

## Chapter 1.3 - DESCRIPTION OF THE TERMINAL

### 1.3.1 General Description

The Terminal, an existing Moss type LNG carrier (the ex “Golar Frost”) converted into a floating terminal, is located 12 nautical miles offshore between Livorno and Pisa in Tuscany, Italy. The geographical coordinates of the terminal are 43° 38’ 40” N 09° 59’ 20” E (Gauss Boaga Datum Roma). The depth of the sea bed is approximately 120 metres. The Terminal is connected to shore via a 32” diameter pipeline built and operated by SRG.

The Terminal specifications are:

Displacement	115,870 metric tonnes
LOA	306.49 m
Gross Tonnage	117.916 metric tonnes
Net Tonnage	35.374 metric tonnes
Maximum width	48 m
Draught (ballast)	10.78 m
Draught (load)	12.30 m

The main functions of the Terminal are:

- i) Receive, allow mooring and unloading of LNG Carriers;
- ii) Store;
- iii) Recover Boil-Off Gas (BOG);
- iv) LNG Regasification;
- v) Wobbe Index correction;
- vi) Importing Gas within the Gas Quality Specification into the National Transmission System;
- vii) Utilities; and
- viii) Safety and control systems

#### i) Receive, allow mooring and unloading of LNG Carriers

The Terminal may receive LNG from LNG Carriers with a capacity ranging from 65,000 m<sup>3</sup> to 180,000 m<sup>3</sup> (or equivalent the class entitled “New Panamax”). The LNG from the LNG Carriers is Unloaded to the Terminal storage tanks. The maximum Unloading rate is 12,000 m<sup>3</sup>/hr. The timings for the completion of the unloading are indicated in greater detail in the Technical Manuals and are intended to be merely indicative.

It is agreed that the Unloading of volumes of LNG exceeding 155,000 m<sup>3</sup><sub>liq</sub> by the same LNG Carrier, pursuant to the provisions of Clause 3.7.3.2, may only be carried out by the User by obtaining the allocation of two consecutive Delivery Slots following the allocation processes envisaged by Clauses 2.1.8 and 2.1.9 and the provisions of the Regasification Code will apply independently to the individual Delivery Slots. The User shall also comply with the provisions and specifications of the Maritime Regulations with regard to the Unloading of volumes of LNG exceeding 155,000 m<sup>3</sup><sub>liq</sub>.

The LNG is transferred via three 16" loading arms onboard the Terminal and a fourth arm is used to maintain the vapour balance in the LNG Carrier by routing BOG generated in the Terminal storage tanks back to the LNG Carrier. The following arms are available:

- 2 liquid,
- 1 vapour, and
- 1 hybrid (liquid/vapour).

The hybrid arm is used to Unload LNG to the Terminal under normal conditions and can be used as the BOG vapour return if there is a failure in the vapour return arm.

## ii) Storage

The Terminal has four Moss® Sphere type LNG containment tanks. Each tank has a diameter of about 40 metres. The storage capacity is approximately 135,000 m<sup>3</sup>. Each storage tank is equipped with an LNG in-tank pump, which transfers the LNG to the regasification module. This pump is retractable and installed in a dedicated pump well. In addition, one existing cargo pump, which has a higher capacity, is installed in the storage tank. These pumps are available to transfer liquid from one tank to another in case of operational requirements. The LNG is stored in the tanks at a temperature of approximately -163 °C and at a pressure of 0.25 barg.

## iii) Boil-Off Gas Facilities

BOG is generated in the LNG tanks as a result of the following:

- Heat ingress from the storage spheres;
- Superheated LNG that flashes into the storage tanks during LNG Carrier Unloading, due to the heat generated by the LNG Carrier's cargo pumps and heat ingress in the loading arms, loading lines/manifolds; and

The generated BOG is collected in the BOG header from where it can be routed to the following:

- LNG Carrier via the vapour return arm (during Unloading)
- The fuel Gas system;
- The recondenser via the BOG compressor (unspared); and
- The atmosphere exclusively in emergency situations.

## iv) LNG Regasification

The LNG pressurised by the booster pumps is routed to three Intermediate Fluid Vaporisers (IFV) of the Tri-Ex type. The LNG is vaporized in a cyclic process with propane as the intermediate fluid. In the first heat exchanger, the LNG will be vaporized against propane vapour, which condenses. A second heat exchanger vaporizes the condensed propane with the heat of the seawater. In a third heat exchanger, the natural gas is superheated with seawater. During normal operation, three vaporisers may be on line simultaneously, together providing a maximum Gas redelivery capacity of 450 tonnes per hour. Below the envisaged minimum send out capacity the Terminal is designed to have a "stand by mode" which allows the Terminal to stay at operating temperature with a low inflexible send out of about 10 tonnes per hour. The Terminal has a permitted regasification capacity of no greater than 3.75 billion cm<sup>3</sup>/year.

## v) Wobbe Index Correction

If the quality of the LNG does not meet the National Transmission System's minimum quality requirements due to imitations on the Gross Calorific Value and/or the Wobbe Index, nitrogen shall be injected at low pressure into the recondenser. Nitrogen is generated by an *ad hoc* nitrogen production unit. The Wobbe Index correction system is sized to produce up to 10,400 Sm<sup>3</sup>/h of nitrogen.

**vi) Importing Gas within the Gas Quality Specification into the National Transmission System**

After vaporisation, Gas shall be routed to a fiscal metering station, which includes ultrasonic flow metering ramps and a protection system (HIPPS). Downstream of the HIPPS, the redelivered Gas is routed to a subsea pipeline via a turret and two flexible risers. The turret is equipped with a swivel which allows 360° Terminal rotation. A subsea safety isolation valve (SSIV) station is installed at the connection between the risers and the submarine gas pipeline, which allows for isolating the Terminal from the National Transmission System in case of emergency.

**vii) Utilities**

The original steam plant has two dual-fuel steam boilers that may burn either Gas (BOG from the LNG tanks or gas from the vaporisers) or marine gas oil. Each boiler has a capacity of 55 t/h of superheated steam at 62 bar g and 510 °C. Two new turbo generators were installed during the conversion work and are fuelled by the steam facility in the engine room.

The Terminal generates its own power exclusively through its own steam turbo generators and does not import electrical power from the onshore national electricity grid. The electric power generating plant, installed in the engine room area, consists of two new 10 MW steam turbo generators, 3.5 MW steam turbo generators and a group of 3.35 MW diesel generators.

**viii) Safety and control system**

The LNG regasification plant is controlled remotely by the centralised control room with an automatic system. This system is divided into two (2) subsystems:

- Distributed control system (DCS) the function of which is the acquisition, processing and regulation of the plant process and monitoring parameters;
- Emergency shutdown system (ESD) the function of which is to carry out the sequences to start up, stop and block the plant equipment which is automatically programmed to switch to a predefined safe mode in an emergency.

The Operating Company shall operate and maintain the Terminal in accordance with the standards of a Reasonable and Prudent Operator.

**1.3.2 Terminal Capacity**

The Terminal regasification capacity is determined by considering the technical, environmental and operational constraints of the Terminal, the number and duration of Berthing Slots, storage capacity, send-out capacity, and the capacity available at the Redelivery Point.

The Terminal shall operate with a permitted regasification capacity of 3.75 bcm/year. Such capacity is the design capacity under normal operating conditions and without considering the operational constraints and the limitations on the National Transmission System operated by SRG. To assess the Terminal capacity the following values must be taken into account:

A. **unloading capacity:** the unloading capacity within a reference period (e.g.: Gas Year) of operations at the Terminal is defined taking into account:

i) maximum number of Berthing Slots;

ii) amount of LNG Unloaded by the LNG Carrier in each of the Berthing Slots, also taking into account the quality of the LNG;

B. **send out capacity:** the send out capacity depends *inter alia* on the availability of each item of equipment, the terminal Fuel and losses, maintenance, the density of the LNG and any constraints imposed by the National Transmission System connected to the Terminal.

**1.3.3 Terminal Manuals**

The User and the Operating Company shall comply, and the Operating Company shall procure that any sub-contractor shall comply, with the provisions of the Terminal Manuals at all times unless any such provisions conflict with the applicable laws or regulations or with International Standards. The User shall also procure that any LNG Carrier and any Ship Owner shall comply with the Technical Manuals, unless any such provisions conflict with the Applicable Law and/or International Standards.