

### Mechanical Control Flow Meters

O <sub>2</sub> range:	Two flow tubes with the ranges of 0 ~ 1 L/Min and 1 ~ 15 L/min
N <sub>2</sub> O range:	Two flow tubes with the ranges of 0 ~ 1 L/Min and 1 ~ 10 L/min
Air range:	Two flow tubes with the ranges of 0 ~ 1 L/Min and 1 ~ 15 L/min
Accuracy:	± 10% of indication

### Environmental Specifications

#### Operating

Temperature:	10 ~ 40°C
Relative humidity:	15 ~ 95% (noncondensing)
Barometric (KPa):	70 ~ 106 kPa

#### Storage

Temperature:	-20 ~ 60°C for main unit
Relative humidity:	10 ~ 95% (noncondensing)
Barometric (KPa):	50 ~ 106 kPa optional

### Electromagnetic Compatibility

Immunity:	Complies with all requirements of IEC 60601-1-2
Emissions:	CISPR 11 group 1 class B

### Breathing System Specification

#### Carbon Dioxide Absorbent Canister

Absorbent capacity:	1500 ml
Integrated expiratory limb water trap	
Water trap	
Capacity:	6 ml

#### System Pressure Gauge

Range:	-20 ~ 100 cmH <sub>2</sub> O
Accuracy:	± (4% of the full scale reading + 4% of the actual reading)

#### Ports And Connectors

Exhalation:	22 mm OD/15 mm ID conical
Inhalation:	22 mm OD/15 mm ID conical
Manual bag port:	22 mm OD/15 mm ID conical

#### Bag-To-Ventilator Switch

Type:	Bi-stable
Control:	Switch between manual and mechanical ventilation

### Integrated Adjustable Pressure Limiting (APL) Valve

Range:	1 ~ 75 cmH <sub>2</sub> O
Tactile knob indication at:	> 30 cmH <sub>2</sub> O
Accuracy:	± 10 cmH <sub>2</sub> O or ± 15% of the measured value, whichever is greater

### Materials

All materials in contact with exhaled patient gases are autoclavable, except flow sensors, O<sub>2</sub> cell, and mechanical pressure meter.  
All materials in contact with patient gas are latex free.

### Breathing Circuit Parameters

Compliance:	Bag mode: ≤ 4 ml/100 Pa Mechanical mode: Automatically compensates for compression losses within the absorber and bellows assembly
Expiration resistance:	< 6 cmH <sub>2</sub> O @ 60 L/min
Inspiration resistance:	< 6 cmH <sub>2</sub> O @ 60 L/min

### Anesthetic Gas Scavenging System (AGSS)

Size:	443 x 145 x 140 mm (H x W x D)
Type of disposal system:	Active: High-flow or Low-flow Passive
Applicable standard:	ISO 8835-3: 2007
Pump rate:	75 ~ 105 L/min (High-flow) or 25 ~ 50 L/min (Low-flow)
Pressure relief device:	Pressure compensation opening to the air
Filter:	Stainless screen with hole diameter of 140 ~ 150 μm
State indication of the disposal system:	The float falls below the "MIN" mark on the sight glass when the disposal system does not work or the pump rate is lower than 25 L/min (Low-flow) or 75 L/min (High-flow).

### Suction Device

#### Venturi Suction Regulator

Gas source:	Air from system gas source
Minimum negative pressure:	> 50 kPa at supply gas pressure of 280 kPa
Minimum flow:	20 L/min

#### Continous Suction Regulator

Supply:	External vacuum
Maximum vacuum:	517.5 mmHg to 540 mmHg (69 kPa to 72 kPa) with external vacuum applied of 540 mmHg and 40 L/min free flow.
Maximum flow:	39 L/min to 40 L/min with external vacuum applied of 540 mmHg and 40 L/min free flow
Minimum flow:	20 L/min suction

# new WATO™ EX-35 Anesthesia Machines

## Technical Specifications (Ver.Jan.2016)

### Physical Specifications

#### Dimensions And Weight

Height:	1410 mm
Width:	780 mm
Depth:	690 mm
Weight:	<145kg

#### Top Shelf

Weight limit:	30 kg
Length:	Depth: 315 mm
Width:	630 mm

#### Work Surface

Height:	850 mm
Width:	545 mm
Depth:	310 mm

#### Drawer (internal dimensions)

Height:	130 mm
Width:	415 mm
Depth:	325 mm

#### Bag Arm

Height:	1030 mm
Length:	320 mm
Connection:	ISO 22 mm OD, 15 mm ID

#### Casters

Diameter:	125 mm
Brakes:	All four casters with brakes

## Ventilator Specifications

### Modes Of Ventilation

Manual/Spontaneous Ventilation	
Volume Control Ventilation (VCV)	with tidal volume compensation
Pressure Control Ventilation (PCV)	
Synchronized Intermittent Mandatory Ventilation (Optional)	(SIMV-Volume and SIMV-Pressure)
Pressure Support Ventilation (PSV) (Optional)	with apnea backup

### Ventilator Parameter Ranges

Tidal volume range:	20 ~ 1500 ml (VCV and SIMV-VC)
Incremental setting:	20 ~ 100 ml (increments of 5 ml) 100 ~ 300 ml (increments of 10 ml) 300 ~ 1500 ml (increments of 25 ml)



Pressure (Pinsp) range:	5 ~ 60 cmH <sub>2</sub> O (increments of 1 cmH <sub>2</sub> O) (PCV)
Pressure (Plimit) range:	10 ~ 100 cmH <sub>2</sub> O (increments of 1 cmH <sub>2</sub> O)
Pressure (Psupp) range:	5 ~ 60 cmH <sub>2</sub> O (3 ~ 60)
Rate range:	4 ~ 100 bpm (increments of 1 bpm) (VCV, PCV) 4 ~ 60 bpm (2 ~ 60)
I:E range:	4:1 ~ 1:8 (increments of 0.5)
Inspiratory pause (Tip: Ti):	Off, 5 ~ 60 % (increments of 5%)
Inspiratory time (Tinsp) range:	0.4 ~ 5s (increments of 0.1s)
Trigger window range:	5 ~ 90% (increments of 5%)
Flow trigger:	0.5 ~ 15 L/min (increments of 0.5 L/min)
Pressure trigger:	-20 ~ -1 cmH <sub>2</sub> O (increments of 1 cmH <sub>2</sub> O)
Expiratory trigger level:	5 ~ 60% (increments of 5%) (SIMV, PSV)
Min. frequency for apnea-ventilation:	2 ~ 30 bpm (PSV)
Tslope:	0 ~ 2s (increments of 0.1s)

### Positive End Expiratory Pressure (PEEP)

Type:	Integrated, electronic controlled
Range:	OFF, 4 ~ 30 cmH <sub>2</sub> O (3 ~ 30)

### Ventilator Performance

Driving pressure:	280 kPa ~ 600 kPa
Peak gas flow:	120 L/min + fresh gas flow
Flow valve range (Inspiratory flow):	1 ~ 120 L/min

### Ventilator monitor

Minute volume range:	0 ~ 100 L/min
Tidal volume range:	0 ~ 2500 ml/min
Inspired oxygen (FiO <sub>2</sub> ):	18 ~ 100%
Peak airway pressure (Paw):	-20 ~ 120 cmH <sub>2</sub> O
Mean pressure (Pmean):	-20 ~ 120 cmH <sub>2</sub> O
Plateau pressure (Pplat):	-20 ~ 120 cmH <sub>2</sub> O
Positive-End-Expiratory-Pressure (PEEP):	0 ~ 70 cmH <sub>2</sub> O

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# WATO™ EX-35

## Anesthesia Machines

### Trend Graph

Continuous trend information with time discrete events for the latest 24 hours TVe, MV, Ppeak, Pplat, PEEP, Pmean, Rate FiO<sub>2</sub>, EtCO<sub>2</sub>, and AA.

Refresh every time after the machine is restarted.

### Trend Table

Continuous trend information together with time discrete events for the latest 24 hours TVe, Ppeak, MV, Pplat, PEEP, Pmean, Rate FiO<sub>2</sub>, EtCO<sub>2</sub> and AA.

Resolution: 30s, 1min, 5min or 30min  
Alarm log book: 100 events storage, first in first out

### Ventilator Accuracy

#### Delivery/Monitoring Accuracy

Volume delivery: < 75 ml, ± 15 ml  
≥ 75 ml, ± 20 ml or ± 10%  
Pressure delivery: ± 3 cmH<sub>2</sub>O or ± 8%  
PEEP delivery: ± 2 cmH<sub>2</sub>O or ± 10%  
Volume monitoring: < 75 ml, ± 15 ml  
≥ 75 ml: ± 20 ml or ± 10%  
Pressure monitoring: ± 3 cmH<sub>2</sub>O or ± 8%

#### Alarm Settings

Tidal volume: Low: 0 ~ 1595 ml  
High: 5 ~ 1600 ml  
Minute volume: Low: 0 ~ 99 L  
High: 0.2 ~ 100 L  
Inspired oxygen (FiO<sub>2</sub>): Low: 18 ~ 98%  
High: 20 ~ 100%  
Apnea alarm: Tve < 10 ml measured in 20s  
Paw < (PEEP+3) cmH<sub>2</sub>O in 20s  
Low airway pressure: 0 ~ 98 cmH<sub>2</sub>O  
High airway pressure: 2 ~ 100 cmH<sub>2</sub>O  
Sustained airway pressure alarm: > 15s  
Subatmospheric pressure alarm: Paw < -10 cmH<sub>2</sub>O  
Alarm silence countdown timer: 120 to 0 seconds

### Ventilator Components

#### Flow Sensor

Type: Variable orifice flow sensor  
Dimensions: 22 mm OD and 15 mm ID  
Location: Inspiratory and expiratory port

#### Oxygen Sensor

Type: Galvanic fuel cell or paramagnetic O<sub>2</sub> sensor (optional)

### Ventilator Screen

Display type: Color active matrix TFT touch screen  
Display size: 10.4 in diagonal  
Pixel format: 1024 x 768  
Brightness: Adjustable  
Screen display configurable  
Display parameters: All setting and alarm parameters (including Breath rate, I/E ratio, Tidal volume, Minute volume, PEEP, Pmean, Ppeak, Pplat, and O<sub>2</sub> concentration, EtCO<sub>2</sub>, N<sub>2</sub>O, Anesthesia gas concentration)  
Display waveforms: P-T, F-T, V-T, EtCO<sub>2</sub>  
Spirometry loops: P-V, F-V, and F-P (optional)  
Timer: On screen timer

### Communication Ports

RS-232C compatible serial interface (DB9 connector)  
Ethernet (RJ45)

### Vaporizers

Vaporizer: Support Mindray V60, and other Mindray validated vaporizers  
Support agents: Halothane, Enflurane, Isoflurane, Sevoflurane, Desflurane  
Position: MAX.2  
Mounting mode: \*Selectatec® with interlock

### Gas Monitor

#### Side-Stream Carbon Dioxide (CO<sub>2</sub>) Module

Measurement range: 0 ~ 99 mmHg  
Accuracy : ± 2 mmHg (0 ~ 40 mmHg)  
± 5% (41 ~ 76 mmHg)  
± 10% (77 ~ 99 mmHg)  
Resolution: 1 mmHg  
Gas compensations: N<sub>2</sub>O, O<sub>2</sub> and Anesthetic Gas Compensation (only for Desflurane)  
Sampling rate: 70 or 100 ml/min  
Sampling rate accuracy: ± 15% or 15 ml/min whichever is larger  
Warming-up time: < 1 min  
AwRR range: 0 ~ 120 rpm  
AwRR accuracy: ± 2 rpm (0 ~ 70 rpm)  
± 5 rpm (70 ~ 120 rpm)  
Response time: When measured with a neonatal watertrap and a 2.5 m-long neonatal sampling line:  
< 3s @ 100 ml/min  
< 3.5s @ 70 ml/min  
When measured with an adult watertrap and a 2.5 m-long adult sampling line:  
< 5s @ 100 ml/min  
< 6.5s @ 70 ml/min

### Anesthesia Gas (AG) Module

Measurement mode: Side-stream  
Monitor gases: CO<sub>2</sub>, N<sub>2</sub>O, Halothane, Enflurane, Isoflurane, Sevoflurane, Desflurane, MAC, Paramagnetic O<sub>2</sub> (optional)  
Warm-up time: 45s (ISO accuracy mode)  
10min (full accuracy mode)  
Sample rate: Adu/Ped: 120, 150, 200 ml/min  
Accuracy: ± 10 ml/min or ± 10%  
Range: CO<sub>2</sub>: 0 ~ 30%  
AA: 0 ~ 30%  
O<sub>2</sub>/N<sub>2</sub>O: 0 ~ 100%  
AwRR range: 2 ~ 100 rpm  
AwRR accuracy: ± 1 rpm (2 ~ 60 rpm)  
Apnea time: 10s, 15s, 20s, 25s, 30s, 35s, 40s

### Electrical Specifications

#### Current Leakage

100 ~ 240V: < 500 µA

#### Power And Battery Backup

Power input: 100-240 Vac, 50/60 Hz, 6.2 ~ 2.6 A  
Battery backup: 90 min for 1 piece battery (powered by new fully-charged batteries with 25°C ambient temperature)  
150 min for 2 pieces battery (powered by new fully-charged batteries with 25°C ambient temperature)  
Battery type: Build-in Li-ion battery, 11.1 VDC, 4400 mAh (single)  
Safety functions: Manual ventilation possible even under total power supply failure condition  
Auxiliary electrical out lets: 4 (optional)

### Pneumatic Specifications

#### Auxiliary Common Gas Outlet (ACGO)

Connector: ISO 22 mm OD and 15 mm ID

#### Gas Supply

Gas type: O<sub>2</sub>, N<sub>2</sub>O and Air  
Pipeline input range: 0.28 ~ 0.6 MPa  
Pipeline connections: NIST, DISS  
Cylinder input: PIN, Maximum 3 cylinders

#### O<sub>2</sub> Controls

Method: N<sub>2</sub>O shut off with loss of O<sub>2</sub> pressure  
Supply failure alarm: < 220 kPa  
O<sub>2</sub> Flush: 25 ~ 75 L/min

#### Hypoxic Guard System

Type: Mechanical  
Range: O<sub>2</sub> concentration not lower than 21% (non-European standard)  
O<sub>2</sub> concentration not lower than 21% (European standard)

### Auxiliary O<sub>2</sub> Flowmeter (Optional)

Range: 0 ~ 15 L/min  
Indicator: Flow tube

### Material

All materials in contact with patient breathing gases are latex free.