Energas Group
派思集团

推动世界能源转型

最理想的径向燃气轮机

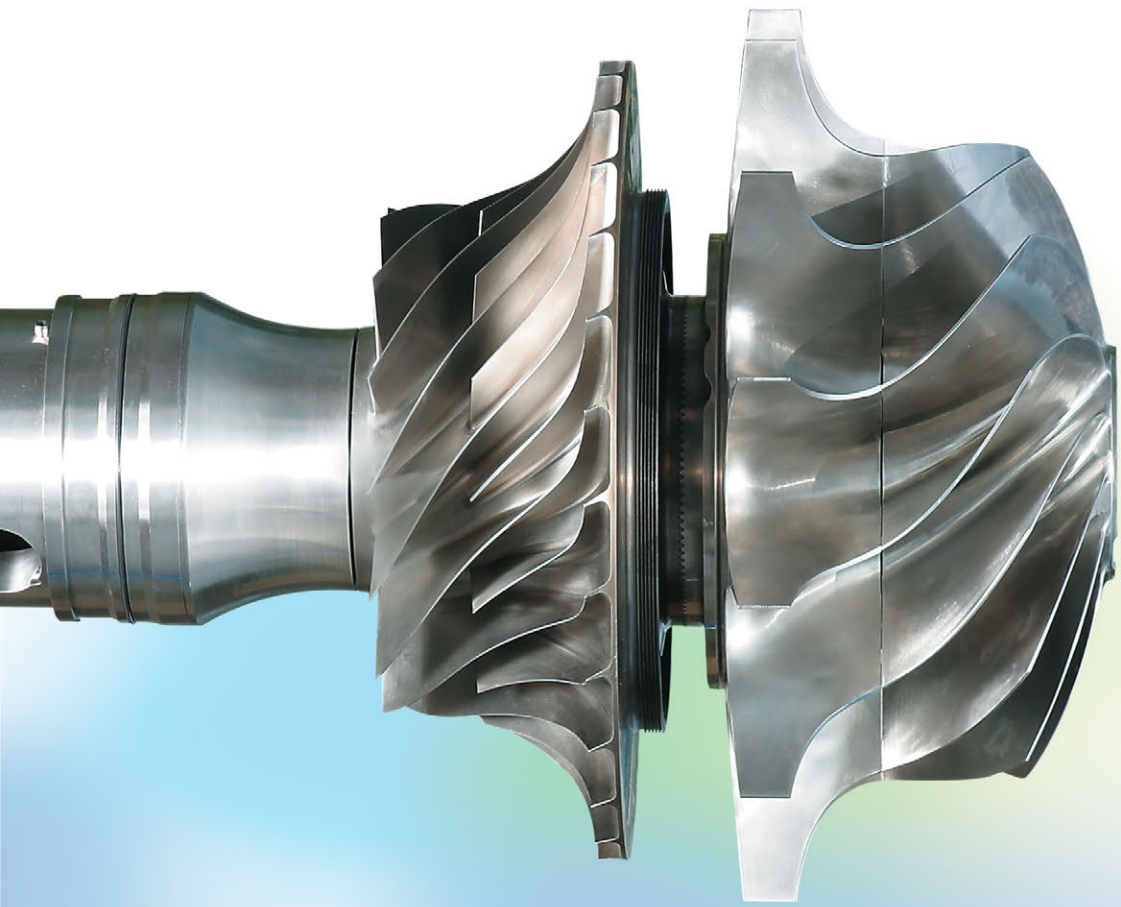
DRIVING THE WORLD'S
ENERGY TRANSITION

OPTIMAL RADIAL
GAS TURBINE

Energas 派思

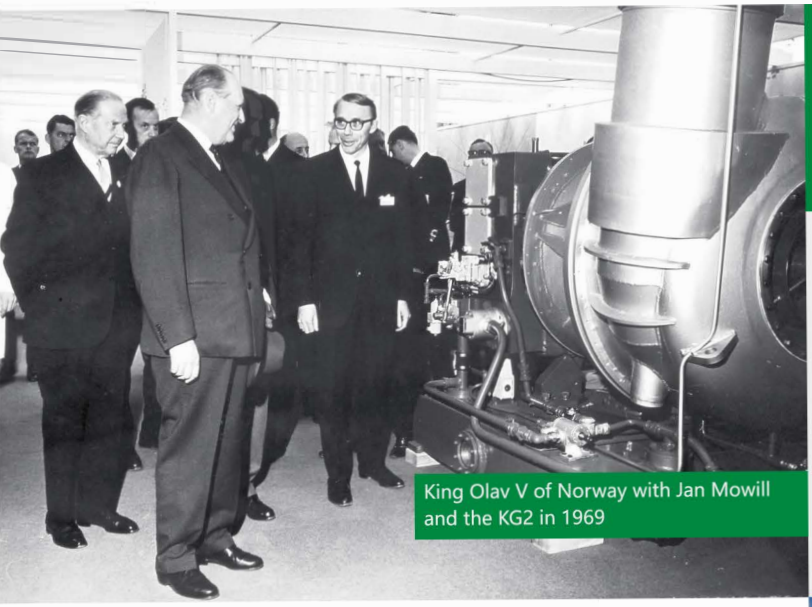
OPRA TURBINES

An Energas Group Company



System Solution　Product R&D　Gas Turbine Sales　After-sales Service

系统开发　新产品研发　燃机销售　售后维护



King Olav V of Norway with Jan Mowill and the KG2 in 1969

1991 年，Jan 和 Hiroko Mowill 创办 OPRA 燃机公司，Jan Mowill 曾在一个大型的挪威工业集团领导燃机部门，1964 年他开发和商业化世界上第一个工业应用的径向燃气涡轮机。

OPRA Turbines was founded by Jan and Hiroko Mowill in 1991. Jan Mowill had previously led the gas turbine division at a major Norwegian industrial conglomerate where he developed and commercialized the world's first radial gas turbine engine for industrial applications in 1964. OPRA Turbines sold its first commercialized gas turbine package in 2005. In 2017 OPRA Turbines opened a new state of the art headquarter facility in Hengelo (NL) to further strengthen and increase production capacity following recent growth in business.

OPRA TURBINES

An Energas Group Company

废物发电 WASTE TO POWER

Biogas 生物质气
Syngas 合成气
Pyrolysis oil 热解油
Industrial offgases 工业尾气
Ammonia plants 耐氨植物
Fertilizer plants 化肥厂
Methanol plants 甲醇厂
VOC utilization 挥发性有机化合物的利用率
Landfills 垃圾填埋

油气 OIL AND GAS

Flare gas 火炬气
Upstream 源头
Onshore in remote sites 陆上远程站点
Offshore platforms 海上平台
Midstream 中间过程
Pipelines and oil 管道和石油
tankers 油轮
Downstream 终端
Refineries 炼油厂
FPSO's 浮式钻井平台

工商业 INDUSTRIAL & COMMERCIAL

Pulp & paper 造纸
Food processing 食品加工
Ceramic 陶瓷
Chemical 化学
Rubber 橡胶
Gypsum 石膏
Hospitals 医院
Hotels 宾馆
Universities 高校
Shopping centers 购物中心
Pharmaceutical 制药
Data centers 数据中心

海洋工程 MARINE

Tankers 油轮
VOCs 挥发性有机化合物
Military 军事
On-board power 船上发电
Cruise ships 游艇

可移动电源 MOBILE POWER

Mobile power Supply truck
移动电源车

燃气轮机应用领域 APPLICATION AREA

大连派思透平动力科技有限公司成立于 2017 年 1 月，位于大连经济技术开发区，占地面积 15000 平方米，专注于燃气轮机整机、部件及应用系统研发、生产、销售及服务。公司以派思自有燃机 OP16 及 KG5 为核心，依托荷兰 OPRA 的技术研发能力，现已实现小型燃机的国产化，成为国内屈指可数的拥有小型燃气轮机全套技术的企业。公司相关产品广泛应用于石油化工、工业领域、海洋工程、分布式能源、可移动电源等多个领域，致力于为客户提供燃机系统设计、辅机系统设计、产品开发、制造等服务。公司自成立以来，承载着推动中国小型燃气轮机发展的社会使命，公司将以不懈的奋斗之心和高度的责任感，为打造中华民族自主品牌贡献一己之力。

Dalian Energas Turbine Technology Co., Ltd established in January 2017, is located in Dalian Economic and Technological Development Zone, covers an area of 15,000 square meters. It focus on gas turbine engine, components and application system development, production, sales and service. As the core of Energas own OP16 and KG5, relying on OPRA Turbines' s technology research and development capabilities in the Netherland,realized the small gas turbine localization, become a handful domestic enterprises which has full set technology of small gas turbine. Its related products are widely used in petrochemical, industry, Marine engineering, distributed energy, portable power and other field and committed to providing customers with gas turbine system design, auxiliary system design, product development, manufacturing and other services. Since its establishment, bearing the social mission to promote the development of China's small gas turbine, with the heart of the unremitting struggle and high sense of responsibility, contributing to create independent brand of the Chinese nation in the future.

研发设计制造核心人员构成	国内研究院校国外专业团队	燃机行业资深机械师	燃机相关专业研究生	吸收派思燃气优秀人才
Core personnel of R&D, design and manufacturing	Domestic research institutions Foreign professional teams	Senior mechanical engineer in gas turbine industry	Gas turbine related postgraduate	Absorb talents from Energas gas fuel company

全球客户服务 GLOBAL CUSTOMER SERVICE

- 24小时紧急支援 / 24-hour emergency support
- 远程监测 / Remote condition monitoring
- 服务水平的培训认证 / Service level training certification
- 安装调试 / Installation and commissioning
- 大修 / Major overhauls
- 3级服务协议 / 3 level service agreements
- 现场服务和检查 / Field service and inspections
- 产品改进和升级 / Product enhancements and upgrades

OP-16 燃气轮机技术精湛结构简单

THE OP16 GAS TURBINE SOPHISTICATED SIMPLICITY

1.8 MW 的 OP16 燃气轮机采用工业全径流设计，具有稳定、可靠、高效和低排放优点。

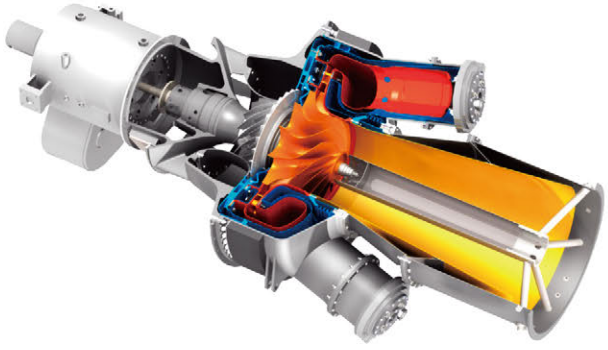
OPRA 燃机可使用不同燃料提供分布式能源解决方案，适用于多种行业，如油气、工商业、垃圾发电和海上平台。双燃料和非标准燃料都可用。

OPRA 燃机在全球销售超过 130 台，发电机组累计运行时间超过 200 万小时，将继续推动世界能源形式的转变。

The 1.8 MW OP16 gas turbine has an industrial, all-radial design which provides robustness,reliability, highest efficiency, and low emissions.

OPRA Turbines can deliver distributed energy solutions from alternative fuel sources which are well suited for a variety of industries including Oil & Gas, Industrial & Commercial, Waste to Power, and Marine. Dual fuel and off-specification fuel options are available.

OPRA Turbines continues to drive the world' s energy transition with over 130 gas turbine generator sets worldwide accumulating over 2 million operating hours.



OP16 特点：

结构简单： 单级离心压气机，单级向心透平
设计新颖： 高速比行星减速齿轮箱
燃料适应性强：4 只筒形燃烧器，满足气、液双燃料应用，可在带负荷下切换
润滑油零消耗：悬臂式轴承支撑结构，热端无轴承
低排放：氮氧化物 NOx＜25ppm
高效率：综合热效率＞85%
可靠性高：年连续运转小时数＞8000，大修周期＞42500 小时

OP16 FEATURES:

Simple & Compact : Single centrifugal compressor & Single radial turbine.
Novel Design : High speed ratio integral epicyclical gear box.
Fuel Flexibility : 4 can combustion system, it operates equally well on liquid and gaseous fuels and can switch under full load when specified as a dual fuel unit.
Zero Oil Consumption : The cantilevered rotor system places both bearings in the cold part of the engine.
Low Emissions : NOx<25ppm.
Efficient : The Combined Heat and Power system overall thermal efficiency can be more than 85% .
Reliability : Consecutive hours of operation >8000, overhaul interval >42500 hours.

OP16的主要优势 OP16'S KEY STRENGTHS

燃料灵活性 FUEL FLEXIBILITY

所需燃气压力低
Low fuel gas pressure required
低排放燃烧器可用
Low emission combustors available
低热值燃料气适用
Low BTU fuel gases possible

可靠的设计 ROBUST DESIGN

全径向设计
All radial design
大修间隔 42500 小时
Overhaul only after 42,500 hours
轴承位于冷端
Bearings located in the cold section
灵活易维护燃烧室
Easily accessible combustors

高热电联产能力 HIGH CHP CAPABILITY

排烟温度高
High exhaust temperature
高热电比
High heat to power ratio
烟气不含油
Oil-free exhaust flow guaranteed

占地面积小 SMALL FOOTPRINT

安装方便 (2 x 20 ft 集装箱)
Easy installation (2 x 20 ft containers)
紧凑、重量低
Compact and low weight
运动部件少
Few moving parts
不需要冷却水
No cooling water needed

燃料灵活性 FUEL FLEXIBILITY

OP16 适用于多种燃料，包括如下：
The OP16 is suitable for a large range of fuels including the following:

高热值的气体 HIGH CALORIFIC GASES

- 天然气 Natural gas
- 火炬气 / 井口天然气 Flare gas/Wellhead gas
- 丙烷 Propane
- LPG（液化石油气）污染气体
- LPG (Liquefied petroleum gas) Contaminated gas

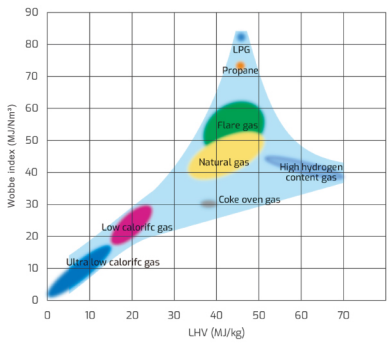
低热值和超低热值气体 LOW & ULTRA-LOW CALORIFIC GASES

- 合成气 Syngas
- 生物质气 Biogas
- VOC（挥发性有机化合物）
- VOC (Volatile organic compounds)
- 工业废气 Industrial waste gas

液体燃料 LIQUID FUELS

- 柴油 Diesel
- 热解油 Pyrolysis Oil
- 乙醇 Ethanol
- 凝析油 Condensate

燃料规格 FUEL SPECIFICATION



OP16 GAS TURBINE GENSET

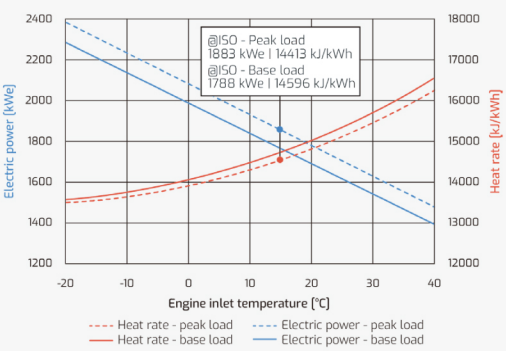
Performance at ISO Conditions

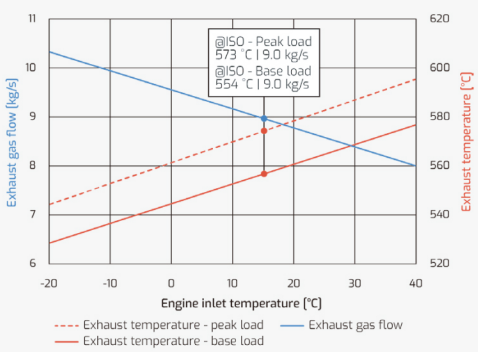
OP16 Gas Turbine Genset	SI | IMPERIAL	VALUE
Power Output (p.f.=1) 输出功率	kWe	1883
Electrical Efficiency (p.f.=1) 电效率	%	25.0
Maximum Total Efficiency 最大总效率	%	>90
Availability 有效性	%	>98
Fuel Consumption 燃料消耗	Nm^3/h I MMBtu/h	864 | 25.7
Heat Rate (p.f.=1) 热耗率	kJ/kWh | Btu/kWh	14413 | 13661
Exhaust Gas Flow 排气流量	kg/s | lb/s	9.0 | 19.8
Exhaust Gas Temperature 排气温度	°C | °F	573 | 1064
Pressure Ratio 压比	-	6.7:1
Required Inlet Gas Pressure* 所需进气压力 *	barg | psig	11-16 | 159-232
Generator Voltage 发电机电压	kV	0.4 - 13.8
Frequency 频率	Hz	50/60
Noise** 噪音 **	db(A)	<80 @ 1m | 3ft
Time Between Major Overhaul 大修间隔时间	Hours	42,500

基于天然气燃料的数据（LHV：38MJ/kg）。可以多燃料。
Data based on natural gas fuel (LHV:38 MJ/kg). Multiple fuels possible.
* 最小进气压力取决于燃料成分和操作条件。
*The minimum inlet gas pressure depends on the fuel composition and operating conditions
** 可以按需满足更低的噪音水平。
**Low levels are available upon request

CERTIFIED ISO 9001

性能曲线 PERFORMANCE CURVES





OPRA 针对不同燃料特性，选用不同的经过验证的燃烧器，使效果达到最佳：
OPRA uses different well proven combustors to optimize specific fuels :

OP16-3A：传统燃烧器
OP16-3A: Conventional combustor

OP16-3B：干式低 NOx 燃烧器
OP16-3B: Dry low NOx combustor

OP16-3C：低热值燃料燃烧器
OP16-3C: Low calorific fuel combustor

供货范围 Scope of Supply

标准发电机组 Standard Generator Package
钢结构底盘 Steel base frame
液压起动系统 Hydraulic starting system
天然气燃料系统 Natural gas fuel system
滑油系统 Lubrication oil system
齿轮驱动主油泵 Gear driven main oil pump
交流辅助润滑油泵 AC pre/post lube oil pump
集成空冷式冷油器 Integrated air/oil cooler
润滑油箱加热器 Lube oil tank heater
双联滤油器 Duplex oil filter
带静态滤芯的过滤通风系统
Air filtration and ventilationsystem with static filter
风雨罩 Weatherproof acoustic
外壳 enclosure (Lp=80dBA @ 1m)

■ **OP16 燃机 OP16 GAS TURBINE**
悬臂式转子 Overhung rotor
单级离心压气机
Single stage centrifugal compressor
单级径向透平 Single stage radial turbine
4x 筒形燃烧器 4 can combustion system
高能电火花点火系统
High energy spark ignition system

■ **CONTROL CABINETS 控制柜**
基于 PLC 的基础控制系统 PLC based control system
发电机自动同步和保护
Generator auto synchronizing and protection
振动监测（发电机和减速齿轮箱）
Vibration monitoring (Generator and gear reduction)
控制系统配有 24VDC 备用电池
24VDC backup battery for control system

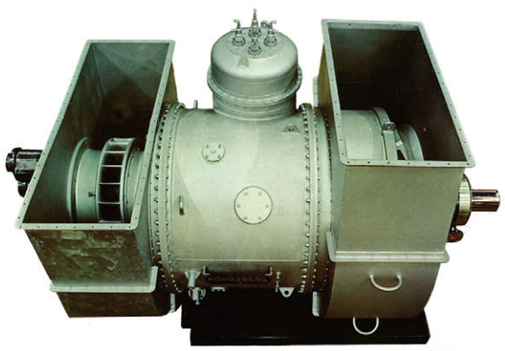
■ **GENERATOR 发电机**
3 相 4 极同步 Synchronous 4-pole, 3 phase
开式防滴结构一体化无刷励磁机
Open drip proof construction Integral brushless exciter
集成固态 AVR H 级绝缘
Integrated solid state AVR H-class insulation
H 级温升 H-class temperature rise

■ **GEAR REDUCTION 齿轮减速箱**
行星齿轮
Integral epicyclical gear
输出速度 1500 或 1800 转 / 分
Output speed 1500 or 1800 rpm
辅助驱动轴 Ancillary drive shafts
驱动端剪切销保护
Shear pin drive shaft protection

■ **可选设备 Optional Equipment**
发电机可选品牌 **Generator brand options**
西门子或 AB 控制系统
Siemens or Allen-Bradley controls
不同电压等级可选 **Alternative voltages**
待机功率 **Standby ratings**
液体燃料系统 **Liquid fuel system**
双燃料系统 **Dual fuel system**
生物气、合成气等燃料系统
Fuel system for biogas, synthetic gas, etc.
干式低排放系统 **Dry low emission system**
红外燃气检测系统 **IR gas detection system**
可用于非稳态基础的三点式底撬
3 point skid for unstable foundations
油雾分离器 **Oil demister**
防冰堵进气滤清器 **Inlet filter anti-icing**
分体式控制室 **Detachable control room**
烟气直排或余热回收 **Exhaust or WHR options**
压气机清洗系统 **Compressor washing system**
天气罩 **Weather hoods**
光学火焰监测 **Optical flame monitoring**
不同运行环境温度（-20 / + 40° C 适中，
-60 / + 30° C 极寒，0 / + 50° C 沙漠）
Different temperature options (-20/+40°C Moderate, -60/+30°C Very cold, 0/+50°C Desert)
自清洗过滤器 **Self cleaning filters**
维修平台 **Maintenance platform**
发电机自动润滑 **Automatic generator lubrication**

包装尺寸 PACKAGE DIMENSIONS

25000kg I 55,115lb 的质量取决于具体配置
(25000kg - 32,000kg I 55,115lb - 70,548lb)
Mass of the unit 25,000kg I 55,115lb depending on particular configuration
(25,000kg to 32,000kg I 55,115lb to 70,548lb)



KG5 特点：

结构紧凑：单级离心式压缩机；
设计新颖：双轴结构，可用于机械驱动；
燃料适应性强：气、液双燃料系统；
效率高：综合热效率＞80%；
维护便捷：单筒燃烧器，易于维护。

KG5 FEATURES:

Compact structure: single-stage centrifugal compressor;
Split shaft design: cross-compound structure, can be used for mechanical drive;
Strong fuel adaptability: gas, liquid, dual fuel system;
High efficiency: comprehensive thermal efficiency>80%;
Easy to maintain: single combustor, easy to maintain

KG5 燃气轮机压缩机采用单级离心叶轮，透平采用单级向心透平和单级轴流透平的分轴结构，既可以驱动发电机又可以驱动其他旋转机械设备，具有起动迅速、稳定耐用的特点，在油气田和海上平台有大量运行业绩。

KG5 gas turbine has a single centrifugal impeller with a single radial turbine and a split axial power turbine design. Which can drive both generator and other rotation machinery equipment. It has the characteristics of starting quickly, running stable, with a lot of operation reference at oil field and offshore platform.

从挪威购买的 KG5 型燃气轮机是原型。在此基础上，采用现代气动和强度分析方法，优化产品的效率和稳定性，使其成为高性能先进燃气轮机。

The KG5 gas turbine design is derived from Norway. On the basis, modern aerodynamic and strength analysis methods are used to optimize the efficiency and stability, which help the gas turbine get a high performance.

满足
307kW-16100kW
范围内发电功率
的任意需求
Satisfy with any
demand within the
range of
307kW-16100kW
power generation

序号No.	功率Power（kW）	派思型号Model	发动机 Engine
1	307/375	EGE301/EGE302	Internal Gas Turbine 内燃机
2	425/500	EGE501/EGE502	Internal Gas Turbine 内燃机
3	875/1000	EGE1001/EGE1002	Internal Gas Turbine 内燃机
4	1876	EGT1800	The Radial Gas Turbine 径向燃机
5	3400	EGT3000	Split Shaft Gas Turbine 分轴燃机
6	4600	EGT4600	Split Shaft Gas Turbine 分轴燃机
7	6600	EGT6600	Light Duty Gas Turbine 轻型燃机
8	10080	EGT10080	Light Duty Gas Turbine 轻型燃机
9	16100	EGT16100	Light Duty Gas Turbine 轻型燃机

Perkins 特点：

Perkins 内燃气发电机组 -4006 系列
Perkins internal combustion engine of generator unit-4006 series

ISO工况 operating condition	单位 Unit	型号 -23TRS1	型号 -23TRS2
Power 功率	kW	307	375
Gas consumption 耗气量	kJ/kw	2.55	2.49
Heat of exhaust smoke 排烟热量	kW	263	311
Temperature of exhaust smoke 排烟温度	°C	495	485
Heat of cylinder liner water 缸套热水量	kW	152	162
Heat of intercooler 中冷器热量	kW	38	57
Oil consumption 机油耗量	g/kWh	0.14	0.14

Perkins 内燃气发电机组 -4008 系列
Perkins internal combustion engine of generator unit-4008 series

ISO工况 operating condition	单位 Unit	型号 -30TRS1	型号 -30TRS2
Power 功率	kW	425	500
Gas consumption 耗气量	kJ/kw	2.51	2.47
Heat of exhaust smoke 排烟热量	kW	350	398
Temperature of exhaust smoke 排烟温度	°C	490	485
Heat of cylinder liner water 缸套热水量	kW	189	211
Heat of intercooler 中冷器热量	kW	67	90
Oil consumption 机油耗量	g/kWh	0.14	0.14

Perkins 内燃气发电机组 -4016 系列
Perkins internal combustion engine of generator unit-4016 series

ISO工况 operating condition	单位 Unit	型号 -61TRS1	型号 -61TRS2
Power 功率	kW	875	1000
Gas consumption 耗气量	kJ/kw	2.51	2.48
Heat of exhaust smoke 排烟热量	kW	661	803
Temperature of exhaust smoke 排烟温度	°C	482	468
Heat of cylinder liner water 缸套热水量	kW	487	445
Heat of intercooler 中冷器热量	kW	134	180
Oil consumption 机油耗量	g/kWh	0.25	0.25

MGT6100 特点：

ISO工况 operating condition	单位 Unit	型号 MGT6100
Power 功率	kW	6630
Efficiency 效率	%	32.2
Exhaust gas temperature 排气温度	°C	505
Exhaust smoke volume 排烟量	kg/s	26.2
Compression ratio 压比		14.8:1
DLE NOx	ppm	15

THM1304 特点：

ISO工况 operating condition	单位 Unit	型号 THM1304
Power 功率	kW	10080
Efficiency 效率	%	29.2
Exhaust gas temperature 排气温度	°C	460
Exhaust smoke volume 排烟量	kg/s	46.5
DLE NOx	ppm	25

Advantages of (Gas Turbine) Mobile Power Supply Unit 移动电源车的优点

全路况的适应性

车辆在公路上行驶，燃机会受到大量的颠簸和震动。EGTM 系列针对性的设计了阻尼减震设备，提高了机组的可靠性。

低重心和高机动性

燃机重量比较轻，重心相对较低，使车辆拥有了更好的机动性。

整体紧凑性

所有必须设备都整合在车内，包括燃油箱、电池、排烟消音器、进气滤芯、电缆等，车体带有铝制罩壳。并有足够的空间用于维护检修。

黑启动、快速冷启动可靠性

不需要外部供电、供油，电源车就可以黑启动提供电力。不需要长时间预热，满足在低温环境下的快速启动发电。

Adaptability of All Terrain

When the vehicle is on the road, the gas turbine will suffer a lot of bumps and shocks. The EGTM series equipped with a special damping device, improve the reliability of the unit.

Low Center of Gravity and High Mobility

Gas turbine has a relatively lighter weight and lower center of gravity which makes the vehicle has a better mobility.

Overall compactness

All necessary equipment is integrated in the car, including fuel tank, battery, exhaust silencer, air intake filter, and cable etc. Otherwise, there is aluminum shell and enough space for maintenance in the car.

Black Start and Fast Cold Start

No external power and fuel supply required, it can black start to provide electricity. Short Warm-up before the cold start under low temperature environment.

型号 Type	功率 Power	效率 Efficiency	燃料 Fuel	品牌 Brang
OP-16	1850KW	26%	气/液 Gas/Liquid	OPRA
EGT3000	3000KW	21%	气/液 Gas/Liquid	派思 Energas
MGT6100	6630KW	32.2%	气/液 Gas/Liquid	MAN

20 尺标准集装箱，易于运输，安装和调试

20 feet standard container:
Easy to transport, install and commissioning

围绕派思自有的 OP16, KG5 等小型燃气轮机为核心，发挥其结构简单小巧，运行稳定可靠的优势，研制适应野外机动的移动电源车，为偏远缺电地区的户外作业提供可靠的电力保障。

Energas Mobile Power Supply Truck is designed based on the Energas owned OP16, KG5 and other small size gas turbine. Due to the compact size and structure, reliable operation advantage, Energas Turbine researched and developed the Mobile Power Supply Truck to fit the outdoor usage and provide reliable power supply for remote area.

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