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PROPRIETARY NOTICE

The information contained in this publication is derived in part from proprietary and patented data. This information has been prepared for the express purpose of assisting in installation, operation, and maintenance of the instruments described herein. Publication of this information does not convey any rights of use or reproduction other than in connection with the installation, operation and maintenance of the equipment described herein. Universal Flow Monitors, Inc. reserves the right to change the information contained in this publication at any time and without prior notice.
NAMEPLATE EXAMPLE

ELECTRICAL SAFETY LABEL

Serial numbers are formatted as YY MM ID 000
YY = year, MM = month, ID = product identifier, 000 through 999 = three-digit sequential number.
GENERAL SPECIFICATIONS

Flow Ranges: 2 SLPM/5 SCFH F.S. to 1300 SLPM/2600 SCFH F.S.
Turndown Ratio: 400:1
Accuracy: ± 1% of reading
Repeatability: ± 0.2% of full-scale
Maximum Measurable Flow: Up to 125% of full-scale, gas dependent
Pressure Effect on Accuracy: Less than ±0.04% of reading/ PSI
Temperature Effect on Accuracy: Less than ±0.04% of reading/ °F
Response Time: 100 msec
Pressure Drop: 2.5 PSI at maximum flow (port to port), gas dependent
Gases:
Gas compatibility: Non-corrosive, non-condensing
Maximum Operating Pressure: 150 PSIG
Sensor Burst Pressure: 200 PSIG
Operating Temperature: -25 to 80 °C (-13 to 176 °F)
Process Connections: 1/8”-1/4”-3/8”-1/2”-3/4” NPT. SAE, BSPT, BSPP also available
Display:
Rate, total, pressure, temperature, multi-gas, alarms, engineering units
Wetted Parts:
Sensors: Ceramic, silicon, gold, epoxy, RTV
Flow body: Stainless steel, anodized aluminum, Viton®
Enclosure Rating:
Type 4

ELECTRICAL SPECIFICATIONS

Analog output: 4-20 mA (2-wire loop powered)
Alarms: 2 independent open-collector outputs (high/low flow rate)
Open-Collector Rating: 30VDC at 50 mA
Electrical Connection: 5-pin connector
Supply Voltage: 10–30 VDC
Supply Current: 22 mA @ F.S. flow (includes over-range)
OPERATION

**FlowStream** flowmeters accurately measure the mass flow rate of most gases. The flow rate is determined by measuring the pressure drop across a unique internal restriction, known as Laminar Flow Element (LFE). The restriction is designed such that the gas molecules are forced into moving in parallel paths along the entire length of the passage for the entire range of operation of the device. Unlike other pressure-flow measuring devices, the relationship between pressure drop and flow is *linear* in laminar flowmeters.

**FlowStream** mass flowmeters utilize an absolute pressure sensor along with a temperature sensor to compensate for density variations of the gas. When combined with the differential pressure (volumetric flow) output, the mass flow rate of the gas can be determined.

![Laminar Flow Illustration](image)

APPLICATIONS

**FlowStream** flowmeters are designed to work with non-corrosive, non-ionic, clean, dry gases only. Introduction of liquids to the internal sensors will damage the unit, and the repair is not covered under warranty. Relative humidity of the gas can be as high as 100%, as long as proper installation guarantees that no internal condensation will occur. A 50-micron filter and/or dryer may be required for some applications.

**Using FlowStream at Varying Temperatures**

Even though **FlowStream** flowmeters measure true mass flow, rapid variations in ambient and/or gas temperature may affect performance. This is due to the time lag of the internal temperature sensor and the slow heating and cooling of the flowmeter body. It is highly recommended that through *proper installation* the following two objectives be met:

- There be minimal difference between gas temperature and ambient temperature;
- Rapid temperature variations be avoided.
Since the temperature sensor is embedded inside the sensor block, if ambient temperature is different from gas temperature, there would be a discrepancy between what the sensor reads and the true gas temperature. The flowmeter body would track ambient temperature while gas temperature would heat/cool the body at a different rate.

Likewise, if temperature variation is rapid, the flowmeter body may not follow it quickly enough due to the mass of the metal flow chamber, which in turn would result in inaccurate measurement of gas temperature.

For optimal performance, always allow two to four hours from the time the ambient and gas temperatures are stabilized to when the first flowmeter reading is taken.

**Reference Conditions for Mass Flow Measurement**

Although the correct units for mass are expressed in grams, kilograms, etc., it has become somewhat standard that mass flow rate is specified in SLPM (standard liters per minute), SCFH (standard cubic feet per hour) or other similar units.

This means that the mass flow rate is calculated by normalizing the volumetric flow rate to some standard temperature and pressure (STP). By knowing the gas density at that STP, one can determine the mass flow rate in grams per minute, kilograms per hour, etc. STP is usually specified at sea level conditions; however, no single standard exists for this convention. UFM uses STP of 70° F and 14.7 PSIA.

Note: If used outside the parameters specified in this manual, the proper operation of the flowmeter cannot be guaranteed.
WIRING DIAGRAMS

Power Connector
5 Pins

4-20 mA Output

<table>
<thead>
<tr>
<th>Pin</th>
<th>Wire color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brown</td>
<td>+24VDC</td>
</tr>
<tr>
<td>2</td>
<td>White</td>
<td>0VDC</td>
</tr>
<tr>
<td>3</td>
<td>Blue</td>
<td>N/U</td>
</tr>
<tr>
<td>4</td>
<td>Black</td>
<td>N/U</td>
</tr>
<tr>
<td>5</td>
<td>Gray</td>
<td>N/U</td>
</tr>
</tbody>
</table>

4-20 mA with Alarm Option

<table>
<thead>
<tr>
<th>Pin</th>
<th>Wire color</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Brown</td>
<td>+24VDC</td>
</tr>
<tr>
<td>2</td>
<td>White</td>
<td>0VDC</td>
</tr>
<tr>
<td>3</td>
<td>Blue</td>
<td>Alarm 1</td>
</tr>
<tr>
<td>4</td>
<td>Black</td>
<td>Common</td>
</tr>
<tr>
<td>5</td>
<td>Gray</td>
<td>Alarm 2</td>
</tr>
</tbody>
</table>

Alarm wiring example:
Using 10K pull-up resistors,
Alarm 1 or 2 output is pulled high when deactivated and goes to ground when activated (transistor conducting).
KEYPAD OPTIONS

UP: Consecutive (short) button press cycles between the following information on top of the display.

a. *Gas*: Current selected Gas
b. *Pressure*: Gas pressure in PSI
c. *Pressure*: Gas pressure in PSIA
d. *Totalizer*: Total volume of gas according to the selected units.
e. *Temperature*: Temperature in degree Celsius
f. *Temperature*: Temperature in degree Fahrenheit

Options are saved in the memory so that next time you turn the power on it will remember the display settings.

DOWN: Consecutive button press cycles between the different flow units in SCFH and SLPM. Once selected, the setting is saved into the memory of the device.

To reset the totalizer, press SET until the LCD shows “TARING”. Release the SET button immediately, and the totalizer will be reset.

To tare the meter (at zero flow) press SET until the LCD shows “TARING”. Keep holding the SET button (for 5 seconds) until the LCD shows “TARED” and the flow output will be set to zero.

5 seconds
**CHG:** Pressing CHG once shows the user menu. Once the desired menu item is selected, you can do one of the following:

- **To change the set points**
  - Press SET to choose the particular menu item.
  - Consecutive pressing of SET will cycle through the different digits of the set point.
  - Press UP or DOWN to increase or decrease the particular digit. Pressing SET will set the digit.
  - Long press SET until “SAVED” is displayed on the upper row of the LCD.
  - Press CHG to exit out of current menu item and change the next item.

- **To change Gas Setting**
  - Consecutive pressing of SET will cycle through the different Gas options.
  - Once the desired gas is selected, keep holding the SET button down until “SAVED” is displayed on the upper row of the LCD.

- **To exit out of the menu**
  Navigate to “EXIT” menu item with consecutive CHG presses. Press SET to exit out. An alternative option is to not touch any buttons for 5 seconds, as the program will exit the user menu after 5 seconds of inactivity. *Note: this option does not save the recent settings."

**USER MENU**

**FLOW HI:** High set point for flow alarm. (This example shows the detailed steps for changing a set point. All other menu items use the same method.)

Press the SET button to change. Range is 0-100% FS. If set to 0, alarm is disabled. Alarm hysteresis is 1% FS.

When first digit starts blinking, use the UP and DOWN buttons to adjust the digit, then press SET to move to the next digit.
When finished, keep holding the SET button down until “SAVED” is displayed, then release the SET button.

**FLOW LO:** Low set point for flow alarm.

Range is 0 to FLOW HI – 2% FS. If set to 0, alarm is disabled. Alarm hysteresis is 1% FS.

Use SET, UP, DOWN buttons as explained above to change the set point.

**OUTPUT SPAN:** Scale the 4-20mA output

Range is 50% to 120% of factory calibration. For example, if the flowmeter was originally ordered for 360 SCFH (20 mA=360 SCFH), you can scale the output to read 20 mA as low as 180 SCFH or as high as 420 SCFH for ease of measurement at user-specific flows.

**THRESH:** Threshold percentage for filtering noisy flow readings.

Use SET, UP, DOWN buttons as explained above to change the set point.

The filtering algorithm can detect outliers and exclude them from signal averaging. The Threshold value (in percent) determines which samples will be left out. Percentage is with respect to the internal moving average. Range is 3-50%. For example, when Threshold is set to 20%, if the moving average is 100 SCFH and a single flow sample is either above 120 SCFH or below 80 SCFH (i.e. 20% of the average), it will be ignored and not added to the moving average. However, if subsequent samples are all outside the threshold band, then they will be counted in and the moving average is updated with the new values (more than one sample signifies a real change in flow, not noise).
**AVG:** Moving average array size.  

Use **SET, UP, DOWN** buttons as explained above to change the set point.

This is the number of samples that are averaged when calculating the flow. Range is 1-100. Samples are added to the internal moving average array and a new output is displayed once every 100 msec.

**GAS:** Current Gas.

Use the **SET** button to change the gas.

Pre-programmed gases are: Air, Argon, CO2, Helium, Nitrogen, Methane, Hydrogen, Oxygen.

**USER FACTOR:**

Range is 0.200 to 2.000. The LCD will show this factor x1000 (i.e. without the decimal point). It is implied that there are 3 decimal places (e.g. 1000 means 1.000).

You can use as many gases with the flowmeter as you wish. If the gas is not on the pre-programmed list, you can enter the gas factor in this menu. Please note that the flowmeter accuracy may be degraded as much as 5% of full-scale when using this option (depending on the accuracy of the gas factor and the nature of the gas itself). There are other factors involved in accurately measuring different gases as well.

**Note 1:** If you change this factor to any values other than 1.000, you must use Air in your gas selection; otherwise, there will be a “double-correction” applied to the output.
**RESET**: Reset the parameters back to the original factory settings.

Hold the SET button until the letters RESET will be displayed on the LCD one by one. This will provide a 5 second delay that is intended to prevent and accidental reset.

The following variables will be reset to their original values:
- 20MA = Full-scale set at the factory
- High flow alarm = 80% of FS
- Low flow alarm = 20% of FS
- Threshold = 20%
- Moving average = 25
- GAS = Air
- USRFCT = 1.000

**EXIT**: Exit the user menu.
AVAILABLE FLOW SIZES

Each size is offered in several optimized maximum flow rates as shown in the table below. These configurations provide the highest accuracy and turndown ratios stated in the specifications. Please refer to the model code in the Ordering Information section to select the desired flow rate.

<table>
<thead>
<tr>
<th>Port size</th>
<th>Max SCFH Air, N, O2, CO2, He, Methane</th>
<th>Max SLPM Air, N, O2, CO2, He, Methane</th>
<th>Max SCFH Argon</th>
<th>Max SLPM Argon</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8&quot;</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>1.5</td>
</tr>
<tr>
<td></td>
<td>30</td>
<td>15</td>
<td>20</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>60</td>
<td>30</td>
<td>45</td>
<td>20</td>
</tr>
<tr>
<td>1/4&quot;</td>
<td>120</td>
<td>60</td>
<td>90</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>240</td>
<td>120</td>
<td>180</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>360</td>
<td>180</td>
<td>270</td>
<td>135</td>
</tr>
<tr>
<td>3/8&quot;</td>
<td>360</td>
<td>180</td>
<td>270</td>
<td>135</td>
</tr>
<tr>
<td></td>
<td>480</td>
<td>240</td>
<td>360</td>
<td>180</td>
</tr>
<tr>
<td></td>
<td>600</td>
<td>300</td>
<td>450</td>
<td>225</td>
</tr>
<tr>
<td>1/2&quot;</td>
<td>600</td>
<td>300</td>
<td>450</td>
<td>225</td>
</tr>
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<td></td>
<td>720</td>
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<td>840</td>
<td>420</td>
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<td>315</td>
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<td>960</td>
<td>480</td>
<td>720</td>
<td>360</td>
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<td></td>
<td>1080</td>
<td>540</td>
<td>810</td>
<td>405</td>
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<td>1200</td>
<td>600</td>
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<td>450</td>
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<tr>
<td></td>
<td>1320</td>
<td>660</td>
<td>990</td>
<td>495</td>
</tr>
<tr>
<td></td>
<td>1440</td>
<td>720</td>
<td>1080</td>
<td>540</td>
</tr>
<tr>
<td>3/4&quot;</td>
<td>1440</td>
<td>720</td>
<td>1080</td>
<td>540</td>
</tr>
<tr>
<td></td>
<td>1560</td>
<td>780</td>
<td>1170</td>
<td>585</td>
</tr>
<tr>
<td></td>
<td>1680</td>
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<td>1260</td>
<td>630</td>
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<td>900</td>
<td>1350</td>
<td>675</td>
</tr>
<tr>
<td></td>
<td>1920</td>
<td>960</td>
<td>1440</td>
<td>720</td>
</tr>
<tr>
<td></td>
<td>2040</td>
<td>1020</td>
<td>1530</td>
<td>765</td>
</tr>
<tr>
<td></td>
<td>2160</td>
<td>1080</td>
<td>1620</td>
<td>810</td>
</tr>
<tr>
<td></td>
<td>2280</td>
<td>1140</td>
<td>1710</td>
<td>855</td>
</tr>
<tr>
<td></td>
<td>2400</td>
<td>1200</td>
<td>1800</td>
<td>900</td>
</tr>
<tr>
<td></td>
<td>2500</td>
<td>1250</td>
<td>1890</td>
<td>945</td>
</tr>
<tr>
<td></td>
<td>2600</td>
<td>1300</td>
<td>1980</td>
<td>990</td>
</tr>
</tbody>
</table>
ORDERING INFORMATION

How To Order Flowstream for a Single Gas
Select the appropriate symbols to build a model code:

Example: FP- E F- 2 N- 360 SCFH- CO2- X1B

**SERIES**
- FP

**MATERIAL FOR METER BODY**
- Anodized Aluminum = E
- 316 Stainless Steel = F

**SEALS**
- Viton® = F

**FLOW RANGE IN SLPM**

<table>
<thead>
<tr>
<th>PIPE SIZE in inches</th>
<th>FLOW RANGE IN SCFH</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8 = 1</td>
<td>0.005  2.0  0.0125 5</td>
</tr>
<tr>
<td>1/4 = 2</td>
<td>0.05   5    0.1   10</td>
</tr>
<tr>
<td>3/8 = 3</td>
<td>0.45   180   0.9   360</td>
</tr>
<tr>
<td>1/2 = 4</td>
<td>0.75   300   1.5   600</td>
</tr>
<tr>
<td>3/4 = 6</td>
<td>1.75   700   3.5   1400</td>
</tr>
<tr>
<td></td>
<td>3.25   1300  6.5   2600</td>
</tr>
</tbody>
</table>

* Argon flow rates are 75% of the above values (multiply by 0.75) due to higher viscosity

**GAS TYPE**
- Air = A
- Argon* = R
- Carbon Dioxide = CO2
- Helium = HE
- Nitrogen = N
- Oxygen = O
- Hydrogen = H
- Methane = M

**OUTPUT**
- 4-20 mA with 2 alarms = X1B

**SPECIAL OPTIONS**
- CLEAN FOR OXYGEN SERVICE = C1
- VACUUM USE = ZVAC
- SPECIFIC PRESSURE (i.e. P10) = P
- ACTUAL GAS CALIBRATION = GAS
DIMENSIONS

<table>
<thead>
<tr>
<th>MODEL</th>
<th>DIM &quot;A&quot;</th>
<th>DIM &quot;B&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>1/8 Inch</td>
<td>3.00 Inches</td>
<td>0.38 Inches</td>
</tr>
<tr>
<td>1/4 Inch</td>
<td>3.00 Inches</td>
<td>0.38 Inches</td>
</tr>
<tr>
<td>3/8 Inch</td>
<td>3.25 Inches</td>
<td>0.50 Inches</td>
</tr>
<tr>
<td>1/2 Inch</td>
<td>3.50 Inches</td>
<td>0.63 Inches</td>
</tr>
<tr>
<td>3/4 Inch</td>
<td>4.00 Inches</td>
<td>0.88 Inches</td>
</tr>
</tbody>
</table>
NOTICE

RETURN MATERIAL AUTHORIZATION

Please read the following UFM policy information carefully. By following the guidelines outlined below you will assist in providing a timely evaluation and response regarding the status of your flowmeter. UFM evaluates all AUTHORIZED RETURNED MATERIALS in a timely manner and will promptly provide notification regarding the status of the related materials and/or a written quotation indicating the total charges and description of the necessary repairs.

1. All returns must have a RMA form completed by the customer.
2. Any meter returned that was previously in service must have the OSHA requirements completed and a MSDS included where applicable.
3. An RMA number will only be issued when UFM has received a copy of the completed RMA form and any applicable MSDS.
4. A “Return Goods” shipping label (located in the back of the Instruction Manual) must be used for returning materials to UFM.
5. Returned goods must be shipped prepaid or they will be rejected.

REPAIRABLE MATERIAL
Written or verbal authorization to proceed with the repair under an assigned Purchase Order must be received within 30 days of repair quotation. If the unit(s) is repaired, the $90.00 evaluation charge will be applied to the quoted repair costs. If no repairs are authorized within this 30-day period, the customer will be billed $90.00 plus shipping charges and the materials will be returned to the customer.

NON-REPAIRABLE MATERIAL
If materials are found non-repairable, a written notice that the material is non-repairable will be provided to the customer by UFM. If no disposition to scrap or return the material is received from the customer within 30 days, non-repairable material will be scrapped and the customer will be billed the $90.00 evaluation charge. If a UFM replacement unit is purchased within 30 days of non-repairable condition notice, the $90.00 evaluation fee will be waived. The return of non-repairable materials may be ordered by a customer Purchase Order; shipping and handling charges will be assumed by customer.

RETURN FOR RE STOCK
All goods returned for restock adjustment must be:
A. New and unused.
B. Returned to the factory within ONE YEAR of date of original shipment.
C. Returned through the distributor where the goods were originally purchased.
D. Returned material will be subject to an evaluation charge of $90.00.

The customer will be advised of the restocking adjustment for all restockable goods. Upon customer’s acceptance of the restocking adjustment, the $90.00 evaluation fee will be waived and UFM will issue a credit to the customer. The customer will be advised of any non-restockable goods and will be charged the $90.00 evaluation fee plus any shipping charges if goods are returned to the customer.
If no disposition is received by UFM within 30 days, the goods will be scrapped and the $90.00 evaluation fee will be billed.

**WARRANTY RETURNS**
Warranty returns must be shipped prepaid to UFM. UFM will review the goods and advise the customer of the evaluation and validity of the warranty claim. Valid warranty claims will be repaired or replaced at no charge. No evaluation fee will be charged for repairs made under warranty. Return shipping costs will be prepaid by UFM. Should UFM determine returned material not to be defective under the provisions of UFM’s standard warranty, the customer will be advised of needed repairs and associated costs. All materials returned for warranty repair that are determined not to have a valid warranty claim will be subject to the “Repairable Material” policy outlined above.
WARRANTY INFORMATION

1) ACCEPTANCE AND INTEGRATION CLAUSE: This Sales Order Acknowledgment and the sales order information that Universal Flow Monitors, Inc. ("Universal") attaches to or associates with it (herein "Acknowledgment"), constitutes an acceptance by Universal of an offer by the buyer upon the conditions and terms and at the prices stated in this Acknowledgment. The Acknowledgment contains the entire understanding of Universal and the buyer regarding the subject matter of said Acknowledgment. This Acknowledgment may only be modified by a written agreement signed by the party against whom enforcement is sought.

2) WAIVER: Waiver by Universal of any default(s) by the buyer shall not constitute waiver by Universal of any of the conditions of the agreement between Universal and the buyer as set forth hereunder with respect to any further or subsequent default by the buyer.

3) FORCE MAJEURE: Universal shall not be responsible for failure or delays in deliveries due to fire, strikes, breakdowns, acts of God, failure of carriers, inability to secure required materials, or other causes beyond Universal's control. Buyer waives any claims for damage arising by virtue of delay in delivery of material by Universal.

4) LIMITED WARRANTY:
   (a) Warranty. For a period of one year from the date of manufacture, Universal warrants that each product covered by this Acknowledgment will be free from defects in material and workmanship. In order to qualify for any remedy provided in this Acknowledgment, buyer must give notice to Universal within the one-year period, return the product to Universal freight paid and intact with Material Safety Data Sheets covering all substances passing through the product or that form a residue on the product.
   (b) Exclusive Remedy. The buyer's EXCLUSIVE REMEDY for failure of any product to conform to any warranty or otherwise for any defect is, at Universal's sole option: (i) repair; (ii) replacement; or (iii) refund of the entire purchase price for the specific product. Without limiting the foregoing, in no case will Universal be liable for de-installation of any defective product or installation of any repaired or replaced product. THIS REMEDY IS THE EXCLUSIVE REMEDY AVAILABLE TO THE BUYER OR ANY OTHER PERSON. UNIVERSAL SHALL NOT BE LIABLE FOR ANY DIRECT, INDIRECT, INCIDENTAL, CONSEQUENTIAL, SPECIAL, PUNITIVE, OR OTHER DAMAGES IN CONNECTION WITH ANY CAUSE OF ACTION, WHETHER IN CONTRACT, TORT, OR OTHERWISE.
   (c) Disclaimer of Other Warranties. The express warranty in this Acknowledgment is in lieu of any other warranty, express or implied. Without limiting the foregoing, UNIVERSAL DISCLAIMS THE IMPLIED WARRANTY OF MERCHANTABILITY AND ANY IMPLIED WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE.
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(c) Definitions. As used in this section, the following definitions apply, whether the terms use initial capitals or not.

"Aircraft" includes powered and non-powered winged aircraft, missiles, spacecraft, and other aeronautical craft or mechanisms.

"Aircraft product" includes:

1. Any ground support or control equipment used with any aircraft;
2. Any article designed for installation in or on aircraft;
3. Any ground handling tools or equipment used with aircraft;
4. Any aircraft training aids, instructions, manuals, or blueprints; and
5. Any engineering, labor or other services involving aircraft. "Hazardous properties" include radioactive, toxic or explosive properties; "Nuclear facility" means

(a) Any nuclear reactor; or
(b) Any equipment or device designed or used for: (1) Separating the isotopes of uranium or plutonium; (2) Processing or utilizing spent fuel; or
(c) Handling, processing or packaging waste.

"Nuclear material" means source material, special material or by-product material;

"Nuclear reactor" means any apparatus designed or used to sustain nuclear fission in a self-supporting chain reaction or to contain a critical mass of fissionable material. "Property damage" includes all forms of radioactive contamination of property.

"Source material," "special nuclear material," and "by-product material" have the meanings given them in the Atomic Energy Act of 1954 and any regulation promulgated thereunder, as the same may be amended from time to time.

"Spent Fuel" means any fuel element or fuel component, solid or liquid that has been used or exposed to radiation in a nuclear reactor.

"Waste" means any waste material (1) containing by-product material and (2) resulting from the operation by any person or organization of any nuclear facility.