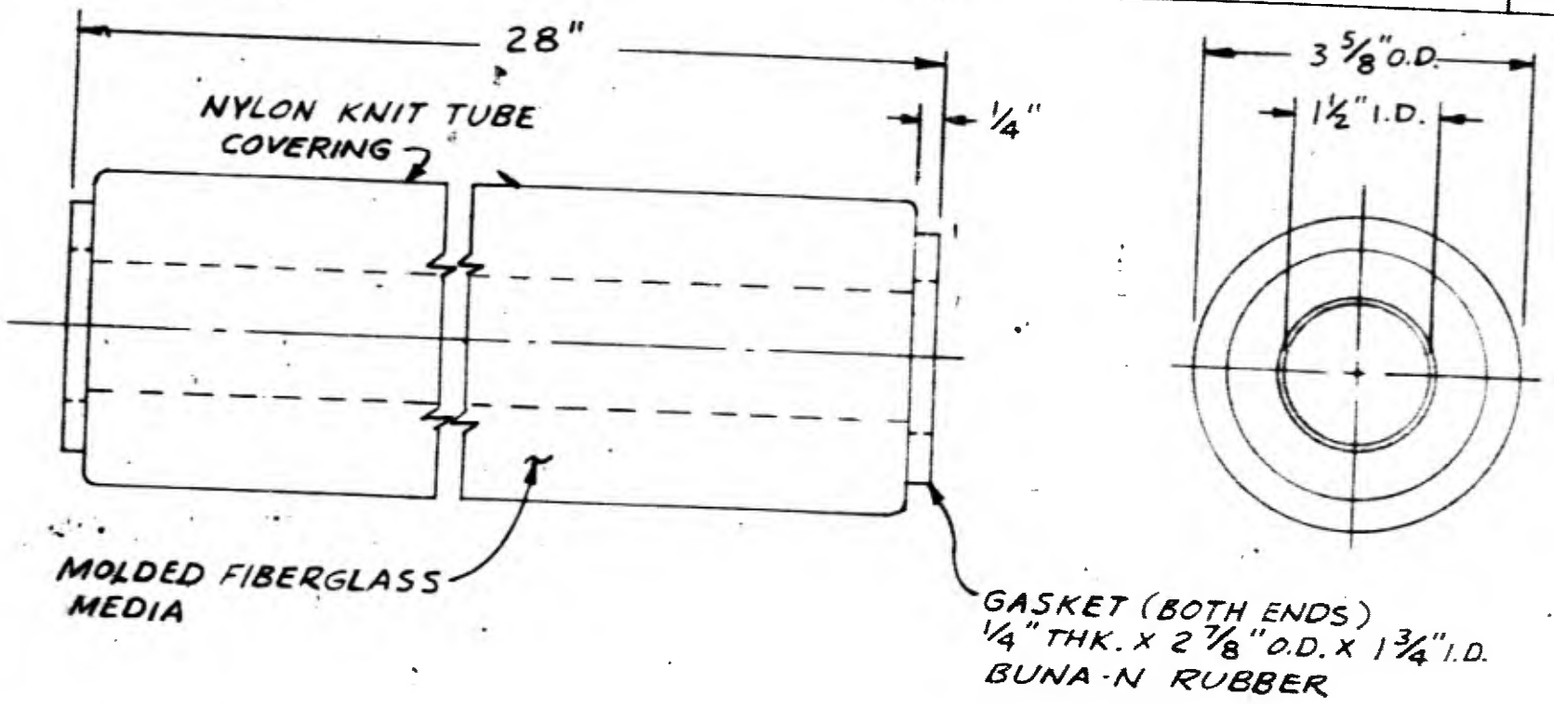
Recommendations:

It is recommended that the Briggs Model PBFS-6-50-V2 filter separator may be accepted as a satisfactory unit for installation in the Petroleum Dispensing kit for motor gasoline service. It is also further recommended that the Briggs Model A-1826 elements be accepted as satisfactorily meeting requirements of MIL-F-8508 A at a flow rate of 17 gpm each. These elements should be changed when the pressure differential reaches 8.5 psi or at the end of one year, whichever occurs earlier.

PART

PART A-1826

E.C. No.	LET.	ALTERATION	DATE	BY	APPR.



MATERIAL AS NOTED

APPROXIMATE WEIGHT

REMOVE ALL BURRS AND SHARP EDGES

DO NOT SCALE - WORK TO DIMENSIONS

UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES
LIMITS ON
FRACTIONS ± DECIMALS ± ANGLES ±

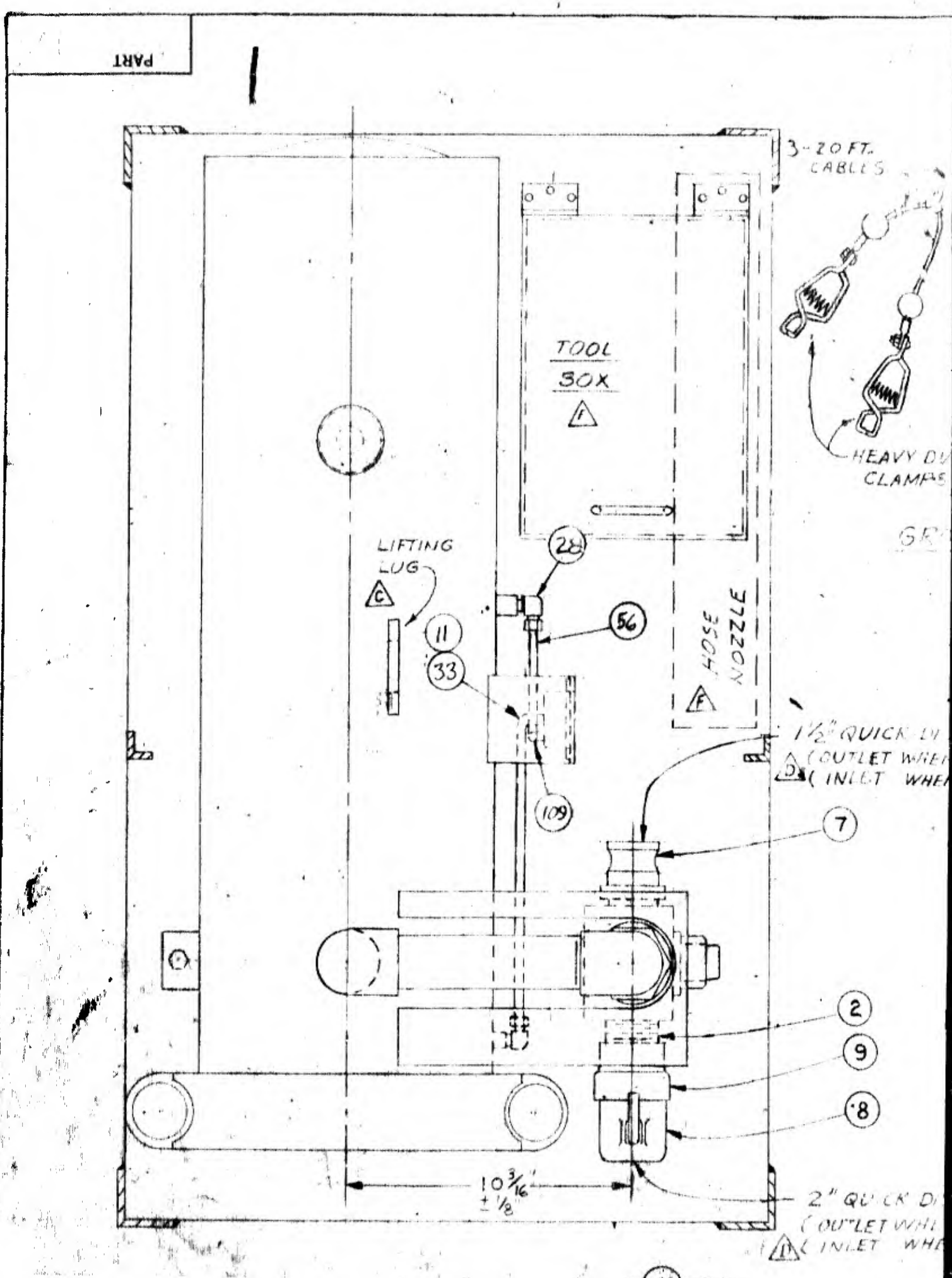
DRAWN	DATE	CHECKED	APPROVED	SCALE
CGR	11-14-60			HALF

THE BRIGGS FILTRATION CO.
WASH. 16, D. C., U. S. A.

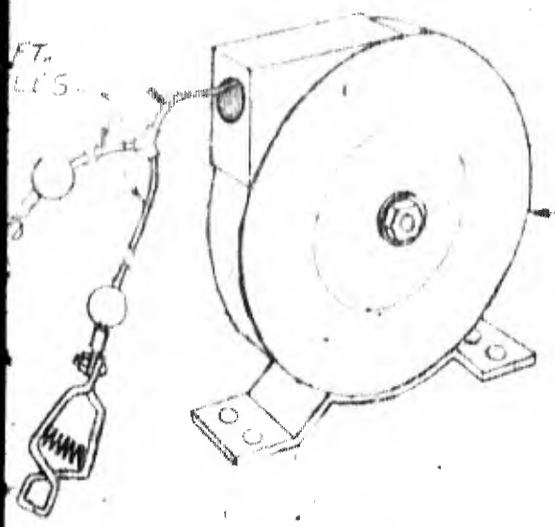
NAME
28" FILTER/COALESCER ELEMENT (OUTLINE)

PART
A-1826

SHEET No. | No. OF SHEETS

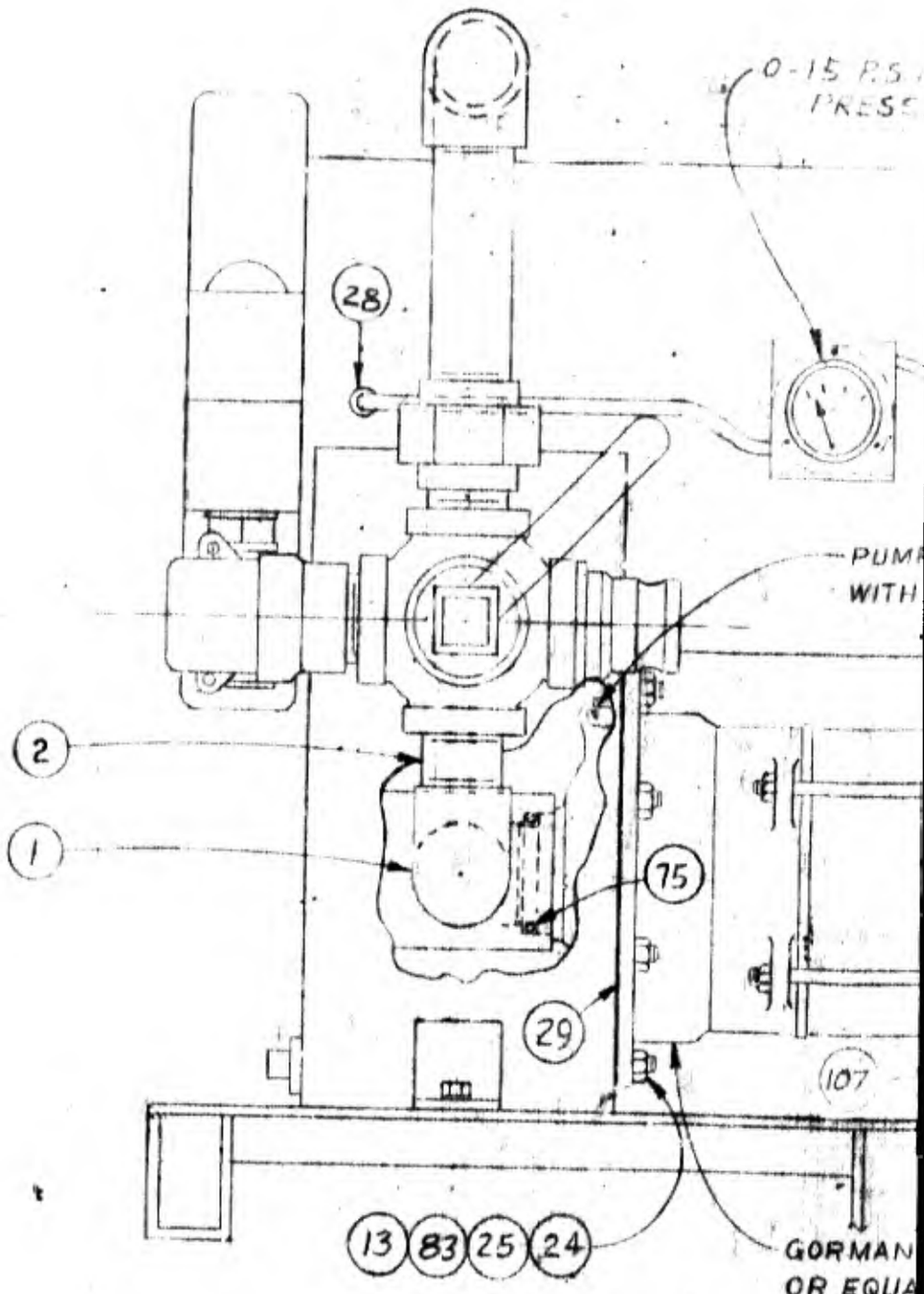

PART
3-20 FT. CABLES
TOOL
30X
F
HEAVY DU
CLAMPS
LIFTING LUG
C
28
56
11
33
HOSE NOZZLE
F
1½" QUICK DI
(OUTLET WHEN
D (INLET WHEN
109
7
2
9
8
10 3/16" ± 1/8
2" QUICK DI
(OUTLET WHI
E (INLET WHE

2



HEAVY DUTY ALLIGATOR CLAMPS, 100 AMP

GROUNDING REEL (109)



UICK DISCONNECT FITTING
LET WHEN FILLING VEHICLE TANK)
T WHEN FILLING TRUCK BAGS)

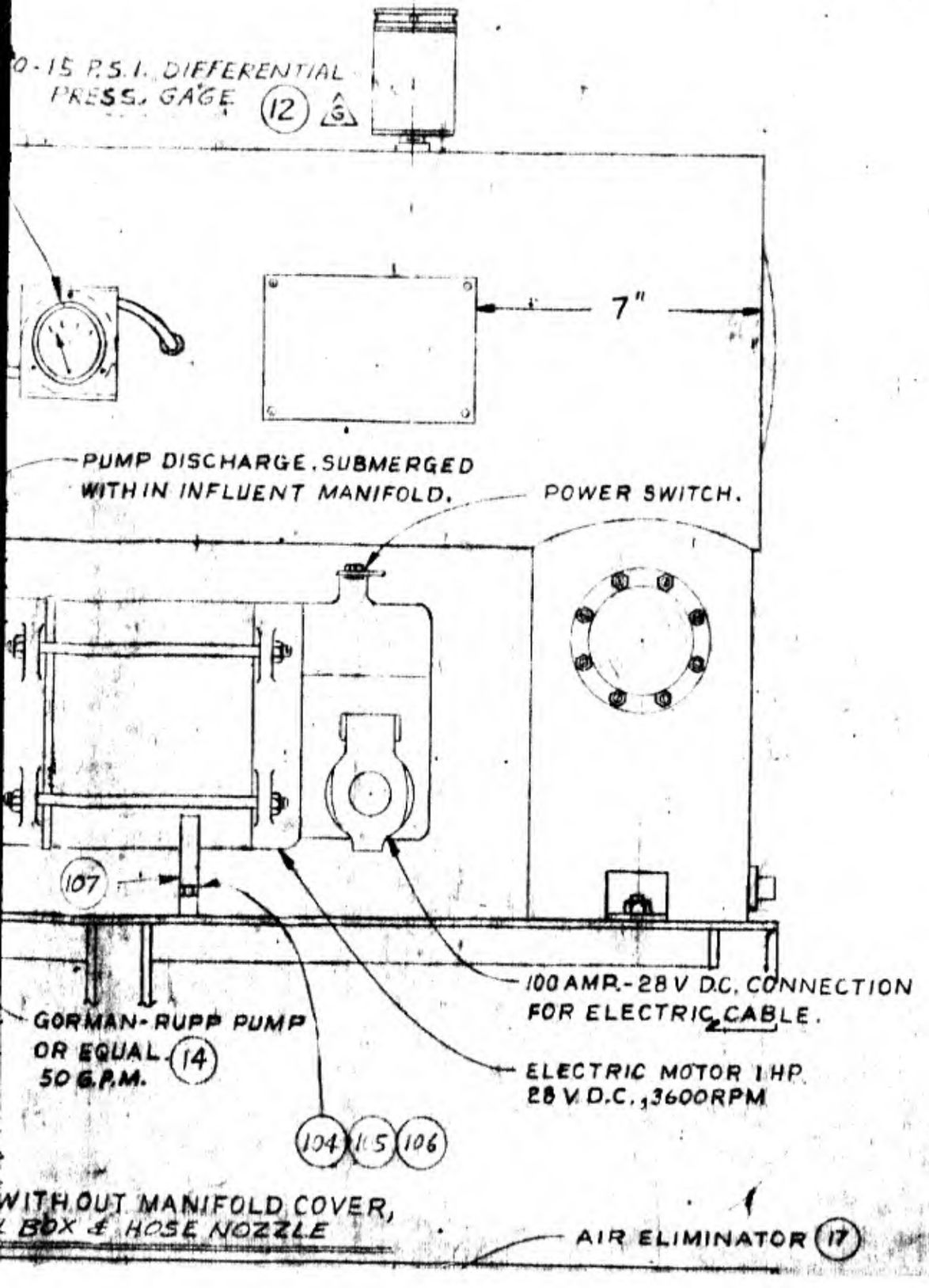
2
9
8

UICK DISCONNECT FITTING
ET WHEN FILLING TRUCK BAGS)
ET WHEN FILLING VEHICLE TANK)

HOSE COILED FOR STORAGE.

SEPARATOR WITHOUT
FRAME, TOOL BOX &

3

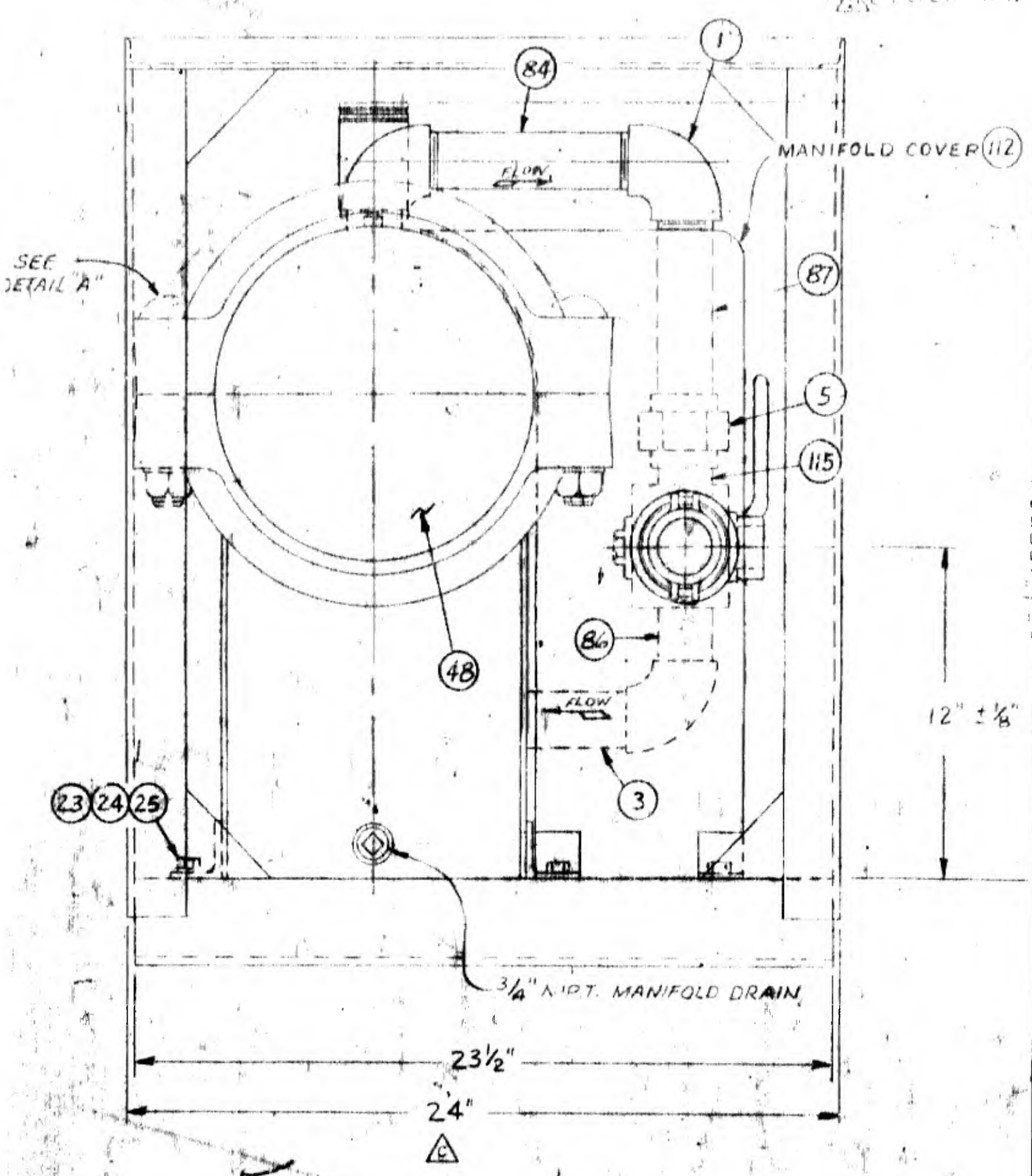

0-15 P.S.I. DIFFERENTIAL PRESS. GAGE (12) A G
7"
PUMP DISCHARGE. SUBMERGED WITHIN INFLUENT MANIFOLD.
POWER SWITCH.
107
100 AMP.-28 V D.C. CONNECTION FOR ELECTRIC CABLE.
GORMAN-RUPP PUMP OR EQUAL (14) 50 G.P.M.
ELECTRIC MOTOR 1 HP. 28 V.D.C., 3600 RPM
104 105 106
WITHOUT MANIFOLD COVER, BOX & HOSE NOZZLE
AIR ELIMINATOR (17)

PART GA-1348-1

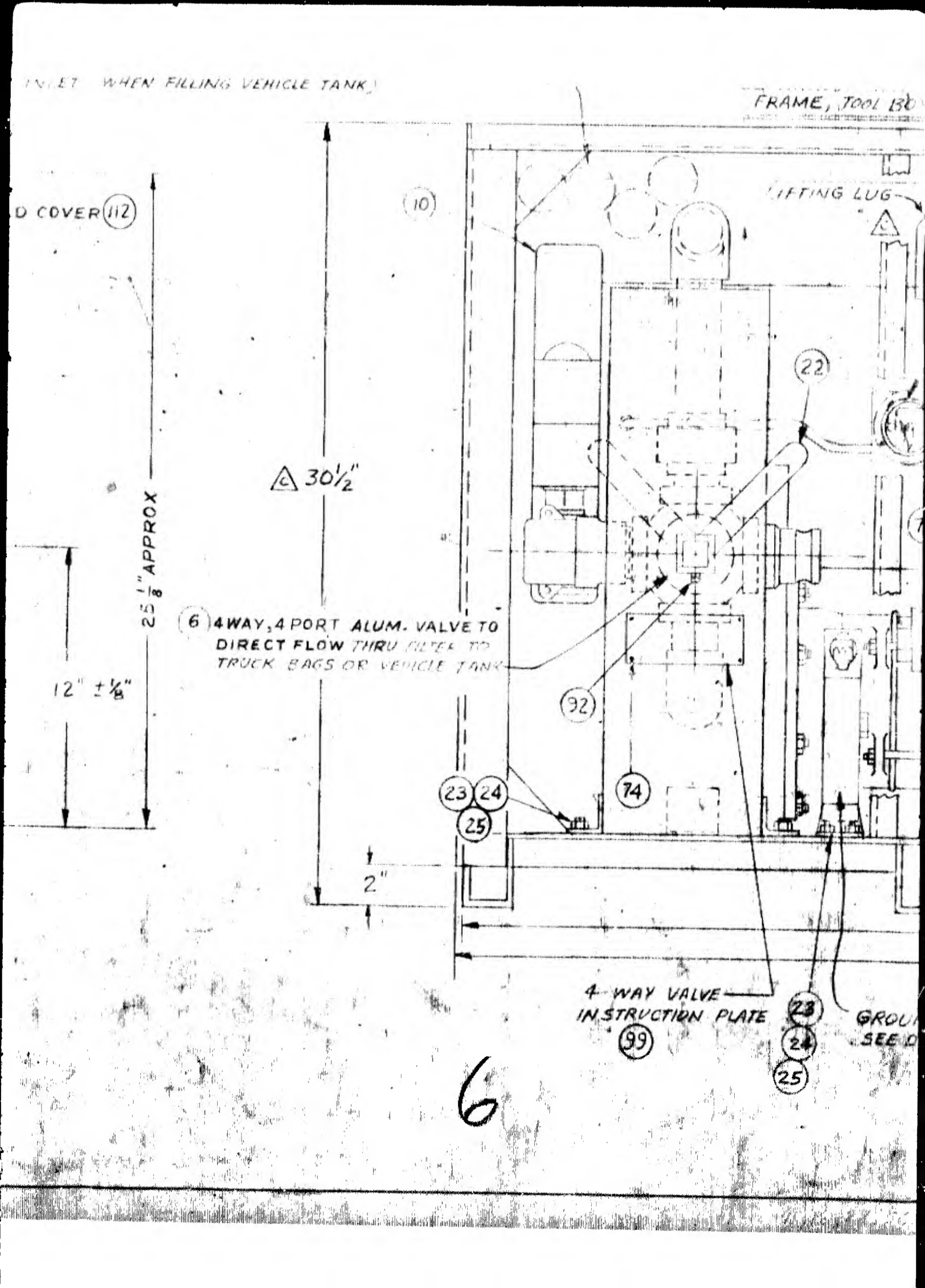
E.C. No.	LET.	ALTERATION	DATE	BY	APPR.
4	A	MISC. REVISIONS (OVERALL DIMENSIONS UNCHANGED)	2-9-60	CGR	
	B	ELEMENT WAS A-1156	5-10-60	CGR	
	C	ADDED FRAME, DETAIL "A" & ACCESSORY ITEMS 89, 102 & 91. ADDED LIFTING EYE, OVERALL DIMENSIONS WERE 37¼" x 23½" x 26⅜"	6-20-60	CGR	
	D	WORDS "INLET" & "OUTLET" REVERSED	7-1-60	CGR	
	E	WAS 7/16" OPEN END/BOXED END (REF. NOTE 7, ITEM 91)	7-6-60	CGR	
	F	REVISED UTILITY BOX, ADDED HOSE NOZZLE & GROUNDING REEL	7-13-60	CGR	
	G	DIFF. GAGE WAS PRESS. GAGE WITH 3-WAY VALVE	7-29-60	CGR	
	H	REF. NOTE 3: ADDED ALTERNATE ELEMENT A-1839	9-15-60	CGR	
	J	REF. NOTE 7: ADDED ITEMS 113 & 114	9-20-60	CGR	

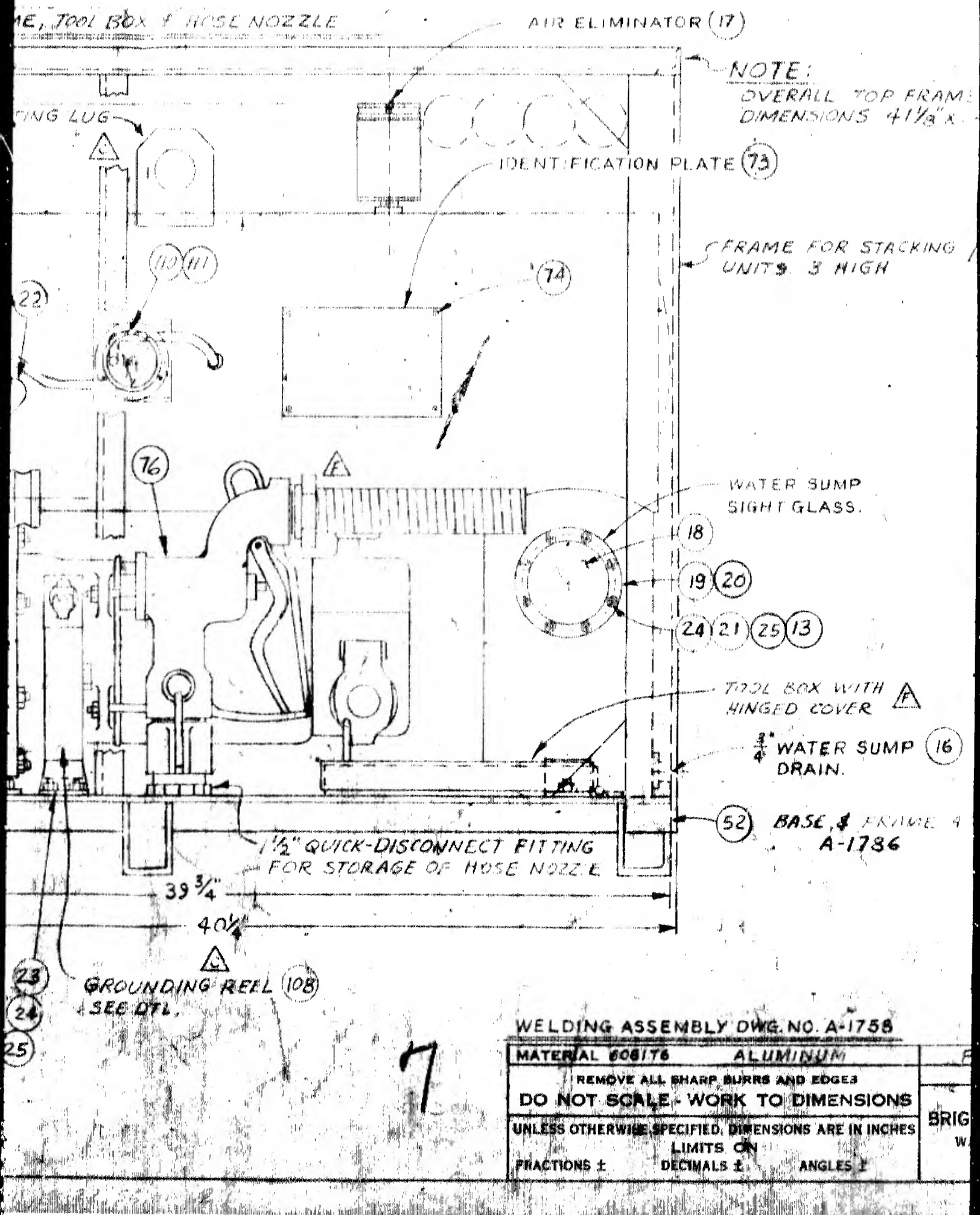
NOTES:

1. WORKING PRESSURE ..... 75 P.S.I.
2. TEST PRESSURE ..... 125 P.S.I.
3. (B) (65) ELEMENTS, BRIGGS FIBER GLASS PART NO. A-1015, 6 REQUIRED.
   (H) ALTERNATE ELEMENT, BRIGGS MOLDED FIBER GLASS PT NO. A 1839, 6 REQ'D.
4. UNIT DESIGNED TO MEET PERFORMANCE REQUIREMENTS OF MIL-F-8508A.
5. WEIGHT - DRY: APPROX. 345 LBS. WET: APPROX. 445 LBS.
6. UNIT DESIGNED TO FIT WITH IN ALLOWABLE AREA, 49" HIGH, 30" WIDE AND 65" LONG.
7. THE FOLLOWING ITEMS ARE TO BE FURNISHED AS ACCESSORIES:
   - (76) ONE 1½" NON-AUTOMATIC FUELING HOSE NOZZLE, OPW #190 WITH ONE #633-B COUPLER.
   - (77) ONE 2" x 1½" COUPLER ASS'Y., OPW #77-BN OR EQ.
   - (78) ONE 2" HOSE X 15' LG. PER FED. SPEC. ZZ-H-471a, CL. I, TYPE 3, W/ ONE FEMALE COUPLER & ONE MALE ADAPTOR.
   - (79) ONE 1½" HOSE X 40' LG. PER FED. SPEC. ZZ-H-471a, CL. I, TYPE 3 W/ ONE FEMALE COUPLER & ONE MALE ADAPTOR.
   - (80) ONE ELECTRIC CABLE, 30' LG. W/ CONNECTIONS TO FIT PUMP MOTOR & POWER SUPPLY ON TRUCK.
   - (81) ONE 1½" DUST CAP, OPW #634-B OR EQ.
   - (82) ONE 2" DUST PLUG, OPW #634-A OR EQ.
   - (E) (89) ONE SPARK PLUG WRENCH FOR REMOVING COVER BOLT (ITEM 93 & 94)
   - (C) (102) ONE 8" ADJUSTABLE WRENCH
   - (E) (C) (91) ONE 7/16 x 5/8" STEEL OPEN END WRENCH FOR PUMP BOLTING.
   - (113) ONE 2" MALE ADAPTOR, OPW #633-F OR EQ.
   - (J) (114) ONE 2" DUST CAP, OPW #634-B OR EQ.


1
84
MANIFOLD COVER 112
FLOW
SEE DETAIL "A"
87
5
115
48
86
FLOW
12" ± 1/8"
3
23 24 25
3/4" N.P.T. MANIFOLD DRAIN
23 1/2"
24"
℄

5


INLET WHEN FILLING VEHICLE TANK)
FRAME, TOOL BO
LIFTING LUG
D COVER (112)
(10)
(22)
△ 30½"
25 1/8" APPROX
12" ± 1/8"
(6) 4 WAY, 4 PORT ALUM. VALVE TO DIRECT FLOW THRU FILTER TO TRUCK BAGS OR VEHICLE TANK
(92)
(74)
(23) (24) (25)
2"
4 WAY VALVE INSTRUCTION PLATE (99)
(23) (24) (25)
GROU
SEE D
6



WELDING ASSEMBLY DWG. NO. A-1758

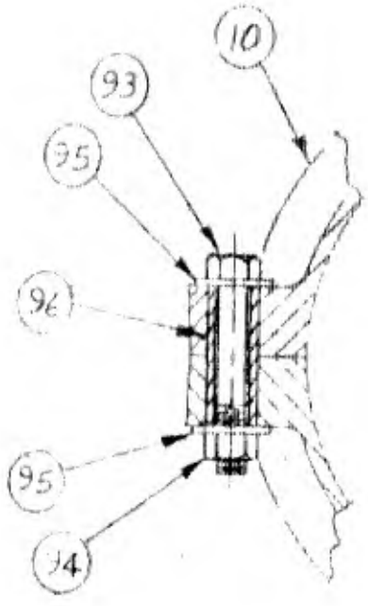
MATERIAL 6061T6 ALUMINUM	
REMOVE ALL SHARP BURRS AND EDGES	
DO NOT SCALE - WORK TO DIMENSIONS	
UNLESS OTHERWISE SPECIFIED, DIMENSIONS ARE IN INCHES LIMITS ON FRACTIONS ± DECIMALS ± ANGLES ±	BRIG W

4 (94) ONE 2" DUST CAP, OPW #634-B OR EQ.

8. UNIT OPERATING INSTRUCTIONS GLUED TO INSIDE OF TOOL BOX COVER. (100)

9. ALL RUBBER PARTS TO WITHSTAND -65° F.

10. UNIT TO BE SUPPLIED WITH CANVAS TARPAULIN. (90)



DETAIL "A"
COVER BOLTING

DATE OF THIS PRINT

NOV 14 1960

R&D CONTRACT DA-19-129-QM-1458
FOR ARMY Q.M. R&D CENTER NATICK, MASS.

SPECIAL

P.T. HAWES	11-17-59	W.J.G.H.S.	K.H.B.	1/4" = 1"
DRAWN	DATE	CHECKED	APPROVED	SCALE

BRIGGS FILTRATION CO.
WASH. 16, D. C., U. S. A.

NAME
R.B.F.S. 6-50-M2
PORTABLE FILTER SEPARATOR
PETROLEUM DISPENSING KIT

PART
GA-1348-

SHEET NO. | REV. | NO. OF SHEETS