CLAIMS

1. A method implemented by computer to calculate in real time the methane number MN of a liquefied natural gas contained in a tank (1) containing natural gas being distributed into:

- a layer of natural gas (11) in the liquid state (1) defined at a given instant t by the temperature T(t) thereof and the density p(t) thereof, said layer of natural gas (11) being in balance with

- a layer of natural gas (12) in the gaseous state (g), defined at a given instant t by the pressure P(t) thereof;

said method being characterised in that it consists of an algorithm comprising, at the given instant t, the following steps:

A. determining, by measuring, the temperature T_0(t) and the density p_0(t) of the layer of natural gas (11) in the liquid state (1), and the pressure Po(t) of the layer of natural gas (12) in the gaseous state (g);

B. approached calculation of the composition of liquefied natural gas (11) contained in the tank (1), by a stressed minimum calculation algorithm, said algorithm comprising the following subs-steps:

b1) determining, by calculating stressed minimum, a first composition of density p_0(t) and to pressure Po(t), or a first envelope of compositions having the same density p_0(t) to pressure Po(t);

b2) determining, by calculating stressed minimum, a second envelope of compositions having the same density p_0(t) to temperature T_0(t) and to pressure

Po(t), and of which the temperature balance $T_{eq}(t)$ to pressure Po(t) is equal to $T_0(t)$;

b3) determining a non-singular point of the second envelope giving a composition approaching the real composition of LNG, the non-singular point of the second envelope being a) the barycentre of the second envelope or the point of the second envelope which is the closest to the barycentre of the second envelope, or b) being calculated as the renormalized average of the normalized compositions of the second envelope, or c) being determined by using other known types of singular points from said barycentre and said renormalized average; and

b4) calculating the methane number MN from said approaching composition.

2. The method according to claim 1, wherein step b1) for determining the first envelope of compositions is carried out as follows, by seeking to resolve the following equations:

$$\min \rho(x, P\circ) - \rho_0$$
$$s.t \begin{cases} \rho(x, P\circ) - \rho_0 \geq 0 \\ \sum x_i = 1 \\ x_i^l \leq x_i \leq x_i^u \end{cases}$$

with:

p meaning the density calculated from x and $P_\circ$,

p_0 meaning the density measured,

Po meaning the pressure measured,

x meaning the composition vector, composed of x_i,

x_i meaning the molar fraction of the component i, the exponents l and u respectively making reference to the lower and upper limit of this molar fraction.

3. The method according to claim 1, wherein step b1) for determining the first envelope of compositions is carried out as follows, by seeking to resolve the following equations:

$$\min((\rho(x, P\circ) - \rho_0)^2)$$
$$s.t \begin{cases} \sum x_i = 1 \\ x_i^l \leq x_i \leq x_i^u \end{cases}$$

with:

p meaning the density calculated from x and Po,

p_0 meaning the density measured,

Po meaning the pressure measured,

x meaning the composition vector, composed of x_i,

x_i meaning the molar fraction of the component i, the exponents l and u respectively making reference to the lower and upper limit of this molar fraction.

4. The method according to any one of the preceding claims, wherein step b2) for determining the second envelope of compositions is carried out as follows by seeking to resolve the following equations:

$$\min T_{eq}(x, P\circ) - T_0$$
$$s.t \begin{cases} T_{eq}(x, P\circ) - T_0 \geq 0 \\ \rho(x, P\circ) - \rho_0 = 0 \\ \sum x_i = 1 \\ x_i^l \leq x_i \leq x_i^u \end{cases}$$

with:

T_0 meaning the temperature measured,

T_{eq} meaning the temperature balance of LNG at pressure Po,

p meaning the density calculated from x and Po,

p_0 meaning the density measured,

Po meaning the pressure measured,

x meaning the composition vector, comprised of x_i,

x_i meaning the molar fraction of the component i, the exponents l and u respectively making reference to the lower and upper limit of this molar fraction.

5. The method according to any one of claims 1 to 3, wherein step b2) for determining of the second envelope of compositions and carried out as follows by seeking to resolve the following equations:

$$\min((T_{eq}(x,P\circ)-T_0)^2)$$
$$s.t\begin{cases}\rho(x,P\circ)-\rho_0=0\\ \sum x_i=1\\ x_i^l\le x_i\le x_i^u\end{cases}$$

with:

T_0 meaning the temperature measured,

T_{eq} meaning the temperature balance of LNG at pressure $P_\circ$,

p meaning the density calculated from x and Po,

p_0 meaning the density measured,

Po meaning the pressure measured,

x meaning the composition vector, comprised of x_i,

x_i meaning the molar fraction of the component i, the exponents l and u respectively making reference to the lower and upper limit of this molar fraction.