

AIR START UNIT GS TYPE



TECHNICAL DESCRIPTION



PLUG & SAVE

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INTRODUCTION

GUINAULT Company has been designing and manufacturing aircraft Ground Support Equipment (GSE) since 1949. Today, GUINAULT is an independent and privately owned company certified ISO9001/2015 which offers a very modern range of products dedicated to all type of aircraft.

Today, more than 20,000 GUINAULT GSE are in operation world-wide in more than 100 countries over the five continents. GUINAULT is the only company, **exclusively** focused on the design and manufacturing APU-OFF solutions, including GPU, ASU, ACU.

Specialization, and in-house expertise are key factors at GUINAULT to offer superior products, ensuring the highest reliability, the highest performance to really substitute to the APU on the ground:



400Hz alternator design, (manufactured by GUINAULT in France), digital electronics, power electronics, industrial refrigeration, thermodynamics are in house expertise.

Thanks to its unique specialized experience in the APU-OFF solutions for decades, GUINAULT claims to be the partner of choice for the airlines, handlers and any third parties looking for savings and emission reductions trough the APU-OFF at the airport.

Because the return on investment for an APU-OFF solution (GPU, ASU, ACU) is impressive, because the reliability of the equipment generates valuable kerosene savings, because too many APUs are still running on the airports due to GSE quality/performances/reliability issues, GUINAULT pays a great attention to the quality of manufacturing, the selection of components, the tests, to ensure the highest performance and reliability. The digital technology is designed in house, to ensure the highest reliability in airport conditions, and to include dedicated service functions to the APU-OFF target.

For all these reasons, GUINAULT is a first choice GSE partner for providing power solutions to handlers, Airports, Airlines, Aircraft/helicopter OEM and Military Armed Forces.

A factory tour being be the best way to witness GUINAULT organization, strategy and expertise: feel free to come, and visit our factory, our design and testing facilities, and its 200 highly qualified and motivated employees.



GUINAULT S.A, Orléans (France)



APU Start Unit (GSU) - Technical Description

This document is confidential and contains proprietary information of our intellectual property of GUINAULT SA.

WHY CHOOSING GUINAULT:

Invest in quality to save over the entire life time of the equipment.



High performances:

- High performances:
- 180 to 400 PPM
- 42 psig steady pressure (40 psig for 400 PPM)
- Full automatic starting cycle



Reliability and robustness:

- DEUTZ or SCANIA engines / GHH Rand screw compressor
- Optimized thermal management: engine cooling / compressor fresh air inlet / hot exhausts on the top
- Engine rpm controlled on real time aircraft demand (1300 – 2000 rpm)



Easy to Use:

- Excellent manoeuvrability due to reduced dimensions / weight and the leading front axle with ball bearing for low turning radius (turn radius = wheel base)
- Control panel with clear indication and heavy duty switches
- Full automatic starting cycle till the return to idle speed after the aircraft starting
- Easy access for maintenance:



Reducing of the Total Cost Ownership:

- Optimized fuel consumption due to the automatic electronic engine speed regulation. The engine speed is adapted to the A/C air flow requirements in real time to significantly reduce fuel consumption, increase reliability and equipment durability
- Low cost of spare parts due to the choice of standard components as much as possible



Multi-purpose:

- The automatic electronic engine speed regulation enables this ASU to adapt to the aircraft requirement and therefore to be the ideal solution for both narrow and wide body aircrafts



Complies with applicable standards in force:

- IATA AHM 976 / EN12312-16 / EN1915...
- Directives 2006/42/CE and 2004/108/CE and delivered with CE Certificate.



MAIN FEATURES

GS180

Engine type	Cylinders	Emission standard	Power (kW)	GHH-RAND Compressor
DEUTZ TCD2015 V6	6	Stage 3A	360	CD26S
SCANIA DC13-L6	6	Stage 5 / Tier4F	331	CD26S

GS280

Engine type	Cylinders	Emission standard	Power (kW)	GHH-RAND Compressor
DEUTZ TCD2015 V8	8	Stage 3A	500	CD42S
DEUTZ TCD16V08	8	Stage 0	565	CD42S
SCANIA DC16-V8	8	Stage 5 / Tier4F	493	CD42S

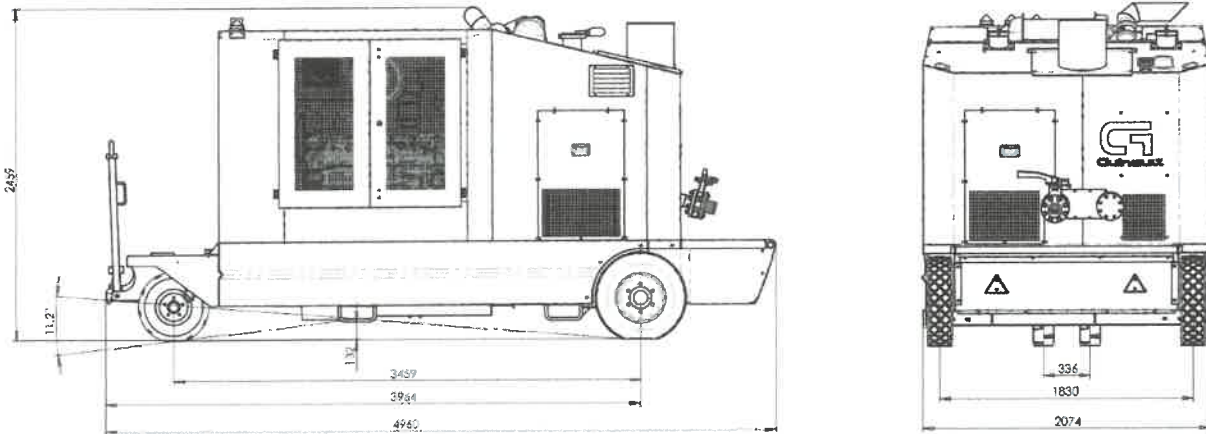
GS400

Engine type	Cylinders	Emission standard	Power (kW)	GHH-RAND Compressor
SCANIA DC16-V8	8	Stage 5 / Tier4F	566	CD72S

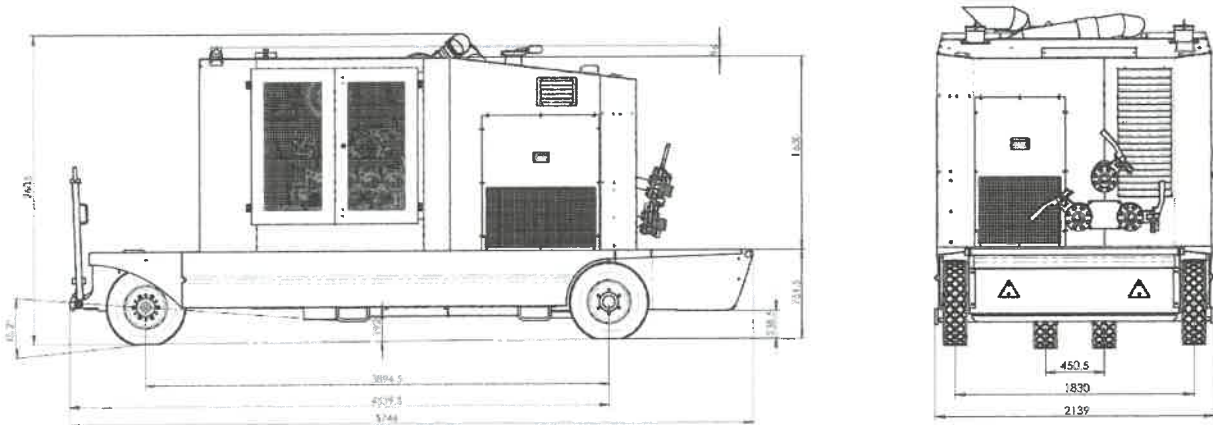


General data	GS180	GS280	GS400
Airflow / pressure	180 PPM/42 psig	280 PPM/42 psig	400 PPM/40 psig
Number of air delivery outputs * 50ft available in option	1 (30ft)*	2 (30ft)*	3 (50ft)
Weight	4800 kg	5700 kg	7500 kg
Fuel tank	300 liters	300 liters	400 liters
Battery System	24 Volts (4x12V/125 Ah batteries)		
Dimensions	See drawings herebelow		

Dimensions for GS180 and GS280



Dimensions for GS400



DESCRIPTION

1- ENGINE

The unit is equipped with DEUTZ (Stage 0 / Stage 3A / EPA Tier 3) or SCANIA (Stage 5 / EPA Tier4) diesel engine. The exhausts are equipped with high efficient mufflers to reduce significantly the noise generated by the engine.

Engine speed regulation is provided by a digital control unit, adapted for the GUINAULT variable speed compressor unit application.



Large access doors are installed on both sides of the units, allowing perfect access to the engine for maintenance purpose.



2- COMPRESSOR

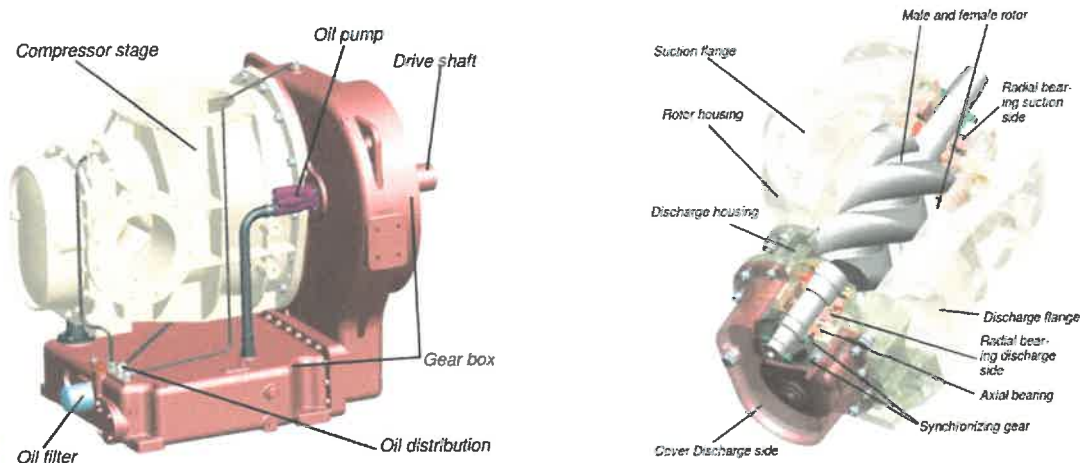
GUINAULT has selected the GHH-RAND range of oil free screw compressors. The Compressor is fitted with an integral multiplication gear in order to reach the requested airflow.



The compressor is a GHH Rand screw compressor type. In order to ensure a continuous air flow in the hottest surrounding conditions, the Guinault ASU is equipped as a standard with special compressor oil cooler.

GUINAULT ASU type	Compressor type	Compressor standalone maximum capacity
GS180	CD26S	180 PPM / 42 psig
GS280	CD42S	300 PPM / 42 psig
GS400	CD72S	450 PPM / 42 psig

The compressor itself, which is made of two screws mounted on bearings. Rotational guidance is provided by cylindrical roller bearings (axial bearings). The male rotor, driven by the multiplication gear, and the female rotor are synchronized by gearing which maintains a tiny gap between the screws. The sealing rings mounted on the shafts prevent any air leakage from the compression chamber across the bearings, as well as oil leakage from the bearings into the compression chamber.



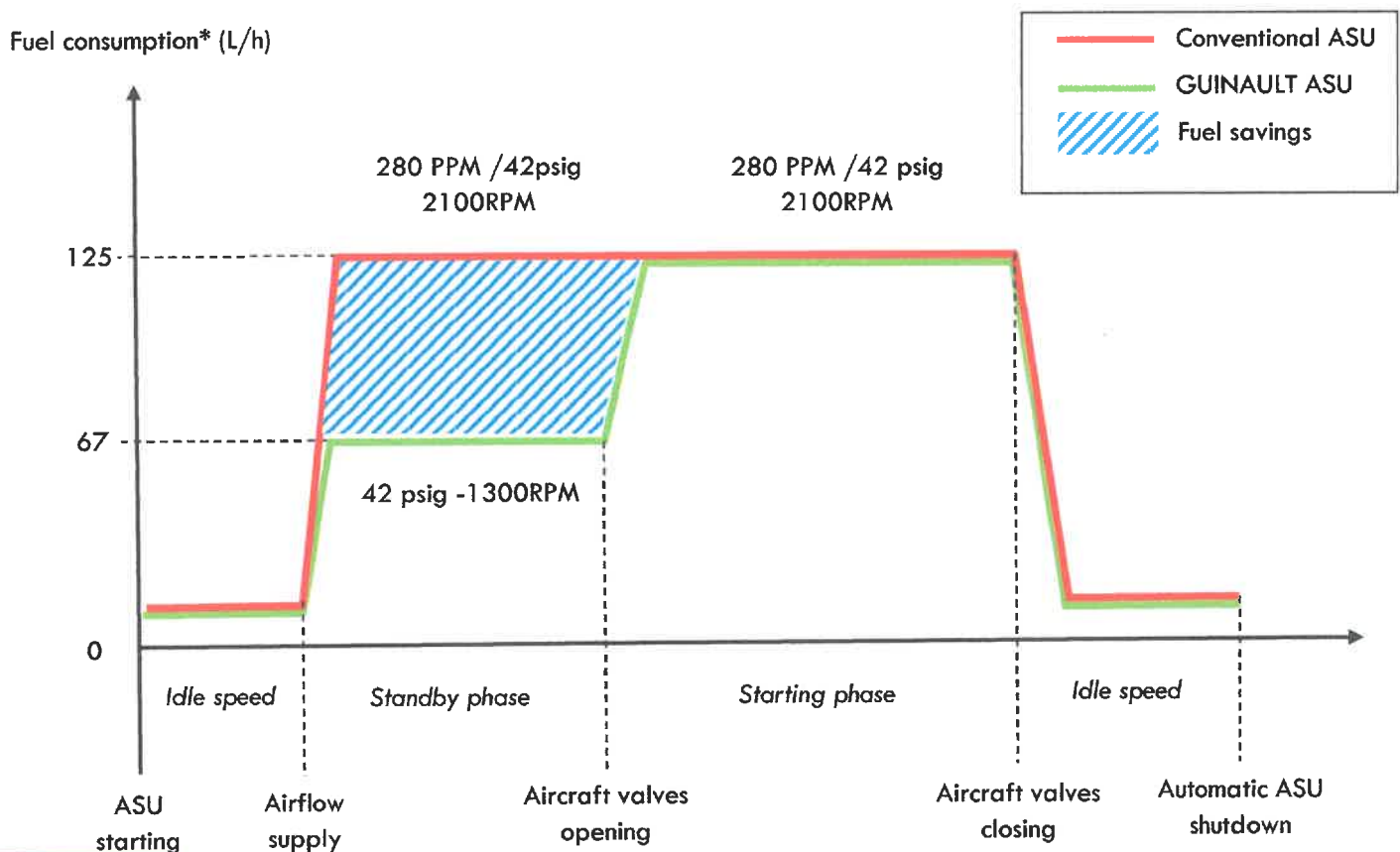
3- EXCLUSIVE PRESSURE / AIRFLOW REGULATION FOR FUEL SAVINGS AND INCREASED DURABILITY

The Air flow and pressure are controlled by a GUINAULT digital regulation system, which adjusts the speed of the engine according to the flow requirement of the engine. The speed of the engine is controlled in order to generate a 40 or 42 psig steady pressure. The by-pass flow is reduced to its minimum, as the speed of the engine is reduced when operating on narrow body aircraft.

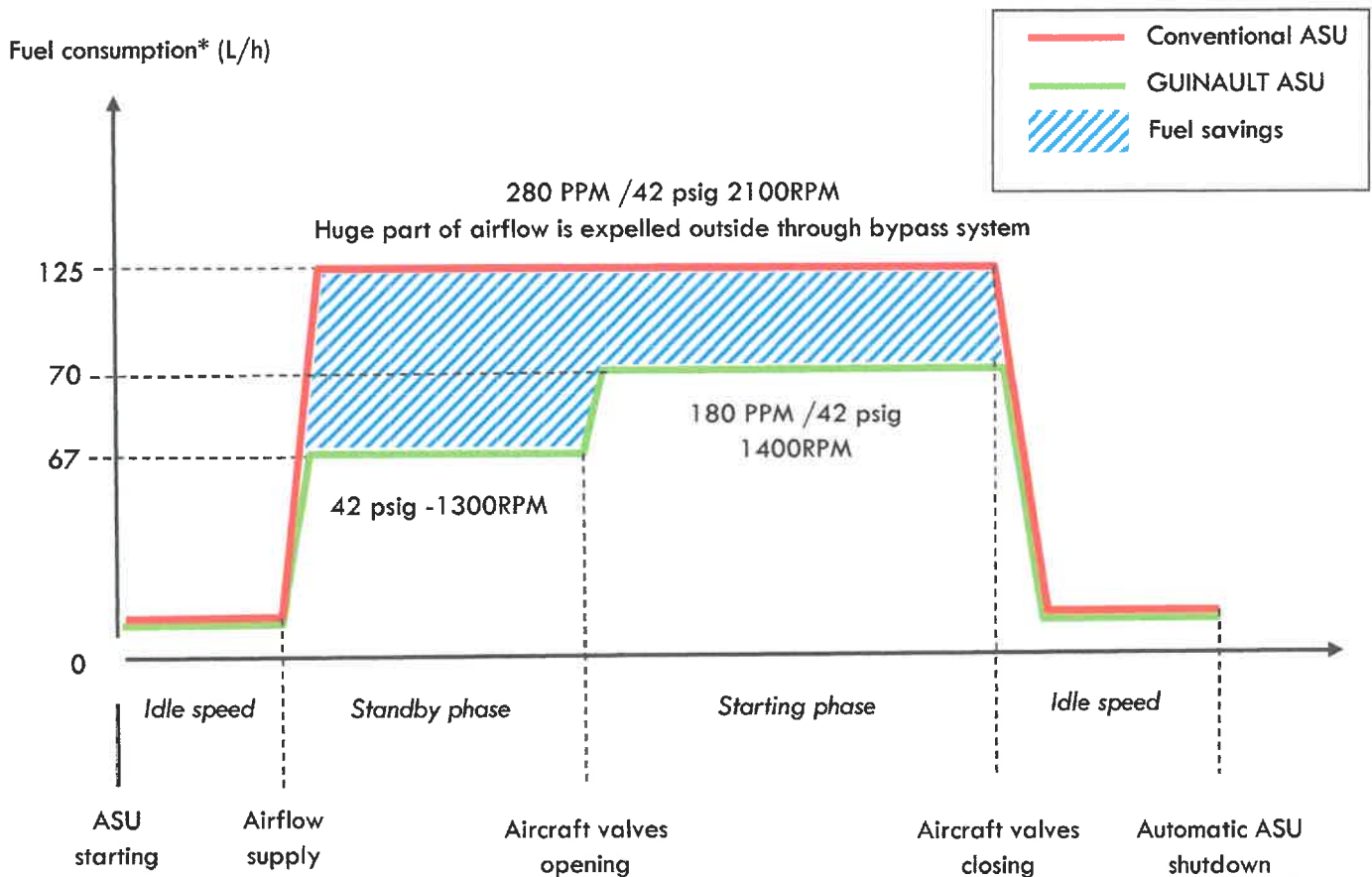
This system offers the following advantages:

- Reduced noise level when starting smaller aircraft which require less than 250 PPM (B737, A320, regional aircrafts....)
- Reduced fuel consumption
- Reduced smoke emission
- Extended lifetime of the engine and compressor, as the system allows it to runs at a lower speed

280 PPM ASU fuel consumption comparison during operation on wide body aircrafts



280 PPM ASU fuel consumption comparison during operation on narrow body aircrafts



*Fuel consumptions using GHH-RAND compressor and Deutz engine data.

We could see on these two graphs, GUINAULT's ASU generates significant savings of fuel, for both wide and narrow body aircraft.

The noise of the machine is mainly generated by engine and compressor rpm, and air flow in the by-pass valve. GUINAULT exclusive on-demand control reduces significantly noise level during the operations. Consequently, User's health is prevented using GUINAULT ASU.

Based on the following assumptions for GS280:

- Aircraft Start: 50% of wide body Aircraft (280 PPM) and 50% of narrow body aircraft (180 PPM)
- Standby and starting phases represent 80% of operating time (40% standby and 40% starting)
- Usage 200 hours per year

The fuel saving reaches 34.000 Liters within 5 years



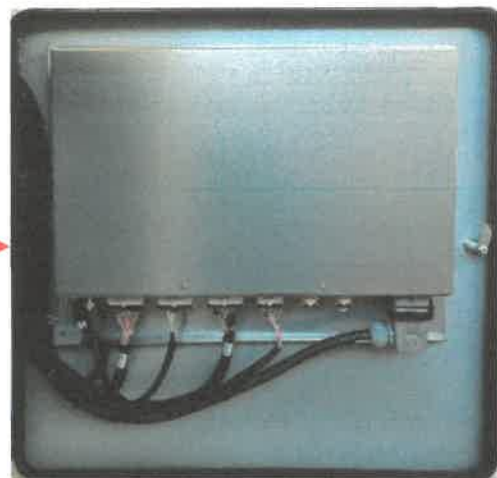
4- ELECTRICAL CABINET

The electrical cabinet, based on digital technology and manufactured by GUINAULT, ensures the complete control of the unit, the pressure/airflow regulation and continuous monitoring of parameters during operation.

The whole Electrical system is manufactured in one Location in France, ensuring a harmonious standard for labelling/wiring for the whole equipment manufactured by GUINAULT (GPU, ASU, ACU, Heater, Static Converters.)

All the boards are encased in an aluminium box in order to ensure optimal protection against humidity, dust and dirt.

The compactness of the electrical cabinet, which is fitted directly on the door, allows excellent access to the compressor for maintenance and servicing operations



5- CONTROL PANEL

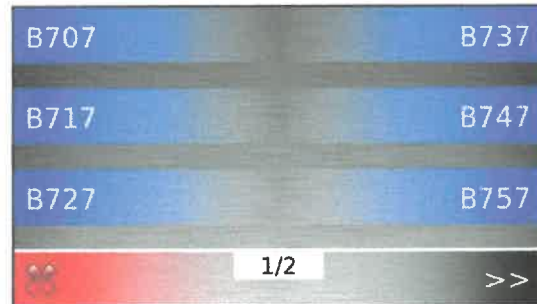
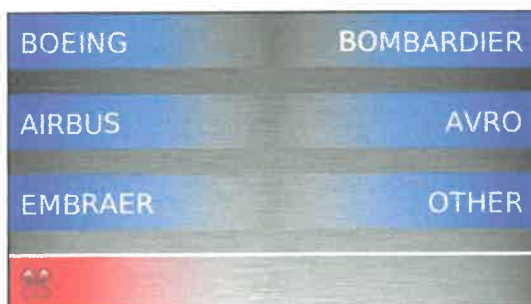
The GPU is equipped with a weatherproof digital control panel, easily accessible, with permanent indications in English or in local language upon request.

The control panel is fitted with robust and large push button, easy to operate in all weather conditions. It is located near air delivery hose(s) and air delivery valve(s) so that operator can have easy and quick access to all control devices.



Once aircraft type has been selected, operator can choose between 2 operating modes, depending on selected options:

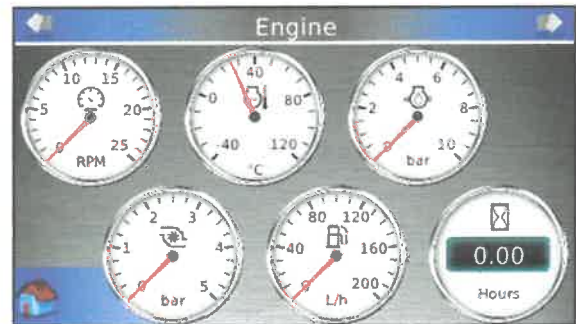
- **Air start mode:** This is the normal operating mode for starting aircraft's engine. Pressure is regulated at 40 or 42 psig and airflow is adjusted automatically by GUINAULT digital system depending on aircraft requirement.
- **Airpacs mode:** This operating mode is used to supply air to aircraft onboard air conditioning system. The pressure is regulated at 36 psig and airflow is adjusted automatically by GUINAULT digital system depending on airpac(s) requirement.



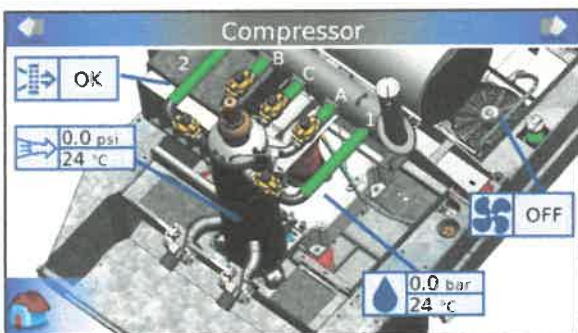
The digital display allows a quick and easy check by the operator of the proper unit operation and all cooling information such as:

- Airflow ON / OFF
- Supplied air pressure
- Supplied air temperature
- Engine coolant temperature, oil pressure, boost pressure, RPM.
- Compressor oil pressure and temperature
- Battery charging voltage
- Hourmeter
- Fuel gauge

The digital display allows a quick check by the user of the good functioning of the unit, as well as an easy communication between the unit and the operator or the technician during maintenance.



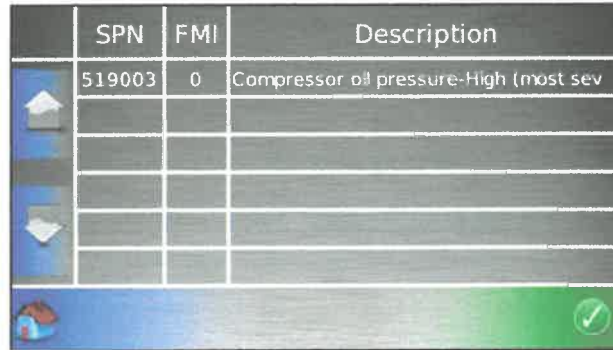
Dedicated parameters display is also available for the technician during maintenance in order to check signals from various sensors and activated inputs/outputs.



Analog inputs		
Sensor	Value	Signal
Compressor air pressure	0.0 psi	4.00 mA
Compressor air temperature	24.0 °C	12.00 mA
Compressor oil pressure	0.0 bar	4.00 mA
Compressor oil temperature	24.0 °C	12.00 mA
Fuel level	59 %	4.00 V 92.0 ohm



The faults display is done through the digital display on the control panel for easy understanding.



	SPN	FMI	Description
↑	519003	0	Compressor oil pressure-High (most sev)
↓			

The digital display is also used as an interface to allow readings of specific warning and fault information detected by the engine controller (On Board Diagnostic using J1939 CAN bus protocol). Engine manufacturer software for engine diagnostic is therefore no longer necessary.



	SPN	FMI	Description
↑	111	17	Engine Coolant Level-Low (least severe)
↓			

Engine diagnostic via J1939 CAN bus protocol

6- THE CONNECTED ASU : INTERNET OF THINGS

The unit is equipped with a unique GPS / WIFI system which allows:

- Real time monitoring of the parameters by connecting a smartphone or tablet using the WIFI connection
- Checking of all of the memorized faults, and status of the machine at the time of fault.
- Checking the past/actual operations of the unit

THE UNIQUE CONNECTED ASU IN OPERATION

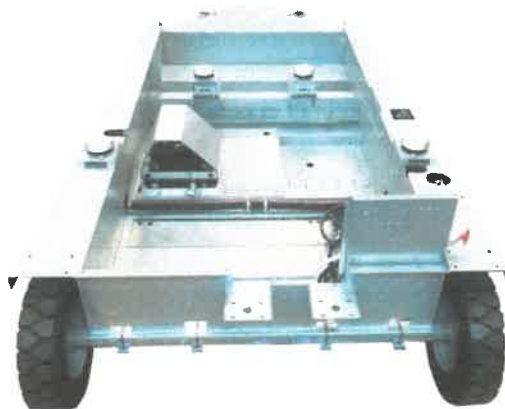


7- CHASSIS AND CANOPY

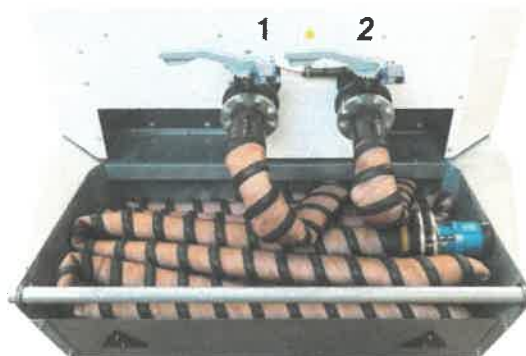
7.1 EXTRA CHASSIS PROTECTION AND POLYMER FUEL TANK FOR HOT AND HUMID AREA

GUINAULT integrates on ASU an Extra-Anti-corrosion package dedicated to extreme weather condition area and/or fuel with high sulphide contain (>50 ppm). It includes:

- Galvanization of the ASU chassis in order to avoid corrosion (treatment in the steel material for better efficiency (not only on surface)
- Steel canopy with cataphoresis treatment and powder coating (no possible corrosion)
- Strong plastic Polymer fuel tank. High sulphur contained in fuel reacts with water to create sulphuric acid. The sulphuric acid corrodes the traditional steel fuel tank to create corrosion in fuel tank and in the fuel circuit (pump, filter...). The use of Polymer fuel tank allows to avoid the corrosion and increases significantly the fuel system life time.

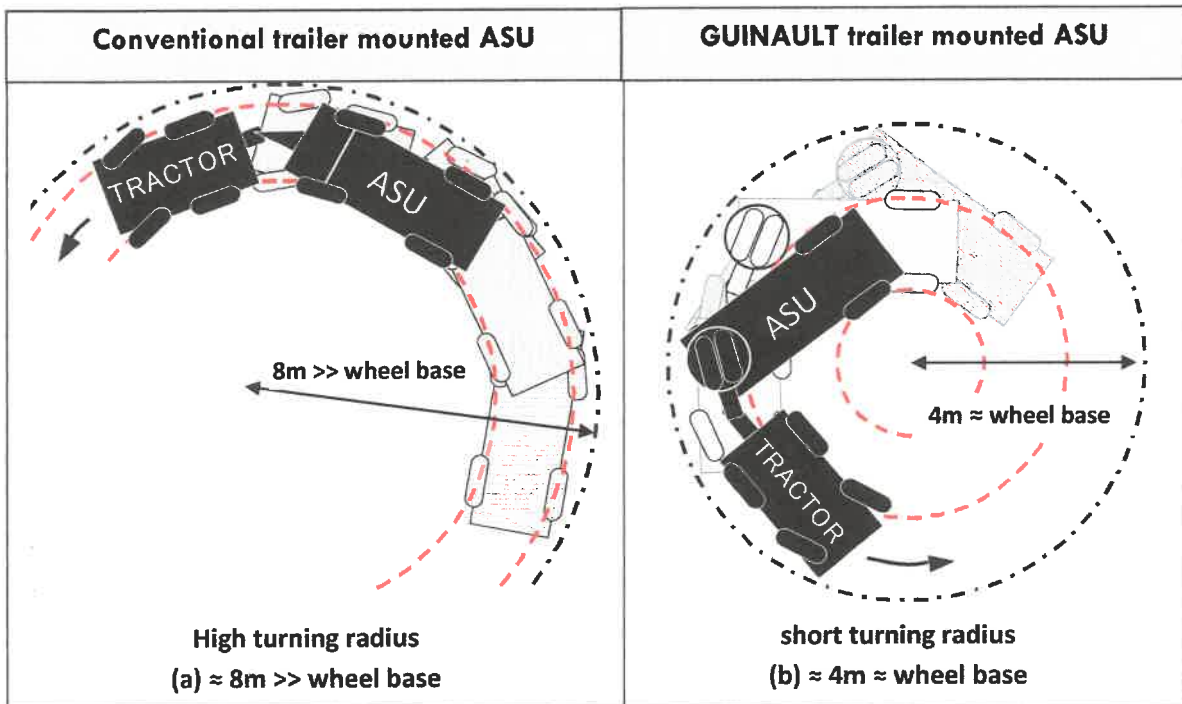


A large storage compartment is fitted on the front side of the chassis, allowing easy storage of the air delivery hose(s).

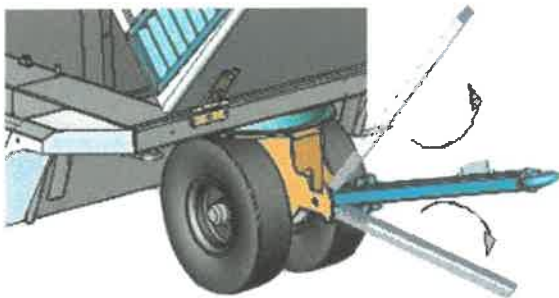


7.2 HIGH MANOEUVRABILITY FRONT AXLE AND BRAKING SYSTEM

The ASU steering is ensured by a steering turn table guaranteeing reliability, robustness and a great manoeuvrability (see schema below).



The braking is ensured by high and low positioning of the tow bar.

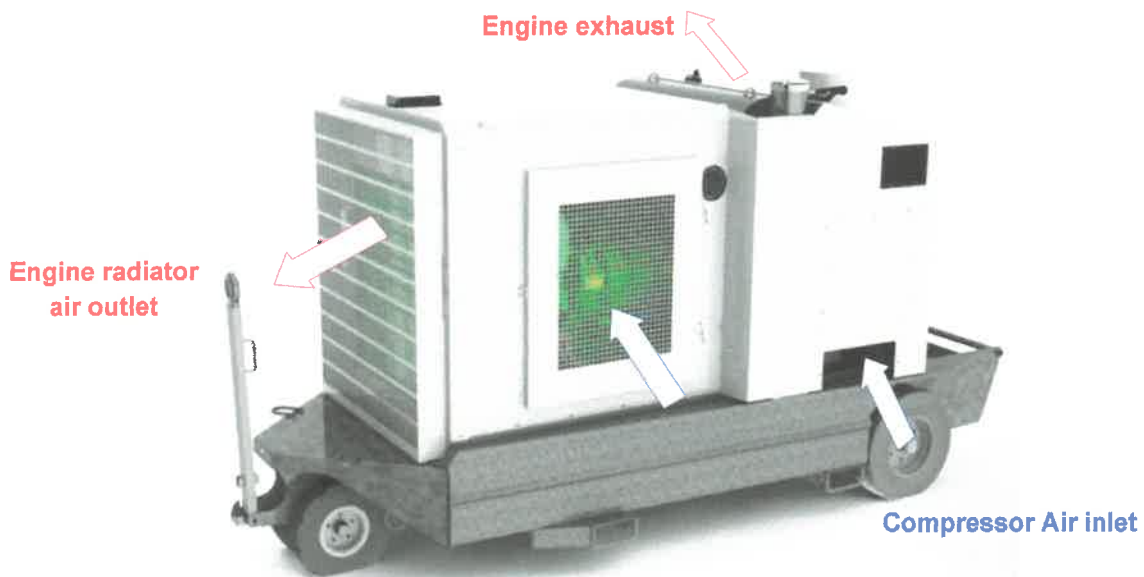


1. BRAKING POSITION
2. MOVING POSITION
3. BRAKING POSITION

7.3 CANOPY / OPTIMIZED AIR CIRCULATION / THERMAL MANAGEMENT FOR DURABILITY AND PERFORMANCE

The heat management is a Performance key for an Air Start Unit. Both compressor and engine generate a huge quantity of heat, which must be dissipated in the atmosphere, without affecting the performance of the unit.

GUINAULT concept separates engine and compressor air inlets, making sure both assemblies are fed with fresh air. All air exhaust (engine exhaust and compressor air bypass) are mounted on the top of the unit, making sure the dissipated heat is not sucked by the engine or compressor – The efficiency of the unit is significantly increased, ensuring good performances in the highest temperature conditions and extended lifetime of the unit.



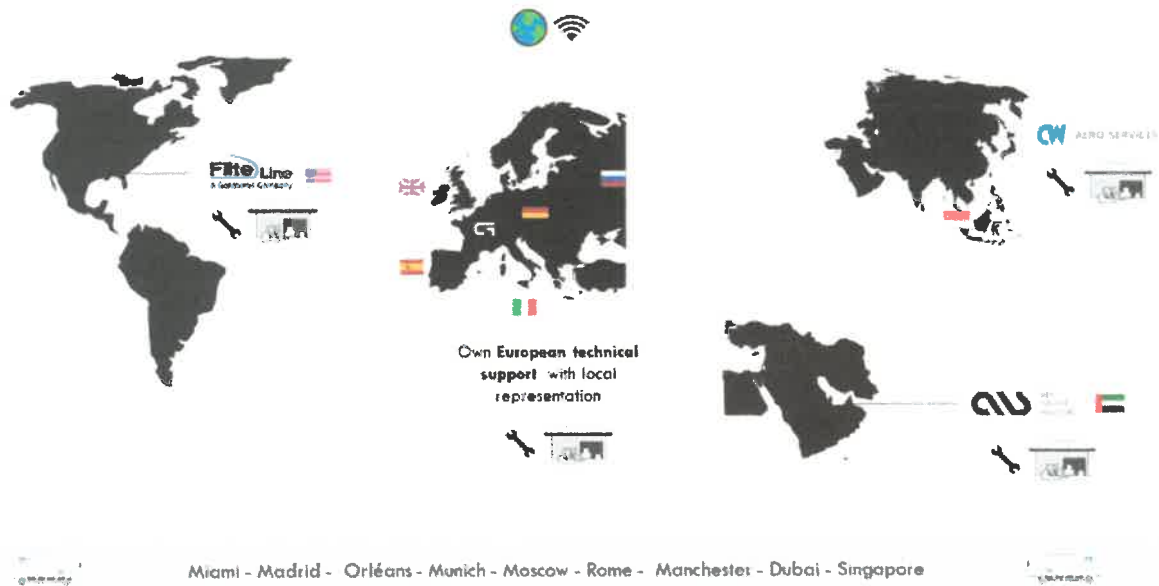
9 TRUCK MOUNTING OPTION

Upon request, the ASU can be mounted on several types of trucks (Mercedes, Iveco or any other types). This integration is preferably made in factory but can also be done at customer's site.



AFTER SALES

TECHNICAL SUPPORT



As a leader of GSE manufacturer, GUINAULT focusses its production and its engineering in a unique site in FRANCE. For the Technical support, GUINAULT has trained “**Technical Excellence Centers**” worldwide which are in permanent relation with Local dealers and customers, with GUINAULT Engineering Department and after sales Service Engineers. This Network, supported by our engineers and the build-in digital technology has been in place for more than 10 years. It has proven its efficiency in term of reactivity, customer satisfaction and quality of support.

- ✓ Covering 5 continents
- ✓ Local Trained Engineer/Technicians
- ✓ World Wide presence
- ✓ Direct relation with OEM and CUSTOMERS
- ✓ Local Airport pass for quick reaction
- ✓ High Quality Technical Support



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