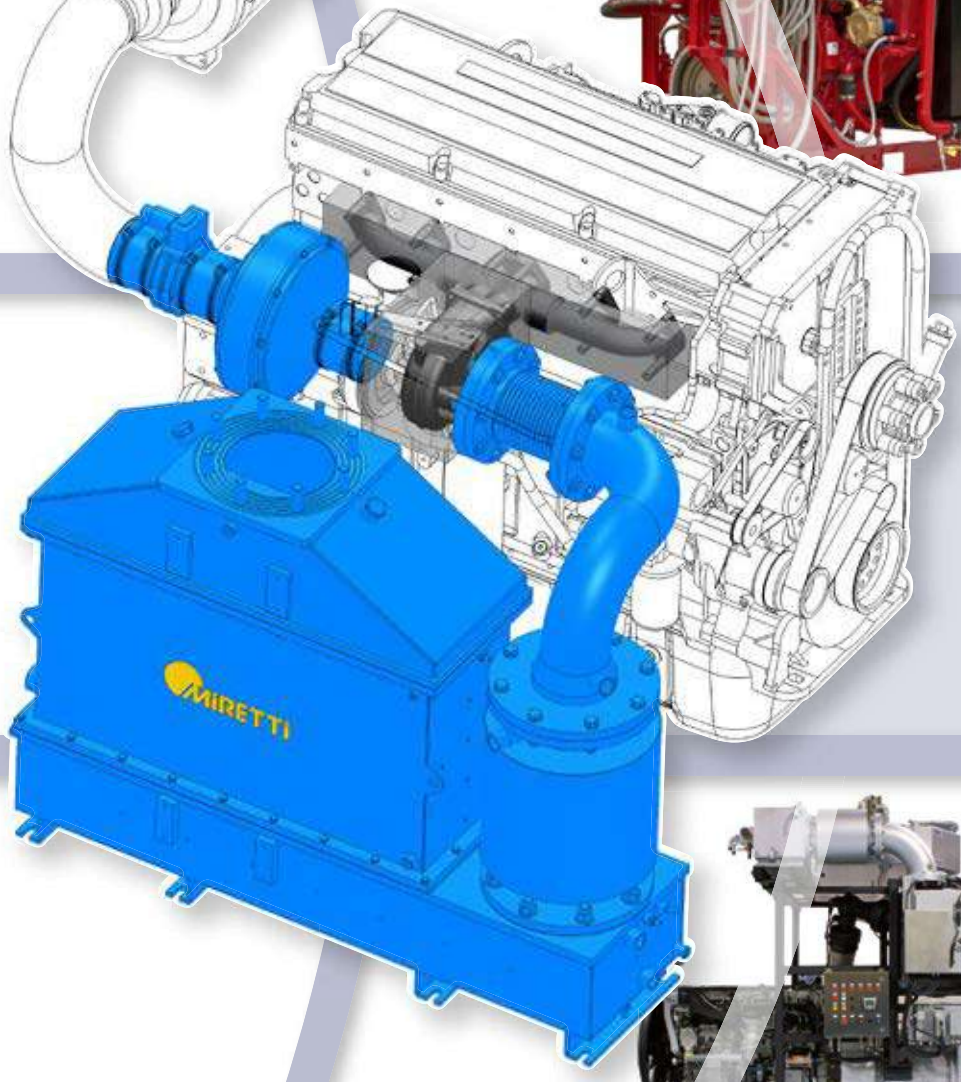





# Miretti Engine Explosion Protection Systems

## Zone 2 (ATEX) Kits

## Class I Div. 1-2 (US)

## TIER 4 Engines

Explosion Proof Protection

**The priority is to ensure safety for the environment and for human beings.**

Diesel engines, working in potentially flammable atmospheres, can be an explosive mix that places workers and businesses at serious risk and could result in untold damage to the environment.

History has taught us the lesson that such risks are very real and the impact is often catastrophic.

Our priority is to protect people and the environment by providing safe, affordable and internationally compliant explosion protection systems; a requirement which cannot be compromised.






## The PROBLEM…

Dangerous ignition sources of unprotected diesel engines such as: electrical, mechanical, or static sparks, overspeed or flame from inlet or exhaust, and hot surfaces that could cause an auto-ignition of a flammable gas or vapour.
Flammable gases in the atmosphere can be sucked in through the air intake along with air for combustion.This results in backfires in the inlet and exhaust or engine overspeed situation whereby the engine runs out of control. Different surfaces on a diesel engine can become hot and therefore sources of ignition. These surfaces need to be protected to avoid the danger of explosion.

## The SOLUTIONS…

### Miretti Engine Explosion Protection Systems

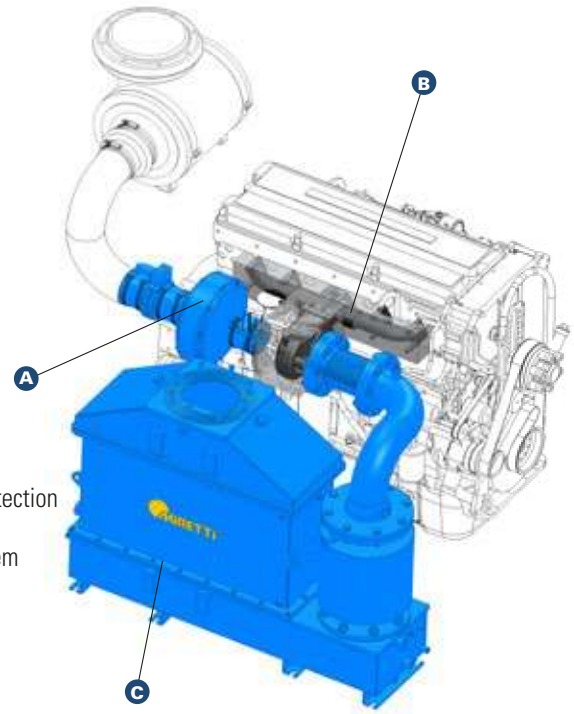
- Zone 2 ATEX compliant kits
- Class I Division 1-2 Explosion Protection Solutions Electrical System
- TIER 4 Engines Explosion Proof Technology

MIRETTI OVER 40 YEARS DEDICATED TO THE ENVIRONMENT AND SAFETY OF THE WORKERS

Miretti has been leader since 1973 in the Explosion Proof Protection of vehicles and boasts impressive experience in the field. The company operates all over the world with branches in USA, China, Germany, UK, France, Hungary, Benelux, Australia, Singapore. Miretti is ISO 9001:2000 certified and is an approved supplier for the most important world producers. Constant research focuses on new technologies and innovative solutions. All explosion proof conversions are developed and implemented in agreement with OEM Original Equipment Manufacturers to maintain original safety levels and ergonomics in conformity with local standards and regulations. Miretti ensures a reliable after-sales service, qualified technicians, quality and fast maintenance.

# Miretti Zone 2 (ATEX) Kits include features designed to prevent an ignition source causing an explosion

Miretti Ex Solutions are available for Atlas Copco, MTU, Cummins, Caterpillar, Volvo, Perkins, JCB, FPT, Deutz, Man, Doosan etc...




Miretti Zone 2 (ATEX) Kits also include:
Battery and electrics Ex Protection
Charge Air Pipe
Automated shut-down system
ECM Ex Protection

**A** **Miretti Air Inlet Flame Arrestor and Shut Down Valve**
Provides shutdown on overspeed

**B** **Miretti CoatEx Exhaust Manifold and Turbocharger**
Ensures surface temperature is below 200°C (T3)

**C** **Miretti FilterEx Flame Arrestor, Heat Exchanger and Spark Arrestor**
Cools the engine exhaust below 200°C (T3). Ensures that no sparks or not particles escape into the atmosphere

## our Certifications, your Safety

All Miretti Ex Solutions Diesel Engine Hazardous Packages are certified, with some having tri-certification to ATEX 2014/34/EU, IECEx and NEC 500.

Miretti Diesel Engine Explosion Protection Systems are designed, tested and certified to support the equipments of our clients, thanks to high quality know-how of our specialist engineers.


## After Sales Service and Training

The Miretti after-sales service, present in most countries, ensures fast response times, dedicated assistance, telephone and on-site support and the availability of specific spare parts for more than ten years to help maintain constant productivity for customers.

Conversions are studied and implemented using solutions that simplify and speed up machinery maintenance. Maintenance interventions are carried out by skilled personnel, authorised and trained for the purpose in our head offices.

The Miretti After-Sales Service and the availability of local technical support through training courses for service engineers (carried out at the Milan HQ or locally when available) will support the client step by step in ensuring continuous uptime and protection of their environment.

Annual and/or three yearly Safety Audits for the Ex protection system are available on request.





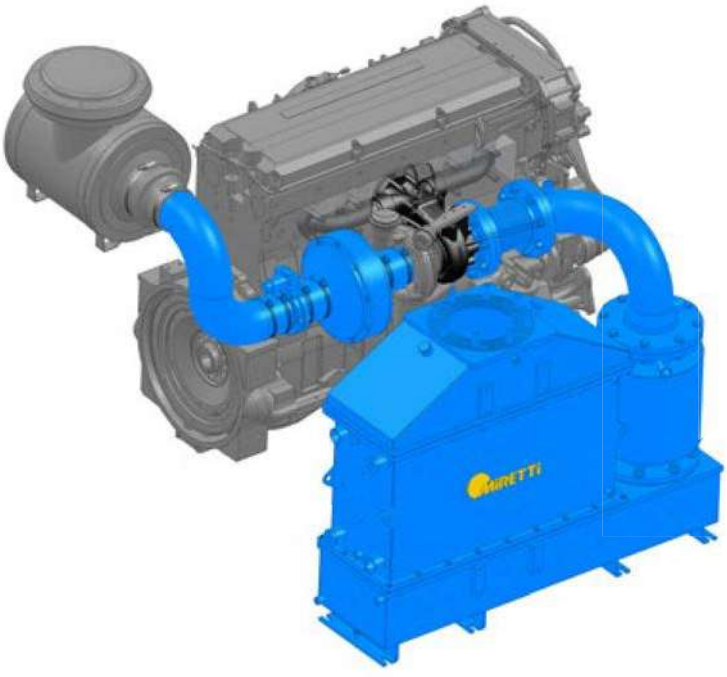
**FilterEx Manicooler**

< 110 kw

# Miretti Zone 2

**FilterEx**

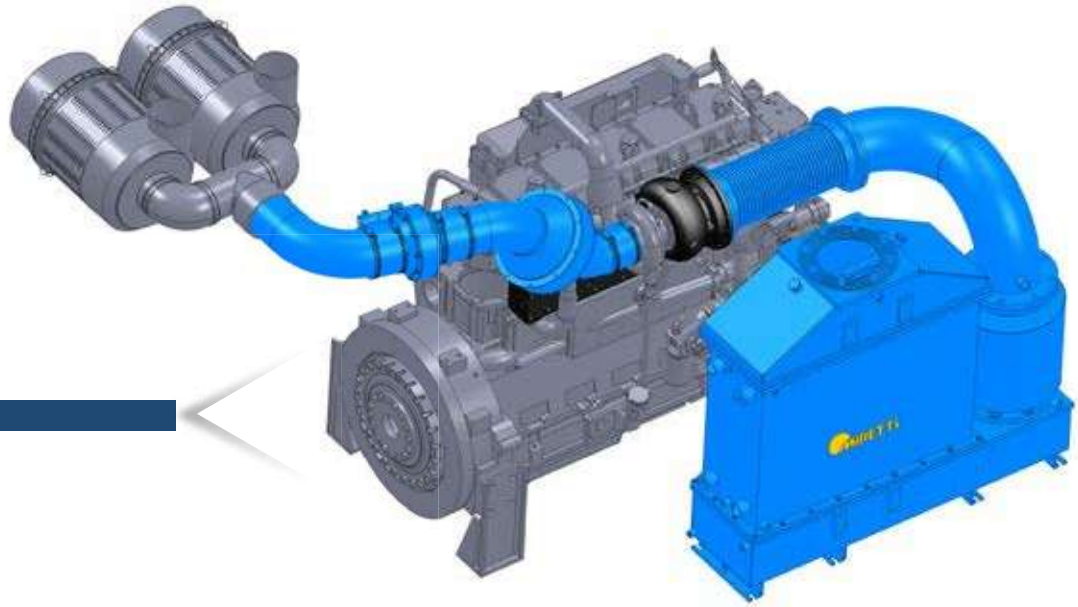
60 -120 kw



**FilterEx**

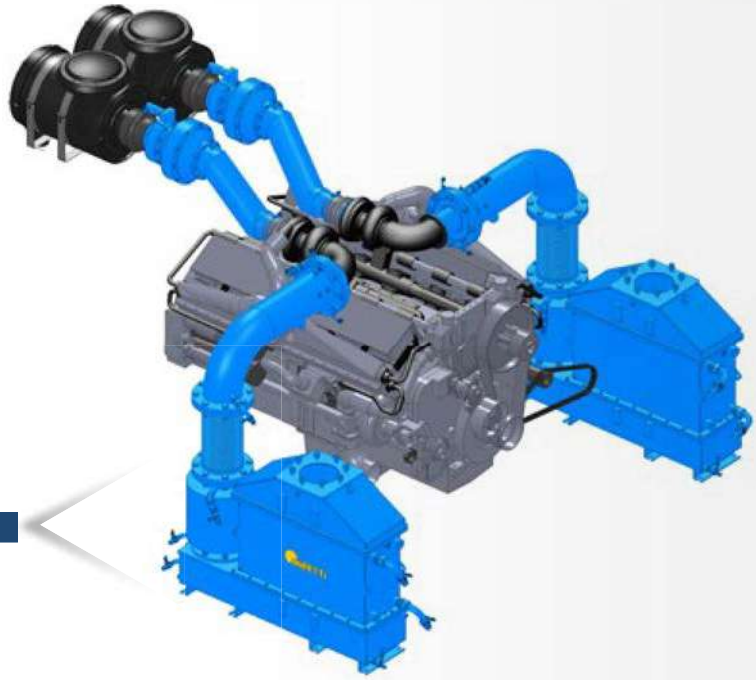
121-250 kw

The images are indicative of a standard engine package.
Options are available .
Please contact us for more information!



**FilterEx**
251-500 kw

# (ATEX) Kits



**FilterEx**
>500 kw







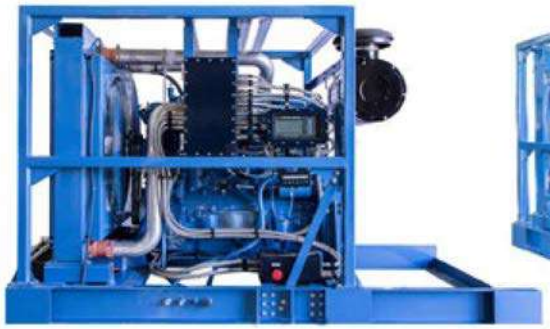




Section 2

## Miretti Class I Division 1
### Explosion Protection Electrical Only

NTRL certified and labeled electrical components. Complete Electrical System Certification available.



## Miretti Class I Division 2
### Explosion Protection Electrical Only

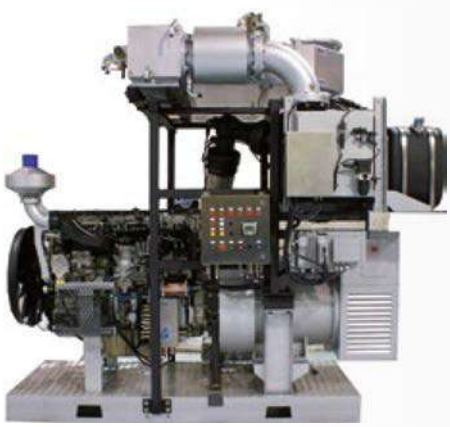
NTRL certified and labeled electrical components.
Complete Electrical System Certification available.

## Miretti Division 2 / Zone 2
### Tri-certification Explosion Protection

ATEX Zone 2, IECEx Zone 2, NEC Class I Div. 2 certificates.

## Miretti TIER 4 Engines
### Explosion Protection ATEX Zone 1-2 / Div. 1-2 (US)

Miretti explosion proof diesel conversions are designed not to have an impact on the functionality and compliance standards of the original diesel engine. Here is an example of Tier 4 Explosion Protected Diesel Engine with tri-certification to NEC 500, ATEX 2014/34/EU, IECEx.



Section 3

# Miretti Oil & Gas
# your ideal Partner able to turn Problems into Solutions

## the problem…

Cost of oilfield equipment "downtime" during operations and the maintenance costs of servicing conventional exhaust flame traps every 20 hours.

## the solution…Miretti FilterEx

A 'compact' exhaust cooling system with integral self-cleaning exhaust flame and spark arrestors.

Enables maximum engine 'uptime' as the self-cleaning flame arrestor can operate for approx. 1,000 hours before requiring cleaning.

Reduces costly service maintenance while conventional exhaust flame arrestors need to be changed every 20 hours.

II 2GD
I M2

Tamb=20 +130°C

*designed to suit any engine type

## the problem…

Cost of replacing "dry" turbocharger and exhaust manifolds of industrial engines with water-cooled versions as part of Zone 2 conversion process.

## the solution…Miretti CoatEx

Provides a thermal barrier between hot engine surfaces (e.g. turbochargers and exhaust manifolds) and the external atmosphere.

Enables the OEM "dry" turbocharger and manifold to be retained reducing Zone 2 conversion costs and minimising risk of failure by fitting non OEM turbo and water cooled manifold.

II 2G IIC
II 2D IIIC

Tamb-20°C +60°C

## Why choose Miretti?

- Expertise of over 40 years
- Quality & Innovation
- Competitive Pricing
- Certifications
- After Sales Service & Training
- Research & Development
- Reliable Customized Solutions
- Global footprint

## the problem…

Cost of "passively" protecting Zone 2 diesel engine oilfield equipment with complex control systems and cost of downtime and service maintenance of cleaning exhaust flame traps every 20 hours.

## the solution…Miretti 3GMIR

Provides gas detection and automatic engine/equipment shutdown for almost any Zone 2 application onshore and offshore. 3GMIR uses infrared gas sensors for robust duty and extended life and has self-calibration capability.

Ensures maximum safety and eliminates the need for exhaust flame traps and equipment "down-time" caused when cleaning conventional exhaust flame traps.

II 3G Ex nC IIC T6 resp. T5 resp. T4 Gc

## the problem…

Cost and complexity for modification and compliance of oilfield and engine equipment electrics to different global/regional standards of explosion protection.

## the solution…Miretti MeecaEx

Unified compact engine control system approved worldwide under ATEX, NEC (FM), IECEx.

Zone 2 electronic controlled system for oilfiel equipment ensures simple installation and operation.

It is compact and is approved worldwide.

## the problem…

Cost of "passive added-safety" for diesel engine and electric battery equipment operating in unclassified areas and risk that equipment continues to operate with explosive atmosphere present.

## the solution…Miretti GasChecker

It's a cost effective protection for a multitude of applications.

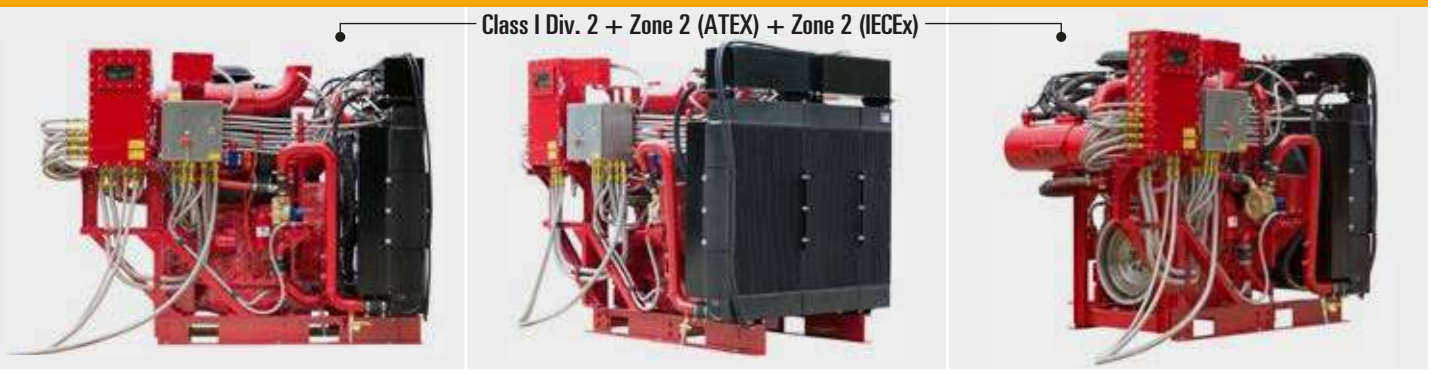
It's a basic kit of parts that can be installed locally to provide gas detection, visual/audible alarms and automatic equipment shutdown at 25% LEL Propane in Air.

Provides for "added-safety" within areas not formally classified.

II 3G Ex nC IIC T6 resp. T5 resp. T4 Gc


*Second gas sensor is an option

# Miretti is at the forefront of New Technologies & Innovative Solutions

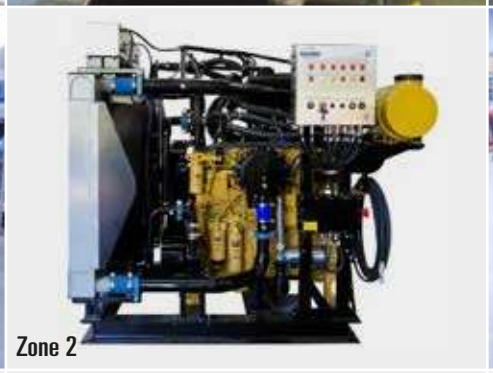
















# We operate all over the world

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**www.miretti.org**
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**MIRETTI'S PRESS RELEASE**
**OSEA 2016 (29 November – 2 December)**

**Innovative & Alternative Approach**
**MIRETTI FILTEREX:**
**A CATALYTIC SELF-CLEANING EXHAUST FLAME TRAPS**
**Miretti Group will present their latest system**
**which enables your engine to run safely for up 1.000 hours**
The appointment is at the Miretti's stand – booth BU3-01 at OSEA Show – Singapore-

Miretti Group, leader in the Explosion Proof Protection of diesel engines and mobile vehicles, will introduce its latest Ex Solution at OSEA 2016

At a time when the oil and gas industry is under increasing pressure to cut costs in line with reduced oil prices, Miretti offers a new EX and ATEX certified solution that help reduce operating costs, maintenance costs and equipment downtime.

Miretti Group, through constant research focused on new technologies and innovative solutions, presents its **FilterEX catalytic self-cleaning exhaust flame traps**. The patented Miretti FilterEX system, when combined with Miretti Zone 1 and 2 exhaust gas coolers, **enables Zone 2 diesel engine equipment to operate for up to 1,000 hours before** the exhaust flame trap(s) are checked and eventually cleaned. Extending operating time from 20 hours to up to 1,000 hours - by not having to service the exhaust flame traps - can have a dramatic impact on the cost of operating equipment such as air compressors, gen-sets, pumps, cranes and wireline units.

Miretti offers also Zone 2 ATEX Kits of part for local OEM installation.

- Look our brochure focused on **Miretti Diesel Engine Explosion Protection Systems Zone 2 (ATEX) Kits, Class I Div. 1-2 (US), TIER 4 Engines**

- Miretti also offers a its latest range of **EX Solutions**

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Finedon Road Industrial Estate
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**What's Miretti FilterEx and how does it work?**

- It's a 'compact' exhaust cooling system with integral self-cleaning exhaust flame arrestors. FilterEx systems have recently been certified by CEC to ATEX 94/9/EC and for EN 1834:2000 Parts 1, 2 and 3;
- It's an innovative system which enables maximum engine 'uptime' as the self-cleaning flame arrestor can operate for approx. 1,000 hours before cleaning;
- It's an alternative approach that reduces costly service maintenance when conventional exhaust flame arrestors need to be changed every 20 hours.

Conventional exhaust flame traps require changing/cleaning every 20 hours. This process can lead to unnecessary operational costs, an inconvenience through equipment downtime that creates health and safety risks during the process of removing, cleaning and replacing them. Diesel engines operating within potentially explosive atmospheres must have exhaust flame trap(s) fitted to prevent a possible explosion occurring. Also exhaust flame traps will be required to comply with European ATEX directives and harmonised European standard EN 1834.1.2000. With most diesel engine oilfield equipment fitted with 'passive' Ex protection rather than "active' gas detection systems the problems of servicing the exhaust flame traps becomes a serious issue for operators. Exhaust flame traps require regular servicing and need to be removed and cleaned every 20 hours because oily carbon deposits clog up the flame traps and can cause the loss of engine power. Servicing of the exhaust flame traps requires equipment 'downtime' when the dirty flame traps are exchanged for clean units or the removed flame traps is cleaned over a period of hours before any operation can start again.

Handling the exhaust flame traps can also be an hazardous event. Each flame trap can weigh as much as 70kg and some engines have fitted up to six flame traps. Access to the flame traps can also be problematic with equipment located on oil rigs.

An alternative approach is to specify for new Zone 1 and 2 engines Miretti exhaust gas cooling systems with Miretti FilterEX 'catalytic' self-cleaning exhaust flame arrestors. Miretti invite operators to do their own calculations to see total cost reduction by Miretti exhaust gas coolers with FilterEX. Miretti is also able to offer exhaust cooling systems with FilterEX to upgrade for most engine types.

**For further information visit Miretti stand number BU3-01 at OSEA 2016 (29 November – 2 December | Singapore)**

*** ***

Miretti has been leader since 1973 in the Explosion Proof Protection of vehicles and boasts impressive experience in the field.

The company operates all over the world with branches in USA, China, Germany, UK, France, Hungary, Benelux, Australia, Singapore.

Miretti is ISO 9001:2000 certified and is an approved supplier for the most important world producers. Constant research focuses on new technologies and innovative solutions. All explosion proof conversions are developed and implemented in agreement with OEM Original Equipment Manufacturers to maintain original safety levels and ergonomics in conformity with local standards and regulations.

Miretti ensures a reliable after-sales service, qualified technicians, quality and fast maintenance.
*** ***

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**MIRETTI'S PRESS RELEASE**
**OSEA 2016 (29 November – 2 December)**

**Our priority is to protect people and the environment: a requirement which cannot be compromised**
**MIRETTI DIESEL ENGINE**
**EXPLOSION PROTECTION SYSTEMS**
**ZONE 2 (ATEX) KITS, CLASS I DIV. 1-2 (US), TIER 4 ENGINE & EX SOLUTIONS**
**Miretti Group will present its safe, affordable and internationally compliant**
**Explosion Protection Systems & Ex Solutions**
The appointment is at the Miretti's stand – booth BU3-01 at OSEA Show – Singapore-

Miretti Group, leader in the Explosion Proof Protection of diesel engines and mobile vehicles, will offers its Diesel Engine Explosion Protection Systems and **Zone 2 ATEX Compliant Kits, Class I Div. 1-2 Explosion Protection Solutions Electrical Systems and TIER 4 Engine EX Technology** for local OEM installation.
The appointment is at our stand BU3-01 - OSEA 2016.

The priority is to ensure safety for the environment and for human beings. Diesel engines, working in potentially flammable atmospheres, can be an explosive mix that places workers and businesses at serious risk and could result in untold damage to the environment. History has taught us the lesson that such risks are very real and the impact is often catastrophic. Our priority is to protect people and the environment by providing safe, affordable and internationally compliant explosion protection systems; a requirement which cannot be compromised.

Miretti offers its Ex Solutions: **Diesel Engine Explosion Protection Systems Zone 2 ATEX** compliant kits, reliable and safe, optimized for installation and 'uptime', maintenance friendly with FilterEx self-cleaning exhaust flame traps and spark arrestor elimination. Miretti offers also **Class I Div. 1-2 Explosion Protection Solutions Electrical System** and **TIER 4 Engines Explosion Proof Technology**.

In fact dangerous ignition sources of unprotected diesel engines such as: electrical, mechanical, or static sparks, overspeed or flame from inlet or exhaust, and hot surfaces that could cause an auto-ignition of a flammable gas or vapour. Flammable gases in the atmosphere can be sucked in through the air intake along with air for combustion. This results in backfires in the inlet and exhaust or engine overspeed situation whereby the engine runs out of control. Different surfaces on a diesel engine can become hot and therefore sources of ignition. These surfaces need to be protected to avoid the danger of explosion.

**Miretti Zone 2 (ATEX) Kits** include features designed to prevent an ignition source causing an explosion.

**Miretti Class I Div. 1 -2 Explosion Protection Electrical Only**: NTRL certified and labeled electrical components. Complete Electrical System Certification is available.

**Miretti TIER 4 Engines Explosion Protection ATEX Zone 1-2/Div. 1-2 (US)**: Miretti explosion proof diesel conversions are designed not to have an impact on the functionality and compliance standards of the original diesel engine. They can have tri-certification to NEC 500, ATEX 2014/34/EU, IECEx

All Ex Solutions Diesel Engine Hazardous Packages are certified, with some having tri-certification to ATEX 94/9/EC, IECEx and NEC 500. Miretti Diesel Engine Explosion Protection Systems are designed, tested and certified to support the equipments of our clients, thanks to hight quality know-how of our specialist engineers.

- Look our brochure focused on **Miretti Diesel Engine Explosion Protection Systems Zone 2 (ATEX) Kits, Class I Div. 1-2 (US), TIER 4 Engines**

Miretti Zone 2 (ATEX) Kits include:

- **Miretti Air Inlet Flame Arrestor and Shut Down Valve** that provides shutdown overspeed
- **Miretti CoatEx Exhaust Manifold and Turbochanger** that ensures surface temperature is below 200 °C
- **Miretti FilterEx Flame Arrestor, Heat Exchanger and Spark Arrestor** that ensures that no sparks or not particles escape into the atmosphere
- **Battery and Electrics Ex Protection**
- **Charge Air Pipe**
- **Automated shut-down system**
- **ECM Ex Protection**

**FilterEx**
**Manicooler < 110 kw**

**FilterEx**
**60-120 kw**

**FilterEx**
**121-250 kw**

**FilterEx**
**251-500 kw**

**FilterEx**
**> 500 kw**

Miretti also offers a its latest range of **EX Solutions**. At a time when the oil and gas industry is under increasing pressure to cut costs in line with reduced oil prices Miretti offer new EX and ATEX certified solutions that help reduce operating costs, maintenance costs and equipment downtime.

- **FilterEx**: enables maximum engine 'uptime' as the self-cleaning flame arrestor can operate for approx. 1000 hours before requiring cleaning;
- **CoatEx**: provides a thermal barrier between hot engine surfaces (e.g. turbochargers and exhaust manifolds) and the external atmosphere;
- **3GMIR**: provides gas detection and automatic engine/equipment shutdown for almost any Zone 2 application onshore and offshore;
- **MeecaEx:** unified compact engine control system approved worldwide under ATEX, NEC (FM), IECEX, CNEX;
- **Gas Checker:** it's a basic kit of parts that can be installed locally to provide gas detection, visual/audible alarms and automatic equipment shutdown at 25% LEL Propane in Air.

Miretti Ex Solutions are available for Atlas Copco, MTU, Cummins, Caterpillar, Volvo, Perkins, JCB, FPT, Deutz, Man, Doosan etc…

**For further information visit Miretti stand number BU3-01 at OSEA 2016 (29 November – 2 December | Singapore)**

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*** ***

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# D. MAINTENANCE OF EXPLOSION-PROOF SYSTEMS

## D.1 EXHAUST GAS SYSTEM MAINTENANCE

This document includes the instructions for maintenance of the components of the exhaust gas system; please refer to **"TABLE C"** for the frequency of the tasks on all components featured on the Miretti systems.

### D.1.1 TURBOCHARGER AND EXHAUST MANIFOLD INSULATION

The Miretti CoatEx insulation, is used to insulate the components and make them fit to be used in potentially explosive areas.
A routine maintenance is required every month to check the state of wear of this coating.

#### COATEX MAINTENANCE AND INSPECTIONS

Carry out maintenance of the COATEX as indicated below:

| | |
|---|---|
| **Every 400 hours** | **VISUAL INSPECTION**<br>Check the integrity of the COATEX insulation.<br><br>**CLEANING**<br>Remove any dirt residues. |

### D.1.2 WATER COOLED PIPING

Based on the design specifications, the pipelines of the exhaust system can be water-cooled; in this case, it is necessary to check every **800 hours** that the clamps and the cooling pipes are not damaged and that there is no coolant leakage.
If threaded quick couplings are installed, inspect the fittings every **800 hours**, check that they are not damaged and that there is no leakage of liquids.
If the pipes and/or clamps or quick fittings are damaged, contact Miretti S.r.l. for the supply of spare parts.
Inspect the cooled pipelines every **1500 hours**; check that they are not damages and that there are no liquid leaks.

### D.1.3 TIGHTENING OF CLAMPS

Check every **800 hours** of work that the clamps are tight and do not leak liquid.
In case you need to use the torque wrench suitable to tighten the clamps, the maximum tightening values for the clamps of the system are listed in **"TABLE B"**.

### D.1.4 TIGHTENING OF THE EXHAUST SYSTEM SCREWS

Every **800 hours**, check and tighten the screws of the exhaust system, using the torque wrench suitable for the tightening torque.
For the tightening torque values, see **"TABLE A"**.

## D.1.5 GASKET

Every **800 hours** of work, be sure to check the state of wear **of all** the gaskets.
In case there were liquid spills from the pipelines/exchangers, proceed immediately to replace the gaskets.
Use the code indicated in the spare parts list.

## D.1.6 EXHAUST FLAME TRAP

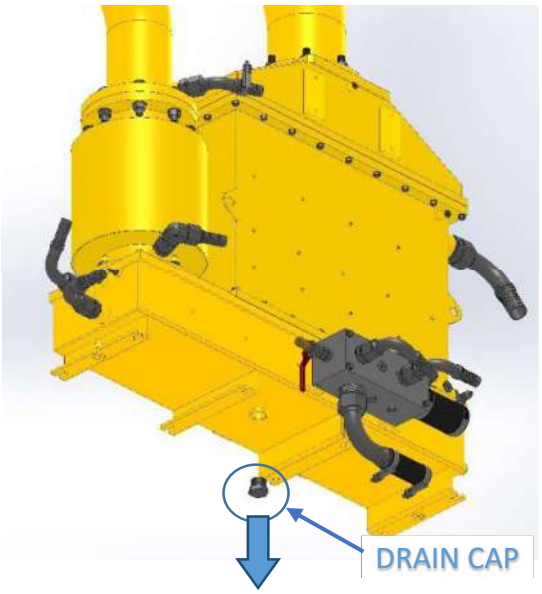
Every **500 hours**, you should visually inspect the exhaust flame trap has not leaking liquids and that the pipe clamps are tightened as indicated in **"TABLE B"**.
Check that there are no deposits and/or residues of potentially explosive material.
Every **1000 hours**, clean the exhaust flame trap, carefully following the procedure described below:

1. **PREPARATION FOR CLEANING AND EMPTYING OF THE COOLING SYSTEM**
    a. Stop the engine.
    b. The maintenance procedures, should be performed with the engine off and in total safety conditions.
    c. Disconnect the cooling pipes by unscrewing the quick couplings.

**WARNING:** Pay particular attention to the leakage of very hot liquids from the equipments.

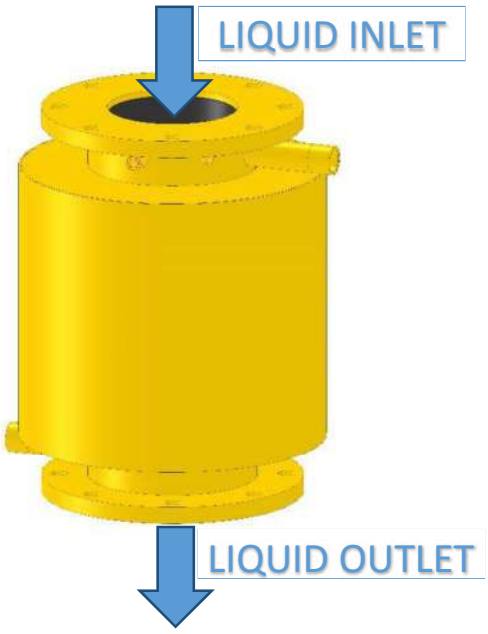
## 2. REMOVAL OF THE EXHAUST FLAME TRAP

a. To remove the piping, loosen the screws and remove them, while paying attention to the weight of the pipes.
b. Be careful of the gaskets between the piping and the exhaust flame trap.
c. Remove the drain plug located below the water-cooled exhaust gas inlet plenum.
d. Be careful of the gaskets between the exhaust flame trap and the water-cooled exhaust gas inlet plenum.
e. **WARNING:** Pay particular attention to the weight of the components.



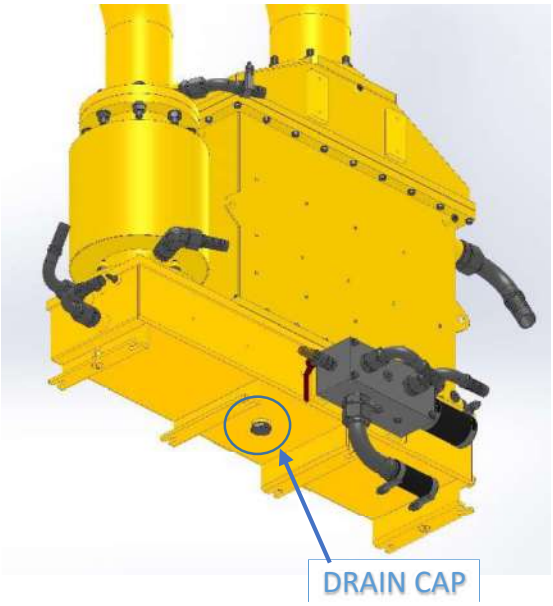

### CLEANING

f. To clean the components of the exhaust gas system, use pressurised water (water jet cleaner), removing any dirt deposits.
g. Let all the liquids used to clean the components drain out by the drain.
h. Make sure the exhaust flame trap is dry before reassembling it.



## 3. REASSEMBLY

a. Place the gaskets between the exhaust flame trap and the cooled piping.
b. Connect the exhaust flame trap to the water-cooled pipes, applying the tightening torques listed in **"TABLE A"**
c. Replace the cap and screw in to the original position on the water-cooled exhaust gas inlet plenum.

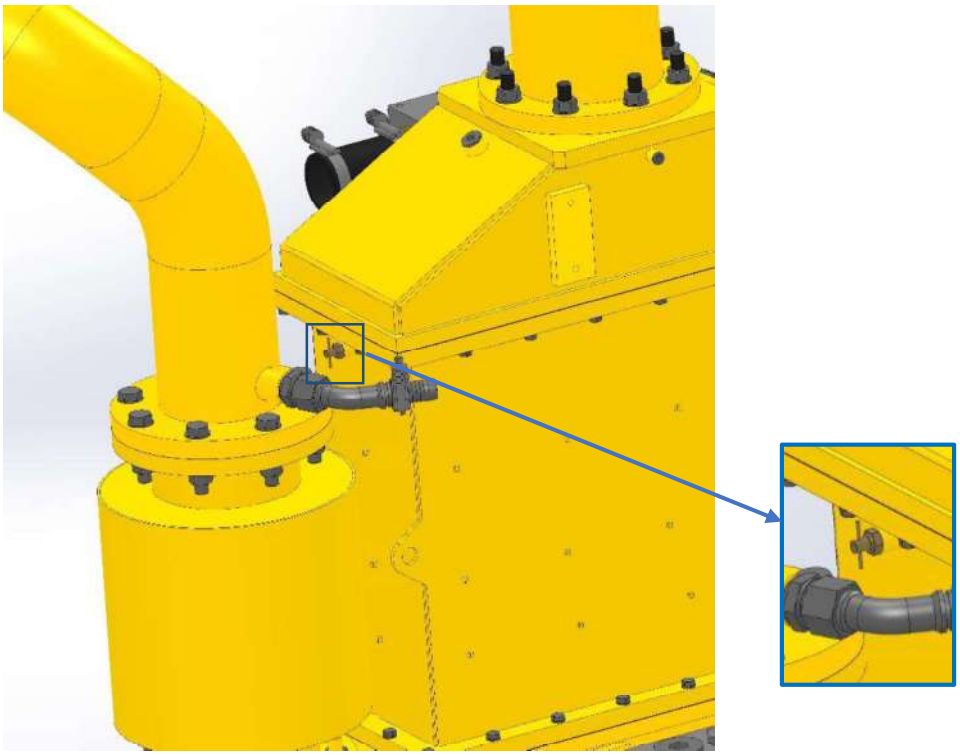


## 4. COOLANT FILLING

a. Connect the cooling piping (tighten the clamps as indicated in **"TABLE B"**) to the exhaust flame trap and the water-cooled pipes.

b. Where there are threaded quick couplings, apply liquid TEFLON of good quality to ensure the seal of all fittings.

c. Check that the manual vent valves (if installed) are open, in order to spill out the possible air bubbles, into the cooling system.



d. Proceed to fill the cooling system.

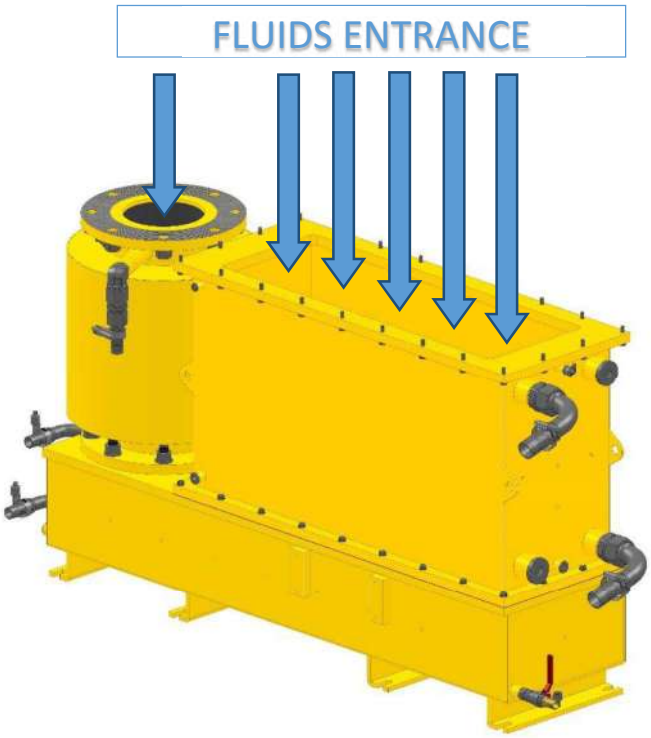
e. Close the manual bleed valve as soon as there is leakage from the exhaust flame trap.

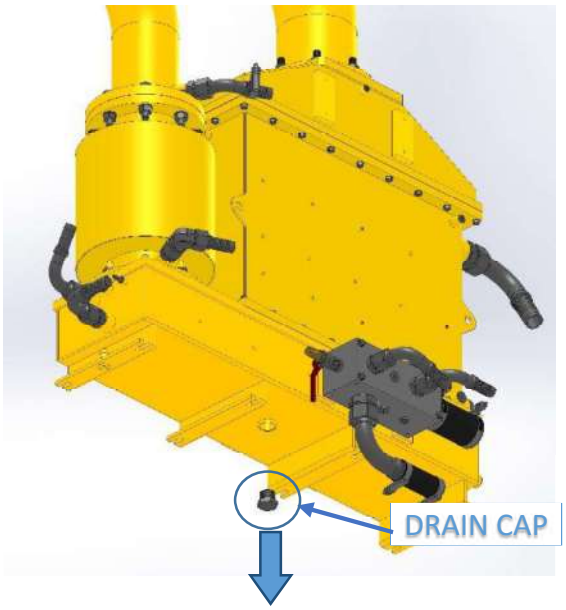
# D.1.7 EXHAUST GAS COOLER

Every **800 hours**, check that the screws are tightened; if they are not, tighten them with a torque wrench suitable for the tightening torque - see **"TABLE A"**.
Check that there are no liquid leaks and/or external defects.
Every **1000 hours**, clean the exhaust gas cooler, according to the following procedure:

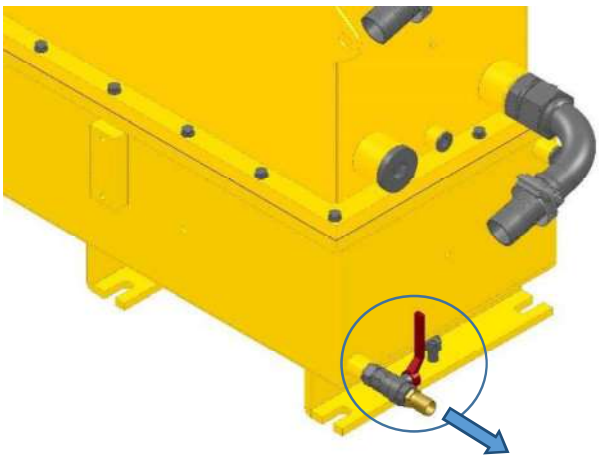
**CLEANING**

a. Remove the fittings.
b. Remove the drain cap under the water-cooled exhaust gas inlet plenum.
c. To clean the components, use pressurised water (water jet cleaner), removing any dirt deposits.
d. Drain all the liquids used for cleaning of the components.




**WARNING:** The fitting illustrate in picture below, should be used to drain the cooling system.
Pay particular attention to the leakage of very hot liquids from the equipments.



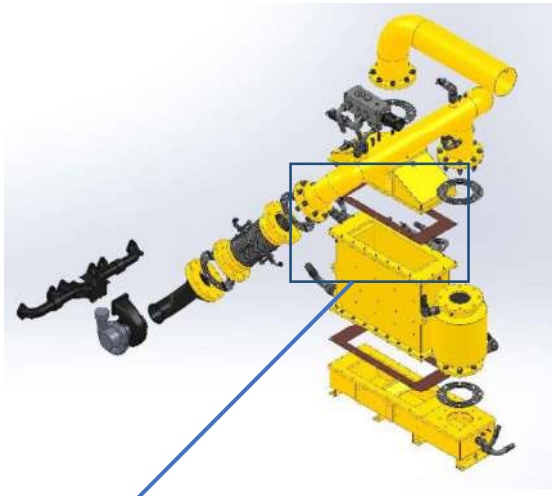
**REASSEMBLY**

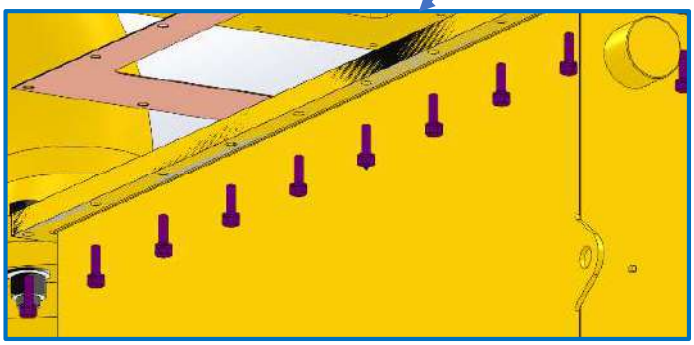
A. Make sure that all the liquids used for cleaning of the component are drained.
B. Replace the cap and screw in to the original position.
C. Place the gasket between the exhaust gas cooler and the water-cooled exhaust gas inlet plenum.
D. Place the gasket between the heat exchanger and the exhaust gas cooler outlet box.
E. Tighten the screws of the conveyor on the exchanger, applying the tightening torques listed in **"TABLE A"**

**WARNING:** Do not tamper for any means, the position of exhaust gas fumes sensor.
If it will cause damages to persons and/or property, Miretti. S.r.l shall not be liable for such damages.


## 5. REMOVAL OF THE EXHAUST GAS COOLER OUTLET BOX.

a. To remove the exhaust gas cooler outlet box and the outlet pipe, loosen the screws paying attention to the weight of the components.
b. Be careful of the gasket between the exhaust piping and the exhaust gas cooler outlet box.
c. Be careful of the gasket between the exhaust gas cooler outlet box and the exhaust gas cooler.





# D.2 AIR INLET SYSTEM MAINTENANCE

## D.2.1 AIR INLET FLAME ARRESTOR

The cartridge of the flame arrestor must be visually inspected every 800 hours of work, being careful not to damage the coupling surfaces of the flanges and firmly tightening all the fixing screws, according to the tightening torques listed in **"TABLE A"**

Every **800 hours**, be sure to check:

1. The tightness of the screws/fixing nuts of the flame arrestor (in case you need to tighten them, refer to **"TABLE A"**)
2. If installed, be sure to check the integrity of the inlet piping
3. Check that the locking clamps are firmly tight (in case you need to tighten them, refer to **"TABLE B"**).

The cartridge of the flame arrestor must be cleaned every **2000 hours** of work.

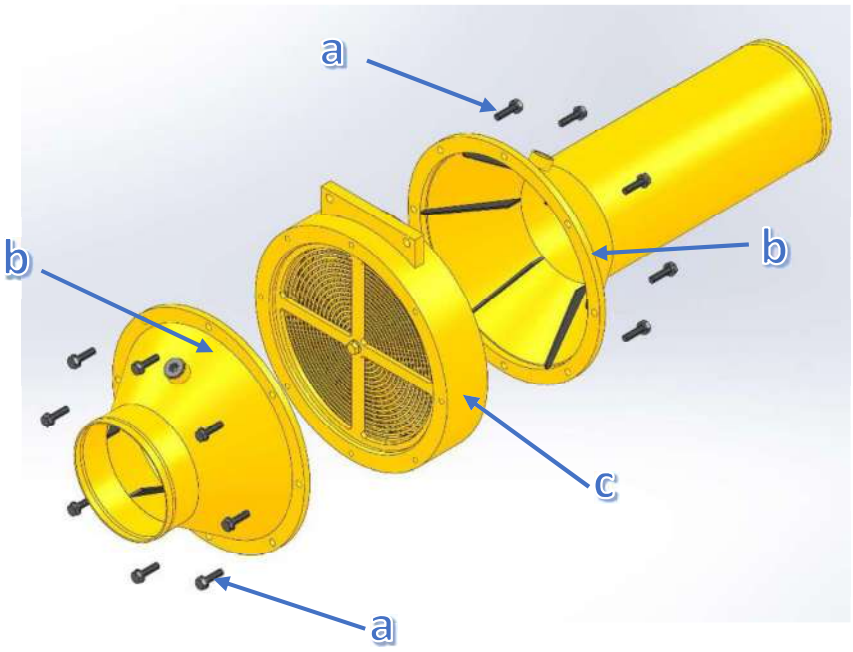
**1. <u>PREPARATION FOR MAINTENANCE</u>**

a. Stop the engine
b. The maintenance procedure should be performed with the engine off and in total safety conditions.

## 2. REMOVAL OF THE AIR INLET FLAME ARRESTOR

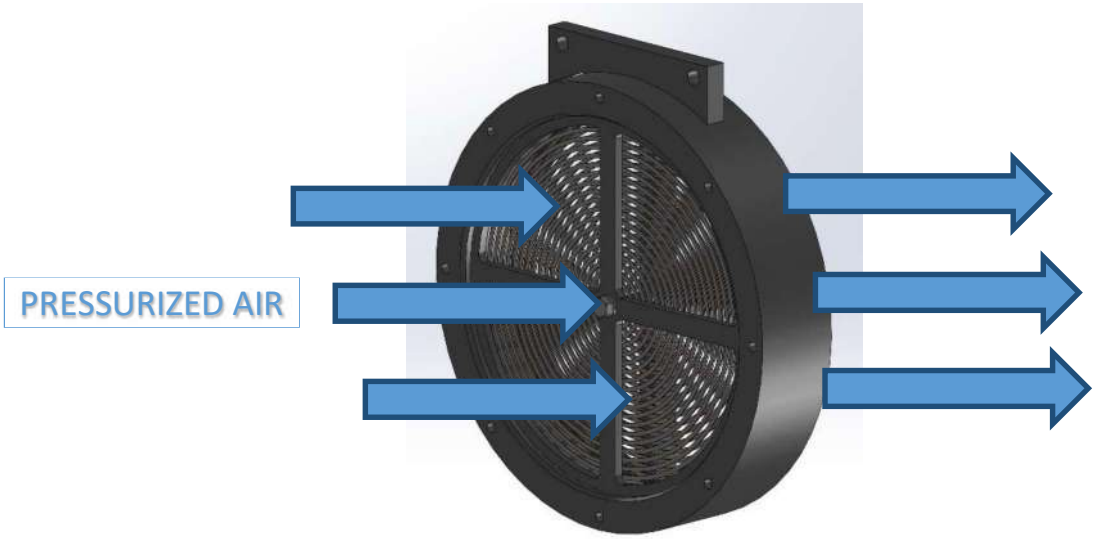
a. Loosen the screws of the air inlet cone adaptors.
b. Remove the air inlet cone adaptors.
c. Remove the flame arrestor cartridge

**WARNING:** Pay particular attention, to the weight of the components.



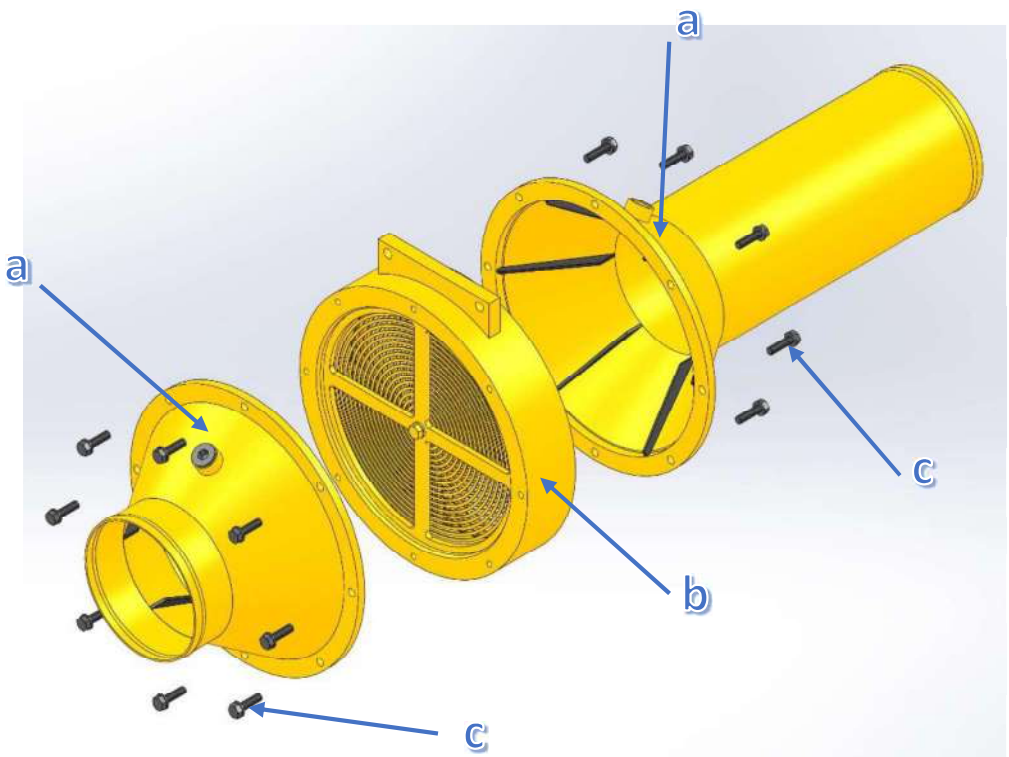
**3. CLEANING**

a. Clean the air inlet flame arrestor, with compressed air.
b. Make sure that you have removed all dirt residue before reassembling.




**4. REASSEMBLY**

a. Assemble the air inlet cone adaptors, tighten the screws, applying the tightening torques listed in "**TABLE A"**
b. Reposition the air inlet flame arrestor.
c. Tighten the screws of the flame arrestor, applying the tightening torques listed in "**TABLE A"**



## D.2.2 ENGINE SHUT DOWN VALVE

In case the engine exceeds the maximum allowed rpm, the stop valve will close immediately, stopping the engine.
Depending on the type of engine and design specifications, you can use different types of stop valves.
For maintenance instructions, please refer to the paragraph: **"MAINTENANCE OF THE ENGINE STOP VALVE"**.

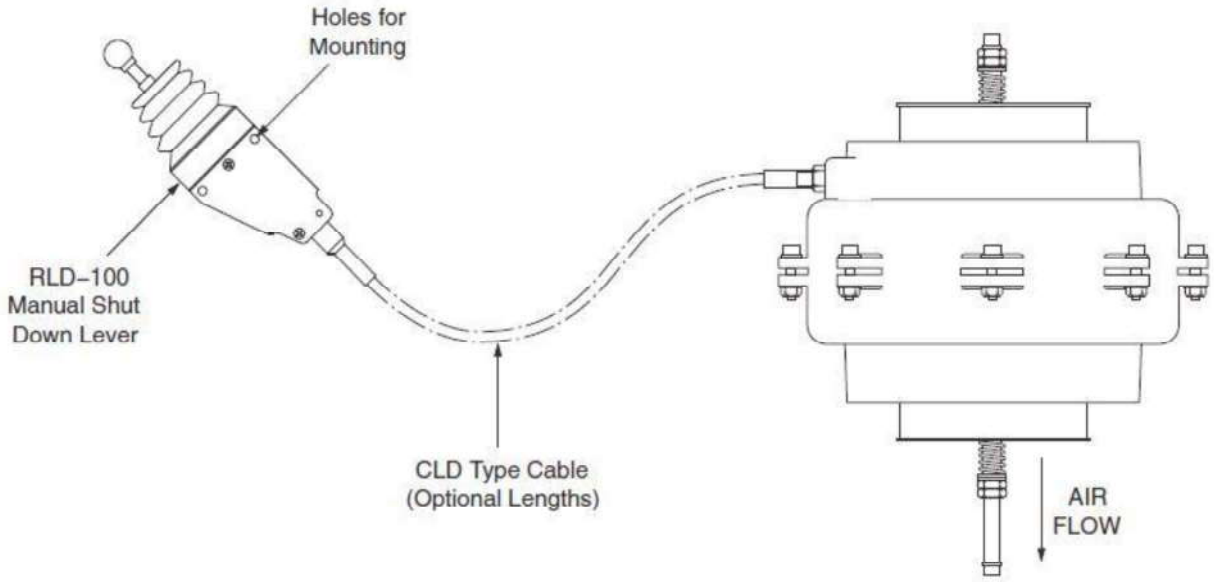
## D.2.3 ENGINE AIR SHUT DOWN VALVE

### OPERATION

When powered, the solenoid valve keeps the stop valve in the open condition (engine running).
In the absence of power supply, the valve automatically closes (engine stopped), with a fail-proof way system.

## ADJUSTMENT

Once the valve is installed, adjustment of the overspeed trip setting is carried out using the adjuster and locknut (refer to diagrams). Basically rotating the adjuster clockwise will increase the engine speed at which automatic shut down occurs.
As supplied, the valve will be adjusted such that shut down will generally occur well below the engine high idle speed. To increase the speed at which automatic shut down occurs, proceed as follows:



1. Check that the manual shut down cable is in the run condition i.e. the 'T' handle is pushed inwards.

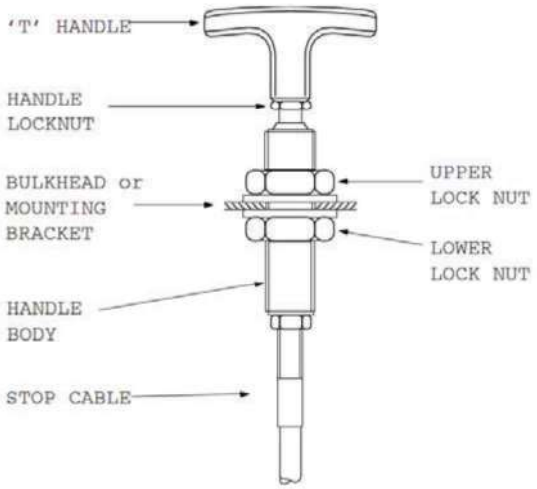
2. Start engine. Slowly accelerate. Note speed at which shut down occurs.

3. Remove hose at **air inlet** to Chalwyn valve to expose the adjuster and locknut (see diagram).

4. Release locknut. Turn adjuster clockwise one turn. Tighten locknut.

5. Refit inlet hose to valve.

6. Start engine. Slowly accelerate. Note speed at which shut down occurs.
7. Repeat steps '**3**' to '**6**' until the first setting at which the engine does not shut down at high idle speed (i.e. full throttle, no load).




Then either:

*a) Use the results of shut down speed versus adjuster setting as a calibration check to make a final adjustment to give the required setting (typically 10% to 15% over high idle).* **or**

*b) If a very precise setting is not required, turn the adjuster a further one turn clockwise to take the shutdown above high idle speed by a suitable margin. When using this setting procedure it may be found that the engine occasionally shuts down during the normal operation. If so, turn the adjuster clockwise by a further one half turn.*

8. Ensure the adjuster locknut is fully tightened. (Use a thread lock adhesive on the locknut threads).

**Notes:**

### Insufficient Adjustment

Should there be insufficient adjustment availale to set the required overspeed trip point, the outlet lock- nut should be released and the outlet adjuster rotated anticlockwise by four turns. The outlet locknut should then be treated with a thread lock adhesive and securely tightened. Further adjustment to the inlet adjuster as per above instructions is then continued.

### Turbocharged Engines

When setting up a valve on a turbocharged engine using the preceding method, it may be found that at high power outputs, the engine will shut down at a lower speed than required. If this occurs, further small adjustments in steps of one-half turn clockwise should be made until the problem is eliminated

# MAINTENANCE

Routine maintenance should be undertaken as below:-

**Daily:** Run engine at a mid range speed. Check satisfactory shut down occurs when the manual emergency stop lever is operated.

**Three Monthly:**

1. Disconnect intake pipework and release the valve from any support brackets etc. to allow it to be removed.
2. Inspect the valve internally for cleanliness. If necessary, clean in paraffin or white spirit taking normal precautions. Dry the valve thoroughly.
3. Check there is no excessive wear and that the valve moves smoothly over its complete operating stroke. **DO NOT LUBRICATE.**
4. Refit valve. Check valve setting based on the "Adjustment" instructions given herein.
5. With the engine running at medium speed pull the manual stop handle. The engine should come to a complete stop within a few seconds.

**Important Notes:**
The three monthly routine maintenance period requirement is dependent on the operating conditions to which the equipment is exposed and, by experience, may need to be varied.

# D.3 OIL BREATHER FLAME ARRESTOR MAINTENANCE

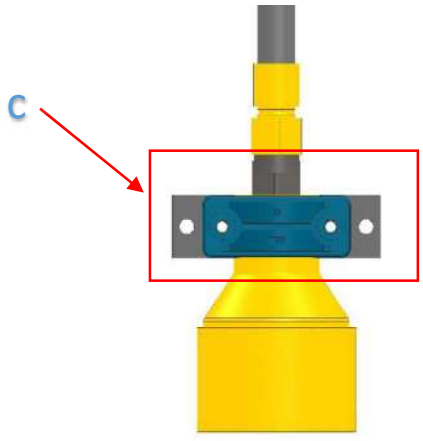
## E.3.1 OIL BREATHER FLAME ARRESTOR

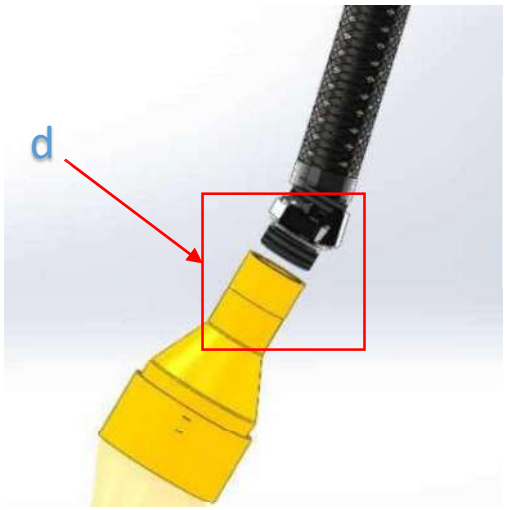
MAINTENANCE

Every **1000 hours**, clean the filter by proceeding as follow:

a. Stop the Engine
b. The maintenance procedure should be performed with the engine off and in total safety conditions.
c. Remove the pipe clamp
d. Turn the filter, disconnecting it from the pipeline.

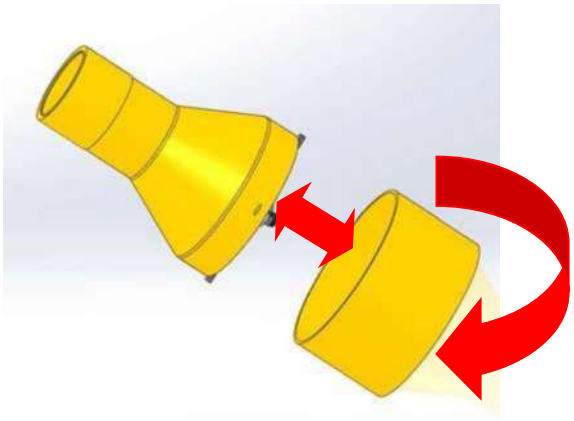
**REMOVING THE COMPONENT**



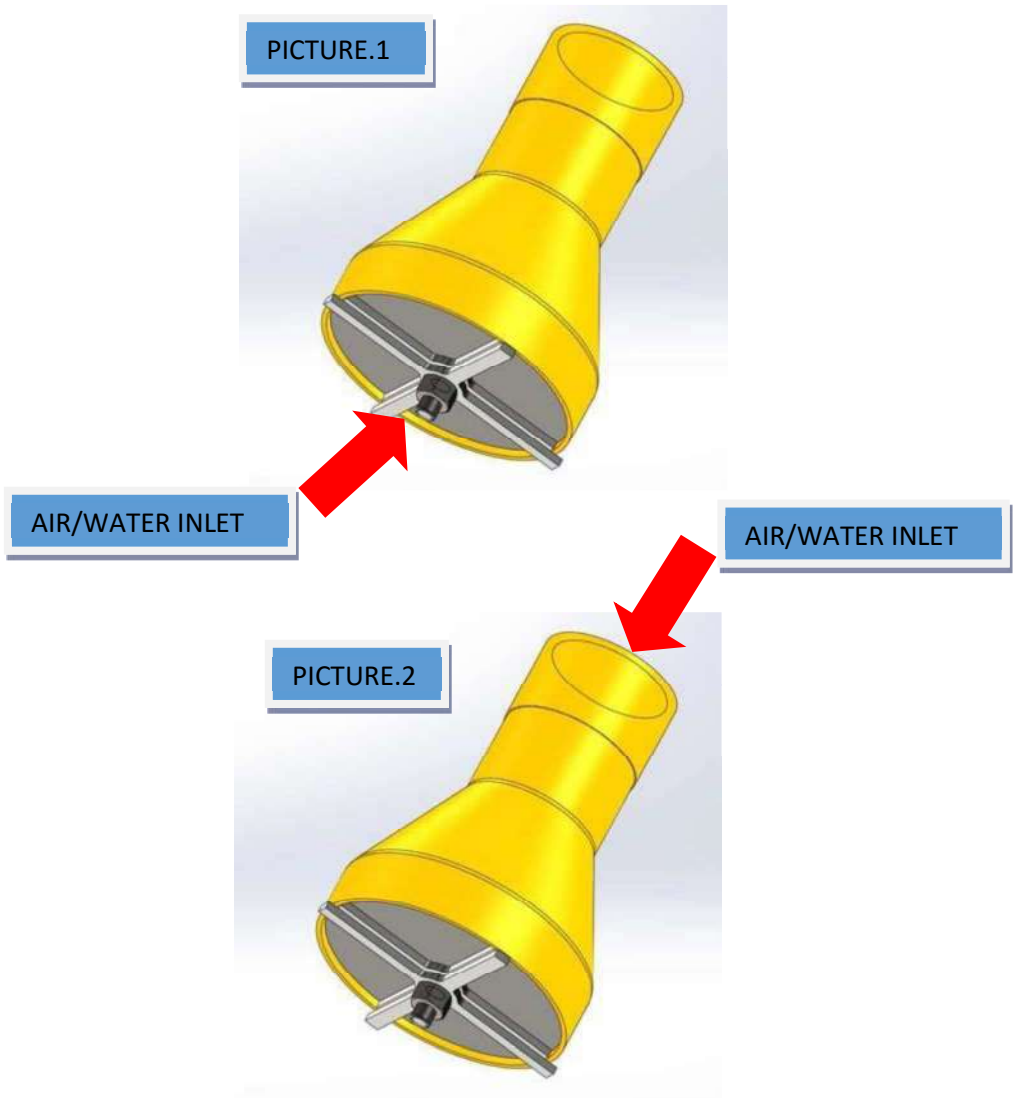

**WARNING:** Pay particular attention to the leakage of oil from the Flame arrestor.

e. Rotate the tray of the oil vapour filter.



CLEANING

a. Using pressurized water and compressed air, remove all liquids in the flame trap filter, as shown in picture 1.
b. Using compressed air and water, remove any residues, as shown in picture 2. Make sure you have removed all residues before reassembling.



REASSEMBLY

a. Reattach the filter to the pipeline.
b. After removing all oil residues, reassemble the oil vapour flame trap filter.
c. Screw the filter on to the pipeline.

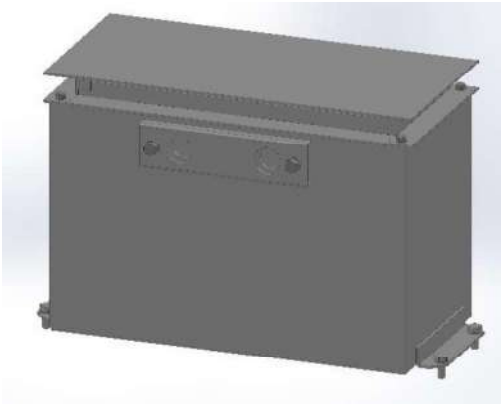
# D.4 BATTERY MAINTENANCE

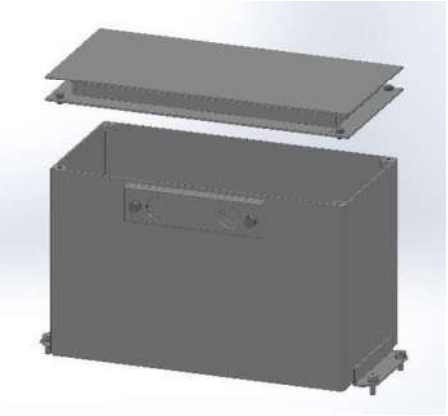
Depending on the type of engine and certification required, different types of cells and batteries and/or charger connectors may be used.

## D.4.1 BATTERY WITH INTERNAL RECHARGING SOCKETS

The battery must be recharged outside the hazardous area, in special premises with good ventilation, complying diligently with the indications below.

1. Interrupt the power circuit using the battery switch
2. Remove the screws and the cover
3. Unscrew the caps from the recharge pins on the battery poles
4. Connect the charging cables supplied with the battery, **BEING SURE TO RESPECT THE POLARITY**
5. Recharge using the battery charger according to the specification of the battery
6. Restore the caps on the recharge pins
7. Replace the cover on the box
8. Tighten the screw of the cover





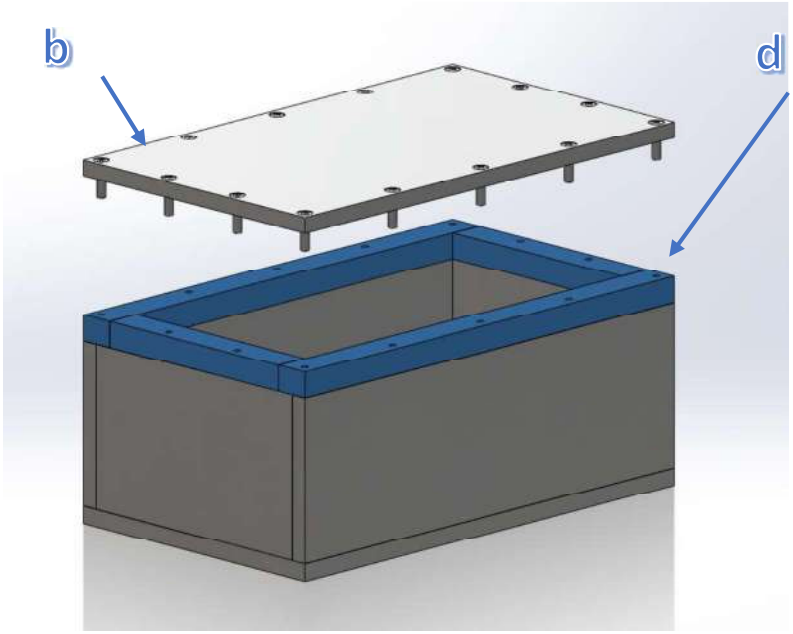
Some equipment shall be provided with an on-line battery charger or devices intended to keep the charge level.

**CAUTION:**
After charging the battery:

- When disconnecting the battery to charge it, always unplug the negative cable first.
- When mounting the battery to charge it, always connect the positive pole first.

The poles should be cleaned.
The poles that display signs of corrosion must be replaced.

# D.5 EXPLOSION PROOF ENCLOSURE MAINTENANCE




The common procedure for maintenance of the explosion-proof enclosures is described below:

a. Disconnect power from the system by pressing the red battery switch
b. Unscrew all the screws of the cover and open the enclosures, being careful not to damage the rolling joints
c. Spread a thin layer of silicone grease on the rolling joints and close the cover delicately and accurately (you will hear a metal coupling sound)
d. Screw the locking screws and tighten them sequentially. The ratio between the diameter of the screw thread and their torque is listed below:
    - **M5: from 2.5 to 5 Nm**
    - **M6: from 5 to 10 Nm**
    - **M8: from 10 to 20 Nm**
    - **M10: from 20 to 40 Nm**

Check with a feeler gauge that the coupling is homogeneous and fixed along the whole perimeter of the enclosure (0.05 mm).
The repair within the Ex d enclosure that the customer can perform is the replacement of the main components, such as the circuit boards, relays, fuses, charger, battery switch

# D.6 ENGINE SENSORS MAINTENANCE

The engine is equipped with sensors that depending on their function control the temperature, pressure and liquid level of the explosion-proof components installed on the engine.
The sensors mainly used are:

| SENSOR | TYPE | SETTING |
|---|---|---|
| Exhaust gas temperature | TEMPERATURE VALVE | T3 |
| OVERSPEED VACUUM VALVE | VACUUM VALVE | 0.1-0.9 bar |

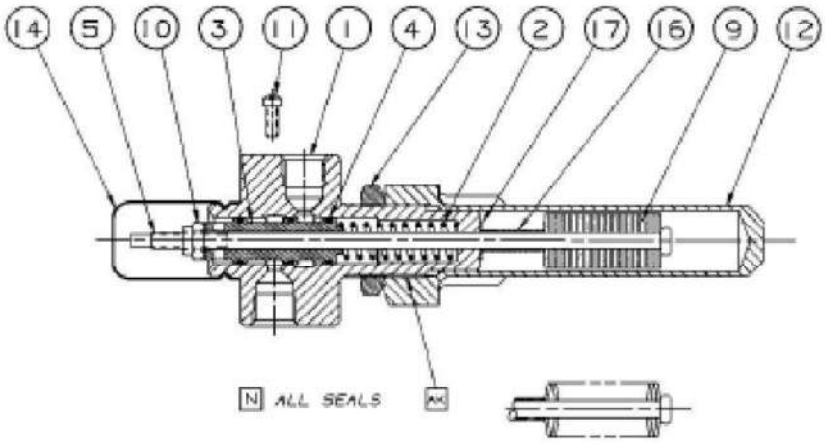
**WARNING:** the values shown here may vary depending on the engine model and/or conversion specifications used.

## D.6.1 EXHAUST FUMES TEMPERATURE VALVE

### ADJUSTMENT

Refer to cut-away view below. This model is checked at factory for proper operation in a still air calibrating oven at approximately 150°C (300°F).
To set the unit on the job to suit operating conditions, it should be piped into the safety control systems and be operational. The master safety control shut off valve should be overridden during adjustments so the machine will continue running.
First remove Cap (14) by pulling upward. It is held in position by a groove in the cap. Gradually lower the setting by holding the flats of Rod (5) firmly with a small adjustable wrench, and turning locknut (10) clockwise until the safety control indicator registers a trip.
Turn Locknut (10) a turn or so counterclockwise, depending on the temperature rise desired for shutdown above the normal operating temperature.
One complete turn of the Locknut (10) adjusts the temperature 25 to 35°F. Nut (10) should be turned sufficiently to effect a bubble-tight seal at the VENT port under normal operating conditions. After adjustment, check to see that the unit operates by manually pushing down on the top of Rod (5) (observing the shutdown indicator for that function).

If the recommended setting procedure is not possible, setting can be done using a pressure gauge in the VENT port, and turning adjusting Nut (10) until the valve cracks open, giving a gauge reading.



# D.7 MAINTENANCE TABLES

## D.7.1 TIGHTENING TORQUE TABLE

| Table "A" - Tightening torques of system screws | | | | |
|---|---|---|---|---|
| PITCH | RESISTANCE CATEGORY | | | |
| TYPE | 8.8 | | 12.9 | |
| | M | f | M | F |
| | Nm | KN | Nm | KN |
| M3 | 1.4 | 2.26 | 2.3 | 3.81 |
| M4 | 2.9 | 3.9 | 4.9 | 6.55 |
| M5 | 6 | 6.36 | 10 | 10.7 |
| M6 | 10 | 9 | 17 | 15.1 |
| M8 | 25 | 16.5 | 41 | 27.9 |
| M10 | 49 | 26.2 | 83 | 44.3 |
| M12 | 85 | 38.3 | 145 | 64.5 |
| M14 | 135 | 52.5 | 230 | 88.5 |
| M16 | 210 | 73 | 355 | 123 |
| M18 | 290 | 88 | 485 | 148 |
| M20 | 410 | 114 | 690 | 192 |
| M22 | 550 | 141 | 930 | 239 |
| M24 | 710 | 164 | 1200 | 276 |
| M27 | 1050 | 215 | 1800 | 363 |
| M30 | 1450 | 262 | 2400 | 442 |

| Table "B" – Clamp tightening | | |
|---|---|---|
| MIRETTI CODE | CLAMP CODE | TIGHTENING TORQUES |
| F041015122 | PIPE TIGHTENING CLAMP JUBILEE W4 JCX020 L9-13x20 | 0.7 Nm |
| F041077122 | PIPE TIGHTENING CLAMP CT175 - DIM. 25X45-L15.8 | 9 Nm |
| F041079122 | PIPE TIGHTENING CLAMP CT200 - DIM. 32X54-L15.8 | 9 Nm |
| F041080122 | PIPE TIGHTENING CLAMP CT250 - DIM. 45X67-L15.8 | 9 Nm |
| F041081122 | PIPE TIGHTENING CLAMP CT300 - DIM. 57X79-L15.8 | 9 Nm |
| F041082122 | PIPE TIGHTENING CLAMP CT350 - DIM. 70X92-L15.8 | 9 Nm |
| F041083122 | PIPE TIGHTENING CLAMP CT400 - DIM. 83X105-L15.8 | 9 Nm |
| F041084122 | PIPE TIGHTENING CLAMP CT450 - DIM. 95X118-L15.8 | 9 Nm |
| F041085122 | PIPE TIGHTENING CLAMP CT500 - DIM. 108X130-L15.8 | 9 Nm |
| F041086122 | PIPE TIGHTENING CLAMP CT550 - DIM. 121X143-L15.8 | 9 Nm |
| F041087122 | PIPE TIGHTENING CLAMP CT600 - DIM. 133X156-L15.8 | 9 Nm |
| F041096122 | PIPE TIGHTENING CLAMP CT650 - DIM. 146X168-L15.8 | 9 Nm |
| F041097122 | PIPE TIGHTENING CLAMP CT750 - DIM. 172X194-L15.8 | 9 Nm |

These torques are indicative values for standard metric threads as per DIN ISO 261 and head support measures as per DIN EN ISO 4762, DIN EN ISO 4032, DIN EN ISO 4014 and DIN 931-2 6012, 7984 and 7990. With these values, 90% of the yield limit of the screws is exploited, based on a coefficient of friction equal to 0.14 (new, untreated, non-lubricated screw).
In extreme cases such as lubricated screws with MOS2 and coupling elements cadmium-plated on both sides, the torque must be reduced by about 20%.
If the joint is made with nuts or self-locking ring nuts, the torque value should be increased by approximately 15%.

# D.7.2 SCHEDULED ROUTINE MAINTENANCE TABLE (REQUIRED)

| Table "C" - Scheduled routine maintenance | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WORKING HOURS | | | | | | | | | | | |
| COMPONENT | No. | | 8 | 200 | 400 | 500 | 600 | 800 | 1000 | 2000 | 4500 | 6000 | 8000 | 10000 |
| 1 | ENGINE OIL CHANGE | * | | | | | | | | | | | | |
| 2 | AIR CLEANERS CLEANING/REPLACEMENT | * | | | | | | | | | | | | |
| 3 | AIR INLET FLAME ARRESTOR | | | | | | | VI | | CM | | | | |
| 4 | OIL BREATHER FLAME ARRESTOR | | | | | | | | CM | | | | | |
| 5 | CHECK AIR INLET SHUT-DOWN VALVE | SEE TYPE OF ENGINE STOP VALVE | | | | | | | | | | | | |
| 6 | ENGINE OIL FILTER REPLACEMENT | * | | | | | | | | | | | | |
| 7 | CHECK CABLE GLANDS RINGS AND SCREWS | | | | | | | VI | | | | | | |
| 8 | CHECK SCREWS, NUTS, TIGHTENING CLAMP | | | | | | | VI | | | | | | |
| 9 | CHECK MIRETTI CONTROL SYSTEMS | | | | | VI | | | | | | | | |
| 10 | PROTECTIVE PLASTIC MATERIAL | | | | | VI | | | | | | | | |
| 11 | CHECK BELTS INTEGRITY | | | | | | | VI | | | | | | |
| 12 | REPLACE DRIVE BELTS | | | | | | | | | | | | | CR |
| 13 | CHECK COUPLINGS AND TIGHTENING | | | | | | | VI | | | | | | |
| 14 | EXHAUST GAS FLAME TRAP | | | | | VI | | | CM | | | | | |
| 15 | CLAMPS | | | | | | | VI | | | | | | |
| 16 | PAE SPARK ARRESTOR MUFFLER | | | | | VI | | | CM # | | | | CM | |
| 17 | EXHAUST GAS COOLER | | | | | VI | | | CM | | | | | |
| 18 | CYLINDRICAL HEAT EXCHANGERS | | | | | VI | | | CM | | | | | |
| 19 | RAPLACEMENT THE COOLANT | | | | | | | | | | | CM | | |
| 20 | APPLY OF SILICONE GREASE ON Exd ENCLOSURES | | | | | | | CM | | | | | | |
| 21 | GASKETS | | | | | | | VI | | | | | | |
| 22 | COATEX INSULATION ON EXHAUST MANIFOLD AND TURBOCHARGER | | | | VI | | | VI | | | | | | |
| 23 | WATERCOOLED EXHAUST MANIFOLD AND TURBOCHARGER | | | | VI | | | VI | | | | | | |
| 24 | CHECK ALL THE SENSORS | ONCE A YEAR | | | | | | | | | | | | |

| | | |
|---|---|---|
| **VI** = VISUAL INSPECTION | **CR** = COMPONENT REPLACEMENT | (#) - LET THE CONDENSATE LIQUIDS IN THE SPARK ARRESTOR DRAIN OUT |
| **CM** = CLEANING/MAINTENANCE | * = REFERENCE TO ORIGINAL MANUAL | - |

Related to the points 14 / 16 / 17 / 18, the above cleaning maintenance intervals may be more frequent, minimum once a month independently from the operating hours, if the conditions below are present:

1. Use of high Sulphur type content diesel fuel or heavy diesel fuel.
2. In case of intermitted use and / or Stop & Go frequent functioning of the engine.
3. Conserving lubricating oil present in the combustion chamber and turbocharger as new engine. Breaking time period.
4. Not proper maintenance condition of the engine and not in conformity with the manufacturers specifications.
5. Use of biodiesel fuels.

The table may contain components that were not supplied; consider only those elements actually used for the conversion.
Failure to perform the above tasks will void all warranties

MIRETTI S.r.l.
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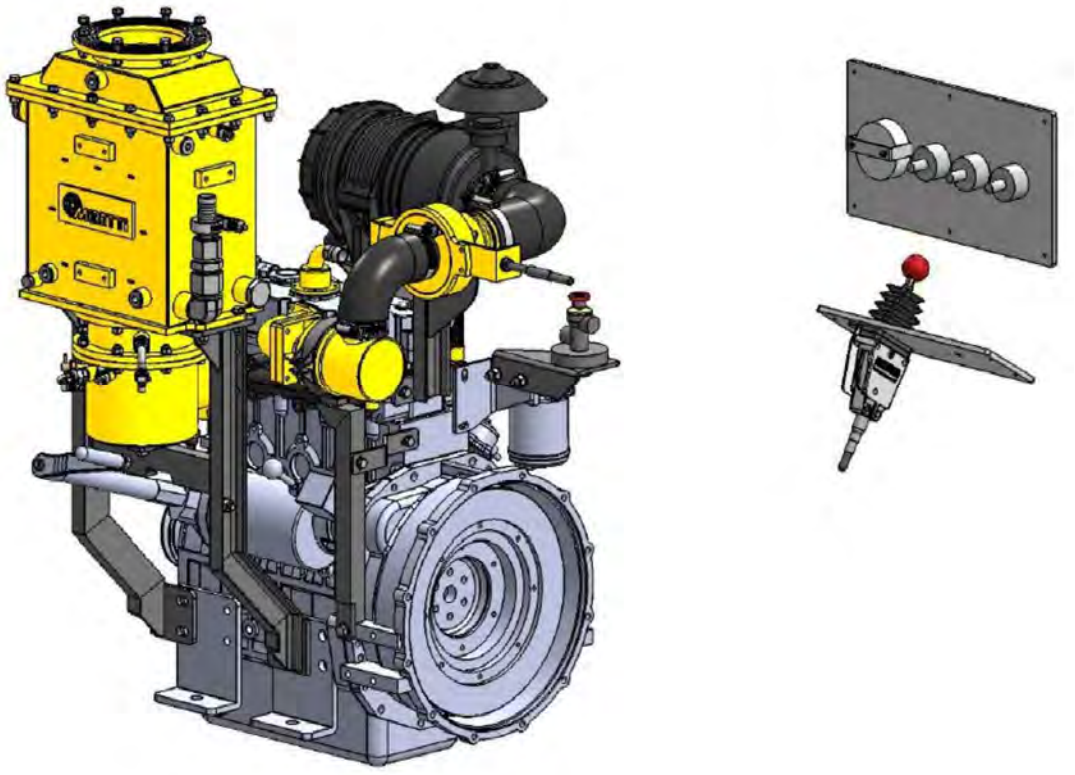
20812 Limbiate (MB) Italia - Via Marconi, 29/31
☎ 02 - 99081.1 - 02 - 99052488

# USE AND MAINTENANCE MANUAL



# PERKINS 404D-22G

**Ref. MIRETTI: D 10732**

# ATEX

## FLAME PROOF CONVERSION
## CATEGORY 3G IIB T3

7227.99.000 REV0 27/06/2019

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| UC | UT | UP | ATEX |
|---|---|---|---|
| | | | |

# EU Declaration of Conformity

| | | |
|---|---|---|
| Product | : | **kit for Diesel engine** |
| Manufacturer | : | **Miretti S.r.l.**<br>**Via Marconi 29/31**<br>**20812 Limbiate (MB), ITALY** |

*This declaration of conformity is issued under the sole responsibility of the manufacturer*

| | | |
|---|---|---|
| Object of the declaration | : | **PERKINS 404D-22G (intake & exhaust kit)** |
| Miretti Serial Number | : | **D10731 - D10732 - D10733 - D10734 - D10735** |
| Marking | : | **Ex II 3G IIB T3** |
| Year of production | : | **2019** |

The object of the declaration described above is in conformity with the relevant Union harmonisation legislation:

- *Potentially Explosive Atmospheres (ATEX) Directive 2014/34/EU*

References to the relevant harmonised standards used or references to the other technical specifications in relation to which conformity is declared:

- *EN 1834-1:2000*

**Name and address of the authorized personnel that made the technical file:** Mr. Fabrizio Bassini Atex Manager at Miretti S.r.l. – Via Marconi29/31 – 20812 Limbiate (MB), Italy

Limbiate, Date 05.09.2019

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TRASFORMAZIONI ANTIDEFLAGRANTI PER MEZZI DIESEL ED ELETTRICI - PER VEICOLI DI TRASPORTO INTERNO – DISPOSITIVI ANTINQUINAMENTO

| UC | UT | UP | ATEX |
|---|---|---|---|
| | | | |

# EU Declaration of Conformity

| | | |
|---|---|---|
| Product | : | **GENERATOR** |
| Manufacturer | : | **Miretti S.r.l.**<br>**Via Marconi 29/31**<br>**20812 Limbiate (MB), ITALY** |

*This declaration of conformity is issued under the sole responsibility of the manufacturer*

| | | |
|---|---|---|
| Object of the declaration | : | **type MECC ALTE ECP 32 2M4** |
| Serial number | : | **0002149828** |
| Year | : | **2019** |
| Marking | : | **II 3G Ex nA IIA T3 Gc** |
| Technical file | : | **MIR ATEX 00193** |
| Miretti job | : | **D10732A** |

The object of the declaration described above is in conformity with the relevant Union harmonization legislation:

- *Potentially Explosive Atmospheres (ATEX) Directive 2014/34/EU*

References to the relevant harmonized standards used or references to the other technical specifications in relation to which conformity is declared:

- *EN 60079-0:2012*
- *EN 60079-15:2010*

**Signed for and on behalf of the above named manufacturer**

Limbiate, Date 05.09.2019

**MIRETTI S.r.l.**
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# INDEX



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# 1. MIRETTI FilterEx Manicooler

**CODE: 7227.22.000**
**MIRETTI JOB N° D10732**

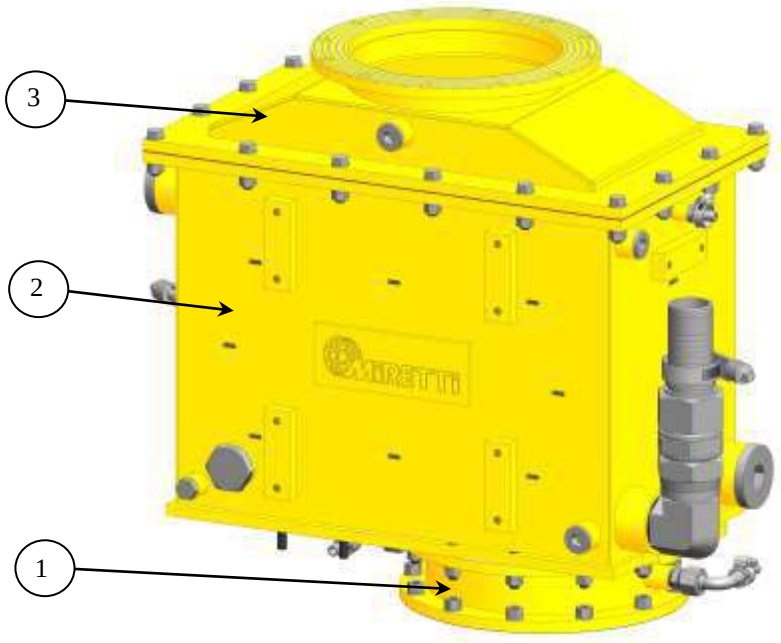
## • INTRODUCTION

This guide, is for the people who are installing, using and storing the Miretti FilterEx Manicooler.
This document contains information which are necessary to start, use, assemble and disassemble, store, transport and maintain the equipment. In addition, this document describes the steps to be performed and gives instructions in case of cleaning and maintenance.
The safe and hassle-free device, is subject to the user's respect of instructions, together with the set of technical conditions during transportation, storage, picking, assembly, use and maintenance.
Miretti FilterEx Manicooler, should be treated as a safety device and maintained by a knowledgeable repair technician. Carefully read and understand this manual, before installing or servicing this product.

## • DESCRIPTION

FilterEx Manicooler is composed by the main parts:

1. Watercooled Self-cleaning Exhaust flame arrestor.
2. Exhaust gas cooler to limit gas temperatures to below temperature class required.
3. Exhaust gas cooler outlet box with flange.




FilterEx Manicooler: 'extended duty-self-cleaning' exhaust flame arrestor which when combined with Miretti compact exhaust gas cooler, is ATEX certified and designed to enable cleaning intervals of typically 1000 hours (subject to inspection intervals and inspection/cleaning of the Exhaust Gas cooler every 500 hours)

Miretti compact exhaust gas cooler is designed to limit the exhaust gas temperatures to below the temperature class required.

**The Miretti Exhaust Gas cooler/FilterEx system has been tested and certified by an ATEX notified body to also act as an exhaust spark arrestor so this component can now be eliminated when using the Miretti Zone 2 FilterEx exhaust cooling system.**

- **MAINTENANCE**

| Scheduled routine maintenance | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | WORKING HOURS | | | | | | | | | | | |
| | COMPONENT | 8 | 200 | 400 | 500 | 600 | 800 | 1000 | 2000 | 4500 | 6000 | 8000 | 10000 |
| | SELF-CLEANING EXHAUST FLAME TRAP | | | | VI | | | CM | | | | | |
| | EXHAUST GAS COOLER | | | | VI | | | CM | | | | | |

| |
|---|
| **VI** = VISUAL INSPECTION |
| **CM** = CLEANING/MAINTENANCE |

The above cleaning maintenance intervals may be more frequent, minimum once a month independently from the operating hours, if the conditions below are present:

1. Use of high sulphur type content diesel fuel or heavy diesel fuel.
2. In case of intermitted use and / or Stop & Go frequent functioning of the engine.
3. Conserving lubricating oil present in the combustion chamber and turbocharger as new engine. Breaking time period.
4. Not proper maintenance condition of the engine and not in conformity with the manufacturers specifications.
5. Use of biodiesel fuels.

Every **500 hours**, you should visually inspect that the exhaust flame trap is not leaking liquids and the screws are tightened as indicated in **"TABLE A"**.
Check that there are no deposits and/or residues of potentially explosive material.
Every **1000 hours**, clean the exhaust flame trap and the exhaust gas cooler, carefully following the procedure described below.

**WARNING: Do not tamper by no means, the position of the exhaust gas probe.**
**It could cause damage to persons and/or property, Miretti. S.r.l shall not be liable for such damages.**

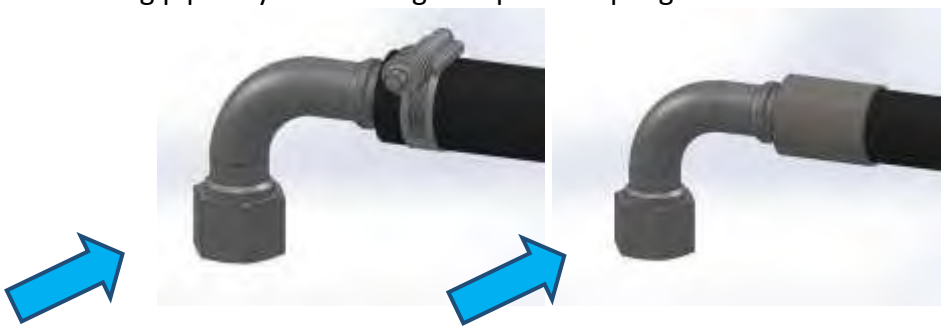
**PREPARATION FOR CLEANING AND EMPTYING OF THE COOLING SYSTEM**

**A.** Stop the engine.

**B.** The maintenance procedures, should be performed with the engine off and in total safety conditions when the coolant and the exhaust parts, are totally cold.

**C.** Disconnect the exhaust gas probe.

**D.** Disconnect the cooling pipes by unscrewing the quick couplings.



**WARNING:** Pay particular attention to the leakage of very hot liquids, from the equipment.

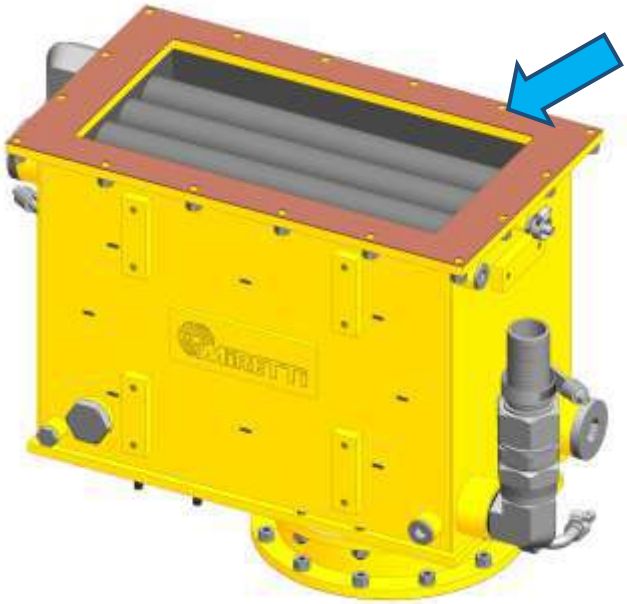
**E.** Remove the exhaust pipe above the exhaust flame trap, paying attention to the weight of the pipes and check all the screws, washers and nuts.

**F.** Be careful about the gasket between the exhaust pipe and the exhaust flame trap.

**G.** Remove the exhaust gas cooler outlet box above the exhaust gas cooler, paying attention to the weight of the component and check all the screws and washers.

**H.** Be careful about the copper gasket, between the exhaust gas cooler and the exhaust gas cooler outlet box.

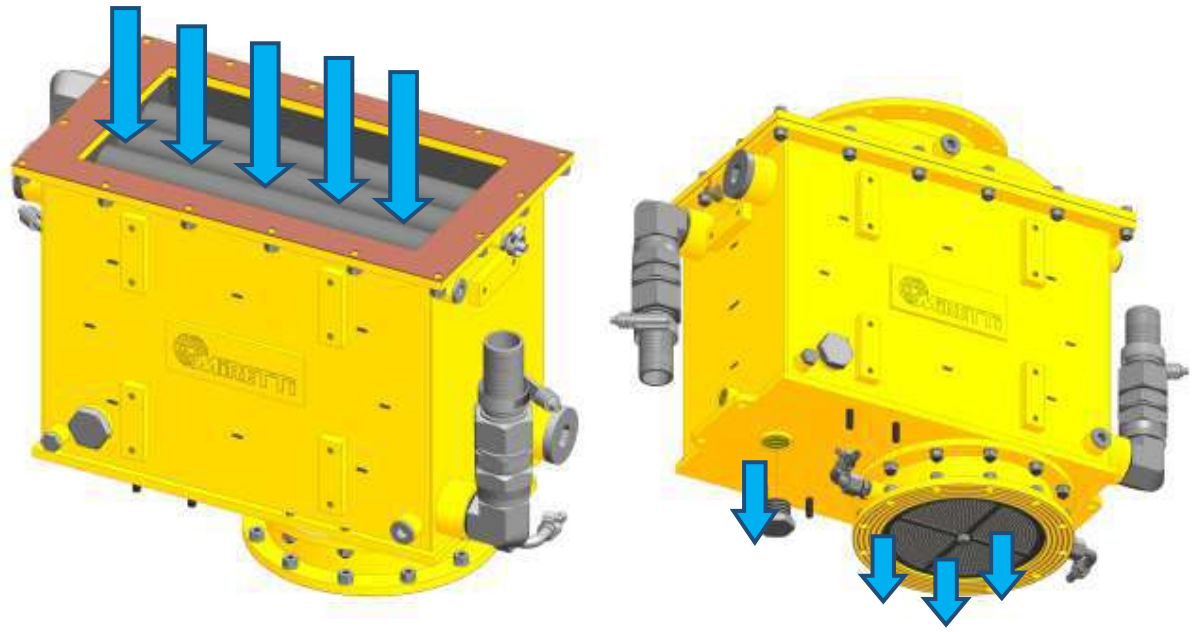
**I.** Remove the cap on the bottom side of the exhaust gas cooler, in order to drain the liquids during the cleaning of the FilterEx.



**CLEANING**

**A.** To clean the Miretti FilterEx system, use pressurised water like (water jet washer), or mild soap removing any dirt deposits. **Do not use chemical solvents.**

**B.** Be sure that the water jet, will work as showed on the image below and be sure that the liquids used to clean the components, will drain out and goes through the components.



**C.** After the cleaning, make sure that the Miretti FilterEx is totally dry before reassembling it.

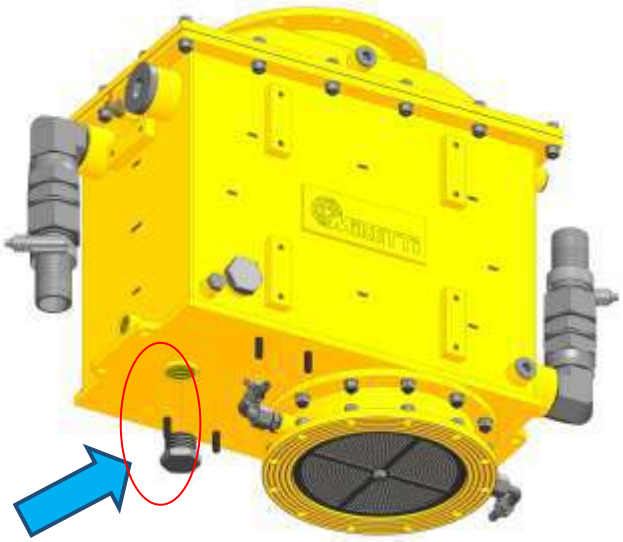
**ASSEMBLY**

**A.** Place the gaskets between the exhaust pipe and the exhaust flame trap and between the exhaust gas cooler and the exhaust gas outlet box.

**B.** Place the exhaust gas cooler outlet box and the exhaust pipe, applying the tightening torques listed on the **"TABLE A"**, on all the screws.

**WARNING:** Pay particular attention to the weight of the components.

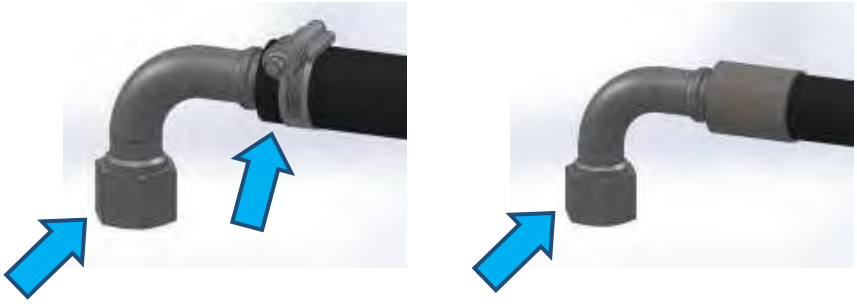
**C.** Put the cap on the bottom side of the exhaust gas cooler, when the liquids used during the cleaning are totally dried.



**D.** Connect the exhaust gas probe.

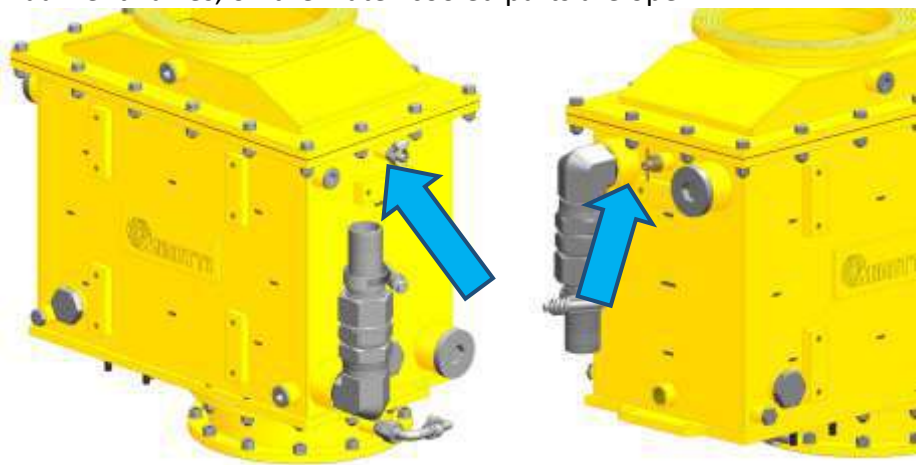
**COOLANT FILLING**

**A.** Connect the cooling piping (tighten the clamps as indicated in **"TABLE B"** to the water-cooled parts.



**B.** Where there are threaded quick couplings, apply liquid TEFLON on the threaded parts.

**C.** Check that the manual vent valves, on the water-cooled parts are open.



**D.** Proceed to fill the cooling system with coolant.

**E.** Run the engine at minimum rpm, in order to completely fill all the water-cooled parts, thanks to the flow on the water pump.

**F.** When some coolant begins to come out from the manual vent valves, close the valves.

**G.** Where are presents, connect the vents fittings “A” to the overflow tank.

In case of coolant draining from the exhaust gas cooler and from the exhaust gas inlet plenum, use the fittings showed on the image below.

- **TIGHTENING TORQUE TABLE**

| Table "A" - Tightening torques of system screws | | | | |
|---|---|---|---|---|
| PITCH | RESISTANCE CATEGORY | | | |
| TYPE | 8.8 | | 12.9 | |
| | M | f | M | F |
| | Nm | KN | Nm | KN |
| M3 | 1.4 | 2.26 | 2.3 | 3.81 |
| M4 | 2.9 | 3.9 | 4.9 | 6.55 |
| M5 | 6 | 6.36 | 10 | 10.7 |
| M6 | 10 | 9 | 17 | 15.1 |
| M8 | 25 | 16.5 | 41 | 27.9 |
| M10 | 49 | 26.2 | 83 | 44.3 |
| M12 | 85 | 38.3 | 145 | 64.5 |
| M14 | 135 | 52.5 | 230 | 88.5 |
| M16 | 210 | 73 | 355 | 123 |
| M18 | 290 | 88 | 485 | 148 |
| M20 | 410 | 114 | 690 | 192 |
| M22 | 550 | 141 | 930 | 239 |
| M24 | 710 | 164 | 1200 | 276 |
| M27 | 1050 | 215 | 1800 | 363 |
| M30 | 1450 | 262 | 2400 | 442 |

| Table "B" – Clamp tightening | | |
|---|---|---|
| MIRETTI CODE | CLAMP CODE | TIGHTENING TORQUES |
| F041015122 | PIPE TIGHTENING CLAMP JUBILEE W4 JCX020 L9-13x20 | 0.7 Nm |
| F041077122 | PIPE TIGHTENING CLAMP CT175 - DIM. 25X45-L15.8 | 9 Nm |
| F041079122 | PIPE TIGHTENING CLAMP CT200 - DIM. 32X54-L15.8 | 9 Nm |
| F041080122 | PIPE TIGHTENING CLAMP CT250 - DIM. 45X67-L15.8 | 9 Nm |
| F041081122 | PIPE TIGHTENING CLAMP CT300 - DIM. 57X79-L15.8 | 9 Nm |
| F041082122 | PIPE TIGHTENING CLAMP CT350 - DIM. 70X92-L15.8 | 9 Nm |
| F041083122 | PIPE TIGHTENING CLAMP CT400 - DIM. 83X105-L15.8 | 9 Nm |
| F041084122 | PIPE TIGHTENING CLAMP CT450 - DIM. 95X118-L15.8 | 9 Nm |
| F041085122 | PIPE TIGHTENING CLAMP CT500 - DIM. 108X130-L15.8 | 9 Nm |
| F041086122 | PIPE TIGHTENING CLAMP CT550 - DIM. 121X143-L15.8 | 9 Nm |
| F041087122 | PIPE TIGHTENING CLAMP CT600 - DIM. 133X156-L15.8 | 9 Nm |
| F041096122 | PIPE TIGHTENING CLAMP CT650 - DIM. 146X168-L15.8 | 9 Nm |
| F041097122 | PIPE TIGHTENING CLAMP CT750 - DIM. 172X194-L15.8 | 9 Nm |

These torques are indicative values for standard metric threads as per DIN ISO 261 and head support measures as per DIN EN ISO 4762, DIN EN ISO 4032, DIN EN ISO 4014 and DIN 931-2 6012, 7984 and 7990. With these values, 90% of the yield limit of the screws is exploited, based on a coefficient of friction equal to 0.14 (new, untreated, non-lubricated screw).

In extreme cases such as lubricated screws with MOS2 and coupling elements cadmium-plated on both sides, the torque must be reduced by about 20%.

If the joint is made with nuts or self-locking ring nuts, the torque value should be increased by approximately 15%.

- **SPARE PARTS**


| Pos. | Description | Q.ty | Code |
|---|---|---|---|
| 16 | HEX NUT M8 | 8 | D003005121 |
| 15 | MANICOOLER MINI SYSTEM | 1 | K004003000 |
| 14 | VENT VALVE M14x1.5 | 1 | V031051122 |
| 13 | CONNECTION A19 1/8-9 | 1 | R003093121 |
| 12 | JCX020 L9-13x20 HOSE CLAMP | 3 | F041015122 |
| 11 | 90° HYDRAULIC CONNECTION 3/8" | 2 | R005094122 |
| 10 | 3/8" F - NIPPLE | 2 | N020098121 |
| 9 | SCREW M8x35 | 16 | VM0308X035 |
| 8 | SCREW HEX HEAD M8x25 | 6 | VM0308X025 |
| 7 | CONIC WASHER DM.8,4 | 30 | R038008121 |
| 6 | WATERCOOLED EXHAUST GAS CONNECTION | 1 | 7227.22.030 |
| 5 | SCREW HEX HEAD M8x20 | 4 | VM0108X020 |
| 4 | FLANGE FOR EXH GAS MANIFOLD | 1 | 7227.22.010 |
| 3 | GASKET FOR EXH GAS FLANGE | 1 | 7212.22.910 |
| 2 | COATEX ON EXH GAS MANIFOLD | 1 | 7227.22.020 |
| 1 | GASKET FOR EXHAUST GAS MANIFOLD | 1 | 7212.22.920 |

## • MARKING

The nameplate of the exhaust flame trap contains the following info:

| | |
|---|---|
| Manufacturer: | **MIRETTI S.r.l. Via Marconi 29/31 (I) 20812 MB** |
| Certificate: | **CEC 15ATEX055** |
| Type : | **FILTEREX** |
| S/N : | **00103** |
| Constr. Year: | **2019** |
| Marking: | **II 2GD**<br>**I M2** |

## • PACKAGING, STORAGE, TRANSPORTATION

The exhaust flame trap is packaged in a proper container to be protected from damage during transport, in case of shipping for replacement.

The exhaust flame trap storage should take place in covered, free from corrosive substance environments.

Transportation must be performed in such a way that no damage can occur, and device must be protected against accidental fall during installation.

## • DOCUMENTS

Each device is equipped with its manual and a copy of Statement of Conformity.

If Purchaser buys a greater number of pieces of equipment, documents are provided in one copy only.

The manufacturer reserves the right to make changes to the design for the quality of technological designs and to improve performance, without altering however the conditions obtained in the CE certification.

## • CONTACTS

For information not contained in this manual please contact:

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**Fax. +39 02 99052488**
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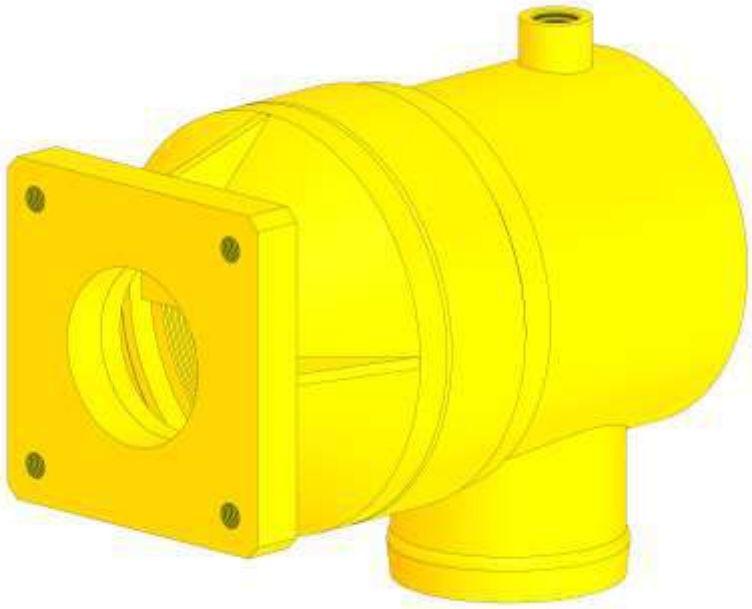
# 2. INLET FLAME ARRESTOR



**CODE: F045187112**
**MIRETTI JOB N° D10732**

- # INTRODUCTION

This guide is for people who are installing, using, storing the cartridge of the flame arrestor.

This document contains information which is necessary to start, use, assemble and disassemble, store, transport and maintain the equipment. In addition, this document describes the steps to be performed and gives instructions in case of failure of the device.

The safe and hassle-free device is subject to the user's respect for instructions together with the set of technical conditions during transportation, storage, picking, assembly, use and maintenance.

- # MAINTENANCE

The cartridge of the flame arrestor must be visually inspected every 800 hours of work, being careful not to damage the coupling surfaces of the flanges and firmly tightening all the fixing screws, according to the tightening torques listed in **"TABLE A"**

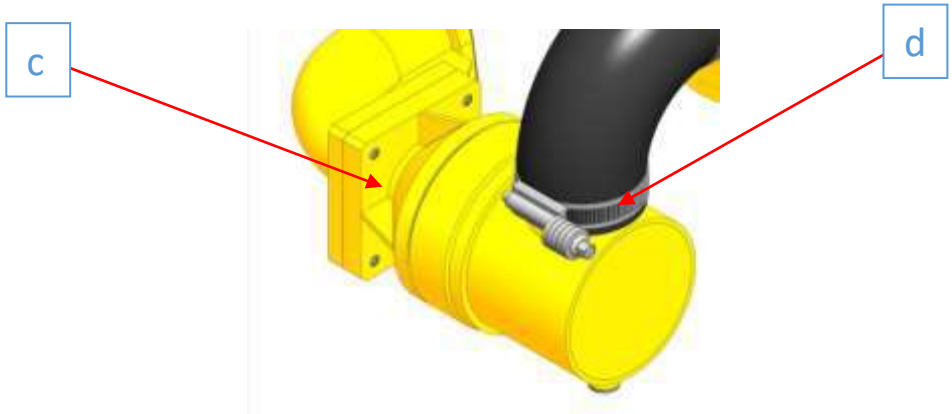
Every **800 hours**, be sure to check:

1. The tightness of the screws/fixing nuts of the flame arrestor (in case you need to tighten them, refer to **"TABLE A"**)
2. If installed, be sure to check the integrity of the inlet piping
3. Check that the locking clamps are firmly tight (in case you need to tighten them, refer to **"TABLE B"**).

The cartridge of the flame arrestor must be cleaned every **2000 hours** of work.

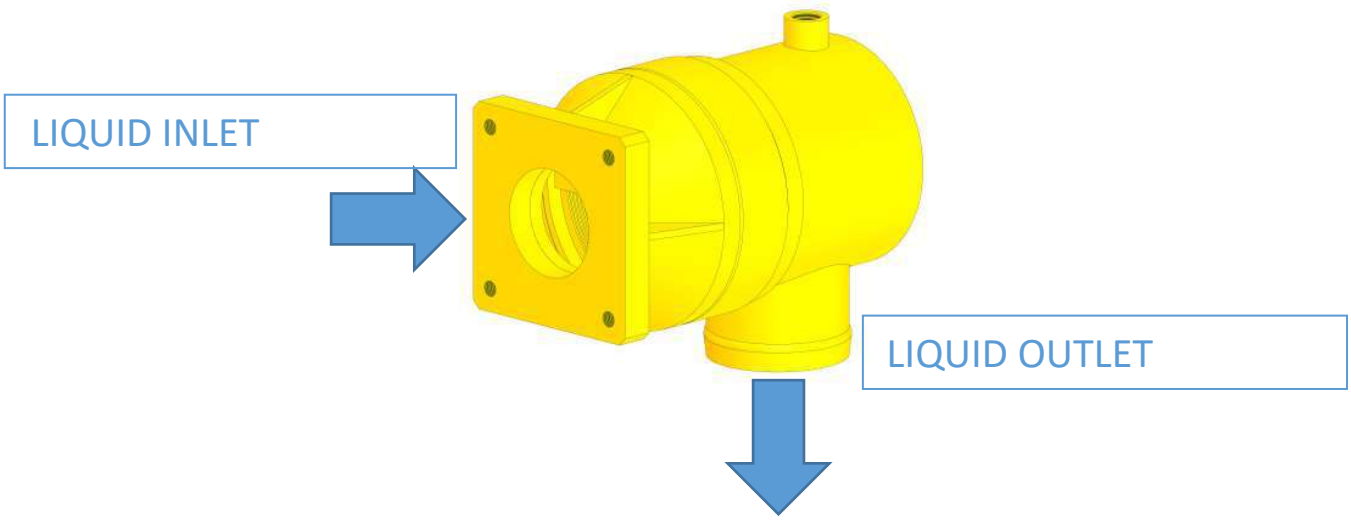
**1. <u>PREPARATION FOR MAINTENANCE</u>**

a. Stop the engine
b. The maintenance procedure should be performed with the engine off and in total safety conditions.
c. Remove the four screws the cartridge of the flame arrestor
d. Remove the clamp screws the cartridge of the flame arrestor



## 2. CLEANING

a. To clean the air inlet flame arrestor, use compressed air to remove any dirt deposits
b. Make sure that the inlet flame arrestor is dry before assembly.




c. Reposition the inlet flame arrestor in the original position

- **TIGHTENING TORQUE TABLE**

| Table "A" - Tightening torques of system screws | | | | |
|---|---|---|---|---|
| PITCH | RESISTANCE CATEGORY | | | |
| TYPE | 8.8 | | 12.9 | |
| | M | f | M | F |
| | Nm | KN | Nm | KN |
| M3 | 1.4 | 2.26 | 2.3 | 3.81 |
| M4 | 2.9 | 3.9 | 4.9 | 6.55 |
| M5 | 6 | 6.36 | 10 | 10.7 |
| M6 | 10 | 9 | 17 | 15.1 |
| M8 | 25 | 16.5 | 41 | 27.9 |
| M10 | 49 | 26.2 | 83 | 44.3 |
| M12 | 85 | 38.3 | 145 | 64.5 |
| M14 | 135 | 52.5 | 230 | 88.5 |
| M16 | 210 | 73 | 355 | 123 |
| M18 | 290 | 88 | 485 | 148 |
| M20 | 410 | 114 | 690 | 192 |
| M22 | 550 | 141 | 930 | 239 |
| M24 | 710 | 164 | 1200 | 276 |
| M27 | 1050 | 215 | 1800 | 363 |
| M30 | 1450 | 262 | 2400 | 442 |

| Table "B" – Clamp tightening | | |
|---|---|---|
| MIRETTI CODE | CLAMP CODE | TIGHTENING TORQUES |
| F041015122 | PIPE TIGHTENING CLAMP JUBILEE W4 JCX020 L9-13x20 | 0.7 Nm |
| F041077122 | PIPE TIGHTENING CLAMP CT175 - DIM. 25X45-L15.8 | 9 Nm |
| F041079122 | PIPE TIGHTENING CLAMP CT200 - DIM. 32X54-L15.8 | 9 Nm |
| F041080122 | PIPE TIGHTENING CLAMP CT250 - DIM. 45X67-L15.8 | 9 Nm |
| F041081122 | PIPE TIGHTENING CLAMP CT300 - DIM. 57X79-L15.8 | 9 Nm |
| F041082122 | PIPE TIGHTENING CLAMP CT350 - DIM. 70X92-L15.8 | 9 Nm |
| F041083122 | PIPE TIGHTENING CLAMP CT400 - DIM. 83X105-L15.8 | 9 Nm |
| F041084122 | PIPE TIGHTENING CLAMP CT450 - DIM. 95X118-L15.8 | 9 Nm |
| F041085122 | PIPE TIGHTENING CLAMP CT500 - DIM. 108X130-L15.8 | 9 Nm |
| F041086122 | PIPE TIGHTENING CLAMP CT550 - DIM. 121X143-L15.8 | 9 Nm |
| F041087122 | PIPE TIGHTENING CLAMP CT600 - DIM. 133X156-L15.8 | 9 Nm |
| F041096122 | PIPE TIGHTENING CLAMP CT650 - DIM. 146X168-L15.8 | 9 Nm |
| F041097122 | PIPE TIGHTENING CLAMP CT750 - DIM. 172X194-L15.8 | 9 Nm |

These torques are indicative values for standard metric threads as per DIN ISO 261 and head support measures as per DIN EN ISO 4762, DIN EN ISO 4032, DIN EN ISO 4014 and DIN 931-2 6012, 7984 and 7990. With these values, 90% of the yield limit of the screws is exploited, based on a coefficient of friction equal to 0.14 (new, untreated, non-lubricated screw).

In extreme cases such as lubricated screws with MOS2 and coupling elements cadmium-plated on both sides, the torque must be reduced by about 20%.

If the joint is made with nuts or self-locking ring nuts, the torque value should be increased by approximately 15%.

- ## MARKING

The nameplate of the inlet flame arrestor contains the following info:

| | |
|---|---|
| Manufacturer: | **MIRETTI S.r.l. Via Marconi 29/31 (I) 20812 MB** |
| Type : | **F045187112** |
| Constr. Year: | **2019** |
| Marking: | **II 2GD**<br>**I M2** |

- ## PACKAGING, STORAGE, TRANSPORTATION

The inlet flame arrestor is packaged in a proper container to be protected from damage during transport, in case of shipping for replacement.

The inlet flame arrestor storage should take place in covered, free from corrosive substance environments.

Transportation must be performed in such a way that no damage can occur, and device must be protected against accidental fall during installation.

- ## DOCUMENTS

Each device is equipped with its manual and a copy of Statement of Conformity.

If Purchaser buys a greater number of pieces of equipment, documents are provided in one copy only.

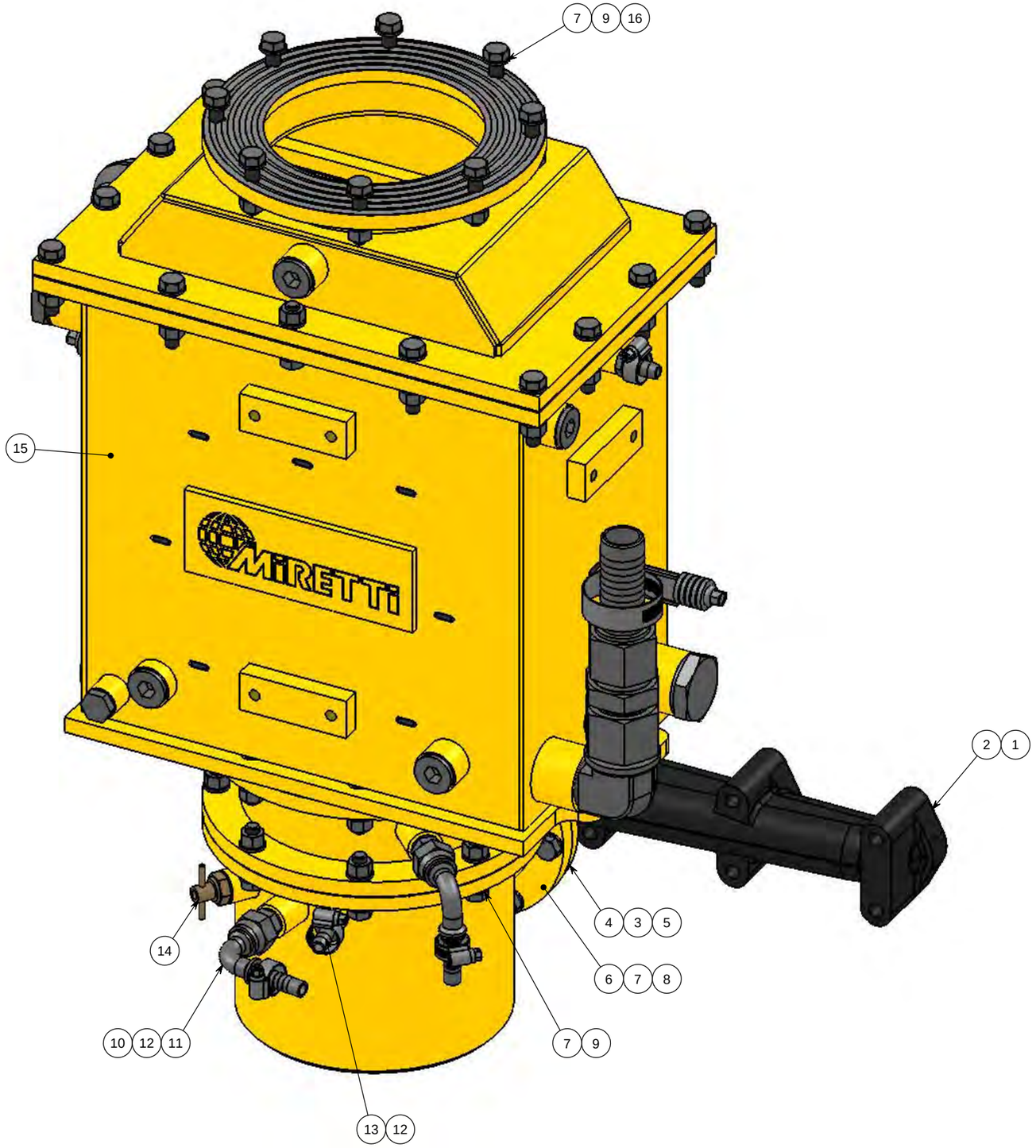
The manufacturer reserves the right to make changes to the design for the quality of technological designs and to improve performance, without altering however the conditions obtained in the CE certification.

- ## CONTACTS

For information not contained in this manual please contact:

**Miretti S.r.l.**
**Via Marconi 29/31**
**20812 – Limbiate (MB) Italy**
**Phone. +39 02 990811**
**Fax. +39 02 99052488**
**Email: sales.department@miretti.com**

| Pos. | Description | Date | Draftsman | Designer | ATEX |
|---|---|---|---|---|---|
| 0 | EMISSIONE DRAFT/PRELIMINARE | 18/01/18 | Mercorillo | GALLI | BASSINI |




| Pos. | Description | Q.ty | Dim. | Material | Ref. Standard | Codice |
|---|---|---|---|---|---|---|
| 16 | HEX NUT M8 | 8 | | Acc.Zinc | UNI 5588 | D003005121 |
| 15 | MANICOOLER MINI SYSTEM | 1 | | CARBON STEEL | | K004003000 |
| 14 | VENT VALVE M14x1.5 | 1 | | OT58 | | V031051122 |
| 13 | CONNECTION A19 1/8-9 | 1 | | Galvanized Steel | | R003093121 |
| 12 | JCX020 L9-13x20 HOSE CLAMP | 3 | | Inox AISI 304 | | F041015122 |
| 11 | 90° HYDRAULIC CONNECTION 3/8" | 2 | | | | R005094122 |
| 10 | 3/8" F - NIPPLE | 2 | | Galvanized Steel | | N020098121 |
| 9 | SCREW M8x35 | 16 | | Acc.Zinc | UNI 5739 | VM0308X035 |
| 8 | SCREW HEX HEAD M8x25 | 6 | | Galvanized Steel | UNI 5739 | VM0308X025 |
| 7 | CONIC WASHER DM.8,4 | 30 | | Galvanized Steel | | R038008121 |
| 6 | WATERCOOLED EXHAUST GAS CONNECTION | 1 | | | | 7227.22.030 |
| 5 | SCREW HEX HEAD M8x20 | 4 | | Galvanized Steel | UNI 5931 | VM0108X020 |
| 4 | FLANGE FOR EXH GAS MANIFOLD | 1 | L=15mm | Steel | UNI 6012 | 7227.22.010 |
| 3 | GASKET FOR EXH GAS FLANGE | 1 | | Rame | | 7212.22.910 |
| 2 | COATEX ON EXH GAS MANIFOLD | 1 | | | | 7227.22.020 |
| 1 | GASKET FOR EXHAUST GAS MANIFOLD | 1 | | Copper | | 7212.22.920 |

Description: ASSIEME SISTEMA DI SCARICO
WEIGHT: DRY:65[Kg] - WET:74[Kg] - COOLANT 9L
EXHAUST SYSTEM MANICOOLER MINI

Application: PERKINS 404D-22G

Treatment

| Scale | Peso Kg |
|---|---|
| 1:2 | 64.65 |

| | Date | Sign |
|---|---|---|
| Draftsman | 18/01/2018 | Mercorillo |
| Designer | 18/01/2018 | GALLI |
| ATEX | 18/01/2018 | BASSINI |

20812 LIMBIATE (MB) - Via Marconi, 31

- Dimensions expressed in mm -

7227.22.000

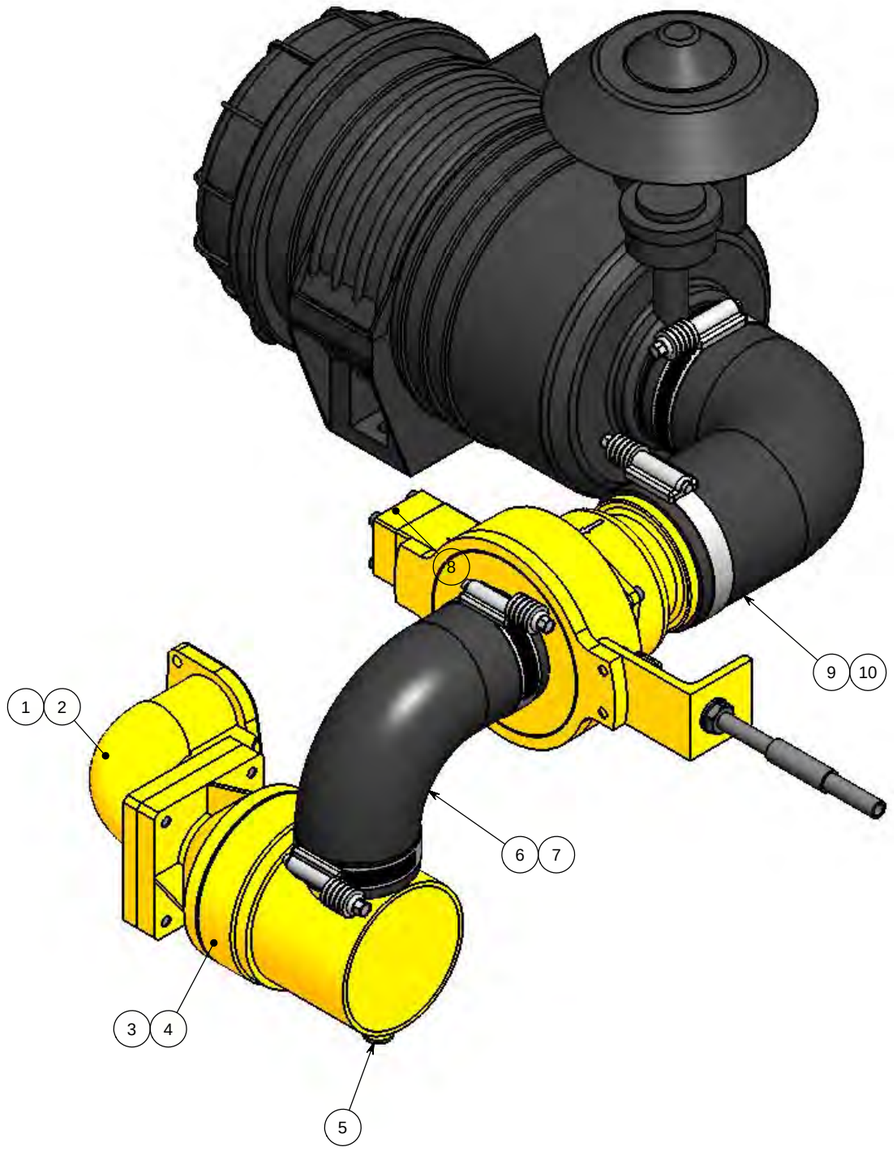
Replace the:

Replaced by:



***In case of any questions or concerns, promptly contact the Miretti technical department.***

| Pos. | Description | Date | Draftsman | Designer | ATEX |
|---|---|---|---|---|---|
| 0 | EMISSIONE DRAFT/PRELIMINARE | 02/01/18 | Mercorillo | GALLI | BASSINI |




| Pos. | Description | Q.ty | Dim. | Material | Ref. Standard | Codice |
|---|---|---|---|---|---|---|
| 10 | HOSE CLAMP CT400-DIM83x105-L15.8 | 2 | | Inox AISI 304 | | F041083122 |
| 9 | RUBBER ELBOW DM.75 | 1 | | | | 7227.23.055 |
| 8 | AIR INLET SD VALVE | 1 | | Aluminum | | V031236122 |
| 7 | HOSE CLAMP CT300 | 2 | | Inox AISI 304 | | F041081122 |
| 6 | RUBBER CURVE DM.60 | 1 | | | | 7227.23.050 |
| 5 | CAP A7-1/4 | 1 | | Galvanized Steel | | R003054121 |
| 4 | INTAKE FLAME ARRESTOR | 1 | | | | F045187112 |
| 3 | SCREW HEX HEAD M8x16 | 4 | | Galvanized Steel | UNI 5931 | VM0108X016 |
| 2 | AIR INLET MANIFOLD | 1 | | | | 7227.23.020 |
| 1 | GASKET FOR AIR INLET MANIFOLD | 1 | | Rame | | 7212.23.921 |

Description: ASSIEME APPARATO DI ASPIRAZIONE

AIR INLET SYSTEM

Application: PERKINS 404D-22G

Treatment

| Scale | Peso Kg |
|---|---|
| 1:2.5 | 7.18 |

| | Date | Sign |
|---|---|---|
| Draftsman | 02/01/2018 | Mercorillo |
| Designer | 02/01/2018 | GALLI |
| ATEX | 02/01/2018 | BASSINI |

MIRETTI

20812 LIMBIATE (MB) - Via Marconi, 31

- Dimensions expressed in mm -

7227.23.000

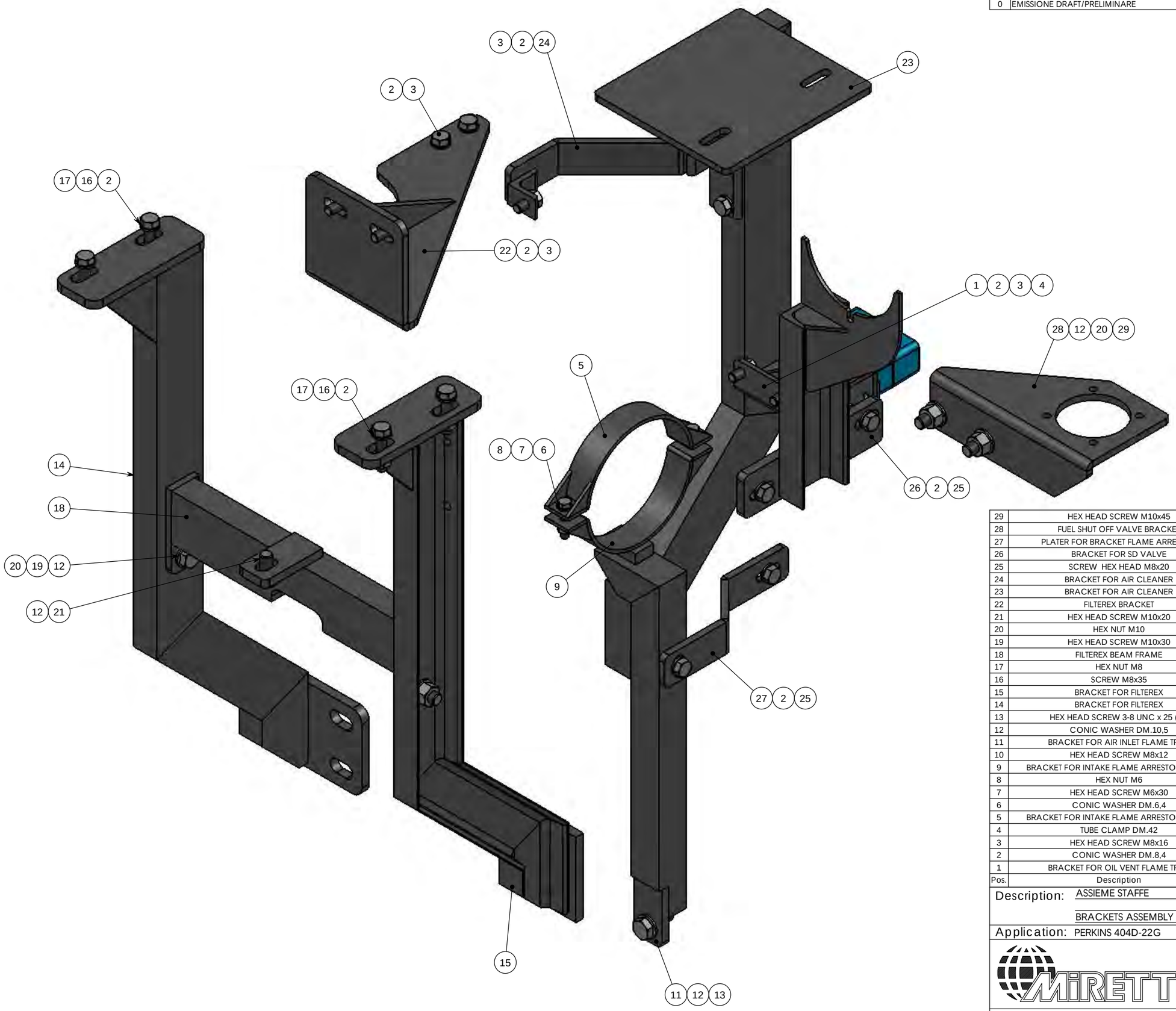


Replace the:

Replaced by:

***In case of any questions or concerns, promptly contact the Miretti technical department.***

| Pos. | Description | Date | Draftsman | Designer | ATEX |
|---|---|---|---|---|---|
| 0 | EMISSIONE DRAFT/PRELIMINARE | 09/02/18 | Mercorillo | GALLI | BASSINI |




| Pos. | Description | Q.ty | Dim. | Material | Ref. Standard | Codice |
|---|---|---|---|---|---|---|
| 29 | HEX HEAD SCREW M10x45 | 2 | | Acc.Zinc | UNI 5739 | VM0310X045 |
| 28 | FUEL SHUT OFF VALVE BRACKET | 1 | | Steel | | 7227.60.080 |
| 27 | PLATER FOR BRACKET FLAME ARRESTOR | 1 | | Steel | | 7227.60.070 |
| 26 | BRACKET FOR SD VALVE | 1 | | | | 7227.60.045 |
| 25 | SCREW HEX HEAD M8x20 | 6 | | Galvanized Steel | UNI 5739 | VM0308X020 |
| 24 | BRACKET FOR AIR CLEANER | 1 | | | | 7227.60.042 |
| 23 | BRACKET FOR AIR CLEANER | 1 | | | | 7227.60.040 |
| 22 | FILTEREX BRACKET | 1 | | | | 7227.60.060 |
| 21 | HEX HEAD SCREW M10x20 | 1 | | Acc.Zinc | UNI 5739 | VM0310X020 |
| 20 | HEX NUT M10 | 4 | | Galvanized Steel | UNI 5588 | D003006121 |
| 19 | HEX HEAD SCREW M10x30 | 2 | | Acc.Zinc | UNI 5739 | VM0310X030 |
| 18 | FILTEREX BEAM FRAME | 1 | | | | 7227.60.020 |
| 17 | HEX NUT M8 | 4 | | Acc.Zinc | UNI 5588 | D003005121 |
| 16 | SCREW M8x35 | 4 | | Acc.Zinc | UNI 5739 | VM0308X035 |
| 15 | BRACKET FOR FILTEREX | 1 | | | | 7227.60.010 |
| 14 | BRACKET FOR FILTEREX | 1 | | | | 7227.60.015 |
| 13 | HEX HEAD SCREW 3-8 UNC x 25 (1") | 1 | | Galvanized Steel | | |
| 12 | CONIC WASHER DM.10,5 | 10 | | Galvanized Steel | DIN 6796 | R038010121 |
| 11 | BRACKET FOR AIR INLET FLAME TRAP | 1 | | | | 7227.60.025 |
| 10 | HEX HEAD SCREW M8x12 | 2 | | Acc.Zinc | UNI 5739 | VM0308X012 |
| 9 | BRACKET FOR INTAKE FLAME ARRESTOR DN.100 | 1 | | | | 7227.60.055 |
| 8 | HEX NUT M6 | 2 | | Acc.Zinc | UNI 5588 | D003004121 |
| 7 | HEX HEAD SCREW M6x30 | 2 | | Acc.Zinc | UNI 5739 | VM0306X030 |
| 6 | CONIC WASHER DM.6,4 | 4 | | Galvanized Steel | | R038006121 |
| 5 | BRACKET FOR INTAKE FLAME ARRESTOR DN.100 | 1 | | | | 7227.60.050 |
| 4 | TUBE CLAMP DM.42 | 1 | | | | C031039122 |
| 3 | HEX HEAD SCREW M8x16 | 7 | | Acc.Zinc | UNI 5739 | VM0308X016 |
| 2 | CONIC WASHER DM.8,4 | 23 | | Galvanized Steel | | R038008121 |
| 1 | BRACKET FOR OIL VENT FLAME TRAP | 1 | | | | 6924.60.050 |

Description: ASSIEME STAFFE

BRACKETS ASSEMBLY

Application: PERKINS 404D-22G

Treatment:

Scale: 1:2

Peso Kg: 16.55

| | Date | Sign |
|---|---|---|
| Draftsman | 09/02/2018 | Mercorillo |
| Designer | 09/02/2018 | GALLI |
| ATEX | 09/02/2018 | BASSINI |

MIRETTI

20812 LIMBIATE (MB) - Via Marconi, 31

- Dimensions expressed in mm -

7227.60.000

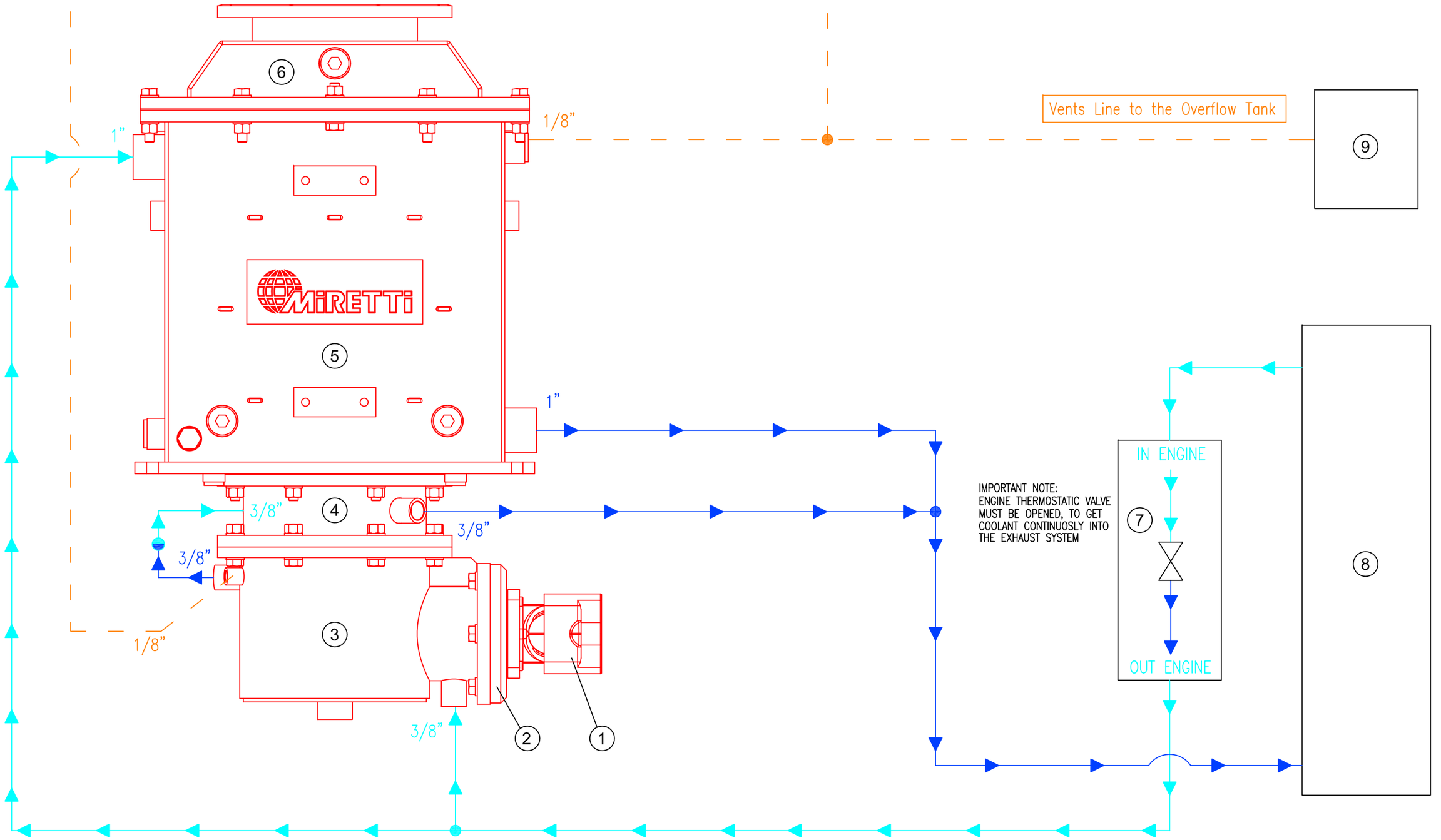


Replace the:

Replaced by:

***In case of any questions or concerns, promptly contact the Miretti technical department.***

| POS. | MOD. NR. | MODIFICATION DESCRIPTION | DATE | DRAFTSMAN | REVIEWED | APPROVED |
|---|---|---|---|---|---|---|
| 00 | | ISSUED | 26.01.18 | Mercorillo | GALLI | BASSINI |




IMPORTANT NOTE:
ENGINE THERMOSTATIC VALVE MUST BE OPENED, TO GET COOLANT CONTINUOSLY INTO THE EXHAUST SYSTEM

| POS. | DESCRIPTION |
|---|---|
| 9 | OVERFLOW TANK |
| 8 | RADIATOR |
| 7 | ENGINE |
| 6 | DRY EXHAUST GAS COOLER OUTLET BOX |
| 5 | EXHAUST GAS COOLER |
| 4 | SELF-CLEANING EXHAUST FLAME TRAP |
| 3 | WATERCOOLED EXHAUST CONNECTION |
| 2 | EXHAUST CONNECTION FLANGE |
| 1 | EXHAUST GAS MANIFOLD WITH COATEX |

Exhaust System

Cooling System - IN

Cooling System - OUT

Vent Line

Description: P & I – EXHAUST GAS COOLING SYSTEM

Object: PERKINS 404D-22G

| | Date | Sign |
|---|---|---|
| Draftsman | 26.01.18 | Mercorillo |
| Reviewed | 26.01.18 | GALLI |
| Approved | 26.01.18 | BASSINI |

MIRETTI 20051 LIMBIATE (MI) – Via Marconi, 31 – ITALY



Replaces DWG

Replaced By

HEAT TREAT.

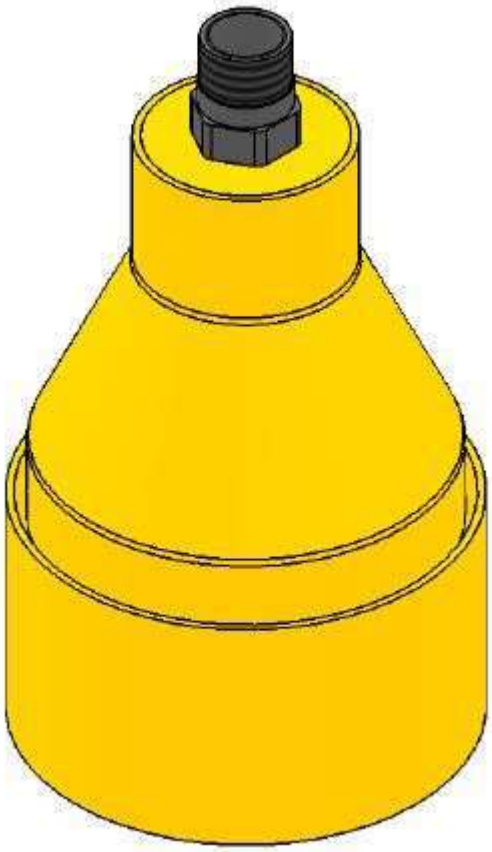
SCALE: 1 : 1

WEIGHT Kg.

–Dimensions in mm.–

DWG NR. 7227.66.100

# 3. FLAME ARRESTOR



**CODE: F045098122**
**MIRETTI JOB N° D10732**

- # INTRODUCTION

This guide is for people who are installing, using, storing the air inlet flame arrestor.

This document contains information which is necessary to start, use, assemble and disassemble, store, transport and maintain the equipment. In addition, this document describes the steps to be performed and gives instructions in case of failure of the device.

The safe and hassle-free device is subject to the user's respect for instructions together with the set of technical conditions during transportation, storage, picking, assembly, use and maintenance.

- # MAINTENANCE

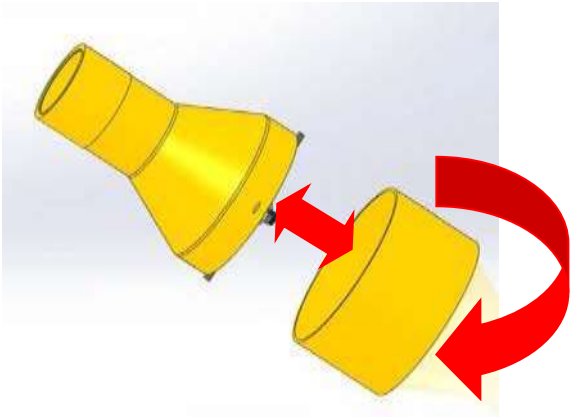
Every **1000 hours**, clean the filter by proceeding as follow:

1. Stop the Engine
2. The maintenance procedure should be performed with the engine off and in total safety conditions.
3. Turn the filter, disconnecting it from the pipeline.

**REMOVING THE COMPONENT**

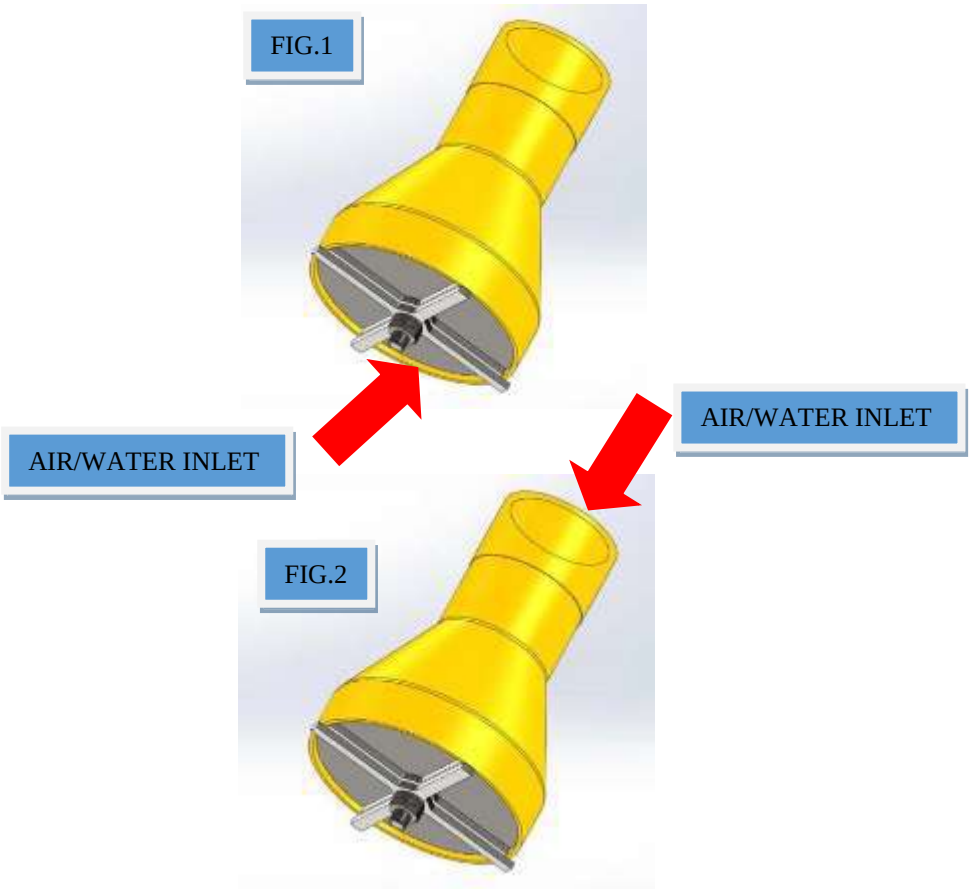
4. Rotate the tray of the oil vapour filter.

**WARNING:** Pay particular attention to the leakage of oil from the Flame arrestor.



## CLEANING

5. Using pressurized water and compressed air, remove all liquids in the flame trap filter, as shown in picture 1.
6. Using compressed air and water, remove any residues, as shown in picture 2. Make sure you have removed all residues before reassembling.



## REASSEMBLY

7. Reattach the filter to the pipeline.
8. After removing all oil residues, reassemble the oil vapour flame trap filter.
9. Screw the filter on to the pipeline.

## MAINTENANCE TABLE

| Table "C" - Scheduled routine maintenance | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | WORKING HOURS | | | | | | | | | | | |
| COMPONENT | No. | | 8 | 200 | 400 | 500 | 600 | 800 | 1000 | 2000 | 4500 | 6000 | 8000 | 10000 |
| 1 | OIL VAPOUR FILTER | | | | | | | | CM | | | | | |

**CM** = CLEANING/MAINTENANCE

Failure to perform the above tasks will void all warranties

- ## MARKING

The nameplate of the flame arrestor contains the following info:

| | |
|---|---|
| Manufacturer: | **MIRETTI S.r.l. Via Marconi 29/31 (I) 20812 MB** |
| Type: | **F045098122** |
| Constr. Year: | **2019** |
| Marking: | **II 2GD**<br>**I M2** |

- ## RULES APPLIED

The flame arrestor compliance with the following standards:

EN ISO 16852 Flame arresters - Performance requirements, test methods and limits for use.

- ## PACKAGING, STORAGE, TRANSPORTATION

The flame arrestor is packaged in a proper container to be protected from damage during transport, in case of shipping for replacement.

The flame arrester's storage should take place in covered, free from corrosive substance environments.

Transportation must be performed in such a way that no damage can occur, and device must be protected against accidental fall during installation.

- ## DOCUMENTS

Each device is equipped with its manual and a copy of Statement of Conformity.

If Purchaser buys a greater number of pieces of equipment, documents are provided in one copy only.

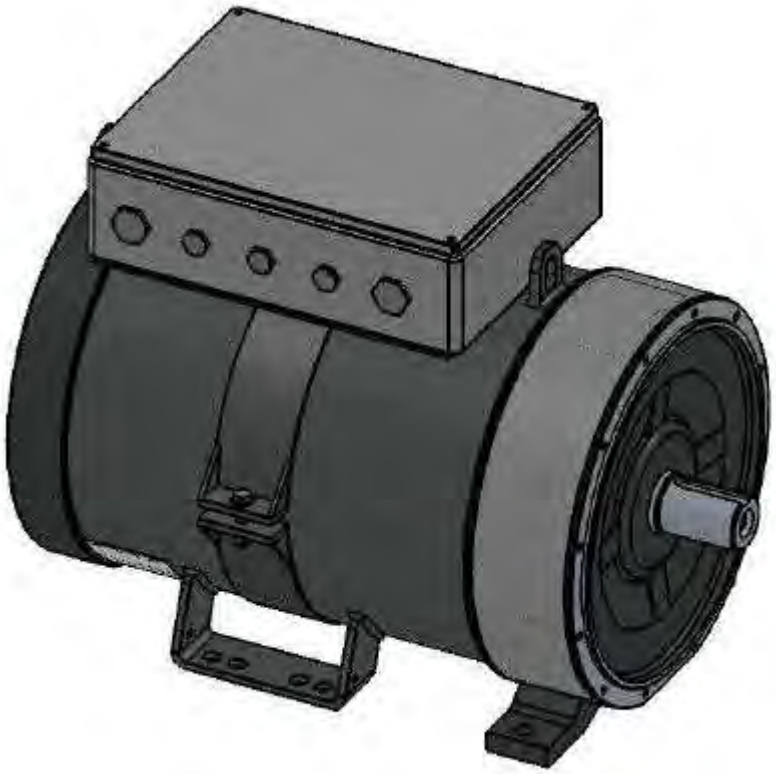
The manufacturer reserves the right to make changes to the design for the quality of technological designs and to improve performance, without altering however the conditions obtained in the CE certification.

- ## CONTACTS

For information not contained in this manual please contact:

**Miretti S.r.l.**
**Via Marconi 29/31**
**20812 – Limbiate (MB) Italy**
**Phone. +39 02 990811**
**Fax. +39 02 99052488**
**Email: sales.department@miretti.com**

# 4. GENERATOR MECC ALTE ECP32



## CODE: G015037112
## MIRETTI JOB N° D10732

# INDEX

# 1. INTRODUCTION

This manual contains information on the operation and use of the DER1 digital regulator.

**MAIN CHARACTERISTICS**

**1. Architecture of the system**

The DER1 is a voltage regulator for synchronous alternators, designed for stand alone working and calibration; to maximize performances, the regulator should be intended as part of a system made up of at least three components: the DER1 (control unit), a communications module (USB2DxR, for example) and a supervision unit, as illustrated in figure 6.

The connectors for connection to and from the power generator and communications module are located on the DER1 regulator.

The supervision unit can be made up of a personal computer, another “synoptic” device or both; it does not have the function of controlling the system in real time, but allows programming and visualisation of all operational parameters of the DER1.

If it is equipped with USB interface, it’s possible to use the USB2DxR communications module for its connection.

**1.1 Regulator**

Since the regulator is designed to control many different types of generators, it must be appropriately configured to obtain the best performance; most of the settings are stored in a non-volatile integrated memory (EEPROM). The first time the regulator is turned on, a default configuration will be present, which satisfies the most widely requested characteristics and is suitable to facilitate installation: the trimmers are active and the inputs for the external potentiometer and the 60 Hz jumper are enabled, therefore the basic calibrations can be performed without the use of additional equipment.

Two versions of the DER 1 and DER 1/A regulators are available; Series 3 to 38 alternators; the two versions differ primarily in the default parameters.

NOTE: the parameter that defines the output voltage (with the VOLT trimmer disabled) is set on 0 (so that the adjustment takes place on the minimum voltage).

**1.2 Communications module**

The USB2DxR communications module (which is provided for connection to the COM connector of the DER1) is equipped with a USB port, through which it is possible to set the parameters (for both configuration and operation) and “monitor” operation of the generator.

## 2. Technical Characteristics of the device installed on board

- Digital controlled regulator, based on DSP
- Suitable for all self-regulated alternators
- Power connections through 20 poles(1) Fast-On connector (see fig.2)
- Protection of power winding with 5A fast acting fuse
- Signal connections (Pext, 60Hz Jumper, APO) through 10 poles mini Fast-On separate connector
- Environmental temperature: -25°C ÷ +70°C
- Voltage supply: 40Vac÷270Vac (2)(from auxiliary winding, output voltage or PMG)
- Maximum continuous output current: 5Adc
- Frequency range: 12Hz÷72Hz
- Three phase or single phase sensing in all connections (Y-□-YY-□□)
- Single phase or three phase sensing automatic recognition
- Average value of voltage regulation
- Voltage regulation range (sensing) from 75Vac to 300Vac
- Precision of voltage regulation: ± 1% from no-load to nominal load in static condition, with any power factor and for frequency variations ranging from -5% to +20% of the nominal value.
- Precision of voltage regulation: ± 0,5% in stabilized conditions (load, temperature).
- Transient voltage drop and overvoltage within ± 15%
- Voltage recovery time within ± 3% of the value set, in less than 300 msec.
- Programmable Soft start
- Parameters: VOLT, STAB, AMP and Hz settable by trimmers (default), 50/60Hz settable by a “jumper” (default), all parameters programmable via software
- 0÷2,5Vdc or -10÷+10Vdc external voltage for analogical remote control of output voltage
- Remote control of output voltage through external potentiometer (from 25Kohm to 100Kohm)
- Underspeed protection with adjustable threshold and slope
- Overvoltage and undervoltage alarms
- Excitation overcurrent protection with delayed intervention
- Underexcitation alarm/loss os excitation(6)
- Management of temporary short circuits (start up of asynchronous motors)
- Open collector output (not insulated) signalling some allarm intervention with programmable activation in respect of each alarm and possibility of the intervention delay and selectable active level(6)
- Allarm conditions storage (type of alarm, number of events, duration of the last event, total time)
- Memorization of the regulator operation time
- USB communications interface (with optional USB2DxR module)

**WARNING : Operation of the DER1 is not specified below 12 Hz.**

NOTE (2): with EMI external filter SDR 128/K, see Fig. 4 (3m without EMI filter)
NOTE (6): Starting from rev. 19 of the firmware

## 1. Inputs and Outputs: technical specifications

| TABLE 1 : CONNECTOR CN1 | | | | |
|---|---|---|---|---|
| Terminal[1] | Name | Function | Specification | Notes |
| 1 | Exc- | Excitation | Continuous Rating: 5Adc<br>Transitory Rating:12Adc at peak | |
| 2 | Aux/Exc+ | | | |
| 3 | Aux/Exc+ | Power | 40÷270 Vac, Frequency: 12÷72Hz [2] | (1) |
| 4 | UFG | Sensing Range 2 | Range 2: 150÷300 Vac Burden: <1VA | U channel |
| 5 | UFG | | | |
| 6 | UHG | Sensing Range 1 | Range 1: 75÷150 Vac Burden: <1VA | |
| 7 | UHG | | | |
| 8 | UHB | Jumper Range1 | | Short for sensing 75÷150 Vac |
| 9 | UFB | | | |
| 10 | UFB | | Board reference | Star point (12 YY or 6 Y leads generators) is hard connected to AVR power supply input [1] |
| 11 | UFB | | | |
| 12 | UFB | | | |
| 13 | - | | Not present | |
| 14 | VFG | Sensing | Range 1: 75÷150 Vac Burden: <1VA | V channel, to be connected in parallel to U channel in case of single phase sensing |
| 15 | VHG | Sensing Range 1 | | |
| 16 | VHB | | Scala 2: 150÷300 Vac Burden: <1VA | |
| 17 | VFB | Range 2 | | |
| 18 | - | | Not present | |
| 19 | WFG | Sensing | Range 1: 75÷150 Vac Burden: <1VA | W channel, unused (with shorted inputs) in case of single phase sensing |
| 20 | WHG | Sensing Range 1 | | |
| 21 | WHB | | Range 2: 150÷300 Vac Burden: <1VA | |
| 22 | WFB | Range 2 | | |

| TABLE 2 : CONNECTOR CN3 | | | | |
|---|---|---|---|---|
| Terminal | Name | Funcion | Specifications | Notes |
| 23 | Common | Active protections output | Type: Non-insulated open collector<br>Current: 100mA<br>Voltage: 30V<br>Max length: 30m [3] | Programmable : active level[6], activating alarm and delay time |
| 24 | A.P.O. | | | |
| 25 | Common | Jumper 50/60Hz | Type: Not insulated Max length: 3m | Selection of underspeed protection threshold [4] |
| 26 | 50/60Hz | | | |
| 27 | 0EXT | Jumper for remote voltage control 0÷2,5Vdc | Type: Not insulated Max length: 3m | Short for 0÷2,5Vdc input or potentiometer |
| 28 | JP1 | | | |
| 29 | 0EXT | Input for remote voltage | Type: Not insulated Max length: 30m [3] | Regulation: ±10 % [5] |
| 30 | PEXT | Input for remote voltage control 0÷2,5Vdc or Pext | Input: 0÷2,5Vdc o Potentiometer 100K | Burden: 0÷1mA (sink) |
| 31 | JP2 | Pext Jumper | Type: Not insulated Max length: 3m | Short for 0÷2,5Vdc input or potentiometer |
| 32 | ±10V | control ±10 Vdc | Input: ±10Vdc | Burden: ±1mA (source/sink) |

Note 1) The terminals are connected to each other on the board: 2 with 3, 4 with 5, 6 with 7, 9 with 10, 11 and 12.

Note 2) Minimum power voltage 40 Vac at 15 Hz, 100 V at 50 Hz, 115 V at 60 Hz Note 3) With external EMI filter 182/K (3m without EMI filter)

Note 4) 50·(100%-αHz%) or 60·(100%-αHz%) where αHz% is the position relative to the Hz trimmer or the percen tage value of parameter P[21]

Note 5) Value not to be exceeded. The effective range depends on parameter P[16]

Nota 6) Starting from revision 19 of the firmware

| TABELLA 3: TRIMMERS | | |
|---|---|---|
| **Name** | **Function** | **Notes** |
| VOLT | Voltage Calibration | From 75Vac to 150Vac or from 150Vac to 300Vac, see paragraph “Setting the voltage” |
| STAB | Calibration of dynamic response | Adjustment of proportional gain, see paragraph on “Stability”. |
| Hz | Calibration of underspeed protection intervention threshold | Variation up to -20% with respect to the nominal speed value set in parameter 50/60. |
| AMP | Calibration of excitation overcurrent protection | See paragraph “Calibration of excitation overcurrent protection” |

## 2. Block diagram

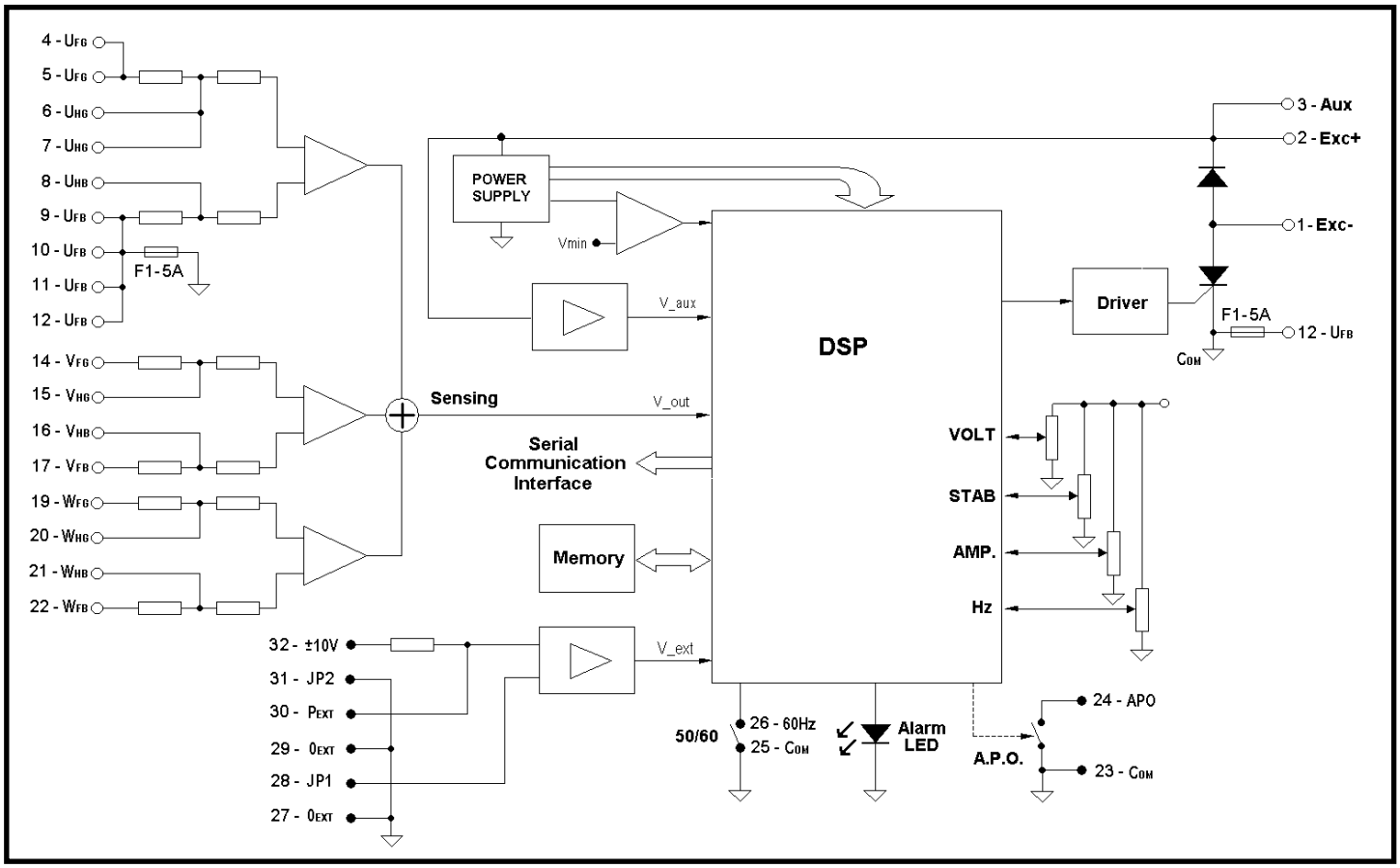


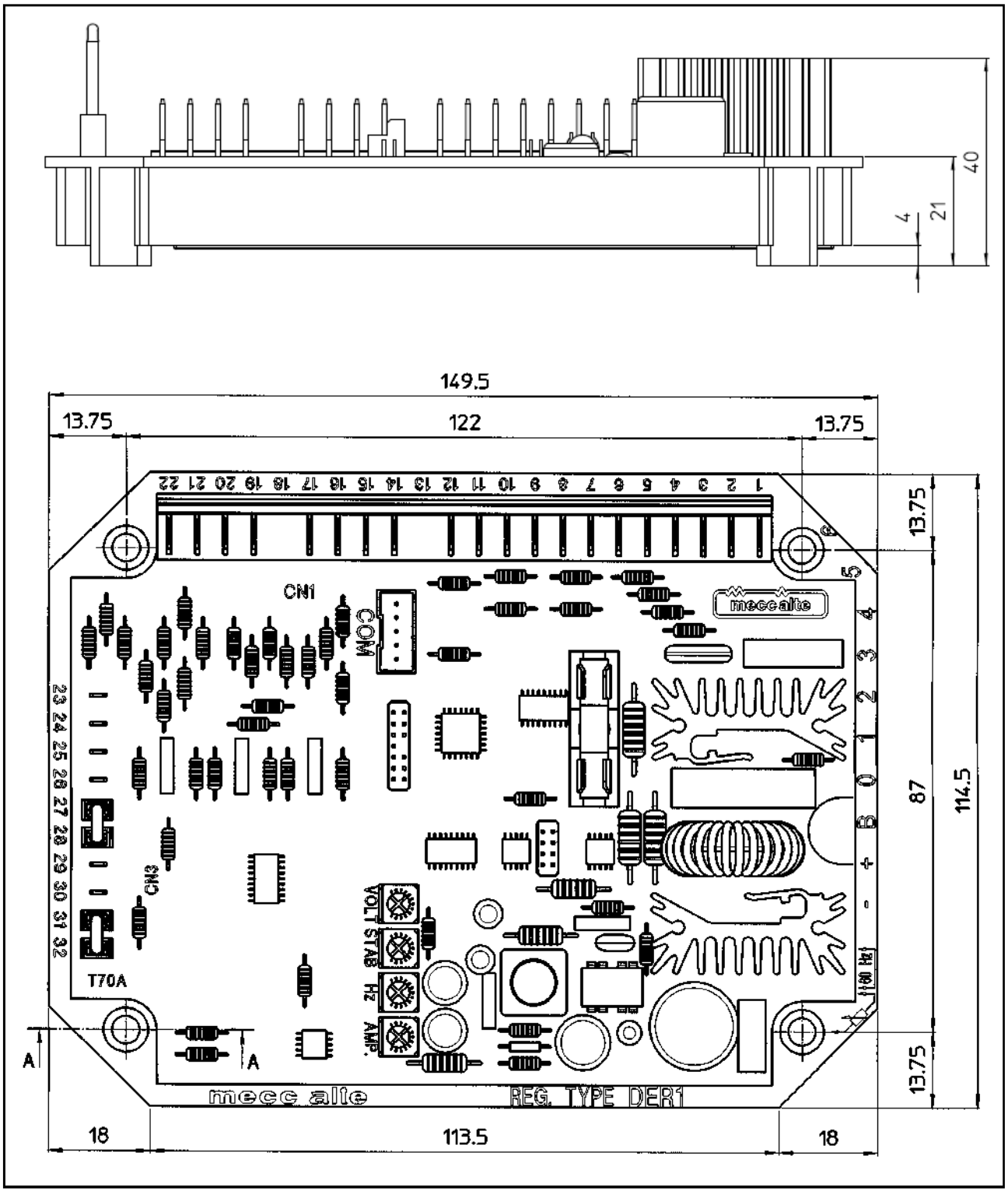

Fig 1

## INSTALLATION

Upon receipt of the digital regulator, performa visual inspection to ensure that no damage has been sustained during transportation and movement of the equipment. In the event of damage, advise the shipper, the insurance company. If the regulator is not installed immediately, store it in its original packaging in a dust and humidity-free environment.

The regulator is normally installed in the generator terminal box. It is fixed with two M4x25 screws and must be installed in a location where the temperature does not exceed the environmental conditions foreseen. The regulator is equipped with a 5A fast-acting protection fuse. If necessary, the fuse must be replaced only wiith a fuse of the same type and rating.

## 1. Overall dimensions drawings




## 2. Connections

The digital regulator connections depend on the application and excitation system.

Figure 1 shows the functional aspect of the connection points to the regulator

An error in connection may have deadly consequences for the unit.

Carefully check to make sure that all connections are precise and in accordance with the attached drawings, before turning on the power.

### 3. Terminals

Figures 1 and 2 show the connection terminals; the connections must be made using cables having a minimum diameter:

- **1,5 mm²** for power cables on terminals from 1 to 22
- **0,5 mm²** for signal cables on terminals from 23 to 32

### 4. DER1 connections

The DER1 regulator has 3 differential inputs, with 2 selectable scales for each of them (see fig.1):

- scale "H" for voltages between 75V and 150V
- scale "F" for voltages between 150V and 300V

### 4.1 Connections based on main alternator voltage

Based on the machine connections, and the desired voltage(1) you can use the three phase or single phase sensing used in one range or the other. Table 4 summarises the connections for the most common voltages.

**TABLE 4: ALTERNATOR VOLTAGE AND SENSING CONNECTION**

| Connection | Phase-to-Phase Voltage [V] | Sensing - Phase | Range | Drawing | Notes |
|---|---|---|---|---|---|
| Series star | 380-400-415-440-460-480-500 (from 260 to 500) | Single phase on half phase | H | SCC0160/02 | |
| | | Three phase on half phase | H | SCC0158/04 | |
| | | Single phase on full phase | F | N.A. | |
| | | Three phase on full phase | F | N.A. | |
| | 530-550-575-600-690-760-800-920-960(from 520 to 1000) | Single phase on half phase | F | SCC0161/02 | |
| | | Three phase on half phase | F | SCC0159/04 | |
| | 1200 (from 1100 to 2000) | Single phase on half phase | F | SCC0202/00 | 2 channels in series |
| Parallel star | 190-200-208-220-230-240-250 (from 130 to 250) | Single phase | H | SCC0160/02 | |
| | | Three phase | H | SCC0158/04 | |
| | 380-400-415-440-460-480-500 (from 260 to 500) | Single phase | F | SCC0161/02 | |
| | | Three phase | F | SCC0159/04 | |
| Series delta | 220-230-240-254-265-277-290 (from 150 to 300) | Single phase on half phase | H | SCC0160/02 | |
| | | Three phase on half phase | H | SCC0158/04 | |
| | 305-320-330-440-460-530-555 (from 300 to 600) | Single phase on half phase | F | SCC0161/02 | |
| | | Three phase on half phase | F | SCC0159/04 | |
| | 220-230-240-254-265-277-290 (from 150 to 300) | Single phase on full phase | F | N.A. | |
| | | Three phase on full phase | F | N.A. | |
| Parallel delta | 110-115-120-127-133-138-145 (from 75 to 150) | Single phase | H | SCC0160/02 | |
| | | Three phase | H | SCC0158/04 | |
| | 152-160-165-220-230-265-277 (from 150 to 300) | Single phase | F | SCC0161/02 | |
| | | Three phase | F | SCC0159/04 | |
| Zig-Zag(2) | 330-346-360-380-400-415-430 (from 260 to 500) | Single phase on full phase | F | N.A. | |
| | | Three phase on full phase | F | SCC0203/00 | 2 channels in series |
| Single phase parallel | 220-230-240-254-265-277-290 (from 150 to 300) | Single phase - Partial | H | SCC0160/02 | |
| | | Single phase - Complete | F | N.A. | |
| | 305-320-330-440-460-530-555 (from 300 to 600) | Single phase - Partial | F | SCC0161/02 | |
| | | Single phase - Complete | F | N.A. | 2 channels in series |

(1) Compatibly with the rated characteristics of the alternator
(2) Sensing only on full phase

### 4.2 DER1 connections for typical applications

Drawings SCC158/04, SCC159/04, SCC160/02, SCC161/02 show DER1 regulator connections for typical applications.

In case of sensing 75V-150V, with half-phase reference the typical drawing for three-phase connection is SCC158/04, while for single phase it is SCC160/02.

In case of sensing 150V-300V, with half-phase reference the typical drawing for three-phase connection is SCC159/04, while for single phase it is SCC161/02.

## 5. Setting up the regulator

Selection of the sensing scale takes place directly according to the connection on the power terminal board; additional settings can be made with 4 trimmers (VOLT, STAB, AMP and Hz) and 3 jumpers (50/60Hz, JP1 and JP2); the output voltage can also be set with an external analogical signal; additional settings, including the previous ones but excluding jumpers JP1 and JP2, can be made by modifying the 25 parameters stored in a non volatile integrated memory.

### 5.1 Alternator voltage signals

Terminals 4-22 of connector CN1 are used for voltage sensing.

### 5.2 Calibrating sensing

A supplementary calibration may be necessary to compensate any existing tolerances on analogical voltage acquisition channels; in this case follow the procedure illustrated below.

1. Write **16384** at location 19 (from the **Settings/Advanced**(1) Menu)
2. Disable VOLT trimmer (from the **Settings/Potentiometers**(1) Menu)
3. Disable Vext (from the **Settings/Advanced**(1) Menu)
4. The parameter present in parameter P[5](if three phase sensing) or p[6] (if single phase sensing)has to be calibrated. Calibration should be adjust in order to obtain 225V from the generator output when the sensing is cabled to $U_{FB}$ (9-10-11-12) and $U_{FG}$ (6-7), or to 125.5V if connected $U_{FB}$ (9-10-11-12) and $U_{HG}$ (6-7).Please note that a paramenter increment will result in a voltage reduction of the system. It is recommended to measure the voltage output with an instrument capable to catch the average value of the voltage.
5. In order to ensure that the value of voltage (available also at location 36) is the same as the value measured at point 6, calibrate the data at location 7, reading the value of Volt box in the "status" area of **Settings/Advanced** (1) menu.
6. Enable the trimmers again, if it is desired to have them active (from the **Settings/Potentiometers**(1)menu).
7. Enable Vext (from the **Settings/Advanced**(1) Menu) if you want to be active.

## 6. 50/60 Signal

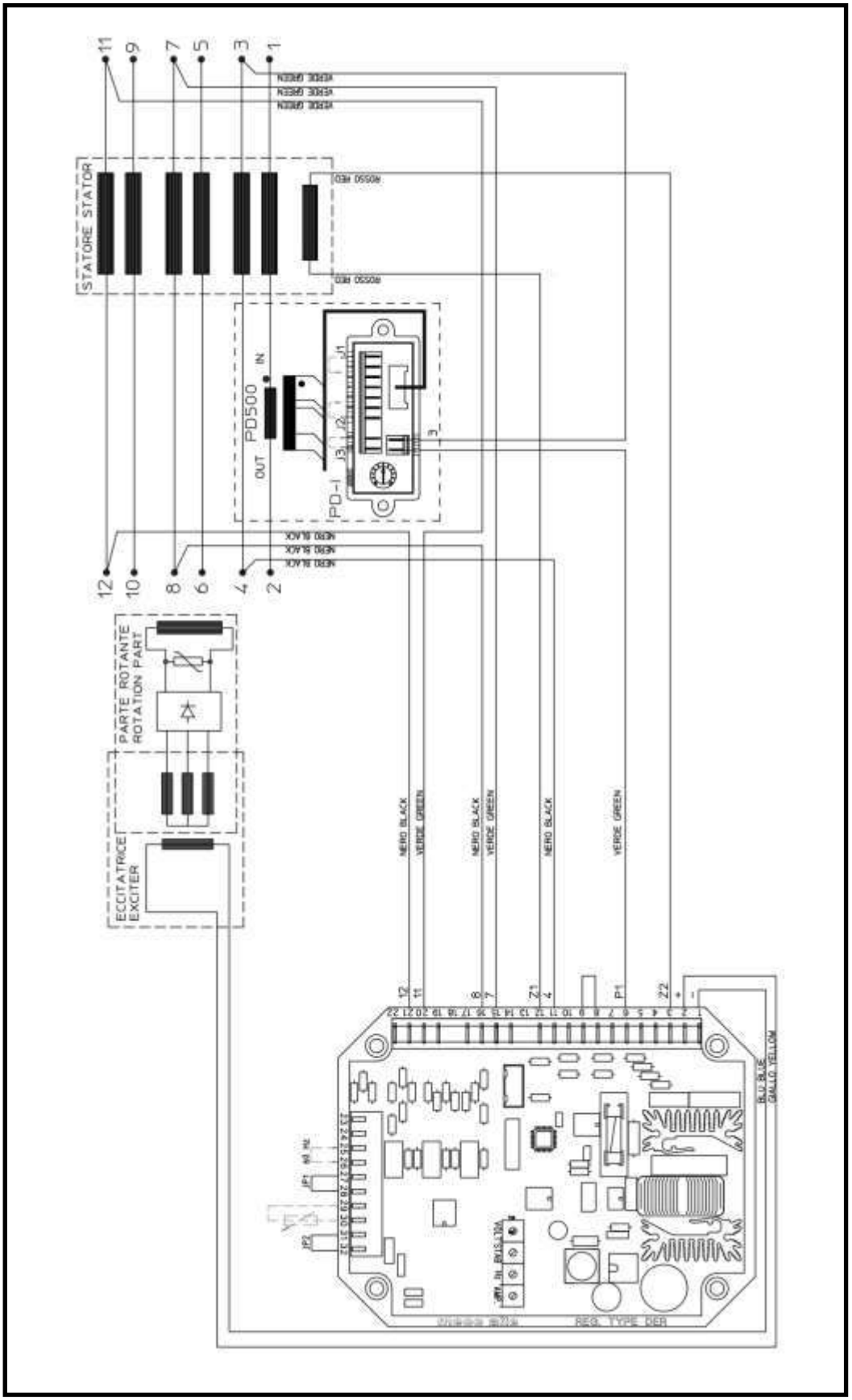
A jumper is located on the 50/60 input (terminals 25 and 26); if enabled from the **Configuration** Menu, it provokes the commutation of the underspeed protection threshold from 50·(100%-αHz%) to 60·(100%-αHz%), where αHz% represents the position relative to the Hz trimmer or the percentage value entered at parameter [21 (where 10% corresponds to 16384).

## 7. APO Contact

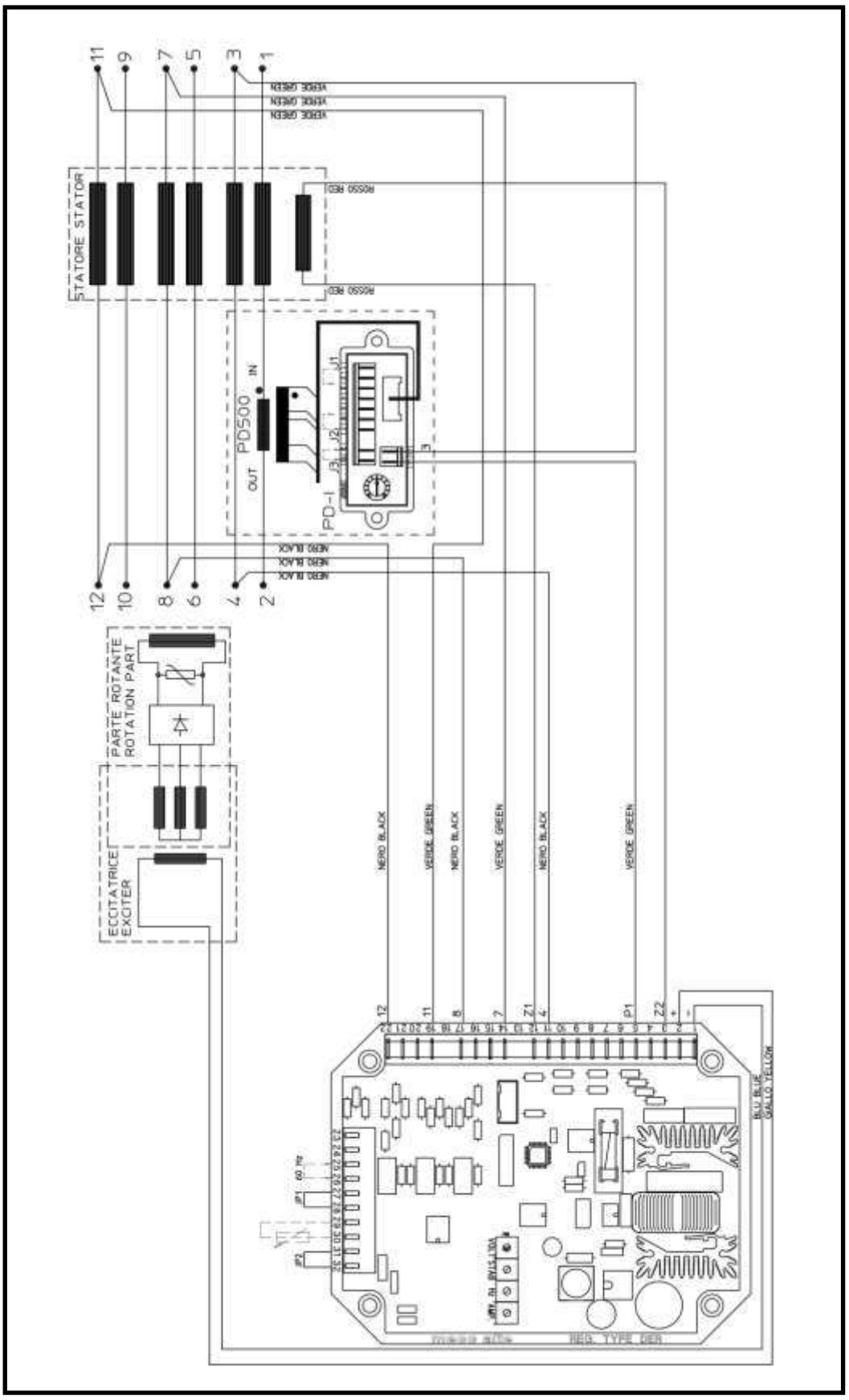
The acronym **APO** stands for **A**ctive **P**rotection **O**utput: (connector CN1 terminals 23 and 24) 30V-100mA non-insulated open collector transistor, normally closed, if the "APO Invert" flag (2) is active (default), opens (with a delay that can be programmed from 1 to 15 seconds) when, of all the alarms, one or several sepa- rately selectable alarms are active.

NOTE (1) : Software DxR Terminal

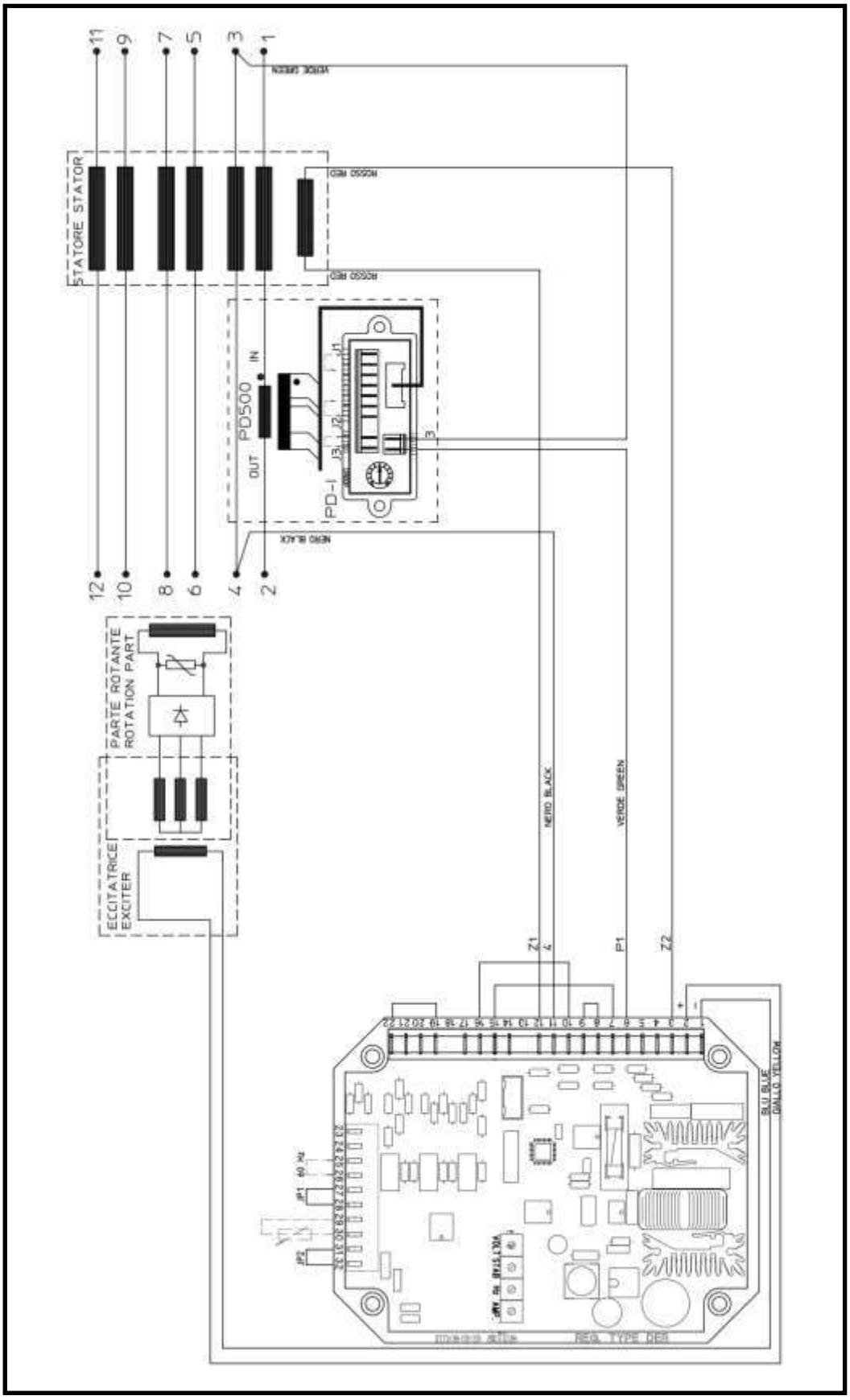
NOTE **(2)** : Starting from rev. 18 of the firmware, if the "APO Invert" flag is not active or for firmware revisions up to 17 the transistor is normally open and it closes in case of an active alarm



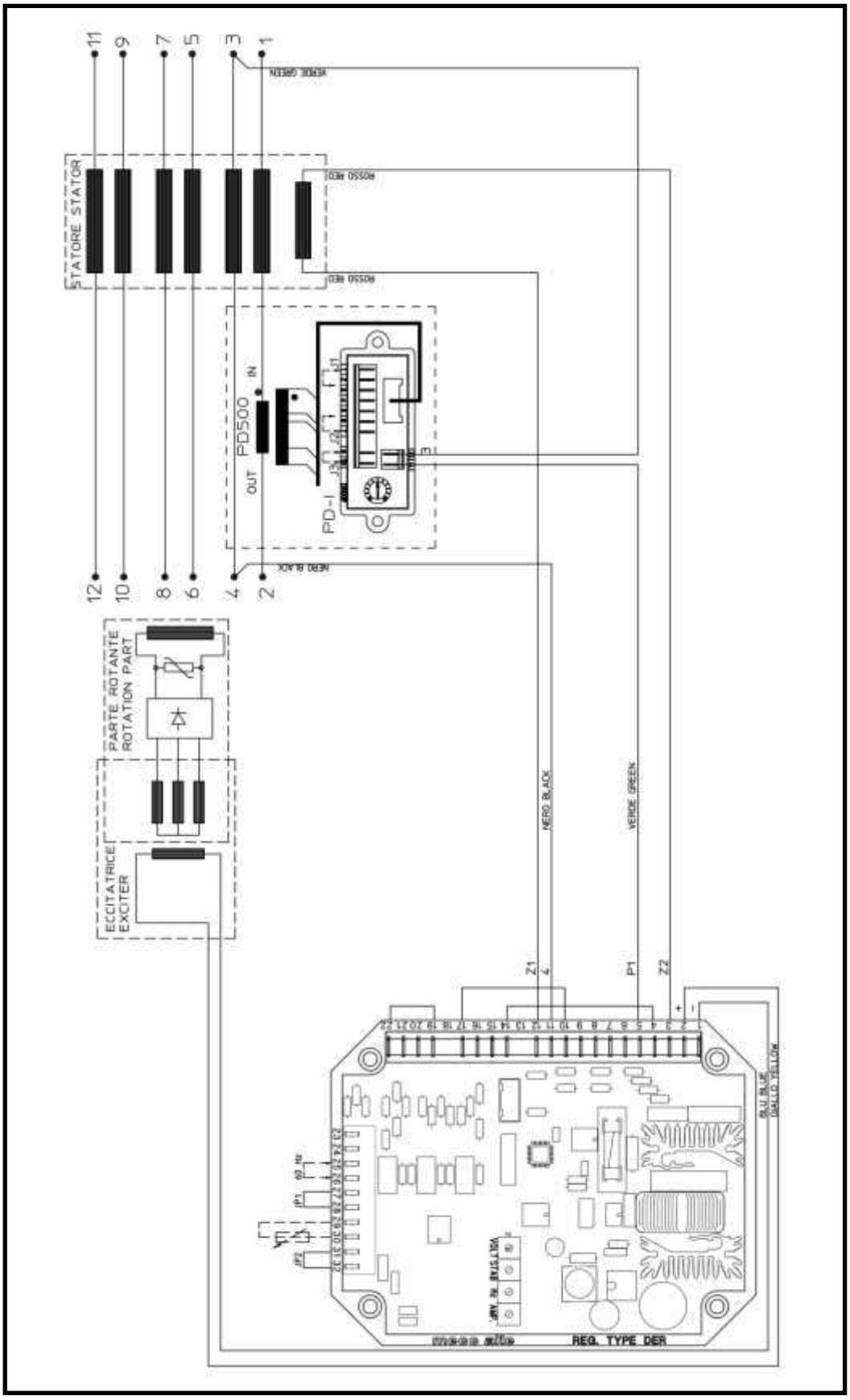

**SCC0158/05: Three phase sensing 75V-150V**



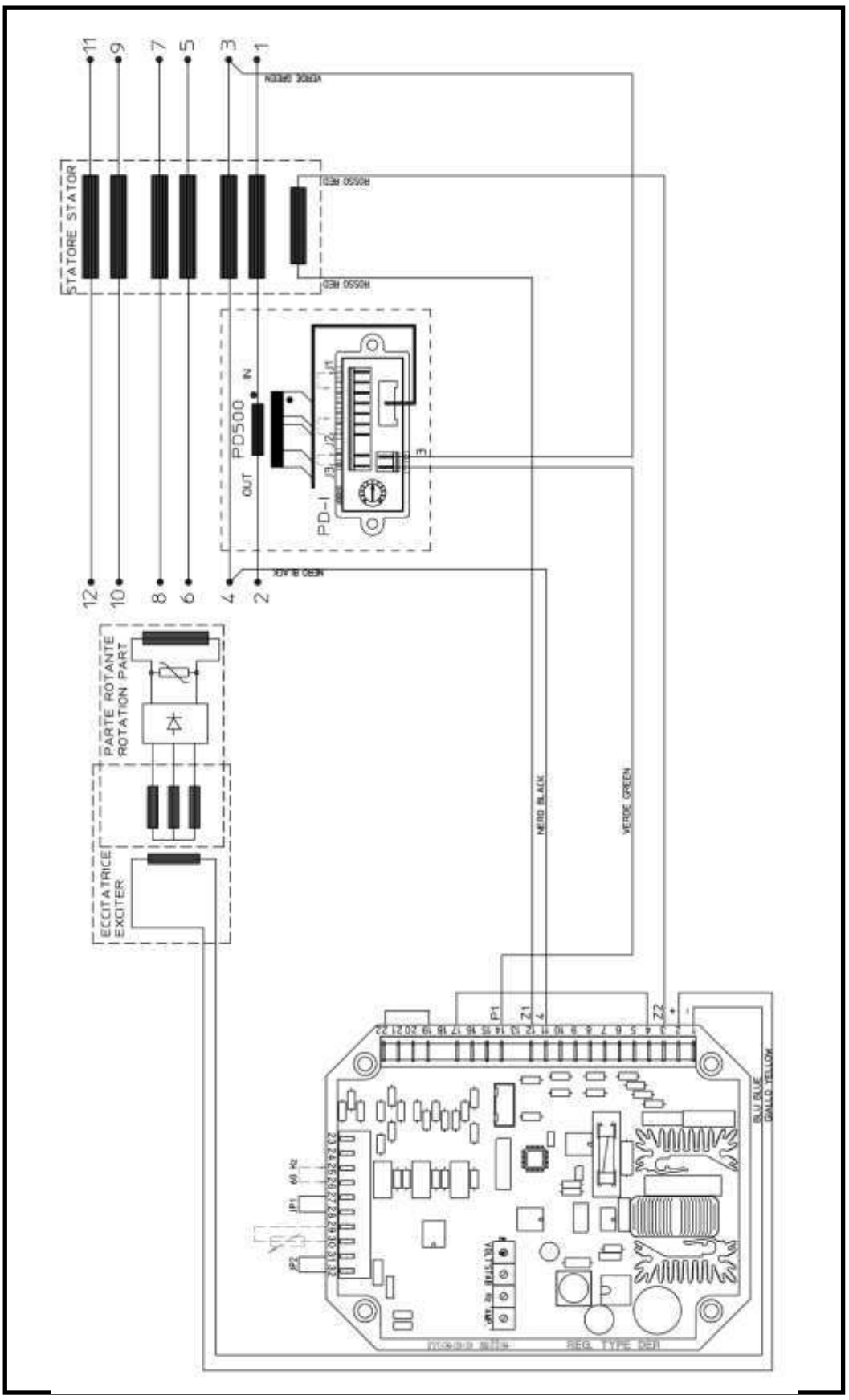

**SCC0159/05: Three phase sensing 150V-300V**



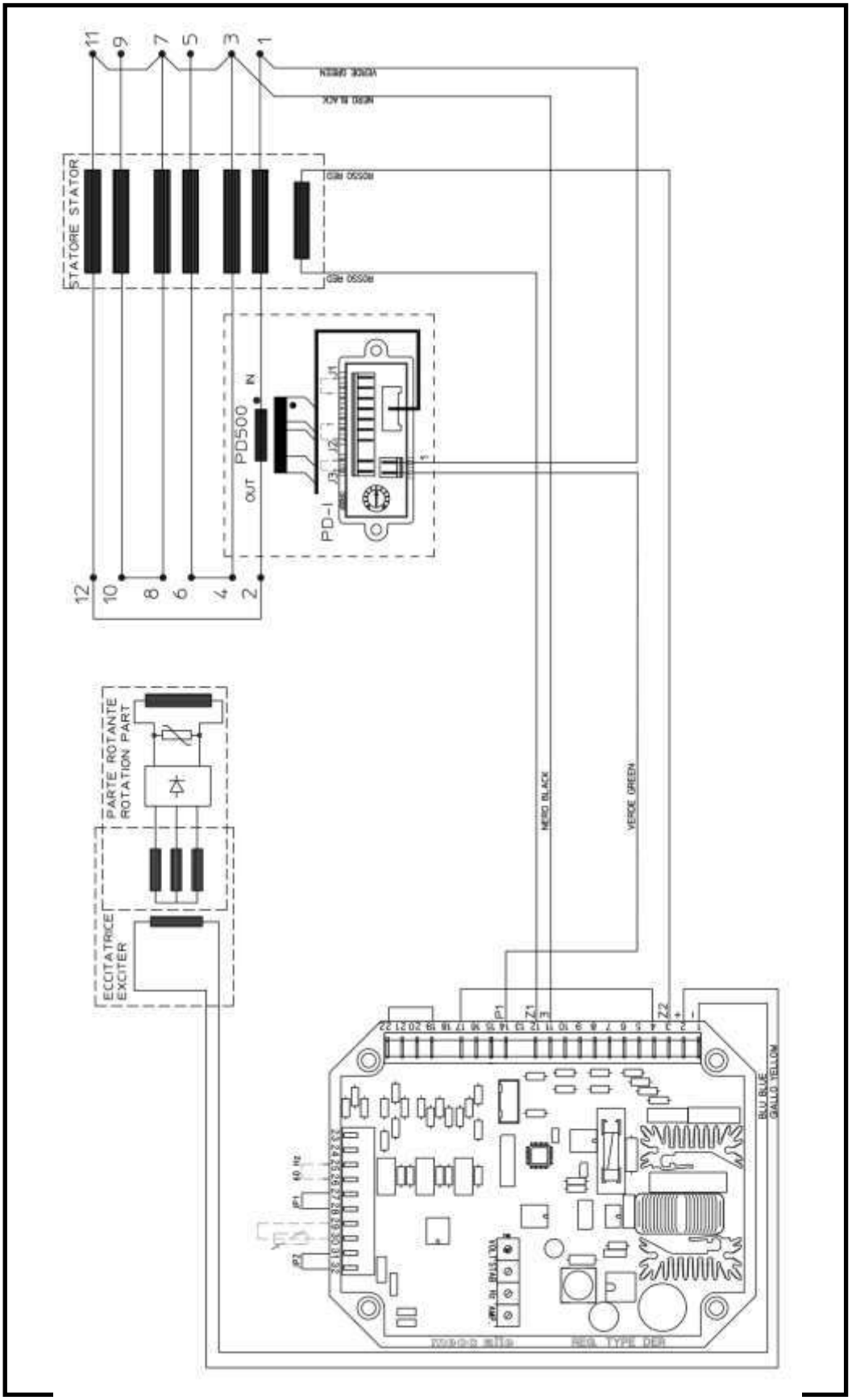

**SCC0160/03: Single phase sensing 75V-150V**




**SCC0161/03: Single phase sensing 150V-300V**




**SCC0202/01: Single phase sensing 300V-600V**




**SCC0203/01: Single phase sensing 300V-600V (generator in threephase ZIG-ZAG connection)**

## 8. Remote control of voltage

The Pext input (terminal 30) and ±10V (terminal 32) allow to obtain remote control of the output voltage by means of a DC signal or an external potentiometer. The output voltage can be controlled by software as well with the P[19]. The excursion range and gain of the remote control can be set independently by software despite the output voltage control device system used (potentiometer, VDC signal or P[19]). If DC voltage is used, it will take effect if it is within the range 0Vdc/2,5Vdc or -10Vdc/+10Vdc, when connected between terminals 30 and 29 and subjected by jumpers JP1 and JP2; for values exceeding the aforementioned limits (or in the event of disconnection), two options are possible: not to take the set point of external input and return to regulation to the voltage value set with the trimmer (if enabled) or with parameter P[19], or keep the minimum (or maximum) value of voltage that can be reached (see figures 3a and 3b). The two options can be set with the **RAM Voltage CTRL** flag in the **Settings/Advanced** menu corresponding to the bit B7 of the configuration word P[10] (see PARAMETERS AND OPERATIONAL DATA - Para. 2). The setting relative to the Vext input are summarised in table 5.

**NOTE:** the source of DC voltage must be capable of absorbing at least 2 mA.
In making adjustments it is reccomended not to exceed the nominal value of voltage of the alternator beyond ± 10%

**Relationship between analogical input and output voltage**

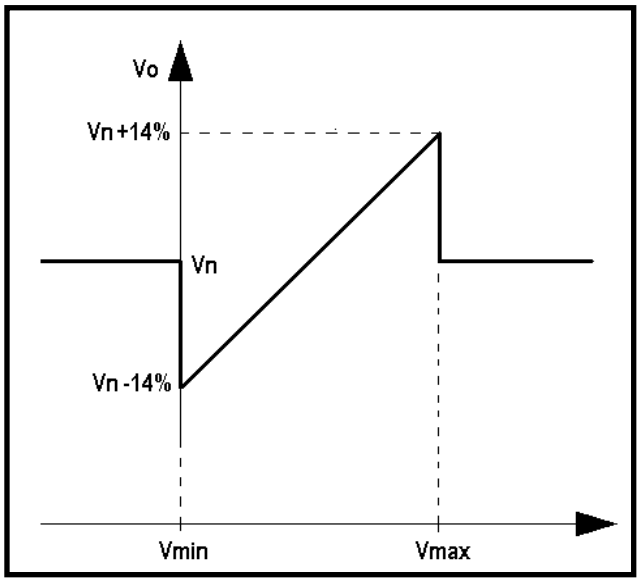



Figure 3a: without saturation of the output voltage upon reaching the input voltage limits.

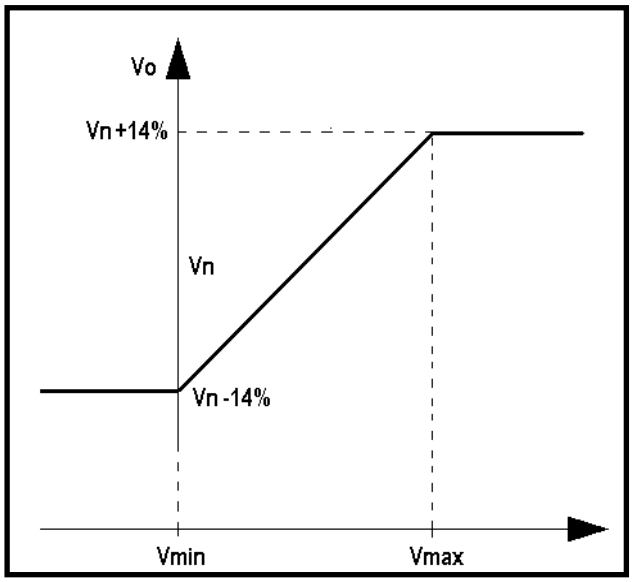



Figure 3b: with saturation of the output voltage upon reaching the input voltage limits

**TABLE 5: HARDWARE AND SOFTWARE CONFIGURATION OF VOLTAGE REMOTE CONTROL**

| | | Jumpers | | Flags ( configuration menu) or Parameter P[10] | |
|---|---|---|---|---|---|
| Type | Input | JP1 (27-28) | JP2 (31-32) | RAM Voltage CTRL | Ext. Input |
| | | Close | Close | Disabled (Bit B7=0) | Enabled (Bit B12=1) |
| | | Close | Close | Disabled (Bit B7=0) | Enabled (Bit B12=1) |
| 0V/2,5V with saturation | 0Ext - Pext (29-30) | Close | Close | Enabled (Bit B7=1) | Enabled (Bit B12=1) |
| -10V/+10V without saturation | 0Ext - ±10V (29-32) | Open | Open | Disabled(Bit B7=0) | Enabled (Bit B12=1) |
| -10V/+10V with saturation | 0Ext - ±10V (29-32) | Open | Open | Enabled (Bit B7=1) | Enabled (Bit B12=1) |
| Parameter P[15] | EEPROM | Close | Close | Disabled(Bit B7=0) | Disabled (Bit B12=0) |
| Location L[49] | RAM | Close | Close | Enabled (Bit B7=1) | Disabled (Bit B12=0) |

With a 100Kohm linear potentiometer connected as shown in figure 4a, you have the full excursion set with parameter P[16] (with the default value P[16]=4608 there is an excursion of ± 14%); with a 25Kohm linear potentiometer in series with a 3.9Kohm resistor, connected as shown in figure 4b, the effect of the external potentiometer is cut in half (with the default value P[16]=4608 there is an excursion of approximately ± 7%).

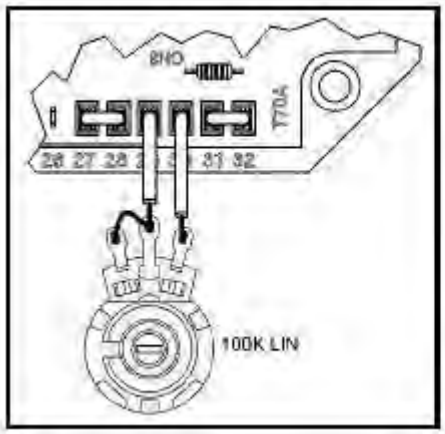



Fig. 4a: 100K external potentiometer connection

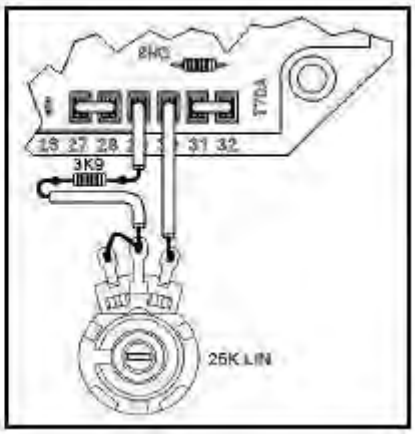



Fig. 4b: 25K external potentiometer connection

### 9. VOLT, STAB, Hz and AMP Trimmers

The trimmers are enabled by the software DxR_Terminal; if they are not enabled, they do not perform any function.
The **VOLT** trimmer allows adjustment from about 75V to about 150V or from about 150V to about 300V.
The **STAB** trimmer adjusts the dynamic response (statism) of the alternator under transient conditions.
The **Hz** trimmer allows for a variation of the "low speed protection" of up to –20% with respect to the nominal speed value set by the 50/60 jumper (if activated) or by the 50/50 box in the **Settings/ UFLO&LAM** menu (at 50 Hz the threshold can be calibrated from 40 Hz to 50 Hz, at 60 Hz the threshold can be calibrated from 48 Hz to 60 Hz).
The **AMP** trimmer adjusts the excitation overcurrent protection intervention threshold.

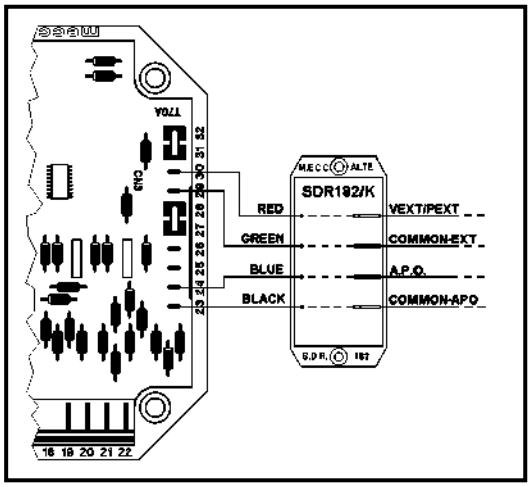



Fig. 5: Connessione filtro EMI SDR182/K

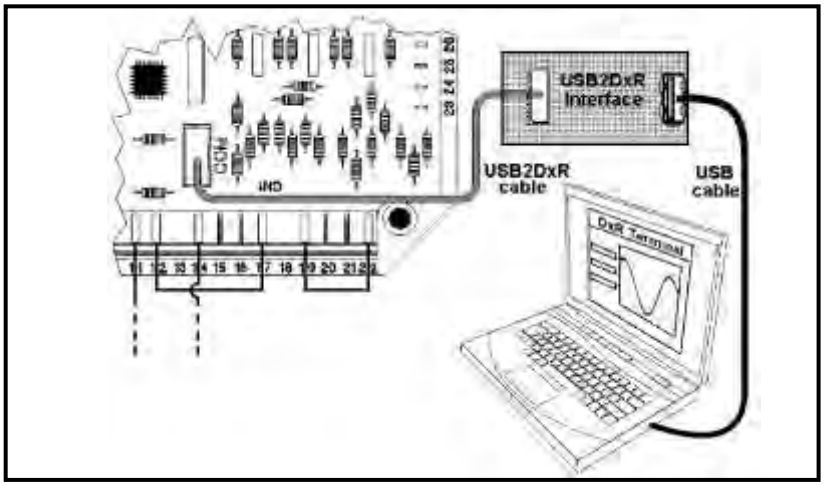



Fig. 6: Connessione tra DER/1 e PC tramite interfaccia digitale USB2DxR

### 10. USB Communications

The COM connector is RESERVED for connection to the USB2DxR communications module through the dedicated cable provided together with the module (see fig. 6).
For the communication, the regulator implements a subsystem of the ModBus standard; the DER1-USB2DxR system performs a “slave” operation the address of which is stored in the DER1 EEPROM and is set during configuration.
Detailed descriptions of the ModBus commands implemented are into the Technical Guide “Digital Regulators Comunication Protocol” available on the web site www.meccalte.com.
The “Master Unit” is made up of a PC or other dedicated equipment and can access the parameters and functions of the regulator.

The master unit has the following possible functions:

- Repetition, or visualisation, of the generator status variables, even from a remote location
- Setting of single parameters
- Uploading and downloading of settings files
- Status readings (alarms, measuring variables)
- Readings of the alarm memory information

## PARAMETERS AND OPERATING DATA

### 1. ModBus registry list

An EEPROM memory is used to store configuration parameters and other information that must not be lost when the generator goes off. Parameters can be read/written and machine operational settings entered through USB connections (with module USB2DxR). Two versions of the regulator are available, called DER1 and DER1/A; they differ primarily in the default value of several parameters. Table 6 shows a complete list of the parameters that can be set, which define all the operational conditions of the regulator.

**TABLE 6 : EEPROM SETTING REGISTRIES**

| Add. | **Description of Parameter** | **Range** | Default | | NOTES |
|---|---|---|---|---|---|
| | | | DER1 | DER1/A | |
| 0 | Firmware revision | 0..65535 | 19 | 19 | Reserved - Do not write |
| 1 | ModBus slave address | 1..31 | 1 | 1 | Identification of RS485 network (or broadcast) |
| 2 | Software configuration | 0..65535 | 16402 | 18962 | Reserved - Do not write |
| 3 | Serial number, high part | 16bit | 0 | 0 | Reserved - Do not write |
| 4 | Serial number, low part | 16bit | 0 | 0 | Reserved - Do not write |
| 5 | Three phase sensing calibration | 0..32767 | 16384 | 16384 | Calibration of voltage channels in 3 ph adjustment |
| 6 | Single Phase sensing calibration | 0..32767 | 16384 | 16384 | Calibration of voltage channels in 1 ph adjustment |
| 7 | Measured voltage calibration | 0..32767 | 16384 | 16384 | Calibration of location L 36 (first “STATUS” box) |
| 8 | Current limit time | 0..32767 | 0 | 0 | Duration of limiting in number of periods |
| 9 | Current limit level | 0..32767 | 32767 | 32767 | Excitation voltage limit upon start-up |
| 10 | Word configuration | 16bit | 7988 | 7988 | Detailed descriptions paragraph 2 table 7 |
| 11 | Shift to LEFT proportional gain | 0..6 | 4 | 5 | n=0…6 is equivalent to a multiplication by $2^n$ |
| 12 | Shift to LEFT integral gain | 0..6 | 3 | 1 | namely 1, 2, 4, 8, 16, 32, 64. |
| 13 | Coefficient tieing Ki to Kp | 0..32767 | 16384 | 26624 | Coefficient to set Ki and Kp separately |
| 14 | Vout / Vaux Ratio | ±32767 | 6000 | 6000 | Limit to voltage reduction as a function of frequency |
| 15 | Reference equivalent to Vext | 0..32767 | 16384 | 16384 | Value used if the Vext input and location L[49] are disabled |
| 16 | Limitation of Vext Variation | 0..6553 | 4608 | 4608 | Limits the effect of external analogical input (0->0; 4608->14%) |
| 17 | APO delay & alarm settings | 0..65535 | 254(1) | 254(1) | Selects alarms that activate the APO contact and sets the delay intervention |
| 18 | Step limitation reference | 1..1000 | 50 | 50 | For rapid variations of voltage setpoint, the passage from one value to another takes place through added or subtracted steps at each period. |
| 19 | Vout Reference | 0..32767 | 0 | 0 | Value used if the VOLT trimmer is disabled |
| 20 | Stability | 0..32767 | 16384 | 16384 | Value used if the STAB trimmer is disabled |
| 21 | Freq. threshold ± 10% $freq_{nom}$ | 0..32767 | 16384 | 16384 | Value used if the Hz trimmer is disabled |
| 22 | Excitation overcurrent threshold | 0..32767 | 16384 | 16384 | Value used if the AMP trimmer is disabled |
| 23 | V/F Slope | 0..32767 | 9000 | 9000 | V/F curve slope during normal operation |
| 24 | V/F curve slope at start up | 0..32767 | 6000 | 6000 | Used only upon start up |
| 25 | Short circuit time | 0..255 | 20 | 20 | Operating time with short circuited alternator, expressed in tenths of seconds (0 ….. 25.5 seconds) [0=excluding STOP] |
| 26 | Overspeed threshold | ±32767 | 0 | 0 | Variation (±10%) of overspeed alarm intervention with respect to the default value of 55/66Hz |
| 27 | Underexcitation threshold (1)(3) | 0..32767 | 512 | 512 | Under-excitation alarm threshold (1) |
| 28 | Ki over-excitement Regulator | 0..32767 | 12287 | 12287 | Integral gain of excitation voltage regulator |
| 29 | AMP slope (f) (1) (3) | 0..32767 | 15154 | 15154 | AMP (f) (1)(3) overexcitation protection slope |
| 30 | Thermal dispersion coefficient | 0..65535 | 63600 | 63600 | Used by AMP alarm temperature estimator |
| 31 | Reserved | 0..65535 | - | - | Do not write |

Note:Locations are ordered to separate the parameters of individual regulators (S.N:, SW versions and calibration) from settings foreseen, in order to facilitate programming of regulators with the same settings but different S.N., SW versions and calibrations. The parameters from 0 to 9 are adjusted at the factory for each regulator. The parameters from 10 to 30 can therefore be freely copied from one to another.

NOTE (1): starting from rev. 18 of the firmware
NOTE (2): shutdown intervention threshold not to be changed in the versions preceding the 18th
NOTE (3): proportional gain of excitation voltage regulator in the versions preceding the 18th

### 2. Configuration word (Parameter P[10])

Configuration of the regulator takes place by setting the individual bits of parameter P[10]. Each of them enables or disables at least one function, on the basis of the fact that its value is respectively 1 or 0.
If the "DxR Terminal" programme is used (see technical guide “Interface communication USB2DxR"), the setting is simplified by the use of the dedicated flags in the different menu corresponding to the specific bit which enables/disables each function.

Alternatively, the DER1 can be configured by directly setting the value of the P[10] parameter; in this case the value is calculated before entry, summing the numbers indicated in the column "Value" of Table 7, corresponding to the functions it is desired t enable.
For example, the default configuration calls for the bits B2, B4, B5 and those from B8 to B12 to be enabled. The corresponding value is therefore: P[10]=4+16+32+256+512+1024+2048+4096=7988.

**TABLE 7 : BIT FUNCTION OF THE CONFIGURATION WORD (PARAMETER P[10] )**

| Bit | Value | Function | Default |
|---|---|---|---|
| B0 | 1 | Not used | 0 |
| B1 | 2 | Periodical reference variation | 0 |
| B2 | 4 | Automatic voltage offset compensation(1) | 1 |
| B3 | 8 | Not used | 0 |
| B4 | 16 | Enable hardware jumper 50/60Hz | 1 |
| B5 | 32 | Inversion APO(4) | 1 |
| B6 | 64 | Force three-phase sensing | 0 |
| B7 | 128 | External location reference L[49] (2) and activation of saturation in the event of overflow(3) | 0 |
| B8 | 256 | Enable VOLT TRIMMER | 1 |
| B9 | 512 | Enable STAB TRIMMER | 1 |
| B10 | 1024 | Enable Hz TRIMMER | 1 |
| B11 | 2048 | Enable AMP TRIMMER | 1 |
| B12 | 4096 | Enable external analogical input | 1 |
| B13 | 8192 | Enable external DAC | 0 |
| B14 | 16384 | 60 Hz setting in the event of disabling of the 50/50 Hz hardware jumper | 0 |
| B15 | 32768 | Reserved | 0 |

NOTE (1): only with single-phase reference
NOTE (2): if analogical input is disabled
NOTE (3): for analogical input
NOTE (4): starting from rev. 18 of the firmware

### 3. RAM location reference, activation of saturation in analogical remote control

The **RAM Voltage CTRL** Flag (corresponding to bit 7 of the P[10] configuration word) performs two functions:

1. If the Pext hardware input is enabled (Flat Ext. Input corresponding to bit 12 of the P[10] configuration word), as previously described, the **RAM Voltage CTRL Flag** activates saturation of output voltage when the analogical control voltage reaches the limit foreseen for input, to which it is applied (see Para. 8 Remote control of voltage).

If saturation is enabled, in the event of removal of the Vext/Pext connection (due to accidental opening, for example) the voltage goes to the maximum value set in parameter P[16] (+14% by default).

2. When Pext is disabled by hardware, the indicated flag defines the value to be used by the software control of the output voltage. If RAM Voltage CTRL is deactivated (B7=0), the non volatile parameter P [15] is used (therefore following shut down and restart of the regulator, the last value memorised remains set): on the start up the location L[49] is initialised with the value of parameter P[15] and is kept aligned to that value. Editing of location L[49] has no effect in this working condition. If RAM Voltage CTRL is active (B7=1) the volatile location L[49] is used for software remote control of the output voltage (when the regulator is energized, the value is stored. If the regulator is shut down, the value is lost). This function is particularly useful for the applications of alternators in parallel with grid, when the regulation of the reactive power exchanged is controlled by means of a third party supplied digital supervisor.

**TABLE 8 : REMOTE VOLTAGE CONTROL FLAGS FUNCTION**

| FLAG **RAM Voltage CTRL** | P[10] Bit B7 | FLAG **Ext. Input** | P[10] Bit B12 | Output voltage control type |
|---|---|---|---|---|
| ❒ | 0 | ✓ | 1 | Analogical without saturation |
| ✓ | 1 | ✓ | 1 | Analogical with saturation |
| ❒ | 0 | ❒ | 0 | Digital - Parameter P[15] |
| ✓ | 1 | ❒ | 0 | Digital - Location L[49] |

## 4. Volatile memory addresses

| TABLE 9 : VOLATILE MEMORY ADDRESSES | | | | |
|---|---|---|---|---|
| Add. | **Add name** | **Range** | **Access** | **Description** |
| 32 | VOLT Trimmer | 0..32767 | Read only | VOLT Trimmer Position |
| 33 | STAB Trimmer | 0..32767 | Read only | STAB Trimmer Position |
| 34 | Hz Trimmer | 0..32767 | Read only | Hz Trimmer Position |
| 35 | AMP Trimmer | 0..32767 | Read only | AMP Trimmer Position |
| 36 | First status word | 0..3200 | Read only | Regulated voltage [tenths of volts] |
| 37 | Second status word | 0..900 | Read only | Frequency [tenths of Hz] |
| 38 | Third status word | 16bit | Read only | Active alarms |
| 39 | Fourth status word | 16bit | Read only | Active configuration |
| 40 | Commands | 16bit | Write | Reserved Word Commands – Do not use |
| 41 | Pext/Vext Inputs | 0..32767 | Read only | Analogical input or external potentiometer value |
| 42 | Setpoint | 0..32767 | Read only | Setpoint value |
| 43 | Setpoint | 0..32767 | Read only | Value modified by regulator in case of alarms, soft-start, etc. |
| 44 | Measured Voltage | 0..32767 | Read only | Internal variable |
| 45 | Estimated temperture | 0..32767 | Read only | Estimates temperature of exciter windings |
| … | … | | | … |
| 49 | Reference corresponding to Vext | 0..32767 | Write | Used if Vext input is disabled and voltage remote control by RAM location is enabled (P[10]-Bit B7=1) |
| 50 | Peak to peak voltage | 0..32767 | Read only | Internal variable |
| 51 | Three phase switch threeshold | 0..32767 | Read only | Internal variable |
| 52 | Offset voltage | 0..32767 | Read only | Internal variable (active only in single phase sensing) |
| 53 | $Kp/2^{P[11]}$ | 0..32767 | Read only | Proportional gain not considering factor $2^{P[11]}$ (1) |
| 54 | $Ki/2^{P[12]}$ | 0..32767 | Read only | Integral gain not considering factor $2^{P[12]}$ (1) |
| 55 | AMP protection threshold | 0..32767 | Read only | Intervention threshold of overexcitation protection(1) |
| 56 | Underexcitation observer | 0..32767 | Read only | Observer of underexcitation or loss of excitation (2) |

## 5. Fourth Status Word (Location L[39])

Location L[39] indicates (almost in real time) the active configuration at any given time; it is not a simple replication of the value recorded in parameter P[10], however, inasmuch as the bits B2, B6 and B14 adjust their value only on the basis of the configuration set, but also of the effective operational status of the DER1 at that time; for example, if the regulator is connected with three phase sensing, even if bit B6 of the configuration word is set on 0 (automatic recognition of single phase – three phase activation), bit B6 of location L[39] will have a value of 1; similarly, if the 60 Hz jumper is engaged and reading is enabled 8Bit B4 of parameter P[10] set on 1), bit B14 of location L[39] will have a value of 1 even if the corresponding bit B14 of the configuration word is set on 0.
The values of the fourth word of status (location L[39]) are shown in table 10, on the basis of the type of the regulation and nominal frequency.

| TABLE 10 :STANDARD VALUES OF THE FOURTH STATUS WORD (LOCATION L[39]) | | |
|---|---|---|
| | Rated frequency: | |
| Sensing | 50Hz | 60Hz |
| Single phase | 7988 | 24372(2) |
| Three phase | 8048(2) | 24432(2) |

| TABLE 11 : BIT FUNCTION OF THE FOURTH STATUS WORD L[39] ( ACTIVE CONFIGURATION ) | | | |
|---|---|---|---|
| **Bit** | Function | **Value** | Default |
| B0 | Not used | 1 | 0 |
| B1 | Bit activating a periodical variation of reference voltage | 2 | 0 |
| B2 | Bit activating automatic compensation of the offset in voltage acquisition channels | 4 | 0/1 (1) |
| B3 | Not used | 8 | 0 |
| B4 | Bit enabling reading of 50/60 Hz jumper hardware | 16 | 1 |
| B5 | Inversion APO(2) | 32 | 1 |
| B6 | Three phase sensing active | 64 | 0 |
| B7 | Voltage remote control by RAM location L[49] or input saturation ( in case of overflow ) | 128 | 0 |
| B8 | Bit enabling reading of reference voltage by VOLT Trimmer | 256 | 1 |
| B9 | Bit enabling reading of stability parameter by STAB Trimmer | 512 | 1 |
| B10 | Bit enabling reading of underspeed protection threshold by Hz Trimmer | 1024 | 1 |
| B11 | Bit enabling reading of excitation current threshold by AMP Trimmer | 2048 | 1 |
| B12 | Bit enabling reading of external voltage input | 4096 | 1 |
| B13 | Bit enabling DAC | 8192 | 0 |
| B14 | 60Hz active setting (jumper 60Hz closed and/or 60Hz active setting on configuration menu)(3) | 16384 | 0/1 (1) |
| B15 | Reserved | 32768 | 0 |

NOTE (1): depending on the sensing and nominal frequency
NOTE (2): starting from revision 18 of the firmware
NOTE (3): software configuration, with jumper 50/60 disabled

# SETTING OF VOLT, STAB, AMP and Hz PARAMETERS.

## 1. Voltage

### 1.1 Setting voltage.

Setting can take place through the trimmer or software: on sensing inputs 6/7 – 10/11/12 (with bridge 8-9), 15-16 and 20-21, the voltage can be set between 75÷150 Vac (scale H); on sensing inputs 4/5 - 9/10/11/12, 14-17 and 19-22 between 150÷300 Vac (scale F).
There are two ways to set from minimum to maximum value:

1. With the VOLT trimmer, which must be enabled by the **Settings/potentiometers** menu of DxR Terminal software
2. With parameter P[19] (The Volt trimmer must be enabled from the **Settings/Potentiometers** menu:

the value 0 corresponds to minimum voltage, 16384 corresponds to the intermediate value (respectively 112.5 V and 225 V), while 32767 corresponds to maximum voltage.
The setting is facilitated using the software DxR Terminal, through **Settings/Potentiometers menu.**

It is possible to vary voltage with respect to the value set, with the Pext input (terminals 29-30) if enabled from the area Pext/Vext in the **Settings/Advanced** menu, with a 25Kohm or 100Kohm potentiometer, with a range of variation that can be programmed up to ±100% (parameter P[16]. The default setting is ± 14%, even if it is opportune not to exceed ±10%). Alternatively, variation can be made with continuous voltage applied on Pext (terminal 30) or ±10V (terminal 32), based on the value of that voltage. If the Pext voltage is disabled, it is possible to vary the voltage with parameter P[15] or location L[49]. For additional details see the paragraph "Remote control of voltage".

### 1.2 Soft Start

In the event of fast start up of the prime mover or sudden regulator excitation with the generator running at nominal speed an uncontrolled regulator could result in a temporary generator overvoltage or in a transitory prime mover overload due to the high peak of excitation current..
These effects can be minimised by setting parameter “Delay” and “Excitation Limit” in the area “Soft-Start” of the **Settings/Advanced** menu, corresponding to parameters P[8] and P[9] : during starting, they determine a limit of the excitation current.
Parameter P[8] sets the duration of the excitation current limitation, namely the value of the parameter corresponds to the number of periods in which the limitation is active. The default value is P[8]=0 which corresponds to deactivation of the soft start. Considering that in most cases the alternator is already at nominal speed, an estimate in temporal terms (corresponding to the setting “Delay” in Soft-Start area) for 4 pole machines, may be obtained with the formula:

$$t_{\lim} = P[8] \cdot \frac{1}{f_n} = P[8] \cdot \frac{30}{\omega_n}$$ Where $f_n$ = nominal frequency in Hz or $\omega_n$ = nominal speed in R.P.M

The parameter P[9] sets the excitation current limit: the value P[9]=0 is setting to zero the excitation current, while the maximum value P[9]=32767 is removing the current limitation. The default value is P[9] =32767. When the interval of action of the soft start has been exceeded, the output voltage moves to the value set. The rapidity of the change is set by parameter P[18] (see paragraph on "Slow voltage variations”)

The optimal values of “Delay” and “Excitation limit” (parameters P[8] and P[9]) depend a great deal on the type of alternator and final application and it must be found through experimentation. An inappropriate setting of parameters P[8] and P[9] could cause failure of the alternator to excite itself.

By way of example, for high power alternators of the ECO46 series, the following settings may be experimented: Delay=1280ms (P[8]=64) and Excitation limit=50% (P[9]=16384); for low power alternators of the ECP3 series, the effects of a reduction of both the duration and limitation of the current may be experimented, such as Delay=320ms (P[8]=16) and Excitation limit=3,72% (P[9]=4096).

### 1.3 Slow voltage variations

In the event of rapid variation of the reference, a procedure of "slow" variation has been foreseen: in response to a step variation, parameter P[18] determines the rapidity with which the transition is made.
A value of 1 involves the slowest possible variation; a value exceeding 100 involves an almost immediate variation. The value 0 disables any variation.

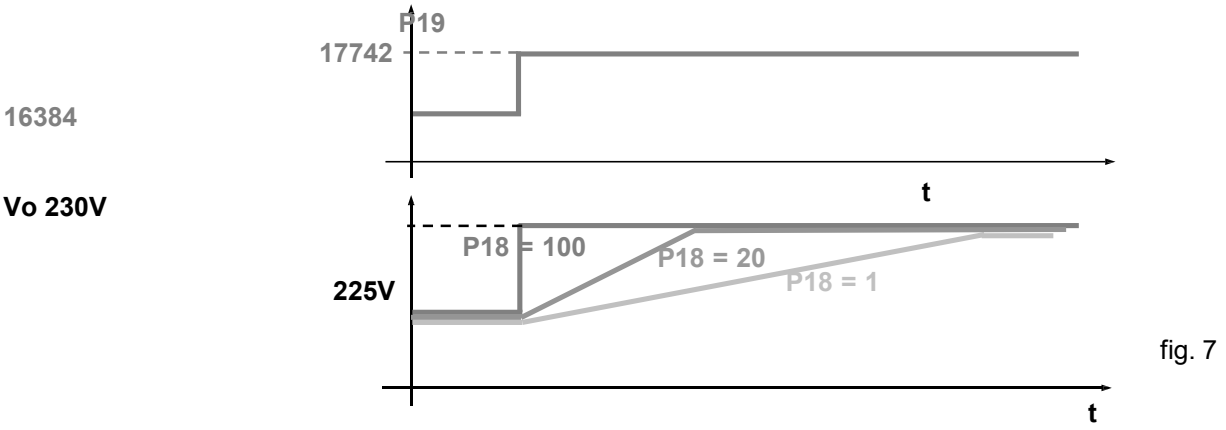



fig. 7

## 2. Stability

### 2.1 Adjustment of stability

The regulator diagram is shown in figure 8.

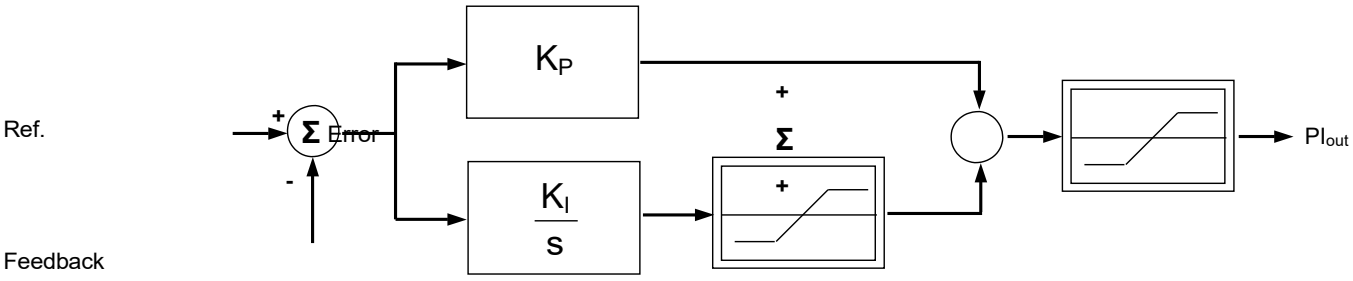



figure 8 : Regulator Diagram

The values of the proportional and integral gain ($K_P$ and $K_I$ respectively) depend on the position of the STAB trimmer if enabled, or the value of parameter P[20] if the trimmer is disabled. The value of the proportional gain $K_P$ also depends on the value of the P[11] parameter. The value of the integral gain $K_I$ depends on the values of parameters P[12] and P[13] and, only for the standard DER1 (grey box) with the STAB trimmer enabled, even on the 50/60Hz(1) setting. In the other DER1 versions, for example DER1/A (blue box), the integral gain $K_I$ does not differ no matter how the 50/60Hz(4) setting is set.
The numeric elaborations carried out by the DER1 for obtaining the proportional and integral gain values are given in the block diagrams in figures 8a(2), 8b(2) and 8c .

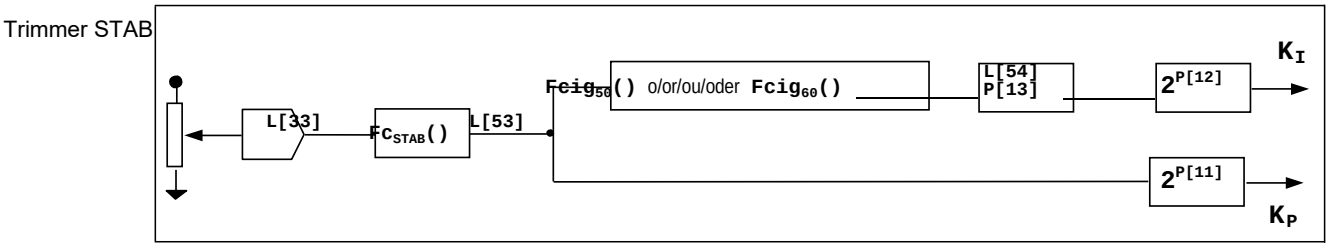



fig. 8a: drawing of the numeric elaboration of the proportional and integral gain by a DER1 (standard) with the STAB trimmer enabled

If the STAB trimmer is enabled (STAB Flag Trimmer present) its angular position, available at location L[33], is transformed by the $Fc_{ST}{}^{(2)}_{AB}$ function into the numeric value available at location L[53] (3) (figs. 8a and 8b). If the STAB trimmer is disabled, the value of location L[53](3) directly becomes the value set using the P[20] parameter (fig. 8c).
The proportional gain $K_P$ is obtained by multiplying the value of location L[53](3) by a coefficient that depends on the value given in parameter P[11](4).

Trimmer STAB

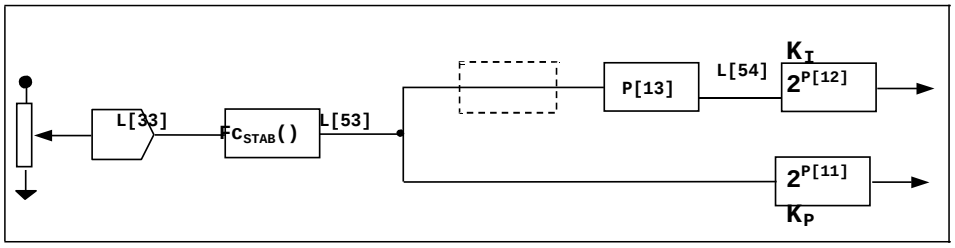



fig. 8b: drawing of the numeric elaboration of the proportional and integral gain by a DER1/A with the STAB trimmer enabled

The integral gain, available at location L[54](3) minus the multiplication by a coefficient, depends on the value of the proportional gain at location L[53](3); in the standard DER1 (grey box) with the STAB trimmer enabled (STAB Flag Trimmer present) the value of location L[53](3) at 50Hz is transformed by the function $Fcig_{50}{}^{(2)}$ and by the multiplication of the value of parameter P[13], in the numeric value available at location L[54](3); at 60Hz the transformation function is $Fcig_{60}$ (2), different from that at 50Hz, (fig. 8a); in the other versions of the DER1 (fig. 8b), for example DER1/A (blue box), or if the STAB trimmer is disabled(4) (fig. 8c), not only is there a difference between the integral value at 50Hz and at 60Hz, but even the value of location L[54](3) is obtained by simply multiplying the proportional gain at location L[53](3) by the value of parameter P[13].

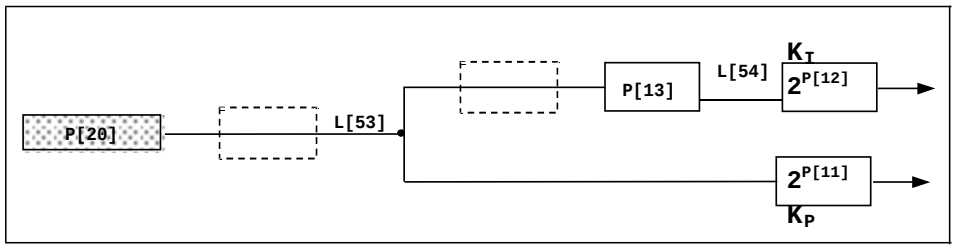



fig. 8c: drawing of the numeric elaborations of proportional and integral gain by all DER1 with STAB trimmer disabled

In both cases, the effective integral gain $K_I$ is obtained by multiplying the value of location L[54](3) by a coefficient that depends on the value given in parameter P[12](4).

The mentioned coefficients can take on values of 1, 2, 4, 8, 16, 32 or 64 according to the values written in parameters P[11] (for proportional gain) and P[12] (for integral gain); these values represent the value assigned to base 2 (fixed) to obtain the required coefficient (e.g. parameter P[11] = 4 => multiplication coefficient of the proportional gain = $2^4$ = 16, P[12] = 3 => multiplication coefficient of the integral gain = $2^3$ = 8).

The following tables show, for every three-phase machine on 50Hz and 60Hz, the STAB trimmer calibration which allows increased speed of response to the transistor with the generator in stand-alone operation. In case of different applications (for example alternators reconnected in single-phase, in parallel among them or in parallel with the grid, with motors having less than 4 cylinders and so on) it may be necessary to readjust the STAB trimmer calibration.
If the voltage cannot be stably adjusted for permanent operation and/or in the transient by the STAB trimmer settings, it may be necessary to vary one or more stability adjustment parameters: P[11], P[12] and P [13] the description of which is given in table 6.

NOTE (1) Starting from Rev. 15 of the firmware
NOTE (2) The $Fc_{STAB}$, $Fcig_{50}$ and $Fcig_{60}$ functions are not implemented in the DER1s with firmware up to version 14, and in the block diagram they are considered as identities, i.e. L[53](3)=$Fc_{STAB}$(L[33])=L[33] e $Fcig_{60}$(L[53] ) = $Fcig_{50}$(L[53])=L[53](3). With these regulators the STAB trimmer needs to be rotated by less than two notches counted clockwise.
NOTE (3) Location available to the user from firmware Rev. 15.
NOTE (4) Structure valid also for DER1s with firmware up to version 14 but without location L[53] and L[54] availability

| TABLE 12 ECO/ECP SERIES: RECOMMENDED SETTINGS OF DER1 STAB TRIMMER Fw Rel. ≥ 15 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Alternator** | | **Nominal frequency = 50Hz** | | | | | | |
| **Type** | **Pole** | **S [KVA]** | **Singlephase** | | | **Threephase** | | |
| | | | **STAB** | **L[33]** | **L[53]** | **STAB** | **L[33]** | **L[53]** |
| ECO38-1SN/4 (1) | 4 | 180 | n.d. | n.d. | n.d. | **6** | 16384 | 8192 |
| ECO38-2SN/4 (1) | 4 | 200 | n.d. | n.d. | n.d. | **8** | 24191 | 17859 |
| ECO38-3SN/4 (1) | 4 | 225 | n.d. | n.d. | n.d. | **8,5** | 26176 | 20910 |
| ECO38-1LN/4 (1) | 4 | 250 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| ECO38-2LN/4 (1) | 4 | 300 | n.d. | n.d. | n.d. | **8** | 24191 | 17859 |
| ECO38-3LN/4 (1) | 4 | 350 | **11** | 32704 | 32640 | **9** | 28096 | 24090 |
| ECO40-1S/4 (2) | 4 | 400 | **11** | 32704 | 32640 | **9** | 28096 | 24090 |
| ECO40-2S/4 (2) | 4 | 450 | **11** | 32704 | 32640 | **8,5** | 26176 | 20910 |
| ECO40-3S/4 (2) | 4 | 500 | **9,5** | 30077 | 27607 | **9** | 28096 | 24090 |
| ECO40-1L/4 (2) | 4 | 550 | **9** | 28096 | 24090 | n.d. | n.d. | n.d. |
| ECO40-1.5L/4 (2) | 4 | 620 | **9** | 28096 | 24090 | **9,5** | 30077 | 27607 |
| ECO40-2L/4 (2) | 4 | 680 | **11** | 32704 | 32640 | n.d. | n.d. | n.d. |
| ECO40-VL/4 (2) | 4 | 720 | **9,5** | 30077 | 27607 | n.d. | n.d. | n.d. |
| ECO43-1SN/4 (2) | 4 | 800 | **9** | 28096 | 24090 | n.d. | n.d. | n.d. |
| ECO43-2SN/4 (2) | 4 | 930 | **9** | 28096 | 24090 | n.d. | n.d. | n.d. |
| ECO43-1LN/4 (2) | 4 | 1100 | **9** | 28096 | 24090 | n.d. | n.d. | n.d. |
| ECO43-2LN/4 (2) | 4 | 1300 | **9** | 28096 | 24090 | n.d. | n.d. | n.d. |
| ECO43-VL/4 (2) | 4 | 1400 | **9** | 28096 | 24090 | n.d. | n.d. | n.d. |
| ECO46-1S/4 (2) | 4 | 1500 | **8** | 24191 | 17859 | n.d. | n.d. | n.d. |
| ECO46-1.5S/4 (2) | 4 | 1650 | **9,5** | 30077 | 27607 | **9,5** | 30077 | 27607 |
| ECO46-2S/4 (2) | 4 | 1800 | **11** | 32704 | 32640 | **9,5** | 30077 | 27607 |
| ECO46-1L/4 (2) | 4 | 2100 | **9,5** | 30077 | 27607 | n.d. | n.d. | n.d. |
| ECO46-1.5L/4 (2) | 4 | 2300 | **11** | 32704 | 32640 | **9** | 28096 | 24090 |
| ECO46-2L/4 (2) | 4 | 2500 | **9** | 28096 | 24090 | n.d. | n.d. | n.d. |

| **Alternator** | | **Nominal frequency = 60Hz** | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **Type** | **Poli** | **S [KVA]** | **Singlephase** | | | **Threephase** | | |
| | | | **STAB** | **L[33]** | **L[53]** | **STAB** | **L[33]** | **L[53]** |
| ECO38-1SN/4 (1) | 4 | 216 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| ECO38-2SN/4 (1) | 4 | 240 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| ECO38-3SN/4 (1) | 4 | 270 | n.d. | n.d. | n.d. | **8** | 24191 | 17859 |
| ECO38-1LN/4 (1) | 4 | 300 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| ECO38-2LN/4 (1) | 4 | 360 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| ECO38-3LN/4 (1) | 4 | 420 | **8,5** | 26176 | 20910 | **9** | 28096 | 24090 |
| ECO40-1S/4 (2) | 4 | 480 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| ECO40-2S/4 (2) | 4 | 540 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| ECO40-3S/4 (2) | 4 | 600 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| ECO40-1L/4 (2) | 4 | 660 | **8,5** | 26176 | 20910 | n.d. | n.d. | n.d. |
| ECO40-1.5L/4 (2) | 4 | 744 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| ECO40-2L/4 (2) | 4 | 816 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| ECO40-VL/4 (2) | 4 | 864 | **9** | 28096 | 24090 | n.d. | n.d. | n.d. |
| ECO43-1SN/4 (2) | 4 | 960 | **8,5** | 26176 | 20910 | n.d. | n.d. | n.d. |
| ECO43-2SN/4 (2) | 4 | 1116 | **8,5** | 26176 | 20910 | n.d. | n.d. | n.d. |
| ECO43-1LN/4 (2) | 4 | 1320 | **8,5** | 26176 | 20910 | n.d. | n.d. | n.d. |
| ECO43-2LN/4 (2) | 4 | 1560 | **8** | 24191 | 17859 | n.d. | n.d. | n.d. |
| ECO43-VL/4 (2) | 4 | 1700 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| ECO46-1S/4 (2) | 4 | 1800 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |
| ECO46-1.5S/4 (2) | 4 | 1980 | n.d. | n.d. | n.d. | **9** | 28096 | 24090 |
| ECO46-2S/4 (2) | 4 | 2160 | **9,5** | 30077 | 27607 | **9** | 28096 | 24090 |
| ECO46-1L/4 (2) | 4 | 2520 | **8,5** | 26176 | 20910 | n.d. | n.d. | n.d. |
| ECO46-1.5L/4 (2) | 4 | 2760 | n.d. | n.d. | n.d. | **8,5** | 26176 | 20910 |
| ECO46-2L/4 (2) | 4 | 3000 | n.d. | n.d. | n.d. | n.d. | n.d. | n.d. |

## 3. EXCITATION OVERCURRENT

### 3.1 Description

The DER1 regulator is equipped with an excitation (main rotor) winding temperature estimator. An estimate of the temperature (in relative values) is available in real time (and it can be read) in location 45; in the lower part of the main window of the DxR terminal software there is a graphic representation of location 45. The progress of the temperature is of the exponential type (see figure 9).
Through parameter P[22] or the AMP trimmer, it is possible to define a limit (which involves intervention of alarm 5) to the excitation voltage and therefore to the temperature.
The function of this alarm is not only to signal an excessive temperature, but it also has an active function in reducing the cause. In fact, an adjustment ring takes control of the voltage generated when the threshold set is exceeded: This reduces the voltage to the point of reducing the excitation current by a value compatible with the ability of thermal dissipation of the machine. The stability of the regulation in case of overexcitation alarm, if necessary, may be adapted to the application by varying the value of parameter 28[(5)]
For an increased protection of the electrical machine, starting from rev. 18 of the firmware, the excitation overcurrent protection was extended to the whole speed interval (frequency) of the alternator, particularly for the lower frequencies, to a preset threshold (56.7Hz with the jumper inserted between the 25 and 26 terminals of connector CN1, if enabled, or, otherwise, if the 50/60, 49Hz setting is enabled) the protection intervenes with an effective threshold (relative to the one set through the AMP trimmer or parameter 22) reduced proportionally to the frequency.
The extent of this reduction depends on parameter 29 which is by default set to an adequate value for the standard alternators, used in three-phase in nominal voltage.
An increment of the value of P[29] determines a bigger reduction of the intervention threshold, based on the frequency reduction, a decrease of the value of P[29] determines a smaller reduction of the intervention threshold.

Caution !

If the magnetic gain of the alternator is high, unstable events may occur when the protections inter- venes, therefore it is necessary to adjust parameter 28 (usually by reducing its value).
When the alternator works with reduced load and speed, overheating, which is dangerous to the integrity of the machine, might occur, if the overcurrent protection threshold is not sufficiently reduced when reducing the frequency.

As you can see in figure 9, when the estimated temperature (represented by the continuous line) reaches the threshold value, the reduction of excitation current (and consequent drop in voltage generated) brings about the stabilisation of the temperature near a limit value.

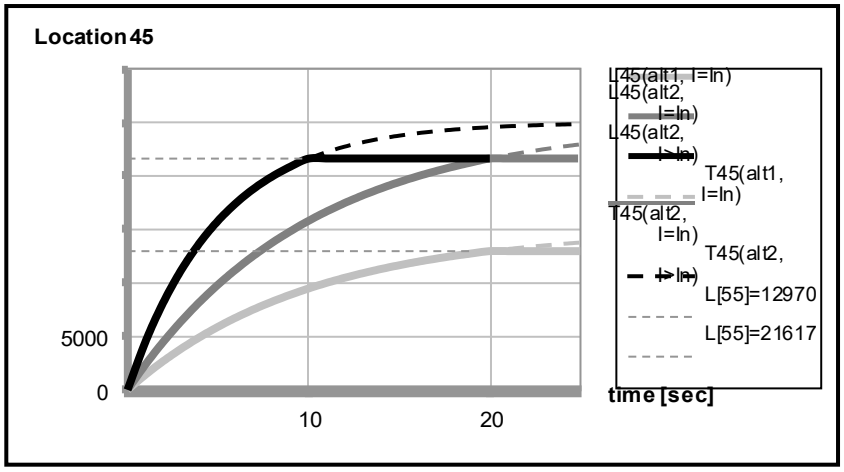



fig. 9

(1) Nominal load and 90% of nominal frequency
(2) with load greater than the nominal one
(3) tarting from rev.15 of the Firmware
(4) starting from rev.15 of the Firmware, L[35] for the previous versions
(5) Starting from rev. 18 of the firmware only the integral gain of the excitation overcurrent regulator can me modified.

**Curve Description**

L[45] (alt1, I=In) : value read at location L[45] with a certain alternator [(1)]
L[45] (alt2, I=In) : value read at location L[45] with a second alternator of a different type [(1)]
L[45] (alt2, I>In) : value read at location L[45] with the second alternator during overloading [(2)]
T[45] (alt1, I=In) : value that would be read at location L[45]with the first alternator, without protection [(1)]
T[45] (alt2, I=In) : value that would be read at location L[45] with the second alternator, without protection [(1)]
T[45] (alt2, I>In) : value that would be read at location L[45] with the second alternator during overloading, without protection [(2)].
L[55]=12970 : Represents the value of the current limit set using the AMP trimmer or the P[22] parameter for the first alternator[(3)]
L[55]=21617 : Represents the value of the current limit set using the AMP trimmer ot the P[22] parameter for the second alternator[(3)]

### 3.2 Calibration with a supervision unit

To calibrate the overload protection, when the machine is cold, perform the following procedure:

1) turn the AMP trimmer fully clockwise (if enabled from the **Settings/Potentiometers** menu) or write 32676 in location 22
2) feed the alternator an overload having cosphi = 0.8 or cosphi = 0 respectively equal to 125% or 110% of the nominal load
3) read the value displayed at location 45 2 minutes after overload application
4) if the AMP trimmer is enabled turn it anti-clockwise until the value read at location 55[(4)] becomes equal to the value read at point 3 (location 45); the operation is simplified a lot by using the DxR terminal software which provides, in the lower part of the main window, a graphic representation of the time evolution of locations 45 ("real excitation", red line) and 55 ("excitation threshold" - yellow line): the intervention threshold must be calibrated so that the yellow line should intersect the red line when, from the application of the overload, the time specified at point 3 has passed.
5) if the AMP trimmer is not enabled, write the value read at point 3 (location 45) in location 22.
6) Alarm 5 should set off (visible both on the main panel of the DxR Terminal and through a change in the LED flash) and the voltage should start to decrease
7) If the load is removed, alarm 5 disappears after a few seconds and the generator voltage goes back to the nominal value.

### 3.3 Calibration without a supervision unit

NB: this calibration can be performed only if the AMP trimmer was previously enabled.
To calibrate the overload protection, perform the following procedure:

1) turn the AMP trimmer fully clockwise
2) feed the alternator an overload having cos phi = 0.8 or cos phi = 0 respectively equal to 125% or 110% of the nominal load
3) after two minutes slowly turn the AMP trimmer anti-clockwise until you get a reduction of the generator's voltage value and the activation of alarm 5 (visible through a change in the LED flash)
4) Calibrate the AMP trimmer so as to get an output voltage value of 97% of the nominal value: alarm 5 is still active.
5) If the load is removed, alarm 5 disappears after a few seconds and the generator voltage goes back to the nominal value.

NOTES: If the machine is used in single phase or voltages different to the ones set by the pro- ducer, a recalibration of the overexcitation protection might be necessary.
If it is not possible to apply the prescribed overload, the overexcitation condition may be simulat- ed by adequately increasing the regulated voltage so as to get an excitation current equivalent to the overload current.

## 4. Underspeed

### 4.1 Description

For speeds lower than a programmable threshold, the machine voltage is no longer constant, but is regulated proportionately with the frequency at a ratio, which is also programmable, as shown in figure 10a e 10b. The intervention threshold depends upon:

- the status of jumper 50/60 (terminals 25 and 26) if enabled from the **Settings/UFLO&LAMS** Menu.
- the status of the 50/60 setting in the **Settings/UFLO&LAMS** Menu
- the position of the Hz trimmer if enabled from the **Settings/Potentiometers** Menu
- the value entered at parameter P[21] **(ref. Settings/UFLO&LAMS menu** or area Transmit/Receive of Settings/Advanced menu).

Activation of the function with voltage proportionate to the frequency is signalled by activation of alarm 6 (visible from the DER1 Terminal control panel and due to a change in the flashing indicator light).

**Parameter P[21]**(equivalent to the Hz trimmer) sets the Underspeed protection intervention threshold; if this is set on 16384, the protection cuts in at 45 Hz (if the 50/60 jumper and 50/60 flag in the **Settings/ UFLO&LAM** menu are not present) or at 54 Hz (if the 50/60 jumper is enabled or the 50/60 flag is active in the **Settings/UFLO&LAM** Menu). Values between 0 and 16384 proportionately lower the threshold, respectively to 40 Hz and 48 Hz; values between 16384 and 32767 proportionately raise the threshold, respectively to 50 Hz and 60 Hz.
Once the underspeed protection has intervened, the frequency is proportionately reduced, as indicated in figure 9a and 9b.

**Parameter P[23]** sets the slope of the voltage/frequency curve; the default value is 9000. An increase in the value of P[23] involves a greater reduction of the voltage as a function of the reduction in frequency. A decrease in the value of P[23] involves a lower reduction of the voltage until the limit of P[23]=0, which means that there is no reduction in voltage. . The above-mentioned calibrations are simplified a lot by using the DxR terminal software which allows, in the **Settings/UFLO&LAMS** menu, through a graphic interface, to change parameters 21 and 23 (with a concurrent disabling of the Hz trimmer) providing the preview of the V/f ratio in the setting phase.

**WARNING:** Overheating could occur, which is dangerous for the machine, if the voltage is not lowered enough to decrease the excitation when the alternator is functioning at a reduced speed

### 4.2 Calibration with a supervision unit

Use the following procedure in order to calibrate the underspeed protection:

1) If the machine has to operate at 60 Hz, make sure the bridge, between terminals 25 and 26 is inserted, or activate 50/60 (ref**. Settings/UFLO&LAMS** menu).
2) If the Hz trimmer is enabled, the value of the protection intervention threshold is read at location L[34], otherwise it is entered directly at parameter P[21].

The value 16384 entered at parameter P[21] (or read at location L[34]) corresponds to an intervention at 45/54 Hz (depending on whether 50/60 is activated or not).
Values between 0 and 16384 correspond to an intervention that varies from 40/48 Hz to 45/54Hz. Values between 16384 and 32767 correspond to an intervention that varies from 45/54 Hz to 50/60Hz.
The operation is much facilitated by the use of the DxR terminal software which provides a graphic representation of the time evolution of the measured frequency (red line) and of the intervention threshold (green line)

3) when the speed decreases under the threshold value the voltage of the generator starts to diminish and alarm 6 is simultaneously visualized on the LED and on the main window of the DxR Terminal software
4) By increasing speed, the generator voltage will normalise and the 6 alarm will disappear.

### 4.3 Calibration without a supervision unit

NOTE: This calibration can be performed only if the Hz trimmer and 50/60 jumper have been previously enabled.
Use the following procedure in order to calibrate the under speed protection:

1) Rotate the Hz trimmer entirely in the counter clockwise direction.
2) If the machine has to operate at 60 Hz, ensure that the bridge is inserted between terminals 25 and 26
3) Bring the generator to 90% of the nominal speed.
4) Slowly turn the “Hz” trimmer, rotating it clockwise until the generator voltage begins to drop and ascertain that the indicator light simultaneously begins flashing rapidly.
5) By increasing speed, the generator voltage will normalise and the alarm will disappear.
6) Set the speed to the nominal value

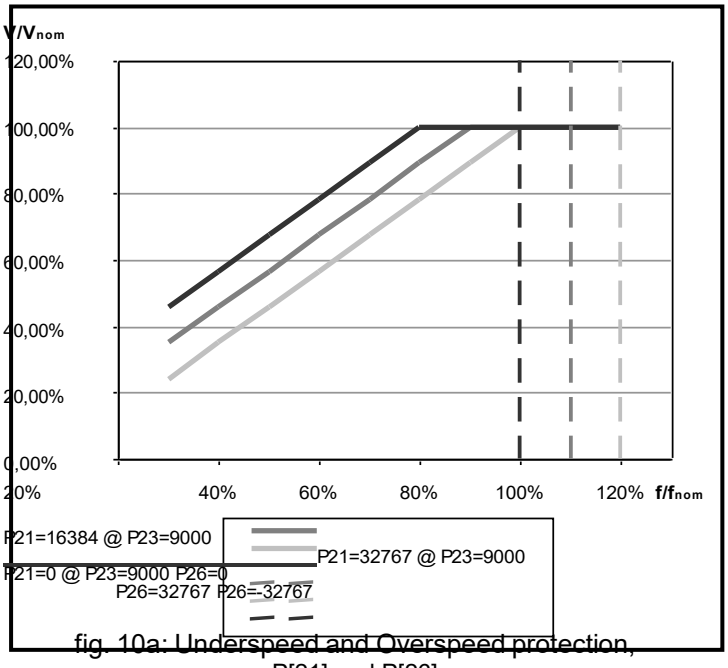



fig. 10a: Underspeed and Overspeed protection, P[21] and P[26]

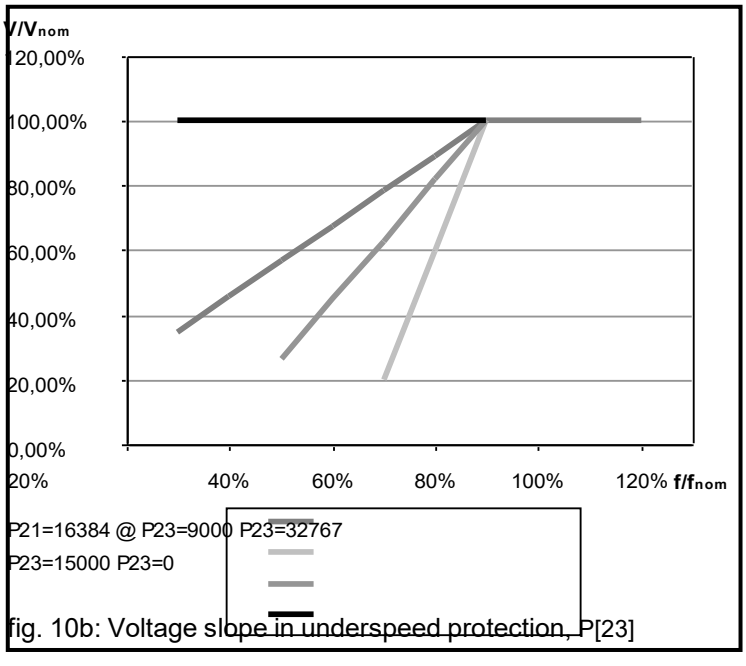



fig. 10b: Voltage slope in underspeed protection, P[23]

### 5. Overspeed

**Parameter P[26]** sets the overspeed alarm intervention threshold; if it is set on 0, the signal cuts in at 55 Hz (if the 50/60 jumper and 50/60 setting in the **Settings/UFLO&LAMS** Menu are absent) or at 66Hz (if the 50/60 jumper is present and enabled or the 50/60 flag in the **Settings/UFLO&LAMS** Menu is activated). Values between 65535 (-1) and 32768 (-32767) lower the threshold proportionately to 50 Hz and 60 Hz, respectively; values between 0 and 32767 raise the threshold proportionately, respectively to 60 Hz and 72 Hz; refer to the broken lines in figure 10a.

### 6. Other parameters

#### 6.1 Vout / Vaux Ratio

In order to guarantee sufficient feeding voltage at speeds lower than the Hz protection intervention threshold, a limit to the reduction of voltage has been foreseen, as a function of frequency.
The limit concerns regulated voltage (Vout). Should the DER1 be powered through an auxiliary winding, it must be born in mind that the voltage generated by the winding (Vaux) may not have the same Vout value; Vaux is considered proportionate to Vout and the proportional coefficient is determined by **parameter P[14].**
If the DER1 is powered directly by the regulated phase, parameter 14 should be set on 0; in case it is powered by auxiliary winding or PMG, the voltage (Vaux) must be measured, in no-load conditions and with output voltage regulated on the nominal value (Vout); the value of parameter P[14] can be obtained with the following formula:

$$P[14] = 32767 \cdot \left( \left| \frac{Vout}{Vaux} - 1 \right| \right)$$

#### 6.2 V/F slope at start up

**Parameter P[24]** sets the slope proper voltage / frequency at start up. After the underspeed alarm frequency threshold has been exceeded (set by parameter P[21] or by the Hz trimmer), the work ramp is used (parameter P[23]).
The default value is 6000; an increase in the value of P[24] will cause a greater reduction of low frequency voltage; a decrease in the value of P[24] will cause a lower reduction in voltage, up to the limit of P[24]=0, which means that no reduction in voltage will take place.

**WARNING:** If the voltage is not lowered enough with low frequency and the alternator is operating in these points, overheating could develop that is dangerous for the machine.

#### 6.3 Short circuit time

**Parameter P[25]** defines the operating time with the alternator short circuited, which is expressed in tenths of a second (from 0.1 seconds to 25.5 seconds); after this period of time the regulator goes to the blocked status; a value of 0 disables the blockage.

#### 6.4 Intervention threshold of low excitation alarm

Starting from rev. 18 of the firmware a warning (alarm A-08) was added in case of low excitation or loss of excitation: if the measured value of excitation voltage does not fall within a preset value range, the anomalous operating condition is signaled (visible on the main panel of the DxR Terminal through the A-08 alarm indicator); no other action is performed by the regulator, except for the switching of APO (if set).
The numeric value identifying in real time the excitation condition is available at location L[56]; the upper detection threshold cannot be modified while the lower threshold can be configured through parameter P[27].
The alarm is activated when the value assumed by location L[56] is higher than the upper threshold or lower than the value assumed by parameter P[27]
For the generators in stand-alone operations, the loss of excitation, on a working regulator, implies also the activation of the low voltage alarm. The underexcitation / loss of excitation alarm is mainly intended for the applications in grid-parallel mode, provided that the regulator stay fully operational (for instance with sufficient residual voltage, direct supply from the phase or from PMG).

CAUTION! :In case of parallel operation of the generators and, most of all, in case of grid-parallel mode, given that the activation of the
underexcitation/loss of excitation alarm does not imply any other action, except for the signalling
and switching of APO (if enabled), the protection of the system is transferred to at least an appro- priate management of the above-mentioned signalling. However, no guarantee is offered for the capacity of the exclusive use of this protection to safeguard the system from all the possible func- tional anomalies correlated to underexcitation / loss of excitation.

# CONTROLLING OF REGULATOR ALARMS

| TABLE 12 : ALARMS LIST | | |
|---|---|---|
| **N.** | **Description of event** | **Action** |
| 1 | Checksum EEprom | Reset default data - Blockage |
| 2 | Over voltage (at rated speed) | APO |
| 3 | Under voltage (at rated speed) | APO |
| 4 | Short circuit | APO, Maximum current - Blockage |
| 5 | Excitation Overcurrent | APO, Reduction of excitation current |
| 6 | Underspeed | APO, V/F Ramp |
| 7 | Overspeed | APO |
| 8 | Underexcitation / loss of excitation | APO |

The status of active alarms is stored at location L[38], which can be read with the USB connection.
The index of bits that have a value of 1 corresponds to the active alarm. If the regulator is correctly working (no alarm active) the bit 11 will be high.

| TABLE 13 : ALARM FLAGS AT LOCATION L[38] | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Location L[38] (third "STATUS" box) | | | | | | | | | | | | | | | |
| $B_{15}$ | $B_{14}$ | $B_{13}$ | $B_{12}$ | $B_{11}$ | $B_{10}$ | $B_9$ | $B_8$ | $B_7$ | $B_6$ | $B_5$ | $B_4$ | $B_3$ | $B_2$ | $B_1$ | $B_0$ |
| 32768 | 16384 | 8192 | 4096 | 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 | 1 |
| | | | | A12 | A11 | A10 | A9 | A8 | A7 | A6 | A5 | A4 | A3 | A2 | A1 |
| J50/60 | - | Reserved | Reserved | OK | - | - | - | Underexcitation | Over speed | Under speed | Over Excitation | Short | Under voltage | Over voltage | Check sum EEPROM |

Example:
Location 38 = 48 = $0000000000110000_2$ : it means that Bits B5 and B4 are at 1, therefore alarms A6 and A5 are active.

## 1. Alarm signals with the indicator lights

During normal operation and a duty cycle of 50% (OK in fig. 11) an indicator light mounted on the board flashes every 2 seconds; it flashes differently in the event of intervention or alarm, as indicated in fig. 11.

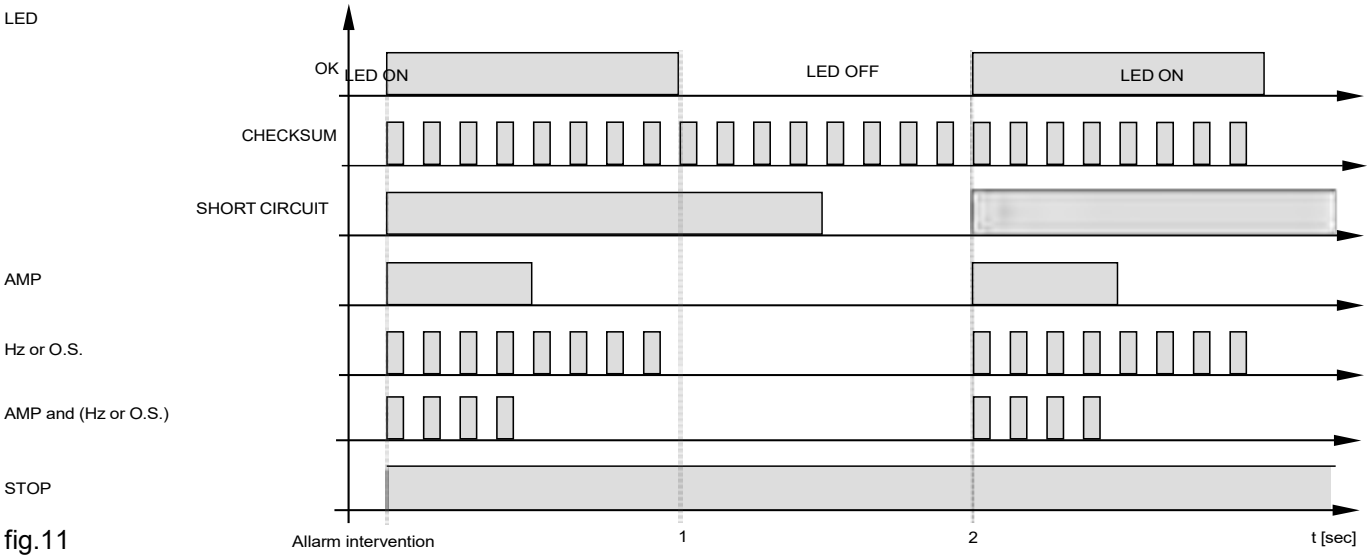
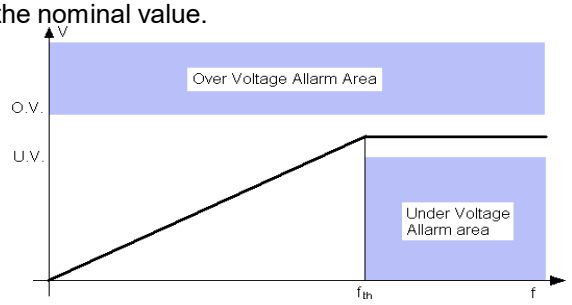



fig.11

## 2.Description of alarms

| TABELLA 14 : DESCRIPTION OF ALARMS | | |
|---|---|---|
| **N.** | **Description of event** | **Action** |
| 1 | EEPROM checksum | Verified upon start up (after DSP reset and initialisation of the peripheral). The actions undertaken are: signalling, locating of default settings, saving in EPPROM and regulator blockage.<br>When the machine is switched on again, if the EEPROM is damaged, the alarm will be repeated. Otherwise the regulator will begin to function with default parameters. |
| 2 | Over Voltage | The alarm does not determine a change in the LED flash, the APO output is active and the alarm is memorised. This can be caused by abnormal operating conditions (such as overspeed or overloading) or by a breakdown of the regulator. The over voltage alarm is activated if the output voltage is lost. The over voltage is calculated using an opportune template, as a function of the speed and is inhibited during transition, for 2 seconds. In the template for the calculation the threshold is set at 5% above the nominal value.<br>  |
| 3 | Under voltage (@ $\omega_N$) | The alarm does not determine a change in the LED flash, is stored and the APO output is active. The under voltage is calculated using an opportune template as a function of the speed (which can be seen in the description of the over voltage alarm); in the template for the calculation the threshold is set at under 5% the nominal value. It intervenes only above the underspeed alarm threshold; it is practically inhibited by this. It is also inhibited in the ent of intervention of the Excitation over voltage and during transients. |
| 4 | Short circuit | The alarm is disabled under 20 Hz, is visualised upon activation of the action and memorised. Tolerated short circuit time goes from 0,1 to 25,5 seconds (programmable in 100 ms steps); then the regulator is blocked after saving DD and TT and signals the STOP status. With the time in short circuit set on zero, the blockage is disabled. The STOP condition causes a fall in excitation, with consequent switching off and successive restarting of the regulator and therefore repetition of the cycle. |
| 5 | Excitation Overcurrent | The function of this alarm is not only to signal an excessive temperature, but it also has an active function in reducing the cause. In fact, there is an adjustment ring that takes control of voltage after the threshold has been exceeded; the action involves reduction of the excitation current and therefore output voltage.The available parameter is the "current threshold", which determines the balanced value at which the system is stabilised. The alarm is signalled and stored. For calibration see the paragraph on excitation overcurrent. |
| 6 | Underspeed | Signalling (immediate) and activation of the V/F ramp. This alarm also appears when the machine is started and stopped. The alarm is not saved among EEPROM data. The alarm intervention threshold depends upon the status of the 50/60 jumper (hardware or software) and on the position of the Hz trimmer or the value of parameter P[21]. Under the threshold the V/F ramp is active. |
| 7 | Overspeed | This is visualised in the same manner as the underspeed alarm and does not involve actions on control, but the alarm is stored. The overspeed condition may provoke an over voltage as in the case of capacitive load. The threshold can be set with parameter P[26]. |
| 8 | underexcitation /loss of excitation | The alarm does not determine a change in the LED flash, enables APO output and is memorized. The alarm condition is recognized by a underexcitation / loss of excitation observer, available for reading at location L[56]: if the value of L[56] is higher than the upper (fixed) threshold or lower than the value of the lower threshold (parameter P[27]), A-08 is activated. The alarm is inhibited during transients. |

**NOTE**: Though the voltage is continuously regulated, the DER1 will switch off if the frequency goes under 20Hz. To reset the system it is necessary to stop completely the alternator.

## 3. APO Output

The APO output status ((Transistor open collector Active Protection Output - connector CN1 terminals 14 and 15)
depends on:

- whether some alarms are activated or not
- setting of parameter P[17]
- setting of the "APO Invert" flag [2]

In normal operating conditions it is closed [2] [3]. It opens [2] (with a configurable delay from 0 to 15 seconds) when, of all the alarms, one or several separately selectable alarms are active and the "APO Invert" flag [2] is active or, immediately, in case of absence of power supply to the regulator; if the "APO Invert" flag [2] is inactive (or for firmware revisions lower than 18) the APO output is inverted (open in normal operating conditions or with regulator switched off, closed, with a configurable delay, in case of one or several active selected alarms).
The selection of which alarms trigger the activation of A.P.O. depends on the value written at location 17. The transistor is closed [2] [3] both when no alarm is active and when, even if the alarm is active, the corresponding enabling bit is set to 0.
The value to set at location 17 is made up of 2 parts: one part allows selection of the alarms which activate the contact, the other one allows setting the intervention delay. To calculate the value to set at location 17 use the following procedure:

a) In relation to table 15. Add up the decimal numbers corresponding to the alarms for which you want APO to be activated obtaining number B. (Example: if you want APO to be activated for overvoltage and overspeed, you get B = 2 +64 = 66)
b) Multiply the delay you want (integer values from 0 to 15 seconds) by the fixed value 4096. You get number A = (0..15) * 4096. (Example: if you want a 5 seconds delay, you get A = 5 * 4096 = 20480)

The sum A + B must be written at location 17 (In the preceding example 20480 + 66 = 20546)
The configuration is simplified a lot by the use of the DxR terminal software which has the APO settings menu dedicated to this purpose.

**TABLE 15 : ALARM SETTINGS THAT ACT ON THE APO**

| A12 | A11 | A10 | A9 | A8 | A7 | A6 | A5 | A4 | A3 | A2 |
|---|---|---|---|---|---|---|---|---|---|---|
| - | - | - | - | Underexcitation | Overspeed | Underspeed | Over Excitation | Short | Under voltage | Over voltage |
| 2048 | 1024 | 512 | 256 | 128 | 64 | 32 | 16 | 8 | 4 | 2 |

## 4. DER1 operation time

If the regulator is working correctly (no alarm) A12 will be active and the bit 11 will be High at location L[38].
When we see one alarm, the A12 is deactivated, bit 11 is reset at location L[38] and operation time is stored.
The total operation time of the regulator is obtained, after the download of the alarms, by adding all the times TT (last column of the file .alr).
For this procedure please refer to the "DownLoad Alarm" function of the Upload/Download Menu of DxR Terminal Software, see Technical guide “Interface communication USB2DxR”.

NOTE (1): starting from rev.18 of the Firmware NOTE
(2): Open for firmware revisions lower than 18

## APPENDIX : DER1 SET UP ON A TEST BENCH

The operations of functional checkout and parameter setting may turn out to be easier if they are performed on a test bench rather than with the regulator connected to the alternator.
The connection diagrams of the DER1 and the USB2DxR communication interface are shown in figures 12a, 12b or 12c based on the requested function and on the available supply voltage

Given that some parts of the DER1 which work at high voltage are not isolated, for the safety of the operator, it is necessary for the power source to be isolated from the electrical grid, for instance by a transformer.

The use of these types of connection is reserved to qualified personnel, able to assess the operational risks of high voltage and who have a full knowledge of the content of this manual.

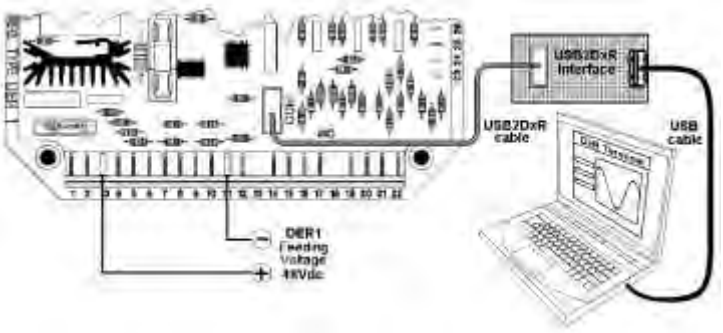



Fig. 12a: DER1 48Vdc power supply (please note that no other connections, other than the power source, are necessary) for the download of the alarms without risking to modify the content of the EEPROM because of the test.

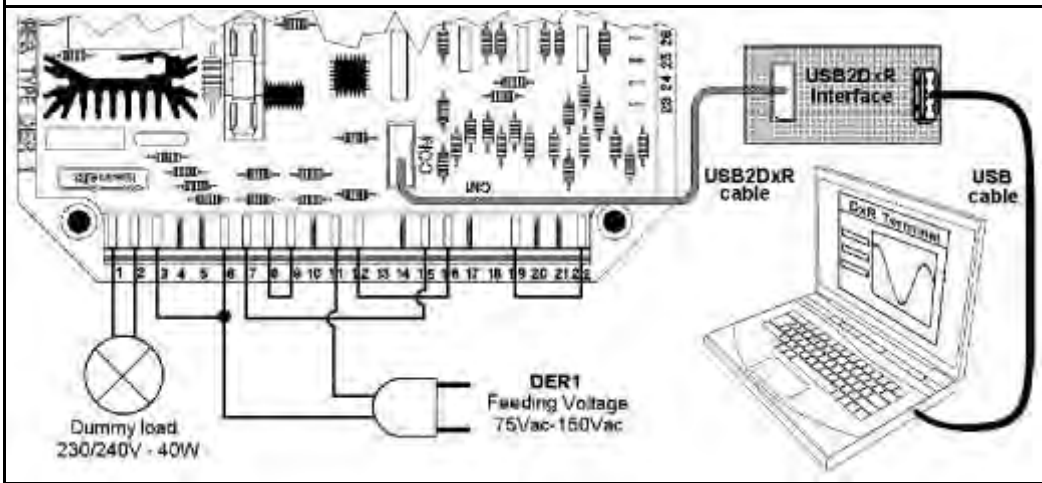



Fig. 12b: DER1 75-145Vac power supply ( Please note the sensing on terminal 7 and the jumper between terminals 6 and 3 of the DER1) for test and setup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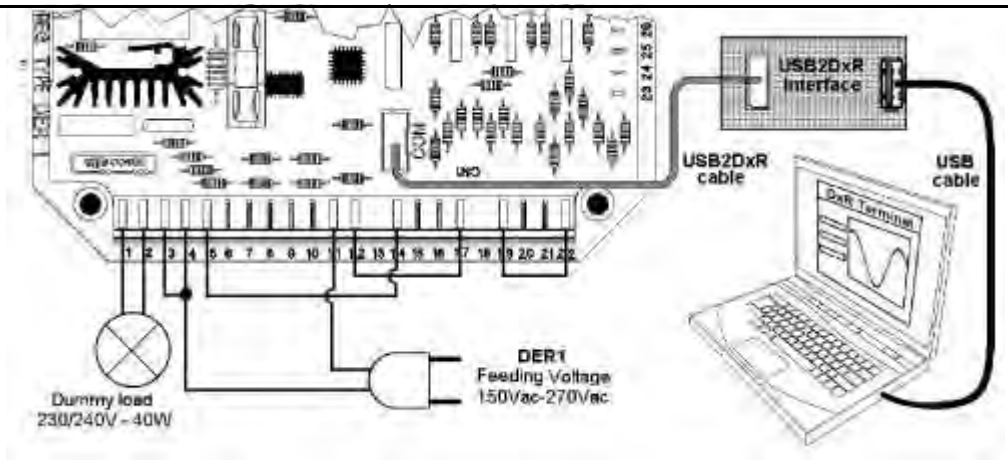



Fig. 12c: DER1 150-270Vac power supply ( Please note the sensing on terminal 5 and the jumper between terminals 4 and 3 of the DER1) for test and setup

## 2. SPARE PARTS


| 6 | CAP M32x1,5 | 2 | T005066122 |
|---|---|---|---|
| 5 | CAP M20x1,5 | 3 | T005047122 |
| 4 | BRACKET | 1 | S170600112 |
| 3 | UPPER BRACKET | 1 | 7149.60.005 |
| 2 | GENERATOR TERMINAL BOX | 1 | C024130112 |
| 1 | 3 PHASES GENERATOR 25 kVA 50/60 Hz 50°C | 1 | G015037112 |
| **Pos.** | **Description** | **Q.ty** | **Code** |

## 3. MARKING

The nameplate of the generator contains the following info:

| | |
|---|---|
| Manufacturer: | **MIRETTI S.r.l. Via Marconi 29/31 (I) 20812 MB** |
| Technical file: | **MIR FT 1164** |
| Type : | **G015037112** |
| Constr. Year: | **2019** |
| Marking: | **II 3G Ex nA IIA T3** |

## 4. PACKAGING, STORAGE, TRANSPORTATION

The generator is packaged in a proper container in order to be protected from damage during transport, in case of shipping for replacement.

The generator storage should take place in covered, free from corrosive substance environments. Transportation must be performed in such a way that no damage can occur, and device must be protected against accidental fall during installation.

## 5. DOCUMENTS

Each device is equipped with its manual and a copy of Statement of Conformity.

If Purchaser buys a greater number of pieces of equipment, documents are provided in one copy only.

The manufacturer reserves the right to make changes to the design for the quality of technological designs and to improve performance, without altering however the conditions obtained in the CE certification.

## 6. CONTACTS

For information not contained in this manual please contact:

**Miretti S.r.l.**
**Via Marconi 29/31**
**20812 – Limbiate (MB) Italy**
**Phone. +39 02 990811**
**Fax. +39 02 99052488**
**Email: sales.department@miretti.com**

CHALWYN by AMOT

# Z-Range Air Intake Shut Down Valves - Bendix Types

## (Manual closure plus automatic closure on engine overspeed, low engine oil pressure, high coolant or high exhaust temperature)

## Selection, Application and Maintenance

Valve Numbers

TMZ-121 to TMZ-302

CE208_TMZ_121_302_0310

# DESCRIPTION

A range of automatic overspeed air intake shut down valves which can also be automatically closed by an engine lubricating oil pressure (or air pressure) system to give shut down on loss of engine oil pressure, high coolant or high exhaust gas temperature. TMZ valves also are also supplied with manual start over-ride/manual emergency stop controls.

TMZ valves are available for all popular combinations of air intake pipe sizes and engine ratings up to 149 kW (turbocharged) or 179 kW (naturally aspirated). For higher engine ratings see “Notes” below.

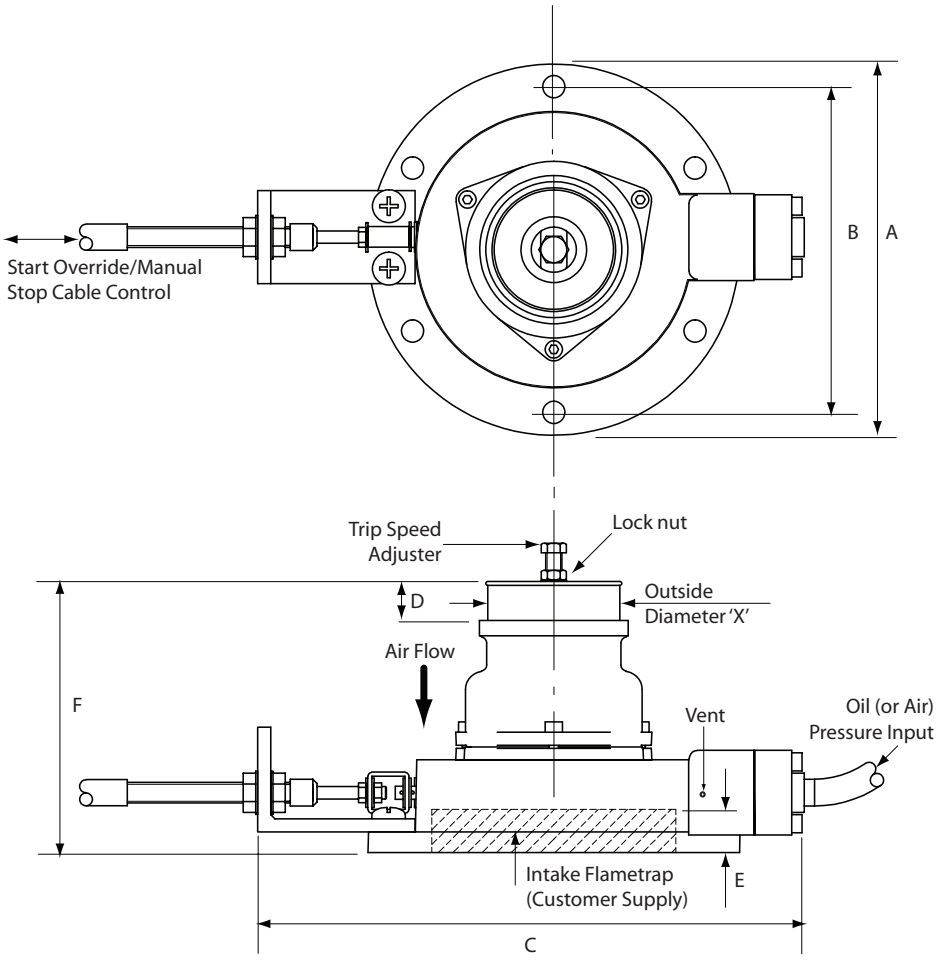
Some smaller TMZ valve sizes are optionally available with an integral intake flame trap housing and/or an integral engine air cleaner.

This type of valve may be fitted to either naturally aspirated or turbocharged engines. It should be noted however that for a given valve setting the repeatability of the actual shut down speed has a greater scatter in the case of a turbocharged engine. However, unless for special reasons a precisely repeatable shut down speed is required, adequate protection from excessive overspeed and potential resulting damage is still achieved.

The basic dimensions for this family of valves are tabulated on page 4.

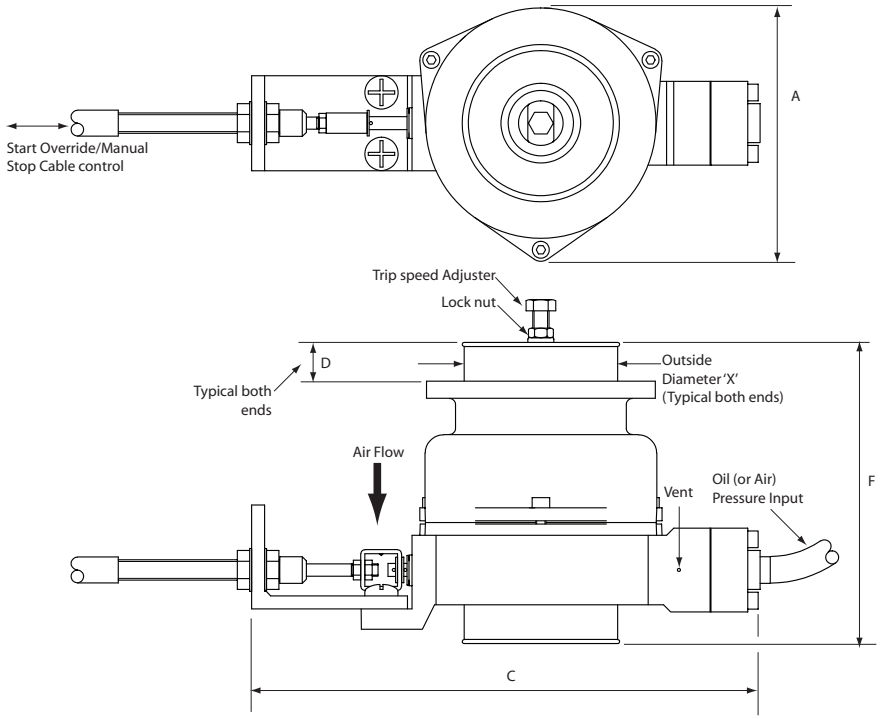
# Typical Arrangement

Valves TMZ-121 to TMZ-128 and TMZ-221 to TMZ-228



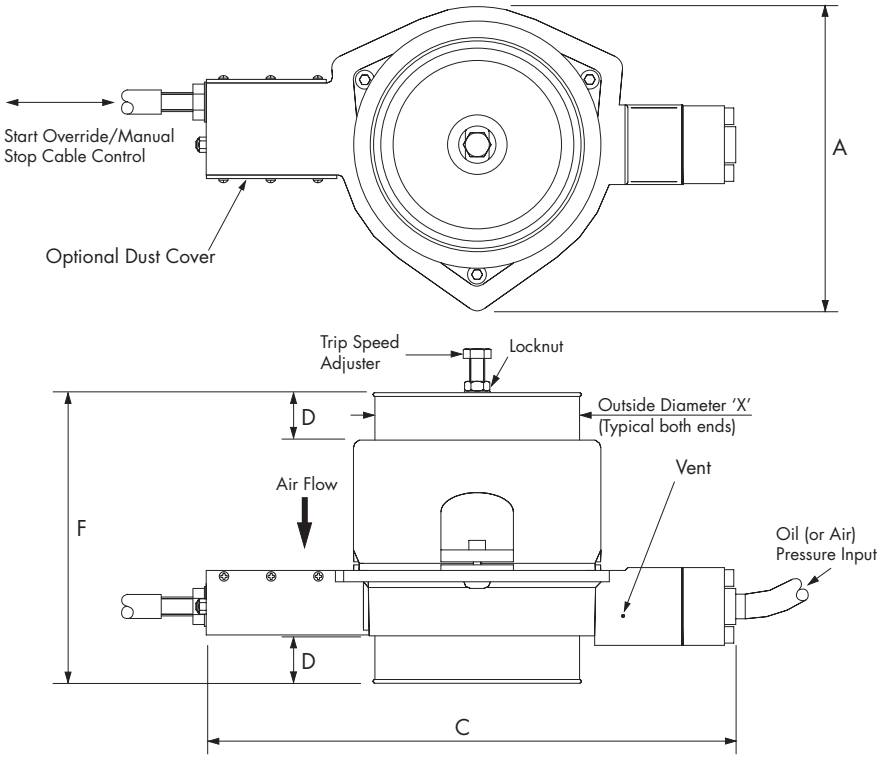
# Typical Arrangement

Valves TMZ-131 to TMZ-134




# Typical Arrangement

Valves TMZ-301 to TMZ-302





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| Valve Part No. | | A (mm) | B (mm) | C (mm) | D (mm) | E Flametrap housing nominal depth (mm) | F (mm) | Overall length with integral air cleaner |
|---|---|---|---|---|---|---|---|---|
| Without integral engine air cleaner | With integral engine air cleaner | | | | | | | |
| TMZ-121 | TMZ125 | 180 | 158 | 265 | 19 | 21 | 132 | 201 |
| TMZ-122 | TMZ-126 | 180 | 158 | 265 | 19 | 21 | 135 | 204 |
| TMZ-123 | TMZ-127 | 180 | 158 | 265 | 19 | 21 | 138 | 207 |
| TMZ-124 | TMZ-128 | 180 | 158 | 265 | 19 | 21 | 139 | 208 |
| TMZ-221 | TMZ-225 | 180 | 158 | 265 | 19 | 40 | 151 | 220 |
| TMZ-222 | TMZ-226 | 180 | 158 | 265 | 19 | 40 | 154 | 223 |
| TMZ-223 | TMZ-227 | 180 | 158 | 265 | 19 | 40 | 157 | 226 |
| TMZ-224 | TMZ-228 | 180 | 158 | 265 | 19 | 40 | 158 | 227 |
| TMZ-131 | n/a | 124 | n/a | 265 | 19 | n/a | 139 | n/a |
| TMZ-132 | n/a | 124 | n/a | 265 | 19 | n/a | 142 | n/a |
| TMZ-133 | n/a | 124 | n/a | 265 | 19 | n/a | 145 | n/a |
| TMZ-134 | n/a | 124 | n/a | 265 | 19 | n/a | 147 | n/a |
| TMZ-301 | n/a | 160 | n/a | 279 | 19* | n/a | 147** | n/a |
| TMZ-302 | n/a | 160 | n/a | 279 | 19* | n/a | 153*** | n/a |

Outside diameter “X” is selected to match the bore of the engine air intake hose - see page 4 “Selection”.
Dimensions marked * increased to 25 mm for outside diameter “X” valves of 86 mm or greater.
Dimensions marked ** increased to 153 mm for outside diameter “X” valves of 86 mm or greater.
Dimensions marked *** increased to 159 mm for outside diameter “X” valves of 86 mm or greater.

**Important Notes:**
The maximum oil (or air) pressure applied to the TMZ valve should not exceed 10 bar (145 psi). When the engine is running, the TMZ valve will close when the oil (or air) pressure falls below approximately 1 bar

applications. It should not be used for heavy duty applications as unacceptable short air cleaner service

Variants of some TMZ valves can be supplied without the oil pressure and manual control - check with your Chalwyn supplier for details.

For higher engine ratings see AMZ and Z range valves - brochures CE231 and CE243.


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# SELECTION

1. Determine the rating of the engine to which the valve is to be fitted and whether or not turbocharged. Using the table below identify which valve(s) would be suitable.

Finalise the selection by identifying the valve which can also be supplied with end diameter(s) “X” to match the bore of the engine air intake hose at the position the valve is to be fitted. Note, end diameters are manufactured to the nearest 1mm. Generally, where more than one valve meets all requirements, select the larger valve size to minimize engine air intake restriction.

## Valve selection chart in metric units

| Valve Part No. | Engine power at rated speed kW | | Engine air intake hose bore mm | |
|---|---|---|---|---|
| | Naturally Aspirated Engines | Turbocharged Engines | Minimum | Maximum |
| TMZ-121 & TMZ-125 | 7.5 to 38 | 7.5 to 32 | 40 | 70 |
| TMZ-122 & TMZ-126 | 15 to 54 | 14 to 45 | 51 | 80 |
| TMZ-123 & TMZ-127 | 22 to 72 | 22 to 60 | 57 | 83 |
| TMZ-124 & TMZ-128 | 30 to 93 | 30 to 78 | 63 | 96 |
| TMZ-221 & TMZ-225 | 7.5 to 38 | 7.5 to 32 | 40 | 70 |
| TMZ-222 & TMZ-226 | 15 to 54 | 15 to 45 | 51 | 80 |
| TMZ-223 & TMZ-227 | 22 to 72 | 22 to 60 | 57 | 83 |
| TMZ-224 & TMZ-228 | 30 to 93 | 30 to 78 | 63 | 96 |
| TMZ-131 | 7.5 to 38 | 7.5 to 32 | 51 | 70 |
| TMZ-132 | 15 to 54 | 15 to 45 | 51 | 80 |
| TMZ-133 | 22 to 72 | 22 to 60 | 57 | 83 |
| TMZ-134 | 30 to 93 | 30 to 78 | 63 | 96 |
| TMZ-301 | 40 to 120 | 40 to 100 | 70 | 102 |
| TMZ-302 | 50 to 179 | 50 to 149 | 70 | 108 |



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## Valve selection chart in non-metric units

| Valve Part No. | Engine power at rated speed kW | | Engine air intake hose bore mm | |
|---|---|---|---|---|
| | Naturally Aspirated Engines | Turbocharged Engines | Minimum | Maximum |
| TMZ-121 & TMZ-125 | 10 to 50 | 10 to 42 | 1 9/16 | 2 3/4 |
| TMZ-122 & TMZ-126 | 20 to 72 | 20 to 60 | 2 | 3 1/8 |
| TMZ-123 & TMZ-127 | 30 to 93 | 30 to 80 | 2 1/4 | 3 1/4 |
| TMZ-124 & TMZ-128 | 40 to 125 | 40 to 104 | 2 1/2 | 3 3/4 |
| TMZ-221 & TMZ-225 | 10 to 50 | 10 to 42 | 1 9/16 | 2 3/4 |
| TMZ-222 & TMZ-226 | 20 to 72 | 20 to 60 | 2 | 3 1/8 |
| TMZ-223 & TMZ-227 | 30 to 93 | 30 to 80 | 2 1/4 | 3 1/4 |
| TMZ-224 & TMZ-228 | 40 to 125 | 40 to 104 | 2 1/2 | 3 3/4 |
| TMZ-131 | 10 to 50 | 10 to 42 | 2 | 2 3/4 |
| TMZ-132 | 20 to 72 | 20 to 60 | 2 | 2 1/8 |
| TMZ-133 | 30 to 93 | 30 to 125 | 2 1/4 | 2 1/4 |
| TMZ-134 | 40 to 125 | 40 to 104 | 2 1/2 | 2 3/4 |
| TMZ-301 | 54 to 161 | 54 to 154 | 2 3/4 | 4 |
| TMZ-302 | 67 to 240 | 67 to 200 | 2 3/4 | 4 1/4 |

2. Select the required length of the manual shut-down cable from the table. Alternative lengths may be available on request.

| Cable Part No. | Length (metres) |
|---|---|
| CHW-150 | 1.5 |
| CHW-200 | 2.0 |
| CHW-300 | 3.0 |
| CHW-400 | 4.0 |

3. Order “start override/manual shut down lever” RLZ-100 with valve and cable.

4. For TMZ-301 and TMZ-302 valves an optional dust cover is available and is recommended for applications where operation is in dusty conditions (see diagram on page 3).


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# FITTING

1. TMZ valves with integral intake flame traps should be bolted directly to a suitable mating flange secured to the engine air intake as close as possible to the engine intake ports.

2. TMZ valves without integral intake flame traps should also generally be fitted as close as possible to the engine intake ports, but must always be fitted upstream of any intake flametrap.

Note: Paragraph 1 and 2 are generally applicable to both naturally aspirated and turbocharged engines but, where there is insufficient space to fit the valve between the turbocharger and engine, or where the air outlet temperature from the turbocharger is in excess of 180°C/365°F, alternative fitting arrangements must be considered.

3. Where more than one Chalwyn valve is fitted to an engine, as in the case of an engine with multiple intake pipes, a balance pipe arrangement must be installed to connect the various intake pipes together downstream (engine side) of the shut down valves. Typically balance pipe diameters should be about 30% of the diameter of the intake pipes. Additionally the RLZ-100 start override/shutdown levers must be arranged to permit simultaneous manual operation.

4. When fitting, ensure the direction of air flow:
a. is in compliance with direction indicated on the body;
b. is between vertically downward and horizontal.

5. Ensure the TMZ valve and the RLZ-100 start override/manual shut down lever are positioned to avoid damage to, or sharp bends in, the interconnecting mechanical cable.

6. Where the valve is located between two flexible pipes, ensure that adequate support is provided. If not, a suitable support bracket to the valve must be fitted.

7. Any engine crankcase breather connections into the intake system between the Chalwyn valve and engine or any internal crankcase breather arrangement venting directly into the engine intake ports must be sealed and replaced by an external breather system venting either atmosphere or to the intake system upstream of the shut down valve. External breather system kits for various engine types are available from Chalwyn.

8. The RLZ-100 start override/shut down lever should be rigidly mounted on a suitable bracket in a convenient position for easy operation.

Notes

a. Optional dust cover (see diagram page 2). Should the dust cover be removed for any reason, ensure it

b. Adjustment of the start override/manual stop cable. Should it be necessary to replace this cable for any reason, adjust as follows: With the valve upright (speed trip adjuster at top) and no oil (or air) pressure applied, adjust the cable such that the valve operates fully between its internal stops at the closed and fully open positions as the RLZ-100 lever is moved between its free (engine stop) position and against the resistance of the internal valve springs to the engine run/start override position.

c. The small cable inside the valve is factory set. DO NOT release from its clamp or adjust in any way.

d. In addition to the TMZ valve, an engine fuel stop must always be retained to enable normal engine shutdown. Use the manual shut down lever of the TMZ valve only for emergency shut down or for system maintenance/checking.



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# OPERATION

### Engine Start
The start override/emergency stop lever must be held in the “start override” position prior to starting the engine. Continue to hold this lever in the start override (engine run) position after starting the engine until it latches in this position (may take up to about 30 seconds if engine oil pressure is the operating fluid). Release lever.

### Engine Stop
Use normal engine fuel stop.

### Emergency Manual Stop
Move the start override/emergency stop lever firmly to the stop position.

**Note:** The start override/emergency stop lever always returns to the ‘stop’ position when the engine is not running.

# ADJUSTMENT

Once the Chalwyn valve is installed, adjustment of the overspeed trip setting is carried out using the adjuster and locknut (refer to diagrams). Basically rotating the adjuster clockwise will increase engine speed at which automatic shut down occurs.

As supplied, the valve will be adjusted such that shut down will generally occur well below the engine high idle speed. To increase the speed at which automatic shut down occurs, proceed as follows:

1. Start engine. Slowly accelerate. Note speed at which shut down occurs.

2. Remove the hose at air inlet to Chalwyn valve to expose the adjuster and locknut (see diagram).

3. Release locknut. Turn adjuster clockwise one turn. Tighten locknut.

4. Refit inlet hose to Chalwyn valve.

5. Start engine. Slowly accelerate. Note speed at which shut down occurs.

6. Repeat steps ‘2’ to ‘5’ until the first setting at which the engine does not shut down at high idle speed (ie maximum throttle, no load).

Then either:
a. Use the results of shut down speed versus adjuster setting as a calibration check to make a final adjustment to give the required setting (typically 10% to 15% over high idle) **or:**
b. If a very precise setting is not required, turn the adjuster a further one turn clockwise to take the shut down above high idle speed by a suitable margin. When using this setting procedure it may be found that the engine occasionally shuts down during the normal operation. If so, turn the adjuster clockwise by a further one half turn.

7. Ensure the adjuster locknut is fully tightened. (Use a thread lock adhesive on the locknut threads).

8. Restart engine. Run at a mid range speed. Move the start override/emergency stop level firmly to the ‘stop’ position. The engine shold stop within a few seconds.

9. Restart engine. Run at a mid range speed. Remove oil/air pressure signal. The engine should stop within a few seconds.

**Notes:**

**Turbocharged Engines**
When fitting a valve fitted to a turbocharged engine using the preceding method, it may be found that at high engine power outputs, the engine will shut down at a lower speed than required. If this occurs, further small adjustments in steps of one half turn clockwise should be made until the problem is eliminated.

**Jammed Valve**
If in the course of adjusting the valve it jams on its seat, release by turning CLOCKWISE viewed from adjuster end.


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# MAINTENANCE

Routine maintenance should be undertaken as below. Note that not all model variants include the air intake flametrap and integral air cleaner housing options.

**Daily:** Run engine at a mid range speed. Check satisfactory shut down occurs when the manual emergency stop lever is operated.

## Three Monthly:

1. Whilst the engine is running, check the small vent holes in the valve (see diagrams on pages 2 and 3) for any sign of oil (or air) leakage. Such leakage is an indicator of a damaged diaphragm. This must be rectified prior to returning the unit to service. (Note: only suitably qualified personnel familiar with the hazards associated with a running engine should carry out this check).

2. Stop engine. Disconnect pipework, any support brackets etc. to permit the valve assembly to be removed for inspection.

3. Carefully remove the air intake flame trap where fitted (see flame trap servicing instructions). Do not detach the valve from the flame trap housing.

4. Inspect the valve internally for cleanliness. If necessary clean in paraffin or white spirit taking normal precautions. Dry thoroughly.

5. Check there is no excessive wear and that the valve and internal control rod both move smoothly over their complete operating strokes. Check the internal cable clamp is free from damage and is tightly clamped.

**Important** Do not remove the cable clamp or in any way attempt to adjust the internal cable as this is factory set.

6. Do not lubricate valve other than lightly greasing the internal cable.

7. Refit intake flame trap element (where applicable).

8. Refit valve. Set valve as per ‘Adjustment’.

9. Run engine a mid range speed. Check satisfactory shut down occurs under manual emergency and loss of oil (or air) pressure signal conditions.

**Integral Engine Air Cleaner** (where fitted)
Replace air cleaner element at the periods recommended by the engine manufacturer. (Spare elements are available from Chalwyn.)

### Important Notes:

The three monthly routine maintenance period requirement is dependent on the operating conditions to which the equipment is exposed and, by experience, may need to be varied.

Any maintenance problems not covered by the routine maintenance schedule should be discussed with your Chalwyn Distributor before any repair work is undertaken.



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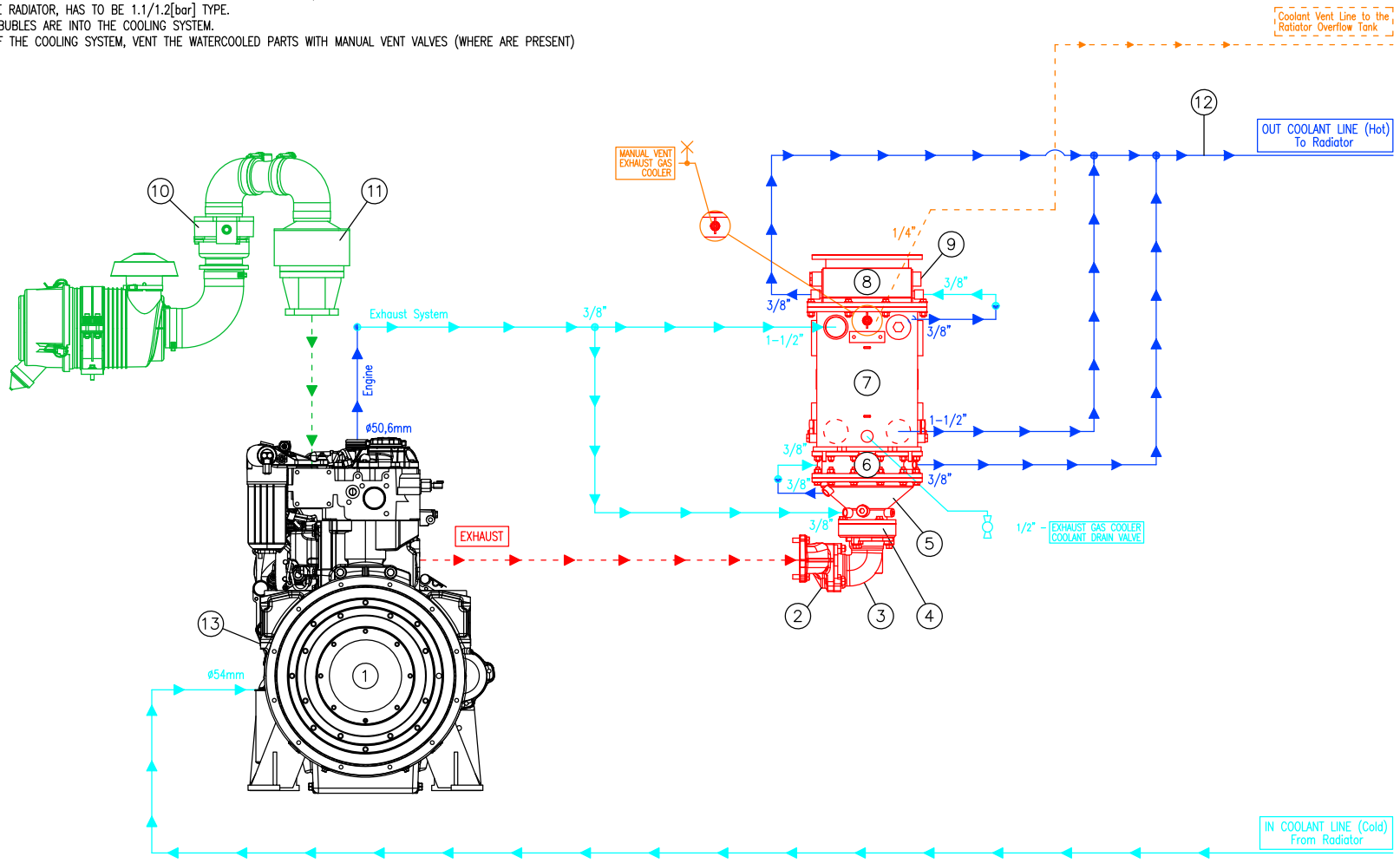
Edmonton,
Alberta, T6N 1K4
Tel: +1 (780) 465 4429
Fax: +1 (780) 469 6275

| POS. | MOD. NR. | MODIFICATION DESCRIPTION | DATE | DRAFTSMAN | REVIEWED | APPROVED |
|---|---|---|---|---|---|---|
| 00 | | ISSUED | 09.04.20 | Mercorillo | SORICE | BASSINI |

**IMPORTANT NOTE:**

- ALWAYS ENSURE A CONSTANT COOLANT FLOW INTO THE EXHAUST SYSTEM AND NEVER USE THE SYSTEM DRY.
- OVERFLOW TANK MUST BE ALWAYS PLACED HIGHER THAN THE WATERCOOLED PARTS.
- EACH VENT LINE HAS TO BE CONNECTED INDIPENDENTLY TO THE OVERFLOW TANK, AVOIDING KINKINGS AND GOOSNECKS.
- PRESSURE CAP OF THE RADIATOR, HAS TO BE 1.1/1.2[bar] TYPE.
- ENSURE THAT NO AIR BUBLES ARE INTO THE COOLING SYSTEM.
- DURING THE FILLING OF THE COOLING SYSTEM, VENT THE WATERCOOLED PARTS WITH MANUAL VENT VALVES (WHERE ARE PRESENT)




| POS. | DESCRIPTION |
|---|---|
| 13 | ENGINE LOW OIL PRESSURE |
| 12 | HIGH COOLANT TEMPERATURE |
| 11 | AIR INLET FLAME ARRESTOR |
| 10 | AIR INLET SHUT-DOWN VALVE |
| 9 | HIGH EXHAUST FUMES TEMPERATURE |
| 8 | WATERCOOLED EXHAUST GAS COOLER OUTLET BOX |
| 7 | EXHAUST GAS COOLER |
| 6 | WATERCOOLED SELF-CLEANING EXHAUST FLAME TRAP |
| 5 | WATERCOOLED EXHAUST GAS CONE CONNECTION |
| 4 | EXHAUST GAS FLANGE ADAPTOR WITH COATEX |
| 3 | EXHAUST GAS CURVE WITH COATEX |
| 2 | EXHAUST GAS MANIFOLD WITH COATEX |
| 1 | PERKINS 1104C-44 ENGINE |

Exhaust System

Air Inlet System

Cooling System – IN

Cooling System – OUT

Vent Line

1/8" = 1/8" BSP CYL. – FITTING FOR HOSE INT.DM 8,5mm

1/4" = 1/4" BSP CYL. – FITTING FOR HOSE INT.DM 8,5mm

3/8" = 3/8" BSP CYL. – FITTING FOR HOSE INT.DM 10mm

1/2" = 1/2" BSP CYL. – FITTING FOR HOSE INT.DM 12mm

1-1/2" = 1-1/2" BSP CYL. – FITTING FOR HOSE INT.DM 38mm

Description: P & I
MAIN PLAN AND ENGINE SIGNALS

Object: PERKINS 1104C-44

| | Date | Sign |
|---|---|---|
| Draftsman | 09.04.20 | Mercorillo |
| Reviewed | 09.04.20 | SORICE |
| Approved | 09.04.20 | BASSINI |

MIRETTI
20051 LIMBIATE (MI) – Via Marconi, 31 – ITALY



Replaces DWG

Replaced By

HEAT TREAT.

SCALE: 1 : 1

WEIGHT Kg.

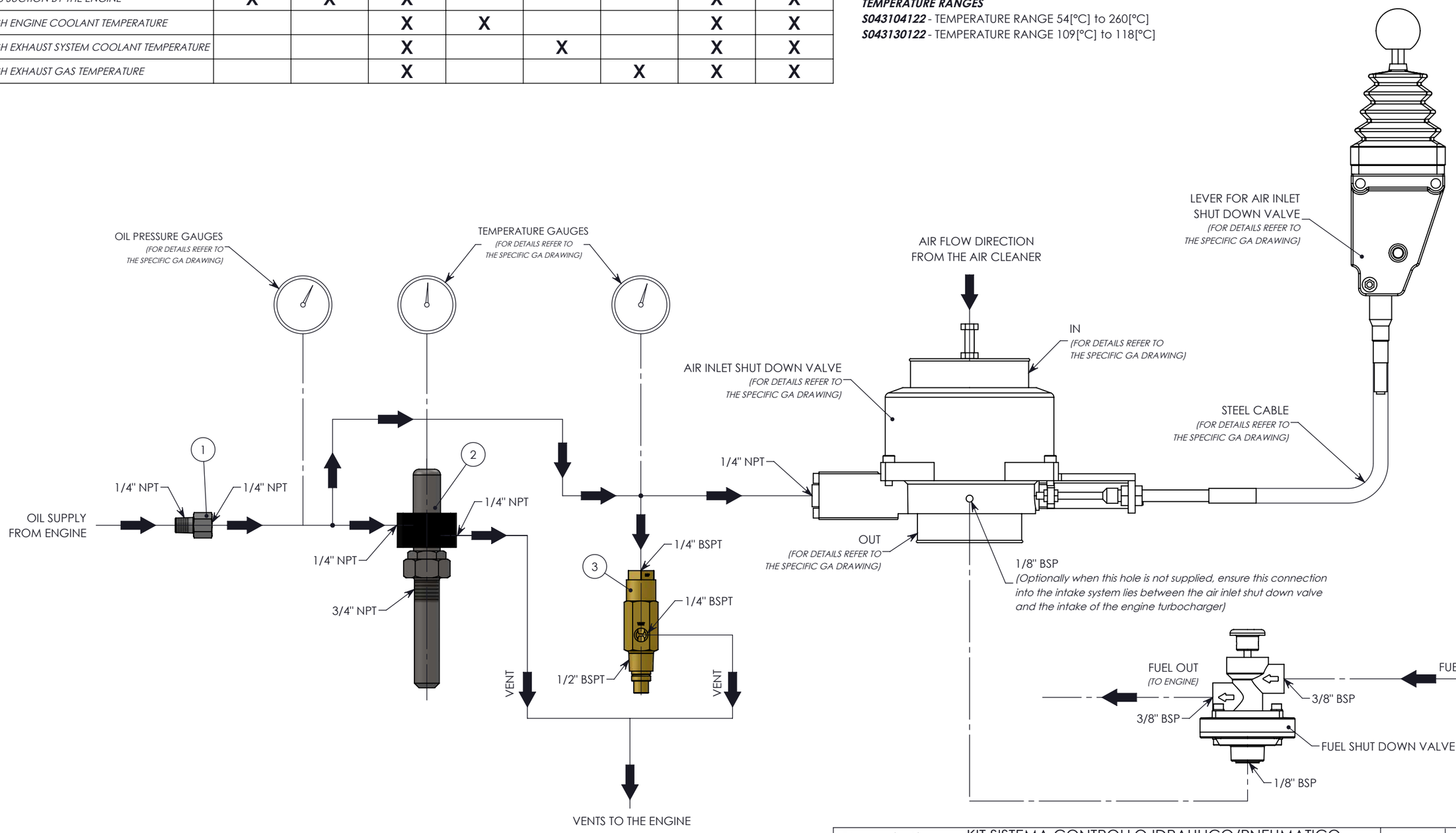
–Dimensions in mm.–

DWG NR. 7523.66.100

| CAUSE \ EFFECT | ENGINE OVERSPEED | CLOSING OF AIR INLET SHUT DOWN VALVE | LOW ENGINE OIL PRESSURE | ACTIVATION OF COOLANT SENSOR *ENGINE COOLANT TEMPERATURE* | ACTIVATION OF COOLANT SENSOR *EXHAUST SYSTEM COOLANT TEMPERATURE* | ACTIVATION OF EXHAUST GAS TEMPERATURE SENSOR | CUT FUEL SUPPLY | ENGINE SHUT DOWN |
|---|---|---|---|---|---|---|---|---|
| *GAS SUCTION BY THE ENGINE* | X | X | X | | | | X | X |
| *HIGH ENGINE COOLANT TEMPERATURE* | | | X | X | | | X | X |
| *HIGH EXHAUST SYSTEM COOLANT TEMPERATURE* | | | X | | X | | X | X |
| *HIGH EXHAUST GAS TEMPERATURE* | | | X | | | X | X | X |

| Pos. | Description | Date | Draftsman | Designer | ATEX |
|---|---|---|---|---|---|
| 0 | EMISSIONE DRAFT/PRELIMINARE | 13/02/20 | Mercorillo | SORICE | BASSINI |

***TEMPERATURE RANGES***
***S043104122*** - TEMPERATURE RANGE 54[°C] to 260[°C]
***S043130122*** - TEMPERATURE RANGE 109[°C] to 118[°C]




| Pos. | Description | Q.ty | Dim. | Material | Ref. Standard | Codice |
|---|---|---|---|---|---|---|
| 3 | 2 WAY TEMPERATURE SENSING VALVE | 1 | | | | S043130122 |
| 2 | HIGH TEMPERATURE VALVE MOD.4075D105-AA | 1 | | | | S043104122 |
| 1 | FLOW RESTRICTOR | 1 | | | | R017007122 |

Description: KIT SISTEMA CONTROLLO IDRAULICO/PNEUMATICO
KIT PNEUMATIC/ HYDRAULIC CONTROL SYSTEM

Application:

| | Date | Sign |
|---|---|---|
| Draftsman | 13/02/2020 | Mercorillo |
| Designer | 13/02/2020 | SORICE |
| ATEX | 13/02/2020 | BASSINI |

MIRETTI
20812 LIMBIATE (MB) - Via Marconi, 31



Replace the:
Replaced by:

***In case of any questions or concerns, promptly contact the Miretti technical department.***

| Treatment | | |
|---|---|---|
| Scale | Peso Kg | |
| 1:3.5 | - | |

- Dimensions expressed in mm -

K003022000

# SENTINEL

## DIESEL ENGINE PROTECTION SYSTEMS

## INSTALLATION GUIDE

**BE SURE** the Master Control (Oil Sentinel) has the proper oil pressure setting for your application - this is determined by knowing engine oil pressure at hot-low idle. Use a setting under the hot-low idle oil pressure to avoid false shut-down at idle speed. The Master Control (Oil Sentinel) can be ordered with 5, 10, 15, 20 or 25 p.s.i. primary settings.

**ALL MASTER CONTROLS HAVE EXCLUSIVE, BUILT–IN VARIABLE SHUT–OFF POINT. IT AUTOMATICALLY PROVIDES A HIGHER OIL PRESSURE SHUT-OFF POINT FOR ENGINE OPERATING UNDER LOAD AT HIGH SPEED.** A unique advantage, particularly for engines that have low idling oil pressure. Engine fuel pressure is inherently used as a force to assist in automatically raising the oil pressure point at which the fuel valve closes. Fuel pressure values correspondingly increase and decrease with RPM, particularly on Detroit Diesel and Cummins Engine. The chart below shows the effect of fuel pressures on the oil pressure shut-off point:

**APPROXIMATE CORRESPONDING OIL PRESSURE SHUT-OFF POINT OF SENTINEL**

| PRESSURE P.S.I | MODEL D-25 PRIMARY SETTING | MODEL D-20 PRIMARY SETTING | MODEL D-15 PRIMARY SETTING | MODEL D-10 PRIMARY SETTING | MODEL D5Y PRIMARY SETTING | MODEL D-5** PRIMARY SETTING |
|---|---|---|---|---|---|---|
| 0 | 25 | 20 | 15 | 10 | 5 | —— |
| 10 | 26 | 21 | 16 | 12 | 7 | —— |
| 20 | 27 | 22 | 17 | 13 | 9 | 5 |
| 30 | 29 | 24 | 19 | 15 | 11 | 7 |
| 40 | 31 | 26 | 20 | 16 | 12 | 8 |
| 60 | 33 | 28 | 22 | 19 | 15 | 12 |
| 80 | 36 | 31 | 26 | 23 | 18 | 15 |
| 100 | 40 | 35 | 30 | 25 | 21 | 17 |
| 125 | 44 | 39 | 34 | 29 | 25 | |
| 150 | 49 | 44 | 39 | 33 | 29 | |
| 175 | 53 | 48 | 43 | 37 | 32 | |

****FOR N SERIES OR OTHER DETROIT DIESELS WITH LOW IDLE OIL PRESSURE WITH 15 TO 20 P.S.I. FUEL PRESSURE AT IDLE.**

By consulting chart, the approximate shut-off point can be determined, both at idle and accelerated speeds – i.e., a Sentinel Master Control with 10 p.s.i. primary oil pressure setting operating on an engine that is idling with 20 p.s.i. fuel pressure will actually shut-off at 13 p.s.i. oil pressure. When engine is accelerated and fuel pressure escalates to 80 p.s.i. the Sentinel will automatically compensate and produce a shut-off point at 23 p.s.i. oil pressure.

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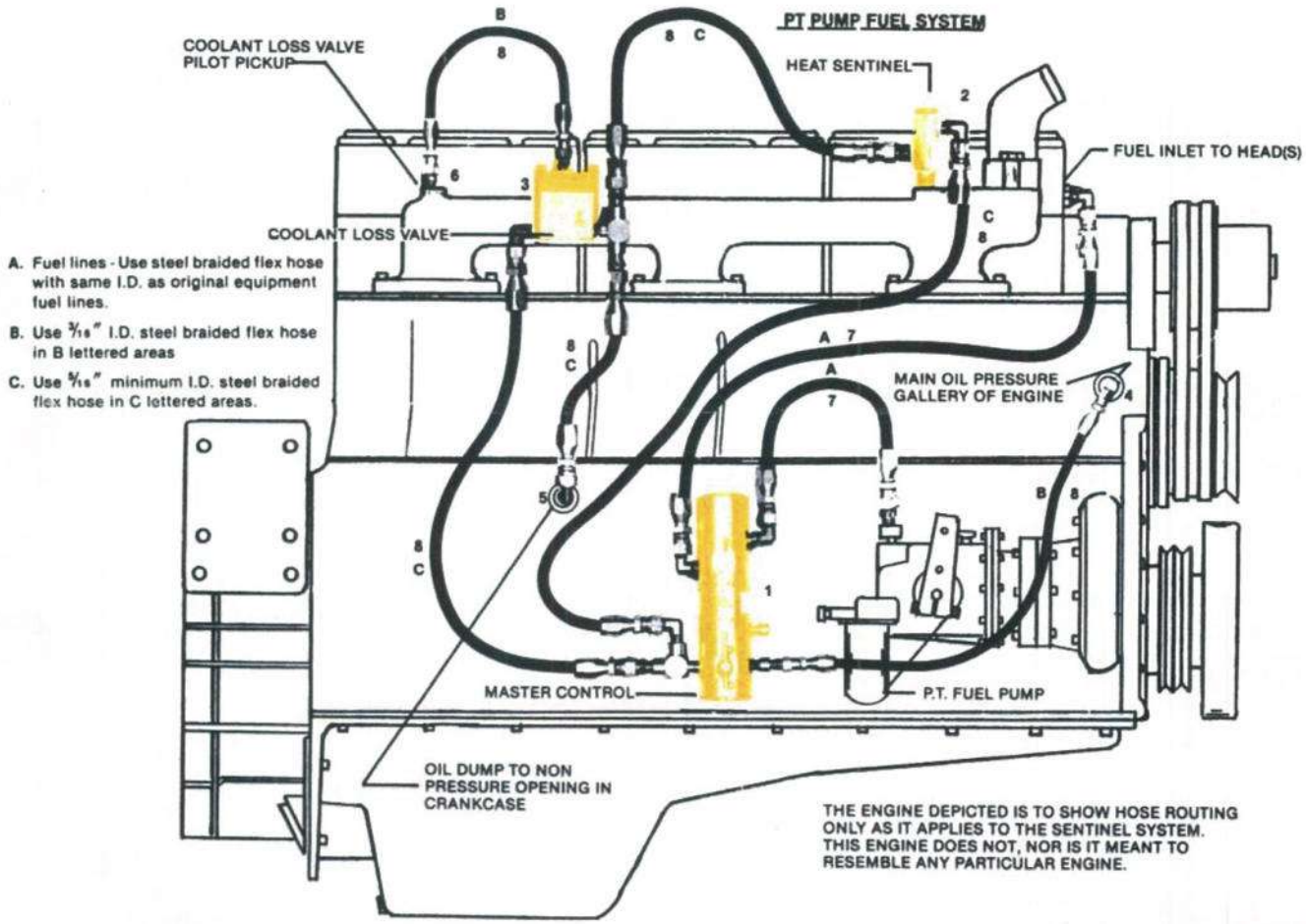
D5 Koln 60, West Germany
(0021) 71720
Telex 8885219

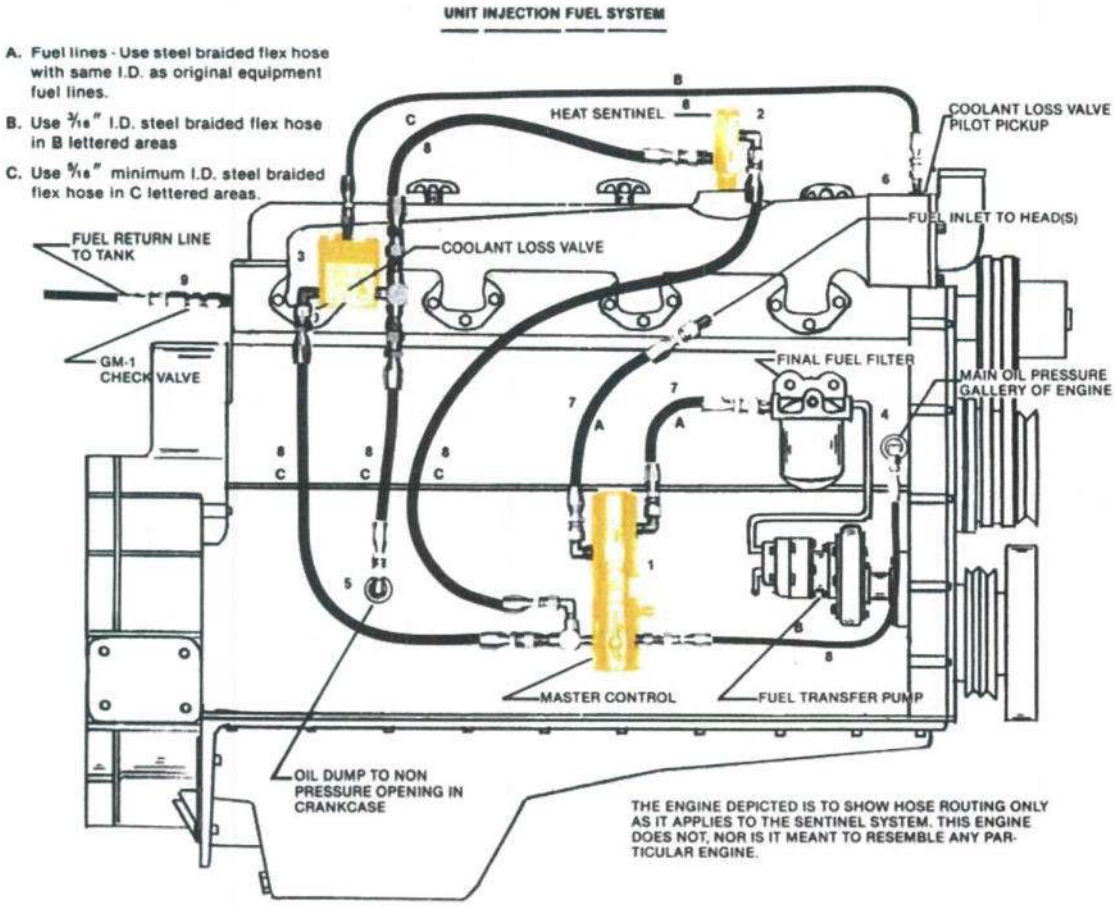
Parker
Filtration




## GENERAL INSTALLATION INSTRUCTION GUIDE FOR ENGINES WITH PT PUMP FUEL SYSTEMS (CUMMINS)

The engine depicted in this illustration is drawn to show hose routing only. Engine components in the illustration are shown in different locations than they appear on engine. This is done to simplify drawing. The hose routing as applied to the Sentinel system valves will be the same on Inline and "V" series engines.

1. Select mounting location for Master Control. The Master Control should be mounted as close as practical between the discharge side of the PT pump and fuel inlet to engine head. The Master Control may be mounted in any position (upside down, sideways, or upright) so as to keep the fuel lines as short as possible. The MB-1 Mounting Bracket may be bent to accommodate this. The Mounting Bracket may be bolted to the engine, engine accessory or other convenient location.
2. The Heat Sentinel should be installed in the hottest part of the coolant flow. This is usually in the water manifold just prior to the thermostat housing. Make sure that any opening selected to install the Heat Sentinel is in the main coolant flow and that no obstructions in the opening can hit the power element and dammage it when installed. Heat Sentinels are available with 1/2" N.P.T.F. or ¾" N.P.T.F. installation threads. Thermowell Reducer Bushings are also available.
3. Using the MB-79 (Mounting Bracket for Coolant Loss Valve) or the four holes in the MB-1 Mounting Bracket, mount the Coolant Loss Valve at approximately the same height as the engine head.
4. Select an oil pressure opening from the main oil pressure gallery of the engine and install a suitable fitting that will accept a #4 Hose End. **DO NOT** tee into an oil supply line that feeds an engine accessory, such as an air compressor.
5. Locate a suitable opening in the non-pressure section of the oil crankcase. There are usually pipe plug openings in the engine block just above the oil pan. In some cases a gear plate or other plate on the engine may have to be removed and a hole be drilled and tapped ¼" N.P.T. for the oil dump. Install a fitting to accept to oil dump line.
6. Locate an opening in the coolant system between the discharge side of the water pump and the engine side of the thermostat. Most engines have numerous openings in the block, water manifold and thermostat housing. Install a suitable fitting in one of the openings that will accept a #4 Hose End. This is the Coolant Loss Valve pilot pickup.
7. Remove the fuel line that runs from the P.T. Pump to the inlet to the head(s). Make two new lines using the same size I.D. hose or one size larger and connect the lines as shown in drawing.
8. Using the drawing as a plumbing guide, makeup the remaining hoses and install as shown. The plumbing does not have to be the exact configuration as shown, but the Heat Sentinel and Coolant Loss Valve must have an oil pressure line from the Master Control to the "IN" port of each and a route form the "OUT" port of each back to the crankcase.

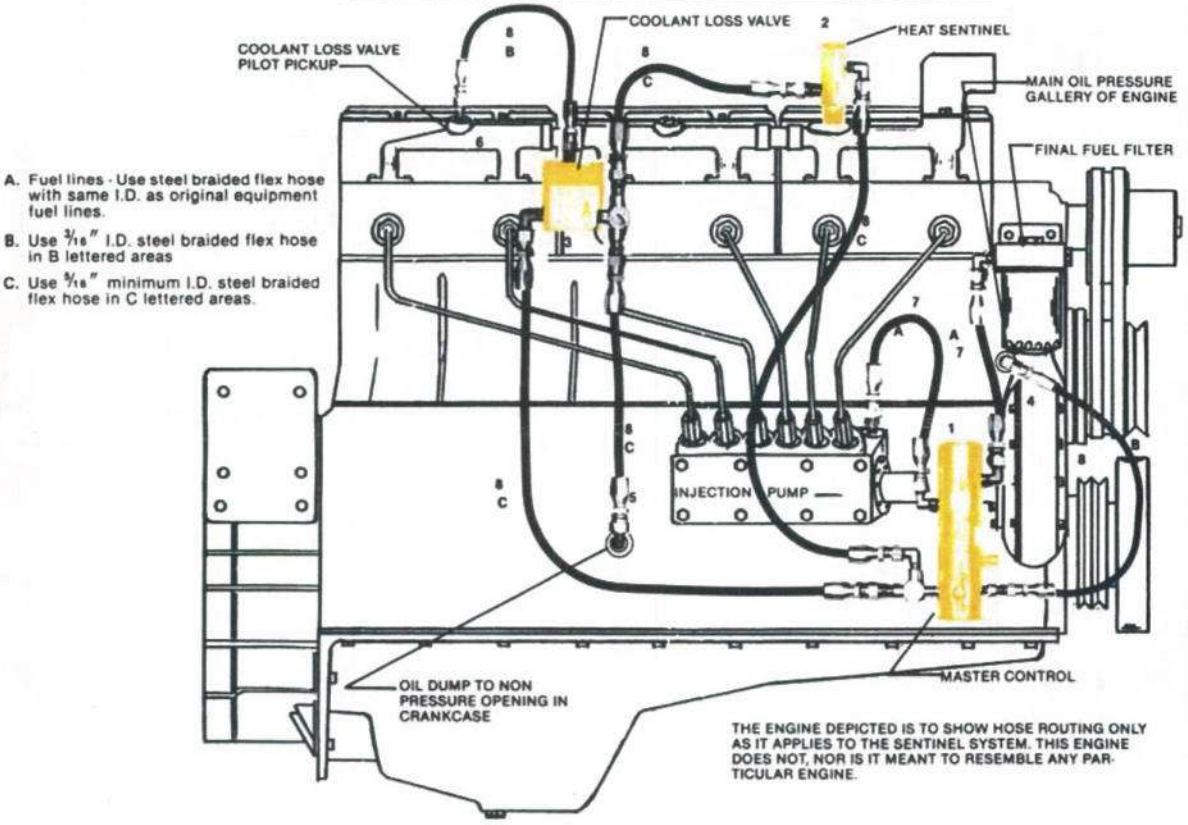



## GENERAL INSTALLATION INSTRUCTION GUIDE FOR ENGINES WITH UNIT INJECTION FUEL SYSTEMS

The engine depicted in this illustration is drawn to show hose routing only. This is a typical engine with unit injection fuel system, but it is not meant to resemble any particular engine. it is shown this way to simplify drawing. There are a number of engine manufacturers who produce engine with unit injection fuel systems. (Example: Detroit Diesel, VC Series Waukesha, V-12 Allis Chalmers, EMD, etc.)

1. Select mounting location for Master Control. The Master Control should be mounted as close as practical between the outlet or the final fuel filter and fuel inlet to the engine head(s). The MB-1 Mounting Bracket may be bolted to the engine, engine accessory or other convenient location. It may be necessary to bend the Mounting Bracket on some installations. Bolt the Master Control to the bracket. Mount Master Control so when the hoses are installed they will not run close to exhaust pipes.
2. The Heat Sentinel should be installed in the hottest part of the coolant flow. This is usually the thermostat housing or water manifold, just prior to the thermostat housing. On some applications where no openings are available, it may be necessary to remove a plate from the engine and drill and tap an opening for the Heat Sentinel. Heat Sentinels are available with ½" N.P.T.F. or ⅜" N.P.T.F. installation threads. Thermowell Reducer Bushings are also available.
3. Using the MB-79 Mounting bracket for Coolant Loss Valve or the four holes in the MB-1 Mounting Bracket, mount the Coolant Loss Valve at approximately the same height as the engine head.
4. Select an oil pressure opening from the main oil pressure gallery of the engine and install a suitable fitting that will accept a #4 Hose End. **DO NOT** tee into an oil supply line that feeds an engine accessory, such as an air compressor.
5. Locate a suitable opening in the non-pressure section of the oil crankcase. There are usually pipe plug openings in the engine block just above the oil pan. In some cases a gear plate or other plate on the engine may have to be removed and a hole be drilled and tapped ¼" N.P.T. for the oil dump. Install a fitting to accept the oil dump line.
6. Locate an opening in the coolant system between the discharge side of the water pump and the engine side of the thermostat. Most engines have numerous openings in the block, water manifold and thermostat housing. Install a suitable fitting in one of the openings that will accept a #4 Hose End. This is the Coolant Loss Valve pilot pickup.
7. Plumb fuel lines. **Inline Engines** - Remove the fuel line that runs from the final fuel filter to the fuel inlet at the head. Make up two new fuel lines and install as shown. Make fuel lines the same size or one size larger than existing fuel lines.
**"V" Series Engines** - on most "V" Series engines there are fuel lines from the final fuel filter to each head. Remove both of these lines and plug one of the fuel outlets at the filter with a pipe plug. Make a new fuel line and run it from the remaining outlet of the filter to the inlet of the Master Control and make two new lines that will run from the tee to each head. Make fuel lines the same size or one size larger than existing lines.
8. Using the drawing as a plumbing guide, makeup the remaining hoses and install as shown. The plumbing does not have to be the exact configuration as shown, but the Heat Sentinel and Coolant Loss Valve must have an oil pressure line from the Master Control to the **"IN"** port of each and a route from the **"OUT"** port of each back to the crankcase.
9. Locate the fuel return line to the tank and install the GM-1 Check Valve with the arrow pointing toward the tank. The Check Valve maybe installed at any convenient location from the restrictor fitting at the outlet of the head to the fuel tank. On "V" series engines make sure that the GM-1 Check Valve is installed down stream after the return lines from each head are connected together.

INJECTION FUEL SYSTEMS THAT HAVE HIGH PRESSURE LINES TO EACH INJECTOR




## GENERAL INSTALLATION INSTRUCTION GUIDE FOR ENGINES WITH INJECTION PUMPS THAT HAVE HIGH PRESSURE LINES TO EACH INJECTOR

Some of the pumps that fall into this category are Bosch, CAV, Caterpillar and Roosa Master. The engine shown in this illustration is for hose routing only and does not resemble any particular engine. It is drawn in this configuration to simplify drawing.

1. Mount the Master Control at a location near the injection pump and in a position to allow the fuel lines to be plumbed at the final fuel filter and injection pump as shown.
   **NOTE:** On some Caterpillar Engines the final fuel filter is mounted on the injection pump or so near it that a fuel adapter is required to break into fuel system. (See Caterpillar specification sheet for details.)
2. The Heat Sentinel should be installed in the hottest part of the coolant flow. This is usually the thermostat housing or water manifold just prior to the thermostat housing. On some older engines or on engines where no openings are available, it will be necessary to drill and tap the water manifold or a plate attached to the engine head to install the Heat Sentinel. Heat Sentinels are available with ½" N.P.T.F. or ¾" N.P.T.F. installation threads. Thermowell Reducer Bushings are also available.
3. Using the MB-79 (Mounting Bracket for Coolant Loss Valve) or the four holes in the MB-1 Mounting Bracket, mount the Coolant Loss Valve at approximately the same height as the engine head.
4. Select an oil pressure opening from the main oil pressure gallery of the engine and install a suitable fitting that will accept a #4 Hose End. **DO NOT** tee into an oil supply line that feeds an engine accessory, such as an air compressor.
5. Locate a suitable opening in the non-pressure section of the oil crankcase. There are usually pipe plug openings in the engine block just above the oil pan. In some cases a gear plate or other plate on the engine may have to be removed and a hole be drilled and tapped ¼" N.P.T. for the oil dump. Install a fitting to accept the oil dump line.
6. Locate an opening in the coolant system between the discharge side of the water pump and the engine side of the thermostat. Most engines have numerous openings in the block, water manifold and thermostat housing. Install a suitable fitting in one of the openings that will accept a #4 Hose End. This is the Coolant Loss Valve pickup.
   **NOTE:** To make certain the opening that is selected is in the main coolant flow, it is recommended a pressure gage that reads in one pound increments be installed to monitor the coolant pressure at the opening. The engine should idle with at least one p.s.i. of coolant pressure and as the engine R.P.M. increases the coolant flow pressure should also increase to at least 5 p.s.i. over idle. If coolant pressure does not increase, select another opening for Coolant Loss Valve pilot pickup.
7. Locate the main fuel supply line that runs from the final fuel filter to the injection pump and remove it. Make up two new fuel lines and plumb Master Control into fuel system as shown. On Caterpillar engines that do not have fuel lines from the final fuel filter to the injection pump a fuel adaptor is required. (See Caterpillar specification sheet.)
8. Using the drawing as a plumbing guide, makeup the remaining hoses and install as shown. The plumbing does not have to be the exact configuration as shown, but the Heat Sentinel and Coolant Loss Valve must have an oil pressure line from the Master Control to the **"IN"** Port of each and a route from the **"OUT"** port of each back to the crankcase.
9. On some applications where the fuel tank is located higher that the injection pump it may be necessary to install a one-way Check Valve in the fuel return line to present fuel from being supplied by gravity to the injection pump when Master Control closes. During self-test if shutdown time is excessive and fuel tank is above injection pump, the check valve is necessary.

# High Temperature Valves

## Models 4075 and 4475

### Overview

The 4075/4475 high temperature valve is used to sense gas or liquid high temperature conditions. The field adjustable temperature setting from 54°C to 260°C (130°F to 500°F) provides wide setpoint flexibility. The standard thermowell provides extended life of the sensor and simplifies calibration and maintenance.

**Type 4075**

**High Temperature Valve**

### Typical applications

- Jacket water temperature
- Compressor discharge temperature
- Steam temperature
- Lube oil temperature
- Processs temperature

### Key features and benefits

- 316 Stainless Steel or Cast Aluminum available
- Field adjustable from 54°C to 260°C (130°F to 500°F)
- Reliable protection
- Few moving parts
- Easy installation - low maintenance
- Thermowell included
- Compatible with complete AMOT shutdown systems
- Viton seals

# High Temperature Valves - Models 4075/4475

## Operation

The 4075/4475 is widely used for sensing high pressure natural gas compressor discharge temperature. When a valve is positioned at each compressor cylinder discharge manifold, an increase in temperature past the valves set point will cause the valve to vent off a control signal.

Removal is quick and easy with the stainless steel thermowell, which is supplied as part of the standard valve assembly. The valve assembly is held into the well by straight thread connections and a locking nut. Unscrewing the valve body/ locknut and disconnecting the tubing fittings is all that is required to remove the valve from the well.

The bi-metallic temperature sensing discs arranged in a stack deflect uniformly as the temperature increases providing a long life, low maintenance actuator for the valve spool.

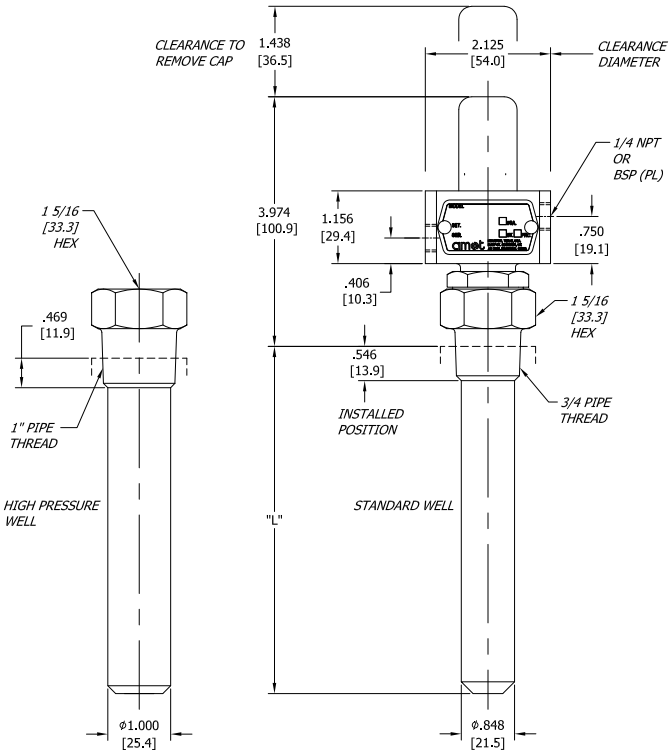
When the temperature of the fluid flowing past the well is below the tripping point, the temperature sensing element assembly is contracted and the loading spring keeps the valve spool in closed position. If the fluid temperature increases, the bi-metallic element assembly expands, moving the valve spool downward (opening valve) against the springs and opening the IN to the VENT port.

## Specification

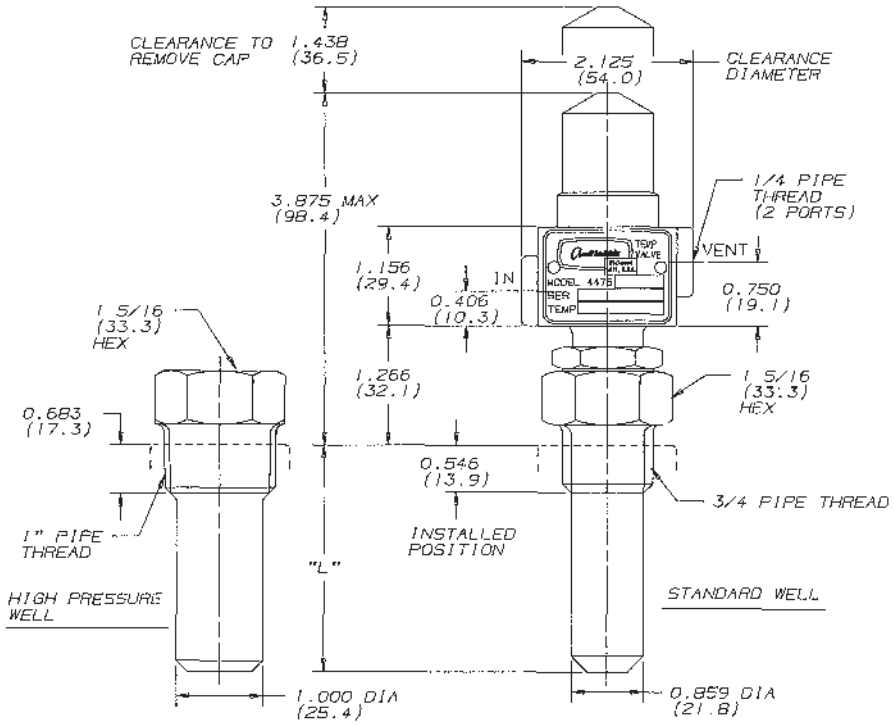
| | | |
|---|---|---|
| **4075 Valve body** | Anodized aluminum | |
| **4475 Valve body** | 316 stainless steel | |
| **4075 Installation threads** | 3/4” BSP(PL) | (3/4” NPT, 1” NPT) |
| **4475 Installation threads** | 3/4” BSP(PL), BSP(Tr) | (3/4” NPT, 1” NPT) |
| **Port threads** | 1/4” NPT | |
| **Typical medium sensed** | Gases | |
| **Adjustable temp. trip range** | 54 - 260°C | (130 - 500°F) |
| **Maximum allowable sensed temperature** | 260°C | (500°F) |
| **Valve well** | Stainless Steel | |
| **Standard seals** | Viton | |
| **Max. pressure at IN port** | 8.62 bar | (125 psi) |
| **Sensor type** | Bi-metallic disc | |
| **Net weight (max. without well)** | 0.9 kg | (2 lbs) |
| **Override** | None | |

# High Temperature Valves - Models 4075/4475

## Dimensions - Model 4075




## Dimensions - Model 4475



# High Temperature Valves - Models 4075/4475

## How to order

Use the table below to select the unique specification of your 4075 High Temperature Valve

| **Example** | 4075D | 1 | 06 | **Code Description** | | | |
|---|---|---|---|---|---|---|---|
| | | | | **Model** | | | |
| **Model Name** | 4075D | | | Anodized aluminum body | | | |
| | | | | **Thread** | | | |
| **Port thread and finish** | | 1 | | 1/4" NPT black anodised | | | |
| | | | | | **Installed depth** | | **Pressure rating*** | |
| | | | | | **mm** | **inches** | **bar** | **psi** |
| | | | 01 | 3/4" NPT | 95 | 3.75 | 379 | 5,500 |
| | | | 02 | 3/4" NPT | 146 | 5.75 | 379 | 5,500 |
| | | | 03 | 1" NPT | 95 | 3.75 | 689 | 10,000 |
| | | | 04 | 1" NPT | 146 | 5.75 | 689 | 10,000 |
| | | | 05 | 3/4" NPT | 95 | 3.75 | 258 | 3,750 |
| | | | 06 | 3/4" NPT | 146 | 5.75 | 258 | 3,750 |
| | | | 07 | 1" NPT | 95 | 3.75 | 413 | 6,000 |
| **Thermowell details installation thread** | | | 08 | 1" NPT | 146 | 5.75 | 413 | 6,000 |
| | | | 11 | 3/4" BSP(PL) | 87 | 3.44 | 258 | 3,750 |
| | | | 12 | 3/4" BSP(PL) | 138 | 5.44 | 258 | 3,750 |
| | | | 41 | 1/2" NPT | 95.3 | 3.75 | 689 | 10,000 |

Temperature range 54°C to 260°C (130°F to 500°F)

Specify trip point temperature when ordering if required to be factory set.
*Pressures shown are maximum allowable. To obtain working pressure, factors of safety should be applied as required by appropriate codes or regulations. In certain adverse conditions, a corrosion or erosion allowance should also be made.

Use the table below to select the unique specification of your 4475 High Temperature Valve

| **Example** | 4475B | 0 | 34 | **Code Description** | | | |
|---|---|---|---|---|---|---|---|
| | | | | **Model** | | | |
| **Model Name** | 4475B | | | 316 Stainless Steel body | | | |
| | | | | **Thread** | | | |
| **Thread type** | | 0 | | NPT | | | |
| | | | | | **Installed depth** | | **Pressure rating*** | |
| | | | | | **mm** | **inches** | **bar** | **psi** |
| | | | 31 | 3/4" NPT | 95 | 3.75 | 258 | 3,750 |
| | | | 32 | 3/4" NPT | 146 | 5.75 | 258 | 3,750 |
| | | | 33 | 1" NPT | 95 | 3.75 | 413 | 6,000 |
| **Thermowell details installation thread** | | | 34 | 1" NPT | 146 | 5.75 | 413 | 6,000 |
| | | | 35 | 3/4" BSP(PL) | 87 | 3.44 | 258 | 3,750 |
| | | | 36 | 3/4" BSP(PL) | 138 | 5.44 | 258 | 3,750 |

Temperature range 54°C to 260°C (130°F to 500°F)

Specify trip point temperature when ordering if required to be factory set.
*Pressures shown are maximum allowable. To obtain working pressure, factors of safety should be applied as required by appropriate codes or regulations. In certain adverse conditions, a corrosion or erosion allowance should also be made.

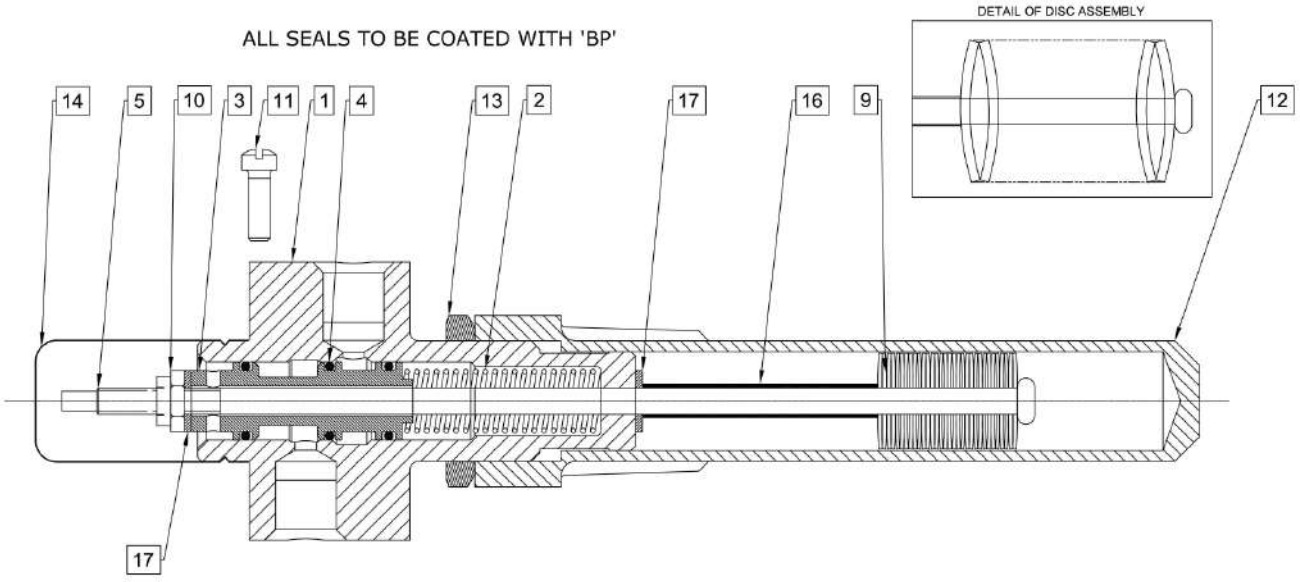
# High Temperature Valves - Models 4075/4475

## Adjustment

Refer to cut-away view below. This model is checked at the factory for proper operation in a still air calibrating oven at approximately 150°C (300°F). To set the unit on the job to suit operating conditions, it should be piped into the safety control systems and be operational. The master safety control shut off valve should be overridden during adjustments so the machine will continue running. First remove Cap (14) by pulling upward. It is held in position by a groove in the Cap. Gradually lower the setting by holding the flats of Rod (5) firmly with a small adjustable wrench, and turning Locknut (10) clockwise until the safety control indicator registers a trip. Turn Locknut (10) a turn or so counterclockwise, depending on the temperature rise desired for shutdown above the normal operating temperature. One complete turn of the Locknut (10) adjusts the temperature 25 to 35°F. Nut (10) should be turned sufficiently to effect a bubble-tight seal at the VENT port under normal operating conditions. After adjustment, check to see that the unit operates by manually pushing down on the top of Rod (5) (observing the shutdown indicator for that function).

If the recommended setting procedure is not possible, setting can be done using a pressure gauge in the VENT port, and turning Adjusting Nut (10) until the valve cracks open, giving a gauge reading.

## Service Parts




**Cut-away View**

Refer to cut-away view above.

| Ref no.: | Qty | Description | Part no. for standard finish |
|---|---|---|---|
| 4 | 3 | O-ring, Viton | 395L009 |
| BP | A/R | Grease, high temperature | 21721L001 |

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# 2-Way Temperature Sensing Valves

## Models 2230D & 4430B


**Model 2230 (Brass)**

**Model 4430 (Stainless steel)**

### Typical applications

- Lube oil
- Jacket water
- Discharge gases
- Bearings or packing

### Key benefits

- Compact, rugged design
- Factory set and field adjustable
- Compatible in hydraulic or gas systems
- Few moving parts
- Compatible with complete AMOT shutdown systems
- No electricity required; failsafe
- No wires to break or corrode

### Key features

- Viton seals standard
- Brass (2230) or Stainless Steel (4430) construction
- Temperature setting available from 30°C - 118°C (95°F - 245°F) standard or 129°C (265°F) high temperature
- Maximum pressure at the IN Port is 8.6 bar (125 psi)
- Maximum internal pressure on the temperature sensing element is 55.1 bar (800 psi)

### Accreditations available

- PED — Suitable for Group 1 & 2 liquids (Ensure materials are compatible)
- ATEX — II 2G TX X
- CE — 2230C/4430B Complies with all relevant EU directives

**www.amot.com**

# 2-Way Temp. Sensing Valves - Models 2230D/4430B

## Contents

# 2-Way Temp. Sensing Valves - Models 2230D/4430B

## Overview

Model 2230/4430 is a normally-closed, 2-way valve which is opened by increasing temperature of engine cooling water, lubricating oil, high pressure gas or other fluids. The 2230/4430 can also be used to sensing high bearing or packing temperatures.

Opening of the valve vents control pressure from an AMOT Mater Safety Control such as Model 2800 or 4261, and protects the engine, compressor, pump, gear case, and industrial machinery from over-temperature.

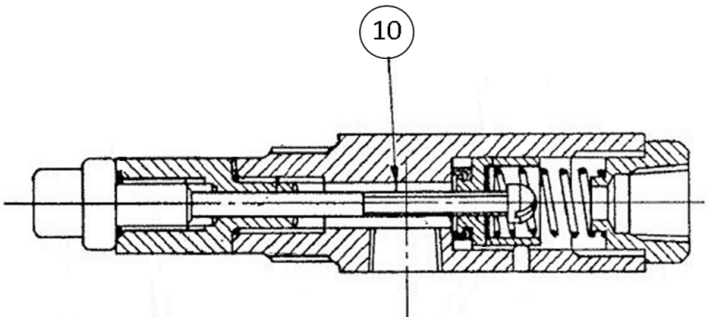
## Operation

Model 2230/4430 operation is simple and straight forward. As the temperature of the sensed fluid increases, wax enclosed in the valve's temperature sensing element expands against a push rod, which in turn unseats a valve allowing flow to travel from the valve's IN port and out the valve's OUT port. For visual indication that the temperature valve has tripped, use AMOT Model 4054 Trip Indicator.

Model 2230/4430 Temperature Valves are set at the factory, and the trip temperature is stamped on the valve body. The valve will start to bleed control pressure at 2°F to 4°F below its calibrated setting. Do not operate 2230/4430 beyond the valve's maximum continuous operating temperature. Both models are field service/adjustable. See 'Adjustment' below.

## Adjustment

Refer to cut-away view to the right. To adjust the temperature setting of the 2230/4430, place a screwdriver through the IN port and in the slot of the adjusting screw ⑩. To RAISE the temperature setting turn the screw counter-clockwise, to LOWER the setting turn the screw clockwise. One turn equals about 10°F. When changing the tripping temperature be sure that the valve is not adjusted beyond the range limit.




## Installation

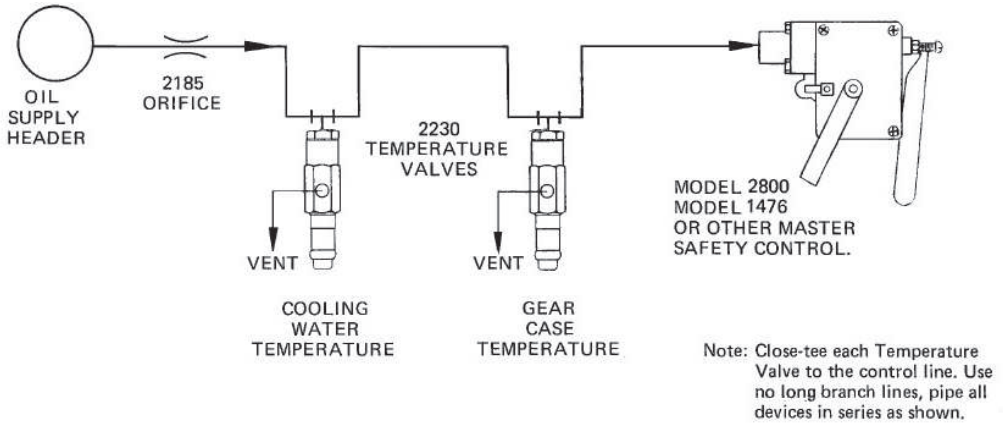
Before installing the Model 4430 it is advisable to run a $^{22}/_{32}$" diameter tap drill through the pipe fitting in which the unit will be placed. Some commercial fittings are not tapped deep enough and the threads may damage the valve's temperature element cup.

Apply a quality thread sealant such as Loctite™ Pipe Sealant to pipe thread connections. Avoid introducing the sealant or other contaminants into the system.

On a system using lubricating oil for control pressure, the vent port is connected to the engine oil sump. If natural gas is used, the vent port is connected to the system vent.

No vent connection is required where air is the control medium, but the port should be protected from contamination by an AMOT 4125 vent closure or a tubing elbow turned downward.

**Typical installation diagram**



# 2-Way Temp. Sensing Valves - Models 2230D/4430B

## Stainless Steel Wells

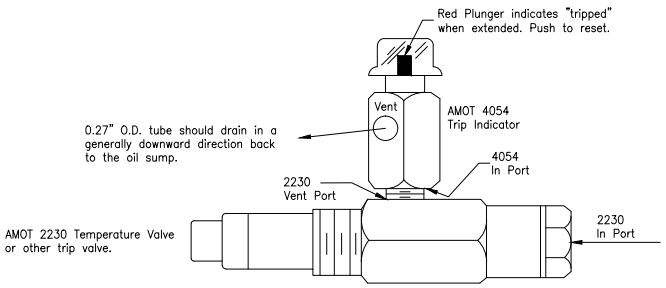
Two types of stainless steel wells may be used with Model 4430 Temperature Valves.

| Well | Connection | Maximum operational pressure |
|---|---|---|
| 2766L | 1" NPT | 10,000 psi |
| 3802L | ¾" NPT | 5,000 psi |

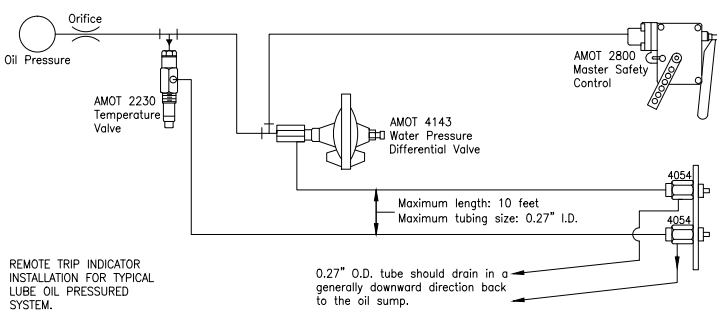
To obtain working pressure, factors of safety should be applied as required by appropriate codes or regulations. In certain adverse conditions, a corrosion or erosion allowance should also be made.

## Optional Visual Trip Indicators

A typical installation for lube oil pressured system.




It is also suitable for air or gas systems when not vented back to the oil sump.




## Valve Characteristics

### Temperature element characteristics

| Code | Temperature element extension | | Installed depth of wells | | | |
|---|---|---|---|---|---|---|
| | Installed depth "L" | | ¾" 3802L Well "M" | | 1" 2766L Well "N" | |
| | Inch | mm | Inch | mm | Inch | mm |
| 0* | 1 3/8 | 34.9 | - | - | - | - |
| 1 | 2 3/16 | 55.6 | 1 11/16 | 42.9 | 2 | 50.8 |
| 2 | 2 1/2 | 63.5 | 1 15/16 | 49.2 | 2 1/4 | 57.2 |
| 3 | 3 | 73.2 | 2 7/16 | 61.9 | 2 3/4 | 69.9 |
| 4 | 3 1/2 | 88.9 | 2 15/16 | 74.6 | 3 1/4 | 82.6 |
| 5 | 4 | 101.6 | 3 7/16 | 87.3 | 3 3/4 | 95.3 |
| 6 | 4 1/2 | 114.3 | 3 15/16 | 100 | 4 1/4 | 107.6 |
| 7 | 5 | 127 | 4 7/16 | 112.7 | 4 3/4 | 120.7 |

**NOTES:**

* No extension, and no well available.

### Temperature ranges

| Code | | Temp. range without a well (add 10°F if in a well) | | Maximum cont. allowable temp. | |
|---|---|---|---|---|---|
| Standard element | Plated element | °F | °C | °F | °C |
| A | K | 60 - 95 | 15 - 35 | 120 | 49 |
| B | M | 96 - 130 | 36 - 54 | 155 | 68 |
| C | N | 131 - 160 | 55 - 71 | 180 | 85 |
| D | P | 161 - 180 | 72 - 82 | 215 | 102 |
| E | R | 181 - 210 | 83 - 99 | 230 | 110 |
| F | S | 215 - 225 | 101 - 107 | 245 | 118 |
| G | T | 226 - 245 | 108 - 118 | 255 | 124 |
| H | W | 265 | 129 | 275 | 135 |
| J | X | 246 - 255 | 119 - 124 | 275 | 135 |

## How to Order

Use the table below to select the unique specification of your Model 2230/4430 2-Way Temperature Sensing Valve.

| Example | 2230D | 1 | 2 | 0 | E | N | 210F | | Code description | Comments |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | **Basic model (A)** | |
| **Basic model (A)** | 2230C | | | | | | | | Brass | UK ONLY |
| | 2230D | | | | | | | | Brass | USA ONLY |
| | 4430B | | | | | | | | Stainless steel | |
| | | | | | | | | | **Finish and thread (B)** | |
| **Finish and thread (B)** | | 1 | | | | | | | Standard, NPT | |
| | | 2 | | | | | | | Standard, BSP (TR) | |
| | | 3 | | | | | | | Plated, NPT | |
| | | 4 | | | | | | | Plated, BSP (TR) | |
| | | | | | | | | | **Seal material (C)** | |
| **Seal material (C)** | | | 2 | | | | | | Viton | |
| | | | | | | | | | **Temperature element extension/installed depth of wells (D)** | |
| **Temperature element extension/installed depth of wells (D)** | | | | * | | | | | For temperature element extensions/installed depths of wells available, refer to the temperature element characteristics table on page 4. | |
| | | | | | | | | | **Temperature Range (E)** | |
| **Temperature range (E)** | | | | | ** | | | | For temperature ranges available, refer to the temperature ranges table on page 4. | |
| | | | | | | | | | **Thermal well code (F)** | |
| **Thermal well code (F)** | | | | | | N | | | Not fitted | |
| | | | | | | V | | | Calibrated in a well | Well not fitted |
| | | | | | | 1 | | | ¾” NPT | |
| | | | | | | 2 | | | 1” NPT | |
| | | | | | | | | | **Temperature setting (G)** | |
| **Temperature setting (G)** | | | | | | | 210F | | (temperature) in °F or °C | |
| | | | | | | | | | **Customer special requirements (H)** | |
| **Customer special requirements (H)** | | | | | | | | -AA | Standard | May be omitted |
| | | | | | | | | -*** | Customer special code | |

# 2-Way Temp. Sensing Valves - Models 2230D/4430B

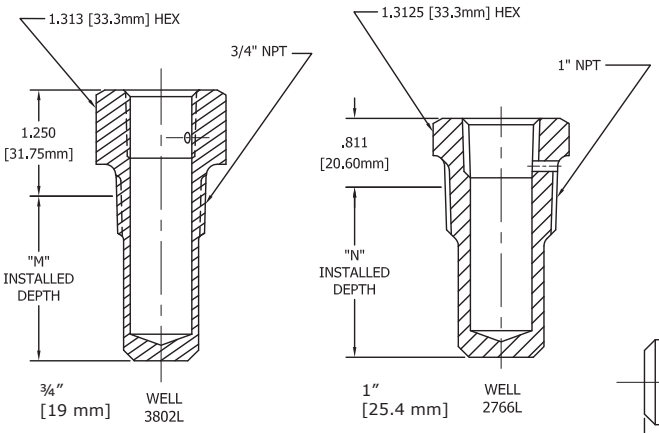
## Specification

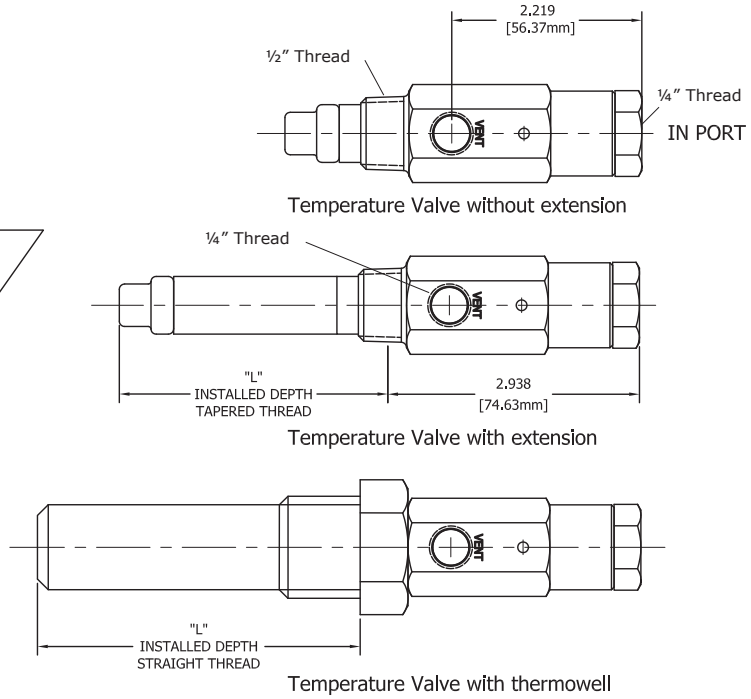
| | 2230C/2230D | | 4430B | |
|---|---|---|---|---|
| | **Metric units** | **English units** | **Metric units** | **English units** |
| **Standard materials** | | | | |
| Body and nut | Brass | | 316 Stainless steel | |
| Seals | Viton | | Viton | |
| Element | Brass | | Brass | |
| Extensions | Brass | | 316 Stainless steel | |
| **Maximum pressure on temperature element** | 55.1 bar | 800 psi | 55.1 bar | 800 psi |
| **Maximum pressure at IN port** | 8.6 bar | 125 psi | 8.6 bar | 125 psi |
| **Maximum net weight** | 0.57 kg | 1 ¼ lbs | 0.57 kg | 1 ¼ lbs |
| **Maximum net weight of well** | 0.45 kg | 1 lb | 0.45 kg | 1 lb |
| **Accreditations available** | PED | Suitable for Group 1 & 2 liquids & gases (Ensure materials are compatible) | | |
| | ATEX | Ex II 2G TX X | | |
| | CE | 2230C/4430B Complies with all relevant EU directives | | |

## Dimensions

Dimensions - inches [mm].

Refer to the temperature element characteristics table on page 4 for dimensions L, M and N.




## Maintenance

AMOT Model 2230/4430 Temperature Sensing Valves can be checked by allowing the fluid temperature to rise to the indicated tripping point where it should trip the primary control. The valve may also be tested in a highly agitated, accurately calibrated, temperature bath of water or water and glycol while still connected to the pressure control system.

DO NOT use oil for calibrating temperature devices.

***AMOT recommends checking any safety control system every FEW months to ensure optimum valve performance.***

There are no user serviceable components in the 2230/4430 Temperature Sensing Valves.

# Contact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**⚠ WARNING**
This product can expose you to chemicals including Lead, which is known to the state of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.

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by AMOT

# Z-Range Air Intake Shut Down Valves - Bendix Types

## (Manual closure plus automatic closure on engine overspeed, low engine oil pressure, high coolant or high exhaust temperature)

## Selection, Application and Maintenance

Valve Numbers

TMZ-121 to TMZ-302

CE208_TMZ_121_302_0516

# DESCRIPTION

A range of automatic overspeed air intake shut down valves which can also be automatically closed by an engine lubricating oil pressure (or air pressure) system to give shut down on loss of engine oil pressure, high coolant or high exhaust gas temperature. TMZ valves also are also supplied with manual start over-ride/manual emergency stop controls.

TMZ valves are available for all popular combinations of air intake pipe sizes and engine ratings up to 149 kW (turbocharged) or 179 kW (naturally aspirated). For higher engine ratings see “Notes” below.

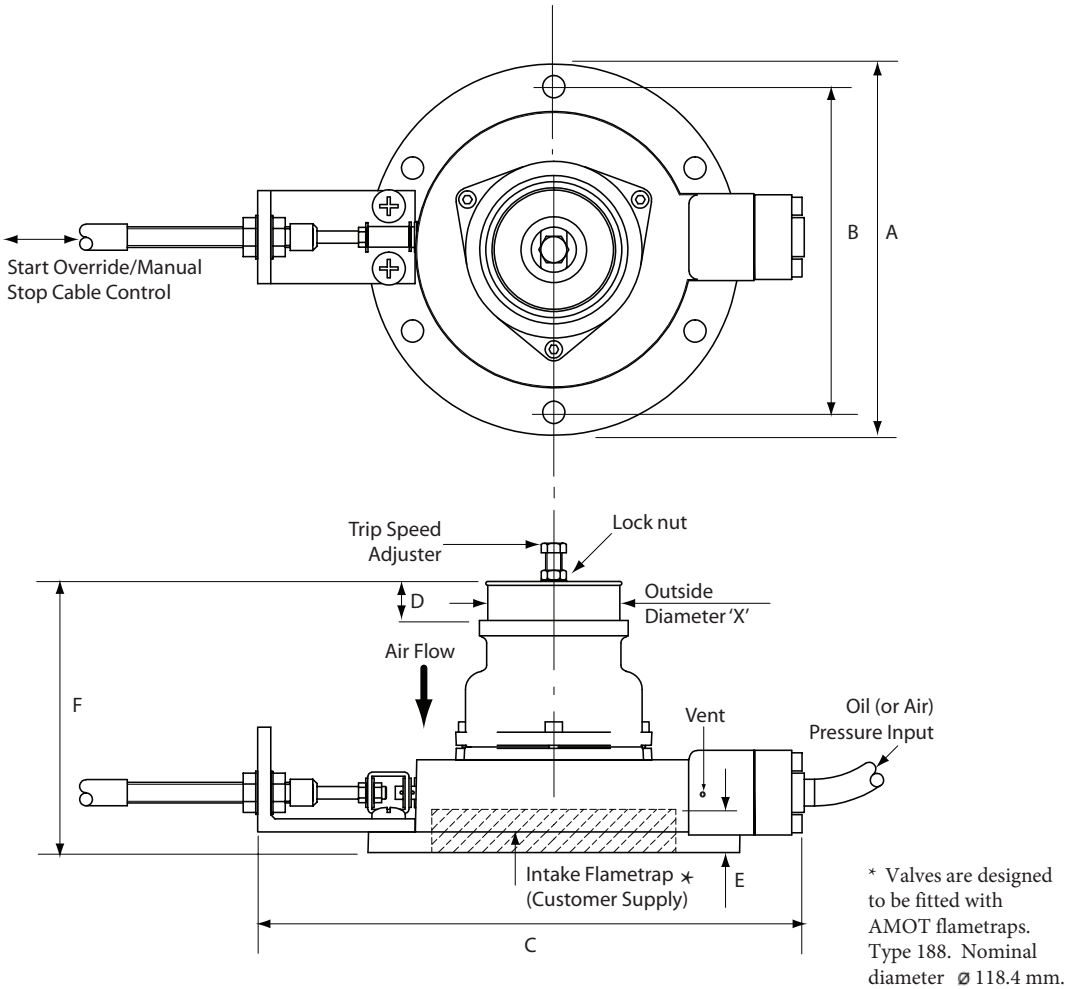
Some smaller TMZ valve sizes are optionally available with an integral intake flame trap housing and/or an integral engine air cleaner.

This type of valve may be fitted to either naturally aspirated or turbocharged engines. It should be noted however that for a given valve setting the repeatability of the actual shut down speed has a greater scatter in the case of a turbocharged engine. However, unless for special reasons a precisely repeatable shut down speed is required, adequate protection from excessive overspeed and potential resulting damage is still achieved.

The basic dimensions for this family of valves are tabulated on page 4.

# Typical Arrangement

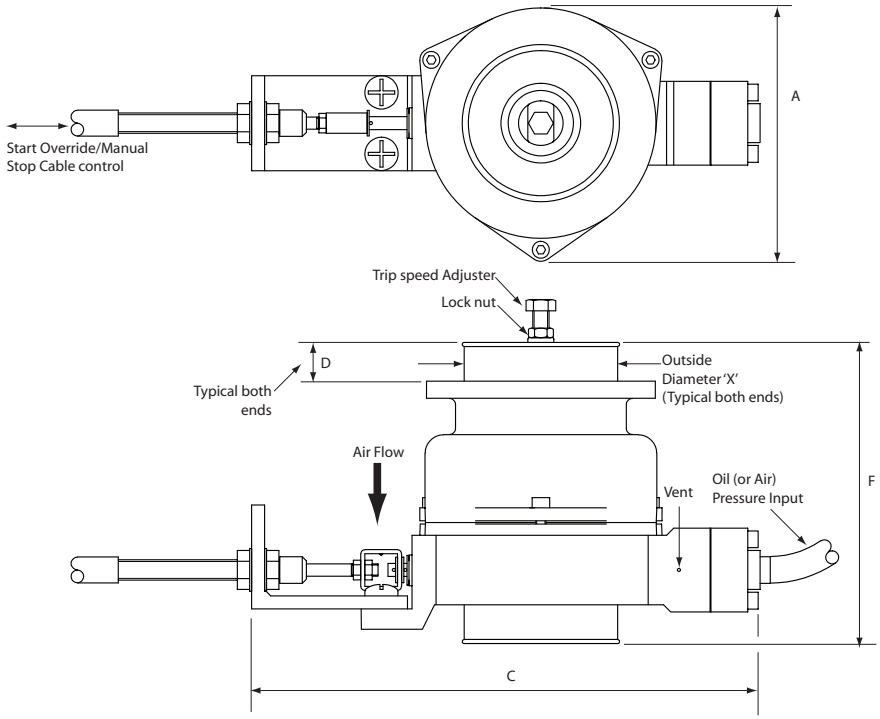
Valves TMZ-121 to TMZ-128 and TMZ-221 to TMZ-228




* Valves are designed to be fitted with AMOT flametraps. Type 188. Nominal diameter ⌀ 118.4 mm.

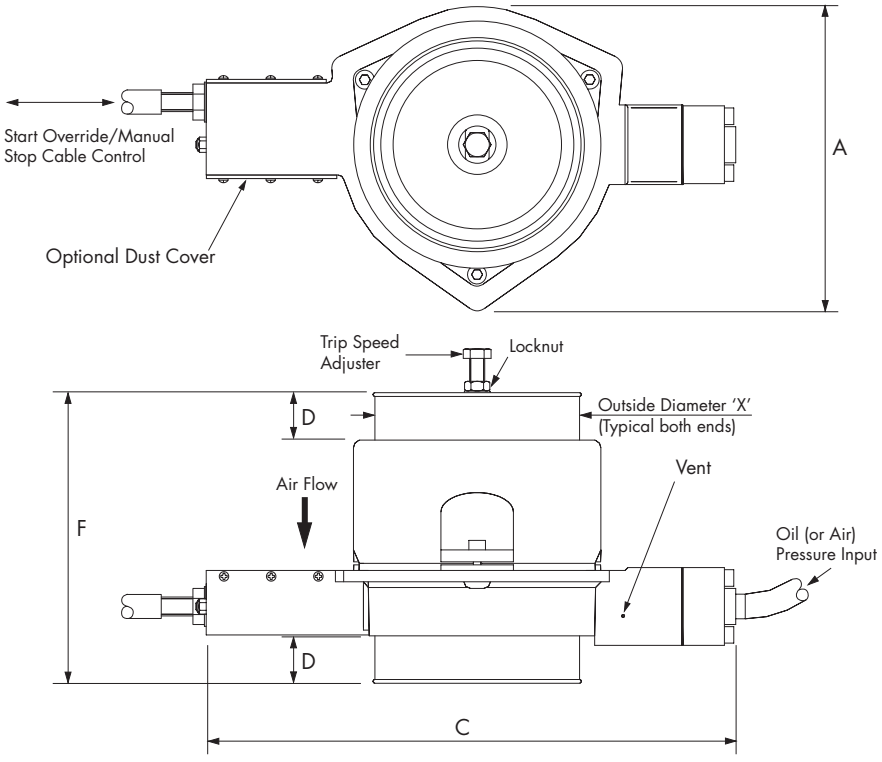
# Typical Arrangement

Valves TMZ-131 to TMZ-134




# Typical Arrangement

Valves TMZ-301 to TMZ-302





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| Valve Part No. | | A (mm) | B (mm) | C (mm) | D (mm) | E Flametrap housing nominal depth (mm) | F (mm) | Overall length with integral air cleaner (fitted) (mm) |
|---|---|---|---|---|---|---|---|---|
| Without integral engine air cleaner | With integral engine air cleaner | | | | | | | |
| TMZ-121 | TMZ125 | 180 | 158 | 265 | 19 | 21 | 132 | 201 |
| TMZ-122 | TMZ-126 | 180 | 158 | 265 | 19 | 21 | 135 | 204 |
| TMZ-123 | TMZ-127 | 180 | 158 | 265 | 19 | 21 | 138 | 207 |
| TMZ-124 | TMZ-128 | 180 | 158 | 265 | 19 | 21 | 139 | 208 |
| TMZ-221 | TMZ-225 | 180 | 158 | 265 | 19 | 40 | 151 | 220 |
| TMZ-222 | TMZ-226 | 180 | 158 | 265 | 19 | 40 | 154 | 223 |
| TMZ-223 | TMZ-227 | 180 | 158 | 265 | 19 | 40 | 157 | 226 |
| TMZ-224 | TMZ-228 | 180 | 158 | 265 | 19 | 40 | 158 | 227 |
| TMZ-131 | n/a | 124 | n/a | 265 | 19 | n/a | 139 | n/a |
| TMZ-132 | n/a | 124 | n/a | 265 | 19 | n/a | 142 | n/a |
| TMZ-133 | n/a | 124 | n/a | 265 | 19 | n/a | 145 | n/a |
| TMZ-134 | n/a | 124 | n/a | 265 | 19 | n/a | 147 | n/a |
| TMZ-301 | n/a | 160 | n/a | 279 | 19* | n/a | 147** | n/a |
| TMZ-302 | n/a | 160 | n/a | 279 | 19* | n/a | 153*** | n/a |

Outside diameter “X” is selected to match the bore of the engine air intake hose - see page 4 “Selection”.
Dimensions marked * increased to 25 mm for outside diameter “X” valves of 86 mm or greater.
Dimensions marked ** increased to 153 mm for outside diameter “X” valves of 86 mm or greater.
Dimensions marked *** increased to 159 mm for outside diameter “X” valves of 86 mm or greater.

**Important Notes:**
The maximum oil (or air) pressure applied to the TMZ valve should not exceed 10 bar (145 psi). When the engine is running, the TMZ valve will close when the oil (or air) pressure falls below approximately 1 bar (14.5 psi). Note, this value varies slightly with engine speed and specific valve build.

Where fitted, the integral engine air cleaner used with this range of valves is designed for light/medium duty applications. It should not be used for heavy duty applications as unacceptable short air cleaner service intervals may result. Further advice is available from the Chalwyn Sales Office.

Variants of some TMZ valves can be supplied without the oil pressure and manual control - check with your Chalwyn supplier for details.

For higher engine ratings see AMZ and Z range valves - brochures CE231 and CE243.


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# SELECTION

1. Determine the rating of the engine to which the valve is to be fitted and whether or not turbocharged. Using the table below identify which valve(s) would be suitable.

Finalise the selection by identifying the valve which can also be supplied with end diameter(s) “X” to match the bore of the engine air intake hose at the position the valve is to be fitted. Note, end diameters are manufactured to the nearest 1mm. Generally, where more than one valve meets all requirements, select the larger valve size to minimize engine air intake restriction.

## Valve selection chart in metric units

| Valve Part No. | Engine power at rated speed kW | | Engine air intake hose bore mm | |
|---|---|---|---|---|
| | Naturally Aspirated Engines | Turbocharged Engines | Minimum | Maximum |
| TMZ-121 & TMZ-125 | 7.5 to 38 | 7.5 to 32 | 40 | 70 |
| TMZ-122 & TMZ-126 | 15 to 54 | 14 to 45 | 51 | 80 |
| TMZ-123 & TMZ-127 | 22 to 72 | 22 to 60 | 57 | 83 |
| TMZ-124 & TMZ-128 | 30 to 93 | 30 to 78 | 63 | 96 |
| TMZ-221 & TMZ-225 | 7.5 to 38 | 7.5 to 32 | 40 | 70 |
| TMZ-222 & TMZ-226 | 15 to 54 | 15 to 45 | 51 | 80 |
| TMZ-223 & TMZ-227 | 22 to 72 | 22 to 60 | 57 | 83 |
| TMZ-224 & TMZ-228 | 30 to 93 | 30 to 78 | 63 | 96 |
| TMZ-131 | 7.5 to 38 | 7.5 to 32 | 51 | 70 |
| TMZ-132 | 15 to 54 | 15 to 45 | 51 | 80 |
| TMZ-133 | 22 to 72 | 22 to 60 | 57 | 83 |
| TMZ-134 | 30 to 93 | 30 to 78 | 63 | 96 |
| TMZ-301 | 40 to 120 | 40 to 100 | 70 | 102 |
| TMZ-302 | 50 to 179 | 50 to 149 | 70 | 108 |



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## Valve selection chart in non-metric units

| Valve Part No. | Engine power at rated speed hp | | Engine air intake hose bore in | |
|---|---|---|---|---|
| | Naturally Aspirated Engines | Turbocharged Engines | Minimum | Maximum |
| TMZ-121 & TMZ-125 | 10 to 50 | 10 to 42 | 1 9/16 | 2 3/4 |
| TMZ-122 & TMZ-126 | 20 to 72 | 20 to 60 | 2 | 3 1/8 |
| TMZ-123 & TMZ-127 | 30 to 93 | 30 to 80 | 2 1/4 | 3 1/4 |
| TMZ-124 & TMZ-128 | 40 to 125 | 40 to 104 | 2 1/2 | 3 3/4 |
| TMZ-221 & TMZ-225 | 10 to 50 | 10 to 42 | 1 9/16 | 2 3/4 |
| TMZ-222 & TMZ-226 | 20 to 72 | 20 to 60 | 2 | 3 1/8 |
| TMZ-223 & TMZ-227 | 30 to 93 | 30 to 80 | 2 1/4 | 3 1/4 |
| TMZ-224 & TMZ-228 | 40 to 125 | 40 to 104 | 2 1/2 | 3 3/4 |
| TMZ-131 | 10 to 50 | 10 to 42 | 2 | 2 3/4 |
| TMZ-132 | 20 to 72 | 20 to 60 | 2 | 2 1/8 |
| TMZ-133 | 30 to 93 | 30 to 125 | 2 1/4 | 2 1/4 |
| TMZ-134 | 40 to 125 | 40 to 104 | 2 1/2 | 2 3/4 |
| TMZ-301 | 54 to 161 | 54 to 154 | 2 3/4 | 4 |
| TMZ-302 | 67 to 240 | 67 to 200 | 2 3/4 | 4 1/4 |

2. Select the required length of the manual shut-down cable from the table. Alternative lengths may be available on request.

3. Order “start override/manual shut down lever” RLZ-100 with valve and cable.

4. For TMZ-301 and TMZ-302 valves an optional dust cover is available and is recommended for applications where operation is in dusty conditions (see diagram on page 3).

| Cable Part No. | Length (metres) |
|---|---|
| CHW-150 | 1.5 |
| CHW-200 | 2.0 |
| CHW-300 | 3.0 |
| CHW-400 | 4.0 |


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# FITTING

## SAFETY

## WARNING

- Care should be taken when unpacking to prevent injury.
- Exhaust gases may cause permanent respiratory problems, suffocation or death. Any exhaust systems should be piped out of enclosed areas.
- Ensure that a hot engine has sufficiently cooled before commencing any work.
- Ensure that the engine is prevented from being started before commencing work.
- Isolate any air or oil supply being connected to the valve before commencing work.
- The D Valve should be located in a safe and easily accessible position to prevent injury to the operator due to moving parts or contact with hot surfaces while setting the valve.
- Parts of the machinery on which workers are likely to move about or stand to set the Valve, should be designed and constructed in such a way as to prevent workers from slipping, tripping or falling on or off these parts.
- A risk assessment should be conducted before commencing work, to ensure that all hazards such as exhaust fumes, risks due to moving parts, noise and hot surfaces have been eliminated or minimised.

## NOTES

- No special handling requirements apply to the D Valve.
- Carefully read and fully understand the installation instructions before commencing work.
- Only competent personnel should install the D valve.
- Wear appropriate Personal Protective Equipment including safety footwear, safety glasses, thermal and oil resistant gloves and ear plugs.
- Any spilt oil should be collected in an appropriate container and disposed of in accordance with COSHH and local regulations.

1. TMZ valves with integral intake flame traps should be bolted directly to a suitable mating flange secured to the engine air intake as close as possible to the engine intake ports.

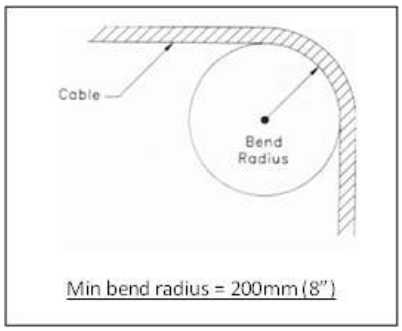
2. TMZ valves without integral intake flame traps should also generally be fitted as close as possible to the engine intake ports, but must always be fitted upstream of any intake flametrap.

Note: Paragraph 1 and 2 are generally applicable to both naturally aspirated and turbocharged engines but, where there is insufficient space to fit the valve between the turbocharger and engine, or where the air outlet temperature from the turbocharger is in excess of 150°C/302°F, alternative fitting arrange-ments must be considered.

3. Where more than one Chalwyn valve is fitted to an engine, as in the case of an engine with multiple intake pipes, a balance pipe arrangement must be installed to connect the various intake pipes together downstream (engine side) of the shut down valves. Typically balance pipe diameters should be about 30% of the diameter of the intake pipes. Additionally the RLZ-100 start override/shutdown levers must be arranged to permit simultaneous manual operation.

4. When fitting, ensure the direction of air flow:
   a. is in compliance with direction indicated on the body;
   b. is between vertically downward and horizontal.

5. Ensure the TMZ valve and the RLZ-100 start override/manual shut down lever are positioned to avoid damage to, or sharp bends in, the interconnecting mechanical cable.




6. Where the valve is located between two flexible pipes, ensure that adequate support is provided. If not, a suitable support bracket to the valve must be fitted.

7. Any engine crankcase breather connections into the intake system between the Chalwyn valve and engine or any internal crankcase breather arrangement venting directly into the engine intake ports must be sealed and replaced by an external breather system venting either atmosphere or to the intake system upstream of the shut down valve. External breather system kits for various engine types are available from Chalwyn.

8. The RLZ-100 start override/shut down lever should be rigidly mounted on a suitable bracket in a convenient position for easy operation.



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**Notes**

a. Optional dust cover (see diagram page 2). Should the dust cover be removed for any reason, ensure it is refitted with a bead of a suitable sealant around the edge to ensure dust tightness.

b. Adjustment of the start override/manual stop cable. Should it be necessary to replace this cable for any reason, adjust as follows: With the valve upright (speed trip adjuster at top) and no oil (or air) pressure applied, adjust the cable such that the valve operates fully between its internal stops at the closed and fully open positions as the RLZ-100 lever is moved between its free (engine stop) position and against the resistance of the internal valve springs to the engine run/start override position.

c. The small cable inside the valve is factory set. DO NOT release from its clamp or adjust in any way.

d. In addition to the TMZ valve, an engine fuel stop must always be retained to enable normal engine shutdown. Use the manual shut down lever of the TMZ valve only for emergency shut down or for system maintenance/checking.

# OPERATION

### Engine Start
The start override/emergency stop lever must be held in the “start override” position prior to starting the engine. Continue to hold this lever in the start override (engine run) position after starting the engine until it latches in this position (may take up to about 30 seconds if engine oil pressure is the operating fluid). Release lever.

### Engine Stop
Use normal engine fuel stop.

### Emergency Manual Stop
Move the start override/emergency stop lever firmly to the stop position.

**Note:** The start override/emergency stop lever always returns to the ‘stop’ position when the engine is not running.

# ADJUSTMENT

## SAFETY

**WARNING**

- When adjusting the D Valve, take care to ensure that contact with hot surfaces or entanglement in adjacent equipment is avoided

**NOTE**

- If a manual shut down cable assembly is fitted, ensure that excessive effort is not required to operate the manual override.

Once the Chalwyn valve is installed, adjustment of the overspeed trip setting is carried out using the adjuster and locknut (refer to diagrams). Basically rotating the adjuster clockwise will increase engine speed at which automatic shut down occurs.

As supplied, the valve will be adjusted such that shut down will generally occur well below the engine high idle speed. To increase the speed at which automatic shut down occurs, proceed as follows:


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1. Start engine. Slowly accelerate. Note speed at which shut down occurs.

2. Remove the hose at air inlet to Chalwyn valve to expose the adjuster and locknut (see diagram).

3. Release locknut. Turn adjuster clockwise one turn. Tighten locknut.

4. Refit inlet hose to Chalwyn valve.

5. Start engine. Slowly accelerate. Note speed at which shut down occurs.

6. Repeat steps '2' to '5' until the first setting at which the engine does not shut down at high idle speed (ie maximum throttle, no load).

Then either:

a. Use the results of shut down speed versus adjuster setting as a calibration check to make a final adjustment to give the required setting (typically 10% to 15% over high idle)

**or:**

b. If a very precise setting is not required, turn the adjuster a further one turn clockwise to take the shut down above high idle speed by a suitable margin. When using this setting procedure it may be found that the engine occasionally shuts down during the normal operation. If so, turn the adjuster clockwise by a further one half turn.

7. Ensure the adjuster locknut is fully tightened. (Use a thread lock adhesive on the locknut threads).

8. Restart engine. Run at a mid range speed. Move the start override/emergency stop level firmly to the 'stop' position. The engine shold stop within a few seconds.

9. Restart engine. Run at a mid range speed. Remove oil/air pressure signal. The engine should stop within a few seconds.

## Notes:

### Turbocharged Engines

When fitting a valve fitted to a turbocharged engine using the preceding method, it may be found that at high engine power outputs, the engine will shut down at a lower speed than required. If this occurs, further small adjustments in steps of one half turn clockwise should be made until the problem is eliminated.

### Jammed Valve

If in the course of adjusting the valve it jams on its seat, release by turning CLOCKWISE viewed from adjuster end.



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# MAINTENANCE

## SAFETY

### WARNING

- When externally cleaning the valve ensure the engine is sufficiently cooled before commencing work, if cleaning a hot valve take extra care to avoid touching hot surfaces and to avoid entanglement in adjacent equipment.
- Take care not to trap fingers when making adjustments to the valve setting.
- When maintaining the valve, isolate pressure sources and ensure that there is no trapped pressure before dismantling.
- Equipment contains springs, during dismantling ensure that spring forces are safely removed.
- When internally cleaning components with chemical agents avoid contact with skin, inhalation and ingestion of the cleaning agents and dirt / debris removed. Appropriate PPE should be worn.

### NOTES

- No special handling requirements apply to the D Valve.
- Carefully read and fully understand the maintenance instructions before commencing work.
- Only competent personnel should maintain the D valve.
- Wear appropriate Personal Protective Equipment including safety footwear, safety glasses, thermal and oil resistant gloves and ear plugs.
- Any spilt oil should be collected in an appropriate container and disposed of in accordance with COSHH and local regulations.

Routine maintenance should be undertaken as below. Note that not all model variants include the air intake flametrap and integral air cleaner housing options.

**Daily:** Run engine at a mid range speed. Check satisfactory shut down occurs when the manual emergency stop lever is operated.

## Three Monthly:

1. Whilst the engine is running, check the small vent holes in the valve (see diagrams on pages 2 and 3) for any sign of oil (or air) leakage. Such leakage is an indicator of a damaged diaphragm. This must be rectified prior to returning the unit to service. (Note: only suitably qualified personnel familiar with the hazards associated with a running engine should carry out this check).

2. Stop engine. Disconnect pipework, any support brackets etc. to permit the valve assembly to be removed for inspection.

3. Carefully remove the air intake flame trap where fitted (see flame trap servicing instructions). Do not detach the valve from the flame trap housing.

4. Inspect the valve internally for cleanliness. If necessary clean in paraffin or white spirit taking normal precautions. Dry thoroughly.

5. Check there is no excessive wear and that the valve and internal control rod both move smoothly over their complete operating strokes. Check the internal cable clamp is free from damage and is tightly clamped.

**Important** Do not remove the cable clamp or in any way attempt to adjust the internal cable as this is factory set.

6. Do not lubricate valve other than lightly greasing the internal cable.

7. Refit intake flame trap element (where applicable).

8. Refit valve. Set valve as per ‘Adjustment’.

9. Run engine a mid range speed. Check satisfactory shut down occurs under manual emergency and loss of oil (or air) pressure signal conditions.



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**Integral Engine Air Cleaner** (where fitted) Replace air cleaner element at the periods recommended by the engine manufacturer. (Spare elements are available from Chalwyn.)

**Important Notes:**
The three monthly routine maintenance period requirement is dependent on the operating conditions to which the equipment is exposed and, by experience, may need to be varied.

Any maintenance problems not covered by the routine maintenance schedule should be discussed with your Chalwyn Distributor before any repair work is undertaken.



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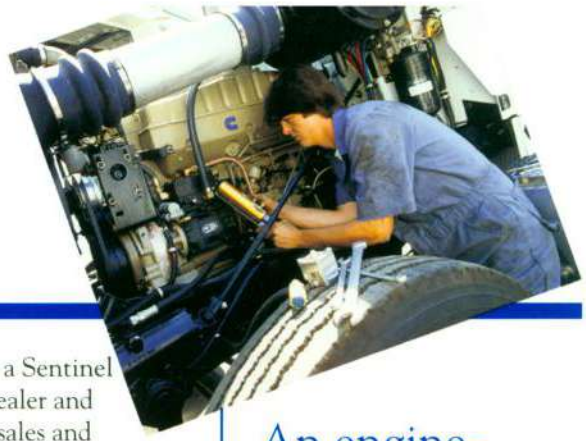
# SENTINEL® ENGINE PROTECTION SYSTEMS



There is no way to predict when or where engine problems will occur. Hoses break, seals crack, and connections fail in the most unlikely places and at the most inopportune times. But, with an engine protection system on the job, diesels are shut down before minor problems can cause major damage.

Mechanical shutdown systems protect diesel engines against a wide range of abnormal conditions, including low oil pressure, loss of coolant, and overheating of the oil and coolant systems.

It's easy to translate these problems into dollars and cents. Replacement costs run between $15,000 and $20,000 and the cost of downtime is escalating. Disrupted schedules and customer dissatisfaction are also real costs in a major mechanical breakdown. An engine protection system is simply an inexpensive form of insurance that pays for itself the first time you need it.

## PROTECTS STATIONARY AND MOBILE ENGINES

While engine protection systems are a valuable asset in managing fleet operations, they are especially important in protecting unattended engines. "Irrigation is a round-the-calendar job out here in the San Joaquin Valley," says Bob McClure. "There are 8,760 hours in a year," he continues, "and some of our stationary engines log from 2,000 to 6,000 hours, running 24 hours a day for long stretches. You can bet that every diesel that goes out of here has got an engine protection system on it."

McClure Equipment, Inc. specializes in the sale, service and rental of diesel engines for irrigation. They handle Deutz air-cooled 5 to 600 horsepower engines and Volvo Penta liquid-cooled 100 to 500 horsepower engines.

McClure Equipment is both a Sentinel Engine Protection System dealer and an end-user. In addition to sales and service, McClure has a rental fleet of 170 irrigation engines ranging from 5 to 400 horsepower. "Whether we sell or rent an engine for stationary work, all our customers specify an engine protection system. Water is absolutely vital in this business," says McClure, "and farmers count on our engines to work hard and reliably." Even with regularly scheduled maintenance programs, water pumps can fail, oil pump shafts break, hoses burst, and engines overheat. When there's trouble, Sentinel Systems shut the engine down.

"The reason we like the Sentinel System," says McClure, "is that it doesn't need any electrical current to keep it energized.

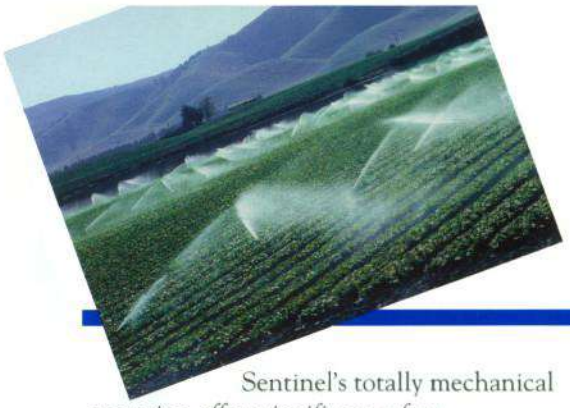
## RELIABLE MECHANICAL DESIGN

The Sentinel System's reliability and low maintenance is derived from its mechanical design and sealed construction. The mechanical operation of the system is doubly important to McClure because many of his engines are also used in the nearby oil fields.

An engine-saving management tool for stationary installations and fleet operations.

SENTINEL®

Parker Racor



Sentinel's totally mechanical operation offers significant safety advantages when engines operate in oil fields, underground construction, marine environments, mines, or any volatile, explosion-prone areas. The system uses no electrical circuits that could malfunction because of moisture, corrosion, severed wiring, blown fuses or severe vibration.

## TROUBLE-FREE SYSTEM

Mechanics find the Sentinel System easy to install and virtually trouble-free. It is made up of only three basic mechanical parts — the Master Control, the Heat Sensor, and the Coolant Pressure Valve.

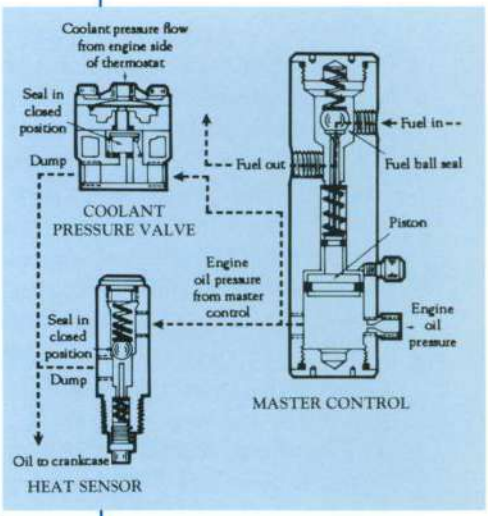
The Master Control fits in the main fuel supply line. In normal operation, the oil pressure from the engine keeps the piston in the raised position, allowing fuel to flow to the engine. The Heat Sensor guards against engine damage due to high coolant temperatures. The Coolant Pressure Valve protects the engine against major failures in the cooling system such as hose breaks, low coolant supply, water pump failure, and loose belts.

The Sentinel System's highly reliable sensors measure low oil pressure, loss of coolant, and high temperatures in the engine. An abnormality in any of these areas causes the piston to drop, completely shutting off the fuel supply on a stationary engine. When McClure's mechanics install Sentinel on air-cooled engines, they place sensors to measure crankcase oil temperature and air fan belt tension. Again, any abnormalities trigger the Master Control and the engine shuts down.

In most cases, Sentinel will last as long as the equipment on which it is installed. The system has few moving parts and no direct metal wear. Racor uses the highest quality aluminum, brass, and stainless steel alloy and precision-machines the parts to 1/1,000 of an inch tolerance for a perfect fit. Inside, special Viton-quad rings on the main piston of the Master Control reflect more Racor quality. Each of these rings provides a double seal between the fuel section and the oil section of the system, assuring that fuel and oil cannot mix within the control itself.

## FITS ANY ENGINE

The Sentinel System is effective on almost any diesel because it can be customized to match the specific operating characteristics of each engine. The unique piston design in the Master Control utilizes the engine fuel pressure to assist in closing the fuel valve. This allows the Master Control to be closed at a higher working oil pressure than its original low idle setting. For example, a Master Control installed on a Detroit Diesel engine would have a primary oil pressure setting of five psi for idle conditions. However, this engine, when running at governored speed under load, produces approximately 70 to 80 psi fuel pressure. Under these conditions, the Sentinel Master Control will close the fuel supply to the engine when diminishing oil pressure reaches 15 psi, not the 5 psi primary setting.



The Sentinel System's totally mechanical operation offers significant safety advantages when engines operate in oil fields, underground construction, marine environments, mines, or any volatile, explosion-prone areas.

Likewise, a Cummins engine would have a 10 psi primary oil pressure setting installed on the pressure side of the PT fuel pump. This engine, when running at governored speed under load, will produce 150 psi fuel pressure. In this instance, the Sentinel Master Control would close the fuel supply at 33 psi, not the 10 psi primary setting for idle conditions.

Temperature and pressure shut-off points can be specified within wide limits, and various options allow Sentinel Systems to be tailored to individual specifications. Settings can be ordered factory-set or made on the job by a shop mechanic. Normally on suction side applications, the Master Control is installed between the fuel filter and the injection pump, as close to the pump as practical. On unit injection engines, it can be installed between the final filter and the heads. On Cummins engines, the control should be installed on the pressure side of the pump.

## SHUTDOWN OPTIONS

For unattended engines in agriculture, construction, mining, and oil drilling, the basic full shutdown is generally specified. A manual override allows engine start-up and emergency operation.

On vehicular applications — trucks, bulldozers, loaders, workboats, for example — either full engine shutdown or reduced horsepower torque can be specified. A visible and audible shutdown warning device signals the driver of an imminent shutdown condition. Another model automatically de-torques an engine to a pre-selected reduced horsepower torque capability. In either case, the driver has complete control, including power steering and power brakes, until he can make a voluntary shutdown.

## OVER-THE -ROAD APPLICATION

This control is what first attracted Jack Frost, president of Jack Frost Trucking in El Paso, Texas, to the Sentinel Engine Protection System. "This device gives the owner control over his trucks no matter where they are. If the truck runs out of oil or overheats anywhere in the country, the Sentinel puts that truck on the side of the road until a trained mechanic can look at it."

Frost's company hauls refrigerated produce throughout the western United States with a fleet of 15 trucks powered by Cummins 400 diesel engines. With this fragile cargo, Frost doesn't take any chances with breakdowns. One major problem convinced Frost of the Sentinel System's performance benefits.

"We had a new truck with less than 10,000 miles on it," said Frost. "The truck blew an oil seal in the turbocharger, the oil went into the exhaust section of the turbocharger and right out the stack. The driver didn't notice the problem and continued to drive until there was no oil in the pan — and wiped out the engine. It cost about $10,000 to fix it."

In his search to find a device that would stop the truck when it got too hot or lost oil pressure, Frost learned about the Sentinel System from his local Cummins dealer. "Now when we buy a truck," says Frost, "it doesn't leave the yard until a Sentinel is installed on it. Sentinel always works — and it completely protects an engine for just several hundred dollars."

In Frost's experience, Sentinel System's provide a continuous, vital daily service. "It's rare if there is a single truck out there that doesn't shut down for one reason or another during the course of a year. When an engine overheats pulling up a long grade or is overworked under tailwind conditions, Sentinel will shut it down." All of Frost's trucks have the Sentinel System set up to meet California's standards for limited stop. Although engine power is reduced, the engine will run at idle with enough power to pull the truck to the side of the road safely.

Fleet owners like Sentinel product safety features that prohibit operators from tampering with, bypassing, or shutting down the system. When trouble occurs, owners want the assurance that the engine will be shutdown before the problem causes expensive engine repair. "Recently, Frost concluded, "we forgot to put anti-freeze in one of our trucks. The driver got in to a below freezing temperature zone and the water started freezing in the radiator. While the driver didn't notice it, the Heat Sensor sensed the water was getting too hot and stopped the engine."

Sentinel System is good business. The protection, savings of time and money, and improved customer relations are valuable assets in today's well-managed diesel operations.

"Sentinel sensed the water was getting too hot and stopped the engine. Saving that repair bill was like putting $10,000 in the bank."

*Jack Frost*
*Jack Frost Trucking, Inc.*

SENTINEL ®

Parker Hannifin Corporation
Racor Division
3400 Finch Rd.
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Parker | Racor

DYNALCO

5450 NW 33rd Ave, Suite 104
Fort Lauderdale, FL 33309

3211 Fruitland Ave
Los Angeles, CA 90058

# MTH-103E

## Tachometer/Hourmeter/Trip

## Installation and Operation Manual


**Rev. C**

P/N145F-13048



Published: February 21, 2013

## System Overview

This manual contains a general product description of the MTH-103E Microprocessor-Based Tachometer/Hourmeter/Trip. It also supplies information about the MTH-103E features, functional design, specifications, and configuration.

## Basic operation

The MTH-103E is a microprocessor-based 5-digit tachometer, hourmeter, and trip. The trip can be programmed to activate on overspeed, underspeed (Class C), or hours. The unit may be magnetic pickup or DC powered. The MTH-103E is CSA approved for Class I, Division 2, Groups A, B, C & D hazardous locations. When pickup powered the MTH103E is rated Class I, Division 1, Groups A, B, C & D.

## Features

The MTH-103E tachometer provides the following features:

- Both signal and power can be derived from a magnetic pickup.
- High accuracy: 5-digit display; 1 RPM resolution; 100,000 hour range.
- Universal: Can be field configured from front keypad for any number of pulses per revolution, trip point value, and preset/reset hours.
- Displays speed, hours, and the setpoint on command. Fast overspeed reaction time of 100 milli-seconds.
- Design incorporates hardware and materials creating a weatherproof unit that allows installation in poorly protected areas. This is ideal for both indoor and outdoor installations.
- Standard Society of Automotive Engineers (SAE) case fits engine panels with 3-3/8 inch (86 millimeter) openings.
- Unit is highly shock and vibration resistant. Face plate is gasketed and spray proof.
- Unit is highly resistant to electrical noise.

## Specifications

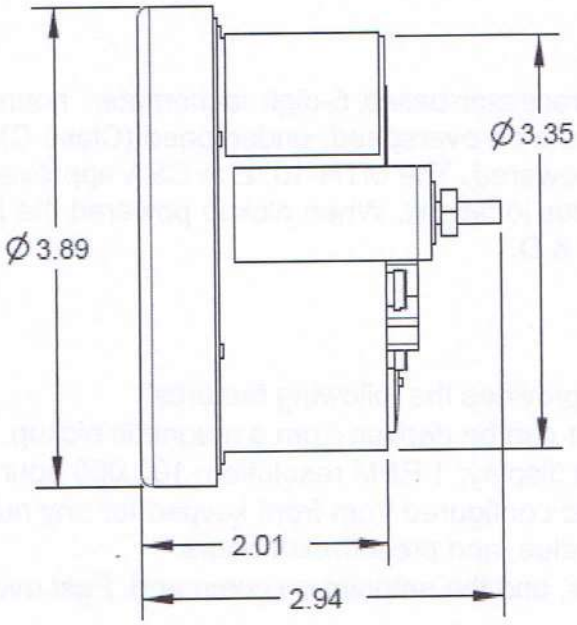
| | |
|---|---|
| Input Signal | Passive (variable reluctance) 2-wire magnetic pickup |
| Digital Output | TRIAC rated @ 0.15 A / 40 VDC |
| Input Power | 9 – 30 VDC or pickup power |
| Display | Backlit Graphic Display |
| Connections | Screw Terminals |
| Operating Temperature Range | - 40 to + 70 Deg C |
| Certification | CSA Class I, Division 1 & 2, Groups A, B, C, D |

## User Interface

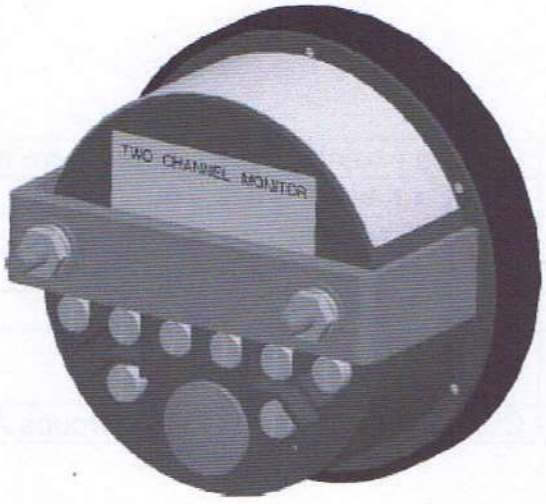
The MTH-103E is configured via the keypad on the front panel which includes a graphical backlit LCD display capable of displaying alpha numeric values. The keypad implements a menu system, which is navigated using the up, down, left, right, enter and escape buttons. The display backlight is enabled only when DC powered.

**Installation:**

The MTH-103E is designed to be panel mounted. The dimensions are shown below.

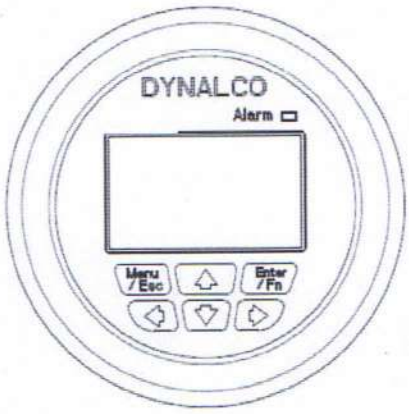


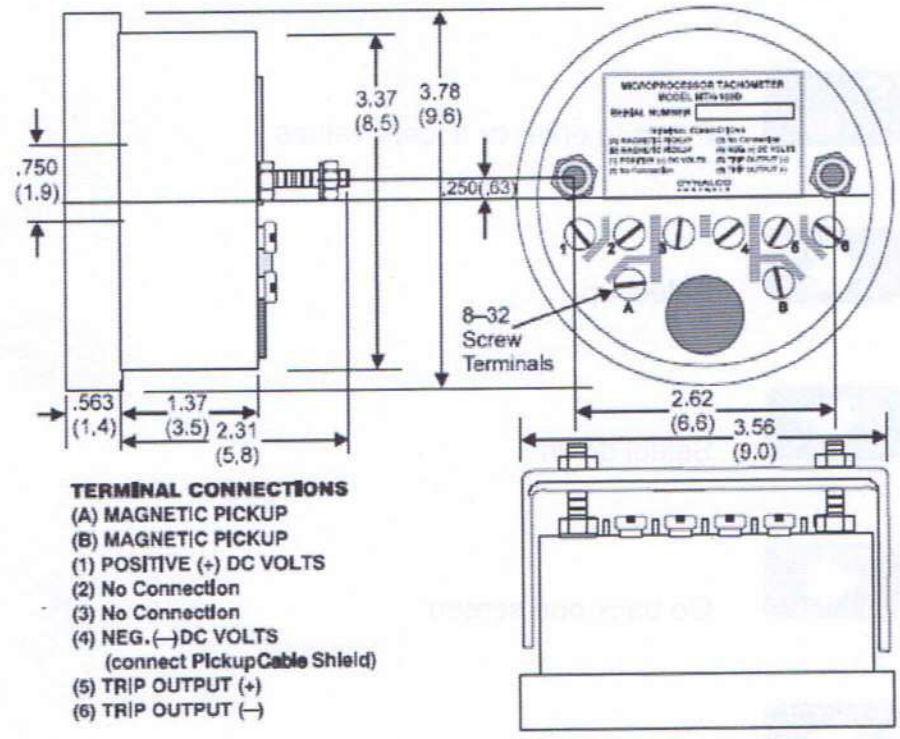

The MTH-103E includes a bracket for securing into the panel.



## Terminal Connections

All connections are made to terminals on the back of the unit.




*Dimensions in inches (cm)*

## Programming Overview


All programming is accomplished through the front keypad.

Below is a brief description of each key.


Press to enter or exit the configuration screens


Press to enter or accept values

Select up

Select down

Go back one screen

Select and advance to next screen

Initial configuration consists of the following steps:

1) Programming the # gear teeth
2) Selecting over / under speed setpoints (if required)
3) Pre-setting hourmeter (if required)

## Programming Instructions

***Important:*** ***The MTH-103E must first be programmed prior to operation.***

When initially powering up the unit, the display will first indicate the firmware version and then go to the operational mode.

To configure each input, first go to the main programming screen by pressing the Menu / Escape key:


*Note: If a screen is displayed showing a keypad, this indicates that a security code has been enabled. Please see "System Settings" section on page 6 for the description of setting a security code.*

The main configuration screen shows the following icons:

| | | |
|---|---|---|
|  | Gear Teeth Settings | - for selecting number of gear teeth |
|  | Hourmeter Settings | - configures hourmeter count up or count down |
|  | Alarm Settings | - for enabling low / high alarms |
|  | Alarm Logs | - for accessing alarm log info |
|  | System Settings | - for selecting default display |

### Configuration of "Gear Teeth Settings" 

Using the arrows on the keypad, select the "Gear Teeth Settings" icon and press enter.

Here, you will need to set the number of gear teeth for proper RPM display. The MTH-103E will allow any number from 1 to 360 teeth.

**Always use the right arrow key  for selecting and advancing to the next screen.**

**Pressing Menu/Esc at any time during configuration will prompt you to save the changes. Select "Yes" to save any changes made. Selecting "No" will not save changes.**

### Configuration of "Hourmeter Settings"

Using the arrows on the keypad, select the "Hourmeter Settings" icon.

The first screen will allow you to configure the hourmeter to either count up or count down by pressing the up / down arrows to select, then pressing the right ▶ arrow to navigate to the next screen. Here, you will be able to either leave the hourmeter to the current setting or pre-select any number up to 99999 hours. Following this, you will be asked to save the changes.

### Configuration of "Alarm Settings"

Using the arrows on the keypad, select the "Alarm Settings" icon.

Here, you can either enable or disable the RPM Alarm and select both underspeed (RPM Alarm Low) and overspeed (RPM Alarm High) setpoints. Note that if underspeed is not required, the parameter should be set to "0." The next screen to the right will allow configuration of the "Hourmeter Alarm" if required. This will allow you to preset an hourmeter value that may be used to alert the user of maintenance required, for example.

### System Settings

Using the arrows on the keypad, select the "System Settings" icon.

There are (2) display layouts available, either "Large RPM Digit" or "RPM + Hourmeter."

*Note that you are selecting the default layout type. You will be able to change the layout during normal operation by pressing the left / right arrows.*

After setting the layout type, pressing the right arrow will allow the user to either enable or disable a "Security Option." The security option allows the user to set a 4-digit security code for locking out the programming function. If this is not required, select "Disable" and press the right arrow. You will then be asked to save any changes.

If you would like to enable the security option, select "Enable" and press the right arrow. The next screen will allow configuration of any 4-digit security code from 1000 to 9999. Pressing "Enter" will allow the code to be set. After pressing the right arrow, you will be asked to save the new settings.

Note that if the security code is enabled, the display will always ask the user to enter the 4-digit code if the "Menu" key is pressed.

In case the security code is mis-placed or forgotten, there is a master code for gaining access to the programming function. The master code is "5034381"

## Operation

Apply power from either:

a. A signal frequency generator or a magnetic pickup (minimum 4.0 VRMS; maximum 15 VRMS) connected to terminals (A) and (B) (no polarity).

Or…

b. 9 – 30 VDC power source connected to terminals (1)(+) and (4)(–). (minimum 1.5V RMS pickup input signal required).

The software revision number will display for one second when power is initially applied.

## Alarm / Shutdown Output

The MTH-103E will alarm or shutdown when the RPM is above or below limits as specified. If an alarm condition is met, an alarm indication on the display will blink and the digital output will trip. Non-latching alarms will reset the alarm if its value returns to normal. Latching alarms require manual resetting via the front keypad. The alarm / shutdown triggers a TRIAC rated at 150 mA for switching either an annunciator input or an external relay. This TRIAC is similar to the SCR used in the previous version MTH-103D in that current flow must be removed to reset the TRIAC. This can be accomplished by providing a momentary contact closure across the (2) output terminals (5 & 6).

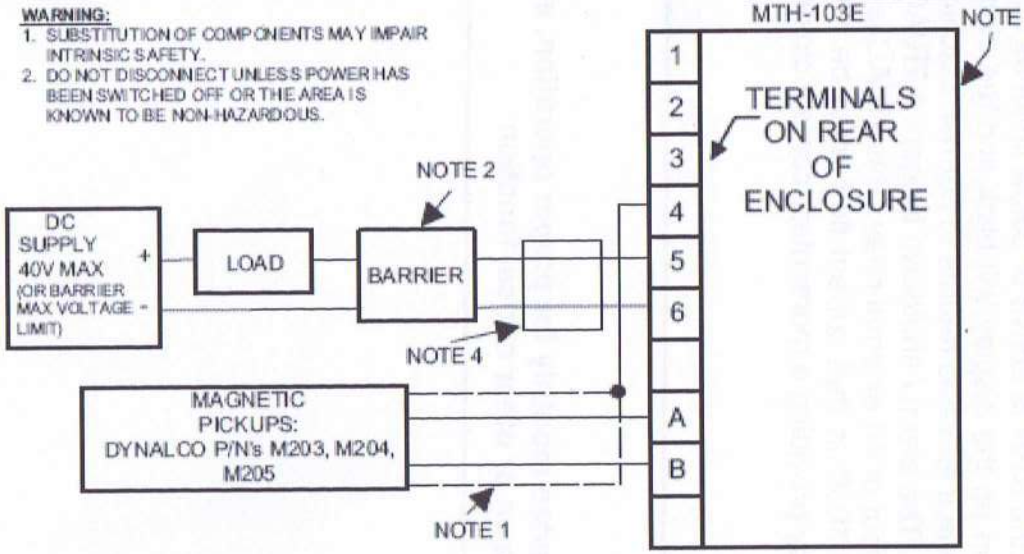
**IMPORTANT:**

**The alarm / shutdown output should be tested monthly for proper operation, especially if being used for engine overspeed shutdown or other critical function.**

# CSA CLASS 1 DIVISION 1
# PICKUP POWERED CONNECTIONS

| REVISIONS | | | |
|---|---|---|---|
| LTR | DESCRIPTION | DATE | APPD |
| A | PCO 8242, Initial Release | 9/17/12 | JLR. |
| B | PCO 8304, CSA Changes | 2/11/13 | JLR. |

**WARNING:**
1. SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
2. DO NOT DISCONNECT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.




NOTES:
1. THE MAGNETIC PICKUP MUST BE CONNECTED TO THE MTH-103E WITH SHIELDED CABLE. SHIELD MUST BE CONNECTED ONLY TO TERMINAL 4 OF THE MTH-103E.

2. IF CLASS 1, DIVISION 1, GROUPS A, B, C,D IS REQUIRED THEN THE TRIP OUTPUT (TERMINAL 5) MUST CONNECTED TO THE LOAD THROUGH A CSA CERTIFIED ZENER BARRIER RATED AT 30V MAX., 330 OHMS MIN. IF ONLY GROUPS C, & D CLASSIFICATION IS NEEDED THEN A CSA CERTIFIED ZENER BARRIER RATED AT 30V MAX., 150 OHMS MIN IS REQUIRED.

3. THE MTH-103E IS CERTIFIED FOR MOUNTING IN A SUITABLE ENCLOSURE. SUITABILITY OF THE FINAL COMBINATION IS TO BE DETERMINED BY CSA OR THE INSPECTION AUTHORITY HAVING JURISDICTION.

4. THE WIRING TO THE TRIP OUTPUT (TERMINALS 5 & 6) MUST CONNECT THE BARRIER, LOAD AND POWER SUPPLY THROUGH A CSA APPROVED SOLID OR FLEXIBLE CONDUIT.

THE MTH-103E IS CSA CERTIFIED FOR USE IN **CLASS I, DIVISION 1, GROUP A, B, C, & D** LOCATIONS WHEN POWERED BY A DYNALCO M203, M204, OR M205 PICKUP AND WHEN THE TRIP OUTPUT ON TERMINAL 5 IS CONNECTED THROUGH A CSA CERTIFIED ZENER BARRIER RATED AT 30V MAX., 330 OHMS MINIMUM.

THE MTH-103E IS CSA CERTIFIED FOR USE IN **CLASS I, DIVISION 1, GROUPS C & D** LOCATIONS WHEN POWERED BYA DYNALCO M203, M204 OR M205 PICKUP AND WHEN THE TRIP OUTPUT ON TERMINAL 5 IS CONNECTED THROUGH A CSA CERTIFIED ZENER BARRIER RATED AT AT 30V MAX., 150 OHMS MINIMUM.

N:\PRODUCTS\MTH-E\DWG\A_800-13049_01_REVB.dsf



DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERENCES ARE:

| FRACT. | DEC. | ANGLES |
|---|---|---|
| +/- 1/64 | .XXX +/- .005 | +/- 1/2 |
| | XX +/- .01 | DEGREE |

MATERIAL:

FINISH:

**DYNALCO**

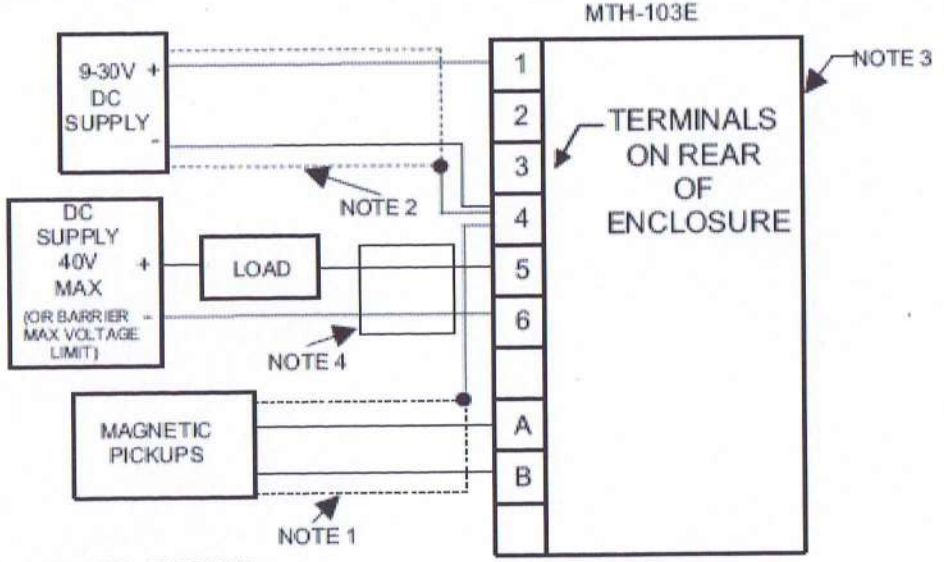
| PRODUCT/PART | DRAWN | DATE |
|---|---|---|
| MTH-103E | Jose Rivero | 2/14/13 |
| | APPROVED | |

TITLE: INTERCONNECTION DRAWING CSA CERTIFIED UNITS - PICKUP POWERED

| SCALE | SIZE | DRAWING NUMBER | REV. |
|---|---|---|---|
| | A | 800-13049 SHT. 1 OF 2 | B |

**WARNING:**
1. SUBSTITUTION OF COMPONENTS MAY IMPAIR INTRINSIC SAFETY.
2. DO NOT DISCONNECT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

# CSA CLASS 1 DIVISION 2
# DC POWERED CONNECTIONS OR PICK-UP POWERED CONNECTIONS




NOTES:

1. THE MAGNETIC PICKUP MUST BE CONNECTED TO THE MTH-103E WITH SHIELDED CABLE. SHIELD MUST BE CONNECTED ONLY TO TERMINAL 4 OF THE MTH-103E.

2. THE DC SUPPLY MUST BE CONNECTED TO THE MTH-103E WITH SHIELDED CABLE. SHIELD MUST BE CONNECTED ONLY TO TERMINAL 4 OF THE MTH-103E.

3. THE MTH-103E IS CERTIFIED FOR MOUNTING IN A SUITABLE ENCLOSURE. SUITABILITY OF THE FINAL COMBINATION IS TO BE DETERMINED BY CSA OR THE INSPECTION AUTHORITY HAVING JURISDICTION.

4.THE WIRING TO THE TRIP OUTPUT (TERMINALS 5 & 6) MUST CONNECT THE LOAD AND POWER SUPPLY THROUGH A CSA APPROVED SOLID OR FLEXIBLE CONDUIT.

THE MTH-103E IS CSA CERTIFIED FOR USE IN **CLASS I, DIVISION 2, GROUP A,B,.C, & D** LOCATIONS WHEN DC POWERED BY 9-30 VDC AND HAVING THE SIGNAL PROVIDED BY DYNALCO M201, M202, M203, M204, M205, M207, M208, M231, M233 or M281 MAGNETIC PICKUP. THE TRIP OUTPUT (TERMINAL 5) MAY BE CONNECTED TO A LOAD NOT TO EXCEED 40V MAX, 0.15 AMP MAX.

THE MTH-103E IS CSA CERTIFIED FOR USE IN **CLASS I, DIVISION 2, GROUPS A, B, C, & D** LOCATIONS WHEN PICK-UP POWERED BY A DYNALCO M203, M204, M205, M207, M208 OR M281 PICKUP AND THE TRIP OUTPUT ON TERMINAL 5 IS CONNECTED DIRECTLY TO A LOAD NOT TO EXCEED 40V MAX., 0.15 AMP MAX.

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DO NOT SCALE THIS DRAWING

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES AND TOLERENCES ARE:

| FRACT. | DEC. | ANGLES |
|---|---|---|
| +/- 1/64 | XXX +/- .005<br>.XX +/- .01 | +/- 1/2 DEGREE |

MATERIAL:

FINISH:

**DYNALCO**

| PRODUCT/PART | DRAWN | DATE |
|---|---|---|
| MTH-103E | Jose Rivero | 2/14/13 |
| | APPROVED | |

TITLE: INTERCONNECTION DRAWING CSA CERTIFIED UNITS - DC POWERED

| SCALE | SIZE | DRAWING NUMBER | REV. |
|---|---|---|---|
| | A | 800-13049 SHT. 2 OF 2 | B |

# Technical Data

## 400 Series 404D-22G

ElectropaK

### Basic technical data

Number of cylinders . . . . . 4
Cylinder arrangement . . . . . Vertical in-line
Cycle . . . . . four stroke
Induction system . . . . . Naturally aspirated
Compression ratio . . . . . 23,3:1
Bore . . . . . 84 mm
Stroke . . . . . 100 mm
Cubic capacity . . . . . 2·216 litres
Direction of rotation . . . . . anti-clockwise when viewed from flywheel
Firing order . . . . . 1, 3, 4, 2
Estimated total weight (dry) . . . . . 242 kg

### Overall dimensions

-height . . . . . 840 mm
-length . . . . . 915 mm
-width . . . . . 477 mm

### Moments of inertia (mk²)

-engine rotational components . . . . . 0,44 kg m²
-flywheel . . . . . 2,55 kg m²

### Centre of gravity

-forward from rear of block . . . . . tba mm
-above centre line of block . . . . . tba mm
-offset to RHS of centre line . . . . . tba mm

### Performance

**Note:** All data based on operation to ISO 3046-1:2002 standard reference conditions

Steady state speed stability at constant load
G2 . . . . . ± 0,75%
Cyclic irregularity
-at 110% stand-by power . . . . . tba

### Test conditions

-air temperature . . . . . 25°C
-barometric pressure . . . . . 100 kPa
-relative humidity . . . . . 31.5%
-air inlet restriction at maximum power (nominal) . . . . . 3 kPa
-exhaust back pressure at maximum power (nominal) . . . . . 10,2 kPa
-fuel temperature (inlet pump) . . . . . 40°C

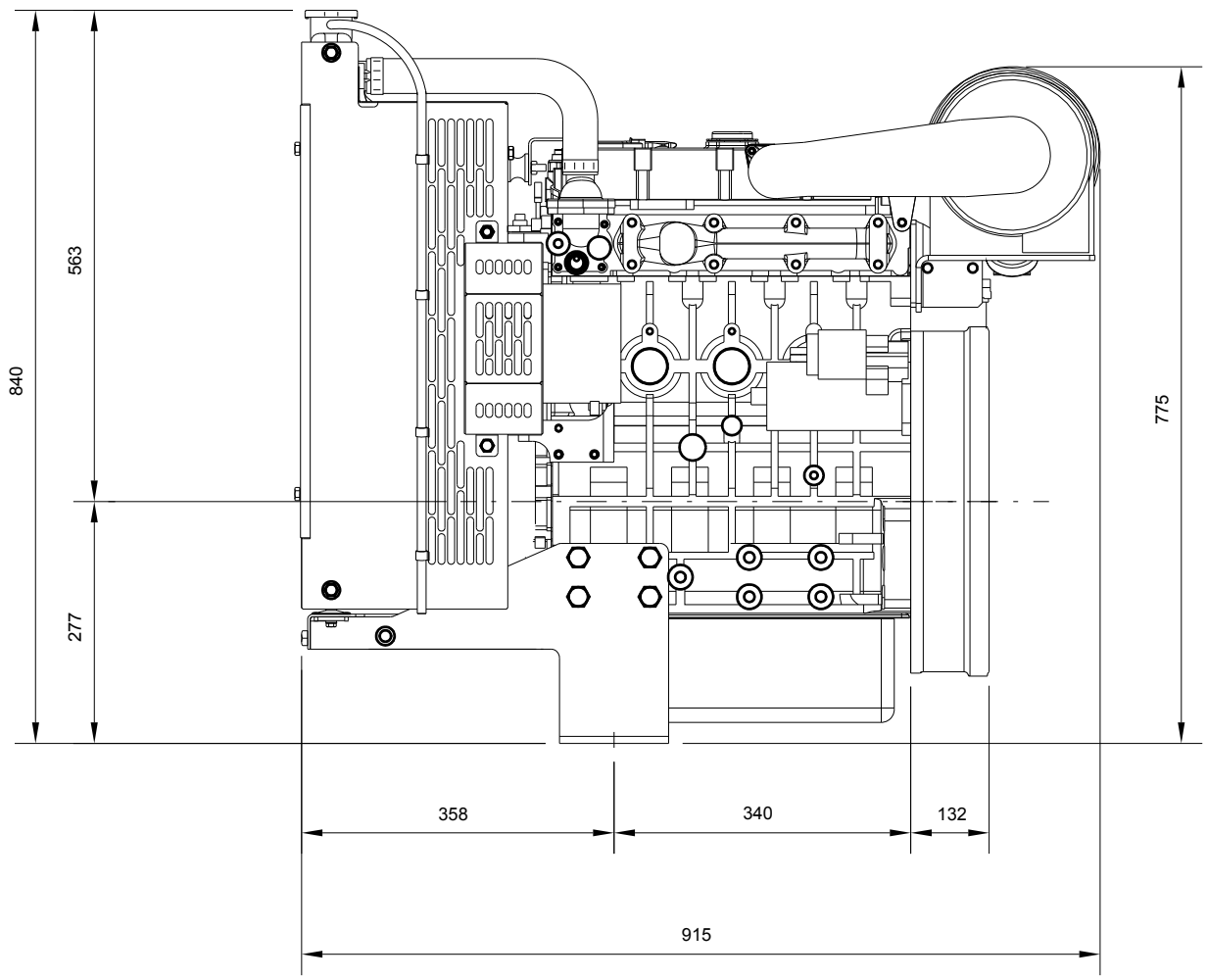
### Sound level

Average sound pressure level for bare engine (without inlet and exhaust) at 1 metre . . . . . 76,4 dB(A)
-all ratings certified to within . . . . . ± 5%
If the engine is to operate in ambient conditions other than those of the test conditions, suitable adjustments must be made for these changes. For full details, contact Perkins Technical Service Department.
**Emissions Statement:** Certified against the requirements of EU2007 (EU97/68/EC Stage II) and EPA Interim Tier 4 (EPA 40 CFR Part 1039 Interim Tier 4) legislation for non-road mobile machinery, powered by constant speed engines.

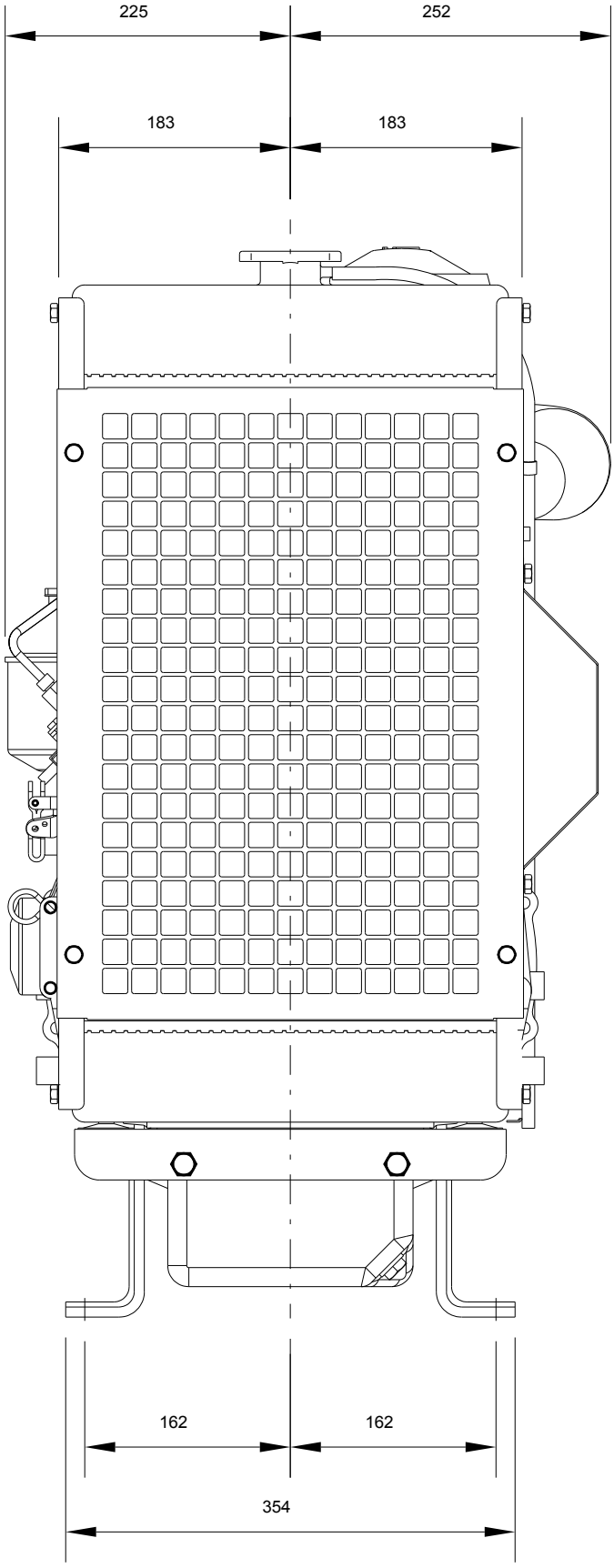
### General installation - 404D-22G @ 1500 rev/min

| Designation | Units | Type of operation and application | |
|---|---|---|---|
| | | Prime | Stand-by |
| | | 50Hz | 50Hz |
| Gross engine power | kWb | 18,7 | 20,6 |
| Brake mean effective pressure | kPa | 669 | 650 |
| Mean piston speed | m/s | 5 | |
| Engine coolant flow (coolant pump ratio 1·25:1) | l/min | 40,3 | |
| Combustion air flow | m³/min | 1,45 | |
| Exhaust gas flow (max) | m³/min | 3,64 | 3,94 |
| Exhaust gas temperature (max) | °C | 445 | 505 |
| Overall thermal efficiency (nett) | % | 35 | 33 |
| Typical genset electrical output (0,8 pf 25°C) | kWe | 16,0 | 17,7 |
| | kVA | 20,0 | 22,1 |
| Assumed alternator efficiency | % | 87 | |
| **Energy balance** | | | |
| Energy in fuel (heat of combustion) | kWt | 53,0 | 61,2 |
| Energy in power output (gross) | kWb | 18,7 | 20,6 |
| Energy to cooling fan | kWt | 0,3 | |
| Energy in power output (nett) | kWm | 18,4 | 20,3 |
| Energy to coolant and lubricating oil | kWt | 17,0 | 19,6 |
| Energy to exhaust | kWt | 14,0 | 16,6 |
| Energy to radiation | kWt | 3,3 | 4,4 |

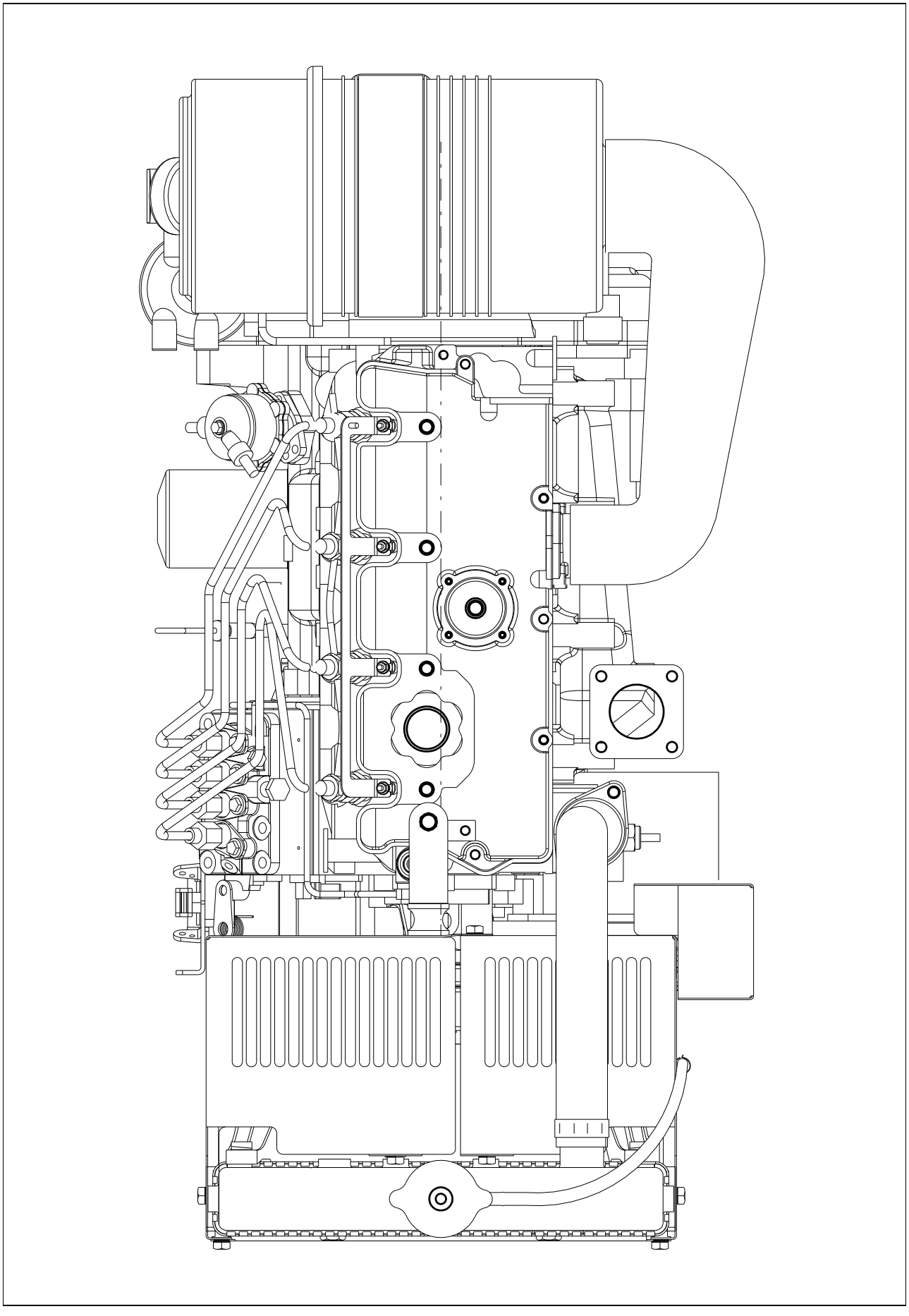
**404D-22G ElectropaK, left side view**



**404D-22G ElectropaK, front view**



**404D-22G ElectropaK, plan view**



## Cooling system

### Radiator

-face area ... 0,167 m²
-rows and materials ... 2 rows, Aluminium
-matrix density and material ... 14,5 fins per inch, Aluminium
-width of matrix ... 334,2 mm
-height of matrix ... 500,0 mm
-pressure cap setting ... 90 kPa
Estimated cooling air flow reserve ... 0,125 kPa

### Fan

-diameter ... 320 mm
-drive ratio ... 1,25:1
-number of blades ... 7
-material ... Plastic
-type ... Pusher

### Coolant

Total system capacity
-with radiator ... 7,0 litres
-without radiator ... 3,6 litres
Maximum top tank temperature ... 112°C
Temperature rise across engine ... 7,5°C
Max.permissible external system resistance ... tba kPa
Thermostat operation range ... 82 - 95°C
Recommended coolant:
Recommended coolant: 50% anti freeze / 50% water. For complete details of recommended coolant specifications, refer to the Operation and Maintenance Manual for this engine model.

### Duct allowance

| Maximum additional restriction (duct allowance) to cooling airflow and resultant minimum airflow | | |
|---|---|---|
| **Ambient clearance 50% Glycol** | **Duct allowance Pa** | **m³/sec** |
| 53°C | 0 | 0,67 |
| 46°C | 125 | 0,49 |

## Electrical system

-alternator ... 65 amps, 12 V
-starter motor ... Bosch 2 kW, 12 V

### Cold start recommendations

Minimum cranking speed ... 150 rev/min

| Minimum starting temperature | Grade of engine lubricating oil | Battery specifications | | | |
|---|---|---|---|---|---|
| °C | | BS3911 Cold start amps | SAEJ537 Cold cranking amps | Number of batteries needed | Commercial ref number |
| 0 | 20W | 540 | 740 | 1 | 647 |
| -15 | 10W | 540 | 740 | 1 | 647 |
| -20 | 5W | 600 | 780 | 1 | 655 |

**Note:** Additional information for battery and cable limits can be found in Chapter 6 (Electrics) of 400D Engine Sales Manual.

## Exhaust system

Maximum back pressure ... 10,2 kPa
Exhaust outlet size ... 42 mm

## Fuel system

Type of injection ... Indirect injection
Fuel injection pump ... Cassette type
Fuel injector ... Pintle nozzle
Nozzle opening pressure ... 14,7 MPa
Max. particle size ... 25 microns

### Fuel lift pump

-type ... mechanical (camshaft driven)
-flow/hour ... 63 litres/hr
-pressure ... 10 kPa
Maximum suction head ... 0,8 m
Maximum static pressure head ... 3,0 m
Governor type ... Mechanical

### Fuel specification

USA Fed Off Highway - EPA2D 89.330-96
Europe Off Highway - CEC RF-06-99
**Note:** For further information on fuel specifications and restrictions, refer to the OMM Fuels section for this engine model.

### Fuel consumption

| Power rating% | | | |
|---|---|---|---|
| g/kWh (litres/hr) | | | |
| **110** | **100** | **75** | **50** |
| 244 (6.1) | 237 (5.3) | 238 (4.0) | 258 (2.9) |

## Induction system

### Maximum air intake restriction

-clean filter . ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... 3,0 kPa
-dirty filter ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... 6,4 kPa
-air filter type .. ... ... ... ... ... ... ... ... ... ... ... ... ... ... . Dry element type

## Lubrication system

### Lubricating oil capacity

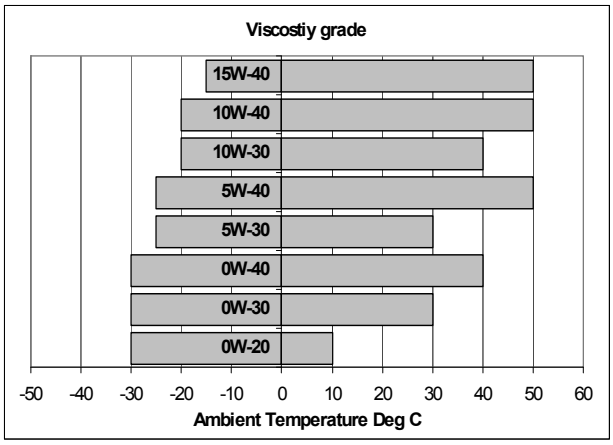
Max. sump capacity ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... .10,6 litres
Min. sump capacity ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ...8,9 litres
Maximum engine operating angles
-front up, front down, right side or left side. ... ... ... 35° continuous

### Lubricating oil pressure

-relief valve opens.. ... ... ... ... ... ... ... ... ... ... ... ... ... ... ...352 - 448kPa
Min. oil pressure. ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... 120 kPa
-at maximum no-load speed .. ... ... ... ... ... ... ... ... ... ... ... ... ... ... tba
Oil flow at rated speed ... ... ... ... ... ... ... ... ... ... ... ... ...109 litres/min
Normal oil temperature .. ... ... ... ... ... ... ... ... ... ... ... ... ... ... .. 125°C

### Recommended SAE viscosity

A single or multigrade oil must be used which conforms API-CH-4 or ACEA E5.




### Maximum static bending moment

at rear face of block .. ... ... ... ... ... ... ... ... ... ... ... ... ... ... ..1400 Nm

## Load acceptance

The below complies with the requirements of classification 3 and 4 of ISO 8528-12 and G2 operating limits stated in ISO 8528-5

| Initial load application: When engine reaches rated speed (15 seconds maximum after engine starts to crank) | | |
|---|---|---|
| **Descriptor** | **Units** | **50 Hz** |
| % of prime power | % | tba |
| Transient frequency deviation | % | tba |
| Frequency recovery | Seconds | tba |

The above figures were obtained under the following test conditions:
-minimum engine block temperature ... ... ... ... ... ... ... ... ... tba °C
-ambient temperature .. ... ... ... ... ... ... ... ... ... ... ... ... ... ... ...25°C
-governing mode . ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... . 5%
-alternator inertia . ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... tba kgm²
-under frequency roll off (UFRO) point set to2% Volt / 1% frequency
-UFRO rate set to ... ... ... ... ... ... ... ... ... . 1 Hz below rated speed
LAM on/off ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... ... off
All tests were conducted using an engine which was installed and serviced to Perkins Engines Company Limited recommendations.

### Derate Curves

Derate curves for altitude and humidity can be found in section six (Ratings) of the 400D Engine Sales Manual

The general arrangement drawings shown in this data sheet are for guidance only. For installation purposes, latest versions should be requested from the Applications Dept., Perkins Engines Stafford, ST16 3UB United Kingdom.

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