



# INSTRUCTION MANUAL

## HASTINGS VACUUM GAUGE

Model VT-6

### CONTENTS

Description of Instrument

Accessories

Principle of Operation

Installation

Operation

Maintenance

Procedure for Recalibration

Notes on Vacuum Measurements

Schematic Diagram

Parts List

MP-22

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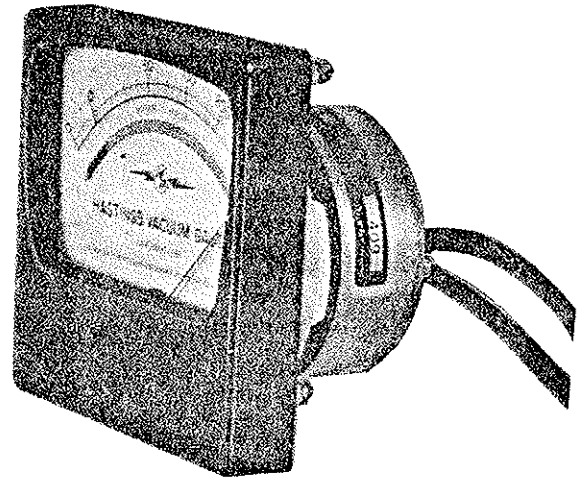
# HASTINGS COMPACT VACUUM GAUGES VT SERIES

FEATURING MINIATURIZED CIRCUITRY

IMPROVED PERFORMANCE ● EXTREME VERSATILITY

## FEATURES

- READY FOR YOUR PANEL
- COMPACT SIZE SAVES SPACE
- SELF-CONTAINED-CIRCUIT
- INTERCHANGEABLE GAUGE TUBES
- MULTI-POSITION ATTACHMENTS AVAILABLE
- TAUT BAND METER

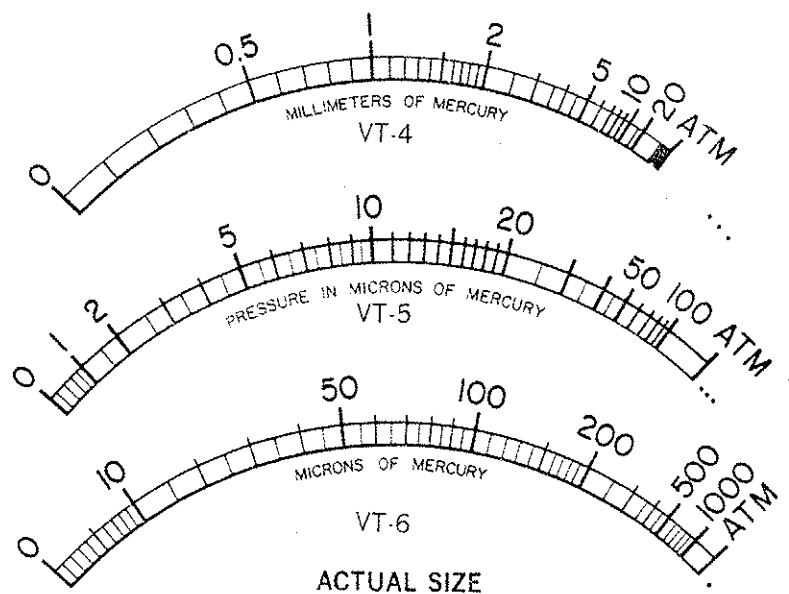


## DESCRIPTION

The compact size of the VT Series offers extreme versatility for all vacuum gauge applications. A self-contained gauge circuit is attached to the rear of the direct reading meter. Solid state circuitry throughout assures long life and low maintenance cost. Circuit includes voltage regulation. Complete assembly mounts in standard 4" meter cut-out.

These instruments utilize Hastings rugged but sensitive gauge tubes which are designed specifically for each range. Tubes are matched and interchangeable without calibration adjustments. They are compensated for temperature and rate of change of temperature. Hastings metal type gauge tubes are connected to the vacuum system by a standard 1/8" IPS male pipe thread. Weather resistant, stainless steel/ceramic and pyrex glass tubes are also available.

AVAILABLE IN 3 RANGES



# HASTINGS COMPACT VACUUM GAUGES

## VT - SERIES

### INSTALLATION AND OPERATION

#### General:

The Hastings Compact Vacuum Gauges, Models VT-4, VT-5 and VT-6 are completely self-contained instruments with the circuitry mounted on the rear of the indicating meter barrel. Two 8 ft. cables are attached, one for connection to the gauge tube and the other for connection to 115 volt a-c/d-c power. The power cable has a grounded 3-wire type plug.

Hastings gauges are calibrated at the factory and no further adjustments should be required.

Cabinet Models VT-4B, VT-5B and VT-6B require only installation of gauge tube and cable as described below and plugging into power line. Turn ON-OFF switch "ON" to place in operation.

The panel cut-out dimensions are the same as for Assembly Products #461 meter and are shown in the outline drawing included in this manual. If the panel is non-magnetic material such as aluminum, install the steel band around the meter barrel. If a steel panel is used, remove this band as it is not required, and discard it.

Install the meter on the panel using the hardware supplied.

Install the gauge tube in the vacuum system with the open end pointing down so as to be self-draining should any vapors condense in it. Either thread it into a 1/8" female IPS thread or use Hastings Quick Connect "O" ring seals for a vacuum-tight installation. Plug the gauge tube cable into the gauge tube.

#### Power:

Plug the instrument into any single-phase a-c or d-c line with the power cord. Any power 90-140 volts a-c or 110-150 volts d-c may be used. Line frequency is unimportant and 25, 50, 60, or 400 cycles or other power will provide satisfactory operation. A 3-wire grounded plug and power cord is supplied. The instrument is now in operation.

If an on-off switch is desired, any switch may be wired into the power cable to provide this function. If you wish to "break" both hot leads use a double pole single throw switch. The power cable may also be cut off and wired into any master switch or circuit breaker on your panel.

### Quick Check of Calibration:

The simplest and quickest method of checking operation and calibration of a gauge and gauge tube is to keep a new spare clean gauge tube on hand as a "standard." When in doubt, install the old and new gauge tubes together in the same vacuum system (preferably a clean dry one) and pump until a steady pressure is observed. Plug the gauge into the old and new gauge tube alternately. If the old tube reads a higher pressure than the new one it indicates a contaminated tube which has caused a shift in calibration of the tube. Cleaning this tube by swishing gently in a solvent such as acetone or trichloroethylene may restore calibration. Thoroughly dry the tube and de-gas it before re-installing in a vacuum system so the solvent will not contaminate your system. If the gauge tube calibration cannot be restored by cleaning the tube, replace it with a new gauge tube. If it is OK, remove the "standard" and store in a clean dry place for future use.

If the instrument fails to operate at all after trying a new gauge tube, return it to the factory for repair, complete with gauge tube and all accessories.

### Recalibration:

Recalibration if necessary can be performed using the techniques described in this manual. The current set potentiometer is a multi-turn trim potentiometer located on the left side of the gauge circuit attached to the rear of the meter when looking at the instrument from the rear. A small hole marks this location into which a small screw driver will easily adjust this potentiometer. Normally readjustment should not be necessary.

INSTALLATION OF SWITCHING ATTACHMENTS  
FOR VT-SERIES VACUUM GAUGES

Two-position and five-position switching attachments are available for use with the VT-Series vacuum gauges. These switching attachments can be mounted on either side, on the top or on the bottom of the gauge adjacent to the meter or they can be mounted some distance away from the gauge if desired. Maximum panel thickness for these attachments is 1/8".

A FULL SIZE TEMPLATE IS ENCLOSED TO FACILITATE PANEL LAYOUT.

**Bottom Mounting:** Drill panel holes as shown on cut-out drawing in this manual.

**Side Mounting:** Use the center line for the meter itself to locate the holes for the switching attachment. The attachment will extend above and below the meter outline approximately 3/16" when side mounted.

The meter center line,  $C_L-C_L$ , is 3/16" above the A-A' meter-hole center line. The X-X' center line will be 2-25/32" from the B-B' center line. When making template or drawing for the attachment holes, simply rotate the attachment outline 90° as desired, about the intersection of center lines B-B' and  $C_L-C_L$ . Holes are pre-drilled in the attachment to fit the meter mounting bolts for all combinations of side, top, or bottom mountings. Note that when looking at the vacuum gauge from the front, if the attachment is mounted on the right side the pilot light is on top. When the attachment is mounted on the left side, the holes are reversed and the pilot light is on the bottom.

**Top Mounting:** Rotate and invert the location of the attachment on B-B' center line. Note that the pilot light hole will now be on the left side and toggle switch hole on the right side of the selector switch hole which is on the B-B' center line.

**To Mount the Attachment:**

1. Install the meter and gauge first, assemble nuts on all mounting bolts and tighten. Cables may be prepared previous to mounting if desired.
2. Remove selector switch knob and on-off escutcheon plate. DO NOT REMOVE NUTS WHICH FASTEN SWITCHES TO ATTACHMENT. DO NOT TOUCH PILOT LIGHT AS IT MERELY EXTENDS THROUGH PANEL HOLE.
3. Position THE ATTACHMENT OVER THE METER MOUNTING BOLTS AND NUT, sliding it into the panel.
4. With the extra switch bushing nuts, assemble the escutcheon plate on the toggle switch, and tighten both switches to the panel.

## PROCEDURE FOR CHECKING CALIBRATION OF HASTINGS VACUUM GAUGES

All Hastings Vacuum Gauges have been carefully checked and calibrated at the factory before shipment. If at any time you desire to check the calibration, you may find one of the following methods helpful:

### A. To Check Span:

Hastings Vacuum Gauges are calibrated by spanning each instrument between two known and easily reproduced pressures and then carefully checking several points in between. To check the span, proceed as follows:

1. Turn power on and allow several minutes for warm-up. With the gauge tube exposed to atmospheric pressure and held in a vertical position, stem down, the meter should read "ATM." If it does not, adjust the mechanical zero of the meter until it does.
2. Evacuate the gauge tube down to any pressure as long as it is known to be less than one-tenth of a micron and continue pumping for at least fifteen minutes after gauge reaches a steady reading. The meter should now read "zero." If it does not, adjust the "Current Set" control until it does. (The Current Set control is usually located on the front panel of standard models and on the back of the meter housing on compact models.)
3. Repeat steps 1 and 2, making slight readjustments if needed. Gauge now reads correctly throughout its range.

### B. To Check Gauge Tube:

Gauge tubes are subjected to contamination in many systems and such contamination can shift calibration and cause indicated pressures to read high. An easy method to check the calibration of a gauge tube in such a case is to have a new spare, clean gauge tube available which can be inserted in the same system to measure the true pressure. By comparing the readings from the two gauge tubes taken on the same indicator, it can be determined if the original gauge tube has shifted calibration. Often the calibration of such a gauge tube can be restored by gently rinsing with a suitable solvent such as acetone or trichloroethylene. (Be sure to thoroughly dry and degas the tube before reinstalling it so that the solvent will not contaminate the system.)

### C. To Check Indicator:

All calibration voltages are set at the factory and will rarely change unless the "Current Set" control is disturbed. If you wish to check the calibration of the indicator, Hastings-Raydist manufactures a Reference Gauge Tube for this purpose. (See Specification Sheet 353.)

## NOTES ON VACUUM MEASUREMENTS

### Effects of Condensable Vapors:

If the readings of Hastings Gauges are to be compared with readings of other types of gauges, consideration must be given to the possible effects of condensable vapors on the other gauges. For example, none of the many types of the McLeod Gauge give correct readings if condensable vapors such as water, alcohol, acetone, etc., are present in the gauge. The McLeod Gauges operate by compressing the residual gases and vapors in obtaining a reading and this compression will tend to condense any vapors that are present. This usually results in the McLeod Gauge reading a pressure that is too low. Furthermore, two different types of McLeod Gauges may disagree and both be incorrect, if vapors are present. Unlike the McLeod Gauges, the Hastings thermopile vacuum gauges have the very useful property of responding to the total pressure of all gases and vapors that are present in the gauge tube.

To exclude vapors from the McLeod type of gauge it is necessary to use a trap of some kind that will absorb or condense the vapors. Water vapor is by far the most common source of this difficulty. A trap cooled by liquid nitrogen is effective in removing vapors, but even so it may be necessary to keep the McLeod Gauge constantly under vacuum for several hours, or days, with a trap before it will read correctly. Reference should be made to the instructions furnished by the manufacturer of the McLeod Gauge to be sure that it is provided with a suitable trap.

### Outgassing:

Hastings Gauge Tubes are made of materials that have been proven by years of usage to be relatively free from outgassing. However, all surfaces of glass and metal that are exposed to the vacuum system may liberate gases and vapors that were previously absorbed during exposure to the atmosphere. If the surfaces are contaminated with foreign matter, this outgassing may be much more persistent than if the surfaces are clean. The possibility of outgassing must be considered in checking the accuracy of Hastings Gauges or in checking for leaks. This is especially important when working with pressures of less than 10 microns of mercury. In this range of pressures, outgassing from surfaces in a newly evacuated system may flood the enclosure. Also, if the system is being pumped continuously, gauges spaced at different distances from the pump will register different pressures. For reliable comparison of different vacuum gauges, it is necessary then to insure that the vacuum system be free of any outgassing or other sources of apparent leaks. This can best be determined by closing the system off from the pumps and observing if there is any rise in pressure within the range of interest.

CHARACTERISTICS OF HASTINGS GAUGE TUBES AND TRANSDUCERS

METAL GAUGE TUBE Pyrex Gauge Tube*	DV-3M DV-17	DV-6M, DV-6R DV-20	DV-4AM DV-16	DV-4D, DV-4R DV-16D
Gauge Tube for Vacuum Gauge Model	GV-3, SV-1 VC-13, VC-23	VT-6, TV-4A, TV-5A, CVT-16, CVT-26, RV-8	SP-1, VC-14 VC-24	VT-4, TP-7A CVT-14, CVT-24 RV-9
Smallest Division Normally on Meter	1 micron	1 micron	0.1 mm	0.1 mm
Maximum Sensitivity	20-200 micron	10-200 micron	.2-5 mm	.2-5 mm
1/2 scale on the Meter	130 microns	70 microns	1.7 mm	1.77 mm
Usable Range	1 to 1000 micron	1 to 1000 micron	.1 to 20 mm	.1 to 20 mm
Internal Volume of Gauge Tube	1/2 cu. in.	1/2 cu. in.	1/20 cu. in.	1/20 cu. in.
Ruggedness	Excellent	Excellent	Excellent	Excellent
Maximum Temperature Rise of the Thermopile in a Hard Vacuum	260° C	300° C	275° C	250° C
Maximum Temperature Rise of the Thermopile at Atmospheric Pressure	15° C	6° C	30° C	30° C
A-C Current through Tube	0.125 amp	.021 amp	0.040 amp	.029 amp
A-C Voltage across Tube	.3 volt	.38 volt	0.37 volt	.32 volt
Power Required by Gauge Tube	0.037 watt	.008 watt	0.015 watt	.009 watt
Millivolt Output at Hard Vacuum (Normal Load)	10 mv	10 mv	10 mv	10 mv
Internal Resistance	2.2 ohms	18 ohms	8 ohms	11 ohms
Response Time Constants**				
Zero to ATM	.12 sec.	.06 sec.	.04 sec.	.04 sec.
ATM to Zero	3.3 sec.	2.9 sec.	.16 sec.	.16 sec.
Maximum Safe Positive Pressure Rating	50 psi	50 psi	150 psi	150 psi

\*\* Response time constants are time to reach 63% of  $P_1$  to  $P_2$  using fast response recorder. Millivoltmeter response time would be additive to values shown. Note that response curves are asymptotic and total time to reach 99.9% of  $P_2$  pressure would be approximately 3 times the constant shown.

NOTE: "Zero pressure as used for these tests is a low enough pressure so that the gauge tube no longer senses a pressure change. For purposes of these tests it is lower than .1 micron Hg.

TEST: Zero to ATM performed by pumping tube to "Zero", sudden air release to ATM.

TEST: ATM to Zero performed by pumping tube to "Zero", no power applied to gauge tube, then suddenly applying power. In this manner it is independent of outgassing, pumping speed, conductance losses of the system and tube volume, etc.

\*NOTE: Pyrex Gauge Tube volume 1.5 cubic inches, Temperature rating 450° C (all). Pressure rating 15 psig.



# CONVERSION FACTORS AND EQUIVALENTS

## VOLUME, WEIGHT AND MASS

	cc	cu.m	cu.ft.	liters	gm	lb	kg
CUBIC CENTIMETER	1	$1 \times 10^{-6}$	$3.53 \times 10^{-5}$	.001			
CUBIC METER	$1 \times 10^{-6}$	1	35.3	1000			
CUBIC FEET	28317	.0283	1	28.32			
LITER	1000	.001	.0353	1			
GRAM					1	.0022	.001
POUND					454	1	.454
KILOGRAM					1000	2.205	1

To convert, multiply by number under vertical column headings.

1 pound air at s.t.p. (760 mm Hg @ 68°F) occupies 13.3 cu.ft. =  
377.6 liters

1 cu.ft. air at s.t.p. (760 mm Hg @ 68°F) weighs .075 lbs = 0.340 kg =  
34.0 gm

1 pound - mole of gas @ 760 mm 32°F weighs its molecular weight in  
pounds and occupies 359 cu.ft.

1 gram - mole of gas @ 760 mm 0°C weighs its molecular weight in grams  
and occupies 22.4 liters

Atmospheric pressure (32°F) = 760 mm Hg = 33.9 ft. H<sub>2</sub>O =  
1.033 kg/sq cm = 14.696 psia = 29.921" Hg

### PRESSURE

1 psia = 2.04" Hg = 2.31 ft. H<sub>2</sub>O = 51.72 mm Hg = 27.67" H<sub>2</sub>O (4°C)

1" Hg = .4898 psia = 25.4 mm Hg at 0°C

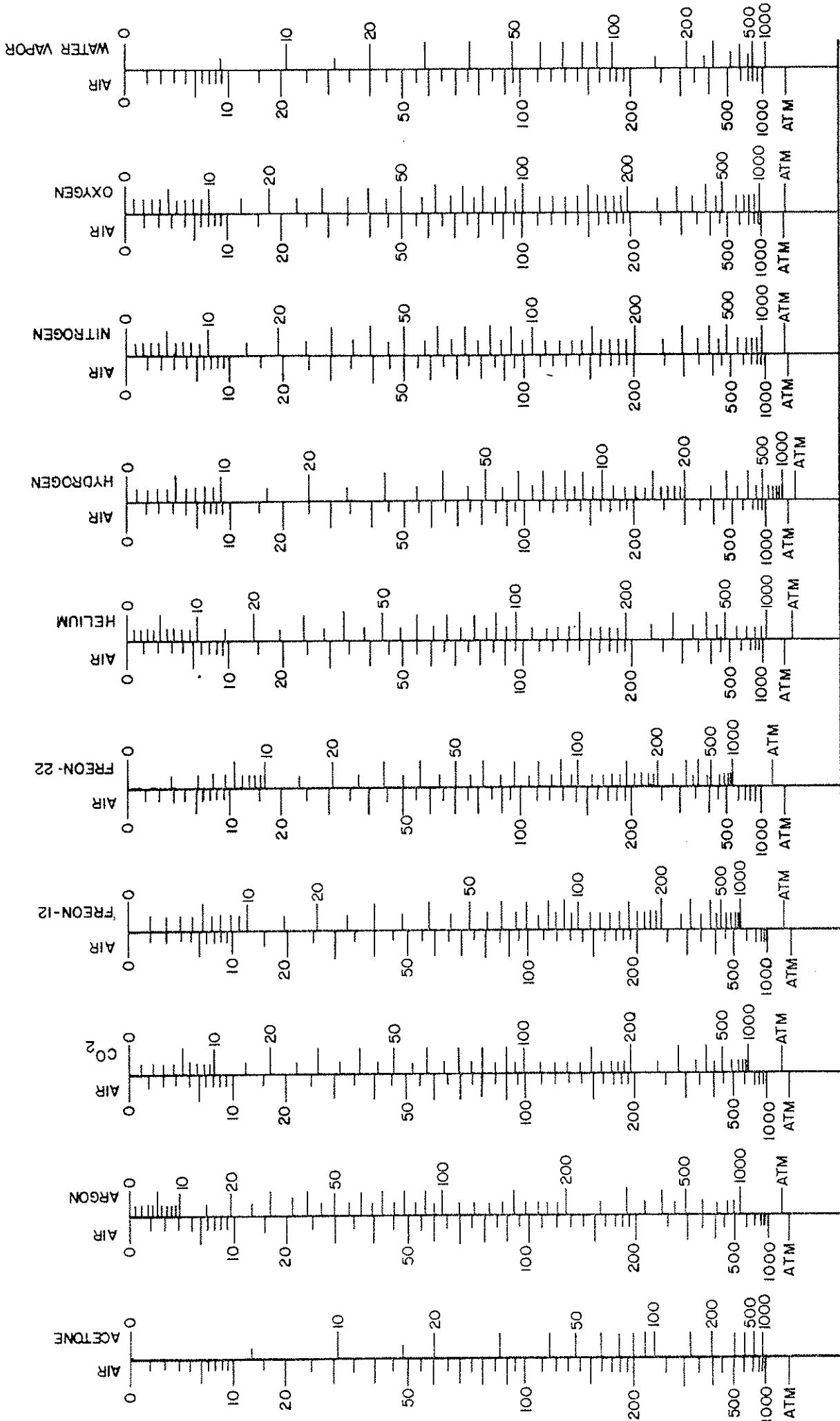
1 mm Hg = .536" H<sub>2</sub>O = 1.33 millibars = .0013 bar

1 ft. water = .434 psia = 22.4 mm Hg at 4°C

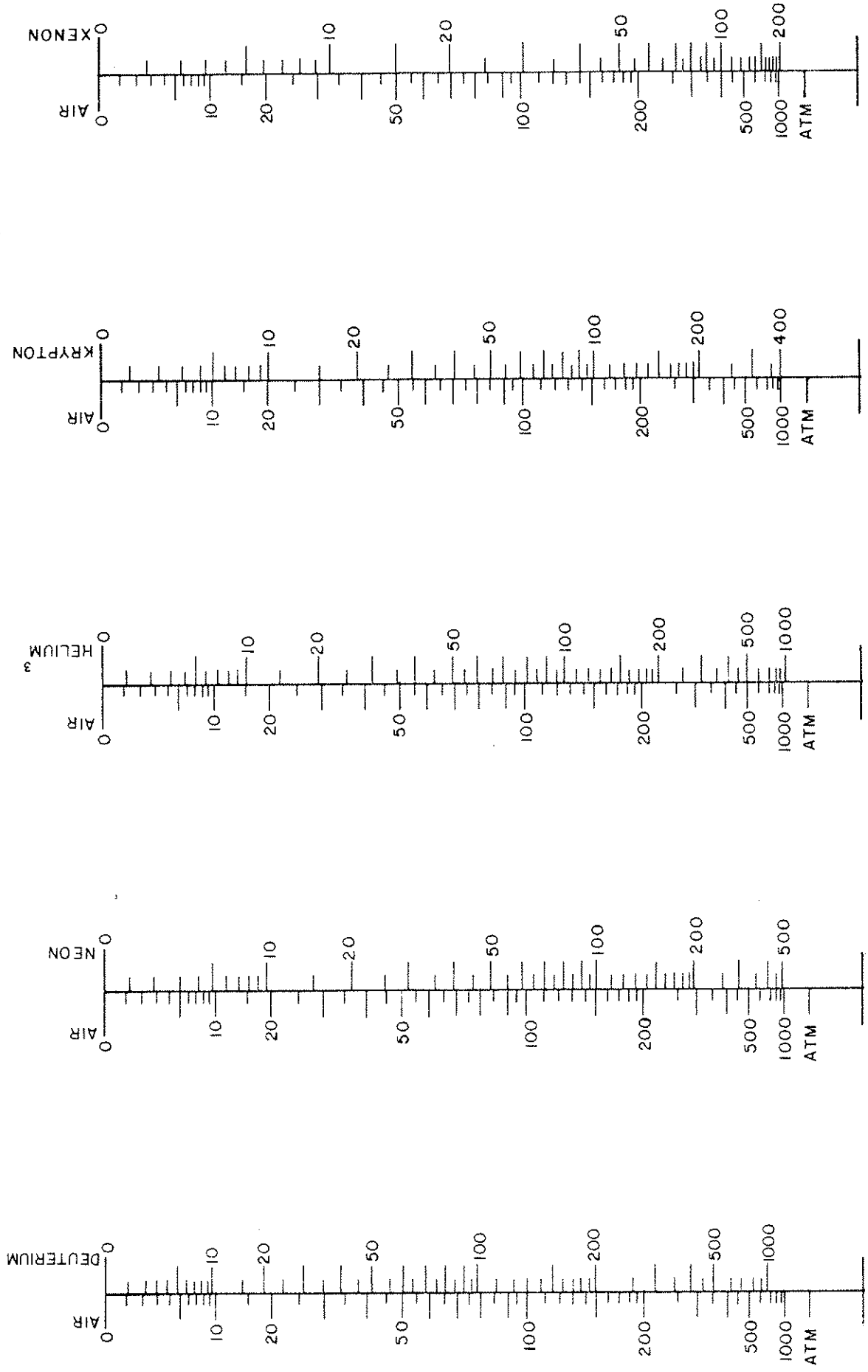
1 mm Hg = 1 torr = 1/760 atm = 1000 microns Hg = .03937" Hg

1 micron Hg = .001 mm Hg =  $1 \times 10^{-3}$  mm Hg = 1/760,000th atm

HASTINGS-RAYDIST  
A Teledyne Company  
Hampton, Virginia 23361



NOMOGRAM SHOWING CALIBRATION OF HASTINGS VACUUM GAUGES WHICH USE THE DV-6 GAUGE TUBE FOR GASES OTHER THAN AIR. TO FIND THE PRESSURE IN A GAS OTHER THAN AIR, LOCATE THE OBSERVED READING ON THE "AIR" SIDE OF THE APPROPRIATE SCALE AND READ, ON THE OPPOSITE SIDE OF THE SCALE, THE TRUE PRESSURE IN MICRONS OF MERCURY FOR THE GAS BEING MEASURED.

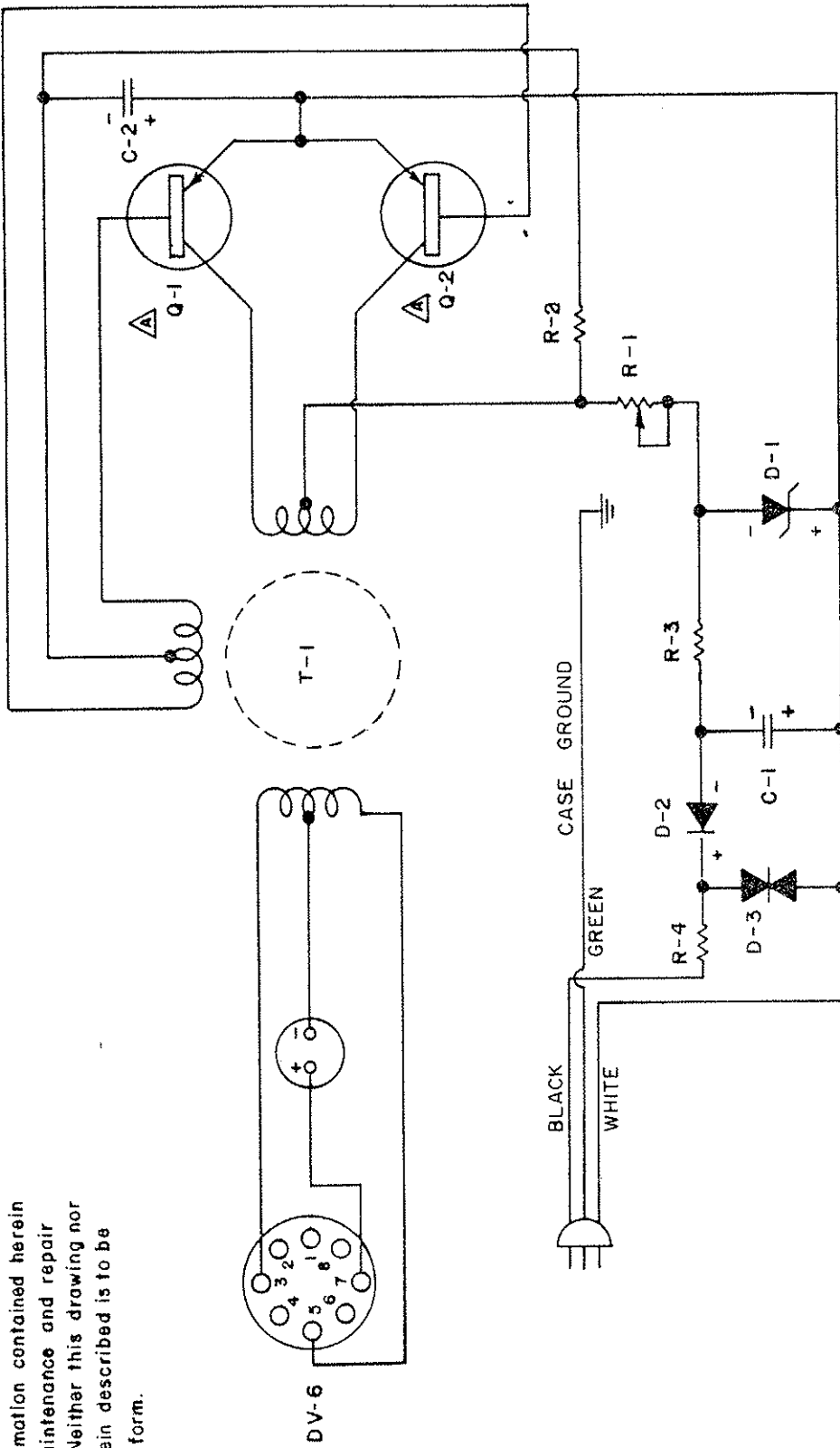


NOMOGRAM SHOWING CALIBRATION OF HASTINGS VACUUM GAUGES WHICH USE THE DV-6M, DV-6R, DV-20 & DV-36 GAUGE TUBES FOR THE GASES SHOWN ABOVE. TO FIND THE PRESSURE IN A GAS OTHER THAN AIR, LOCATE THE OBSERVED READING ON THE "AIR" SIDE OF THE APPROPRIATE SCALE AND READ, ON THE OPPOSITE SIDE OF THE SCALE, THE TRUE PRESSURE IN MICRONS OF MERCURY FOR THE GAS BEING MEASURED.

HASTINGS - RAYDIST  
HAMPTON, VIRGINIA

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- (1) VT-CARD
- T-1 TOROID TRANSFORMER △ 26-1-150A
- M-1 METER △ 28-8-166B
- C-1 4 mfd 250 V CONDENSER 24-1-
- C-2 20 mfd 10 V CONDENSER 11-3-103
- R-1 1 K POTENTIOMETER △ 11-3-102
- R-2 15 K 1/2 WATT RESISTOR △ 19-5-5A
- R-3 15 K 2 WATT RESISTOR 18-2-138
- D-1 DIODE 18-2-162
- D-2 IN2071 DIODE △ 13-1-105
- Q-1,2 GA-1824 TRANSISTOR 36-1-31
- (1) TIN 80FV 51-2-1
- (1) ALUMINUM COVER 65-41-41
- (1) LINE CORD 28-6-265
- (2) HEYCO #5 15-17-7A
- (16) EYELETS 28-6-59
- R-4 100Ω 1/2 WATT RESISTOR 28-10-96
- D-3 SURGE SUPPRESSOR 18-2-365
- 13-1-76

REVISIONS

LFT.	DESCRIPTION	AUTH.	DATE
	PARTS LIST REVISED R-4 & D-3 ADDED		
A	Q-1 & 2 CHANGED FROM 2N185 TO TI 376		11/30/62
B	PARTS LIST REVISED		12/9/64
C	PARTS LIST REVISED		5/5/68

HASTINGS  
VACUUM GAUGE  
MODEL VT-6  
SCHEMATIC

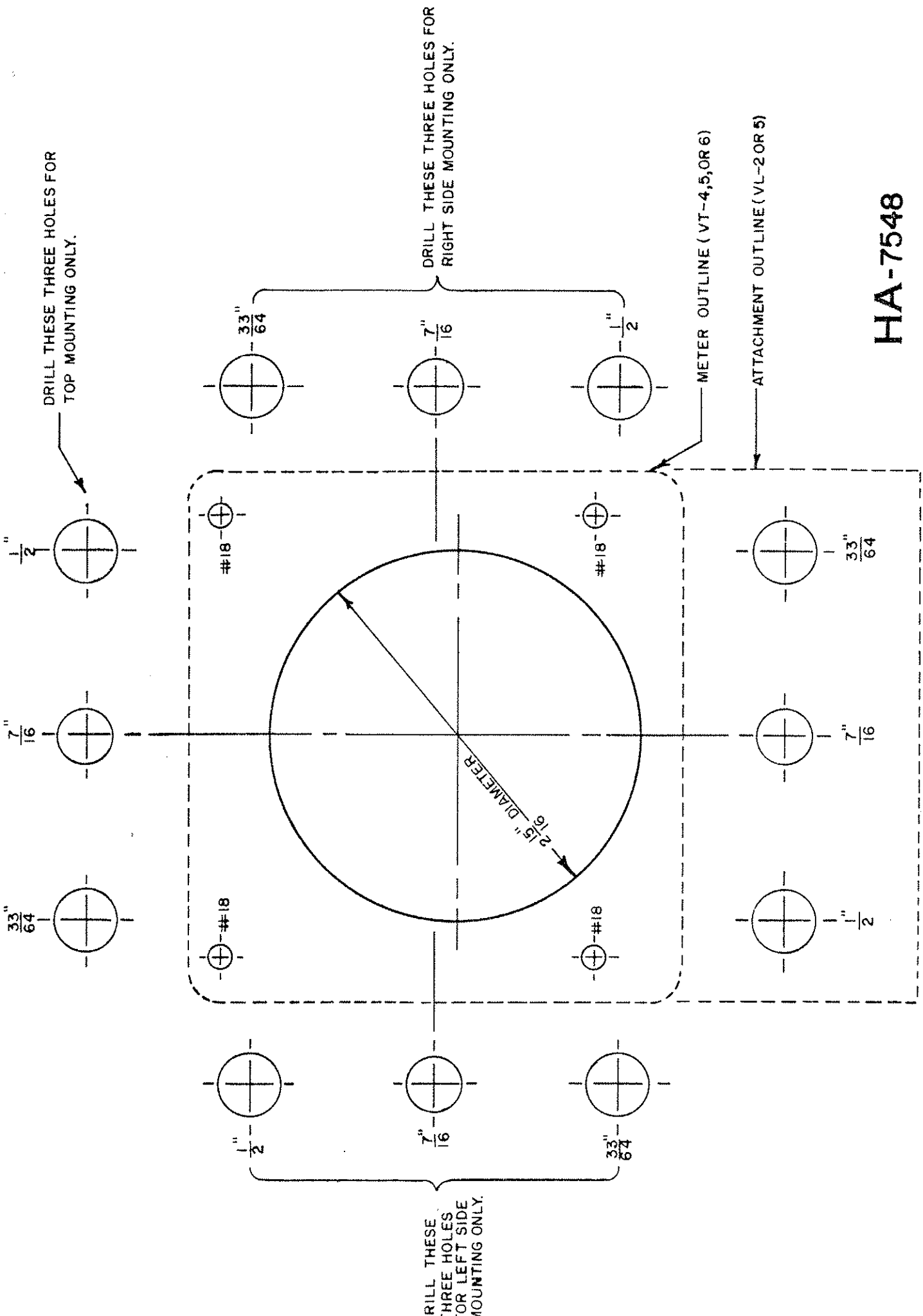
MATERIAL NOTED

HASTINGS-RAYDIST  
INCORPORATED  
HAMPTON, VIRGINIA

TOLERANCES  
FRAC. ± DEC. ± ANG. ±  
UNLESS OTHERWISE SPECIFIED

DES. DR. 3/9/61 M.E.B. APP.  
CK. WAR

HA-7373



HA-7548

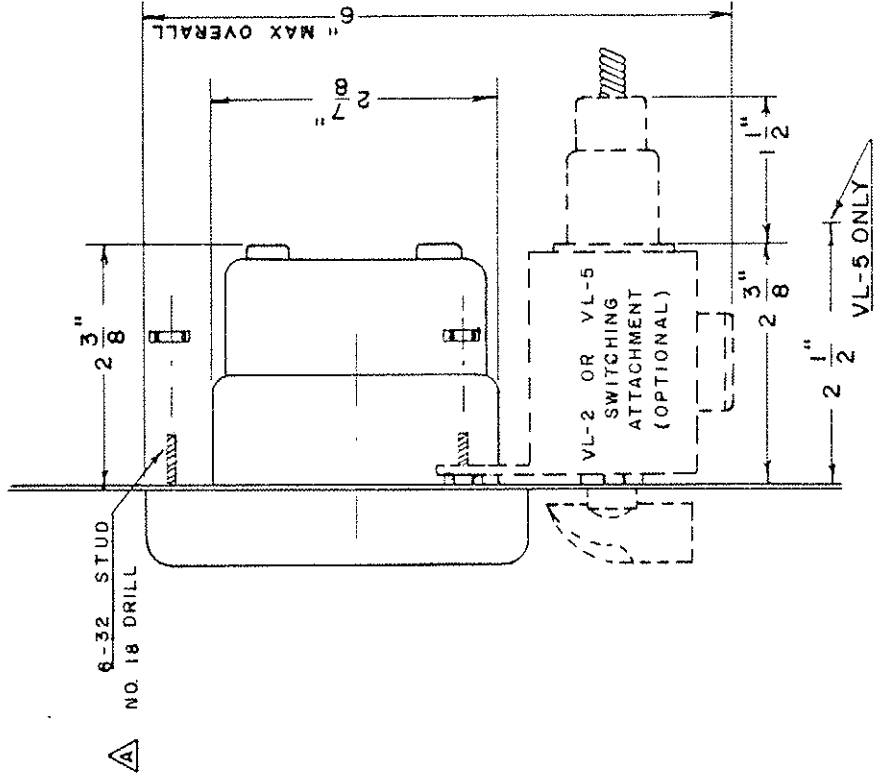
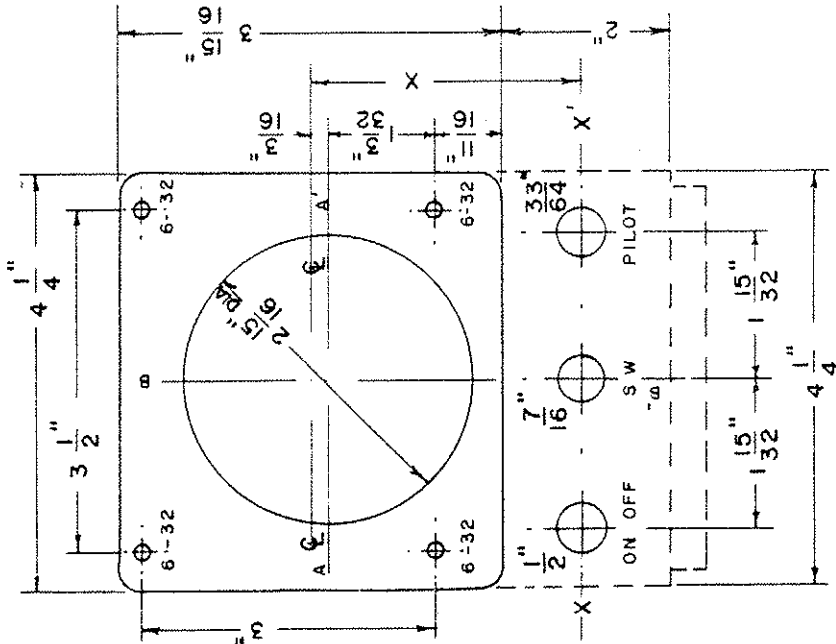
HASTINGS - RAYDIST  
INCORPORATED  
HAMPTON, VIRGINIA

DRILL THESE THREE HOLES FOR BOTTOM MOUNTING ONLY

HASTINGS  
VACUUM GAUGE  
MODEL VT-4.5, OR 6 MOUNTING TEMP. AT

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REVISIONS

LET.	DESCRIPTION	AUTH.	DATE
A	MOUNTING HOLES ENLARGED.	<i>[Signature]</i>	10/5/62

**HASTINGS**  
VACUUM GAUGE  
PANEL CUT-OUT & OUTLINE DRAWING  
MODEL VT-4, 5 & 6  
MATERIAL

**HASTINGS-RAYDIST**  
INCORPORATED  
HAMPTON, VIRGINIA

TOLERANCES  
FRAC. ± DEC. ± ANG. ±  
UNLESS OTHERWISE SPECIFIED

HA-7420

DES. DR. 11/13/61 M.E.B. C.K. APP.

X = 2 25/32" FROM C-C CENTERLINE FOR TOP OR BOTTOM MTG., OR FROM B-B' FOR SIDE MTG.



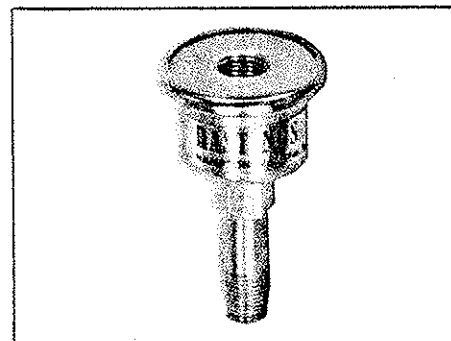
# HASTINGS •

## INSTALLATION ACCESSORIES for VACUUM GAUGE TUBES

### SAVE TIME - TROUBLE - TUBES

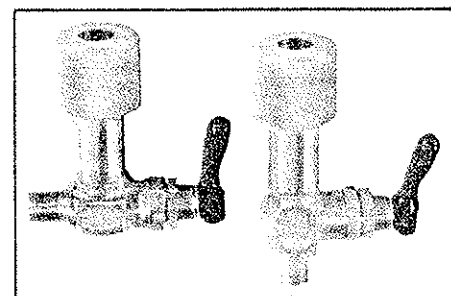
#### DROP-OUT TRAP Type DO-1

A particle drop-out trap which also provides an effective optical baffle. It has the equivalent of eight 90 degree bends. Protects gauge tube from flying particles, evaporated metals, etc. The gauge tube threads into the trap which installs in existing gauge tube fitting. Simple piggy-back installation. "Monel"/nickel plated brass constructed. Clean with steam, solvents, air hose, ultrasonics, etc. 1/8" NPT fittings: female for gauge tube, male to system.



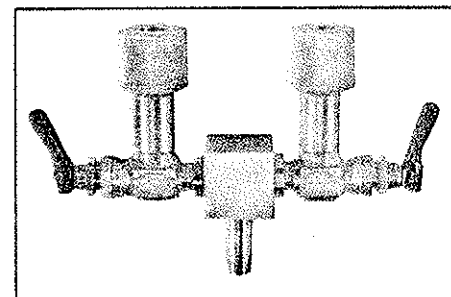
#### VALVED QUICK CONNECT Type OS-V & OS-VR

Provides a quick-connect "O" ring seal fitting for the gauge tube with toggle type shut-off valve. Permits removal and replacement of a gauge tube in many systems without "breaking" the entire system to atmospheric pressure. Also permits closing off tube during "dirty" portion of cycle. Installs in 1/8" NPT female thread. Type OS-VR is right angle pattern valve. Size: 1" x 3" x 3 1/2" Brass construction.



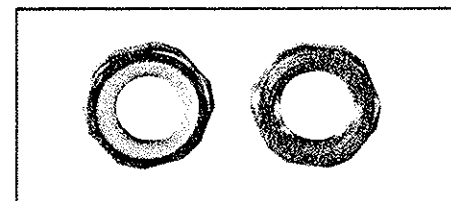
#### DUAL VALVED QUICK CONNECT Type OS-V2

Similar to above except permits use of an additional tube in a second pressure range, or as a calibration check against production tube. Keeps an unused spare ready to go. Installs in 1/8" female threaded fitting of existing gauge tube. Adjustable for angled or straight installation. Brass construction, 7 1/2" x 1" x 3 3/4".



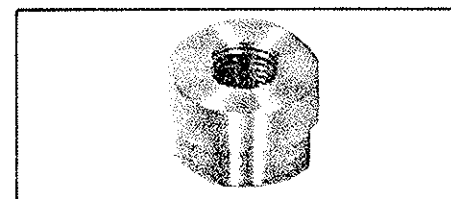
#### HASTINGS SEAL-NUT Type OS-H

A metal hex nut with "Teflon" insert. Threads over 1/8" NPT male thread and jams against fitting to provide a dry, non-shredding reusable vacuum tight seal. Eliminates messy liquid sealants. Use to install gauge tubes, quick connects, drop-out trap and other 1/8" NPT male fittings in vacuum systems. Supplied in packages of 10, 25, 50 and 100.



#### TEE ADAPTOR Type OS-J

Adaptor solders into standard tubing "tee" to provide 1/8" NPT thread for gauge tubes, valved quick connects, DO-1, etc. Four sizes fit 3/4", 1", 1 1/4" and 1 1/2" OD tees. Nickel plated brass construction.



HASTINGS INSTALLATION ACCESSORIES  
FOR VACUUM GAUGE TUBES

Price List

TYPE	DESCRIPTION	PRICE
DO-1	Particle Drop-Out Trap	\$24.00
OS-V	Valved Quick Connect (Straight pattern)	16.00
OS-VR	Valved Quick Connect (Right angle)	17.00
OS-V2	Dual Valved Quick Connect	39.00
OS-A	Quick Connect (5/8" OD)	7.00
OS-V	Quick Connect (3/8" NPT)	7.00
OS-C	Quick Connect (Tube threads to 8 mm OD)	7.00
OS-D	Quick Connect (1/2" union)	12.00
OS-E	Quick Connect Drain Plug	8.00
OS-F	Quick Connect (1/8" NPT)	8.00
OS-G	Plug for Quick Connect	package of 5 6.00
OS-H	Hastings Seal Nuts (1/8" NPT)	package of 10 6.00 package of 25 13.00 package of 50 23.00 package of 100 38.00
OS-J75	Tee Adaptor (for 3/4" OD tee)	package of 3 6.00
OS-J100	Tee Adaptor (for 1" OD tee)	package of 3 7.00
OS-J125	Tee Adaptor (for 1-1/4" OD tee)	package of 3 8.00
OS-J150	Tee Adaptor (for 1-1/2" OD tee)	package of 3 9.00

Prices are subject to change without notice

All Prices F.O.B. Hampton, Virginia

Terms: Net 30 Days

HASTINGS-RAYDIST  
A Teledyne Company  
Hampton, Virginia 23361 U.S.A.

Telephone: 703-723-6531

TWX: 710-882-0085





HASTINGS-RAYDIST

TELEPHONE COMPANY

Specification Sheet No. 353

# HASTINGS ●

## REFERENCE TUBE

### A QUICK CALIBRATION DEVICE FOR HASTINGS VACUUM GAUGES

#### General:

The Hastings Reference Tube is an evacuated, sealed vacuum gauge tube accurately calibrated and marked at its exact pressure. It is electrically equivalent to the metal and Pyrex gauge tubes used with Hastings Instruments. It permits quick and easy recalibration of Hastings Vacuum Gauge Indicators by merely plugging the instrument into the reference and adjusting the calibration "current set" potentiometer until the instrument reads the exact pressure noted on the reference. Hastings Reference Tubes are available equivalent to each Hastings Gauge Tube.

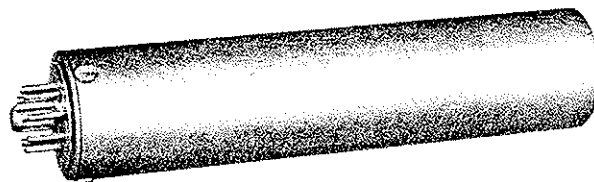
#### Construction:

Hastings Reference Tubes employ the same patented Hastings noble metal thermopile used in all Hastings Vacuum Gauge Tubes. The thermopile is sealed in a Pyrex glass capsule which has been evacuated, baked, outgassed, sealed and then aged to insure stability over long periods of time. The sealed capsule is then housed in a protective metal shell to provide a rugged, trouble-free assembly.

#### Calibration:

Considerable care and time are required in the manufacture to obtain the high degree of precision and stability required for the reference tube.

The thermopile is matched to the reference letter of the customer's tubes and maintains its calibration over long periods of time. However, for applications requiring the highest possible degree of accuracy a periodic return of the Reference Tube to the factory for a check and recalibration may be desirable. An annual or semi-annual check assures the customer of an accurate and reliable reference at all times.



- Instant Calibration Check
- Recalibration of Hastings Gauges
- Adjusts Gauge for Any Length Cable

**STABLE, ACCURATE, RUGGED, RELIABLE**

#### Application:

Hastings Vacuum Gauge Indicators, Controllers or Recorders can be checked or recalibrated in seconds by merely plugging the gauge tube cable into the reference tube. If calibration adjustment is necessary the "Current Set" potentiometer is adjusted until the instrument indicates the exact pressure marked on the reference tube. The customer now knows his instrument is correctly calibrated.

Whenever cable lengths between gauge tube and instrument are changed some error may be introduced, requiring that the instrument be re-adjusted to compensate for any losses involved. By plugging the Reference Tube into the new cable and readjusting the instrument for a correct reading, this "error" is eliminated.