



**Heise Bourdon
Tube Gauges
Models "CC",
"CM" and "CMM"
Installation and
Maintenance Manual**



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1.0 PURPOSE AND SCOPE OF MANUAL

This manual is provided by Ashcroft Inc. to guide users of the Heise Models "CC", "CM" and "CMM" Bourdon tube precision pressure gauges in:

- (1) Installing the equipment
- (2) Routine operations

The instructions in this manual are designed to be performed by qualified instrument maintenance personnel.

Ashcroft Inc. does not recommend trouble-shooting or repairs beyond the scope of this manual. Problems, which cannot be remedied by following the instructions in this manual, should be referred to the manufacturer. Immediate assistance can often be supplied by telephone. Defective components will be repaired or replaced by the manufacturer at his discretion and will be returned to the user by the same mode of shipment. Airmail or air express is recommended for urgent shipments. Returned goods should be accompanied by information requested in Section 6.

Additional Assistance

Contact Customer Service at:
Ashcroft Inc.
250 East Main Street
Stratford, CT 06614
Phone: 203-378-8281

1.1 SAFETY PRECAUTIONS

Bourdon tube pressure gauges must be selected and used in accordance with recognized industry codes and safety practices to avoid the possibility of misuse or misapplication, which could result in personal injury or property damage. Personnel responsible for selection and installation should also be familiar with the safety recommendations of ANSI B40.1, that apply to elastic pressure elements and their application in general and specific services. ANSI B40.1 is available from:

ANSI
1430 Broadway
New York, NY 10018 or

ASME
345 47th Street
New York, NY 10017

- | | |
|----------------|---|
| 1. Pressure | – Select a range so that the maximum applied pressure will never exceed the upper range limit. |
| 2. Vibration | – Excessive vibration could cause loosening of components resulting in loss of instrument accuracy or failure to provide valid data. |
| 3. Pulsation | – Excessive pressure pulsation could result in fatigue failure of the pressure element. |
| 4. Temperature | – Operation of the instrument in an environment where temperatures are in excess of design ratings may result in loss of accuracy and failure. |
| 5. Process | – Pressure boundary materials must be resistant to the process media. Failure to assure compatibility may result in pressure sensing element deterioration or failure. Instruments used on high-pressure gas, or potentially hazardous service, such as oxygen should be carefully selected in accordance with the recommendations of ANSI B40. |

See also Section 3.2

2.0 PRODUCT DESCRIPTION – THEORY OF OPERATION – CONSTRUCTION

2.1 PRODUCT DESCRIPTION

The Heise Bourdon Tube Gauge

The Heise plant specializes in the manufacture of precision pressure gauges based on the principle of the Bourdon tube. Scientific design of the tube section and other significant features and scrupulous adherence to high quality in manufacturing methods make the Heise Gauge a superior instrument for applications where accuracy is paramount. The Heise Gauge is accurate to 0.1% of full scale, including the effect of hysteresis.

Some of the more recent developments available in Heise gauges are:

The Clean "Utilized" Single and Multicoiled Bourdon tube free from internal entrapments leak proof and virtually eliminates hysteresis and creep.

The longer scale extending to 300° of pointer travel in the Model CC Gauge, 350° in the Model CM Gauge and 660° in the Model CMM Gauge.

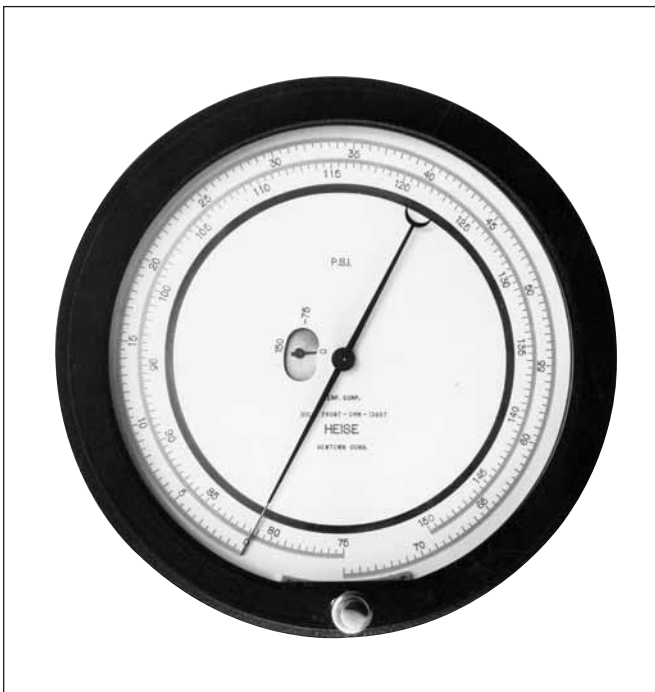
The Solid Front Safety Gauge Case which provides a heavy cast aluminum front wall and a blow out back.

Tube Tip Bleeder for purging, flushing or bleeding the Bourdon tube.

Micro-slide by which the gauge may be conveniently adjusted in the field.



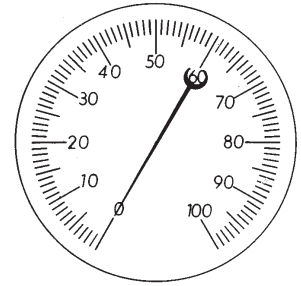
Model CC and CM



Model CMM

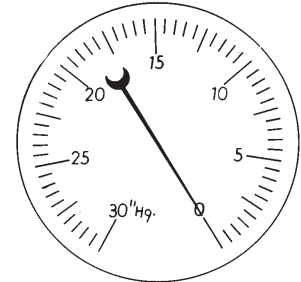
Pressure Gauge

A gauge to measure and indicate pressure using ambient* pressure as a datum point.



Vacuum Gauge

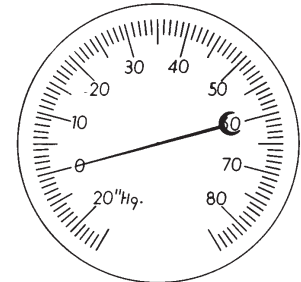
A gauge to measure and indicate pressure below ambient, using ambient* pressure as the datum point.



Compound Gauge

A gauge to measure and indicate pressure both above and below ambient* pressure, using ambient pressure as the datum point.

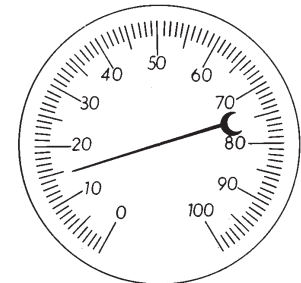
*Ambient pressure equals pressure surrounding the measuring element, generally atmospheric pressure.



Absolute Pressure Gauge

A gauge to measure and indicate pressure above zero absolute pressure, using absolute zero pressure as a datum point.

The Heise Absolute Pressure Gauge does not incorporate Automatic barometric pressure compensation. The barometric pressure at the time of use must be set into the gauge by using the External Dial Adjuster.

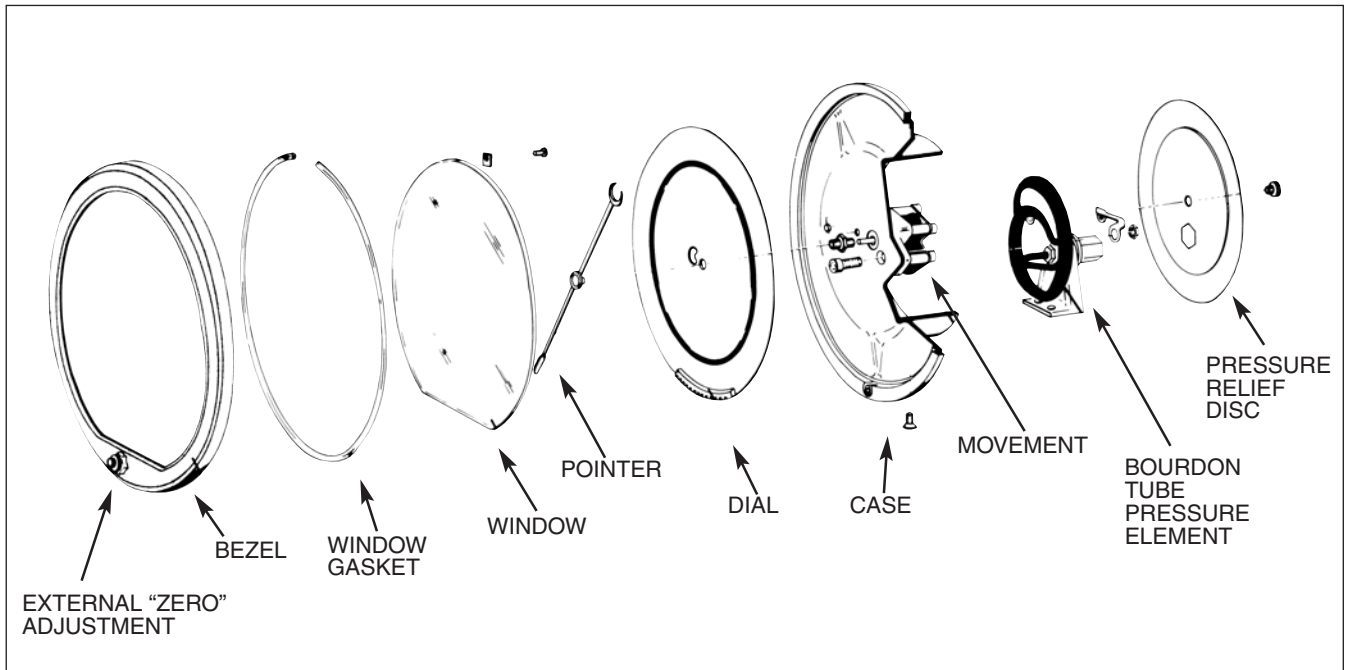


2.1.1. TYPES OF HEISE GAUGES

Heise Gauges are supplied to meet the individual needs of laboratories, instrument shops and engineering departments throughout the world.

Four standard dial sizes, 6", 8½", 12" and 16" and numerous pressure ranges between 12 psi and 100,000 psi are available. Dials are provided to meet specification and may be graduated to read in standard English or metric units of pressure. Special dials in other pressure related engineering units, or with double scale to eliminate need for conversion, are available.

Where specified, gauges have been equipped with automatic thermal compensator, slotted link for protection against sudden pressure release, peak load indicating pointers, or other optional features.



2.2 THEORY OF OPERATION

The Bourdon Tube Gauge is a calibrated pressure indicating instrument operated by the effect of internal pressure on a tube, which is oval in cross section and is bent into a circular arc. Pressure within the tube tends to straighten it. The motion of the free end of the Bourdon tube is transmitted by a linkage and a movement to a pointer, which moves across a graduated dial to indicate the pressure.

2.3 CONSTRUCTION

2.3.1 CASE AND BEZEL

Solid Front Case

A solid front case of cast aluminum protects the operator when working with high-pressure systems. In the event of tube rupture through excessive over-loading, protection is provided by this wall.

Blow-Out Safety Back

A light gauge stainless steel disc, covering the entire back of the gauge case, is spring-loaded against a seal machined in the periphery of the case. An abnormal rise of pressure within the gauge case causes this disc to flex outward, releasing the pressure.

Bezel

A hinged bezel protecting the dial and pointer is equipped with an external dial zero adjustment. It is also the mounting for the lens.

External Dial Zero Adjustment

A co-axial zero adjustment knob on the front of the gauge case, makes it possible to set dial zero to atmospheric pressure or other benchmarks required.

Limit Stops

High and low pressure limit stops are mounted on the interior of the gauge case, restraining tube tip travel within the rated operating range of the gauge.

2.3.2 BOURDON TUBE SERVICE

Heise Clean Bourdon Tube

The most highly developed pressure sensing element in the industry, the Heise Bourdon tube was the 'first' to lend itself to certain and positive cleaning. A product of more than 40 years of intensive, continuous research, the "unitized" one-piece Heise tube system is an outstanding example of modern technology.

Through exclusive Heise tube section designs and manufacturing technique, uniform stress distribution is provided in a wide range of tubes of varying sectional configurations formed from a single piece of metal.

Tubes of #403 Stainless Steel are standard for ranges 50 psi and above. Beryllium Copper may be supplied for low pressures and special applications. See Sections 5.1 and 5.2 for additional information.

The Bourdon Tube used in the Model CM and Model CMM Gauges is a "Unitized" multi-coiled element, which is approximately three times the length of tubes used in competitive gauges. The greater length results in a much lower deflection rate, provides minimal fiber stress and virtually eliminates hysteresis, creep and fatigue effect.

"UNITIZED" tube design eliminates soldered, welded or threaded joints, providing controlled stress distribution.

Internal traps in which foreign matter may accumulate are also eliminated. The interior of the Heise tube may be easily cleaned by flushing or purging.

Heat Treatment

Bourdon tubes are heat treated in high vacuum, maintaining internal cleanliness and optimizing mechanical properties.

Ultra-High Pressure Gauges

Heise laboratories pioneered and continues to lean in the development of precision Bourdon tubes for ultra-high pressure gauges in ranges to 100,000 psi.



HEISE multi-coiled Bourdon tube

External Bleeder Cap

High accuracy in measurement is enhanced by efficient bleeding of entrapped fluids from the Bourdon tube. The bleeder also facilitates flushing, cleaning and purging. It is an integral part of the Bourdon tube and is accessible by removal of the blow out back.

Pressure Connections

Pressure connections may be either bottom or back locations.

End Piece Assembly

The end piece assembly is pivotally mounted on the free end of the Bourdon tube. It comprises a quadrant and clamp arrangement to permit adjustment of its angular position, and a quadrant slide upon which the connecting link is pivoted. It is used to establish the angular relationship of the connecting link and the sector slide, which controls linearity in the pointer movement.

Connecting Link

The Connecting Link transmits motion from the end piece assembly to sector slide of the movement.

2.3.3 MOVEMENT

Integral Movement

A basic concept in unified instrument design, a single rigid casting supports all moving parts of the gauge in one unit, maintaining critical alignment under all conditions. No significant calibration error occurs in the Heise gauge, resulting from distortion or shifting of supporting parts.

Ball Bearing Pinion Shaft

Friction and wear are minimized and sensitivity improved at the pinion shaft by precision miniature stainless steel ball bearings. Smooth action at this critical point in the movement assures an immediate, accurate response to minute pressure changes, making the Heise gauge the most sensitive instrument in its field.

Gear Sector and Drive

The gear sector drives the pointer pinion directly in the Model "CC" and "CM" and through a compound gear in the Model "CMM". The pointer pinion is spring loaded against the backlash by a hairspring in the Model "CC" and "CM", and through an idler gear in the Model "CMM". For maximum accuracy it is important that the original tooth relationship be maintained throughout the system. If for any reason the gears are to be disengaged they should first be marked to assure correct re-engagement.

Hair Spring

The Hair Spring takes up backlash in the gearing and maintains the smooth sensitive action of the movement. This spring has been pre-set to approximately 2 turns counter clockwise. Lack of tension will result in erratic pointer motion. Should this occur in the field the gears may be disengaged, observing the precautions noted above, the hairspring tightened, and the gears re-engaged.

Sector Slide

The Sector Slide is mounted on the gear sector. It permits adjustment of the ratio of pointer travel to Bourdon Tube motion by altering the multiplication through the "Micro-Slide" adjustment. This adjustment controls the pointer travel or range of the gauge.

Micro Slide Adjustment

The micro slide adjustment provides convenient and simplified development in calibration methods. When required, precise recalibration adjustment may be made in the total effective length of the sector slide. The micrometer screw attached to the slide may be adjusted to .005", when extremely minute corrections are necessary. The preloaded adjustment spring stabilizes the calibration setting against accidental shock.

End Piece Adjustment

The unique quadrant and slide design of the Heise adjustable tip piece permits simple and accurate adjustment of the angular relationship between the connecting link and sector slide. This adjustment controls linearity; coupled with the range adjustment it may be used to readily recalibrate the gauge.

Thermal Compensator

Holds the gauge in calibration through ambient temperature changes from -25°F to +125°F (optional).

2.3.4 DIAL AND POINTER

Concentric Dial Mounting

The dial is supported at the center by a dial pivot, which passes through the solid front gauge case and extends into an aligning recess in the base casting of the movement. This provides concentricity of the dial and movement pointer shaft, assuring maximum accuracy.

Dial

Black dial graduations on a white background are clearly defined and high legible assuring the resolution necessary to obtain accurate measurements.

Mirror band, eliminating parallax-reading errors, is standard on all Heise dials.

Each gauge carries an individual serial number on the dial to facilitate identification.

For standard dial graduations see Graduation Tables (Section 5).

Pointer

The reading end of the knife-edge pointer provides a plane, which is perpendicular to the mirror band on the dial face, eliminating parallax.

External Dial Zero Adjustment

A co-axial zero adjustment knob on the front of the gauge case, makes it possible to set dial zero to atmospheric pressure or other benchmarks required. One knob rotates the dial, but not the pointer, through approximately 30 degrees of arc; the other knob locks the bezel. A friction brake, acting on the dial, prevents accidental rotation.

Where a constant value is to be carried through a series of readings, such as a tare, this adjustment eliminates the need for computing values at each reading.

2.4 OPTIONAL FEATURES

Special Range Scales

A Heise gauge may be ordered with special range scales to indicate pressure or pressure equivalent units in any scale desired. Commonly used scales include standard English, metric (kg/cm², bar, mm Hg, etc.) or SI (Pascal) units, feet of water (fresh-sea), force on ram, absolute, vacuum, compound (vacuum-pressure), or dual scale.

Thermal Compensator (Patented)

The thermal compensator comprises a bimetal bar forming part of the linkage between the tip of the Bourdon tube and the gear segment slide of the gauge movement. Deflection of the bimetal bar, resulting from a change in ambient temperature, causes the point at which motion is imparted to the gear segment slide, to move in an arc – changing both the angular position and effective length of the slide.

Operation of the Heise thermal compensator is completely independent of the tube material, permitting its use with any Bourdon tube as selected for optimum service in a specific application. Correction for ambient temperature change is completely automatic and requires no adjustment of the compensator, pointer or dial for any variation from –25°F to +125°F.

Slotted Link

When test gauges are used for tensile testing, compressive strength testing or similar applications, a sudden release of pressure is the norm. A slotted link prevents violent flutter of the pointer and possible damage to the gauge movement.

Peak Load Indicator

Retaining the highest reading reached after pressure on the gauge has receded; the peak load indicator is mounted through the window, over the indicating pointer. Movement of the pointer actuates the peak load indicator in a positive direction only. An exterior knob permits convenient resetting for subsequent readings. Available on models CC and CM.

Carrying Case

Sturdy, high impact resistant case, black grain finish, with protective insert, for carrying 6" or 8½" Heise bottom connected gauges. Measures 12" x 13" x 4½".

3.0 INSPECTION, INSTALLATION AND OPERATION

3.1 UNPACKING AND INSPECTION

Every Heise gauge is carefully packed to prevent shipping damage.

After unpacking, visually inspect the gauge for any damage that may have occurred during shipment.

If damage is observed consult factory for further instructions.

Heise gauges are shipped with a small piece of plastic sponge between the pointer hub and the inside of the glass. This prevents the pointer from "whipping" during shipment. When your new gauge is unpacked, this cushion should be removed and discarded.

To remove bezel and glass remove the inner small chrome knob at the bottom of the bezel. Lift the bottom of the bezel and slide it off of the upper hinge pin.

Note – When replacing the bezel gently turn the outer dial adjustment knob (large chrome knob) to assure that the gear teeth on the adjuster mesh with the rack on the dial.

All Heise gauges are accurately calibrated to ±0.1% of full scale, or better, against standards that are traceable to the N.I.S.T. A certified copy of test results is furnished with each gauge. Standard conditions for calibration conform to N.I.S.T.

To inspect gauge for accuracy after unpacking, follow instructions in Section 4.0 – Calibration.

Important Information

Gauges for use with corrosive or hazardous media such as mercury or radioactive solutions should be tested with a non-corrosive non-hazardous medium such as air, water or oil prior to acceptance. Faults found after an instrument has been contaminated will be the sole responsibility of the user.

Contaminated instruments may not be returned to the factory without written authorization. Failure to obtain authorization may inadvertently result in personal injury to Heise personnel and property damage.

3.2 INSTALLATION

Precautions

Where the gauge is to be used with oxygen, it should be clearly specified and the gauge dial will be so marked. In these cases, special precautions are taken to eliminate all trace of organic matter, which might otherwise cause an explosion hazard.

The gauge should not be used with hydrogen, mercury, or other elements or compounds deleterious to metals unless it has been specified for this use.

Gauges are factory calibrated in an upright, or vertical position, unless otherwise specified on the order. Gauges should always be mounted in the same position as calibrated to eliminate possibility of positional error. If gauges are to be mounted in other than vertical position the order should specify the angle in which to be mounted to permit factory calibration in same position.

Mounting dimensions are given in the dimensional drawings and charts in Section 5.

3.3 OPERATION

All Heise pressure gauges are precision instruments and certain precautions must be observed in their operation.

The gauge should be mounted in an upright position when connected to a liquid pressure system and the bleeder should be operated before readings are taken. Accurate readings on a liquid pressure system are impossible unless all air or other gas has been evacuated. All Heise gauges are equipped with a bleeder as an integral part of the Bourdon tube.

When operating the bleeder valve support the free end of the Bourdon tube with fingers to prevent disengagement of the gear teeth or possible bending of the link or tip piece. To operate the bleeder, the valve is opened slightly and pressure applied to the gauge to force fluid through it. Since some oil may have accumulated in the tube, it should be permitted to flow for several seconds. Any air or gas present in the gauge should then escape followed by a steady flow of the pressure medium. The bleeder may then be closed.

It is good procedure to apply full pressure on the gauge for several minutes before each period of use. The pressure should then be removed and the dial zero adjusted if necessary.

All Heise gauges are equipped with a dial adjuster and friction brake. The dial adjuster is operated from the front cover of the case and rotates the dial – not the pointer – through approximately 30 degrees. This adjustment may be set to agree with the barometric pressure so that the gauge reads in terms of absolute pressure. In tests involving an initial pressure, which is ordinarily carried through the calculations as a tare, a resetting of the dial will simplify the calculations by eliminating the tare figure entirely.

The Heise gauge is a “Test” or “Master” gauge and if properly cared for should retain its inherent accuracy indefinitely. However, where gauges are used for highly critical work over a long period of time, it is good practice to check them at regular intervals against a dead weight tester. The procedure for testing and adjusting is given in Section 4.0.

Pressure Surges

Utmost precaution must be taken at all times to protect the gauge from high-pressure surges or shocks. The sudden application or removal of pressure will cause the pointer to whip around, and by its inertia, to damage the multiplying mechanism, or move the pointer on its shaft.

When the gauge application requires the sudden release of pressure, a “Slotted Link” can be supplied to protect the mechanism.

Temperature Error

Heise gauges are typically used where temperatures are maintained within close limits. In cases where extreme temperature variations will be encountered, corrections may be calculated and applied to the gauge readings. When temperatures rise the Bourdon tube reads faster and when they drop it reads slower at a rate of one percent per 50°F. The Heise Automatic Thermal Compensator is recommended for greater accuracy and convenience in these cases. When equipped with the compensator, the gauge accuracy will be maintained through temperatures from –25°F to +125°F.

Loose Pointer

Gauge error may be caused by a loose pointer. If pointer shift should be suspected during a test, it can always be checked by returning to zero pressure. If it is necessary to correct the pointer, it should be pressed firmly on the shaft using the fingers only. The pointer should never be hammered in place.

4.0 CALIBRATION

4.1 CALIBRATION STANDARDS

In order to properly check and adjust the calibration of a precision gauge, a reliable standard of reference is required. Care should be taken in the selection of a dead weight tester since the resulting operation can be no more accurate than the standard on which it is based.

A primary pressure standard with accuracy of 0.025 percent of reading or better is recommended to properly check or calibrate the displayed value. Corrections for local gravity effects, air buoyancy, and temperature should be applied to the pressure standard to compensate for environmental conditions.

Note: If a secondary transfer standard is used, it should be of the same range as the instrument being tested and have accuracy of 0.025 percent of span or better.

4.2 CHECK CALIBRATION

Apply full pressure on the gauge for several minutes and then release the pressure. Re-zero the gauge, if necessary.

Load the gauge to 20 known pressures equally spaced within the range of the gauge and records the readings.

If the error exceeds the amount of permissible for the intended service, follow recalibration procedure. (Section 4.3).

4.3 RECALIBRATION PROCEDURES

The Bourdon tube must be completely free of entrapped gas or, if tested with gas, must be free of any liquid.

Load the gauge to full-scale pressure and return to zero.

Adjust the pointer to zero with the dial centered.

Load the gauge to one-half scale pressure and record the reading.

Load the gauge to full-scale pressure and observe that reading. If linearity is normal, the reading at full-scale pressure should be double the reading at one-half scale pressure so as to produce a straight-line relationship.

If the readings are not linear, recalibration procedure as follows is indicated:

The first adjustment is to “straight line” the gauge. That is to make the readings linear or proportional to the load. At this point the actual value of the readings at any given load is secondary. Once linearity has been established, range adjustment to bring the full scale reading into agreement with the full-scale load will complete the calibration.

4.3.1 LINEARITY ADJUSTMENT

Remove the bezel and the back blow out cover.

CAUTION:

At this point it is advisable to mark the tooth relationship between the sector and its mating pinion. If the sector and pinion are accidentally disengaged these marks will assist in proper re-alignment. For optimum performance the original tooth engagement should be maintained.

4.3.1.1

To compensate for a full scale reading greater than twice the one-half scale reading:

Loosen the two clamping screws on the quadrant slide and slide it upward thereby decreasing the angle α . Or, if the error is slight, rotate the pointer and pinion shaft counter clockwise to indicate about twice the extent of the error. Holding the pointer in this position release the quadrant clamp screw permitting the Bourdon Tube to adjust its position when reclamp. This also results in a decrease in angle α .

4.3.1.2

To compensate for a full-scale reading less than twice the one-half scale reading use the same procedure outlined in 4.3.1.1 except as follows:

Move the quadrant slide outward, thereby increasing the angle α , or rotate the pointer and pinion shaft clockwise to indicate about twice the amount of the error. Holding the pointer in this position release the quadrant clamp screw permitting the Bourdon Tube to adjust its position then reclamp. This also results in an increase in angle α .

4.3.1.3

Reset the pointer to zero and repeat linearity check to evaluate the adjustment. Repeat until linearity is established within the desired tolerance.

4.3.1.4

Check Range: Starting with the pointer at zero apply full-scale pressure. If the full-scale reading does not agree with the applied pressure adjust the range as follows:

4.3.2 RANGE ADJUSTMENT**4.3.2.1**

Load the gauge to full-scale pressure by dead weight and note the reading on the gauge. If the full-scale reading is not correct within the required tolerance proceed as follows:

If the pointer indicates greater pressure than the dead weight, turn the Micro-Slide adjusting screw counter clockwise.

If the pointer indicates less pressure than the dead weight, turn the Micro-Slide adjusting screw clockwise.

Should the range adjustment be excessive, loosen the two Micro-Slide clamping screws and move the slide inward to increase the range and outward to decrease the range.

4.3.2.2

Adjustment of the Micro-Slide screw changes the amount of pointer travel between zero and full scale. It is necessary after each adjustment to return the pressure to zero, readjust the pointer to zero and repeat to determine the effectiveness of the adjustment.

Adjustment of the Micro-Slide screw requires a movement of approximately 180 degrees in order to have a pointer show a change of $\frac{1}{2}$ of one percent of full scale reading

on most gauge dials. To correct some gauges an adjustment of as little as .0005" or a turn of approximately 10° of the Micro-Slide screw is required. The adjusting screw may be operated with a small Allen wrench.

4.3.2.3

When range has been adjusted within the required tolerance, recheck linearity adjustment.

Range and linearity adjustments are interrelated and must be checked together to achieve proper calibration.

4.3.3 FINAL ADJUSTMENT

The range and linearity adjustments are inter-dependent and must be coordinated, with linearity established, fine re-adjustment may be made in range and linearity rechecked to bring both adjustments within the desired limits of accuracy.

4.3.4 CHECK FOR HYSTERESIS**4.3.4.1**

Connect the gauge to the dead weight tester in a vertical operating position.

If the gauge has been drained, fully or partially, air may be entrapped in the Bourdon tube and this trapped air must be removed through the bleeder valve to insure positive, accurate response.

If the gauge has been used with and contains mercury, care should be taken to avoid contamination of brass tubing and fittings on the tester.

Gauges used in pneumatic systems should, of course, be cleaned of oil, water, or similar entrapped matter before use.

4.3.4.2

Set the pointer to zero using the dial adjustment.

4.3.4.3

Applying the pressure slowly, load the gauge to one half-scale pressure and record the reading.

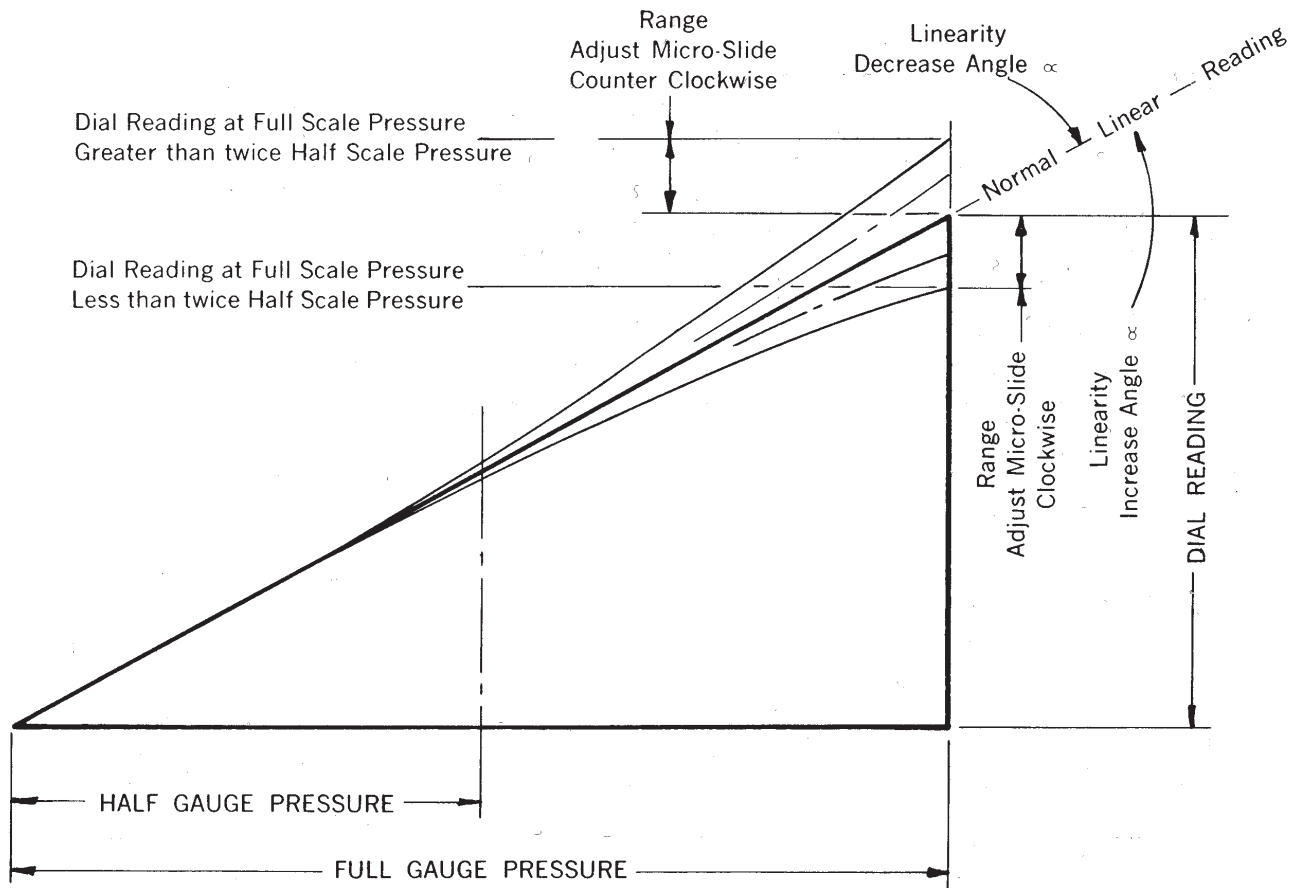
4.3.4.4

Load to full-scale pressure, release to one-half scale pressure and compare the reading.

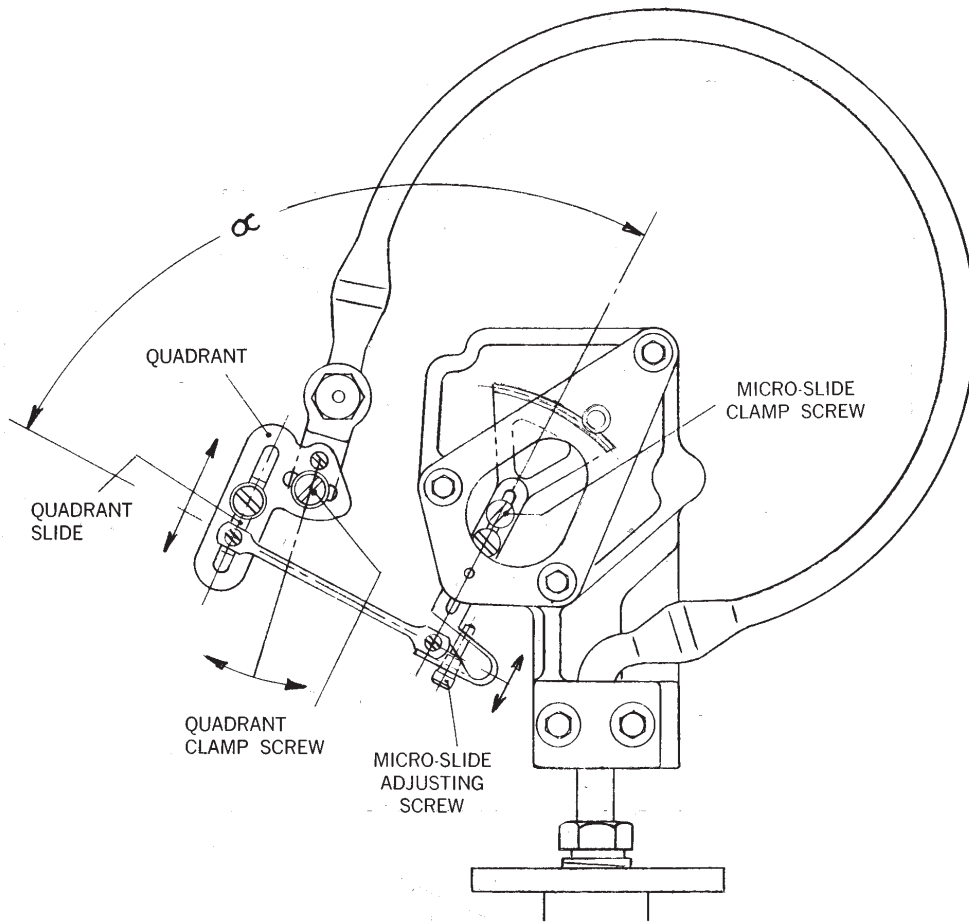
4.3.4.5

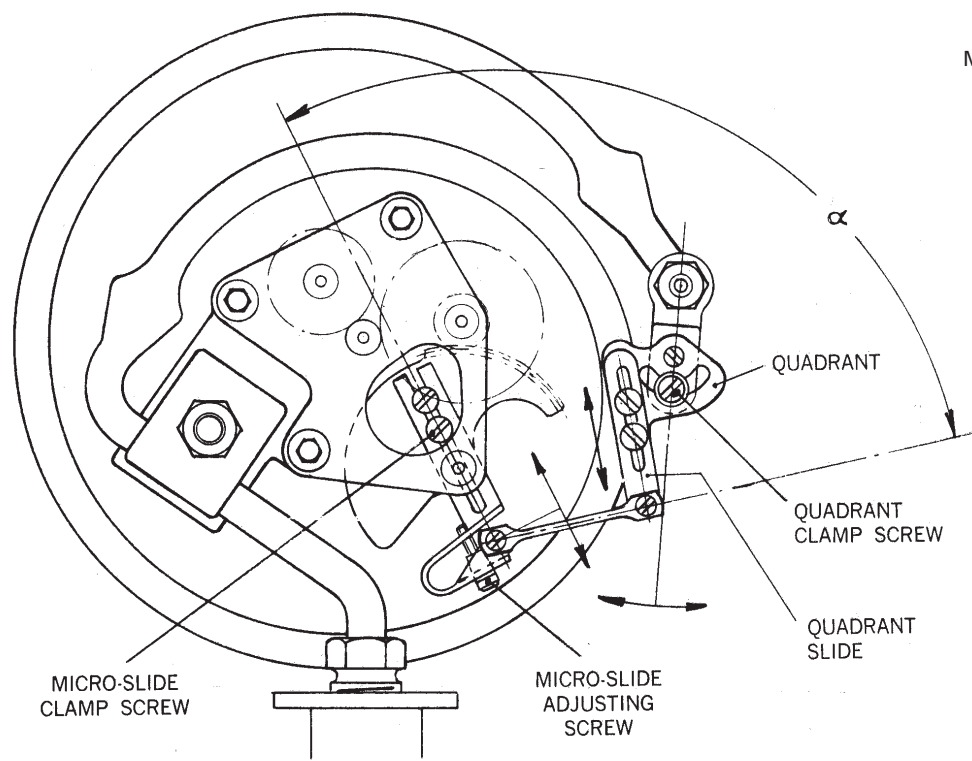
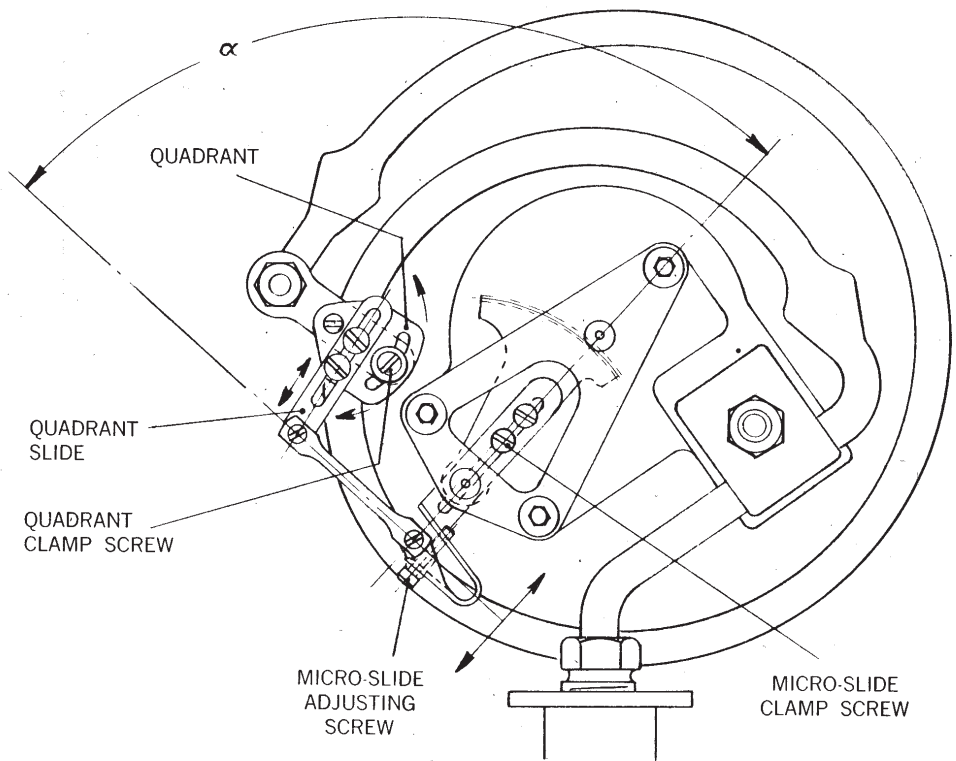
If the second reading is higher than the first it may be caused by either hysteresis or friction. With dead weight still at one-half load, tap the gauge gently. If the pointer returns to substantially the original one-half load reading, the difference in readings was caused by friction. If the amount of tap is not excessive it might be considered satisfactory for use. It is normal procedure to tap an instrument to observe its sensitivity. If the tap is excessive it is usually remedied by cleaning the mechanism with solvent such as ether, carbon tetrachloride, Freon, etc.

If after tapping the gauge the pointer still reads higher than the first reading, the cause is hysteresis. Increased hysteresis effect may be brought about by crystallization of the Bourdon tube due to excessive cycling. A similar condition may result from exposure to excessively high pressure causing a partial fracture of the tube. A new tube is the only remedy for these conditions and it should be installed at our plant.



Model "CC"





5.0 SPECIFICATION-RANGES-DIMENSIONS

5.1 STANDARD SPECIFICATIONS

Accuracy

All Heise gauges are accurate to $\pm 0.1\%$ of full-scale reading throughout the entire dial range. All gauges are calibrated for vertical mounting. If installation is other than vertical, the order must specify mounting positions to assure proper accuracy. A certified copy of test results, traceable to the N.I.S.T., is furnished with each gauge. Standard conditions for calibration conform with N.I.S.T.

Sensitivity

0.01% of full scale

Repeatability

0.02% of full scale

Hysteresis

Not greater than 0.1% of full scale reading after application of maximum scale pressure. For optional AISI 316 stainless steel Bourdon tube hysteresis may exceed 0.1% of full scale.

Gauge Types

Pressure Gauge – A gauge to measure and indicate pressure using ambient* pressure as a datum point.

Compound Gauge – A gauge to measure and indicate pressure both above and below ambient* pressure, using ambient pressure as the datum point.

Vacuum Gauge – A gauge to measure and indicate pressure below ambient*, using ambient pressure as the datum point.

Absolute Pressure Gauge – A gauge to measure and indicate pressure above zero absolute pressure, using absolute pressure as a datum point.

The Heise Absolute Pressure Gauge does not incorporate Automatic barometric pressure compensation. The barometric pressure at the time of use must be set into the gauge by using the External Dial Adjuster.

Pressure Ranges

Model CC – From 0-12 psi to 30,000 psi

Model CM – From 0-15 psi to 100,000 psi

Model CMM – From 0-30 psi to 10,000 psi

Bourdon Tube Materials

Bourdon tubes are available in the following materials:

AISI 403 Stainless steel – standard for ranges 50 psi and above – optional below 50 psi.

Beryllium copper – standard for ranges below 50 psi – optional for ranges to 20,000 psi in Models CC and CM, to 5,000 psi in Model CMM.

AISI 316 Stainless steel – Model CC only in ranges up to 5,000 psi maximum. When used, hysteresis may be up to five times greater than 0.1% of full scale.

The Bourdon tube used in the Model CC is a “unitized” single coil while models CM and CMM use a “unitized” multi-coiled element, which is approximately three times the length of tubes used in competitive gauges. The greater length results in a lower deflection rate, which lowers stress and virtually eliminates hysteresis, creep, and increases tube life. The Bourdon tube incorporates the inlet, the tube, and bleeder in one piece.

Dial and Pointer

White dial, highly reflective mirror band, black graduations and a knife-edge pointer combine for maximum legibility and precise readings. The knife-edge pointer and mirror band eliminates parallax-reading errors.

External Dial Zero Adjustment

A co-axial zero adjustment knob on the front of the gauge case, makes it possible to set dial zero to atmospheric pressure or other benchmarks required.

5.4 GAUGE ASSEMBLY DRAWINGS

5.2 RANGES-GRADUATIONS-DIVISIONS

5.2.1 RANGE SELECTION CHART –
PSI-INCHES MERCURY-INCHES WATER

PSIG				
STANDARD BOURDON TUBE MATERIAL**	STANDARD RANGE PSIG	CC	CM	CMM
BERYLLIUM COPPER (J)	0-12/3-15	[Shaded]	[Shaded]	[Shaded]
	0-15			
	0-20			
	0-25			
	0-30			
	0-40			
	0-50			
403 STAINLESS STEEL (V)	0-60			
	0-75			
	0-100			
	0-150			
	0-200			
	0-250			
	0-300			
	0-400			
	0-500			
	0-600			
	0-750			
	0-1000			
	0-1500			
	0-2000			
	0-3000			
	0-4000			
	0-5000			
	0-6000			
	0-7500			
	0-10,000			
	0-15,000			
	0-20,000			
	0-25,000			
0-30,000				
0-40,000				
0-50,000				
0-60,000*				
0-75,000*				
0-100,000*				

*Available in 8½, 12, 16 Model "CM" only.

**For optional Bourdon tube materials see standard specifications. Shaded areas indicate gauge models available.

Inches Mercury				
STANDARD BOURDON TUBE MATERIAL**	STANDARD RANGE INCHES MERCURY	CC	CM	CMM
BERYLLIUM COPPER (J)	0-30	[Shaded]	[Shaded]	[Shaded]
	0-40			
	0-50			
	0-60			
	0-75			
AISI 403 STAIN. STEEL (V)	0-100			
	0-125			
	0-150			
	0-200			
	0-250			
	0-300			
	0-400			
	0-500			
	0-600			
	0-750			
0-1000				
Vacuum				
BERYLLIUM COPPER (J)	-30 to 0	[Shaded]	[Shaded]	[Shaded]
Compound				
	VAC-PRESSURE	CC	CM	CMM
BERYLLIUM COPPER (J)	15" Hg - 15" Hg	[Shaded]	[Shaded]	[Shaded]
	30" Hg - 30" Hg			
AISI 403 STAIN. STEEL (V)	30" Hg - 60" Hg			
	30" Hg - 100" Hg			
BERYLLIUM COPPER (J)	30" Hg - 150" Hg			
	30" Hg - 15 psi			
AISI 403 ST. STEEL (V)	30" Hg - 30 psi			
	30" Hg - 60 psi			
	30" Hg - 100 psi			
	30" Hg - 150 psi			
	30" Hg - 300 psi			
Inches Water				
STANDARD BOURDON TUBE MATERIAL**	STANDARD RANGE INCHES MERCURY	CC	CM	CMM
BERYLLIUM COPPER (J)	0-350	[Shaded]	[Shaded]	[Shaded]
	0-400			
	0-450			
	0-500			
	0-600			
	0-750			
	0-800			
	0-1000			

**For optional Bourdon tube materials see standard specifications. Shaded areas indicate gauge models available.

5.2.2 RANGE SELECTION CHART – METRIC

Metric						
STANDARD BOURDON TUBE MATERIAL**	STANDARD RANGE MILLIMETERS MERCURY			CC	CM	CMM
BERYLLIUM COPPER (J)	0-760					
	0-1000					
	0-1250					
	0-1500					
AISI 403 STAIN. STEEL (V)	0-2500					
	0-3000					
	0-4000					
	0-5000					
BERYLLIUM COPPER (J)	bar	kPa	mPa			
	kg/cm ²					
	kp/cm ²					
	0.2-1	–	–			
	0-1	0-100	–			
	0-1.6	0-160	–			
AISI 403 STAINLESS STEEL (V)	0-2	0-200	–			
	0-2.5	0-250	–			
	0-3	0-300	–			
	0-4	0-400	–			
	0-5	0-500	–			
	0-6	0-600	–			
	0-7.5	0-750	–			
	0-10	0-1000	0-1			
	0-12	0-1250	0-1.25			
	0-16	0-1600	0-1.6			
	0-20	0-2000	0-2			
	0-25	0-2500	0-2.5			
	0-30	0-3000	0-3			
	0-40	0-4000	0-4			
	0-50	0-5000	0-5			
	0-60	0-6000	0-6			
	0-75	0-7500	0-7.5			
	0-100	0-10,000	0-10			
	0-125	–	0-12.5			
	0-160	–	0-16			
	0-200	–	0-20			
	0-250	–	0-25			
	0-400	–	0-40			
	0-500	–	0-50			
	0-600	–	0-60			
	0-750	–	0-75			
	0-1000	–	0-100			
	0-1250	–	0-125			
0-1600	–	0-160				
0-2500	–	0-250				
0-4000	–*	0-400				
0-6000	–*	0-600				
0-7000	–*	0-700				
Vacuum						
BERYLLIUM COPPER (J)	–1 to 0	–100 to 0				

*Available in 8½, 12, 16 inch Model "CM" only.

**For optional Bourdon tube materials see standard specifications. Shaded areas indicate gauge models available.

5.2.3 GRADUATION TABLES

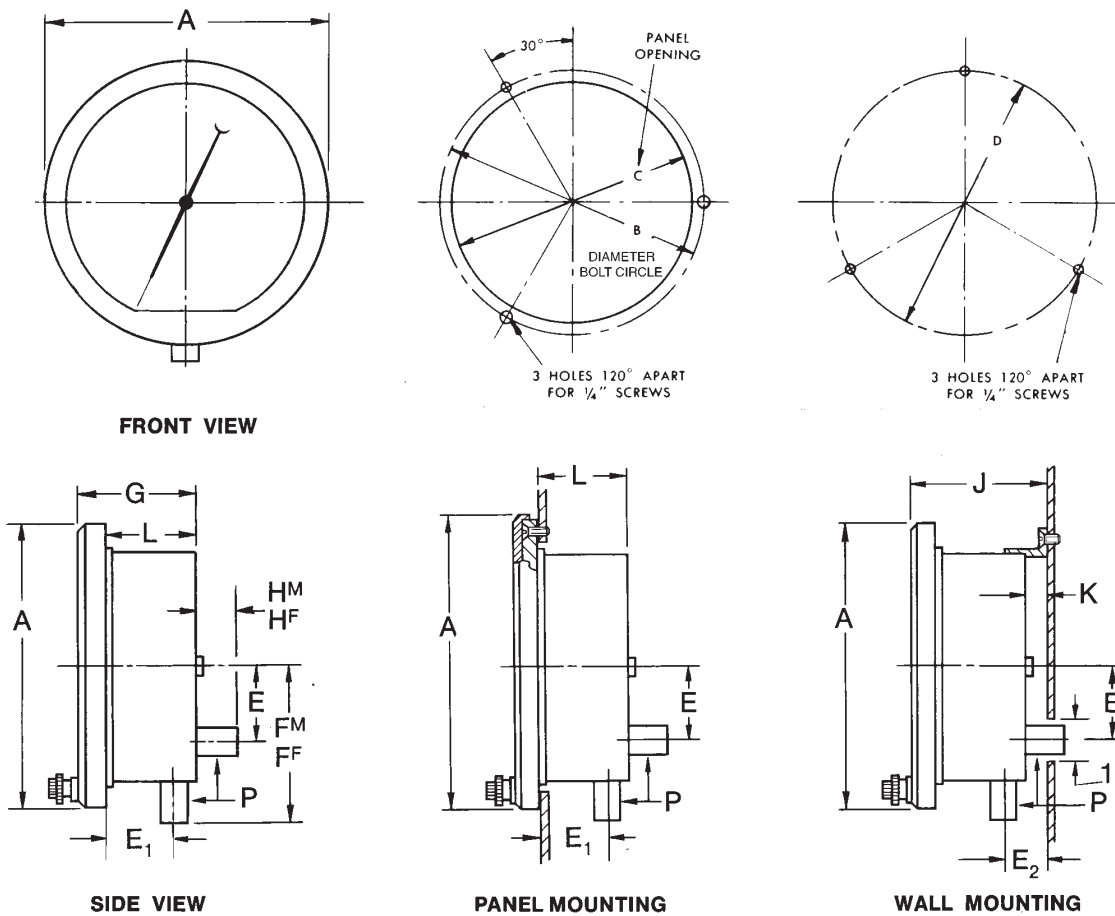
Scale for All Units of Measure	6" CM & 8 1/2" CC, CM				12" CC, CM & 6" CMM				16" CC, CM & 8 1/2" CMM				12" & 16" CMM				Scale for All Units of Measure
	Total Number of Divisions	Value per Division	Division Pattern	Numeral Value	Total Number of Divisions	Value per Division	Division Pattern	Numeral Value	Total Number of Divisions	Value per Division	Division Pattern	Numeral Value	Total Number of Divisions	Value per Division	Division Pattern	Numeral Value	
0-1	500	.002	1/5	.05	1000	.001	1/5	.05	1000	.001	1/5	.05	1000	.001	1/5	.05	0-1
0-1.6	800	.002	1/5	.1	800	.002	1/5	.1	800	.002	1/5	.1	1600	.001	1/5	.05	0-1.6
0-2	400	.005	1/2	.1	1000	.002	1/5	.1	1000	.002	1/5	.1	1000	.002	1/5	.1	0-2
0-2.5	500	.005	1/2	.1	1000	.0025	1/4	.1	1250	.002	1/5	.1	1250	.002	1/5	.1	0-2.5
0-3	600	.005	1/2	.2	600	.005	1/2	.2	1500	.002	1/5	.1	1500	.002	1/5	.1	0-3
0-4	400	.01	1/5	.2	800	.005	1/2	.2	800	.005	1/2	.2	1600	.0025	1/4	.1	0-4
0-5	500	.01	1/5	.2	1000	.005	1/2	.2	1000	.005	1/2	.2	1000	.005	1/2	.2	0-5
0-6	600	.01	1/5	.2	600	.01	1/5	.2	1200	.005	1/2	.2	1200	.005	1/2	.2	0-6
0-7.5	750	.01	1/5	.5	750	.01	1/5	.5	1500	.005	1/2	.5	1500	.005	1/2	.5	0-7.5
0-10	500	.02	1/5	.5	1000	.01	1/5	.5	1000	.01	1/5	.5	1000	.01	1/5	.5	0-10
0-15	750	.02	1/5	1	750	.02	1/5	1	1500	.01	1/5	.5	1500	.01	1/5	.5	0-15
0-16	800	.02	1/5	1	800	.02	1/5	1	800	.02	1/5	1	1600	.01	1/5	.5	0-16
0-20	400	.05	1/2	1	1000	.02	1/5	1	1000	.02	1/5	1	1000	.02	1/5	1	0-20
0-25	500	.05	1/2	1	1000	.025	1/4	1	1250	.02	1/5	1	1250	.02	1/5	1	0-25
0-30	600	.05	1/2	2	600	.05	1/2	2	1500	.02	1/5	1	1500	.02	1/5	1	0-30
0-40	400	.1	1/5	2	800	.05	1/2	2	800	.05	1/2	2	1600	.025	1/4	1	0-40
0-50	500	.1	1/5	2	1000	.05	1/2	2	1000	.05	1/2	2	1000	.05	1/2	2	0-50
0-60	600	.1	1/5	2	600	.1	1/5	2	1200	.05	1/2	2	1200	.05	1/2	2	0-60
0-75	750	.1	1/5	5	750	.1	1/5	5	1500	.05	1/2	5	1500	.05	1/2	5	0-75
0-100	500	.2	1/5	5	1000	.1	1/5	5	1000	.1	1/5	5	1000	.1	1/5	5	0-100
0-150	750	.2	1/5	10	750	.2	1/5	10	1500	.1	1/5	5	1500	.1	1/5	5	0-150
0-160	800	.2	1/5	10	800	.2	1/5	10	800	.2	1/5	10	1600	.1	1/5	5	0-160
0-200	400	.5	1/2	10	1000	.2	1/5	10	1000	.2	1/5	10	1000	.2	1/5	10	0-200
0-250	500	.5	1/2	10	1000	.25	1/4	10	1250	.2	1/5	10	1250	.2	1/5	10	0-250
0-300	600	.5	1/2	20	600	.5	1/2	20	1500	.2	1/5	10	1500	.2	1/5	10	0-300
0-400	400	1	1/5	20	800	.5	1/2	20	800	.5	1/2	20	1600	.25	1/4	10	0-400
0-500	500	1	1/5	25	1000	.5	1/2	20	1000	.5	1/2	20	1000	.5	1/2	20	0-500
0-600	600	1	1/5	25	600	1	1/5	25	1200	.5	1/2	20	1200	.5	1/2	20	0-600
0-750	750	1	1/5	50	750	1	1/5	50	1500	.5	1/2	50	1500	.5	1/2	50	0-750
0-760	760	1	1/5	40	760	1	1/5	40	1520	.5	1/2	40	1520	.5	1/2	20	0-760
0-1000	500	2	1/5	50	1000	1	1/5	50	1000	1	1/5	50	1000	1	1/5	50	0-1000
0-1500	750	2	1/5	100	750	2	1/5	100	1500	1	1/5	50	1500	1	1/5	50	0-1500
0-1600	800	2	1/5	100	800	2	1/5	100	800	2	1/5	100	1600	1	1/5	50	0-1600
0-2000	400	5	1/2	100	1000	2	1/5	100	1000	2	1/5	100	1000	2	1/5	100	0-2000
0-2500	500	5	1/2	100	1000	2.5	1/4	100	1250	2	1/5	100	1250	2	1/5	100	0-2500
0-3000	600	5	1/2	200	600	5	1/2	200	1500	2	1/5	150	1500	2	1/5	100	0-3000
0-4000	400	10	1/5	200	800	5	1/2	200	800	5	1/2	200	1600	2.5	1/4	100	0-4000
0-5000	500	10	1/5	250	1000	5	1/2	200	1000	5	1/2	200	1000	5	1/2	200	0-5000
0-6000	600	10	1/5	250	600	10	1/5	250	1200	5	1/2	200	1200	5	1/2	200	0-6000
0-7500	750	10	1/5	500	750	10	1/5	500	1500	5	1/2	500	1500	5	1/2	500	0-7500
0-10000	500	20	1/5	500	1000	10	1/5	500	1000	10	1/5	500	1000	10	1/5	500	0-10000
0-15000	750	20	1/5	1000	750	20	1/5	1000	1500	10	1/5	500	1500	10	1/5	500	0-15000
0-20000	400	50	1/2	1000	1000	20	1/5	1000	1000	20	1/5	1000	1000	20	1/5	1000	0-20000
0-25000	500	50	1/2	1000	1000	25	1/4	1000	1250	20	1/5	1000	1250	20	1/5	1000	0-25000
0-30000	600	50	1/2	2000	600	50	1/2	2000	1500	20	1/5	1000	1500	20	1/5	1000	0-30000
0-40000	400	100	1/5	2000	800	50	1/2	2000	800	50	1/2	2000	1600	25	1/4	1000	0-40000
0-50000	500	100	1/5	2500	1000	50	1/2	2000	1000	50	1/2	2000	1000	50	1/2	2000	0-50000
0-60000	600	100	1/5	2500	600	100	1/5	2500	1200	50	1/2	2000	1200	50	1/2	2000	0-60000
0-75000	750	100	1/5	5000	750	100	1/5	5000	1500	50	1/2	5000	1500	50	1/2	5000	0-75000
0-100000	500	200	1/5	5000	1000	100	1/5	5000	1000	100	1/5	5000	1000	100	1/5	5000	0-100000

Division Pattern



5.3 GAUGE CASE DIMENSIONS

5.3.1 MODEL "CC"



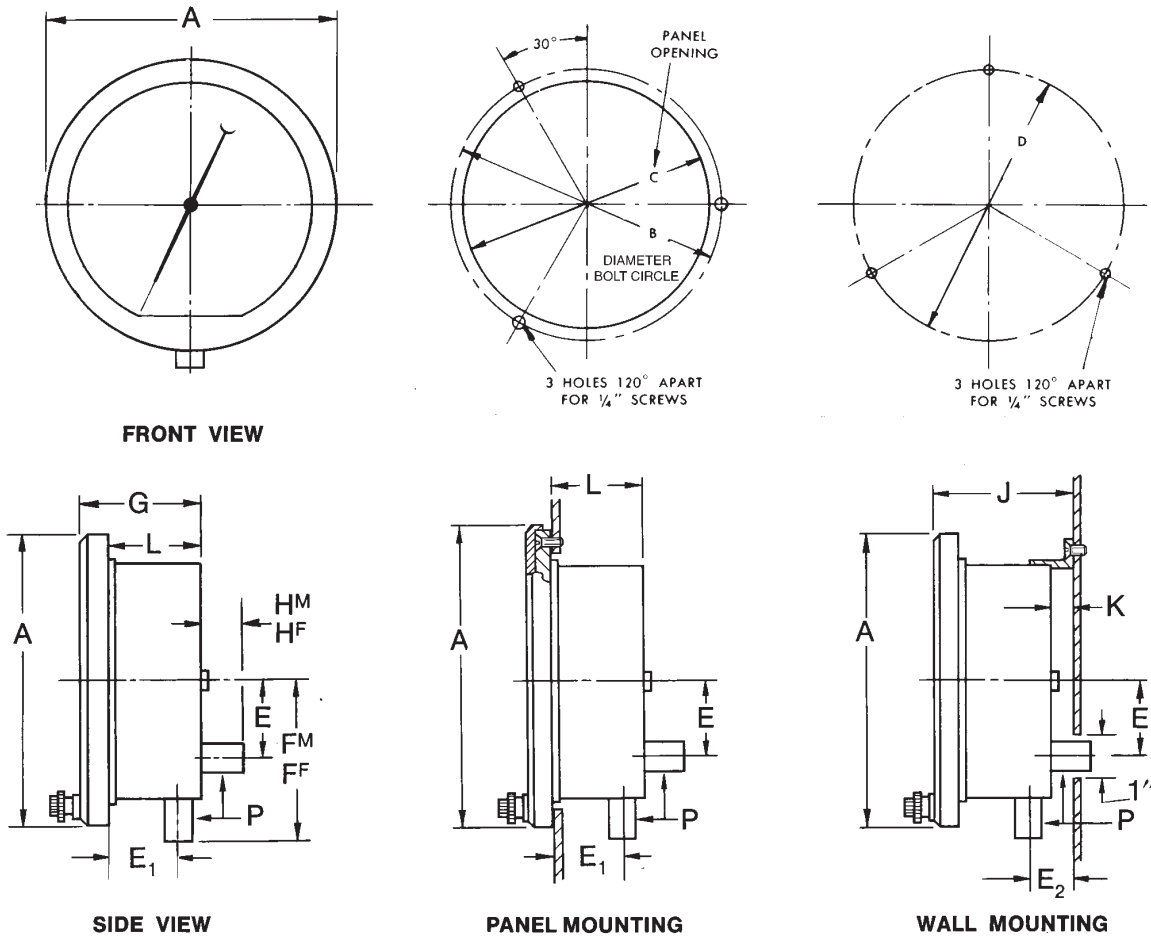
Model "CC"

Size	Dim. Units	A	B	C	D	E	E ₁	E ₂	F ^M	F ^F	G	H ^M	H ^F	J	K	L
8 1/2"	in.	10 ^{5/16}	9 ^{3/8}	8 ^{15/16}	9 1/2	3 1/4	1 ^{5/16}	1 ^{63/64}	5 ^{9/16}	5 1/4	3 1/2	1 ^{3/8}	1 ^{1/16}	4 ^{1/8}	4 ^{1/64}	2 ^{5/8}
	mm	261.9	238.1	228.6	241.3	82.6	33.3	50.4	141.3	133.4	88.9	35.0	27.0	104.8	16.3	66.7
12"	in.	13 ^{21/32}	12 ^{3/4}	12 ^{3/8}	9 1/2	3 1/4	1 ^{5/16}	1 ^{63/64}	5 ^{9/16}	5 1/4	3 1/2	1 ^{3/8}	1 ^{1/16}	4 ^{1/8}	4 ^{1/64}	2 ^{5/8}
	mm	346.9	323.9	314.3	241.3	82.6	33.3	50.4	141.3	133.4	88.9	35.0	27.0	104.8	16.3	66.7
16"	in.	17 ^{23/32}	16 ^{3/4}	16 ^{3/8}	9 1/2	3 1/4	1 ^{5/16}	1 ^{63/64}	5 ^{9/16}	5 1/4	3 1/2	1 ^{3/8}	1 ^{1/16}	4 ^{1/8}	4 ^{1/64}	2 ^{5/8}
	mm	450.0	425.5	415.9	241.3	82.6	33.3	50.4	141.3	133.4	88.9	35.0	27.0	104.8	16.3	66.7

Inlet Pressure Connection* P	Male - 1/8 Male NPT 1/4 Male NPT MS 33656-4	Female - 1/8 Female NPT 1/4 Female NPT	AND 10050-4 Aminco 45-11310 Autoclave F-250-C	
	Weight	Dial Size	8 1/2"	12"
	Net Weight	8 lbs.	10 lbs.	14 1/2 lbs.
	Shipping Weight	9 1/2 lbs.	12 1/2 lbs.	18 3/4 lbs.

*Standard Inlet Fittings: 1/4 NPT Female Back Connection for ranges up to and including 10,000 psi. AMINCO 45-11310 or AUTOCLAVE F-250-C for ranges over 10,000 psi.

5.3.2 MODEL "CM" AND "CCM"



Model "CM" and "CMM"

Size	Dim. Units	A	B	C	D	E	E ₁	E ₂	F ^M	F ^F	G	H ^M	H ^F	J	K	L
6"	in.	7 ⁷ / ₈	7	6 ¹ / ₂	7	2	1 ⁷ / ₈	1 ¹ / ₄	4 ⁹ / ₁₆	4 ¹ / ₄	3 ¹ / ₄	1 ³ / ₈	1 ¹ / ₁₆	3 ²⁷ / ₃₂	5 ⁵ / ₈	2 ¹⁵ / ₃₂
	mm	200	177.8	165.1	177.8	50.8	47.6	31.8	115.8	107.9	82.3	34.9	27	97.6	15.9	62.7
8 ¹ / ₂ "	in.	10 ⁵ / ₁₆	9 ³ / ₈	8 ¹⁵ / ₁₆	9 ¹ / ₂	2	1 ⁷ / ₈	1 ¹ / ₄	5 ⁴³ / ₆₄	5 ²³ / ₆₄	3 ¹ / ₄	1 ³ / ₈	1 ¹ / ₁₆	4 ¹ / ₃₂	5 ⁵ / ₈	2 ²¹ / ₃₂
	mm	261.9	238.1	228.6	241.3	50.8	47.6	31.8	144	136.1	82.3	34.9	27	102.4	15.9	67.4
12"	in.	13 ²¹ / ₃₂	12 ³ / ₄	12 ³ / ₈	9 ¹ / ₂	2	1 ⁷ / ₈	1 ¹ / ₄	5 ⁴³ / ₆₄	5 ²³ / ₆₄	3 ¹ / ₄	1 ³ / ₈	1 ¹ / ₁₆	4 ¹ / ₃₂	5 ⁵ / ₈	2 ²¹ / ₃₂
	mm	346.9	329.9	314.3	241.3	50.8	47.6	31.8	144	136.1	82.3	34.9	27	102.4	15.9	67.4
16"	in.	17 ²³ / ₃₂	16 ³ / ₄	16 ³ / ₈	9 ¹ / ₂	3 ¹ / ₄	1 ⁵ / ₁₆	1 ⁶³ / ₆₄	5 ⁹ / ₁₆	5 ¹ / ₄	3 ²⁵ / ₆₄	1 ³ / ₈	1 ¹ / ₁₆	4 ¹ / ₁₆	4 ¹ / ₆₄	2 ²¹ / ₃₂
	mm	450.1	425.2	415.9	241.3	82.6	33.3	50.4	141.3	133.4	86.1	35.0	27.0	103.1	16.3	67.4

Inlet Pressure Connection*	P	Pressure connection is illustrated in both back and bottom configurations. See page 4 for available fitting types.			
Approximate Weight	Dial Size	6"	8 ¹ / ₂ "	12"	16"
	Net Weight	4 ¹ / ₂ lbs.	7 ³ / ₄ lbs.	10 ³ / ₄ lbs.	14 ¹ / ₄ lbs.
	Shipping Weight	7 lbs.	10 lbs.	15 lbs.	21 lbs.

*Standard Inlet Fittings: 1/4 NPT Female Back Connection for ranges up to and including 10,000 psi. AMINCO 45-11310 or AUTOCLAVE F-250-C for ranges over 10,000 psi.

Drawings showing assembly, part numbers, recommended spares and parts pricing are available on request. Contact customer service (See Section 1.0).

6.0 WARRANTY – SHIPPING INSTRUCTIONS – HOW TO ORDER

6.1 WARRANTY AND LIMITATION OF LIABILITY

All Heise Products and Parts carry a warranty against defective material and workmanship for period of one (1) year from date of shipment.

A complete warranty and limitation of liability statement is made on the standard quotation form at the time of sale.

6.2 SHIPPING INSTRUCTIONS FOR RETURN TO FACTORY

Pack securely to prevent possible damage in shipment.

SHIP TO: Ashcroft Inc.
250 East Main Street
Stratford, CT 06614

Attention: Service Section

IMPORTANT – Obtain written authorization to return instruments that have been in contact with corrosive or hazardous materials such as mercury and radioactive solutions.

Furnish the following information with return of instrument:

SHIPPING INSTRUCTIONS

Company Name _____
 Phone Number _____
 Person to Contact _____
 Address _____

 Model _____
 Serial Number _____
 Symptoms _____

6.3 TO ORDER A GAUGE

Select:

1. Model – “CC”, “CM” or “CMM”
2. Dial Size – 6” (Models CM and CMM Only), 8½”, 12” and 16”
3. Gauge Type – Pressure, Absolute, Vacuum or Compound
4. Pressure Range (See Section 5)
5. Pressure Medium – Air, Helium, Oil, Water, etc.
6. Pressure Inlet – (a) Location; (b) Type; (c) Size
7. Mounting – Panel or Wall
8. Optional Features (See Section 2.4)

1 Model	Pointer travel Degrees	2 Dial Size	Scale Length Inches	4 Gauge Type	6a. Location	6b. & c. Male	6b. & c. Female	7 Mounting
CC	300	8½ (215.9) 12 (304.8) 16 (406.4)	21½ (546) 27½ (698.5) 37½ (952.5)	Pressure Compound Vacuum Absolute	Back or Bottom	½ Male NPT ¼ Male NPT MS 33656	⅝ Female NPT ¼ Female NPT AND 10050-4 MS 33649-4 AMINCO 45-11310 AUTOCLAVE F-250-C	Panel or Wall
CM	350†	6 (152.4) 8½ (215.9) 12 (304.8) 16 (406.4)	27½ (457.2) 25 (635) 31½ (800.1) 43¾ (1111.3)					
CMM	660	6 (152.4) 8½ (215.9) 12 (304.8) 16 (406.4)	32 (812.8) 45 (1143) 60 (1524) 80 (2032)					

†Model CM above 50,000 psi has less travel.

*Ambient pressure equals pressure surrounding the measuring elements.

Dimensions in () are millimeters.

Replacement gauges can be supplied by furnishing the model and serial number of the gauge being replaced.

Ashcroft Inc. Sales and Customer Service Locations

World Headquarters

U.S.A.

Ashcroft Inc. 250 East Main Street
Stratford, CT 06614-5145 U.S.A.
Tel: (203) 378-8281
Fax: (203) 385-0408 (Domestic)
Fax: (203) 385-0357 (International)
email: info@heise.com
www.ashcroft.com

International Operations

Brazil (Willy Plant)

Willy Instrumentos de Medicao e
Controle Ltda.
An Ashcroft Inc. Company
Rua Senador Vergueiro No. 433
09521-320 Sao Caetano Do Sul
Sao Paulo, Brazil
Tel: 55-11-4224-7400
Fax: 55-11-4229-8710
Fax: 55-11-4221-9712
Fax: 55-11-4224-7477
Alexandre Nakashato B14 #
Contact: 55-11-4224-7412
email: alexandre.nakashato@ashcroft.com

Commercial Gauge Plant

Willy Instrumentos de Medicao e
Controle Ltda.
Divisao Commercial Gauge
Rua Joao Pessoa, 620
CEP. 09520-000
Sao Caetano Do Sul, Sao Paulo, Brazil
Tel: 55-11-4223-3900
Fax: 55-11-4227-5163
Contact: Alexandre Nakashato-Sales
email: alexandre.nakashato@ashcroft.com

Canada

Ashcroft Instruments Canada Inc.
151 Steeles Ave. East, Upper Level
Milton, Ontario L9T 1Y1
Tel: 905-864-4989 Ext. 610
Fax: 905-864-7383
email: lloyd.clarke@ashcroft.com

China

Ashcroft China Representative Office
Room 203, First Shanghai Center,
No. 39 Liang Ma Qiao Road
Beijing, China 100016
Tel: 86-10-8453-5127
86-10-8453-5259
Fax: 86-10-8453-5259
Contact: Mr. Wei Dong (Sales Manager)
(C) 86-13901216821
Mr. Peter Wei (Sales Application Engineer)
(C) 86-13911185210
email: sales@ashcroft.com.cn
wei.dong@ashcrofrt.com.cn
peter.wei@ashcrofrt.com.cn

France

Ashcroft GmbH Sales Office
Division Instrumentation
206 Rue des Campanules, Le Mandinet
F77185 Lognes
France
Tel: 33-1-60-3725-30
Fax: 33-1-60-3725-39
Contact: Jackier Lacamus
email: ashcroft.europe@wanadoo.fr

Germany

Ashcroft Instruments GmbH
Postfach 11 20
Max-Planck-Strasse 1
D-52499 Baesweiler, Germany
Tel: 49-24-01-8080
Fax: 49-24-01-7027
Contact: Mr. Joerg Muller 49-24-01-808-134 or
Mr. Dietmar Heinen 49-24-01-808-165
email: sales@ashcrofteurope.com
dietmar.heinen@ashcrofteurope.com

Mexico

Ashcroft Instruments Mexico,
S.A. de C.V.
Henry Ford No. 114
Esq. Foulton
Fracc. Industrial San Nicolas
54030 Tlalnepantla, Edo De Mexico
Tel: 525-55-310-7217
525-55-310-8983
525-55-311-2829
525-55-311-2875
Fax: 525-55-310-2608
Contact: Mr. Javier Mendieta or
Ms. Eliette Rovira
email: jmendieta@ashcroft.com.
mxerovira@ashcroft.com.mx

Saudi Arabia

Joint Venture with
Al-Rushaid -Investment Co., Ltd.
P.O. Box 10145, Support Industry Park
Section E, Lot 1, Block 5K
Saudi Arabia 31981
Tel: 966-3-341-0278
Fax: 966-3-341-7624
Contact: D. R. Pai
(P) 966-3-341-0278 x 13 or
(F) 966-3-341-0696Rahul V J
email: drpai@darvico.com
rahul@darvico.com

Singapore

Ashcroft Instruments Singapore Pte. Ltd.
Block 1004 Toa Payoh North
#07-15/17
Singapore 318995
Tel: 65-6252-6602
Fax: 65-6252-6603
Contact: Mr. John Wong (Director, Asia Pacific) or
Mr. Joseph Tan (Area Sales Manager)
email: Sales@ashcroft.com.
sgJohn.Wong@ashcroft.com.
sgJoe.Tan@ashcroft.com.sg

United Kingdom/Sales Office

Ashcroft Instruments GmbH Sales Office
Cambridge Office
Unit 5 William James House
Cowley Road
Cambridge CB4 0WX
Tel: 44-01223-395500
Fax: 44-01223-395501
Contact: Selwyn Hammond, Territory
Sales Manager, South
email: sales@ashcrofteurope.net

Venezuela

Manufacturas Petroleras Venezolanas
KM 7 Carretera A
El Mojan Calle 18
#15B355 ZONA
Ind. Norte Sector Canchancha
Maracaibo Edo Zulia Venezuela
Tel: 58-261-757-9070/9762
Fax: 58-261-757-9461
email: contactenos@mapvensa.com
www.mapvensa.com

Visit our web site www.heise.com