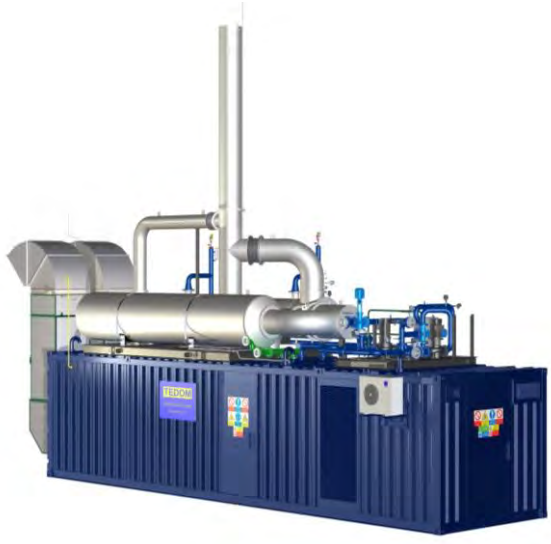
CHP Technical Data Sheet for

T180 Natural Gas Containerised

Cento Series

Power Therm



The Cento series benefits from having Tedom's own built in-house high performance gas engines. Available to run on a variety of gas fuels. Multiple units can be run in synch, and high-end digital controllers make synchronising with the mains simple.

Standard Features

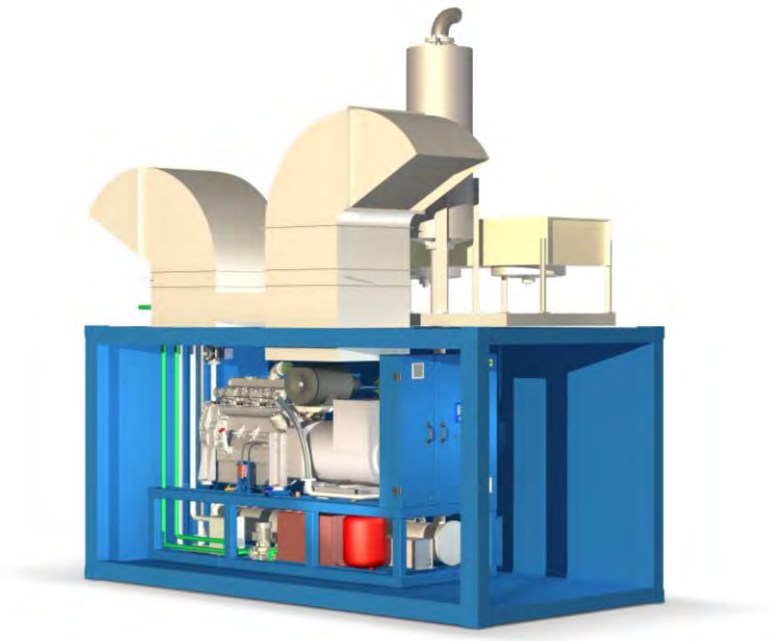
- High performance electrical efficiency
- Fully modulating output
- 3 packages – Open frame, Indoor Canopy, Outdoor Container
- Sophisticated web remote monitoring
- Bosch engine management
- Long service intervals
- 27 month warranty
- Standby power options
- Low noise options

ELECTRICITY OUTPUT	THERMAL OUTPUT	ELECTRIC EFFICIENCY	THERMAL EFFICIENCY	TOTAL EFFICIENCY
184 kWe	218 kWt	39.2 %	46.4 %	85.6 %

shenton**group** has the exclusive distributorship for Tedom products in the UK, Ireland and Channel Islands.

We provide dedicated services for CHP projects, ranging from design assistance, through project management, to commissioning and long-life support.

Tedom is a global CHP manufacturer with 600 employees. There are over 2,000 Tedom CHP units in service in over 35 countries worldwide.



t. +44 (0)844 888 444 5 e. info@shentongroup.co.uk www.shentongroup.co.uk
Shenton House, Walworth Road, Walworth Business Park, Andover, SP10 5LH

Cento Series Features

The TEDOM Cento T series of CHP units are machines of medium outputs, within a range of outputs from 80 to 200 kWe. The block arrangement of these units contains engine-generator set, heat installation, exhaust silencer and electric switchboard with power and control parts. They are intended for gas fuels, and in container version are intended for outdoor installation.

TEDOM CHP Unit Merits:

- Automatic air-fuel ratio control - this method of reducing emissions is in the standard supply of CHP unit.
- CHP units are fitted with BOSCH engine-management which optimises engine operation.
- CHP units form easily connect-able compact complex.
- By use of containerised enclosure, CHP units are characterized by low noise output and protected against external conditions.
- Ability to adapt to different temperature gradients of heating systems.
- Due to modular arrangement of control system, the number of binary and analogue inputs for monitoring and controlling following devices can be extended easily.
- Basic signals for CHP unit control (external emergency stop, external start, etc) can be connected to the customer's terminal box.
- Units are functionally tested for operation in production plant.
- TEDOM CHP units are continuously innovated from the knowledge of previous projects.

By decision of Notified Body 1015*, certificate 'E-30-01048-10' was issued, to confirm the compliance of the Cento series with the requirements of Directive 2009/142/EC (Government Decree No. 22/2003 Coll.). TEDOM is also the holder of QMS and EMS Quality Management Certificates. In terms of tests performed on the control switchboard, the Electrotechnical Testing Institute, Certification Body No. 3018, accredited by Czech Accreditation Institute, granted certificate according to ČSN EN 45011. Amongst others, the product is also certified for EAC countries and Ukraine.
** Machinery Testing Institute, Brno, Czech Republic.*

Design	Containerised
Operation	SP - synchronous, parallel with mains
Fuel	Natural gas

Basic Technical Data

Nominal electric output			184	kW
Heat output			218	kW
Load	**50**	**75**	**100**	%
Heat output	132	174	218	kW
Fuel input	261	365	469	kW
Electrical efficiency	35.2	37.8	39.2	%
Heat efficiency	50.5	47.8	46.4	%
Total efficiency (fuel use)	85.7	85.6	85.6	%
Fuel consumption	27.6	38.6	49.7	m^3/h

Basic technical data above is valid for standard conditions according to the 'Technical Instructions' document.

The minimum permanent electric output is 50% of nominal output.

Gas consumption is expressed under standard conditions (15°C, 101,325 kPa).

Emissions

Emissions	CO	NOx
At 5% O_2 in exhaust gas	650 mg/Nm^3	500 mg/Nm^3

Generator

Model	LSA 46.2 L9 LSA 46.2 VL12
Manufacturer	Leroy Somer
Cos φ	1.0
Efficiency in working point	95.4 %
Voltage	400 V
Frequency	50 Hz

Engine

Model	TG 190 G5V TW 86
Manufacturer	Tedom
Number of cylinders	6
Arrangement of cylinders	In Series
Bore × stroke	130 × 150 mm
Displacement	11946 cm³
Compression ratio	12 : 1
Speed	1500 rpm
Oil consumption normal / maximum	0.3 / 0.5 g/kWh
Maximum output of engine	192.9 kW

TG 190 G5V TW 86_850; Revision E: 18.9.2013

Thermal System

Secondary Circuit:

This circuit is used to deliver the main heat output of the CHP unit to the heating system. Secondary circuit transfers heat from the primary circuit. Observance of the maximum permissible return water temperature is essential for trouble-free operation of the unit. Parts of secondary circuit located outdoors (interconnection pipe) must be protected against freezing. The circuit is not equipped with circulating pump.

The heating water to charge the hydraulic circuits must be treated, its composition must correspond to the 'Technical Instructions' document. In case CHP unit is shut down for the heating season, the circuit's external parts must be protected against freezing.

Heat carrier	Water
Heat output of circuit	218 kW
Nominal water temperature inlet / outlet	70 / 90 °C
Temperature of return water min / max	40 / 70 °C
Nominal flow rate	156 l/min
Maximum working pressure	600 kPa
Water volume in CHP unit circuit	30 dm³
Pressure loss at nominal flow rate	25 kPa
Nominal temperature drop	20 °C

Primary Circuit:

This is the internal closed pressure circuit, which takes heat from engine water jacket and exhaust gases and passes it into the secondary circuit. If this circuit's thermal output cannot be removed in marginal modes of operation, this output or its part can be removed by dry cooler for emergency cooling, which can be also supplied.

Heat output of circuit	218 kW
Maximum working pressure	250 kPa
Water volume in CHP unit circuit	280 dm³

Aftercooler Circuit:

This is the filling mixture cooling circuit. The utilization level of the heat output from this circuit and its cooling both influence the attainment of basic technical data values. This circuit is equipped with circulating pump.

The aftercooler circuit's heat output can be used in low-temperature circuits (domestic water-pre-heating, heating of water in swimming pools or other technologies). If it is not possible to use the heat, and the permanent electrical output is required, it must be wasted through the dry cooler, which is installed on the CHP container roof.

Heat carrier	Water + Ethylene-glycol
Ethylene glycol concentration	35 %
Heat output of circuit	14 kW
Nominal coolant temperature at the inlet	35 °C
Nominal flow rate	90 l/min
Maximum working pressure	300 kPa
Water volume in CHP unit circuit	50 dm³

Fuel, Gas Inlet

Fuel type	Natural Gas
Heat value	34 MJ/m³
Minimum methane number	80
Gas pressure	5 - 10 kPa
Maximum pressure change under varying consumption	10 %
Maximum gas temperature	35 °C

CHP units can be operated on natural gas, biogas, propane and landfill gas (the fuels can be further modified as agreed with the technical design department). The limit parameters of biogas and other fuels that limit their fitness for use are given in the 'Technical Instructions' document.

The CHP unit's gas route is constructed in conformity to TPG 811 01 and contains a set of two independent quick-closing electromagnetic valves to shut off the gas inlet when the CHP unit is turned off, gas pressure zero regulator and metal hose for connection to mixer. Gas filter is installed for biogas applications. Gas connection of suitable size with adequate accumulation volume is required for the correct operation of CHP unit, to avoid gas pressure decrease in distribution system at the moment of incremental gas off-take. This gas connection will be terminated by manual gas stop and fitted with a pressure gauge.

Combustion & Ventilation Air

The unusable heat (radiated from hot parts of the CHP unit) is removed from the container by forced air ventilation, which enters the unit in the inlet port on the container roof. Ventilation air leaves the container through the ceiling port in the opposite area. The flow of ventilation air is ensured by the fan.

Both Inlet and outlet openings of the ventilation system are fitted with rain protection canopies and the air-conditioning flap with actuator. Part of the air inside the container is separated from ventilation air and used as combustion air.

Electric heating elements are installed for temperature treatment of the container interior. These elements will allow temperature treatment during CHP unit shut-down in the heating season, to ensure the temperature inside the container doesn't fall below the minimum necessary to start the engine-generator.

Unusable heat removed by ventilation air	23 kW
Outdoor air temperature min / max	-20 / 35 °C
Quantity of combustion air	776 Nm^3/h

Exhaust Gas & Condensate Outlet

Combustion products exit from the CHP unit through the outlet exhaust conduit connected to exhaust silencer's outlet flange. Exhaust silencer is placed on the container roof. Exhaust gases can be removed as required into suitable stack through an exhaust conduit, or can leave directly into atmosphere. The linked exhaust conduit (if used) must be inclined away from the unit.

Exhaust gas quantity	816 Nm^3/h
Exhaust gas temperature nominal / maximum	120 / 150 °C
Maximum back-pressure behind CHP unit flange	10 mbar
Exhaust gas speed at outlet (DN 150)	18.5 m/s

Lubricants

Quantity of lubricating oil in engine	56 dm^3
Volume of replenishment oil tank	125 dm^3

Noise Parameters

Noise parameters indicate the acoustic pressure level measured in free field conditions. Determination of measuring point and method of evaluation comply with ČSN 09 0862 and ČSN EN ISO 3746. The noise may contain a tone component.

CHP unit 10m from container	63 dB(A)

Electrical Parameters

Nominal voltage	230 / 400 V
Nominal frequency	50 Hz
Power factor[1]	0.8
Nominal current at cos φ=0.8	332 A
Generator circuit breaker	NSX400F 3P
Short-circuit resistance of switchboard	25 kA
Contribution of the actual source to short-circuit current	< 3 kA
Power switchboard protection closed/opened	IP 31/00
Control switchboard protection closed/opened	IP 31/00
Recommended superior circuit breaker	350 A
Recommended connection cable[2] (length <50m, at temperature <35°C)	NYY-J 3×185+95

[1] *Power factor adjustable from 0.8C - 1 - 0.8L (range from 0.8C - 1 must be verified according to the various types of generators).*
L = inductive load - overexcited
C = capacitive load - underexcited
Operation of the generator with a power factor of less than 0.95 causes a power limitation sets the following table:

Power factor [-]	1	0.95	0.8
Output [% Pnom]	100	100	98

[2] *The stated cables are for information only. A check calculation for temperature rise and voltage drop must be made according to the actual length, placement and type of cable (maximum allowed voltage drop is 10 V).*

Switchboard Design

The electrical part of the CHP unit is located in sheet-steel switchboard that includes both the power and control parts.

Power Switchboard Contains:

- Generator circuit breaker, which protects generator and part of power line against over-current and short circuit.
- Generator contactor that is used as a switching component for synchronizing generator to mains.
- XV terminal box for connecting the power cable.
- XG terminal box for connecting the generator.
- Current measuring transformers.

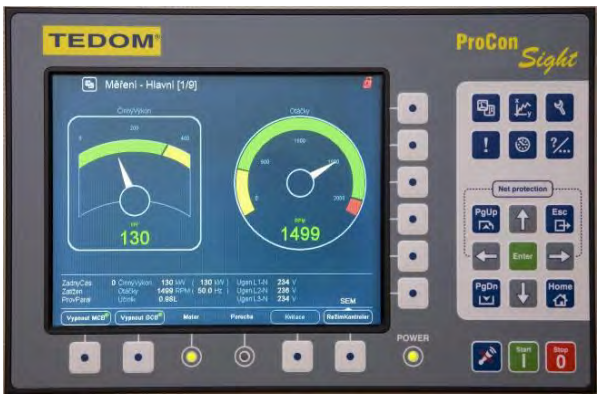
Control Switchboard Contains:

- Central part of the control system, and any extension modules.
- Protecting and tripping components.
- Controlling components for maintenance purposes.
- 24VDC power supply.
- Terminal boxes for connecting analogue sensors, binary switches, controlled devices, remote communication etc.
- Customer terminal box.

Control System

Control of the CHP unit is enabled by ProCon Sight control system, which allows fully automated operation. It is a multi-processor modular system, consisting of the control unit, display unit and extension modules with analogue and binary inputs and outputs.

Due to colour display with high resolution, plus the context and navigation buttons, the display unit provides easy access to all data about gen-set, monitored values, and history log of these values. ProCon Sight display unit can communicate in up to seven languages, one of which can be graphical (e.g. Chinese, Korean).



Main Features of Display Unit:

- Large 8” colour TFT display with 800 × 600 pixel resolution.
- Easier and faster operation by using the context buttons.
- Permanently displayed status bar.
- Time history display of selected values - graphs.
- Clearer display of history.
- Windows CE operating system.

Measured Values

The control system measures and evaluates following values:

Electrical Values:

- 3 × generator voltage
- 3 × generator current
- 3 × mains voltage

Listed Electrical Values Are Used For:

- Evaluation of the mains parameters.
- Automatic synchronization of generator to mains.
- Calculations and evaluation of required electrical values.

Technological Values:

CHP unit is equipped with set of binary and analogue sensors that monitor all the necessary processes to optimize them. Optimization is performed by the relevant outputs in control of relevant applications.

Operation Methods

Local:

- By buttons located on the display unit.

Remote (on request):

- By voltage-free contacts (external timer, superior control system etc.)
- Depending on the required power level or building consumption level.
- From local or remote PC.
- Via SMS messaging.

Building Consumption Control (on request):

- The system obtains information on the building consumption from the converter which measures direction and size of the demand/supply from/to the mains.

Required Power Control (on request):

- By analogue signal - e.g. 0/4-20mA
- Via data path - e.g. MODBUS-RTU protocol.

Gen-set Operation Monitoring

From Local PC - Connection Options:

- RS232
- RS485
- USB

From Remote PC - Connection Options (on request):

- Analogue modem
- GSM modem
- Internet

Via SMS Messaging (on request)

Colour Design

Engine, generator and internal parts of unit	RAL 5015 (Blue)
Container	RAL 5013 (Blue)

Dimensions & Weight Information

Dimensions vary depending on optional extras included. Please see relevant GA drawing for full details.

Length Total / Transport	5550 / 5000 mm
Width Total / Transport	3000 / 2500 mm
Height Total / Transport	6500 / 2660 mm
Operational weight of CHP	9285 Kg

Additional Documents

- Dimensional drawing of CHP: Cento T160-T200 Containerised GA Drawing_R1261A.
- P&ID: Cento T160-T200 Containerised P&ID_S0489A.
- Generally binding source materials according to the 'Technical Instructions' document.

Amendments

Due to our policy of continual improvement, we reserve the privilege to change this document and consequential documents without notice.