KES

Electronic Design of Welding Fixture

KES G – M306B

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1. Scope of Application

This standard for electric design of welding fixture, in principal, shall be applied to the electric design of the welding fixture related to production of white body for Kia Motors (Inc.), unless specially mentioned.

2. Purpose

The purposes are the electric design and general wiring jointing relations of various welded fixtures, and common specifications of rational and universally valid electric design.

3. Control Box and Compartment

3.1 Mount of equipment

3.1.1 Mount inside control box and compartment

(1) The control box and compartment shall be constructed to appropriately protect from influences by driving environment of the machine, such as dusts, oil, cutting, emulsion, chips, etc. or mechanical damage.

Add another strong protection for equipments that are especially easy to be affected by the environment.

(2) Heat-emitting parts (Resistors, electric plate, etc.) shall be arranged so that a rise of temperature of control devices and parts inside the control box and the compartment do not exceed their allowable limits.

3.1.2 Concentration of control structure

Control of construction machine and braking-and-making machinery except push button switches, limit switches or a brake and make switch operated by workers shall be put together into one control box or compartment as much as possible.

3.1.3 Easiness of repair inspection

(1) Machineries attached inside the control box or the compartment shall be easy to be

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inspected for repairs to strip other parts of machinery when a door is opened or a cover is taken off.

(2) In order to maintain right driving of the machine, the whole machinery shall be easily inspected and parts or device methods shall be easily replaced if necessary.

(3) Terminals shall be easily inspected for repairs and be lined in order of numbers from top to bottom or from left to right. In addition, equip spare terminals.

3.2 Required conditions of control box and compartment

3.2.1 Structure

(1) The control panel and the compartment shall be closed in order to give appropriate protection according t o3.1.1.

(2) In case that the control box and the compartment are connected to floor, base or other parts inside the machine (For example, lubricants for cutting emulsion, tank in operating part or other compartments, which oil and other fluids invades), consider that it is not closed. (However, for compartments that water drops may possibly be condensed, equip a hole that the water can go out.)

(3) Equip a drawing box inside the control panel and the compartment.
(So that A3 binder can be inserted)

(4) An angle that a door opens is about 165 °.

3.2.2 Ventilation

(1) In order to use heat-emitting parts as in 3.1.1 (6), it is permitted to be ventilated in case that the rise of temperature exceeds an allowable limit.

(2) The ventilation method shall prevent invasion of dusts and oil cutting emulsion to the control box and the compartment as much as possible.

3.2.3 Door

(1) Prepare a door with a perpendicular hinge for the control box and the compartment as much as possible, and it shall be closed with a proper method.

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(2) Screws and bolts used for the door shall be structured so that they will not fall out when opening and closing.

(3) Width of the door shall not exceed 1000mm.

(4) Prepare gasket, which quality can be resistant against oil, for the door of the control box and the compartment.

3.2.4 Size of panel

(1) Size of panel shall be enough for the control box and the compartment to be put easily.

(2) For small part of an electric device, leave spaces for modification and addition.

3.2.5 Machine parts

(1) Machinery devices (Rotating axles, etc.), hydraulic pressure, pneumatic pressure devices (Electric change, etc.), etc. shall not be within the control box and the compartment.

(2) The control box and the compartment shall not interfere with machine devices, hydraulic devices, etc. for repair.

3.2.6 Color of interior paint of control box and compartment

Act on Kia color standard for color of paint of the control box compartment and its interior, unless there is a special request by a user.

3.3 Handling of control box

The control box equipped separately or independently from the machine due to transportation shall be easy to be carried.

3.4 Indication method of electric device

3.4.1 Indication name plate

Use non-corrosive material for the indication name plate of electric device and type, capacity (Performance), joint, operation, etc. of a machinery, and finish with the ones that are not easy to be erased by descriptions (Characteristics symbol, picture, chart, etc.), which are easy-to-read and not be misunderstood.

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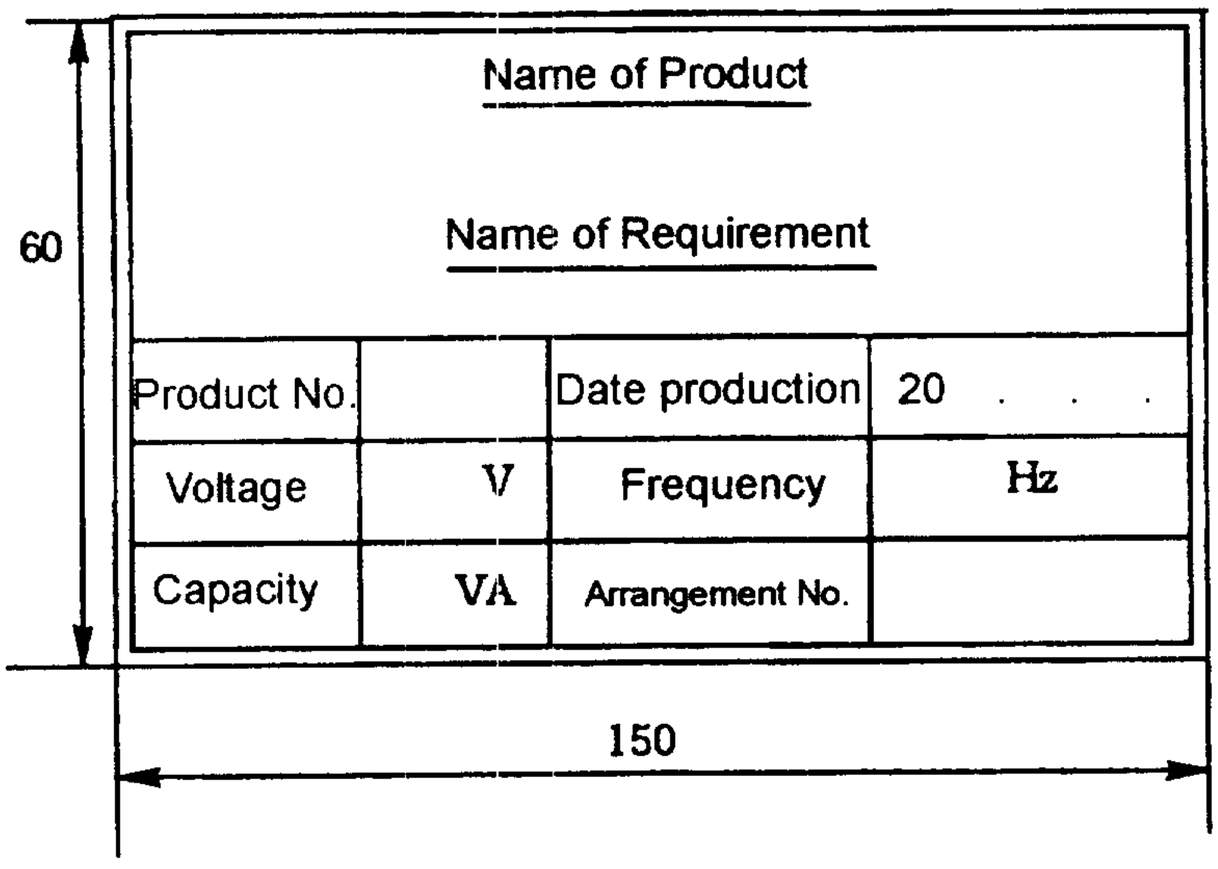
3.4.2 Name plate of control panel

Follow Phase 3 for the name plate of the control panel, and follow (1) ~ (2) of the following for its indications of mounts and structure inside the control panel.



Quality of material : Acryl

Processing method :

Gothic type, ground is white, black letters (From the back)

Mounting method : Fix with bolt of M4

Figure 3

(1) Mount point of name plate

Although it is standardized to mount the name plate of the control panel on the following mounting points, if those standard mount points are too high (By installation), mount in a place, where it is easy to see (Ground clearance 1.5m ~ 1.8m).

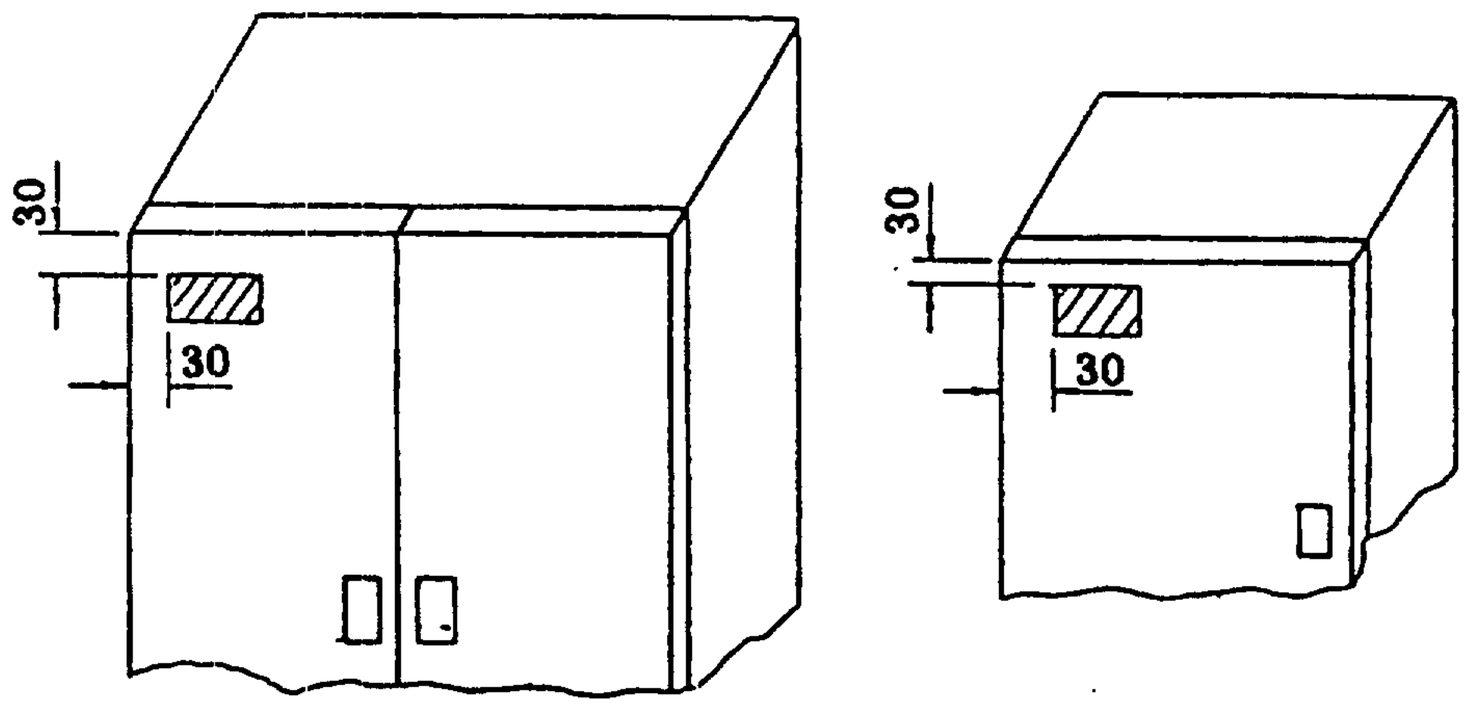


Figure 4

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(2) Indication of control machinery

Indications of machinery inside the control panel shall satisfy all the following contents.

(a) Indicate the indications with imperishable inks, etc. and shall not be changed by environments or years, or disappeared.

(b) Indicate pair number or symbol on top part and middle plate of a duct cover.

(c) Indicate setup values for timer, fuse, counter, etc. and correct the indications if there are changes in the setup values.

3.4.3 Indication of type of electric equipment

Indicate types, capacity, name of manufacturer and other indications on equipments such as limit switch, electric converter, electric motor, etc. However, if there is a type (Name plate) of the manufacturer and indication contents and conditions to see clearly are satisfied, additional indications are not necessary, but if not seen from the mount condition, indicate as an overlap.

3.4.4 Indication of rotational direction of electric motor

Indicate the indication of rotational direction of electric motor with yellow paint (Black paint for parts painted by silver), which is not erasable in atmosphere.

3.4.5 Indication of number function of electric equipment

Mount a name plate (Metal name plate, which thickness is more than 5mm, size of letters is larger than 6.0mm, and is easy to read) with indications of degree of joint of expansion or relative degree of joint for machineries such as limit switch, electric converter, electric motor, etc. along with indications of number function of name, on the machinery and equipment.

3.4.6 Indication of console

Perform the function indication using name plates on indications for operation button switches etc. and other operation equipments installed on the console and the indication panel.

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In addition, make the indication method to be characteristics indication by simple terminology.

3.5 Console

3.5.1 Structure of console

The structure of console is made of metallic material, which is perfectly prepared for vibration, water and oil resistance, and shall satisfy the following conditions.

(1) It shall be strong enough not to operate the push button with difficulty.

(2) For the console (or indication panel), which needs more than 6 switch indication lamps (Pilot lamps), make the console door possible to be opened and closed in the field, and install a terminal support inside the console to connect.

3.5.2 Installation condition for console

Although the console for the machinery and the device are put together and installed at one place in principle, for multistation of the machinery and the device, install a necessary sub-console for manual operation. In addition, the sub-console must have an emergency stop button switch.

3.5.3 Arrangement of push buttons

For the arrangement of the push buttons on the console, take easiness of operations and confirmations by a worker as a priority, and then satisfy the arrangement of the conditions in the following Figure 5.

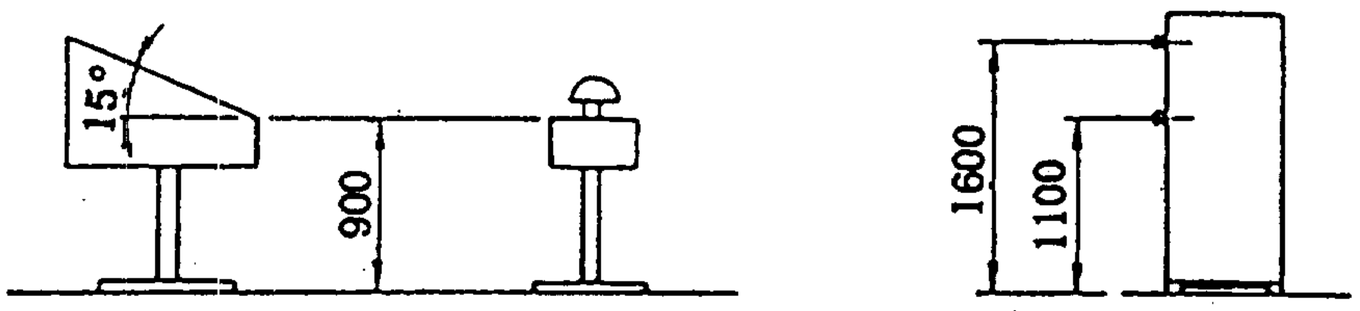

Figure 5

(1) Operation switches used ordinarily shall be arranged near a hand, which operates.

(2) All running button switches shall be arranged upper or left sides of related stop button switches.

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(3) Draw a line by yellow tape or paints on the automatic and manual operation switches to distinguish from the surroundings.

(4) On the upper side of the manual operation switch, indicate orders (Numbers) to operate one-cycle operation.

(5) When it is necessary to confirm the operation, place the indication lamp on the upper side of the button switch.

(6) Place the stop button switch on the right bottom of the console.

(7) Arrange related operation switches by orders of their functions.

3.5.4 Installation of integrating meter

A counter mounted to recognize a number of productions and exchange time of tools shall be designed as the following specifications.

(1) A work counter shall be 4-row total counter.

(2) A tool exchange counter shall have a 4-row exchange time notification, and install grouping number + Number of the tool. However, it is possible to install 6-row counter if necessary.

4. Electric Wire

4.1 Cross section area of electric wire

4.1.1 The cross section area of the electric wire shall be selected from sum total notice, etc. Especially for connections in long sections, in order to lower excessive voltage drop by electric coil motions or start of electric motor, use the one with large cross section area.

4.1.2 Minimum cross section area for use

Due to mechanical reasons, the cross section area of the electric wire shall not be smaller than the following sizes. However, if special functions are required, it is allowed to use special wires.

(1) Wires for the control box and the compartment

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Table 4

In general		1.25mm^2
In case of low-current devices such as electric parts	Single core	0.75mm^2
	Two cores	0.5mm^2
	More than three cores	0.3mm^2
	Shield wire	0.3mm^2
In case of frequent bending motions		1.25mm^2

(2) Wires inside the control box and the compartment

Table 5

In general	0.75mm^2
In case of low-current devices such as electric parts	0.2mm^2

4.2 Insulation of electric wire

In principle, use KS C 3302 [600V Vinyl Insulation Wire (IV)].

Insulation background of the wire used for voltage higher than 100V is originated from a test voltage of minimum 1500V. Thickness of the insulation material of the vinyl wire touching the metal part shall be more than 0.8mm. The wires used under special environments such as high temperature, liquid solvent, etc. are appropriate for usage conditions as this.

4.3 Type of electric wire

Use snarled wires for the electric wires. However, indicate the allowance current of vinyl wires for electric equipments (KIV) as the following Table 6.

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Table 6

Official cross section area (㎟)	Allowance current for 40℃ of surrounding temperature (A)							
	Vinyl wires for electric equipments							
	Exposed wiring	Number of wires in identical pipe						
		Less than 3	4	5~6	7~15	16~40	41~60	More than 61
0.75	5.7	4	3.6	3.2	2.9	2.6	2.2	1.9
0.9	14	9	9	8	7	6	5.4	4.7
1.25	15	10	10	8	7	6	6	5.3
2	22	16	14	12	10	9	8	
3.5	30	21	19	16	15	13	12	10
5.5	40	28	25	22	20	17	15	13
8	50	35	31	28	25	21	19	7
14	72	51	45	40	35	31	28	24
22	94	66	59	53	46	40	27	32
30	114	79	71	64	56	49	44	39
38	133	93	84	75	65	57	52	45
50	156	109	98	87	76	67	61	53
60	178	125	112	100	87	76	69	61
80	210	148	133	118	103	90	82	72
100	244	171	154	137	120	105	95	83
125	282	197	177	157	138	121	110	96
150	324	226	204	181	157	139	126	110
200	385	267	242	216	189	165	150	132
250	456	319	287	255	223	196	178	155
325	533	373	336	299	261	230	208	182
400	611	426	385	342	299	263	238	208
500	690	484	435	387	338	297	250	226

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Remark 1. Follow installation standard for values above.

2. The above does not apply to electric wires for center, ground and control circuit.

4.4 Electric wires and wiring

4.4.1 Kinds and standards of electric wires

(1) Inside the control panel

(a) Electric power cable

Use KS C 3302, and decide the standard according to Paragraph 130 "Allowance current" (Interior wiring regulation hereinafter) of Chapter 1 of the interior wiring.

(b) Control electric wire

As in KS C 3325 [Vinyl insulation wire for electric equipments (KIV)], use $2mm^2$ for its standard.

However, if relay and P.C terminal are M3.5, use a wire with $1.25mm^2$.

(c) However, for the place that has mobile electric equipments, use KS C 3303 (Rubber Code) and KS C 3319.

(d) For wires used for other special purpose, use the electric wires suitable for the standard.

(2) Wire to field equipment in control panel

(a) Electric power cable

KS C 3302

KS C 3128 [600V Polyethylene insulation wire (IE)]

KS C 3325

Use JS C 3328 [600V Class 2 Vinyl insulation wire (HIV)], and decide the standard according to the wiring standard.

(b) Control wire

Use KS C 3325, KS C 3319 and KS C 3330 (Vinyl insulation vinyl shield case cable for control), and the standards are $1.25mm^2$. However, for SOL and L/S control wire,

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use VCT cable 1.25mm^2 – three cores.

(c) However, for the place that has mobile electric equipments, use KS C 3303 (Rubber Code) and KS C 3319.

(d) For wires used for other special purpose, use the electric wires suitable for the standard.

4.4.2 Indication of electric wire

For marking of indicated wire number of expansion connection schematic and relative connection schematic, put wire mark tube (All white except for special indication of color) on control circuit wires of the electric device, and describe with an ink, which is difficult to erase. Tube shall be appropriate to circumference of the wire, and it shall be checked not to be separated from the wire. In addition, an outline of description of the wire number is as following. (Refer to Figure 6)

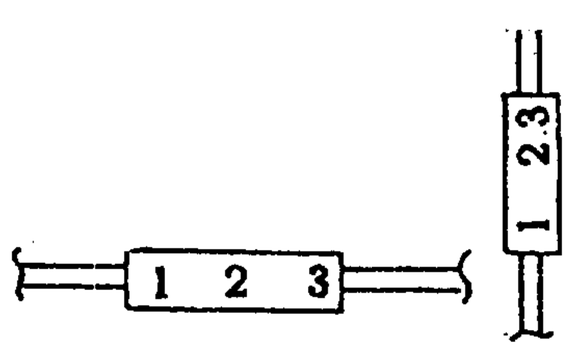

Figure 6

(1) For vertical direction connection, describe from bottom to top.

(2) For horizontal direction connection, from left to right.

4.4.3 Maker of electric wire

Use KS marked products. (Choose from products by 3 companies, Kumsung electric wires, Daehan electric wires, Kukjae electric wires, and use. However, for products, which are not made by the above 3 companies, use the products with KS mark.)

4.4.4 For matters except this specification, consult with a person in charge and decide.

4.4.5 Protection of wiring

Protect electric circuit wires in machineries and devices with wire duct, wire pipe,

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etc., and they have to satisfy the following criteria.

(1) In case of installing metallic wire duct, install more than 2m above from F.L.

(2) For wiring inside the control panel and the compartment, use semi-proof wire duct.

(3) As a structural metallic structure of half wire duct, for places required to secure the strength and hollow, the structure shall have one more layer of cover.

In addition, it shall prevent dusts, etc. from interfering by constructing with screws or other methods.

However, use quick fastener (Possible for easy construction and disassembly) for construction of cover.

(4) Structure of internal wire duct

Use inelastic plastics, which has a form (Structure) easy to be repaired.

(a) Follow the following Figure 7 for recommended form of the internal duct.

(b) Rate of wire dropping of the internal duct is within 80%.

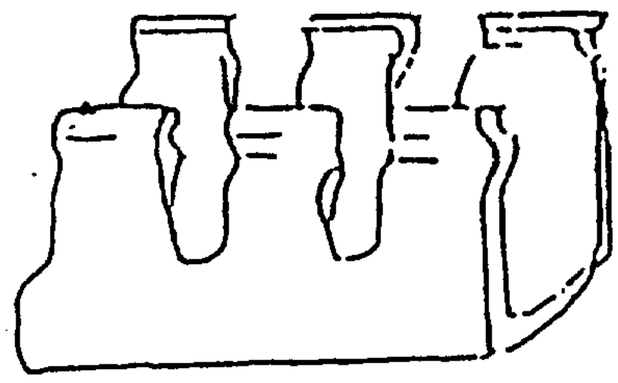

Figure 7

4.4.6 Terminal box

Structure of hollow part of the electric circuitry (If necessary) shall be able to prevent water, oil, dusts, etc. adhered on the outer part from entering into inside, and the surface area of the cover shall be more than 2500cm^2. Or, for the one installed at 2m above, which is more than 1000cm^2, shall be hinge type.

(1) Entrance and exit wiring as a terminal shall be designed from the bottom as priority, and if difficulty does not exist, it is possible to be designed from the side, however, it shall not be designed from the top.

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(2) On the terminal box, indicate the indicated number from the drawing.

4.4.7 Type of terminal

Use compressed terminal for the electric wire terminal as following usages, and do not use other methods such as lapping, etc.

(1) As a type of the compressed terminal, it is prohibited to use the one with an insulation cover.

(2) Shape of the terminal shall be ring-shaped. (For outer wiring) However, spare wire and column difference shall secure 20% of tolerance.

4.5 Installation of equipment and device

4.5.1 Arrangement of control panel

The installation of the control panel shall be performed at a position, where general operation, repairs, inspection, etc. can be conducted easily, after considering possible direction of repairs (Direction that the door of the control panel opens) while checking operation and state of the machine and device.

4.5.2 Mount of control machinery

Mounting standard for control device and wiring machinery inside the control panel and the compartment is as following.

(1) For the mounting of the machinery, construct by processing a screw in the middle plate, or make by rail method, which is possible to obtain confidence of machinery mount.

(2) For same kinds of the control machinery, arrange from left to right or from top to bottom by tracking the numbers as its usage.

(3) The control equipment shall not be attached on the door or the other side of the door.

(4) The distance between the mount machinery and the wire duct shall ensure more than 25mm for required length of the wiring.

4.5.3 Arrangement of electric motor

Install while satisfying the following conditions.

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(1) Conclusion of the electric motor shall be in a condition, which is easy for bolts, mounts of nuts, and repair work.

(2) Operations concerning the terminal box (Disconnection, etc.) shall be easy.

(3) Perimeters of the compartment containing the electric motor shall secure space, which can accommodate a motor one size larger, at a point of the design.

4.5.4 Arrangement of terminal box

For the arrangement of the terminal box, select a place, which is easy for the wiring construction and is not affected by vibrations, and install.

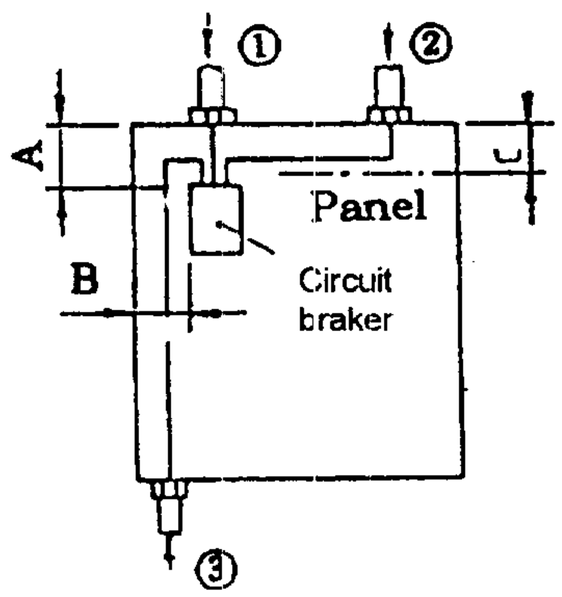
4.6 Wiring construction

4.6.1 Connection of 1st power

The 1st power shall be connected directly to a circuit braker of the control panel, and if it is impossible, indicate whether it is connected regardless of the circuit braker.

Table 7

In case of AC 220V



①~③ are example of positions that 1st power is inserted

Capacity of machine device(kW)		Instantaneous size (mm)		
Excess	Less than	A(More than)	B(More than)	C(More than)
	8	80	50	80
8	10	100	60	80
10	15	110	60	80
15	20	130	80	100
20	30	150	80	130
30	40	170	100	130
40	50	200	120	150
50	70	250	140	150
70	80	300	160	200
80	100	350	180	250

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4.6.2 Wiring of control panel and console

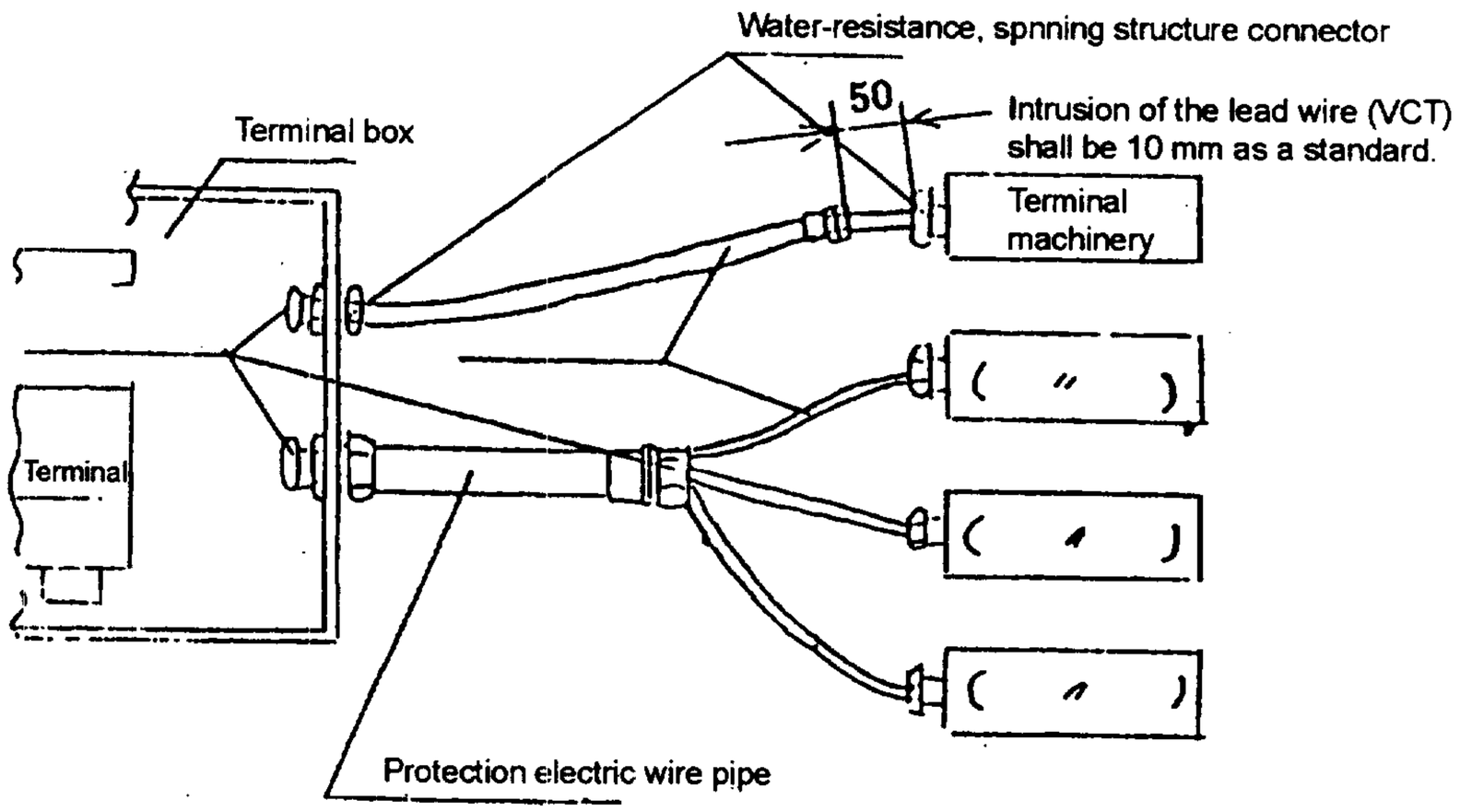
The wires of the control panel of construction machine and device and the desk-type console shall be constructed with about extra 2m of outer wiring, to prepare for modification (Change of layout, etc.).

4.6.3 Wiring of terminal machinery

(1) In principle, use vinyl keep cable (O-VCT 1.25mm^2) for wiring of the terminal machinery (Limit switch solenoid valves, etc.), and for places, that are considered to be harmed by welding sparks, etc., protect with flicker tube, etc.

(2) For the wiring of the terminal machinery, use 1-machine-1-wire-2-connectors as a principle.

(3) In order to accommodate the terminal machinery, put at least 6 spare wires (Increase according to the size of the box) in the terminal box, and in addition, the device of the terminal shall be installed on the outside of the device considering its maintenance.



(Prepare for water-resistance) In case that it is larger than 1mm, handle as the drawing above, and treat with flicker tube piping from the terminal to terminal box at that bottom.

Note Avoid the usage of the top and the side of the terminal box.

(4) Spare wire

(a) Spare wires shall at least be 6 and shall be more than 20% of wires used.

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(b) On the spare wires, attach an indication of destination with a tape and write the destination clearly.

Put the spare wires inside the wiring duct. Arrange as shown in the terminal map.

(5) Protect wiring of the cable (Lead wire) attachment electric equipment, according to exclusive protection of its equipment, up to its wiring pipe.

(6) Captire cable (VCT)

(a) Use a captire cable, which is larger than 1.25mm^2.

(b) Use a captire cable, which is oil-resistance.

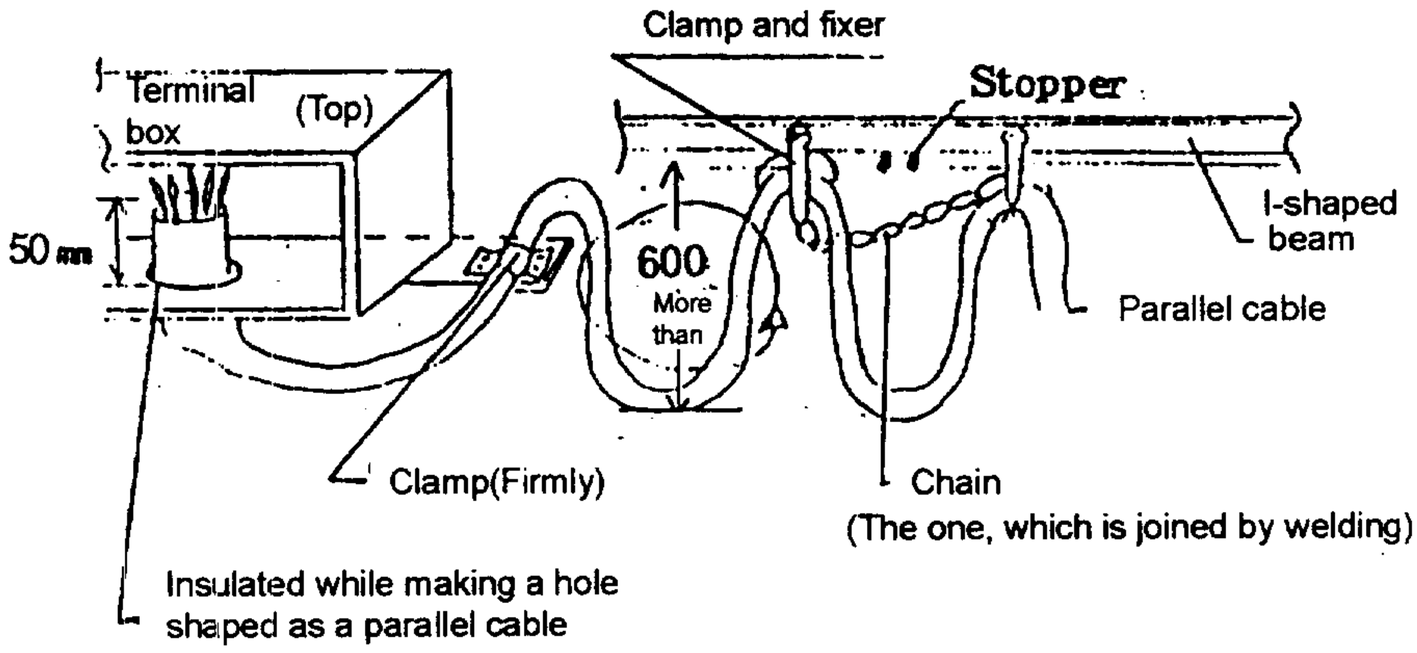
However, there is no limit for the one, which is installed by fixed type at 2m from the floor.

(c) Use VCT for fixation wiring part of the captire cable and B-VCT for mobile part.

4.6.4 Wiring for mobile equipment

It shall specify a piping method for purpose of protection of wires at wiring of the electric devices for mobile equipment.

(1) Pulley method



· For the items related in the drawing above, the both ends shall be finished with a method that the pipes are not mobile by metallic chains or mobile rail.

· When using the method above, do not use except the parallel cable.

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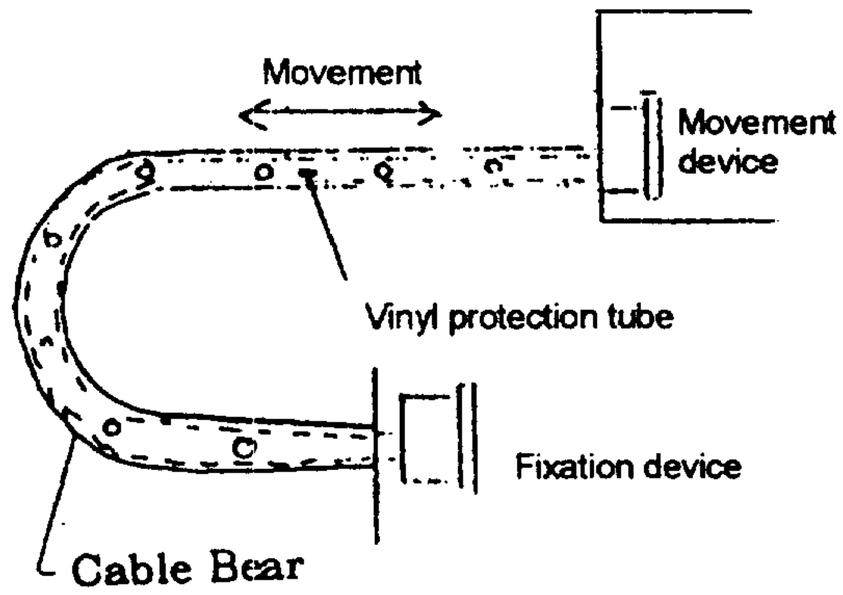

(2) Cable bear method

· The method above is used for a device, which movement speed is less than 60m/min (For the speed faster than 60m/min, persons in charge shall adjust)

· For curve R, take curve R of the wire pipe as a standard.

(More than 7 times that of the outer diameter of the wire pipe)

· Fore the wire pipe used, use the vinyl protection tube and follow the size below.

4.6.5 Separation limit

Do not separate from the 1st power of the circuit braker. However, for the illumination inside and partial illumination, it is allowed to locate near the separation braker as a special case.

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4.7 Partial illumination

4.7.1 Installation condition

The partial illumination, for safety and increase of operation efficiency of worker, besides an illumination of an entire factory among the operation machinery and device, shall be installed at places that are required to ensure the manufacturing processes and supervision. However, illuminations, which make rotating body to be seemed stopped, glimmering (Dazing), or make lights go into eyes of operator directly, are prohibited.

Remark Use a shield or diffuser for the illumination as a safety precaution.

4.7.2 Power and circuitry

Obtain partial illumination circuitry from the 1st power or 100V power for the illumination, make the circuitry powered regardless of the power for the machine and device, and power-saving circuitry shall be constructed.

Especially, when taking the power from the 1st power, certainly install a fuse.

(1) Turn out 10 minutes (installation of timer (TR)) after an automatic cycle run starts.

(2) Install 'Select Push Button Switch' to turn on during the automatic cycle run if necessary. However, it shall turn out 10 minutes after it is turned on.

(3) During the manual drive, it shall be turned on by changing the 'Select Push Button Switch' to ON position.

5. Joint

5.1 General

5.1.1 Joint

Including the connection of the ground wire, they shall not be loosened by a vibration of the whole.

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