

**ET – ENRG – GD Nr 6**

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**TECHNICAL SPECIFICATION  
TRANSPORT SYSTEM  
FOR CNG CONTAINERS MODULES**



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## PART 1 – GENERAL ASPECTS

### 1.1 PURPOSE

Project, construction, tests, licenses and revision of transport systems for CNG **container modules** regulation as regards road transportation of hazardous substances. It shall be a supplement to the law in force or the one superseding it.

### 1.2 SCOPE

It applies to all the systems made up of CNG **container modules** and their **transport**, so as to supply natural gas to fixed installations, where it is not technically or economically viable to lay out or increase the transportation capacity of a pipeline devoted to:

- Distribution grids,
- CNG Satellite Filling Stations
- Industries, or
- Farming activities.

Fixed installations for filling and discharging transport units, and the natural gas distribution grids and internal discharging installations shall be approved by an only Distribution Licensee.

### 1.3 DEFINITIONS

The following definitions apply to this specification:

**ENARGAS:** Ente Nacional Regulador del Gas (National Entity of Gas Regulation).

**CNG Cylinder (Cylinder):** Seamless steel container, manufactured according to one of the standards recognized by Ente Nacional Regulador del Gas (ENARGAS), in its Resolution 138/95 and future ones, used for **CNG** storage at a 250 bar maximum working pressure and 150 liters maximum water volume capacity.

**Manufacturer (Constructor):** Physical or legal Person with enough civil, technical, economic and financial responsibility qualified to be registered as **transport** manufacturer in ENARGAS Registry of Qualifying Licenses.

**CNG:** Compressed Natural Gas.

**Container module (module):** Set of **CNG cylinders** and fittings and the metallic self-portable structure supporting them; transportable; fixed to the transport unit or dismountable and replaceable or interchangeable.

**Operator:** Physical person or legal Entity with enough civil, technical, economic and financial capacity to operate the CNG **transport** and that:

- Complies with the requirements of Law 24.449 (Traffic and Road Safety), its regulation and particularly, Annex S (Rule for the transport of dangerous goods by road), its supplementary standards or amendments and other applicable national, provincial or municipal standards;
- Complies with the requirements of this document; and
- Covers all the risks involved in road vehicle operation and CNG transport, with the corresponding unlimited insurance against liabilities to third parties,

**Certification Organization (CO):** Entity accredited by ENARGAS according to Resolution ENARGAS N° 138/95, and its related ones or amendments.

**Technical Representative (TR):** Engineer duly skilled and qualified in the design, construction, operation or inspection of high pressure cylinders or in road or other ways of transport of combustible substances. He shall be registered at the corresponding Professional Association and licensed by a Gas Distribution Licensee as first class installer.

**Transport unit:** Vehicle for the transport of one or more **modules**, licensed to transport hazardous goods by national roads, according to the national provisions in force.

Note: If transport is performed within a certain province, the corresponding provincial law shall apply, and in case of there not being any law, transport shall be performed according to the corresponding national law.

#### 1.4 APPLICABLE AND REFERENCE DOCUMENTS

Law N° 24.449, Traffic and Road Safety

Regulatory decree N° 779/95, Traffic and Road Safety

Law N° 24.653, Road Transportation of Goods

Regulatory decree N° 105/98 of the Law for Road Transportation of Goods

Resolution N° 195/97 - Transportation of Hazardous Goods issued by the Secretariat of Works, Public Services and Transport - S.O.P.Y.T.

Resolution ST Nr. 110/97 and its amendment Nr. 65/2000 - Road Transportation of Hazardous Goods issued by the Secretariat of Transport

GE-N1-115: Regulation. Definitions and Terminology, Specifications and Procedures. Technical documentation to be complied with by all the categories registered in the manufacturer and importer's registry.

GE-N1-116: Minimum technical and safety standards and specifications for on-board CNG Fuel Systems installation and testing.

GE-N1-117: Technical standards for components designed to operate with compressed natural gas (CNG) in carbureted vehicles and operation requirements.

GE-N1-118: Regulation for CNG Filling stations.

GE-N1-121/1986: Standards about in bulk transport of Liquefied Petroleum Gases by road or waterways.

GE-N1-144: Technical specification for periodic inspection of CNG seamless steel cylinders according to IRAM 2529 standard.

ENARGAS, ET-ENRG-GD N° 2, Revision 1, 2/9/97: Technical Specification – Motor Vehicles for CNG Transport.

ANSI B 31.3: “Code for Pressure Piping – Chemical Plant and Petroleum Refinery Piping”.

API RP 520: “Recommended Practice for the Design and Installation of Pressure-Relieve Systems in Refineries”.

API RP 576: “Recommended Practice for the Inspection of Pressure Relieve Devices”.

CGA S-1.1 of Compressed Gas Association, Inc.: “Pressure Relief Device Standards Part 1-Cylinders for Compressed Gases”.

IAP-CA-3.01: Industrial use, Bourdon Type Pressure Gauges.

IRAM 2670: Non cryogenic tanks for the transport of compressed, liquefied and pressure dissolved gases.

IRAM 5144: Steel nuts. Characteristics, methods of test and marking.

IRAM 5214: ISO metric thread screws, bolts and steel studs, with total diameter not wider than 39 mm. Material characteristics, labeling, marking and methods of test.

IRAM-IAS U 500-169: Welding. Inspector’s qualification and certification.

IRAM-IAS U 500-138: Welding. Inspector’s qualification and certification.

ANSI/AGA-CGA NGV 1: “Compressed Natural Gas Vehicle (NGV) Fueling Connection Devices”.

SAE J133 “Fifth Wheel Kingpin Performance - Commercial Trailers and Semi trailers – Recommended Practice”.

SAE J684 “Trailer Couplings, Hitches and Safety Chains - Automotive Type - Standard”.

SAE J685 “Data Plate – Automotive Type Trailers – Recommended Practice”.

SAE J697 “Safety Chain of Full Trailers or Converter Dollies” – Recommended Practice.

SAE J700 “Fifth Wheel Kingpin - Commercial Trailers and Semi trailers – Standard”.

SAE J701 “Truck Tractor Semi trailer Interchange Coupling Dimensions – Information Report”.

SAE J847 “Full Trailer Tow Bar Eye – Recommended Practice” .

SAE J848 “Fifth Wheel Kingpin, Heavy Duty - Commercial Trailers and Semi trailers – Recommended Practice” .

SAE J849 “Connections and accessory locations for towing double trailers and multi-axle trailers – Recommended Practice” .

Draft of standard NAG-142 “Argentine standard for CNG in bulk transport of cylinder groups or tubes” (1994).

Draft of standard NAG-143 “Argentine standard for the project, construction, operation and maintenance of in-bulk CNG and PNG filling and discharging Plants.” (draft 2, 1999).

Draft1 of standard IRAM 2671- August 1<sup>st</sup>, 1998: Tanks for the transport of dangerous or environmentally hazardous, flammable, toxic or corrosive substances.

**Note:** *The versions of the quoted standards and specifications shall be the last updated ones, previously considered by ENARGAS.*

## **1.5 ROUTING AND PARKING**

### **1.5.1 Routing**

Delays in reaching the destination point shall be reasonably avoided, when the transport unit is filled with CNG,

The transport unit shall not be used as storage unit.

The transport unit shall not be used to tow any type of vehicle when transporting natural gas.

Routing shall be planned by the operator and its possible alternatives, complying with Section III of “General Regulation for Road Transportation of Hazardous Goods “, Decree Nr. 779/95, Annex S. The operator shall control the routing compliance and departure and arrival times shall be recorded.

### **1.5.2 Parking**

Parking of transport units, other than the one required for filling and discharging, shall be at open areas:

- Away from hazardous flammable substances or open flames.; and
- Other than residential, densely populated areas, areas where people or vehicles concentrate or public spaces.

In case of emergency, the indications given in paragraphs 1 and 2, subsection 26 of Section III of “General Regulation for the transport of hazardous goods by road”, Decree 779/95, Annex S, shall govern.

## 1.6 REQUIREMENTS FOR QUALIFICATION OF TRANSPORTATION PERSONNEL

Transport unit drivers shall be qualified according to the requirements indicated by the law in force or one superseding it.

Drivers shall comply with regulatory decree 779/95 of Traffic Law N°24449, especially Annex S; and the supplementary Resolution N° 110/97 of the Transport Secretariat and its amendment N° 65/2000 (Mandatory Basic Training Course for Drivers of Vehicles used to transport dangerous or environmentally hazardous goods by road).

At least the following shall be taken into account so as to comply with the requirements of Section 8° of the Transport Secretariat Resolution N° 110/97 (specific training):

- ✓ Manuals indicated in 5.1.10 y 5.1.11 of this Technical Specification,
- ✓ Concepts included in the "Sample Chart for drivers of CNG container modules transport units" included in ANNEX I of this Technical Specification,
- ✓ Routing or pre determined route according to point 1.5.1 of this technical specification, and
- ✓ The prohibition of filling or discharging natural gas in not legally authorized facilities.

The Person shall have completed his elementary school in all these cases.

Furthermore, in order to be fit to drive a semi-trailer truck, one (1) year driving experience of motor vehicles transporting heavy loads shall be required.

## 1.7 RESPONSIBILITIES

### 1.7.1 Routing

The following cases may be taken into account according to the natural gas destination:

#### 1.7.1.1 Supply to a distribution grid

The Distribution Licensee or Sub distributor shall be in charge of the transport operation.

It may act as Operator as defined in point 1.3 or recognize another person or legal entity so as to comply with the requirements indicated in that point.

#### 1.7.1.2 Supply to industry, farming activity or CNG Satellite Filling Station

The Operator and the Technical Representative shall be jointly responsible. Based on the definitions of point 1.3, the Operator shall be recognized and controlled by a Distribution Licensee.

#### 1.7.1.3 Simultaneous Supply

When the transport unit provides natural gas to a distribution grid and to any or all of the ones indicated in 1.7.1.2 simultaneously, the requirements of point 1.7.1.1 shall apply.



## **1.7.2 RELATED STEADY INSTALLATIONS**

The following installations are not included in the scope of this Technical Specification, and are covered by other standards; however, the following indications are provided since they comprise a system with the transport.

### **1.7.2.1 Filling and discharge**

On-site Installations for transport units filling and discharging shall be licensed and controlled by the Distribution Licensee. The following standards shall apply: GE-N1-118, draft of standard NAG 143 or technical documents superseding them, notwithstanding the requirements of the regulation in force.

### **1.7.2.2 Internal installations**

On-site installations of the items indicated in 1.7.1.2, for the use of transported natural gas shall be governed by the same standards of similar distribution grid supplied installations.

## **1.7.3 NATURAL GAS FILLING PERMIT**

Natural gas filling permit issued by a Distribution Licensee shall be shown by the Driver previous to the filling and the filling plant shall verify it is valid and not expired.

## PART 2 - MODULES

### 2.1 MATERIALS

Materials for module construction shall be new and suitable for working conditions, and shall comply with the requirements of this specification.

### 2.2 CORROSION RESISTANCE

Modules construction components shall be weather resistant.

Metallic construction materials shall withstand a Salt Spray (Fog) Test, according to standard IRAM 121, with a water solution of sodium chloride (Cl Na) at 5% (5g+/-1g) ClNa/100g solution at 35°C+/-1°C for 240 hours, without evidencing red rust or corrosive protection peeling off.

### 2.3 WELDED JOINTS

Welded joints shall comply with the resistance tests specified herein.

Welding procedures and welded joints inspection and tests shall comply with the requirements of standard ANSI/ASME B 31.3, and shall be guaranteed by a level II or III welding inspector, qualified and certified according to standard IRAM -IAS U 500-169.

Based on the applicable standard for welding procedures, welders or welding operators shall be qualified and certified by a recognized Authority according to standard IRAM-IAS U 500-138.

Non destructive tests shall be performed by level 2 qualified personnel, according to standard IRAM-CNEA and 9712.

### 2.4 JOINT ELEMENTS

Bolts, nuts, screws and studs shall comply with standards IRAM 5214 and 5144 or equivalent ones, and shall bear yield strength of at least 0.2 % of minimum 600 MPa, corresponding to 8.8 resistance class.

They shall be protected with hot zinc surface treatment or an equivalent anti corrosive one.

Bolts shall be engraved with the resistance values.

### 2.5 MECHANICAL PROTECTION OF VALVES, FITTINGS AND CHANNELING

Valves, fittings and channeling shall not project outside the external perimeter of the container module structure, and a mechanical protection withstanding impacts of up to 100 joule, applied on the most critical directions shall be provided.

## 2.6 PIPING, TUBING AND FITTINGS

Every element for natural gas use shall comply with a recognized manufacturing standard. Every component listed in the technical documents recognized by ENARGAS Resolution N° 138/95 or one superseding it, shall be backed by the corresponding Approval Certificate, and granted by a CO.

High pressure pipes and fittings shall be manufactured and tested complying with ANSI/ASME B 31.3.

Fittings shall be forged and made of a material of similar characteristics to those of an ASTM A 105 grade 70.

Each component and the installation shall be designed at least to withstand hydrostatic test pressure (1.5 times the working pressure).

Furthermore, they shall be protected against mechanical impacts, so that their safety remains unaltered in case of an accident.

### 2.6.1 Rigid piping

Seamless steel pipes, ASTM A 53 grade B or ASTM A 106 grade B shall be used to allow the material to reach at least 60% of the minimum specified yield strength during the hydrostatic test.

All branching and direction changes shall be performed with forged steel standardized fittings, "socket-weld" type,

Pressure -Temperature ratings of the installation components shall be according to the service to be subjected to.

### 2.6.2 Cylinders interconnection

Interconnection of cylinders and between cylinder and manifold shall only be performed from the cylinder valve, by means of stainless steel seamless tubes AISI 316 (hereinafter, tubes) of ½ " maximum nominal diameter.

Tube arrangement between connections or fixed points shall consider elastic expansion in order to conveniently absorb excessive stress and mechanical vibration.

The curvature for the elastic arrangement shall be large enough for ensuring resilience and avoiding tube choking and creases or resistance impairment.

Fittings shall be exclusively forged stainless steel AISI 316.

### 2.6.3 Piping minimum thickness (min. T)

Piping and tubing shall be sized according to ANSI code B 31.3, for the container module hydrostatic pressure test.

#### **2.6.4 Filling and discharging manifolds**

Manifolds shall not bear stresses caused by structural support and shall include resilient supports to lessen vibrations.

Each cylinder shall be connected to the manifold from its manual valve by means of tubes and tube connecting devices, according to 2.6.2.

Maximum speed of the gas contained inside them shall not be higher than 25 m/s under normal conditions of use.

#### **2.6.5 Valves**

Valves shall be brass or forged steel.

##### **2.6.5.1 Excess flow valves**

They shall be installed at each cylinder outlet, at the outlet of the discharge manifold and in the interconnection of modules.

They shall be sized and callipered so as to ensure immediate shut off in case the piping or other fitting cracks or ruptures.

##### **2.6.5.2 Check valves**

They shall be installed at the inlet of the refueling manifold.

They shall prevent the return of gas content to the cylinders if a piping or other fitting cracks or ruptures during the filling operation.

##### **2.6.5.3 Cylinder valve**

CNG cylinders shall be fitted with an approved spherical manual and fast activation valve. It may be integrated or not to the excess flow valve; but in both cases, it shall be located downstream of the excess flow valve.

Each cylinder valve shall include a combined type pressure relief device (fusible metal and burst disc), compliant with the requirements of point 1.1.2.1. of GE-N1-116 standard or one superseding it.

Minimum vent flow rate of the device shall comply with the requirements of point 5.5 of CGA S-1.1. Venting channeling shall be upwards and windward.

The valve and pressure relief device shall be certified by a CO.

Cylinder arrangement shall be such as to allow easy access to each operating valve.

##### **2.6.5.4 Overpressure relief valve**

Each container module shall be at least equipped with a self-recovery overpressure relief valve installed immediately downstream of the cylinder valves.

It shall be sized according to standard API RP 520 and gauged at an opening pressure 1.2 times the module working pressure. It shall be sealed to protect it from unauthorized third parties.

Valve vent flow rate shall be at least the maximum module supply flow rate during filling.

The permanent marks of the valve shall consist of at least: manufacturer or make, model, serial number, design pressure, opening pressure and venting capacity (in m<sup>3</sup> std. of air/hour), date of calibration expiration and any other data required by the applied standard of design.

The valve shall vent freely through a rooftop channeling, and vertically upwards the container module, without any obstacles.

Vent discharge shall bear a device preventing water access. This device shall be self-recovery, manufactured with anti spark material.

Its location shall be such as to prevent gas discharge from affecting the electrical installation.

The system including the valve shall withstand the dynamic stresses generated during full flow.

#### **2.6.5.5 Filling and discharge valves**

CNG filling valve shall include a standardized fast coupling system for vehicle refueling, or a NGV1 type.

Discharge valve shall be NGV1 type.

In both cases, they shall be combined with manual valves, certified by a CO.

#### **2.6.6 Pressure gauge**

It shall be immersed glycerin bath type, fit to operate in the open air and under vibration stresses.

It shall comply with the indications of GE-N1-115, GE-N1-117 and IRAM-IAP A 5165 or others superseding it and shall be approved by a CO.

Bourdon device material shall be seamless stainless steel.

Maximum working pressure design indicated with a reference mark shall be located within the mid third of its range and shall be class 1 or lower.

Its quadrant shall be of 100 mm minimum diameter.

A polycarbonate safety visor and protective mesh shall be part of the pressure gauge.

Its location shall be such as to make it readily visible to the operator during the filling.

The connection shall have a limiting orifice, valve and vent.

## 2.7 LIFTING EYES

The transport unit shall be designed with at least four lifting eyes, in case hoist cranes or other structures are required for hoisting under operating conditions or due to an accident.

Lifting eyes shall be located so that the vertical tensor of the crane or structure coincides with the vertical line of the filled module center of gravity.

Each lifting eye shall withstand the complete weight of the fully filled module without evidencing structure distortion.

## 2.8 ANCHORAGE SYSTEM

The transport unit shall be equipped with an anchorage system to ensure the firm support of container modules and shall be designed and manufactured so as to withstand intensive use.

Each module shall be provided with an anchorage system in at least four points, guaranteeing safe attachment to the transport unit and avoiding slackening due to vibration or accidental operation.

Anchorage system for dismountable modules shall be of fast activation and transport unit operation friendly, so as to allow module interchangeability.

## 2.9 MECHANICAL RESISTANCE OF MODULE

According to the manufacturer design and mounting indications, anchorage of each module shall be designed to withstand a static load equal to twice the total module weight (fully loaded with CNG) applied on any of the module's angular points or free sides, on the most critical directions.

The test shall be considered successful if after applying the load for one (1) minute on the most critical direction, no anchorage irreversible distortions, disconnection or uselessness are observed.

## 2.10 MECHANICAL RESISTANCE OF ANCHORAGE SYSTEM

Each module support to the transport unit shall bear a static load on the most critical points and directions, equal to twice the total module weight (fully loaded with gas).

## 2.11 CYLINDERS SUPPORT

Cylinder support in the container module shall be designed to withstand all the static and dynamic stresses produced during transport, under any soil condition and type, and in the event of vehicle crash or rollover.

Cylinder support shall allow easy dismounting of each cylinder without deteriorating the system, for maintenance tasks and periodic revision.

Direct contact among cylinders or among cylinders and supports shall not be allowed; aluminum or rubber separators between support straps and cylinders shall be used so as

to avoid it. In case of using rubber, it shall be non-hygroscopic and its hardness shall not be less than 70 Shore.

Cylinder support shall be designed so that the resulting tensions do not exceed 40% of the minimum yield strength of the used material, when withstanding a static load equal to twice the total cylinder weight (fully loaded with CNG) applied on the cylinder on the most critical directions and in the event of crashes or rollovers.

The test to verify cylinder support shall be considered successful if after applying the load for one minute, no irreversible distortions are shown in the supports.

Cylinder fastening shall be designed so as to avoid longitudinal displacement.

## **2.12 LIFTING AND MOUNTING COMPONENTS**

Dismountable container modules shall be equipped with devices that shall lift them and mount them on the transport unit under maximum safety conditions, if the case so requires it.

## **2.13 IDENTIFICATION PLATE**

Each container module shall be provided with an identification plate that shall be stainless steel or made of other anti corrosive material of similar mechanical resistances.

This plate shall be placed on a readily visible area both during module transport and use. Two plates may be used if necessary, to ensure visibility.

The identification plate shall bear the following information with 8 mm height fonts engraved or embossed:

1. Constructor's trade name, address and telephone.
2. Module serial number.
3. Operator's trade name, address and telephone.
4. Country of origin.
5. Maximum volume storage in water liters.
6. Maximum operating pressure: (200 or 250 bar, as may correspond).
7. Gross weight.
8. Module expiration date, including four additional spaces for new expiration dates. This date shall coincide with the first expiration date of module cylinders.
9. CO approval seal.

## 2.14 WARNING SIGNS

Apart from the requirements of the legislation in force as regards dangerous substances, modules shall include the following warning signs on their four vertical sides, readily visible and with characters equal or larger than 25 mm:

1. High Pressure Natural Gas.
2. No smoking.
3. Operator's address and telephone.

## PART 3 – TRANSPORT UNITS DEVICES AND COMPONENTS

### 3.1 GENERAL ASPECTS

Transport of container modules shall comply with the requirements of Law N° 24.449 – Traffic and Road Safety, its Regulatory Decree Nr. 779/95, the Resolution of the Secretariat of Public Works and Transport Nr 195/97 – on Traffic and Road Safety and its addenda, amendments or superseding ones.

If the vehicle is doing inter jurisdictional or international transport, the Jurisdictional Authority shall be the transport domestic authority: National Jurisdiction (JN). If the vehicle is doing intra jurisdictional transport, the Jurisdictional Authority shall be the respective transport authority: Local Authority (JL).

It shall also comply with sections 5 and 6 of Technical Specification ET-ENRG N° 2, Revision 1 of ENARGAS or the ones superseding them.

### 3.2 LIFTING AND MOUNTING MECHANISM

A safe mechanism for lifting, mounting or any other movement of each container module transported shall be available, if applicable.

The mechanism shall be compatible with the module transported and shall bear a stress equivalent to 2.5 times the maximum weight it shall be subjected to, without evidencing irreversible distortion.

If this mechanism is integrated on the transport unit, suspension neutralization mechanisms shall be provided during module lifting or mounting on the transport unit.

Equipment not integrated in the transport unit shall be fitted with anti rollover devices on four directions and shall include critical angle signaling.

Handling more than one module simultaneously is not allowed.

### 3.3 IDENTIFICATION PLATE

The identification plate attached on the transport unit shall be made of stainless steel or other material of similar mechanical and corrosion resistance properties. This plate shall include the following data:



1. Constructor's trade name, address and telephone
2. Transport unit license plate
3. Operator's trade name, address and telephone
4. Country of origin
5. Maximum Tare to be transported
6. Maximum allowable load
7. Approval stamp granted by the CA

### **3.4 GROUNDING**

Each module shall include elements for grounding before connecting for filling or discharge.

Furthermore, the electric continuity between modules and transport unit shall be ensured.

The transport unit shall include an electric connection between its metallic structure and the ground, such as a metallic mesh dragging without losing ground contact every time.

### **3.5 FIRE EXTINGUISHING EQUIPMENT**

#### **3.5.1 Transport**

Each transport unit shall be equipped with at least one portable fire extinguisher suitable for ABC fires, with a capacity not lower than 2.5 kg; fit for fighting engine, cabin and tires fire of the transport unit, designed in such a way not to worsen a fire caused by natural gas load.

The extinguisher and its load shall comply with the corresponding IRAM standards

Requirements from any Authority having jurisdiction as regards this Technical Specification, shall be complied with in addition to.

#### **3.5.2 Filling**

Besides the extinguisher required in 3.6.1, a portable extinguisher suitable for ABC fire with a capacity not lower than 10 kg shall be provided suitable for fighting tires, brakes and natural gas fire, designed in such a way not to worsen a fire in the tractor.

The extinguisher and its extinguishing load shall comply with the corresponding IRAM standards.

Requirements from any Authority having jurisdiction as regards this Technical Specification, shall be complied with.

### 3.6 ELECTRIC INSTALLATION

Standards GE-N1-121 and IRAM 2670, the Technical Specification of ENARGAS ET-ENRG-GD N° 2 and Draft 1 of standard IRAM 2671-1: 1998, or the ones determined by ENARGAS in the future, shall be complied with.

### 3.7 TELESCOPIC SUPPORT, KINGPIN AND FIFTH WHEEL

They shall comply with the following:

- Standard IRAM 2670;
- ENARGAS ET-ENRG-GD N° 2 technical specification;
- Points 6.1 and 6.2 of Draft 1 of standard IRAM 2671-1: 1998;
- Last version of SAE standards, recommended practices and report: J133, J684, J685, J697, J700, J701, J847, J848 and J 849, indicated below;
- Standards to be determined by ENARGAS in the future.

### 3.8 BRAKES

The transport unit shall be fitted with two independent brake systems, allowing vehicle's movement control, brake and stop. At least one of these systems shall be able to stop the vehicle at a ten (10) meter distance, while driving along a horizontal, dry and smooth road, at thirty kilometers per hour (30); the other system shall be able to keep the vehicle stopped with its maximum load, on a six (6%) percent slope. In case of a semi-trailer which useful load exceeds one thousand five hundred kilograms (1500 kg), it shall be equipped with a brake system, operated by the driver that shall comply with the breaking conditions indicated above.

## PART 4 - TESTS

All the system units in operation for the transport of CNG container modules shall be subjected to the tests indicated below, under the supervision of the Operator's Technical Responsible person and recorded in a book, numbered and signed by the area Distributor Licensee; notwithstanding the tests required by the Traffic Law (e.g.: Mandatory Technical Inspection).

The Operator's TR shall be responsible for carrying out the tests in the stipulated time; otherwise, installations shall be disqualified until all the required tests are complied with. Reports issued by the Operator's TR shall bear his signature.

Tests shall be controlled by the Distribution Licensee.

The CO involved in the approval process shall perform the corresponding controls in case of any modification, repair or accident that may affect safety. The Operator's TR shall record any modification or alteration of the approved initial characteristics of the equipment and shall inform them to the corresponding CO and to the Distribution Licensee.

Tests and controls shall be at least implemented according to the following plan:

### 4.1 KINGPIN AND FIFTH WHEEL

The pertinent controls shall be implemented according to point 1.6.1 of standard GE-N1-121 (GE-N1-102, Preventive Maintenance of semi-trailer tanks, in its amended version) and point 6.2 of the draft of standard IRAM 2671-1.1998; or the ones determined by ENARGAS in the future.

### 4.2 MONTHLY TESTS

#### 4.2.1 Valves

They shall be verified for leak absence and correct operation.

#### 4.2.2 Check and excess flow valves

They shall be verified for correct operation.

#### 4.2.3 Safety valves

They shall be verified for leak absence and to ensure that scheduled calibration date has not expired.

#### 4.2.4 Electric signaling system

Its condition shall be controlled (insulations, contacts, integrity, terminals, etc.).

### **4.3 HALF YEARLY TESTS**

#### **4.3.1 Anchorage system**

The state of the surfaces of union between the transport unit and the module, the bolts integrity, the quality of subjection devices and their operative aptitude, shall be verified.

The adjustment of all the joint elements shall be verified.

#### **4.3.2 Extinguishers**

The general condition, the load and pressure of each extinguisher, and likewise the corresponding expiration dates shall be verified.

#### **4.3.3 Discharge Valve**

Tightness shall be verified at working pressure once coupled to the fixed installation and with the manual valve in open position.

Its general condition shall be controlled.

### **4.4 ANNUAL TESTS**

#### **4.4.1 Lifting and mounting mechanisms**

Their general condition shall be controlled for wear possibility.

#### **4.4.2 Pressure gauges**

They shall be controlled according to the Recommended Practice IAP-CA-3.01.

The control date shall be engraved on a weather proof plate, affixed to the body.

#### **4.4.3 Piping and fittings**

Their general conditions shall be controlled.

#### **4.4.4 Safety valves**

Calibration shall be verified according to API RP 576 Recommended practice.

The verification comprises a general condition control and thereafter a pressure test for calibration and operation control.

The control date shall be engraved on the body or on a plate made with inalterable material, affixed to the body.

#### **4.4.5 Filling valve**

If the valve is a fast coupling standardized valve for CNG filling, a size control shall be performed according to the requirements of standard GE-N1-118 or one superseding it.

If it is an NGV1 type valve, the general conditions shall be controlled.

#### **4.4.6 Tightness**

Connections shall be verified for leak absence.

#### **4.4.7 Mounting**

Verifications shall be performed to ensure that all components are safely mounted and in their original places.

### **4.5 FIVE YEARLY TESTS**

They shall consist of a complete inspection of the system's cylinders, tubing and connections.

**4.5.1** The date of the first periodic inspection of the container modules cylinders shall agree with the date of inspection of the first expired cylinder.

Cylinders shall be inspected at a CNG Cylinder Periodic Inspection Center, approved by ENARGAS, according to standard GE-N1-144 or one superseding it.

**4.5.2** The cylinder and valve interconnection tubing shall be hydrostatically tested according to the requirements of point 4.5.1, at 1.5 times the maximum working pressure and dried after test completion.

**4.5.3** A pneumatic leak control shall be implemented after completion of the tests indicated in 4.5.1 and 4.5.2, and once cylinders, tubing, valves and fittings of the container module have been mounted.

This control shall be performed with inert gas at working pressure, verifying leak absence in connections and valves by means of soapy water or any other adequate means.

**4.5.4** After the previous steps have been implemented, the verification indicated in 4.4.8 shall be performed.

**4.5.5** Once all the pertinent verifications have been satisfactorily performed, the CO shall re-qualify the unit for another five years and shall communicate it to the Distribution Licensee.

### **4.6 NON PERIODIC TESTING**

When the unit's safety is affected by repairs, modifications, accidents, or when the original characteristics have been altered, the Operator's TR shall perform unscheduled tests and inform the Distribution Licensee and the corresponding CO.

#### **4.6.1 Previous to filling the module with CNG**

The module's general condition shall be inspected (damages, loose or detached connections, safety valve seal conditions, electric cabling integrity, grounding, extinguisher availability, qualification and operation, etc.).

#### **4.6.2 Leak control**

According to Paragraph 29 of Section IV Chapter 2 of the General Regulation for the transport of hazardous goods by road, Annex S, Decree N° 779/95, the driver shall regularly inspect the possible existence of leaks, especially after each filling. This control shall require a leak detector of updated calibration.

## PART 5 - APPROVAL

### 5.1 DOCUMENTATION

Two copies of at least the following documentation signed by the TR shall be submitted to the CO by the Constructor.

1. Note requesting transport approval, providing details of the technical identification characteristics.
2. TR appointment note.
3. Plan of details of the complete system, indicating dimensions, material, treatment of surfaces and subsets.
4. Electric installation plan.
5. Technical report of sizing calculations and of components verification.
6. Technical report of the manufacturing process.
7. Data sheet of fittings and instruments supplied by the constructor company.
8. Transport data sheet supplied by the constructor company.
9. Certificate of CNG cylinder type and batch approval.
10. System operation and maintenance manual (module and transport unit) including at least, all the control and safety requirements established in this document.
11. Emergency and safety plan guaranteed by the Firefighters Superintendence of the Argentine Federal Police. The Firefighters of the transport area shall be provided with a copy.

### 5.2 APPROVAL

The CO shall approve the "CNG container module transport system".

The system shall be taken to the Technical Mandatory Inspection workshop of the Transport National Executive Consultant (CENT) together with the approval certificate, for the corresponding qualification for National Jurisdiction Transport.

### 5.3 QUALIFICATION

Once complete mounting has been carried on, a thorough inspection of the unit shall take place for the qualification of the transport unit and its container modules.

Testing shall at least include the following and the AC shall implement any other control it deems convenient.

- Hydrostatic test of tubing, piping and fittings, at 1.5 the maximum working pressure.

- Pneumatic leak test at working pressure according to 4.5.3.
- Complete visual inspection to check surfaces, welding, cleanliness, thread adjustment, linearity and perpendicularity, tubing construction, filling, venting and anchorage systems and lifting and mounting mechanisms so as to ensure compliance with this specification and the good art rules.
- Axle weight control, in compliance with the legislation in force.
- Electric system control, to verify the operation of each circuit, adequate connection assembly and sections of conductors utilized.

The tests and assays indicated above shall be performed according to the guidelines established by the manufacturing standards used, this technical specification and the corresponding Authorities.

Modifications performed during construction and after qualification shall require the AC approval.

#### **5.4 INSPECTIONS**

The CO shall assign an exclusive and permanent identification number to each transport unit qualified. The responsible company shall paint this number in order to guarantee identification in the mid upper section of the front and rear part of each module and in the transport unit. Numbers shall be 150 mm high and 30 mm wide. Furthermore, these numbers shall be repainted when necessary so as to ensure easy visibility at all times.



## ANNEX I – SAMPLE CHART FOR DRIVERS OF CNG CONTAINER MODULES TRANSPORT UNITS

The chart shall at least contain the following items.

### A – NATURAL GAS

Naturally occurring mixture of hydrocarbon gases found in porous formations beneath the earth's surface, often in association with petroleum.

Its main constituent is methane; the remaining ones are higher hydrocarbons, water vapor in variable proportions, and it may contain carbon dioxide, nitrogen, sulfur hydrogen, helium, etc. Depending on whether its hydrocarbon content is greater than methane content, it may be called rich gas or dry gas.

The calorific power of natural gas varies according to its composition, and is generally between 8850 and 10200 kcal/m<sup>3</sup>.

### B – BASIC INFORMATION ON NATURAL GAS

1. Why is it important to know the properties of natural gas?

It allows risk free operation within the adequate safety parameters.

2. Where does natural gas come from?

Gas fields.

3. Where are natural gas fields in our country?

In Tierra del Fuego, Santa Cruz, Chubut, Neuquén, Mendoza, Salta and Jujuy.

4. What is the natural gas composition?

Mostly methane and ethane, propane, butane and higher hydrocarbons in smaller proportions.

5. How and where is natural gas stored?

It is stored in containers under pressure, in gaseous status; in other cases, it is stored in liquid status at low pressure and very low temperature.

6. How is natural gas transported?

It is transported through pressure pipelines (gas pipelines); or in containers such as the ones described in this document.

7. What is the odor and color of natural gas like?

Natural gas is odorless; this is why a pestilent odor spray is used to facilitate its detection. Natural gas is also colorless.

8. Is natural gas lighter than air?

Yes, contrary to liquefied gas (propane, butane), natural gas is lighter than air. The densities of these gases in relation to air are:

Air	1.0
Natural gas	0.61
Propane	1.5
Butane	2.0

Therefore, natural gas rises to the atmosphere and this favors its dilution in air.

9. Is natural gas toxic?

No it isn't. However a gas leak produced in a close environment when oxygen is displaced, obliges the personnel working in such environment to use autonomous breathing equipment. Overexposure may cause dizziness, disorientation, excitement and finally asphyxia.

10. When is natural gas explosive?

When the proportion is between 5 to 15 parts of gas in 95 to 85 parts of air respectively, and it contacts a flame or spark. Ignition temperature of methane in air is 632 °C. Gas shall not ignite or exploit while interacting with water.

11. Shall an ignited gas leak be quenched when plugging the leak is impossible?

No; if the fire is quenched, the gas leak shall persist and might even cause an explosion if it contacts a flame or spark, resulting in fatalities. However, when an incipient ignited leak (blower effect), acts on the walls of any natural gas confining element, it shall be intensively cooled, especially in the area affected by the incipient fire. In case the fire is not incipient but affects any gas confining element or is uncontrollable, personnel and firefighters shall be immediately evacuated at a distance of at least 100 m.

12. What does a 250 bar pressure mean, or 250 kg/cm<sup>2</sup> which is approximately the same?

For comparing, a pressure applied on the whole hand and fingers would be equal to a force of 45 tons.

## **C –DRIVER’S GUIDE**

### **C.1 - Documentation**

Drivers shall have the following documentation:

- Personal identification.
- Driver’s license for cargo vehicles, issued by an Authority having jurisdiction.
- This chart with basic information on bulk CNG transport.
- Record where works carried on the vehicle are registered.
- Transport unit qualification.
- Filling permit issued by the Distribution Licensee of the area where CNG is dispensed.

### **C.2 - Responsibilities**

National, provincial and municipal provisions regulating the transport of dangerous substances in streets and roads of the country shall be complied with.

Especially before the beginning of each trip, satisfactory maintenance of the unit condition (containers, valves, connections, gauges, grounding devices, engine operation, tires, brakes, roller train, kingpin and fifth wheel, if applicable, windscreen wipers, warning lights, bumper, flame arrester, electric system, lights, mirrors, etc.), shall be controlled

Be acquainted with the filling and discharge operations.

Ensuring availability of telephone numbers to inform the Distribution Companies, Firefighters, Police, transport unit owner, and breakdown and tow trucker company, shall be complied with in case of accidents.

All bulk CNG transport standards, provisions, recommendations and procedures issued by ENARGAS, shall be complied with.

## **D – DRIVER’S GUIDELINES**

Vehicle drivers shall consider the following:

**Smoking:** smoking shall not be allowed inside or close to the transport unit.

**Exclusive use:** When the unit is used to transport empty or loaded modules, it shall not be used for other purposes.

**Delegation of responsibilities:** The vehicle shall only be driven by a licensed driver.

**Pushing or towing:** Vehicles that have broken down on the road shall not be pushed or towed by the transport unit

**Parking:**

Transport units shall not be parked:

1. less than 5 meters away from a similar unit;
2. in slopes, without the corresponding chocks;
3. without its corresponding tractor unit in case of trailers or semi trailers;
4. close to flames or heat sources;
5. in areas without adequate lighting by night. If this cannot be done, spot lights shall be left on or markers shall be placed at the front and rear part of the vehicle. Open flame markers shall be prohibited.

**The following shall be considered when the vehicle is parked:**

1. parking brake must be on;
2. chocks shall be used on uneven soil;
3. vehicle shall be sheltered from the sun when possible

**Speed:** The transport unit shall circulate at speeds complying with the requirements of section 51 of law 24.449 or one superseding it; in case of there not being any provision from the Authorities having jurisdiction, speed, shall not exceed 40 km/h.

In case of adverse weather conditions, (intensive rain, fog, ice, etc.), speed shall be reduced and safety measures intensified, or the vehicle shall be stopped if the situation so requires it.

Precautions shall be intensified in road curves, and speeding and braking deserve special attention, moreover considering the type of load and conditions of the transport unit that is being driven.

**Highways – Main roads:** Vehicles shall use the main roads or highways and town surrounding ways. In case of having to drive along urban ways in which the circulation of vehicles transporting flammable substances is forbidden, a special permit shall be required from the authorities having jurisdiction.

**Alcoholic drinks – Stimulants:** The driver shall not take alcoholic drinks or stimulants during working hours or in the six (6) previous ones.

**Non-authorized persons:** Persons not related to the service shall not be transported in the unit.

**Vehicles without product:** Transports circulating with residual pressure shall be subjected to the same safety treatment applied to transports loaded at maximum pressure.

**Transport mechanical repairs:** Container modules shall be dismantled before the transport unit is sent to a workshop for repairing the chassis, running gear, etc.

**Periodic inspection:** Periodic Inspection shall take place involving not only containers and piping system, but the tractor and its components.

**Approval - Qualification:** Vehicle used for CNG bulk transportation shall be previously approved and qualified by a CO.

**Modifications:** Modifications that may pose a risk to public safety shall not be carried out on transports without CO's authorization.

**Inspection:** Operator's TR and Distribution Licensee shall inspect the units so as to verify they are in good conditions, according to the frequency stated in Section 4 of ET-ENRG-GD-N° 6.

**Accident:** Any transport involved in an accident, even when there are no apparent consequences, shall be immediately reported to the intervening CO.

**Railroad Grade crossing:** The vehicle shall be fully stopped when reaching a grade crossing and after verifying there is no train or locomotive approaching, it shall be crossed carefully at a speed lower than 15 km/h.

**Notice about containers:** In case a container shows signs of dents, corrosion areas, slits, loss or any minor damage or any other condition posing a risk to normal operation at any stage, the Operator's TR shall notice the area Distribution Licensee and the corresponding Certification Organization.

**Out of service:** Any transport unit out of service for one year or more shall not operate without previous re-qualification by the CO.

**Training:** Drivers shall be adequately trained for driving the vehicle and its ancillary equipment.

**CNG characteristics – Emergency procedure:** Drivers shall be acquainted with CNG main characteristics, safety handling and shall have been trained as regards emergency procedure in case of accidents with this product.

**Leaks:** Before any operation or trip begins, the perfect closure of system valves and the absence of piping leaks shall be verified.

**Fire extinguishers:** During filling and discharging, the ruled fire extinguishers shall be located where corresponds and ready to be operated. The driver shall know how to maintain and operate these elements.

**Running conditions:** Running conditions of the engine shall be checked involving mechanical and electrical components.

**Markers - Chocks – Lanterns - Tools:** The necessary warning lights for complying with the provisions of F.2.3.1.3, chocks, lanterns and tools adequate for the operational needs and any other required element for a safe operation and status and use conditions shall be regularly verified.

**Kingpin – Fifth Wheel:** Kingpin condition shall be carefully verified and in case of detecting any anomaly, it shall be reported to the skilled personnel. Before inspection, vapor cleaning shall be carried out.

**Driver's cabin:** It shall be functional so as to ensure non-fatigue driving.

#### **E – SAFETY PROCEDURE DURING FILLING OR DISCHARGING**

***For guaranteeing public safety, unit and acting personnel safety, inspection and control of compliance with all the following issues is carried out. Therefore, all drivers shall cooperate.***

1. Each driver shall comply with the following instructions at destination.  
When the vehicle enters the discharging facility, an appointed responsible person shall inspect it. He shall check the electrical installation, industrial installation, general transport condition, fire extinguishers load and maintenance, chocks, placement of the flame arrester constructed according to the standards, etc.; vehicle qualification by the CO and that the driver has the documents specified in point C.1 of this chart.
2. Exhaust emission system (exhaust pipe) shall be inspected so as to check the absence of ruptures, cracks, etc. which may pose a safety risk.
3. Vehicle shall access and circulate at a speed not higher than 5 km/h.
4. Once parked, the corresponding chocks shall be located so as to avoid displacement.
5. Vehicle shall be grounded with the corresponding installation specifically located at the facility, ensuring it is correctly carried out (tight connections on clean surfaces).
6. Fire extinguishers stock in each area shall be enhanced with the vehicle own extinguisher, placing it on windward.
7. In case of an accident at the discharge area, the driver shall follow the instructions for transport unit withdrawal given by the personnel in charge.
8. Once the operation is completed, the driver shall check disconnection or withdrawal of related elements. In case of product leakage, the vehicle shall not be started up, until the problem is solved and no explosive mixture is detected using an explosimeter.
9. The vehicle shall circulate up to the exit at a speed lower than 5 km/h.
10. It shall enter carefully into the road allowing other vehicles to pass, if any.
11. If tools are needed, they shall be anti-spark type.

## F – PROCEDURES TO FOLLOW IN CASE OF TRANSPORT ACCIDENT

### F.1 - If we consider the accident and its results, any of the following cases may arise:

*F.1.1* - Accident "**without**" rollover and "**without**" consequences for vessels and their fittings (only the vehicle was damaged).

*F.1.2* - Accident "**with**" potential damages on vessels or fittings, "**without**" product leakage.

*F.1.3* - Accident "**with**" product leakage (CNG).

In any of those cases, after the accident the circumstances shall be immediately inspected in detail so as to assess the situation and proceed.

In *F.1.2.-* and *F.1.3.-* cases, the area police and firefighters personnel shall be called so as to take the adequate measures and shall notify the operator's TR and the area Distribution Licensee.

Nevertheless, the unit must be completely inspected.

The CA shall re-qualify the unit so that it may continue operating.

### F.2 – Recommendations:

As regards the previous alternatives, the following shall be carried out:

*F.2.1* - Accident "**without**" rollover and "**without**" consequences for vessels and their fittings (only the vehicle was damaged):

Tractor shall be replaced by other one.

In case of fire in the tractor, its fire extinguisher shall be quickly used; if it is emptied and the fire has not been extinguished, blankets, earth, etc. must be used immediately. If possible, it shall be detached placing it far from the vessels.

Except in the case of force majeure, the driver shall never leave the vehicle unattended or attended by unauthorized persons.

*F.2.2* - Accidents "**with**" potential damages on vessels or fittings, "**without**" product leakage:

Three possibilities shall be considered:

***F.2.2.1* – The vehicle did not roll over and is able to continue circulating:**  
Carefully and at a reduced speed, the transport unit shall go up to the destination point whereby the modules shall be immediately unloaded or natural gas shall be vented at a safe place, considering the precautions stated in *F.2.3.1.1* to *F.2.3.1.3*, so that vessels and fittings shall be subjected to a thorough and full inspection required by the standards in force for these cases.

**F.2.2.2 – The vehicle did not roll over but it cannot continue circulating:** If, Carefully place the modules in another transport if possible; otherwise if it is not possible, the product shall be vented carefully according to F.2.3.1.1 to F.2.3.1.3.

**F.2.2.3 – The vehicle rolled over:** The modules shall be transferred If adequate hoisting elements are available. Otherwise, the product shall be vented carefully; and when the modules are emptied, they shall be placed at their normal position using the adequate hoisting elements, under general safety precautions so as to prevent the vessels from being damaged again.

**F.2.3 - Accident "with" CNG leakage:**

**F.2.3.1 – “Without” fire:**

General recommendations:

F.2.3.1.1 – In case of product leakage caused by the accident, the people shall be evacuated from the area, eliminating simultaneously the ignition source. Engine shall be stopped and electrical circuit disconnected.

F.2.3.1.2 – People shall keep far more than 100 meters away from the accident location opposite to the direction in which the wind blows or to gas leakage affecting the area – whichever the worst case is -; except for personnel working to prevent a disaster.

F.2.3.1.3 – Vehicles circulation shall be stopped in a 100 m radius as regards the vehicle involved in the accident.

F.2.3.1.4 – If leakage starts in a piping, the corresponding valves shall be shut off such as to interrupt gas flow.

If leakage starts on a vessel, procedures stated in F.2.3.1.1.- shall be followed and complete depressurizing shall be allowed.

F.2.3.1.5 – If the unit can be transported, it shall be taken to a safe place; valves or piping shall not be damaged during transportation which shall be safely performed.

F.2.3.1.6 – Once the vessels are emptied, they shall be inertized for transportation and submitted to inspection and conditioning according to standards.

Operations (vessels transfer, hoisting or unit transportation, etc.) shall only be carried out when absence of leaks or explosive mixture in the environment is ensured.

**F.2.3.2 – “With” fire:**

**In case of incipient fire,** fire extinguishers shall be used for putting it out, and if possible, fuel leakage shall be eliminated. If fire cannot be extinguished, abundant water shall be applied on every heat exposed surface.



Water supply device shall be located as far as possible from the accident location so as to avoid exposure.

Simultaneously, all persons shall be evacuated within a 100 m minimum radius from the accident location, traffic shall be interrupted and all sources of fire shall be put out. The equipment and personnel (police, firefighters and civil defense) involved in the operation shall be exempted. The intervening personnel shall be the minimum required and shall proceed carefully.

If fire is controlled, water shall be applied until it is totally quenched due to fuel consumption.

**In case of a non-incipient fire** affecting any gas confining element or if it is uncontrollable, all the personnel, including firefighters shall be immediately evacuated far away the minimum 100 m distance.

The same measure shall be taken when in the first case, water is not sufficient enough for cooling the surface of any gas confining element.

Once the fire has been quenched, the unit shall be transported to an adequate location for its inspection and assessment of potential repair and re-qualification, with the pertinent police authorization.

## Form for proposals on the Technical Specification

<b>PROPOSALS ON THE TECHNICAL SPECIFICATION "SYSTEMS FOR TRANSPORT OF CNG CONTAINER MODULES"-ET-ENRG-GD-N° 6</b>		
<b>Company:</b>		<b>Technical Representative:</b>
<b>Address:</b>	<b>Zip Code:</b>	<b>Telephone:</b>
<b>Page:</b>	<b>Point:</b>	<b>Paragraph:</b>
<b>Quote:</b>		
<b>Proposal:</b>		
<b>Substantiation for proposal:</b>		

Signature:

Type or print:

Position:

Page of

## INSTRUCTIONS TO COMPLETE THE FORM FOR PROPOSALS

- 1) Complete in bold letters (hand written or printed), with indelible ink.
- 2) In the space identified as "Quote", copy the text you propose to modify or else summarize it as long as there are no doubts or ambiguities about the text it refers to.
- 3) In the space identified as "Proposal", indicate the exact wording to be inserted.
- 4) In the space identified as "Substantiation for Proposal", state the problem that will be resolved or improved by your recommendation. Give the specific reason for your proposal including the technical bibliography on which it is grounded providing copies, if possible, or else describing the experience it is based on.
- 5) This Proposal must be submitted to the Distribution Management of the ENTE NACIONAL REGULADOR DEL GAS (ENARGAS) Suipacha 636 4° Piso (C 1008AAN) Ciudad de Buenos Aires, TE 011-4325-2500.