

MHE 24-1500  
MHE 48-2000  
MHE 60-2000  
MHE 110-2000  
MHE 125-2000  
MHE 220-2000

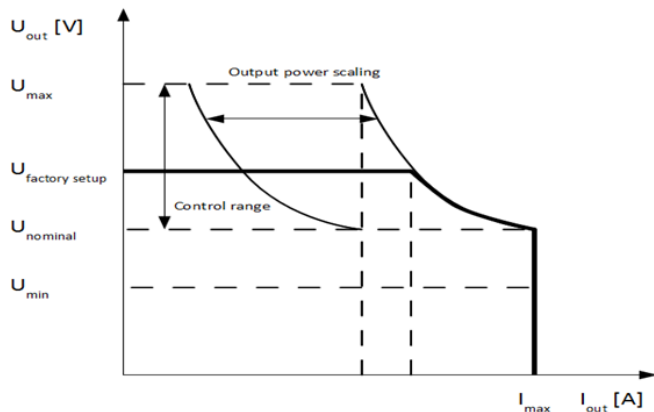


## Product Description

The MHE rectifier utilizes Efore's long experience and latest technology on high performance industrial power supplies. MHE rectifiers are designed to meet demanding requirements of utility, industrial, rail and telecom applications with high efficiency and reliability requirements.

MHE rectifiers are convection cooled and requires no fans. Rated output power is 2000 W in 48 V – 220 V output versions and 1500 W in 24 V version. Rectifier input is single phase, range 85-300 VAC.

Rectifiers can be operated either with a VIDi+ system controller or as stand-alone modules with or without batteries in the output.



## Features



- Efficiency up to 97 %
- Convection cooled – *No Fans*
- MTBF 1 800 000 h @ 25°C, Telcordia SR-332
- Output models 24, 48, 60, 110, 125, 220 VDC
- 2000 W output power, 24 VDC 1500 W
- Lacquered PCB for rail and metro applications
- Nominal Input voltage 100-250 VAC, range 85-300 VAC
- Soft-start generator input feature
- Active load current sharing
- Internal over temperature protection
- Digital communication over CAN bus with Efore VIDi controller
- Flexible design with full front cabling
- EMC:
  - Generic EN 61000-6 -1 / -2 / -3 / -4
  - Power Utility EN61000-6-5, surge level 2
  - Railway EN 50121-4
  - Telecom ETSI EN 300386
- Safety:
  - EN/IEC/UL/CSA 62368-1
  - EN 50124-1 Railway insulation coordination

# Technical Specifications

| AC Input                               | MHE<br>24-1500   | MHE<br>48-2000                     | MHE<br>60-2000                     | MHE<br>110-2000                    | MHE<br>125-2000                    | MHE<br>220-2000                    |
|--|--|------------------------------------|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| Input voltage                          | Nominal 100VAC - 250VAC  |                                    |                                    |                                    |                                    |                                    |
| Input range                            | Max range 85 – 300 VAC<br>Rated full power range: 48-220V models 180VAC – 275VAC, 24V models 140-275VAC<br>See derating curves at page 3, 1200W power available at nominal 120VAC input<br>Temporary high voltage range 275-300VAC, continuous supply voltage above 275VAC not recommended |                                    |                                    |                                    |                                    |                                    |
| Start-up / shut down limits            | Start-up voltage 90VAC / Shut down at 85 VAC<br>Shut down over voltage limit 300VAC / re-start at 290VAC   |                                    |                                    |                                    |                                    |                                    |
| Input frequency                        | Rated 45 - 66 Hz, reduced power at 35 - 45 Hz. Shut down at 35 Hz  |                                    |                                    |                                    |                                    |                                    |
| Maximum current                        | 12.5A<br>@ U <sub>in</sub> 85-130V   | 12.5A<br>@ U <sub>in</sub> 85-180V | 12.5A<br>@ U <sub>in</sub> 85-180V | 12.5A<br>@ U <sub>in</sub> 85-180V | 12.5A<br>@ U <sub>in</sub> 85-180V | 12.5A<br>@ U <sub>in</sub> 85-180V |
| Max current at U <sub>nom</sub> 220VAC | 8 A  | 11 A                               | 11 A                               | 11 A                               | 11 A                               | 11 A                               |
| Inrush current                         | ETS 300 132-1, Active limitation typical <20A  |                                    |                                    |                                    |                                    |                                    |
| Power factor (typical)                 | >0.99 at 85-275VAC input   |                                    |                                    |                                    |                                    |                                    |
| THD (typical)                          | < 5% @ 100%, < 9% @ 50% at 85-275VAC input   |                                    |                                    |                                    |                                    |                                    |
| Input protection                       | External MCB 16A C-curve (24V C10A or C16A), Internal varistor and gas discharge tube for transient surge protection, Automatic shut-off above 300 VAC (restart at 290 VAC)  |                                    |                                    |                                    |                                    |                                    |
| Generator start-up ramp                | 7 seconds ramp from 200W to full 2kW controlled by Input power, used with generator input supply (User programmable feature, enable/disable, default disable)  |                                    |                                    |                                    |                                    |                                    |
| Start-up delay                         | Default start-up time approx. 5 sec, User Programmable additional delay 0-120s (+15% / 0%).  |                                    |                                    |                                    |                                    |                                    |

| DC Output                        | MHE<br>24-1500  | MHE<br>48-2000   | MHE<br>60-2000   | MHE<br>110-2000   | MHE<br>125-2000   | MHE<br>220-2000  |
|----------------------------------|---|------------------|------------------|-------------------|-------------------|------------------|
| Voltage range                    | 21-33 VDC   | 42-59 VDC        | 51-72 VDC        | 90-150 VDC        | 100-160 VDC       | 178-280 VDC      |
| Voltage factory setting          | 27.24 VDC   | 54.48 VDC        | 68.10 VDC        | 122.58 VDC        | 136.20 VDC        | 245.16 VDC       |
| Maximum current @ nominal output | 62.5 A<br>@ 24 V  | 41.7 A<br>@ 48 V | 33.3 A<br>@ 60 V | 18.5 A<br>@ 108 V | 16.7 A<br>@ 120 V | 9.3 A<br>@ 216 V |
| Constant output power            | 1500 W  | 2000 W           |                  |                   |                   |                  |
| Current limit                    | < 65 A  | < 45 A           | < 35 A           | < 20 A            | < 20 A            | < 10 A           |
| Type of Current limit            | MHE rectifier supplies constant short circuit current 500sec, then hiccup mode in 500sec cycles                                     |                  |                  |                   |                   |                  |
| Hold-up time                     | > 20 ms at 80% load, output voltage reduces from float voltage to nominal   |                  |                  |                   |                   |                  |
| Static voltage regulation        | ± 0.5 % (load, line, temperature)   |                  |                  |                   |                   |                  |
| Dynamic load regulation          | ± 5.0 % for 10%-90% or 90%-10% load step, recovery time < 2.0 ms  |                  |                  |                   |                   |                  |
| Ripple and noise                 | < 50 mVp-p  | < 100 mVp-p      | < 115 mVp-p      | < 225 mVp-p       | < 250 mVp-p       | < 450 mVp-p      |
| Output protection                | Output overvoltage shutdown<br>Power limiting & shutdown based on: temperature, input voltage and frequency, derating curves page 3 |                  |                  |                   |                   |                  |

| Features  | MHE<br>24-1500  | MHE<br>48-2000 | MHE<br>60-2000 | MHE<br>110-2000 | MHE<br>125-2000 | MHE<br>220-2000 |
|---|---|----------------|----------------|-----------------|-----------------|-----------------|
| Efficiency, typical 30-70% load, V <sub>in</sub> 230VAC | > 95 %  | > 96 %         | > 96 %         | > 96 %          | > 96%           | > 95%           |
| MTBF, calculated  | > 1 800 000 h @ 25°C, Telcordia SR-332, Method I-D, Ground Fixed uncontrolled environment   |                |                |                 |                 |                 |
| Dielectric strength, type test                          | Input – GND (basic), 2 kVAC or 2.83 kVDC, 1 min<br>Input - Output (reinforced) 3.75kVac or 5.3 kVDC, 1 min<br>Output – GND (basic) 2 kVAC or 2.83 kVDC, 1 min           |                |                |                 |                 |                 |
| Load current share                                      | ± 5 % from true average current between the modules (>50% load, controlled by VID1)   |                |                |                 |                 |                 |
| Alarms  | Mains fault alarm, Low output voltage alarm, Overvoltage shutdown alarm, Rectifier alarm, Temperature Alarm, Totally +40 configurable system alarms via VID1 controller |                |                |                 |                 |                 |
| Visual Indications                                      | LED: Green/Red/Yellow, see the rectifier user manual for more details   |                |                |                 |                 |                 |
| Energy saving mode                                      | See Efore VID1 controller manual  |                |                |                 |                 |                 |

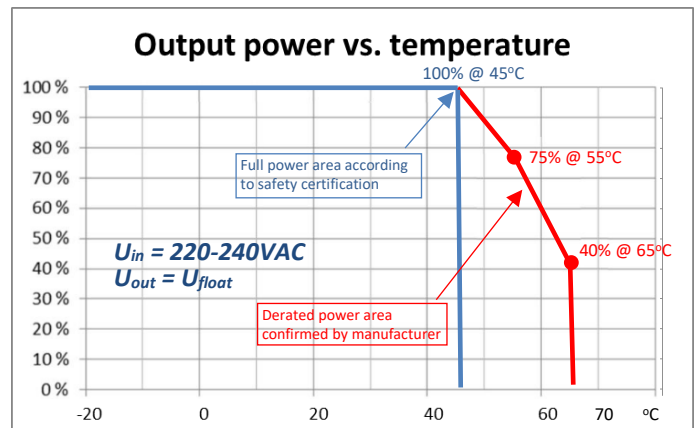
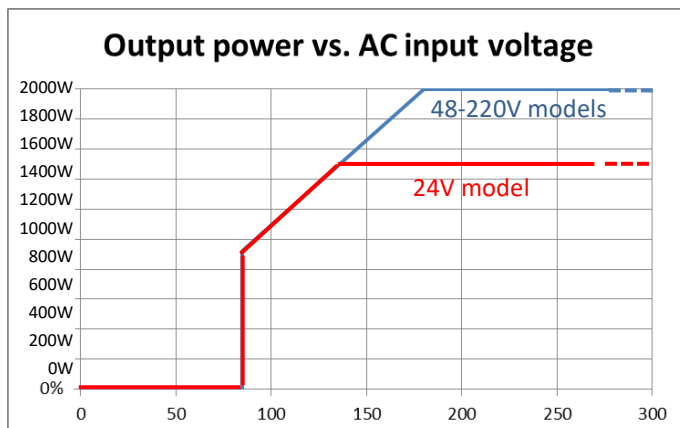
| Mechanical                  |   |
|-----------------------------|---|
| Dimensions (HxWxD)          | 169 x 83 x 357 mm, see drawing  |
| Weight                      | 4.6 kg  |
| Protection class, IEC 60529 | IP20 when counter-connector in place, DC connector IP10 without counter-connector |

| Connections         |   |
|---------------------|---|
| Connector, AC       | Appliance inlet IEC 60320-1, C20 style, 16 A male               |
| Connector, DC       | Phoenix terminal PC 5/ 4-G-7.62, 4 x 4mm <sup>2</sup> (+ + - -) |
| Connector, PowerCAN | 2 pcs RJ-45   |

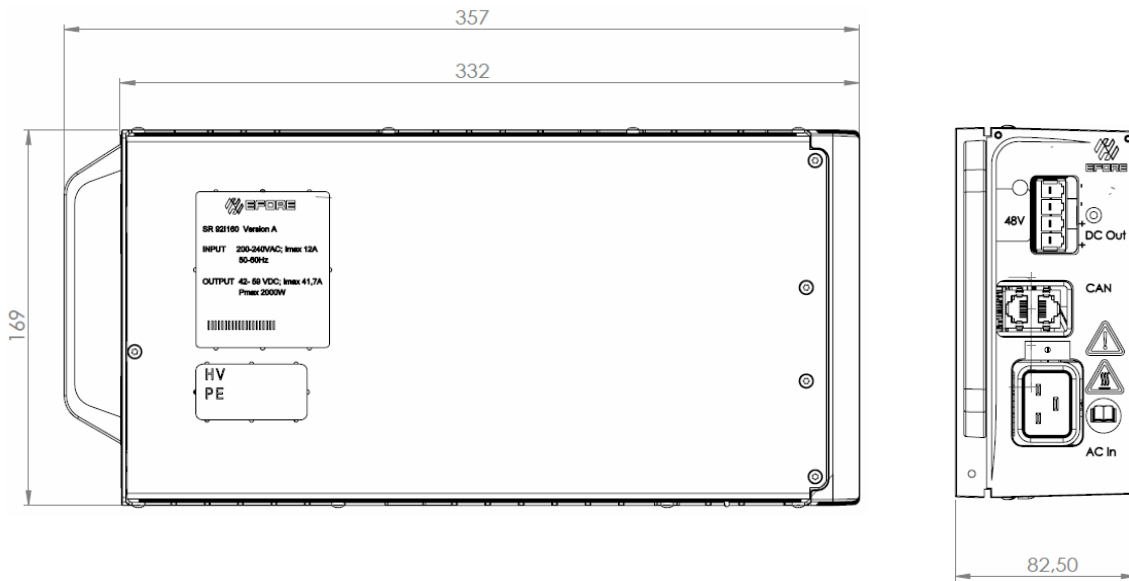
| Environmental                    |   |
|----------------------------------|---|
| Cooling                          | Natural convection  |
| Acoustic noise                   | < 40 dB   |
| Operating temperature            | Full power according to Safety Certification -25°C ... +45°C, Start-up at -40°C<br>Derated power at +45°C ... +65°C, max 40% power at 65°C, see curve below |
| Storage temperature              | -40 °C ... +85 °C   |
| Environmental protection         | Lacquered PCB   |
| Humidity                         | 95 % relative humidity, non-condensing  |
| Altitude according to EN 62368-1 | Full power: 2000 m (6500 feet) above sea level<br>De-rating -2% / 100m above 2000m, max altitude 5000m  |

| Applicable Standards |  |
|----------------------|--|
| EMC                  | Generic IEC61000-6-1, IEC61000-6-2, IEC61000-6-3, IEC61000-6-4<br>Power Utility immunity EN61000-6-5, surge level 2, 2kV line to ground<br>Railway EN 50121-4<br>Telecom ETSI EN 300 386     |
| Environment          | Operation: ETS 300 019-2-3 cl T3.2<br>Storage: ETS 300 019-2-1 cl T1.2   |
| Safety               | EN 62368-1:2014+A11:2017,<br>UL 62368-1 2nd Ed.<br>CAN/CSA C22.2 NO. 62368-1-14<br>Railway EN 50124-1, Indoor use, Not connected to contact line, Pollution degree 2, Overvoltage category 2 |
| Approvals            | CE Declaration of Conformity<br>CB Certificate, CB test report<br>UL 62368-1 and CAN/CSA C22.2 NO. 62368-1-14 Certificate & Listing report   |
| Quality              | Manufacture and design conform to ISO 9001, ISO 14001  |

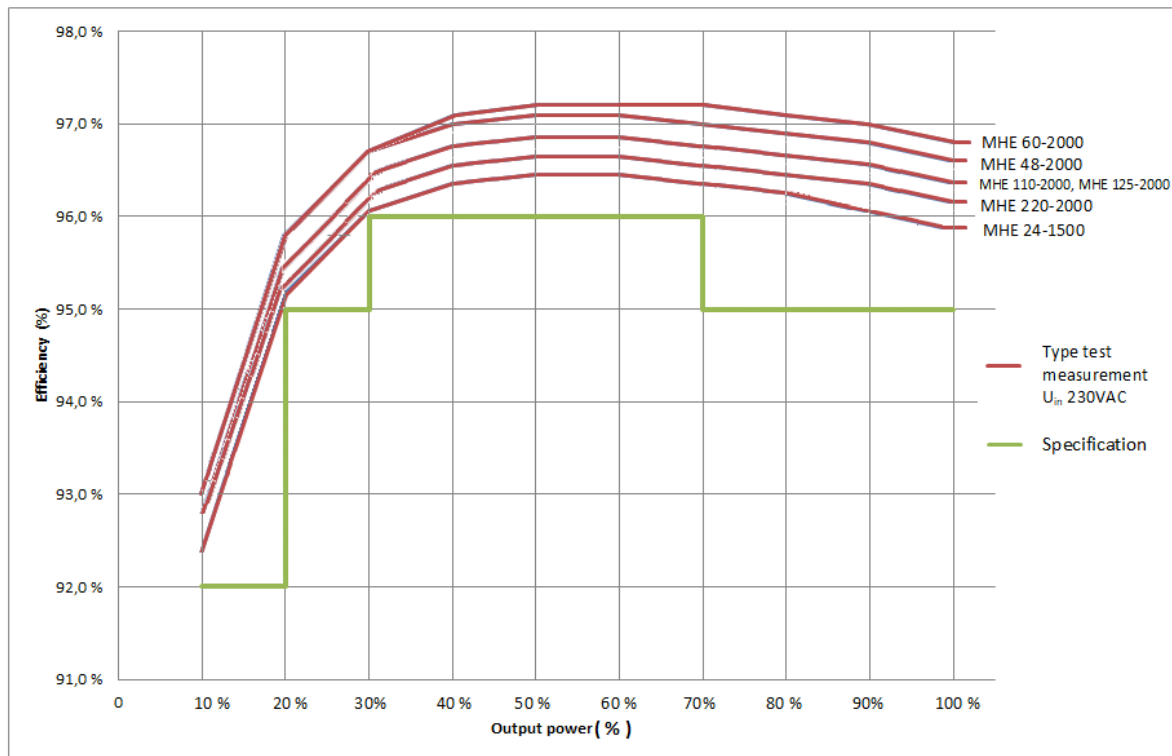
## Derating curves



## Main dimensions



## Efficiency curves



## Order Information

| Description  | Order number | Voltage / Current |
|--------------|--------------|-------------------|
| MHE 24-1500  | 92I280       | 24VDC / 62.5A     |
| MHE 48-2000  | 92I160       | 48VDC / 41.7A     |
| MHE 60-2000  | 92I290       | 60VDC / 33.3A     |
| MHE 110-2000 | 92I250       | 110VDC / 18.5A    |
| MHE 125-2000 | 92I260       | 125VDC / 16.7A    |
| MHE 220-2000 | 92I270       | 220VDC / 9.3A     |