CERTIFICATE OF COMPLIANCE

for IMC Energy Meters

EMP1-0050
EMP1-0075
EMP1-0100
EMP1-0150
EMP1-0200

With OIML R 75-1 Specification

Date: 15 May 2010

SUMMARY

The objective of this document is to show conformance and to certify that IMC's EMP1 energy meters are in compliance with the OIML R 75-1 specification. Public Utility and / or PUBLIC SERVICE COMMISSIONS requiring this conformance will find itemized and detail explanation of compliance to the **OIML R 75-1 Specification**

This compliance may be required for the purpose of metering Solar Hot Water energy for Domestic and or Space heating use.

Certifying engineer …. 

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Signiture Date

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OIML R 75-1 Standards for Heat Meters

Sections 1 to 3 are generic requirements.

Section 4: Terminology and Symbols

For the purposes of this Recommendation, the following terms, definitions and symbols apply.

4.1 Response time, $\tau_{0,5}$
Time interval between the instant when the flow, the temperature or the temperature difference is subjected to a specified abrupt change, and the instant when the response reaches 50 % of its final steady value.

4.2 Fast response meter
Meter suitable for heat-exchange circuits with rapid dynamic variations in the exchanged heat.

4.3 Rated voltage, Un
Voltage of the external power supply required to operate the heat meter, conventionally the voltage of the AC mains supply.

4.9 Types of error
4.9.1 Error (of indication) of a measuring instrument Indication of the measuring instrument minus the conventional true value of the corresponding input quantity [adapted from VIM 5.20].

4.9.2 Intrinsic error (of a measuring instrument):
Error of a measuring instrument, determined under reference conditions [VIM 5.24].

4.9.3 Initial intrinsic error:
Intrinsic error of a measuring instrument as determined prior to performance tests and durability tests.

4.9.4 Durability error:
Difference between the intrinsic error after a period of use and the initial intrinsic error.

4.9.5 Maximum permissible error, MPE:
Extreme values of the error (positive or negative) permitted by this Recommendation [adapted from VIM5.21].

Section 5: Rated Operating Conditions

5.2 Limits of temperature differences

5.2.1 The temperature difference, Δθ, (expressed in K) is the absolute value of the difference between the temperatures of the heat-conveying liquid at the flow and return of the heat-exchange circuit.

5.2.2 The upper limit of the temperature difference, Δθmax, is the highest temperature difference, at which the heat meter shall function within the upper limit of thermal power without the maximum permissible errors being exceeded.

5.2.3 The lower limit of the temperature difference, Δθmin, is the lowest temperature difference, at which the heat meter shall function without the maximum permissible errors being exceeded.

5.3 Limits of flow rate
5.3.1 The upper limit of the flow rate, qs, is the highest flow rate, at which the heat meter shall function for short periods (less than 1 h/day and less than 200 h/year) without the maximum permissible errors being exceeded.

5.3.2 The permanent flow rate, qp, is the highest flow rate at which the heat meter shall function continuously without the maximum permissible errors being exceeded.

5.3.3 The lower limit of the flow rate, qi, is the lowest flow rate, above which the heat meter shall function without the maximum permissible errors being exceeded.

5.4 Limits of thermal power
The upper limit of the thermal power, Ps, is the highest power at which the heat meter shall function without the maximum permissible errors being exceeded.

5.5 Maximum admissible working pressure, MAP
The maximum positive internal pressure that the heat meter can withstand permanently at the upper limit of the temperature range, expressed as a PN-series as defined in ISO 7268.

5.6 Maximum pressure loss
The loss of pressure in the heat-conveying liquid passing through the flow sensor when the flow sensor is operating at the permanent flow rate, qp.

Section 6: Technical Characteristics
The materials used and the construction of heat meters shall ensure sufficient stability to enable the instrument to comply with the maximum permissible errors stated when the device is set up in accordance

IMC HEAT METERS are in compliance. Please see manual : EMP1 OP & INSTALL INSTRUC 5-15-10

6.1 Materials and construction
All the constituent elements of heat meters shall be solidly constructed of materials having appropriate qualities to resist the various forms of corrosion and wear which occur under rated operating conditions, especially those due to impurities in the heat-conveying liquid. Correctly installed meters shall also be able to OIML R 75-1: 2002 (E)9 withstand normal external influences. Meters shall, in all circumstances, withstand the maximum admissible pressure and the temperatures for which they are designed, without malfunction.

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IMC HEAT METERS are in compliance. Please see manual : EMP1 OP & INSTALL INSTRUC 5-15-10

6.1.1 Suppliers of heat meters shall declare any limitations with regard to installation of the heat meter and its orientation with respect to the vertical.

IMC HEAT Meters and differential Controllers are all wall mounted in the VETICAL position

6.1.2 Casings of heat meters shall protect the parts inside against water and dust ingress. The minimum forms of enclosure protection shall be IP54 for enclosures that are to be installed into pipe work and IP52 for other enclosures, all in accordance with IEC 61010-1.

IMC HEAT METERS are in compliance. Please see manual : EMP1 OP & INSTALL INSTRUC 5-15-10

6.1.3 Heat meters may be fitted with interfaces allowing the connection of supplementary devices. Such connections shall not modify the metrological qualities of the heat meter.

NOT APPLICABLE

6.1.4 The maximum pressure loss at qp shall not exceed 0.25 bar, except where the heat meter includes a flow controller or also acts as a pressure-reducing device.

IMC HEAT METERS are in compliance. Please see manual : EMP1 OP & INSTALL INSTRUC 5-15-10

6.2 Requirements outside the limiting values of the flow rate
When the flow rate is less than a threshold value declared by the supplier, no registration is allowed. For flow rates greater than qs, the behavior of the meter, e.g. the production of spurious or zero signals, shall be declared by the manufacturer. Flow rates greater than qs shall not result in a positive error greater than 10 %.

IMC HEAT METERS are in compliance. Please see manual : EMP1 OP & INSTALL INSTRUC 5-15-10

Note: The flow rate through a "nominally" closed valve the movement of liquid in the pipe behind a closed valve caused by thermal expansion and contraction should not be recorded.

6.3 Display (indicating device)
6.3.1 The quantity of heat shall be indicated in joules, watt-hours or in decimal multiples of those units. The name or symbol of the unit in which the quantity of heat is given shall be indicated adjacent to the display.

IMC HEAT METERS are in compliance. The display is in KWH. Please see manual : EMP1 OP & INSTALL INSTRUC 5-15-10.

6.3.2 The display shall include a numerical or semi-numerical scale. Heat meters shall be so designed that, in the event of an external power supply failure (mains or external DC), the meter indication of energy at the time of failure is not lost, and remains accessible for a minimum of one year.

IMC HEAT METERS are in compliance. The KWH total values is permanently stored in permanent memory for a period exceeding 15 years. Please see manual : EMP1 OP & INSTALL INSTRUC 5-15-10

Signiture Date

Note: Compliance with 6.3.2 will not necessarily ensure that the heat meter will continue to register the heat consumed in the event of a power supply failure.

6.3.3 The indicating device shall provide an easily read, reliable and unambiguous indication.

IMC HEAT METERS are in compliance.

6.3.4 The real or apparent height of the figures on the display for energy shall not be less than 4 mm.

IMC HEAT METERS are in compliance. The display digits are 5.5mm

6.3.5 The figures indicating decimal fractions of a unit shall be separated from the others by the decimal divider. In addition, the figures indicating decimal fractions of energy shall be clearly distinguishable from the others.

IMC HEAT METERS are in compliance.

6.3.6 Where the display is of the roller-type, the advance of a figure of a particular significance shall be completed during the time when the figure of next lower significance changes from 9 to 0. The roller carrying the figures of lowest significance may have a continuous movement, of which the visible displacement shall then be from bottom to top.

NOT APPLICABLE. IMC HEAT METERS have no mechanical moving parts in the totalizers

6.3.7 The display indicating the quantity of heat shall be able to register, without overflow, a quantity of heat at least equal to the transfer of energy which corresponds to a continuous operation for 3000 h at the upper limit of the thermal power, Ps, of the heat meter. The quantity of heat, measured by a heat meter operating at the upper limit of the thermal power for 1 h, shall correspond to at least one digit of lowest significance of the display.

IMC HEAT METERS are in compliance. Overflow will occur after a maximum of 830,000.0 KWH 's have been registered in the heat meter. This will meet or exceed 8000 hrs at maximum heat capacity. There after KWH totalizing register will rest to ZERO and resume totalizing.

6.4 Protection against fraud

Heat meters shall have protective devices which can be sealed in such a way that, after sealing, both before and after the heat meter has been correctly installed, there is no possibility of dismantling, removing, or altering the heat meter or its adjustment devices without evident damage to the device(s) or seal(s).Means shall also be provided for meters with external power supply, either to give protection against the meter being disconnected from the power supply or to make it evident that this has taken place. Sites shall be provided for marks (e.g. legal status marks) to be sited on that part of the heat meter indicating the quantity of heat for a complete meter or on each sub-assembly for combined meters. All parts of the heat meter that might be separated after calibration and testing shall have sites for placing an identity mark. The sites for these marks shall be situated so that the marks are clearly visible when attached. Note: The incorporation in the meter casing of a counter indicating the hours run will make it evident if the power supply has been disconnected.

IMC HEAT METERS are in compliance. The registers carrying the total KWH are software sealed. The only alteration that can be done is to RESET THE KWH COUNTERS TO ZERO

6.5 Supply voltage

The instrument shall be fully operational and shall not exceed the maximum permissible errors if the electric power supply is influenced as described in 6.5.1 to 6.5.4.

IMC HEAT METERS are in compliance. Energy totals are internally stored in NON VOLATILE

MEMORIES and can not be altered or suffer memory loss in the event of powered FAILURES.

6.5.1 Instruments supplied by AC mains supply

• Variations in AC mains voltage of – 15 % to + 10 % related to the instrument's rated nominal voltage.

• Variations in AC mains frequency of – 2 % to + 2 % related to the instrument's rated nominal frequency.

IMC HEAT METERS are in compliance.

6.5.2 Instruments supplied by external AC or DC low voltage (< 50 V)

• Variations in AC remote voltage of □50 % related to the instrument's rated nominal voltage.
• Variations in DC remote voltage of – 50 % to + 75 % related to the instrument's rated nominal voltage.
NOT APPLICABLE

6.5.3 Instruments supplied by internal non-rechargeable batteries or rechargeable

batteries that cannot be (re)charged during the operation of the measuring instrument

When the battery voltage has dropped to a critical value, this shall be clearly indicated by the instrument at a time safely before the instrument starts functioning improperly (resulting in for instance poor display, unstable memory function, errors exceeding MPE, etc.), or the instrument shall automatically switch off, storing actual data and time at the moment of switching off for a period of at least 1 year. The moment of switching off may be preprogrammed. The minimum period of time during which the instrument shall function properly without renewing or recharging batteries shall be specified by the manufacturer, and shall be at least 2 years.

NOT APPLICABLE. IMC HEAT METERS have no batteries

6.5.4 Instruments supplied by internal rechargeable batteries that are intended to be (re)charged

during the operation of the measuring instrument

These instruments shall:

either comply with the requirements for battery supplied instruments (6.5.3) with the external supply switched off (manually or by accident),

or comply with the requirements for instruments supplied by external AC or DC low voltage (6.5.2) with the external supply switched off (manually or by accident), and shall additionally:

comply with the requirements for AC-powered instruments (6.5.1) with the mains supply switched on.

NOT APPLICABLE. IMC HEAT METERS have no batteries

Section 7: Specified working range

- **The working parameters of the heat meter are bounded by the limiting values of the temperature range, the temperature difference, the thermal power and the flow rates (qs and qi). If the measurement of heat is affected by the pressure of the heat-conveying liquid, pressure shall be regarded as a parameter.**
  IMC HEAT METERS are in compliance.

7.1 Temperature difference

The ratio of the upper and lower limits of the temperature difference shall not be less than 10. The lower limit shall be stated by the supplier to be either 1, 2, 3, 5 or 10 K. The preferred value is 3 K.

IMC HEAT METERS use lower temperature difference LIMIT of 3K (5.4F) as recommended.

7.2 Flow rate

- **The ratio of the permanent flow rate to the lower limit of the flow rate (qp/qi) shall be 10, 25, 50, 100 or 250.**

IMC HEAT METERS use the permanent flow to the lower limit of the flow rate of 10 as recommended.

Section 8: Heat Transmission Formula

Heat transmitted to or from a body of liquid can be determined from knowledge of its mass, specific heat capacity and change in temperature.

The conventional true value of the heat coefficient k for water, if it is used as the system heat-conveying liquid, shall be obtained from the formulas (A.1.) to (A.5.) in Annex A, where the pressure shall be set to 16 bar.

For meters intended for use with heat-conveying liquids other than water, the supplier shall declare the heat coefficient used as a function of temperature and pressure.

Note: Tables with values for the heat coefficient for liquids other than water can be found in the book Handbuch der Wärmeverbrauchsmessung, by Dr. F. Adunka, Vulkan-Verlag, Essen, ISBN 3-8027-2373-2

The heat meter is meant to be used with the following heat-conveying fluid. Heat coefficient information will be supplied for the applicable fluid.

Water

IMC HEAT METERS are in compliance with above listed Annex A as well as with constants published by ASHRAE.

Other fluid

IMC HEAT METERS are in compliance with PROPYLENE GLYCOLS as manufactured by
1) DOW CORNING ™ DOW FROST-HD
2) NOBLE COMPANY ™ NO BURST-HD

Section 9: Metrological characteristics (maximum permissible errors, MPEs)

Heat meters shall meet the tolerances stated which are considered as being the maximum permissible errors in type approval tests, initial and subsequent verification.

9.1 General

- **9.1.1 Flow sensors of heat meters and complete instruments belong to one of the following three accuracy classes: class 1, class 2 and class 3. The class of the complete instrument is determined by the class of the flow sensor.**

- **9.1.2 The maximum permissible errors of heat meters, positive or negative, in relation to the conventional true value of the heat, are defined as relative errors varying as a function of the temperature difference and flow rate.**

- **9.1.3 The maximum permissible errors of subassemblies, positive or negative, are calculated from the temperature difference in the case of the calculator and the temperature sensor pair and from the flow rate in the case of the flow sensor.**

- **9.1.4 The relative error, E, is expressed as:**

E = (Xd – Xc) / Xc *100 %
Where:
Xd is the indicated value;
Xc is the conventional true value.

9.2 Values of maximum permissible errors

9.2.1 Maximum permissible relative errors of a complete instrument

The MPEs of a complete instrument are calculated as a function of the temperature difference ratio (Δθ min/Δθand the flow rate ratio (qp/q). The MPEs of the complete instrument of accuracy classes 2 and 3 are the arithmetic sums of Ec (in 9.2.2.1), Et (in 9.2.2.2) and Ef (in 9.2.2.3). The classes of heat meters are defined by the class of the flow sensor.

Class 1: see note in 9.2.2.3
Class 2 and Class 3: E = Ec + Et + Ef

9.2.2 Maximum permissible relative errors of sub-assemblies

9.2.2.1 Calculator

Ec= (0.5 + Δθ min/Δθ where the error, Ec, relates the value of the heat indicated to the conventional true value of the heat.

As recommended sec 7.1 use lower temperature difference LIMIT of 3K (5.4F)

IMC COMPLIANCE STATEMENT

All of our ENERGY METERS over the specified fluid temperature range of :
Minimum Temperature:60F (15.5C)
Maximum Temperature: 220F (104.4C)
The Fluids included are :
1) WATER
2) PROPYLENE GLYCOL … Dow Frost-HD and No Burst-HD

Maximum allowable Calculator Error
Ec= .5 + 5.4F/5.4 = 1.5% error at min Temp Diff
Ec = .5 + 5.4F/50F = .51% error at max Temp Diff

IMC HEAT METERS have a maximum CALCULATOR error of 0.4%
IMC HEAT METERS are in compliance.

9.2.2.2 Temperature sensor pair

Et = (0.5 + 3 Δθ min/Δθ

where the error, Et, relates the indicated value to the conventional true value of the relationship between temperature sensor pair output and temperature difference. The relationship between temperature and resistance of each single sensor of a pair shall not differ from the values of the formula given in IEC 60751 (using the standard values of the constants A, B and C) by more than an amount equivalent to 2 K.

IMC COMPLIANCE STATEMENT

Min Temp Diff rec. 5.4F(3K), Max Temp Diff is 50F (18C)
Allowable Temperature difference Error "Et"
Et=.5 + 3 * 5.4F/5.4F = 3.5% error at min Temp Diff
Et=.5 + 3 * 5.4F/50F = 3.1% error at max Temp Diff

IMC HEAT METERS error at MAX Temp Diff is +/-0.2F/50.0 = 0 .4%
at MIN Temp Diff is +/-0.18/F5.4 = 3.5%
IMC HEAT METERS are in compliance.

9.2.2.3 Flow sensor

Class 1: Ef = See note

Class 2: Ef = (2 + 0.02 qp/q), but not more than 5 %

As recommended in sec 7.2 use qp/qi= 10

IMC COMPLIANCE STATEMENT for CLASS 2

Allowable Flow Sensor Error "Ef"
Ef = (2 + 0.02 qp/q)= (2+.02 *10) = 2.2%
IMC FLOW METERS have a maximum of 2.0 % error over the active measuring range
IMC HEAT METERS are in compliance.

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Class 3: Ef = ±(3 + 0.05 qp/q), but not more than ±5 %

As recommended in sec 7.2 use qp/qi= 10
IMC COMPLIANCE STATEMENT for CLASS 3
Allowable Flow Sensor Error "Ef"
Ef = ±(3 + 0.05 qp/q) = (3+.05 * 10) = 3.5%
IMC FLOW METERS have a maximum of 2.0 % error over the active measuring range
IMC HEAT METERS are in compliance.

where the error, Ef, relates the indicated value to the conventional true value of the relationship between flow sensor output signal and mass or volume.

Note: E and Ef for class 1 will be defined when improvements in testing procedures and flow sensors make it possible.

The definitions for class 1 flow sensors could be presumed to be:

- **For complete meters:**
  E = ±(2 + 4Δθ min/Δθ + 0.01 qp/q).

- **For flow sensors:**
  Ef = ±(1 + 0.01 qp/q), but not more than ±3.5 %.

It is presumed that these maximum permissible errors could be applied to heat meters with flow sensors of qp ≥100 m3/h.

The heat meter meets the previous criteria for the following class:
Class 1
NOT IN COMPLIANCE.
Class 2
IMC HEAT METERS are in compliance.
Class 3
IMC HEAT METERS are in compliance.

9.3 Application of maximum permissible errors

9.3.1 For a combination of sub-assemblies as defined in 3.4, the maximum permissible error for the combination is the arithmetic sum of the maximum permissible errors of all sub-assemblies.

IMC HEAT METERS are in compliance.

9.3.2 The errors of combined instruments shall not exceed the arithmetic sum of the maximum permissible errors of the sub-assemblies indicated in 9.2.2.1 to 9.2.2.3.

IMC HEAT METERS are in compliance.

9.3.3 Suppliers of combined instruments can stipulate that they shall be considered as complete instruments for the application of the maximum permissible errors.

IMC HEAT METERS are in compliance.

9.4 Maximum permissible errors in service
Where different values for maximum permissible errors in service and at verification are prescribed by national regulations, the values of the maximum permissible errors in service shall be equal to 2 times the maximum permissible errors fixed for verification.

IMC HEAT METERS are in compliance.

Section 10: Environmental classification
Heat meters shall conform to one or more of the following environmental classifications according to
the application.

10.1 Environmental class A (domestic use, indoor installations)
• Ambient temperature: + 5 °C to + 55 °C
• Low level humidity conditions
• Normal electrical and electromagnetic conditions
• Low level mechanical conditions

10.2 Environmental class B (domestic use, outdoor installation)
• Ambient temperature: – 25 °C to + 55 °C
• Normal level humidity conditions
• Normal electrical and electromechanical conditions
• Low level mechanical conditions

10.3 Environmental class C (industrial installations)
• Ambient temperature: + 5 °C to + 55 °C
• Normal level humidity conditions
• High electrical and electromagnetic conditions
• Low level mechanical conditions

The heat meter meets the previous criteria for the following class:
IMC HEAT METERS COMPLIES with Environmental Class A
IMC HEAT METERS COMPLIES with Environmental Class C

Section 11: Heat meter specifications, inscriptions and instruction manual
Each heat meter shall be accompanied by an instruction manual and data sheets, which shall include all the information listed in 11.1 to 11.4.
IMC HEAT METERS are in compliance.

A heat meter and/or its sub-assemblies shall be marked clearly and indelibly with the information listed in *italics* in 11.1, 11.2, 11.3 and 11.4.
IMC HEAT METERS are in compliance.

11.1 Flow sensor
• *Supplier (name or trade mark)*
IMC INSTRUMENTS

• *Type identification, year of manufacture, serial number*
See individual product label
• *Accuracy class*
IMC HEAT METERS are in compliance with CLASS 2 and 3
• *Limits of flow rate (qi, qp and qs)*
See individual Flow meter name plate
• *Limits of temperature (min and max)*
Minimum Temperature is 60F. Max Temperature is 200F
• *Maximum admissible working pressure (PN-class)*
See individual Flow meter name plate
• *One or more arrows to indicate the direction of flow*
• *Environmental class*
IMC HEAT METERS COMPLIES with Environmental Class A and C
• *Heat conveying liquid if other than water*
1) DOW CORNING ™ DOW FROST-HD
2) NOBLE COMPANY ™ NO BURST-HD
• *Nominal meter factor (litres/pulse or corresponding factor for normal output)*
NOT APPLICABLE
• *Orientation limitations for installing the meter*
See individual Flow meter name plate
• **Maximum pressure loss (pressure loss at qp)**
See individual Flow meter name plate
• **Installation requirements, including installation pipe lengths**
see manual : EMP1 OP & INSTALL INSTRUC 5-15-10
• **Physical dimensions (length, height, width, weight, thread/flange specification)**
see manual : EMP1 OP & INSTALL INSTRUC 5-15-10
• **Output signal for rated operation (type/levels)**
NOT APLICABLE

• **Output signal for testing (type/levels)**
NOT APPLICABLE
• **Performance at flow rates greater than qs**
NOT RECOMMENDED
• **Low flow threshold value**
See individual Flow meter name plate
• **Response time - for fast response meters**
5 SECONDS
• **Mains power supply requirements - voltage, frequency**
115VAC, 60HZ
• **Battery power supply requirements – battery voltage, type, life-time**
NOT APPLICABLE- No batteries. Stores in permanent memory

11.2 Temperature sensor pair
• *Supplier (name or trade mark)*
IMC INSTRUMENTS
• *Type identification, e.g. Pt 100, year of manufacture, serial number*
NTC THERMISTOR 10K, serial number marked with each sensor pair
• *Limits of temperature (min and max)*
Minimum Temperature is 60F. Max Temperature is 220F

• *Limits of temperature difference (min and max)*
MINIMUM Temperature Diff is 5.4F. Max temperature Diff is 50F
• *Maximum admissible working pressure for direct mounted sensors (PN-class)*
MAX pressure is 250 PSIG
• *Identification of flow and return temperature sensors, if needed*
NOT APPLICABLE
• **Wiring of sensors (e.g. 4- or 2-wire)**
2 WIRE
• **Total resistance of a 2-cable wire**
20OHMS max. See manual : EMP1 OP & INSTALL INSTRUC 5-15-10
• **Principle of operation**
BRIDGE EXCITATION
• **Maximum RMS value of sensor current**
One Milliamp
• **Physical dimensions**
1/4" diameter . See manual : EMP1 OP & INSTALL INSTRUC 5-15-10
• **Installation requirements (e.g. for pocket mounting)**
Direct and in Thermowells. See manual : EMP1 OP & INSTALL INSTRUC 5-15-10
• **Maximum liquid velocity for sensor over 200 mm length**
2 feet per second
• **Minimum immersion depth**
One inch. See manual : EMP1 OP & INSTALL INSTRUC 5-15-10
• **Output signal for rated operation (type/levels)**
NOT APPLICABLE
• $\tau_{0.5}$ **response time**
3 seconds

11.3 Calculator
• *Supplier (name or trade mark)*
IMC INSTRUMENTS
• *Type identification, year of manufacture, serial number*
See individual product label
• *Type of temperature sensors (e.g. Pt 100 or Pt 500, etc.)*
NTC THERMISTOR 10K
• *Environmental class*
IMC HEAT METERS COMPLIES with Environmental Class A and C
• *Installation requirements, including wiring of temperature sensors, indication if shielding is necessary or not*
see manual : EMP1 OP & INSTALL INSTRUC 5-15-10
• *Limits of temperature (min and max)*
Minimum Temperature is 60F. Max Temperature is 220F
• *Limits of temperature difference (min and max)*
MINIMUM Temperature Diff is 5.4F. Max temperature Diff is 50F
• *Required input signal from the flow sensor*
PLUG and PLAY connection from IMC Flow meter
• *Heat conveying liquid if other than water*
1) DOW CORNING ™ DOW FROST-HD
2) NOBLE COMPANY ™ NO BURST-HD
• *Flow sensor to be operated at the flow or return temperature*
At the RETURN
• **Display unit options (MJ, kWh)**

KWHRS

• Dynamic behavior (circumstances of temperature measurement and integration)

Intergral Time is summated and completed every 17 seconds

• Maximum value of thermal power (Ps)

500 KW

• Other functions in addition to heat indication

Differential Temperature Controller

• Physical dimensions

See manual : EMP1 OP & INSTALL INSTRUC 5-15-10

• Mains power supply (voltage, frequency)

115 VAC at 60 HZ

• Battery power supply requirements (battery voltage, type, lifetime)

NOT APPLICABLE. USES PERMANENT MEMORIES

• RMS value of temperature sensor current

One Milliamp

• Maximum permissible flow sensor signal (pulse rate)

NOT APLICABLE

• Output signal for normal operation (type/levels)

NOT APLICABLE

• Output signal for testing (type/levels)

NOT APLICABLE

11.4 Complete instrument

• *Supplier (name or trade mark)*

IMC INSTRUMENTS

• *Type identification, year of manufacture, serial number*

See individual product label

• *Limits of flow rate (qi, qp and qs)*

See individual product label

• *Limits of temperature (min and max) of the flow sensor/temperature sensor pair*

Minimum Temperature is 60F. Max Temperature is 220F

• *Limits of temperature difference (min and max)*

MINIMUM Temperature Diff is 5.4F. Max temperature Diff is 50F

• *Accuracy class*

IMC HEAT METERS are in compliance with CLASS 2 and 3

• *Maximum admissible working pressure (PN-class)*

See individual product label

• *Environmental class*

IMC HEAT METERS COMPLIES with Environmental Class A and C

• *Maximum admissible working pressure for the flow sensor, MAP*

See individual product label

• *Heat conveying liquid if other than water*

1) DOW CORNING ™ DOW FROST-HD

2) NOBLE COMPANY ™ NO BURST-HD

• *Meter to be installed in flow or return*

Flow meter to be installed in RETURN

• *One or more arrows to indicate the direction of flow*

See individual product label

• *Orientation limitations for installing the meter*

See individual product label

• Display unit option (MJ, kWh)

KWHRS
• Other functions in addition to heat indication
Differential Temperature Controller
• Maximum value of thermal power (Ps)
500KW
• Low flow threshold value
See individual product label of FLOW METER
• Maximum pressure loss of flow sensor (pressureloss at qp)
See manual : EMP1 OP & INSTALL INSTRUC 5-15-10
• Installation requirements, including installation pipe lengths
See manual : EMP1 OP & INSTALL INSTRUC 5-15-10
• Physical dimensions (length, height, width, weight, thread/flange specification)
See manual : EMP1 OP & INSTALL INSTRUC 5-15-10
• Mains power supply requirements (voltage, frequency)
115 VAC at 60HZ
• Battery power supply requirements (battery voltage, type, lifetime)
NOT APPLICABLE. USES PERMANENT MEMORIES
• Output signal for normal operation (type/levels)
NOT APLICABLE
• Output signal for testing (type/levels)
NOT APLICABLE
• Performance at flow rates greater than qs
NOT RECOMENDED
• Response time for the temperature sensor pair
5 seconds
• Response time, for fast response meters
5 seconds

Section 12: Information to be delivered with the heat meter or sub-assemblies
Installation instructions under the following heading shall include at least the following information.

Flow sensor:
See manual : EMP1 OP & INSTALL INSTRUC 5-15-10
- **flushing the system before installation;**
- **installation in flow or return as stated on calculator;**
- **minimum straight installation pipe length upstream and downstream;**
- **orientation limitations;**
- **need for flow straightener;**
- **requirement for protection from risk of damage by shock and vibration;**
- **requirement to avoid installation stresses from pipes and fittings.**

Temperature sensor pair:

See manual : EMP1 OP & INSTALL INSTRUC 5-15-10
- **possible need for symmetrical installation in the same pipe size;**
- **use of pockets or fittings for temperature sensor;**
- **use of thermal insulation for pipe and sensor heads.**

Calculator (and flow meter electronics):

See manual : EMP1 OP & INSTALL INSTRUC 5-15-10

- **free distance around the meter;**
- **distance between meter and other equipment;**
- **need for adapter plate to fit standardized holes.**

Wiring

See manual : EMP1 OP & INSTALL INSTRUC 5-15-10

- **need for earth connection;**
- **maximum cable lengths;**
- **required separation between signal and power cables;**
- **requirement for mechanical support;**
- **requirements for electrical screening.**

Other

See manual : EMP1 OP & INSTALL INSTRUC 5-15-10

- **initial function check and operation instructions;**
- **installation security sealing.**

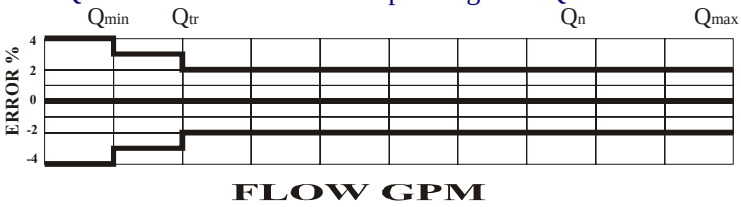
IMC ENERGY METER PERFORMANCE SPECIFICATIONS SECTION

THERMAL ENERGY METER MODEL " EAGLE 2 EMP1 " 1-5-2010

PERFORMANCE SPECIFICATIONS

The ENERGY METER shall consist of the following :

1) Flow meter having an error no greater than 2.0 % over the measuring range from its minimun transitional flow Qtr to its maximum normal operating flow Qn. See below



The flow meter must have test certificates showing conformance to the above required accuracies by approved test methods or labs. In order to minimize other possible sources of error, installation guide lines for proper fluid entry and exit to the flow meters must be strictly adhered to.

For Physical and Electrical specifications please refer to attached Flow meter specifications and or Literature.

2) Two Precision Matched IMMERSION Temperature sensors with a temperature difference error no greater than 0.2 degrees F from a measured temperature of 77 F (25C) to 220 F (104.4C). Insure that the temperature sensors are properly exposed to the heat transfer fluid media and insulated from the effects of external temperatures.

The Temperature sensors must have a test certificate that is NIST traceable showing conformance to the stated accuracies of this specification .

3) Differential Solar Temperature Controller with four-matched temperature channels and a built in

ENERGY METER TOTALIZER using the precision sensors and the flow meter to provide a sum total of the accumulated thermal energy to be displayed in a continuous RUNNING TOTAL of Electrical equivalent of thermal energy expressed in KILOWATT HOURS. The sum total can be manually reset to Zero only. No other alterations to the VALUE are possible. For Physical and Electrical specifications please refer to attached Flow meter specifications and or Literature.

4) Energy Computer to calculate and Totalize the Thermal Energy elements with a maximum of a 17 second interval frequency. The calculations must follow well-established calorimetric methology as set forth by the ASHRAE HAND BOOK of FUNDAMENTALS. Physical constants for the heat transfer fluid must be accurately defined for the Density and Specific Heat of the heat transfer fluid every 10 degrees F from a temperature of 77 F (25C) to 220 F (104.4C) and must be included in the energy content calculations. If Glycol is part of the Heat Transfer fluid, the Density and Specific Heat constants obtained form a recognized Laboratory must also be included in accordance with the water to Glycol mixture and temperatures that the fluid is at when the energy measurements are made.

a) The Kilowatt-Hours readings will be stored in the energy computer's PERMANENT memory and retained for a period of at least 12 years. NO BATTERIES ARE REQUIRED. The maximum number of Kilowatt-Hours is 830,000 at which time the contiguous counter will reset to ZERO and start over again.

PERFORMANCE SPECIFICATIONS cont

b) The over all accuracy of the Thermal Energy meter is dependant on the magnitude of the heat transfer fluid temperature increase thru the solar collection as follows:

Temp Diff	Flow Mtr Error	Sensor error	Calculator error	MAXIMUM TOTAL error
50.0 F **	+/- 2.0% Max	+/-0.2F/50.0 = 0 .4%	+/- 0.4%	2.8%**
14.0 F	+/- 2.0% Max	+/-0.2F/14.0 = 1.4%	+/- 0.4%	3.8%
11.2 F	+/- 2.0% Max	+/-0.2F/11.2 = 1.8%	+/- 0.4%	4.2%
7.5 F	+/- 2.0% Max	+/-0.2/F7.5 = 2.6%	+/- 0.4%	5.0%
5.4 F**	+/- 2.0% Max	+/-0.18/F5.4 = 3.5%	+/- 0.4%	5.9%**
3.5 F	+/- 2.0% Max	+/-0.2F/3.5 = 5.7%	+/- 0.4%	8.1%

-- Currently The following PROPYLENE GLYCOLS are approved and stored in our computers for use with IMC ENERGY METERS …

Dow Frost-HD -The Dow Chemical
No Burst-HD - The Noble Company

As other Glycols are approved they will be characterized and entered into the IMC Energy METERS. Please contact the factory for additional information

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