

factair

F2235-H AIR QUALITY CHECKER

NSN: 4240 99 846 2718

OPERATING MANUAL



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Introduction

The F2235-H Air Quality Checker provides a quick and easy method for checking the levels of water, oil, carbon monoxide and carbon dioxide in breathing-air contained in HP dive cylinders.

The European Standard for breathing-air quality is EN12021, which should be referred to in conjunction with any overriding national standards.

The F2235-H is supplied with the F3002 high pressure regulator and the connection hose. These items are especially suited to not retaining moisture and allow testing of HP cylinders without the test components effecting the result.

The unit is manually operated and is supplied complete with a stop watch for timing the tests, a tube tip cutter for cutting the detector tubes and storing the glass shards, and a transit container for storing the used detector tubes. All equipment is stowed within a lightweight storage case which has additional storage locations to stow 3 packs of detector tubes, a pack of oil impactors and a location to stow an Analox O₂ EII oxygen analyser (not supplied).

An air quality check is carried out using the Draeger Impactor for oil with chemical reagent tubes for carbon monoxide, carbon dioxide and water. These are supplied in packs of 10 per type and the chemical reagent tubes show the degree of contaminant present as a colour change to the crystals that they contain. The extent of this is read against the scale on the tube. For the Impactor the degree of oil contamination is displayed on a screen.

To restrict potential damage, if the pressure regulator has been left fully open, the pressure gauge is restricted to maximum span of 0 to 2 barg.

Extracts from the relevant air quality standards are listed below:-

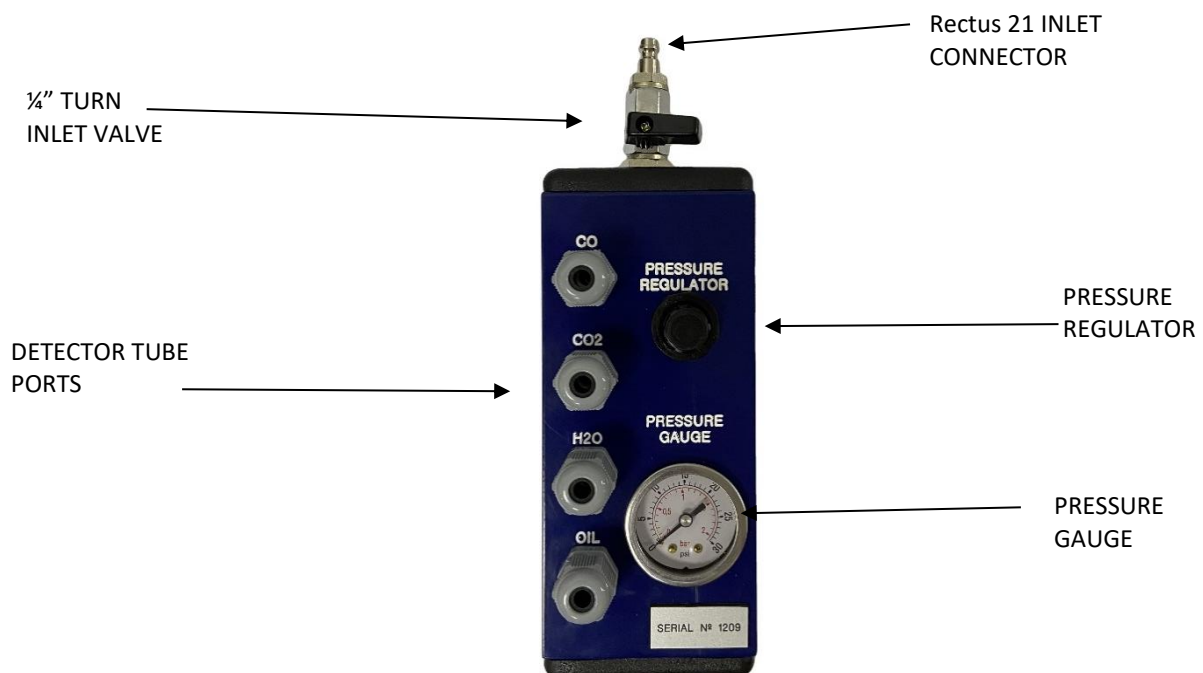
BS:EN12021: 2014 Requirements						
	Cylinders ≤ 200Bar	Cylinders > 200 bar	HP Charging Compressors	Oxygen compatible Air	Nitrox	Oxygen and Nitrogen Gas mixtures
Water	≤ 50mg/m ³	≤ 35mg/m ³	≤ 25mg/m ³	≤ 25mg/m ³	≤ 25mg/m ³	15mg/m ³
Oil	≤ 0.5mg/m ³	≤ 0.5mg/m ³	≤ 0.5mg/m ³	≤ 0.1mg/m ³	≤ 0.1mg/m ³	≤ 0.1mg/m ³
CO	≤ 5ppm	≤ 5ppm	≤ 5ppm	≤ 5ppm	≤ 5ppm	≤ 3ppm
CO₂	≤ 500ppm	≤ 500ppm	≤ 500ppm	≤ 500ppm	≤ 500ppm	≤ 5ppm

DIVE-CHECK F2235-H SPECIFICATION

Case Dimensions	370mm L x 340mm W x 130mm H
Weight	1.75 kg
Maximum inlet pressure	10 bar g (145 psi g)
Minimum inlet pressure	2 bar g (30 psi g)
Test pressure	0.9 bar g (13 psi g)
Inlet connector	Rectus 21 Plug
Flow accuracy @ 0.9 bar g	± 5%
Approved detector tubes	Draeger

The Dive-Check is pre-set for use with the following array of Draeger gas detector tubes and the Oil Impactor:

Detector Tube	Part No	NSN No	Manufacturer
CO	67 28511	6630-12-1893125	Draeger
CO ₂	67 28521	6630-12-1893126	Draeger
H ₂ O	67 28531	6630-12-1893127	Draeger
OIL IMPACTOR	8103530	6630-12-3817870	Draeger



EQUIPMENT OVERVIEW



F3002 HP
Regulator



Note: Above image shows Analox O2E2 Oxygen Analyser stored in case. This is not provided as standard with the unit.

OPERATING INSTRUCTIONS

1. Connect the F3002 regulator to the cylinder to be tested. The F3002 has a 5/8" DIN thread suitable for testing cylinders up to 300 bar. *(Note: always test a full cylinder)*
2. Connect the hose to the F3002 regulator and the inlet of the F2235-H.
3. Ensure the F2235-H pressure regulator is turned fully anti-clockwise. *(Note: Pull the regulator adjusting knob fully out prior to adjusting)*
4. With the ¼ turn inlet valve off, open the cylinder valve, then open the ¼ turn inlet valve.
5. Adjust the pressure regulator until the gauge is set to 2 bar (30 psi) and purge the unit for approximately 5 minutes.
6. During the purge use the water and oil ports to carry out an odour test.
7. When the purge is complete adjust the pressure regulator anti-clockwise until the gauge reads 0.9 bar (13psi).
8. Turn off the ¼ turn inlet valve.
9. Cut both ends of the detector tubes and, ensuring that no glass shards are present in the glands, insert the tubes and impactor into the relevant ports and rotate the gland nut clockwise until there is a gentle finger-tight tension. Always check to ensure the tube is inserted correctly with the arrows pointing outwards.
10. Simultaneously, open the ¼ turn inlet valve and start the stopwatch. Re-adjust the pressure regulator to 0.9 bar (13 psi) if required.
11. Remove the CO₂ tube after 5 minutes, leave the unit running with the remaining tubes and impactor fitted. Check the pressure gauge and readjust to 0.9 bar if required.
12. Remove the oil impactor after 6 minutes, leave the unit running with the remaining tubes fitted. Check the pressure gauge and readjust to 0.9 bar if required.
13. Remove the CO tubes after 10 minutes, leave the unit running with just the water tube fitted. Check the pressure gauge and readjust to 0.9 bar if required.

14. After 12 minutes 30 seconds, close the ¼ turn inlet valve and remove the water tube.

CONTAMINENT	FLOW RATE	TEST DURATION
CARBON DIOXIDE (CO ₂)	200 ml/min	5 minutes
OIL IMPACTOR	4 l/min	6 minutes
CARBON MONOXIDE (CO)	200 ml/min	10 minutes
WATER VAPOUR (H ₂ O)	4 l/min	12 mins 30 secs

15. Turn off the air cylinder valve, open the ¼ turn inlet valve ensuring all air has been relieved then rotate pressure regulator fully anti-clockwise. The F3002 and hose can then be disconnected from the cylinder.

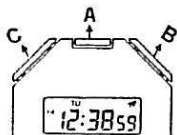
16. Record the results using Factair's record pad – refer to "Reading Draeger detector tubes" data sheet.

STOPWATCH INSTRUCTIONS

STOPWATCH USER'S INSTRUCTIONS

Features

- Time / Calendar display
- Hour (12/24-hour format), minute, second, month, date and day
- Stopwatch: 1/100 second for 30 minutes, 1 second up to 24 hours



Function Keys

- A. MODE button: Switch among normal time mode, stopwatch mode, alarm time setting mode and normal time setting mode.
- B. START/STOP button: Toggle between normal time and month/date display.
- C. SPLIT/RESET button: Toggle between normal time and alarm time display.

Display Symbols

Normal Time Mode

1. Day of the week
2. Hour
3. Minute
4. Second



Alarm Time Mode

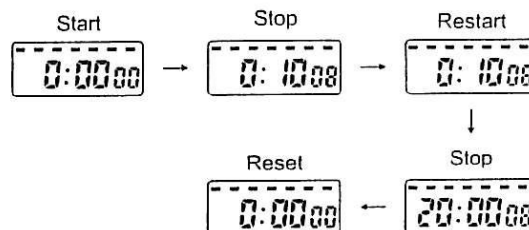
1. Alarm time
2. Alarm icon



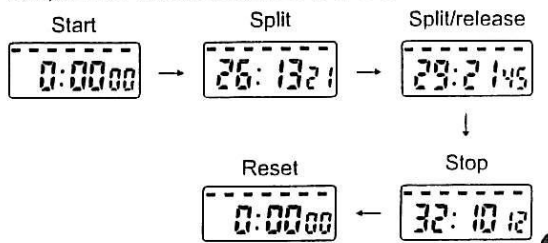
Stopwatch Mode

In normal time mode, press A once to activate this mode. Press C to reset the stopwatch to "0:00" before using the stopwatch.

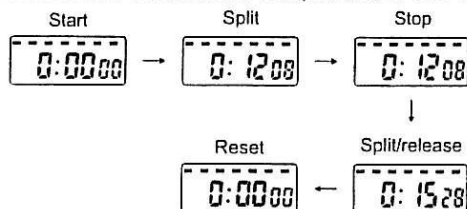
1. Accumulate elapsed time measurement: B-B-B-B-C



2. Split time measurement: B-C-C-B-C



3. Measurement between two competitors: B-C-B-C-C

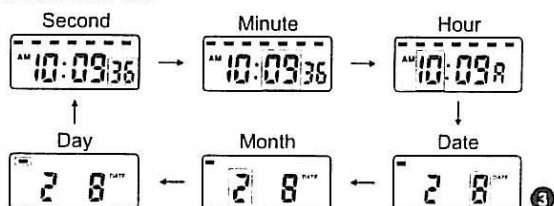


Press A to return to the normal time mode.

Time / Calendar Setting

1. In normal time mode, press A thrice to activate this mode.
2. Press C to select the setting items. The sequence will be: second > minute > hour > date > month > day.
3. Press B to increase the setting value and change 12/24 hour format when setting the hour.
4. Press A to return to normal time mode.

Note: Press B to add one minute when the second is more than or equal to 30 and reset it to 00 when the value is less than 30.



Alarm Time Setting

1. In normal time mode, press A twice to activate this mode.
2. Press B to change the hour value.
3. Press C to select the minute and press B to change the minute value.
4. Press A to return to normal time mode.

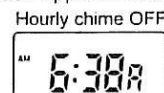


Note 1: To turn the alarm ON/OFF, press B and C at the same time.

Note 2: When the alarm is on, (1) It will last one minute without pressing any button then not sound again until the next day. (2) When the alarm is sounding, press B to activate the snooze function and the alarm will start again after 5 minutes. It will sound up to one minute then not sound again until the next day. (3) Press C to stop the alarm.

Hourly Chime Setting

1. In normal time mode, press and hold C with alarm time displayed.
2. Press A until all days of the week appear / disappear.



Battery Replacement

When the LCD becomes dim, replace with a new LR44 battery at once.



P175010GB060

HELPFUL TIPS

With detector tubes

- Ensure that there are no fragments of glass in the tube glands prior to fitting detector tubes, clean if required.
- Always remove the ends of the detector tubes cleanly using the correct tube tip cutter. Do not use pincers or other devices.
- Always remove both ends of the detector tubes prior to fitting.
- Always fit detector tubes with the arrows facing outwards.
- Only use the detector tubes that the Dive-Check is set for.
- Once used, be aware that the tube tip cutter contains ground glass and glass fragments. Take appropriate precautions for the disposal of these. Dispose of as sharps.
- When using the tube tip cutter ensure only a light pressure is applied to the tube whilst rotating for scoring.
- Detector tube life can be affected by heat, always store in a cool place out of direct sunlight.

General

- Maximum inlet pressure to the Dive-Check is 10 bar. If exposed to excessive pressure then damage could occur.
- If the Dive-Check has been used on an excessively wet supply it can be purged dry by running for an extended purge period.
- For the most accurate results it is recommended that the test is carried out on a freshly filled dive cylinder.

Draeger Tube Tip Cutter

The F2187 is especially designed to prevent glass from falling out of the opener by accident. The reservoir for the broken-off tips is easy to empty.

Instructions

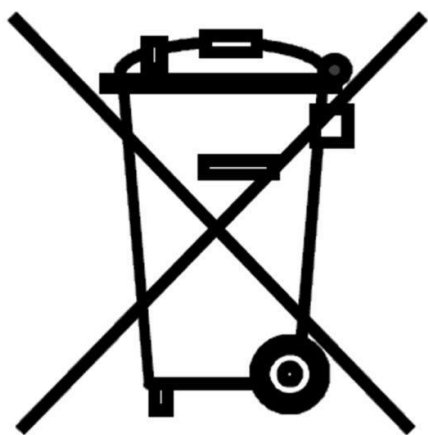
1. Place the end of the tube between the 3 blades, and turn to score the end.



2. Push the tube at an angle to break the tip.



3. Repeat steps 1 and 2 with the other end of the tube.



The following information is only for EU-member states:

The use of the symbol indicates that this product may not be treated as household waste. By ensuring this product is disposed of correctly you will help prevent potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling of this product. For more detailed information about the recycling of this product please contact your local city office, your household waste disposal service of the manufacturer/shop from whom you purchased the product.

Reading the Draeger Oil Impactor and Chemical Reagent Tubes

Oil Impactor

The Oil Impactor's protective seal must be kept in place for the duration of the test and only removed after the test has been completed.

With a standard measurement range of 0.1 to 1.0 mg/m³ the Impactor has a limit of detection of 0.05 mg/m³. The Impactor can detect all mineral and synthetic oils, it features a series of 3 horizontal lines, each formed by a series of precision manufactured nozzles. These horizontal lines of nozzles are calibrated to a different concentration of oil. When air is passed through these nozzles any oil present in the air is deposited on the glass plate prior to the air being exhausted by vents around its circumference, this allows the user to easily and quickly identify minute quantities of oil.

For tests that pass with an oil concentration of less than 0.05mg/m³, the screen will remain blank. For tests above that read as follows:

The bottom line represents an oil concentration of 0.1 mg/m³. When the oil deposited forms a continuous line then the concentration is in excess of 0.1 mg/m³. The middle line represents a concentration of 0.5 mg/m³, again when the oil deposited forms a continuous line the concentration is in excess of 0.5 mg/m³. The top line represents a concentration of 1.0 mg/m³, again when this forms a continuous line the concentration is in excess of 1.0 mg/m³.



Pass -
greater
than
0.05mg/m³
but less
than
0.1mg/m³



Pass (to EN
12021) -
greater
than
0.1mg/m³
but less
than
0.5mg/m³



Fail -
greater
than
 $0.5\text{mg}/\text{m}^3$
but less
than
 $1.0\text{mg}/\text{m}^3$



Fail -
greater
than
 $1.0\text{mg}/\text{m}^3$

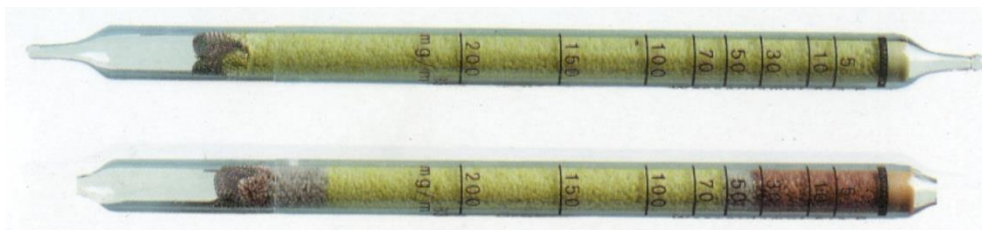
Each pack of tubes has its own instruction leaflet but the following notes should help you take readings after the tests have been completed.

Each tube has an expiry date which is located on the back of its storage box.

Water (H₂O) (67 28531)

- REQUIREMENTS** - FOR HIGH-PRESSURE CYLINDERS THE FOLLOWING UPPER LIMITS APPLY: - 40 TO 200 BAR = $50\text{MG}/\text{M}^3$, ABOVE 200BAR = $35\text{MG}/\text{M}^3$
- FOR HIGH-PRESSURE CYLINDER CHARGING COMPRESSORS THE UPPER LIMIT = $25\text{MG}/\text{M}^3$

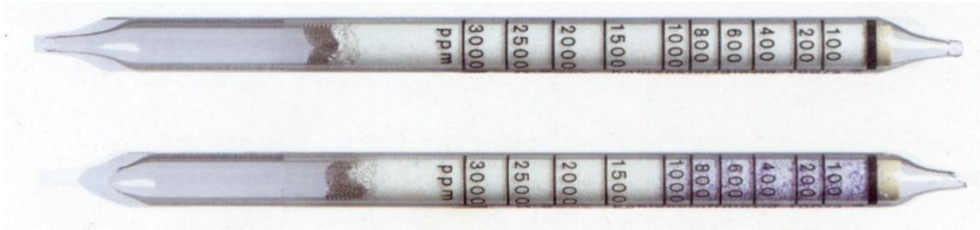
A reddish brown discoloration will show the extent of the water content, which is read from the scale printed on the tube in mg/m^3 .



Carbon Dioxide (CO₂) (67 28521)

REQUIREMENT - MAXIMUM READING OF 500 PPM (BS EN12021)

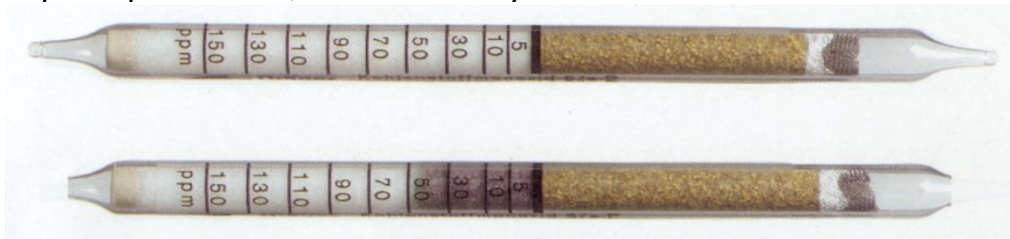
The media in the detector tube will discolour to show the presence of carbon dioxide. The total length of the discoloration read from the printed scale at that point is a measure of the concentration in parts per million.



Carbon Monoxide (CO) (67 28511)

REQUIREMENT - MAXIMUM READING OF 3 PPM (BS EN12021)

The media will discolour to show the presence of carbon monoxide in the air sample. The total length of the discoloration is the measure of concentration read directly from the scale in parts per million, but divided by 2.



Note: The CO tube is provided with a double length sample to increase accuracy at the low reading level. Therefore, as an example, a reading on the tube of 5ppm should be divided by 2 and would thus represent a CO level of 2.5ppm.

Disposal of Draeger-Tubes

When Draeger tubes have been used, or unopened tubes have exceeded their expiry date, they should be disposed of using one of the following methods:

Used Tubes

Submerge the tube(s) in a beaker or metal container filled with water and allow to soak for 24 hours. Treat the residual water in accordance with local authority waste regulations (some tube aqueous waste may require neutralisation prior to disposal). Place the tubes in a “sharps” or glass bin wearing protective gloves and safety spectacles. Dispose of the bin via the company’s normal industrial waste disposal method(s) i.e. landfill or incineration.

OR

Place the tubes in a “sharps” or glass bin wearing protective gloves and safety spectacles. Dispose of the bin via the company’s normal hazardous waste disposal method(s) i.e. landfill or incineration.

OR

Place the tubes in a “sharps” or glass bin wearing protective gloves and safety spectacles. Dispose of the container via incineration.

Unused Tubes

Open the Draeger tube at both ends using the special tube opener or the cutter on the hand pump. Break any ampoules where applicable. Dispose of the tubes as stated in Methods 1, 2 or 3.

NOTE: *As an alternative a local authority approved waste disposal contractor can be employed to collect used and unused tubes from site and dispose of them in a safe manner.*

AIR QUALITY TESTING – WHY?

The required quality of breathing air is stated in EN12021 is to provide information on the safe limits of potential contaminant gases within breathing air and to ensure that the life support gas of oxygen is of an adequate level.

Compressed air for breathing normally originates from a compressor system installed or operating at the place of use and there are various factors that can affect the quality and safety of this air.

- The air intake to the compressor can ingest airborne contamination from local processes and vehicle exhaust fumes which are not removed by standard breathing air filtration. Such air borne contamination may not be continuous but the pollution of the air supply may persist for hours or days.
- Malfunctioning compressors, especially reciprocating type, can produce unsafe levels of both carbon monoxide and carbon dioxide.
- Breathing air filtration has a finite life and can fail causing high levels of oil and water contamination to be present in the air.
- The performance of desiccant filters is dramatically affected by operating temperature. Infrequent validation may result in poor quality air being supplied for an extended period
- Failure of the compressed air aftercooling will result in air entering the filtration at too high a temperature, this will cause the filtration to prematurely fail and pass excess levels of oil and water.
- Malfunctioning dryers can disturb the oxygen concentration to outside safe levels within the breathing air.
- High levels of water in breathing air can freeze within RPE demand valves causing the air supply to fail.
- Insufficient air flow or pressure to the RPE will reduce the protection factor of the RPE and potentially expose the user to ingress of external contaminants.
- The effects of contaminants when breathed at elevated pressure can have a much greater effect on users than it would at normal pressure.
- Changes in the performance of compressor and filtration equipment are usually rapid in nature. Any failure affecting outlet air quality may injure users for an extended period if quality validation is infrequent.
- Odour alone is a poor indicator of air quality, toxic as asphyxiant gasses are often odourless, the limits for oil pollution are lower than the threshold detection level that most people will notice.

All employers have a duty of care to their employees to ensure that the breathing air they are supplied with is adequate for the RPE they are using and safe to breathe.

F2235H - MAINTENANCE REQUIREMENTS

ANNUAL FUNCTIONAL TEST (AFT)

It is the responsibility of the individuals or units holding FACTAIR F2235-H to ensure that their equipment is serviceable and in date for service with an AFT. The AFT comprises of:

F2235-H Air Quality Checker

- The AFT for the FACTAIR F2235-H is to confirm the accuracy of the pressure gauges and flow volumes through each port. The testing is carried out using the F2247 or F2247P test equipment. The accuracy of the air tests conducted using the F2235-H is reliant on accurate time and flow through each port.
The wrong pressure = the wrong flow = the wrong results.
- The AFT is valid for a period of 12 months. Certification showing latest test information should always accompany the F2235-H.

F3002 High Pressure Regulator

- It cannot be assumed that a regulator is in good working order on the basis that it has received little use since it was last serviced. Remember that prolonged or improper storage can still result in internal corrosion and/or deterioration of O-ring seals.
- The F3002 must obtain a manufacturer prescribed service annually by an approved and qualified service technician who is suitably trained and experienced and have completed an Apeks course in the servicing requirements of the DS4 regulator. Only approved OEM service kits and parts are to be used.
 - **Note:** The F3002's output regulated pressure is to be set to circa 6 barg.

F2247/F2247P Test Equipment

Units are to be calibrated annually to ensure the accuracy of test results conducted on F2235H units.

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