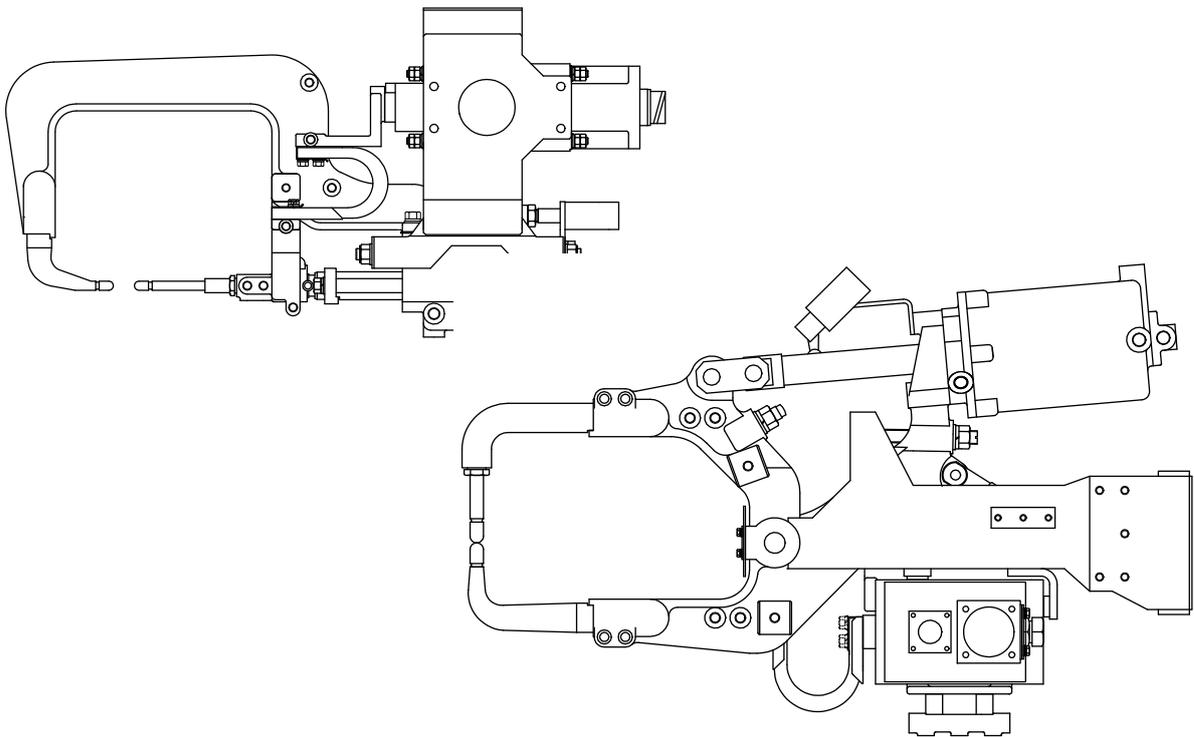


INSTRUCTION MANUAL

ROBOT GUN WITH TRANSFORMER

MODEL TGX & TGC



Before using this equipment, please read thoroughly the safety precautions for using the equipment safely. After reading the manual, keep it on hand to ensure effective use.



DENYO KOGYO CO., LTD.

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1. Safety Instructions

1-1. Introduction

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Read this instruction manual thoroughly at first and only then use the unit correctly.

- In order to guarantee safety, the installation, inspection, maintenance, and repairing of this welding unit should only be done by a person who either has the qualifications or has a thorough knowledge of welding units.
- In order to ensure safety, the operation of this welding unit should be done by a person who has fully understood the contents of this instruction manual and has the knowledge and technical skill to handle the unit safely.
- After reading this instruction manual, store it carefully in a place where it can always be referred to by all related persons. This instruction manual should be read again as and when the need arises.
- When there is any item that is not clear to you, please contact our sales office or representative's office. The addresses and telephone numbers of the offices to which you can direct your inquiries are given on the back cover of this manual.



1-2. Safety Precautions

- Read this instruction manual thoroughly before using the unit and use it correctly as described in this manual.
- The precautions given in this instruction manual not only let you use the unit safely but also prevents injury and loss to you or to other persons nearby.
- Although this welding unit has been designed and manufactured with sufficient considerations given to safety, it is essential that you always follow the precautions given in this instruction manual during the use of the unit. If these precautions are not followed during the use of the unit, it can cause accidents of serious human injury or even death of persons.
- If the handling of the unit is mistaken, it is possible that several different levels of losses or injury can occur. These levels are classified into the following three ranks in this instruction manual, and each of these levels are assigned separate attention attracting symbols which are given below along with the alarm indications given in signal terms. These attention symbols and signal terms are used exactly with the same meanings in the unit and the alarm labels.

Attention symbol	Description
 High Danger!	If the handling of the unit is mistaken, an extremely dangerous condition can occur which can lead to serious injury or death.
 Danger!	If the handling of the unit is mistaken, a dangerous condition can occur which can lead to serious injury or death.
 Caution!	If the handling of the unit is mistaken, a dangerous condition can occur which can lead to medium level injuries or minor injuries or may merely cause material losses.

The attention symbols are shown for the usual conditions.

The word "serious injury" mentioned above are those in which loss of sight, physical injury, burns (hot and cold burns), electric shock, broken bones, poisoning, etc., are caused, and can be of the type which leave after effects or of the type which require hospitalization or hospital visits over long periods. Further, the term "medium level injuries or minor injuries" mentioned above are those in which physical injury, burns, or electric shock are caused, although they do not require hospitalization or hospital visits over long periods. The term "material losses" used above refer to large losses such as breakage of property or damage to the equipment, etc.

In addition, the "Items that should be done" and the "Items that should NOT be done" during the handling of the unit are indicated as follows.

 Compulsory	The items that should be done. For example, "Grounding work", etc.
 Prohibited	The items that should NOT be done.

These symbols are shown for the usual conditions.

1-3. Items to be Followed for Ensuring Safety



Always follow the items given below in order to avoid serious human injury accidents.

1. Although this welding unit has been designed and manufactured with sufficient considerations given to safety, it is essential that you always follow the precautions given in this instruction manual during the use of the unit. If these precautions are not followed during the use of the unit, it can cause accidents of serious human injury or even death of persons.
2. Follow the governmental regulations and your own company's internal standards regarding the input side driving power supply works, selection of the location of installation, handling, storage, and piping of high pressure gases, storage of products after welding, and processing of waste materials, etc.
3. Make sure that persons do not come accidentally near the welding unit or near the place of welding work.
4. Make sure that persons wearing cardiac pace makers do not come near an operating welding unit or near the place of welding work, unless and until they have obtained permission from their doctors. The welding unit generates strong magnetic fields when power is supplied to it, and this magnetic field can have bad effects on the operation of cardiac pace makers.
5. In order to guarantee safety, the installation, inspection, maintenance, and repairing of this welding unit should only be done by a person who either has the qualifications or has a thorough knowledge of welding units.
6. In order to ensure safety, the operation of this welding unit should be done by a person who has fully understood the contents of this instruction manual and has the knowledge and technical skill to handle the unit safely.
7. Never use this welding unit for any purpose other than welding.



Always follow the items given below to avoid electric shock hazards.



- * Never touch any electrically live part other than the secondary conductor.
- * Never touch both ends of the secondary conductor at the same time.

1. Never touch any electrically live part other than the secondary conductor.
2. Get grounding work done for the welding unit according to governmental regulations (such as technical standards for electrical equipment) by an electrician having the qualifications to carry out such work.
3. During installation or maintenance inspection, always make sure that the input side power supply has been switched off by the switch in the power distributor box, and carry out the work at least five minutes after switching off the power supply. Even when the input side power supply has been switched off, there will be electrical energy stored in the capacitors, and hence carry out the work after confirming that there is no charge on the capacitors.
4. Never use cables that have insufficient voltage/current capacity, or that have been damaged, or whose conductors are exposed.
5. Make sure that the connecting part of cables are firmly tightened and covered with insulating sheath.
6. Never use the welding unit with its case or cover removed.
7. Never use torn or wet gloves. Always use dry and insulating gloves.
8. Carry out regular maintenance inspection, and use the unit after repairing the damaged parts.
9. For the cooling water, be sure to use good quality water with low sediment content and with a resistivity of 5000Ω-cm or better.
10. When procuring the cables, compressed air hose, water hose, etc., be sure to use items that can sufficiently bear the specified load or pressure.
11. When not being used, always switch off the power supply of all units.



Never place your hand or fingers in between the electrodes.



* Placing any part of your body such as a hand, fingers, or arm, etc., in between the electrodes can cause injury or broken bones.

1. Never place any part of your body such as a hand, fingers, or arm, etc., in between the electrodes.
2. Before switching on the power or the compressed air supply of the welding unit, always confirm the safety around the welding unit.
3. When not being used, switch off the power supply of all units, and shut off the supply of compressed air and cooling water.



Use protective wear to protect yourself and other persons from the dust (splashes and sputters) generated during welding and from noise.



- * The dust splashing out can cause damage to the eyes or burns on the body.
- * The noise can cause hearing abnormalities.

1. To protect your eyes from the dust splashing out during welding, always wear protective goggles.
2. Wear protective gloves, long sleeved clothes, and leather apron, etc., for protection.
3. Place protective curtains around the place of welding operation so that the dust does not hit other persons in the neighborhood.
4. If the noise level is high, use sound protection tools.



Always follow the items listed below to avoid fires and explosions.

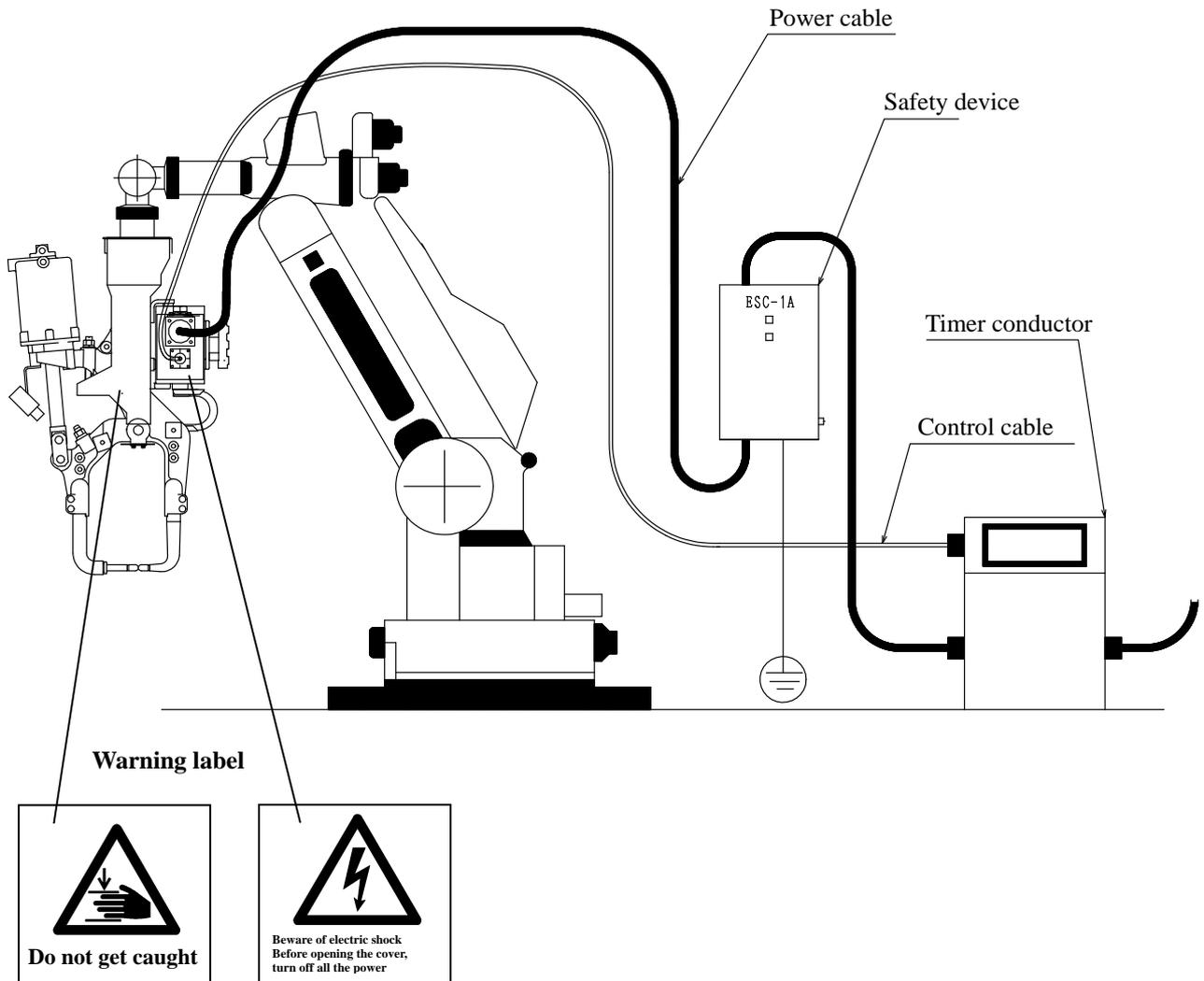


- * The dust splashing out during welding and the hot work piece immediately after welding can cause fires.
- * If there is any imperfect connections of cables, the heat generated at such parts can cause fires.

1. Remove all flammable materials in the neighborhood of the welding place so that the dust splashing out during welding does not fall on flammable materials. If it is not possible to remove flammable materials, cover them with non-flammable covers.
2. Never carry out welding near flammable gases.
3. Never take the hot work pieces immediately after welding near flammable materials.
4. Firmly tighten the connecting parts of cables and cover them with insulating sheath.
5. Place a fire extinguisher near the welding work place for use in an emergency.

1-4. Display of Dangers and Precautions

1. The power cables, which supply high voltages, are extremely dangerous. Be sure to use a safety device (ESC-1A) or an earth leakage breaker (ELB).
2. Always check normal water flow before welding.
3. Make sure that the transformer is grounded.



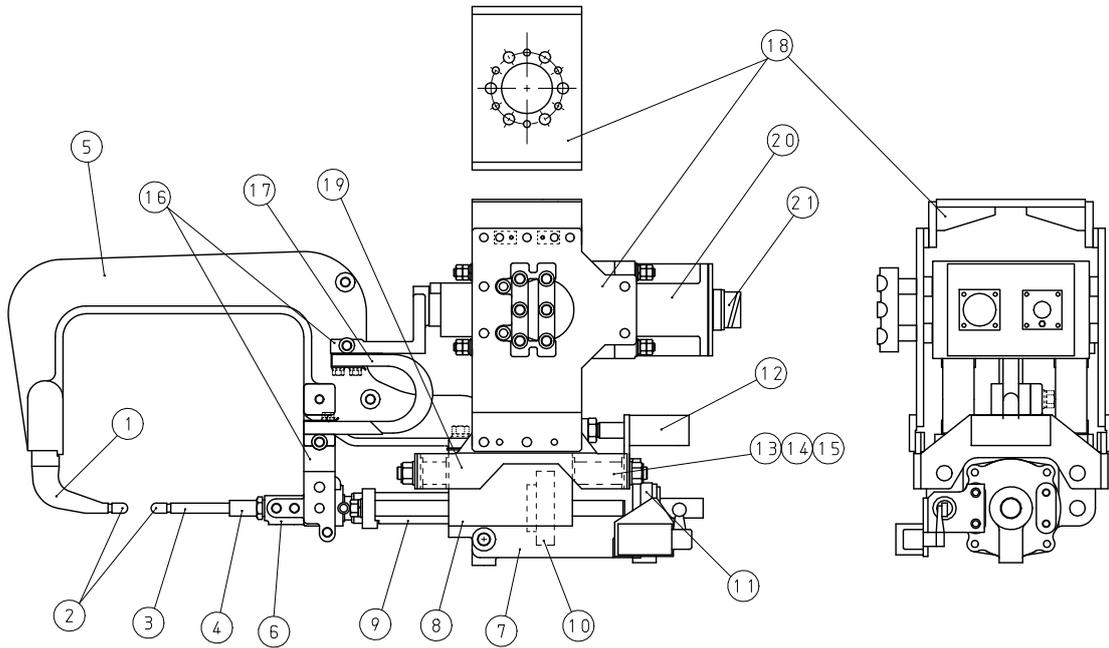
4. Do not splash water over the equipment.
5. Make sure that the power supply is turned off when approaching the robot.
6. Turn off the air stop valve and the power supply when dressing the tip.
7. Turn off power supply when replacing the cable.

Caution

A high voltage is supplied to the wires in the box. Anyone other than those who have knowledge of handling electrical equipment and have received training for handling this welding equipment is not allowed to touch the equipment.

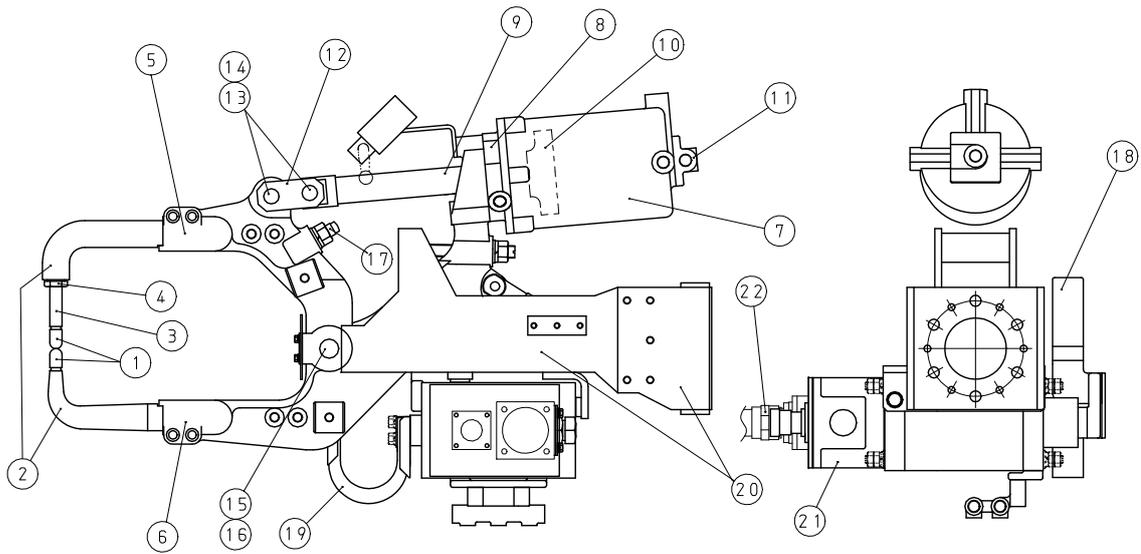
2. Name of the components of a Robot Gun with Transformer

2-1. Model C Gun (TGC Type)



No.	Name	No.	Name
1	Bend shank	12	Equalizing cylinder
2	Cap tip	13	Equalizing rod
3	Straight shank	14	Stroke bush
4	Screw adapter	15	Spring
5	Arm	16	Secondary conductor
6	Point holder	17	Flexible conductor
7	Cylinder	18	Braket
8	Bush	19	Flame
9	Piston rod	20	Welding transformer
10	Piston	21	Connector
11	Cylinder cover	22	

2-2. Model X Gun (TGX Type)



No.	Name	No.	Name
1	Cap tip	12	Link
2	Bend shank	13	Support axis pin
3	Straight shank	14	Insulation (support)
4	Screw adapter	15	Main axis pin
5	Arm (1)	16	Insulation (main)
6	Arm (2)	17	Stopper bolt
7	Cylinder	18	Secondary conductor
8	Cylinder cover	19	Flexible conductor
9	Piston rod	20	Bracket
10	Piston	21	Welding transformer
11	Terminal	22	Connector

3. Model C Robot Gun Maintenance and Inspection Procedure

To use a Model C robot gun in the optimum condition, periodic maintenance and inspection are necessary according to the usage condition. It is desirable to follow the inspection instructions provided below for each unit.

3-1. Unit Name

- (1) Electrode section (chips, shank, holder, and chip base)
- (2) Equalizing unit
- (3) Cylinder assembly
- (4) Secondary welding section (arm, point holder, flexible conductor, and terminal)

3-2. Timing of Maintenance and Inspection

No	Unit name	Main component name	Inspection timing	Compensated life span	Remarks
1	Electrode section	Chip Shank Chip base Holder	3000 to 5000 strokes	3000 to 10,000 One million strokes One million strokes One million strokes	There will be a substantial variation according to the usage condition.
2	Equalizing unit	Frame Stroke bush Equalizing rod Spring Cushion stopper Stopper bolt (for single-step stroke)	Million strokes or 3 months	3 ~ 5 million strokes 1.5 ~ 2 million strokes 1.5 ~ 3 million strokes 1.5 ~ 2 million strokes 1.5 ~ 2 million strokes	
3	Cylinder assembly	Cylinder Bush Piston Piston rod Seals Scraper Baffle bush Guide rod Cylinder cover	Million strokes or 3 months	3 ~ 5 million strokes 1.5 ~ 3 million strokes 3 ~ 5 million strokes 3 ~ 5 million strokes 1.5 ~ 3 million strokes 1.5 ~ 3 million strokes 1.5 ~ 3 million strokes 1.5 ~ 3 million strokes 3 ~ 5 million strokes	Cylinders with surface treatment
4	Equalizing cylinder	Equalizing cylinder	Million strokes or 3 months	3 ~ 5 million strokes	
5	Secondary welding section	Flexible conductor Terminal Secondary conductor Arm Point holder	50,000 strokes or 1 week (mainly tightening the screws to prevent sparks occurring due to electric corrosion)	0.5 million strokes 3 ~ 5 million strokes 3 ~ 5 million strokes 3 ~ 5 million strokes 3 ~ 5 million strokes	* * * * *

(*1) Those marked with (*) require cautions on electric erosion, heat generation, and discoloration.

(*2) Use shorter one of the number of strokes or period for the inspection timing.

3-3. Maintenance and Inspection of Each Unit

3-3-1. Maintenance and inspection of an equalizing unit

To use an equalizing unit in an optimum state, periodic inspection is necessary according to the usage condition. Following the instructions provided below for inspection.

[1] Periodic inspection

Check the following points at periodic inspection.

- (1) The equalizing unit function runs smoothly.
- (2) The spring effect has been installed and adjusted to a proper load and the lock unit is not loose.
- (3) Bolts and nuts are not loose.
- (4) The sections where the stopper bolt touches are free from cracks, deformation, or abrasion.
- (5) There are no scratch marks on the equalizing rod.

Check the sections indicated above. When detecting any abnormalities, tighten the loose parts again or disassemble the parts before starting processing.

[2] Disassembly inspection

When detecting any abnormalities in periodic inspection, check the following sections and take the necessary action.

No	Inspection section	Abnormality	Action
1	Equalizing unit	Cracks on the frame section	Check if the deficiency interferes with the facility functions during operation and replace with a new one.
		Cushion stopper deformation	If the cushion is deformed or damaged, replace with a new one.
		Damage of a stroke bush	Check if the seal is not cut off or the balls in the bearing are normal and replace with a new one if necessary.
2	Surface of equalizing rod	Shallow sliding scratch marks	No adverse influence on the operation (when the rod runs smoothly)
		Deep sliding scratch marks	Replace with a new one
3	Spring	Broken coil	Since an abnormal load is applied to the spring, replace with a spring and adjust the adjustment bolt to an appropriate load. Reduce the external load (cable load, etc.)
4	Stopper section (2-step strokes)	Deformation, abrasion, or crack of the section where the stopper bolt touches	A local deformation of about 2mm does not influence the operation. A local deformation of about 3mm requires replacement of the part. A noticeable crack or abrasion requires replacement with a new part.
5	Equalizing cylinder	Air leakage	When detecting air leakage, replace the seal or replace with a new cylinder.

[3] Notes on disassembling

- (1) When disassembling the unit, allocate an ample space free from any dust.
- (2) When disassembling an equalizing rod and a guide rod, replace U nuts with new ones, instead of reusing them.
- (3) Provide a marking-off line before disassembling the unit since engagement process is applied for thenock-pins connecting a frame and a bracket.

[4] Notes on assembling

- (1) Before installing an equalizing unit, wash the components thoroughly and check that the unit is free from any dust.
- (2) Lubricate thoroughly the rod, bush, and stock bush before assembling the unit.
- (3) When components are rusted, remove the any rust thoroughly.
- (4) Assemble the unit under a clean environment and make sure that no foreign objects enter into the unit.
- (5) When inserting an equalizing rod in the stroke bush, make sure the balls of the bearing are properly set on the corner of the rod and check that there is no damage on the seal after assembling.
- (6) Apply the necessary tightening torque when tightening bolts and nuts.

3-3-2. Maintenance and inspection of a cylinder

To use a cylinder in the optimum condition, it is necessary to inspect the cylinder periodically according to the usage condition. Inspection should be carried out according to the following items.

[1] Periodic inspection

Check the following items at periodic inspection.

- (1) Loose bolts and nuts for installation of a cylinder
- (2) Loose or abnormal flexure of the cylinder installation section
- (3) Whether the unit runs smoothly
- (4) External leakage
- (5) Loose fitting at the end of the rod, point holder, bolts, etc.
- (6) Abnormality in the stroke
- (7) Scratch marks on the rod

Check the above items and when detecting any abnormality, tighten the loose sections or disassemble and take the necessary measures.

[2] Inspection by disassembling the unit

When detecting any abnormality, check the sections indicated in the table below and take the necessary measures. However, all the defective seals should be replaced.

No	Inspection section	Abnormal state	Measure
1	Inside of a tube	Shallow sliding scratch mark	No adverse influence on the operation. Polish the surface lightly with paper.
		Deep sliding scratch mark	If the scratch mark cannot be removed, replace with a new one.
		Baking scratch mark	Replace with a new one
2	Rod sliding surface	Complies with the tube	
3	Inside of a bush	Shallow sliding scratch mark	No adverse influence on the operation. Polish the surface lightly with paper.
		The unsymmetrical abrasion is 0.2 or more Cracked bush	Replace with a new one. Check if an abnormal horizontal load is applied. As above
4	Surface of the piston	Shallow sliding scratch mark	No adverse influence on the operation. Polish the surface lightly with paper.
		Deep sliding scratch mark	When the fault cannot be fixed, replace with a new one. Examine thoroughly if the cylinder or the pipe contains a foreign object.
		Crack on the piston	Replace with a new one
		Abnormal abrasion of the piston	Check if any abnormal horizontal load is applied to the piston rod.
5	Engagement of piston rod	Looseness	Tighten the piston rod and check the condition of the baffle.
		Crack	Check if any inertia force is applied and replace with a new one.
6	Others	Check overall cracks in the baffle and screws worn excessively	

[3] Notes on disassembling

- (1) Provide an ample room for disassembling free from dust.
- (2) After removing a cylinder, protect the end of pipe and the edge of the rubber hose with cloth to prevent any dust from entering.
- (3) Disassemble the unit carefully so as not to make scratch marks the sliding section.
- (4) When disassembling a piston and a rod, check the engagement mode of the rod or piston carefully and make sure not to make scratch marks on the sliding section.

[4] Notes on assembling

- (1) Before installing a cylinder, wash the components thoroughly and check that the unit is free from any dust. Do not use a lubricant in which seals are immersed. However, do not use the same lubricant that is used for immersing seals.
- (2) Lubricate thoroughly the rod, bush, and stock bush before assembling the unit.
- (3) When components are rusted, remove the rust thoroughly.
- (4) Assemble the unit under a clean environment and make sure that no foreign objects enter into the unit.
- (5) When attaching a seal, make sure that the seal is not scratched.
- (6) When inserting a piston in the tube and a rod in a bush, make sure that the seal is not scratched.
- (7) Apply the necessary tightening torque when tightening bolts and nuts.

3-3-3. Maintenance and inspection of the secondary welding section

To use the secondary welding section in the optimum condition, periodic inspection is necessary according to the usage conditions. This inspection should be performed according to the following items. (Arm, secondary conductor, flexible conductor, and terminal)

[1] Periodic inspection

Check the following items at periodic inspection.

- (1) Loose bolts and nuts that are fixing the welding section
- (2) Whether the flexible conductor and secondary conductors are fixed to the specified positions (according to the various related drawings)
- (3) Loose bolts and nuts that are fixing the secondary cable and the connection section
- (4) Loose bolts and nuts
- (5) Whether the material that is insulating the + and - electrodes is burnt or melted
- (6) Presence or absence of cracks on an aluminum alloy arm at each 500,000 strokes after 3 million strokes

Check the above items and when detecting an abnormality, tighten the loose bolts and nuts or disassemble the unit and take the necessary measures.

[2] Inspection by disassembling the unit

When detecting any abnormality at periodic inspection, check the following items and take the necessary measures.

No	Inspection section	Abnormal state	Measure
1	Welding section of Arm, flexible conductor, and secondary conductor	Shallow electric corrosion	Smooth the surface with a file and polish with paper.
		Deep electric corrosion	Smooth the surface with machine process. When the section cannot be fixed by a machine process, use some other welding section. Alternatively, replace with a new one.
		Abnormal heat generation	Check the utilization rate, current value, water-cooling condition, the number of strokes and tact, and level the strokes. Check any abnormality in the insulation material and if the insulation material has been discolored, replace it.
2	Flexible conductor	Bend	Check for any interference in the work and tools during operation. If there is not fragmentation, the conductor can be used.
		Fragmentation	Fragmentation of 2 to 3 sheets does not influence the operation. However, cut off the section with scissors to prevent the fragmented sections leaking with other parts. If 5 or more sheets are fragmented, replace with new ones.
		Discoloration	When detecting discoloration due to heat generation, the utilization rate for the set flexible conductor exceeded the limit (150°C or more). Therefore, check the welding condition such as the utilization rate and review the setting.

[3] Notes on disassembling

- (1) When disassembling the unit, wipe off any spatters, oil, and dust attached to the unit in advance.
- (2) Before removing the secondary cable, provide a marking-off line on the gun and the cable installation section to enable replication of the assembly direction and angle.
- (3) Before removing the hoses (water and air), preparation for enabling replication of the IN/OUT and assembly directions is necessary.
- (4) When disassembling the secondary welding section, handle small components (insulation materials, bolts, nuts, and tools) with great care so as not to drop or leave them inside of the facility.
- (5) Before disassembling an arm, provide a mark-off line between chips in advance to prevent any drifts occurring between electrodes.
- (6) When disassembling the unit, make sure that the welding section is not scarred.

[4] Notes on assembling

- (1) Before assembling the unit, wash each component thoroughly, check the presence of any dust, and wipe off all the stains.
- (2) Check any discoloration and changes due to oxidization on the welding sections.
- (3) Assemble the unit under a clean environment and make sure that no foreign objects enter into the unit.

4. Model X Robot Gun Maintenance and Inspection Procedure

To use a Model X robot gun in the optimum condition, periodic maintenance and inspection are necessary according to the usage condition. It is desirable to follow the inspection instructions provided below for each unit.

4-1. Unit Name

- (1) Electrode section (chips, shank, holder, and chip base)
- (2) Cylinder assembly
- (3) Secondary welding section (fixed, movable arm, flexible conductor, and terminal)
- (4) Main shaft section and spindle section

4-2. Timing of maintenance and inspection

No	Unit name	Main component name	Inspection timing	Compensated life span	Remarks
1	Electrode section	Chip Shank Chip base holder Screw adaptor Holder	3000 to 5000 strokes	3000~10,000 One million strokes One million strokes One million strokes One million strokes	There will be a substantial variation according to the usage condition.
2	Cylinder assembly	Cylinder Bush Piston Piston rod Various seals Scraper Cylinder cover	300,000 strokes or 2 months	1 ~ 1.5 million strokes 0.75 ~ 1.5 million strokes 1 ~ 2 million strokes 1 ~ 2 million strokes 1 ~ 1.5 million strokes 1 ~ 1.5 million strokes 2 ~ 3 million strokes	Cylinder without surface treatment
3	Secondary welding section	Fixed arm Movable arm Flexible conductor Terminal	50,000 strokes or 1 week (mainly tightening the screws to prevent sparks occurring due to electric corrosion)	3 ~ 5 million strokes 3 ~ 5 million strokes 0.5 ~ 1 million strokes 3 ~ 5 million strokes	
4	Main shaft Spindle	Bracket Main shaft and spindle Insulation board Bearing	300,000 strokes or 2 months	2 ~ 3 million strokes 2 ~ 3 million strokes 0.5 ~ 1 million strokes 1 ~ 1.5 million strokes	Needle bearing

4-3. Maintenance and Inspection of Each Unit

4-3-1. Maintenance and inspection of a cylinder

See the description of the maintenance and inspection of the model C cylinder.

4-3-2. Maintenance and inspection of the secondary welding section

See the description of the maintenance and inspection of the model C cylinder.

4-3-3. Maintenance and inspection of a main shaft and a spindle

To use a main shaft and a spindle in the optimum condition, periodic inspection according to the usage conditions is necessary. It is desirable to following the instructions provided below for the inspection.

[1] Periodic inspection

Check the following items at periodic inspection.

- (1) There are any deformation or cracks on the bracket.
- (2) There is a looseness of 1.5mm or more between the electrodes of the fixed arm and movable arm.
- (3) There is a point position error of 2.0mm or more when the bracket is fixed.
- (4) The insulation board is burnt by the spatter.
- (5) Loose bolts and nuts

Check the above items and when detecting any abnormality, tighten the bolts and nuts or disassemble the unit and take the necessary measure.

[2] Inspection by disassembling the unit

When detecting any abnormality, check the following sections and take the necessary measures.

No	Inspection section	Abnormal state	Measure
1	Bracket	Deformation or crack on the bracket	Check if the bracket interferes with the facility function during operation and if so, replace with a new one. When there is interference with the facility, make the necessary adjustments
		Drift of strokes	Check if the insulation board or the spacer is worn out. If so, replace with a new one of the same size. If the bracket arm is worn out, replace with a thick insulation board.
2	Stroke position	Drift of electrode core	Check abrasion of the insulation board of used in the fixed arm and the movable arm.
3	Main shaft and spindle	Shallow scratch mark	No adverse influence on the operation. Polish with paper lightly.
		Deep scratch mark	When the scratch mark cannot be fixed, replace with a new one.
		Abrasion by electric corrosion	Check the leaked position between the + and - electrodes and replace the insulation board with a new one or remove the cause such as spatter.
		Crack	Replace with a new one.
4	Bearing	Malfunction	Check abrasion by the rotation condition, galling, impression, and presence of foreign objects such as spatter and if the problem is light malfunctioning, replace with a new one.
5	Insulation board	Damage by burn	When there is a leakage between the + and - electrodes due to the damage by burn caused by spatter, replace with a new one. Re-design the welding conditions to prevent any spatter. Install a spatter cover.
		Abrasion	Check any welding quality problems such as stroke position drift and electrode core drift and replace with a new one.

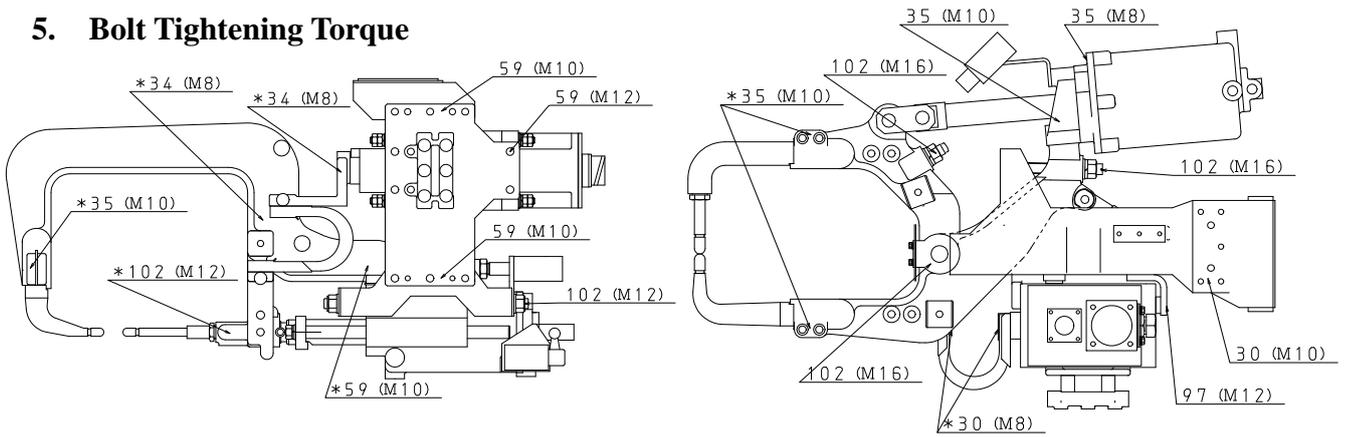
[3] Notes on disassembling

- (1) Before disassembling the unit, wipe off all the spatters, oil, and dusts that are attached.

[4] Notes on assembling

- (1) Clean thoroughly each component and wipe off any stains.
- (2) Before assembling, apply ample lubricants on the main shaft, spindle, and bearing.
- (3) When components are rusted, remove the rust completely, particularly any rust on the sliding section and rotating section.
- (4) Assemble the unit under a clean environment and make sure that no foreign objects enter in the unit.
- (5) Assemble the shaft and spindle carefully so as not to scratch the bearing and insulation board.
- (6) Tighten the main shaft, spindle, and nuts by adjusting the degrees to eliminate any core drift and rattle, achieving a smooth operation.

5. Bolt Tightening Torque



(Unit: N·m)

Those sizes in () indicate bolt sizes.

Caution

- The torques indicated above must be observed for the sections marked with * by using a tension wrench at maintenance.
- The torque to be set varies according to the bolt diameter and the material used.
- For the bolt intensity classification, use 12.9T for hexagon socket head cap screws and 10.9T for hexagonal head bolts.
- Set bearing stress 58.8MPa (6kg·f/mm²) for baking.
- Set bearing stress 187.8MPa (11kg·f/mm²) for epoxy.

Torque list

Size	Bolt shape With Washer	Standard torque N·m (kg·f·cm)	Torque for aluminum N·m (kg·f·cm)	Torque for baking N·m (kg·f·cm)	Torque for epoxy N·m (kg·f·cm)
M5	Hexagonal head bolt	6.8- 7.6 (69- 77)	6.8- 7.6 (69- 77)		
	Hexagon socket head cap screw	7.9- 8.8 (80- 89)			
M6	Hexagonal head bolt	11.5- 12.8 (117- 130)	11.1- 12.3 (113- 125)	4.8- 5.2 (48- 53)	8.8- 9.8 (89- 99)
	Hexagon socket head cap screw	13.3- 14.8 (135- 150)			
M8	Hexagonal head bolt	28.2- 31.3 (287- 319)	21.1- 23.4 (215- 238)	9.1- 10.1 (92- 102)	16.6- 18.5 (169- 188)
	Hexagon socket head cap screw	32.9- 36.5 (335- 372)			
M10	Hexagonal head bolt	55.9- 62.2 (570- 634)	32.0- 35.6 (326- 326)	13.7- 15.3 (139- 155)	25.2- 27.9 (256- 284)
	Hexagon socket head cap screw	65.4- 72.6 (666- 740)			
M12	Hexagonal head bolt	96.7- 107.5 (986-1096)	48.7- 54.1 (496- 551)	16.9- 18.8 (172- 191)	30.9- 34.4 (315- 350)
	Hexagon socket head cap screw	113.0- 125.6 (1152-1280)			
M16	Hexagonal head bolt	244.2- 271.4 (2490-2767)	59.2- 65.8 (603- 670)	25.4- 28.24 (258- 287)	46.5- 51.6 (474- 526)
	Hexagon socket head cap screw	285.2- 316.9 (2908-3231)			
M20	Hexagonal head bolt	476.9- 530.0 (4863-5404)	90.0- 99.9 (917- 1018)		

6. Check Sheet

1. Monthly and Half-Yearly Checking Sheet

Machine condition	Mark
Good	○
No Good	×
Improvement and recovery	⊗

Line name		GUN NO.	
Machine No.		GUN NO.	

No	Item	Checkpoint	Interval	1	2	3	4	5	6	7	8	9	10	11	12
1	Gun main unit	Cleaning and removal of spatters	1/month												
2	Gun main unit	Tightening condition of each bolt	1/month												
3	Welding stroke position	No flexure, slippage, core drift abnormality	1/month												
4	Cylinder	Runs smoothly No abnormality in stroke	1/month												
5	Equalization	Correct balance	1/month												
6	Each rod	No damage	1/month												

No	Item	Checkpoint	Interval	Front stage						Back stage					
1	Equalizing section Spindle	Re-greasing	1/6 months												
2	Cylinder	Seal Scraper	1/6 months												
3	Gun – transformer	Insulation resistance	1/6 months												
4	Arm – body	Insulation resistance	1/6 months												
5	Spindle	Insulation resistance	1/6 months												

2. Weekly Checking Sheet

Machine condition	Mark
Good	○
No Good	×
Improvement and recovery	⊗

Line name		GUN NO.	
Machine No.		GUN NO.	

No	Item	Checkpoint	Interval	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	
1	Gun main unit	Check if there is any damage.	1/week																											
2	Valve LS, etc.	Check if there is any damage. Check the setting position.	1/week																											
3	Secondary conductor section	Check the bolts on the joints and if loose, tighten the bolts.	1/week																											
4	Primary feeding section	Check if there is any damage and any loose sections.	1/week																											
5	Electrode (chip)	Electrode drift MAX 1.6mm	1/week																											
6	Shunt	The sectional area of the shunt is 2/3 or more.	1/week																											

No	Item	Checkpoint	Interval	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	
1	Gun main unit	Check if there is any damage.	1/week																											
2	Valve LS, etc.	Check if there is any damage. Check the setting position.	1/week																											
3	Secondary conductor section	Check the bolts on the joints and if loose, tighten the bolts.	1/week																											
4	Primary feeding section	Check if there is any damage and any loose sections.	1/week																											
5	Electrode (chip)	Electrode drift MAX 1.6mm	1/week																											
6	Shunt	The sectional area of the shunt is 2/3 or more.	1/week																											



3. Daily Checking Sheet

Machine condition	Mark
Good	○
No Good	×
Improvement and recovery	⊗

Line name		GUN NO.	
Machine No.		GUN NO.	

No	Item	Check-point	Interval	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	
1	Electrode (chip)	Edge of electrode MAX φ8mm	1/shift																																
2	Air circuit	Check the air pressure.	1/shift																																
3	Air circuit	No air leakage	1/shift																																
4	Cooling water	Check the flow rate.	1/shift																																
5	Cooling water	Check water leakage.	1/shift																																
6	Primary cable	The primary cable does not interface with tools during operation.	1/shift																																
7	Entire gun	Abnormal heat generation 110°C or less	1/shift																																
8	Shunt	Abnormal heat generation 70oC or less	1/shift																																



■ Cautions on use

- (1) Read the instruction manual before using the equipment.
- (2) Do not insert hands, etc. between electrodes of the gun when connecting the power supply to the controller.
- (3) Check, clean, re-tighten, and re-lubricate each section, and replace perishable items as required according to the use frequency.
- (4) Any questions regarding product should be address to our sales staff or the head office or sales office indicated below.
- (5) We are not liable for theft and crime prevention of the gun.

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DENYO KOGYO CO., LTD.

Head Office and Plant: Kamanashi Kinzoku Kogyo Danchi, 1648-5, Showa-cho Tuijiarai ,
Nakakoma-gun, Yamanashi Prefecture 409-3853
Tel: 055-275-6811 (main number)
Fax: 055-275-6810

Kanagawa Office: Samukawa-cho Okada 4-6-31, Koza-gun, Kanagawa Prefecture 253-0105
Tel: 0467-75-9251 (main number)
Fax: 0467-75-9253

Nagoya Office: Kamiya-cho 1390-169, Kasugai-shi, Aichi Prefecture 480-0304
Tel: 0568-88-0403 (main number)
Fax: 0568-88-6337

North Kanto Office: 2311-15 Simogurimachi, Utunomiya-shi, Tochigi
Prefecture 321-0923
Tel: 028-657-8022
Fax: 028-657-8023

