



Non-Invasive Ventilation (NIV) with the Oxylog® VE300 and Oxylog® 3000 plus

WARNING

This booklet is not a substitute for the Instructions for Use of the Oxylog® VE300 and Oxylog® 3000 plus. Before any use of the devices, the user must carefully read and fully understand the Instructions for Use of the devices.

IMPORTANT NOTE

Medical knowledge is subject to constant change due to research and clinical experience. This booklet focuses on Non-Invasive Ventilation during transport and emergency care. The authors have taken great care to make certain that the views, opinions and assertions included, particularly those concerning applications and effects, correspond with the current state of knowledge. However, this does not absolve readers from their obligation to take clinical measures on their own responsibility.

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Non-Invasive Ventilation (NIV)

INTRODUCTION TO NIV

“Non-Invasive Ventilation (NIV) is the delivery of mechanically-assisted breathing without placement of an artificial airway such as an endotracheal tube or tracheostomy.

During the first decades of the 20th century, negative-pressure ventilation (iron lung) provided mechanical ventilatory assistance. By the 1960s, however, invasive (i.e., by means of an endotracheal tube) positive-pressure ventilation superseded negative-pressure ventilation as the primary mode of support for ICU patients because of its superior delivery of support and better airway protection.

Over the past decade, the use of NIV has been integrated into the treatment of many medical diseases, largely because the development of nasal ventilation in the home care market. NIV has the potential benefit of providing ventilatory assistance with greater convenience, comfort, safety, and less cost than invasive ventilation. NIV is delivered by a tightly fitted mask or helmet that covers the nose, face, or head. NIV is used in various clinical settings and is beneficial in acute medical situations⁽¹⁾.”

Non-Invasive Ventilation has received increased attention in emergency care situations in recent years as researchers and practitioners provide proof of benefited patients outcome:

- NIV has been shown to be effective in acute respiratory failure of various etiologies. It is complementary to invasive ventilation, as an adjunct therapy to usual medical care. NIV as a first line intervention prevents patients from deteriorating to the point at which intubation is needed^(2, 5).
- An important benefit of NIV includes the reduction of complications associated with intubation, particularly endotracheal tube associated infections. In intubated patients there is a 1% risk per day of developing pneumonia. This complication is associated with longer ICU stays, increased cost and increased morbidity and mortality⁽²⁾.
- NIV has proven to have the potential to avoid intubation for 1 in every 4 patients, to reduce the number of complications up to 68% and reduce treatment failure up to 20%⁽³⁾.

- NIV failure is still relatively high because of patient intolerance, particularly due to the choice of interface and ventilator settings. Improved patient ventilator synchronization reduces intolerance and improves the chance of successful NIV treatment.^(5,7)
- NIV can be successfully initiated in the Emergency Department^(7,8) and delaying the initiation of NIV reduces the possibility of success of treatment.^(2,3,4,5)
- Out of hospital NIV proved to be feasible, safe and more effective for the treatment of ARF compared with standard medical therapy. Out of hospital NIV promotes in-hospital treatment with NIV and may reduce the frequency and length of ICU stays.⁽¹²⁾
- The pre-hospital and non-invasive ventilation is an effective and appropriate therapy for the treatment of patients with acute respiratory insufficiency.⁽⁶⁾
- Patients that were successfully treated with NIV during their hospital admission also exhibited lower mortality rates, a reduction in hospital re-admissions and in the need for long-term oxygen therapy.⁽²⁾
- NIV is feasible and improves emergency management of acute cardiogenic pulmonary edema when initiated in pre-hospital settings.⁽⁹⁾

POTENTIAL NIV ADVANTAGES

- Reduce the risk of Ventilator Associated Pneumonia (VAP)⁽²⁾
- Reduce work of breathing⁽⁷⁾
- Decrease mortality⁽²⁾
- Decrease the intubation rate⁽³⁾
- Reduction in health care costs⁽²⁾
- Decrease length of stay in the hospital⁽⁸⁾
- Decrease hospital re-admission⁽²⁾

NIV INDICATIONS⁽¹³⁾

- Acute exacerbation of COPD
- Facilitate extubation in COPD
- Cardiogenic pulmonary edema
- Immuno-suppression
- Postoperative patients
- Palliative care

SUCCESS METRICS OF NIV⁽¹³⁾

| Criterion | Success Criterions of NIV |
|-----------------------|------------------------------------|
| Dyspnoea | Reduction |
| Vigilance | Increasing improvement |
| Respiratory Rate (RR) | Reduction |
| Ventilation | PaCO ₂ -reduction |
| pH-value | Increase |
| Oxygenation | Increase of SaO ₂ ≥ 85% |
| Heart Rate (HR) | Reduction |

ABSOLUTE CONTRAINDICATIONS⁽¹³⁾

- Lack of spontaneous breathing
- Gaspings
- Partial or complete airway blocking
- Aspiration, gastrointestinal bleeding or ileus

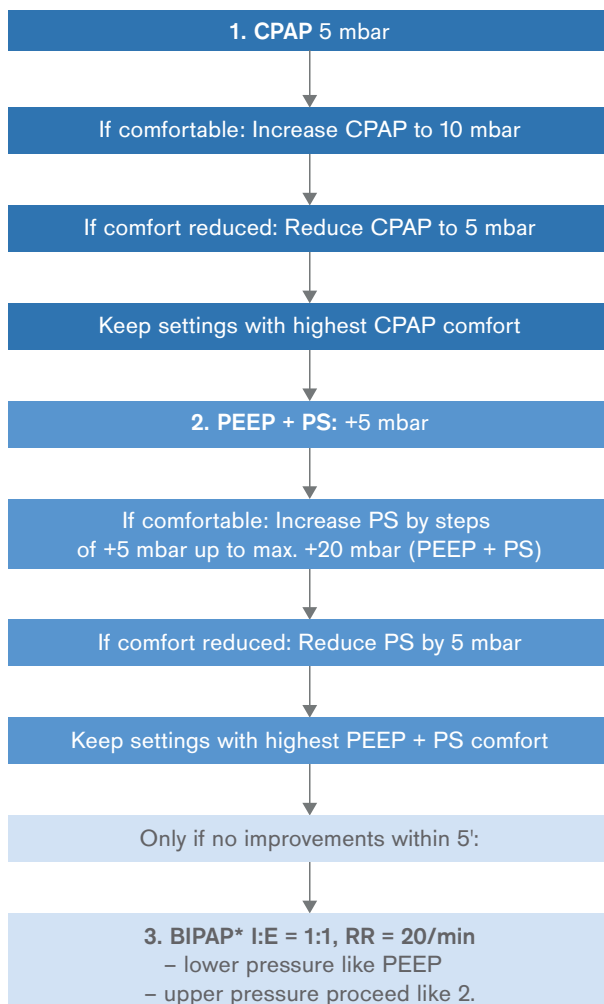
RELATIVE CONTRAINDICATIONS⁽¹³⁾

- Coma
- Massive retention of secretions despite bronchoscopy
- Massive agitation
- Acidosis (pH < 7.1)
- Hemodynamic instability (cardiogenic shock, myocardial infarction)
- Status post: upper gastrointestinal surgery

POTENTIAL SIDE EFFECTS

- Excessive leakage⁽¹⁾
- Patient discomfort as a result of asynchrony and increased work of breathing⁽⁸⁾
- Gastric distension⁽²⁾
- Facial skin necrosis⁽¹⁾
- Eye irritation (conjunctivitis)⁽¹⁾
- Increased risk of aspiration⁽²⁾
- Anxiety⁽⁸⁾

FLOW CHART FOR ADJUSTING NON-INVASIVE VENTILATION PARAMETERS⁽¹²⁾





NIV APPLICATION WITH THE OXYLOG VE300 AND OXYLOG 3000 PLUS

Time and time again, Dräger has contributed to major advances in emergency medicine with innovations of medical engineering. Back in 1907, the portable Pulmotor was the world's first emergency ventilator and resuscitator. In 1978 Dräger again set new standards in primary care with the first Oxylog ventilator. The new benchmarks in emergency and transport ventilation are the Oxylog VE300 and Oxylog 3000 plus, both supporting the application of NIV.

OPTIMAL PATIENT VENTILATION WITH AUTOMATIC LEAKAGE COMPENSATION

Both the Oxylog VE300 and Oxylog 3000 plus automatically adjust to meet the requirements of mask ventilation. Mask leakages are automatically compensated up to a maximum level of 100 L/min. Furthermore, the triggering is compensated in case of mask leakages enabling optimal support during ventilation. The measured values for V_{T_e} and M_{V_e} are also compensated to show the delivered volumes the patient receives.

WORK SMARTER WITH OPTIMIZED ALARM SYSTEM

When activating the NIV function of the Oxylog VE300 or Oxylog 3000 plus, the leakage alarm will be deactivated automatically, eliminating unnecessary alarms. Monitoring of ventilatory parameters is possible during NIV.

WARNING

Dead space increases when using masks. Note the mask manufacturer's instructions!

WARNING

Ensure that NIV is not activated for intubated patients. Risk of undetected leaks and inadequate ventilation!

WARNING

Check MV alarm limits after deactivating NIV mode!

WARNING

Avoid high airway pressure. Risk of aspiration!

WARNING

Set the lower alarm limit MV $\sqrt{}$ according to the minimum ventilation required for the patient. Otherwise, there is a risk of the patient receiving insufficient ventilation.

WARNING

If NIV is not activated, measured values for V_{T_e} and M_{V_e} will be inconsistent if there are leakages during ventilation.



NIV with the Oxylog VE300

PREPARED TO TAKE ON ANY CHALLENGE

The new Oxylog® VE300 is more than just a new emergency ventilator. It combines all sorts of features that make it ideally suitable for first responses as well as emergency ventilation of the patient during transport and in the hospital.

At your disposal are volume-controlled ventilation, non-invasive ventilation (NIV with CPAP) as well as spontaneous breathing and pressure support.

VENTILATION MODES

NIV can be activated as a supplementary function in the pressure controlled ventilation modes SPN-CPAP and SPN-CPAP/PS.

Mask leakages are detected by the device, compensated and included in the measured values for VT_e and MV_e.

SYNCHRONIZATION WITH SPONTANEOUSLY BREATHING PATIENTS

The spontaneous breathing can be supported by the option 'Pressure Support' (PS) in the mode SPN-CPAP.



OPERATION OF THE OXYLOG VE300

Preparing

NIV is available for the device in the pressure-controlled ventilation mode **SPN-CPAP** or **SPN-CPAP/PS**. In this ventilation mode **NIV** is the default setting and is activated by 3 steps from standby mode:

- 1 Select the patient category
- 2 Select the ventilation category: **SPN-CPAP**
- 3 Start ventilation

Adjusting

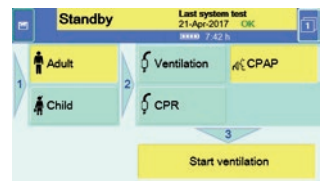
- 1 Adjust the following parameters using the therapy controls:
 - A Maximum airway pressure Pmax
 - B Positive end-expiratory pressure PEEP
- 2 Press the **More settings** button (C) and adjust the following parameters and settings:
 - A Inspiratory oxygen concentration **FiO₂** (100 % O₂ or O₂ /air mix)
 - B Non-invasive ventilation **NIV (On or Off)**
 - C Pressure support **ΔPsupp**
 - D Trigger sensitivity **Trigger**
 - E Pressure rise time **Slope**

The parameter **Trigger** can only be changed when a value > 0 mbar has been set for **ΔPsupp**.

The parameter **Slope** can then be changed:

- **Flat** = slow pressure rise
- **Medium** = medium pressure rise
- **Steep** = fast pressure rise

If Pressure Support (PS) is not active, the patient's spontaneous breathing is supported only by an increased PEEP.



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Use NIV

The Oxylog VE300 automatically adjusts to the requirements of non-invasive ventilation. Mask leakage is detected by the device and compensated for. This means that the leakage for the displayed measured values **VT_e** and **MV_e** has already been taken into account. The leakage alarm is not available.

Deactivating NIV

1 In ventilation modes **SPN-CPAP** and **SPN-CPAP/PS** touch the **More settings** button.

2 For **NIV**, touch the **Off** button and confirm.

The adjunct **NIV** is hidden in the on-screen ventilation mode field, and in the ventilation category the mask symbol is replaced by a tube symbol.

Turning NIV back on

1 Touch the **More settings** button.

2 For **NIV**, touch the **On** button and confirm.

The adjunct **NIV** behind the ventilation mode is displayed again, and in the ventilation category the mask symbol reappears.

WARNING

If NIV is not activated, measured values for **VT_e** and **MV_e** will be inconsistent if there are leakages during ventilation.



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WARNING

Set the lower alarm limit **MV** $\sqrt{\quad}$ according to the minimum ventilation required for the patient. Otherwise, there is a risk of the patient receiving insufficient ventilation.



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Setting alarm limits with CPAP/PS

The following alarm options are possible with Oxylog VE300:

- Airway pressure **Paw**
- Respiratory rate **RR**
- Minute volume **MVe** (option)

To set the alarm limits:

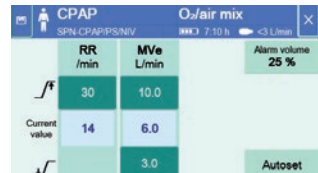
- 1 In operation mode, touch the **Alarm settings** button (A).
- 2 The following settings can be made depending on the selected options:
 - For the respiratory rate **RR**: Upper alarm limit
 - For the minute volume **MVe**: Upper alarm limit and lower alarm limit

The automatic setting **Autoset** enables the upper and lower alarm limits to be set automatically. This applies to all parameters.

Please refer to the Oxylog® VE300 Instructions for Use for information about using alarms and settings.



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NIV with the Oxylog 3000 plus

OPTIMAL PATIENT CARE

The Oxylog 3000 plus offers sophisticated ventilation for patients in emergency situations and during transport in and between hospitals. Designed to support a wide range of patients and medical conditions, Oxylog 3000 plus offers volume and pressure based modes, for controlled, synchronized or spontaneous ventilation. When transporting critical care patients, the need of interrupting ventilation therapy is therefore eliminated.

VENTILATION MODES

The Oxylog 3000 plus offers a wide range of advanced ventilation modes, including VC-CMV, VC-AC, VC-SIMV, PC-BIPAP* and SPN-CPAP, allowing the user to adapt the ventilator to the condition of the patient. Also AutoFlow® is as option available.

SYNCHRONIZATION WITH SPONTANEOUSLY BREATHING PATIENTS

Spontaneous breathing is actively supported through the Pressure Support (PS) option in the VC-SIMV, SPN-CPAP and PC-BIPAP modes.

NIV

NIV can be activated as a supplemental function in the ventilation modes SPN-CPAP (/PS), PC-BIPAP (/PS), VC-CMV/AF, VC-AC/AF and VC-SIMV/AF.

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Please refer to the Oxylog® 3000 plus Instructions for Use for information about using alarms and settings.

OPERATION OF THE OXYLOG 3000 PLUS

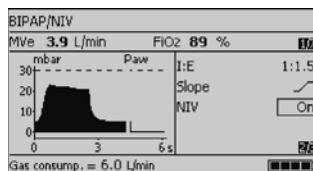
Setting Non-invasive (mask) Ventilation

To switch on NIV

- Press **“Settings”** key
until screen page 2 appears
- Activate line **“NIV off”**
- Select **“on”** and confirm

The supplement NIV appears in the top line of the screen.

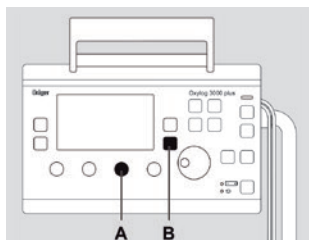
The Oxylog 3000 plus automatically adjusts to the requirements of mask ventilation. Mask leakages are detected by the device and compensated for. Therefore, the displayed measured values V_{Te} and MVe do not include the leakage. The leakage alarm is inactive.



Setting the alarm limits

The following alarm settings are possible with Oxylog 3000 plus:

- Pressure limitation with **Pmax** (A).
- Alarm limits for **MVe**, **RRsp** and **etCO₂** (option)
 Example: upper alarm limit for MVe:
 - Press the key **Alarms** (B).
 - Select and activate the line **MVe** on the display
 - Set and confirm the value with the rotary knob.
- Setting alarm limits automatically
 - Press the key **Alarms** (B).
 - Select and activate the line **“Alarms: Autoset”** and confirm with the rotary knob.



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Information about using alarms and settings are available in the Oxylog® 3000 plus Instructions for Use.

Dräger Accessories for Non-Invasive Ventilation using Oxylog ventilators

Dräger also provides accessories for its Oxylog ventilators. These accessories improve economical, clinical, and process values, and offer excellence in performance and therapeutic benefits. As an integral part of the Dräger solution, these accessories are specific to the devices.

We offer a wide variety of new disposable breathing circuits. The VentStar Oxylog circuits are dedicated accessories to be used with the Dräger Oxylog family.

Dräger offers a large portfolio of filters, which protect the patients from potentially present microorganisms in the inspired air. Our HMEs efficiently humidify and heat the inspired air.

In order to guarantee correct measurement by the Dräger device, it is very important to use the correct accessories. We have designed and tested various products used with our Oxylog range of ventilators and have now added to our wide portfolio of products the disposable CO₂ cuvette for non-invasive measurement of CO₂. Prerequisite is the installation of the CO₂ option. In the clinical environment, but also emergency situation capnography is applied as a non-invasive way for evaluating a patient's ventilatory status.



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VentStar®



MT-4386-2007

SafeStar®

Minimizing leakage is the most important challenge in NIV. Leaks often result from a poor seal between the mask and the skin, reducing alveolar ventilation and synchrony between the patient and the ventilator.⁽¹⁰⁾ The next major challenge is finding an interface which is comfortable, and free of unwanted side-effects. Although NIV is generally perceived as more comfortable for patients than invasive ventilation, mask intolerance remains a major cause of NIV failure. Failure rates range from below 10% to over 40%, despite the best efforts of skilled caregivers.⁽¹¹⁾

The NIV oronasal mask ClassicStar plus features a soft and anatomically shaped silicone lip as the sealing interface to the patient's face. The forehead support is easy to adjust and is fitted with a soft silicone pad to enable the mask to be individually adjusted to the sensitive bridge of the nose. This efficiently prevents pressure points and leakages. The mask is available in four sizes S, M, L and XL as oronasal and nasal mask.

The NovaStar mask has a fine silicone gel-filled cushion as well as a pliable ring built into the transparent mask shell. This pliable ring allows the NovaStar mask to be shaped to match the individual patient's face, providing a truly customized fit, which, together with the fine gel-filled cushion, maximize patient comfort.

CO₂ Cuvettes

D-585-2.009



ClassicStar® plus

D-10386-2016

Combining ventilation accessories such as our dedicated Oxylog circuits with outstanding products like the NovaStar NIV masks and certain general commodities such as filter/HMEs etc. then together with e.g. Dräger Oxylog 3000 plus ventilator, enables Dräger to offer a “one-step” and “one-stop” solution for the entire non-invasive ventilation therapy in emergency care. This allows the caregiver to improve efficiency and increase effectiveness, which in turn may lead to improved therapy for the patient.

Dräger offers compatibility certificates for its systems. This means that Dräger Oxylog ventilators and Dräger ventilation accessories are tested as a system to ensure your device is performing to the maximum efficiency and to reduce compatibility risk thus ensuring patient safety.

ACCESSORIES FOR OXYLOG VE300 AND OXYLOG 3000 PLUS

| ACCESSORIES | ORDER NO. |
|---|------------|
| Breathing Circuits | |
| VentStar® Oxylog® VE300 and Oxylog® 3000 plus, 1.5 m, disp., 5 pcs. | 57 03 041* |
| VentStar® Oxylog® VE300 and Oxylog® 3000 plus, 3 m, disp., 5 pcs. | MP 00 335* |
| VentStar® Oxylog® 3000 plus (P), 1.9 m, disp., 5 pcs. | 57 04 964 |
| VentStar® Oxylog VE300, 1,5 m, 5 pcs. | MP 01 370 |
| VentStar® Oxylog VE300, 3 m, 5 pcs. | MP 01 371 |
| Filter/HMEs | |
| Filter SafeStar® 80, 50 pcs. | MP 01 785 |
| Filter SafeStar® 55, 50 pcs. | MP 01 790 |
| Filter SafeStar® 60A, 50 pcs. | MP 01 795 |
| Filter/HME TwinStar® 90, 50 pcs. | MP 01 800 |
| Filter/HME TwinStar® 55, 50 pcs. | MP 01 805 |
| Filter/HME TwinStar® 65 A, 50 pcs. | MP 01 810 |
| Filter/HME TwinStar® 25, 50 pcs. | MP 01 815 |
| Filter CareStar® 45, 50 pcs. | MP 01 755 |
| Filter CareStar® 40A, 50 pcs. | MP 01 765 |
| Filter CareStar® 30, 50 pcs. | MP 01 770 |
| CO₂ Cuvettes | |
| Disposable CO ₂ Cuvette – adults, 10 pcs. | MP 01 062 |
| Disposable CO ₂ Cuvette – pediatrics, 10 pcs. | MP 01 063 |
| Reusable CO ₂ Cuvette – adults, 1 pcs. | 68 70 279 |
| Reusable CO ₂ Cuvette – pediatrics, 1 pcs. | 68 70 280 |
| Breathing Masks | |
| NIV oronasal mask ClassicStar® SE, disposable, size S | MP 01 573 |
| NIV oronasal mask ClassicStar® SE, disposable, size M | MP 01 574 |
| NIV oronasal mask ClassicStar® SE, disposable, size L | MP 01 575 |

* Product is compatible with Oxylog® VE300 and Oxylog® 3000 plus

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Abbreviations

| | |
|--------------------|--|
| COPD | Chronic Obstructive Pulmonary Disease |
| ED | Emergency Department |
| FiO ₂ | Fraction of inspiratory oxygen |
| HME | Heat and Moisture Exchanger |
| ICU | Intensive Care Unit |
| MV | Minute Volume |
| MVe | Total expiratory minute volume |
| NIV | Non-Invasive ventilation |
| Paw | Airway pressure |
| PC-BIPAP | Pressure Controlled – Biphasic Positive Airway Pressure |
| PEEP | Positive end expiratory pressure |
| P _{insp} | Set value of the upper pressure level |
| P _{max} | Maximum airway pressure |
| PS | Pressure Support |
| PS | Pressure Support |
| RR | Respiratory Rate (frequency) |
| RR _{sp} | Spontaneous Respiratory Rate |
| SPN-CPAP | Spontaneous Continuous Positive Airway Pressure |
| VC-AC | Volume Controlled–Assist Control |
| VC-CMV | Volume Controlled–Controlled Mandatory Ventilation |
| VC-SIMV | Volume Controlled–Synchronized Intermittent Mandatory Ventilation |
| VT | Set tidal volume |
| V _{Te} | Expiratory Tidal Volume |
| ΔP _{supp} | Positive pressure above PEEP |

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