

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	120,000 metric tonnes
LOA	310 m
Gross Tonnage	117,916 metric tonnes
Net Tonnage	35,364 metric tones
Maximum width	49 m
Draught (ballast)	10.78 m
Draught (load)	12.30 m

The main functions of the Terminal are (**Terminal Specifications**):

- i) Receive and allow mooring to LNG Carriers and receive LNG
- ii) Store
- iii) Handling boil off gas (BOG)
- iv) LNG Regasification
- v) Wobbe Index correction
- vi) Exporting Gas within the Gas Quality Specification into the SRG grid
- vii) Utilities
- viii) Safety and control system

i) Receive and provide a mooring for LNG Carriers and receive LNG

The Terminal LNG handling system is designed to receive LNG from LNG Carriers with a capacity range from 65,000 m³ to 155,000 m³. The LNG from the LNG Carriers is Unloaded to the Terminal storage tanks. The maximum Unloading rate is 12,000 m³/hr.

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 load 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 135,000 m³. 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, shall remain 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 -161 °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 offloading, due to the heat generated by the LNG Carrier’s cargo pumps and heat ingress in the loading arms, loading lines/manifolds. Additional flashing shall occur if the vapour pressure of the loaded LNG is higher than the operating pressure of the Terminal storage tank; and
- Displacement of the vapour out of the tanks due to the incoming liquid during loading.

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 via the cold natural gas vent only in emergency situations.

iv) LNG Regasification

The pressurised LNG from the booster pumps is routed to three Intermediate Fluid Vaporisers (IFV) of the Tri-Ex type. The LNG shall be vaporized in a cyclic process with propane as the intermediate fluid. In the first heat exchanger, the LNG shall be vaporized against propane vapour, which shall condense. A second heat exchanger shall vaporize the condensed propane with the heat of the seawater. In a third heat exchanger, the natural gas shall be superheated with seawater. During normal operation, three vaporisers shall be on line simultaneously. Each vaporiser shall have a design capacity of 150 tonnes of LNG per hour, giving a peak Gas redelivery capacity for the Terminal of 450 tonnes per hour. Below the normal designed operating send out capacity the Terminal is designed to have a “stand by modus” which allows the Terminal to stay at operating temperature with a low unflexible send out of about 10 tonnes per hour. The Terminal has a permitted regasification capacity of no greater than 3.75 Bcm/year.

v) Wobbe Index Correction

If the quality of the LNG does not meet the the Grid’s minimum quality requirements due to imitations on the Gross Calorific Value and the Wobbe Index, nitrogen shall injected at low pressure into the recondenser gas inlet. Nitrogen is generated by an *ad hoc* nitrogen generation unit. The Wobbe Index correction system is sized to produce up to 10,400 Sm³/h of nitrogen.

vi) Exporting Gas within the Gas Quality Specification into the SRG grid

After vaporisation, Gas shall be routed to a fiscal metering station, which includes ultrasonic flow metering ramps and a high pressure 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 export pipeline, which allows for isolating the pipeline from the risers in case of emergency, with umbilical control from the Terminal.

vii) Utilities

Two new steam generators supplement the steam plant in the engine room. Additional turbo generators steam exhaust lines connect into the new cover/steam inlet on top of the main condenser. The original steam plant has two dual-fuel steam boilers that may burn either fuel Gas (BOG from the LNG tanks or gas from the vaporisers) or marine gas oil. Each boiler has a steam output capacity of 55 t/h of superheated steam at 62 bar g and 510°C.

The Terminal generates its own power using steam turbo generators and shall not import electrical power from the onshore national electricity grid. The electric power generating plant, installed in the engine room area, consists of three 3.35 MW generating sets (two steam turbo generators and one diesel driven generator set), which shall be used as a backup auxiliary system. An additional set of two new 10 MW steam turbo generators shall be used as the main power generation source.

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 and to automatically put the plant into a predefined safe mode in the event of an emergency.

The Operating Company shall, at all times during the Service Period 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 grid 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 equipment, the terminal Fuel and losses, the Planned Service Reductions, the density of the LNG and any constraints imposed by the Grid connected to the Terminal

All services related or connected to the Services provided by the Terminal referred to in this Access Code are subject to change and/or changes in the course of the Start-up Period. The annual capacity and the services defined after this period will be deemed final and will be offered by the Operating Company in the subsequent Gas Years.

1.3.3 Terminal Manuals

The Customer 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, including the the ECS Manual, and the Technical Manual, unless any such provisions conflict with the applicable laws or regulations, any other applicable laws, the Capacity Agreement and/or International Standards. The Customer shall also procure that any LNG Carrier and any Shipowner shall comply with the Technical Manual, unless any such provisions conflict with Applicable Law, the Capacity Agreement and/or International Standards.