

Engström Carestation™

Breathing life into critical care

Features

- Simplified user interface
- Paramagnetic O₂ sensing
- Non-Invasive ventilation (Optional)
- Secure access to central stations
- Sophisticated power management control with battery backup
- Auxiliary pressure sensor
- Airway Resistance Compensation

Integrated Ventilation and Monitoring

- Advanced ventilation
- INview™ Suite: SpiroDynamics™ and FRC INview
- Plug and play modules
- Patient Spirometry
- Gas monitoring with metabolics and energy expenditure
- Optional use of proximal Neo Flow Sensor with Neonatal ventilation

Exceptional Design

- Adaptable to your environment
- Flexible and moveable display
- Transferable module bay
- Quick-release expiratory valve
- Multiple trolley configurations

Aerogen Aeroneb® Pro

- Built-in advanced nebulization system
- Operated in-line or independently for infants through adults



Physical Specifications

Dimensions

Height: 44.5 cm/17.5 in (Display down)
67.5 cm/26.6 in (Display up)

Height including cart: 122 cm/48 in (Display down)
145 cm/57.1 in (Display up)

Width: 38 cm/15 in

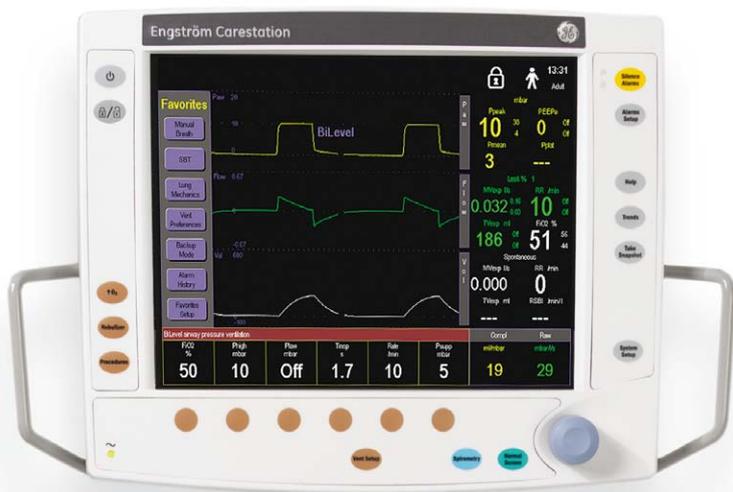
Depth: 36 cm/14 in

Weight: 31 kg/68.3 lb (not including cart);
76 kg/167.6 lb (including cart)

Display motion

Vertical tilt: 160° in raised position
60° in lowered position

Height adjustment: 23 cm/9.1 in



Key:



Available only when Adult patient type is selected



Available only when Pediatric patient type is selected



Available only when Neonatal patient type is selected

Note: Neonatal software is an optional feature. If not specified with the  icon, features listed in this specifications sheet apply to Adult/Pediatric units and patient population selections.

Note: Ranges and Settings without an icon pertain to both Adult and Pediatric patient types.

Modes of Ventilation

Volume Controlled (VCV)

Pressure Controlled (PCV)

Pressure Controlled, Volume Guaranteed (PCV-VG)

Synchronized Intermittent Mandatory Ventilation,
Volume Controlled (SIMV-VC)

Synchronized Intermittent Mandatory Ventilation,
Pressure Controlled (SIMV-PC)

Synchronized Intermittent Mandatory Ventilation, Pressure
Controlled, Volume Guaranteed (SIMV-PCVG) (optional)

BiLevel Airway Pressure Ventilation (APRV capable)

BiLevel with Volume Guaranteed (BiLevel-VG) (optional)

Non-Invasive Ventilation (NIV) (optional); nCPAP available
with Neonatal option

Constant Positive Airway Pressure/Pressure Support
Ventilation (CPAP/PSV)

Apnea backup available in SIMV-VC, SIMV-PC, BiLevel,
SIMV-PCVG, BiLevel-VG, CPAP/PSV and VG-PS
(institutionally selectable defaults)

Volume Guarantee Pressure Support (VG-PS) available
with Neonatal option

Control and Ranges

Maximum

peak flow: 200 L/min

Flow: 0.2 to 30 L/min (0.004 to 0.5 L/sec) 

2 to 90 L/min (0.04 to 1.5 L/sec) 

2 to 160 L/min (0.04 to 2.6 L/sec) 

Incremental

settings: 0.2 to 5 L/min (increments of 0.1 L/min) 

5 to 30 L/min (increments of 0.5 L/min) 

2 to 40 L/min (increments of 1 L/min)

40 to 90 L/min (increments of 5 L/min) 

40 to 160 L/min (increments of 5 L/min) 

FiO₂: 21 to 100% O₂

Rate: 3 to 150 breaths per minute for VCV, PCV,
PCV-VG and BiLevel (increments of 1 breath
per minute) 

3 to 120 breaths per minute for VCV, PCV,
PCV-VG and BiLevel (increments of 1 breath
per minute)

2 to 60 breaths per minute for SIMV-VC,
SIMV-PC, SIMV-PCVG, BiLevel-VG
(increments of 1 breath per minute) 

1 to 60 breaths per minute for SIMV-VC,
SIMV-PC, SIMV-PCVG and BiLevel-VG
(increments of 1 breath per minute)

Control and Ranges (continued)

Minimum rate:	2 to 60 breaths per minute for VG-PS (increments of 1 breath per minute)  0 to 60 breaths per minute for CPAP/PSV and 0 to 40 breaths per minute for NIV (increments of 1 breath per minute)	Inspiratory time:	0.1 to 10 sec 0.1 to 1 sec (increments of 0.01) 1 to 4 sec (increments of 0.1) 4 to 10 sec (increments of 0.25)  0.25 to 15 sec 0.25 to 1 sec (increments of 0.05) 1 to 4 sec (increments of 0.10) 4 to 15 sec (increments of 0.25)
Inspiratory/ expiratory ratio:	1:199 to 40:1 in BiLevel  1:9 to 4:1 (ventilator setting) 1:79 to 60:1 in BiLevel	T_{high} :	0.1 to 10 sec 0.1 to 1 sec (increments of 0.01) 1 to 4 sec (increments of 0.1) 4 to 10 sec (increments of 0.25)  0.25 to 15 sec 0.25 to 1 sec (increments of 0.05) 1 to 4 sec (increments of 0.1) 4 to 15 sec (increments of 0.25)
Tidal volume range:	2 to 350 mL  20 to 2000 mL	T_{low} :	0.25 to 18 sec 0.25 to 1 sec (increments of 0.01) 1 to 4 sec (increments of 0.1) 4 to 18 sec (increments of 0.25)  0.25 to 18 sec 0.25 to 1 sec (increments of 0.05) 1 to 4 sec (increments of 0.1) 4 to 18 sec (increments of 0.25)
Incremental settings:	2 to 50 mL (increments of 0.5 mL) 50 to 100 mL (increments of 1 mL) 100 to 350 mL (increments of 5 mL) For VCV, PCV-VG, SIMV-VC, SIMV-PCVG, VG-PS and BiLevel-VG  20 to 50 ml (increments of 0.5 ml) 50 to 100 ml (increments of 1 ml) 100 to 300 ml (increments of 5 ml) 300 to 1000 mL (increments of 25 mL) 1000 to 2000 mL (increments of 50 mL) For VCV, PCV-VG, SIMV-VC, SIMV-PCVG and BiLevel-VG	T_{supp} :	0.1 to 0.8 sec (increments of 0.01)  0.25 to 4 sec for NIV 0.25 to 1 sec (increments of 0.05) 1 to 4 sec (increments of 0.1)
Patient weight:	0.25 to 1 kg (increments of 0.01 kg) 1 to 7 kg (increments of 0.1 kg) 0.5 to 2 lb (increments of 0.02 lb) 2 to 15 lb (increments of 0.2 lb)  5 to 15 kg (increments of 0.5 kg) 15 to 100 kg (increments of 1 kg) 100 to 200 kg (increments of 2 kg) 10 to 34 lb (increments of 1 lb) 34 to 220 lb (increments of 2 lb) 220 to 440 lb (increments of 5 lb)	Expiratory time:	0.25 to 59.75 sec 0.25 to 29.9 sec Invasive vent modes  0.5 to 59.75 sec for NIV
Inspiratory pressure (P_{insp}) range:	1 to 98 cm H ₂ O (increments of 1 cm H ₂ O)	Rise time:	0 to 500 ms of inspiratory period for either flow or pressure depending on the mode selected. Active in VCV, PCV, PCV-VG, SIMV-VC, SIMV-PC, SIMV-PCVG, BiLevel-VG, NIV and BiLevel (increments of 50 ms)
P_{high} :	1 to 98 cm H ₂ O (increments of 1 cm H ₂ O)	PSV rise time:	0 to 500 ms of inspiratory period for pressure supported breaths only. Active in SIMV-VC, SIMV-PC, SIMV-PCVG, BiLevel, BiLevel-VG, CPAP/PSV and VG-PS (increments of 50 ms)
P_{low} :	Off, 1 to 50 cm H ₂ O (increments of 1 cm H ₂ O)	Trigger window:	0 to 80% of expiration time (increments of 5%)
Pressure limit (P_{limit}) range:	7 to 100 cm H ₂ O for VCV and SIMV-VC (increments of 1 cm H ₂ O)	Flow trigger:	0.2 to 1 L/min (increments of 0.05 L/min)  1 to 3 L/min (increments of 0.1 L/min) 3 to 9 L/min (increments of 0.5 L/min)
Max. inspiratory pressure (P_{max}) limit:	7 to 100 cm H ₂ O (increments of 1 cm H ₂ O) 9-100 cm H ₂ O (increments of 1 cm H ₂ O) in NIV and nCPAP	Pressure trigger:	-10 to -3 cm H ₂ O (increments of 0.5 cm H ₂ O) -3 to -0.25 cm H ₂ O (increments of 0.25 cm H ₂ O)
PEEP:	Off, 1 to 50 cm H ₂ O (increments of 1 cm H ₂ O) 2-15 cm H ₂ O (increments of 1 cm H ₂ O) in nCPAP  2-20 cm H ₂ O (increments of 1 cm H ₂ O) in NIV	Bias flow rate:	2 to 15 L/min (increments of 0.5 L/min) for nCPAP  2 to 10 L/min (increments of 0.5 L/min) 8 to 20 L/min for NIV (increments of 0.5 L/min)

Control and Ranges (continued)

Insp. pause:	0 to 75% of inspiration time (increments of 5%)
T_{pause} :	0 to 7.5 sec 0 to 1 sec (increments of 0.05) 1 to 4 sec (increments of 0.1) 4 to 7.5 (increments of 0.25)
Pressure support from PEEP level:	0 to 60 cm H ₂ O for SIMV-VC, SIMV-PC, SIMV-PCVG, BiLevel, BiLevel-VG and CPAP/PSV (increments of 1 cm H ₂ O) 0 to 30 cm H ₂ O for NIV (increments of 1 cm H ₂ O)
End flow level:	5 to 80% of peak flow for NIV, SIMV-VC, SIMV-PC, SIMV-PCVG, BiLevel, BiLevel-VG, VG-PS and CPAP/PSV (increments of 5%)

Alarm Settings

Tidal volume:	Low: Off, 1 to 345 mL Off, 5 to 1950 mL High: 3 to 350 mL, Off 10 to 2000 mL, Off
Minute volume:	Low: 0.01 to 10 L/min 0.01 to 40 L/min High: 0.02 to 40 L/min 0.4 to 99 L/min
Respiratory rate:	Low: Off, 1 to 99/min High: 2 to 150/min, Off 2 to 120/min, Off
Inspired oxygen (FiO ₂):	Low: 18 to 99% High: 24 to 100%, Off
P_{max} :	High: 7 to 100 cm H ₂ O 9-100 cm H ₂ O (increments of 1 cm H ₂ O) in NIV and nCPAP
P_{peak} :	Low: 1 to 97 cm H ₂ O
PEEP _e :	Low: Off, 1 to 20 cm H ₂ O High: 5 to 50 cm H ₂ O, Off
PEEP _i :	High: 1 to 20 cm H ₂ O, Off
P_{limit} :	7 to 100 cm H ₂ O
Apnea alarm:	User adjustable: 5 to 20 sec 10 to 60 sec
Circuit leak:	10 to 90%, Off

EtO ₂ :	Low: Off, 10 to 99% High: 11 to 100%, Off
EtCO ₂ :	Low: Off, 0.1 to 14.9% or Off, 0 to 114.5 mmHg High: 0.2 to 15%, off or 0.5 to 115 mmHg, Off

Ventilation soft limit indicators: When adjusting selected ventilator parameters, color indicators show when parameters are approaching their setting limits.

Parameters with soft limits: P_{max} , PEEP, P_{insp} , P_{supp} , T_{insp} , RR, I:E, P_{high} , P_{low} , T_{high} and T_{low}

Alarm System

Escalating alarms:	High priority alarms escalate to a higher pitch if unattended for specified time
Adjustable to:	0, 10, 20 and 30 sec, Off
Auto limits:	Alarm limits calculated on the current measured values for selected parameters

Procedures

Suction

Program routine:	Automatic
Pre-oxygenation:	≤ 2 minutes with 100% O ₂ with automatic disconnection detection*
Standby pause:	≤ 2 minutes with automatic patient (re-connection) detection
Post-oxygenation:	≤ 2 minutes with 100% O ₂ *

Note: FiO₂ can be set to level other than 100%

*Note: 5 to 75% above current FiO₂ setting

Manual breath

Intrinsic PEEP (includes PEEP_i Volume)

Lung Mechanics:	PØ.1 NIF Vital Capacity
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Inspiratory hold: 2 to 15 sec (increments of 1 sec)

Expiratory hold: 2 to 20 sec (increments of 1 sec)

Spontaneous Breathing Trial (SBT)
(Adjustable range: 2 to 120 minutes)

Spirometry

Data source:	Ventilator or Compact Airway Module* (M-COV, M-COVX, M-CAiOV, M-CAiOVX; E-COV, E-COVX, E-CAiOV, E-CAiOVX)
Loop types:	Pressure-Volume, Pressure-Flow and Flow-Volume
Saved loop:	Up to six loops can be saved
Reference loop:	A saved loop can be selected as the reference loop to compare with the current loop being displayed
Cursor:	Freezes current loops and provides numeric display of X and Y axis as cursor moves across loops
Pulmonary mechanics:	P_{peak} , P_{plat} , P_{mean} , $PEEP_e$, $PEEP_i$, TV_{insp} , TV_{exp} , MV_{insp} , MV_{exp} , Compliance and Resistance

Auxiliary Pressure

Auxiliary pressure (P_{aux}):	Measured range: -20 to +120 cm H ₂ O Alarm range: 12 to 100 cm H ₂ O
Purge flow:	Low flow to clear the P_{aux} line, can be turned Off

SpiroDynamics (optional)

Note: Not available when Neonatal patient type is selected

- Tracheal Pressure – Volume loop displayed
- Dynostatic Curve displays calculated alveolar pressure
- Tracheal pressure measured via GE's intratracheal pressure sensor*
 - Connects directly to Engström's auxiliary pressure port
- 3 point compliance measurement
 - at 5-15% of the breath
 - at 45-55% of the breath
 - at 85-95% of the breath
- Store up to 6 SpiroDynamic loops
- Store up to 6 Dynostatic curves
- Overlay up to 2 separate loops and/or curves over current loop
- Cursor available across all displayed loops and curves
 - Pressure and volume values displayed at cursor position
- P_{peak} , $PEEP_e$ and Raw displayed

* For complete specifications, see product specification sheets.

FRC INview (optional)

Note: Not available when Neonatal patient type is selected

- Functional Residual Capacity measurement
 - Wash-in and Wash-out method provides 2 separate FRC measurements
- FRC displayed both numerically and graphically
- The most recent 5 FRC procedures displayed
- $PEEP_e$ and $PEEP_i$ displayed with each FRC
- FRC Event Log records:
 - FRC measurements
 - Ventilator settings and procedures that may affect the FRC procedure
- Programmable time intervals for automatic FRC measurements

PEEP INview (available with FRC INview)

Note: Not available when Neonatal patient type is selected

- Measures FRC at up to 5 different PEEP levels
- Graphic and numeric display of FRC values
- User selectable beginning and ending PEEP levels
 - Ventilator evenly spaces additional PEEP levels
 - PEEP levels can either increase or decrease
- $PEEP_e$ and $PEEP_i$ displayed during each FRC measurement

Lung INview (available with SpiroDynamics and FRC INview)

Note: Not available when Neonatal patient type is selected

- Integrates SpiroDynamics and FRC INview within the PEEP INview procedure
- Measures the amount of volume between the Dynostatic curves at each FRC measurement
- Estimate of recruitment volume

INview Vent Calculations (optional)

Note: Not available when Neonatal patient type is selected

Data from Engström Care station and external lab results are used to provide the following values:

- PAO_2 – Alveolar partial pressure of oxygen
- $AaDO_2$ – Alveolar arterial oxygen difference
- Pa/FiO_2 – Oxygenation index
- PaO_2/PAO_2 – Alveolar arterial oxygen pressure difference
- CO – Cardiac output
- Vd/Vt – Dead space ventilation
- Vd – Dead space volume
- VA – Alveolar ventilation

Non-Invasive Ventilation (NIV) (optional)

Mask ventilation: Yes

Integrated unique leak recognition algorithm

Automatic Patient Detection (APD)

Patient

re-connection: Automatic detection in standby

Detection by: Back pressure to Bias-flow

100% O₂ (↑O₂)

Delivers 5 to 75% above current FiO₂ setting for ≤ 2 minutes 

Delivers 100% O₂ for ≤ 2 minutes

Can be adjusted to other O₂%

Take Snapshot

Immediate capture and storage of critical data currently on the Engström's display

Stored data: 3 waveform segments
Alarm messages (up to 5, currently active)
All measured parameters
All set ventilator parameters

Maximum stored

Snapshots: 10 most recent

Cursor: Ability to cursor across waveforms for specific measured values

Ventilator Preferences

Back-up Mode: Establishes the specific ventilator mode and parameters used in the event that the ventilator switches to Back-up ventilation

ARC: Allows control and setting of the airway resistance compensation

Assist Control: Allows the user to turn the Assist Control capability On or Off

Leak

Compensation: Allows the user to turn the Leak Compensation capability On or Off

Trigger

Compensation: Allows the user to turn On or Off compensation for flow triggering

TV Based

Conditions: Allows setting between ATPD (Ambient Temperature Pressure Dry) or BTPS (Body Temperature Pressure Saturated)

Airway Resistance Compensation (ARC)

Note: Not available in Neonatal option 

Type of

compensation: Electronic tube compensation

Compensation for: Endotracheal and tracheostomy tubes

Tube diameter: 5 to 10 mm

Level of

compensation: 25 to 100%

Mode Families

Allows user adjustment to specify certain parameters that align with the hospital's current ventilator usage.

Adjustable

parameters: Flow and Inspiratory timing

Family 1: Flow control is On/Insp. Timing is I:E

Family 2: Flow control is Off/Insp. Timing is I:E

Family 3: Flow control is On/Insp. Timing is T_{insp}

Family 4: Flow control is Off/Insp. Timing is T_{insp}

Family 5: Flow control is On/Insp. Timing is T_{pause}

Ventilator Monitoring

Airway pressure -20 to +120 cm H₂O

Patient flow 0.1 to 32 L/min 
1 to 200 L/min

Tidal volume 0.5 to 1,000 mL with Neonatal Flow Sensor 
1 to 1,000 mL without the Neonatal Flow Sensor 
5 to 2,500 mL

Minute volume 0 to 99.9 L/min

CO₂ 0 to 30%/0 to 225 mmHg

Compliance 0.1 to 150 mL/cm H₂O

Resistance 1 to 500 cm H₂O/L/s

RQ 0.6 to 1.3

VO₂ 50 to 1000 mL/min

VCO₂ 50 to 1000 mL/min

Rate 0 to 150 breaths per minute (increments of 1 breath per minute) 
0 to 120 breaths per minute (increments of 1 breath per minute)

FiO₂ 10 to 100%

Rapid Shallow Breathing Index (RSBI)

1 to 999 bpm/L

Note: Not available in Neonatal option 

Oxygen Monitoring

Technology:	Dynamic Paramagnetic Oxygen monitoring system
Life span:	Unlimited operating life due to the use of non-depleting technology

Screen

Display type:	30.5 cm/12 inch touch screen full color LCD adjustable viewing angle
Waveforms in screen:	Three at a time
Waveform parameters:	Pressure, flow, volume, CO ₂ , O ₂ and auxiliary pressure
Graphic scaling:	Automatic scaling for optimal size or independent scaling
Data:	Control parameters, patient data, alarm settings and messages
Status indicator:	Ventilation mode, battery level, clock
Favorites:	23 Hyperlink shortcuts to choose from 7 selectable at one time

Monitoring Accuracy**

Pressure readings:	±2 cm H ₂ O
Volume readings:	±10% or ±1 mL, whichever is greater (with proximal neonatal flow sensor) ±10% or ±5 mL, whichever is greater (nCPAP)  ±10% or ±15 mL, whichever is greater
O ₂ concentration monitor:	±3%

Delivery Accuracy**

Inspired pressure control:	±2 cm H ₂ O
Oxygen – Air mixing:	±3% V/V of setting
Tidal volume delivery:	±10% of setting or ±1 mL, whichever is greater (with proximal neonatal flow sensor)  ±10% of setting or ±5 mL, whichever is greater

** Ventilation delivery specifications requirements:

- Operating at EN794 and ASTM F1100 patient conditions
- Operating at 21°C and at 1000 mbar ambient pressure
- All volumes are at ambient temperature and pressure, dry (ATPD)

Nebulization

Nebulizer:	Aeroneb Nebulizer System built-in
Nebulizer technology:	Electronic micro pump
Nebulizer run time:	10, 15, 20 or 30 minutes
Auto-repeat capability:	Cycles: 1 to 10 Pause Time: 30 sec to 8 hr 1 to 5 minutes (increments of 1 minute) 5 to 55 minutes (increments of 5 minutes) 1 to 8 hours (increments of 0.5 hour)
Nebulizer volume setting:	2.5, 3, 5 or 6 mL
Particle size:	Aeroneb Pro: average 2.1 microns MMAD (Mean Mass Aerodynamic Diameter) Aeroneb Solo: 3.4 microns MMAD
Residual volume:	Aeroneb Pro: average 0.3 mL Aeroneb Solo: average < 0.1 mL

Performance may vary depending upon the type of drug used. For additional information contact Aerogen or drug supplier.

Pneumatic nebulizer

Flow compensation:	1 to 4 L/min (increments of 0.5 L/min)  1 to 12 L/min (increments of 0.5 L/min)
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Monitor Module

Module capacity	4 single slot or 2 double slot modules
Compact airway module compatibility	M-C, M-CO, M-COV, M-COVX, M-CAiO, M-CAiOV, M-CAiOVX, E-CO, E-COV, E-COVX, E-CAiO, E-CAiOV, E-CAiOVX, M-miniC, E-miniC

Note: The Engström Carestation does not utilize the Ai (inhaled anesthetic) feature of the compact airway modules at this time.

Note: The Engström Carestation does not utilize any of the compact airway modules when the Neonatal Option is in use. 

Trends

Trend data:	Set parameters and measured data
Trend styles:	Measured and graphic
Maximum trending:	14 days (336 hours)
Trend scaling:	12 min, 1h, 2h, 4h, 6h, 8h, 10h, 12h, 24h, 36h, 48h and 72h
Resolution:	1 minute intervals for most recent 12 hours, 5 minute intervals for 12 to 48 hours, 30 minute intervals after 48 hours
Mini-Trends:	Waveform values can be displayed as a trend in a split screen view

Trends (continued)

Mini-Trends parameters are based on the waveform displayed:

Paw (P_{peak} , P_{plat} or Leak)
Flow (MV_{exp}, RR)
Volume (Spont MV or Mech MV,
Spont RR or Mech RR)
 P_{aux} (P_{peak})
CO₂ (EtCO₂)
O₂ (EtO₂, FiO₂)

External Communications

Communication ports: Serial port (RS-232), RS-485 port, RS-422 port, 1 USB port, Ethernet port, Compact flash card socket, nurse call

EView (optional)

Data Available: 10 snapshots
7 days of vent data
Optional breath to breath waveform data

Electrical Specifications

Line supply

Line voltage: 85 to 132 Vac, 47/63 Hz
190 to 264 Vac, 47/63 Hz

Power consumption: < 200 W

Battery supply

Back-up battery: Built-in

Type: Lead acid gel

Battery

back-up time: 120 minutes typical, 30 minute minimum, battery fully charged

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GE imagination at work

Gas supply

Single gas operation: Yes

Emergency air valve: Built-in

Oxygen supply

Pressure range: 240 to 641 kPa/35 to 94 psi

Flow: 160 L/min

Air supply

Pressure range: 240 to 641 kPa/35 to 94 psi

Flow: 160 L/min

Environmental Specifications

Thermal

Operating range: 10° to 40°C

Storage range: -20° to 65°C

Humidity

Operating range: 15 to 95% RH Non-condensing

Storage range: 15 to 95% RH Non-condensing
In accordance with IEC 68-2-3

Vibration and shock

Random

vibration: 9.5 grms @ 30 min unpacked
2 to 5000 Hz

Altitude

Operating range: -440 to 3565 m/500 to 800 mmHg

Storage range: -440 to 5860 m/375 to 800 mmHg

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