

**HYUNDAI CLEAN-POWER**  
**MV INVERTER** *hi*RUN  
**N5000**



# HiRUN N5000

## MEDIUM VOLTAGE INVERTER

- ▶ High Performance and Efficiency ◀
- ▶ Supplies of clean power for motors ◀
- ▶ Small footprint and economical maintenance ◀

### Model Name Indication

N5000

Series Name



Applicable Motor Output (kW)

Voltage Class

### C O N T E N T S

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We build a better future!

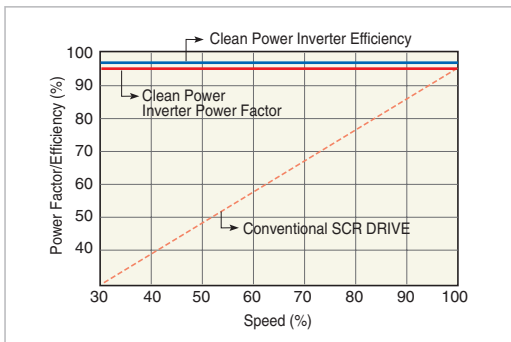
# CLEAN HYUNDAI INVERTER POWER!



## Features

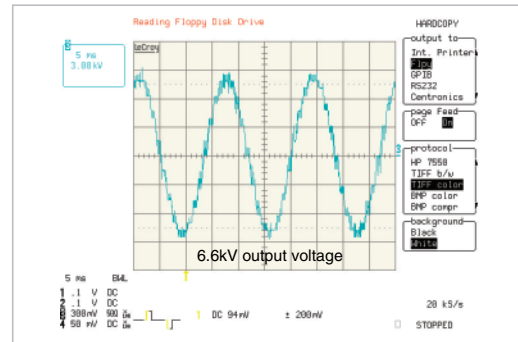
### High Performance and Efficiency

- ▶ **Power Factor: over 0.95**  
No requirements for power factor correction capacitor
- ▶ **System Efficiency: over 96%**  
System efficiency is improved by connecting the power and motor without input-output filter and output transformer



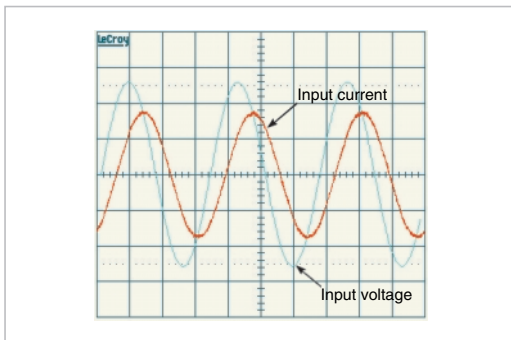
### Supplies of Clean Power for Motors

- ▶ Output waveforms, without a filter, are close to sine waves due to multiple PWM control
  - No cable length & motor type restrictions
  - Existing motor can be used without modifications
  - Reduced noise and vibration of motors
  - 3.3kV - 13 level/6.6kV - 25 level output



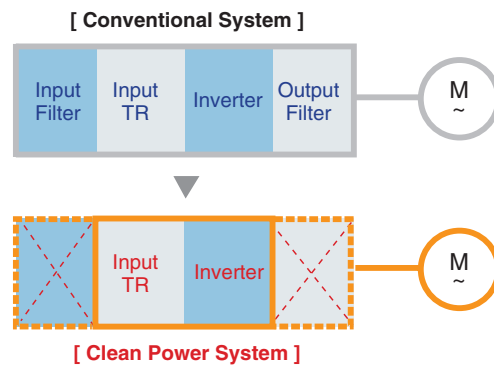
### Clean Power Input

- ▶ A clean input wave is achieved via a secondary phase-shifted transformer
- ▶ Without a filter, N5000 meets the stringent harmonic requirements of IEEE-519 (1992)
- ▶ Protects the other equipment from harmonic disturbance



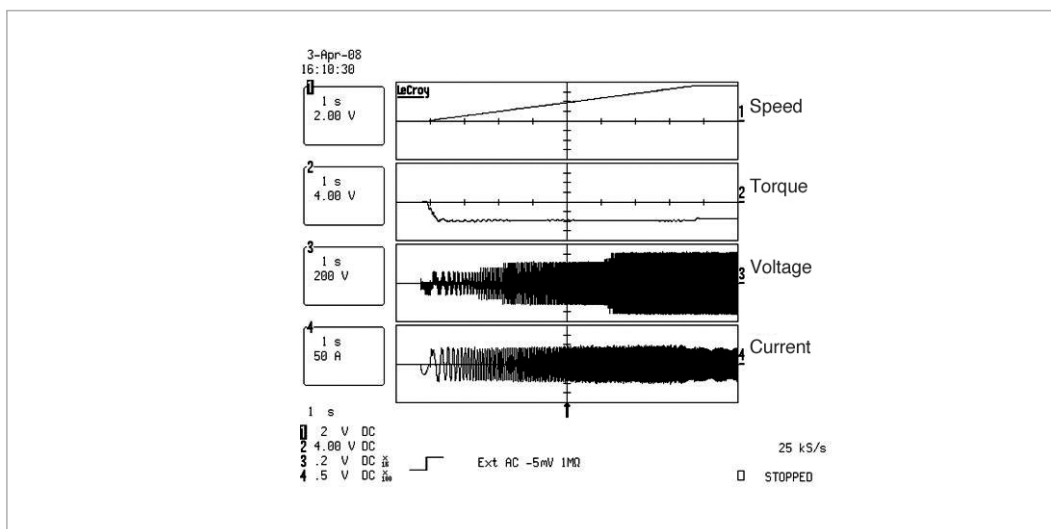
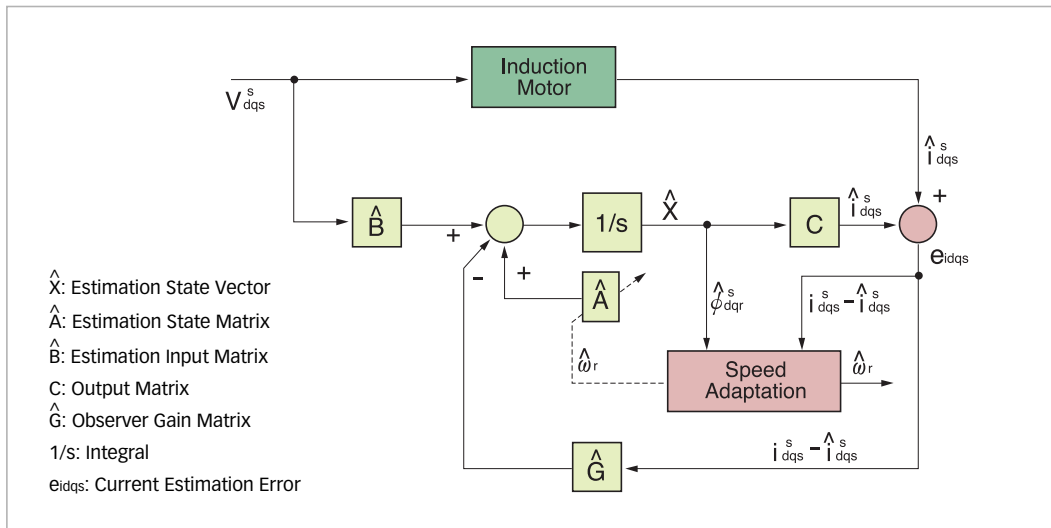
### Small footprint and economical maintenance

- ▶ Small footprint and reduced installation costs due to no requirements for ancillary equipments such as input & output filter and the integral structure incorporating the input transformer and inverter panel
- ▶ Thanks to the modularized single-phase inverter of draw-out type, easy maintenance and time saving are achieved.



### Outstanding operation features by the improved sensorless vector control

- ▶ Energy saving V/F control for the fluid load (Fan, Pump)
- ▶ Inherent speed sensorless vector control of N5000
  - High starting torque operation
  - Control of current, speed and vibration of motor at the low speed range of light duty
  - Quick torque responsiveness and improved speed precision
  - Strong control regardless of motor specifications



- ▶ Much more improved vector control functions can be achieved if the encoder is installed (*Option*).



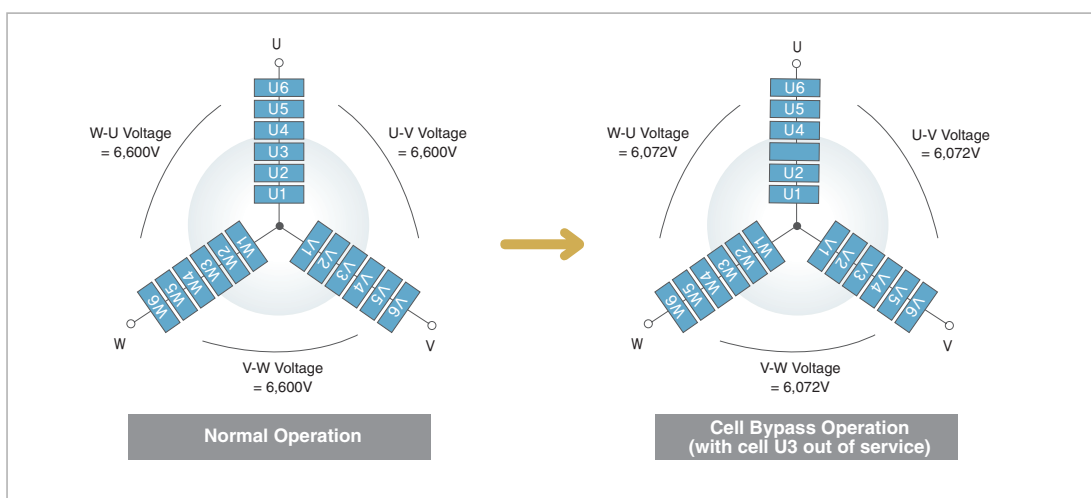
## Features

### Functions for trip-free operation (Option)

#### ► Improved Cell Bypass

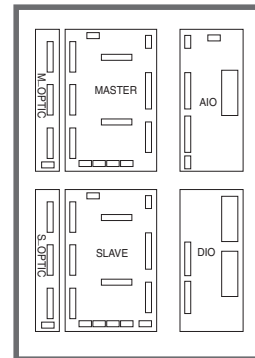
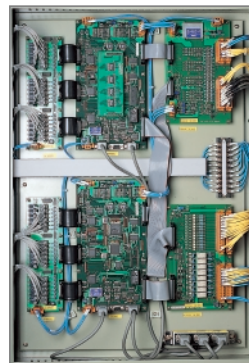
In case of cell failure during operation, the faulty cell will be bypassed and the neutral point will be shifted (balance is restored through angle adjustment).

92% of the rated voltage can be output after the failure of one cell.



#### ► Redundant Inverter Controller

If the master controller is out of service during operation, output is generated due to automatic switching to the slave controller



#### ► Redundant Fiber-Optic Cable for CAN Communication

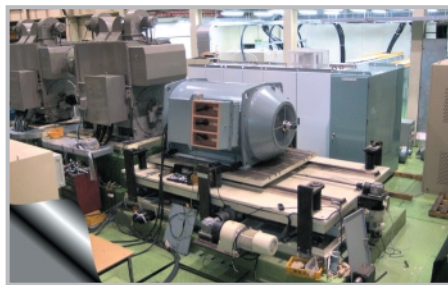
If there are problems with the optic cable during operation, an automatic switching to the standby reserve optical communication H/W is made

#### ► Redundant Control Power

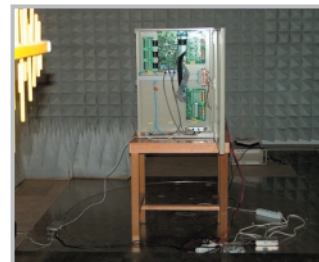
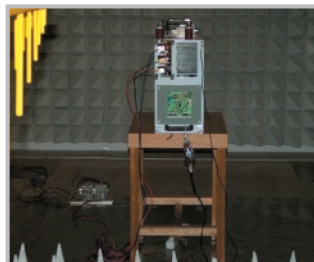
The redundant control power module is equipped with AC 440V and DC 120V and monitors the control power. In case of the failure of a control power module, an automatic switching to the reserve module is made

**Certification** (Korea Electro-Technology Research Institute)

▶ **Performance Test: Harmonics, Power Factor & Control**



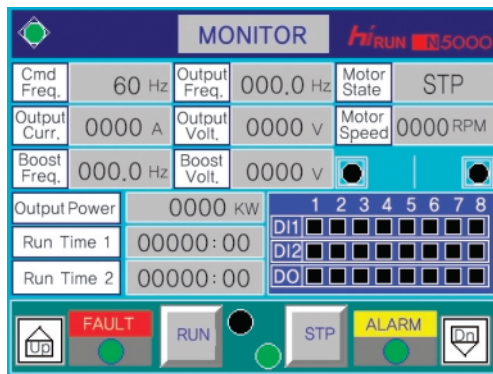
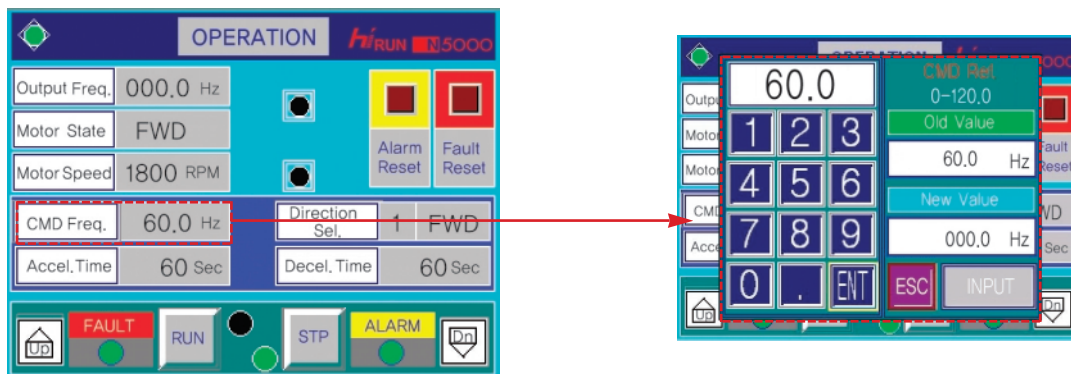
▶ **Environmental Tests of Cell Inverter and Control Parts: Constant Temperature, Vibration, EMI/EMC**



## Features

### ► Inverter Operator with Convenient Functions (Color LCD)

#### Easy Touch Key Settings

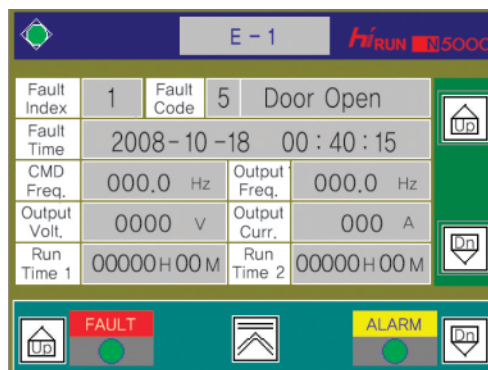


#### Inverter Operation Status Display

- Operation frequency, input-output voltage, output current
- Input-output of external signals
- Warning status

#### Inverter Fault Display

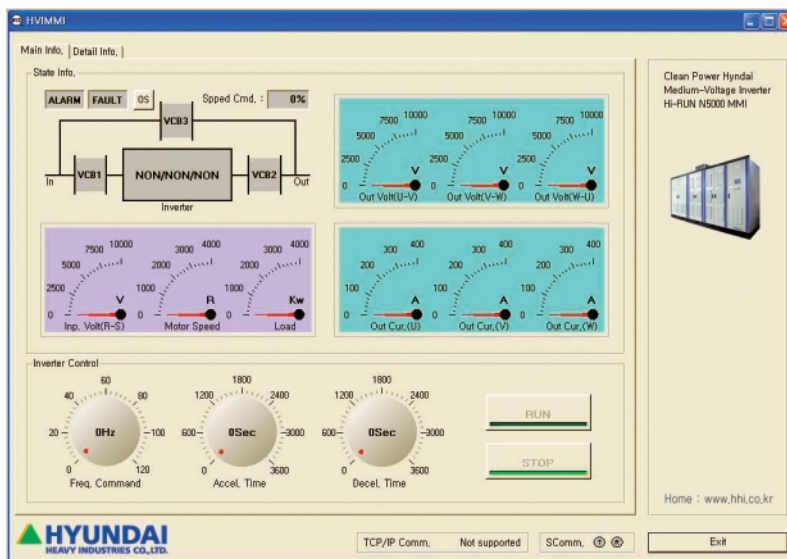
- Fault type
- Time of Fault
- Operating frequency at time of fault
- Voltage and current at time of fault



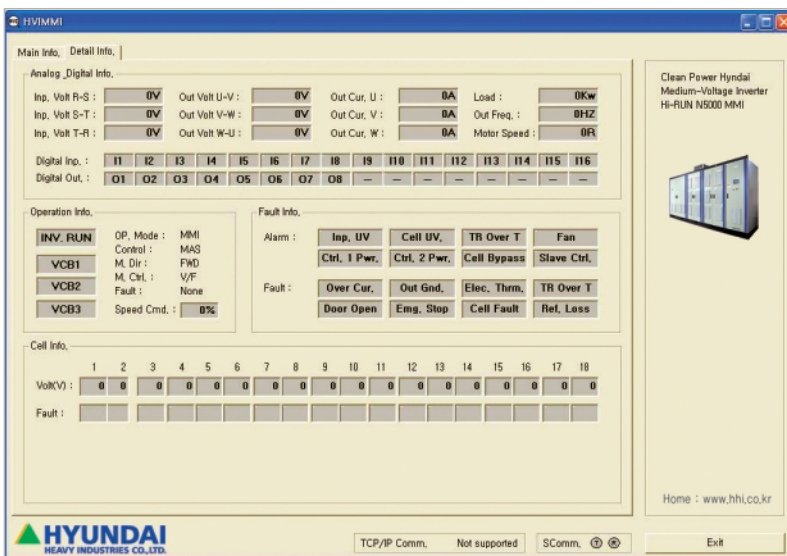


**Optional User Friendly PC-based Console (Option)**

- ▶ Remote operation and monitoring via laptop or desktop
- ▶ Easy parameter setting and monitoring
- ▶ Multiple communication interfaces (RS-232, RS-485, MODBUS)
- ▶ Custom-made MMI display and upgrade support

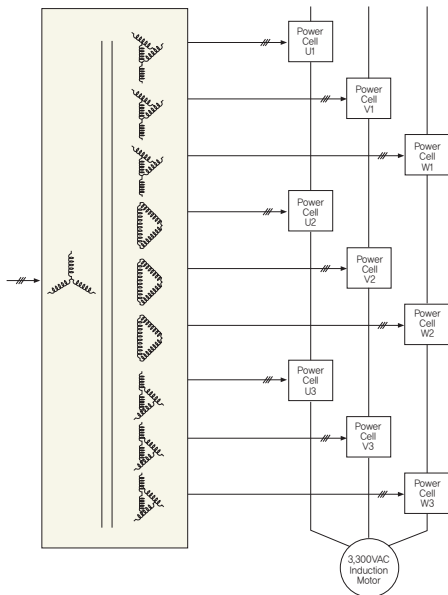


**▶ Display of Detailed Information**

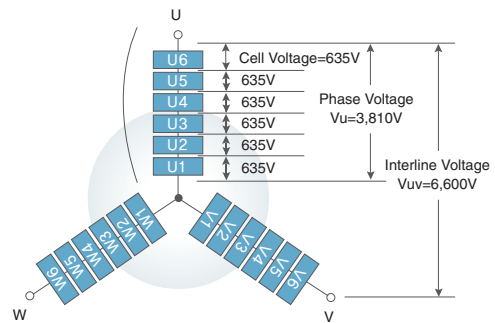
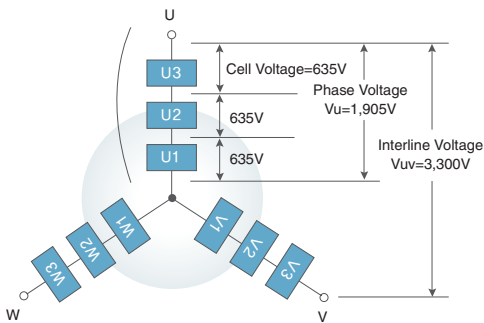
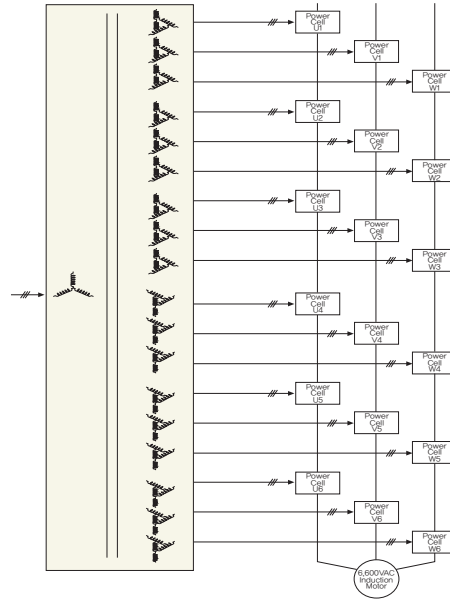


## Circuit Configuration

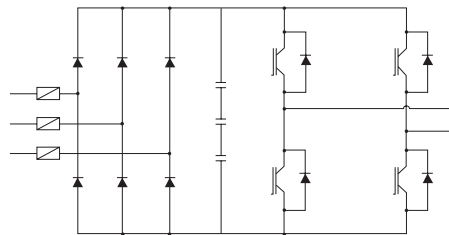
### 3.3kV System Circuit Configuration



### 6.6kV System Circuit Configuration



### Single-phase Cell Inverter (Power Cell)



## Specifications

| Voltage class                               |                                | 3300V <sup>1)</sup>                                                                                                                                                                                                                                                      |     |     |      |      |      |      |      |      |      |      |      |
|---------------------------------------------|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|-----|------|------|------|------|------|------|------|------|------|
| 3.3kV output capacity (kVA)                 |                                | 200                                                                                                                                                                                                                                                                      | 300 | 400 | 500  | 600  | 750  | 1000 | 1250 | 1500 | 1750 | 2000 | 2250 |
| Rated output current (A)                    |                                | 35                                                                                                                                                                                                                                                                       | 53  | 70  | 88   | 105  | 132  | 175  | 219  | 263  | 307  | 350  | 394  |
| Motor power output (kW) <sup>2)</sup>       |                                | 155                                                                                                                                                                                                                                                                      | 245 | 325 | 410  | 490  | 620  | 835  | 1040 | 1270 | 1500 | 1710 | 1940 |
| Voltage class                               |                                | 6600V <sup>1)</sup>                                                                                                                                                                                                                                                      |     |     |      |      |      |      |      |      |      |      |      |
| 6.6kV output capacity (kVA)                 |                                | 400                                                                                                                                                                                                                                                                      | 600 | 800 | 1000 | 1200 | 1500 | 2000 | 2500 | 3000 | 3500 | 4000 | 4500 |
| Rated output current (A)                    |                                | 35                                                                                                                                                                                                                                                                       | 53  | 70  | 88   | 105  | 132  | 175  | 219  | 263  | 307  | 350  | 394  |
| Motor power output (kW) <sup>2)</sup>       |                                | 330                                                                                                                                                                                                                                                                      | 495 | 675 | 835  | 1000 | 1270 | 1700 | 2130 | 2590 | 3020 | 3450 | 3930 |
| Output                                      | Output frequency (Hz)          | 50 or 60Hz                                                                                                                                                                                                                                                               |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Overload capacity              | 120%, 60 sec                                                                                                                                                                                                                                                             |     |     |      |      |      |      |      |      |      |      |      |
| Input                                       | Main circuit                   | 3phase 3300V, 50/60Hz or 3phase 6600V, 50/60Hz                                                                                                                                                                                                                           |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Control circuit                | 3phase 220V or 440V, 50Hz or 60Hz                                                                                                                                                                                                                                        |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Tolerance                      | Voltage: $\pm 10\%$ , Frequency: $\pm 5\%$                                                                                                                                                                                                                               |     |     |      |      |      |      |      |      |      |      |      |
| Power factor of main power supply           |                                | Approx 95% or more at normal operating speed                                                                                                                                                                                                                             |     |     |      |      |      |      |      |      |      |      |      |
| Efficiency                                  |                                | Approx 96% (Including transformer)                                                                                                                                                                                                                                       |     |     |      |      |      |      |      |      |      |      |      |
| Control specification                       | Control method                 | Sensorless vector control + Multi-level sinusoidal PWM (Pulse Width Modulation)                                                                                                                                                                                          |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Frequency precision            | $\pm 0.5\%$ of maximum output frequency (Analog input)                                                                                                                                                                                                                   |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Torque characteristics of load | Square torque load, Constant torque load                                                                                                                                                                                                                                 |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Acceleration/deceleration time | 0.1~3600 sec (depend on GD <sup>2</sup> of load machine)                                                                                                                                                                                                                 |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Main control function          | Soft stall (Automatic load reduction control during overload), Ride-through function (0-83ms, non-torque control), specific frequency evasion function, total run time display function, non-stop operation during speed reference loss, multiple Acc./Dcc. rate setting |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Main protective function       | Current limit, overcurrent, overvoltage, overload, undervoltage, ground fault, CPU error, cooling fan abnormal, control power abnormal                                                                                                                                   |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Data transmission              | 2ea among RS485/232/modbus (standard), ethernet, profibus-DP <i>Option</i>                                                                                                                                                                                               |     |     |      |      |      |      |      |      |      |      |      |
| Operation board                             | Display                        | Color LCD graphic display: Color TFT touch method 5 inch LCD                                                                                                                                                                                                             |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Control method                 | Start, stop, reset fault, interlock (Emergency stop)                                                                                                                                                                                                                     |     |     |      |      |      |      |      |      |      |      |      |
| Signal interface                            | Analog                         | Input: 4 channel (DC 0-10V or DC 4-20mA) Output: 4 channel (DC 0-10V or DC 4-20mA)                                                                                                                                                                                       |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Digital                        | Input: 16 channel (Dry contact)<br>Output: 8 channel (Dry contact: AC 250V 5A or DC 30V 5A)                                                                                                                                                                              |     |     |      |      |      |      |      |      |      |      |      |
| Main reliability function ( <i>Option</i> ) | Cell bypass                    | If an inverter cell functions abnormally, continuous operation is possible via reduced power output                                                                                                                                                                      |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Control device redundancy      | When main control device is abnormal, auxiliary control device is communicated with optical signal transmitter                                                                                                                                                           |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Control power redundancy       | In case of power failure, it is possible to continuous operation without UPS, because AC and DC can be received together for control input power                                                                                                                         |     |     |      |      |      |      |      |      |      |      |      |
| Input transformer                           |                                | Temperature class H, dry type, tapping range $\pm 5\%$ , only for N5000                                                                                                                                                                                                  |     |     |      |      |      |      |      |      |      |      |      |
| Construction                                | Protection degree of enclosure | IP20 (IEC-529)                                                                                                                                                                                                                                                           |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Panel construction             | Free standing, front maintenance type, door handle key attached                                                                                                                                                                                                          |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Cooling                        | Air cooled by ventilation fans mounted on panels                                                                                                                                                                                                                         |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Panel color                    | Munsell No. 5Y 7/1                                                                                                                                                                                                                                                       |     |     |      |      |      |      |      |      |      |      |      |
| Ambient constructions                       | Ambient temperature            | 0 - 40°C                                                                                                                                                                                                                                                                 |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Humidity                       | Max 85% (No condensation)                                                                                                                                                                                                                                                |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Altitude                       | 1000m above sea level or less                                                                                                                                                                                                                                            |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Vibration                      | 0.5G or less at 10-50Hz                                                                                                                                                                                                                                                  |     |     |      |      |      |      |      |      |      |      |      |
|                                             | Installation                   | Indoors                                                                                                                                                                                                                                                                  |     |     |      |      |      |      |      |      |      |      |      |
| Applications                                |                                | Fan, blower, pump, compressor, extruder, mixer etc. (Non-Regenerative devices)                                                                                                                                                                                           |     |     |      |      |      |      |      |      |      |      |      |
| Standards                                   |                                | Electrical performance: IEC Components and others: KS                                                                                                                                                                                                                    |     |     |      |      |      |      |      |      |      |      |      |

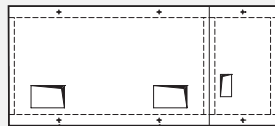
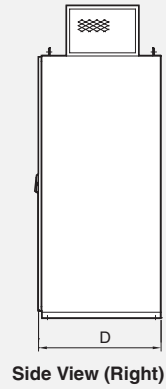
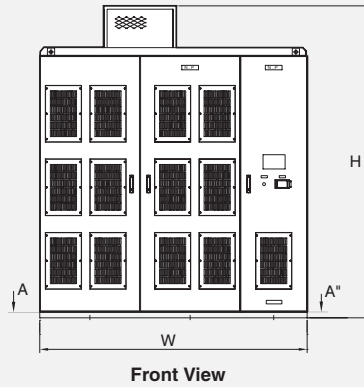
※ 1) As for the non-standard voltage (3.0kV, 4.16kV, 6.0kV) motor, please contact Hyundai Heavy Industries Co., Ltd.

2) Based on Hyundai Heavy Industries Co., Ltd.'s standard squirrel type 4 pole motors

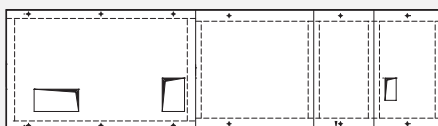
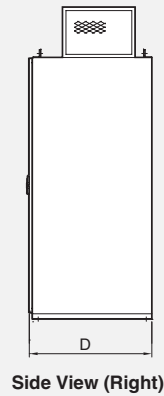
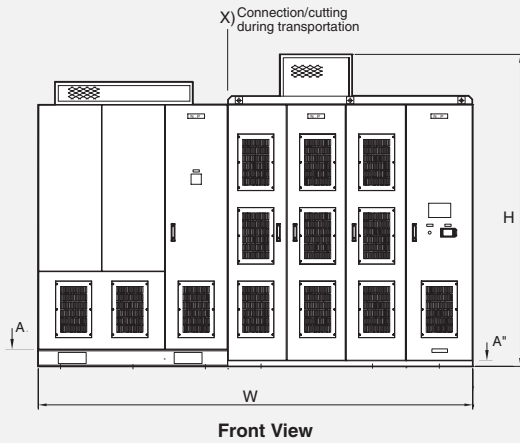


## Outline and Dimensions

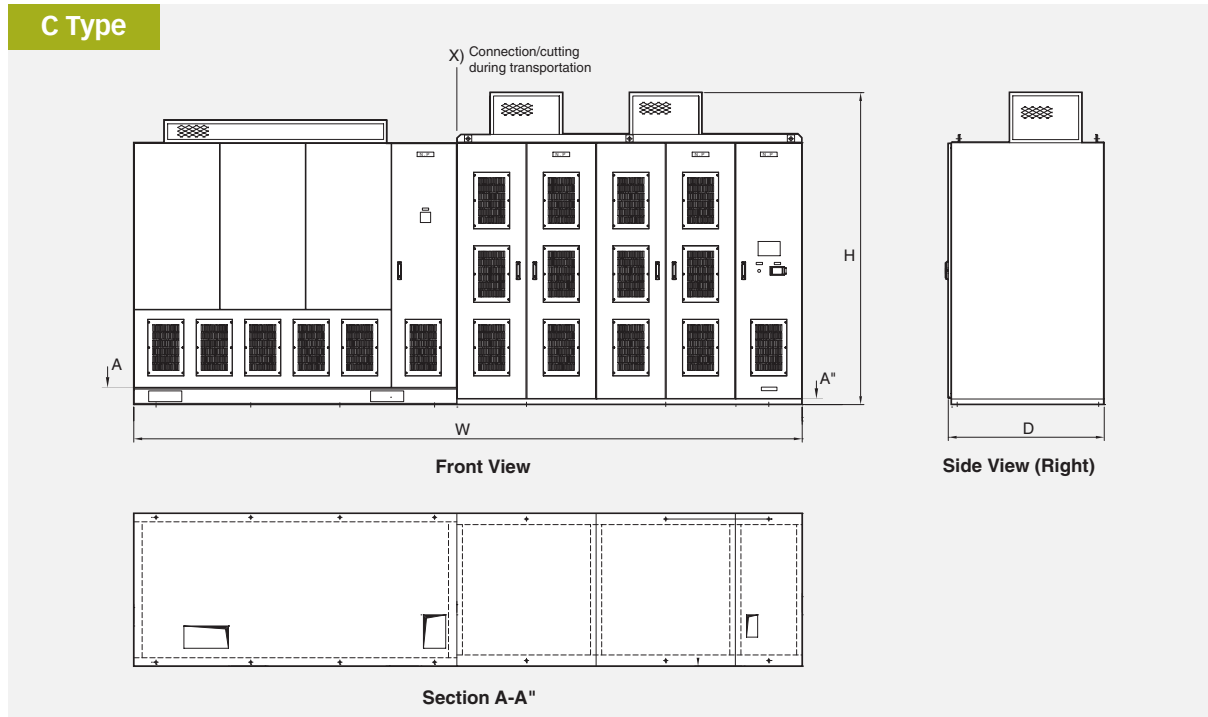
### A Type



### B Type

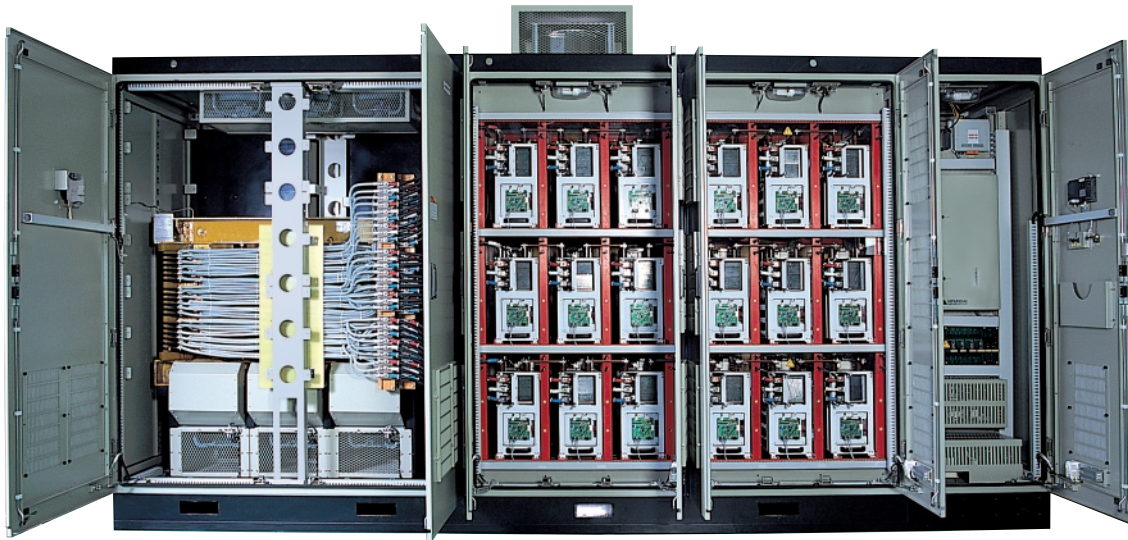


### C Type



| Voltage (V) | Capacity (kVA) | Type | W (mm) | D (mm) | H (mm) | Weight (Approx) (kg) |
|-------------|----------------|------|--------|--------|--------|----------------------|
| 3300        | 200            | A    | 2000   | 2800   | 1100   | 2,700                |
|             | 300            | A    | 2000   | 2800   | 1100   | 3,000                |
|             | 400            | A    | 2400   | 2800   | 1100   | 3,400                |
|             | 500            | A    | 2400   | 2800   | 1100   | 3,600                |
|             | 600            | B    | 3300   | 2800   | 1100   | 4,300                |
|             | 750            | B    | 3300   | 2800   | 1100   | 4,600                |
|             | 1000           | B    | 3600   | 2800   | 1200   | 5,200                |
|             | 1250           | B    | 3600   | 2800   | 1200   | 5,600                |
|             | 1500           | B    | 3800   | 2800   | 1400   | 6,300                |
|             | 1750           | B    | 3800   | 2800   | 1400   | 6,800                |
|             | 2000           | B    | 3900   | 2800   | 1400   | 7,500                |
| 6600        | 2250           | B    | 3900   | 2800   | 1400   | 8,000                |
|             | 400            | B    | 3200   | 2800   | 1100   | 4,400                |
|             | 600            | B    | 3200   | 2800   | 1100   | 5,000                |
|             | 800            | B    | 3900   | 2800   | 1100   | 5,700                |
|             | 1000           | B    | 3900   | 2800   | 1100   | 6,000                |
|             | 1200           | C    | 4900   | 2800   | 1100   | 6,800                |
|             | 1500           | C    | 4900   | 2800   | 1100   | 7,300                |
|             | 2000           | C    | 5100   | 2800   | 1200   | 8,500                |
|             | 2500           | C    | 5100   | 2800   | 1200   | 9,000                |
|             | 3000           | C    | 5200   | 2800   | 1400   | 10,000               |
|             | 3500           | C    | 5700   | 2800   | 1400   | 11,000               |
| 4000        | C              | 5900 | 2800   | 1400   | 13,000 |                      |
| 4500        | C              | 6000 | 2800   | 1400   | 13,500 |                      |

## Components (6.6kV)



Multi-Winding  
Phase-Shifted Transformer

Cell Inverter

Control  
Panel

### Multi-Winding Phase-Shifted Transformer Section

- ▶ Power supply lead-in terminal and output terminal section to the cell inverter
- ▶ 3.3kV: 9 phase shift windings
- ▶ 6.6kV: 18 phase shift windings
- ▶ Free standing panel type

### Power Cell Section

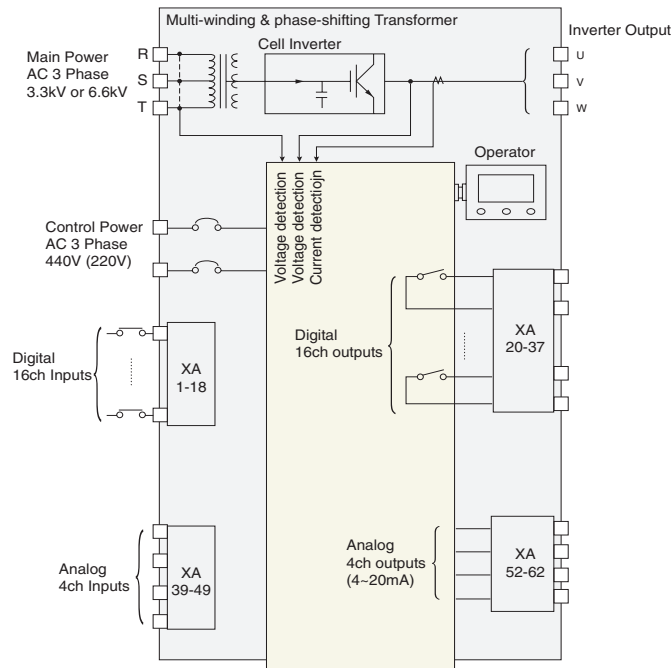
- ▶ 3 or 6 cells connected in series per inverter output phase
- ▶ Modulization of PWM controller and power conversion section
- ▶ 13 level (3.3kV)/25 level (6.6kV) 3 phase direct output

### Control Panel

- ▶ Process controller for high speed calculating digital signal process
- ▶ Self-Diagnostic
- ▶ Extendable I/O board
- ▶ CAN communication control and optical signal transmission
- ▶ UPS for back-up of control power (*Option*)



## Connection



## Form for Quotation

※ To get a price quotation, you are required to fill out the following form.

|    |                                        |                                                                                                                                                                                                                                                                                                                                        |
|----|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1  | Name of Application                    |                                                                                                                                                                                                                                                                                                                                        |
| 2  | Type of Load                           | <input type="checkbox"/> Pump <input type="checkbox"/> Fan <input type="checkbox"/> Blower <input type="checkbox"/> Compressor <input type="checkbox"/> Others                                                                                                                                                                         |
| 3  | Torque Characteristics                 | <input type="checkbox"/> Variable Torque <input type="checkbox"/> Proportional Torque<br><input type="checkbox"/> Constant Torque <input type="checkbox"/> Constant Output $J(GD^2/4) \text{ kg} \cdot \text{m}^2$                                                                                                                     |
| 4  | Operation Conditions                   | Motor Current _____ A, Annual Operation Time _____ hours                                                                                                                                                                                                                                                                               |
| 5  | Motor Specifications                   | <input type="checkbox"/> Squirrel-Cage Induction motor <input type="checkbox"/> Wound-Rotor Type Motor <input type="checkbox"/> Existing <input type="checkbox"/> New<br>Output _____ kW, Voltage _____ V, Frequency _____ Hz, Pole Number _____ P<br>Speed _____ min, Rated Current _____ A, Efficiency _____ %, Power Factor _____ % |
| 6  | Speed Control Range                    | Minimum _____ /min to Maximum _____ /min or<br>Minimum _____ /Hz to Maximum _____ /Hz                                                                                                                                                                                                                                                  |
| 7  | Acceleration/Deceleration Time Setting | Acceleration Time _____ Second(s)/ _____ min<br>Deceleration Time _____ Second(s)/ _____ min                                                                                                                                                                                                                                           |
| 8  | Overload Capacity                      | _____ % / _____ Second(s)                                                                                                                                                                                                                                                                                                              |
| 9  | By-Pass Operation Circuit              | <input type="checkbox"/> Required < <input type="checkbox"/> Automatic <input type="checkbox"/> Manual >                                                                                                                                                                                                                               |
| 10 | Power Supply Specifications            | Power Supply Short-Circuit Capacity _____ MVA, Main Circuit Voltage _____ V, _____ Hz<br>Control Circuit Voltage 200/220V or 400/440V, 50/60Hz                                                                                                                                                                                         |
| 11 | Ambient Conditions                     | Indoors <input type="checkbox"/> Ambient Temperature _____ °C, <input type="checkbox"/> Humidity _____ % or less<br><input type="checkbox"/> Air-Conditioning Facility ( <input type="checkbox"/> Provided <input type="checkbox"/> Not Provided)                                                                                      |