

# KING-GAGE® Marine Systems

Tank Level and Draft Indicating Systems for the Marine and Offshore Industries

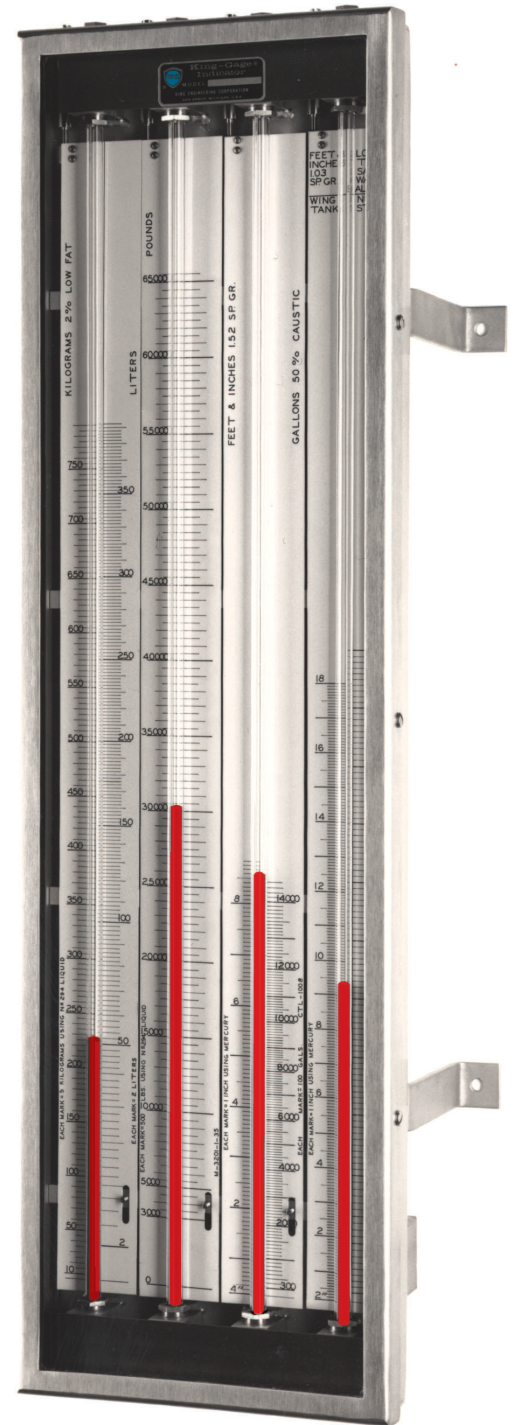
## Multi-Tube Model 3250 Tank Level Indicator

- View Multiple Tank Levels Simultaneously
- Simple All Pneumatic Operation
- Durable Marine Grade Construction
- No Periodic Calibration Needed

This precision pneumatic instrument offers multiple fluid filled display columns within a single housing. It is designed for use with a downpipe level sensor for liquid level and tank gauging applications. Intended for bulkhead mounting, the Model 3250 Multi-Tube Indicator is available for 2, 4, 6, 8, or 10 tank level display columns. The efficient design permits closer grouping, reducing overall space required as compared to individual indicators.

Working as a frictionless hydrostatic force balance, an indicating liquid rises within the glass tube in direct proportion to pressure being applied. In liquid level measurement, this is actual hydrostatic pressure created by depth that the level sensor transmits to the indicator. Based on the inherent accuracy of the U-tube manometer, there are no mechanical linkages that can suffer wear and misalignment, nor are there any periodic calibration procedures necessary. All pneumatic operation makes it compatible for use in explosion hazard zones.

King indicator scales provide for accurate readings whether the application is draft measurement or gauging tank levels. Due to overall length of the scales, graduated units are clearly marked for excellent readability and better interpretation of the column display showing level in service tanks (fuel oil, ballast) or liquid cargo tanks. The indicating system may also be used for ship's draft readings. The length of the indicator display can be selected based on range and desired resolution (minimum readable change in depth or capacity). Case construction is carbon steel with durable black polyurethane finish.



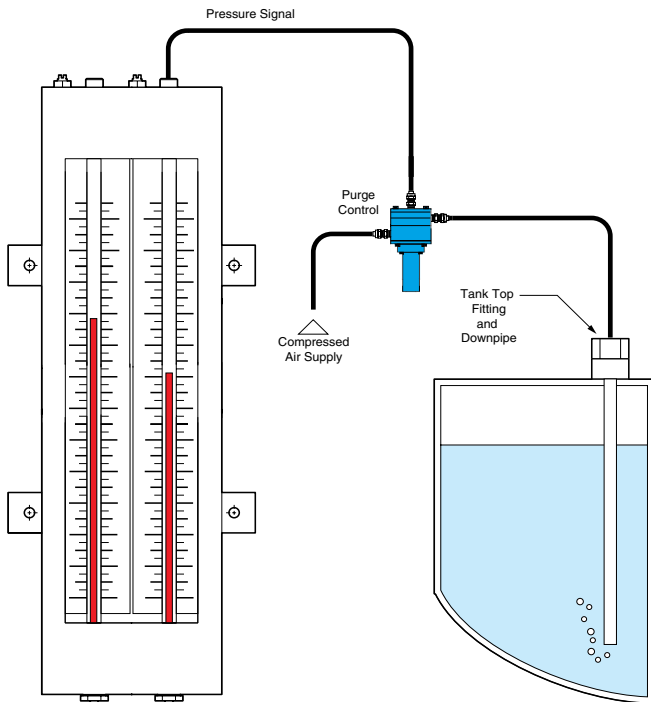
**Tank Level and Draft  
Indicating System**

## Principles of Operation

The KING-GAGE system uses hydrostatic pressure measurement to determine liquid level. This pressure is created by the actual depth of liquid above the measurement point. Individual indicator scales are calibrated to the pressure range (depth), density (specific gravity) of the liquid, and the volumetric capacity of the tanks or compartment. For draft measurement, these only factors needed are pressure and density.

The KING-GAGE Model 3250 Multi-Tube Indicator works as a frictionless hydrostatic force balance. Within the glass display tube, a liquid fill rises in direct proportion to the magnitude of pressure applied. The indicating liquid used determines the actual pressure range of this instrument (refer to Determining Scale Range).

Bubbler (Downpipe) System - uses compressed air to purge an open ended pipe extending down into the tank. A KING-GAGE Purge Control regulates a continuous flow of air into the downpipe. Pressure is created as liquid is purged from the downpipe, increasing until it reaches an equilibrium point (air pressure = hydrostatic pressure). Excess air escapes through the bottom of the downpipe (and bubble up through the tank contents) to maintain equilibrium.



**Typical Downpipe Purge System**

The resulting downstream pressure (within the pipe) is directly proportional to liquid depth. As depth increases, the corresponding pressure increases as well. Conversely, as depth decreases, downstream pressure is equally reduced as excess air flows out the immersed end of the pipe. Tubing conveys this pressure to the indicator as the basis for the tank level reading.

## Indicator Scales

Each system scale is individually calibrated and custom marked in any specified unit of measurement (depth, total weight, or volume). An optional 2nd scale unit can be included to combine different measurements such as depth and volume. Scales are manufactured for the individual tank geometry and specific gravity of tank contents. Due to the factory calibrated scale, the Multi-Tube Indicator can be used for almost any kind and shape of tank.

## Determining Scale Range

Overall length of the scale can vary depending upon the range and degree of readability necessary for the application. This "readability" refers to the minimum readable change in liquid depth detectable at the indicator.

Three factors determine scale length:

- Maximum tank depth
- Specific gravity (density) of tank contents
- Type of indicating liquid (scale factor)

A simple calculation using these factors will yield the minimum scale length required:

$$D \text{ (depth)} \times G \text{ (sp.gr.)} \times L \text{ (liquid scale factor)} = \text{Scale Length}$$

The resulting value represents the scale length in inches. Refer to the scale sizes for the indicator and select one that will accommodate the calculated length.

Liquid	Color	Specific Gravity	Liquid Scale Factor
Mercury	Silver	13.546	0.074
No. 294	Red	2.940	0.337
No. 175	Purple	1.750	0.566

## Tank Level and Draft Applications

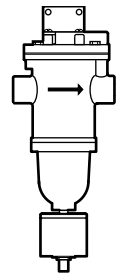
The KING-GAGE indicators can be mounted directly to a panel, bulkhead, or other rigid structural member. Depending upon the application, install these indicators in the engine room, control center, or ship's bridge.

### Applications include:

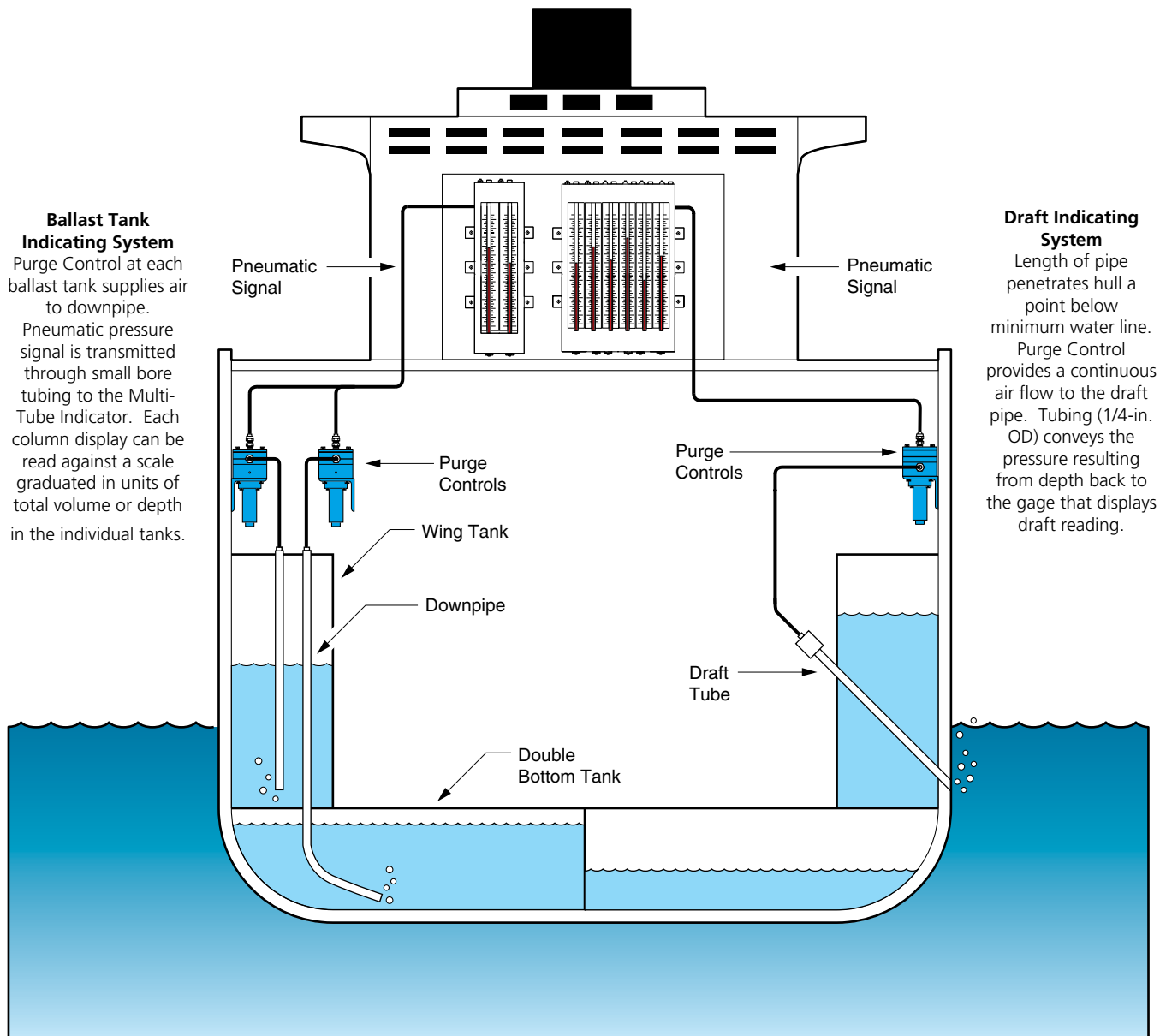
- Ship's draft measurement
- Ballast water tanks
- Fuel oil tanks
- Day tanks
- Bunker oil tanks
- Drill water tanks
- Liquid cargo tanks

## Compressed Air Requirements

All pneumatic instrumentation requires extremely clean, dry, and oil-free compressed air. It must be noted that failure to use adequately filtered compressed air will result in unsatisfactory performance. Use of a compressed air coalescing filter (such as King Air-Guard or King Air Control Station) upstream in the supply line is expressly recommended.



**Air-Guard  
Coalescing  
Filter**



**Ballast Tank Indicating System**  
Purge Control at each ballast tank supplies air to downpipe. Pneumatic pressure signal is transmitted through small bore tubing to the Multi-Tube Indicator. Each column display can be read against a scale graduated in units of total volume or depth in the individual tanks.

**Draft Indicating System**  
Length of pipe penetrates hull a point below minimum water line. Purge Control provides a continuous air flow to the draft pipe. Tubing (1/4-in. OD) conveys the pressure resulting from depth back to the gage that displays draft reading.

# KING-GAGE® Marine Systems

## KING-GAGE Multi-Tube Indicator

Multiple tank indicator surface mounts to bulkhead or other structural surface. Available with optional overflow check valve to prevent indicating liquid from being forced out of glass tube in the event of overpressurization.

### Operating Principle

Well type manometer acts as frictionless hydrostatic force balance. A liquid fill is raised in direct proportion to the magnitude of pressure applied. (Varies based on type of indicating liquid specified.)

### Resolution

Infinite resolution based on type of indicating liquid employed.

### Input Connection(s)

1/4" NPT tapped connection for typical tube fittings.

### Materials of Construction

Formed channel indicator housing; carbon steel with durable black polyurethane textured finish, or 304 stainless steel with brushed finish. Heavy plate glass window; acrylic plastic available as special order.

### Wetted Parts

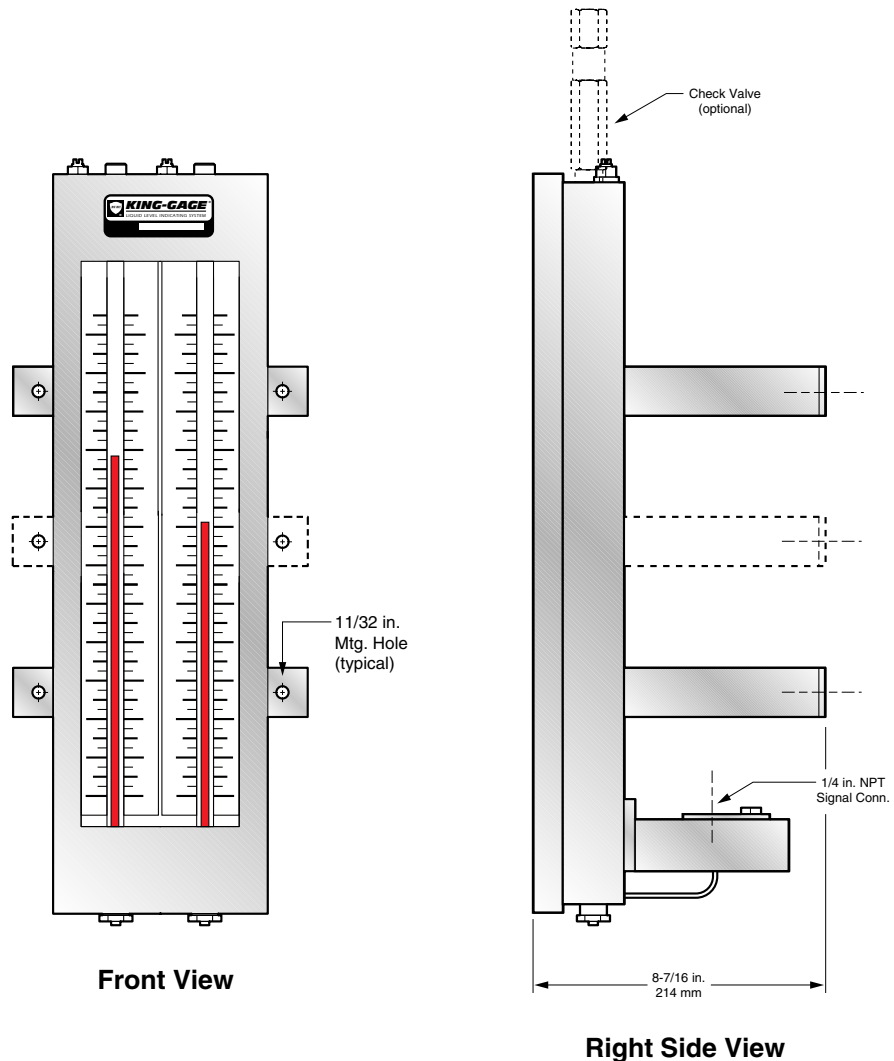
316 stainless steel liquid well and tubing.

### Indicating Tubes

High strength, fully annealed glass.

### Range Height Dimension

Note that width varies upon number of indicating display tubes.



Range	Height	Height w/ Optional Check Valve
20	25-1/2"	30" maximum
30	35-1/2"	40" maximum
40	45-1/2"	50" maximum
50	55-1/2"	60" maximum
60	65-1/2"	70" maximum
80	85-1/2"	90" maximum

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All specifications are subject to change without notice.



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