

# TOTEM

## Cogeneration (CHP) Range



**TOTEM**

### User's Manual

TOTEM 10 -TOTEM 20 -TOTEM 25 MICROCOGENERATORS



EXPERTLY ENGINEERED FOR YOU

## Preliminary Warnings

**Is strictly forbidden any kind of modification or tampering to the Product, replacement of components with non-original spare parts and/or any alteration to the original Product conformity unless approved by TOTEM ENERGY.**

**Every kind of modification and/or alteration to the chassis or internal components causes immediate suspension and/or exclusion of the Product Warranty.**

**For example, but not limited to, before or after the commissioning of the Product, is not allowed to:**

- **Execute holes in the chassis, canopy or any internal components of the Product;**
- **Execute of weld or gluing of parts or components to the chassis or other parts of the Product;**
- **Modify electrical systems and/or internal devices of the Product;**
- **Transport and position of the Product not following manufacturer's recommendations;**
- **Electric grounding not in compliance with manufacturer's recommendations;**
- **Storage of the Product not in compliance with manufacturer's recommendations;**
- **Modification and/or Tampering of the software and/or of the control parameters;**
- **Power supply to the Product not following manufacturer's recommendations.**

### **WARNING**

**In order to increase TOTEM unit running hours, meanwhile improving system efficiency and customer's savings, the starts of TOTEM should have priority over others heat generators. It's possible with a proper set up of temperature set point of the TOTEM and others heat generators.**

**In order to ensure product reliability it's user responsibility to make available a minimum thermal request to allow the properly TOTEM operation, so TOTEM must operate a minimum monthly average of 2 hours for each start cycle.**



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# 1. Declaration of Conformity

**Manufacturer**

TOTEM ENERGY srl

**Address**

Via Ivrea, 74 | 10098 Rivoli, Torino, Italy

Declares under its sole responsibility that the cogenerator

**Model****Model Year****Serial Number**

to which this declaration relates, it is compliant with the indispensable safety requirements imposed by:

- Machinery Directive 2006/42/EC and following amendments
- Electromagnetic Compatibility Directive 2014/30/EC and following amendments
- Low Voltage Directive 2014/35/EC and following amendments.

Harmonized standards and technical specifications provided as a reference for the design, construction and testing of the machines are listed in the technical file of the CHP, filed in TOTEM ENERGY. The Technical file was made up from TOTEM ENERGY and it is available at its headquarters located in Via Ivrea, 74 | 10098 Rivoli (To).

This declaration relates exclusively to the machinery in the state in which it was placed on the market, and excludes components that are added and/or the operations carried out subsequently by the final user.

Rivoli, 25<sup>th</sup> of April 2016

TOTEM ENERGY srl

Il Responsabile



## 2. General Safety Instructions

### A. Symbols Used in the Guide



**[Danger]** This symbol indicates operating procedures whose incorrect performance can cause injury or even death.



**[Warning]** This symbol indicates operating procedures whose incorrect performance can seriously damage the equipment.



**[Information]** This symbol indicates important information related to the use of the equipment.

### B. Glossary of Terms and Definitions

**Machine Operator:** "Machine Operator" shall mean any member of staff with no specific skills who can only perform simple tasks, namely: operating the unit by using the operator's control devices, checking on its proper functioning and reporting any possible anomaly to the Technical Support Service;

**Qualified Technician:** "Qualified Technician" shall mean a trained professional possessing specialist technical expertise in the fields of heating systems, hot water production systems, electrical and electrical energy generating systems, combustible gas-fired plants and appliances equipped with Otto or Miller-cycle endothermic engines as well as components thereof. Such professionals must be licensed as required by the applicable laws in force in the place where the TOTEM® is installed.

**Maintenance staff:** "Maintenance staff" shall mean a Qualified Technician possessing formally recognized professional skills, trained and authorized by Totem Energy to carry out maintenance operations on the TOTEM® units.

**Personal Protective Equipment (PPE):** "personal protective equipment" (PPE) shall mean the following safety wear and equipment:

- hearing protections (earmuffs or earplugs) for the hearing protection of workers operating on the TOTEM® unit in operation with the sound insulation panels removed (which can be done solely for troubleshooting or maintenance purposes).
- protective gloves and goggles when working with battery acid, glycol and engine lubricant oil;
- safety shoes;
- dielectric face shield and gloves when carrying out operations on energized electrical parts.

PPE must be worn by Maintenance staff at all times when performing installation, starting and maintenance activities on the TOTEM®.

## C. Safety Instructions



If you smell gas odor:

- turn your gas supply valve off;
- ventilate the room;
- do not operate any electrical device or appliance, including cell phones;
- leave the premises and call a Qualified Technician or the gas utility company immediately from a different location. If they are unavailable or in case of an emergency, call the local Fire Brigade;
- if the room is equipped with a gas leak detection system, please report any possible malfunctioning of said active safety equipment.



If you smell products of combustion:

- turn the appliance off;
- ventilate the room;
- call a Qualified Technician;
- if the room is equipped with a smoke/carbon monoxide detection system, please report any possible malfunctioning of said active safety equipment.



If you see water, glycol, oil, or other fluids' spills on the floor or near the Totem Unit:

- turn the unit off;
- call a Qualified Technician;
- shut off the User system's circuits, if any, e.g. water or gas supply



Installation, calibration and modification of the gas feed system must be performed by a Qualified Technician abiding by all applicable national and local standards as well as by the instructions provided in this Guide.



Installation, calibration or modification of the electrical system must be performed by a Qualified Technician abiding by all applicable national and local standards as well as by the instructions provided in this Guide.



Installation, calibration or modification of the water system must be performed by a Qualified Technician abiding by all applicable national and local standards as well as by the instructions provided in this Guide.













It is mandatory to connect the exhaust gas evacuation line of the appliance to an exhaust gas evacuation duct built in compliance with all applicable legal requirements in force in the place where the TOTEM® unit is installed. Failure to comply with said rule poses a serious risk to human and animal safety.



According to the provisions for use, the user has an obligation to keep the installed unit in good condition and to ensure the safe and reliable functioning of

the micro cogenerator and of all systems connected thereto, having the relevant activities performed by Qualified Technicians.

-  The user has an obligation to have the appliance maintained by a Qualified Technician in accordance with the provisions of this Guide and ensuring compliance with all applicable domestic and International standards.  
TOTEM ENERGY shall not be held liable for any damage to people, things or animals that may arise from incorrect installation or bad maintenance.
-  Before switching the unit on, always ensure that all protective panels and guards have been properly mounted to avoid risks to the safety of personnel.
-  Do not obstruct, not even partially, the suction duct and exhaust pipe ends.
-  Do not use or store any hazardous materials, such as explosive, combustible or flammable materials in the same room where the micro cogenerator is installed.
-  When the unit is in operation, do not stay in the room where the unit is installed.
-  The micro cogenerator, any auxiliary components thereof, the systems needed for its functioning (GAS, water, power, shut-off devices, firefighting equipment, detectors, panels, switchboards, components of the Totem Unit's equipment room etc.) must not be tampered with, modified or otherwise altered for any reason whatsoever. Failure to comply with this provision may cause injuries or may damage, including severely, people, animals or things.
-  This booklet is an integral and fundamental part of the micro cogenerator and it must be carefully kept by the user for future reference. In the event of a change of ownership of the micro cogenerator or of the premises where it is installed, please ensure that this booklet is handed over to the new user.
-  This booklet contains up-to-date information referring to the date it has been issued, without prejudice to possible amendments or technical updates.  
Since our products are constantly updated, slight differences may be found in pictures, process descriptions and technical data.  
If you wish to request the most updated version of this document, to suggest improvements or report any discrepancy, please contact the company.
-  This micro cogenerator must be used solely for the purpose it was expressly designed for, namely, the combined production of:
  - hot water in domestic and/or industrial closed-circuit water systems;
  - low voltage (400 Volts) power for net metering, feed-in to the grid or self consumption.
-  TOTEM ENERGY shall bear no liability - either contractual or extra-contractual – for any damages arising from the incorrect installation or use of the unit and, in

any case whatsoever, from failure to comply with the manufacturer's instructions or with all applicable national and local laws.

## D. Potential Safety Risks

### Risk related to Mechanical Hazards

Injuries from mechanical hazards can occur when the safety devices - panels or guards protecting the micro cogenerator's moving parts - are removed.

Said activities must, therefore, be performed solely by the Maintenance staff trained specifically for said purpose and wearing the appropriate PPE.

### Risk related to Electrical Hazards

Electrical injuries can occur when safety devices are removed from the system, from the control switchboard, or from the ignition system.

Moreover, modifications of the existing power supply system may cause serious hazards if performed by unauthorized personnel.

Said activities must, therefore, be performed solely by Maintenance staff trained specifically for said purpose and wearing the appropriate PPE.

### Risk related to Thermal Hazards

During regular functioning, some of the TOTEM®'s inner components may reach high temperatures. The entire appliance must, therefore, work under safe conditions with frame panels properly mounted, thus preventing access to hot components.

Only authorized Maintenance staff are authorized to remove the unit's panels.

### Risk related to Noise Hazards

In regular operation, the whole TOTEM® unit must work under safe conditions with the frame's heat-insulation panels properly mounted, which lowers the Unit's noise emissions.

### Risk related to Vibration Hazards

The TOTEM® unit is fitted with suitably sized anti-vibration mounts to reduce vibration transmission to the structures and installations connected thereto.

The removal of anti-vibration fittings from connections with the gas supply grid, the exhaust fumes line and the heating system is strictly forbidden.

### Risk related to Electromagnetic Radiation/Waves Hazards

The TOTEM unit complies with Directive 2004/108/EC relating to electromagnetic compatibility. However, the electromagnetic fields from the asynchronous generator can cause disturbances temporarily affecting the functioning of electro-medical devices such as, for example, pacemakers or hearing aids located in close proximity to it.

### Risk related to Contact with Hazardous Materials and Substances

On the inside, the TOTEM® module contains chemicals that are essential to its proper functioning.

Namely, it contains substances such as battery acid, fresh/spent lube oil and glycol-water mixtures.



In the presence of spills outside the TOTEM® unit, any direct contact of these substances with skin and eyes must be avoided at all times.

In the event that you come into contact with these chemicals, you must thoroughly wash the affected body parts and seek medical advice if necessary, bringing the relevant Product Safety Data Sheet with you. Said substances may even be hot and cause skin burns.

When in operation, the TOTEM module also produces a constant flow of exhaust fumes.

In the event of exhaust fumes build-up or leaks from the exhaust gas evacuation system, leave the area immediately and switch off the module if possible.

Based on the standards in force in the TOTEM®'s place of installation, you may also be required to install a CO/CH<sub>4</sub> gas detector in the module's room.

The TOTEM already has an incorporated CH<sub>4</sub> leak detector. Please contact our Technical Support Service for the detector's periodic calibration.

#### Risk related to Slip, Trip and Fall Hazards

Following breakdown or malfunctioning, lubricant oil, water-glycol fluids or battery acid leaks may occur, making the floor slippery thus creating a risk for falls.

Said spills must be readily contained and whenever possible disposed of according to the relevant laws in force.

#### Risk related to Emergency stop/Emergency shutdown

The TOTEM® module is designed to stop immediately following the activation of one or more external safety devices connected to it.

#### Risk related to Power Supply Interruption

The TOTEM® is designed to enable an immediate safe stop function in the event of an interruption of the mains power supply. A suitable interface protection device – not supplied by TOTEM ENERGY - approved based on the applicable standards in the module's place of installation can implement the module's disconnection from power supply whenever the standards of applicable regulations are not met.

#### Risk related to Control Switchboard malfunction/failure

The TOTEM® module is designed to enable an immediate safe stop in case of control switchboard malfunction or failure.

#### Risk from Breakdown during Regular Operation

If kept intact, used for the purpose it was designed for ensuring compliance with the technical parameters set by TOTEM ENERGY as well as properly maintained, the TOTEM® is designed to work under conditions that are fully safe for machine operators and systems connected to it.

#### Hazards from Use in Environments at Risk of Fire/Explosion - EX

The TOTEM® is not intended for use in environments at risk of fire or explosion (Ex). Do not keep or store materials that may increase the risk of explosion or fire in the room where the TOTEM® is installed.

### 3. Product Description

#### A. General Information

This User's Guide is intended to provide the necessary information for the use of TOTEM units. TOTEM micro cogeneration units are appliances that allow for the combined production of electricity and heat at the user's site, thus optimizing the use of the fuel's primary energy and reducing grid distribution and separate generation losses.

CHP units, indeed, can be easily integrated into any technological environment, enabling fulfillment of the heating requirements of different users in a variety of sectors:

- hospitality;
- wellbeing;
- catering;
- health-care;
- housing;
- public;
- agri-food;
- distribution chains.

Using a micro cogeneration unit allows to achieve significant economic savings and environmental benefits.

The unit consists of an endothermic engine originally devised for the automotive industry, coupled to an asynchronous generator.

The heat produced in the endothermic engine's combustion process is almost fully recovered by means of a high-efficiency heat exchangers system and made available to users as hot water.

Thanks to its modern propellers manufactured by FCA, specially engineered to run on gas and optimized to work under steady-state, the unit allows for optimized performance and longer maintenance intervals. Moreover, its modern Euro 6 technology enables a significant reduction of nitrogen oxides - NO<sub>x</sub> - and carbon monoxide - CO - emissions as compared to conventional condensing boilers.



TOTEM® units' compact size and versatility allows installation in tight equipment rooms and their use on existing premises, including with environmental or architectural constraints.

Its control systems allow to monitor and log data for power and heating load profiles, including remotely. Moreover, it enables service staff to monitor any alarm signal detected thus enabling emergency service in case of breakdown or malfunctioning.



## B. Product ID

Each TOTEM® micro cogeneration unit is fitted with a special plate providing all details for its identification.

 1936-18 CE-1936CT0009			
microCHP			TOTEM 20
Serial number			
Construction year			XXXX
Weight			XXX kg
Net electrical power ( $P_{el}$ )			XX kW
Max thermal power ( $P_{th}$ )			XX kW
Input power (Q)			XX kW
Inlet water temperature range			XX °C
Outlet water temperature range			XX °C
Max water pressure			XX bar
Tension			XXX V-3F
Frequency			XX Hz
Nominal current			XX A
Short circuit current generated			XXX A
Max Short circuit current admitted			XX kA
Power factor			0.97
Electrical diagram			XXXXXXXXXXXX
Max ambient temperature			XX °C
Max altitude			XXXX m
Appliance type			XX
Country of destination			
Appliance category			XXX
Gas supply pressure			XX mbar
<b>Asja Ambiente Italia spa</b> via Ivrea, 70 - 10098 Rivoli (To) - Italy <a href="http://www.totem.asja.energy">www.totem.asja.energy</a>		<a href="mailto:customercare@totem.energy">customercare@totem.energy</a> T +39 011 9579211	

## C. Module Main Components

Every TOTEM® module is the result of painstaking engineering research and selected technological solutions combining high quality materials from specialist suppliers. A detailed description of the module's main components is provided in the following sections.

### - Endothermic Engine

FCA Fire 1.4 51 kW Bifuel Euro 6, four stroke, Otto cycle endothermic engine, fuel feeding system fitted with a Venturi and throttle for fuel injection adjustment; fuel injection is governed by a stepper motor.

Engine speed for the TOTEM® module 10 is set at 1,500 revs/minute.

Engine speed for the TOTEM® module 20 and 25 is set at 3,000 revs/minute.

Displacement	cm <sup>3</sup>	1368
Maximum shaft power	kW	51
Maximum Output Torque		104 Nm@3250 RPM
Arrangement / Number of Cylinders		L-NA / 4
Valves per cylinder		2
Compression ratio		11 : 1
Oil Pressure at 1,500 revs	bar	> 1.8
Oil Pressure at 3,000 revs	bar	> 3.5
Crankcase		Cast Iron
Cylinder head		Steel
Engine weight	kg	88

### - Asynchronous Generator

#### TOTEM 10 ASYNCHRONOUS GENERATOR - TECHNICAL FEATURES

Rated power	kW	11
Electric power output	kW	10
Pole number		4 - 1500 RPM
Rotor		Squirrel cage
Cooling system		Liquid
Type of cooling fluid		water + glycol (max 30%)
Cooling circuit max pressure	bar	3
Max pressure drop with max flow rate	bar	0.5
Coolant temp. range	°C	30 - 75
Hydraulic In/Out threading/coupling size	inch	1"
Installation environment temp. range	°C	-20°C +60
Mechanical Design		B3/B5 (foot and flange mounting)
Direction of axis		horizontal
Terminal box position		On top, with cable exit holes on the back

Efficiency		91.7 (Efficiency class: IE3)
Power supply - Voltage - Frequency		Three-phase - 400V - 50 Hz
Insulation/Duty class		H/S1 – continuous duty
Rated power factor		>0.81
Winding connection		Delta/Wye 400/690 V
Height of axis	mm	160
Shaft diameter	mm	42
Length	mm	620 (shaft excluded)
Shaft length	mm	110

### TOTEM 20 ASYNCHRONOUS GENERATOR - TECHNICAL FEATURES

Rated power	kW	21
Electric power output	kW	20
Pole number		2 - 3000 RPM
Rotor		Squirrel cage Brushless
Cooling system		Liquid
Type of cooling fluid		water + glycol (max 30%)
Cooling circuit max pressure	bar	3
Max pressure drop with max flow rate	bar	0.5
Coolant temp. range	°C	30 - 75
Hydraulic In/Out threading/coupling size	Inch	1"
Installation environment temp. range	°C	-20°C +60
Mechanical Design		B3/B5 (foot and flange mounting)
Direction of axis		horizontal
Terminal box position		On top, with cable exit holes on the back
Efficiency		94.6 (Efficiency class: IE3)
Power supply - Voltage - Frequency		Three-phase- 400V - 50 Hz
Insulation/Duty class		H/S1 – continuous duty
Rated power factor		>0.81
Winding connection		Delta/Wye 400/690 V
Height of axis	mm	160
Shaft diameter	mm	42
Length	mm	620 (shaft excluded)
Shaft length	mm	110

### TOTEM 25 ASYNCHRONOUS GENERATOR - TECHNICAL FEATURES

Rated power	kW	26,5
Electric power output	kW	25
Pole number		2 - 3000 RPM
Rotor		Squirrel cage Brushless

Cooling system		Liquid
Type of cooling fluid		water + glycol (max 30%)
Cooling circuit max pressure	bar	3
Max pressure drop with max flow rate	bar	0.5
Coolant temp. range	°C	30 - 75
Hydraulic In/Out threading/coupling size	Inch	1"
Installation environment temp. range	°C	-20°C +60
Mechanical Design		B3/B5 (foot and flange mounting)
Direction of axis		horizontal
Terminal box position		On top, with cable exit holes on the back
Efficiency		94.6 (Efficiency class: IE3)
Power supply - Voltage - Frequency		Three-phase- 400V - 50 Hz
Insulation/Duty class		H/S1 – continuous duty
Rated power factor		>0.81
Winding connection		Delta/Wye 400/690 V
Height of axis	mm	160
Shaft diameter	mm	42
Length	mm	620 (shaft excluded)
Shaft length	mm	110

Compliance with standards:

- 2006/42/EC Machinery Directive;
- 2006/95/EC Low Voltage Directive;
- 2004/108/EC EMC Directive;
- IEC EN 60034;
- 1997/23/EC Directive.

#### - **Heat Recovery System**

The TOTEM® unit is equipped with a high performance in-built heat exchange system that can recover heat energy from the gen set, the engine water and oil circuits, and exhaust fumes. The system does not include any heat dissipator device, therefore, it is only activated following heat demand.

Heat is recovered by means of the following equipment:

- Asynchronous generator: the heat recovery system is incorporated in the gen set canopy. Please see the generator features section.
- Engine Oil: AISI 316L stainless steel water/oil brazed plate heat exchanger
- Engine water: AISI 304 stainless steel brazed plate heat exchanger
- Exhaust gases: AISI 304 stainless steel water/fumes tube bundle heat exchanger.

The engine water circuit is governed by a high-efficiency circulator pump having the following technical features:

Power supply	V	230
Frequency	Hz	50
Max. current	A	< 2
Minimum inlet pressure		0.1 bar with fluid at 95°C
Fluid temperature	°C	-10 to + 95
Protection grade		IP X2D
Insulation class		H
Equipment class		I

The TOTEM's internal circuit size, flow rates, temperature deltas and circuit pressure values have been carefully calculated and set upon design.

#### - **Exhaust Treatment and Discharge Line**

Exhaust gases from the endothermic engine are conveyed along the treatment and cooling line before being expelled. The exhaust discharge line comprises a 4-1 manifold, a coaxial exchanger, a three-way catalyst, a tube bundle exchanger for heat recovery and an in-built silencer.

The 4-1 manifold conveys exhaust gases from the 4 engine cylinders into the exhaust duct. It is equipped with a lambda sensor for injected mass control as well as with a sensor checking gas temperature right at the engine outlet.

The manifold is efficiently insulated so as to minimize heat dispersion along this section. Gases then go through the coaxial heat exchanger where a first cooling stage takes place, after which they are sent to the three-way catalyst where emissions are lowered. The ceramic substrate catalyst simultaneously reduces CO, NO<sub>x</sub> and HC emissions. It is fitted with a sensor at the inlet to check the right operating temperature for the catalyst, plus a lambda sensor downstream for a second level titration control. The catalyst is thermally insulated, too. The gases leaving the catalyst reach the tube bundle exchanger where they are cooled down until condensation occurs (T<70°C). Before being discharged, gases go through an exhaust gas silencer, specifically devised to lower the noise emissions from the micro-cogenerator for the given rev number.

#### - **Electrical and Control Switchboard**

The Electrical Switchboard complies with current applicable standards and it contains all the electrical safety devices as well as all control devices governing the unit's functioning.

The TOTEM is governed by 3 control units:

- ECU (Engine Control Unit): manufactured by Magneti Marelli, it governs control of the endothermic engine. The control unit is set to work under steady state conditions and it interfaces through CANbus system with the MCU. It is located inside the unit's enclosure;
- MCU (Machine Control Unit) "Arya": developed to fit specific TOTEM ENERGY requirements, it governs the control and operation of the TOTEM® unit through an interface with the ECU via CANbus and with the Gateway. Also, it is connected with MODBus RTU to a multi-function multimeter that conforms to a 0.5s accuracy class in compliance with IEC 62053-22 standards;

- Gateway: unit for data communication to external networks. It governs data transmission to the in Cloud remote control platform and to external BMS if present. It communicates according MODBus TCP/IP standards via LAN, Wi-Fi, GSM and CANBus with MCU.

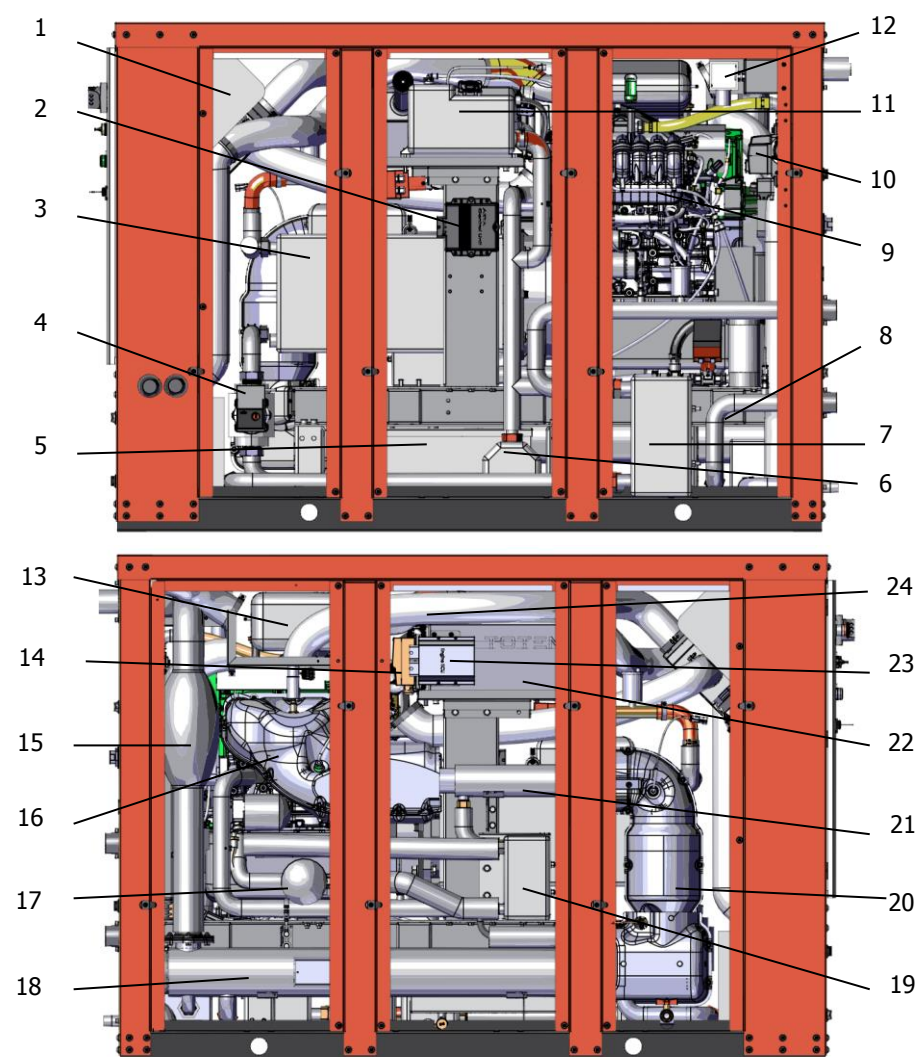
- **Frame and Panels**

Frame with self-supporting base, made of press-bent steel panels. Panels are powder-coated with polyester-based coating.





## D. TOTEM - Layout of Components



1	Enclosure air vent	13	Engine air filter
2	ARYA control unit	14	Safety frame structure temperature sensor
3	Water cooled asynchronous generator	15	Exhaust silencer
4	Engine water circulator pump	16	Exhaust manifold
5	Spent oil tank	17	Oil filter
6	Thermostatic valve	18	Fumes to water tube bundle heat exchanger
7	Water to water plate heat exchanger	19	Water to oil plate heat exchanger
8	Condensate collector tray	20	Marelli three-way catalyst
9	FIAT FIRE endothermic engine	21	Water to fumes coaxial heat exchanger
10	Zero governor valve	22	Fresh oil tank
11	Water tray	23	Marelli ECU
12	Methane gas safety detector	24	Engine air suction snorkel

## E. Safety Instructions

The TOTEM is equipped with EN ISO 13849 compliant safety systems so as to protect machine operators and maintenance staff against hazards linked to the micro-cogenerator operation.

Risk analysis has identified the following hazards:

- Exhaust gas emissions
- Lack of water flow
- Spark advanced with temperature increase
- Methane gas leak

The system is composed of a chain of safety sensors: an electromechanical thermostat, a methane gas sensor, and an emergency pushbutton.

### **Methane gas leakage hazard**

The TOTEM is fitted with a catalytic methane gas sensor for gas leaks. The sensor features a two-threshold calibration that trigger safety system activation when gas leaks are detected inside the unit's enclosure. The first threshold value is set to 20% of LEL. Values exceeding threshold are sent to the ARYA PLC that will command the unit to turn off thus restoring safety conditions. The second threshold value is set to 50% of LEL, exceeding of this values is reported directly to the safety relay that is actuated even in the event of PLC malfunctioning, closing the gas supply valve and turning the unit off. The electrical switchboard terminal block includes a contact for connection to the natural gas solenoid of the central heating system. In the event of a gas leak, the relay opens this circuit, too, for commanding valve closure.

### **Exhaust Gas Emission Hazard, Lack of Water Flow Hazard, Timing variation Hazard**

The above mentioned occurrences can pose a danger by causing an increase in temperature which may cause some of the unit's parts to become hot thus putting the operator at risk of burns, or by causing a discharge of exhaust gases that upstream of the catalyst feature a high carbon monoxide content.

These anomalies can be detected by a safety thermostat fitted inside the unit's enclosure and calibrated to actuate the emergency relay upon reaching 75°C, which will switch the unit off. This is a certified system guaranteeing high reliability even in the event of a failure of all other control systems fitted onto the TOTEM.

### **Emergency Pushbutton**

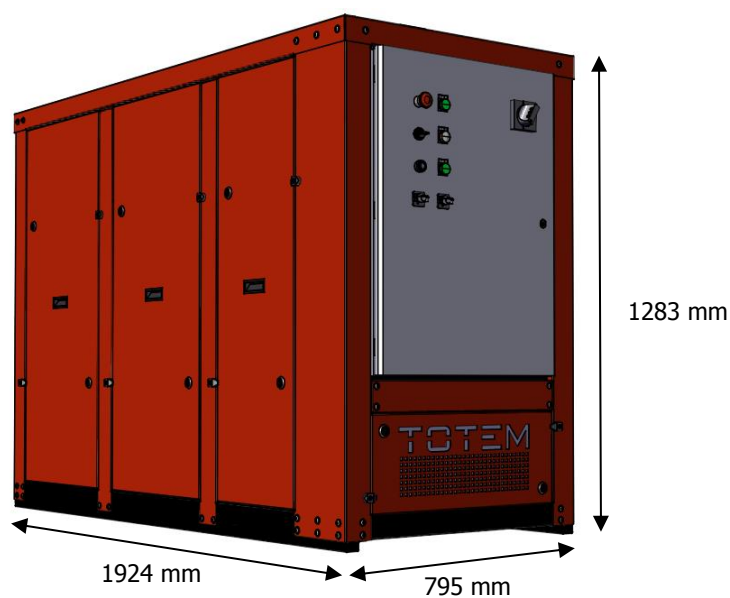
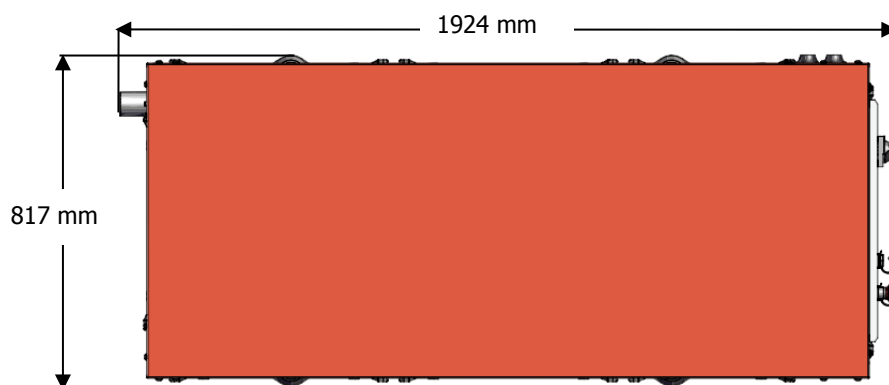
The Operator Panel features an emergency pushbutton that can be pressed in the event of any risk situation. The emergency pushbutton actuates the emergency relay that will switch the micro cogenerator off thus restoring safety.

In order to ensure proper functioning of the safety devices and, consequently, Totem's operation under fully safe conditions, the following requirements must mandatorily be met upon installation:

- The central heating system solenoid must be connected to the specially devised terminal block located on the TOTEM electrical switchboard;
- Proper room ventilation – at least 600 m<sup>3</sup>/h must be ensured or, alternatively, enough windows must be provided in the room so as to ensure an equivalent

ventilation rate according to volumes, or a CO sensor must be installed in the central heating system.

## F. Size and Overall Dimensions

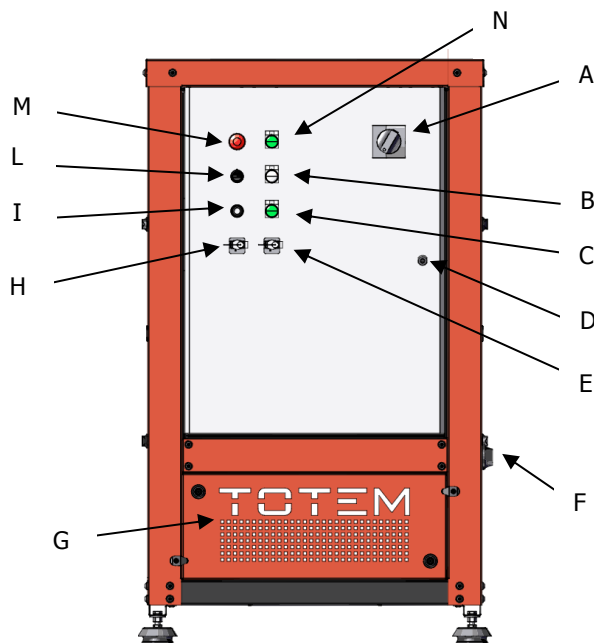


## G. Control Switchboard

Machine Operators can operate the machine solely by using the controls available on the control switchboard; access to the inside of the Control switchboard cabinet remains strictly forbidden due to the presence of energized and hot parts.

The Control switchboard features the following control devices:

- Main Switch (A): by operating the Main Switch, the battery cable (12 V) and the grid cables (400 V) set between the inlet point and the Main Switch, are still energized. For removing completely voltage on the Totem, please disconnect the battery and operate on the external main switchboard;
- Emergency pushbutton (M): in the event of an emergency, the unit can be switched off by pressing the emergency pushbutton;
- Emergency relay manual reset pushbutton (I): if the unit is switched off by means of the emergency pushbutton or following activation of one of the alarms along the safety chain (high temperature or fuel leak), the emergency relay must be manually reset by pressing the reset button before restarting the unit;
- Switch (L): selector for switching;
- Green LED (N): auxiliaries powered;
- Yellow LED (B): fault;
- Green LED (C): grid connection;
- Diagnosis connection (E);
- LAN connection (H): the LAN port enables connection to other devices providing access the operator panel and the MODBus TCP/IP.



A	Main Switch	G	Air intake compartment
B	Fault	H	LAN
C	LED grid connection	I	Reset
D	Control switchboard lock	L	On/Off

E	Diagnosis	M	Emergency push button
F	Power cable entry	N	Power on

The Electrical Board and Air intake compartment can be opened with a special key solely by authorized personnel.

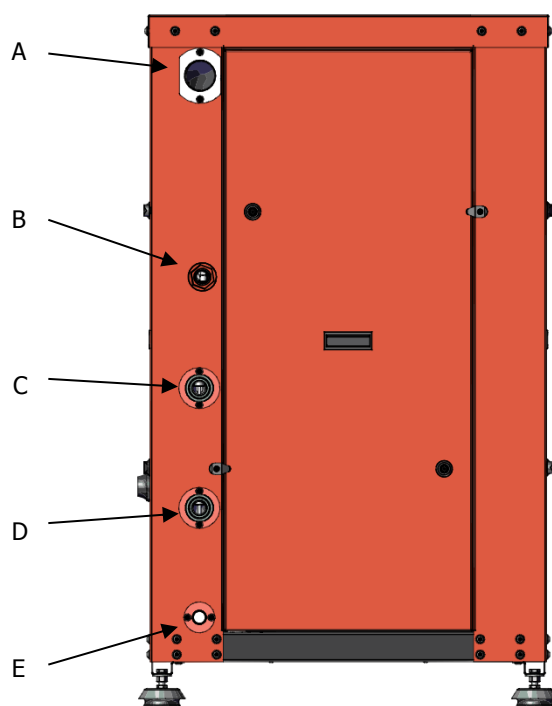
## H. Connection Panel

All process connections are located on one of the vertical members of the unit's back side, opposite to the Control Switchboard.

The connections' position is shown in figure.

In a standard configuration, process connections must fulfill the following requirements:

- Fumes discharge :60 mm
- Natural gas connection:  $\frac{3}{4}$ " GAS female
- User Water outlet: 1"  $\frac{1}{4}$  GAS female
- User Water inlet : 1"  $\frac{1}{4}$  GAS female
- Condensate Drain:  $\frac{3}{4}$ " GAS male



A	Fumes discharge
B	Fuel gas supply (natural gas)
C	User water outlet
D	User water inlet
E	Condensate drain

## I. Noise Emissions and Vibrations

Thanks to its high-quality technical solutions and its high-performing sound insulation materials, the TOTEM® units feature low noise emissions.

The data shown in the technical datasheet are measured at 1 m distance, free-field, as per standards.

Despite its carefully selected sound-insulating, vibration-damping materials, when in operation the TOTEM® unit can generate small vibrations that may in some cases be transferred to surrounding structures.

For extremely sound sensitive applications, additional solutions may be necessary to further reduce noise and vibrations.

## 4. Use of the Micro Cogenerator

### A. Preparing the Unit for Use

Before starting the unit, ensure that all connections described in the Installation Guide have been performed correctly.

All installation procedures must be performed solely by Qualified Technicians.

A description of said procedures is provided in the Installation Guide.

In all cases, commissioning must be performed solely by authorized Totem Energy personnel by calling the Technical Support Service. Carrying out commissioning without the supervision of Totem Energy authorized personnel will nullify the warranty. In the event that the unit has to be restarted after prolonged inactivity, we recommend calling the Technical Support Service.

Once all connections to the User systems have been checked, it is possible to operate the Main Switch thus powering the Electrical Board and switching the green led on in a few minutes.

TOTEM units use air for combustion. The proper amount of air for recirculation in the room - 600 m<sup>3</sup>/hour - must also be provided through suitably sized openings in the building envelope. Such airflow inlets must not interfere with pre-existing openings, if any, created for other devices or heat generators.

To ensure the unit's proper functioning, the ambient operating temperature must range between 1°C and 40°C.

For applications with ambient temperatures that may, even occasionally, be equal to or lower than 0°C, it is mandatory to treat the user system's water properly and add an anti-freeze solution in suitable concentration.

For applications in areas with ambient temperatures that may, even occasionally, get lower than -15°C, it is mandatory to properly treat the micro cogenerator's internal circuit coolant, too. Please contact TOTEM ENERGY's Technical Support Service.



## B. Starting and Working Principle

TOTEM units work based on the "thermal priority" principle, that is to say, they automatically switch to simultaneous delivery of heat and electricity whenever a heat load is present that allows to recover heat from the internal recovery system of the TOTEM unit.

In addition to fulfilling the aforementioned condition, the unit's Start must be enabled by the User by operating the "ON" button that is found on the Operator panel.

Once start is enabled, the TOTEM starts functioning following a demand for heat under the following conditions:

- Activation of the User's Water system circulator pump, as detected by the unit's on-board flow switch;
- Water temperature below the value set by the User.

The temperature value can be set in the "Settings" screenshot on your device in the range from 15 to 70°C.

In addition to the start temperature value, the stop temperature value will also be set. When the temperature of water from the supply line exceeds the set value, the unit automatically stops, going into stand-by mode.

The unit is also fitted with an external pump control outlet. When the start is enabled the pump start command is also enabled. When the unit stops, the pump is also commanded to stop with a delay that can be set by the user. The delay is needed to let water circulate within the unit after it is switched off thus allowing it to cool down.

## C. Operating Conditions

Under standard operating conditions, the units work under fixed point steady state mode.

Electric power output is equal to 10, 20 and 25 kW respectively.

Thermal power depends on user water inlet temperature and it can range from 21.6-25.2 kW, 41.9-48.5 kW and 50.2-57.6 kW for the three models respectively.

Inlet temperature can vary from a maximum of 72°C to 35°C. Water flow rate must be 2.5 m<sup>3</sup>/h for T10, 4 m<sup>3</sup>/h for T20 and 5 m<sup>3</sup>/h for T25. Outlet temperature depends on inlet temperature and flow rate. Thermal gradient can vary from 5 to 11°C according to water flow rate. Methane feeding pressure must be in the range of 20mbar +/- 5%. Engine exhaust fumes temperature is approximately 740°C for TOTEM 25, 720°C for TOTEM 20 and 620°C for TOTEM 10. Fumes stack temperature is comprised between 60 and 80°C.

## D. Fuel Characteristics

The TOTEM can run on natural grid gas. Said fuel gas must fulfill the requirements of quality for natural gas.

The parameters for Quality Control are listed hereunder:

- Higher Heating Value (HHV): 34.95÷45.28 MJ/Sm<sup>3</sup>
- Wobbe Index: 47.31÷52,33
- Relative density: 0.5548÷0.8
- Oxygen: < 0.6 %mol
- Water dew point: <= -5°C

- Hydrocarbon dew point:  $\leq 0^{\circ}\text{C}$
- Max temperature:  $< 50^{\circ}\text{C}$
- Carbon dioxide:  $\leq 3\%\text{mol}$

Polluting compounds are tolerated within the following thresholds:

- Hydrogen Sulphide  $\leq 6.6 \text{ mg/Sm}^3$
- Mercaptans  $\leq 15.5 \text{ mg/Sm}^3$
- Total Sulphur  $\leq 150 \text{ mg/Sm}^3$

Under operating conditions, the gas used must not contain traces of water or liquid state hydrocarbons, solid particulate matter or other elements that may impact safety.

Gas pressure at the TOTEM inlet must be higher than 13 mbar. Lower pressure values may generate an error alert.

The natural gas consumption data shown in the technical datasheets refer to natural grid gas with a Lower Heating Value of  $10.2 \text{ kWh/Nm}^3$  (PCS  $11.3 \text{ kWh/Nm}^3$ ).

## E. User System's Water Characteristics

TOTEM's process water cannot be directly drawn off the domestic hot water or drinking water circuit. Appropriate hydraulic separation systems must be installed for said applications.

The water used in the user circuit must fulfil the requirements provided in nationale standards and have the following chemical and chemical/physical parameters for water in heating systems for civilian applications:

- Clear appearance ;
- pH above 7 (below 8 for the user system's sections made in light alloys, if any)
- iron (as Fe)  $< 0.5 \text{ mg/kg}$  (higher values indicate presence of corrosion that must be removed before connection to the TOTEM® unit);
- copper (as Cu)  $< 0.1 \text{ mg/kg}$  (higher values indicate presence of corrosion that must be removed before connection to the TOTEM unit).

Further provisions also require to:

- fill the heating system with water having a low limestone content, with a French degree of water hardness between  $15^{\circ}\text{F}$  and  $25^{\circ}\text{F}$ , based on the installed capacity and the system's overall content;

Therefore, it is mandatory to install a suitable water treatment system on heating systems that do not comply with the limits imposed.

The limits set by the aforementioned provisions and supplemented by legal provisions and regulations in force in the place of installation are aimed to:

- optimize TOTEM®'s and user systems' performance and reliability;
- guarantee system safety;
- preserve the systems' components over time;
- ensure regular functioning of auxiliary equipment;
- minimize energy consumption.





Using suitably treated water for the user water system serves the dual purpose of ensuring compliance with applicable regulations and TOTEM ENERGY's / leading heat generator manufacturers' recommendations, and contributing to reducing operating costs and consumption.

For applications featuring an environment temperature below 1°C, an anti-freeze mixture (glycol) must be added to the user circuit. Depending on its glycol content, the water/anti-freeze mixture may reduce the heat exchange capacity and heating output.

Frequent refilling of the circuit should be avoided. Care should be taken in choosing water softening techniques based on deionization and cation exchange. We advise against using chemical additives as they may cause harmful dirt/residues to precipitate and possibly damage the system.

If the TOTEM® is installed in pre-existing heating systems that may be subject to deterioration, including corrosion, algae formation, lime scale build-up, or dirt deposits, the user system should be preemptively flushed with appropriate products depending on the problem identified. In some specific cases, a suitable hydraulic separation device (exchanger) shall have to be installed to protect the TOTEM®'s internal circuit from possible damages and avoid treating the preexisting systems too aggressively.

## F. Emergency Stop and Shutdown

The TOTEM® can be switched off manually by the User from the Control switchboard or following the reaching of the pre-set supply temperature, or even following activation of an alarm signal.

The Arya PLC developed by Totem Energy monitors a set of parameters for engine functioning and it governs the unit's shutdown in case a value exceeding the manufacturer's preset range is detected.

In addition to being governed by the PLC, the TOTEM® shutdown can also follow actuation of the emergency relay. Namely, the safety line can be activated in the presence of the following potentially dangerous malfunctions:

- Push the Emergency button
- High temperature within the unit's enclosure detected by the temperature limiter
- Methane detected by the unit's on-board sensor

## G. Calendar

Through the Calendar function, it is possible to program the Unit to start on set days and time ranges.

With the Calendar function disabled, the unit will only start following manual input by the operator from the operator panel.

With the Calendar function enabled, the unit will only be switched on on the days and time ranges set by the User.

## H. Diagnostics

If the machine is shut down following a command by the PLC, an alarm signal (yellow LED) is switched on.

The alarm signal can be reset to enable unit's restart. If the alarm stays on, the unit won't start. If that occurs, call the Technical Support Service.

If the unit was switched off due to activation of the safety devices, alongside the alarm the emergency relay reset button will also light up.

To restart the unit, press the emergency relay manual reset button and reset all alarms on the Control switchboard.

## 5. Maintenance

Scheduled Maintenance shall be performed according to the maintenance plan shown in the tables hereunder for each type of Unit.

The Maintenance Plan provides for four types of operation, to be carried out with different timing according to model:

### TOTEM 10:

- 1A to be carry out every 3,000 hours
- 2 to be carry out every 6,000 hours
- 3 to be carry out every 30,000 hours
- 4 to be carry out every 60,000 hours

### TOTEM 20:

- 1B to be carry out every 2,500 hours
- 2 to be carry out every 5,000 hours
- 3 to be carry out every 20,000 hours
- 4 to be carry out every 60,000 hours

### TOTEM 25:

- 1B to be carry out every 2,500 hours
- 2 to be carry out every 5,000 hours
- 3 to be carry out every 15,000 hours
- 4 to be carry out every 60,000 hours

Detailed instructions on how to carry out basic maintenance operations are provided in the Service Manual.

## TOTEM 10 MAINTENANCE PLAN

0-60,000 hours

TOTEM by asja		MAINTENANCE PLAN "EXCELLENT" TOTEM 10 0-60.000								
Service hours	3000	6000	9000	12000	15000	18000	21000	24000	27000	30000
	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%
Job	Maintenance 1A	Maintenance 1A	Maintenance 2	Maintenance 1A	Maintenance 1A	Maintenance 2	Maintenance 1A	Maintenance 1A	Maintenance 2	Maintenance 3
Machine check up	X	X	X	X	X	X	X	X	X	X
Fastener and hose torque and check	X	X	X	X	X	X	X	X	X	X
Electrical connection torque and check	X	X	X	X	X	X	X	X	X	X
Engine coolant level check	X	X	X	X	X	X	X	X	X	X
CH4 leaking sensor check	X	X	X	X	X	X	X	X	X	X
Engine oil replacement/tank refill	X	X	X	X	X	X	X	X	X	X
Engine oil filters replacement	X	X	X	X	X	X	X	X	X	X
Primary air filter replacement	X	X	X	X	X	X	X	X	X	X
Valve gap check and setting	X	X	X	X	X	X	X	X	X	
Spark plug replacement			X			X			X	
Cylinder head replacement			X			X			X	
Spark plug cables replacement			X			X			X	
Distribution belt and tensioner replacement			X			X			X	
Engine coolant replacement			X			X			X	X
Lambda probe replacement (pre catalytic converter)			X			X			X	X
Secondary air filter replacement			X			X			X	X
Lambda probe replacement (post catalytic converter)										X
Exhaust gas heat exchanger cleaning (fumes side)										X
Water heat exchanger cleaning (user water side)										X
Three way catalyzer replacement										X
Engine Replacement										X
Battery replacement										X
Gas actuator replacement										X
Flexible tubes replacement				X				X		
Insualtions replacement										X
Generator replacement										
Service hours	33000	36000	39000	42000	45000	48000	51000	54000	57000	60000
	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%
Job	Maintenance 1A	Maintenance 2	Maintenance 1A	Maintenance 1A	Maintenance 2	Maintenance 1A	Maintenance 1A	Maintenance 2	Maintenance 1A	Maintenance 4
Machine check up	X	X	X	X	X	X	X	X	X	X
Fastener and hose torque and check	X	X	X	X	X	X	X	X	X	X
Electrical connection torque and check	X	X	X	X	X	X	X	X	X	X
Engine coolant level check	X	X	X	X	X	X	X	X	X	X
CH4 leaking sensor check	X	X	X	X	X	X	X	X	X	X
Engine oil replacement/tank refill	X	X	X	X	X	X	X	X	X	X
Engine oil filters replacement	X	X	X	X	X	X	X	X	X	X
Primary air filter replacement	X	X	X	X	X	X	X	X	X	X
Valve gap check and setting	X	X	X	X	X	X	X	X	X	
Spark plug replacement		X			X			X		
Cylinder head replacement		X			X			X		
Spark plug cables replacement		X			X			X		
Distribution belt and tensioner replacement		X			X			X		
Engine coolant replacement		X			X			X		X
Lambda probe replacement (pre catalytic converter)		X			X			X		X
Secondary air filter replacement		X			X			X		X
Lambda probe replacement (post catalytic converter)										X
Exhaust gas heat exchanger cleaning (fumes side)										X
Water heat exchanger cleaning (user water side)										X
Three way catalyzer replacement										X
Engine Replacement										X
Battery replacement										X
Gas actuator replacement										X
Flexible tubes replacement		X				X				X
Insualtions replacement										X
Generator replacement										X

## TOTEM 20 MAINTENANCE PLAN

0-60,000 hours

TOTEM by asja		MAINTENANCE PLAN "EXCELLENT" TOTEM 20 0-60.000											
Service hours	2500	5000	7500	10000	12500	15000	17500	20000	22500	25000	27500	30000	
	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	
Job	Maintenance 1B	Maintenance 2	Maintenance 1B	Maintenance 2	Maintenance 1B	Maintenance 2	Maintenance 1B	Maintenance 3	Maintenance 1B	Maintenance 2	Maintenance 1B	Maintenance 2	
Machine check up	X	X	X	X	X	X	X	X	X	X	X	X	
Fastener and hose torque and check	X	X	X	X	X	X	X	X	X	X	X	X	
Electrical connection torque and check	X	X	X	X	X	X	X	X	X	X	X	X	
Engine coolant level check	X	X	X	X	X	X	X	X	X	X	X	X	
CH4 leaking sensor check	X	X	X	X	X	X	X	X	X	X	X	X	
Engine oil replacement/tank refill	X	X	X	X	X	X	X	X	X	X	X	X	
Engine oil filters replacement	X	X	X	X	X	X	X	X	X	X	X	X	
Primary air filter replacement	X	X	X	X	X	X	X	X	X	X	X	X	
Valve gap check and setting	X	X	X	X	X	X	X		X	X	X	X	
Spark plug replacement	X	X	X	X	X	X	X		X	X	X	X	
Cylinder head replacement		X		X		X				X		X	
Spark plug cables replacement		X		X		X				X		X	
Distribution belt and tensioner replacement		X		X		X				X		X	
Engine coolant replacement		X		X		X		X		X		X	
Lambda probe replacement (pre catalytic converter)		X		X		X		X		X		X	
Secondary air filter replacement		X		X		X		X		X		X	
Lambda probe replacement (post catalytic converter)								X					
Exhaust gas heat exchanger cleaning (fumes side)								X					
Water heat exchanger cleaning (user water side)								X					
Three way catalyzer replacement				X				X				X	
Engine Replacement								X					
Battery replacement								X					
Gas actuator replacement								X					
Flexible tubes replacement				X				X				X	
Insualtions replacement								X					
Generator replacement						X						X	
Service hours	32500	35000	37500	40000	42500	45000	47500	50000	52500	55000	57500	60000	
	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	
Job	Maintenance 1B	Maintenance 2	Manutenzione 1B	Maintenance 3	Maintenance 1B	Maintenance 2	Maintenance 1B	Maintenance 2	Maintenance 1B	Maintenance 2	Manutenzione 1B	Maintenance 4	
Machine check up	X	X	X	X	X	X	X	X	X	X	X	X	
Fastener and hose torque and check	X	X	X	X	X	X	X	X	X	X	X	X	
Electrical connection torque and check	X	X	X	X	X	X	X	X	X	X	X	X	
Engine coolant level check	X	X	X	X	X	X	X	X	X	X	X	X	
CH4 leaking sensor check	X	X	X	X	X	X	X	X	X	X	X	X	
Engine oil replacement/tank refill	X	X	X	X	X	X	X	X	X	X	X	X	
Engine oil filters replacement	X	X	X	X	X	X	X	X	X	X	X	X	
Primary air filter replacement	X	X	X	X	X	X	X	X	X	X	X	X	
Valve gap check and setting	X	X	X		X	X	X	X	X	X	X		
Spark plug replacement	X	X	X		X	X	X	X	X	X	X		
Cylinder head replacement		X				X		X		X			
Spark plug cables replacement		X				X		X		X			
Distribution belt and tensioner replacement		X				X		X		X			
Engine coolant replacement		X		X		X		X		X		X	
Lambda probe replacement (pre catalytic converter)		X		X		X		X		X		X	
Secondary air filter replacement		X		X		X		X		X		X	
Lambda probe replacement (post catalytic converter)				X								X	
Exhaust gas heat exchanger cleaning (fumes side)				X								X	
Water heat exchanger cleaning (user water side)				X								X	
Three way catalyzer replacement				X				X				X	
Engine Replacement				X								X	
Battery replacement				X								X	
Gas actuator replacement				X								X	
Flexible tubes replacement				X				X				X	
Insualtions replacement				X								X	
Generator replacement						X						X	

## TOTEM 25 MAINTENANCE PLAN

### 0-60,000 hours

TOTEM by asja		MAINTENANCE PLAN "EXCELLENT" TOTEM 25 0-60.000											
Service hours	2500	5000	7500	10000	12500	15000	17500	20000	22500	25000	27500	30000	
	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	
Job	Maintenance 1B	Maintenance 2	Maintenance 1B	Maintenance 2	Maintenance 1B	Maintenance 3	Maintenance 1B	Maintenance 2	Maintenance 1B	Maintenance 2	Maintenance 1B	Maintenance 3	
Machine check up	X	X	X	X	X	X	X	X	X	X	X	X	
Fastener and hose torque and check	X	X	X	X	X	X	X	X	X	X	X	X	
Electrical connection torque and check	X	X	X	X	X	X	X	X	X	X	X	X	
Engine coolant level check	X	X	X	X	X	X	X	X	X	X	X	X	
CH4 leaking sensor check	X	X	X	X	X	X	X	X	X	X	X	X	
Engine oil replacement/tank refill	X	X	X	X	X	X	X	X	X	X	X	X	
Engine oil filters replacement	X	X	X	X	X	X	X	X	X	X	X	X	
Primary air filter replacement	X	X	X	X	X	X	X	X	X	X	X	X	
Valve gap check and setting	X	X	X	X	X		X	X	X	X	X		
Spark plug replacement	X	X	X	X	X		X	X	X	X	X		
Cylinder head replacement		X		X				X		X			
Spark plug cables replacement		X		X				X		X			
Distribution belt and tensioner replacement		X		X				X		X			
Engine coolant replacement		X		X		X		X		X		X	
Lambda probe replacement (pre catalytic converter)		X		X		X		X		X		X	
Secondary air filter replacement		X		X		X		X		X		X	
Lambda probe replacement (post catalytic converter)						X						X	
Exhaust gas heat exchanger cleaning (fumes side)						X						X	
Water heat exchanger cleaning (user water side)						X						X	
Three way catalyzer replacement				X				X				X	
Engine Replacement						X						X	
Battery replacement						X						X	
Gas actuator replacement						X						X	
Flexible tubes replacement				X				X				X	
Insualtions replacement						X						X	
Generator replacement						X						X	
Service hours	32500	35000	37500	40000	42500	45000	47500	50000	52500	55000	57500	60000	
	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	±5%	
Job	Maintenance 1B	Maintenance 2	Maintenance 1B	Maintenance 2	Maintenance 1B	Manutentione 3	Maintenance 1B	Maintenance 2	Maintenance 1B	Maintenance 2	Maintenance 1B	Maintenance 4	
Machine check up	X	X	X	X	X	X	X	X	X	X	X	X	
Fastener and hose torque and check	X	X	X	X	X	X	X	X	X	X	X	X	
Electrical connection torque and check	X	X	X	X	X	X	X	X	X	X	X	X	
Engine coolant level check	X	X	X	X	X	X	X	X	X	X	X	X	
CH4 leaking sensor check	X	X	X	X	X	X	X	X	X	X	X	X	
Engine oil replacement/tank refill	X	X	X	X	X	X	X	X	X	X	X	X	
Engine oil filters replacement	X	X	X	X	X	X	X	X	X	X	X	X	
Secondary air filter replacement	X	X	X	X	X	X	X	X	X	X	X	X	
Valve gap check and setting	X	X	X	X	X		X	X	X	X	X		
Spark plug replacement	X	X	X	X	X		X	X	X	X	X		
Cylinder head replacement		X		X				X		X			
Spark plug cables replacement		X		X				X		X			
Distribution belt and tensioner replacement		X		X				X		X			
Engine coolant replacement		X		X		X		X		X		X	
Lambda probe replacement (pre catalytic converter)		X		X		X		X		X		X	
Primary air filter replacement		X		X		X		X		X		X	
Lambda probe replacement (post catalytic converter)						X						X	
Exhaust gas heat exchanger cleaning (fumes side)						X						X	
Water heat exchanger cleaning (user water side)						X						X	
Three way catalyzer replacement				X				X				X	
Engine Replacement						X						X	
Battery replacement						X						X	
Gas actuator replacement						X						X	
Flexible tubes replacement				X				X				X	
Insualtions replacement						X						X	
Generator replacement						X						X	

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## Advenco also offer the following products and services:

- Bespoke system design
  - Maintenance and service packages
  - Buffer tanks
  - Indirect and direct hot water systems
  - Off-site manufacturing of skids and plant rooms
  - Controls systems
  - Packaged plate heat exchangers
  - Solar thermal systems
  - Gas fired heating systems
  - Combined heat & power cogeneration systems
- 



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[www.advenco.co](http://www.advenco.co)

# TOTEM

## Cogeneration (CHP) Range



TOTEM

### Fault codes

TOTEM 10 -TOTEM 20 -TOTEM 25 MICROCOGENERATORS



EXPERTLY ENGINEERED FOR YOU

## Notes





To connect to your new TOTEM you should access its WiFi network from your smartphone, PC or tablet by following these simple steps!



1. **Activate** your WiFi network



2. Wait for the system to locate the TOTEM line: **TotemWiFi\_XXX**  
**XXX** is the progression of the serial number on the aluminum label which is on the left side of the TOTEM (eg 2017-**123**-ACM25A-EN)



3. To connect, enter the password: **TotemPassword**



4. Open your browser and  
write the IP address: **192.168.200.1**



5. At the top right, **select** your language



6. Enter the following data in the required fields

user: **Totem**

password: **Energy**



Congratulations! Now you are connected with the TOTEM



**Still have no access?**



Try to repeat the steps from **point 1**.

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
5400	GENERIC	Temperature Generic Error	System		
5401	ENGINE COOLANT	Engine coolant outlet temperature	Functional	Engine coolant temperature above the maximum threshold	-verifying the user water flow of the internal pump -verifying that the mixing valve is assembled in a proper way -verifying the user water flow and the Totem thermal gradient -verifying the engine performance
5406	MIXING VALVE	Thermostatic valve coolant outlet temperature	Electric	NTC probe circuit open or disconnected	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
5407	MIXING VALVE	Thermostatic valve coolant outlet temperature	Electric	NTC probe ground short-circuited	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
5408	MIXING VALVE	Thermostatic valve coolant outlet temperature	Functional	Thermostatic valve coolant outlet temperature above maximum threshold	-verifying the user water flow of the internal pump -verifying that the mixing valve is assembled in a proper way -verifying the user water flow and the Totem thermal gradient -verifying the engine performance
5409	MIXING VALVE	Thermostatic valve coolant outlet temperature	Electric	Generic electric error	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
540B	ENGINE WATER	Engine coolant inlet temperature	Electric	NTC probe circuit open or disconnected	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
540C	ENGINE WATER	Engine coolant inlet temperature	Electric	NTC probe ground short-circuited	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
540D	ENGINE WATER	Engine coolant inlet temperature	Functional	Temperature inlet engine coolant above maximum threshold	-verifying the user water flow of the internal pump -verifying that the mixing valve is assembled in a proper way -verifying the user water flow and the Totem thermal gradient -verifying the engine performance
540E	ENGINE WATER	Engine coolant inlet temperature	Electric	Generic electric error	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
5410	BOX TEMPERATURE	Box temperature sensor	Electric	NTC probe circuit open or disconnected	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
5411	BOX TEMPERATURE	Box temperature sensor	Electric	NTC probe ground short-circuited	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
5412	BOX TEMPERATURE	Box temperature	Functional	Difference between box and environmental temperature above the threshold	-Verifying the correct position of box temperature probe -Verifying the correct electric functioning of internal fan -verifying the correct position of the internal piping -verifying the correct disposal of the internal ventilation flow rate by means of its transition through the base. -verifying the correct environmental ventilation
5413	BOX TEMPERATURE	Box temperature	Functional	Difference between box and environmental temperature above threshold in case of environmental temperature error	-Verifying the correct position of box temperature probe -Verifying the correct electric functioning of internal fan -verifying the correct position of the internal piping -verifying the correct disposal of the internal ventilation flow rate by means of its transition through the base -verifying the correct environmental ventilation

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
5414	BOX TEMPERATURE	Box temperature sensor	Electric	Generic electric error	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
5416	TEMPERAURE EXHAUST MANIFOLD	Manifold exhaust gas temperature probe	Electric	PT200 probe circuit open or disconnected	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
5417	TEMPERAURE EXHAUST MANIFOLD	Manifold exhaust gas temperature probe	Electric	PT200 probe ground short-circuited	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
5418	TEMPERAURE EXHAUST MANIFOLD	Manifold exhaust gas temperature probe	Functional	Exhaust temperature above maximum threshold	-verifying the engine performance -verifying the misfire existence or the ignition coil diagnosis -verifying that box and environmental temperature are imposed within limits -verifying that the engine coolant temperature is imposed within limits -verifying correct reading of the PT200 probe
5419	TEMPERAURE EXHAUST MANIFOLD	Manifold exhaust gas temperature probe	Functional	Generic electric error	-verifying the engine performance -verifying the misfire existence or the ignition coil diagnosis -verifying that box and environmental temperature are imposed within limits -verifying that the engine coolant temperature is imposed within limits -verifying correct reading of the PT200 probe
541B	TEMPERATURE GAS INLET CATALYTIC CONVERTER	Exhaust sensor temperature inlet catalytic converter	Electric	PT200 probe circuit open or disconnected	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
541C	TEMPERATURE GAS INLET CATALYTIC CONVERTER	Exhaust sensor temperature inlet catalytic converter	Electric	PT200 probe ground short-circuited	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
541D	TEMPERATURE GAS INLET CATALYTIC CONVERTER	Exhaust sensor temperature inlet catalytic converter	Functional	Exhaust temperature inlet catalytic converter above maximum threshold	- Verifying engine performance - Verifying coaxial exchanger performance - Verifying misfire or ignition coil - Verifying box and environmental temperature are imposed within limits - Verifying the engine coolant temperature is imposed within limits - Verifying the correct reading of the PT200
541E	TEMPERATURE GAS INLET CATALYTIC CONVERTER	Exhaust sensor temperature inlet catalytic converter	Functional	Exhaust temperature inlet catalytic converter above maximum threshold	- Verifying engine performance - Verifying coaxial exchanger performance - Verifying misfire or ignition coil - Verifying box and environmental temperature are imposed within limits - Verifying the engine coolant temperature is imposed within limits - Verifying the correct reading of the PT200
541F	TEMPERATURE GAS INLET CATALYTIC CONVERTER	Exhaust sensor temperature inlet catalytic converter	Electric	Generic electric error	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
5420	TEMPERATURE GAS INLET SILENCER	Exhaust sensor temperature inlet silencer	Electric	PT200 probe circuit open or disconnected	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
5421	TEMPERATURE GAS INLET SILENCER	Exhaust sensor temperature inlet silencer	Electric	PT200 probe ground short-circuited	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
5422	TEMPERATURE GAS INLET SILENCER	Exhaust sensor temperature inlet silencer	Functional	Exhaust temperature inlet silencer above the maximum threshold	-verifying the engine performance -verifying the correct function of the tube bundle -verifying box and environmental temperature are imposed within limits -verifying user water temperature is imposed within limits -verifying the correct reading of NTC probe
5423	TEMPERATURE GAS INLET SILENCER	Exhaust sensor temperature inlet silencer	Electric	Generic electric error	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
5426	USER WATER TEMPERATURE	User water temperature sensor inlet Totem	Electric	NTC probe circuit open or disconnected	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
5427	USER WATER TEMPERATURE	User water temperature sensor inlet Totem	Electric	NTC probe ground short-circuited	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe
5428	USER WATER TEMPERATURE	User water temperature inlet Totem	Functional	User water temperature inlet Totem above maximum threshold	-Verifying correct user water flow: 2500 l/h [T10] - 4000 l/h [T20] - 5000 l/h [T25] -verifying correct position NTC probe -verifying correct probe connection with wiring -verifying correct reading NTC probe
5429	USER WATER TEMPERATURE	User water temperature inlet Totem	Electric	Generic electric error	-verifying the connector from the wiring harness side: • terminals have to be crimped in the right way; • terminals in the right position; -verifying the connector from the probe side: • terminals have to be crimped in the right way; • terminals in the right position -replacing the probe

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
542B	USER WATER TEMPERATURE	User water temperature sensor outlet Totem	Electric	NTC probe circuit open or disconnected	-verifying the connector from the wiring harness side: <ul style="list-style-type: none"> <li>• terminals have to be crimped in the right way;</li> <li>• terminals in the right position;</li> </ul> -verifying the connector from the probe side: <ul style="list-style-type: none"> <li>• terminals have to be crimped in the right way;</li> <li>• terminals in the right position</li> </ul> -replacing the probe
542C	USER WATER TEMPERATURE	User water temperature sensor outlet Totem	Electric	NTC probe ground short-circuited	-verifying the connector from the wiring harness side: <ul style="list-style-type: none"> <li>• terminals have to be crimped in the right way;</li> <li>• terminals in the right position;</li> </ul> -verifying the connector from the probe side: <ul style="list-style-type: none"> <li>• terminals have to be crimped in the right way;</li> <li>• terminals in the right position</li> </ul> -replacing the probe
542D	USER WATER TEMPERATURE	User water temperature sensor outlet Totem	Functional	User water temperature outlet Totem above maximum threshold	-Verifying correct user water flow: 2500 l/h [T10] - 4000 l/h [T20] - 5000 l/h [T25] -verifying correct position NTC probe -verifying correct probe connection with wiring -verifying correct reading NTC probe
542E	USER WATER TEMPERATURE	User water temperature sensor outlet Totem	Electric	Generic electric error	-verifying the connector from the wiring harness side: <ul style="list-style-type: none"> <li>• terminals have to be crimped in the right way;</li> <li>• terminals in the right position;</li> </ul> -verifying the connector from the probe side: <ul style="list-style-type: none"> <li>• terminals have to be crimped in the right way;</li> <li>• terminals in the right position</li> </ul> -replacing the probe
5430	ENVIRONMENTAL TEMPERATURE	Environmental temperature sensor	Electric	NTC probe circuit open or disconnected	-verifying the connector from the wiring harness side: <ul style="list-style-type: none"> <li>• terminals have to be crimped in the right way;</li> <li>• terminals in the right position;</li> </ul> -verifying the connector from the probe side: <ul style="list-style-type: none"> <li>• terminals have to be crimped in the right way;</li> <li>• terminals in the right position</li> </ul> -replacing the probe
5431	ENVIRONMENTAL TEMPERATURE	Environmental temperature sensor	Electric	NTC probe ground short-circuited	-verifying the connector from the wiring harness side: <ul style="list-style-type: none"> <li>• terminals have to be crimped in the right way;</li> <li>• terminals in the right position;</li> </ul> -verifying the connector from the probe side: <ul style="list-style-type: none"> <li>• terminals have to be crimped in the right way;</li> <li>• terminals in the right position</li> </ul> -replacing the probe
5432	ENVIRONMENTAL TEMPERATURE	Environmental temperature	Functional	Environmental temperature above maximum threshold	-verifying correct environmental ventilation -verifying correct reading NTC probe

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
5490	GENERATOR	Thermal sensor generator	Electric	Thermal sensor generator	-Electric overload of electric machine: verifying electric parameters (Active power, reactive power, phase current) -substitution of electric machine
5500	HYDRAULIC CIRCUIT	Generic error hydraulic circuit	System		
5501	HYDRAULIC CIRCUIT	Internal flow switch	Functional	Zero/low user water flow	-verifying correct user water flow: 2500 l/h [T10] - 4000 l/h [T20] - 5000 l/h [T25] -verifying correct position of flow switch: palette direction perpendicular to the flow -verifying correct connection of connector switch flow -change the switch flow
5502	HYDRAULIC CIRCUIT	Engine coolant level in the expansion tank	Functional	Engine coolant level below minimum or open circuit	-verifying water and glycol level into engine circuit -verifying correct movement of float of sensor -verifying correspondence between signal and float position: • low level-> open circuit • high level-> close circuit -change the sensor
5600	OIL CIRCUIT	Generic error oil circuit	System		
5601	OIL CIRCUIT	Automatic oil change	Functional	Automatic oil change is not completed	-lower tank waste oil, full: emptying crankcase isn't allowed -electrovalve oil unload don't driven: • verifying integrity of fuses • verifying output relay operation • verifying electric connection of electrovalve • verifying meccanic position of electrovalve - verifying possible obstructions to unloading pipe -verifying movement of body and actuator of valve -change the valve -check amount new oil into upper tank -Electrovalve oil load don't driven: • verifying integrity of fuses • verifying output relay operation • verifying electric connection of electrovalve • verifying meccanic position of electrovalve -verifying integrity oil loaded pipe -verifying correct level of level switch: • min level: close circuit



CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
5602	OIL CIRCUIT	Engine oil level	Functional	Engine oil level lower minimum threshold	<ul style="list-style-type: none"> <li>-verifying the oil amount in the crankcase</li> <li>-check engine oil leakages in the circuit of low and high pressure               <ul style="list-style-type: none"> <li>-lower connector crankcase</li> <li>-water oil exchanger connector</li> </ul> </li> <li>-verifying leakages level switch</li> <li>-verifying leakages engine oil filter</li> </ul>
5603	OIL CIRCUIT	Oil pressure in grid connection	Functional	Pressure of engine oil during grid parallel operation	<ul style="list-style-type: none"> <li>-absence engine oil pressure</li> <li>-verifying and potentially change the oil filter</li> <li>-verifying engine oil pressure wiring</li> <li>-change engine oil pressure sensor</li> </ul>
5604	OIL CIRCUIT	Oil pressure with engine OFF	Functional	Low pressure of engine oil	<ul style="list-style-type: none"> <li>-absence engine oil pressure</li> <li>-verifying and potentially change the oil filter</li> <li>-verifying engine oil pressure wiring</li> <li>change engine oil pressure sensor</li> </ul>
5605	OIL CIRCUIT	Oil pressure with engine ON	Functional	High pressure of engine oil	<ul style="list-style-type: none"> <li>- High oil pressure</li> <li>- Excess oil in the pan</li> <li>- Check and replace oil filter, if required</li> <li>- Check the terminals of oil pressure sensor</li> <li>-Replace oil pressure sensor</li> </ul>
5A00	SAFETY LINE	Generic error safety system	System	Generic error safety system	
5A01	SAFETY LINE	Emergency button	System	Emergency button	<ul style="list-style-type: none"> <li>-verifying emergency button is pushed and not reset manually.</li> <li>-verifying NC contact</li> <li>-verifying NC contact with electric board</li> <li>-change emergency button</li> <li>-change NC contacts</li> </ul>
5A02	SAFETY LINE	Safety chain	System	Safety chain	<ul style="list-style-type: none"> <li>-verifying emergency relay is powered:               <ul style="list-style-type: none"> <li>-check the 24 voltage</li> <li>-verifying the correct setting of control relay voltage KA18 and the contact closure</li> </ul> </li> <li>-verifying the supply line and the correct operation of the sensor CH4</li> <li>-verifying the presence of a jumper on terminal 1601-1801 of the electric board or, the presence of the closure of external circuit in the line</li> <li>-verifying correct functioning of safety thermostat</li> <li>-verifying correct emergency relay connection</li> <li>-change emergency relay</li> </ul>
5B00	ENGINE	Generic error engine system	System	Generic error engine system	

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
5B01	ENGINE	Magneti Marelli generic fault	Functional	MIL	-Error OBD relevant in the engine control unit with MIL on
5B02	ENGINE	Engine rotation speed in grid connection	Functional	Engine rotation speed in grid connection	-Magnetic field of electric machine above the maximum. -reading rotation from engine control unit is not correct
5B03	ENGINE	Max engine rotation speed	Functional	Max engine rotation speed is reached	-malfunctioning of KM1 switch during engine speed ramp up -check the functioning of KM1 switch and change it if necessary.
5B04	ENGINE	Control closure gas valve with engine OFF	Functional	Control closure gas valve with engine OFF	-Absence of fuel supply during functioning engine -rotation engine, control unit engine ON and electrovalve driven
5B05	ENGINE	Target power not reached	Functional	Failure power achievement	-verifying engine performance -verifying exhaust backpressure • exhaust backpressure in condition of new machine: 35-50 mbar [T20] -verifying flow and pressure of the fuel -verifying electric machine performance -verifying electric connection of electric machine
5B06	ENGINE	Failure start	Functional	Failure start	-verifying battery charge -verifying working of relay KA14 -verifying of fuse FU10 -verifying of electric connections and terminal tightening -change starting electric motor
5B07	ENGINE	Crankshaft learning fail	Functional	Crankshaft learning fail	-failure fuel supply -verifying electric connection and position crankshaft -change sensor crankshaft -change engine control unit
5C00	COMMUNICATION	Generic error communication	System	Generic error communication	

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5C01	COMMUNICATION	Marelli communication fault	System	Engine control unit communication	-verifying the wiring: <ul style="list-style-type: none"> <li>• connector BOSCH 56 vie: PIN 23 e PIN 11 perfectly integrated</li> <li>• connector FCI 64 vie: PIN 4N e 4O perfectly integrated</li> </ul> - Verifying of relay KA8: engine control unit supply <ul style="list-style-type: none"> <li>• verifying closure of clamps</li> <li>• verifying the terminal</li> </ul> - change engine control unit
5C02	COMMUNICATION	Analyzer grid communication	System	Analyzer grid communication	-verifying communication setting of analyzer grid <ul style="list-style-type: none"> <li>• Address: 1</li> <li>• Baud rate: 38400</li> <li>• Parity: None</li> </ul> -verifying closure of clamps -verifying correct connection with electric board -change grid analyzer
5C03	COMMUNICATION	Inverter communication	System	Inverter communication	
5C04	COMMUNICATION	Gateway communication	System	Gateway communication	
5C05	COMMUNICATION	Analyzer grid communication	System	Data transmitted by the gateway	
5C06	COMUNICAZIONE	Gateway communication	Sistema	Data transmitted by the gateway	
5C07	COMUNICAZIONE	Arya communication	Sistema	Maximum number of attempts to restart Arya	
5D01	COMANDI	Switch off contact #1 (external)	Sistema	Unit shut down due to opening of external contact 1	

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
5D02	COMANDI	Switch off contact #2 (external)	Sistema	Unit shut down due to opening of external contact 2	
5E00	ELECTRIC	Generic error electric plant	System		
5E01	ELECTRIC	Contact closure relay KM1	Functional	Control KM1 ideal and real position	-verifying auxiliar contact KM1: <ul style="list-style-type: none"> <li>• check correct connection</li> <li>• check the closure of clamps</li> </ul> - Verifying test button is free - change the auxiliar contact of KM1
5E02	ELECTRIC	Maximum current in more than one phase	System	Maximum percentage rate of change for the current of every phase over limits.  The value of the variation of current showed by analyzer grid is valid just updated for less then 1 s	-verifying performance of electric machine -verifying correct functioning of capacitors: <ul style="list-style-type: none"> <li>• check fuses FUC</li> <li>• check correct functioning of contactor KC1</li> <li>• check terminals and the wiring of copacitors</li> </ul> -verifying grid balancing -verifying setting of electric board
5E03	ELECTRIC	Power absorbed in grid connection	System	Control of electric power absorbed: the electric power created must be positive in grid connection PLCST_GRID_CONNECT and if the power measure is valid (updated less then 1 s)	-verifying correct fuel engine supply <ul style="list-style-type: none"> <li>• check fuel pressure supply</li> <li>• check correct fuel flow</li> </ul> -verifying the correct functioning of DUNGS Multiblock: <ul style="list-style-type: none"> <li>•check fuse FU6</li> <li>•check relay KA4</li> <li>•check the contact on QF1</li> <li>•check correct flow rate design of multiblock valve</li> <li>•check the integrity of inlet pipe fuel line</li> </ul> -verifying the connection with terminal block of electric machine -verifying the correct functioning of trasmission seals -change relay KA4 -change QF1 -change the DUNGS multiblock system
5E06	ELECTRIC	Grid frequency control	System	Grid frequency control based on the regulations of country of installation.  The standard regulations: <ul style="list-style-type: none"> <li>- CEI 0-21</li> <li>- G59</li> <li>- VDE4105</li> </ul>	-verifying correct setting refeal grid
5E11	ELECTRIC	Phase 1 to neutral voltage	System	Phase to neutral voltage control. The voltage detected by the power analyzer shall not exceed the set value. The control is not activated if there is no active communication with the power analyzer.	- Check mains power - Check the settings of the power analyzer

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
5E12	ELECTRIC	Phase 2 to neutral voltage	System	Phase to neutral voltage control. The voltage detected by the power analyzer shall not exceed the set value. The control is not activated if there is no active communication with the power analyzer.	- Check mains power - Check the settings of the power analyzer
5E13	ELECTRIC	Phase 3 to neutral voltage	System	Phase to neutral voltage control. The voltage detected by the power analyzer shall not exceed the set value. The control is not activated if there is no active communication with the power analyzer.	- Check mains power - Check the settings of the power analyzer
5E14	ELECTRIC	Line 1 to Line 2 voltage	System	Line to line voltage control. The voltage detected by the power analyzer shall not exceed the set value. The control is not activated if there is no active communication with the power analyzer.	- Check mains power - Check the settings of the power analyzer
5E15	ELECTRIC	Line 2 to Line 3 voltage	System	Line to line voltage control. The voltage detected by the power analyzer shall not exceed the set value. The control is not activated if there is no active communication with the power analyzer.	- Check mains power - Check the settings of the power analyzer
5E16	ELECTRIC	Line 3 to Line 1 voltage	System	Line to line voltage control. The voltage detected by the power analyzer shall not exceed the set value. The control is not activated if there is no active communication with the power analyzer.	- Check mains power - Check the settings of the power analyzer
5E21	ELECTRIC	Phase 1 current	System	Control grid voltage. Grid voltage is recognised by the grid analyzer and it must be in the set value. The control isn't activated if the communication with the grid analyzer isn't active	- verifying the electric machine performance - verifying the correct grid analyzer setting - verifying the correct functioning of capacitors: <ul style="list-style-type: none"> <li>• check fuses FUC</li> <li>• check correct functioning of contactor KC1</li> <li>• check the terminals and the wiring of capacitors</li> </ul> - verifying the correct connection of the electric machine: triangle connection - verifying the grid balancing status

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5E22	ELECTRIC	Phase 2 current	System	Control grid voltage. Grid voltage is recognised by the grid analyzer and it must be in the set value. The control isn't activated if the communication with the grid analyzer isn't active	- verifying the electric machine performace -verifying the correct setting of grid analyzer -verifying the correct functioning of capacitors: <ul style="list-style-type: none"> <li>• check fuses FUC</li> <li>• check correct functioning of contactor KC1</li> <li>• check the terminals and the wiring of capacitors</li> </ul> -verifying the correct connection of the electric machine: triangle connection -verifying the grid balancing status
5E23	ELECTRIC	Phase 3 current	System	Control grid voltage. Grid voltage is recognised by the grid analyzer and it must be in the set value. The control isn't activated if the communication with the grid analyzer isn't active	- verifying the electric machine performace -verifying the correct setting of grid analyzer -verifying the correct functioning of capacitors: <ul style="list-style-type: none"> <li>• check fuses FUC</li> <li>• check correct functioning of contactor KC1</li> <li>• check the terminals and the wiring of capacitors</li> </ul> -verifying the correct connection of the electric machine: triangle connection -verifying the grid balancing status
5E30	ELECTRIC	KM1 contactor functioning check	System	KM1 contactor correct disarming check. In case of malfunctioning the recovery on QF1 is activated.	- Verifying KM1 contacts contactor - Verifying anomalous consumption
5F00	FUEL	Generic error fuel line	System		
5F01	FUEL	Air fuel ratio control	Functional	Check of pre-cat Lambda probe switchings: The Lambda probe signal is giving a fixed value for a time longer than the sampling period.	-verifying correct engine fuel supply <ul style="list-style-type: none"> <li>• verifying the fuel supply pressure</li> <li>• verifying the correct fuel flow</li> </ul> -verifying the correct functioning of DUNGS Multiblock <ul style="list-style-type: none"> <li>• check fuse FU6</li> <li>• check relay KA4</li> <li>• check thecontact on QF1</li> <li>• check the flow in the multiblock valve</li> <li>• check integrity of DUNGS Multiblock inlet pipe</li> <li>•check integrity of fuel inlet pipe</li> </ul> -verifying the correct functioning of step motor: control of movement zero and bottom before to start the machine -verifying the electric connection of Step-motor -verifying the correct lambda probe signal before catalytic converter -change relay KA4 -change contact QF1 -change DUNGS Multiblock -change step motor

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5F02	FUEL	Lambda probe after catalytic converter diagnosis	Functional	Electrical signal control lambda probe after catalyst. Diagnosis is activated when lambda probe before catalytic converter is in the operational status. Diagnosis signs an error when the signal of lambda probe after catalyst has a value lower than minimum or higher than maximum for period bigger than sampling time	-Verifying correct functioning of lambda probe after catalytic converter -check fuse FU16 -check the correct position of insulation on catalyst: lambda probe need space -change lambda probe after catalyst
5F03	FUEL	Step motor positioning	Functional	Correct positioning of step motor control. The check isn't activated in the PLCST_WAIT_START and PLCST_STARTING mode.	-verifying electric connection of step motor -change the step motor
5F04	FUEL	Fuel pressure	System	Fuel pressure control. It's always activated. Diagnosis signs the error if appears for a period bigger than sampling time.	-verifying the pressure switch calibration of DUNGS Multiblock -verify the electric connections of the pressure switch of DUNGS Multiblock -verifying the pressure in the fuel circuit -verifying the integrity of the internal fuel piping -change the pressure switch of DUNGS Multiblock
5F05	FUEL	Fuel sensor leakage	System	Checking possible fuel leakage into the Totem by sensor detector. The signal is sent by the sensor detector when the concentration is above of LEL imposed. The diagnosis is always active.	-verifying possible fuel leakage in or out the Totem - verifying the electric connection of detector sensor - verifying the 24 voltage - verifying the correct functioning of detector sensor - change the detector sensor
5F06	FUEL	Fuel selection	Functional	Consistency check between selection command of fuel sent to ARYA and the fuel selected by engine control unit.  The diagnosis is active when the engine control unit is ON.  The control find an error if the number of attempts to select the fuel is above than the number of maximum attempts in the sampling time.	-verifying the accuracy of the software on the Arya Control Unit -verifying part number of oil control unit -verifying electric connection between the ARYA pin 2H and engine control unit pin 16 -change engine control unit
5F07	FUEL	Lambda probe after catalytic converter	Functional	Functional diagnosis of signal read by lambda probe after catalytic converter. The control defines when lambda probe is in the functioning state: NOT OPERATIONAL, WAITING, OPERATIONAL. Depending on the functioning state, the signal that the Lambda probe reads is compared with threshold values. The control gives an error when the signal is besides threshold values for a given time	- verifying fuse FU16 - verifying electric connection of lambda probe after catalytic converter - change the sensor
5F08	FUEL	Pre-cat Lambda probe enabled	Function Control	Functional check of the pre-cat Lambda probe. The engine ECI checks the operation of the Lambda probe according to the embedded control logic.	- Check proper operation of the pre-cat Lambda probe - Check the power of the heater - Replace the pre-cat Lambda probe - Replace the engine ECU.

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
5F10	FUEL	Air / Fuel mixture too rich	Function Control	Check of pre-cat Lambda probe switchings: The Lambda probe signal is giving a high value for a time longer than the sampling period.	<ul style="list-style-type: none"> <li>- Check the fuel feed of the internal combustion engine</li> <li>- Check the fuel pressure</li> <li>- Check the fuel flow rate</li> <li>- Check the gas train for proper operation: <ul style="list-style-type: none"> <li>- check the FU6 fuse</li> <li>- check the KA4 relais</li> <li>- check the QF1 contact</li> </ul> </li> <li>- check the flow rate calibration of the Multiblock valve</li> <li>- check the fuel inlet hose for damages</li> <li>- Check the stepper motor for proper operation: check the zero and limit switch movements prior to engine start</li> <li>- Check the wiring of the stepper motor</li> <li>- Check the pre-cat Lambda probe for correct signaling</li> <li>- Replace the KA4 relais</li> <li>- Replace the QF1 contact</li> <li>- Replace the Multiblock gas train</li> <li>- Replace the stepper motor</li> <li>- Replace the pre-cat Lambda probe</li> </ul>
5F11	FUEL	Air / Fuel mixture too lean	Function Control	Check of pre-cat Lambda probe switchings: The Lambda probe signal is giving a low value for a time longer than the sampling period.	<ul style="list-style-type: none"> <li>- Check the fuel feed of the internal combustion engine</li> <li>- Check the fuel pressure</li> <li>- Check the fuel flow rate</li> <li>- Check the gas train for proper operation: <ul style="list-style-type: none"> <li>- check the FU6 fuse</li> <li>- check the KA4 relais</li> <li>- check the QF1 contact</li> </ul> </li> <li>- check the flow rate calibration of the Multiblock valve</li> <li>- check the fuel inlet hose for damages</li> <li>- Check the stepper motor for proper operation: check the zero and limit switch movements prior to engine start</li> <li>- Check the wiring of the stepper motor</li> <li>- Check the pre-cat Lambda probe for correct signaling</li> <li>- Replace the KA4 relais</li> <li>- Replace the QF1 contact</li> <li>- Replace the Multiblock gas train</li> <li>- Replace the stepper motor</li> <li>- Replace the pre-cat Lambda probe</li> </ul>
0132	ENGINE CONTROL	Lambda probe before catalytic converter	Electric	Periodic check: 4 ms	change the sensor
0115	ENGINE CONTROL	sensor temperature engine water	Electric	Periodic check: 1000 ms	change the sensor
0110	ENGINE CONTROL	sensor temperature intake air	Electric	Periodic check: 1000 ms	change the sensor



CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
0560	ENGINE CONTROL	System voltage	Electric	Periodic check: 12 ms	change the battery
0138	ENGINE CONTROL	Lambda probe after catalytic converter	Electric	Periodic check: 100 ms	change the sensor
0325	ENGINE CONTROL	Knock sensor	Functional		
0340	ENGINE CONTROL	Camshaft sensor	Functional	Control on crankshaft missing teeth	
0335	ENGINE CONTROL	Sensor position drive shaft	Functional	Control on front positive edge	
0351	ENGINE CONTROL	Primary winding 1	Electric	Periodic check: 100 ms	- change the winding - change the engine control unit
0352	ENGINE CONTROL	Primary winding 2	Electric	Periodic check: 100 ms	- change the winding - change the engine control unit
0353	ENGINE CONTROL	Primary winding 3	Electric	Periodic check: 100 ms	- change the winding - change the engine control unit
0354	ENGINE CONTROL	Primary winding 3	Electric	Periodic check: 100 ms	- change the winding - change the engine control unit
0685	ENGINE CONTROL	Principal relay of supply	Electric	Periodic check: 12 ms	- verifying electric connections of main relay KM2 - change the main relay KM2

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
0135	ENGINE CONTROL	Lambda probe heater before catalytic converter	Electric	Periodic check: 100 ms	- Verifying fuse FU16 - Verifying electrical connection of lambda probe before catalytic converter - change the sensor
0141	ENGINE CONTROL	Lambda probe heater after catalytic converter	Electric	Periodic check: 100 ms	- Verifying fuse FU16 - Verifying electrical connection of lambda probe after catalytic converter - change the sensor
0657	ENGINE CONTROL	Main relay voltage	Functional	Periodic check: 100 ms	- verifying electric connections of main relay KM2 - change the main relay KM2
0651	ENGINE CONTROL	Failure main relay voltage	System	Periodic check: 4 ms	- verifying electric connections of main relay KM2 - change the main relay KM2
0641	ENGINE CONTROL	Failure reference voltage main relay	System	Periodic check: 4 ms	- verifying electric connections of main relay KM2 - change the main relay KM2
0604	ENGINE CONTROL	Memory RAM error	System	Start control: PowerOn	change engine control unit
0601	ENGINE CONTROL	Memory control unit error	System	Start control: PowerOn	change engine control unit
0606	ENGINE CONTROL	Processor control unit	System	Start control: PowerOn	change engine control unit
C426	ENGINE CONTROL	Immobilizer	Functional	Start control: PowerOn	change engine control unit
0219	ENGINE CONTROL	Overspeed engine	Functional		

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
0120	ENGINE CONTROL	Pedal 1	Electric	Periodic check: 12 ms	- verifying electrical connections of pin 1F of ARYA and of pin 13 of engine control unit - change engine control unit - change ARYA control unit
0121	ENGINE CONTROL	Throttle position signal 1 wrong	Electric	Periodic check: 4 ms	- Verifying electric connections of engine control unit with throttle body - change throttle body - change engine control unit
0221	ENGINE CONTROL	Throttle position signal 2 wrong	Electric	Periodic check: 4 ms	- Verifying electric connections of engine control unit with throttle body - change throttle body - change engine control unit
1121	ENGINE CONTROL	Plausability throttle position signal	Electric	Periodic check: 4 ms	- Verifying electric connections of engine control unit with throttle body - change throttle body - change engine control unit
023D	ENGINE CONTROL	Plausability manifold absolute pressure	Functional		change the sensor - change engine control unit
0101	ENGINE CONTROL	Flow meter air signal wrong	Functional		change the sensor - change engine control unit
060B	ENGINE CONTROL	Exit VSS control unit	System	Periodic check: 100 ms	change engine control unit
1684	ENGINE CONTROL		Functional	Periodic check: 4 ms	change engine control unit
1687	ENGINE CONTROL		Functional	Periodic check: 4 ms	change engine control unit
1683	ENGINE CONTROL		Functional	Periodic check: 4 ms	change engine control unit

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
1680	ENGINE CONTROL		Functional	Periodic check: 4 ms	change engine control unit
1686	ENGINE CONTROL		Functional	Periodic check: 4 ms	change engine control unit
1681	ENGINE CONTROL		Functional	Periodic check: 4 ms	change engine control unit
1120	ENGINE CONTROL		Functional	Periodic check: 4 ms	change engine control unit
NOHDTC	ENGINE CONTROL		System		change engine control unit
0638	ENGINE CONTROL	Throttle actuator signal 1 wrong	System	Periodic check: 4 ms	<ul style="list-style-type: none"> <li>- Verifying electric connections of engine control unit with throttle body</li> <li>- change throttle body</li> <li>- change engine control unit</li> </ul>
060C	ENGINE CONTROL	Performance principal control module	System		change engine control unit
C001	ENGINE CONTROL		System		change engine control unit
1300	ENGINE CONTROL		Functional		change engine control unit
2226	ENGINE CONTROL		Electric	Periodic check: 100 ms	change engine control unit

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
0016	ENGINE CONTROL	Position of camshaft	Functional		
2227	ENGINE CONTROL		Functional		
1106	ENGINE CONTROL		Functional		
0069	ENGINE CONTROL	Barometric pressure signal	Functional		- change the sensor -change engine control unit
0053	ENGINE CONTROL	Resistance heater lambda probe before catalytic converter	System		- change the sensor -change engine control unit
0012	ENGINE CONTROL	camshaft advance	System		- change the sensor -change engine control unit
0011	ENGINE CONTROL	delay camshaft	System		- change the sensor -change engine control unit
0009	ENGINE CONTROL	Performance system engine position	System		- change the sensor -change engine control unit
0010	ENGINE CONTROL	Actuator camshaft	System		- change the sensor - change the actuator -change engine control unit
0300	ENGINE CONTROL	Misfire multiple: fuel GPL	EOBD		- change spark plugs - change the reels - change engine control unit

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
0301	ENGINE CONTROL	Misfire cylinder 1: fuel GPL	EOBD		- change spark plugs - change the reels - change engine control unit
0302	ENGINE CONTROL	Misfire cylinder 2: fuel GPL	EOBD		- change spark plugs - change the reels - change engine control unit
0303	ENGINE CONTROL	Misfire cylinder 3: fuel GPL	EOBD		- change spark plugs - change the reels - change engine control unit
0304	ENGINE CONTROL	Misfire cylinder 3: fuel GPL	EOBD		- change spark plugs - change the reels - change engine control unit
1000	ENGINE CONTROL	Misfire multiple: fuel methane	EOBD		- change spark plugs - change the reels - change engine control unit
1001	ENGINE CONTROL	Misfire cylinder 1: fuel methane	EOBD		- change spark plugs - change the reels - change engine control unit
1002	ENGINE CONTROL	Misfire cylinder 2: fuel methane	EOBD		- change spark plugs - change the reels - change engine control unit
1003	ENGINE CONTROL	Misfire cylinder 3: fuel methane	EOBD		- change spark plugs - change the reels - change engine control unit
1004	ENGINE CONTROL	Misfire cylinder 4: fuel methane	EOBD		- change spark plugs - change the reels - change engine control unit
7100	SKID	TOTEM fault	TOTEM digital signal check	Periodic check: 500ms	Verify DTC TOTEM

CODE	AREA	DESCRIPTION	TYPE OF DIAGNOSIS	DIAGNOSIS	TRIPPING CAUSE
7200	SKID	Heat Pump fault	Heat Pump digital signal check	Periodic check: 500ms	Verifying the fault on the Heat pump LCD
7301	SKID	Pump 1 fault	ModBus signal check	Periodic check: 100ms	Verifying the fault on the Heat pump LCD
7302	SKID	Pump 2 fault	ModBus signal check	Periodic check: 100ms	Verifying the fault on the Heat pump LCD
7303	SKID	Pump 3 fault	ModBus signal check	Periodic check: 100ms	Verifying the fault on the Heat pump LCD
7304	SKID	Pump 4 fault	ModBus signal check	Periodic check: 100ms	Verifying the fault on the Heat pump LCD
7401	SKID	Temperature sensor fault in TOTEM puffer	Electric	Periodic check: 100ms	-Verifying connections on the electrical board - Changing the sensor
7402	SKID	Temperature sensor fault in Heat Pump puffer	Electric	Periodic check: 100ms	-Verifying connections on the electrical board - Changing the sensor
7403	SKID	Fault temperature sensor return in TOTEM puffer	Electric	Periodic check: 100ms	-Verifying connections on the electrical board - Changing the sensor
7404	SKID	Fault temperature sensor return in Heat Pump puffer	Electric	Periodic check: 100ms	-Verifying connections on the electrical board - Changing the sensor
7405	SKID	Fault temperature sensor hot water flow outgoing	Electric	Periodic check: 100ms	-Verifying connections on the electrical board - Changing the sensor
7406	SKID	Fault temperature sensor hot water flow return	Electric	Periodic check: 100ms	-Verifying connections on the electrical board - Changing the sensor
7407	SKID	Fault temperature sensor cold water flow outgoing	Electric	Periodic check: 100ms	-Verifying connections on the electrical board - Changing the sensor
7408	SKID	Fault temperature sensor cold water flow return	Electric	Periodic check: 100ms	-Verifying connections on the electrical board - Changing the sensor