Department of consumer and corporate affairs / Ministère de la consommation et des corporations

STANDARDS BRANCH - DIRECTION DES NORMES

NOTICE OF APPROVAL G-26-3

OTTAWA April 5, 1971.

DRESSER MEASUREMENT DIVISION "ROOTSMETER"
ROTARY-TYPE POSITIVE DISPLACEMENT
GAS METER

This approval supersedes Circular G-26-2, dated May 9, 1968.

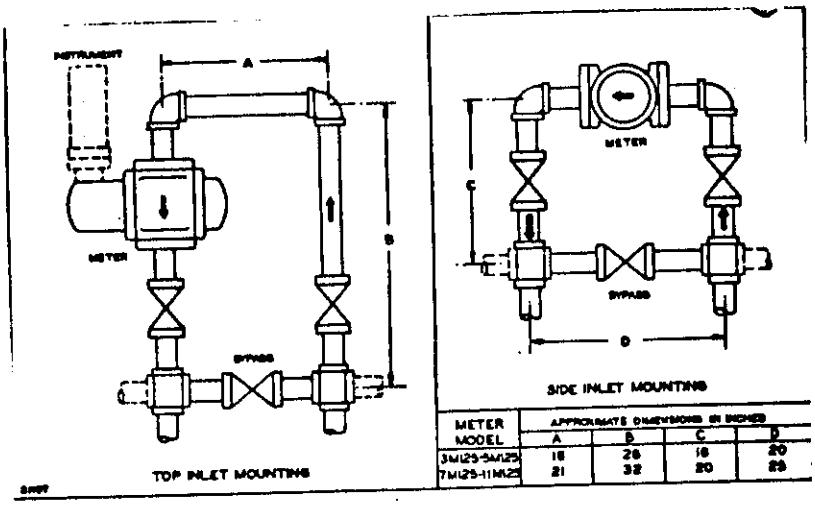
Apparatus

Model	Max. Pressure P.S.I.G. Static	Max. Pressure P.S.I.G. Operating[5]	Max. Displacement Cu. Ft./Hr.
1.5M125[1]	125	125	1,500
3M125[2]	125	125	3,000
5M125[3]	125	125	5,000
7M125[2]	125	125	7,000
11M125[2]	125	125	11,000
16M125	125	125	16,000
23M125	125	125	23,000
38M125	125	125	38,000
56M125	125	125	56,000
102M125	125	125	102,000
102M300	300	300	102,000
2M900	1200	900	2,000
3M1200[4]	1200	1200	3,000
4.6M900	1200	900	4,600
8M400	600	400	8,000
11.5M400	600	400	11,500
19M400	600	400	19,000

1. This is an aluminum meter with transparent plastic dome, available only with a counter type register.

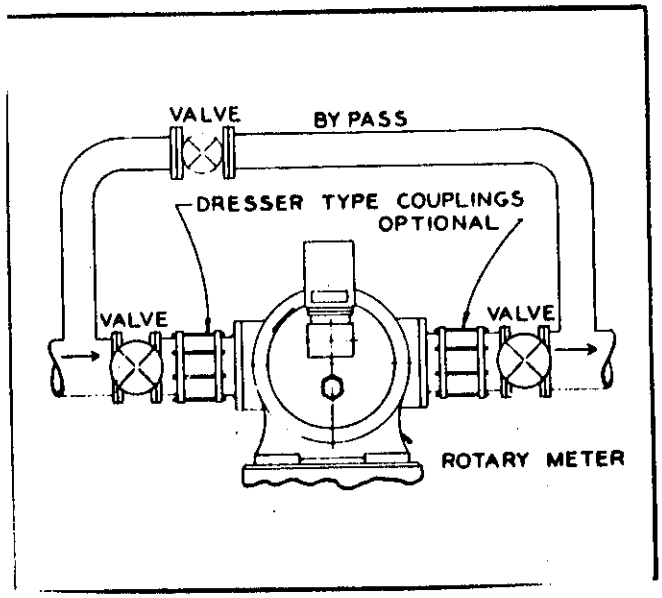
2. These meters are available with either cast iron or aluminum impellers. Meters with aluminum impellers will have green nameplates.

DRESSER MEASUREMENT DIVISION "ROOTSMETER" ROTARY-TYPE POSITIVE DISPLACEMENT GAS METER



METER MODEL	APPROXIMATE DIMENSIONS IN INCHES			
	A	B	C	D
3M125-5M125	18	26	18	20
7M125-11M125	21	32	20	25

- Suggested Installations of Line-mounted Rotary Meters.



Suggested Meter Installation of Foot-Mounted Meters in Horizontal Pipeline

3. Available only with aluminum impellers.

4. Available only with aluminum 3-lobe, spiral impellers.

5. Any meter which is not equipped with an instrument drive, or does not incorporate an auxiliary pressure correcting device is APPROVED FOR USE ON LOW PRESSURE ONLY of approximately seven ounces per square inch or less.

Description

Except for the model 3M1200, all other Roots rotary positive-displacement gas meters consist of two two-lobed straight impellers or rotors contained in a cylindrical housing enclosed by head plates at both ends. In the model 3M1200 the two-lobed impellers are replaced by two three-lobed spiral impellers. Two pressure sealed domes, bolted through these head plates, enclose the timing gears which fix the position of the impellers to each other and provide for their contrarotation. The larger of the two end domes also contains the reduction gearing for the read-out counter or the instrument drive shaft. Both end-domes serve as oil sumps for the splash lubrication of the gears. Bullseye-type oil sight gauges are provided so that the oil can be maintained at the correct level. The size, strength and thickness of the construction materials used for the case, end-domes and gearing of these meters depends on the requirements for capacity and working pressures.

The 1.5M125 meter, illustrated herein, has its casing formed of a one-piece aluminum alloy extrusion. Inlet and outlet gas connections are 1½ inch, threaded pipe nipples 3 inch in length. The metering chamber is closed at the ends by headplates of die cast aluminum which carry all rotating parts. Gas tight aluminum end covers are bolted through the head-plates to the case of the meter and sealed with O-rings. The end cover at the register side of the meter encloses a radial type magnetic coupling which serves to drive the counter register. A plastic see-through dome attached to this cover contains a gear reduction unit, odometer type register and two (2) dials. One rotates at meter R.P.M. and the other makes one revolution for every 10 cubic feet of displaced volume and serves as a test dial. The register has total capacity of seven digits but the lowest two digits are covered so that volume registration is in 100 cubic feet increments.

Gears and bearings are continuously lubricated with oil by dip and splash method, the oil being supplied from three independent sumps formed by the two end covers and the plastic dome. Each sump is provided with an oil level indicator and plugged filling and draining holes.

DRESSER MEASUREMENT DIVISION "ROOTSMETER" ROTARY-TYPE POSITIVE DISPLACEMENT GAS METER

Roots meters are normally equipped with a counter type register which indicates the volume of gas in 100 cu. ft. increments at meter, or line conditions of temperature and pressure. The last dial of the register has no numerals but it is subdivided into 10 equal increments, each representing one cu. ft. volume for 3M, 5M, 7M and 11M meters, and 10 cu. ft. volume for larger capacity meters. One of the ten lines on this dial is wider so that complete number of revolutions of this dial may be established when testing the meter.

The counter registers have five digits for meters up to, and included, 11M models, and six digits for higher capacity meters. Both Veeder-Root and Durant counter registers are approved. The latter is illustrated in this circular.

The meters may be equipped with an instrument drive gear box in place of the counter register for models 3M, 5M, 7M, and 11M, or in addition to the counter for larger capacity meters. Meter model 3M1200 is available with instrument drive only.

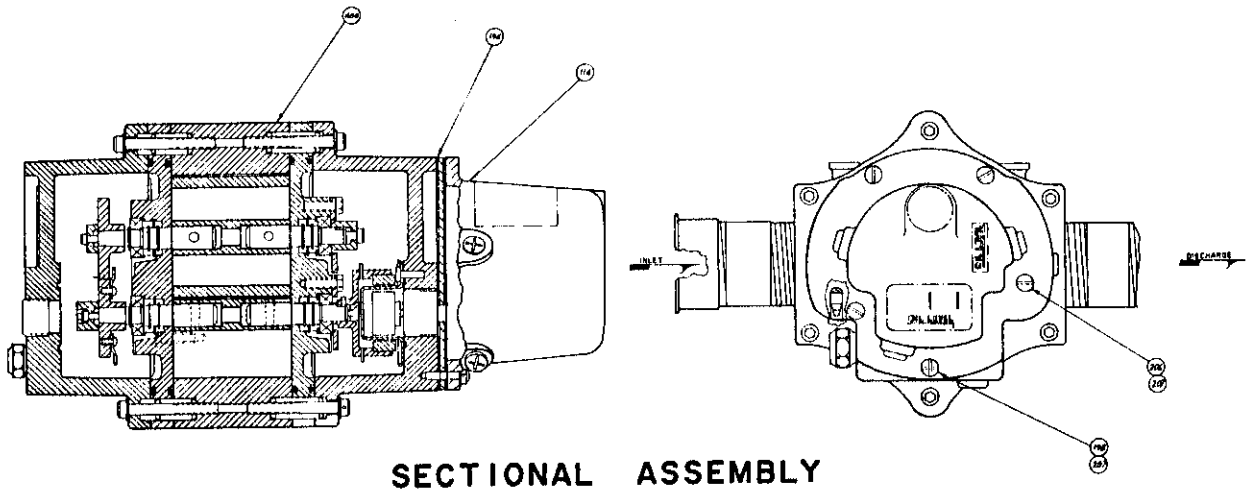
The output shaft rotation of the instrument drive corresponds to 10 cu. ft. per rev. for 3M, 5M, 7M and 11M models, and to 100 cu. ft. per revolution for larger capacity meters.

In operation, the flow of gas causes the impellers to rotate thus measuring the volume by each rotor sweeping out the compartment formed by half the wall of the cylindrical housing and the surface of half the corresponding rotor. The rotational speed of the impeller is proportional to the flow of gas through the meter and the measured volume closely approximates the volume of the measuring chambers times the number of impeller revolutions, except at low speeds where the small amount of slippage of the gas begins to have a more appreciable effect.

The rotary meter measures gas volume at line conditions and when these fluctuate and billing volume refers to other than meter conditions, suitable and approved, volume correcting devices shall be used to account for changes in volume caused by the effects of temperature, pressure and supercompressibility. Pressure connections to these correcting devices shall be taken from the inlet side of the meter.

The computation of the volume of gas, at the contract temperature and pressure, which has been registered in cubic feet at line conditions is based on the ideal gas laws modified by a deviation factor available in the form of a Supercompressibility factor (Fpv), determined according to the A.G.A. Gas Measurement Committee Report No. 3, Orifice Metering of Natural Gas.

DRESSER MEASUREMENT DIVISION
DRESSER INDUSTRIES, INC.
HOUSTON, TEXAS, U.S.A.



SECTIONAL ASSEMBLY

1.5MI25 COUNTER VERSION METER

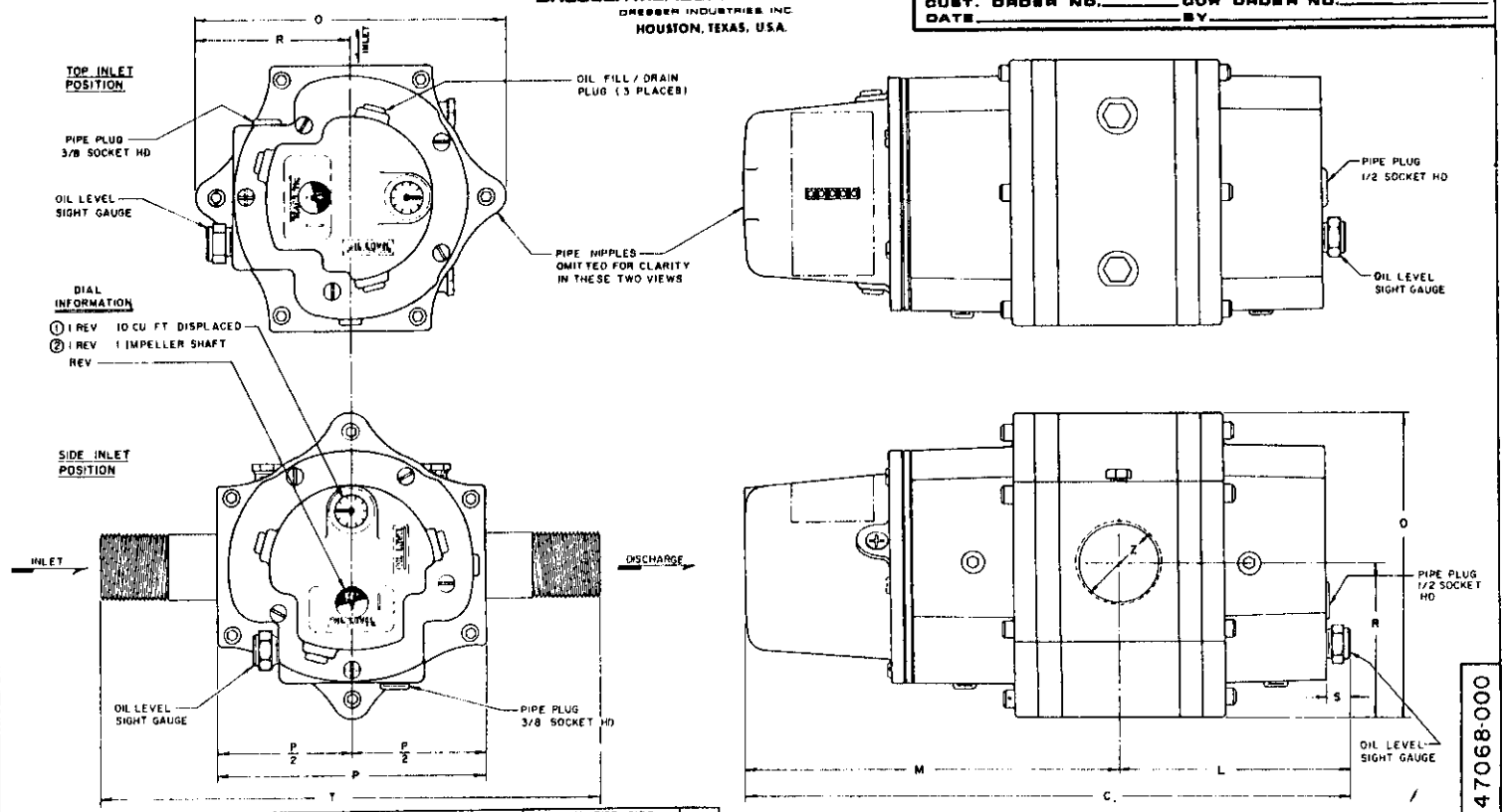
SIDE OR TOP INLET

D047057-000

APPROVED FOR CONSTRUCTION

DRESSER MEASUREMENT DIVISION
DRESSER INDUSTRIES, INC.
HOUSTON, TEXAS, U.S.A.

CUSTOMER _____
CUST. ORDER NO. _____ OUR ORDER NO. _____
DATE _____ BY _____



DIMENSIONS IN INCHES								NOMINAL PIPE SIZE		APPROX OIL CAP. (QTS)		APPROX WT. (LB)	MAX. WORKING PRESSURE
MODEL	C	L	M	O	P	R	S	Z	Y APPROX	TOP INLET	SIDE INLET		
1.5MI25	13 3/16	5 3/64	8 1/64	6 23/32	6 1/16	3 3/16	3/8	1 1/2 – 11 1/2 NPT	11	9 3/4	3 1/2	19	125 PSIG

SERIES 125LMA-COUNTER VERSION

D047068-000

The general equation for converting the meter readings at line conditions to a contract base pressure and temperature is

$$Qs = Qd\ Pm\ Tm\ (Fpv)^2$$

Qs = Quantity of gas at the contract base pressure and temperature, cu. ft.

Qd = Actual (displaced) gas passed at existing meter conditions, cu. ft.

Pm = Pressure multiplier

$$= \frac{\text{Weighted average existing gauge pressure + barometric pressure}}{\text{Absolute pressure base}}$$

Tm = Temperature multiplier

$$= \frac{\text{Temperature base + 460}}{\text{Weighted average flowing gas temperature + 460}}$$

Fpv = Supercompressibility factor based upon the weighted average gas pressure and temperature and the normal composition of the gas. The composition is represented by its specific gravity, its content of nitrogen and carbon dioxide and its calorific value as used in the derivation of Fpv values.

The selection of the weighted average supercompressibility factor, Fpv, should be based on a record of the flowing gas volumes, pressures and temperatures. If no continuous record is available, the variations in pressure and temperature normally existing in the line must not introduce an error greater than ± 0.5% in the selected $(Fpv)^2$ factor.

Line mounted meters may be installed in either horizontal or vertical gas lines which carry clean and dry gas. Preferred installation, however, is in a vertical pipe line due to self-cleaning action of the meter. In vertical lines the flow through the meter must always be downward. The oil level sight gauges are interchangeable and their proper location depends on the mounting position of the meter. The manufacturer recommends that the meter out-of-level shall not exceed 1/16 of an inch per foot in any direction. The level can be checked in two directions at one of the pipe flanges, at the machined stacking pads on the meter body, or at the piping for 1.5M size meters.

Correct direction of gas flow for both positions is shown clearly by a large arrow on the meter nameplate. Small labels located on each side of the counter window also indicate which side of the meter must be on top for either top inlet or side inlet installations. These meter position indications must be followed without exception, so that the lubrification system will function, the counter can be read, and oil will not enter the gas metering chamber.

Line mounted meters are designed for direct in-the-line mounting, requiring no additional means of direct support. The manufacturer's suggested installation requirements for the top and side inlet mounting are shown on two sketches. It should be noted that the manufacturer recommends the use of a uniform pipe size in the vicinity of the meter.

DRESSER MEASUREMENT DIVISION "ROOTSMETER" ROTARY-TYPE POSITIVE DISPLACEMENT GAS METER

SERIES 125 ROOTS METERS - STANDARD METERS WITH READOUT IN CUBIC FEET									
	MODEL								
PHYSICAL DATA	3M	5M	7M	11M	16M	23M	38M	56M	102M
Maximum Capacity MCFH (Dial Rate)	3	5	7	11	16	23	38	56	102
Counter Displacement per Revolution	.02217	.03603	.06074	.09870	0.1765	0.2620	0.5128	0.8825	2.0940
Planetary Gear Reduction Ratio	451.000 to 1	277.538 to 1	164.645 to 1	101.320 to 1	566.500 to 1	381.625 to 1	195.000 to 1	113.317 to 1	47.755 to 1
Counter Increments Cu. Ft.	100	100	100	100	100	100	100	100	100
Test Dial Increments - Cu. Ft.	1	1	1	1	10	10	10	10	10
Instrument Drive Rate Cu.Ft./Rev.	10	10	10	10	100	100	100	100	100
Number of Counter Digits	5	5	5	5	6	6	6	6	6
Maximum Volume Registration Cu.Ft.	10MM	10MM	10MM	10MM	100MM	100MM	100MM	100MM	100MM
Flange Connection Size - Inches	2	3	3	4	4	6	6	8	10
Shipping Weight - Lbs. (Approx.)	50	70	130	165	400	560	815	1215	2450
Crated for Export Volume $Ft.^3$(Approx.)	1.03	1.13	2.0	2.2	9.7	13.4	15.3	27.1	54.5

Other piping layouts based on established practices may be equally satisfactory to those shown, but in any case it is recommended that the meter be placed in a side loop with the bypass going straight through. The piping must be properly aligned, and supported on each side of the meter if possible.

This results in a solid pipe line, and at the same time removes piping strains from the meter if sufficient flexibility is provided in the meter loop. All meters of 16M size and larger are foot-mounted and are intended for installation in horizontal lines only, as shown on the manufacturer's suggested installation sketch.

Since the proper operation of the meter depends upon maintaining proper clearances between the impellers and the case, care must be taken to be sure that the piping transmits no stresses to the meter. The pipe flanges must match up squarely with the meter flanges before the piping is bolted up. This will eliminate distortion of the case and prevent rubbing or binding at the impellers. To further minimize distorting the case, the piping must be supported independently of the meter, so the meter bears none of the weight of the piping.

Expansion joints should not normally be necessary. Dresser type couplings are preferred as they will accommodate slight misalignment of piping. A temperature difference resulting in slight expansion will also be compensated for with this type fitting, providing it is installed properly. Refer to local piping practices or codes. The sketch shows a recommended basic piping system for the meter, including essential shutoff valves and a bypass line. This basic piping may be modified to accomplish desired results or to provide additional safeguards for the system. Use of isolating valves at inlet and discharge, with a valved bypass loop around the meter, is recommended.

While the selection of the size of the meter, type of readout and installation usually governs the choice of vertical or horizontal flow line positioning, the meters types 8M400, 11.5M400 and 19M400 are at present available with top inlet only.

All meters operating on pressure of 400 p.s.i.g. or greater require a critical flow restricting orifice to prevent meter overspeeding. This orifice is normally placed between the flanges connecting the meter to the gas line on the downstream side.

All meters accepted for service shall be effectively sealed to ensure that no access can be gained to the register of the meter.

Meters manufactured by Dresser Measurement Division, Connersville, Indiana, U.S.A., and distributed in Canada by Dresser Industries Canada Limited shall carry the American nameplates, illustrated on Fig. 1 for high pressure meters, and on Fig. 2 for meters with working pressure up to 125 p.s.i.g.

Rotary meters assembled in Canada by Dresser Industries Canada Limited shall carry the Canadian nameplate illustrated on Fig. 3.

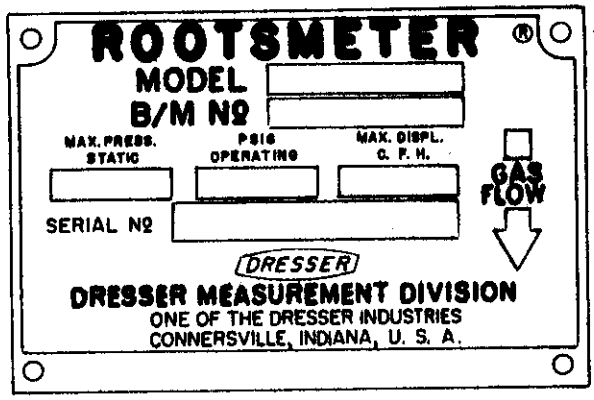


Fig. 1

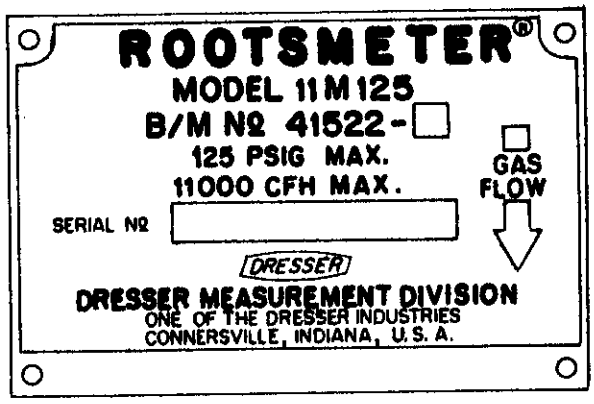


Fig. 2

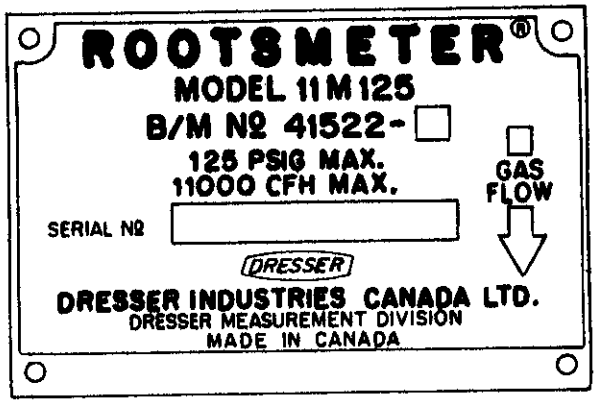


Fig. 3

For more detailed information on rotary meters refer to Technical Bulletin No. 3 and illustrated data sheet.

Approval granted to:

Dresser Industries Canada Ltd.,
Toronto,
Ontario.

J.S.T. Swanson, P. Eng.,
Chief, Standards Laboratory,
Standards Branch.

W.J.S. Fraser,
Chief, Electricity & Gas Division,
Standards Branch.

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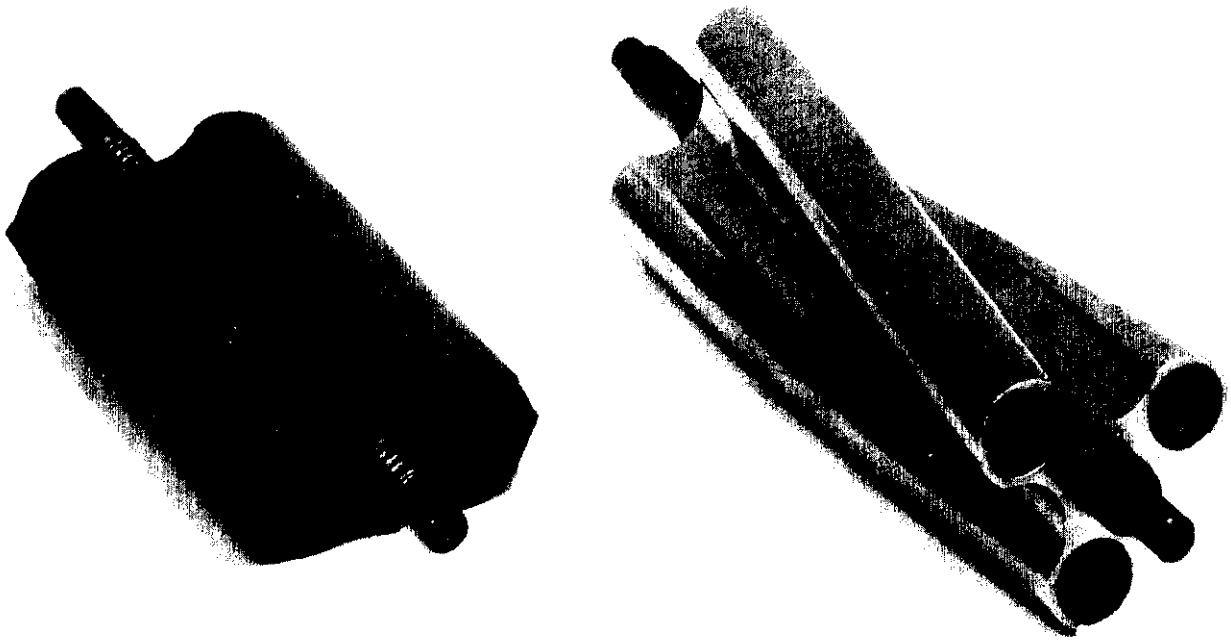
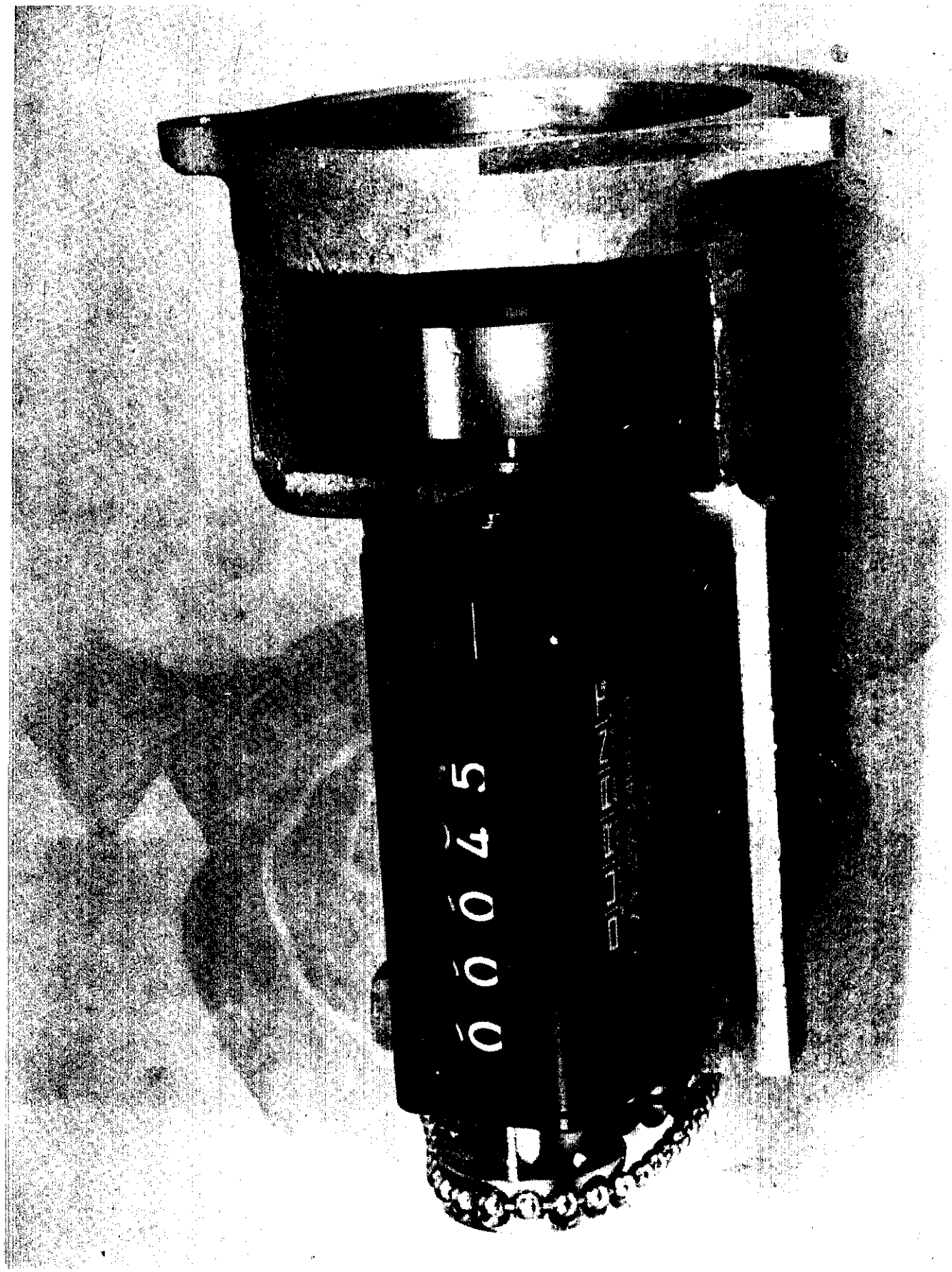


3M1200 Roots meter impeller comparison

Left to Right: 3M125 cast iron impeller
3M1200 aluminum impeller

DRESSER MEASUREMENT DIVISION "ROOTSMETER" ROTARY-TYPE POSITIVE DISPLACEMENT GAS METER



DRESSER MEASUREMENT DIVISION "ROOTSMETER" ROTARY-TYPE POSITIVE DISPLACEMENT GAS METER