

**ientek**

**INSTRUMENTS, INC.**

**THE FLOW MEASUREMENT**

**2005 / 2006**

# Mass Ultrasonic Flow meter



HVA/C Mass Flow Meter  
(HVA/C 1510)



HVA/C Mass Flow Meter  
(HF 1820)



Industrial Mass Flow Meter  
(HMFM 3100)



Industrial Mass Flow Meter  
(HMFM 3200)



Stack Mass Flow Meter  
(SMFM 3420)



Air Master  
(AM 4386)



Ultrasonic Flow Meter  
(UFT 7210,7220,7230)



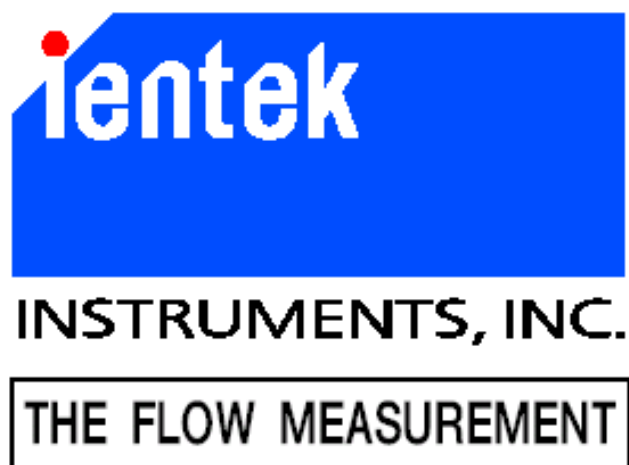
Ultrasonic Flow Meter  
(UFT 7240)



Compact Pressure Transmitter  
(CPT-H-010G)



Humidity & Temp. Transmitter  
(HTT-20B)



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| HF 1810S Smart IN-line Gas Mass Flow Meter<br>HF 1820S Smart IN-line Liquid Mass Flow Meter  |        |    |      |
| <b>High Flow Thermal Mass Flow Meters</b>  | 質量流量計  | 17 | 3100 |
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# Flow meters with various measuring principle to meet your needs

Simply select to suit the application

| Application           |                      | Type       | Thermal mass   |           | Ultrasonic     | Electromagnetic | Diff. pressure | Vortex          |
|-----------------------|----------------------|------------|----------------|-----------|----------------|-----------------|----------------|-----------------|
|                       |                      |            | Inline         | Insertion |                |                 |                |                 |
| Object of measurement | Liquid               |            | X              |           | O              | O               | O              | O               |
|                       | Gas                  |            | O              |           | X              | X               | O              | O               |
|                       | Vapor                |            | X              |           | X              | X               | O              | O               |
|                       | Steam                |            | X              |           | X              | X               | O              | O               |
| Application           | Control              |            | O              |           | O              | O               | O              | O               |
|                       | Monitor              |            | O              |           | O              | O               | O              | O               |
|                       | Supply               |            | O              |           | X              | O               | X              | X               |
| Operating condition   | Temperature          |            | -40 to 260 °C  |           | -40 to 200 °C  | -20 to 120 °C   | -40 to 600 °C  | -40 to 200 °C   |
|                       | Pressure             |            | Max 7MPa       |           | —              | -1 to 2MPa      | -0.1 to 42MPa  | Max 5MPa        |
|                       | Pressure loss        |            | Negligible     |           | None           | None            | Large          | Small           |
|                       | Range ability        |            | Large          |           | Large          | Large           | Small          | Medium          |
| Installing condition  | Bore                 |            | Φ 13 to Φ 6000 |           | Φ 13 to Φ 6000 | Φ 2.5 to Φ 300  | Φ 25 to Φ 3000 | Φ 4 to Φ 100    |
|                       | Straight Pipe length | Upstream   | 1D             | 10D       | 10D            | 10D             | 30D            | 15D             |
|                       |                      | Downstream | 0D             | 5D        | 5D             | 5D              | 15D            | 5D              |
|                       | Piping work          |            | Required       |           | Not required   | Required        | Required       | Required        |
|                       | Explosion-proofing   |            | O              |           | X              | X               | O              | X               |
| Performance           | Accuracy             |            | ±0.5% F.S.     |           | ±1% of rate    | ±0.5% of rate   | ±2.0% F.S.     | 1 to 3% of rate |
|                       | Velocity range       | Liquid     | 0.1~140m/s     |           | 0 ~+32m/s      | 0.3 ~ 10m/s     | 1.0 ~ 10m/s    | 0.5 ~ 10m/s     |
|                       |                      | Gas, Steam |                |           |                |                 | 2.0 ~ 120m/s   | 1.5 ~ 80m/s     |

Note : Straight pipe length (D) : Represents pipe bore.

## Typical application for flow meter

| Application                           | Measuring fluid  | Oil                           | Ultra-demineralized water                    | Chemical | Warm cooling water | Pure water | Drainage | Sludge | Condensed sludge | High purity alcohol | Liquor | Milk/fruit juice | Soy sauce, dip | Air | Vapor |
|---------------------------------------|--|-------------------------------|--|----------|--------------------|------------|----------|--------|------------------|---------------------|--------|------------------|----------------|-----|-------|
|                                       |  | Chemical & Petroleum chemical | Crude oil, refined oil, fertilizer, chemical | ✓        |                    | ✓          |          |        |                  |                     |        |                  |                |     |       |
| Steel                                 | Cooling water  |                               |  |          | ✓                  |            |          |        |                  |                     |        |                  |                |     |       |
| Water treatment                       | Pure water, drainage, sludge, Condensed sludge, chemical air |                               |  | ✓        |                    | ✓          | ✓        | ✓      | ✓                |                     |        |                  |                | ✓   |       |
| Semiconductor                         | Demineralized water, chemical drainage                       |                               | ✓  | ✓        |                    |            | ✓        |        |                  |                     |        |                  |                |     |       |
| Food & beverage                       | Water, liquor, milk, fruit juice, sauce, etc.                |                               |  |          |                    |            |          |        |                  | ✓                   | ✓      | ✓                | ✓              |     | ✓     |
| Pharmaceuticals                       | Chemical, water  |                               |  | ✓        |                    | ✓          |          |        |                  |                     |        |                  |                |     |       |
| Building and regional heating/cooling | Chilled water, hot water                                     |                               |  |          | ✓                  |            |          |        |                  |                     |        |                  |                |     |       |
| Energy conservation                   | Air, vapor, water  |                               |  |          | ✓                  |            |          |        |                  |                     |        |                  |                | ✓   | ✓     |
| Assembly plant                        | Air, vapor, water, chemical oil                              | ✓                             |  | ✓        | ✓                  | ✓          |          |        |                  |                     |        |                  |                | ✓   | ✓     |
| Molding plant                         | Cooling water  |                               |  |          | ✓                  |            |          |        |                  |                     |        |                  |                |     |       |

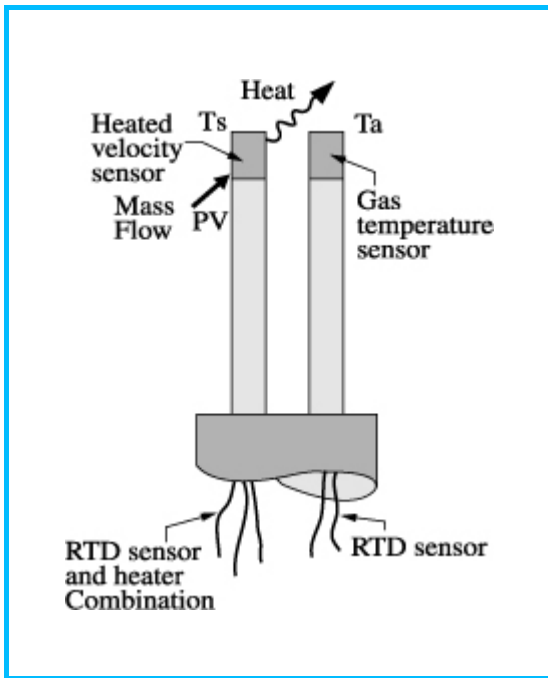
## Applicable flow meter

| Fluid                     | Type | Thermal mass | Ultrasonic | Electromagnetic | Diff. pressure | Vortex |
|---------------------------|------|--------------|------------|-----------------|----------------|--------|
| Oil                       |      | X            | ○          | X               | ◎              | ○      |
| Ultra-demineralized water |      | X            | ◎          | X               | △              | △      |
| Chemical                  |      | X            | ◎          | ◎               | ○              | ○      |
| Warm cooling water        |      | X            | ◎          | ◎               | ○              | ◎      |
| Pure water                |      | X            | ◎          | ◎               | ○              | ○      |
| Drainage                  |      | X            | ○          | ◎               | △              | △      |
| Sludge                    |      | X            | △          | ◎               | △              | △      |
| Condensed sludge          |      | X            | X          | ○               | X              | X      |
| High purity alcohol       |      | X            | ◎          | X               | ○              | ○      |
| Liquor                    |      | X            | ○          | ○               | ○              | ○      |
| Milk, fruit juice         |      | X            | ○          | ○               | ○              | △      |
| Soy sauce, dip            |      | X            | ○          | ○               | ○              | ○      |
| Air                       |      | ◎            | X          | X               | ○              | ○      |
| Vapor                     |      | X            | X          | X               | ◎              | ◎      |
| Gas                       |      | ◎            | X          | X               | ◎              | ◎      |

◎ : Optimum  
 ○ : Suitable  
 △ : May be used (but conditional)  
 X : Should not be used

# Flow Sensing Principle

## Thermal Mass Flow Sensing



Series 3000 SMART-IN™ SENSOR

ientek's unique SMART-IN™ sensor probe is responsible for the unsurpassed accuracy, ruggedness and reliability of ientek industrial flow meters.

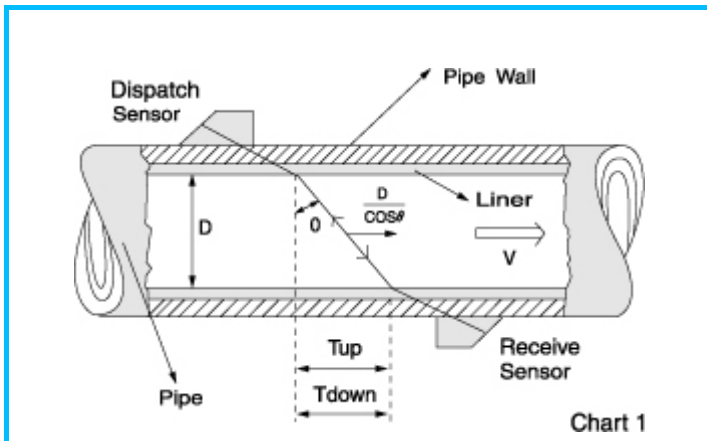
The immersible SMART-IN™ sensor consists of two sensing elements a velocity sensor and a temperature sensor that automatically corrects for changes in gas temperature.

When power is applied to the flow meter, the transducer electronics heats the velocity sensor to a constant temperature differential above the gas temperature and measures the cooling effect of the gas flow.

The electrical power required to maintain a constant temperature differential is directly proportional to the gas mass flow rate.

Both sensors are reference-grade platinum resistance temperature detectors (RTDs). The platinum RTD wire is wound on a rugged ceramic mandrel for strength and stability. SMART IN™ sensors are clad in a rugged, sealed 316 stainless steel encasement. (Series 3000)

## Ultrasonic Flow Sensing



Series 7200 SMART-IN™ US ULTRASONIC SENSOR

When the ultrasonic spreads in the liquid, the fluid flow will take a little change to the spreading time and time changes positive ratio the fluid velocity, through this we can get the fluid velocity.

As chart 1, on the surface of the pipe for measuring mounting a pair of sensors according to relative positions.

The method includes "Z" and "V" one sensor receives current pulses and produces ultrasonic pulses, through pipe-fluid-pipe the second sensor receiving the spreading time according to up and down direction is :

$$T_{UP} = \frac{MD / \cos\theta}{C_0 + V \sin\theta} \quad (1)$$

$$T_{DOWN} = \frac{MD / \cos\theta}{C_0 - V \sin\theta} \quad (2)$$

$$V = \frac{MD}{\sin 2\theta} \cdot \frac{\Delta T}{T_{UP} \times T_{DOWN}}$$

# Product Selection Guide

| ientek Product Name  | Fluids              | Flow Body         | Process Line Size                                |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
|--|---------------------|-------------------|--|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|----------------------------|--------------------------|---------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| <b>Thermal Mass Flow Meter (Series 1500)</b>                 |                     |                   |  |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| HVAC 1510S Smart Insertion Gas Flow Meter                    | Clean & inert gas   | Insertion         | 2-72 inch pipe or duct                           |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| HVAC 1520S Smart Insertion Liquid Flow Meter                 | Clean water         | Insertion         | 2-72 inch pipe or duct                           |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| <b>Thermal Mass Flow Meter (Series 1800)</b>                 |                     |                   |  |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| HF 1810S Smart In-line Gas Mass Flow Meter                   | Clean & inert gas   | In-line           | 2-72 inch pipe or duct                           |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| HF 1820S Smart In-line Liquid Flow Meter                     | Clean water         | In-line           | 2-72 inch pipe or duct                           |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| <b>High Flow Thermal Mass Flow Meter (Series 3000)</b>       |                     |                   |  |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| 3110S Smart-IN™ Mass Flow Meter                              | Industrial gas      | Insertion         | 2-72 inch pipe or duct                           |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| 3120S Smart-IN™ Mass Flow Meter(EX)                          | Industrial gas      | Insertion         | 2-72 inch pipe or duct                           |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| 3210S Smart-IN™ FLG Mass Flow Meter                          | Industrial gas      | In-line           | 1/4, 1/2, 3/4, 1, 1.5, 2, 3, 4, 6, 8 inch flange |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| 3220S Smart-IN™ FLG Mass Flow Meter(EX)                      | Industrial gas      | In-line           | 1/4, 1/2, 3/4, 1, 1.5, 2, 3, 4, 6, 8 inch flange |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| 3410S Smart-IN™ Stack Mass Flow Meter                        | Industrial gas      | In-line           | 1/4, 1/2, 3/4, 1, 1.5, 2, 3, 4, 6, 8 inch flange |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| 3420S Smart-IN™ Stack Mass Flow Meter(EX)                    | Industrial gas      | In-line           | 1/4, 1/2, 3/4, 1, 1.5, 2, 3, 4, 6, 8 inch flange |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
|  |                     |                   | Velocity   | Volumetric Flowrate      | Temperature              | Differential Pressure    | Thermal / Pitot          | Humidity                 | Dew point                | Wet Bulb Temperature     | Heat Flow Calculations   | CO <sub>2</sub> density  | Data Logging / Downloading | Statistics / Review Data | Density Correction Factor | Variable Time Constant   | Articulating Probe       | Printer Output           | Calibration Certificate  |                          |
| <b>Air Velocity Meter (Series 4300) Air Master®</b>          |                     |                   |  |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| 4384   | Air Velocity Meter® | Clean & inert gas | Insertion  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                          |                          |                          |                          |                          |                          | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4384A  | Air Velocity Meter® | Clean & inert gas | Insertion  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                          |                          |                          |                          |                          |                          | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4385   | Air Velocity Meter® | Clean & inert gas | Insertion  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                          |                          |                          |                          | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4385A  | Air Velocity Meter® | Clean & inert gas | Insertion  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                          |                          |                          |                          | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4386   | Air Velocity Meter® | Clean & inert gas | Insertion  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                          | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4386A  | Air Velocity Meter® | Clean & inert gas | Insertion  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |                          | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4387   | Air Velocity Meter® | Clean & inert gas | Insertion  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| 4387A  | Air Velocity Meter® | Clean & inert gas | Insertion  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>   | <input type="checkbox"/> | <input type="checkbox"/>  | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| <b>Ultrasonic Flow Meter (Series 7200)</b>                   |                     |                   |  |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| 7210S Smart-IN <sup>US</sup> Wall Ultrasonic Flow Meter      | Liquid              | Clamp-on          | DN 20-6000mm                                     |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| 7220S Smart-IN <sup>US</sup> PORT Ultrasonic Flow Meter      | Liquid              | Clamp-on          | DN 20-1000mm                                     |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| 7230S Smart-IN <sup>US</sup> PAN Ultrasonic Flow Meter       | Liquid              | Clamp-on          | DN 20-6000mm                                     |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |
| 7240S Smart-IN <sup>US</sup> Hand-held Ultrasonic Flow Meter | Liquid              | Clamp-on          | DN 20-1000mm                                     |                          |                          |                          |                          |                          |                          |                          |                          |                          |                            |                          |                           |                          |                          |                          |                          |                          |

| Flow Range(1)                                  | Temp. Range                             | Pressure Range | Accuracy | Comments / Application                 |
|--|---|----------------|----------|--|
| 0~200 to 0~20,000 sfpm<br>(0~1 to 0~100 nmps)  | -10~80°C (14~176°F)                     | 10 bar max     | 1% F.S.  | Smart Insertion                        |
| 0~200 to 0~2000 sfpm<br>(0~1 to 0~10 nmps)     | -10~80°C (14~176°F)                     | 10 bar max     | 1% F.S.  | Smart Insertion                        |
| 0~100 to 0~500 SLPM<br>(0~10 to 0~50 m/s)      | -10~80°C (14~176°F)                     | 10 bar max     | 1% F.S.  | Smart Insertion                        |
| 0~10 to 0~100 SLPM<br>(0~1 to 0~10 m/s)        | -10~80°C (14~176°F)                     | 10 bar max     | 1% F.S.  | Smart Insertion                        |
| 0~1 to 0~100 smps<br>(0~3.28 to 0~328 sfps)    | -10~120°C (230°C)<br>(10~247°F (446°F)) | 70 bar max     | 2% rate  | Smart Insertion                        |
| 0~1 to 0~100 smps<br>(0~3.28 to 0~328 sfps)    | -10~120°C (230°C)<br>(10~247°F (446°F)) | 70 bar max     | 2% rate  | Smart Insertion, Explosion-proof       |
| 0~20 to 0~12000 scmh<br>(0~0.8 to 0~7000 scfm) | -10~120°C (230°C)<br>(10~247°F (446°F)) | 70 bar max     | 2% rate  | Smart In-line                          |
| 0~20 to 0~12000 scmh<br>(0~0.8 to 0~7000 scfm) | -10~120°C (230°C)<br>(10~247°F (446°F)) | 70 bar max     | 2% rate  | Smart In-line, Explosion-proof         |
| 0~20 to 0~12000 scmh<br>(0~0.8 to 0~7000 scfm) | -10~120°C (230°C)<br>(10~247°F (446°F)) | 70 bar max     | 2% rate  | Smart Stack mass flow                  |
| 0~20 to 0~12000 scmh<br>(0~0.8 to 0~7000 scfm) | -10~120°C (230°C)<br>(10~247°F (446°F)) | 70 bar max     | 2% rate  | Smart Stack mass flow, Explosion-proof |

| Flow Range(m/s) |               | DRY Temp. (DB °C) | Humidity(RH %)   | Wet Temp.(WB °C) | Dew Point Temp.(DP °C) | CO2(%) | Note |
|-----------------|---------------|-------------------|------------------|------------------|------------------------|--------|------|
| Thermal         | Pitot         |                   |                  |                  |                        |        |      |
| 0~50 m/s        |               | -40~120°C ±0.5°C  |                  |                  |                        |        |      |
| 0~50 m/s        |               | -40~120°C ±0.5°C  |                  |                  |                        |        |      |
| 0~50 m/s        | 1.27~78.7 m/s | -40~120°C ±0.5°C  | 0~100% RH ±2% RH |                  |                        |        |      |
| 0~50 m/s        | 1.27~78.7 m/s | -40~120°C ±0.5°C  | 0~100% RH ±2% RH |                  |                        |        |      |
| 0~50 m/s        | 1.27~78.7 m/s | -40~120°C ±0.5°C  | 0~100% RH ±2% RH | +5~+60°C         | -15~+60°C              |        |      |
| 0~50 m/s        | 1.27~78.7 m/s | -40~120°C ±0.5°C  | 0~100% RH ±2% RH | +5~+60°C         | -15~+60°C              |        |      |
| 0~50 m/s        | 1.27~78.7 m/s | -40~120°C ±0.5°C  | 0~100% RH ±2% RH | +5~+60°C         | -15~+60°C              | 0~5%   |      |
| 0~50 m/s        | 1.27~78.7 m/s | -40~120°C ±0.5°C  | 0~100% RH ±2% RH | +5~+60°C         | -15~+60°C              | 0~5%   |      |

|           | clamp-on<br>transducer | wetted<br>transducer |              |         |                  |
|-----------|------------------------|----------------------|--------------|---------|------------------|
| 0~+32 m/s | -20~80°C               | -20~+120°C           | Unlimitation | 1% rate | Wall mount type  |
| 0~+32 m/s | -20~80°C               | -20~+120°C           | Unlimitation | 1% rate | Portable type    |
| 0~+32 m/s | -20~80°C               | -20~+120°C           | Unlimitation | 1% rate | Panel mount type |
| 0~+32 m/s | -20~80°C               | -20~+120°C           | Unlimitation | 1% rate | Hand-held type   |

Note(1) : Range are different fluids. smps : Standard meter per sec.  
scmp : Standard cubic meter per hour  
scfm : Standard cubic feet per minute  
sfpm : Standard feet per minute  
Standard conditions for air 70F and 1 atmosphere pressure.

## Features

- Fast response flow meter ideal for inert gas and liquid mass flow measurement applications
- Smart electronics permit field adjustment of critical flow meter setting
- Field validation of flow meter calibration
- 200 millisecond response to changes in flow rate
- Outstanding range ability
- Optional 2 x 16 backlight LCD display
- Minimal flow blockage and low pressure drop
- RS-232 communication
- Gas & Liquid

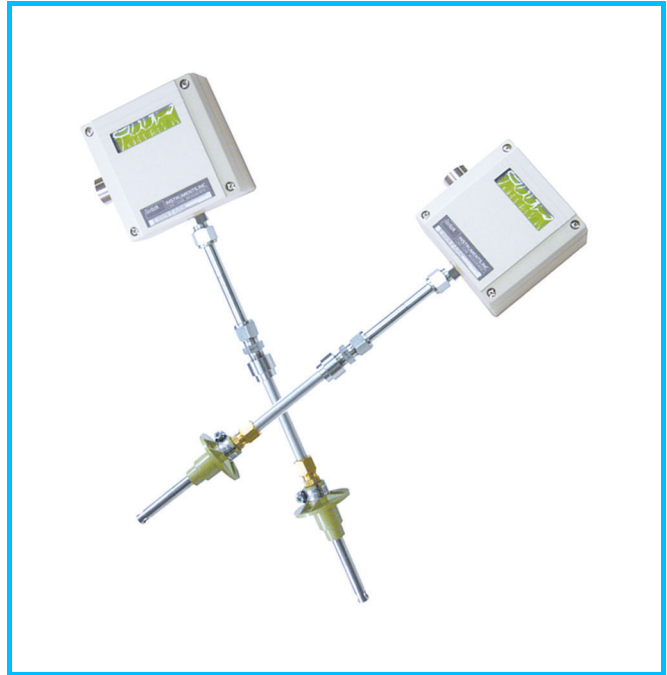
## Description

ientek Instrument's Series 1500S Smart Insertion mass flow meter provides an alternative for inert gas and clean water flow measurement applications. The meter's sensor offers long-term reliability and 200 millisecond response to changes in flow rate.

The versatile microprocessor-based transmitter integrates the functions of flow-range adjustment, meter validation and diagnostics in a probe-mounted NEMA 4X (IP65) housing. Mass flow rate and totalized flow, as well as other configuration variables, can be displayed on the meter's optional 2 x 16 backlight LCD panel.

The meter also provides an optical / galvanic isolated 4-20 mA, 0-10VDC output and two alarm outputs.

The programmable transmitter is easily configured via RS-232 and ientek Smart Interface Windows®-based software minimum 8 MB of RAM, preferred 16 MB of RAM. This series 1500S is suitable for pipes or ducts from 2 inch to 48 inches (DN 50 to DN 1200)



# 1500 Series Velocity Transmitter for HVAC Application (Gas, Liquid)

1500

## Performance Specifications

### Accuracy of Point Velocity

± 1% of full scale

### Repeatability

± 0.2% of full scale

### Temperature Coefficient

±0.02% of reading per °F within ±50°F of customer specified conditions.

±0.03% of reading per °F within ±50°F to 100°F of customer specified conditions.

±0.04% of reading per °C within ±25°C of customer specified conditions.

±0.06% of reading per °C within ±25°C to 50°C of customer specified conditions.

### Pressure Coefficient

0.02% per psia for air, consult factory for other gases  
, Liquid

### Response Time

200 milliseconds to 63% of final velocity value

## Operating Specifications (Gas)

### Gases

Most non-combustible, non-corrosive gases

### Mass Flow Rates

0 to 200 sfpm (0 to 1 nmmps) minimum, 0 to 20,000 sfpm (0 to 100 nmmps) maximum for air and nitrogen (maximum full scale varies with other gases consult factory)

### Gas Pressure

145 psia (10 barg) maximum

### Pressure Drop

Negligible

### Gas & Ambient Temperature

Gas ..... 14°F to 176°F (-10°C to 80°C)

Ambient ..... Operating : 32°F to 122°F (0°C to 50°C)

Storage : -40°F to 180°F (-40°C to 80°C)

0 to 90% relative humidity, non-condensing conditions

### Power Requirements

DC 24 V ±10% (regulated), 150 mA maximum

Warm-up time : 10 minutes(max)

## Operating Specifications (Liquid)

### Flow Rates

0 to 200 sfpm (0 to 1 nmmps) minimum

0 to 2000 sfpm (0 to 10 nmmps) maximum

### Liquid Pressure

145 psia (10 barg) maximum

### Pressure Drop

Negligible

### Water & Ambient Temperature

Water ..... 14°F to 176°F (-10°C to 80°C)

Ambient ..... Operating : 32°F to 122°F (0°C to 50°C)

Storage : -40°F to 180°F (-40°C to 80°C)

0 to 90% relative humidity, non-condensing conditions

### Power Requirements

DC 24 V ±10% (regulated), 300 mA maximum

Warm-up time : 10 minutes(max)

## Operating Specifications (Gas)

### Output Signal

Linear 0~10 VDC, 1000 ohms minimum load resistance or

Linear 4~20 mA proportional mass flow rate.

700 ohms maximum resistance power supply dependent

User-selectable ... Active non-galvanic ally separated or

passive galvanic ally separated

(loop power required)

### Alarms

Hard contact user-adjustable high and low dead band

adjustable with Smart Interface windows<sup>®</sup> software

Relay ratings ... Maximum 42 VDC or VAC, 140 mA

### Displays

Alphanumeric 2 x 16 digit backlight LCD

Adjustable variables via on-board switches

(password protected) or with Smart Interface windows<sup>®</sup> software

Adjustable variables ... Full scale (50 to 100 %)

Time Response (1 to 7 seconds)

Correction factor setting (0.5 to 5)

Zero and span

High and low alarm settings

### Totalize

Seven digits (9,999,999.9) in engineering units

Reset table by software, on-board switches or external magnet

### Software

Smart Interface Windows<sup>®</sup>-based software minimum

8 MB of RAM, preferred 16 MB of RAM

RS-232 communication

Additional features ... Alarm dead band adjustment

Zero cut-off adjustment

Linearization adjustment

Save / Load configurations

Flow meter validation

## Physical Specifications

### Wetted Materials

316L, 304 stainless steel

### Enclosure

NEMA 4X

(IP65)

Powder-coated cast aluminum

### Electrical Connections

One 1/2 inch NPT ... NEMA 4X Enclosure (IP65)

### Mounting (Optional)

1/2-inch tube compression fitting with 1/2-inch male NPT

1/2-inch duct mounting bracket

### Certifications\*

CE (All enclosures)

CSA -----

(Explosion-proof for Class 1, Division 1, Groups B, C, D)

EEx (EEx d IIC T6...T2)

FM -----

(Explosion-proof for Class 1, Division 1, Groups B, C, D)

\* Certifications Pending, Contact factory

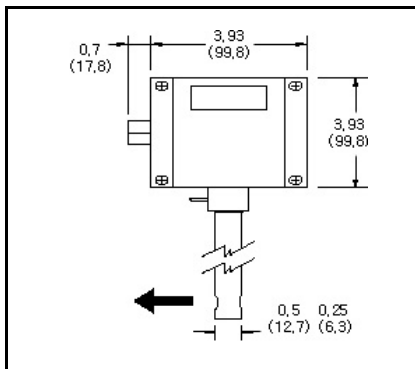
## Mass Flow Ranges (Gas)

### 1500S-Minimum pipe diameter 1"

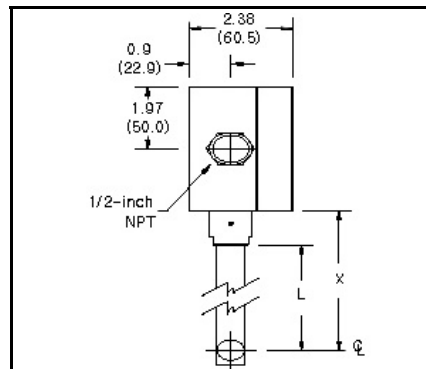
| Gas Code | Spec(%FS)             | Gas             | Max Vel (SFPM) | Max Vel (NMPS) | Max PSIA |
|----------|-----------------------|-----------------|----------------|----------------|----------|
| 0        | Standard accuracy     | Air             | 20,000         | 102            | 145      |
| 1        | Standard accuracy     | Argon           | 28,000         | 142            | 145      |
| 2        | Standard accuracy     | CO <sub>2</sub> | 20,800         | 106            | 145      |
| 6        | Standard accuracy     | Helium          | 12,400         | 63             | 145      |
| 10       | Standard accuracy     | N <sub>2</sub>  | 19,800         | 101            | 145      |
| 99       | Other-consult factory |                 |                |                |          |

## Dimensional Specification

Compression Fitting-Front View (EN2)



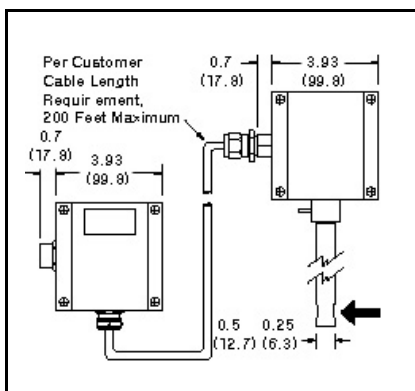
Compression Fitting-Side View (EN2)



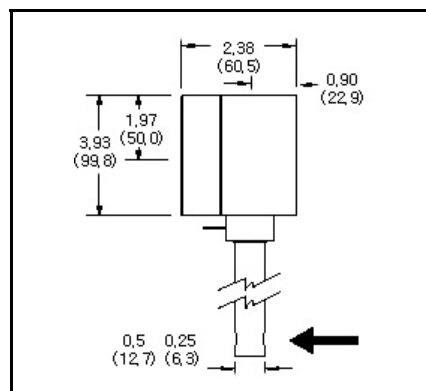
## Table

| Length Chart |                 |                 |
|--------------|-----------------|-----------------|
| Code         | L               | X               |
| L06          | 6.0<br>(152.4)  | 8.6<br>(218.4)  |
| L09          | 9.0<br>(228.6)  | 11.6<br>(294.6) |
| L13          | 13.0<br>(330.2) | 15.6<br>(396.2) |
| L18          | 18.0<br>(457.2) | 20.6<br>(523.2) |
| L24          | 24.0<br>(609.6) | 26.6<br>(675.6) |
| L36          | 36.0<br>(914.4) | 38.6<br>(980.4) |

Remote Mount Junction Box-Front (EN4)



Remote Mount Junction Box-Side (EN4)





## Features

- Fast response flow meter ideal for inert gas and liquid mass flow measurement applications
- Smart electronics permit field adjustment of critical flow meter setting
- Field validation of flow meter calibration
- 200 millisecond response to changes in flow rate
- Outstanding range ability
- Optional 2 x 16 backlight LCD display
- Minimal flow blockage and low pressure drop
- RS-232 communication
- Gas & Liquid



1800

## Description

*i*entek Instrument's Series 1800S Smart Insertion mass flow meter provides an alternative for inert gas and clean water flow measurement applications. The meter's sensor offers long-term reliability and 200 millisecond response to changes in flow rate.

The versatile microprocessor-based transmitter integrates the functions of flow-range adjustment, meter validation and diagnostics in a probe-mounted NEMA 4X (IP65) housing. Mass flow rate and totalized flow, as well as other configuration variables, can be displayed on the meter's optional 2 x 16 backlight LCD panel.

The meter also provides an optical / galvanic isolated 4-20 mA, 0-10VDC output and two alarm outputs.

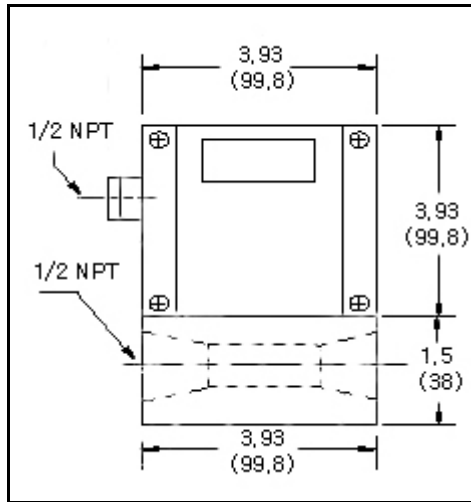
The programmable transmitter is easily configured via RS-232 and ientek Smart Interface Windows®-based software minimum 8 MB of RAM, preferred 16 MB of RAM.

# 1800 Series Hi-Flow Gas Mass or Liquid Flow Meter with Digital Display

The information contained herein is subject to change without notice.

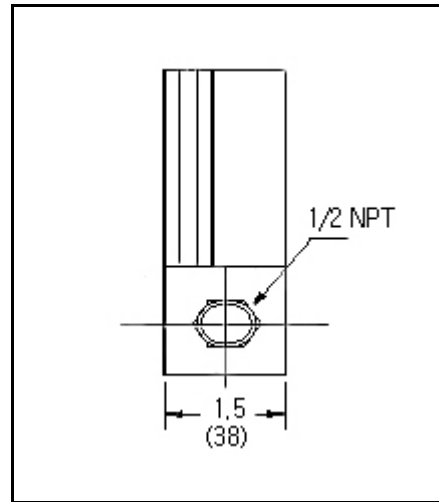
## Dimensional Specification

Series 1810 Side View



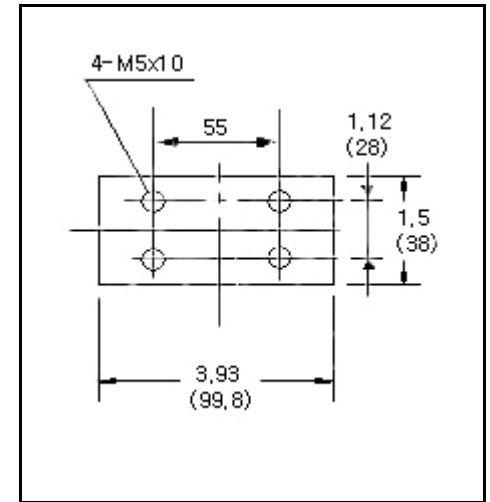
HF1810S-W-N2-EN2-P2

Series 1810-Outlet View



HF1810S-W-N2-EN2-P2

Series 1810-Bottom View



HF1810S-W-N2-EN2-P2

All dimensions are inches and in parentheses are millimeters.  
Certified drawings are available on request.

## Performance Specifications

### Accuracy

± 1% of full scale including linearity over 15° to 25°C and 5 to 60 psia (0.3 to 4 barg)

If the meter is mounted with a vertical (up or down) flow path the following accuracy de-rating applies:

| Inlet Pressure Deviation <sup>2</sup> | OPERATING PRESSURE (Gas) |                      |                      |
|---------------------------------------|--------------------------|----------------------|----------------------|
|                                       | 50 psia                  | 100 psia             | 150 psia             |
| ± 1 psia                              | ± 1.5% of full scale     | ± 1.5% of full scale | ± 1.5% of full scale |
| ± 5 psia                              | ± 3.8% of full scale     | ± 4.5% of full scale | ± 5.3% of full scale |
| ± 10 psia                             | ± 6% of full scale       | ± 7.5% of full scale | ± 9% of full scale   |

Notes: (1) Do not exceed ± 145 psia.

(2) Difference between inlet pressure and calibrated pressure.  
Do not exceed ± 10 psia.

### Repeatability

± 0.5% of full scale

### Temperature Coefficient

0.08% of full scale per °F (0.15% of full scale per °C), or better

### Pressure Coefficient

0.01% of full scale per psia (0.15% of full scale per bar), or better

### Response Time

800 ms time constant; six seconds (typical) within ± 2% of final value over 25 to 100% of full scale

## Operating Specifications

### Fluid

Clean Gas, Air, Clean water, specify when ordering.

### Flow Rates

Gas : 0-100 SLPM to 0-500 SLPM (50m/s)

Liquid : 0-10 SLPM to 0-100 SLPM (10m/s)

### Fluid Pressure

145 psia (10 barg) maximum

20 psia (1.4 barg) optimum

### Fluid & Ambient Temperature

Fluid : 14°F to 176°F (-10°C to 80°C)

Ambient : 32°F to 122°F (0°C to 50°C)

### Leak Integrity

1 X 10<sup>-4</sup> atm cc/sec of helium maximum

### Pressure Drop

| Gas       |             | Liquid    |             |
|-----------|-------------|-----------|-------------|
| Flow Rate | Cm of water | Flow Rate | Cm of water |
| 50 SLPM   |             | 10 SLPM   |             |
| 100 SLPM  |             | 20 SLPM   |             |
| 150 SLPM  |             | 40 SLPM   |             |
| 200 SLPM  |             | 60 SLPM   |             |
| 300 SLPM  |             | 70 SLPM   |             |
| 400 SLPM  |             | 80 SLPM   |             |
| 500 SLPM  |             | 100 SLPM  |             |

### Power Requirements

Gas : DC24 V ± 10% (regulated), 150 mA maximum

Liquid : DC24 V ± 10% (regulated), 300 mA maximum

## Operating Specifications

### Output Signal

Linear 0~10 VDC, 1000 ohms minimum load resistance or  
Linear 4~20 mA proportional mass flow rate.  
700 ohms maximum resistance power supply dependent  
User-selectable ... Active non-galvanic ally separated or  
Passive galvanic ally separated  
(loop power required)

### Alarms

Hard contact user-adjustable high and low dead band  
adjustable with Smart Interface™ software  
Relay ratings ... Maximum 42 VDC or VAC, 140 mA

### Displays

Alphanumeric 2 x 16 digit backlight LCD  
Adjustable variables via on-board switches (password  
protected) or with Smart Interface windows® software  
Adjustable variables ... Full scale (50 to 100 %)  
Time Response (1 to 7 seconds)  
Correction factor setting (0.5 to 5)  
Zero and span  
High and low alarm settings

### Totalize

Seven digits (9,999,999.9) in engineering units  
Reset table by software, on-board switches or external magnet

### Software

Smart Interface Windows®-based software minimum 8 MB  
of RAM, preferred 16 MB of RAM  
RS-232 communication  
Additional features ... Alarm dead band adjustment  
Zero cut-off adjustment  
Linearization adjustment  
Save / Load configurations  
Flow meter validation

## Physical Specifications

### Wetted Materials

316L, 304 stainless steel

### Enclosure

NEMA 4X  
(IP65)  
Powder-coated cast aluminum

### Electrical Connections

One 1/2 inch NPT ... NEMA 4X Enclosure (IP65)

### Certifications\*

CE (All enclosures)  
CSA (Explosion-proof for Class 1, Division 1, Groups B, C, D)  
EEx (EEx d IIC T6...T2)  
FM (Explosion-proof for Class 1, Division 1, Groups B, C, D)  
\* Certifications Pending, Contact factory



## Features

- Close loop control
- 24 bit Analog digital converter (ADC)
- Output accuracy  $\pm 0.1\%$ ,  $\pm 2.5 \mu\text{A}$  (4~20mA)  
Output accuracy  $\pm 0.01\%$ ,  $\pm 1\text{mV}$  (0~10VDC)
- Field adjustment of critical flow meter settings Smart interface (RS-232)
- Field validation of flow meter calibration
- Direct mass flow monitoring eliminates need for temperature and pressure compensation
- Greatly reduces upstream piping requirements
- Outstanding Range ability
- One-second response to changes in flow rate
- CE, EEx, CENELEC (Pending)



## Description

*i*entek Instruments ientek 3100S Smart Insertion mass flow meter accommodates the change measurement requirements and instrument-validation demands of industrial gas flow monitoring installations.

The versatile microprocessor-based transmitter integrates the functions of flow measurement, flow range adjustment, meter validation and diagnostics, in either a probe-mounted or remote housing.

Mass flow rate and totalized flow, as well as other configuration variables, are displayed on the meter's optional  $2 \times 16$  LCD panel. The programmable transmitter is easily configured via an RS-232 communication port and ientek's Smart Interface™ software, or via the display and magnetic switches on the instrument panel.

The ientek 3100S allows you to configure or change the following password protected parameters : flow range, totalize, alarm settings, time response, low flow cutoff and a calibration correction factor that compensates for flow profile flow variations.

ientek's Smart Interface™ software guides you through a procedure to fully validate instrument performance.

The meter is available with a variety of input power, output signal, mounting and packaging options.

The information contained herein is subject to change without notice.

# 3100 Series Smart-IN™ Mass Flow Meter

3100

## Performance Specifications

### Accuracy of Point Velocity

±2% of reading from 10 to 100% of calibrated range  
±0.5% of full scale below 10% of calibrated range

### Repeatability

±0.2% of full scale

### Temperature Coefficient

±0.02% of reading per °F within ±50 °F of customer specified conditions.  
±0.03% of reading per °F within ±50 °F to 100 °F of customer specified conditions.  
±0.04% of reading per °C within ±25 °C of customer specified conditions.  
±0.06% of reading per °C within ±25 °C to 50 °C of customer specified conditions.

### Pressure Coefficient

0.02% per psi for air, consult factory for other gases

### Response Time

One second 63% of final velocity value.

## Operating Specifications

### Gases

Most gases compatible with 316L stainless steel

### Gas Pressure(2 limitations)

Compression fittings : 500 psia(34 barg)  
1-inch 150 lb flange(-40°F to 150°F) : 185 psia(12.8 barg)  
Low Pressure Hot Tap : 100 psia(7 barg)  
High Pressure Hot Tap : 1000 psia(70 barg)  
Application gas pressure :  
See mass flow range tables for maximum application gas pressures.

### Pressure Drop

Negligible for pipes three inches in diameter or larger

### Gas & Ambient Temperature

Gas ..... 15°F to 250°F (-10°C to 120°C )  
Optional -40°F to 450°F (-40°C to 230°C),  
Application dependent  
Higher temperature available, consult factory  
Ambient ... -5°F to 120°F (-20°C to 50°C )

### Leak Integrity

$5 \times 10^{-4}$  atm cc/sec of helium maximum

### Power Requirements

DC 24 V ±10% (regulated), 625mA maximum  
90-240 VAC ±10% (regulated), 15watts maximum

### Output Signal

Linear 0~10VDC , 1000 ohms minimum load resistance or  
Linear 4~20mA proportional mass flow rate.  
700 ohms maximum resistance power supply dependent  
User - selectable ... Active non-galvanic ally separated or  
passive galvanic ally separated (loop power required)

### Alarms

Hard contact user-adjustable high and low  
Dead band adjustable with Smart Interface™ software  
Relay ratings - Maximum 42VDC or VAC, 140mA

### Displays

Alphanumeric 2 × 16 digit backlight LCD  
Adjustable variables via on-board switches  
(password protected) or with Smart Interface™ software  
Adjustable variables ... Full scale (50 to 100%)  
Time Response (1 to 7 seconds)  
Correction factor setting (0.5 to 5)  
Zero and span  
High and low alarm settings

### Totalize

Seven digits (9,999,999.9) in engineering units  
Reset table by software, on-board switches or external magnet

### Software

Smart Interface™ Windows® - bases software minimum 8 MB of RAM, preferred 16 MB of RAM  
RS-232 communication  
Additional features...Alarm dead band adjustment  
Zero cut-off adjustment  
Linearization adjustment  
Save/Load configurations  
Flow meter validation

## Physical Specifications

### Wetted Materials

316L stainless steel

### Enclosure

Hazardous-Area Location Enclosure (IP67) or NEMA 4X (IP65)  
Both are powder-coated cast aluminum

### Electrical Connections

Two 3/4 inch NPT...Hazardous-Area Location Enclosure (IP67)  
One 1/2 inch NPT...NEMA 4X Enclosure (IP65)

### Mounting (optional)

ANSI 1-inch 150 lb flange  
3/4-inch tube compression fitting with 1-inch male NPT.  
Hot tap systems

### Certifications\*

CE (All enclosures)  
CSA(Explosion-proof for Class 1, Division 1, Groups B,C,D)  
EEx (EEx d IIC T6...T2)  
FM (Explosion-proof for Class 1, Division 1, Groups B,C,D)  
\* Certifications Pending, Contact factory

## Mass Flow Ranges

EEx approved meters maximum velocities and flow rate are 50% of standard values shown in charts.

### 3100S-Air-Gas Code 0 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 20,000         | 120        | 189                     | 120      |
| standard accuracy | 1-1/2"    | 0.0142      | 20,000         | 284        | 448                     | 120      |
| standard accuracy | 2"        | 0.0233      | 20,000         | 466        | 735                     | 120      |
| standard accuracy | 3"        | 0.0513      | 20,000         | 1026       | 1618                    | 120      |
| standard accuracy | 4"        | 0.0884      | 20,000         | 1768       | 2788                    | 120      |
| standard accuracy | 6"        | 0.2010      | 20,000         | 4020       | 6340                    | 120      |
| standard accuracy | 8"        | 0.3470      | 20,000         | 6940       | 10945                   | 120      |
| standard accuracy | 10"       | 0.5480      | 20,000         | 10960      | 17285                   | 120      |
| standard accuracy | 12"       | 0.7770      | 20,000         | 15540      | 24508                   | 120      |
| standard accuracy | 14"       | 0.9390      | 20,000         | 18780      | 29618                   | 120      |
| standard accuracy | 16"       | 1.2270      | 20,000         | 24540      | 38703                   | 120      |
| standard accuracy | 18"       | 1.5530      | 20,000         | 31060      | 48985                   | 120      |
| standard accuracy | 24"       | 2.7920      | 20,000         | 55840      | 88066                   | 120      |
| standard accuracy | 36"       | 6.4920      | 20,000         | 129840     | 204773                  | 120      |

### 3100S-Digester-Gas Code 4 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 17,200         | 103        | 163                     | 30       |
| standard accuracy | 1-1/2"    | 0.0142      | 17,200         | 244        | 385                     | 30       |
| standard accuracy | 2"        | 0.0233      | 17,200         | 401        | 632                     | 30       |
| standard accuracy | 3"        | 0.0513      | 17,200         | 882        | 1392                    | 30       |
| standard accuracy | 4"        | 0.0884      | 17,200         | 1520       | 2398                    | 30       |
| standard accuracy | 6"        | 0.2010      | 17,200         | 3457       | 5452                    | 30       |
| standard accuracy | 8"        | 0.3470      | 17,200         | 5968       | 9413                    | 30       |
| standard accuracy | 10"       | 0.5480      | 17,200         | 9426       | 14865                   | 30       |
| standard accuracy | 12"       | 0.7770      | 17,200         | 13364      | 21077                   | 30       |
| standard accuracy | 14"       | 0.9390      | 17,200         | 16151      | 25472                   | 30       |
| standard accuracy | 16"       | 1.2270      | 17,200         | 21104      | 33284                   | 30       |
| standard accuracy | 18"       | 1.5530      | 17,200         | 26712      | 42127                   | 30       |
| standard accuracy | 24"       | 2.7920      | 17,200         | 48022      | 75737                   | 30       |
| standard accuracy | 36"       | 6.4920      | 17,200         | 111662     | 176105                  | 30       |

### 3100S-Argon-Gas Code 1 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 28,000         | 168        | 265                     | 120      |
| standard accuracy | 1-1/2"    | 0.0142      | 28,000         | 398        | 627                     | 120      |
| standard accuracy | 2"        | 0.0233      | 28,000         | 652        | 1029                    | 120      |
| standard accuracy | 3"        | 0.0513      | 28,000         | 1436       | 2265                    | 120      |
| standard accuracy | 4"        | 0.0884      | 28,000         | 2475       | 3904                    | 120      |
| standard accuracy | 6"        | 0.2010      | 28,000         | 5628       | 8876                    | 120      |
| standard accuracy | 8"        | 0.3470      | 28,000         | 9716       | 15324                   | 120      |
| standard accuracy | 10"       | 0.5480      | 28,000         | 15344      | 24199                   | 120      |
| standard accuracy | 12"       | 0.7770      | 28,000         | 21756      | 34312                   | 120      |
| standard accuracy | 14"       | 0.9390      | 28,000         | 26292      | 41486                   | 120      |
| standard accuracy | 16"       | 1.2270      | 28,000         | 34356      | 54184                   | 120      |
| standard accuracy | 18"       | 1.5530      | 28,000         | 43484      | 68579                   | 120      |
| standard accuracy | 24"       | 2.7920      | 28,000         | 78176      | 123293                  | 120      |
| standard accuracy | 36"       | 6.4920      | 28,000         | 181776     | 286683                  | 120      |

### 3100S-Digester-Gas Code 5 Application Temp.=15-250 °F

| Spec (%rdg)    | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|----------------|-----------|-------------|----------------|------------|-------------------------|----------|
| 4% correlation | 1"        | 0.0060      | 17,200         | 103        | 163                     | 120      |
| 4% correlation | 1-1/2"    | 0.0142      | 17,200         | 244        | 385                     | 120      |
| 4% correlation | 2"        | 0.0233      | 17,200         | 401        | 632                     | 120      |
| 4% correlation | 3"        | 0.0513      | 17,200         | 882        | 1392                    | 120      |
| 4% correlation | 4"        | 0.0884      | 17,200         | 1520       | 2398                    | 120      |
| 4% correlation | 6"        | 0.2010      | 17,200         | 3457       | 5452                    | 120      |
| 4% correlation | 8"        | 0.3470      | 17,200         | 5968       | 9413                    | 120      |
| 4% correlation | 10"       | 0.5480      | 17,200         | 9426       | 14865                   | 120      |
| 4% correlation | 12"       | 0.7770      | 17,200         | 13364      | 21077                   | 120      |
| 4% correlation | 14"       | 0.9390      | 17,200         | 16151      | 25472                   | 120      |
| 4% correlation | 16"       | 1.2270      | 17,200         | 21104      | 33284                   | 120      |
| 4% correlation | 18"       | 1.5530      | 17,200         | 26712      | 42127                   | 120      |
| 4% correlation | 24"       | 2.7920      | 17,200         | 48022      | 75737                   | 120      |
| 4% correlation | 36"       | 6.4920      | 17,200         | 111662     | 176105                  | 120      |

### 3100S-CO<sub>2</sub>-Gas Code 2 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 19,800         | 119        | 187                     | 120      |
| standard accuracy | 1-1/2"    | 0.0142      | 19,800         | 281        | 443                     | 120      |
| standard accuracy | 2"        | 0.0233      | 19,800         | 461        | 728                     | 120      |
| standard accuracy | 3"        | 0.0513      | 19,800         | 1016       | 1602                    | 120      |
| standard accuracy | 4"        | 0.0884      | 19,800         | 1750       | 2760                    | 120      |
| standard accuracy | 6"        | 0.2010      | 19,800         | 3980       | 6277                    | 120      |
| standard accuracy | 8"        | 0.3470      | 19,800         | 6871       | 10836                   | 120      |
| standard accuracy | 10"       | 0.5480      | 19,800         | 10650      | 17112                   | 120      |
| standard accuracy | 12"       | 0.7770      | 19,800         | 15385      | 24263                   | 120      |
| standard accuracy | 14"       | 0.9390      | 19,800         | 18592      | 29322                   | 120      |
| standard accuracy | 16"       | 1.2270      | 19,800         | 24295      | 38316                   | 120      |
| standard accuracy | 18"       | 1.5530      | 19,800         | 30749      | 48495                   | 120      |
| standard accuracy | 24"       | 2.7920      | 19,800         | 55282      | 87186                   | 120      |
| standard accuracy | 36"       | 6.4920      | 19,800         | 128542     | 202726                  | 120      |

### 3100S-Helium-Gas Code 6 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 12,400         | 74         | 117                     | 120      |
| standard accuracy | 1-1/2"    | 0.0142      | 12,400         | 176        | 278                     | 120      |
| standard accuracy | 2"        | 0.0233      | 12,400         | 289        | 456                     | 120      |
| standard accuracy | 3"        | 0.0513      | 12,400         | 636        | 1003                    | 120      |
| standard accuracy | 4"        | 0.0884      | 12,400         | 1096       | 1729                    | 120      |
| standard accuracy | 6"        | 0.2010      | 12,400         | 2492       | 3931                    | 120      |
| standard accuracy | 8"        | 0.3470      | 12,400         | 4303       | 6786                    | 120      |
| standard accuracy | 10"       | 0.5480      | 12,400         | 6795       | 10717                   | 120      |
| standard accuracy | 12"       | 0.7770      | 12,400         | 9635       | 15195                   | 120      |
| standard accuracy | 14"       | 0.9390      | 12,400         | 11644      | 18363                   | 120      |
| standard accuracy | 16"       | 1.2270      | 12,400         | 15215      | 23996                   | 120      |
| standard accuracy | 18"       | 1.5530      | 12,400         | 19257      | 30371                   | 120      |
| standard accuracy | 24"       | 2.7920      | 12,400         | 34621      | 54601                   | 120      |
| standard accuracy | 36"       | 6.4920      | 12,400         | 80501      | 126959                  | 120      |

### 3100S-Chlorine-Gas Code 3 Application Temp.=50-90 °F

| Spec (%FS)     | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|----------------|-----------|-------------|----------------|------------|-------------------------|----------|
| 5% correlation | 1"        | 0.0060      | 3,261          | 1.5        | 1                       | 120      |
| 5% correlation | 1-1/2"    | 0.0142      | 3,333          | 6.5        | 10                      | 120      |
| 5% correlation | 2"        | 0.0233      | 3,380          | 12.0       | 19                      | 120      |
| 5% correlation | 3"        | 0.0513      | 3,333          | 20         | 32                      | 120      |
| 5% correlation | 4"        | 0.0884      | 3,169          | 45         | 71                      | 120      |
| 5% correlation | 6"        | 0.2010      | 3,219          | 75         | 118                     | 120      |
| 5% correlation | 8"        | 0.3470      | 3,411          | 175        | 276                     | 120      |

# Mass Flow Ranges

EEx approved meters maximum velocities and flow rate are 50% of standard values shown in charts.

## 3100S-Hydrogen-Gas Code 7 Application Temp.=50-90 °F

| Spec (%FS)                                      | Pipe Size | Area (SqFt) | Max Vel (SFPm) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|---|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy                               | 1"        | 0.0060      | 9,600          | 58         | 91                      | 135      |
| standard accuracy                               | 1-1/2"    | 0.0142      | 7,042          | 100        | 158                     | 135      |
| standard accuracy                               | 2"        | 0.0233      | 4,290          | 100        | 158                     | 135      |
| standard accuracy                               | 3"        | 0.0513      | 1,950          | 100        | 158                     | 135      |
| standard accuracy                               | 4"        | 0.0884      | 1,130          | 100        | 158                     | 135      |
| standard accuracy                               | 6"        | 0.2010      | 500            | 100        | 158                     | 135      |
| standard accuracy                               | 8"        | 0.3470      | 290            | 100        | 158                     | 135      |
| See chart below for flows greater than 100 SCFM |           |             |                |            |                         |          |
| standard accuracy                               | 1-1/2"    | 0.0142      | 9,600          | 136        | 215                     | 85       |
| standard accuracy                               | 2"        | 0.0233      | 9,600          | 224        | 354                     | 85       |
| standard accuracy                               | 3"        | 0.0513      | 4,873          | 250        | 395                     | 85       |
| standard accuracy                               | 4"        | 0.0884      | 2,828          | 250        | 395                     | 85       |
| standard accuracy                               | 6"        | 0.2010      | 1,243          | 250        | 395                     | 85       |
| standard accuracy                               | 8"        | 0.3470      | 720            | 250        | 395                     | 85       |
| See chart below for flows greater than 250 SCFM |           |             |                |            |                         |          |
| standard accuracy                               | 3"        | 0.0513      | 7,797          | 400        | 630                     | ambient  |
| standard accuracy                               | 4"        | 0.0884      | 4,525          | 400        | 630                     | ambient  |
| standard accuracy                               | 6"        | 0.2010      | 1,990          | 400        | 630                     | ambient  |
| standard accuracy                               | 8"        | 0.3470      | 1,153          | 400        | 630                     | ambient  |

## 3100S-CH<sub>4</sub>-Gas Code 8 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPm) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 16,000         | 96         | 151                     | 30       |
| standard accuracy | 1-1/2"    | 0.0142      | 16,000         | 227        | 358                     | 30       |
| standard accuracy | 2"        | 0.0233      | 16,000         | 373        | 588                     | 30       |
| standard accuracy | 3"        | 0.0513      | 16,000         | 821        | 1295                    | 30       |
| standard accuracy | 4"        | 0.0884      | 16,000         | 1414       | 2231                    | 30       |
| standard accuracy | 6"        | 0.2010      | 16,000         | 3216       | 5072                    | 30       |
| standard accuracy | 8"        | 0.3470      | 16,000         | 5552       | 8756                    | 30       |
| standard accuracy | 10"       | 0.5480      | 16,000         | 8768       | 13828                   | 30       |
| standard accuracy | 12"       | 0.7770      | 16,000         | 12432      | 19607                   | 30       |
| standard accuracy | 14"       | 0.9390      | 16,000         | 15024      | 23695                   | 30       |
| standard accuracy | 16"       | 1.2270      | 16,000         | 19632      | 30962                   | 30       |
| standard accuracy | 18"       | 1.5530      | 16,000         | 24848      | 39188                   | 30       |
| standard accuracy | 24"       | 2.7920      | 16,000         | 44672      | 70453                   | 30       |
| standard accuracy | 36"       | 6.4920      | 16,000         | 102872     | 163819                  | 30       |

## 3100S-CH<sub>4</sub>-Gas Code 9 Application Temp.=15-250 °F

| Spec (%rdg)    | Pipe Size | Area (SqFt) | Max Vel (SFPm) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|----------------|-----------|-------------|----------------|------------|-------------------------|----------|
| 4% correlation | 1"        | 0.0060      | 16,000         | 96         | 151                     | 120      |
| 4% correlation | 1-1/2"    | 0.0142      | 16,000         | 227        | 358                     | 120      |
| 4% correlation | 2"        | 0.0233      | 16,000         | 373        | 588                     | 120      |
| 4% correlation | 3"        | 0.0513      | 16,000         | 821        | 1295                    | 120      |
| 4% correlation | 4"        | 0.0884      | 16,000         | 1414       | 2231                    | 120      |
| 4% correlation | 6"        | 0.2010      | 16,000         | 3216       | 5072                    | 120      |
| 4% correlation | 8"        | 0.3470      | 16,000         | 5552       | 8756                    | 120      |
| 4% correlation | 10"       | 0.5480      | 16,000         | 8768       | 13828                   | 120      |
| 4% correlation | 12"       | 0.7770      | 16,000         | 12432      | 19607                   | 120      |
| 4% correlation | 14"       | 0.9390      | 16,000         | 15024      | 23695                   | 120      |
| 4% correlation | 16"       | 1.2270      | 16,000         | 19632      | 30962                   | 120      |
| 4% correlation | 18"       | 1.5530      | 16,000         | 24848      | 39188                   | 120      |
| 4% correlation | 24"       | 2.7920      | 16,000         | 44672      | 70453                   | 120      |
| 4% correlation | 36"       | 6.4920      | 16,000         | 102872     | 163819                  | 120      |

## 3100S-Nitrogen-Gas Code 10 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPm) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 19,800         | 119        | 187                     | 120      |
| standard accuracy | 1-1/2"    | 0.0142      | 19,800         | 281        | 443                     | 120      |
| standard accuracy | 2"        | 0.0233      | 19,800         | 461        | 728                     | 120      |
| standard accuracy | 3"        | 0.0513      | 19,800         | 1016       | 1602                    | 120      |
| standard accuracy | 4"        | 0.0884      | 19,800         | 1750       | 2760                    | 120      |
| standard accuracy | 6"        | 0.2010      | 19,800         | 3980       | 6277                    | 120      |
| standard accuracy | 8"        | 0.3470      | 19,800         | 6871       | 10836                   | 120      |
| standard accuracy | 10"       | 0.5480      | 19,800         | 10650      | 17112                   | 120      |
| standard accuracy | 12"       | 0.7770      | 19,800         | 15385      | 24263                   | 120      |
| standard accuracy | 14"       | 0.9390      | 19,800         | 18592      | 29322                   | 120      |
| standard accuracy | 16"       | 1.2270      | 19,800         | 24295      | 38316                   | 120      |
| standard accuracy | 18"       | 1.5530      | 19,800         | 30749      | 48495                   | 120      |
| standard accuracy | 24"       | 2.7920      | 19,800         | 55282      | 87186                   | 120      |
| standard accuracy | 36"       | 6.4920      | 19,800         | 128542     | 202726                  | 120      |

## 3100S-Oxygen-Gas Code 11 Application Temp.=15-250 °F

| Spec (%rdg)    | Pipe Size | Area (SqFt) | Max Vel (SFPm) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|----------------|-----------|-------------|----------------|------------|-------------------------|----------|
| 4% correlation | 1"        | 0.0060      | 19,800         | 119        | 187                     | 120      |
| 4% correlation | 1-1/2"    | 0.0142      | 19,800         | 281        | 443                     | 120      |
| 4% correlation | 2"        | 0.0233      | 19,800         | 461        | 728                     | 120      |
| 4% correlation | 3"        | 0.0513      | 19,800         | 1016       | 1602                    | 120      |
| 4% correlation | 4"        | 0.0884      | 19,800         | 1750       | 2760                    | 120      |
| 4% correlation | 6"        | 0.2010      | 19,800         | 3980       | 6277                    | 120      |
| 4% correlation | 8"        | 0.3470      | 19,800         | 6871       | 10836                   | 120      |
| 4% correlation | 10"       | 0.5480      | 19,800         | 10650      | 17112                   | 120      |
| 4% correlation | 12"       | 0.7770      | 19,800         | 15385      | 24263                   | 120      |
| 4% correlation | 14"       | 0.9390      | 19,800         | 18592      | 29322                   | 120      |
| 4% correlation | 16"       | 1.2270      | 19,800         | 24295      | 38316                   | 120      |
| 4% correlation | 18"       | 1.5530      | 19,800         | 30749      | 48495                   | 120      |
| 4% correlation | 24"       | 2.7920      | 19,800         | 55282      | 87186                   | 120      |
| 4% correlation | 36"       | 6.4920      | 19,800         | 128542     | 202726                  | 120      |

## 3100S-Propane-Gas Code 12 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPm) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 13,200         | 79         | 125                     | 30       |
| standard accuracy | 1-1/2"    | 0.0142      | 13,200         | 187        | 296                     | 30       |
| standard accuracy | 2"        | 0.0233      | 13,200         | 308        | 485                     | 30       |
| standard accuracy | 3"        | 0.0513      | 13,200         | 677        | 1068                    | 30       |
| standard accuracy | 4"        | 0.0884      | 13,200         | 1167       | 1840                    | 30       |
| standard accuracy | 6"        | 0.2010      | 13,200         | 2653       | 4184                    | 30       |
| standard accuracy | 8"        | 0.3470      | 13,200         | 4580       | 7224                    | 30       |
| standard accuracy | 10"       | 0.5480      | 13,200         | 7234       | 11408                   | 30       |
| standard accuracy | 12"       | 0.7770      | 13,200         | 10256      | 16176                   | 30       |
| standard accuracy | 14"       | 0.9390      | 13,200         | 12395      | 19548                   | 30       |
| standard accuracy | 16"       | 1.2270      | 13,200         | 16196      | 25544                   | 30       |
| standard accuracy | 18"       | 1.5530      | 13,200         | 20500      | 32330                   | 30       |
| standard accuracy | 24"       | 2.7920      | 13,200         | 36854      | 58124                   | 30       |
| standard accuracy | 36"       | 6.4920      | 13,200         | 85694      | 135150                  | 30       |

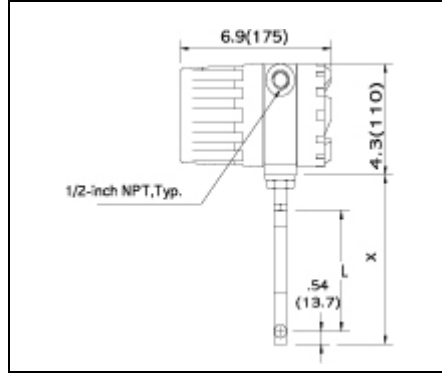
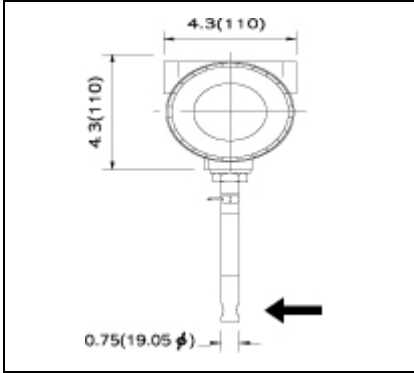
## 3100S-Propane-Gas Code 13 Application Temp.=15-250 °F

| Spec (%rdg)    | Pipe Size | Area (SqFt) | Max Vel (SFPm) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|----------------|-----------|-------------|----------------|------------|-------------------------|----------|
| 4% correlation | 1"        | 0.0060      | 13,200         | 79         | 125                     | 120      |
| 4% correlation | 1-1/2"    | 0.0142      | 13,200         | 187        | 296                     | 120      |
| 4% correlation | 2"        | 0.0233      | 13,200         | 308        | 485                     | 120      |
| 4% correlation | 3"        | 0.0513      | 13,200         | 677        | 1068                    | 120      |
| 4% correlation | 4"        | 0.0884      | 13,200         | 1167       | 1840                    | 120      |
| 4% correlation | 6"        | 0.2010      | 13,200         | 2653       | 4184                    | 120      |
| 4% correlation | 8"        | 0.3470      | 13,200         | 4580       | 7224                    | 120      |
| 4% correlation | 10"       | 0.5480      | 13,200         | 7234       | 11408                   | 120      |
| 4% correlation | 12"       | 0.7770      | 13,200         | 10256      | 16176                   | 120      |
| 4% correlation | 14"       | 0.9390      | 13,200         | 12395      | 19548                   | 120      |
| 4% correlation | 16"       | 1.2270      | 13,200         | 16196      | 25544                   | 120      |
| 4% correlation | 18"       | 1.5530      | 13,200         | 20500      | 32330                   | 120      |
| 4% correlation | 24"       | 2.7920      | 13,200         | 36854      | 58124                   | 120      |
| 4% correlation | 36"       | 6.4920      | 13,200         | 85694      | 135150                  | 120      |

## Dimensional Specifications

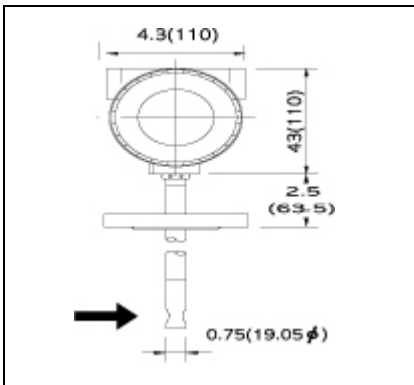
## Tables

Compression Fitting - Front View (E2)    Compression Fitting - Side View (E2)

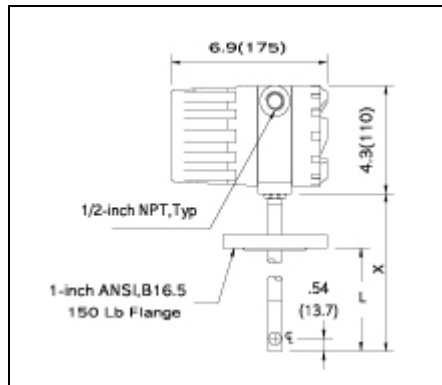


| Length Chart |                 |                 |
|--------------|-----------------|-----------------|
| Code         | L               | X               |
| L06          | 6.0<br>(152.4)  | 7.0<br>(177.8)  |
| L09          | 9.0<br>(228.6)  | 10.0<br>(254.0) |
| L13          | 13.0<br>(330.2) | 14.0<br>(355.6) |
| L18          | 18.0<br>(457.2) | 19.0<br>(482.6) |
| L24          | 24.0<br>(609.6) | 25.0<br>(635.0) |
| L36          | 36.0<br>(914.4) | 37.0<br>(939.8) |

Flange Mounting - Front View (E2)

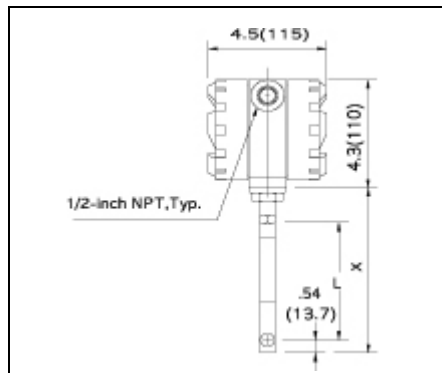
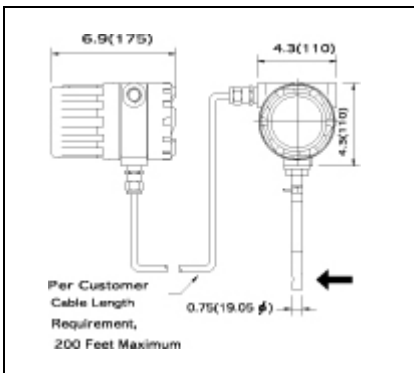


Flange Mounting - Side View (E2)



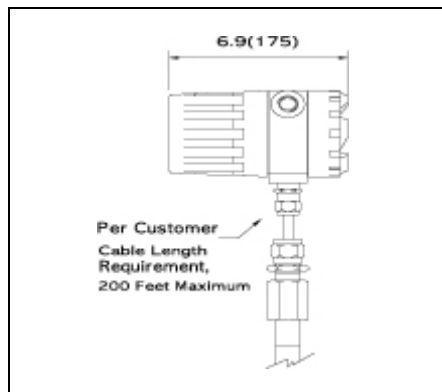
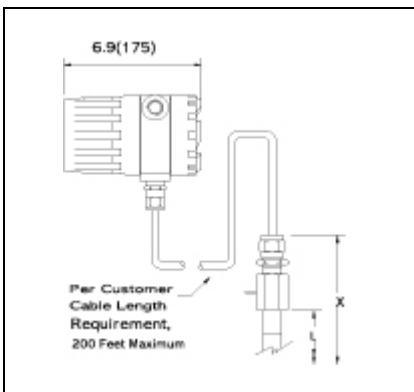
| Length Chart |                 |                 |
|--------------|-----------------|-----------------|
| Code         | L               | X               |
| L06          | 6.0<br>(152.4)  | 9.0<br>(228.6)  |
| L09          | 9.0<br>(228.6)  | 12.0<br>(304.8) |
| L13          | 13.0<br>(330.2) | 16.0<br>(406.4) |
| L18          | 18.0<br>(457.2) | 21.0<br>(533.4) |
| L24          | 24.0<br>(609.6) | 27.0<br>(685.8) |
| L36          | 36.0<br>(914.4) | 39.0<br>(990.6) |

Remote Mount Junction Box - Front View (E4)    Remote Mount Junction Box - Side View (E4)

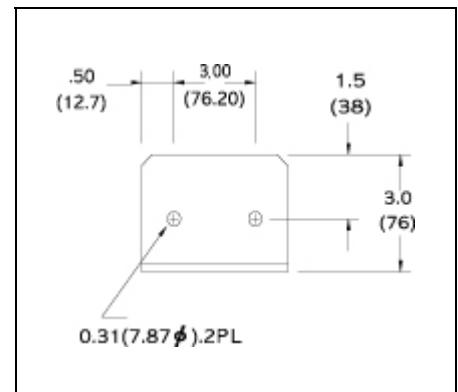


| Length Chart |                 |                 |
|--------------|-----------------|-----------------|
| Code         | L               | X               |
| L06          | 6.0<br>(152.4)  | 7.5<br>(190.5)  |
| L09          | 9.0<br>(228.6)  | 10.5<br>(266.7) |
| L13          | 13.0<br>(330.2) | 14.5<br>(368.3) |
| L18          | 18.0<br>(457.2) | 19.5<br>(495.3) |
| L24          | 24.0<br>(609.6) | 25.5<br>(647.7) |
| L36          | 36.0<br>(914.4) | 37.5<br>(952.5) |

Remote Mount - Front View (E3, EEx only)    Remote Mount - Side View (E3, EEx only)



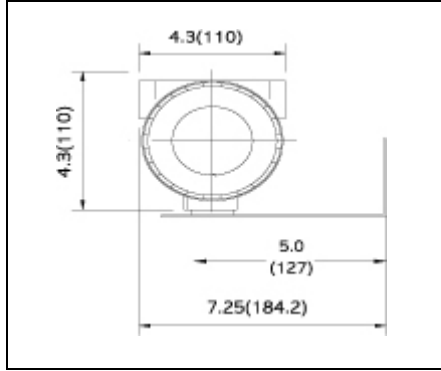
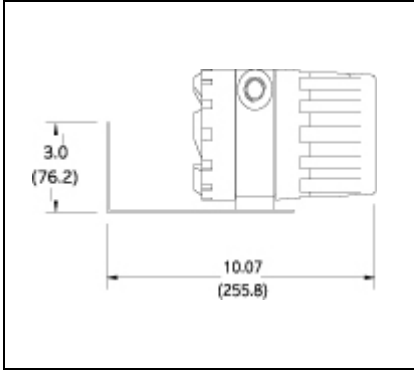
Mounting Holes for Remote Bracket



All dimensions are inches. Millimeters are in parentheses. Certified drawings are available on request.

## Dimensional Specifications ( I )

### Remote Rear Bracket Mounted Electronics Remote Side Bracket Mounted Electronics

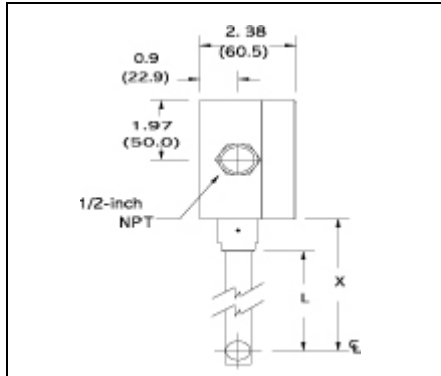
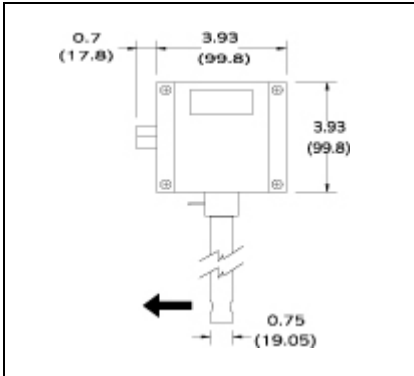


## Tables

| Length Chart |                 |                 |
|--------------|-----------------|-----------------|
| Code         | L               | X               |
| L06          | 6.1<br>(154.9)  | 7.1<br>(180.3)  |
| L09          | 9.1<br>(231.1)  | 10.1<br>(256.5) |
| L13          | 13.1<br>(332.7) | 14.1<br>(358.1) |
| L18          | 18.1<br>(459.7) | 19.1<br>(485.1) |
| L24          | 24.1<br>(612.1) | 25.1<br>(637.5) |
| L36          | 36.1<br>(916.9) | 37.1<br>(942.3) |

## NEMA 4X Dimensional Specifications

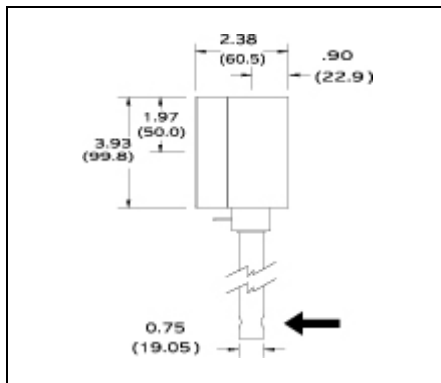
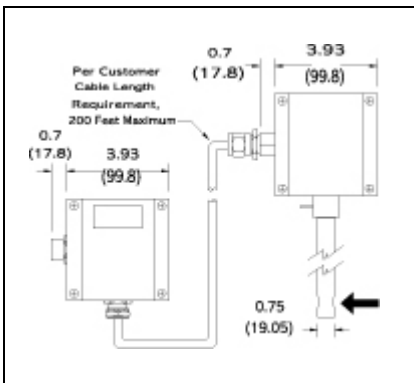
### Compression Fitting - Front View (EN2) Compression Fitting - Side View (EN2)



## Tables

| Length Chart |                 |                 |
|--------------|-----------------|-----------------|
| Code         | L               | X               |
| L06          | 6.0<br>(152.4)  | 8.6<br>(218.4)  |
| L09          | 9.0<br>(228.6)  | 11.6<br>(294.6) |
| L13          | 13.0<br>(330.2) | 15.6<br>(396.2) |
| L18          | 18.0<br>(457.2) | 20.6<br>(523.2) |
| L24          | 24.0<br>(609.6) | 26.6<br>(675.6) |
| L36          | 36.0<br>(914.4) | 38.6<br>(980.4) |

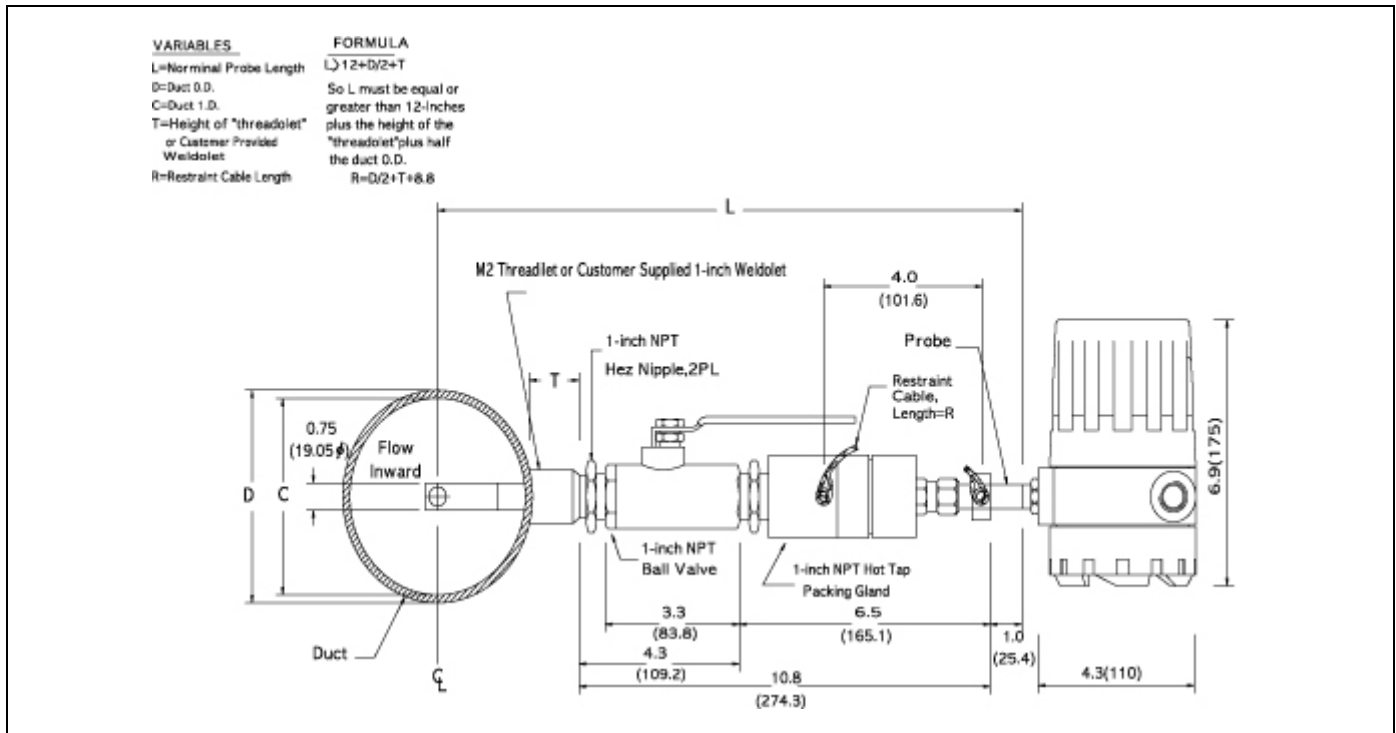
### Remote Mount Junction Box - Front View (EN4) Remote Mount Junction Box - Side View (EN4)



All dimensions are inches. Millimeters are in parentheses. All drawings have a  $\pm 0.25$  inch(6.4mm) tolerance. Certified drawings are available on request.

# Low Pressure Hot Tap Dimensional Specification

## Side View



All dimensions are inches. Millimeters are in parentheses.

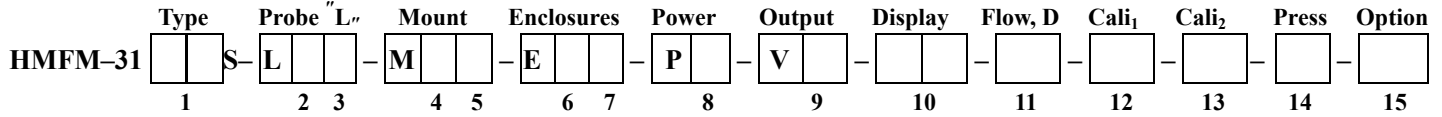
All drawings have a  $\pm 0.25$  inch (6.4mm) tolerance. Certified drawings are available on request.

## Up & Downstream Requirements

Select an installation site that will minimize possible distortion in the flow profile. Valves, elbows, control valves and other piping components may cause flow disturbances. Check your specific piping condition against the examples shown below. In order to achieve accurate and repeatable performance install the flow meter using the recommended number of straight run pipe diameters upstream and downstream of the sensor.

| Example | A-Upstream(1)Requirements | B-Downstream(2)Requirements |
|---------|---------------------------|-----------------------------|
| 1       | 15D                       | 5D                          |
| 2       | 20D                       | 5D                          |
| 3       | 40D                       | 10D                         |
| 4       | 15D                       | 5D                          |
| 5       | 30D                       | 10D                         |
| 6       | 40D                       | 5D                          |

(1)Number of diameter(D)of straight pipe required between upstream disturbance and the flow meter.  
 (2)Number of diameter(D)of straight pipe required downstream of the flow meter.



| Model Direction                     | Code 1 |
|-------------------------------------|--------|
| NAEA 4X                             | 10     |
| Hazardous-Area Location Enclosure   | 20     |
| Agency approved, customer specified | W      |

| Input Power                         | Code 8 |
|-------------------------------------|--------|
| DC24V ±10%                          | 2      |
| 90-240VAC ±10%, E20 ONLY.           | 3      |
| Agency approved, customer specified | W      |

| Calibration 2 <sup>9</sup>                            | Code 13 |
|---|---------|
| 70 °F (21.1 °C) <sup>8</sup><br>14.7 psia (1.103 bar) | A       |
| 32 °F (0 °C)<br>14.7 psia (1.103 bar)                 | B       |
| Agency approved, customer specified                   | W       |

| Insertion Length <sup>4</sup>        | Code 2,3 |
|--------------------------------------|----------|
| 6- inch (15cm)                       | 06       |
| 9- inch (23cm)                       | 09       |
| 13-inch (33cm)                       | 13       |
| 18-inch (46cm)                       | 18       |
| 24-inch (61cm)                       | 24       |
| 36-inch (92cm)                       | 36       |
| Special Length                       | (in)     |
| Probe with 1-inch 1501b Flange       | (in)-M5  |
| High Pressure Hot Top with Retractor | (in)-M9  |
| Agency approved, customer specified  | WW       |

| Output                              | Code 9 |
|-------------------------------------|--------|
| Relay output(High, Low)             | 1      |
| 0-10 VDC, Linear                    | 3      |
| 4-20 mA, Linear                     | 4      |
| Agency approved, customer specified | W      |

| Pressure                                    | Code 14 |
|---|---------|
| Low pressure<br>50 psia [ 3.5 bar ] Max.    | L       |
| Medium pressure<br>250 psia [ 17 bar ] Max. | M       |
| Agency approved, customer specified         | W       |

| Display                             | Code 10 |
|-------------------------------------|---------|
| No Readout                          | NR      |
| Digital Display                     | DD      |
| Agency approved, customer specified | WW      |

| Mounting   | Code 4,5 |
|--|----------|
| None   | 0        |
| Compression Fitting <sup>2</sup><br>(3/4-inch tube x 1-inch Male NPT)                          | 10       |
| Thread let (3/4-inch Female NPT)<br>Specify pipe O.D. in parentheses                           | 2 ( )    |
| Flat Duct Bracket<br>(3/4-inch tube compression Fitting)                                       | 3        |
| Curved Duct Bracket (3/4-inch tube<br>compression Fitting) Specify duct O.D.<br>in parentheses | 4 ( )    |
| Low Pressure Hot Tap.<br>Specify duct O.D. in parentheses                                      | 8 ( )    |
| Quick Removal Tap.<br>Maximum 40 psig (2.8 barg)   | 15 ( )   |
| Agency approved, customer specified  | WW       |

| Flow Direction                                | Code 11 |
|---|---------|
| Horizontal right to left, or<br>Vertical up   | 1       |
| Horizontal left to right, or<br>Vertical down | 2       |
| Agency approved, customer specified           | W       |

| Option                     | Code 15 |
|----------------------------|---------|
| Pressure Test Certificate  | PT      |
| Certificate of Conformance | CC      |
| NACE Certificate           | NC      |
| 24VDC Supply Unit          | DC      |
| RS-232 Cable 1M            | RS      |

| Enclosures <sup>5</sup>  | Code 6,7 |
|--|----------|
| Hazardous-Area Location Enclosure                                  | 20       |
| Remote Hazardous-Area Location<br>Enclosure (Only with EEx Meters) | 3(ft)    |
| Remote Hazardous-Area Location<br>Enclosure with Junction Box      | 4(ft)    |
| NEMA 4X  | N2       |
| Remote NEMA 4X with Junction Box                                   | N4(ft)   |
| Agency approved, customer specified                                | WW       |

| Calibration 1 <sup>9</sup>  | Code 12 |
|---|---------|
| Standard Calibration  | A       |
| Air, only for 3 inch and large pipe<br>size                                   |         |
| Compressed Air, only for 3 inch<br>and larger pipe sizes                      | D       |
| Customer Calibration  | B       |
| Air   |         |
| Air equivalency (digester gas, flue,<br>gas, etc).                            | C       |
| Nitrogen, helium, argon, carbon<br>dioxide, compressed air or digester<br>gas | E       |
| Hydrocarbons(natural gas, methane,<br>ethane, propane, etc).                  | F       |
| Hydrogen or hydrogen mixture  | G       |
| Agency approved, customer specified   | W       |

**Notes**

- Flange is tapped and threaded on the compression fitting.
- Material matches the selection in Box 2. Metal ferrule permanently locks after tightening compression fitting.
- Flange must be ANSI or DIN specifications.
- Maximum length is 60 inches [1524 mm].
- Enclosure required for agency approvals.  
T6 rated at 104°F [40°C].
- Wire resistance must be less than 8 ohms.
- Turndown ratio is 10:1 minimum and 100:1 maximum
- SFPS is the abbreviation for standard feet per second at 14.7 psia [1.01 bar(a)] and 70°F [21.1°C].
- Customer specified calibration must not exceed temperature and pressure limitations of the 1500. 1800.3000 series product specifications.
- Remote configuration is only available with aluminum local enclosure.

## Features

- Close loop control
- 24 bit Analog digital converter(ADC)
- Output accuracy  $\pm 0.1\%$ ,  $\pm 2.5 \mu A$ (4~20mA)  
Output accuracy  $\pm 0.01\%$ ,  $\pm 1mV$ (0~10VDC)
- Field adjustment of critical flow meter settings Smart Interface (RS-232)
- Field validation of flow meter calibration
- Direct mass flow monitoring eliminates need for temperature and pressure compensation
- Greatly reduces upstream piping requirements
- Outstanding Range ability
- One-second response to changes in flow rate
- CE, EEx, CENELEC(Pending)

## Description

The 3200S Smart-IN™ flow body eliminates velocity profile distortions, swirl and temperature stratifications in the gas stream and reduces the amount of upstream piping required for accurate flow measurement.

The versatile microprocessor-based transmitter integrates the functions of flow measurement, flow-range adjustment, meter validation and diagnostics, in either a probe-mounted or remote housing.

Mass flow rate and totalized flow, as well as other configuration variables, are displayed on the meter's optional  $2 \times 16$  LCD panel. The programmable transmitter is easily configured via an RS-232 communication port and ientek's Smart Interface™ software, or via the display and magnetic switches on the instrument panel.

The Series 3200S allows you to configure or change the following password protected parameters : flow range, totalize, alarm settings, time response, low flow cutoff and a calibration correction factor that compensates for flow profile variations.

ientek's Smart Interface™ software guides you through a procedure to fully validate instrument performance.

The meter is available with a variety of input power, output signal, mounting and packaging options.



# 3200 Series Smart-IN™ FLG Mass Flow Meter

3200

## Performance Specifications

### Accuracy

±2% of reading from 10 to 100% of calibrated range  
±0.5% of full scale below 10% of calibrated range

### Repeatability

±0.2% of full scale

### Temperature Coefficient

±0.02% of reading per °F within ±50°F of customer specified conditions.  
±0.03% of reading per °F within ±50°F to 100°F of customer specified conditions.  
±0.04% of reading per °C within ±25°C of customer specified conditions.  
±0.06% of reading per °C within ±25°C to 50°C of customer specified conditions.

### Pressure Coefficient

0.02% per psi for air, consult factory for other gases

### Response Time

One second 63% of final velocity value.

## Operating Specifications

### Gases

Most gases compatible with 316L stainless steel (consult factory)

### Gas Pressure(2 limitations)

Mechanical design pressure :

Compression fittings : 500 psia(34.5 barg)

150 lb flange or PN16 DIN(-40°F to 100°F)  
: 230 psia(15.9 barg)

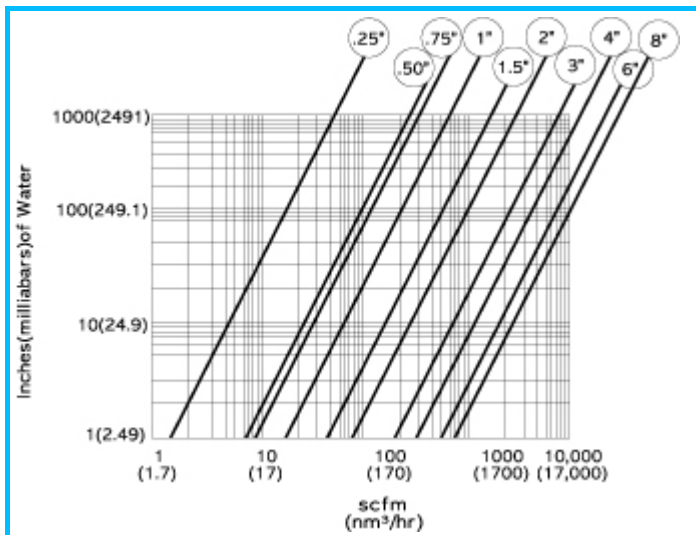
150 lb flange or PN16 DIN(250°F) : 185 psia(12.8 barg)

150 lb flange or PN16 DIN(450°F) : 155 psia(10.7 barg)

NPT (-40°F to 250°F) : 500 psia(34.5 barg)

Application gas pressure : See mass flow range tables for maximum application gas pressures.

### Pressure Drop



### Gas & Ambient Temperature

Gas 15°F to 250°F (-10°C to 120°C) Gas dependent.

See mass flow range tables for details

Ambient -5°F to 120°F (-20°C to 50°C)

### Leak Integrity

$5 \times 10^{-4}$  atm cc/sec of helium maximum

### Power Requirements

DC 24 V ±10% (regulated), 625mA maximum

90-240 VAC ±10% , 50/60Hz, 15watts maximum

### Output Signal

Linear 0~10 VDC, 1000 ohms minimum load resistance or

Linear 4~20mA proportional to mass flow rate,

700 ohms maximum resistance power supply dependent

User - selectable ... Active non-galvanic ally separated or

Passive galvanic ally separated

(loop power required)

### Alarms

Hard contact user-adjustable high and low

Dead band adjustable with Smart Interface™ software

Relay ratings - Maximum 400 VDC or VAC(peak),

140mA

### Displays

Alphanumeric 2×16 digit backlight LCD

Adjustable variables via on-board switches

(password protected) or with Smart Interface™ software

Adjustable variables ... Full scale (50 to 100%)

Time Response (1 to 7 seconds)

Correction factor setting (0.5 to 5)

Zero and span

High and low alarm settings

### Totalize

Seven digits (9,999,999.9) in engineering units

Reset table by software, on-board switches or external magnet

### Software

Smart Interface™ Windows®-bases software minimum 8 MB of RAM, preferred 16 MB of RAM

RS-232 communication

Additional features ... Alarm dead band adjustment

Zero cut-off adjustment

Linearization adjustment

Save/Load configurations

Flow meter validation

## Physical Specifications

### Wetted Materials

316L stainless steel

Carbon steel flow bodies available in some sizes

### Enclosure

Hazardous-Area Location Enclosure (IP67) or NEMA 4X (IP65)  
are powder-coated cast aluminum

### Electrical Connections

Two 3/4 inch NPT·····Hazardous-Area Location Enclosure (IP67)

One 1/2 inch NPT·····NEMA 4X Enclosure (IP65)

### Piping Requirements

| STRAIGHT PIPE LENGTH REQUIREMENTS AT 1 ATM |                 |               |                  |
|--|-----------------|---------------|------------------|
| Piping Condition                           | 3210S Smart-IN™ |               | Orifice Plate(3) |
|  | Upstream(1)     | Downstream(2) |                  |
| Single 90 Elbow<br>or T-Piece              | 1D              | 0D            | 28D              |
| Reduction(4:1)                             | 3D              | 0D            | 14D              |
| Expansion(4:1)                             | 3D              | 0D            | 30D              |
| After Control Valve                        | 3D              | 0D            | 32D              |
| Two 90 Elbows<br>(In Same Plane)           | 3D              | 0D            | 36D              |
| Two 90 Elbows<br>(Different Planes)        | 5D              | 0D            | 62D              |

- Notes :
- (1) Number of diameters (D) of straight pipe required between upstream disturbance and the flow meter.
  - (2) Number of diameters (D) of straight pipe required downstream of the flow meter.
  - (3) For comparison purposes only. Table shows number of diameters (D) of upstream straight pipe length required for an ISO Standard 5167 Orifice Plate with a beta ratio of 0.7
  - (4) Consult factory for pressure effects.

### Certifications\*

CE (All enclosures)

CSA (Explosion-proof for Class 1, Division 1, Groups B, C, D)

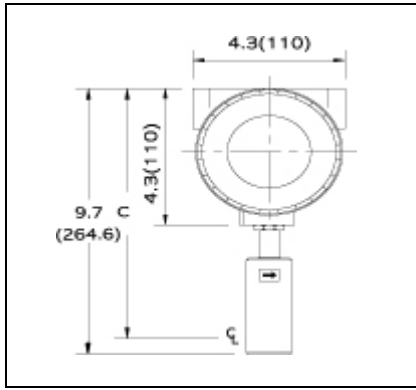
EEx (EEx d IIC T6···T2) CENELEC

FM (Explosion-proof for Class 1, Division 1, Groups B, C, D)

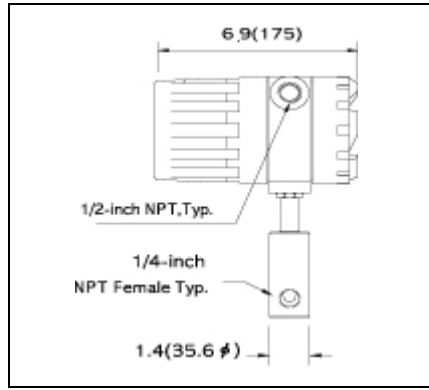
\* Certifications Pending, Contact factory

# Dimensional Specifications

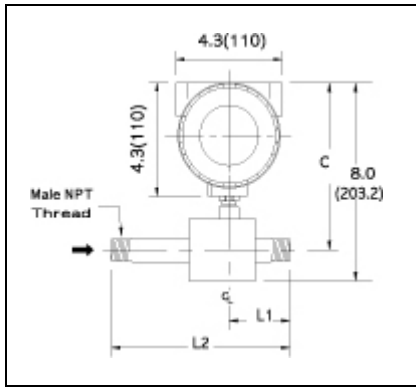
1/4 - inch NPT - Front View (E2)



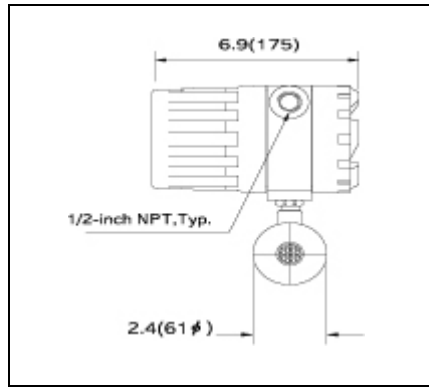
Compression Fitting - Side View (E2)



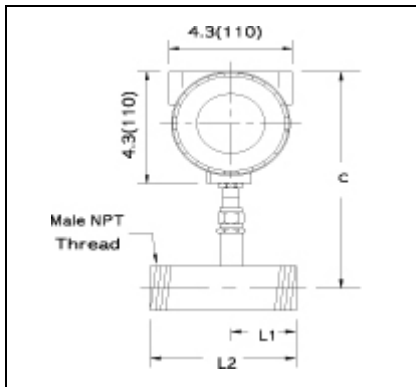
1/2, 3/4 - inch NPT - Front View (E2)



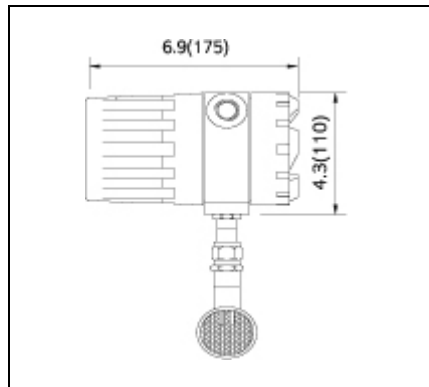
1/2, 3/4 - inch NPT - Side View (E2)



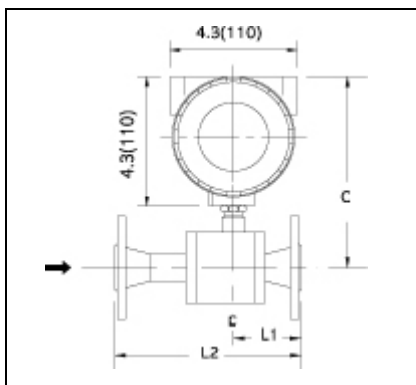
1 - inch Through 8 - inch NPT - Front View (E2)



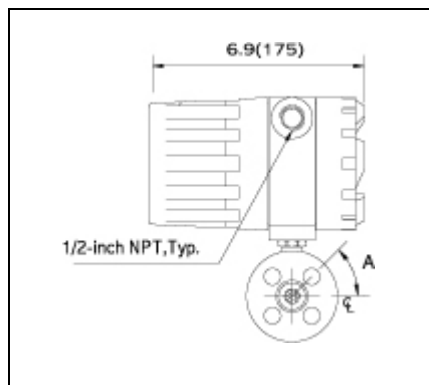
1 - inch Through 8 - inch NPT - Side View (E2)



1/2, 3/4 - inch 150 lb Flange - Front View (E2)



1/2, 3/4 - inch 150 lb Flange - Side View (E2)

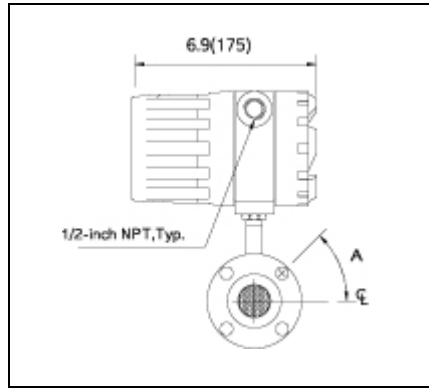
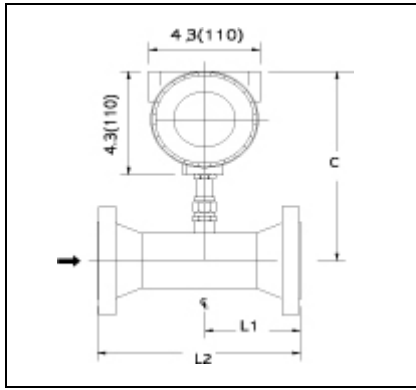


| SIZES FOR NPT |                  |                  |                 |                  |
|---------------|------------------|------------------|-----------------|------------------|
| Size          | H1               | C                | L1              | L2               |
| 1/4-inch      | 8.41<br>(213.6)  | 9.28<br>(235.7)  | —               | —                |
| 1/2-inch      | 7.79<br>(197.9)  | 6.94<br>(176.3)  | 2.20<br>(55.9)  | 6.50<br>(165.1)  |
| 3/4-inch      | 7.79<br>(197.9)  | 6.94<br>(176.3)  | 2.20<br>(55.9)  | 7.00<br>(177.8)  |
| 1-inch        | 8.97<br>(227.8)  | 9.00<br>(228.6)  | 1.50<br>(38.1)  | 3.50<br>(88.9)   |
| 1.5inch       | 8.97<br>(227.8)  | 9.00<br>(228.6)  | 2.25<br>(57.2)  | 5.25<br>(133.4)  |
| 2-inch        | 8.97<br>(227.8)  | 10.45<br>(265.4) | 3.50<br>(88.9)  | 7.50<br>(190.5)  |
| 3-inch        | 8.97<br>(227.8)  | 11.45<br>(290.8) | 4.00<br>(101.6) | 10.00<br>(254)   |
| 4-inch        | 8.98<br>(228.1)  | 11.45<br>(290.8) | 4.00<br>(101.6) | 12.00<br>(304.8) |
| 6-inch        | 10.98<br>(278.9) | 12.45<br>(316.2) | 6.00<br>(152.4) | 18.00<br>(457.2) |
| 8-inch        | 12.98<br>(329.7) | 13.45<br>(341.6) | 8.00<br>(203.2) | 24.00<br>(609.6) |

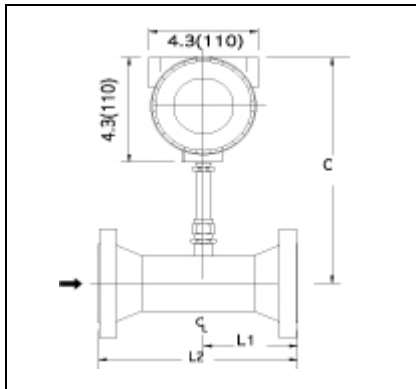
| SIZES FOR 150 LB ANSI FLANGES |                 |                 |                |                 |     |
|-------------------------------|-----------------|-----------------|----------------|-----------------|-----|
| Size                          | H1              | C               | L1             | L2              | A   |
| 1/2-inch                      | 7.79<br>(197.9) | 6.94<br>(176.3) | 2.60<br>(66.0) | 6.95<br>(176.5) | 45° |
| 3/4-inch                      | 7.79<br>(197.9) | 6.94<br>(176.3) | 2.78<br>(70.6) | 7.56<br>(192.0) | 45° |

## Dimensional Specifications

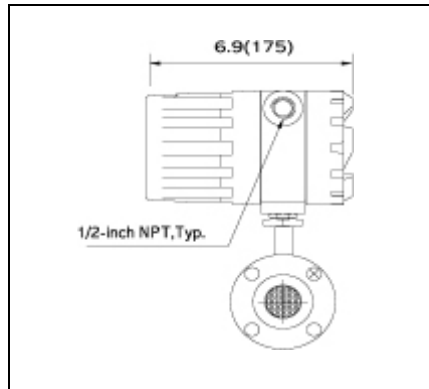
1" Through 8" 150 lb Flange - Front View (E2) 1" Through 8" 150 lb Flange - Side View (E2)



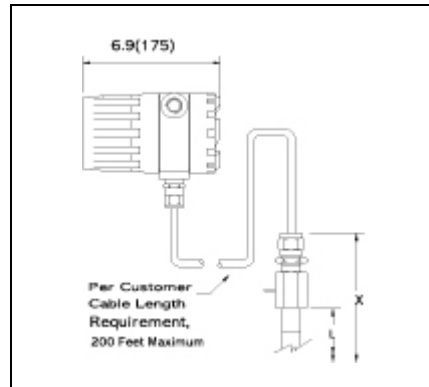
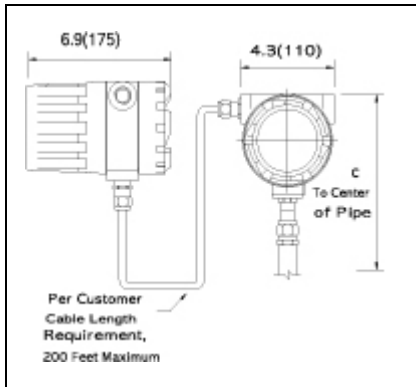
DIN Flange - Front View (E2)



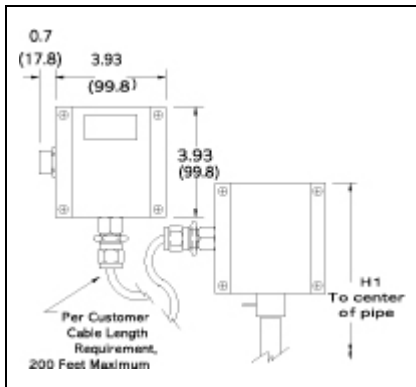
DIN Flange - Side View (E2)



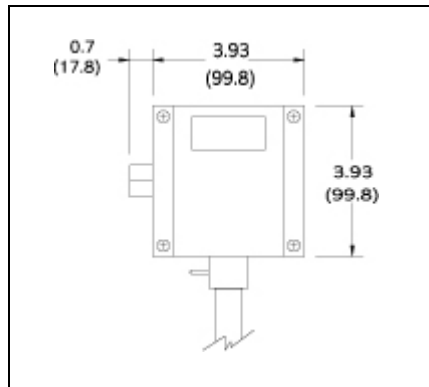
Remote Mounted with Junction Box (E4) Remote Mounted



Remote Mounted with Junction Box (EN4)



NEMA 4X Enclosure (EN2)

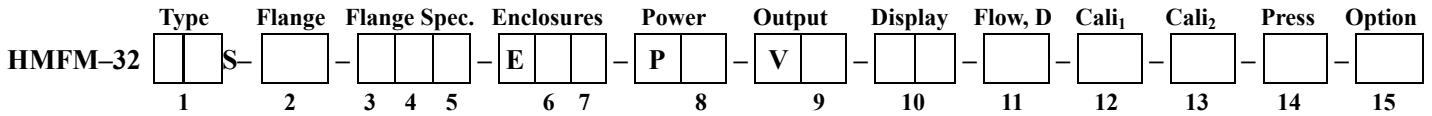


## Tables

| SIZES FOR 150 LB ANSI FLANGES |                  |                  |                 |                  |       |
|-------------------------------|------------------|------------------|-----------------|------------------|-------|
| Size                          | H1               | C                | L1              | L2               | A     |
| 1-inch                        | 6.35<br>(161.3)  | 9.47<br>(240.5)  | 3.60<br>(91.4)  | 7.40<br>(188.0)  | 45°   |
| 1.5-inch                      | 7.35<br>(186.7)  | 9.47<br>(240.5)  | 3.80<br>(96.5)  | 7.50<br>(190.5)  | 45°   |
| 2-inch                        | 7.35<br>(186.7)  | 9.47<br>(240.5)  | 3.50<br>(88.9)  | 7.50<br>(190.5)  | 45°   |
| 3-inch                        | 8.35<br>(212.1)  | 9.47<br>(240.5)  | 4.00<br>(101.6) | 10.00<br>(254.0) | 45°   |
| 4-inch                        | 8.35<br>(212.1)  | 9.47<br>(240.5)  | 4.00<br>(101.6) | 12.00<br>(304.8) | 22.5° |
| 6-inch                        | 9.35<br>(237.5)  | 11.47<br>(291.3) | 6.00<br>(152.4) | 18.00<br>(457.2) | 22.5° |
| 8-inch                        | 10.35<br>(262.9) | 13.47<br>(342.1) | 8.00<br>(203.2) | 24.00<br>(609.6) | 22.5° |

| SIZES FOR PN16 DIN FLANGES |                  |                  |                 |                  |
|----------------------------|------------------|------------------|-----------------|------------------|
| Size                       | H1               | C                | L1              | L2               |
| DN25                       | 8.30<br>(210.8)  | 8.88<br>(225.6)  | 3.18<br>(80.8)  | 7.40<br>(188.0)  |
| DN40                       | 8.90<br>(226.1)  | 9.50<br>(241.3)  | 3.61<br>(91.7)  | 7.40<br>(188.0)  |
| DN50                       | 10.10<br>(256.5) | 10.70<br>(271.8) | 3.34<br>(84.8)  | 7.10<br>(180.3)  |
| DN80                       | 9.90<br>(251.5)  | 10.50<br>(266.7) | 4.14<br>(105.2) | 10.20<br>(259.1) |
| DN100                      | 10.00<br>(254.0) | 10.60<br>(269.2) | 4.57<br>(116.1) | 12.60<br>(320.0) |
| DN150                      | 11.80<br>(299.7) | 12.40<br>(315.0) | 6.77<br>(172.0) | 18.90<br>(480.1) |
| DN200                      | 13.90<br>(353.1) | 14.50<br>(368.3) | 8.47<br>(215.1) | 24.40<br>(619.8) |

| SIZES FOR REMOTE MOUNTED |               |
|--------------------------|---------------|
| Size                     | H2            |
| 1/4 - inch               | 6.28 (159.5)  |
| 1/2 - inch               | 5.21 (132.3)  |
| 3/4 - inch               | 5.21 (132.3)  |
| 1 - inch                 | 6.41 (162.8)  |
| 1.5 - inch               | 6.41 (162.8)  |
| 2 - inch                 | 7.32 (185.9)  |
| 3 - inch                 | 8.32 (211.3)  |
| 4 - inch                 | 6.32 (160.5)  |
| 6 - inch                 | 8.32 (211.3)  |
| 8 - inch                 | 10.32 (262.1) |



| Model Direction                     | Code 1 |
|-------------------------------------|--------|
| NAEA 4X                             | 10     |
| Hazardous-Area Location Enclosure   | 20     |
| Agency approved, customer specified | W      |

| Flange Standard                     | Code 2 |
|-------------------------------------|--------|
| DIN Flange                          | D      |
| ANSI Flange                         | A      |
| Agency approved, customer specified | W      |

| Flange Spec. <sup>1,3</sup> | Code 3,4,5           |
|-----------------------------|----------------------|
| Size                        | NPT 150 1b PN16 PN40 |
| 1/4 - inch                  | N1 —                 |
| 1/2 - inch                  | N2 F2                |
| 3/4 - inch                  | N3 F3                |
| 1 - inch(DN25)              | N4 F4 D4 E4          |
| 1.5 - inch(DN40)            | N5 F5 D5 E5          |
| 2 - inch(DN50)              | N6 F6 D6 E6          |
| 2.5 - inch(DN65)            | N7 F7 D7 E7          |
| 3 - inch(DN80)              | N8 F8 D8 E8          |
| 3.5 - inch(DN90)            | N9 F9 D9 E9          |
| 4 - inch(DN100)             | N10 F10 D10 E10      |
| 5 - inch(DN125)             | N11 F11 D11 E11      |
| 6 - inch(DN150)             | N12 F12 D12 E12      |
| 7 - inch(DN175)             | N13 F13 D13 E13      |
| 8 - inch(DN200)             | N14 F14 D14 E14      |

| Enclosures <sup>5</sup>   | Code 6,7 |
|---|----------|
| Hazardous-Area Location Enclosure   | 20       |
| Remote Hazardous-Area Location Enclosure (Only with EEx Meters) <sup>10</sup> | 3(ft)    |
| Remote Hazardous-Area Location Enclosure with Junction Box                    | 4(ft)    |
| NEMA 4X   | N2       |
| Remote NEMA 4X with Junction Box  | N4(ft)   |
| Agency approved, customer specified   | WW       |

| Input Power                         | Code 8 |
|-------------------------------------|--------|
| DC24V ±10%                          | 2      |
| 90-240VAC ±10%, E20 ONLY.           | 3      |
| Agency approved, customer specified | W      |

| Output                              | Code 9 |
|-------------------------------------|--------|
| Relay output(High, Low)             | 1      |
| 0-10 VDC, Linear                    | 3      |
| 4-20 mA, Linear                     | 4      |
| Agency approved, customer specified | W      |

| Display                             | Code 10 |
|-------------------------------------|---------|
| No Readout                          | NR      |
| Digital Display                     | DD      |
| Agency approved, customer specified | WW      |

| Flow Direction                             | Code 11 |
|--|---------|
| Horizontal right to left, or Vertical up   | 1       |
| Horizontal left to right, or Vertical down | 2       |
| Agency approved, customer specified        | W       |

| Calibration 1 <sup>9</sup>  | Code 12 |
|---|---------|
| Standard Calibration  | A       |
| Air, only for 3 inch and large pipe size                                |         |
| Compressed Air, only for 3 inch and larger pipe sizes                   | D       |
| Customer Calibration  | B       |
| Air   |         |
| Air equivalency (digester gas, flue, gas, etc).                         | C       |
| Nitrogen, helium, argon, carbon dioxide, compressed air or digester gas | E       |
| Hydrocarbons(natural gas, methane, ethane, propane, etc).               | F       |
| Hydrogen or hydrogen mixture  | G       |
| Agency approved, customer specified                                     | W       |

| Calibration 2 <sup>9</sup>                            | Code 13 |
|---|---------|
| 70 °F (21.1 °C) <sup>8</sup><br>14.7 psia (1.103 bar) | A       |
| 32 °F (0 °C)<br>14.7 psia (1.103 bar)                 | B       |
| Agency approved, customer specified                   | W       |

| Pressure                                    | Code 14 |
|---|---------|
| Low pressure<br>50 psia [ 3.5 bar ] Max.    | L       |
| Medium pressure<br>250 psia [ 17 bar ] Max. | M       |
| Agency approved, customer specified         | W       |

| Option                     | Code 15 |
|----------------------------|---------|
| Pressure Test Certificate  | PT      |
| Certificate of Conformance | CC      |
| NACE Certificate           | NC      |
| 24VDC Supply Unit          | DC      |
| RS-232 Cable 1M            | RS      |

**Notes**

- Flange is tapped and threaded on the compression fitting.
- Material matches the selection in Box 2. Metal ferrule permanently locks after tightening compression fitting.
- Flange must be ANSI or DIN specifications.
- Maximum length is 60 inches [1524 mm].
- Enclosure required for agency approvals. T6 rated at 104°F [40°C].
- Wire resistance must be less than 8 ohms.
- Turndown ratio is 10:1 minimum and 100:1 maximum
- SFPS is the abbreviation for standard feet per second at 14.7 psia [1.01 bar(a)] and 70°F [21.1°C].
- Customer specified calibration must not exceed temperature and pressure limitations of the 1500. 1800.3000 series product specifications.
- Remote configuration is only available with aluminum local enclosure.
- Code No3 F : Female M : Male.

## Features

- Close loop control
- 24 bit Analog digital converter (ADC)
- Output accuracy  $\pm 0.1\%$ ,  $\pm 2.5 \mu A$  (4~20mA)  
Output accuracy  $\pm 0.01\%$ ,  $\pm 1mV$  (0~10VDC)
- Field adjustment of critical flow meter settings Smart interface (RS-232)
- Field validation of flow meter calibration
- Direct mass flow monitoring eliminates need for temperature and pressure compensation
- Greatly reduces upstream piping requirements
- Outstanding Range ability
- One-second response to changes in flow rate
- CE, EEx, CENELEC (Pending)

## Description

The ientek Instruments ientek 3400S Smart Insertion mass flow meter accommodates the change measurement requirements and instrument-validation demands of industrial gas flow monitoring installations.

The versatile microprocessor-based transmitter integrates the functions of flow measurement, flow range adjustment, meter validation and diagnostics, in either a probe-mounted or remote housing.

Mass flow rate and totalized flow, as well as other configuration variables, are displayed on the meter's optional  $2 \times 16$  LCD panel. The programmable transmitter is easily configured via an RS-232 communication port and ientek's Smart Interface™ software, or via the display and magnetic switches on the instrument panel.

The ientek 3400S allows you to configure or change the following password protected parameters : flow range, totalize, alarm settings, time response, low flow cutoff and a calibration correction factor that compensates for flow profile flow variations.

ientek's Smart Interface™ software guides you through a procedure to fully validate instrument performance.

The meter is available with a variety of input power, output signal, mounting and packaging options.



# 3400 Series Smart-IN™ Stack Mass Flow Meter

3400

## Performance Specifications

### Accuracy of Point Velocity

±2% of reading from 10 to 100% of calibrated range  
±0.5% of full scale below 10% of calibrated range

### Repeatability

±0.2% of full scale

### Temperature Coefficient

±0.02% of reading per °F within ±50 °F of customer specified conditions.  
±0.03% of reading per °F within ±50 °F to 100 °F of customer specified conditions.  
±0.04% of reading per °C within ±25 °C of customer specified conditions.  
±0.06% of reading per °C within ±25 °C to 50 °C of customer specified conditions.

### Pressure Coefficient

0.02% per psi for air, consult factory for other gases

### Response Time

One second 63% of final velocity value.

## Operating Specifications

### Gases

Most gases compatible with 316L stainless steel

### Gas Pressure(2 limitations)

Compression fittings : 500 psia(34 barg)  
1-inch 150 lb flange(-40°F to 150°F) : 185 psia(12.8 barg)  
Low Pressure Hot Tap : 100 psia(7 barg)  
High Pressure Hot Tap : 1000 psia(70 barg)  
Application gas pressure :  
See mass flow range tables for maximum application gas pressures.

### Pressure Drop

Negligible for pipes three inches in diameter or larger

### Gas & Ambient Temperature

Gas ..... 15°F to 250°F (-10°C to 120°C )  
Optional -40°F to 450°F (-40°C to 230°C ),  
Application dependent  
Higher temperature available, consult factory  
Ambient ... -5°F to 120°F (-20°C to 50°C )

### Leak Integrity

$5 \times 10^{-4}$  atm cc/sec of helium maximum

### Power Requirements

DC 24 V ±10% (regulated), 625mA maximum  
90-240 VAC ±10% (regulated), 15watts maximum

### Output Signal

Linear 0~10VDC , 1000 ohms minimum load resistance or  
Linear 4~20mA proportional mass flow rate.  
700 ohms maximum resistance power supply dependent  
User - selectable ... Active non-galvanic ally separated or  
passive galvanic ally separated (loop power required)

### Alarms

Hard contact user-adjustable high and low  
Dead band adjustable with Smart Interface™ software  
Relay ratings - Maximum 42VDC or VAC, 140mA

### Displays

Alphanumeric 2 × 16 digit backlight LCD  
Adjustable variables via on-board switches  
(password protected) or with Smart Interface™ software  
Adjustable variables ... Full scale (50 to 100%)  
Time Response (1 to 7 seconds)  
Correction factor setting (0.5 to 5)  
Zero and span  
High and low alarm settings

### Totalize

Seven digits (9,999,999.9) in engineering units  
Reset table by software, on-board switches or external magnet

### Software

Smart Interface™ Windows® - bases software minimum 8 MB of RAM, preferred 16 MB of RAM  
RS-232 communication  
Additional features...Alarm dead band adjustment  
Zero cut-off adjustment  
Linearization adjustment  
Save/Load configurations  
Flow meter validation

## Physical Specifications

### Wetted Materials

316L stainless steel

### Enclosure

Hazardous-Area Location Enclosure (IP67) or NEMA 4X (IP65)  
Both are powder-coated cast aluminum

### Electrical Connections

Two 3/4 inch NPT...Hazardous-Area Location Enclosure (IP67)  
One 1/2 inch NPT...NEMA 4X Enclosure (IP65)

### Mounting (optional)

ANSI 1-inch 150 lb flange  
3/4-inch tube compression fitting with 1-inch male NPT.  
Hot tap systems

### Certifications\*

CE (All enclosures)  
CSA(Explosion-proof for Class 1, Division 1, Groups B,C,D)  
EEx (EEx d IIC T6...T2)  
FM (Explosion-proof for Class 1, Division 1, Groups B,C,D)  
\* Certifications Pending, Contact factory

## Mass Flow Ranges

EEx approved meters maximum velocities and flow rate are 50% of standard values shown in charts.

### 3400S-Air-Gas Code 0 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 20,000         | 120        | 189                     | 120      |
| standard accuracy | 1-1/2"    | 0.0142      | 20,000         | 284        | 448                     | 120      |
| standard accuracy | 2"        | 0.0233      | 20,000         | 466        | 735                     | 120      |
| standard accuracy | 3"        | 0.0513      | 20,000         | 1026       | 1618                    | 120      |
| standard accuracy | 4"        | 0.0884      | 20,000         | 1768       | 2788                    | 120      |
| standard accuracy | 6"        | 0.2010      | 20,000         | 4020       | 6340                    | 120      |
| standard accuracy | 8"        | 0.3470      | 20,000         | 6940       | 10945                   | 120      |
| standard accuracy | 10"       | 0.5480      | 20,000         | 10960      | 17285                   | 120      |
| standard accuracy | 12"       | 0.7770      | 20,000         | 15540      | 24508                   | 120      |
| standard accuracy | 14"       | 0.9390      | 20,000         | 18780      | 29618                   | 120      |
| standard accuracy | 16"       | 1.2270      | 20,000         | 24540      | 38703                   | 120      |
| standard accuracy | 18"       | 1.5530      | 20,000         | 31060      | 48985                   | 120      |
| standard accuracy | 24"       | 2.7920      | 20,000         | 55840      | 88066                   | 120      |
| standard accuracy | 36"       | 6.4920      | 20,000         | 129840     | 204773                  | 120      |

### 3400S-Digester-Gas Code 4 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 17,200         | 103        | 163                     | 30       |
| standard accuracy | 1-1/2"    | 0.0142      | 17,200         | 244        | 385                     | 30       |
| standard accuracy | 2"        | 0.0233      | 17,200         | 401        | 632                     | 30       |
| standard accuracy | 3"        | 0.0513      | 17,200         | 882        | 1392                    | 30       |
| standard accuracy | 4"        | 0.0884      | 17,200         | 1520       | 2398                    | 30       |
| standard accuracy | 6"        | 0.2010      | 17,200         | 3457       | 5452                    | 30       |
| standard accuracy | 8"        | 0.3470      | 17,200         | 5968       | 9413                    | 30       |
| standard accuracy | 10"       | 0.5480      | 17,200         | 9426       | 14865                   | 30       |
| standard accuracy | 12"       | 0.7770      | 17,200         | 13364      | 21077                   | 30       |
| standard accuracy | 14"       | 0.9390      | 17,200         | 16151      | 25472                   | 30       |
| standard accuracy | 16"       | 1.2270      | 17,200         | 21104      | 33284                   | 30       |
| standard accuracy | 18"       | 1.5530      | 17,200         | 26712      | 42127                   | 30       |
| standard accuracy | 24"       | 2.7920      | 17,200         | 48022      | 75737                   | 30       |
| standard accuracy | 36"       | 6.4920      | 17,200         | 111662     | 176105                  | 30       |

### 3400S-Argon-Gas Code 1 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 28,000         | 168        | 265                     | 120      |
| standard accuracy | 1-1/2"    | 0.0142      | 28,000         | 398        | 627                     | 120      |
| standard accuracy | 2"        | 0.0233      | 28,000         | 652        | 1029                    | 120      |
| standard accuracy | 3"        | 0.0513      | 28,000         | 1436       | 2265                    | 120      |
| standard accuracy | 4"        | 0.0884      | 28,000         | 2475       | 3904                    | 120      |
| standard accuracy | 6"        | 0.2010      | 28,000         | 5628       | 8876                    | 120      |
| standard accuracy | 8"        | 0.3470      | 28,000         | 9716       | 15324                   | 120      |
| standard accuracy | 10"       | 0.5480      | 28,000         | 15344      | 24199                   | 120      |
| standard accuracy | 12"       | 0.7770      | 28,000         | 21756      | 34312                   | 120      |
| standard accuracy | 14"       | 0.9390      | 28,000         | 26292      | 41486                   | 120      |
| standard accuracy | 16"       | 1.2270      | 28,000         | 34356      | 54184                   | 120      |
| standard accuracy | 18"       | 1.5530      | 28,000         | 43484      | 68579                   | 120      |
| standard accuracy | 24"       | 2.7920      | 28,000         | 78176      | 123293                  | 120      |
| standard accuracy | 36"       | 6.4920      | 28,000         | 181776     | 286683                  | 120      |

### 3400S-Digester-Gas Code 5 Application Temp.=15-250 °F

| Spec (%rdg)    | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|----------------|-----------|-------------|----------------|------------|-------------------------|----------|
| 4% correlation | 1"        | 0.0060      | 17,200         | 103        | 163                     | 120      |
| 4% correlation | 1-1/2"    | 0.0142      | 17,200         | 244        | 385                     | 120      |
| 4% correlation | 2"        | 0.0233      | 17,200         | 401        | 632                     | 120      |
| 4% correlation | 3"        | 0.0513      | 17,200         | 882        | 1392                    | 120      |
| 4% correlation | 4"        | 0.0884      | 17,200         | 1520       | 2398                    | 120      |
| 4% correlation | 6"        | 0.2010      | 17,200         | 3457       | 5452                    | 120      |
| 4% correlation | 8"        | 0.3470      | 17,200         | 5968       | 9413                    | 120      |
| 4% correlation | 10"       | 0.5480      | 17,200         | 9426       | 14865                   | 120      |
| 4% correlation | 12"       | 0.7770      | 17,200         | 13364      | 21077                   | 120      |
| 4% correlation | 14"       | 0.9390      | 17,200         | 16151      | 25472                   | 120      |
| 4% correlation | 16"       | 1.2270      | 17,200         | 21104      | 33284                   | 120      |
| 4% correlation | 18"       | 1.5530      | 17,200         | 26712      | 42127                   | 120      |
| 4% correlation | 24"       | 2.7920      | 17,200         | 48022      | 75737                   | 120      |
| 4% correlation | 36"       | 6.4920      | 17,200         | 111662     | 176105                  | 120      |

### 3400S-CO<sub>2</sub>-Gas Code 2 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 19,800         | 119        | 187                     | 120      |
| standard accuracy | 1-1/2"    | 0.0142      | 19,800         | 281        | 443                     | 120      |
| standard accuracy | 2"        | 0.0233      | 19,800         | 461        | 728                     | 120      |
| standard accuracy | 3"        | 0.0513      | 19,800         | 1016       | 1602                    | 120      |
| standard accuracy | 4"        | 0.0884      | 19,800         | 1750       | 2760                    | 120      |
| standard accuracy | 6"        | 0.2010      | 19,800         | 3980       | 6277                    | 120      |
| standard accuracy | 8"        | 0.3470      | 19,800         | 6871       | 10836                   | 120      |
| standard accuracy | 10"       | 0.5480      | 19,800         | 10650      | 17112                   | 120      |
| standard accuracy | 12"       | 0.7770      | 19,800         | 15385      | 24263                   | 120      |
| standard accuracy | 14"       | 0.9390      | 19,800         | 18592      | 29322                   | 120      |
| standard accuracy | 16"       | 1.2270      | 19,800         | 24295      | 38316                   | 120      |
| standard accuracy | 18"       | 1.5530      | 19,800         | 30749      | 48495                   | 120      |
| standard accuracy | 24"       | 2.7920      | 19,800         | 55282      | 87186                   | 120      |
| standard accuracy | 36"       | 6.4920      | 19,800         | 128542     | 202726                  | 120      |

### 3400S-Helium-Gas Code 6 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 12,400         | 74         | 117                     | 120      |
| standard accuracy | 1-1/2"    | 0.0142      | 12,400         | 176        | 278                     | 120      |
| standard accuracy | 2"        | 0.0233      | 12,400         | 289        | 456                     | 120      |
| standard accuracy | 3"        | 0.0513      | 12,400         | 636        | 1003                    | 120      |
| standard accuracy | 4"        | 0.0884      | 12,400         | 1096       | 1729                    | 120      |
| standard accuracy | 6"        | 0.2010      | 12,400         | 2492       | 3931                    | 120      |
| standard accuracy | 8"        | 0.3470      | 12,400         | 4303       | 6786                    | 120      |
| standard accuracy | 10"       | 0.5480      | 12,400         | 6795       | 10717                   | 120      |
| standard accuracy | 12"       | 0.7770      | 12,400         | 9635       | 15195                   | 120      |
| standard accuracy | 14"       | 0.9390      | 12,400         | 11644      | 18363                   | 120      |
| standard accuracy | 16"       | 1.2270      | 12,400         | 15215      | 23996                   | 120      |
| standard accuracy | 18"       | 1.5530      | 12,400         | 19257      | 30371                   | 120      |
| standard accuracy | 24"       | 2.7920      | 12,400         | 34621      | 54601                   | 120      |
| standard accuracy | 36"       | 6.4920      | 12,400         | 80501      | 126959                  | 120      |

### 3400S-Chlorine-Gas Code 3 Application Temp.=50-90 °F

| Spec (%FS)     | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|----------------|-----------|-------------|----------------|------------|-------------------------|----------|
| 5% correlation | 1"        | 0.0060      | 3,261          | 1.5        | 1                       | 120      |
| 5% correlation | 1-1/2"    | 0.0142      | 3,333          | 6.5        | 10                      | 120      |
| 5% correlation | 2"        | 0.0233      | 3,380          | 12.0       | 19                      | 120      |
| 5% correlation | 3"        | 0.0513      | 3,333          | 20         | 32                      | 120      |
| 5% correlation | 4"        | 0.0884      | 3,169          | 45         | 71                      | 120      |
| 5% correlation | 6"        | 0.2010      | 3,219          | 75         | 118                     | 120      |
| 5% correlation | 8"        | 0.3470      | 3,411          | 175        | 276                     | 120      |

# Mass Flow Ranges

EEx approved meters maximum velocities and flow rate are 50% of standard values shown in charts.

## 3400S-Hydrogen-Gas Code 7 Application Temp.=50-90 °F

| Spec (%FS)                                      | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|---|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy                               | 1"        | 0.0060      | 9,600          | 58         | 91                      | 135      |
| standard accuracy                               | 1-1/2"    | 0.0142      | 7,042          | 100        | 158                     | 135      |
| standard accuracy                               | 2"        | 0.0233      | 4,290          | 100        | 158                     | 135      |
| standard accuracy                               | 3"        | 0.0513      | 1,950          | 100        | 158                     | 135      |
| standard accuracy                               | 4"        | 0.0884      | 1,130          | 100        | 158                     | 135      |
| standard accuracy                               | 6"        | 0.2010      | 500            | 100        | 158                     | 135      |
| standard accuracy                               | 8"        | 0.3470      | 290            | 100        | 158                     | 135      |
| See chart below for flows greater than 100 SCFM |           |             |                |            |                         |          |
| standard accuracy                               | 1-1/2"    | 0.0142      | 9,600          | 136        | 215                     | 85       |
| standard accuracy                               | 2"        | 0.0233      | 9,600          | 224        | 354                     | 85       |
| standard accuracy                               | 3"        | 0.0513      | 4,873          | 250        | 395                     | 85       |
| standard accuracy                               | 4"        | 0.0884      | 2,828          | 250        | 395                     | 85       |
| standard accuracy                               | 6"        | 0.2010      | 1,243          | 250        | 395                     | 85       |
| standard accuracy                               | 8"        | 0.3470      | 720            | 250        | 395                     | 85       |
| See chart below for flows greater than 250 SCFM |           |             |                |            |                         |          |
| standard accuracy                               | 3"        | 0.0513      | 7,797          | 400        | 630                     | ambient  |
| standard accuracy                               | 4"        | 0.0884      | 4,525          | 400        | 630                     | ambient  |
| standard accuracy                               | 6"        | 0.2010      | 1,990          | 400        | 630                     | ambient  |
| standard accuracy                               | 8"        | 0.3470      | 1,153          | 400        | 630                     | ambient  |

## 3400S-CH<sub>4</sub>-Gas Code 8 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 16,000         | 96         | 151                     | 30       |
| standard accuracy | 1-1/2"    | 0.0142      | 16,000         | 227        | 358                     | 30       |
| standard accuracy | 2"        | 0.0233      | 16,000         | 373        | 588                     | 30       |
| standard accuracy | 3"        | 0.0513      | 16,000         | 821        | 1295                    | 30       |
| standard accuracy | 4"        | 0.0884      | 16,000         | 1414       | 2231                    | 30       |
| standard accuracy | 6"        | 0.2010      | 16,000         | 3216       | 5072                    | 30       |
| standard accuracy | 8"        | 0.3470      | 16,000         | 5552       | 8756                    | 30       |
| standard accuracy | 10"       | 0.5480      | 16,000         | 8768       | 13828                   | 30       |
| standard accuracy | 12"       | 0.7770      | 16,000         | 12432      | 19607                   | 30       |
| standard accuracy | 14"       | 0.9390      | 16,000         | 15024      | 23695                   | 30       |
| standard accuracy | 16"       | 1.2270      | 16,000         | 19632      | 30962                   | 30       |
| standard accuracy | 18"       | 1.5530      | 16,000         | 24848      | 39188                   | 30       |
| standard accuracy | 24"       | 2.7920      | 16,000         | 44672      | 70453                   | 30       |
| standard accuracy | 36"       | 6.4920      | 16,000         | 102872     | 163819                  | 30       |

## 3400S-CH<sub>4</sub>-Gas Code 9 Application Temp.=15-250 °F

| Spec (%rdg)    | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|----------------|-----------|-------------|----------------|------------|-------------------------|----------|
| 4% correlation | 1"        | 0.0060      | 16,000         | 96         | 151                     | 120      |
| 4% correlation | 1-1/2"    | 0.0142      | 16,000         | 227        | 358                     | 120      |
| 4% correlation | 2"        | 0.0233      | 16,000         | 373        | 588                     | 120      |
| 4% correlation | 3"        | 0.0513      | 16,000         | 821        | 1295                    | 120      |
| 4% correlation | 4"        | 0.0884      | 16,000         | 1414       | 2231                    | 120      |
| 4% correlation | 6"        | 0.2010      | 16,000         | 3216       | 5072                    | 120      |
| 4% correlation | 8"        | 0.3470      | 16,000         | 5552       | 8756                    | 120      |
| 4% correlation | 10"       | 0.5480      | 16,000         | 8768       | 13828                   | 120      |
| 4% correlation | 12"       | 0.7770      | 16,000         | 12432      | 19607                   | 120      |
| 4% correlation | 14"       | 0.9390      | 16,000         | 15024      | 23695                   | 120      |
| 4% correlation | 16"       | 1.2270      | 16,000         | 19632      | 30962                   | 120      |
| 4% correlation | 18"       | 1.5530      | 16,000         | 24848      | 39188                   | 120      |
| 4% correlation | 24"       | 2.7920      | 16,000         | 44672      | 70453                   | 120      |
| 4% correlation | 36"       | 6.4920      | 16,000         | 102872     | 163819                  | 120      |

## 3400S-Nitrogen-Gas Code 10 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 19,800         | 119        | 187                     | 120      |
| standard accuracy | 1-1/2"    | 0.0142      | 19,800         | 281        | 443                     | 120      |
| standard accuracy | 2"        | 0.0233      | 19,800         | 461        | 728                     | 120      |
| standard accuracy | 3"        | 0.0513      | 19,800         | 1016       | 1602                    | 120      |
| standard accuracy | 4"        | 0.0884      | 19,800         | 1750       | 2760                    | 120      |
| standard accuracy | 6"        | 0.2010      | 19,800         | 3980       | 6277                    | 120      |
| standard accuracy | 8"        | 0.3470      | 19,800         | 6871       | 10836                   | 120      |
| standard accuracy | 10"       | 0.5480      | 19,800         | 10650      | 17112                   | 120      |
| standard accuracy | 12"       | 0.7770      | 19,800         | 15385      | 24263                   | 120      |
| standard accuracy | 14"       | 0.9390      | 19,800         | 18592      | 29322                   | 120      |
| standard accuracy | 16"       | 1.2270      | 19,800         | 24295      | 38316                   | 120      |
| standard accuracy | 18"       | 1.5530      | 19,800         | 30749      | 48495                   | 120      |
| standard accuracy | 24"       | 2.7920      | 19,800         | 55282      | 87186                   | 120      |
| standard accuracy | 36"       | 6.4920      | 19,800         | 128542     | 202726                  | 120      |

## 3400S-Oxygen-Gas Code 11 Application Temp.=15-250 °F

| Spec (%rdg)    | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|----------------|-----------|-------------|----------------|------------|-------------------------|----------|
| 4% correlation | 1"        | 0.0060      | 19,800         | 119        | 187                     | 120      |
| 4% correlation | 1-1/2"    | 0.0142      | 19,800         | 281        | 443                     | 120      |
| 4% correlation | 2"        | 0.0233      | 19,800         | 461        | 728                     | 120      |
| 4% correlation | 3"        | 0.0513      | 19,800         | 1016       | 1602                    | 120      |
| 4% correlation | 4"        | 0.0884      | 19,800         | 1750       | 2760                    | 120      |
| 4% correlation | 6"        | 0.2010      | 19,800         | 3980       | 6277                    | 120      |
| 4% correlation | 8"        | 0.3470      | 19,800         | 6871       | 10836                   | 120      |
| 4% correlation | 10"       | 0.5480      | 19,800         | 10650      | 17112                   | 120      |
| 4% correlation | 12"       | 0.7770      | 19,800         | 15385      | 24263                   | 120      |
| 4% correlation | 14"       | 0.9390      | 19,800         | 18592      | 29322                   | 120      |
| 4% correlation | 16"       | 1.2270      | 19,800         | 24295      | 38316                   | 120      |
| 4% correlation | 18"       | 1.5530      | 19,800         | 30749      | 48495                   | 120      |
| 4% correlation | 24"       | 2.7920      | 19,800         | 55282      | 87186                   | 120      |
| 4% correlation | 36"       | 6.4920      | 19,800         | 128542     | 202726                  | 120      |

## 3400S-Propane-Gas Code 12 Application Temp.=15-250 °F

| Spec (%rdg)       | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|-------------------|-----------|-------------|----------------|------------|-------------------------|----------|
| standard accuracy | 1"        | 0.0060      | 13,200         | 79         | 125                     | 30       |
| standard accuracy | 1-1/2"    | 0.0142      | 13,200         | 187        | 296                     | 30       |
| standard accuracy | 2"        | 0.0233      | 13,200         | 308        | 485                     | 30       |
| standard accuracy | 3"        | 0.0513      | 13,200         | 677        | 1068                    | 30       |
| standard accuracy | 4"        | 0.0884      | 13,200         | 1167       | 1840                    | 30       |
| standard accuracy | 6"        | 0.2010      | 13,200         | 2653       | 4184                    | 30       |
| standard accuracy | 8"        | 0.3470      | 13,200         | 4580       | 7224                    | 30       |
| standard accuracy | 10"       | 0.5480      | 13,200         | 7234       | 11408                   | 30       |
| standard accuracy | 12"       | 0.7770      | 13,200         | 10256      | 16176                   | 30       |
| standard accuracy | 14"       | 0.9390      | 13,200         | 12395      | 19548                   | 30       |
| standard accuracy | 16"       | 1.2270      | 13,200         | 16196      | 25544                   | 30       |
| standard accuracy | 18"       | 1.5530      | 13,200         | 20500      | 32330                   | 30       |
| standard accuracy | 24"       | 2.7920      | 13,200         | 36854      | 58124                   | 30       |
| standard accuracy | 36"       | 6.4920      | 13,200         | 85694      | 135150                  | 30       |

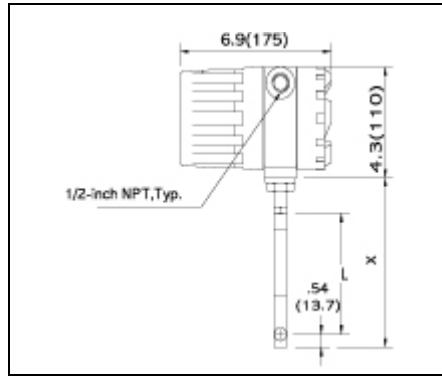
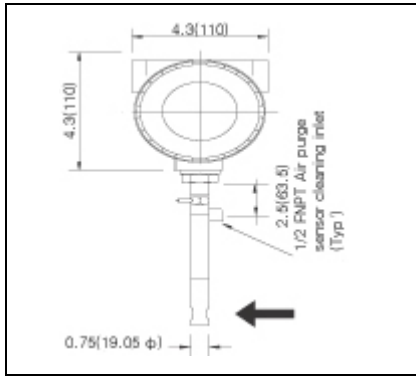
## 3400S-Propane-Gas Code 13 Application Temp.=15-250 °F

| Spec (%rdg)    | Pipe Size | Area (SqFt) | Max Vel (SFPM) | Max (SCFM) | Max nm <sup>3</sup> /hr | Max PSIA |
|----------------|-----------|-------------|----------------|------------|-------------------------|----------|
| 4% correlation | 1"        | 0.0060      | 13,200         | 79         | 125                     | 120      |
| 4% correlation | 1-1/2"    | 0.0142      | 13,200         | 187        | 296                     | 120      |
| 4% correlation | 2"        | 0.0233      | 13,200         | 308        | 485                     | 120      |
| 4% correlation | 3"        | 0.0513      | 13,200         | 677        | 1068                    | 120      |
| 4% correlation | 4"        | 0.0884      | 13,200         | 1167       | 1840                    | 120      |
| 4% correlation | 6"        | 0.2010      | 13,200         | 2653       | 4184                    | 120      |
| 4% correlation | 8"        | 0.3470      | 13,200         | 4580       | 7224                    | 120      |
| 4% correlation | 10"       | 0.5480      | 13,200         | 7234       | 11408                   | 120      |
| 4% correlation | 12"       | 0.7770      | 13,200         | 10256      | 16176                   | 120      |
| 4% correlation | 14"       | 0.9390      | 13,200         | 12395      | 19548                   | 120      |
| 4% correlation | 16"       | 1.2270      | 13,200         | 16196      | 25544                   | 120      |
| 4% correlation | 18"       | 1.5530      | 13,200         | 20500      | 32330                   | 120      |
| 4% correlation | 24"       | 2.7920      | 13,200         | 36854      | 58124                   | 120      |
| 4% correlation | 36"       | 6.4920      | 13,200         | 85694      | 135150                  | 120      |

## Dimensional Specifications

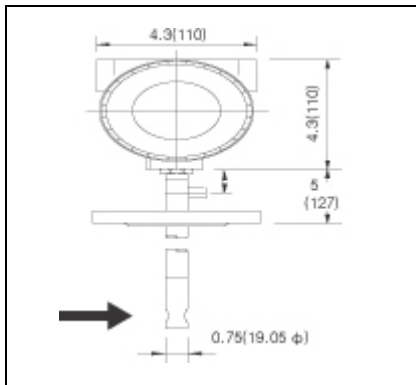
## Tables

Compression Fitting - Front View (E2)    Compression Fitting - Side View (E2)

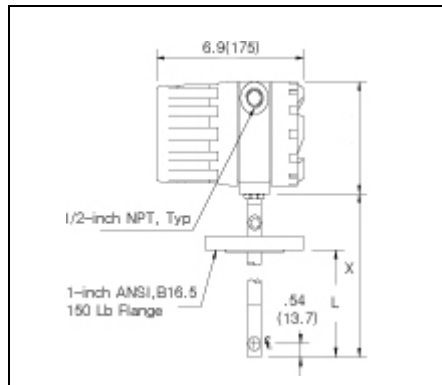


| Length Chart |                 |                 |
|--------------|-----------------|-----------------|
| Code         | L               | X               |
| L06          | 6.0<br>(152.4)  | 7.0<br>(177.8)  |
| L09          | 9.0<br>(228.6)  | 10.0<br>(254.0) |
| L13          | 13.0<br>(330.2) | 14.0<br>(355.6) |
| L18          | 18.0<br>(457.2) | 19.0<br>(482.6) |
| L24          | 24.0<br>(609.6) | 25.0<br>(635.0) |
| L36          | 36.0<br>(914.4) | 37.0<br>(939.8) |

Flange Mounting - Front View (E2)

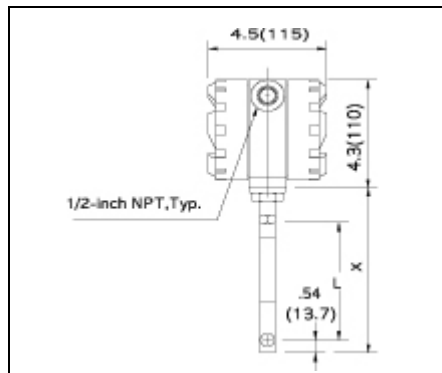
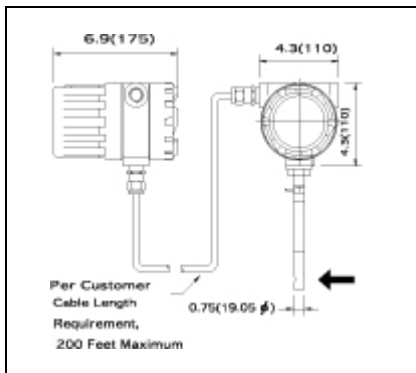


Flange Mounting - Side View (E2)



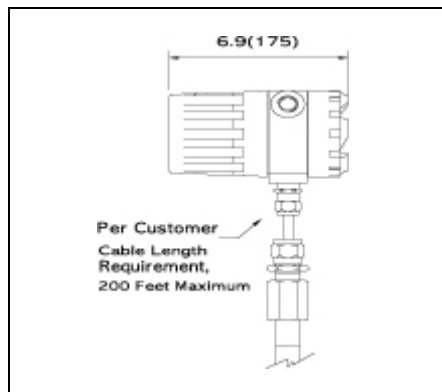
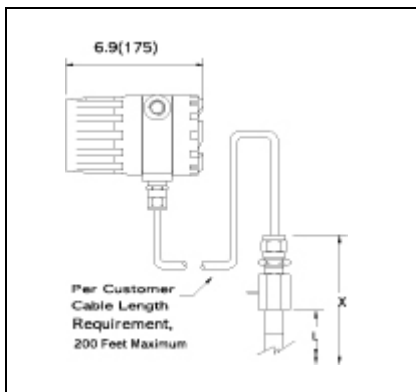
| Length Chart |                 |                   |
|--------------|-----------------|-------------------|
| Code         | L               | X                 |
| L06          | 6.0<br>(152.4)  | 11.54<br>(293.1)  |
| L09          | 9.0<br>(228.6)  | 14.54<br>(369.3)  |
| L13          | 13.0<br>(330.2) | 18.54<br>(470.9)  |
| L18          | 18.0<br>(457.2) | 23.54<br>(597.9)  |
| L24          | 24.0<br>(609.6) | 29.54<br>(750.3)  |
| L36          | 36.0<br>(914.4) | 41.54<br>(1055.1) |

Remote Mount Junction Box - Front View (E4)    Remote Mount Junction Box - Side View (E4)

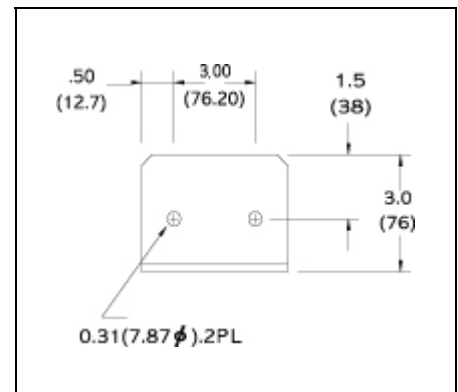


| Length Chart |                 |                   |
|--------------|-----------------|-------------------|
| Code         | L               | X                 |
| L06          | 6.0<br>(152.4)  | 13.04<br>(331.2)  |
| L09          | 9.0<br>(228.6)  | 16.04<br>(407.4)  |
| L13          | 13.0<br>(330.2) | 20.04<br>(509.0)  |
| L18          | 18.0<br>(457.2) | 25.04<br>(636.0)  |
| L24          | 24.0<br>(609.6) | 31.04<br>(788.4)  |
| L36          | 36.0<br>(914.4) | 43.04<br>(1093.2) |

Remote Mount - Front View (E3, EEx only)    Remote Mount - Side View (E3, EEx only)



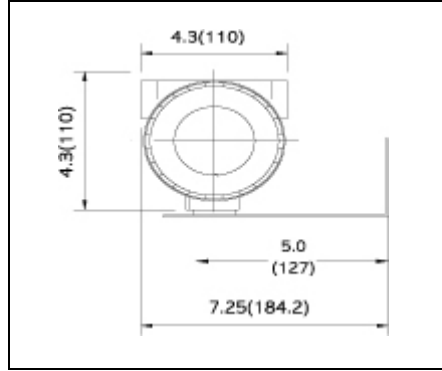
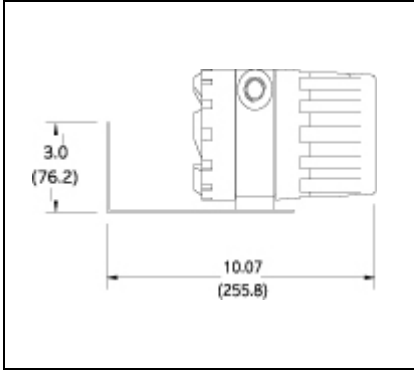
Mounting Holes for Remote Bracket



All dimensions are inches. Millimeters are in parentheses. Certified drawings are available on request.

## Dimensional Specifications ( I )

### Remote Rear Bracket Mounted Electronics Remote Side Bracket Mounted Electronics

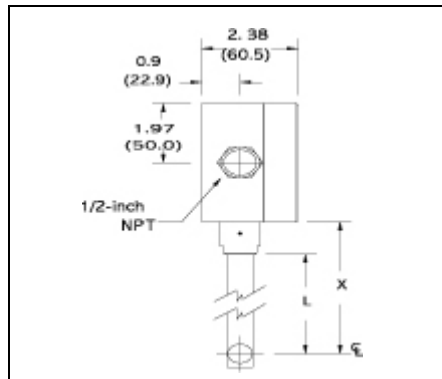
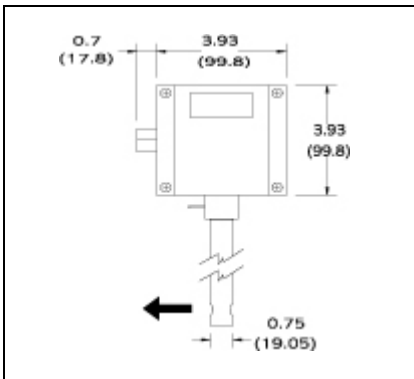


## Tables

| Length Chart |                 |                   |
|--------------|-----------------|-------------------|
| Code         | L               | X                 |
| L06          | 6.1<br>(154.9)  | 12.64<br>(321.0)  |
| L09          | 9.1<br>(231.1)  | 15.64<br>(397.2)  |
| L13          | 13.1<br>(332.7) | 19.64<br>(498.8)  |
| L18          | 18.1<br>(459.7) | 24.64<br>(625.8)  |
| L24          | 24.1<br>(612.1) | 30.64<br>(778.2)  |
| L36          | 36.1<br>(916.9) | 42.64<br>(1083.0) |

## NEMA 4X Dimensional Specifications

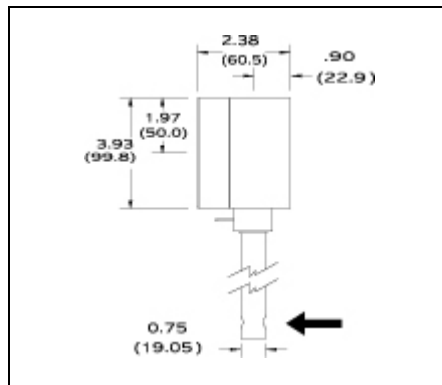
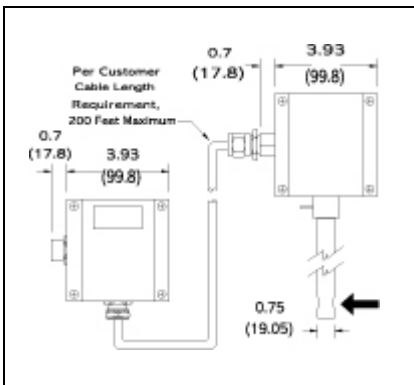
### Compression Fitting - Front View (EN2) Compression Fitting - Side View (EN2)



## Tables

| Length Chart |                 |                  |
|--------------|-----------------|------------------|
| Code         | L               | X                |
| L06          | 6.0<br>(152.4)  | 13.6<br>(345.4)  |
| L09          | 9.0<br>(228.6)  | 16.6<br>(421.6)  |
| L13          | 13.0<br>(330.2) | 20.6<br>(523.2)  |
| L18          | 18.0<br>(457.2) | 25.6<br>(650.2)  |
| L24          | 24.0<br>(609.6) | 31.6<br>(802.6)  |
| L36          | 36.0<br>(914.4) | 43.6<br>(1107.4) |

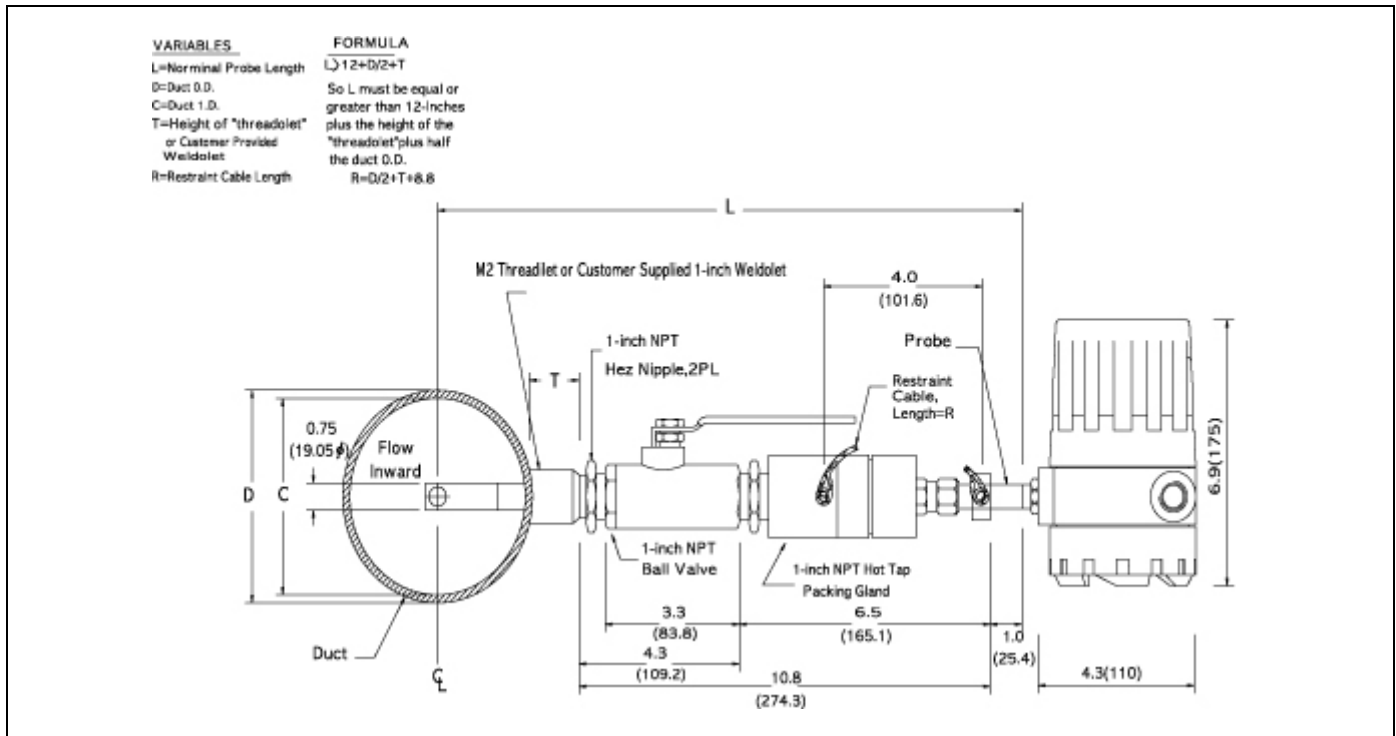
### Remote Mount Junction Box - Front View (EN4) Remote Mount Junction Box - Side View (EN4)



All dimensions are inches. Millimeters are in parentheses. All drawings have a  $\pm 0.25$  inch(6.4mm) tolerance. Certified drawings are available on request.

# Low Pressure Hot Tap Dimensional Specification

## Side View



All dimensions are inches. Millimeters are in parentheses.

All drawings have a  $\pm 0.25$  inch (6.4mm) tolerance. Certified drawings are available on request.

## Up & Downstream Requirements

Select an installation site that will minimize possible distortion in the flow profile. Valves, elbows, control valves and other piping components may cause flow disturbances. Check your specific piping condition against the examples shown below. In order to achieve accurate and repeatable performance install the flow meter using the recommended number of straight run pipe diameters upstream and downstream of the sensor.

| Example | A-Upstream(1)Requirements | B-Downstream(2)Requirements |
|---------|---------------------------|-----------------------------|
| 1       | 15D                       | 5D                          |
| 2       | 20D                       | 5D                          |
| 3       | 40D                       | 10D                         |
| 4       | 15D                       | 5D                          |
| 5       | 30D                       | 10D                         |
| 6       | 40D                       | 5D                          |

(1)Number of diameter(D)of straight pipe required between upstream disturbance and the flow meter.  
 (2)Number of diameter(D)of straight pipe required downstream of the flow meter.

SMFM-34 

|   |   |   |
|---|---|---|
|   |   | S |
| 1 | 2 | 3 |

 - 

|   |   |   |
|---|---|---|
|   |   | M |
| 4 | 5 | 6 |

 - 

|   |   |   |
|---|---|---|
|   |   | E |
| 6 | 7 | 8 |

 - 

|   |   |    |
|---|---|----|
|   |   | P  |
| 8 | 9 | 10 |

 - 

|   |    |    |
|---|----|----|
|   |    | V  |
| 9 | 10 | 11 |

 - 

|    |    |    |
|----|----|----|
|    |    |    |
| 11 | 12 | 13 |

 - 

|    |    |    |
|----|----|----|
|    |    |    |
| 12 | 13 | 14 |

 - 

|    |    |    |
|----|----|----|
|    |    |    |
| 13 | 14 | 15 |

| Model Direction                     | Code 1 |
|-------------------------------------|--------|
| NAEA 4X                             | 10     |
| Hazardous-Area Location Enclosure   | 20     |
| Agency approved, customer specified | W      |

| Insertion Length <sup>4</sup>        | Code 2,3 |
|--------------------------------------|----------|
| 6- inch (15cm)                       | 06       |
| 9- inch (23cm)                       | 09       |
| 13-inch (33cm)                       | 13       |
| 18-inch (46cm)                       | 18       |
| 24-inch (61cm)                       | 24       |
| 36-inch (92cm)                       | 36       |
| Special Length                       | (in)     |
| Probe with 1-inch 1501b Flange       | (in)-M5  |
| High Pressure Hot Top with Retractor | (in)-M9  |
| Agency approved, customer specified  | WW       |

| Mounting   | Code 4,5 |
|--|----------|
| None   | 0        |
| Compression Fitting <sup>2</sup><br>(3/4-inch tube x 1-inch Male NPT)                          | 10       |
| Thread let (3/4-inch Female NPT)<br>Specify pipe O.D. in parentheses                           | 2 ( )    |
| Flat Duct Bracket<br>(3/4-inch tube compression Fitting)                                       | 3        |
| Curved Duct Bracket (3/4-inch tube<br>compression Fitting) Specify duct O.D.<br>in parentheses | 4 ( )    |
| Low Pressure Hot Tap.<br>Specify duct O.D. in parentheses                                      | 8 ( )    |
| Quick Removal Tap.<br>Maximum 40 psig (2.8 barg)   | 15 ( )   |
| Agency approved, customer specified  | WW       |

| Enclosures <sup>5</sup>  | Code 6,7 |
|--|----------|
| Hazardous-Area Location Enclosure  | 20       |
| Remote Hazardous-Area Location <sup>10</sup><br>Enclosure (Only with EEx Meters) | 3(ft)    |
| Remote Hazardous-Area Location<br>Enclosure with Junction Box                    | 4(ft)    |
| NEMA 4X  | N2       |
| Remote NEMA 4X with Junction Box   | N4(ft)   |
| Agency approved, customer specified  | WW       |

| Input Power                         | Code 8 |
|-------------------------------------|--------|
| DC24V ±10%                          | 2      |
| 90-240VAC ±10%, E20 ONLY.           | 3      |
| Agency approved, customer specified | W      |

| Output                              | Code 9 |
|-------------------------------------|--------|
| Relay output(High, Low)             | 1      |
| 0-10 VDC, Linear                    | 3      |
| 4-20 mA, Linear                     | 4      |
| Agency approved, customer specified | W      |

| Display                             | Code 10 |
|-------------------------------------|---------|
| No Readout                          | NR      |
| Digital Display                     | DD      |
| Agency approved, customer specified | WW      |

| Flow Direction                                | Code 11 |
|---|---------|
| Horizontal right to left, or<br>Vertical up   | 1       |
| Horizontal left to right, or<br>Vertical down | 2       |
| Agency approved, customer specified           | W       |

| Calibration 1 <sup>9</sup>  | Code 12 |
|---|---------|
| Standard Calibration  | A       |
| Air, only for 3 inch and large pipe<br>size                                   |         |
| Compressed Air, only for 3 inch<br>and larger pipe sizes                      | D       |
| Customer Calibration  | B       |
| Air   |         |
| Air equivalency (digester gas, flue,<br>gas, etc).                            | C       |
| Nitrogen, helium, argon, carbon<br>dioxide, compressed air or digester<br>gas | E       |
| Hydrocarbons(natural gas, methane,<br>ethane, propane, etc).                  | F       |
| Hydrogen or hydrogen mixture  | G       |
| Agency approved, customer specified   | W       |

| Calibration 2 <sup>9</sup>                            | Code 13 |
|---|---------|
| 70 °F (21.1 °C) <sup>8</sup><br>14.7 psia (1.103 bar) | A       |
| 32 °F (0 °C)<br>14.7 psia (1.103 bar)                 | B       |
| Agency approved, customer<br>specified                | W       |

| Pressure                                    | Code 14 |
|---|---------|
| Low pressure<br>50 psia [ 3.5 bar ] Max.    | L       |
| Medium pressure<br>250 psia [ 17 bar ] Max. | M       |
| Agency approved, customer<br>specified      | W       |

| Option                     | Code 15 |
|----------------------------|---------|
| Pressure Test Certificate  | PT      |
| Certificate of Conformance | CC      |
| NACE Certificate           | NC      |
| 24VDC Supply Unit          | DC      |
| RS-232 Cable 1M            | RS      |

**Notes**

- Flange is tapped and threaded on the compression fitting.
- Material matches the selection in Box 2. Metal ferrule permanently locks after tightening compression fitting.
- Flange must be ANSI or DIN specifications.
- Maximum length is 60 inches [1524 mm].
- Enclosure required for agency approvals. T6 rated at 104°F [40°C].
- Wire resistance must be less than 8 ohms.
- Turndown ratio is 10:1 minimum and 100:1 maximum
- SFPS is the abbreviation for standard feet per second at 14.7 psia [1.01 bar(a)] and 70°F [21.1°C].
- Customer specified calibration must not exceed temperature and pressure limitations of the 1500. 1800.3000 series product specifications.
- Remote configuration is only available with aluminum local enclosure.

### CUSTOMER INFORMATION

| <b>CUSTOMER INFORMATION</b>  |   |         |         |            |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |
|--|---|---------|---------|------------|------------|-------------|-------|-------|-------|-------|---------------|-------|-------|-------|-------|------------|-------|-------|-------|-------|---|
| <b>Customer Name &amp; Address :</b>   | <b>P.O. No :</b>  |         |         |            |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |
|  | <b>Customer Order No:</b>   |         |         |            |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |
| <b>Contact :</b>   | <b>Tag Number(s) :</b>  |         |         |            |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |
| <b>Phone :</b>   |   |         |         |            |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |
| <b>Fax :</b>   | <b>E-mail :</b>   |         |         |            |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |
| <b>PROCESS DETAILS</b>   | <b>INSTRUMENT DETAILS</b>   |         |         |            |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |
| <b>Application Description</b><br>Describe type of application (example; boiler feed, flare gas, etc.)   | <b>Flow Element Mounting</b><br><input type="checkbox"/> Horizontal pipe, side mount, flow left to right<br><input type="checkbox"/> Horizontal pipe, side mount, flow right to left<br><input type="checkbox"/> Horizontal pipe, top mount, flow left to right<br><input type="checkbox"/> Horizontal pipe, top mount, flow right to left<br><input type="checkbox"/> Vertical pipe, Flow up<br><input type="checkbox"/> Vertical pipe, Flow down  |         |         |            |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |
| <b>Process Media</b><br>Include gas name and percent composition by volume (moles) or Weight (mass). Please attach a gas composition list or fill in composition below. Total composition must add up to 100%<br><br>Gas Components : <input type="checkbox"/> % Volume (moles) <input type="checkbox"/> % Weight (mass)<br>_____ %<br>_____ %<br>_____ %<br>_____ %<br>_____ %<br>_____ %   | <b>Flow Transmitter Setup</b><br>Input Power : <input type="checkbox"/> 110VAC ± 10% <input type="checkbox"/> 220VAC ± 10% <input type="checkbox"/> 24VDC ± 10%<br><input type="checkbox"/> 90 ~ 240 VAC<br>Application : <input type="checkbox"/> Flow (default)<br><input type="checkbox"/> Temperature<br>Signal Output : <input type="checkbox"/> 4 to 20mA<br><input type="checkbox"/> 1 to 5VDC<br><input type="checkbox"/> 0 to 5VDC<br><input type="checkbox"/> 0 to 10VDC<br><input type="checkbox"/> RS-232C<br><br>Output Units    _____<br>Zero Value      _____<br>Full Scale        _____<br>Alarm Set points _____ |         |         |            |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |
| <b>Process Conditions</b><br><table style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%;"></th> <th style="width: 15%;">Nominal</th> <th style="width: 15%;">Minimum</th> <th style="width: 15%;">Maximum</th> <th style="width: 15%;">Flow Units</th> </tr> </thead> <tbody> <tr> <td>Flow Rate :</td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>Temperature :</td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> <tr> <td>Pressure :</td> <td>_____</td> <td>_____</td> <td>_____</td> <td>_____</td> </tr> </tbody> </table> |   | Nominal | Minimum | Maximum    | Flow Units | Flow Rate : | _____ | _____ | _____ | _____ | Temperature : | _____ | _____ | _____ | _____ | Pressure : | _____ | _____ | _____ | _____ | <b>Stander Temperature and Pressure</b><br>70 °F and 14.7 psia [ 21.1 °C and 1.013 bar(a) ] is the factory calibration default for standard temperature and pressure unless otherwise indicated below.<br><br>Standard <input type="checkbox"/> 70 °F [ 21.1 °C ] <input type="checkbox"/> 14.7 psia [ 1.013 bar(a) ]<br>Other                _____ |
|  | Nominal   | Minimum | Maximum | Flow Units |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |
| Flow Rate :  | _____   | _____   | _____   | _____      |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |
| Temperature :  | _____   | _____   | _____   | _____      |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |
| Pressure :   | _____   | _____   | _____   | _____      |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |
| <b>Required Dimensions</b><br>Pipe/Dute Size (ID and units of measurement) _____<br>B-dimension per diagram below : _____<br>Upstream straight length pipe/duct : _____<br>Downstream straight length pipe/duct : _____<br>Upstream disturbance _____  | <b>Note (Remark)</b><br><br><br>  |         |         |            |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |
| <b>Installation Details or Drawing</b><br><br><br><br><br>Hot tap <input type="checkbox"/> No <input type="checkbox"/> Yes   |   |         |         |            |            |             |       |       |       |       |               |       |       |       |       |            |       |       |       |       |   |

## Features

- Wide velocity range of 0 to 50 m/s (10,000 ft/min)
- Flow rate feature makes simple calculations of volumetric flow rate when the user inputs the duct shape and size, K factor or horn size
- Velocity measurements are made from the thermal sensor or a Pitot tube
- Automatic conversion between actual and standard velocity readings
- Direct calculation of dew point and wet bulb temperature no psychrometric chart needed (Model 4386, 4387 only)
- Heat flow function calculates heat transferred after a heating or cooling element (Model 4386, 4387 only)
- Stable digital display when measuring fluctuating flows
- Back-lit display is easy to read in poor lighting conditions
- 115 cm telescoping probe with etched length marks make duct traverse measurements easier
- Optional articulating probe available
- Optional portable printer provides hard copy documentation of your measurements
- CO<sub>2</sub> density can measurements (Model 4387 only)



## Description

*i* entek Air Master<sup>®</sup> simultaneously measure and data log several ventilation parameters using a single probe with multiple sensors.

Based on the model, these hand-held instruments measure velocity, temperature, differential pressure, humidity and CO<sub>2</sub> density.

All versions calculate volumetric flow rate.

The Model 4386 also performs dew point, wet bulb temperature and heat flow calculations.

The information contained herein is subject to change without notice.

4300 Series Air Velocity Meter

<sup>®</sup>  
Air Master

## Performance Specifications

### Velocity of Thermal Sensor (all model)

Measuring principle : Thermal Mass Flow Sensor  
Measuring range : 0.1 ~ 100 m/s  
Accuracy<sup>1&2</sup> :  $\pm 2\%$  of reading or  $\pm 0.05$  m/s  
Response Time :  $< 2$  S (depending on velocity and dT)  
Warm up time :  $< 1$  min (according to mounting)  
Temperature range :  $-30 \sim +100^\circ\text{C}$  Short term to  $150^\circ\text{C}$   
Permissible humidity : 0-95% RH (no condensate)  
Substrate material : Ceramic 0.15 mm  
Dimension sensor : 7 x 2.4 x 0.15 mm

### Velocity of Pitot Tube (Model 4385, 4386, 4387)

Range<sup>3</sup> : 1.27 to 78.7 m/s (250 to 15,500 ft/min)  
Accuracy<sup>4</sup> :  $\pm 1.5\%$  at 10.16 m/s (2,000 ft/min)  
Resolution : 0.01 m/s (1 ft/min)

### Volumetric Flow Meter (all models) :

Range : Actual range is a function of maximum velocity, pressure, duct size, and K factor

### Duct Size (all models)

Range : 1 to 635 cm in increments of 0.1 cm  
(1 to 250 inch in increments of 0.1 inch)

### Static/Differential Pressure

#### (Models 4385(A) and 4386(A) 4387(A))

- Precisely located, burr-free static pressure holes.
- Hemispherical tip design, best for accuracy if imperfectly aligned and nearly impossible to damage.
- Long lasting 304 stainless steel construction.
- ASME design meets AMCA and ASHRAE specifications.
- 5/16" models rated to  $1500^\circ\text{F}$
- Extended static connection helps guide tip within recommended  $15^\circ$  of air flow direction.  
Range<sup>5</sup> :  $-9.3$  to  $+28.0$  mmHg, or  $-1245$  to  $+3735$  Pa  
( $-5$  to  $+15$  in  $\text{H}_2\text{O}$ )  
Accuracy<sup>6</sup> :  $\pm 1\%$  of reading,  $\pm 1$  Pa or  $\pm 0.01$  mmHg  
( $\pm 0.005$  in  $\text{H}_2\text{O}$ )  
 $\pm 0.03\%$  /  $^\circ\text{C}$  ( $\pm 0.02\%$  /  $^\circ\text{F}$ )  
Resolution : 1 Pa, 0.01 mmHg (0.001 in  $\text{H}_2\text{O}$ )

### Temperature & Humidity (all models)

Application of industrial CMOS processes with patented micro-machining (CMOSens<sup>®</sup> technology) ensures highest reliability and excellent long term stability. The device includes a capacitive polymer sensing element for relative humidity and a bandgap temperature sensor.

Operating (Probe) :  $-30 \sim 100^\circ\text{C}$  (  $-22$  to  $212^\circ\text{F}$  )  
Operating (Electronics) :  $+5 \sim 45^\circ\text{C}$  (  $41$  to  $113^\circ\text{F}$  )  
Storage :  $-20 \sim +60^\circ\text{C}$  (  $-4$  to  $140^\circ\text{F}$  )

### Wet Bulb Temperature

Range :  $-15$  to  $+50^\circ\text{C}$  (  $40$  to  $140^\circ\text{F}$  )  
Resolution :  $0.1^\circ\text{C}$  (  $0.1^\circ\text{F}$  )

### Dew Point Temperature

Range :  $+5$  to  $+60^\circ\text{C}$  (  $5$  to  $122^\circ\text{F}$  )  
Resolution :  $0.1^\circ\text{C}$  (  $0.1^\circ\text{F}$  )

### Heat Flow (Models 4386, 4387)

Range : Function of Flow Rate, Temperature, Humidity and Barometric Pressure  
Measurements Available : Sensible Heat Flow, Latent Heat Flow, Total Heat Flow and Sensible Factor  
Units Measured : BTU/h, KW

### Time Constant

Intervals : 1sec, 2sec, 5sec, 10sec, 15sec, 20sec

### External Meter Dimensions (all Models)

Size Measurements : 10.6cm x 18.5cm x 3.8cm  
(4.2 inch x 7.2 inch x 1.5 inch)

### Meter Probe Dimensions (all Models)

Probe Length : 108.5 cm (42.7 inch)  
Probe Diameter of Tip : 7.19 mm (0.283 inch)  
Probe Diameter of Base : 11 mm (0.433 inch)

### Probe Handle Dimensions

Articulating Section Length : 12.18 cm ( 4.79 inch)  
Diameter of Handle : 24.35 mm (0.96 inch)

### Meter Weight (all models)

Weight ( with batteries ) : 0.57 kg ( 1.25 lbs )

### Power Requirements (all models)

Four AA-size batteries ( included ) or AC adapter (optional) 5 VDC, 1 A, 5 watts (input voltage and frequency)

## Temperature & Humidity Sensor Performance Specification

| Humidity             | Conditions                  | Min.                  | Typ.  | Max.  | Units  |
|----------------------|-----------------------------|-----------------------|-------|-------|--------|
| Resolution           |                             | 0.5                   | 0.03  | 0.03  | %RH    |
|                      |                             | 8                     | 12    | 2     | Bit    |
| Repeatability        |                             |                       | ±0.1  |       | %RH    |
| Accuracy Uncertainty | linearized                  | see figure 1          |       |       |        |
| Interchangeability   |                             | Fully interchangeable |       |       |        |
| Nonlinearity         | raw data                    |                       | ±3    |       | %RH    |
|                      | linearized                  |                       | < 1   |       | %RH    |
| Range                |                             | 0                     |       | 100   | %RH    |
| Response time        | 1/e (63%) slowly moving air |                       | 4     |       | S      |
| Hysteresis           |                             |                       | ±1    |       | %RH    |
| Long term stability  | typical                     |                       | < 0.5 |       | %RH/yr |
| <b>Temperature</b>   |                             |                       |       |       |        |
| Resolution           |                             | 0.04                  | 0.01  | 0.01  | °C     |
|                      |                             | 0.07                  | 0.02  | 0.02  | °F     |
|                      |                             | 12                    | 14    | 14    | bit    |
| Repeatability        |                             |                       | ±0.1  |       | °C     |
|                      |                             |                       | ±0.2  |       | °F     |
| Accuracy             |                             | see figure 1          |       |       |        |
| Range                |                             | -40                   |       | 123.8 | °C     |
|                      |                             | -40                   |       | 254.9 | °F     |
| Response time        | 1/e (63%)                   | 5                     |       | 30    | S      |

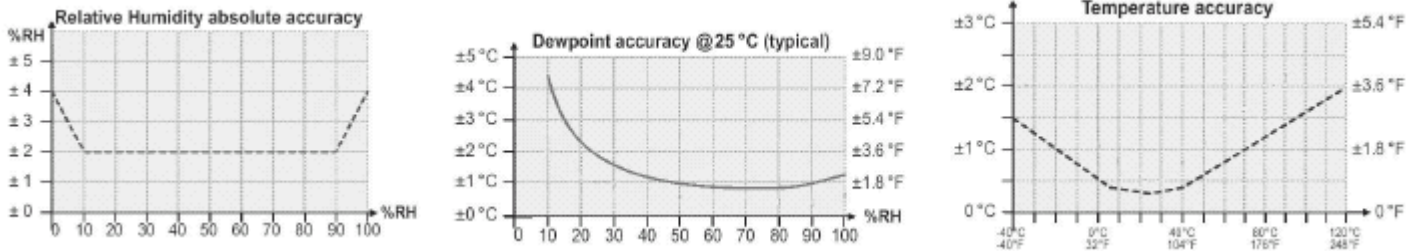


Figure 1 Rel. Humidity, Temperature and Dew point accuracies

Where 43XX(A) is listed, the specifications apply to both the 43XX (straight probe) and 43XX A (articulating probe) models.

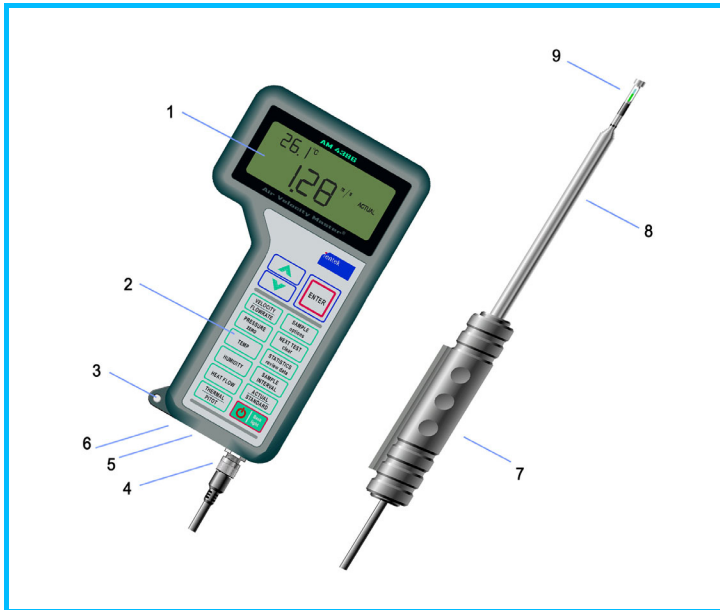
1. Temperature compensated over an air temperature range of 5 to 65 °C (40 to 150°F)
2. The accuracy statement of  $\pm 3.0\%$  of reading or  $\pm 0.015$  m/s ( $\pm 3$  ft/min), whichever is greater, begins at 30 ft/min through 9,999 ft/min.
3. Pressure velocity measurements are not recommended below 1,000 ft/min and are best suited to velocities over 2,000 ft/min. Range can vary depending on barometric pressure.
4. Accuracy is a function of converting pressure to velocity. Conversion accuracy improves when actual pressure values increase.
5. Overpressure range = 520 mmHg, 69 kPa (275 in H<sub>2</sub>O)
6. Accuracy with instrument case at 25 °C (77°F), add uncertainty of 0.03%/°C (0.02 %/°F) for change in instrument temperature.
7. Accuracy with instrument case at 25 °C (77°F), add uncertainty of 0.03%/°C (0.05 °C/°F) for change in instrument temperature.
8. Accuracy with probe at 25 °C (77°F). Add uncertainty of 0.2%RH/°C (0.1%RH/°F) for change in probe temperature. Includes 1% hysteresis.

Specifications are subject to change without notice.

## Data Logging Capabilities

- Data logging ability allows user to log 1394 samples with a time and date stamp
- Simultaneously records all parameters available in each model
- Single point and continuous data logging modes to fit your application
- Data can be reviewed on-screen, printed or downloaded to a computer spreadsheet program
- ientek downloading software permits easy transfer of data to a computer
- Statistics function displays average, maximum and minimum values, and the number of recorded samples

## Parts Identification



**Figure 1-2 Air Master® 4300 Series**

- |                     |                    |
|---------------------|--------------------|
| 1. Display          | 6. AC Adapter Port |
| 2. Keypad           | 7. Sensor Handle   |
| 3. Linking          | 8. Sensor Probe    |
| 4. Sensor Connector | 9. Sensor          |
| 5. RS-232C port     |                    |

|                                  | 4384 | 4385 | 4386 | 4387 |
|----------------------------------|------|------|------|------|
| <b>Velocity</b>                  | ●    | ●    | ●    | ●    |
| <b>Volumetric Flow Meter</b>     | ●    | ●    | ●    | ●    |
| <b>Temperature</b>               | ●    | ●    | ●    | ●    |
| <b>Differential Pressure</b>     |      | ●    | ●    | ●    |
| <b>Thermal/Pitot</b>             |      | ●    | ●    | ●    |
| <b>Humidity</b>                  |      |      | ●    | ●    |
| <b>Dew Point</b>                 |      |      | ●    | ●    |
| <b>Wet Bulb Temperature</b>      |      |      | ●    | ●    |
| <b>Heat Flow Calculations</b>    |      |      | ●    | ●    |
| <b>CO<sub>2</sub></b>            |      |      |      | ●    |
| <b>Data Logging/Downloading</b>  | ●    | ●    | ●    | ●    |
| <b>Statistics/Review Data</b>    | ●    | ●    | ●    | ●    |
| <b>Density Correction Factor</b> | ●    | ●    | ●    | ●    |
| <b>Variable Time Constant</b>    | ●    | ●    | ●    | ●    |
| <b>Printer Output</b>            | ●    | ●    | ●    | ●    |

All models are available with either a straight or articulating probe.

## Features

Series 7200 is single-board, self-contained and state-of-the-art ultrasonic flow meter.

It has the notable characteristics of high precision, high reliability, high performance, low price etc..

Main features are

- The sensors being clamp-on type, there's no pressure loss. The sensors are easily mounted on the surface of the pipe without interrupting the flow for installation or maintenance..
- Advanced intelligent display, computation and printing to suit user's diversified requirements. The flow is displayed in all pertinent engineering units. It runs out of regular power(110V/220V), built-in battery or DC power.
- Using the most advanced direct-time-measuring method, the unit offers a signal resolution of 0.2ms. In addition, advanced data processing functions ensure series 7200 of high linearity.
- Signal outputs including current signal, frequency signal and RS - 232 serial data ; switch output includes one OCT and one relay output ; And all the outputs displayed on the unit can be configured to be transmitted to a PC via RS-232C.

## Description

When an ultrasonic wave travels in a liquid, the flow of the liquid will cause its speed to change.

When it travels in the flow direction, its speed increases and against it, it decreases. By measuring the difference in travel times between both directions, one can measure the flow speed.

As shown in Chart 1, a pair of sensors are mounted upstream and downstream on the surface of the pipe. Its mounting configuration can be 'Z' or 'V'. The time - difference of ultrasonic signals transmitted and received across upstream and downstream are calculated as below;

$$T_{UP} = \frac{MD / \cos\theta}{C_0 + V \sin\theta} \quad (1) \quad T_{DOWN} = \frac{MD / \cos\theta}{C_0 - V \sin\theta} \quad (2)$$

M - travel time

D - inner diameter

$\theta$  - transmit angle

$C_0$  - fluid static sound velocity

$T_{UP}$  - travel time of upstream signal

$T_{DOWN}$  - travel time of downstream signal

$\Delta T$  - time difference as per equations (1) and (2), Using these, we can get the average velocity across the pipe diameter :

$$V = \frac{MD}{\sin 2\theta} \cdot \frac{\Delta T}{T_{UP} \times T_{DOWN}}$$

The information contained herein is subject to change without notice.



7200

7200 Series

Smart-IN<sup>US</sup>

Ultrasonic Flow Meter

## Technical Specifications

### Liquids Measured

Water, sea water and other clean liquids with a content of suspended solids less than 10000ppm (mg / l) and without a high content of air bubbles.

-20°C ~ +80°C, without ice in pipes at low temperature

### Pipe Materials Measured

Steel, stainless steel, cast iron, plastics etc. (25 ~ 3000mm)

### Up & Down Stream Straight Runs

In the upstream, it must be 10D and in the downstream 5D.

If there's a pump in the upstream, the length must be at least 30D from the pump.

### Flow Velocity

0 ~ ±32m/s

### Measurement Accuracy

±0.5 ~ 1% of rate

Repeatability : ±0.2 ~ 0.5 % at 0 ~ ±32 m/s

Linearity : ±0.5%

Pipe size : 25mm ~ 3000mm (ID)

### Display

Alphanumeric 2 x 20 digit backlight LCD

Total (m<sup>3</sup>), flow velocity (m/s), and instant flow (m<sup>3</sup> / hr)

W / 4x4 keyboard

### Output

0/4 ~ 20mA(precision 0.1%)

Frequency output : 1 ~ 9999Hz

Relay Output

RS-232C serial output. (Optional RS-485)

### Power Requirement

Wall mount type : 110VAC, 220VAC ±10% or 8~36VDC

Portable type : 110VAC, 220VAC ±10% (Recharge)

Panel mount type : 220VAC ±10% or 8~36VDC

Hand-held type : 80-240VAC ±10% (Recharge)

### Printer Output

Via RS - 232C : Total flow, flow velocity and instant flow.

### Operating Condition

Host : Temp : -20 ~ +50°C

Humid : 85% RH max.

Sensor : Temp : -20~+80°C

Humid : 98% RH max.

(able to operate immersed in water depth of 2m max.)

### Weight

Series 7210 Wall mount Type - 3.1kg

Series 7220 Portable Type - 6.5kg

Series 7230 Panel mount Type - 2kg

Series 7240 Hand-held Type - 4.5kg

## Sensor Distance

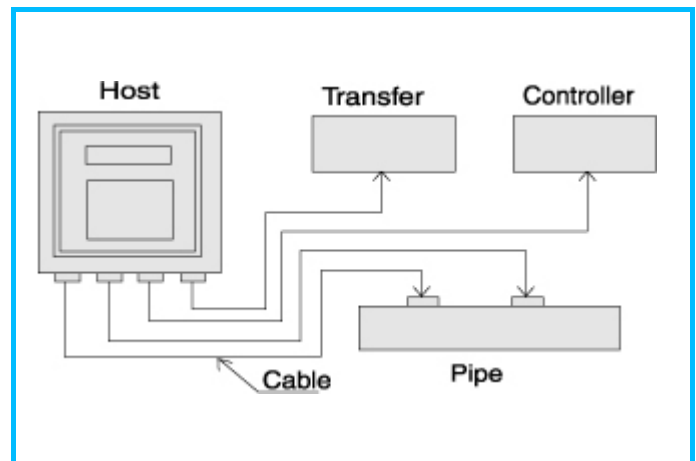
The distance takes the fronts edges as the standard.

After inputting the necessary parameter, check up the numbers displayed in M25 window, sensors and pipe wall.

At the some time, on the horizontal pipe sensors must be mounted horizontally and symmetrically, to prevent existing air bubble on the upper part in the pipe, this will effect the measurement precision.

Pay attention to the mounting direction.

## Series 7200 SYSTEM SCHEMATIC



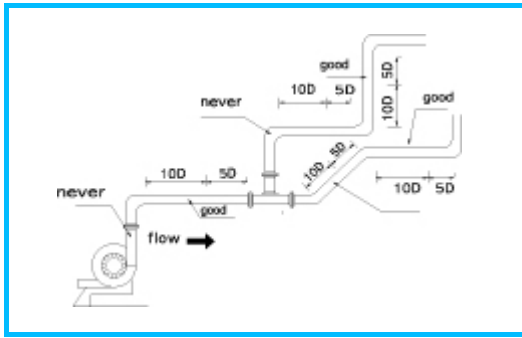
## Transducer Type

- Standard - M1 (50 ~ 700 mm range)
- Standard - S1 (20 ~ 100 mm range)
- Standard - L1 (300 ~ 6000 mm range)

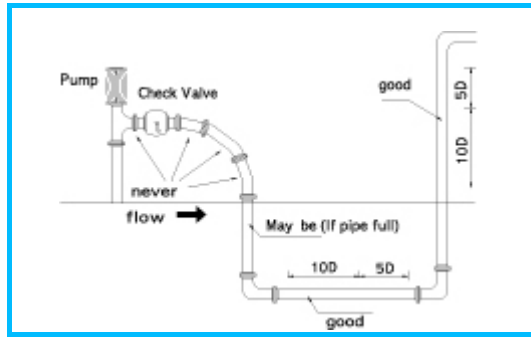
## Application

- Water supply, draining off and the processor of filthy water
- Oil field, petroleum chemical engineer system
- Power plant (heat power, water power, fire power)
- Steel factory, mining industry
- Food, Medicine, paper-made
- Automobile making and check-up  
Semi-conductor (Pure water)
- Heat net balance of heat supply system

## Sensor Installation



Site Selection

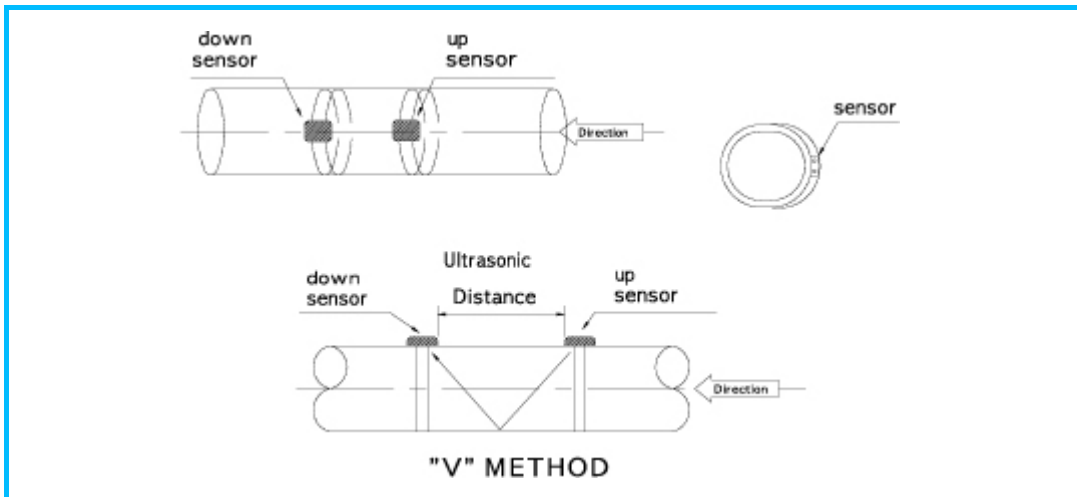


Sensor Location

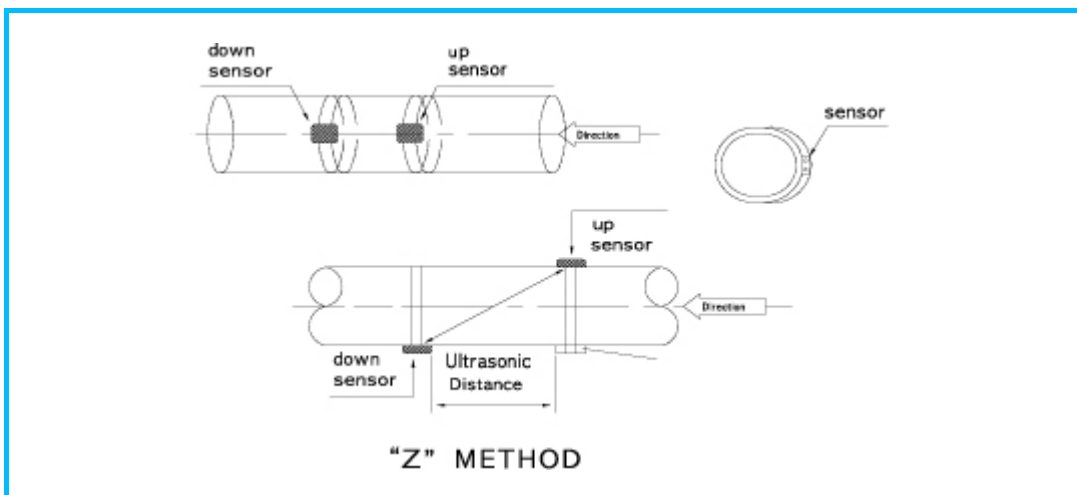
## Mounting method of sensor

There are two mounting methods, “V” method and “Z” method :

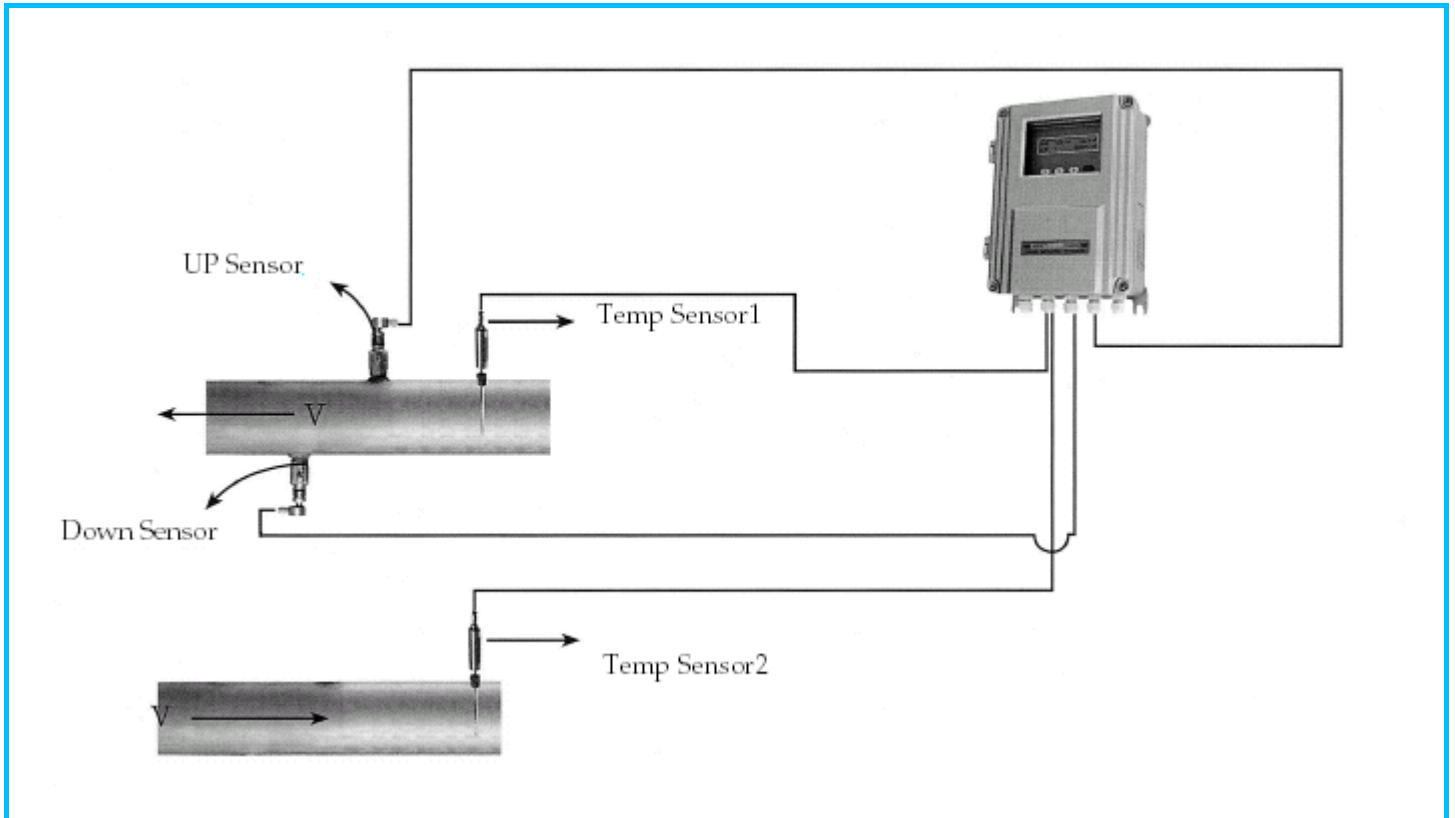
“V” method : usually “V” method is the standard method. It’s easier to install and offers high grade of accuracy. The scope of pipe diameter that “V” method can measure is 50 ~ 350mm; while mounting, two sensors should be horizontal and aligned, their axis and the center lines should be aligned.



“Z” method : When the signal can be attenuated or interfered by scale quilted up inside pipe, by a thick liner, suspended solids in the fluid, etc., use “Z” method instead. Using “Z” method ultrasonic wave spreads in the pipe directly without diffraction (straight sound signal path)



## 7200 Series Ultrasonic Calorimeter

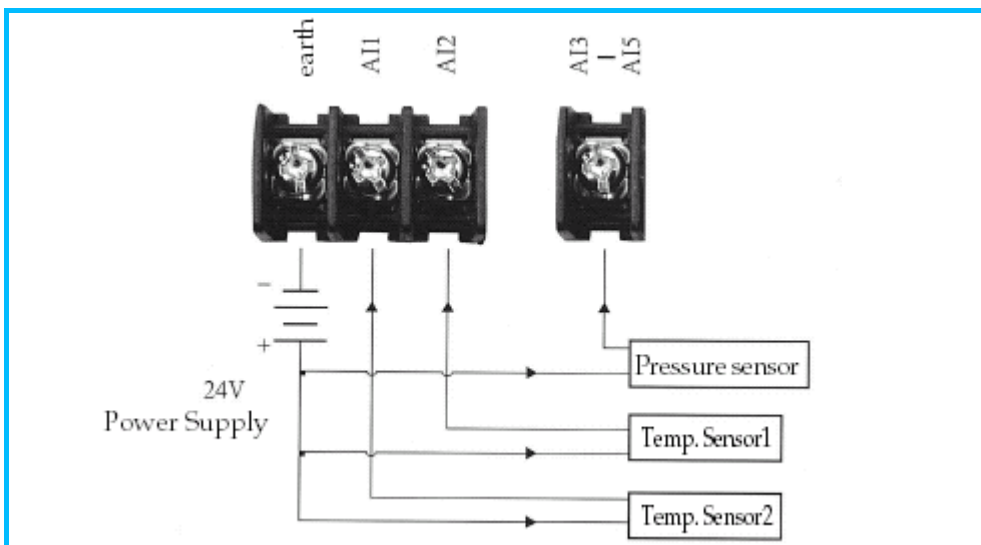


## Ultrasonic + Temp sensor = Ultrasonic Calorimeter

- Display of flow calorimeter, Net calorimeter, Temp.
- Select of Temperature Range
- Temp output : 4-20 mA (PT100, PT1000, Semi con)

## Method of Calorimeter Calculation

- Calorimeter = flow rate x  $((\Delta T1 \times K) - (\Delta T2 \times K))$
- Calorimeter = flow rate x  $\Delta T \times K$  (Thermal capacity)



# Various Ultrasonic Sensor

## 1. Clamp-on Sensor Type



Standard "S1" (Magnetic)  
DN15 - DN100  
Fluid Temp. < 80°C

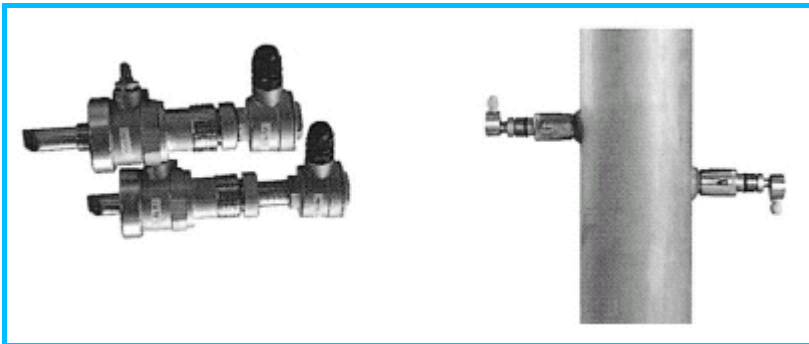


Standard "M1" (Magnetic)  
DN50 - DN700  
Fluid Temp. < 80°C



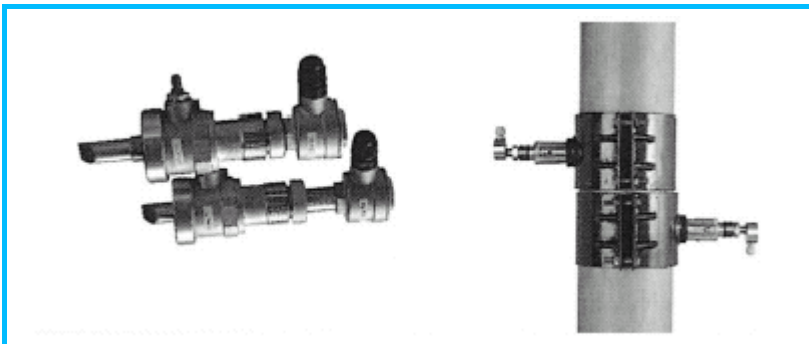
Standard "L1"  
DN300 - DN6000  
Fluid Temp. < 80°C

## 2. Insert Type



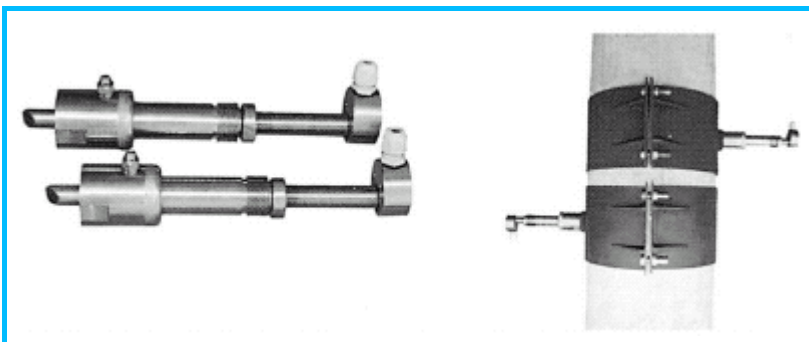
Wetted "WS"

- (1) Wetted Type (WS)  
DN50 ~ Fluid Temp. < 120°C



Cast iron Pipe Band "CI"

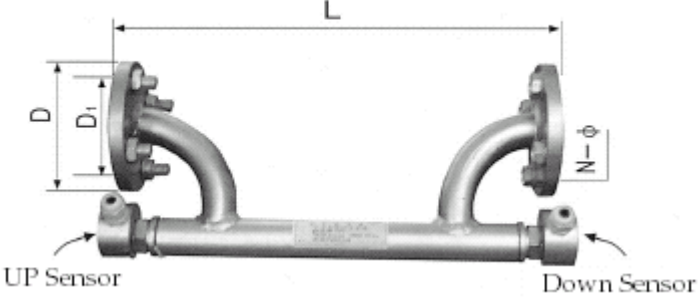
- (2) Cast iron Pipe Type (CI)  
DN50 ~ Fluid Temp. < 120°C



Cement Pipe Band "CB"

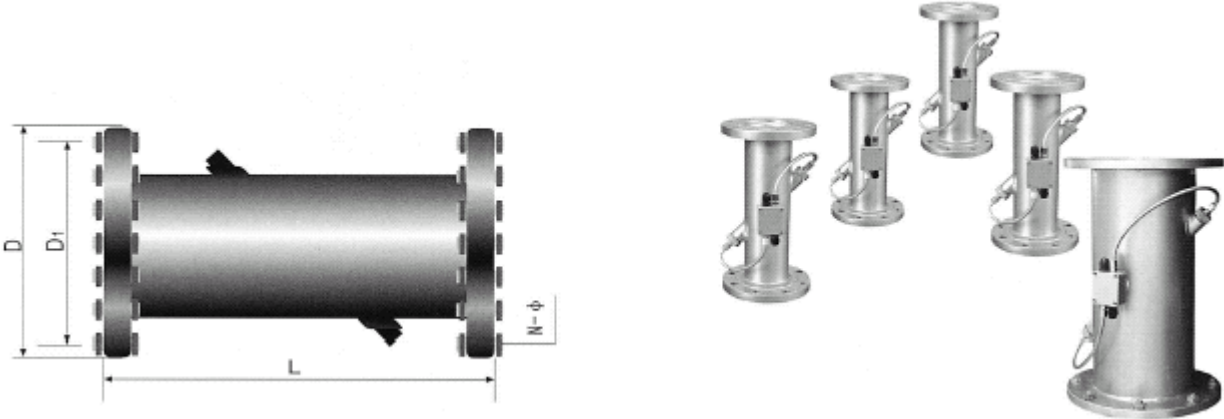
- (3) Cement Pipe Band (CB)  
DN100~ Fluid Temp. < 120°C

### 3. Standard “л” pipe Sensor Type



| DN(mm) | L(mm) | SIZE (mm) |     |      | Pressure MAX. (Mpa) |
|--------|-------|-----------|-----|------|---------------------|
|        |       | D         | D1  | N-Ø  |                     |
| 15     | 360   | 95        | 65  | 4-14 | 2.5                 |
| 20     | 460   | 105       | 75  | 4-14 |                     |
| 25     | 520   | 115       | 85  | 4-14 |                     |
| 32     | 600   | 135       | 100 | 4-18 |                     |
| 40     | 630   | 145       | 110 | 4-18 |                     |

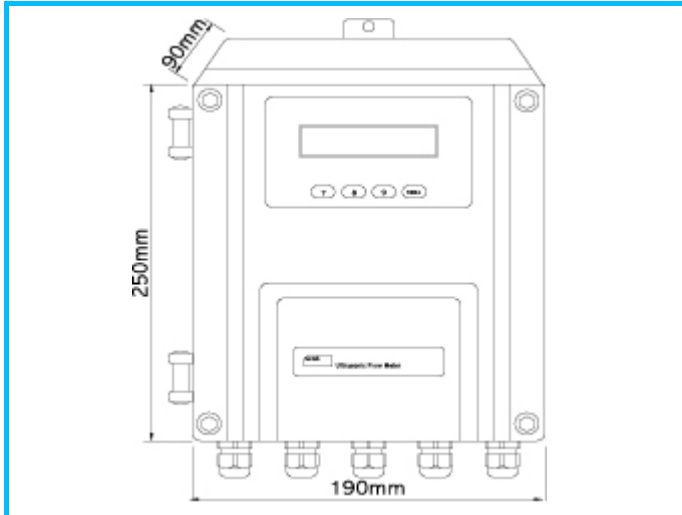
### 4. Flange Type



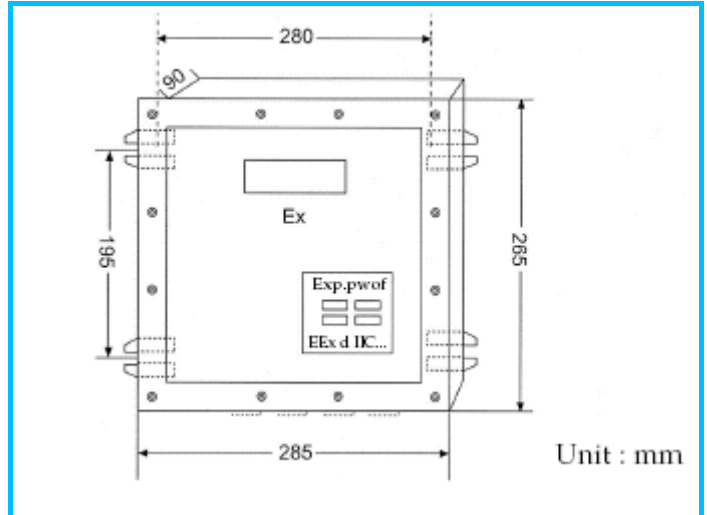
| PIPE DIA<br>DN(mm) | PIPE LENGTH<br>(mm) | SIZE (mm) |     |       | Max. Pressure<br>(Mpa) |
|--------------------|---------------------|-----------|-----|-------|------------------------|
|                    |                     | D         | D1  | N-Ø   |                        |
| 50                 | 350                 | 160       | 125 | 4-18  | 1.6                    |
| 65                 | 350                 | 180       | 145 | 4-18  |                        |
| 80                 | 350                 | 195       | 160 | 8-18  |                        |
| 100                | 400                 | 215       | 180 | 8-18  |                        |
| 125                | 425                 | 245       | 210 | 8-18  |                        |
| 150                | 450                 | 280       | 240 | 8-23  |                        |
| 200                | 500                 | 335       | 295 | 12-23 |                        |
| 250                | 575                 | 405       | 355 | 12-25 |                        |
| 300                | 650                 | 460       | 410 | 12-25 |                        |
| 350                | 700                 | 520       | 470 | 16-25 |                        |
| 400                | 750                 | 580       | 525 | 16-30 |                        |
| 450                | 800                 | 640       | 585 | 20-30 |                        |
| 500                | 850                 | 705       | 650 | 20-34 |                        |
| 600                | 950                 | 840       | 770 | 20-41 |                        |

## Dimensional Specification

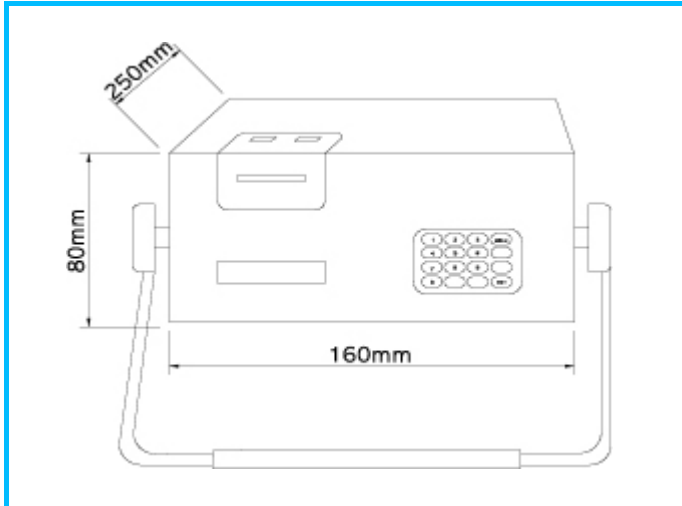
- Series 7210 HOST (Wall mount Type EN2)



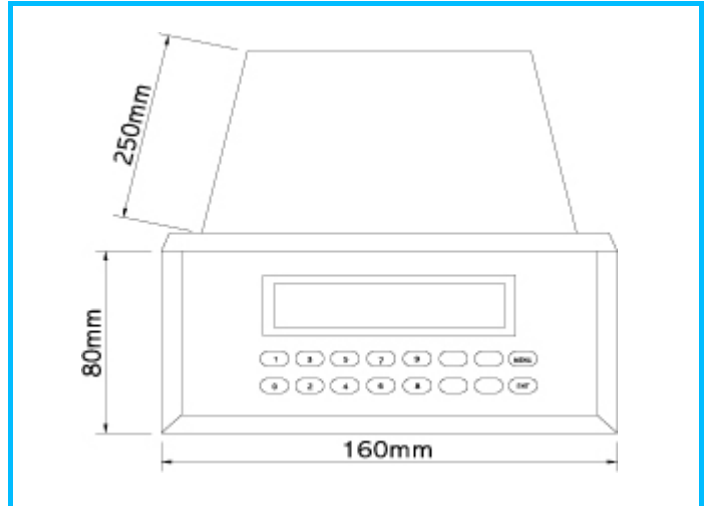
- Series 7210 HOST (Wall mount Type E2)



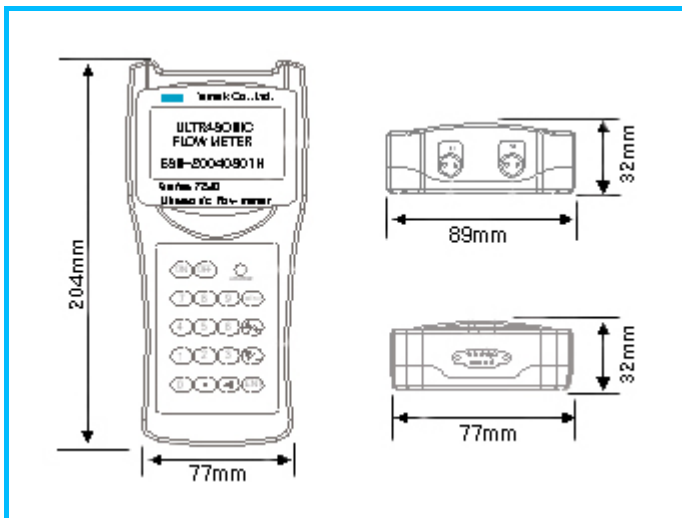
- Series 7220 HOST (Portable Type)



- Series 7230 HOST (Panel mount Type)



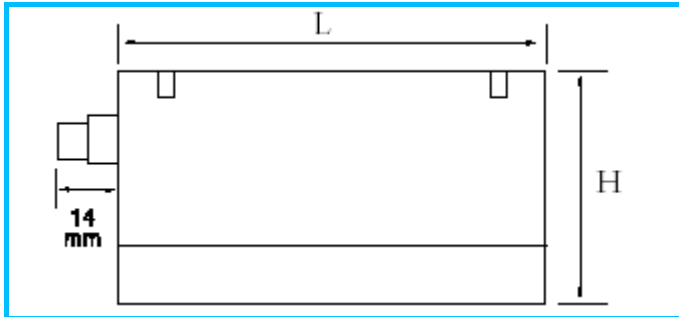
- Series 7240 HOST (Hand-held Type)



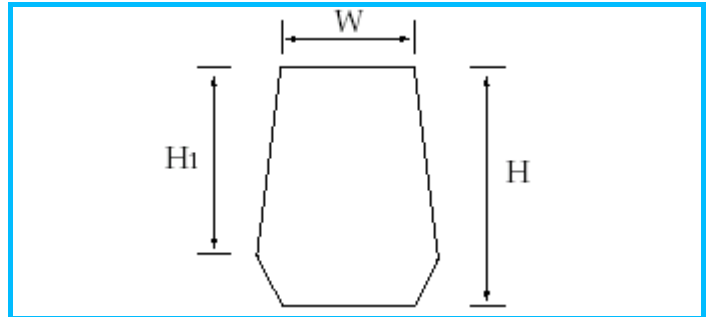
## Transducer dimension

- UFT-7210, 7220, 7230

| Size | L    | H    | H1   | W    | Note |
|------|------|------|------|------|------|
| S1   | 45mm | 30mm |      | 30mm |      |
| M1   | 60mm | 45mm | 35mm | 45mm |      |
| L1   | 80mm | 70mm |      | 55mm |      |



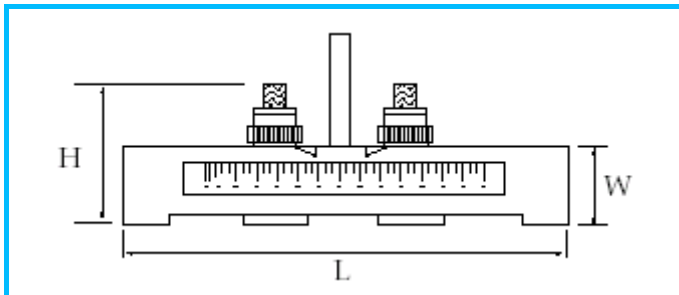
Front View



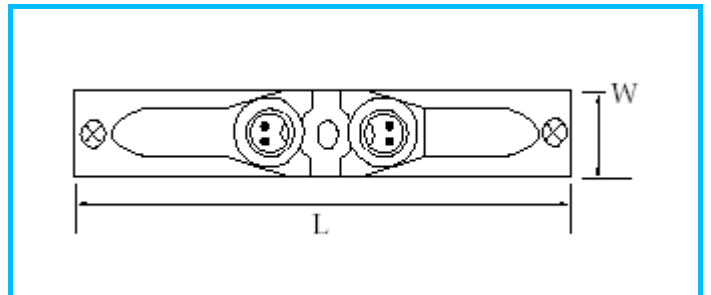
Side View

- UFT-7240

26mm (W) x 200mm (L) x 42mm (H)



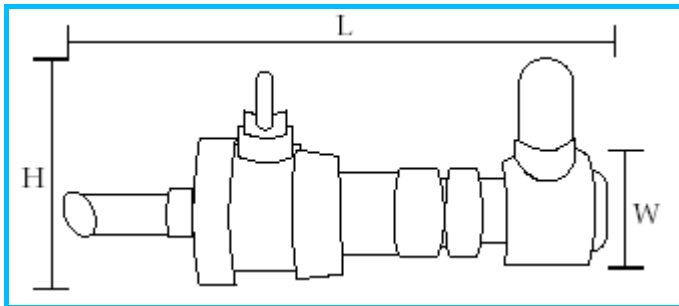
Front View



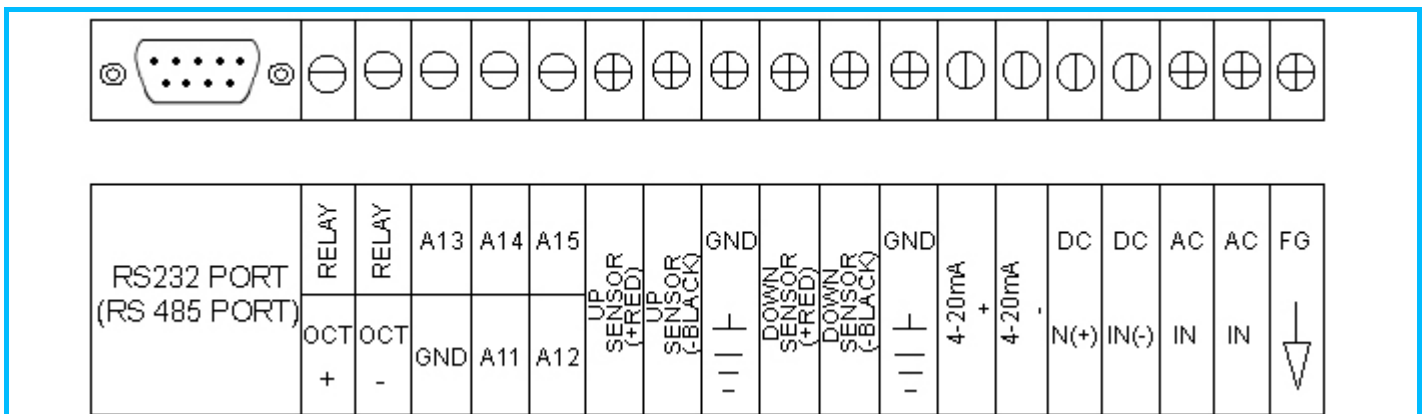
Side View

- Wetted type sensor - L

52mm (W) x 141mm (L) x 77mm (H)



## Wiring Connection (UFT-7210)



Factor2 (P)153-803  
 Daeryung Technotown 5th #407  
 493, Gasan-dong Gumcheon-Gu Seoul, Korea  
 TEL : +82(2)-2107-7999 FAX : +82(2)-2107-7990  
 www.flowcountry.com , www.flowcountry.co.kr

UFT-72 

|      |  |
|------|--|
| Type |  |
|------|--|

 S- 

|        |  |
|--------|--|
| Agency |  |
|--------|--|

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|-------------|--|
| Sensor Type |  |
|-------------|--|

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|-------|--|
| Power |  |
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| Output |  |
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|---------|--|
| Display |  |
|---------|--|

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| Cable Con. |  |
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|            |  |
|------------|--|
| Cable Len. |  |
|------------|--|

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| Enclosures |  |
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| Model Direction                     | Code 1 |
|-------------------------------------|--------|
| WALL Ultrasonic Flow Meter          | 10     |
| PORT Ultrasonic Flow Meter          | 20     |
| PAN Ultrasonic Flow Meter           | 30     |
| HAND Ultrasonic Flow Meter          | 40     |
| Agency approved, customer specified | W      |

| Agency Approvals  | Code 2 |
|---|--------|
| Non-Agency Approved Meter                               | NAA    |
| Explosion Proof for Class 1, Division 1, Groups B, C, D | CSA    |
| Ex d IIC T6...T2 CENELEC                                | EEx    |
| Explosion Proof for Class 1, Division 1, Groups B, C, D | FM     |
| Agency approved, customer specified                     | W      |

| Sensor Type                         | Code 3 |
|-------------------------------------|--------|
| Clamp-on transducer "S1"            | CS1    |
| Clamp-on transducer "M1"            | CM1    |
| Clamp-on transducer "L1"            | CL1    |
| Wetted transducer "WS"              | WS     |
| Cast Iron Pipe Bend "CI"            | CI     |
| Cement Pipe Bend "CB"               | CB     |
| Standard "ㄱ" pipe DN15              | D15    |
| Standard "ㄱ" pipe DN20              | D20    |
| Standard "ㄱ" pipe DN25              | D25    |
| Standard "ㄱ" pipe DN32              | D32    |
| Standard "ㄱ" pipe DN40              | D40    |
| Flange type DN ( )                  | F ( )  |
| * DN( ) : 50-600 mm                 |        |
| Agency approved, customer specified | W      |

| Input Power                         | Code 4 |
|-------------------------------------|--------|
| DC24V ±10%                          | P2     |
| AC 110V ±10%                        | P3     |
| AC 220V ±10%                        | P4     |
| AC 80-240V Adaptor (7240 Only)      | P5     |
| Agency approved, customer specified | W      |

| Output                              | Code 5 |
|-------------------------------------|--------|
| 0/4 ~ 20mA and pulse                | V1     |
| Relay Output(when using in net)     | V2     |
| RS-232 series port                  | V3     |
| RS-485 (Option)                     | V4     |
| Agency approved, customer specified | W      |

| Display                             | Code 6 |
|-------------------------------------|--------|
| No Readout                          | NR     |
| Digital Display                     | DD     |
| Agency approved, customer specified | W W    |

| Cable Connector                     | Code 7 |
|-------------------------------------|--------|
| Standard Connector                  | SC     |
| BNC Connector                       | BC     |
| Agency approved, customer specified | W      |

| Cable Length                        | Code 8 |
|-------------------------------------|--------|
| Standard Length (5m)                | S5     |
| Special Length ( )m                 | S( )   |
| Agency approved, customer specified | W      |

| Enclosures                          | Code 9 |
|-------------------------------------|--------|
| Hazardous-Area Location Enclosure   | E2     |
| NEMA 4X                             | EN2    |
| Agency approved, customer specified | W      |

| Pipe Dimension                      | Code 10 |
|-------------------------------------|---------|
| Pipe Dia. DN ( ) mm                 | D ( )   |
| Not Application                     | NA      |
| Agency approved, customer specified | W       |

| Option                                 | Code 11 |
|--|---------|
| Pressure Test Certificate              | PT      |
| Certificate of Conformance             | CC      |
| NACE Certificate                       | NC      |
| Mount Fixture (Transducer Space 200mm) | SFA     |
| Mount Fixture (Transducer Space 75mm)  | SFB     |
| Mount Fixture (Transducer Space 350mm) | SFC     |
| Mounting ball valve w/drill hall tool. | MVT     |
| Agency approved, customer specified    | W       |

# Q E C

## *Certificate Of Registration*



**This is to certify that**

**ientek Co., Ltd.**

**407HO 5<sup>TH</sup> DAERYUNG TECHNOTOWN  
493 GASANDONG GUMCHEON-GU SEOUL  
REPUBLIC OF KOREA**

Has been assessed by Quality and Environmental Certification Ltd.  
Their Quality Management System was confirmed to be in compliance with:

**ISO 9001 : 2000**

Registration is authorised on condition that the certification  
rules and regulations issued to them are adhered to:

|                               |   |
|-------------------------------|---|
| <b>Scope of Certification</b> | DESIGN, DEVELOPMENT, AND MANUFACTURE<br>OF FLOW METER |
| <b>Registration Number</b>    | 5361  |
| <b>Date of Issue</b>          | 27/11/2003  |
| <b>Valid To</b>               | 26/11/2006  |

A handwritten signature in black ink, appearing to read 'J. Ward'.

*Signed on behalf of the Certification Manager QEC Ltd*

Quality and Environmental Certification Limited, 10 Thyme Court, Farnborough, Hampshire GU14 9XT

# EC Attestation of Conformity

No.: E8 03 08 47696 003



ientek Co., Ltd.

Daeryung Technotown V#407,  
493 Gasan-Dong, Gumcheon-Gu,  
Seoul, Korea

Item Identification:      Devices acc. to EMC directive  
   Mass flow meter

Item Description:            MFM  
   Input: 24 V d.c.

The equipment complies with the principal protection requirements of the EMC Directive (Directive 89/336/EEC relating to electromagnetic compatibility) based on a voluntary test.

This attestation applies only to the particular sample of the product and its technical documentation provided for testing and certification. The detailed test results and all standards used as well as the operation mode are listed in

Test report no. :    ERI-EN03-0070

Test standards:    EN 60730-2-18:1999

This attestation is released with the above mentioned attestation number by the Certification Body of TÜV PRODUCT SERVICE. It does not permit the use of a TÜV PRODUCT SERVICE certification mark.

After preparation of the necessary technical documentation as well as the conformity declaration the CE marking as shown below can be affixed on the equipment as stipulated in Article 10.1 of the Directive. Other relevant Directives have to be observed.



*Karl Pfeiffer*



Department:            EMCKR / ysy  
Date:                      Aug-29-2003

TÜV PRODUCT SERVICE GMBH · Zertifizierstelle · Ridlerstrasse 65 · D-80339 München

# EC Attestation of Conformity

No.: E8 03 01 47696 002



ientek Co., Ltd.

Daeryung Technotown V#407,  
493 Gasan-Dong, Gumcheon-Gu,  
Seoul, Korea

Item Identification: Devices acc. to EMC directive

Mass Flow Sensor

Item Description: MFS

Input: 24 V d.c., 625 mA

The equipment complies with the principal protection requirements of the EMC Directive (Directive 89/336/EEC relating to electromagnetic compatibility) based on a voluntary test.

This attestation applies only to the particular sample of the product and its technical documentation provided for testing and certification. The detailed test results and all standards used as well as the operation mode are listed in

Test report no. : ERI-EN-0306

Test standards: EN 60730-2-18:1999

This attestation is released with the above mentioned attestation number by the Certification Body of TÜV PRODUCT SERVICE. It does not permit the use of a TÜV PRODUCT SERVICE certification mark.

After preparation of the necessary technical documentation as well as the conformity declaration the CE marking as shown below can be affixed on the equipment as stipulated in Article 10.1 of the Directive. Other relevant Directives have to be observed.



*Kap-Phoo*



Department: EMCKR / ysy  
Date: Jan-03-2003

TÜV PRODUCT SERVICE GMBH · Zertifizierstelle · Ridlerstrasse 65 · D-80339 München



# CERTIFICATE

of  
Electrical equipment for use in explosive atmospheres

**Ref. Cert. No.**

**2003-1112-Q1**

- 1 Application No. ;  
**KTL454-221/2003**
- 2 This certificate is issued for the equipment ;  
**MASS FLOW METER**  
[ Model (Rating) : MFM (DC 24V, 625<sub>lit</sub>A. Max) ]  
[ Special conditions : Amb. Temp = -10℃ ...+40℃, Flow gas Temp. = 0℃ ...+80℃ ]
- 3 Manufactured and submitted for certification by ;  
**Ientek Co., Ltd.**  
( ADDRESS : 1271. Sa1-dong, Ansan, Kyonggi-do, Korea )
- 4 This equipment and any acceptable variation thereto are specified in the schedule to this certificate and the test report therein referred to.
- 5 The KTL, being an Approved Certification Body in accordance with Article 33 of the Industrial Safety & Health Law and Article 27 of Enforcement Ordinance, Article 46 of Detailed Enforcement Regulation of the Law, confirms that the apparatus has been found to comply with the following Korean Standards ;  
**Notification No.2003-18 (Ministry of Labor)**  
**IEC 60079-0 (2000) + Amd No.1 (2000),**  
**IEC 60079-1 (2002), IEC 60079-11 (1999)**  
( Above IEC standards are applied with appropriate modifications )  
and has successfully met the examination and test requirements recorded in confidential report number ;  
**KTL Test Report No. R454-221/01-DEC-2003**
- 6 The code for the electrical apparatus is ;  
**Ex dia IIB T3**
- 7 This equipment may be marked Designated Mark specified in Article 46-7 of Detailed Enforcement Regulation of the Industrial Safety & Health Law.
- 8 The validity of this certificate is until 01 December 2008.

Seoul, 02 December 2003

Approved by  
Woo-Sup, Lee

## KOREA TESTING LABORATORY

Page 1/1



## 특 허 증

특 허 제 0209169 호

출원 번호 제 1997-0014113 호  
출원 일 1997년 04월 17일  
등록 일 1999년 04월 20일

발명의명칭 공기유량/유속 센서소자 및 그 제조방법

특허 권자 등록 사항란에 기재

발명자 등록 사항란에 기재

위의 발명은 특허법에 의하여 특허등록원부에  
등록되었음을 증명합니다.

1999년 04월 20일

## 특 허 청





# 특 허 증

특 허 제 0244902 호

|    |    |                  |
|----|----|------------------|
| 출원 | 번호 | 제 1997-0016906 호 |
| 출원 | 일  | 1997년 05월 01일    |
| 등록 | 일  | 1999년 11월 24일    |

발명의명칭      공기유속 센서소자 및 그 측정회로

특허 권자      등록 사항란에 기재

발명자      등록 사항란에 기재

위의 발명은 특허법에 의하여 특허등록원부에  
등록되었음을 증명합니다.

1999년 11월 24일

# 특 허 청





# 특 허 증

특 허 제 0244807 호

|    |    |                  |
|----|----|------------------|
| 출원 | 번호 | 제 1997-0036914 호 |
| 출원 | 일  | 1997년 08월 01일    |
| 등록 | 일  | 1999년 11월 24일    |

발명의명칭      세라믹 수중 히터

특허 권리자      등록 사항란에 기재

발명자            등록 사항란에 기재

위의 발명은 특허법에 의하여 특허등록원부에  
등록되었음을 증명합니다.

1999년 11월 24일

# 특 허 청





## 특 허 증

특 허 제 0276021 호

출원 번호 제 1998-0041027 호  
출원 일 1998년 09월 30일  
등록 일 2000년 09월 26일

발명의명칭 세라믹 수증히터

특허 권자 등록 사항란에 기재

발명자 등록 사항란에 기재

위의 발명은 특허법에 의하여 특허등록원부에  
등록되었음을 증명합니다.

2000년 09월 26일

특 허 청





DIPL.-ING. KURT KAHLER;  
 DIPL.-WIRTSCH.-INGENIEUR  
 DIPL.-ING. JÜRGEN KÄCK;  
 PATENTANWÄLTE, LANDSBERG

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 MAXIMILIANSTRASSE 57

YOU & I International Patent & Law Office  
 Rm 1405, Yoksam Heights Bldg.  
 642-19, Yoksam-dong,  
 Kangnam-gu, Seoul 135-080

VORDERER ANGER 268  
 D-86899 LANDSBERG

|                      |             |   |                |
|----------------------|-------------|---|----------------|
| Republic of Korea    | Telephone   | : | [0]8191-59210  |
| Receipt              | Facsimile 1 | : | [0]8191-59209  |
| acknowledged.....    | Facsimile 2 | : | [0]8191-59225  |
| (Date and Signature) | eMail       | : | mail@kkpot.com |
|                      | Web         | : | www.kkpot.com  |

***Please return for Confirmation. Thank you.***

October 15, 2001

Report about the Filing of a German Patent Application  
 Your ref.: GP/01/110 - Our ref.: 61 115 DE J/kn

Dear Mr. Choi:


We are pleased to report that we have filed the above mentioned German Patent Application according to the following particulars:

- |                                   |   |
|-----------------------------------|---|
| 1. Applicant:                     | Entek Co., Ltd.   |
| 2. Title:                         | MENDURCHFLUSSENSOR UND<br>MESSVORRICHTUNG<br>(Mass Flow Sensor and Measuring Apparatus) |
| 3. Priority claimed:              | none  |
| 4. Filing Date:                   | October 12, 2001  |
| 5. Application No.:               | 101 50 544.2  |
| 6. Examination requested:         | YES   |
| 7. Declaration of Inventor filed: | YES   |
| 8. Formal Drawings filed:         | YES   |
| 9. Priority Document(s) filed:    | NO (not necessary)  |

Remarks

For the present application no priority has been claimed. However, we assume that there exists a corresponding Korean patent application so that applicants are not interested to file further applications claiming priority of the present application. If this should not be correct, please advise.

We will keep you promptly informed about the further progress of the application.

원본대조필 

SUZUYE PATENT & TRADEMARK OFFICE

6TH FLOOR, OSAKA FUKOKUSEIMEI BUILDING,  
2-4, KOMATSUBARACHO, KITA-KU,  
OSAKA-SHI, OSAKA 530-0018, JAPAN

PATENT  
UTILITY MODEL  
DESIGN  
TRADEMARK

PHONE: 81-6-6312-0187  
FAX: 81-6-6312-5733

YOU&I 国際特許法律事務所  
大韓民国  
ソウル特別市江南区  
駅三洞 642-19 駅三ハイツ 1405 号

DEBIT NOTE

COPY

Debit Note No. YI-1301  
(Please quote in remittance)

Bankers: The Daiwa Bank Ltd.,  
Umeda Branch, Osaka

Ordinary Deposit Account No. 585764

Your Ref. : JPP-01-108

Our Ref. : 131241

September 28, 2001

日本国特許出願番号 : 特願 2001-297789  
発明の名称 : 質量流体流量センサー及び流体流れ検出装置  
出願人 : 株式会社エンテック

整理番号 = PE-131241

提出日 平成13年 9月27日  
特願2001-297789 頁: 1/ 1

【書類名】 出願審査請求書  
【整理番号】 PE-131241  
【提出日】 平成13年 9月27日  
【あて先】 特許庁長官殿  
【出願の表示】  
【出願番号】 特願2001-297789  
【請求項の数】 7  
【請求人】  
【住所又は居所】 大韓民国京畿道安山市四1洞1271安山テクノパーク  
401号  
【氏名又は名称】 株式会社エンテック

원본대조필

# Conversion Factors

## VOLUME

|                                 |   |                                       |
|---------------------------------|---|---------------------------------------|
| 1 cubic meter (m <sup>3</sup> ) | = | 1000 liters (l)                       |
| 1 cubic meter (m <sup>3</sup> ) | = | 35.32 cubic feet (ft <sup>3</sup> )   |
| 1 cubic foot (ft <sup>3</sup> ) | = | 28.32 liters (l)                      |
| 1 liters (l)                    | = | 1000 cubic centimeters (cc)           |
| 1 liters (l)                    | = | 0.03532 cubic feet (ft <sup>3</sup> ) |

## VOLUMETRIC FLOW RATE, Q

|  |   |  |
|--|---|--|
| 1 cubic meter per hour (m <sup>3</sup> /h) | = | 0.5886 cubic feet per minute (cfm)     |
| 1 cubic centimeter per minute (ccm)        | = | 0.00003532 cubic feet per minute (cfm) |
| 1 liter per minute (lpm)                   | = | 0.03532 cubic feet per minute (cfm)    |
| 1 liter per minute (lpm)                   | = | 1000 cubic centimeter per minute (ccm) |

## MASS FLOW RATE, m

|                              |   |                                    |
|------------------------------|---|------------------------------------|
| 1 kilogram per second (kg/s) | = | 1000 grams per second (gm/s)       |
| 1 kilogram pre second (kg/s) | = | 7937 pounds mass per hour (lbm/hr) |

## VELOCITY, V

|                          |   |                                   |
|--------------------------|---|-----------------------------------|
| 1 meter per second (m/s) | = | 100centimeters of oer second(cps) |
| 1 meter per second (m/s) | = | 196.9 feet per minute (fpm)       |
| 1 miles per hour(mph)    | = | 88 feet per minute(fpm)           |

## PRESSURE, P

|  |   |   |
|--|---|---|
| 1 atmosphere (atm)                                     | = | 86.00 centimeters of mercury (cm Hg)                        |
| 1 atmosphere (atm)                                     | = | 14.70 pounds per square inch (psi)                          |
| 1 bar  | = | 10 <sup>5</sup> Newton per square meter (N/m <sup>2</sup> ) |
| 1 bar  | = | 14.50 pounds per square inch (psi)                          |
| 1 dyne per second centimeter (d/cm <sup>2</sup> )      | = | 0.00001450 pounds per square inch (psi)                     |
| 1 inches of mercury (in Hg)                            | = | 13.62 inches of water (inH <sub>2</sub> O)                  |
| 1 inch of water (in H <sub>2</sub> O)                  | = | 0.03609 pounds per square inch (psi)                        |
| 1 kilogram per square centimeter (kg/cm <sup>2</sup> ) | = | 14.22 pounds per square inch (psi)                          |
| 1 kilogram per square meter (kg/m <sup>2</sup> )       | = | 0.001422 pounds per square inch (psi)                       |
| 1 Newtown per square meter (N/m <sup>2</sup> )         | = | 0.0001450 pounds per square inch (psi)                      |
| 1 Pascal   | = | 1 Newton per square meter (N/m <sup>2</sup> )               |
| 1 Kilopascal   | = | 0.1450 pounds per square inch (psi)                         |
| pounds per square inch absolute (psia)                 | = | 14.70 pounds per square inch gauge (psig)                   |

## TEMPERATURE, T

|                     |   |                                |
|---------------------|---|--------------------------------|
| degrees Centigrade  | = | (°F-32) x 0.5556               |
| degrees Fahrenheit  | = | 1.8 x °C+32                    |
| degrees Kelvin (°K) | = | 283.15 degrees Centigrade (°C) |
| degrees Rankin (°R) | = | 459.67 +degrees Fahrenheit(°F) |

## MASS DENSITY, p

|   |   |  |
|---|---|--|
| 1 kilogram per cubic meter (kg/m <sup>3</sup> ) | = | 0.06243 pounds mass per cubic foot (lb/ft <sup>3</sup> ) |
| 1 gram per liter (gm/l)                         | = | 0.001 gm per cubic centimeter (gm/cc)                    |
| 1 gram per cubic centimeter (g/cc)              | = | 62.43 pounds mass per cubic foot (lb/ft <sup>3</sup> )   |

## SPECIFIC HEAT, Cp

|              |   |                |
|--------------|---|----------------|
| 1cal/gm • °C | = | 1 Btu/lbm • °F |
|--------------|---|----------------|

## VISCOSITY, μ

|                        |   |                   |
|------------------------|---|-------------------|
| 1 poise = 1gm/cm • sec | = | 241.9 lbm/ft • hr |
|------------------------|---|-------------------|

# Conversion Table

| MULTIPLY                     |                           |                           | MULTIPLY                                       |                           |  |
|------------------------------|---------------------------|---------------------------|--|---------------------------|--|
| DENSITY                      | BY                        | TO OBTAIN                 | HEATING VALVE                                  | BY                        | TO OBTAIN                                  |
| Grams per cc .....           | 62.428                    | Pounds per cubic feet     | 8 TU / ft <sup>3</sup> .....                   | 0.037                     | Joules / cm <sup>3</sup>                   |
| .....                        | 0.03613                   | Pounds per cubic inch     | 8 TU / pound .....                             | 2.32444                   | Joules / gram                              |
| .....                        | 8.345                     | Pounds per U.S. gallon    | <b>VOLUME</b>                                  |                           |  |
| Pound per cubic foot .....   | 16.02                     | Kg. per cubic meter       | Cubic centimeter .....                         | 0.001                     | Liters                                     |
| Gram-moles of ideal Gas      |                           |                           | .....  | 0.0610                    | Cubic inches                               |
| @ 0°C & 760 mmHg .....       | 22.4140                   | Liters                    | Liters .....                                   | 0.2642                    | Gallons                                    |
| Pounds per cubic inch .....  | 1728                      | Pounds per cubic feet     | .....  | 0.0353                    | Cubic feet                                 |
| .....                        | 27.68                     | Grams per cc.             | .....  | 1.0567                    | Quarts                                     |
| Pound-moles of ideal Gas     |                           |                           | .....  | 61.025                    | Cubic Inches                               |
| @ 0°C & 760 mmHg .....       | 359.05                    | Cubic feet                | Cubic feet .....                               | 28317                     | Cubic centimeters                          |
| <b>PRESSURE</b>              |                           |                           | .....  | 1728                      | Cubic Inches                               |
| Atmospheres .....            | 101.4                     | Kilopascals               | .....  | 0.03704                   | Cubic yards                                |
| .....                        | 760                       | Millimeters of mercury    | .....  | 7.481                     | Gallons                                    |
| .....                        | 29.921                    | Inches of mercury         | .....  | 28.32                     | Liters                                     |
| .....                        | 33.93                     | Feet of water             | .....  | 0.028                     | Cubic meters                               |
| .....                        | 10332                     | Kg. per square meter      | Cubic inches .....                             | 16.387                    | Cubic centimeters                          |
| .....                        | 14.696                    | Lbs. per square inch      | .....  | 0.01639                   | Liters                                     |
| .....                        | 2116.2                    | Lbs. per square inch      | .....  | 4.329 * 10 <sup>-3</sup>  | Gallons                                    |
| .....                        | 1.0133                    | Bars                      | .....  | 0.01732                   | Quarts (liquid)                            |
| .....                        | 1.0332                    | Kg. per square centimeter | .....  | 1.6387 * 10 <sup>-5</sup> | Cubic meters                               |
| Bars .....                   | 100                       | Kilopascals               | <b>MASS</b>                                    |                           |  |
| Centimeters of Hg .....      | 5.3524                    | Inches of water           | Pounds .....                                   | 0.4536                    | Kilograms                                  |
| .....                        | 0.4460                    | Feet of water             | .....  | 435.59237                 | Grams                                      |
| .....                        | 1.33                      | Kilopascals               | .....  | 0.04448                   | Joules / cm                                |
| .....                        | 0.1934                    | Lbs. per square inch      | .....  | 4.448                     | Joules / meter                             |
| .....                        | 27.845                    | Lbs. per square foot      | Pounds of water .....                          | 0.01602                   | Cubic feet                                 |
| .....                        | 135.95                    | Kg. per square meter      | .....  | 27.68                     | Cubic inches                               |
| Feat of water .....          | 0.02947                   | Atmosphere                | .....  | 0.1198                    | Gallons                                    |
| .....                        | 0.4335                    | Lbs. per square inch      | Ounces .....                                   | 28.349527                 | Grams                                      |
| .....                        | 62.378                    | Lbs. per square foot      | <b>TEMPERATURE</b>                             |                           |  |
| .....                        | 2.99                      | Kilopascals               | Degrees Fahrenheit= 1.8(degrees Celsius) + 32  |                           |  |
| Inches of Hg .....           | 0.03342                   | Atmospheres               | Degrees Kelvin = degrees Celsius + 273.16      |                           |  |
| .....                        | 13.60                     | Inches of water           | Degrees Rankin's = degrees Fahrenheit + 459.69 |                           |  |
| .....                        | 1.133                     | Feet of water             | <b>VISCOSITY (Absolute)</b>                    |                           |  |
| .....                        | 3.389                     | Kilopascals               | Poise .....                                    | 1.0                       | Gm / cm sec.                               |
| .....                        | 0.4912                    | Lbs. per square inch      | .....  | 1.0                       | Dyne sec / cm <sup>2</sup>                 |
| .....                        | 7.0727                    | Lbs. per square foot      | .....  | 100                       | Centipoises                                |
| .....                        | 345.32                    | Kg. per square meter      | Centipoises .....                              | 0.000672                  | Lb./ ft. dec.                              |
| Inches of water .....        | 0.249                     | Kilopascals               | .....  | 0.0000209                 | Lb. sec. / ft <sup>2</sup>                 |
| .....                        | 0.03609                   | Lbs. per square inch      | .....  | 2.42                      | Lb./ ft. hr                                |
| .....                        | 5.1981                    | Lbs per square foot       | <b>VISCOSITY (Kinematics)</b>                  |                           |  |
| .....                        | 25.38                     | Kg. per square meter      | Stoke .....                                    | 1.0                       | cm <sup>2</sup> / sec                      |
| Kg. per square               |                           |                           | .....  | 0.155                     | in. <sup>2</sup> / sec                     |
| centimeter .....             | 0.9678                    | Atmospheres               | .....  | 0.001076                  | Ft. <sup>2</sup> / sec                     |
| .....                        | 98.1                      | Kilopascals               | .....  | density                   | Poise                                      |
| .....                        | 14.22                     | Lbs. per square meter     | .....  | (gm / cm <sup>3</sup> )   |  |
| Pounds per square            |                           |                           | <b>MISC. PHYSICAL CONSTANTS</b>                |                           |  |
| inch .....                   | 70.31                     | Grams per cm <sup>2</sup> | CONSTANT                                       | NUMERICAL                 | UNITS                                      |
| .....                        | 6.9                       | Kilopascals               |  | VALUE                     |  |
| .....                        | 2.036                     | Inches of mercury         | Abogadro's Number                              | 6.0228 * 10 <sup>23</sup> | Molecules / gm-mole                        |
| .....                        | 2.311                     | Feet of water             | Gas-Law Constant R                             | 1.987                     | Cal./(gm-mole) ( °K.)                      |
| <b>FLOW</b>                  |                           |                           | .....  | 1.987                     | BTU/(lb.-mole) ( °R.)                      |
| Ft <sup>3</sup> / min .....  | 472                       | cm <sup>3</sup> / sec     | .....  | 82.06                     | (cm <sup>3</sup> )(atm)(gm-mole)(°K.)      |
| .....                        | 0.4719                    | Liters / sec              | .....  | 0.08205                   | (liter)(atm)(gm-mole)( °K)                 |
| Ft <sup>3</sup> / hour ..... | 7.87                      | cm <sup>3</sup> / sec.    | .....  | 10.731                    | (ft <sup>3</sup> )(lb.)(in)(lb.-mole)( °R) |
| .....                        | 28.31605                  | Liters / hour             | .....  | 0.7302                    | (ft <sup>3</sup> )(atm)(ib.mole)( °R.)     |
| Ft <sup>3</sup> / sec. ....  | 28.31605                  | Liters / sec              | .....  | 8.31432 * 10 <sup>3</sup> | J(k mole) ( °K.)                           |
| .....                        | 1698.963                  | Liters / min              |  |                           |  |
| Gallons / hour .....         | 28316.847                 | cm <sup>3</sup> / sec     |  |                           |  |
| .....                        | 6.3090 * 10 <sup>-5</sup> | m <sup>3</sup> / min      |  |                           |  |
| .....                        | 3.7854                    | Liters / hour             |  |                           |  |

# Gas Factor Table

| Actual Gas                           | Chemical Symbol                                   | Ref. Gas       | K-Factor Rel. to Ref. Gas | K-Factor Relative N2 | Cp (Cal / g) | Density (g / l) @0°C | Elastomer O-Ring Valve O-Ring Seat |
|--------------------------------------|---|----------------|---------------------------|----------------------|--------------|----------------------|------------------------------------|
| Acetylene                            | C <sub>2</sub> H <sub>2</sub>                     | N <sub>2</sub> | 0.58                      |                      | 0.4035       | 1.162                |                                    |
| Air                                  |   | N <sub>2</sub> | 1.00                      |                      | 0.240        | 1.293                |                                    |
| Allen (Prop dine)                    | C <sub>3</sub> H <sub>4</sub>                     | N <sub>2</sub> | 0.43                      |                      | 0.352        | 1.787                | KR                                 |
| Ammonia                              | NH <sub>3</sub>                                   | N <sub>2</sub> | 0.73                      |                      | 0.492        | 0.760                | NEO                                |
| Argon                                | Ar  | Ar             | 1.000                     | 1.45                 | 0.1244       | 1.762                |                                    |
| Arsine                               | AsH <sub>3</sub>                                  | N <sub>2</sub> | 0.67                      |                      | 0.1167       | 3.478                | KR                                 |
| Boron Dichloride                     | BCl <sub>3</sub>                                  | N <sub>2</sub> | 0.41                      |                      | 0.1279       | 5.227                | KR                                 |
| Boron Trifluoride                    | BF <sub>3</sub>                                   | N <sub>2</sub> | 0.51                      |                      | 0.1778       | 3.025                | KR                                 |
| Bromine                              | Br <sub>2</sub>                                   | N <sub>2</sub> | 0.81                      |                      | 0.0539       | 7.130                |                                    |
| Boron Tribromide                     | BrF <sub>5</sub>                                  | N <sub>2</sub> | 0.38                      |                      | 0.0647       | 11.18                | KR                                 |
| Bromine Pent fluoride                | BrF <sub>3</sub>                                  | N <sub>2</sub> | 0.26                      |                      | 0.1369       | 7.803                | KR                                 |
| Bromine Trifluoride                  | BrF <sub>3</sub>                                  | N <sub>2</sub> | 0.38                      |                      | 0.1161       | 6.108                | KR                                 |
| Bromotrifluoromethane (freon-13 B1)  | CBrF <sub>3</sub>                                 | N <sub>2</sub> | 0.37                      |                      | 0.1113       | 6.644                |                                    |
| 1, 3-Butadiene                       | C <sub>4</sub> H <sub>6</sub>                     | N <sub>2</sub> | 0.32                      |                      | 0.3514       | 2.413                |                                    |
| Butane                               | C <sub>4</sub> H <sub>10</sub>                    | N <sub>2</sub> | 0.26                      |                      | 0.4007       | 2.593                | KR                                 |
| 1-Butane                             | C <sub>4</sub> H <sub>8</sub>                     | N <sub>2</sub> | 0.30                      |                      | 0.3648       | 2.503                | KR                                 |
| 2-Butane                             | C <sub>4</sub> H <sub>8</sub> CIS                 | N <sub>2</sub> | 0.324                     |                      | 0.336        | 2.503                | KR                                 |
| 2-Butane                             | C <sub>4</sub> H <sub>8</sub> TRANS               | N <sub>2</sub> | 0.291                     |                      | 0.374        | 2.503                |                                    |
| Carbon Dioxide                       | CO <sub>2</sub>                                   | N <sub>2</sub> | 0.74                      |                      | 0.2016       | 1.964                |                                    |
| Carbon Disulfide                     | CS <sub>2</sub>                                   | N <sub>2</sub> | 0.60                      |                      | 0.1428       | 3.397                |                                    |
| Carbon Monoxide                      | CO  | N <sub>2</sub> | 1.00                      |                      | 0.2488       | 1.250                |                                    |
| Carbon Tetrachloride                 | CCl <sub>4</sub>                                  | N <sub>2</sub> | 0.31                      |                      | 0.1655       | 6.860                | KR                                 |
| Carbon Tetra fluoride (Feon-14)      | CF <sub>4</sub>                                   | N <sub>2</sub> | 0.42                      |                      | 0.1654       | 3.926                | KR                                 |
| Carbonyl Fluoride                    | COF <sub>2</sub>                                  | N <sub>2</sub> | 0.54                      |                      | 0.1710       | 2.945                |                                    |
| Carbonyl Sulfide                     | COS   | N <sub>2</sub> | 0.66                      |                      | 0.1651       | 2.680                |                                    |
| Chlorine                             | CL <sub>2</sub>                                   | N <sub>2</sub> | 0.86                      |                      | 0.114        | 3.163                | KR                                 |
| Chlorine Trifluoride                 | ClF <sub>3</sub>                                  | N <sub>2</sub> | 0.40                      |                      | 0.1650       | 4.125                | KR                                 |
| Chlorodifluoromethane (Freon-22)     | CHClF <sub>2</sub>                                | N <sub>2</sub> | 0.46                      |                      | 0.1544       | 3.858                | KR                                 |
| Chloroform                           | CHCl <sub>3</sub>                                 | N <sub>2</sub> | 0.39                      |                      | 0.1309       | 5.326                | KR                                 |
| Chloropentafluoroethane (Freon-115)  | C <sub>2</sub> ClF <sub>5</sub>                   | N <sub>2</sub> | 0.24                      |                      | 0.164        | 6.892                | KR                                 |
| Chlorotrifluoromethane (Freon-13)    | CClF <sub>3</sub>                                 | N <sub>2</sub> | 0.38                      |                      | 0.153        | 4.660                | KR                                 |
| Cyanogens                            | C <sub>2</sub> N <sub>2</sub>                     | N <sub>2</sub> | 0.61                      |                      | 0.2613       | 2.322                |                                    |
| Cyanogens Chloride                   | CICN  | N <sub>2</sub> | 0.61                      |                      | 0.1739       | 2.742                | KR                                 |
| Cyclopropane                         | C <sub>3</sub> H <sub>5</sub>                     | N <sub>2</sub> | 0.46                      |                      | 0.3177       | 1.877                | KR                                 |
| Deuterium                            | D <sub>2</sub>                                    | N <sub>2</sub> | 1.00                      |                      | 0.1722       | 1.799                |                                    |
| Diborane                             | B <sub>2</sub> H <sub>6</sub>                     | N <sub>2</sub> | 0.44                      |                      | 0.508        | 1.235                | KR                                 |
| Dibromodifluoromethane               | CBr <sub>2</sub> F <sub>2</sub>                   | N <sub>2</sub> | 0.19                      |                      | 0.15         | 9.362                | KR                                 |
| Dibromomethane                       |   | N <sub>2</sub> | 0.47                      |                      | 0.075        | 7.76                 | KR                                 |
| Dichlorodifluoromethane (Freon-12)   | CCl <sub>2</sub> F <sub>2</sub>                   | N <sub>2</sub> | 0.35                      |                      | 0.1432       | 5.395                | KR                                 |
| Dichlorofluoromethane (Freon-21)     | CHCl <sub>2</sub> F                               | N <sub>2</sub> | 0.42                      |                      | 0.140        | 4.952                | KR                                 |
| Dichloromethylsilane                 | (CH <sub>3</sub> ) <sub>2</sub> SiCl <sub>2</sub> | N <sub>2</sub> | 0.25                      |                      | 0.1882       | 5.758                | KR                                 |
| Dihlorosilane                        | SiH <sub>2</sub> Cl <sub>2</sub>                  | N <sub>2</sub> | 0.40                      |                      | 0.150        | 4.506                | KR                                 |
| Dichloroetrafluoroethane (Freon-114) | C <sub>2</sub> Cl <sub>2</sub> F <sub>4</sub>     | N <sub>2</sub> | 0.22                      |                      | 0.1604       | 7.620                | KR                                 |
| 1, 1-Difluoroethylene (Freon-1132A)  | C <sub>2</sub> H <sub>2</sub> F <sub>2</sub>      | N <sub>2</sub> | 0.43                      |                      | 0.224        | 2.857                | KR                                 |
| Dim ethylamine                       | (CH <sub>3</sub> ) <sub>2</sub> MH                | N <sub>2</sub> | 0.37                      |                      | 0.366        | 2.011                | KR                                 |

| Actual Gas                   | Chemical Symbol                               | Ref. Gas       | K-Factor Rel. to Ref. Gas | K-Factor Relative N2 | Cp (Cal / g) | Density (g / l) @0°C | Elastomer O-Ring Valve O-Ring Seat |
|------------------------------|---|----------------|---------------------------|----------------------|--------------|----------------------|------------------------------------|
| Diethyl Ether                | (CH <sub>3</sub> ) <sub>2</sub> O             | N <sub>2</sub> | 0.39                      |                      | 0.3414       | 2.055                | KR                                 |
| 2, 2-Dimethylpropane         | C <sub>3</sub> H <sub>12</sub>                | N <sub>2</sub> | 0.22                      |                      | 0.3914       | 3.219                | KR                                 |
| Ethane                       | C <sub>2</sub> H <sub>6</sub>                 | N <sub>2</sub> | 0.50                      |                      | 0.4097       | 1.342                |                                    |
| Ethanol                      | C <sub>2</sub> H <sub>6</sub> O               | N <sub>2</sub> | 0.39                      |                      | 0.3395       | 2.055                | KR                                 |
| Ethyl Acetylene              | C <sub>4</sub> H <sub>6</sub>                 | N <sub>2</sub> | 0.32                      |                      | 0.3513       | 2.413                | KR                                 |
| Ethyl Chloride               | C <sub>2</sub> H <sub>5</sub> Cl              | N <sub>2</sub> | 0.39                      |                      | 0.244        | 2.879                | KR                                 |
| Ethylene                     | C <sub>2</sub> H <sub>4</sub>                 | N <sub>2</sub> | 0.60                      |                      | 0.1365       | 1.251                |                                    |
| Ethylene Oxide               | C <sub>2</sub> H <sub>4</sub> O               | N <sub>2</sub> | 0.52                      |                      | 0.268        | 1.965                | KR                                 |
| Flouring                     | F <sub>2</sub>                                | N <sub>2</sub> | 0.980                     |                      | 0.1873       | 1.695                | KR                                 |
| Fluoroform (Freon-23)        | CHF <sub>3</sub>                              | N <sub>2</sub> | 0.50                      |                      | 0.176        | 3.127                | KR                                 |
| Freon-11                     | CCl <sub>3</sub> F                            | N <sub>2</sub> | 0.33                      |                      | 0.1357       | 6.129                | KR                                 |
| Freon-12                     | CCl <sub>2</sub> F <sub>2</sub>               | N <sub>2</sub> | 0.35                      |                      | 0.1432       | 5.395                | KR                                 |
| Freon-13                     | CCIF <sub>3</sub>                             | N <sub>2</sub> | 0.38                      |                      | 0.153        | 4.660                | KR                                 |
| Freon-13                     | B <sub>1</sub> CFRF <sub>3</sub>              | N <sub>2</sub> | 0.37                      |                      | 0.1113       | 6.644                | KR                                 |
| Freon-14                     | CF <sub>4</sub>                               | N <sub>2</sub> | 0.42                      |                      | 0.1654       | 3.926                |                                    |
| Freon-21                     | CHCl <sub>2</sub> F                           | N <sub>2</sub> | 0.42                      |                      | 0.140        | 4.952                | KR                                 |
| Freon-22                     | CHClF <sub>2</sub>                            | N <sub>2</sub> | 0.46                      |                      | 0.1544       | 3.858                | KR                                 |
| Freon-113                    | CCl <sub>2</sub> FCCIF <sub>2</sub>           | N <sub>2</sub> | 0.20                      |                      | 0.161        | 8.360                | KR                                 |
| Freon-114                    | C <sub>2</sub> Cl <sub>2</sub> F <sub>4</sub> | N <sub>2</sub> | 0.22                      |                      | 0.160        | 7.636                | KR                                 |
| Freon-115                    | C <sub>2</sub> ClF <sub>5</sub>               | N <sub>2</sub> | 0.24                      |                      | 0.164        | 6.892                | KR                                 |
| Freon-C318                   | C <sub>4</sub> F <sub>6</sub>                 | N <sub>2</sub> | 0.17                      |                      | 0.185        | 8.397                | KR                                 |
| Germane                      | GeH <sub>4</sub>                              | N <sub>2</sub> | 0.57                      |                      | 0.1404       | 3.418                |                                    |
| Germanium Tetrachloride      | GeCl <sub>4</sub>                             | N <sub>2</sub> | 0.27                      |                      | 0.1071       | 9.565                | KR                                 |
| Helium                       | He  | He             | 1.000                     | 1.454                | 1.241        | 0.1786               |                                    |
| Hexafluoroethane (Freon-116) | C <sub>2</sub> F <sub>6</sub>                 | N <sub>2</sub> | 0.24                      |                      | 0.1834       | 6.157                | KR                                 |
| Hexane                       | C <sub>6</sub> H <sub>14</sub>                | N <sub>2</sub> | 0.18                      |                      | 0.3968       | 3.845                | KR                                 |
| Hydrogen                     | H <sub>2</sub>                                | He             | 1.000                     | 1.01                 | 3.419        | 0.0899               |                                    |
| Hydrogen Bromide             | HBr   | N <sub>2</sub> | 1.000                     |                      | 0.0861       | 3.610                | KR                                 |
| Hydrogen Chloride            | HCl   | N <sub>2</sub> | 1.000                     |                      | 0.1912       | 1.627                | KR                                 |
| Hydrogen Cyanide             | HCN   | N <sub>2</sub> | 1.070                     |                      | 0.3171       | 1.206                | KR                                 |
| Hydrogen Fluoride            | HF  | N <sub>2</sub> | 1.000                     |                      | 0.3479       | 0.893                | KR                                 |
| Hydrogen Iodide              | HI  | N <sub>2</sub> | 1.000                     |                      | 0.0545       | 5.707                | KR                                 |
| Hydrogen Selenide            | H <sub>2</sub> Se                             | N <sub>2</sub> | 0.79                      |                      | 0.1025       | 3.613                | KR                                 |
| Hydrogen Sulfide             | H <sub>2</sub> S                              |                | 0.80                      |                      | 0.2397       | 1.520                | KR                                 |
| Iodine Pent fluoride         | IF <sub>5</sub>                               | N <sub>2</sub> | 0.25                      |                      | 0.1108       | 9.90                 | KR                                 |
| Isobutene                    | CH(CH <sub>3</sub> )                          | N <sub>2</sub> | 0.27                      |                      | 0.3872       | 3.593                | KR                                 |
| Isobutylene                  | C <sub>4</sub> H <sub>8</sub>                 | N <sub>2</sub> | 0.29                      |                      | 0.3701       | 2.503                | KR                                 |
| Krypton                      | Kr  | Ar             | 1.002                     | 1.453                | 0.0593       | 3.739                |                                    |
| Methane                      | CH <sub>4</sub>                               | N <sub>2</sub> | 0.72                      |                      | 0.5328       | 0.715                |                                    |
| Methanol                     | CH <sub>3</sub> OH                            | N <sub>2</sub> | 0.58                      |                      | 0.3274       | 2.429                |                                    |
| Methyl Acetylene             | C <sub>3</sub> H <sub>4</sub>                 | N <sub>2</sub> | 0.43                      |                      | 0.3547       | 1.787                | KR                                 |
| Methyl Bromide               | CH <sub>2</sub> Br                            | N <sub>2</sub> | 0.58                      |                      | 0.1106       | 4.236                |                                    |
| Methyl Chloride              | CH <sub>3</sub> Cl                            | N <sub>2</sub> | 0.63                      |                      | 0.1926       | 2.253                | KR                                 |
| Methyl Fluoride              | CH <sub>3</sub> F                             | N <sub>2</sub> | 0.68                      |                      | 0.3221       | 1.518                | KR                                 |
| Methyl Mecraptan             | CH <sub>3</sub> SH                            |                | 0.52                      |                      | 0.2459       | 2.146                | KR                                 |
| Methyl Trichlorosilane       | (CH <sub>3</sub> )SiCl <sub>3</sub>           | N <sub>2</sub> | 0.25                      |                      | 0.164        | 6.669                | KR                                 |
| Molybdenum Hex fluoride      | MoF <sub>6</sub>                              | N <sub>2</sub> | 0.21                      |                      | 0.1373       | 9.366                | KR                                 |
| Monethylamine                | C <sub>2</sub> H <sub>5</sub> NH <sub>2</sub> | N <sub>2</sub> | 0.35                      |                      | 0.387        | 2.011                | KR                                 |
| Monomethylamine              | CH <sub>3</sub> NH <sub>2</sub>               | N <sub>2</sub> | 0.51                      |                      | 0.4343       | 1.386                | KR                                 |
| Neon                         | NE  | Ar             | 1.006                     | 1.46                 | 0.245        | 0.900                |                                    |
| Nitric Oxide                 | NO  |                | 0.990                     |                      | 0.2328       | 1.339                |                                    |
| Nitrogen                     | N <sub>2</sub>                                | N <sub>2</sub> | 1.000                     |                      | 0.2485       | 1.25                 |                                    |
| Nitrogen Dioxide             | NO <sub>2</sub>                               | N <sub>2</sub> | 0.74                      |                      | 0.1933       | 2.052                |                                    |

| Actual Gas                         | Chemical Symbol                     | Ref. Gas       | K-Factor Rel. to Ref. Gas | K-Factor Relative N2 | Cp (Cal / g) | Density (g / l) @0°C | Elastomer O-Ring Valve O-Ring Seat |
|------------------------------------|-------------------------------------|----------------|---------------------------|----------------------|--------------|----------------------|------------------------------------|
| Nitrogen Trifluoride               | NF <sub>3</sub>                     |                | 0.48                      |                      | 0.1797       | 3.168                | KR                                 |
| Nitrosyl Chloride                  | NOCl                                | N <sub>2</sub> | 0.61                      |                      | 0.1632       | 2.920                | KR                                 |
| Nitrous Oxide                      | N <sub>2</sub> O                    |                | 0.71                      |                      | 0.2088       | 1.964                |                                    |
| Octafluorocyclobutane (Freon-C318) | C <sub>4</sub> F <sub>6</sub>       | N <sub>2</sub> | 0.17                      |                      | 0.185        | 8.397                | KR                                 |
| Oxygen Difluoride                  | OF <sub>2</sub>                     | N <sub>2</sub> | 0.63                      |                      | 0.1917       | 2.406                |                                    |
| Oxygen                             | O <sub>2</sub>                      | N <sub>2</sub> | 1.000                     |                      | 0.1293       | 1.427                |                                    |
| Ozone                              | O <sub>3</sub>                      | N <sub>2</sub> | 0.446                     |                      | 0.3          | 2.144                |                                    |
| Pentaborane                        | B <sub>5</sub> H <sub>9</sub>       | N <sub>2</sub> | 0.26                      |                      | 0.38         | 2.816                | KR                                 |
| Pentane                            | C <sub>5</sub> H <sub>12</sub>      | N <sub>2</sub> | 0.21                      |                      | 0.398        | 3.219                | KR                                 |
| Perchloryl Fluoride                | ClO <sub>3</sub> F                  | N <sub>2</sub> | 0.39                      |                      | 0.1514       | 4.571                | KR                                 |
| Pentafluoropropane                 | C <sub>3</sub> F <sub>8</sub>       |                | 0.174                     |                      | 0.197        | 8.388                | KR                                 |
| Phosgene                           | COCl <sub>2</sub>                   | N <sub>2</sub> | 0.44                      |                      | 0.1394       | 4.418                | KR                                 |
| Phosphate                          | PH <sub>3</sub>                     |                | 1.070                     |                      | 0.2374       | 1.517                | KR                                 |
| Phosphorous Oxchloride             | POCl <sub>3</sub>                   | N <sub>2</sub> | 0.36                      |                      | 0.1324       | 6.843                | KR                                 |
| Phosphorous Pent fluoride          | PH <sub>5</sub>                     | N <sub>2</sub> | 0.30                      |                      | 0.1610       | 5.620                |                                    |
| Phosphorous Dichloride             | PCl <sub>5</sub>                    | N <sub>2</sub> | 0.30                      |                      | 0.1250       | 6.127                | KR                                 |
| Propane                            | C <sub>3</sub> H <sub>8</sub>       |                | 0.36                      |                      | 0.3885       | 1.967                | KR                                 |
| Propylene                          | C <sub>3</sub> H <sub>6</sub>       | N <sub>2</sub> | 0.41                      |                      | 0.3541       | 1.877                | KR                                 |
| Silence                            | SiH <sub>4</sub>                    |                | 0.60                      |                      | 0.3189       | 1.433                | KR                                 |
| Silicon Tetrachloride              | SiCl <sub>4</sub>                   | N <sub>2</sub> | 0.28                      |                      | 0.1270       | 7.580                | KR                                 |
| Silicon Tetrafluoride              | SiF <sub>4</sub>                    | N <sub>2</sub> | 0.35                      |                      | 0.1691       | 4.643                | KR                                 |
| Sulfur Dioxide                     | SO <sub>2</sub>                     | N <sub>2</sub> | 0.69                      |                      | 0.1488       | 2.858                | KR                                 |
| Sulfur Hexafluoride                | SF <sub>6</sub>                     | N <sub>2</sub> | 0.26                      |                      | 0.1592       | 6.516                | KR                                 |
| Sulfur Fluoride                    | SO <sub>2</sub> F <sub>2</sub>      | N <sub>2</sub> | 0.39                      |                      | 0.1543       | 4.562                | KR                                 |
| Teas                               |                                     | N <sub>2</sub> | 0.090                     |                      |              |                      | KR                                 |
| Tetra fluorahydrazine              | N <sub>2</sub> F <sub>4</sub>       | N <sub>2</sub> | 0.32                      |                      | 0.182        | 5.64                 | KR                                 |
| Trichlorofluoromethane (Freon-11)  | CCl <sub>3</sub> F                  | N <sub>2</sub> | 0.33                      |                      | 0.1357       | 6.129                | KR                                 |
| Trichlorosilane                    | SiHCl <sub>3</sub>                  | N <sub>2</sub> | 0.33                      |                      | 0.1380       | 6.043                | KR                                 |
| 1,1,2-Trichloro-1,2,2              | CCl <sub>2</sub> FCClF <sub>2</sub> | N <sub>2</sub> | 0.20                      |                      | 0.161        | 8.360                | KR                                 |
| Trifluoroethane (Freon-113)        |                                     | N <sub>2</sub> |                           |                      |              |                      |                                    |
| Trisobutyl Aluminum                | (C <sub>4</sub> H <sub>9</sub> )Al  | N <sub>2</sub> | 0.061                     |                      | 0.508        | 8.848                | KR                                 |
| Titanium Tetrachloride             | TiCl <sub>4</sub>                   | N <sub>2</sub> | 0.27                      |                      | 0.120        | 7.465                | KR                                 |
| Tricolor Ethylene                  | C <sub>2</sub> HCl <sub>3</sub>     | N <sub>2</sub> | 0.32                      |                      | 0.163        | 5.95                 | KR                                 |
| Trim ethylamine                    | (CH <sub>3</sub> ) <sub>3</sub> N   | N <sub>2</sub> | 0.28                      |                      | 0.3710       | 2.639                | KR                                 |
| Tungsten Hex fluoride              | WF <sub>6</sub>                     | N <sub>2</sub> | 0.25                      |                      | 0.0810       | 13.28                | Teflon                             |
| Uranium Hex fluoride               | UF <sub>6</sub>                     | N <sub>2</sub> | 0.20                      |                      | 0.0888       | 15.70                | KR                                 |
| Vinyl Bromide                      | CH <sub>2</sub> CHBr                | N <sub>2</sub> | 0.46                      |                      | 0.1241       | 4.772                | KR                                 |
| Vinyl Chloride                     | CH <sub>2</sub> CHCl                | N <sub>2</sub> | 0.48                      |                      | 0.12054      | 2.788                | KR                                 |
| Xenon                              | Xe                                  | Ar             | 0.993                     | 1.44                 | 0.0378       | 5.858                | KR                                 |

■ 화학적 부식표

| CHEMICAL RESISTANT TABLE     |   |            | 주철 | 강철 | 청동 | 스테인리스 스틸27종 | 스테인리스 스틸32종 | C-20 | 하스텔로이-C | 하스텔로이-B | 모넬(상표명)니켈 구리의 합금 | TITANIUM | POLYPROPYLENE | POLYETHYLENE | TEFLON(PTFE), RULON | 에폭시(우레) | 아크릴 수지 | PVC | POLYACETAL, DURACON | 나일론 | 노벨(NORYL(PP)) | PVDF, KAYNAR | ABS, CYCOLAC | NEOPRENE | NITRILE RUBBER | VITON(FPM) | 합소고무(EPODM) | EPDM고무(EPODM) | 실리콘고무 | 세라믹 | 카본 그라파이트 |
|------------------------------|---|------------|----|----|----|-------------|-------------|------|---------|---------|------------------|----------|---------------|--------------|---------------------|---------|--------|-----|---------------------|-----|---------------|--------------|--------------|----------|----------------|------------|-------------|---------------|-------|-----|----------|
| Acetaldehyde                 | CH <sub>3</sub> CHO                                 | 아세트알데히드    | ○  | ○  |    |             |             |      |         |         |                  |          | ○             | ▲            | ▲                   |         |        |     |                     |     | ▲             | ▲            | ▲            | ▲        | ▲              | ▲          | ▲           | ▲             | ▲     |     |          |
| Acetic Acid, glacial         | CH <sub>3</sub> COOH                                | 아세트산       | ▲  | ▲  | ▲  | ○           |             |      |         | ▲       |                  |          | ▲             | ▲            | ▲                   | ▲       | ○      | ○   | ▲                   |     |               | ▲            | ▲            | ▲        | ▲              | ▲          | ▲           | ○             |       |     |          |
| Acetic Acid, 10%             | CH <sub>3</sub> COOH                                | 초산(10%)    | ▲  | ○  | ○  |             |             | △    | △       | △       |                  |          |               |              |                     |         |        | △   | ▲                   |     |               | ○            | ○            | △        | ○              | ○          | ○           |               |       |     |          |
| Acetic Acid, 20%             | CH <sub>3</sub> COOH                                | 초산(20%)    | ▲  | △  | ○  |             |             | △    | △       | △       |                  |          |               |              |                     |         |        | △   | ▲                   |     |               | ○            | ○            | ▲        | ○              | ○          | ○           |               |       |     |          |
| Acetic Acid, 80%             | CH <sub>3</sub> COOH                                | 초산(80%)    | ▲  | △  | ○  | △           |             | △    | △       | △       |                  |          | △             | △            | △                   | △       | △      | △   | ▲                   |     |               | ▲            | ▲            | ▲        | ▲              | ▲          | ○           | △             |       |     |          |
| Acetic Anhydride             | (CH <sub>3</sub> CO) <sub>2</sub> O                 | 아세트산 무수물   | ○  | ▲  | ○  | ○           |             | ○    |         | △       |                  |          | ▲             | ▲            | ▲                   | ▲       | ▲      | ▲   | ▲                   | ▲   | ▲             | ○            | ▲            | ▲        | ▲              | ▲          | ▲           | ▲             | ○     |     |          |
| Aceton                       | CH <sub>3</sub> COCH <sub>3</sub>                   | 아세톤        |    |    |    |             |             |      |         |         |                  |          | ▲             | ▲            | ▲                   | ▲       | ▲      | ▲   | ▲                   | ▲   | ▲             | ○            | ○            | ○        | ○              | ○          | ○           | ○             |       |     |          |
| Acetylene                    | C <sub>2</sub> H <sub>2</sub>                       | 아세틸렌       |    |    |    |             |             |      |         |         |                  |          | △             | ▲            | ▲                   | ▲       | ▲      | ▲   | ▲                   | ▲   | ▲             | ○            | ○            | ○        | ○              | ○          | ○           | ○             |       |     |          |
| Acrylonitrile                | CH <sub>2</sub> CHCN                                | 아크릴로니트릴    | ○  | ○  |    |             |             |      |         |         |                  |          | ○             | ▲            | ▲                   | ▲       | ▲      | ▲   | ▲                   | ▲   | ▲             | ▲            | ▲            | ▲        | ▲              | ▲          | ▲           | ▲             | ▲     |     |          |
| Alcohol, Amyl                | C <sub>5</sub> H <sub>12</sub> O                    | 아밀알코올      |    |    |    |             |             |      |         |         |                  |          |               |              |                     | ○       |        |     |                     |     | ○             |              |              |          |                |            |             |               |       | ▲   |          |
| Alcohol, Benzyl              | C <sub>6</sub> H <sub>5</sub> CH <sub>2</sub> OH    | 벤질알코올      |    |    |    |             |             |      |         |         |                  |          |               |              |                     | △       | ▲      |     |                     |     |               | ▲            | ▲            | ▲        | ○              | ○          | ○           | △             |       |     |          |
| Alcohol, Butyl               | C <sub>4</sub> H <sub>9</sub> OH                    | 부틸알코올      |    |    |    |             |             |      |         |         |                  |          |               |              |                     | ▲       |        |     |                     |     |               | ○            |              |          |                |            |             |               |       | ○   |          |
| Alcohol, Ethyl               | C <sub>2</sub> H <sub>5</sub> OH                    | 에틸알코올      |    |    |    |             |             |      |         |         |                  |          |               |              |                     | ▲       |        |     |                     |     |               | ○            |              |          |                |            |             |               |       |     |          |
| Alcohol, Hexyl               | C <sub>6</sub> H <sub>13</sub> OH                   | 헥실알코올      |    |    |    |             |             |      |         |         |                  |          |               |              |                     | ▲       | ○      |     |                     |     |               | △            | △            |          |                |            |             |               |       |     |          |
| Alcohol, Isobutyl            | C <sub>4</sub> H <sub>9</sub> OH                    | 이소부틸알코올    | ○  | ○  |    |             |             |      |         |         |                  |          | △             | △            | △                   | △       | △      |     |                     |     | △             |              |              |          |                |            |             | ▲             | ○     |     |          |
| Alcohol, Isopropyl           | C <sub>3</sub> H <sub>7</sub> OH                    | 이소프로필알코올   | ○  | ○  |    |             |             |      |         |         |                  |          |               |              |                     |         |        |     |                     |     |               | ○            |              |          |                |            |             |               |       |     |          |
| Alcohol, Methyl              | CH <sub>3</sub> OH                                  | 메틸알코올      |    |    |    |             |             |      |         |         |                  |          |               | ▲            |                     | ○       |        |     |                     |     |               | ▲            |              | ○        | ○              |            |             |               |       |     |          |
| Alcohol, Octyl               | C <sub>8</sub> H <sub>17</sub> OH                   | 옥틸알코올      |    |    |    |             |             |      |         |         |                  |          | △             | △            | △                   | △       | △      |     |                     |     |               | △            | △            |          |                |            |             |               |       |     |          |
| Alcohol, Propyl              | C <sub>3</sub> H <sub>7</sub> OH                    | 프로필알코올     | ○  | ○  |    |             |             |      |         |         |                  |          |               |              |                     | ▲       |        |     |                     |     |               | ○            |              |          |                |            |             |               |       |     |          |
| Alum                         | Al(SO <sub>4</sub> ) <sub>2</sub> 12OH <sub>2</sub> | 명반         | ▲  | ▲  | ○  | ▲           | ○           |      | ○       |         |                  |          |               |              |                     |         |        |     |                     |     | ▲             |              |              |          |                |            |             |               |       |     | ○        |
| Aluminium Chloride           | AlCl <sub>3</sub>                                   | 염화알루미늄     | ▲  | ▲  | ○  | ▲           | ○           |      | ○       |         |                  |          |               |              |                     | ▲       |        |     |                     |     | △             | ○            |              |          |                |            |             |               |       |     | ○        |
| Aluminium Fluoride           | AlF <sub>3</sub>                                    | 불화알루미늄     | △  | △  | ▲  | ○           | △           | ○    | △       | △       | ○                |          |               |              |                     |         |        |     |                     |     |               | ○            | △            |          | △              |            |             |               |       |     | ○        |
| Aluminium Hydroxide          | Al(OH) <sub>3</sub>                                 | 수산화알루미늄    | ○  | ○  | ○  |             | ○           |      | ○       | ○       |                  |          |               |              |                     |         |        |     |                     |     |               |              | △            |          |                |            |             |               |       |     | △        |
| Aluminium Sulfate            | Al <sub>2</sub> (SO <sub>4</sub> ) <sub>3</sub>     | 황산알루미늄     | ▲  | ▲  |    |             |             |      |         | ▲       |                  |          |               |              |                     | △       |        |     |                     |     |               |              | △            |          |                |            |             |               |       |     |          |
| Amines                       | R-NH <sub>3</sub>                                   | 아민류        |    |    | ○  |             |             |      |         | △       |                  |          |               |              | ○                   | △       | ○      |     |                     |     |               | △            | ▲            | ▲        | ▲              | ▲          | ▲           | ○             | ▲     |     |          |
| Ammonia Anhydrous            | NH <sub>3</sub>                                     | 무수암모니아     |    |    | ▲  |             |             |      |         | ▲       |                  |          |               |              | ▲                   | ▲       |        |     |                     |     |               | ○            |              |          |                | ▲          | ○           |               |       |     |          |
| Ammonia Water, 10%           | NH <sub>4</sub> OH                                  | 암모니아수(10%) |    |    | ▲  |             |             |      |         | ▲       |                  |          |               |              | ▲                   |         |        |     |                     |     |               |              |              |          |                | ○          |             |               |       | △   |          |
| Ammonium Carbonate           | (OH <sub>4</sub> ) <sub>2</sub> CO <sub>3</sub>     | 탄산암모늄      |    |    | ▲  |             |             |      |         | ○       |                  |          |               |              |                     |         |        |     |                     |     |               |              |              |          |                |            |             |               |       |     | ○        |
| Ammonium Chloride            | NH <sub>4</sub> Cl                                  | 염화암모늄      | ▲  | ▲  | ▲  | ▲           | ▲           | ○    | △       | ○       |                  |          |               |              |                     |         |        |     |                     |     |               |              |              |          |                |            |             |               |       |     | ○        |
| Ammonium Hydroxide           | NH <sub>4</sub> OH                                  | 수산화암모늄     |    |    |    |             |             |      |         |         |                  |          |               |              |                     | △       |        |     |                     |     |               | ○            |              |          | ▲              | ○          |             |               |       |     |          |
| Ammonium Nitrate             | NH <sub>4</sub> NO <sub>3</sub>                     | 질산암모늄      | ▲  | ▲  | ▲  |             |             |      |         | ○       | ▲                | ▲        |               |              |                     |         |        |     |                     |     |               | ▲            |              |          |                |            |             |               |       |     | ○        |
| Ammonium Oxalate             | NH <sub>4</sub> C <sub>2</sub> O <sub>4</sub>       | 옥살산암모늄     | ▲  | △  | ▲  | ▲           | △           |      |         | △       | △                | △        |               |              |                     |         |        |     |                     |     | ○             | △            | △            | △        | △              | △          | △           |               | △     |     | △        |
| Ammonium Phosphate, mono     | (NH <sub>4</sub> ) <sub>2</sub> PO <sub>4</sub>     | 제 1 인산암모늄  | ▲  | ▲  | ▲  | ○           | ○           |      |         | △       |                  |          |               |              |                     |         |        |     |                     |     | ○             |              | △            |          |                |            |             |               |       |     |          |
| Ammonium Phosphate, dibasic  | (NH <sub>4</sub> ) <sub>2</sub> HPO <sub>4</sub>    | 제 2 인산암모늄  | ○  | ○  | ○  | ○           | ○           |      |         | △       |                  |          |               |              |                     |         |        |     |                     |     | ○             |              | △            |          |                |            |             |               |       |     |          |
| Ammonium Phosphate, tribasic | (NH <sub>4</sub> ) <sub>2</sub> PO <sub>4</sub>     | 제 3 인산암모늄  | ○  | ○  | ○  |             |             |      |         | △       |                  |          |               |              |                     |         |        |     |                     |     | ○             |              |              |          |                |            |             |               |       |     |          |

# CHEMICAL RESISTANT TABLE

- : Good (사용에 문제없음)
- : Fair (사용은 가능)
- ▲: Unsuitable (부적당)
- △: Insufficient data (사용불가)

|                           |   |            | 주철  | 강철 | 청동 | 스테인리스 스틸27종 | 스테인리스 스틸32종 | C-20 | 하스텔로이-C | 하스텔로이-B | 모넬(상표명) (니켈 구리의합금) | TITANIUM | 폴리프로필렌 | 폴리에틸렌 | 테플론(PTFE), RULON | 아크릴 수지 | PVC | POLYACETAL, DURACON | 폴리아세탈 | 나이론 | NORYL(PPO) | 노린 | PVDF, KAYNAR | 불화비나리덴 | ABS, CYCOLAC | 4BS | NEOPRENE | NITRILE RUBBER | VBR고무 | VITON(FPM) | 불소고무(FEPM) | HYPALON(CSM) | CSM고무 | EPT RUBBER(EPRM) | 에프티고무 | SILICONE | 실리콘고무 | CERAMICS | 세라믹 | CARBON GRAPHITE | 카본 그래파이트 |   |   |   |   |
|---------------------------|---|------------|-----|----|----|-------------|-------------|------|---------|---------|--------------------|----------|--------|-------|------------------|--------|-----|---------------------|-------|-----|------------|----|--------------|--------|--------------|-----|----------|----------------|-------|------------|------------|--------------|-------|------------------|-------|----------|-------|----------|-----|-----------------|----------|---|---|---|---|
| Ammonium Sulfate          | (NH <sub>4</sub> ) <sub>2</sub> SO <sub>4</sub>                   | 황산암모늄      | ▲▲  |    |    | ○           |             |      |         | △       |                    |          |        |       |                  |        |     | ○                   | ○     |     |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Ammonium Thio-sulfate     | (NH <sub>4</sub> ) <sub>2</sub> S <sub>2</sub> O <sub>2</sub>     | 티오황산암모늄    | ▲○▲ |    |    |             |             | △    | △       | △       | △                  |          | △      | △     | △                | △      | △   | △                   | △     | △   | △          | △  | △            | △      | △            | △   | △        | △              | △     | △          | △          | △            | △     | △                | △     | △        | △     | △        | △   | △               | △        | △ | △ |   |   |
| Amyl Acetate              | C <sub>5</sub> H <sub>4</sub> COOH                                | 초산아밀       | ○   | ○  | ○  |             |             |      |         |         |                    |          | ▲      | ▲     | ▲                | ▲      | ▲   |                     |       |     |            | ○  |              |        | ▲            | ▲   | ▲        | ▲              | ▲     | ▲          | ▲          | ▲            | ▲     | ▲                | ▲     | ▲        | ▲     | ▲        | ▲   | ▲               | ▲        | ▲ | ▲ |   |   |
| Aniline                   | C <sub>6</sub> H <sub>7</sub> N                                   | 아닐린        | ○   | ○  | ○  |             |             |      |         |         |                    |          | ▲      |       |                  |        |     |                     |       |     |            | ○  | ▲            |        | ▲            | ▲   | ▲        | ▲              | ▲     | ▲          | ▲          | ▲            | ▲     | ▲                | ▲     | ▲        | ▲     | ▲        | ▲   | ▲               | ▲        | ▲ | ▲ |   |   |
| Aqua Regia                | Cl <sub>2</sub> +NOCl+2H <sub>2</sub> O                           | 왕수         | ▲   | ▲  | ▲  | ▲           | ▲           | ▲    | ▲       | ▲       | ▲                  | ▲        | ○      | ▲     |                  |        |     |                     |       |     |            |    | ○            | ▲      | ▲            | ▲   | ▲        | ▲              | ▲     | ▲          | ▲          | ▲            | ▲     | ▲                | ▲     | ▲        | ▲     | ▲        | ▲   | ▲               | ▲        | ▲ | ▲ |   |   |
| Asphalt                   |   | 아스팔트       |     |    |    |             |             |      |         |         |                    |          | △      |       |                  |        |     |                     |       |     |            |    | ○            |        | △            | △   | △        | △              | △     | △          | △          | △            | △     | △                | △     | △        | △     | △        | △   | △               | △        | △ | △ |   |   |
| Barium Carbonate          | BaCO <sub>3</sub>   | 탄산바륨       |     |    | ○  |             |             |      |         | △       | △                  |          |        |       |                  |        |     |                     |       |     |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          | △ |   |   |   |
| Barium Chloride           | BaCl <sub>2</sub>   | 염화바륨       | ▲   | ▲  | ○  |             |             |      |         |         |                    |          |        |       |                  |        |     |                     |       |     |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Barium Fluoride           | BaF <sub>2</sub>  | 불화바륨       | △   | △  | △  | △           | △           | △    | △       | △       | △                  | △        | △      | △     | △                | △      | △   | △                   | △     | △   | △          | △  | △            | △      | △            | △   | △        | △              | △     | △          | △          | △            | △     | △                | △     | △        | △     | △        | △   | △               | △        | △ | △ | △ |   |
| Barium Hydroxide          | Ba(OH) <sub>2</sub>   | 수산화바륨      | ○   | ○  | ○  |             |             |      |         |         | △                  |          |        |       |                  |        |     |                     |       |     |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Barium Nitrate            | Ba(NO <sub>3</sub> ) <sub>2</sub>                                 | 질산바륨       | ○   | ○  | ▲  |             |             |      |         |         | △                  |          |        |       |                  |        |     |                     |       |     |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Barium Sulfate            | BaSO <sub>4</sub>   | 황산바륨       | ○   | ○  | ○  |             |             |      |         |         | △                  | ▲        |        |       |                  |        |     | △                   | ○     |     |            |    |              |        | △            |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Barium Sulfate            | BaSO <sub>4</sub>   | 황화바륨       | ○   | ○  | ○  |             |             |      |         |         | △                  | ▲        |        |       |                  |        |     | △                   | ○     |     |            |    |              | △      |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Beer                      |   | 맥주         | ▲   | ▲  |    |             |             |      |         |         |                    |          |        |       |                  |        |     | ○                   |       | ▲   |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Benzaldehyde              | C <sub>6</sub> H <sub>5</sub> CHO                                 | 벤즈알데히드     |     |    |    |             |             | △    | △       | △       |                    | ○        | ▲      | ▲     | ▲                | ▲      | ▲   | ▲                   | ▲     | ▲   | ▲          | ▲  | ▲            | ▲      | ▲            | ▲   | ▲        | ▲              | ▲     | ▲          | ▲          | ▲            | ▲     | ▲                | ▲     | ▲        | ▲     | ▲        | ▲   | ▲               | ▲        | ▲ | ▲ | ▲ | ▲ |
| Benzene(Benzol)           | C <sub>6</sub> H <sub>6</sub>                                     | 벤젠(벤졸)     |     |    |    |             |             |      |         |         |                    |          | ▲      | ▲     | ▲                | ▲      | ▲   | ▲                   | ▲     | ▲   | ▲          | ▲  | ▲            | ▲      | ▲            | ▲   | ▲        | ▲              | ▲     | ▲          | ▲          | ▲            | ▲     | ▲                | ▲     | ▲        | ▲     | ▲        | ▲   | ▲               | ▲        | ▲ | ▲ | ▲ | ▲ |
| Benzine                   |   | 벤진(휘발유)    |     |    |    |             |             |      |         |         |                    |          |        |       |                  |        |     |                     |       |     |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Benzoic Acid              | C <sub>6</sub> H <sub>5</sub> COOH                                | 벤조산        | ▲   | ▲  | ○  |             |             |      |         |         |                    |          |        |       |                  |        |     | ○                   | ○     | ▲   | ○          |    |              |        |              |     | ○        | ○              |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Benzyl Chloride           | C <sub>6</sub> H <sub>5</sub> Cl                                  | 염화벤진       | ▲   | ▲  |    |             |             |      |         |         |                    |          | △      | ▲     | ▲                | ▲      | ▲   | ▲                   | ▲     | ▲   | ▲          | ▲  | ▲            | ▲      | ▲            | ▲   | ▲        | ▲              | ▲     | ▲          | ▲          | ▲            | ▲     | ▲                | ▲     | ▲        | ▲     | ▲        | ▲   | ▲               | ▲        | ▲ | ▲ | ▲ |   |
| Borax(Sodium Tetraborate) | Na <sub>2</sub> B <sub>4</sub> O <sub>7</sub> ·10H <sub>2</sub> O | 붕사         |     | ○  |    |             |             |      |         |         |                    | △        |        |       |                  |        |     |                     |       |     |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Boric Acid                | H <sub>3</sub> BO <sub>3</sub>                                    | 붕산         | ▲   | ▲  |    |             |             |      |         |         |                    |          |        |       |                  |        |     |                     |       |     |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Butadiene                 | C <sub>4</sub> H <sub>6</sub>                                     | 부타디엔       | ○   | ○  | ○  |             |             | △    | △       | △       | △                  | △        | △      | △     | △                | △      | △   | △                   | △     | △   | △          | △  | △            | △      | △            | △   | △        | △              | △     | △          | △          | △            | △     | △                | △     | △        | △     | △        | △   | △               | △        | △ | △ | △ | △ |
| Butane                    | C <sub>4</sub> H <sub>10</sub>                                    | 부탄         |     |    |    |             |             |      |         |         |                    |          | △      |       |                  |        |     |                     |       |     |            | ○  |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Butter milk               |   | 버터밀크       |     |    |    |             |             |      |         |         |                    |          |        |       |                  |        |     |                     |       |     |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   | △ |   |
| Butyl Acetate             |   | 초산부틸       |     |    |    |             |             |      |         |         |                    |          | ▲      | ▲     | ▲                | ▲      | ▲   | ▲                   | ▲     | ▲   | ▲          | ▲  | ▲            | ▲      | ▲            | ▲   | ▲        | ▲              | ▲     | ▲          | ▲          | ▲            | ▲     | ▲                | ▲     | ▲        | ▲     | ▲        | ▲   | ▲               | ▲        | ▲ | ▲ | ▲ |   |
| Butylic Acid              | C <sub>4</sub> H <sub>7</sub> COOH                                | 낙산         | ▲   | ▲  | ○  |             |             |      |         |         |                    |          | ○      | ▲     | ▲                | ▲      | ▲   | ▲                   | ▲     | ▲   | ▲          | ○  |              |        | ○            | ▲   | ▲        | ▲              | ▲     | ▲          | ▲          | ▲            | ▲     | ▲                | ▲     | ▲        | ▲     | ▲        | ▲   | ▲               | ▲        | ▲ | ▲ | ▲ |   |
| Calcium Carbonate         | CaCO <sub>3</sub>   | 탄산칼슘       |     |    |    |             |             |      |         |         |                    |          |        |       |                  |        |     |                     |       |     |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   | △ |   |   |
| Calcium Chlorate          |   | 염소산칼슘      | ○   | ○  | ○  | ○           | ○           | ○    | △       |         |                    |          |        |       |                  |        |     |                     |       |     |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Calcium Chloride          | CaCl <sub>2</sub>   | 염화칼슘       | △   | △  |    | △           | △           |      |         |         |                    |          |        |       |                  |        |     |                     |       |     |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Calcium Hydroxide         | Ca(OH) <sub>2</sub>   | 수산화칼슘(소석회) |     |    |    |             |             |      |         |         |                    |          |        |       |                  |        |     |                     |       |     |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Calcium Hypochlorite, 5%  | Ca(ClO) <sub>2</sub>  | 차아염소산칼슘 5% | ▲   | ▲  | ▲  | ○           | ▲           | ○    | ▲       | ○       | ▲                  | ○        |        |       |                  |        |     |                     | ▲     | ▲   |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Calcium Sulfate           | CaSO <sub>4</sub>   | 황산칼슘       |     |    |    |             |             |      |         |         |                    |          |        |       |                  |        |     |                     |       |     |            |    |              |        |              |     |          |                |       |            |            |              |       |                  |       |          |       |          |     |                 |          |   |   |   |   |
| Carbon Bisulfate          | C(SO <sub>4</sub> ) <sub>2</sub>                                  | 2 황화탄소     |     | ▲  |    |             |             |      |         |         |                    |          | ▲      | ▲     | ▲                | ▲      | ▲   | ▲                   | ▲     | ▲   | ▲          | ▲  | ▲            | ▲      | ▲            | ▲   | ▲        | ▲              | ▲     | ▲          | ▲          | ▲            | ▲     | ▲                | ▲     | ▲        | ▲     | ▲        | ▲   | ▲               | ▲        | ▲ | ▲ |   |   |

# CHEMICAL RESISTANT TABLE

- : Good (사용에 문제없음)
- : Fair (사용은 가능)
- ▲ : Unsuitable (부적당)
- △ : Insufficient data (사용불가)

|                      |  |         | 주철 | 강철 | 청동 | 스테인레스 스틸27종 | 스테인레스 스틸32종 | C-20 | 하스텔로이-C | 하스텔로이-B | 모넬(상표명)(니켈 구리의 합금) | TITANIUM | POLYPROPYLENE | POLYETHYLENE | TEFLON(PTFE), RULON | ACRYLIC RESIN(PMMA) | PVC | POLYACETAL, DURACON | NYLON | NORYL(PPO) | PVDF, KAYNAR | ABS, CYCOLAC | VR고무 | NITRILE RUBBER | VITON(FPM) | HYPALON(GSM) | EPT RUBBER(EPDM) | SILICONE | CERAMICS | CARBON GRAPHITE |   |
|----------------------|--|---------|----|----|----|-------------|-------------|------|---------|---------|--------------------|----------|---------------|--------------|---------------------|---------------------|-----|---------------------|-------|------------|--------------|--------------|------|----------------|------------|--------------|------------------|----------|----------|-----------------|---|
| Carbon Dioxide       | CO <sub>2</sub>                                  | 이산화탄소   | ○  |    |    |             |             |      |         |         |                    |          |               |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 |   |
| Carbon Tetrachloride | CCl <sub>4</sub>                                 | 사염화탄소   | ○  | ▲  |    | ○           |             |      |         |         |                    | ▲        | ▲             |              | ▲                   | ▲                   |     |                     | ▲     |            | ▲            | ▲            | ▲    | ▲              | ▲          | ▲            | ▲                | ▲        | ▲        |                 |   |
| Carbonic Acid        | H <sub>2</sub> CO <sub>4</sub>                   | 탄산      | ○  | ○  | ○  |             |             |      |         |         |                    |          |               |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 |   |
| Caster Oil           |  | 피자마유    |    |    |    |             |             |      |         |         | △                  |          |               |              |                     |                     |     |                     |       |            |              | ○            |      | △              |            |              |                  |          |          |                 |   |
| Chloric Acid         | HClO <sub>3</sub>                                | 염소산     | ▲  | ▲  | ▲  | ▲           | ▲           |      | △       | ▲       | ▲                  | ▲        | ▲             | ▲            | ▲                   |                     |     | ▲                   | ▲     | ▲          | ▲            | ▲            | ▲    | ▲              | ▲          | ○            | ▲                | ▲        | ▲        | ▲               |   |
| Chlorinated Solvents |  | 염소화용제   |    | △  |    | ○           | ○           |      | △       | △       | △                  | △        | △             | △            | ○                   |                     |     |                     |       | △          | △            | ▲            | ▲    | ▲              | ○          | ▲            | ▲                | ▲        | ▲        | ▲               |   |
| Chlorine Anhydrous   | Cl <sub>2</sub>                                  | 무수염소    | ○  | △  | ▲  | ▲           | ▲           | ▲    | △       | △       | △                  | △        | △             | △            | △                   | △                   |     |                     |       |            | △            | △            | ▲    | ▲              | ○          | ▲            | ▲                | ▲        | ▲        | ▲               |   |
| Chlorine Water       | HCl  | 염소수     | ▲  | ▲  | ▲  | ▲           | ▲           | △    | △       | △       |                    |          |               |              |                     |                     |     |                     |       |            |              |              | ▲    | ○              | ○          | ○            | ▲                | ▲        | ▲        | ▲               |   |
| Chloro acetic Acid   | CH <sub>2</sub> ClCOOH                           | 클로로아세트산 | ▲  | ▲  | ▲  | ▲           | ▲           |      |         |         |                    | ▲        | ▲             |              | ▲                   | ▲                   | ▲   | ▲                   | ▲     | ▲          | ▲            | ▲            | ▲    | ▲              | ○          | ○            | ○                | ▲        | ▲        | ▲               |   |
| Chloro benzene       | C <sub>6</sub> H <sub>5</sub> Cl                 | 클로로벤젠   | ○  | ○  |    |             |             |      |         |         |                    | ○        | ▲             |              | ▲                   | ▲                   |     |                     |       |            |              | ▲            | ▲    | ▲              | ▲          | ▲            | ▲                | ▲        | ▲        | ▲               |   |
| Chloro form          | CHCl <sub>3</sub>                                | 클로로포름   | ▲  | ▲  |    |             |             |      |         |         |                    | ○        | ○             |              | ▲                   | ▲                   | ▲   | ▲                   | ▲     | ▲          | ▲            | ▲            | ▲    | ▲              | ▲          | ▲            | ▲                | ▲        | ▲        | ▲               |   |
| Chlorosulfonic Acid  | ClSO <sub>3</sub> H                              | 클로로술폰산  | ▲  | ▲  | ▲  | ▲           | ○           |      | △       |         |                    | ▲        | ▲             |              | ▲                   | ▲                   | ▲   | ▲                   | ▲     | ▲          | ▲            | ▲            | ▲    | ▲              | ▲          | ▲            | ▲                | ▲        | ○        | ○               |   |
| Chromic Acid, 10%    | H <sub>2</sub> CrO <sub>4</sub>                  | 크롬산 10% | ▲  | ▲  | ○  | ○           | △           |      | △       | △       |                    |          |               |              |                     |                     |     |                     |       |            |              |              | ▲    | ▲              |            |              |                  |          |          |                 |   |
| Chromic Acid, 50%    | H <sub>2</sub> CrO <sub>4</sub>                  | 크롬산 50% |    |    |    |             | ○           |      | ▲       | ○       | ▲                  | ○        |               |              |                     |                     |     |                     |       |            |              |              | ▲    | ▲              |            |              |                  |          |          |                 | ○ |
| Cider                |  | 사이다     | ▲  | ○  |    |             |             |      |         |         |                    |          |               |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 |   |
| Citric Acid          | C <sub>6</sub> H <sub>8</sub> O <sub>7</sub>     | 구연산     | ▲  | ▲  | ▲  | ○           |             |      |         |         |                    |          |               |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 |   |
| Copper Chloride      | CuCl   | 염화동     | ▲  | ▲  | ▲  | ▲           | ▲           | ○    | △       | ▲       |                    |          |               |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 |   |
| Copper Cyanide       |  | 시안화동    | ▲  | ▲  | ▲  |             |             |      |         |         |                    |          |               |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 |   |
| Copper Fluoborate    |  | 붕소화동    | ▲  | ▲  | ▲  | ▲           | ▲           | △    | △       | △       |                    |          |               |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 | △ |
| Copper Sulfate       | CuSO <sub>4</sub>                                | 황산동     | ▲  | ▲  | ▲  | ○           |             |      | ▲       | ▲       |                    |          |               |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 | ○ |
| Copper Sulfate, 5%   | CuSO <sub>4</sub>                                | 황산동 5 % | ▲  | ▲  | ▲  |             | △           |      | △       | △       |                    |          |               |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 | △ |
| Corn oil             |  | 옥수수기름   |    | △  |    |             |             | △    | △       | △       |                    |          |               |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 |   |
| Cottonseed Oil       |  | 면실유     |    | △  |    |             |             |      |         |         |                    |          |               |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 |   |
| Cresol               | C <sub>6</sub> H <sub>4</sub> (CH <sub>3</sub> ) | 크레졸     | ○  | ○  |    |             |             |      |         |         |                    |          | ○             | ○            |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 |   |
| Crotonaldehyde       | CH <sub>3</sub> CH                               | 크로톤알데히드 |    |    |    |             |             |      |         |         |                    | △        | △             | △            |                     |                     |     |                     |       |            |              |              |      |                |            | △            |                  |          |          |                 | △ |
| Cyclohexane          | C <sub>6</sub> H <sub>12</sub>                   | 시클로헥산   |    |    |    |             |             |      |         |         |                    | ▲        | ▲             |              |                     |                     |     |                     |       |            |              |              |      |                |            | ▲            | ▲                | ▲        | ▲        | ▲               | ▲ |
| Cyclohexanol         | C <sub>6</sub> H <sub>10</sub> H                 | 시클로헥사놀  |    |    |    |             |             |      |         |         |                    |          | ○             |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 | ○ |
| Diatomaceous Slurry  |  | 규조토     |    |    |    |             |             |      |         |         |                    |          |               |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 |   |
| Dichlorobenzene      | C <sub>6</sub> H <sub>4</sub> Cl <sub>2</sub>    | 디클로로벤젠  | △  |    |    |             |             |      | △       |         |                    |          |               |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 |   |
| Dichloroethane       | CH <sub>2</sub>                                  | 디클로로에탄  | △  | △  | △  |             | △           | △    | △       | △       |                    | ○        | ▲             |              |                     |                     |     |                     |       |            |              |              |      |                |            | ○            | ▲                |          |          |                 | △ |
| Disel fuel           |  | 디젤연료    |    |    |    |             |             | △    | △       | △       |                    | ○        | △             |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 |   |
| Diethylene Glycol    |  | 디에틸렌글리콜 |    |    |    |             |             |      |         |         |                    |          |               |              |                     |                     |     |                     |       |            |              |              |      |                |            |              |                  |          |          |                 | ○ |



# CHEMICAL RESISTANT TABLE

- : Good (사용에 문제없음)
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- △ : Insufficient data (사용불가)

|                          |   |            | 주철 | 강철 | 청동 | 스테인레스 스틸27종 | 스테인레스 스틸32종 | C-20 | 하스텔로이-C | 하스텔로이-B | 모넬(상표명)(니켈 구리의합금) | TITANIUM | POLYPROPYLENE | POLYETHYLENE | TEFLON(PTFE), RULON | ACRYLIC RESIN(PMMA) | PVC | POLYACETAL, DURACON | NYLON | NORYL(PPO) | PVDF, KAYMAR | ABS, CYCOLAC | NEOPRENE | NITRILE RUBBER | VITON(FPM) | HYPALON(CSM) | EPT RUBBER(EPDM) | SILICONE | CERAMICS | CARBON GRAPHITE |  |
|--------------------------|---|------------|----|----|----|-------------|-------------|------|---------|---------|-------------------|----------|---------------|--------------|---------------------|---------------------|-----|---------------------|-------|------------|--------------|--------------|----------|----------------|------------|--------------|------------------|----------|----------|-----------------|--|
| Hydraulic Oil(Petroleum) | 유압유   |            |    |    |    |             |             |      | △       | △       |                   | △        | ○             | △            |                     | △                   |     |                     |       | △          |              |              |          |                |            |              |                  |          |          |                 |  |
| Hydrazine                | NH <sub>2</sub> NH <sub>2</sub>                   | 히드라진       | ▲  | ▲  | ▲  |             |             |      |         | △       | ▲                 | ▲        | ▲             | ▲            | ▲                   | ▲                   | ▲   | ▲                   | ▲     | △          | △            |              |          |                |            |              |                  |          | ▲        | ○               |  |
| Hydrobromic Acid         | HB <sub>2</sub>                                   | 취화수소산      | ▲  | ▲  | ▲  | ▲           | ▲           | ▲    |         | ▲       |                   |          |               |              |                     |                     | △   | ▲                   | ▲     | ○          | △            | ○            | ▲        |                |            |              |                  | ▲        |          |                 |  |
| Hydrobromic Acid, 20%    | HB <sub>2</sub>                                   | 취화수소산 20%  | △  | △  | △  | ▲           | ▲           | ▲    | △       | △       | △                 | ○        |               |              |                     | △                   | △   | ▲                   | ▲     |            | △            | ○            | ▲        |                |            |              |                  | △        |          |                 |  |
| Hydrochloric Acid, 15%   | HCl   | 염산 15%     | ▲  | ▲  | ▲  | ▲           | ▲           | ○    |         | △       | ○                 |          |               |              |                     |                     |     | ▲                   | ▲     |            |              |              | ○        |                |            |              |                  | ○        |          |                 |  |
| Hydrochloric Acid, 25%   | HCl   | 염산 25%     | ▲  | ▲  | ▲  | ▲           | ▲           | △    | ○       | △       | △                 | ○        |               |              |                     |                     |     | ▲                   | ▲     |            |              | ○            | ○        | ○              |            |              |                  | ○        |          |                 |  |
| Hydrochloric Acid, 35%   | HCl   | 염산 35%     | ▲  | ▲  | ▲  | ▲           | ▲           | △    | ○       | △       | △                 | ▲        |               |              |                     |                     |     | ▲                   | ▲     |            |              | ○            | ▲        | ▲              | ○          | ○            | ○                | ▲        |          |                 |  |
| Hydrocyanic Acid         | HCN   | 시안화수소산     | ▲  | ▲  | ▲  | ○           |             |      |         | ○       |                   |          |               |              |                     | ▲                   | ▲   | ▲                   |       |            | △            | △            | △        | △              | △          | △            | △                | △        |          |                 |  |
| Hydrocyanic Acid, 10%    | HCN   | 시안화수소산 10% | △  | △  | △  | ▲           | ▲           | △    | △       | △       |                   |          |               |              |                     | ▲                   | ▲   | ▲                   | ▲     | ▲          | △            | △            | ○        | △              | △          | △            | △                | △        | △        |                 |  |
| Hydrofluoric Acid, 10%   | HF  | 불화수소산 10%  | ▲  | ▲  | ▲  | ▲           | ▲           |      | △       | ▲       | ○                 | ○        |               |              | ▲                   | ○                   | ▲   | ▲                   | ▲     |            | ▲            | ○            | ▲        |                |            |              | ▲                | ▲        | ▲        |                 |  |
| Hydrofluoric Acid, 40%   | HF  | 불화수소산 40%  | ▲  | ▲  | ▲  | ▲           | ○           |      |         | ▲       | ○                 | ○        |               |              | ▲                   | ○                   | ▲   | ▲                   | ▲     |            | ▲            | ○            | ▲        |                |            |              | ▲                | ▲        | ▲        |                 |  |
| Hydrofluoric Acid, 75%   | HF  | 불화수소산 75%  | ▲  | ▲  | ▲  | ▲           | △           |      | △       | ▲       | ▲                 | ▲        | ▲             | ▲            | ▲                   | ▲                   | ▲   | ▲                   | ▲     |            | △            | ○            | ▲        |                |            | ○            | ▲                | ▲        | ▲        |                 |  |
| Hydrogen Peroxide        | H <sub>2</sub> O <sub>2</sub>                     | 과산화수소      | ▲  | ▲  | ▲  |             |             |      |         |         |                   | ▲        |               |              |                     | ○                   | ▲   | ▲                   |       | ○          | △            | ▲            | ▲        | ▲              | ○          | ○            |                  |          | ▲        |                 |  |
| Hydrogen Peroxide, 10%   | H <sub>2</sub> O <sub>2</sub>                     | 과산화수소 10%  | ▲  | ▲  | ▲  |             | △           |      | △       | △       |                   |          |               |              |                     |                     | △   | ▲                   |       |            |              | ▲            | ▲        | ▲              |            |              |                  |          | ▲        |                 |  |
| Hydrogen Peroxide, 50%   | H <sub>2</sub> O <sub>2</sub>                     | 과산화수소 50%  | ▲  | ▲  | ▲  |             |             |      |         |         |                   | ○        |               |              | ○                   |                     | ○   | ○                   |       | △          | ▲            | ▲            | ▲        | ▲              | ○          | ○            | △                |          | ▲        |                 |  |
| Hydrogen Sulfide         | H <sub>2</sub> S                                  | 황화수소       | ▲  | ▲  | ▲  | ○           | ○           | ○    | ○       |         |                   |          |               |              |                     |                     |     | ○                   | ○     |            |              | ○            | ○        | ○              | ○          | ○            | ○                | ▲        | ○        |                 |  |
| Hydrogen Sulfide, aq.sol | H <sub>2</sub> S                                  | 황화수소용액     | ▲  | ▲  | ▲  |             | △           | ○    | △       | △       |                   |          |               |              | △                   |                     | ○   | ○                   |       |            | △            | ○            |          |                |            |              | ▲                |          |          |                 |  |
| Hypochlorous Acid        | HClO  | 차아염소산      | ▲  | ▲  | ▲  | ▲           | ▲           |      | △       |         |                   | ▲        |               |              |                     |                     | ▲   | △                   |       |            | △            | ▲            |          |                |            |              |                  |          | ▲        |                 |  |
| Iodoform                 | CHI <sub>3</sub>                                  | 요도포름       | ○  | ○  | ○  |             |             |      |         |         |                   |          | ▲             | ▲            | △                   | △                   | △   | △                   |       |            | △            | ▲            | ▲        | ▲              | ▲          | ▲            | ▲                | ▲        |          |                 |  |
| Isopropyl Acetate        |   | 초산이소프로필    | △  |    | △  |             |             |      | △       | △       | △                 | △        | △             | △            | △                   | △                   | △   | △                   | △     |            | △            | △            | ▲        | ▲              | ▲          | ▲            | ▲                | ▲        | △        |                 |  |
| Kerosene                 |   | 등유         |    |    |    |             |             |      |         |         |                   |          | ▲             |              |                     |                     |     |                     |       | ▲          |              |              | ▲        |                |            | ▲            | ▲                | ▲        |          |                 |  |
| Ketones                  |   | 케톤류        |    |    |    |             | △           |      | △       | △       |                   | ▲        | ▲             | ▲            | ▲                   | ▲                   | ▲   | ▲                   |       | ▲          | ○            | △            | ▲        | ▲              | ▲          | ▲            | ▲                | ▲        | △        |                 |  |
| Lacquers                 |   | 락카         | ○  | ○  |    |             |             |      |         |         |                   | ▲        | ▲             | ▲            | ▲                   | ▲                   | ▲   | ▲                   |       | ▲          | ▲            | ▲            | ▲        | ▲              | ▲          | ▲            | ▲                | ▲        |          |                 |  |
| Lactic Acid              |   | 젖산         | ▲  | ▲  | ○  |             |             |      | ▲       |         |                   |          |               |              | ○                   |                     | ○   | ○                   |       |            |              |              |          |                |            |              |                  |          |          |                 |  |
| Lead Acetate             | Pb(CH <sub>3</sub> CO <sub>2</sub> ) <sub>2</sub> | 초산연(납)     | ▲  | ▲  | ▲  |             |             |      |         |         |                   |          | ○             |              | △                   |                     |     |                     |       | ○          | ○            | ▲            |          | ▲              |            | ▲            |                  |          |          |                 |  |
| Lead Chloride            | PbCl <sub>2</sub>                                 | 염화연        | ▲  | ▲  | ○  | ○           | ○           |      | ▲       |         |                   | △        |               | △            | △                   | △                   | △   | △                   |       |            |              | △            |          |                | △          | △            | △                | △        | △        |                 |  |
| Lead Nitrate             | Pb(NO <sub>3</sub> ) <sub>2</sub>                 | 질산연        | ▲  | ▲  |    | ○           | ○           |      | ▲       |         |                   |          |               |              | △                   |                     | △   | △                   | △     |            | △            |              |          |                |            |              | ○                |          |          |                 |  |
| Lead Sulfate             |   | 황산연        | ▲  | ▲  |    |             |             |      |         |         |                   |          | △             |              | △                   |                     | △   | △                   | △     |            | △            |              |          |                |            |              | △                |          |          |                 |  |
| Lime water, 30%          |   | 석탄수 30%    |    | △  |    |             |             |      | △       |         |                   |          | △             |              | △                   |                     | ▲   | △                   | △     |            | △            | ○            |          |                |            |              | ▲                | ○        |          |                 |  |
| Linseed Oil              |   | 아마인류       |    |    |    |             |             |      |         |         |                   | ▲        |               |              |                     |                     |     |                     |       | ○          | ○            | ○            |          |                | ○          | ○            | △                |          |          |                 |  |
| Lithium Bromide          |   | 취화리튬       |    |    | △  | △           | △           | △    | △       | △       | △                 | △        | △             | △            | △                   | △                   | △   | △                   | △     |            | △            | ○            | ▲        |                |            | △            | △                | △        |          |                 |  |
| Lithium Chloride         |   | 염화리튬       | △  | △  | △  | △           | △           | △    | △       | △       | △                 | △        | △             | △            | △                   | △                   | △   | △                   | △     | △          | △            | △            | △        | △              | △          | △            | △                | △        | △        |                 |  |





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|                            |   |            | 주철 | 강철 | 청동 | 스테인레스 스틸27종 | 스테인레스 스틸32종 | C-20 | 하스텔로이-C | 하스텔로이-B | 모넬(상표표명)니켈 구리의합금 | TITANIUM | POLYPROPYLENE | POLYETHYLENE | TEFLON(PTFE, RULON | 아크릴 수지 | PVC | POLYACETAL, DURACON | NYLON | NYLON(PO) | PVDF, KAYNAR | ABS, CYCOLAC | 4BS | VR고무 | NITRILE RUBBER | VBR고무 | 불소고무(EPDM) | HYPALONICS(M) | CSM고무 | EPT고무(EPDM) | SILICONE | 실리콘고무 | CERAMICS | 세라믹 | CARBON GRAPHITE | 카본 그래파이트 |   |
|----------------------------|---|------------|----|----|----|-------------|-------------|------|---------|---------|------------------|----------|---------------|--------------|--------------------|--------|-----|---------------------|-------|-----------|--------------|--------------|-----|------|----------------|-------|------------|---------------|-------|-------------|----------|-------|----------|-----|-----------------|----------|---|
| Potassium Cyanide, sol.    | KCN   | 청산가리(칼륨)   |    |    | ▲  |             |             |      |         |         |                  | ○        |               |              |                    |        |     |                     |       |           |              |              |     |      |                |       |            |               |       |             |          |       |          |     |                 |          |   |
| Potassium Dichromate, 40%  | K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>   | 중크롬산카리     |    | ○  | ○  |             |             |      |         | △       | △                |          |               |              |                    | △      |     | ○                   | ▲     |           |              |              |     |      |                |       |            |               |       |             |          |       |          |     |                 |          |   |
| Potassium Ferrocyanide     | K <sub>4</sub> [Fe(CN) <sub>6</sub> ]           | 페로시아화카리    | △  | △  |    |             | △           |      | △       | △       |                  |          |               |              |                    |        |     | △                   |       | △         |              |              |     |      |                |       |            |               |       |             |          |       |          |     |                 |          |   |
| Potassium Hydroxide        | KOH   | 수산화칼륨      | ○  | ○  | ▲  |             |             |      |         |         |                  | ○        |               |              |                    | ○      |     |                     |       |           |              |              |     |      | ○              | ○     |            |               |       |             |          |       |          |     |                 |          |   |
| Potassium Hypochlorite     |   | 차아염소산카리    | ▲  | ▲  |    |             | ▲           | ▲    |         | △       | ▲                |          |               |              |                    |        |     |                     | △     |           |              |              |     | △    | ○              | ○     |            |               |       |             |          |       |          |     |                 | ○        |   |
| Potassium Nitrate          | KNO <sub>3</sub>                                | 질산카리       |    |    |    |             |             |      |         | △       |                  |          |               |              |                    |        |     |                     |       |           |              |              |     |      |                |       |            |               |       |             |          |       |          |     |                 |          |   |
| Potassium Permanganate     | KMnO <sub>4</sub>                               | 과망간산카리     |    |    |    |             |             |      |         | △       |                  |          |               |              |                    | ○      |     |                     | ▲     |           |              |              |     | ○    | ○              |       |            |               |       |             |          |       |          |     |                 |          |   |
| Potassium Phosphate        |   | 인산카리       | ▲  | ▲  | ○  |             |             |      |         |         |                  | △        | △             | △            | △                  | △      | △   | △                   | △     | △         | △            | △            |     |      |                |       | △          | △             | △     | △           | △        | △     | △        | △   | △               | △        |   |
| Potassium Sulfate          | K <sub>2</sub> SO <sub>4</sub>                  | 황산카리       |    |    |    |             |             |      |         |         |                  |          |               |              |                    |        |     |                     |       | ○         |              | ○            |     |      |                |       |            |               |       |             |          |       |          |     |                 |          |   |
| Propane(Liquidified)       | CH <sub>3</sub> CH <sub>2</sub> CH <sub>3</sub> | 액체 프로판     | △  |    |    |             |             | △    | △       | △       | △                | △        | △             | ▲            | △                  | △      | ▲   |                     |       |           |              |              |     |      |                |       |            |               |       |             |          |       |          |     |                 |          |   |
| Propionic Acid             | CH <sub>3</sub> CH <sub>2</sub> COOH            | 프리티온산      | △  | △  | △  |             |             | △    | △       | △       | △                | △        | △             | △            | △                  | △      | ○   | △                   | △     | △         | △            | △            | △   | △    | △              | △     | △          | △             | △     | △           | △        | △     | △        | △   | △               | △        |   |
| Propylene Glycol           |   | 프로필렌글리콜    |    |    |    |             |             |      | △       | △       | △                | △        | △             | △            | △                  | △      | △   |                     |       |           |              |              |     |      | ○              |       |            |               |       |             |          |       |          |     |                 |          |   |
| Propylene Oxide            |   | 산화프로피렌     | △  | △  | ▲  | △           | △           | △    | △       | △       | △                | △        | ○             | ○            | △                  | △      |     |                     |       | △         | ○            | △            | △   | △    | △              | △     | △          | △             | △     | △           | △        | △     | △        | △   | △               | △        |   |
| Pyridine                   | C <sub>5</sub> H <sub>5</sub> N                 | 피리딘        |    |    | △  |             |             | △    | △       | △       |                  |          | ○             | ○            | △                  | △      |     |                     |       | ○         | ○            | △            | △   | △    | △              | △     | △          | △             | △     | △           | △        | △     | △        | △   | △               | △        |   |
| Pyrogalllic Acid           |   | 피로갈산       | ○  | ○  |    |             |             |      |         |         |                  | △        | △             | △            | △                  | △      |     |                     |       |           |              |              |     |      |                |       |            |               |       |             |          |       |          |     |                 |          |   |
| Salicylic Acid             | C <sub>7</sub> H <sub>6</sub> O <sub>3</sub>    | 사리실산       | ▲  | ▲  | ○  |             |             |      |         |         |                  | △        | △             | △            | △                  | △      |     | ○                   | △     | ○         |              |              |     | △    | △              |       | △          | △             | △     | △           | △        | △     | △        | △   | △               | △        |   |
| Silicone                   |   | 실리콘        |    | △  |    |             |             |      |         | △       | △                |          |               |              |                    |        | ▲   |                     |       |           |              |              |     |      |                |       |            |               |       |             |          |       |          |     |                 |          | ▲ |
| Silver Cyanide             | AgCN  | 시아화은       | △  | ▲  |    |             |             |      |         |         | △                | △        | △             | △            |                    |        |     |                     |       | △         |              |              |     | △    |                |       |            |               |       |             |          |       |          |     |                 |          | △ |
| Silver Nitrate             | AgNO <sub>3</sub>                               | 질산은        | ▲  | ▲  | ▲  |             |             |      |         |         | ▲                |          |               |              |                    |        |     |                     |       |           |              |              |     |      |                |       |            |               |       |             |          |       |          |     |                 |          |   |
| Soap Solutions             |   | 비누용액       |    |    |    |             |             |      |         |         |                  |          |               |              |                    |        |     |                     |       |           |              |              |     |      |                |       |            |               |       |             |          |       |          |     |                 |          |   |
| Sodium Acetate             | CH <sub>3</sub> CO <sub>2</sub> Na              | 초산소다(나트륨)  | ○  | ○  |    |             |             |      |         |         |                  |          |               |              |                    |        |     |                     |       |           |              |              |     |      | ▲              | ○     | ○          | ○             |       |             |          |       |          |     |                 |          |   |
| Sodium Bicarbonate         |   | 중탄산소다      | ○  | ○  |    |             |             |      |         |         |                  |          |               |              |                    |        |     |                     |       |           |              |              |     |      |                |       |            |               |       |             |          |       |          |     |                 |          |   |
| Sodium Bisulphate          |   | 중황산소다      | ▲  | ▲  | ○  | ○           |             |      |         |         | ○                |          |               |              |                    |        |     |                     |       |           |              |              |     |      |                |       |            |               |       |             |          |       |          |     |                 |          | △ |
| Sodium Carbonate(Soda Ash) | Na <sub>2</sub> CO <sub>3</sub>                 | 탄산소다       |    |    |    |             |             |      |         |         |                  |          |               |              |                    |        |     |                     |       |           |              |              |     |      | ○              |       |            |               |       |             |          |       |          |     |                 |          |   |
| Sodium Chlorate            | NaClO <sub>3</sub>                              | 염소산소다      | △  | ○  |    | ○           | ○           | ○    | △       | △       |                  |          |               |              |                    |        |     |                     |       |           |              |              |     |      | △              |       | ▲          |               |       |             |          |       |          |     |                 |          | ▲ |
| Sodium Chloride            | NaCl  | 염화나트륨      | ○  | ○  |    | ○           | ○           |      |         |         |                  |          |               |              |                    |        |     |                     |       |           |              |              |     |      |                |       |            |               |       |             |          |       |          |     |                 |          |   |
| Sodium Cyanide             |   | 시아화소다      |    |    | △  |             |             |      |         | △       | ▲                |          |               |              |                    |        |     |                     |       |           |              |              |     | ○    |                |       |            |               |       |             |          |       |          |     |                 |          | ○ |
| Sodium Dichromate          | Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub>  | 중크롬산소다     |    |    |    |             |             | △    | ○       | △       | △                |          |               |              |                    | △      |     | △                   |       |           |              |              |     |      |                |       |            |               |       |             |          |       |          |     |                 |          | △ |
| Sodium Fluoride            |   | 불화소다       | ▲  | ▲  | ○  | ○           |             |      |         |         |                  |          |               |              |                    |        |     |                     |       |           |              |              |     |      |                |       |            |               |       |             |          |       |          |     |                 |          | ▲ |
| Sodium Hydrosulphite       |   | 수산화소디      | △  | △  | ○  | △           | △           | △    | △       | △       | △                |          |               |              |                    |        |     | △                   | ○     | △         | △            | △            | △   | △    | △              | △     | △          | △             | △     | △           | △        | △     | △        | △   | △               | △        | △ |
| Sodium Hydroxide, 20%      | NaOH  | 가성소다 20%   |    | △  | ○  |             |             | △    | △       | △       |                  |          |               |              |                    |        |     | △                   | △     | ○         |              |              |     | ○    |                | ○     |            |               |       |             |          |       |          |     |                 | ○        |   |
| Sodium Hydroxide, 45%      | NaOH  | 가성소다 45%   |    |    | ○  |             |             |      |         |         |                  |          |               |              |                    |        |     |                     |       |           |              |              |     |      | ○              | ○     |            |               |       |             |          |       |          |     |                 | ○        |   |
| Sodium Hydroxide, 80%      | NaOH  | 가성소다 80%   | ○  | ○  | ○  | ○           |             |      |         |         |                  |          |               |              |                    |        |     |                     |       |           |              |              |     |      |                | ▲     | ▲          |               |       |             |          |       |          |     |                 | ▲        |   |
| Sodium Hypochlorite, 5%    |   | 차아염소산소다 5% | ▲  | ▲  | ▲  | ○           |             |      | △       | △       |                  | ○        |               |              |                    |        |     | △                   |       |           |              |              |     | ○    |                | ○     |            |               |       |             |          |       |          |     |                 |          | ▲ |

# CHEMICAL RESISTANT TABLE

- : Good (사용에 문제 없음)
- : Fair (사용은 가능)
- ▲: Unsuitable (부적당)
- △: Insufficient data (사용불가)

|                            |   |               | 주철  | 강철 | 청동 | 스테인레스 스틸27종 | 스테인레스 스틸32종 | C-20 | 하스텔로이-C | 하스텔로이-B | 모넬(상표명)(니켈 구리의 합금) | TITANIUM | POLYPROPYLENE | POLYETHYLENE | TEFLON(PTFE), RULON | ACRYLIC RESIN(PMMA) | PVC | POLYACETAL, DURACON | NORYL(NYON) | NORYL(PPO) | PVDF, KAYNAR | ABS, CYCOLAC | NEOPRENE | NITRILE RUBBER | VITON(FPM) | 불소고무(EPDM) | HYPALON(CSM) | EPT고무(EPDM) | 실리콘고무 | SILICONE | CERAMICS | CARBON GRAPHITE |   |   |
|----------------------------|---|---------------|-----|----|----|-------------|-------------|------|---------|---------|--------------------|----------|---------------|--------------|---------------------|---------------------|-----|---------------------|-------------|------------|--------------|--------------|----------|----------------|------------|------------|--------------|-------------|-------|----------|----------|-----------------|---|---|
| Sodium Hypochlorite, 20%   |   | 차아염소산소다 20%   | ▲▲▲ |    |    |             |             |      |         |         |                    |          |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sodium(Meta) Silicate      | Na <sub>2</sub> Si <sub>2</sub> O <sub>5</sub>                    | 규산소다          | ○   | ○  |    |             |             |      |         |         |                    |          |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sodium Nitrate             | NaNO <sub>3</sub>   | 질산소다          |     |    | ○  |             | ○           |      |         | △       |                    |          |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sodium Nitrite             |   | 아질산소다         |     |    |    |             |             |      |         |         |                    |          |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sodium Perborate           |   | 과붕산소다         |     |    | ▲  |             | ○           |      |         |         |                    | △        |               |              |                     |                     | △   | △                   |             |            |              |              |          |                |            |            |              |             |       |          |          |                 | △ |   |
| Sodium Peroxide            | Na <sub>2</sub> O <sub>2</sub>                                    | 과산화소다         | ○   | ○  | ○  |             |             |      |         |         |                    |          |               |              |                     |                     |     | △                   | ▲           |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sodium Phosphate, mono     |   | 제 1 인산소다      | ○   | ○  |    |             | ○           | ○    |         |         |                    |          |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sodium Phosphate, di & tri |   | 제 2,3 인산소다    | ○   | ○  | ○  |             |             |      |         |         |                    |          |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sodium Sulfate             | Na <sub>2</sub> SO <sub>4</sub>                                   | 황산소다          |     |    |    |             | ○           |      |         |         |                    |          |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sodium Sulfide             |   | 황화소다          |     |    |    |             | ○           |      |         |         |                    |          |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sodium Sulfite             | Na <sub>2</sub> SO <sub>3</sub>                                   | 아황산소다         | ○   | ○  | ○  |             |             |      |         | △       |                    |          |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sodium Tetraborate(Borax)  | Na <sub>2</sub> B <sub>4</sub> O <sub>7</sub> ·10H <sub>2</sub> O | 붕산소다          |     | ○  |    |             |             |      |         |         |                    | △        |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sodium Thiosulphate(Hypo)  | Na <sub>2</sub> S <sub>2</sub> O <sub>3</sub>                     | 티오황산소다        | ▲   | ▲  | ▲  | ▲           | ▲           |      |         | △       | ○                  |          |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sodium Chloride            |   | 염화 제 2 석      | ▲   | ▲  | ▲  | ▲           | ▲           |      |         | △       | ○                  |          |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Stannous Chloride          |   | 염화 제 1 석      | ▲   | ▲  | ▲  | ▲           | ○           |      |         | △       | ○                  |          |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   | △ |
| Starch                     | (C <sub>5</sub> H <sub>10</sub> O <sub>5</sub> ) <sub>x</sub>     | 전분            | ○   | ○  |    |             |             |      |         |         |                    | △        |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Stearic Acid               | C <sub>18</sub> H <sub>36</sub> O <sub>2</sub>                    | 스테아린산         | ○   | ○  | ○  |             |             |      |         |         |                    | ▲        |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Styrene                    |   | 스티렌           | △   |    |    |             |             | △    | △       | △       | △                  | △        | △             | △            | △                   | △                   | △   | △                   | △           | △          |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sulphur Chloride           |   | 염화유황          | ▲   | ▲  | ▲  | ▲           | ▲           | ○    |         |         |                    | △        | ▲             | ▲            | ▲                   |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   | ○ |
| Sulphur Dioxide            | SO <sub>2</sub>   | 2 산화유황(아황산가스) | ○   | ○  | ▲  | ○           |             |      |         |         | △                  | ○        |               | ○            |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sulphur Trioxide           | SO <sub>3</sub>   | 3 산화유황(무수황산)  | ○   | ○  | ○  |             |             |      |         |         | △                  | △        | ▲             | ○            |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sulphuric Acid, 5-10%      | H <sub>2</sub> SO <sub>4</sub>                                    | 황산 5-10%      | ▲   | ▲  | ▲  | ▲           | ○           |      |         |         |                    |          |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sulphuric Acid, 10-75%     | H <sub>2</sub> SO <sub>4</sub>                                    | 황산 10-75%     | ▲   | ▲  | ▲  | ▲           |             |      |         |         |                    |          | ○             | ○            |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sulphuric Acid, 75-95%     | H <sub>2</sub> SO <sub>4</sub>                                    | 황산 75-95%     | ▲   | ▲  | ▲  | ▲           |             |      |         |         |                    |          | ▲             | ▲            | ▲                   | ▲                   | ▲   | ▲                   | ▲           | ▲          |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Sulphuric Acid, conc       | H <sub>2</sub> SO <sub>4</sub>                                    | 농황산           | △   | △  |    |             |             |      | △       | △       | △                  | ▲        | ▲             | ▲            | ▲                   | ▲                   | ▲   | ▲                   | ▲           | ▲          | ▲            | ▲            | ▲        | ▲              | ▲          | ▲          | ▲            | ▲           | ▲     | ▲        | ▲        | ▲               | ▲ | ▲ |
| Sulphurous Acid            | H <sub>2</sub> SO <sub>3</sub>                                    | 아황산           | ▲   | ▲  | ▲  | ○           |             |      |         |         |                    | △        |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Tannic Acid                |   | 탄닌산           | ○   | ○  | ○  |             |             |      |         |         |                    |          |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Tartaric Acid              | C <sub>4</sub> H <sub>6</sub> O <sub>6</sub>                      | 주석산           | ▲   | ▲  |    |             |             |      |         |         |                    | ○        |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Tetrachloroethane          | CCl <sub>4</sub>  | 사염화탄소         | ○   | △  | ○  |             |             | △    | △       | △       |                    |          | ▲             | ▲            | ▲                   | ▲                   | ○   |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Toluene(Toluol)            | C <sub>7</sub> H <sub>8</sub>                                     | 톨루엔           |     |    |    |             |             |      |         |         |                    |          | ○             | ▲            | ▲                   | ▲                   | ▲   | ▲                   | ▲           | ▲          | ▲            | ▲            | ▲        | ▲              | ▲          | ▲          | ▲            | ▲           | ▲     | ▲        | ▲        | ▲               | ▲ |   |
| Trichlorethylene           | CHClCCl <sub>2</sub>  | 트리클로로에틸렌      | ▲   | ▲  | ○  |             |             |      |         |         |                    |          | ○             | ▲            | ▲                   | ▲                   | ▲   | ○                   |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Turpentine                 |   | 테레핀유          |     |    |    |             |             |      |         |         |                    |          | ○             | ▲            |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |
| Urea                       | CO(NH <sub>2</sub> ) <sub>2</sub>                                 | 요소            | △   | ▲  | ○  |             |             |      | △       | ○       | ○                  | △        |               |              |                     |                     |     |                     |             |            |              |              |          |                |            |            |              |             |       |          |          |                 |   |   |

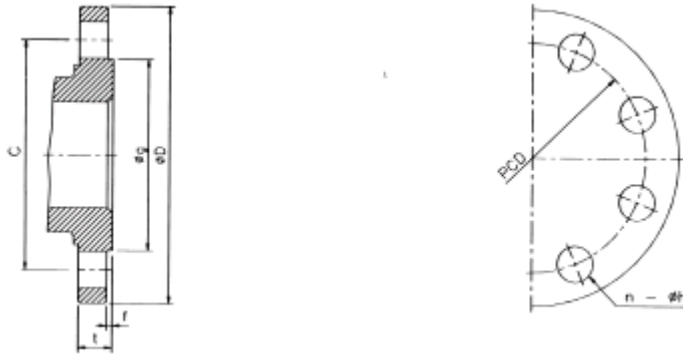


## Dimensions normalisées des brides

| BRIDES ISO ou ANSI B16-5 |         |          |     |      |       |      |   |     |       |
|--------------------------|---------|----------|-----|------|-------|------|---|-----|-------|
| DN                       | PN      | class    | Ø D | C    | Ø K   | Ø L  | N | fl  | Ø d1  |
| 15<br>1/2"               | 10/40   |          | 95  | 24   | 65    | 14   | 4 | 2   | 45    |
|                          | 20      | 150      | 89  | 24   | 60.3  | 15.8 | 4 | 1.6 | 34.9  |
| 20<br>3/4"               | 10/40   |          | 105 | 26   | 75    | 14   | 4 | 2   | 58    |
|                          | 20      | 150      | 99  | 26   | 69.8  | 15.8 | 4 | 1.6 | 42.9  |
| 25<br>1"                 | 10/40   |          | 115 | 26   | 85    | 14   | 4 | 2   | 68    |
|                          | 20      | 150      | 108 | 26   | 79.4  | 15.8 | 4 | 1.6 | 50.8  |
| 32<br>1 1/4"             | 10/16   |          | 140 | 16   | 100   | 18   | 4 | 2   | 78    |
|                          | 20      | 150      | 117 | 15.9 | 88.9  | 15.8 | 4 | 1.6 | 63.5  |
|                          | 25/40   |          | 140 | 18   | 100   | 18   | 4 | 2   | 78    |
|                          | 50      | 300      | 133 | 19   | 98.4  | 19   | 4 | 1.6 | 63.5  |
| 40<br>1 1/2"             | 10/40   |          | 150 | 18   | 110   | 18   | 4 | 3   | 88    |
|                          | 20      | 150      | 127 | 17.5 | 98.4  | 15.8 | 4 | 1.6 | 73    |
|                          | 50      | 300      | 156 | 20.6 | 114.3 | 22.2 | 4 | 1.6 | 73    |
|                          | 100     | 600      | 156 | 28.8 | 114.3 | 22.2 | 4 | 6.4 | 73    |
|                          | 150/250 | 900/1500 | 178 | 38.2 | 123.8 | 28.5 | 4 | 6.4 | 73    |
| 50<br>2"                 | 10/16   |          | 165 | 18   | 125   | 18   | 4 | 3   | 102   |
|                          | 20      | 150      | 152 | 19.1 | 120.6 | 19   | 4 | 1.6 | 92.1  |
|                          | 25/40   |          | 165 | 20   | 125   | 18   | 4 | 3   | 102   |
|                          | 50      | 300      | 165 | 22.4 | 127   | 19   | 8 | 1.6 | 92.1  |
|                          | 100     | 600      | 165 | 31.8 | 127   | 19   | 8 | 6.4 | 92.1  |
|                          | 150/250 | 900/1500 | 216 | 44.5 | 165.1 | 25.4 | 8 | 6.4 | 92.1  |
|                          | 420     | 2500     | 235 | 50.8 | 171.5 | 28.5 | 8 | 6.4 | 92.1  |
| 80<br>3"                 | 10/16   |          | 200 | 20   | 160   | 18   | 8 | 3   | 138   |
|                          | 20      | 150      | 190 | 23.9 | 152.4 | 19   | 8 | 1.6 | 127   |
|                          | 25/40   |          | 200 | 24   | 160   | 18   | 8 | 3   | 138   |
|                          | 50      | 300      | 210 | 28.4 | 168.3 | 22.2 | 8 | 1.6 | 127   |
|                          | 100     | 600      | 210 | 38.2 | 168.3 | 22.2 | 8 | 6.4 | 127   |
|                          | 150     | 900      | 241 | 44.5 | 190.5 | 25.4 | 8 | 6.4 | 127   |
|                          | 250     | 1500     | 267 | 54.2 | 203.2 | 31.8 | 8 | 6.4 | 127   |
| 100<br>4"                | 10/16   |          | 220 | 22   | 180   | 18   | 8 | 3   | 158   |
|                          | 20      | 150      | 229 | 23.9 | 190.5 | 19   | 8 | 1.6 | 157.2 |
|                          | 25/40   |          | 235 | 26   | 190   | 22   | 8 | 3   | 162   |
|                          | 50      | 300      | 254 | 31.8 | 200   | 22.2 | 8 | 1.6 | 157.2 |
|                          | 100     | 600      | 273 | 44.5 | 215.9 | 25.4 | 8 | 6.4 | 157.2 |
|                          | 150     | 900      | 292 | 50.9 | 235   | 31.8 | 8 | 6.4 | 157.2 |

| BRIDES suivant DIN 2501 |        |     |    |     |     |   |    |      |  |
|-------------------------|--------|-----|----|-----|-----|---|----|------|--|
| DN                      | PN     | Ø D | C  | Ø K | Ø L | N | fl | Ø d1 |  |
| 15                      | 10/40  | 95  | 24 | 65  | 14  | 4 | 2  | 45   |  |
| 20                      | 10/40  | 105 | 26 | 75  | 14  | 4 | 2  | 58   |  |
| 25                      | 10/40  | 115 | 26 | 85  | 14  | 4 | 2  | 68   |  |
| 40                      | 10/40  | 150 | 18 | 110 | 18  | 4 | 3  | 88   |  |
|                         | 63/100 | 170 | 26 | 125 | 22  | 4 | 3  | 88   |  |
|                         | 160    | 170 | 28 | 125 | 22  | 4 | 3  | 88   |  |
|                         | 250    | 185 | 34 | 135 | 26  | 4 | 3  | 88   |  |
| 50                      | 10/40  | 165 | 18 | 125 | 18  | 4 | 3  | 102  |  |
|                         | 63     | 180 | 26 | 135 | 22  | 4 | 3  | 102  |  |
|                         | 100    | 195 | 28 | 145 | 26  | 4 | 3  | 102  |  |
|                         | 160    | 195 | 30 | 145 | 26  | 4 | 3  | 102  |  |
|                         | 250    | 200 | 38 | 150 | 26  | 8 | 3  | 102  |  |
| 80                      | 10/16  | 200 | 20 | 160 | 18  | 8 | 3  | 138  |  |
|                         | 25/40  | 200 | 24 | 160 | 18  | 8 | 3  | 138  |  |
|                         | 63     | 215 | 28 | 170 | 22  | 8 | 3  | 138  |  |
|                         | 100    | 230 | 32 | 180 | 26  | 8 | 3  | 138  |  |
|                         | 160    | 230 | 36 | 180 | 26  | 8 | 3  | 138  |  |
|                         | 250    | 255 | 46 | 200 | 30  | 8 | 3  | 138  |  |
| 100                     | 10/16  | 220 | 20 | 180 | 18  | 8 | 3  | 162  |  |
|                         | 25/40  | 235 | 24 | 190 | 22  | 8 | 3  | 162  |  |
|                         | 63     | 250 | 30 | 200 | 26  | 8 | 3  | 162  |  |
|                         | 100    | 265 | 36 | 210 | 30  | 8 | 3  | 162  |  |
|                         | 160    | 265 | 40 | 210 | 30  | 8 | 3  | 162  |  |

## ■CLASS 150#, 300# Flange Dimension



### ANSI 150#

| Nominal Size |     | D      |     | t       |      | C     |       | g       |     | Bolt |       | Bolt hole |    |
|--------------|-----|--------|-----|---------|------|-------|-------|---------|-----|------|-------|-----------|----|
| B            | A   | inch   | mm  | inch    | mm   | inch  | mm    | inch    | mm  | No.  | Dia.  | inch      | mm |
| 1/2          | 15  | 3 1/2  | 89  | 1/16    | 11.2 | 2 3/8 | 60.5  | 1 3/8   | 35  | 4    | 1/2   | 5/8       | 16 |
| 3/4          | 20  | 3 7/8  | 98  | 1/16    | 11.2 | 2     | 70.0  | 1 11/16 | 43  | 4    | 1/2   | 5/8       | 16 |
| 1            | 25  | 4 1/4  | 108 | 1/16    | 11.2 | 3     | 79.5  | 2       | 51  | 4    | 1/2   | 5/8       | 16 |
| 1 1/4        | 32  | 4 3/8  | 117 | 1/2     | 12.7 | 3     | 89.0  | 2 1/2   | 64  | 4    | 1/2   | 5/8       | 16 |
| 1 1/2        | 40  | 5      | 127 | 9/18    | 14.3 | 3     | 98.5  | 2 7/8   | 73  | 4    | 1/2   | 5/8       | 16 |
| 2            | 50  | 6      | 152 | 5/8     | 15.9 | 4     | 120.5 | 3 3/8   | 92  | 4    | 5/8   | 3/4       | 19 |
| 2 1/2        | 65  | 7      | 178 | 11/16   | 17.5 | 5     | 139.5 | 4 1/8   | 105 | 4    | 5/8   | 3/4       | 19 |
| 3            | 80  | 7 1/2  | 191 | 3/4     | 19.1 | 6     | 152.5 | 5       | 127 | 4    | 5/8   | 3/4       | 19 |
| 4            | 100 | 9      | 229 | 15/16   | 23.9 | 7     | 190.5 | 6 3/16  | 157 | 8    | 3/4   | 3/4       | 19 |
| 5            | 125 | 10     | 254 | 15/16   | 23.9 | 8     | 216.0 | 7 3/16  | 186 | 8    | 3/4   | 1/8       | 22 |
| 6            | 150 | 11     | 279 | 1       | 25.4 | 9     | 241.5 | 8 1/2   | 216 | 8    | 3/4   | 1/8       | 22 |
| 8            | 200 | 13 1/2 | 343 | 1 1/8   | 28.6 | 11    | 298.5 | 10 5/8  | 270 | 8    | 3/4   | 1/8       | 22 |
| 10           | 250 | 16     | 406 | 1 3/16  | 30.2 | 14    | 362.0 | 12 3/4  | 324 | 12   | 7/8   | 1         | 25 |
| 12           | 300 | 19     | 483 | 1 1/4   | 31.8 | 17    | 342.0 | 15      | 381 | 12   | 7/8   | 1         | 25 |
| 14           | 350 | 21     | 533 | 1 3/8   | 35.0 | 18    | 176.0 | 16 1/4  | 413 | 12   | 1     | 1 1/8     | 29 |
| 16           | 400 | 23 1/2 | 597 | 1 7/16  | 36.6 | 21    | 539.5 | 18 1/4  | 470 | 16   | 1     | 1 1/8     | 29 |
| 18           | 450 | 25     | 635 | 1 9/16  | 39.7 | 22    | 578.0 | 21      | 533 | 16   | 1 1/8 | 1 1/4     | 32 |
| 20           | 500 | 27 1/2 | 698 | 1 11/16 | 42.9 | 25    | 635.0 | 23      | 584 | 20   | 1 1/8 | 1 1/4     | 32 |

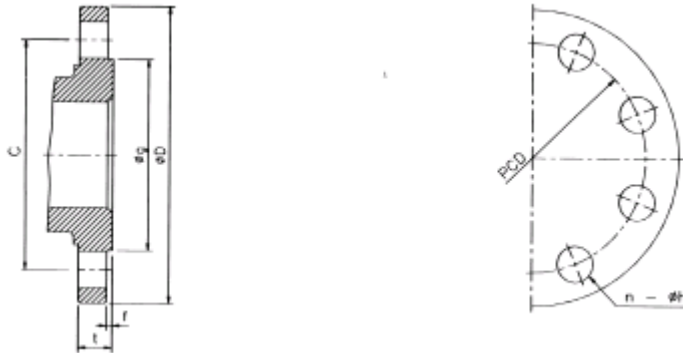
Includes 1/16 raised face=1.6mm

### ANSI 300#

| Nominal Size |     | D      |     | t      |      | C      |       | g       |     | Bolt |       | Bolt hole |    |
|--------------|-----|--------|-----|--------|------|--------|-------|---------|-----|------|-------|-----------|----|
| B            | A   | inch   | mm  | inch   | mm   | inch   | mm    | inch    | mm  | No.  | Dia.  | inch      | mm |
| 1/2          | 15  | 3 3/4  | 95  | 9/16   | 14.3 | 2 3/8  | 66.5  | 1 3/8   | 35  | 4    | 1/2   | 5/8       | 16 |
| 3/4          | 20  | 4 3/8  | 117 | 5/8    | 15.9 | 3 1/4  | 82.5  | 1 11/16 | 43  | 4    | 5/8   | 3/4       | 19 |
| 1            | 25  | 4 7/8  | 124 | 11/16  | 17.5 | 3 1/2  | 89    | 2       | 51  | 4    | 5/8   | 3/4       | 19 |
| 1 1/4        | 32  | 5 1/4  | 133 | 3/4    | 19.1 | 3 7/8  | 98.5  | 2 1/2   | 64  | 4    | 5/8   | 3/4       | 19 |
| 1 1/2        | 40  | 6 1/8  | 156 | 15/16  | 20.7 | 4 1/2  | 114.5 | 2 7/8   | 73  | 4    | 3/4   | 1/8       | 22 |
| 2            | 50  | 6 1/2  | 165 | 1/8    | 22.3 | 5 1/8  | 127   | 3 3/8   | 92  | 8    | 5/8   | 3/4       | 19 |
| 2 1/2        | 65  | 7 1/2  | 190 | 1 1/8  | 25.4 | 5      | 149   | 4 1/8   | 105 | 8    | 3/4   | 1/8       | 22 |
| 3            | 80  | 8 1/4  | 210 | 1      | 28.6 | 6 3/8  | 168   | 5       | 127 | 8    | 3/4   | 1/8       | 22 |
| 4            | 100 | 10     | 254 | 1 1/4  | 31.8 | 7 7/8  | 200   | 6 3/16  | 157 | 8    | 3/4   | 1/8       | 22 |
| 5            | 125 | 11     | 279 | 1 3/8  | 35.0 | 9 1/4  | 235   | 7 3/16  | 186 | 8    | 3/4   | 1/8       | 22 |
| 6            | 150 | 12 1/2 | 318 | 1 7/16 | 36.6 | 10 3/8 | 270   | 8 1/2   | 216 | 12   | 3/4   | 1/8       | 22 |
| 8            | 200 | 15     | 381 | 1 3/8  | 41.3 | 13     | 330   | 10 5/8  | 270 | 12   | 3/4   | 1         | 25 |
| 10           | 250 | 17 1/2 | 444 | 1 1/8  | 47.7 | 15 1/4 | 387.5 | 12 3/4  | 324 | 16   | 7/8   | 1 1/8     | 29 |
| 12           | 300 | 20 1/2 | 521 | 2      | 50.8 | 17 3/4 | 451   | 15      | 381 | 16   | 1     | 1 1/8     | 29 |
| 14           | 350 | 23     | 584 | 2 1/8  | 54.0 | 20 1/4 | 514.5 | 16 1/4  | 413 | 20   | 1 1/8 | 1 1/4     | 32 |
| 16           | 400 | 25 1/2 | 648 | 2 1/4  | 57.2 | 22 1/2 | 571.5 | 18 1/4  | 470 | 20   | 1 1/4 | 1 3/8     | 35 |
| 18           | 450 | 28     | 711 | 2 3/8  | 60.5 | 24 3/4 | 628.5 | 21      | 533 | 24   | 1 1/8 | 1 3/8     | 35 |
| 20           | 500 | 30 1/2 | 775 | 2 1/2  | 63.5 | 27     | 686.0 | 23      | 584 | 24   | 1 1/4 | 1 3/8     | 35 |

Includes 1/16 raised face=1.6mm

## ■CLASS 600#, 900# Flange Dimension



### ANSI 600#

| Nominal Size |     | D      |     | t      |      | C      |       | g       |     | Bolt |       | Bolt hole |    |
|--------------|-----|--------|-----|--------|------|--------|-------|---------|-----|------|-------|-----------|----|
| B            | A   | inch   | mm  | inch   | mm   | inch   | mm    | inch    | mm  | No.  | Dia.  | inch      | mm |
| 1/2          | 15  | 3 3/4  | 95  | 9/16   | 14.3 | 2 3/8  | 66.5  | 1 3/8   | 35  | 4    | 5/8   | 5/8       | 16 |
| 3/4          | 20  | 4      | 117 | 5/8    | 15.9 | 3 1/4  | 82.5  | 1 11/16 | 43  | 4    | 3/4   | 3/4       | 19 |
| 1            | 25  | 4      | 124 | 11/16  | 17.5 | 3 1/2  | 89.0  | 2       | 51  | 4    | 3/4   | 3/4       | 19 |
| 1 1/4        | 32  | 5 1/4  | 133 | 15/16  | 20.7 | 3 7/8  | 98.5  | 2 1/2   | 64  | 4    | 3/4   | 3/4       | 19 |
| 1 1/2        | 40  | 5      | 156 | 1/8    | 22.3 | 4 1/2  | 114.5 | 2 3/8   | 73  | 4    | 3/4   | 1/8       | 22 |
| 2            | 50  | 6 1/2  | 165 | 1      | 25.4 | 5      | 127.0 | 3 3/8   | 92  | 8    | 1/8   | 3/4       | 19 |
| 2 1/2        | 65  | 7 1/2  | 190 | 1 1/8  | 28.6 | 5 7/8  | 149.0 | 4 1/8   | 105 | 8    | 3/4   | 1/8       | 22 |
| 3            | 80  | 8 3/4  | 210 | 1 1/4  | 31.8 | 6 3/8  | 168.0 | 5       | 127 | 8    | 1/8   | 1/8       | 22 |
| 4            | 100 | 10 3/4 | 273 | 1 1/2  | 38.1 | 8 1/2  | 216.0 | 6 3/16  | 157 | 8    | 1/8   | 1         | 25 |
| 5            | 125 | 13     | 330 | 1 3/4  | 44.5 | 10 1/2 | 266.5 | 7 3/16  | 186 | 8    | 1     | 1 1/8     | 29 |
| 6            | 150 | 14     | 356 | 1 7/8  | 47.7 | 11 1/2 | 292.0 | 8 1/2   | 216 | 12   | 1 1/8 | 1 1/8     | 29 |
| 8            | 200 | 16 1/2 | 419 | 2 3/16 | 55.6 | 13 3/4 | 349.0 | 10 5/8  | 270 | 12   | 1 1/8 | 1 1/4     | 32 |
| 10           | 250 | 20     | 508 | 2 1/2  | 63.5 | 17     | 432.0 | 12 3/4  | 324 | 16   | 1 1/4 | 1 3/8     | 35 |
| 12           | 300 | 22     | 559 | 2 5/8  | 66.7 | 19 1/4 | 489.0 | 15      | 381 | 20   | 1 3/8 | 1 3/8     | 35 |
| 14           | 350 | 23 3/4 | 604 | 2 3/4  | 69.9 | 20 3/4 | 527.0 | 16 1/4  | 413 | 20   | 1 3/8 | 1 1/2     | 38 |
| 16           | 400 | 27     | 686 | 3      | 76.2 | 23 3/4 | 603.0 | 18 1/4  | 470 | 20   | 1 1/2 | 1 3/8     | 41 |
| 18           | 450 | 27     | 686 | 3 1/4  | 82.6 | 25 3/4 | 654.0 | 21      | 533 | 20   | 1 5/8 | 1 3/4     | 45 |
| 20           | 500 | 32     | 813 | 3 1/2  | 88.9 | 28 1/2 | 724.0 | 23      | 584 | 24   | 1 5/8 | 1 3/4     | 45 |

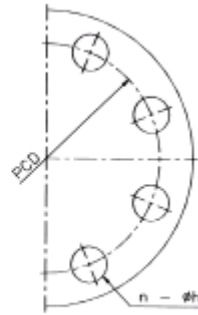
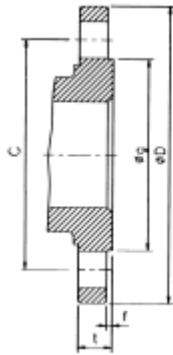
Includes 1/16 raised face=1.6mm

### ANSI 900#

| Nominal Size |     | D      |     | t      |       | C      |       | g       |     | Bolt |       | Bolt hole |    |
|--------------|-----|--------|-----|--------|-------|--------|-------|---------|-----|------|-------|-----------|----|
| B            | A   | inch   | mm  | inch   | mm    | inch   | mm    | inch    | mm  | No.  | Dia.  | inch      | mm |
| 1/2          | 15  | 4 3/4  | 121 | 1/8    | 22.3  | 3 1/4  | 82.5  | 1 3/8   | 35  | 4    | 3/4   | 1/8       | 22 |
| 3/4          | 20  | 5 1/8  | 130 | 1      | 25.4  | 3 1/2  | 89.0  | 1 11/16 | 43  | 4    | 3/4   | 1/8       | 22 |
| 1            | 25  | 5 7/8  | 149 | 1 1/8  | 28.6  | 4      | 101.5 | 2       | 51  | 4    | 1/8   | 1         | 25 |
| 1 1/4        | 32  | 6 1/4  | 159 | 1 1/8  | 28.6  | 4 3/8  | 111.0 | 2 1/2   | 64  | 4    | 1/8   | 1         | 25 |
| 1 1/2        | 40  | 7      | 178 | 1 1/4  | 31.8  | 4 7/8  | 124.0 | 2 3/8   | 73  | 4    | 1     | 1 1/8     | 29 |
| 2            | 50  | 8 1/2  | 216 | 1 1/2  | 38.1  | 6 1/2  | 165.0 | 3 3/8   | 92  | 8    | 1/8   | 1         | 25 |
| 2 1/2        | 65  | 9 3/8  | 244 | 1 5/8  | 41.3  | 7 1/2  | 190.5 | 4 1/8   | 105 | 8    | 1     | 1 1/8     | 29 |
| 3            | 80  | 9 1/4  | 241 | 1 1/2  | 38.1  | 7 1/2  | 190.5 | 5       | 127 | 8    | 1/8   | 1         | 25 |
| 4            | 100 | 11 1/2 | 292 | 1 3/4  | 44.5  | 9 1/4  | 235.0 | 6 3/16  | 157 | 8    | 1 1/8 | 1 1/4     | 32 |
| 5            | 125 | 13 3/4 | 349 | 2      | 50.8  | 11     | 279.5 | 7 3/16  | 186 | 8    | 1 1/4 | 1 3/8     | 35 |
| 6            | 150 | 15     | 381 | 2 3/16 | 55.6  | 12 1/2 | 317.5 | 8 1/2   | 216 | 12   | 1 1/8 | 1 1/4     | 32 |
| 8            | 200 | 18 1/2 | 470 | 2 1/2  | 63.5  | 15 1/2 | 393.5 | 10 5/8  | 270 | 12   | 1 3/8 | 1 1/2     | 38 |
| 10           | 250 | 21 1/2 | 546 | 2 3/4  | 69.9  | 18 1/2 | 470.0 | 12 3/4  | 324 | 16   | 1 3/8 | 1 1/2     | 38 |
| 12           | 300 | 24     | 610 | 3 3/8  | 79.4  | 21     | 533.5 | 15      | 381 | 20   | 1 3/8 | 1 1/2     | 38 |
| 14           | 350 | 25 3/4 | 641 | 3 3/8  | 85.8  | 22     | 559.0 | 16 1/4  | 413 | 20   | 1 1/2 | 1 3/8     | 41 |
| 16           | 400 | 27 3/4 | 705 | 3 1/2  | 88.9  | 24 1/4 | 616.0 | 18 1/4  | 470 | 20   | 1 5/8 | 1 3/4     | 45 |
| 18           | 450 | 31     | 787 | 4      | 101.6 | 27     | 686.0 | 21      | 533 | 20   | 1 7/8 | 2         | 51 |
| 20           | 500 | 33 3/4 | 857 | 4 1/4  | 108.0 | 29 1/2 | 749.5 | 23      | 584 | 20   | 2     | 2 1/8     | 54 |

Includes 1/16 raised face=1.6mm

■CLASS 150#, 300# Flange Dimension



JIS 10K [mm]

| Nominal Size                  |       | D   | FLANGE |   |     | Bolt |     |      | Bolt Dia |
|-------------------------------|-------|-----|--------|---|-----|------|-----|------|----------|
| B                             | A     |     | t      | f | g   | c    | No. | Hole |          |
| <sup>3</sup> / <sub>8</sub>   | 10    | 90  | 12     | 1 | 48  | 65   | 4   | 15   | 12       |
| <sup>1</sup> / <sub>2</sub>   | 15    | 95  | 12     | 1 | 52  | 70   | 4   | 15   | 12       |
| <sup>3</sup> / <sub>4</sub>   | 20    | 100 | 14     | 1 | 56  | 75   | 4   | 15   | 12       |
| 1                             | 25    | 125 | 14     | 1 | 70  | 90   | 4   | 19   | 16       |
| 1 <sup>1</sup> / <sub>4</sub> | 32    | 135 | 16     | 2 | 80  | 100  | 4   | 19   | 16       |
| 1 <sup>1</sup> / <sub>2</sub> | 40    | 140 | 16     | 2 | 85  | 105  | 4   | 19   | 16       |
| 2                             | 50    | 155 | 16     | 2 | 96  | 120  | 4   | 19   | 16       |
| 2 <sup>1</sup> / <sub>2</sub> | 65    | 175 | 18     | 2 | 120 | 140  | 4   | 19   | 16       |
| 3                             | 80    | 185 | 18     | 2 | 130 | 150  | 8   | 19   | 16       |
| 3 <sup>1</sup> / <sub>2</sub> | (90)  | 195 | 18     | 2 | 140 | 160  | 8   | 19   | 16       |
| 4                             | 100   | 210 | 18     | 2 | 155 | 175  | 8   | 19   | 16       |
| 5                             | 125   | 250 | 20     | 2 | 185 | 210  | 8   | 23   | 20       |
| 6                             | 150   | 280 | 22     | 2 | 215 | 240  | 8   | 23   | 20       |
| 7                             | (175) | 305 | 22     | 2 | 240 | 265  | 12  | 23   | 20       |
| 8                             | 200   | 225 | 22     | 2 | 265 | 290  | 12  | 23   | 20       |
| 9                             | (225) | 350 | 22     | 2 | 285 | 310  | 12  | 23   | 20       |
| 10                            | 250   | 400 | 24     | 2 | 325 | 355  | 12  | 25   | 22       |
| 12                            | 300   | 445 | 24     | 3 | 370 | 400  | 16  | 25   | 22       |
| 14                            | 350   | 490 | 26     | 3 | 415 | 445  | 16  | 25   | 22       |
| 16                            | 400   | 560 | 28     | 3 | 475 | 510  | 16  | 27   | 24       |

JIS 16K [mm]

| Nominal Size                  |      | D   | FLANG |   |     | Bolt |     |      | Bolt Dia. |
|-------------------------------|------|-----|-------|---|-----|------|-----|------|-----------|
| B                             | A    |     | t     | f | g   | c    | No. | Hole |           |
| <sup>3</sup> / <sub>8</sub>   | 10   | 90  | 12    | 1 | 48  | 65   | 4   | 15   | 12        |
| <sup>1</sup> / <sub>2</sub>   | 15   | 95  | 12    | 1 | 52  | 70   | 4   | 15   | 12        |
| <sup>3</sup> / <sub>4</sub>   | 20   | 100 | 14    | 1 | 56  | 75   | 4   | 15   | 12        |
| 1                             | 25   | 125 | 14    | 1 | 70  | 90   | 4   | 19   | 16        |
| 1 <sup>1</sup> / <sub>4</sub> | 32   | 135 | 16    | 2 | 80  | 100  | 4   | 19   | 16        |
| 1 <sup>1</sup> / <sub>2</sub> | 40   | 140 | 16    | 2 | 85  | 105  | 4   | 19   | 16        |
| 2                             | 50   | 155 | 16    | 2 | 96  | 120  | 4   | 19   | 16        |
| 2 <sup>1</sup> / <sub>2</sub> | 65   | 175 | 18    | 2 | 120 | 140  | 4   | 19   | 16        |
| 3                             | 80   | 185 | 18    | 2 | 130 | 150  | 8   | 19   | 16        |
| 3 <sup>1</sup> / <sub>2</sub> | (90) | 195 | 18    | 2 | 140 | 160  | 8   | 19   | 16        |
| 4                             | 100  | 210 | 18    | 2 | 155 | 175  | 8   | 19   | 16        |
| 5                             | 125  | 250 | 20    | 2 | 185 | 210  | 8   | 23   | 20        |
| 6                             | 150  | 280 | 22    | 2 | 215 | 240  | 8   | 23   | 20        |
| 8                             | 200  | 225 | 22    | 2 | 265 | 290  | 12  | 23   | 20        |
| 10                            | 250  | 400 | 24    | 2 | 325 | 355  | 12  | 25   | 22        |
| 12                            | 300  | 445 | 24    | 3 | 370 | 400  | 16  | 25   | 22        |
| 14                            | 350  | 490 | 26    | 3 | 415 | 445  | 16  | 25   | 22        |
| 16                            | 400  | 560 | 28    | 3 | 475 | 510  | 16  | 27   | 24        |

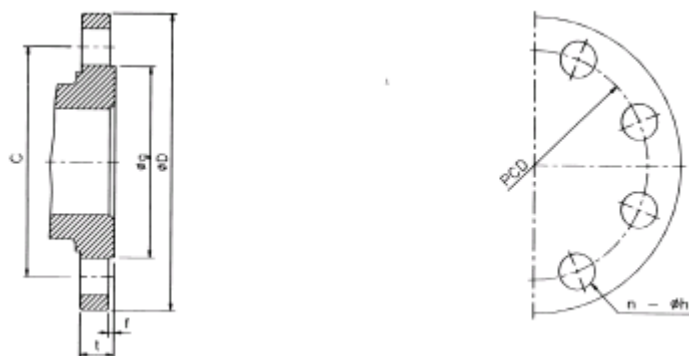
JIS 20K [mm]

| Nominal Size                  |      | D   | FLANGE |   |     | Bolt |     |      | Bolt Dia |
|-------------------------------|------|-----|--------|---|-----|------|-----|------|----------|
| B                             | A    |     | t      | f | g   | c    | No. | Hole |          |
| <sup>3</sup> / <sub>8</sub>   | 10   | 90  | 14     | 1 | 48  | 65   | 4   | 15   | 12       |
| <sup>1</sup> / <sub>2</sub>   | 15   | 95  | 14     | 1 | 52  | 70   | 4   | 15   | 12       |
| <sup>3</sup> / <sub>4</sub>   | 20   | 100 | 16     | 1 | 56  | 75   | 4   | 15   | 12       |
| 1                             | 25   | 125 | 16     | 1 | 70  | 90   | 4   | 19   | 16       |
| 1 <sup>1</sup> / <sub>4</sub> | 32   | 135 | 18     | 2 | 80  | 100  | 4   | 19   | 16       |
| 1 <sup>1</sup> / <sub>2</sub> | 40   | 140 | 18     | 2 | 85  | 105  | 4   | 19   | 16       |
| 2                             | 50   | 155 | 18     | 2 | 96  | 120  | 8   | 19   | 16       |
| 2 <sup>1</sup> / <sub>2</sub> | 65   | 175 | 20     | 2 | 120 | 140  | 8   | 19   | 16       |
| 3                             | 80   | 200 | 22     | 2 | 135 | 160  | 8   | 23   | 20       |
| 3 <sup>1</sup> / <sub>2</sub> | (90) | 210 | 24     | 2 | 145 | 170  | 8   | 23   | 20       |
| 4                             | 100  | 225 | 24     | 2 | 160 | 185  | 8   | 23   | 20       |
| 5                             | 125  | 270 | 26     | 2 | 195 | 225  | 8   | 25   | 22       |
| 6                             | 150  | 305 | 28     | 2 | 230 | 260  | 12  | 25   | 22       |
| 8                             | 200  | 350 | 30     | 2 | 275 | 305  | 12  | 25   | 22       |
| 10                            | 250  | 430 | 34     | 2 | 345 | 380  | 12  | 27   | 24       |
| 12                            | 300  | 480 | 36     | 3 | 395 | 430  | 16  | 27   | 24       |
| 14                            | 350  | 540 | 40     | 3 | 440 | 480  | 16  | 33   | 30       |
| 16                            | 400  | 605 | 46     | 3 | 495 | 540  | 16  | 33   | 30       |

JIS 30K [mm]

| Nominal Size                  |      | D   | FLANG |   |     | Bolt |     |      | Bolt Dia. |
|-------------------------------|------|-----|-------|---|-----|------|-----|------|-----------|
| B                             | A    |     | t     | f | g   | c    | No. | Hole |           |
| <sup>3</sup> / <sub>8</sub>   | 10   | 110 | 16    | 1 | 52  | 75   | 4   | 19   | 16        |
| <sup>1</sup> / <sub>2</sub>   | 15   | 115 | 18    | 1 | 55  | 80   | 4   | 19   | 16        |
| <sup>3</sup> / <sub>4</sub>   | 20   | 120 | 18    | 1 | 60  | 85   | 4   | 19   | 16        |
| 1                             | 25   | 130 | 20    | 1 | 70  | 95   | 4   | 19   | 16        |
| 1 <sup>1</sup> / <sub>4</sub> | 32   | 140 | 22    | 2 | 80  | 105  | 4   | 19   | 16        |
| 1 <sup>1</sup> / <sub>2</sub> | 40   | 160 | 22    | 2 | 90  | 120  | 4   | 23   | 20        |
| 2                             | 50   | 165 | 22    | 2 | 105 | 130  | 8   | 19   | 16        |
| 2 <sup>1</sup> / <sub>2</sub> | 65   | 200 | 26    | 2 | 130 | 160  | 8   | 23   | 20        |
| 3                             | 80   | 210 | 28    | 2 | 140 | 170  | 8   | 23   | 20        |
| 3 <sup>1</sup> / <sub>2</sub> | (90) | 230 | 30    | 2 | 150 | 185  | 8   | 25   | 22        |
| 4                             | 100  | 240 | 32    | 2 | 160 | 195  | 8   | 25   | 22        |
| 5                             | 125  | 275 | 36    | 2 | 195 | 230  | 8   | 25   | 24        |
| 6                             | 150  | 325 | 38    | 2 | 235 | 275  | 12  | 27   | 24        |
| 8                             | 200  | 370 | 42    | 2 | 280 | 320  | 12  | 27   | 24        |
| 10                            | 250  | 450 | 48    | 2 | 345 | 390  | 12  | 33   | 30        |
| 12                            | 300  | 515 | 52    | 3 | 405 | 450  | 16  | 33   | 30        |
| 14                            | 350  | 560 | 54    | 3 | 450 | 495  | 16  | 33   | 30        |
| 16                            | 400  | 630 | 60    | 3 | 510 | 560  | 16  | 39   | 36        |

## ■CLASS 600#, 900# Flange Dimension



### JIS 40K

[mm]

| Nominal Size                  |      | D   | FLANGE |   |     | Bolt |     |      | Bolt Dia. |
|-------------------------------|------|-----|--------|---|-----|------|-----|------|-----------|
| B                             | A    |     | t      | f | g   | c    | No. | Hole |           |
| <sup>3</sup> / <sub>8</sub>   | 10   | 110 | 18     | 1 | 52  | 75   | 4   | 19   | 16        |
| <sup>1</sup> / <sub>2</sub>   | 15   | 115 | 20     | 1 | 55  | 80   | 4   | 19   | 16        |
| <sup>3</sup> / <sub>4</sub>   | 20   | 120 | 20     | 1 | 60  | 85   | 4   | 19   | 16        |
| 1                             | 25   | 130 | 22     | 1 | 70  | 95   | 4   | 19   | 16        |
| 1 <sup>1</sup> / <sub>4</sub> | 32   | 140 | 24     | 2 | 80  | 105  | 4   | 19   | 16        |
| 1 <sup>1</sup> / <sub>2</sub> | 40   | 160 | 24     | 2 | 90  | 120  | 4   | 23   | 20        |
| 2                             | 50   | 165 | 26     | 2 | 105 | 130  | 8   | 19   | 16        |
| 2 <sup>1</sup> / <sub>2</sub> | 65   | 200 | 30     | 2 | 130 | 160  | 8   | 23   | 20        |
| 3                             | 80   | 210 | 32     | 2 | 140 | 170  | 8   | 23   | 20        |
| 3 <sup>1</sup> / <sub>2</sub> | (90) | 230 | 34     | 2 | 150 | 185  | 8   | 25   | 22        |
| 4                             | 100  | 250 | 36     | 2 | 165 | 205  | 8   | 25   | 22        |
| 5                             | 125  | 300 | 40     | 2 | 200 | 250  | 8   | 27   | 24        |
| 6                             | 150  | 355 | 44     | 2 | 240 | 295  | 12  | 33   | 30        |
| 8                             | 200  | 405 | 50     | 2 | 290 | 345  | 12  | 33   | 30        |
| 10                            | 250  | 475 | 56     | 2 | 355 | 410  | 12  | 33   | 30        |
| 12                            | 300  | 540 | 60     | 3 | 410 | 470  | 16  | 39   | 36        |
| 14                            | 350  | 585 | 64     | 3 | 455 | 515  | 16  | 39   | 36        |
| 16                            | 400  | 645 | 70     | 3 | 515 | 570  | 16  | 39   | 36        |

### JIS 63K

[mm]

| Nominal Size                  |      | D   | FLANGE |   |     | Bolt |     |      | Bolt Dia. |
|-------------------------------|------|-----|--------|---|-----|------|-----|------|-----------|
| B                             | A    |     | t      | f | g   | c    | No. | Hole |           |
| <sup>3</sup> / <sub>8</sub>   | 10   | 115 | 22     | 1 | 52  | 80   | 4   | 19   | 16        |
| <sup>1</sup> / <sub>2</sub>   | 15   | 120 | 22     | 1 | 55  | 85   | 4   | 19   | 16        |
| <sup>3</sup> / <sub>4</sub>   | 20   | 135 | 24     | 1 | 60  | 95   | 4   | 23   | 20        |
| 1                             | 25   | 140 | 26     | 1 | 70  | 100  | 4   | 23   | 20        |
| 1 <sup>1</sup> / <sub>4</sub> | 32   | 150 | 28     | 2 | 80  | 110  | 4   | 23   | 20        |
| 1 <sup>1</sup> / <sub>2</sub> | 40   | 175 | 30     | 2 | 90  | 130  | 4   | 25   | 22        |
| 2                             | 50   | 185 | 32     | 2 | 105 | 145  | 8   | 23   | 20        |
| 2 <sup>1</sup> / <sub>2</sub> | 65   | 220 | 36     | 2 | 130 | 175  | 8   | 25   | 22        |
| 3                             | 80   | 230 | 38     | 2 | 140 | 185  | 8   | 25   | 22        |
| 3 <sup>1</sup> / <sub>2</sub> | (90) | 255 | 40     | 2 | 150 | 205  | 8   | 27   | 24        |
| 4                             | 100  | 270 | 42     | 2 | 165 | 220  | 8   | 27   | 24        |
| 5                             | 125  | 325 | 48     | 2 | 200 | 265  | 8   | 33   | 30        |
| 6                             | 150  | 365 | 52     | 2 | 240 | 305  | 12  | 33   | 30        |
| 8                             | 200  | 425 | 58     | 2 | 290 | 360  | 12  | 33   | 30        |
| 10                            | 250  | 500 | 66     | 2 | 355 | 430  | 12  | 39   | 36        |
| 12                            | 300  | 560 | 74     | 3 | 410 | 485  | 16  | 39   | 36        |
| 14                            | 350  | 615 | 78     | 3 | 455 | 530  | 16  | 46   | 42        |
| 16                            | 400  | 680 | 86     | 3 | 515 | 590  | 16  | 46   | 42        |

# MEMO

Date :  
200 . . .

Note :

A large rectangular area filled with a grid of blue dashed lines, intended for writing notes. The grid consists of approximately 25 columns and 35 rows of small squares.

Date :  
200 . . .

Note :

A large rectangular area filled with a grid of blue dashed lines, intended for writing notes. The grid consists of approximately 25 columns and 35 rows of small squares.

# MEMO

Date :  
200 . . .

Note :

A large rectangular area filled with a grid of blue dashed lines, intended for writing notes. The grid consists of approximately 25 columns and 35 rows of small squares.

Date :  
200 . . .

Note :

A large rectangular area filled with a grid of blue dashed lines, intended for writing notes. The grid consists of approximately 25 columns and 35 rows of small squares.



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