WATO EX-35

Anesthesia Machine

Physical Specifications

Dimensions and Weight

Height	1410 mm
Width	780 mm (not including breathing system) 945 mm (including breathing system)
Depth	690 mm
Weight	<145 kg (without vaporizers and cylinders)

Top Shelf

Weight limit	30 kg
Width	630 mm
Depth	315 mm

Work Surface

Height	850 mm
Width	545 mm
Depth	310 mm

Drawer (Internal Dimension)

Height	130 mm
Width	415 mm
Depth	325 mm

Bag Arm

Height	1150 mm
Length	312 mm
Connection	ISO 22mm OD, 15mm ID

Casters

Diameter	125 mm
Brakes	All four casters with brakes

Ventilator Specifications

Modes of Ventilation

Manual/Spontaneous Ventilation/Bypass
Volume Control Ventilation (VCV) with PLV function
Pressure Control Ventilation (PCV)
Pressure Control Ventilation with volume guarantee (PCV-VG)
Synchronized Intermittent Mandatory Ventilation
(SIMV-Volume Controlled and SIMV-Pressure Controlled)
Pressure Support Ventilation (PS) with apnea backup

Compensation

Circuit gas leakage compensation and automatic compliance compensation

Ventilation Parameters Range

Patient Size	Adult, Pediatric, Infant
Tidal volume	20~1500 mL (Volume Mode) (increments of 1 mL) 5~1500 mL (Pressure Mode)
Pinsp	5~60 cmH_2O (increments of 1 cmH_2O)
Plimit	10~100 cmH_2O (increments of 1 cmH_2O)
ΔPsupp	3~60 cmH_2O (increments of 1 cmH_2O)
Rate	4~100 bpm (increments of 1 bpm)
I:E	4:1 - 1:8 (increments of 0.5)
Inspiratory pause (Tip:Ti)	OFF, 5% - 60% (increments of 1%)
Inspiratory time (Tinsp)	0.2 - 5.0 s (increments of 0.1 s)
Trigger window	5% - 90% (increments of 5%)
Flow trigger	0.5 ~ 15 L/min (increments of 0.5L/min)
Pressure trigger	-20~ -1 cmH_2O (increments of 1 cmH_2O)
Expiration termination level	5% - 60% (increments of 5%)
Min Rate	2 - 60 bpm (increments of 1 bpm)
Tslope	0.0 - 2.0 s (increments of 0.1 s)
Apnea I: E	4:1~1:8 (increments of 0.5)
ΔPapnea	3 - 60 cmH_2O (increments of 1 cmH_2O)

Positive End Expiratory Pressure (PEEP)

Type	Integrated, electronic controlled
Range	OFF, 3~30 cmH_2O (increments of 1 cm H_2O)

Ventilator Performance

Driving pressure	280 kPa to 600 kPa
Peak gas flow	120 L/min + Fresh Gas Flow

Monitoring Parameters

Minute volume	0 ~ 100 L/min
Tidal volume	0~2500 ml
Inspired oxygen (FiO_2)	18% ~ 100%
Peak airway pressure	-20 ~ 120 cmH_2O
Mean pressure	-20 ~ 120 cmH_2O
Plateau pressure	-20 ~ 120 cmH_2O
I:E	8:1 ~ 1:10
Rate	0 ~120 bpm
PEEP	0 ~ 70 cmH_2O
Resistance (R)	0 ~ 600 cmH_2O/(L/s)
Compliance (C)	0 ~ 300 ml/ cmH_2O

Control Accuracy

Volume delivery	< 75 ml: ± 15 ml ≥75 ml: ± 15 ml or ± 10% of the set value, whichever is greater
Pressure delivery	± 3.0 cmH_2O or ± 8% of the set value, whichever is greater
PEEP delivery	OFF: ≤4.0 cmH_2O 3 to 30 cmH_2O: ± 2.0 cmH_2O or ±8% of the set value, whichever is greater

Monitoring Accuracy

Volume monitoring	< 75 ml: ± 15 ml ≥75 ml: ± 15 ml or ± 10% of the reading, whichever is greater
Pressure monitoring	± 2.0 cmH_2O
PEEP monitoring	± 2.0 cmH_2O or ± 10% of the reading, whichever is greater
MV monitoring	±15% of the reading

Trend Graph

Continuous trend information with time discrete events for the latest 48 hours

Trend Table
Continuous trend information together with time discrete events for the latest 48 hours

Alarm Log Book
500 events storage, first in first out

Alarm Setting

Tidal volume	Low: 0 ~ 1595 ml
	High: 5 ~ 1600 ml
Minute volume	Low: 0 ~ 99 L/min
	High: 0.2 ~ 100 L/min
Inspired oxygen	Low: 18% ~ 98%
	High: OFF, 20% ~ 100%
Apnea alarm	VTe < 10ml measured in 20s
	Paw < (PEEP + 3) cmH_2O in 20s
Airway pressure low	0 ~98 cmH_2O
Airway pressure high	2 ~100 cmH_2O

Sustained airway pressure alarm: 15s
Subatmospheric pressure alarm: Paw < -10 cmH_2O
Alarm silence countdown timer: 120 to 0 seconds

Ventilator Components

Flow Sensor

Type	Variable orifice flow sensor
Location	Inspiratory and expiratory port

Oxygen Sensor

Type	Galvanic fuel cell
FiO_2 displayed	18% to 100%
Accuracy	± (volume fraction of 2.5 % +2.5 % gas level)
Response Time	≤20 seconds

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, MEAN, PEAK, PLAT, and O_2 concentration, $EtCO_2$, N_2O, Aesthesia gas concentration)
Display waveforms	P-T, F-T, V-T, CO_2 , O_2, Anesthetic gas, N_2O
Spirometry loops	P-V, F-V and F-P
Timer	On screen timer

Communication Ports
One RS-232C connector and one DB9 connector
Ethernet (RJ-45)
USB

Vaporizers

Vaporizer	Mindray V60 Anesthetic Vaporizer or Penlon Sigma Delta Anesthetic Vaporizer
Support agents	Halothane, Enflurane, Isoflurane, Sevoflurane
Position	MAX.2
Mounting mode	Selectatec®, with interlocking function
	Plug-in®, with interlocking function

Modules

Anesthesia Gas (AG) Module

Measurement mode	Side-stream
Monitor gases	CO_2, N_2O, Halothane, Enflurane, Isoflurane, Sevoflurane, Desflurane, MAC, Paramagnetic O_2 (optional)
Warm-up time	45 s (ISO accuracy mode)
	10min (full accuracy mode)
Sample rate	Adu/Ped: 150, 180, 200 ml/min
	Neo: 100, 110, 120 ml/min
Accuracy	± 10 mL/min or ± 10% of the set value, whichever is greater
Range	CO_2: 0% ~ 10%
	Des: 0% ~ 18 %
	Sev: 0% ~ 8%
	Enf, Iso, Hal: 0% ~ 5%
	O_2/N_2O: 0% ~ 100%
AwRR range	2 ~100 bpm
AwRR accuracy	2 bpm ~ 60 bpm：± 1 bpm
	61 bpm ~ 100 bpm：± 2 bpm

Carbon Dioxide (CO_2) Modules

Method	Infrared absorption
Module type	Mindray side-stream
	Capnostat mainstream
	Oridion micro-stream
	(optional)
Work mode	Standby or measurement
Displayed numerics	$EtCO_2$, $FiCO_2$
Waveform	Capnography

Side-Stream Carbon Dioxide (CO_2) Module

Measurement range	0 ~ 99 mmHg
Accuracy	± 2 mmHg (0 ~ 40 mmHg)
	± 5% of the reading (41 ~ 76 mmHg)
	± 10% of the reading (77 ~ 99 mmHg)
Resolution	1 mmHg
Sampling rate	Neonatal: 100 mL/min and 120 mL/min optional
	Adult/children: 120 mL/min and 150 mL/min optional
Sampling rate accuracy	± 15% of the set value or ± 15 mL/min, whichever is greater
Warming-up time	<1 min, enter the ISO accuracy mode
	After 1 min, enters the full accuracy mode
Response time	<4.5 s@100 mL/min
	<4.5 s@120 mL/min
	Measured by using neonatal watertrap and 2.5 m neonatal sampling line
	<5.5 s@120 mL/min
	<5 s@150 mL/min
	Measured by using adult watertrap and 2.5 m adult sampling line

Capnostat Mainstream CO_2 Module

Measurement range	0 ~ 150 mmHg
Accuracy	± 2 mmHg (0 ~ 40 mmHg)
	± 5% of the reading (41 ~ 70 mmHg)
	± 8% of the reading (71 ~ 100 mmHg)
	± 10% of the reading (101 ~ 150 mmHg)
Resolution	1 mmHg
Rise time	<60 ms
Response time	<2 s
Alarm limit	$EtCO_2$ High: OFF, 2 ~ 150 mmHg
	$EtCO_2$ Low: OFF, 0 ~ 148 mmHg
	$FiCO_2$ High: OFF, 1 ~ 150 mmHg

Micro-stream CO_2 Module

Measurement range	0 ~ 99 mmHg
Accuracy	0 ~ 38 mmHg: ± 2 mmHg

	39 ~ 99 mmHg: ± (5 % of the reading + 0.08 % of (the reading minus 38 mmHg))
Sampling rate	50 ml/min
Sampling accuracy	-7.5 ml/min ~ + 15 ml/min
Initialization time	30s
Response time	2.9s
Rising time	< 190 ms
Delay time	2.7s
Alarm range	$EtCO_2$ High: OFF, 2 ~ 99 mmHg $EtCO_2$ Low: OFF, 0 ~ 97 mmHg $FiCO_2$ High: OFF, 1 ~ 99 mmHg

Electrical Specifications

Current Leakage

100 ~ 240V	< 500 µA

Power And Battery Backup

Power input	220-240 Vac, 50/60 Hz, 6A 100-120 Vac, 50/60 Hz, 7A 100-240 Vac, 50/60 Hz, 7A
Auxiliary electrical outlets	
	Up to 4 outlets (3A for each, total 5A)
Battery backup	90 min for 1 piece battery (powered by new fully-charged batteries with 25°C ambient temperature) 240 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, 4500 mAh
Safety feature	In case of electricity and battery failure, manual ventilation, gas delivery and agent delivery are possible

Pneumatic Specifications

ACGO (Auxiliary Common Gas Outlet)

Connector	ISO 22 mm OD and 15 mm ID

Pipeline Supply

Gas type	O_2, N_2O and Air
Pipeline input range	280 to 600 kPa
Pipeline connections	DISS or NIST

Pipeline Supply Pressure Gauges

Display type	Mechanical
Ranges	0 to 1000kPa
Accuracy	± (4% of the full scale reading + 8% of the actual reading)

Cylinder Supply

Cylinder Supply	E Cylinder (American style or UK style)
O_2 Input Range	6.9 to 20 MPa
N_2O Input Range	4.2 to 6 MPa
Air Input Range	6.9 to 20 MPa
Cylinder Connections	Pin-Index Safety System (PISS)
Yoke Configuration	O_2, N_2O, Air

Cylinder Supply Pressure Gauges

Display type	Mechanical
Air Range	0 to 25 MPa
O_2 Range	0 to 25 MPa
N_2O Range	0 to 10 MPa
Accuracy	± (4% of the full scale reading+8% of the actual reading)

O_2 Controls

Method	N_2O shut off with loss of O_2 pressure
Supply failure alarm	≤ 220.6 kPa
O_2 Flush	25 ~ 75 L/min

O_2-N_2O Link system

Type	Mechanical
Range	O_2 concentration not lower than 25%

Auxiliary O_2 Flowmeter (optional)

Range	0 ~ 15 L/min
Indicator	Flow tube

Mechanical Control Flow Meters

O_2 flow range	Two flow tubes with the ranges of 0 ~ 1 L/Min and 1 ~ 15 L/min
Air flow range	Two flow tubes with the ranges of 0 ~ 1 L/Min and 1 ~ 15 L/min
N_2O flow range	Two flow tubes with the ranges of 0 ~ 1 L/Min and 1 ~ 10 L/min
Accuracy	between -10% and +10% of the indicated value (under 20°C and 101.3 kPa, for flow between 10% and 100% of full scale)

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, -20 ~ 50°C for O_2 sensor
Relative humidity	10% ~ 95% (noncondensing)
Barometric	50 ~ 106 kPa

Electromagnetic Compatibility

Immunity	Complies with all requirements of IEC 60601-1-2
Emissions	Complies with all requirements of IEC 60601-1-2

Breathing System Specification

Breathing system volume (Pre-pak)

Automatic ventilation	2850 ml
Manual ventilation	1800 ml

Breathing system volume (Non Pre-pak)

Automatic ventilation	2600 ml
Manual ventilation	1800 ml

Carbon dioxide absorbent canister

Absorbent capacity	1500 mL
Integrated expiratory limb water trap	
	Capacity: 6 mL

Breathing Circuit Parameters

Compliance	≤4 mL/100Pa (bag mode) Automatically compensates for compression losses within the breathing circuit in mechanical mode
Expiration resistance	< 6.0 cm H_2O @60 L/min
Inspiration resistance	< 6.0 cm H_2O @60 L/min

System Pressure Gauge

Range	-20 ~ 100 cmH_2O
Accuracy	± (2% 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_2O

Tactile knob indication at above 30 cmH_2O

Accuracy	± 10 cmH_2O or ± 15% of the setting value, which is greater

Anesthetic Gas Scavenging System (AGSS)

Size (H x W x D)	430 x 132 x 114 mm
Type of disposal system	Active: High-flow or Low-flow Passive
Applicable standard	ISO 80601-2-13
Pump rate	75 ~ 105 L/min (High-flow) 25 ~ 50 L/min (Low-flow)

Pressure relief device: Pressure compensation opening to the air
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).

Filter	Stainless screen with hole diameter of 140 ~ 150 μm

Connector of the disposal system: ISO 9170-2

Materials

All materials in contact with exhaled patient gases are autoclavable, except flow sensors (being not capable of being autoclaved), O_2 sensor, and mechanical pressure Gauge.
All materials in contact with patient gas are latex free.

Suction Device

Venturi Suction Regulator

Gas source	Air, from system gas source
Minimum flow	20 L/min
Maximum vacuum	≥72 kPa at supply gas pressure of 280 kPa; ≥73 kPa at supply gas pressure of 600 kPa

Continuous Suction Regulator

Supply	Negative Pressure Suction
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 540mmHg and 40 L/min free flow
Minimum flow	20 L/min

Please contact your local Mindray sales representative for the most current information.

www.mindray.com

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