

Requirements on Minimum Energy Performance Standard, Labelling and Inspection of Rotodynamic Water Pumps (Draft)

1. The end suction single stage rotodynamic water pump referred to in this Announcement are those driven by a three-phase motor (“Water Pumps” or “products” hereafter), including Water Pumps units with motors or Water Pumps without motors , respectively the end suction single stage own bearing rotodynamic water pumps, end suction single stage close coupled rotodynamic water pumps and end suction single stage close coupled inline rotodynamic water pumps, which shall be in compliance with the applicable scope indicated in the Appendix 1.
2. The Water Pumps shall be tested for the energy efficiency measured value pursuant to the requirements of grade 2 or higher under currently effective National Standards of the Republic of China (“CNS”) 16017, or the equivalent requirements of grade 2 or higher under International Organization for Standardization (“ISO”) 9906.

The measured energy efficiency values of the Water Pumps without motors in the preceding paragraph shall not be lower than the minimum energy performance standard requirements for Water Pumps (see Appendix 2) and shall be higher than or equal to the product rated value. The measured energy efficiency index values of the Water Pumps units with motors shall not be higher than the minimum energy performance standard requirements for Water Pumps and the product rated value (see Appendix 2). The three-phase motor driving the water pump which is designated by the Central Competent Authority's announcement shall comply with the minimum energy performance standards for the motor.

3. While manufacturing or importing the Water Pumps for domestic use, the product manufacturer or importer (hereafter referred to as “the dealer”) shall submit the following documentation to the Central Competent Authority to apply for the registration account and password for Minimum Energy Performance Standard Management System (hereafter referred to as “Management System”), in order to

access the Management System:

(1) Original copy of the Application Form for Management System Registration Account and Password (Appendix 3).

(2) Copy of the product dealer's corporate registration certificate or commercial registration certificate, or other equivalent certificates.

4. After obtaining the Management System account and password, the product dealer shall apply for registration of the energy efficiency via the Management System, and submit the following documentation to the Central Competent Authority:

(1) Original Copy of the Application Form for Registration of Water Pumps Energy Efficiency (see Appendix 4).

(2) Registration of single model: Each category of Water Pumps shall be divided into four ranges (1) 0.75kW ~ less than 7.5kW;(2) 7.5kW ~ less than 37kW; (3) 37kW ~ less than 75kW and (4) above 75kW. For application for more than three models in each range, the product dealer shall provide a copy of the test report on energy efficiency of two models designated by the Central Competent Authority with official corporate seal. For application for Water Pumps energy efficiency registration of no more than two models, a copy of the test report on energy efficiency of all models of product shall be submitted with official corporate seal.

(3) Registration of serial models: For application for more than five models of each category of Water Pumps, the product dealer shall provide a copy of the test report on energy efficiency of full impeller diameter and minimum trimmed impeller diameter of four models of designated products with official corporate seal. While applying for the registration of Water Pumps energy efficiency of no more than four models of products, the test report on energy efficiency of full impeller diameter and minimum trimmed impeller diameter of all models of products shall be submitted with official corporate seal.

The energy efficiency test report mentioned in Section 4.(2)and 4.(3) shall be issued by laboratories approved by the certified authorities that are members to the mutual recognition agreement signed by the

Taiwan Accreditation Foundation (“TAF”) and the International Laboratory Accreditation Cooperation (“ILAC”), or be issued by Underwriters Laboratories Inc. (“UL”) or Technischer Überwachungs-Verein (“TÜV”).

For registration of single model, Water Pumps with either different rated power, number of poles of motors, drive link method, inlet and outlet diameter or impeller diameter shall be deemed Water Pumps of different basic models.

For registration of serial models, Water Pumps with either different number of poles of motors, drive link method or the maximum (full) impeller diameter shall be deemed Water Pumps of different series.

5. The Central Competent Authority shall approve the registration number of the product in accordance with the energy efficiency test report and energy efficiency rated value registered by the product dealers. The Central Competent Authority may conduct product sampling and testing before approving, and the product dealer shall bear the related costs.
6. When manufacturing or importing the Water Pumps for domestic use, the product dealer shall re-apply for the registration for the energy efficiency in the following instances:
 - (1) The design of the product has been changed and such change affects its energy efficiency.
 - (2) The product model number has been changed.
7. While manufacturing or importing the products for domestic use, the product dealer shall post the following items on metal nameplates on a prominent area of the products. These items shall all be labeled in Traditional Chinese, provided that the unit symbols, special characters, trademark and symbol cannot be indicated in Traditional Chinese. The product dealer shall not conceal, destroy or in any other way make the following information unrecognizable:
 - (1) Name of the product: end suction single stage own bearing rotodynamic water pumps (or ESOB water pumps), end suction single stage close coupled rotodynamic water pumps (or ESCC water pumps), and end suction single stage close coupled inline

rotodynamic water pumps (or ESCCi water pumps);

- (2) Product model number: different single model or series models shall have different model numbers. The model number of Water Pumps without motors shall be different from Water Pumps units with motors. The model number for Water Pumps without motors shall be XXX-poles+B, and the model number for Water Pumps units with motors shall be XXX-poles+BM;
- (3) Rated power (kW): it shall refer to the rated output power of motors; if this information has been labeled on the nameplate of motor in Water Pumps units, it can be omitted;
- (4) Rated voltage(V) and frequency(Hz): if this information has been labeled on the nameplate of motor for water pumps units, it can be omitted;
- (5) Speed (rpm): it shall refer to the speed of the pump at the best efficiency point;
- (6) Inlet and outlet diameters (millimeter, mm): it shall be labeled as inlet diameter×outlet diameter, e.g., 100×80mm;
- (7) Full (or maximum) impeller diameter (millimeter, mm);
- (8) Trimmed impeller diameter (millimeter, mm), if impeller is not trimmed, it can be omitted;
- (9) Flow rate at best efficiency point (square meter/ minute, m³/min). If the impeller is trimmed, flow rate at trimmed impeller shall be labeled; otherwise, flow rate at full impeller shall be labeled ;
- (10) Head at best efficiency point (meter, m). If the impeller is trimmed, head at trimmed impeller shall be labeled; otherwise, head at full impeller shall be labeled;
- (11) Hydraulic pump efficiency at best efficiency point (%). If the impeller is trimmed, efficiency at trimmed impeller shall be labeled; otherwise, efficiency at full impeller shall be labeled;
- (12) Energy Efficiency index EEI: Water Pumps units shall be labeled;
- (13) Product registration number;
- (14) Number and year of manufacture;

(15) Production country or region;

(16) Name of the manufacturer or OEM consigner: for imported products, the name of the manufacturer or OEM consigner, agent, or distributor shall be labeled.

Water Pumps shall be labeled in conformity with the requirements set forth in the preceding paragraph while being exhibited or sold.

8. The product dealer shall report the volume of product sales of the preceding year in the Management System by end of February each year.
9. The Central Competent Authority may designate the model and volume of Water Pumps annually for product sampling and testing. The product dealer shall send such product to the designated testing laboratory for testing within the period informed by the Central Competent Authority.. For products fail to meet the requirements in section 2, the Central Competent Authority will request related manufacturers to re-submit samples for re-testing. The re-tested samples shall be of the same model and twice as many as the first-tested samples. All the incurred cost associated with the re-testing shall be borne by manufacturers.
10. If the product testing or re-testing is not conducted, or if the re-tested samples do not completely comply with the requirements, the Central Competent Authority shall act in accordance with Articles 21 and 24 of the Energy Management Act. For those fail to complete the corrective actions within the designated period, the Central Competent Authority shall nullify its energy efficiency registration, provided that the product dealer fails to conduct the energy efficiency test due to the fact that the designated sampling and testing products are no longer produced or imported, and the Central Competent Authority has approved and canceled its energy efficiency registration.
The Central Competent Authority shall disclose the information under the preceding paragraph on the Management System pursuant to the Consumer Protection Act and the relevant regulations.
11. The volume of the first sampling and testing products in Section 9 shall be determined based on the totality of the products sold in the preceding

year: one sample shall be tested out of 200 units of end suction single stage own bearing rotodynamic water pumps, a maximum of 5 units for each dealer, while there are less than 200 units sold, one sample shall still be tested; One sample shall be tested out of 200 units of end suction single stage close coupled rotodynamic water pumps, a maximum of 5 units for each dealer, while there are less than 200 units sold, one sample shall still be tested; One sample shall be tested out of 100 units of end suction single stage close coupled inline rotodynamic water pumps, a maximum of 5 units for each dealer, while there are less than 100 units sold, one sample shall still be tested.

The Central Competent Authority may adjust the sampling model or volume based on actual needs.

Appendix 1

Applicable Scope of End Suction Single Stage Rotodynamic Water Pumps

1. This standard applies to end suction single stage rotodynamic water pumps without motors and water pumps units with motors, which have rated frequency of 60Hz, rated power of 0.75 (1HP) to 200kW (270HP), volume flow rate of greater than or equal to $6\text{m}^3/\text{hr.}$, head of less than or equal to 140m, and driven by a three-phase motor with nominal speed of 3600rpm (2 poles) or 1800rpm (4 poles), including:

(1) End Suction Single Stage Own Bearing rotodynamic water pumps (ESOB water pumps):

An end suction single stage rotodynamic water pump in which liquid enters the pump in a direction parallel to the impeller shaft and is discharged through a volute in a plane perpendicular to the shaft, the driving motor component remains dry, a sealed shaft connection between the impeller in the pump body and the motor, and is equipped with own bearings.

(2) End Suction Single Stage Close Coupled rotodynamic water pumps (ESCC water pumps):

An end suction single stage rotodynamic water pump in which liquid enters the pump in a direction parallel to the impeller shaft and is discharged through a volute in a plane perpendicular to the shaft, the driving motor component remains dry, a sealed shaft connection between the impeller in the pump body and the motor, and the motor shaft is extended as the pump shaft.

(3) End Suction Single Stage Close Coupled Inline rotodynamic water pumps (ESCCi water pumps):

An end suction single stage rotodynamic water pump in which liquid enters and is discharged through a volute in a plane perpendicular to the shaft, the driving motor component remains dry and the motor is mounted on the top, a sealed shaft connection between the impeller in the pump body and the motor, the motor shaft is extended as the pump shaft, and the water inlet and outlet of the pump is on the same axis.

2. Excluded Items:

(1) water pumps designed specifically for pumping clean water at temperatures below $-10\text{ }^\circ\text{C}$ or above $120\text{ }^\circ\text{C}$;

(2) water pumps designed only for fire-fighting applications, and the overall unit (including pump body, motor and other ancillary facilities) has obtained the firefighting pump certification of the Competent Authority.

(3) displacement water pumps: means a water pump that moves clean water by enclosing a volume of clean water and forcing this volume of water to the outlet of the pump

- (4) self-priming water pumps: means a water pump that moves clean water which can start and/or operate when only partly filled with water;
- (5) axial flow pump or mixed flow pump which liquid is discharged through a volute in a plane non-perpendicular to the impeller shaft

Appendix 2

Minimum Energy Performance Standard Requirements for Rotodynamic Water Pumps

1. The energy efficiency standard for Water Pumps without motors (“bare pump”) shall be calculated according to the following formulas:

$$\eta_{pump,BEP} = 88.59 x + 13.46 y - 11.48 x^2 - 0.85 y^2 - 0.38 xy - C \quad (a)$$

$$\eta_{pump,PL} = 0.947 \times \eta_{pump,BEP} \quad (b)$$

$$\eta_{pump,OL} = 0.985 \times \eta_{pump,BEP} \quad (c)$$

$x = \ln(n_s)$, $y = \ln(Q_{100\%})$, $Q_{100\%}$: volume flow rate of the water pump at best efficiency point (m³/h)

$\eta_{pump,BEP}$: energy efficiency standard of the water pump at best efficiency point (%);

$\eta_{pump,PL}$: energy efficiency standard for the operating point of the water pump at 75 % of the flow at best efficiency point (%);

$\eta_{pump,OL}$: energy efficiency standard for the operating point of the water pump at 110 % of the flow at best efficiency point (%);

n_s : specific speed of pump (min⁻¹), $n_s = n \cdot \frac{\sqrt{Q''_{100\%}}}{(\frac{1}{7}H_{100\%})^{3/4}}$, n : the revolutions per minute of the shaft (rpm);

$Q''_{100\%}$: volume flow rate of the water pump at best efficiency point (m³/s);

$H_{100\%}$: head of the water pump at best efficiency point (m);

i : the number of series impellers in the water pump

C : a constant of efficiency for different pump types.

Type	C value	
end suction single stage own bearing rotodynamic water pumps	motor (3600rpm)	128.07
	motor (1800rpm)	130.27
end suction single stage close coupled rotodynamic water pumps	motor (3600rpm)	128.46
	motor (1800rpm)	130.77
end suction single stage close coupled inline rotodynamic water pumps	motor (3600rpm)	132.30
	motor (1800rpm)	133.69

Note:(1)Formula(a), (b), (c) apply to Water Pumps with full impeller diameter.

(2) Best efficiency point means the operating point of water pumps at which it is at the maximum hydraulic pump efficiency measured with clean cold water.

- (3) The measured energy efficiency value of bare pumps shall not be lower than $\eta_{pump,BEP}$, $\eta_{pump,PL}$, $\eta_{pump,OL}$ as calculated by formula (a), (b), (c), and shall be higher than or equal to the rated values of product.
- (4) The measured energy efficiency value of bare pumps shall be calculated to the first place of decimal fraction and rounded up after decimal fraction.
- (5) The volume flow rate (Q), head (H) and motor power input (P) shall be translated to the value on the basis of the nominal speed 3600rpm(2pole) or 1800rpm(4poles). The conversion equations are as follow:

$$Q_{i,nominal\ speed} = Q_i \left(\frac{n_{nominal\ speed}}{n_i} \right)$$

$$H_{i,nominal\ speed} = H_i \left(\frac{n_{nominal\ speed}}{n_i} \right)^2$$

$$P_{i,nominal\ speed} = P_i \left(\frac{n_{nominal\ speed}}{n_i} \right)^3$$

- (6) The equations for measured energy efficiency value of bare pumps is:

$$\eta_{over\ efficiency,i} = \frac{\text{hydraulic output power } (P_{h,i})}{\text{motor power input } (P_{1,i})} \times 100\%$$

$$\begin{aligned} \eta_{over\ efficiency,i} &= \frac{\text{hydraulic output power } (P_{h,i})}{\text{power transmitted to the pump by its motor } (P_{2,i})} \times 100\% \\ &= \frac{\text{hydraulic output power } (P_{h,i})}{\text{motor power input } (P_{1,i}) \times \text{motor efficiency } (\eta_{motor,i})} \times 100\% \\ &= \frac{\eta_{overall\ efficiency,i} (\%)}{\text{motor efficiency } (\eta_{motor,i})} \times 100\% \end{aligned}$$

$$P_{h,i} = \rho g Q_i H_i \text{ (kW)}$$

Where:

i : load point corresponding to 75%, 100%, and 110% of BEP (best efficiency point) flow

n_i : speed at 75%, 100%, and 110% of BEP flow

$n_{nominal\ speed}$: 3600rpm or 1800rpm

Q_i , H_i , P_i : the measured volume flow rate (m^3/s), head (m), and motor power input (kW) at load point i of the tested pump

$P_{h,i}$: the measured hydraulic output power at load point i of the tested pump (kW)

$P_{1,i}$: the measured motor power input at load point i of the tested pump (kW)

$P_{2,i}$: the measured power transmitted to the pump by its motor at load point i of the tested pump (kW)

$\eta_{motor,i}$: motor efficiency at load point i (%)

ρ : density of water delivered by pump (kg/m^3)

g : local acceleration due to gravity (m/sec^2) calculated according to the equations under CNS16017 or ISO 9906

- (7) When the approval for serial models is applied for Water Pumps, the energy efficiency standard of the bare pump with minimum trimmed impeller at best efficiency point $\eta_{pump,BEP,trimmed}$ shall not be less than 90% of energy efficiency standard of the maximum (full) impeller at best efficiency point $\eta_{pump,BEP}$. The measured energy efficiency values of the bare pump with trimmed impeller shall not be lower than the energy efficiency standard, $\eta_{pump,BEP,trimmed}$, and shall be higher than or equal to the product rated value, the related information including efficiency of maximum (full) impeller and minimum trimmed impeller shall both be registered.
- (8) When the approval for serial models is applied for Water Pumps, the measured energy efficiency values at best efficiency point of all impeller diameter between minimum trimmed impeller and maximum (full) impeller shall be not lower than the energy efficiency standard of minimum trimmed impeller diameter at best efficiency point, $\eta_{pump,BEP,trimmed}$, and shall be higher than or equal to the product rated value.
- (9) Test requirements:
- I. The test shall be conducted with at least seven flow points, the flow points shall be selected at 40%, 60%, 75%, 90%, 100%, 110%, and 120 % of the expected Best Efficiency Point (BEP) flow rate of the pump. For pumps that cannot be tested to flows beyond 120% of the expected BEP, the test shall be conducted at the flow points of 40%, 50%, 60%, 70%, 80%, 90% and 100% of the expected BEP flow rate.
 - II. The curve of best fit of efficiency versus rate of flow for the determination of BEP shall be a polynomial up to 6th order function in the region of the BEP rate of flow and with the maximum R^2 value, indicating the value of best fit. The curve of best fit of the pump total head versus flow rate shall be a polynomial up to the 6th order function and with the maximum R^2 value, indicating the best fit.
 - III. The head and motor input power at 75%, 100%, and 110% of the BEP flow rate shall be determined according to regression analysis.

2. The energy efficiency index EEI for Water Pumps units (with motors) shall be calculated according to the following formulas:

- (1) energy efficiency standard of the Water Pumps with the maximum (full) impeller at best efficiency point, $\eta_{pump,BEP}$, or the energy efficiency standard of Water Pumps with minimum trimmed impeller at best efficiency point, $\eta_{pump,BEP,trimmed}$, shall be calculated according to formulas in the preceding paragraph.
- (2) The reference motor power input, $P_{1,ref}$, shall be calculated:

$$P_{1,ref} = \frac{P_{2,ref}}{\eta_{motor,ref}}$$

$$P_{2,ref} = \frac{P_{h,ref}}{\eta_{pump,BEP} \text{ or } \eta_{pump,BEP,trimmed}}$$

$$P_{h,ref} = \frac{\rho g H_{100\%} (Q_{100\%}/3600)}{1000}$$

$P_{1,ref}$: reference motor power input of the maximum (full) impeller or minimum trimmed impeller (kW)

$P_{2,ref}$: reference power transmitted to the pump by its motor of the maximum (full) impeller or minimum trimmed impeller (kW)

$P_{h,ref}$: reference hydraulic output power of the maximum (full) impeller or minimum trimmed impeller (kW)

$\eta_{motor,ref}$: full load efficiency of three phase induced motor equipped for the maximum (full) impeller or minimum trimmed impeller of Water Pumps (%) , if the motors apply to IE3 regulation shall be meet.

$Q_{100\%}, H_{100\%}$: volume flow rate(m³/s), head(m) of the maximum (full) impeller or minimum trimmed impeller

ρ = the density of water is 1000 kg/m³ for calculating $P_{h,ref}$

g = acceleration due to gravity is 9.81m /s² for calculating $P_{h,ref}$

$\eta_{pump,BEP}$: energy efficiency standard of the maximum (full) impeller at best efficiency point (%)

$\eta_{pump,BEP,trimmed}$: energy efficiency standard of the minimum trimmed impeller at best efficiency point (%) is $0.9 \times \eta_{pump,BEP}$

(3) Energy efficiency index EEI for Water Pumps units (with motors) shall be calculated:

I. The weighted average motor power input $P_{1,avg}$ shall be calculated as:

$$P_{1,avg} = \sum_{i=1}^3 \left(\frac{\Delta t}{100}\right)_i P_{1,i}$$

i : load point corresponding to 75%, 100%, and 110% of BEP flow of maximum (full) impeller or minimum trimmed impeller

$P_{1,i}$: the measured motor power input of the maximum (full) impeller or minimum trimmed impeller at 75%, 100%, and 110% of BEP flow (kW)

$\frac{\Delta t}{100}$: the reference flow-time profile, as

Flow Q in % of Q _{100%}	75%	100%	110%
$\frac{\Delta t}{100}$	25%	50%	25%

II. The energy efficiency index EEI shall be calculated as:

$$EEI = P_{1,avg}/P_{1,ref}$$

III. The measured EEI shall not be higher than 0.988 and the product rated value.

IV. When the approval of serial models is applied for Water Pumps, the EEI of all impeller diameters between maximum(full) and minimum trimmed impeller diameter shall be not higher than the EEI of the maximum(full) impeller and the product rated value. The motor power must also be within the range of motor power of the maximum (full) impeller and minimum trimmed impeller. At the same time, the pump efficiency, EEI and related information for the maximum (full) impeller and minimum trimmed impeller shall be registered.

Appendix 3
Permitted Energy Consumption Standard Management System
Account and Password Application Form

Prepared on (ROC year, month, date)

Applicant (Company): _____

Applicant: _____ Tel: _____ Fax: _____

E-MAIL: _____

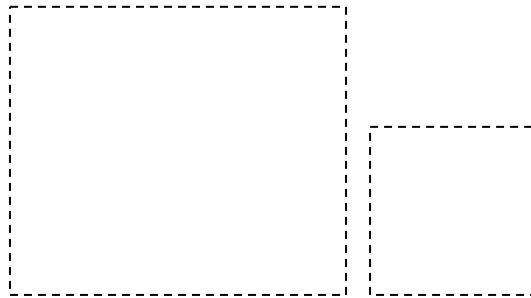
Category of the Product: _____

Account ID: _____

Password: _____

This company is applying for log-in and use of the Permitted Energy Consumption Standard Management System, and will be responsible for all information registered.

Stamp (seals of the company and the responsible person):



(official seals of the company and responsible person)

Appendix 4

Application number:

Energy Efficiency Performance Standard Registration Application Form for the Water Pumps

Prepared on (ROC year, month, date)

1. Applicant (Product Dealer) Information

Company name: _____

Company address: _____

Responsible Person: _____ Business ID: _____

Contact: _____ Department: _____ Title: _____

Tel: _____ Mobile: _____ Fax: _____

Email: _____

2. Manufacturer Name and Address

same as the Applicant

Manufacturer name: _____

Manufacturer address: _____

3. Contents of Registration

No.	Model No.	Name	motor rated power (kW)	Motor type/ Mode /pole	Rated voltage (V)/ Rated frequency (Hz)	Inlet / outlet diameter of pump (mm)	Full impeller (three load points)					Trimmed impeller					Production country or region	Energy Efficiency Index (EEI)	pump dimensions
							diameter (mm)	Flow rate (m3/min in)	Head (m)	Bare pump efficiency (%)	speed at BEP (rpm)	diameter (mm)	Flow rate at BEP (m3/min)	Head at BEP (m)	pump efficiency at BEP (%)	speed at BEP (rpm)			
1.																			
2.																			
3.																			

Note: 1. Information of trimmed impeller can be omitted if impeller is not trimmed;

2. For serial models, information of the full impeller and minimum trimmed impeller shall be filled in.

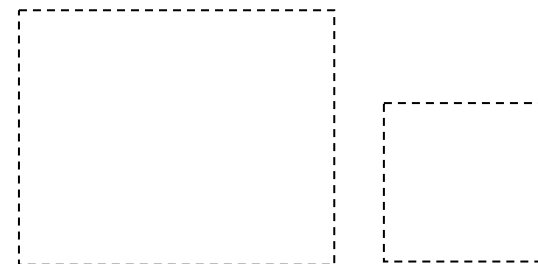
3. Three load points refer to volume flow, head and efficiency at 75%, 100%, 110% of the flow at the best efficiency point.

4. Product Dealer shall log in the Minimum Energy Performance Standard Management System to fill out the application form and download for further use.

4. Application Declaration and Affidavit

This company hereby declares to the central competent authority that all information contained in this application is true, and this company will be responsible for false, if any, and bear all legal liabilities. This company hereby declares that products available on the markets shall have the same energy efficiency labelling information as given in this application form. In case of any false, this company, without any objection, shall be subject to registration revocation and any disposition under the energy management regulations.

Stamp (Seals of company and responsible person)



(official seals of company and responsible person)

5. Power of Attorney (not applicable for applicants apply for registration by themselves)

For those apply for registration through attorney(s), the attorney(s) shall be approved by the applicants.

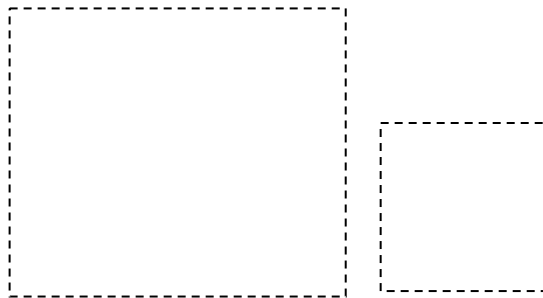
Company Name of the Attorney:

Responsible Person:

Address:

Business ID:

Tel:



(official seals of company and responsible person)
