FINAL REPORT

SALT IMMERSION CHAMBER

Serial No. 1324

Contract #DA-30-069-504-ORD-3015

Standard
CABINET COMPANY

FINAL REPORT

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Serial No. 1324

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FINAL REPORT

SALT IMMERSION CHAMBER

Serial No. 1324

Contract No. DA-30-069-504-ORD-3013

I. General Description:

A. Purpose: 1. Preliminary investigation and tests conducted at Springfield Armory by Armory personnel indicated that under controlled conditions, total immersion of specimens in a salt solution gave rapid, accurate and repeatable results indicating the resistance to corrosion of various types of protective coatings used on small arms and related equipment.

These tests showed that the results were more conclusive and consistent than those which might be expected from the standard salt spray test currently in use.

2. The objective of this contract was to design and construct a prototype tester in which certain conditions of solution strength, temperature and flow could be accurately reproduced and results studied.

B. Description: 1. The equipment as finally delivered to Springfield Armory consists of a rectangular plastic tank with rounded ends, insulated to minimize heat loss. Flow of salt solution in the tank is from right to left across the forward or working section and left to right across the rear or conditioning section. A partition is provided which divides the front and rear sections.

Turning vanes and straightening vanes are provided at each end of the tank to minimize turbulence and assure a constant velocity across the work space section. Circulating pump, controller and other mechanical equipment is located in a compartment at the left hand end of the unit. An insulated cover is provided to prevent excessive heat loss and evaporation of water from the tank. A segment of the cover, over the work space provides access to the work area.

For general appearance of unit see photograph #1324A (VIII Appendix) which shows the unit after completion of basic equipment but before final testing. Detail changes were made during and after testing to improve performance and eliminate certain operating difficulties.

II. Design Data and Characteristics

A. Basic Criteria: Basic criteria were outlined in "Data Sheet - Case No. SAL3859 which accompanied the initial Quotation Request No. NYOD 7471. These criteria were as listed below:

1. Design, develope and fabricate an Immersion Corrosion Testing Apparatus with suitable controls.

2. The apparatus shall consist of but not be limited to:

a. A solution tank for immersion of specimens.

b. A heating device to obtain a desired temperature.

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c. An aerating device to oxygenate the solution.

d. A means of removing CO_2 from this air.

e. A circulating pump to provide controlled flow of the solution.

f. A fixed baffle in the tank or other means to assure uniform solution flow passing the specimens.

g. A tank cover to minimize heat and evaporation losses.

h. A minimum of controls to obtain and maintain desired conditions.

3. The section of the tank for the immersion of specimens shall be a minimum of three feet in length, one and one half feet in width and three feet in depth. The tank shall be fabricated with a material or inner lined with a material to withstand corrosive effects of a saline solution of 2 to 5% concentration at 160°F nominal. This material shall not be brittle. The tank shall also be constructed to assure complete bottom drainage. Provisions shall be made for racks for suspending specimens.

4. An adequate heating device shall be provided to raise the temperature of the solution to 150°F in a period of 60 minutes.

5. An air inlet shall be provided with aerating device at a rate of 50 cc/liter/minute.

6. A circulating pump shall be incorporated to produce a solution speed of 30 feet/minute linear flow past the specimens. The rotor and other areas of the pump that will be exposed to the saline solution shall be corrosion resistant.

7. It is desirable but not mandatory for the cover to be constructed of a transparent material to allow for observation of a test. The cover shall be designed and fabricated in such a manner that it can be opened easily and expose the entire test area. This condition would also facilitate cleaning operations.

8. The following minimum controls shall be provided.

   a. Recording controller to regulate, record and maintain the solution temperature at 150°F plus or minus 2°F.

   b. Automatic control to maintain solution at constant desired level.

   c. A one hour timer which could be set in minutes and have an audible alarm.

   d. Solution flow control, manual adjustment with visual flow meter gauge.

III. Approach to Problem.

A. Initial Approach; Our initial approach to the problem was outlined in our Quotation and subsequent correspondence and conferences, and was divided into two separate methods. These are outlined below.

1. See sketch dated 9/29/59 "Flow Diagram - Immersion Testing Apparatus - Approach No. 1." (VIII Appendix) Briefly described the circuit is as follows: "The solution enters at one end of the tank into a plenum chamber and through a distributing baffle, into the work space. Velocity throughout the work space is uniform due to the arrangement of the distributing baffle. Outlet from the tank is through the collecting baffle and suction plenum, through the level control valve to the surge tank. The fluid level in the tank is sensed by the level controller, which in turn sends a pneumatic signal to the level control valve. If the fluid level drops, the level control valve tends to close, causing some of the fluid stored in the surge tank to back up in the working tank until proper level is restored. If the working tank level increases the opposite action occurs. Make up water is controlled by a float valve in the surge tank.

From the surge tank the fluid passes through the flow regulating bypass valve, which is a manual three way valve. Flow rate is controlled by bypassing solution from the pump discharge back to the suction. The pump is a 10 HP centrifugal pump capable of circulating about 1000 GPM.

Next in the flow pattern is the heater, which is a 100 KW heater as is required to attain the specified heat up rate. At the outlet of the heater is the main flowmeter, which is an indicating, variable area flowmeter calibrated in FPM flow through the tank.

The aerating air supply is injected into fluid stream after the flowmeter. The air supply is taken from a 10 CFM air compressor or from the plant air supply. CO_2 is removed from the air by a chemical type CO2 absorber. Air flow rate is measured by a variable area flowmeter.

Temperature control is by a single pen round chart, filled system recorder controller which controls the heater."

2. See sketch dated 9/28/59 "Flow Diagram - Immersion Testing Apparatus - Approach No. 2". (VIII Appendix) Briefly described the circuit is as follows: "The system consists simply of a large tank with rounded ends and a separating baffle, one side of the tank is the work space and the other contains the necessary circulator, heaters, flow control vanes, etc. "Eggcrate" type flow straighteners and turning vanes are used to minimize turbulence and provide an approximately even flow pattern through the work space. Flow measurement is by means of an indicating pitot tube type flowmeter. Temperature control is by a single pen round chart, filled system recorder controller which controls the heaters."

IV. Solution of problem.

A. Preliminary conclusions and tests.

1. Upon study it appeared that Approach No. 2 presented the fewest problems and held more chance of producing a satisfactory outcome at the lowest possible cost. The design of the unit was complicated by the request that all components of the system in contact with the solution should be of plastic, glass, rubber or similar material which is practically inert with respect to reaction with the salt solution.

2. Investigation showed that a circulator similar to that shown in the sketch was likely to prove prohibitively costly if it were specially constructed to meet this requirement and centrifugal pumps capable of delivering the required flow of approximately 1000 GPM were, while obtainable were not practical from a physical size point of view (See Approach No. 1).

3. Some method other than those shown in the two preliminary approaches was required to circulate the fluid if the requirement that no metals contact the solution was to be met. Some tests were made of various ideas including large paddle wheel devices but the most promising was the idea that a high velocity jet of solution would, if allowed to enter a large tank of solution below the level in the tank, entrain a much larger mass of fluid and by conversion of low mass-

high velocity energy to high mass-low velocity energy, produce the desired result with a small circulating pump capable of delivering a fraction of the flow rate required at a relatively high velocity to a submerged nozzle.

Tests were conducted on this method using a garden hose in an open tank. The desired result was obtained but it was determined that multiple nozzles would be required to produce an even flow through the work chamber. See sketch dated 11/26/62 "Flow Diagram - Immersion Testing Apparatus - Approach No. 3."

B. The sketch shows Approach No. 3 (VIII Appendix) to be somewhat of a hybrid of Nos. 1 & 2, in that, as in Approach No. 1. Solution is removed from the work tank and circulated externally and, as in Approach No. 2 solution flows a loop type circulating pattern within the tank.

C. Detailed design was made, based on Approach No. 3 (Note that Approach No. 3 was not sketched until preparation of this report. Design was based on crude sketches and resulted in finished drawings). The design was submitted to Springfield Armory and was approved with minor changes. Material and major component selection was as follows:

1. Tank Material: Polypropylene plastic sheet - Availability of material, ease of fabrication and resistance

to saline solution and temperature.

2. Piping Material: Polyvinyl Chloride (PVC) - Availability and apparent ability to withstand effects of saline solution and temperature.

3. Pump: Hard rubber chemical pump - Availability and suitability for the required service.

4. Heaters: Glass enclosed immersion elements with rubber covered connecting leads.

5. Temperature Controller-Recorder: Standard filled system, 12" diameter electric contact instrument with plastic covered sensing element exposed to solution at exit from work space.

6. Flow Indicator: Pitot tube with inclined tube manometer, plastic construction.

7. CO_2 Absorber: Specially fabricated tank containing a CO_2 absorbent chemical through which air to aerating nozzle must pass.

8. Aerating Air Flowmeter: Standard variable area type, glass tube meter.

9. Aerating Air Compressor: Carbon ring type to prevent oil contamination of air supply.

D. Basic Design Calculations.

1. Flow through work space: Cross Sectional Area of Flow: 3 x 1.5 = 4.5 square feet.

Cubic feet per minute of flow = 4.5 x 30 = 135.0 cubic feet per minute.

Gallons per minute of flow = 13.5 x 7.48 = 1009.8 GPM.

2. Air required for aeration at rate of 50 cc/liter/minute.

Volume of fluid in tank = 61.5 cubic feet

= 1741.6 liters

Volume of Air Required = 1741.6 x 50 = 87080 cc/min.

= 87080 ÷ 28320

= 3.08 CFM

3. Operating time between recharging of CO_2 absorber.

CO2 contained in normal air = .045% by weight (from Marks' Handbook).

Pounds per minute of air flow = 3.08 CFM x .075 CF/LB = .231 lb/min.

Pounds of air per hour = .231 x 60 = 13.86 lbs./hr.

Pounds of CO_2 per hour to be removed from air = 13.86 x .00045 = .00624 pounds per hour.

Since commercial CO_2 absorbing chemical is normally furnished in 5 gallon pails which contain approximately 35# of absorbent material the CO_2 absorber tank is designed to contain one pail of chemical. Information furnished by the supplier is that the chemical is capable of absorbing 25% of its own weight of CO_2.

Therefore the absorbing capacity of a single charge is:

35 LBS. x .25 = 8.75 lbs.

Time required to saturate single charge of absorbent chemical at maximum flow rate of air;

8.75 ÷ .00624 = 1402 hours.

4. Time required to heat fluid in tank to 150°F using 30 KW of heat. Note that 30 KW was determined by conference to be a practical maximum heat input without undue load on power distribution facilities.

Volume of fluid in tank = 61.5 cubic feet. For approximation of heat required to increase temperature of fluid in tank the following assumptions were made:

Specific Heat of Fluid = 1.0

Specific Gravity of Fluid - 1.0

Temperature Rise = +70 to =150°F = 80°F

Weight of water = 62.5 lbs per cubic foot

Heat leakage through insulation is relatively small and is negligible.

BTU required to increase temperature of fluid = 61.5 x 62.5 x 80 = 307,500 BTU.

Heat input of 30 KW = 30 x 3413 = 102,390 BTU/HR.

Time required to heat fluid in tank = 307,500 ÷ 102,390 = 3.00 hours (approximately).

E. Changes indicated after initial testing of completed unit:

1. The PVC pipe was found to be unsuitable for the application in that it was impossible to prevent leakage of the threaded joints after the unit was heated and cooled. This was apparently due to the softening of the plastic and distortion under pressure at the temperature of +160°F which was selected as the test tem-

perature since it is the design maximum.

Efforts to solvent weld the joints proved ineffective so it was determined to use a different material. Note that published data and manufacturer's recommendations showed that PVC was a suitable material.

After considerable inquiry it was determined to repipe the unit using hard rubber pipe and fittings. This was installed and no further difficulty was noted.

2. The velocity pressure resulting from the flow of fluid at 30 FPM proved insufficient to give accurate or consistent measurement of flow by means of a pitot tube. Several shapes and types of pitot tube were tried but none proved suitable.

Another means of measuring velocity of the fluid was sought and finally tests were run to determine the relationship of the velocity of fluid in the work space with the pressure of the fluid at the impelling nozzles. Flow rate was determined by visual means, timing the rate at which an almost submerged chip of wood traversed the 3' width of the work space and charts of the relationship of nozzle pressure to velocity were compiled and reduced to graphic form. This curve is shown on the graph. "Pressure at Nozzle vs. Flow Rate Through Work Space" dated 1/16/62 (VIII Appendix).

Subsequent checks showed that flow rates were reproducible to within ±3 FPM by adjusting the nozzle pressure to values shown on the graph.

V. Drawings and Detail Design.

A. A recapitulation of minor problems, drafting and design procedures are not warranted in this report. Since the equipment intended to be a prototype, wherever selection of equipment was to be made and a choice was indicated, the higher performance selection was made with the thought that fewer changes would be required to meet the performance requirements and should subsequent equipment of this type be fabricated equipment could be selected on the basis of performance of the prototype.

B. The following detail drawings are attached to and made part of this report:

Dwg. No.	Title and Description of Drawing
1023	Salt Solution Chamber: Assembly drawing showing all major details, location of components and piping.
W-1036	Control & Power Wiring: Schematic wiring diagram showing power and control circuits.
M-1042	CO_2 Absorber: Assembly and details CO_2 Absorber tank.
D-1062	Inner Liner Salt Solution Chamber: Details and assembly of polypropylene brine tank.

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Dwg. No.	Title and Description of Drawing
D-1063	Cover Liner: Details and assembly of polypropylene inner casing of brine tank cover.
D-1064	Door Liner and Float Sleeve: Details of polypropylene work space door inner casing and water level control float sleeve.
D-1065	Heater Support & Specimen Hanger Frame: Detail of heater support rack and work chamber Specimen support frame.
P-1066	Salt Solution Circulation Piping: Dimensioned salt solution piping detail.
P-1067A	Aerating Piping and Fresh Water Piping: Dimensioned aerating and fresh water piping detail.
D-1068	Door - Salt Solution Chamber Assembly and details of working space door and windows.
D-1069	Control Panel: Framing and cutout detail showing CO_2 absorber mounting and instrument location.
D-1258	Cabinet: Steel framing and sheet metal casing details.
D-1259	Cabinet Cover: Steel framing and sheet metal casing detail showing location of openings, gaskets, etc.

VI. Operating Instructions:

A. General Description;

1. The equipment consists of a tank fabricated of polypropylene plastic, capable of withstanding the salt solution temperature specified. Means is provided to circulate and heat the solution.

2. The tank is oblong in shape and has a dividing partition lengthwise at the center of the tank. The straight portion of the front section is the work space. The rounded ends of the tank contain turning or guide vanes to assure a smooth, even flow of solution through the work space.

3. The space at the rear of the tank, corresponding to the work space, is occupied by the quartz type immersion heaters, the solution impelling nozzles and the aerating pipes.

4. The solution is impelled by "jet action" from a series of properly spaced nozzles. A small portion of the fluid which is circulated is drawn from the bottom of the tank at the outlet end of the work space by a centrifugal pump and discharged under 15 to 30 PSI pressure to the "jet action" nozzles. The high velocity jet leaving the nozzles pushes the larger mass of fluid, resulting in a uniform motion of the entire mass at low velocity.

5. The heaters are Thermal Electric fused quartz type

immersion heaters arranged in banks for close temperature control, and are plugged into a series of plug-ins at the rear of the chamber unit.

6. Aeration of the solution in the tank is accomplished by injection of atmospheric air into the solution through a system of nozzles near the bottom of the tank. Air is supplied by a small compressor through a CO_2 absorber tank.

7. Temperature control is by a Bristol single pen recorder-controller which, at control point, will switch the heaters on and off.

8. The purpose of the equipment is to provide a controlled temperature, controlled flow rate (velocity) bath for the testing of finishes, coatings, etc., in a salt solution.

B. Design Criteria and Performance:

1. Only chemically inert substances, such as plastics. glass, rubber, etc., can come in contact with the solution, except for test specimens.

2. Operating temperature range:

Room ambient to +160°F.

3. Linear flow rate through work space approximately 30 FPM.

4. Aeration of solution at the rate of 50 cc of air per minute per liter of solution. (Approximately 3 SCFM.)

5. Power supply 550V/3 PH./60 CPS.

110V/1 PH./60 CPS.

C. Installation:

1. Locate the unit on a solid level floor. Use shims if necessary to level the unit. Note that when the tank is full of water the weight of the unit is in the general area of 6000 to 7000 pounds and the floor must be capable of holding this weight. The load may be considered a static load since the mechanical vibration of the unit when under operation is very slight.

2. The unit was shipped assembled except for the glass immersion heaters. These are packed separately to minimize possibility of breakage.

To install the heaters:

a) Remove the top cover of the unit by breaking all piping and wiring connections between the top of the cover and the body of the unit. Flanges, unions or electrical plugs are provided for this purpose.

b. Four lifting eyes are provided on the cover. Using these eyes, carefully lift the cover from the unit. Take care not to damage the fluid jet or air injection nozzles or piping or the water make-up float. DO NOT set cover down on floor but on horses or blocks.

c. Carefully unpack the heaters. They are glass and should be handled accordingly.

d. Install heaters in the rack provided at the rear of the tank. Insert the heaters into the holes until they rest on the rubber top caps to which the wiring pigtails are secured. Slip the heavy rubber sheet which has holes corresponding to those on the heater mounting rack over the bottom of the heaters to a height of 4 to 5 inches from the bottom of the heaters. The purpose of this sheet is to prevent the heaters from hitting each other due to motion of the fluid. Be sure to install heaters so that the plugs on the pigtails reach the receptacles in the manifold on the rear of the unit.

e. Replace cover. Bring heater pigtails out opening over the heaters and plug into receptacles. Reconnect all piping and wires. Be sure nozzles face so that they discharge in the direction of flow, that is to the right as one faces the front of the unit.

3. Connect water supply to connection tagged "water inlet".
4. Connect drain to valve at machinery end of unit.
5. Connect 550/3/60 power supply to main fuses in electrical box at rear of unit, and 110/1/60 power to the control wiring outlet. Ground frame of unit.

D. Preparing the unit for Normal Operation:

1. Fill the tank with the proper solution. If it is

desired to do the mixing in the tank, this may be done as described below. The tank holds approximately 455 gallons when filled to a depth of 36".

To mix solution in tank, first fill tank with fresh water, either by means of a hose or through the normal water make-up system. To fill through the water make-up system, switch on Master Switch, set Timer Switch to "manual", switch on Water Make-up Switch. Check operation of float switch to avoid overfilling tank. Normal water level is 6" from top of tank.

Do not add salt to water until the unit is in operation and water is circulating to assure proper mixing.

2. When tank is full of solution or water, start the unit up as follows:

a. Energize power supplies.

b. Switch on Master Switch.

c. Set Timer switch to "Manual".

d. Switch on Pump Switch. Pump should start. Check direction of rotation of pump and correct if necessary.

e. Observe flow of solution through work space. Flow should be uniform across the width of work space. If flow is not uniform, adjust position of jet nozzles. Turning the nozzle assembly toward the rear of the unit will increase flow at the front of the work space and decrease flow at the rear of the work space, and turning the nozzle assembly toward the front of the unit will increase the flow at the rear of the work space and decrease the flow at the front of the work space.

3. Turn on Air Compressor Switch and note that air passes through the flowmeter into the tank.

4. Turn on Heat Switch and set controller to temperature slightly above the temperature of fluid in tank. Push High Heat push button and allow fluid to warm up slightly until set point of controller is reached, and observe if low heat automatically comes on.

5. Slowly add salt to water if only fresh water has been used to this point.

6. The unit is now ready for normal operation.

E. Normal Operation:

1. Assuming that the unit is starting cold, proceed as follows:

   a. Switch on all operating switches except Master and High Heat.

   b. Set controller for desired temperature and set recorder chart to proper time.

   c. Switch on Master Switch. The unit will start operating on high heat, the pump and air compressor will operate and water make-up will operate if required.

d. Adjust rate of flow of air by means of manual valve and flowmeter. Normal flow rate is approximately 3 CFM.

e. Adjust rate of fluid flow by means of pressure gauge and manual pump by-pass valve at machinery end of unit. A graph showing flow rate in FPM vs pressure in PSI is attached.

f. Allow solution temperature to reach set point and commence testing. Note that from 4 to 6 hours are required to reach +160°F starting at normal room ambient temperatures.

2. Should it be desired to have unit ready to test the first thing in the morning:

a. Set 24 hour timer to switch on the unit at a time during the night that experience shows will have unit up to temperature by the required time in the morning.

b. Switch on Master Switch, Pump Switch and Heat Switch. Air Compressor and Water Make-up should be off.

c. Set Timer Switch to "Auto".

d. The unit will then come on at the time required by the timer.

e. When it is desired to use the equipment, switch on Air Compressor and Water Make-up. Adjust air and flow rate as previously described.

3. To remove atmospheric CO_2 from the aerating air:

   a. Before placing equipment in operation, remove cover from CO_2 absorber tank located in the equipment space. The cover is accessible through an access plate in the top of the machinery compartment.

   b. Remove absorbent basket from absorber tank and fill with a CO_2 absorbent chemical. "Sodasorb" is recommended and a single filling of "Sodasorb" should be good for from 500 to 600 hours of operation at an air flow rate of 3 SCFM of normal air.

   c. Replace absorbent basket, bolt cover in position and reconnect air piping.

VII. Maintenance and Lubrication Instructions:

A. Lubrication: Maintenance and Service of this unit should be minimum and maintenance should be limited to the procedures of normal practice. Lubrication of motors, door hinges, door counterweight cable and pulleys is all that is necessary.

B. Exterior Maintenance: Since the outer casing and frames of the unit are of carbon steel, salt encrustment due to spilled solution should be promptly cleaned. Any rust or corrosion spots should be scraped and/or wirebrushed to bare metal and refinished with suitable corrosion resistant paints.

C. Service: Since this is a piece of mechanical equipment, service due to failure of components will undoubtedly be required from time to time. The following are a few suggestions as to procedures which should be observed:

1. Never use a Stillson or other serrated jaw wrench on the plastic piping. A canvas or leather strap wrench should be used on pipes, and where flats are provided on fittings or valves a monkey or other flat jawed wrench can be used.

2. Keep solution away from heater connections. Always have unit frame well grounded and as an added precaution it might be well to ground the solution by means of a monel metal bar immersed in the solution and electrically connected to the grounded frame or to a separate ground. The latter precaution is particularly important since there is possibility of solution penetration of the heater connections which are on 550 volt power.

3. Do not attempt to work on heaters unless power is disconnected.

4. Keep solution tank reasonably clean.

5. Maintain a stock of spare parts. The parts which might not be readily available in local supply houses or maintenance parts stock are listed on the attached "Suggested Spare Parts List". Parts lists will be found on pertinent drawings.

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RECOMMENDED SPARE PARTS LIST

Quantity	Part	Manufacturer or Supplier
2	Vitreosil Immersion Heaters 5 KW, 220 Volt	Thermal American Fused Quartz Co., Dover, N. J.
1 Box	Recorder Charts #0363	The Bristol Co., Waterbury, Conn.
1	Shaft Seal for Type WAM H. R. Pump	American Hard Rubber Co., Butler, N. J.
1	#S220, 1/2" FPT 115/60 Solenoid Valve	Alco Valve Co., St. Louis, Mo.
1	"Ace ite" 3/4" Screwed Diaphragm Valve w/R/2 diaphragm	American Hard Rubber Co., Butler, N. J.
1	Diaphragm, 1-1/2" Screwed	American Hard Rubber Co., Butler, N. J.

NOTE: All other parts used in this equipment are normally carried in stock in local supply houses or in maintenance stock. Refer to pertinent drawings for parts lists.

VIII. Appendix

A. Charts and Sketches

1. Approach #1

2. Approach #2

3. Approach #3

4. Flow vs. Pressure

B. Photographs

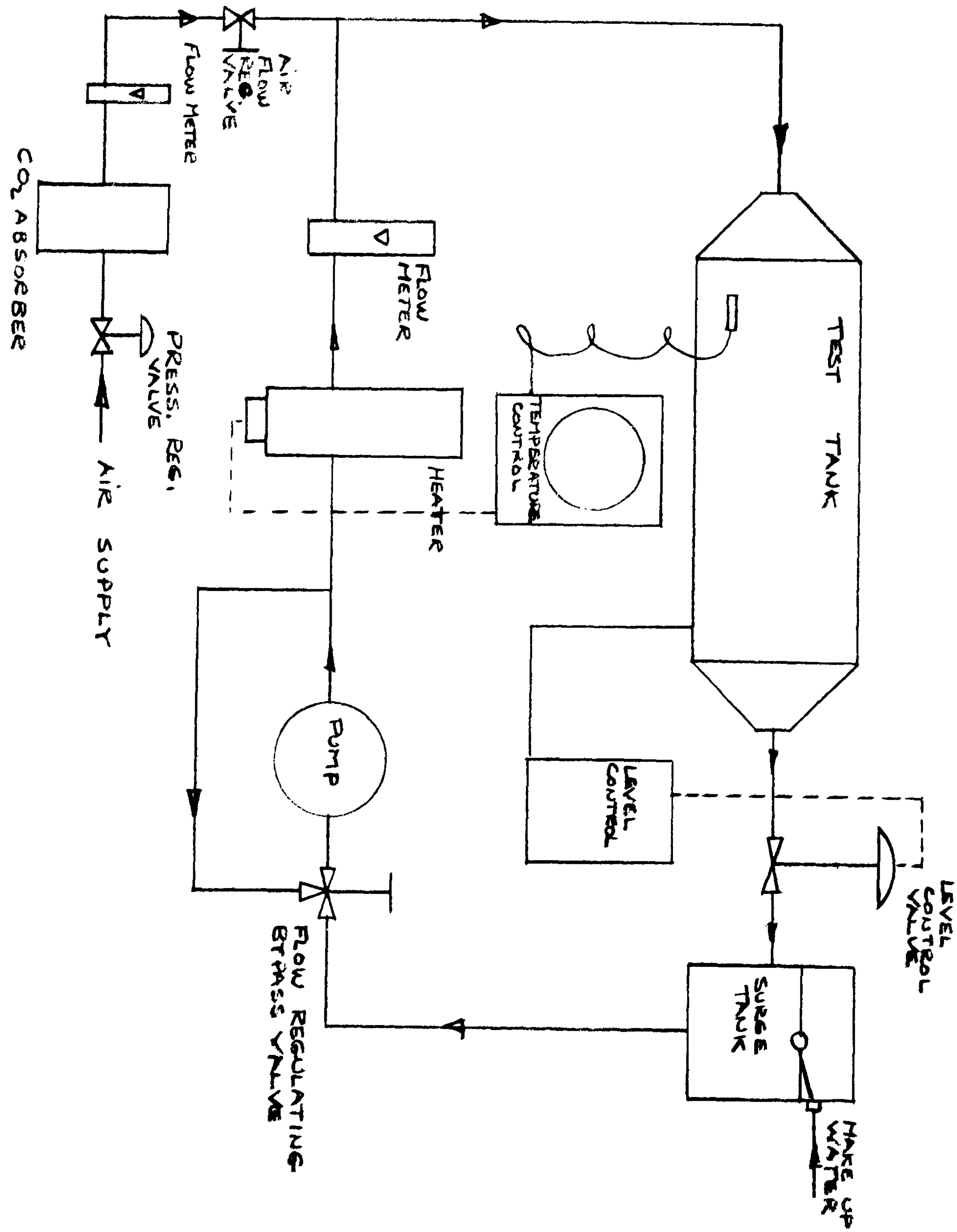
1. Photo #1324

BY R.R.N. DATE 9/29/59 SUBJECT FLOW DIAGRAM - IMMERSION TESTING APPARATUS APPROACH No. 1

SHEET NO. 1 OF 2

CHKD. BY .... DATE ....

JOB NO. PROPOSAL NYOD # 7471

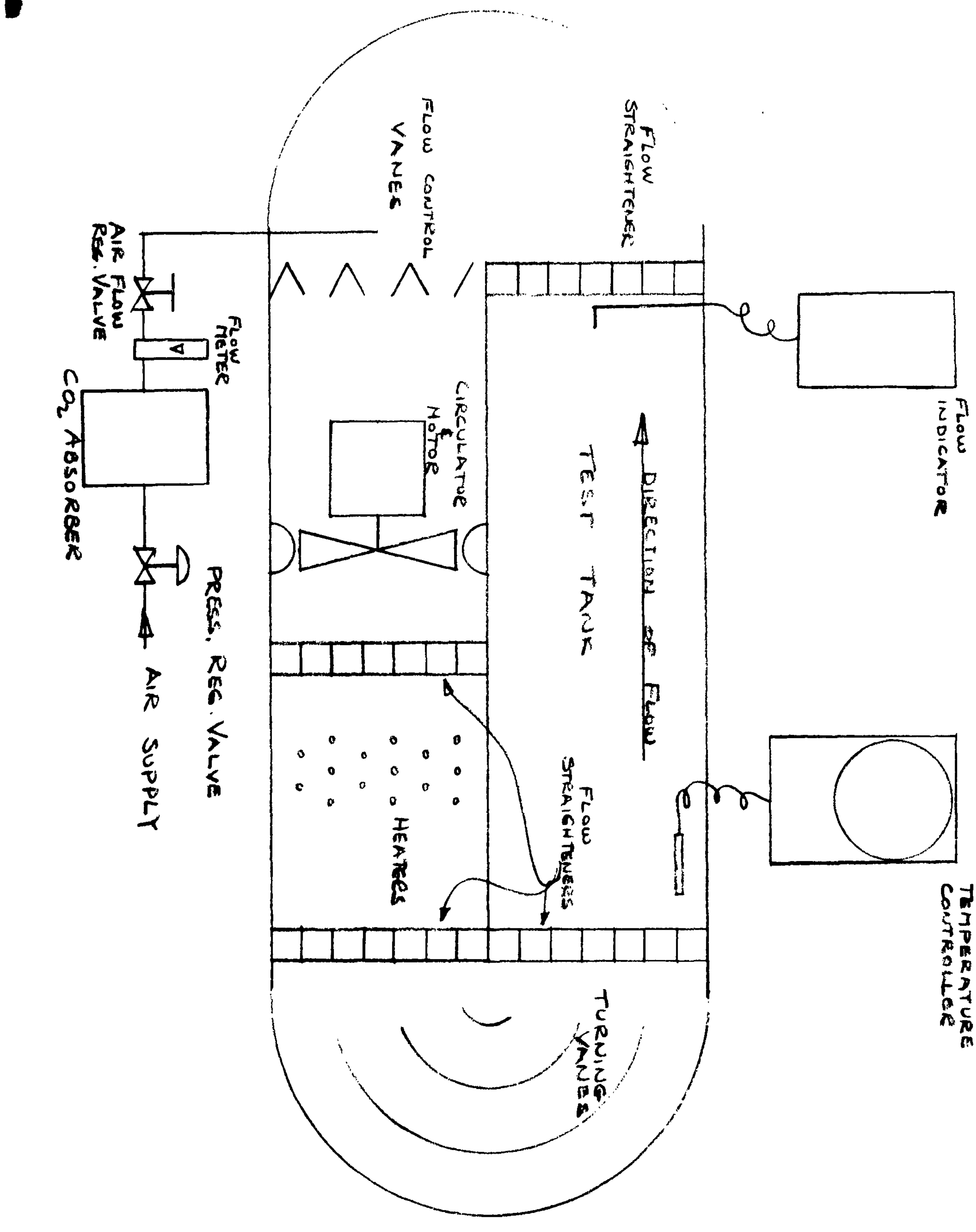


BY RON DATE 9/28/59 SUBJECT FLOW DIAGRAM — IMMERSION TEST APPARATUS — APPROACH No 2

CHKD. BY .... DATE ....

SHEET NO. 2 OF 2

JOB NO. PROPOSAL NYOD # 1471



BY RON DATE 11/26/60 SUBJECT FLOW DIAGRAM
IMMERSION TEST APPARATUS
APPROACH No 3.

SHEET NO. ______ OF ______

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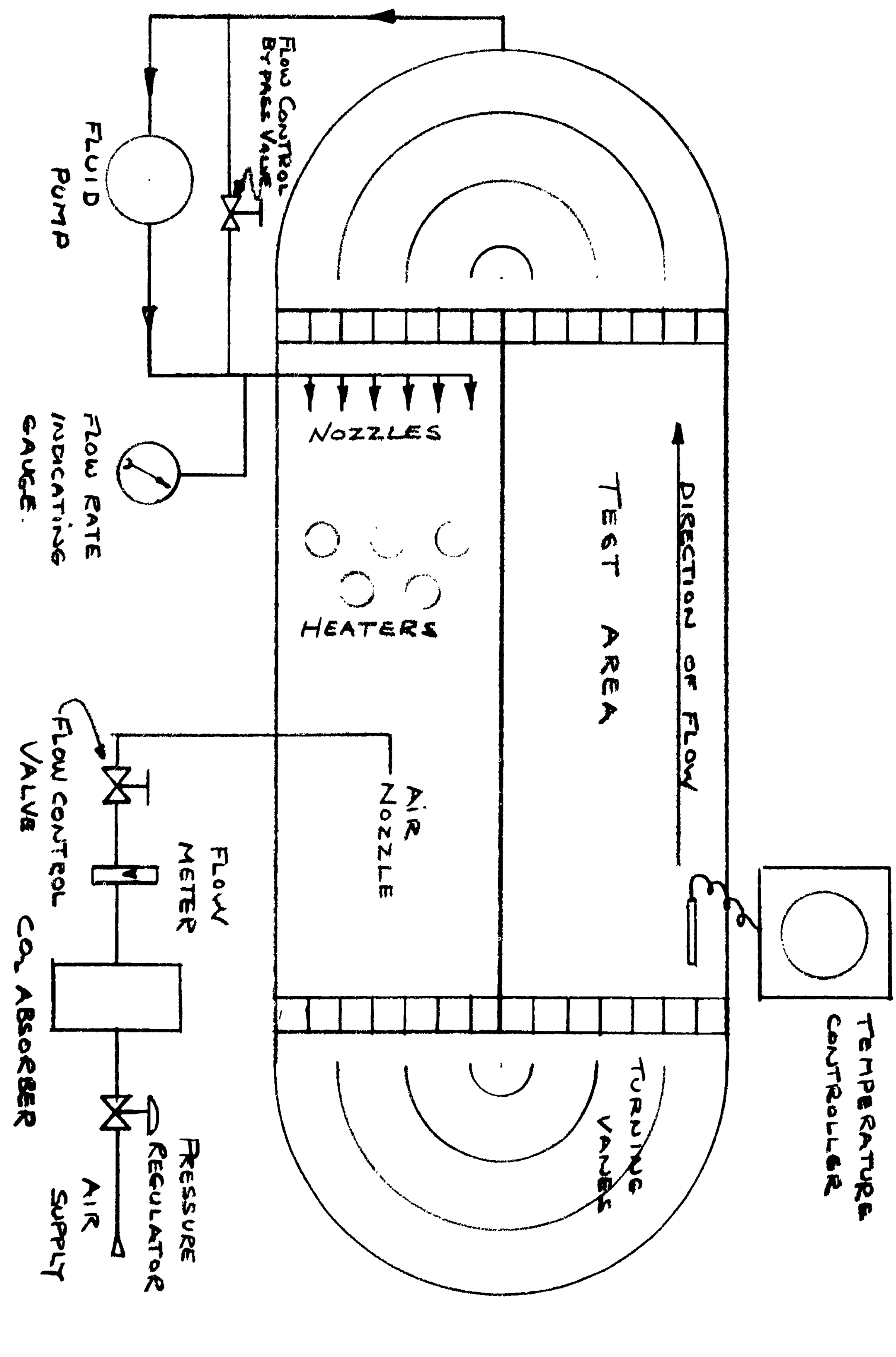
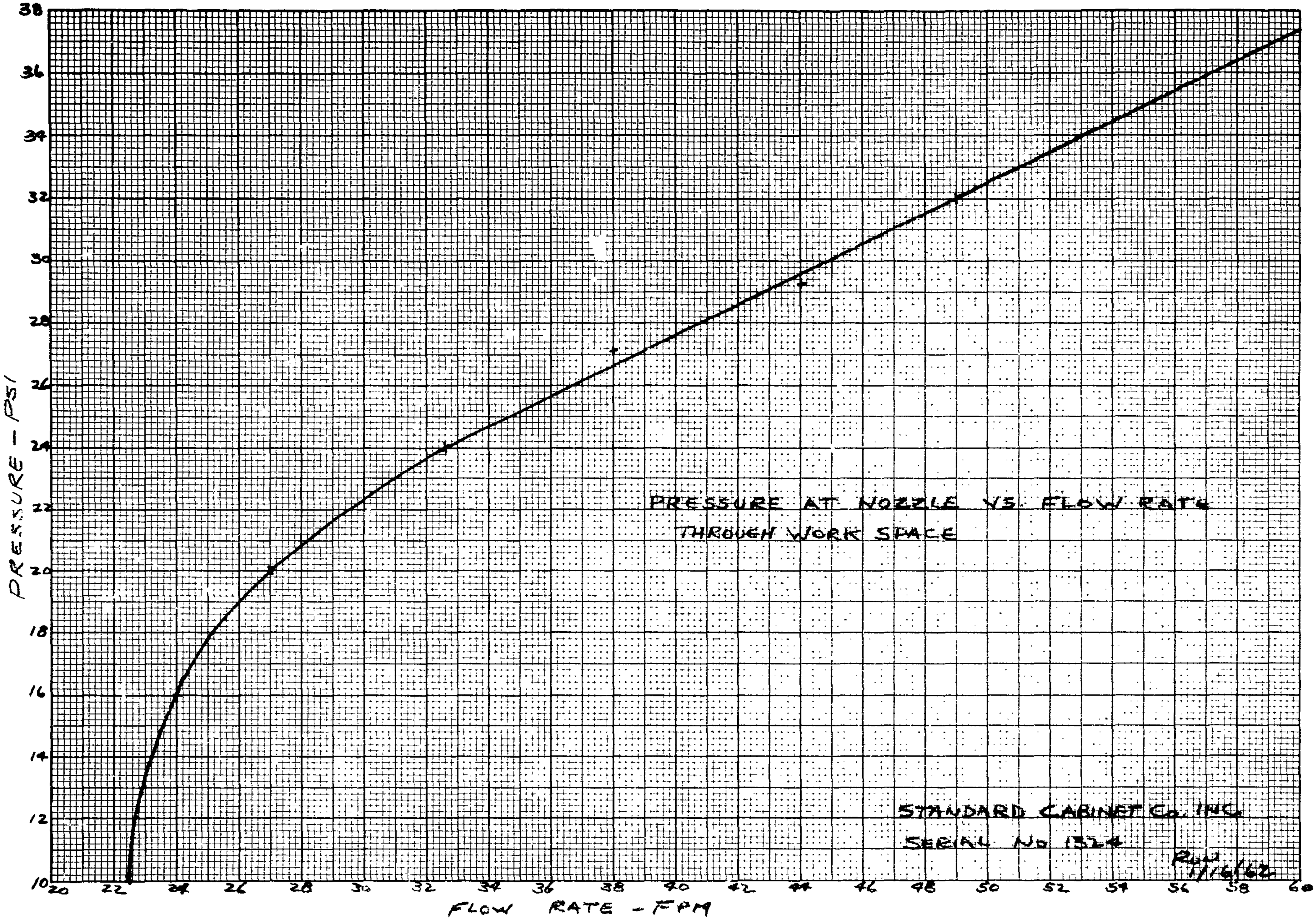
JOB NO. 1324





PRESSURE - PSI
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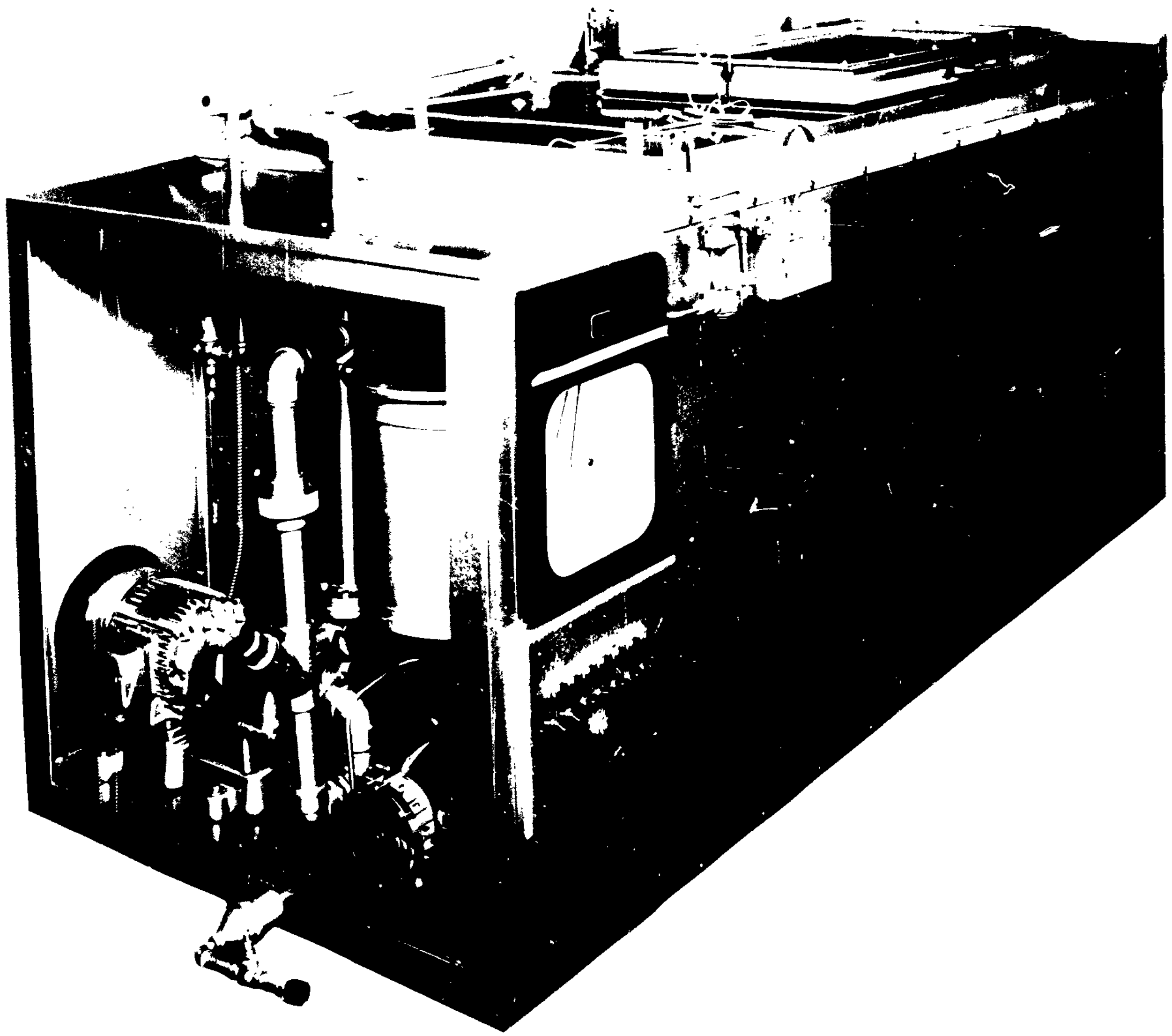
FLOW RATE - FPM
PRESSURE AT NOZZLE VS FLOW RATE
THROUGH WORK SPACE
STANDARD CABINET Co. INC.
SERIAL No 1524
1/16/62



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