



KUBOTA Corporation

Pipe Systems Global Marketing & Sales Dept.

1-3, Kyobashi 2-chome, Chuo-ku, Tokyo, 104-8307, JAPAN

Tel : +81-3-3245-3111

Website : <https://www.kubota.com/products/ironpipe/>

E-mail : kbt_g.ironpipe@kubota.com

KUBOTA Membrane USA Corporation

ERDIP Dept. / LA Office

3528 Torrance Boulevard, Suite 112,

Torrance, CA 90503, USA

Tel : +1-424-358-5200

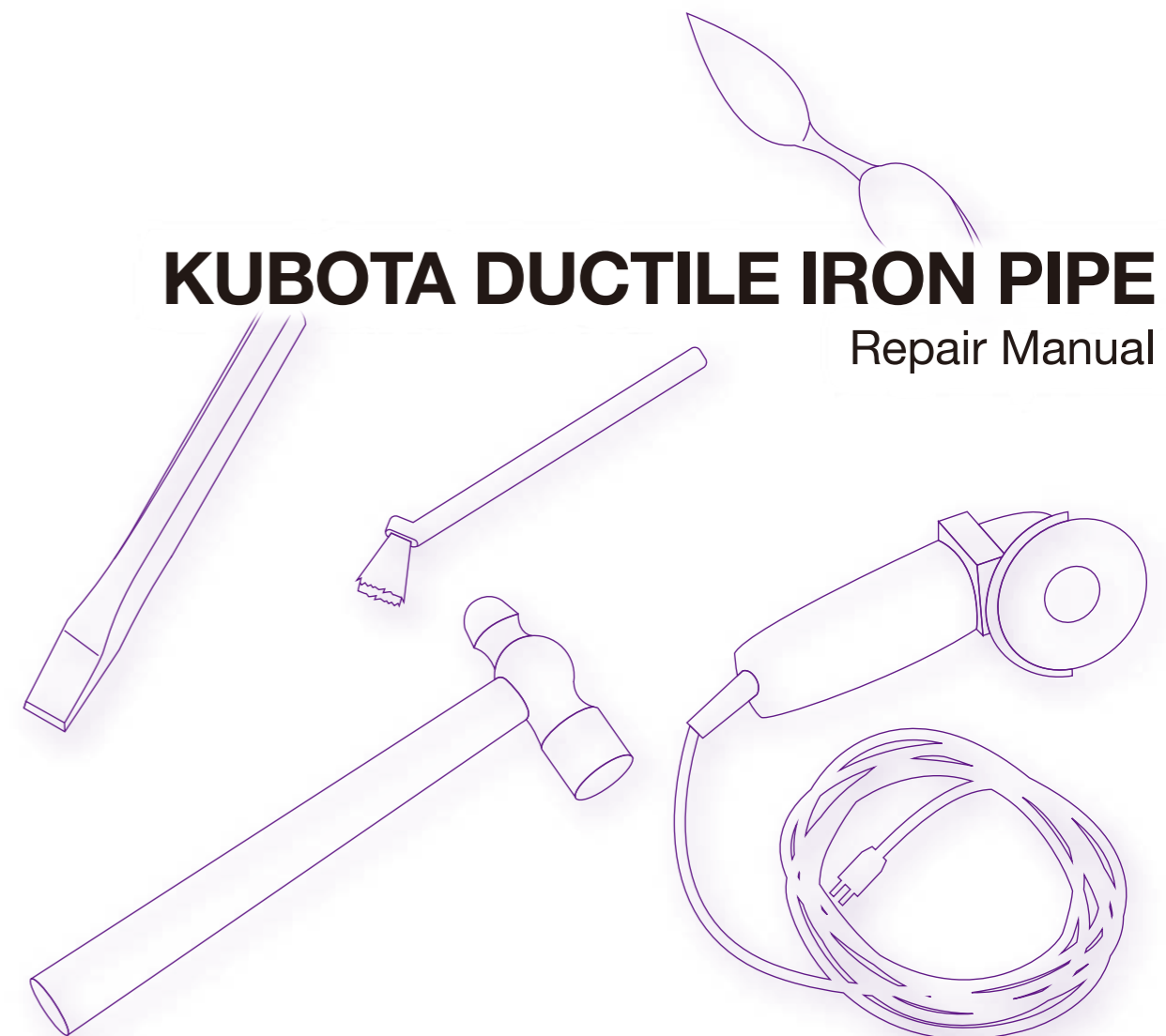
Website : <https://www.kubota-membrane.com/page/erdip>

E-mail : kbt_g.erdip-usa@kubota.com

Ductile Iron Pipes
WEBSITE



facebook



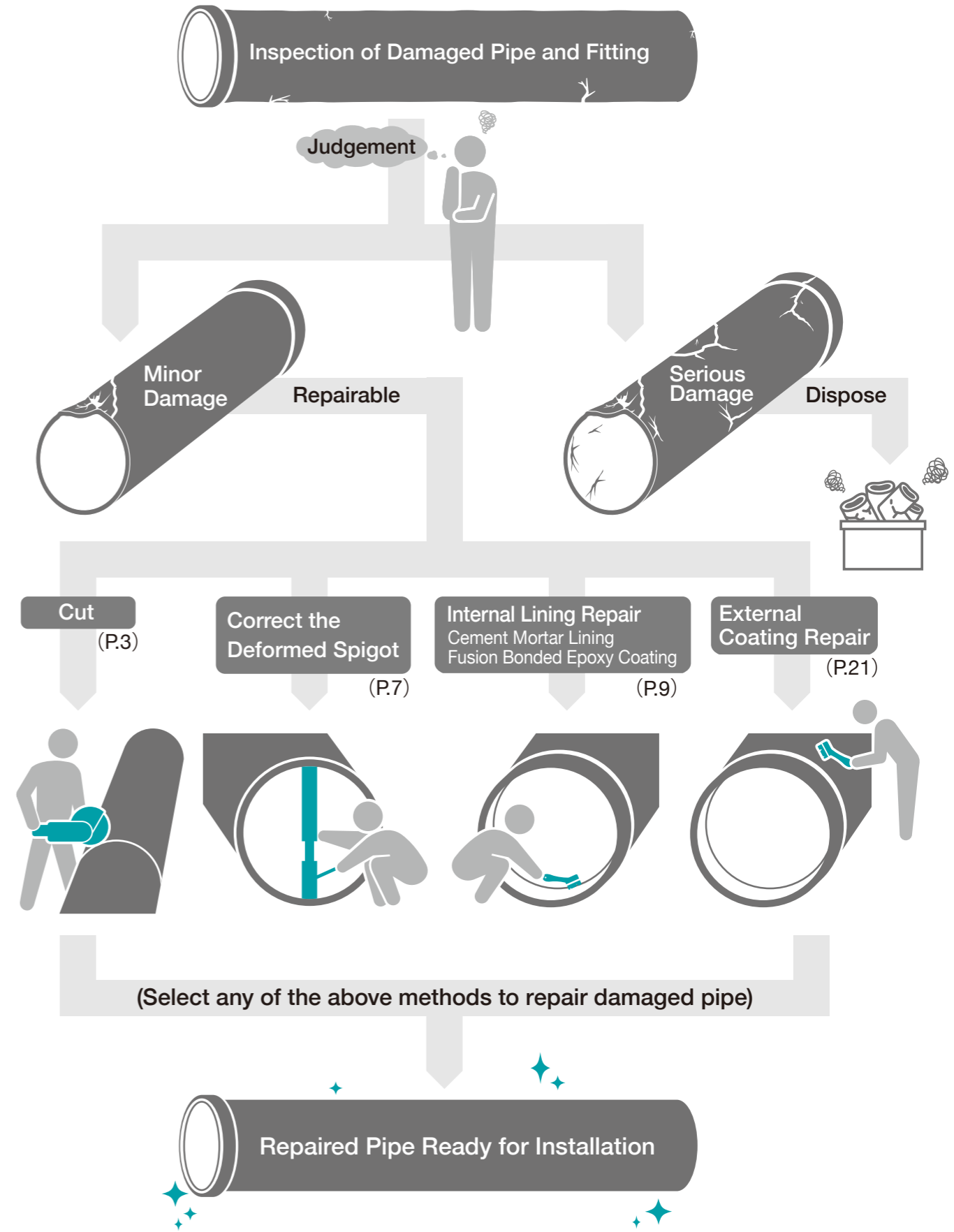
KUBOTA DUCTILE IRON PIPE

Repair Manual

Damage to ductile iron pipes, caused by improper handling during transportation, may be rectified by applying certain repair procedures.

This manual has been compiled to offer some quick and effective methods of repairing damaged pipes. Although these methods may change according to site conditions, Kubota would advise the site supervisor to follow the repairs outlined in this manual.

The ultimate purpose of this manual is to ensure that the pipes provide lasting service and stand up to the heavy usage regardless of the minor maintenance required.

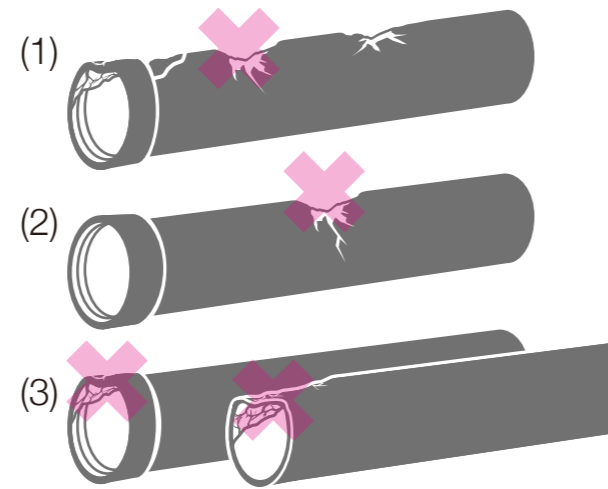


CUTTING OF PIPE

Inspection

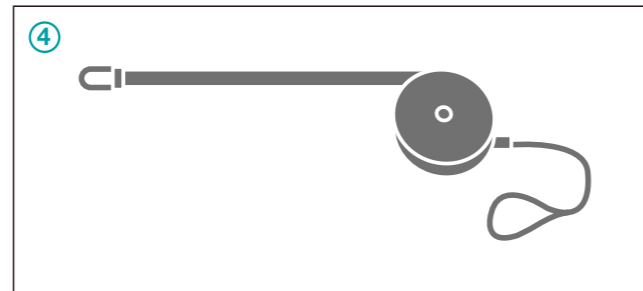
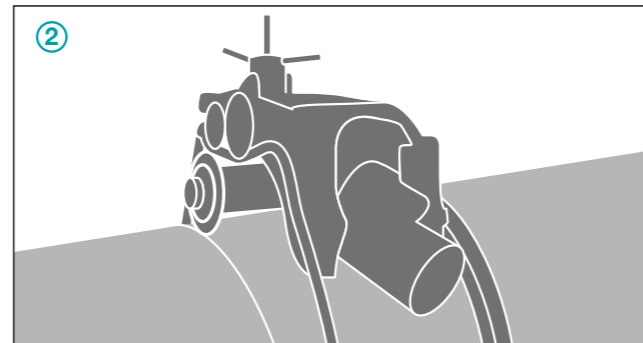
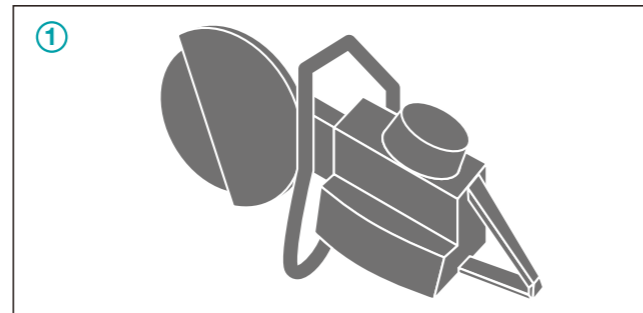
Before cutting, carefully inspect the pipe:

- (1) If the pipe is seriously damaged
→ reject the pipe.
- (2) If there is a hole or crack in the pipe body
→ reject or cut off the damaged portion.
- (3) If the socket is deformed or the spigot is seriously damaged
→ cut off the damaged portion.



Tools and Equipment

- Engine driven cutter (Picture ①)
or Power operated metal saw (Picture ②)
- Portable disc grinder (Picture ③)
- Measuring tape (Picture ④)



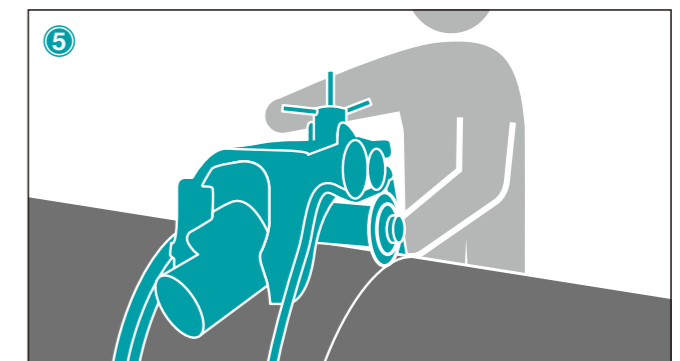
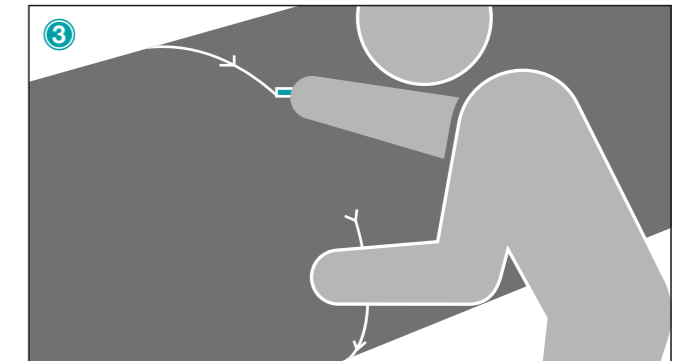
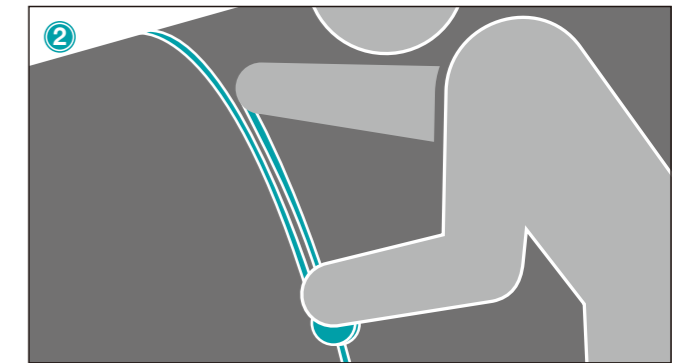
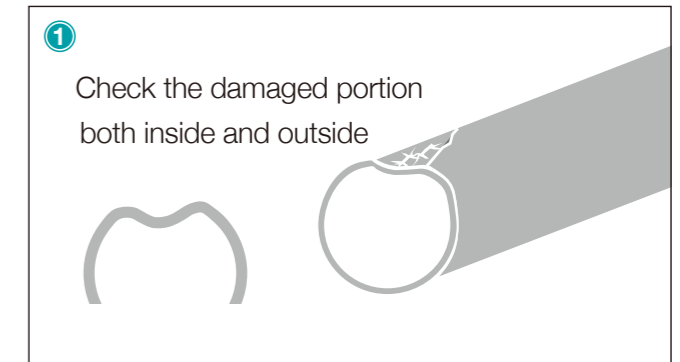
Procedure

(1) **Identify** the deformed portion (Picture ①).

(2) **Measure** the circumference with a measuring tape (Picture ②).
• Dimension must be within the tolerance in Table 1 of page 6. If it is not, find a portion that satisfies the value.

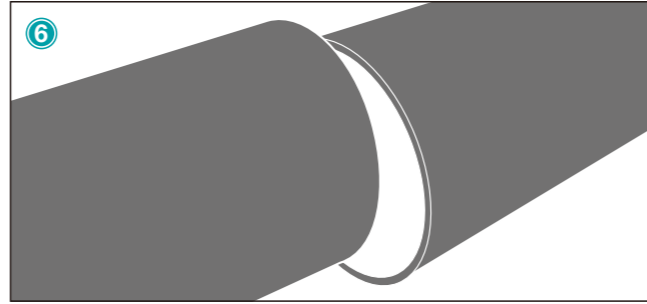
(3) **Draw** a line to indicate where to cut (Picture ③).

(4) **Cut** the pipe along the line using an engine driven cutter (Picture ④) or a power operated metal saw (Picture ⑤).



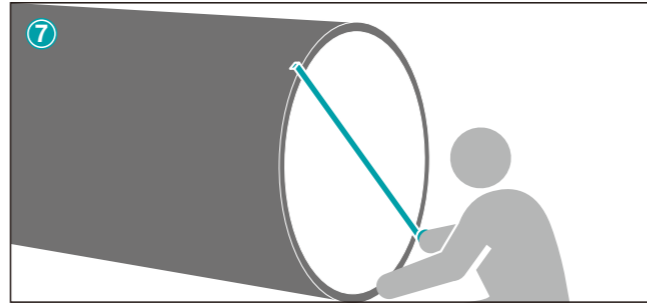
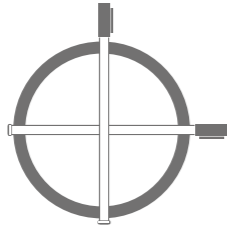
CUTTING OF PIPE

(5) **Completion** of cutting (Picture ⑥).

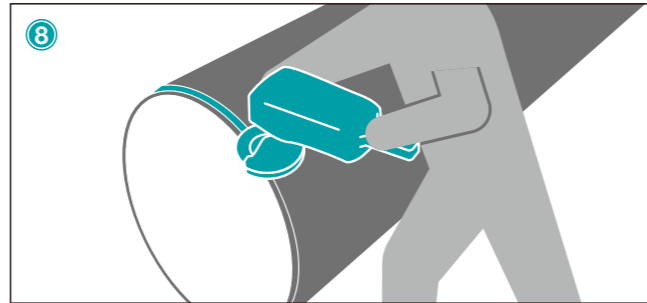


(6) **Measure** the outside diameter in two or more different directions (Picture ⑦).

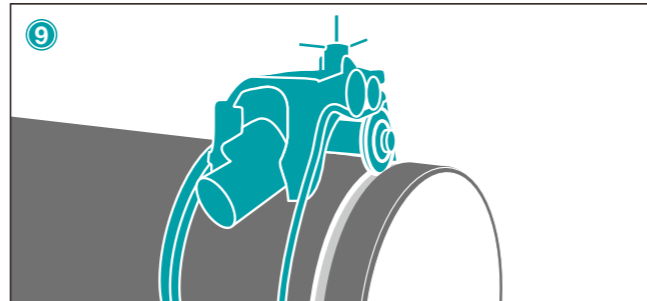
*The dimensions must be within the tolerance in Table 1 (In case of JWWA pipe size)/ Table 2 (In case of AWWA pipe size) of page 6. If it is not in the tolerance, correct the outside diameter according to the procedure "Corrections of Deformed Spigot" (See page 7, 8). (JWWA:Japan Water Works Association)



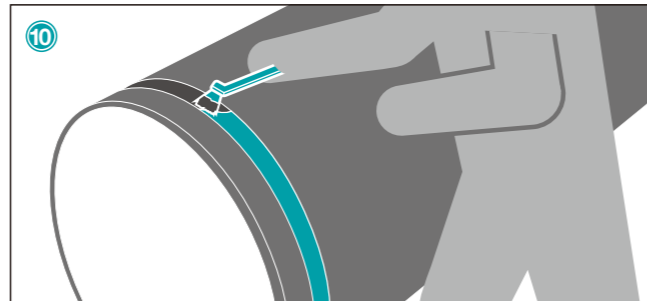
(7) **Bevel** the edge of the spigot end with portable disc grinder (Picture ⑧).



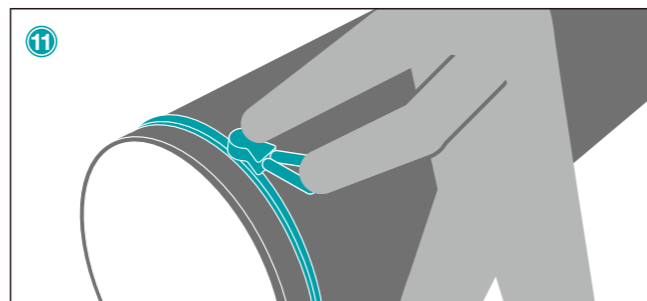
(8) **Make** the groove with Power operated metal saw same as original pipe (Picture ⑨).



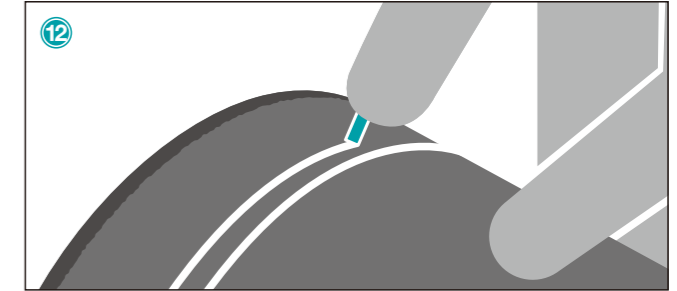
(9) **Clean** the surface of cutting portion, then apply the epoxy paint (Picture ⑩).



(10) **Make** the spigot projection as per assembling manual (Picture ⑪).



(11) **Draw** white lines for assembling same as the original spigot (Picture ⑫).



Tolerances on Diameter and Circumference (JWWA G113)

Table 1 (JWWA Pipe Size) (Unit:mm)

DN	Outside diameter		Allowable circumferential length		
	(inch)	Nominal			Tolerance
75	3	93.0	+1.5	-1.5	287.5 ~ 296.9
100	4	118.0	+1.5	-1.5	366.0 ~ 375.4
150	6	169.0	+1.5	-1.5	526.2 ~ 535.6
200	8	220.0	+1.5	-1.5	686.4 ~ 695.9
250	10	271.6	+1.5	-1.5	848.5 ~ 858.0
300	12	322.8	+1.5	-2	1007.8 ~ 1018.8
350	14	374.0	+1.5	-2	1168.7 ~ 1179.7
400	16	425.6	+1.5	-2	1330.8 ~ 1341.8
450	18	476.8	+1.5	-2	1491.6 ~ 1502.6
500	20	528.0	+2	-2	1652.5 ~ 1665.0
600	24	630.8	+2	-2	1975.4 ~ 1988.0
700	28	733.0	+2	-3	2293.4 ~ 2309.1
800	32	836.0	+2	-3	2616.9 ~ 2632.7
900	36	939.0	+2	-3	2940.5 ~ 2956.2
1000	40	1041.0	+2	-3	3261.0 ~ 3276.7
1100	44	1144.0	+2	-4	3581.4 ~ 3600.3
1200	48	1246.0	+2	-4	3901.9 ~ 3920.7
1400	56	1400.0	+2	-4	4385.7 ~ 4404.5
1500	60	1554.0	+2	-4	4869.5 ~ 4888.3
1600	64	1650.0	+2	-4	5171.1 ~ 5189.9
1650	66	1701.0	+2	-4	5331.3 ~ 5350.1
1800	72	1848.0	+2	-4	5793.1 ~ 5811.9
2000	80	2061.0	+2	-4	6462.3 ~ 6481.1
2100	84	2164.0	+2	-4	6785.8 ~ 6804.7
2200	88	2280.0	+2	-4	7150.3 ~ 7169.1
2400	96	2458.0	+2	-4	7709.5 ~ 7728.3
2600	104	2684.0	+2	-4	8419.5 ~ 8438.3

Note : Minus tolerance on outside diameter can be increased additionally minus 0.5 mm for DN≤600 and plus minus 1 mm for DN>600 when the measured circumference of the pipe is within the allowable value.

Tolerances on Diameter and Circumference (AWWA C151)

Table 2 (AWWA Pipe Size) Unit:mm (inch)

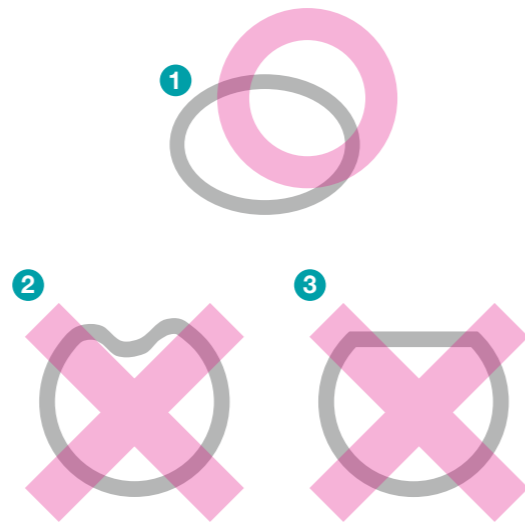
DN	Outside diameter		Allowable circumferential length		
	(inch)	Nominal			Tolerance
6		175.3	1.5	-1.5	546.0 ~ 555.4 (21.49) ~ (21.86)
		(6.90)	(0.06)	-(0.06)	
8		229.9	1.5	-1.5	717.5 ~ 727.0 (28.25) ~ (28.62)
		(9.05)	(0.06)	-(0.06)	
12		335.3	1.5	-1.5	1048.7 ~ 1058.1 (41.22) ~ (41.65)
		(13.20)	(0.06)	-(0.08)	

CORRECTION OF DEFORMED SPIGOT

Inspection

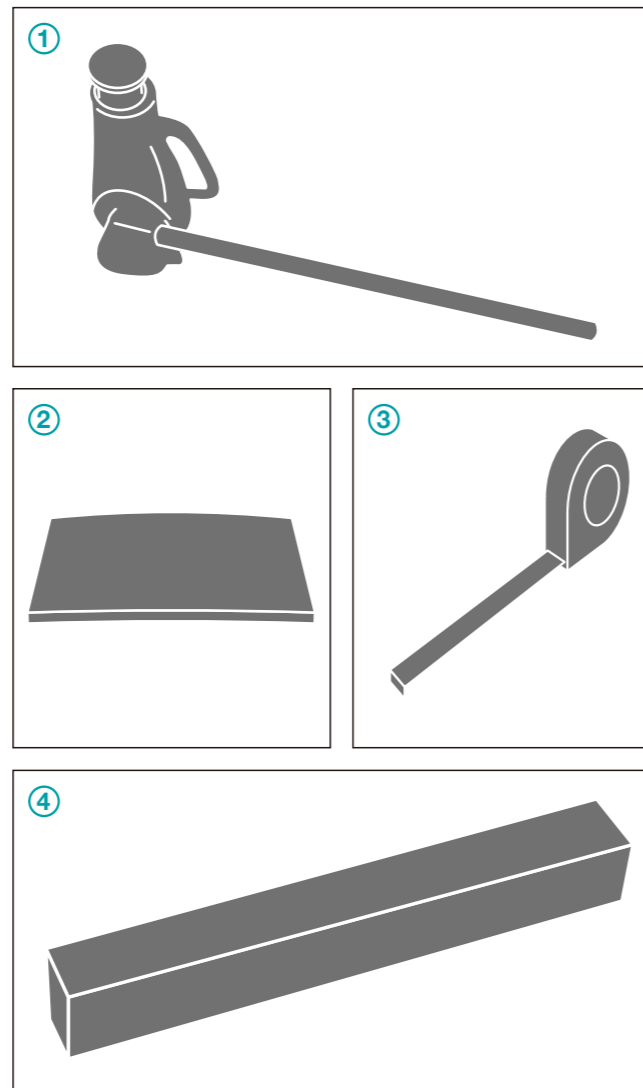
Although ductile iron pipes are tough and strong, they may be accidentally deformed by improper handling. However minor deformations can be repaired by the following method.

Generally only ellipse on the spigot end can be corrected (Picture 1). However, if the spigot is severely deformed and concave (Picture 2) or extensively flat (Picture 3), generally it can not be corrected. In such a case, the deformed portion need to be cut.



Tools and Equipment

- Hydraulic jack (Picture 1)
- Rubber sheet/iron plate/wood (Picture 2)
- *This is for prevention of lining damage.
- Measuring tape (Picture 3)
- Wood block (Picture 4)

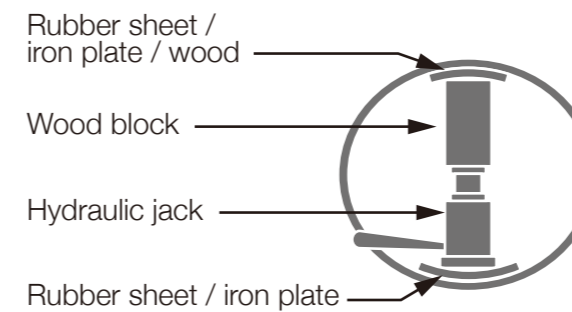


CORRECTION OF DEFORMED SPIGOT

Procedure

(1) **Place** the pipe so that the minimum diameter point is located vertically (Picture 1).

(2) **Place** the hydraulic jack, a wood block and rubber sheets/iron plates in the pipe (Picture 2).

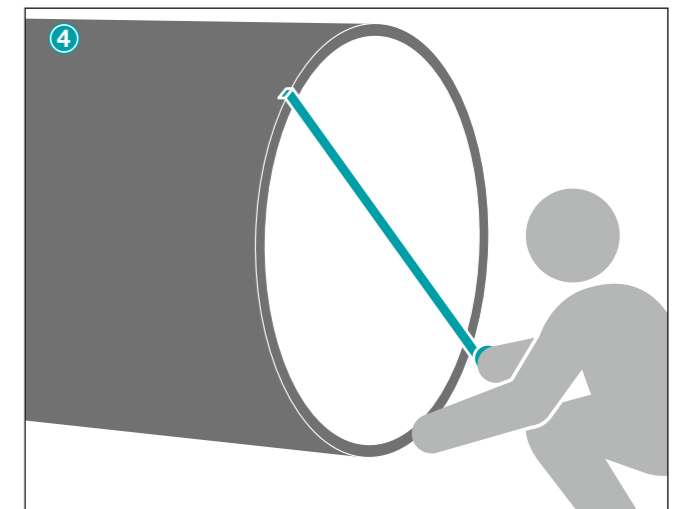
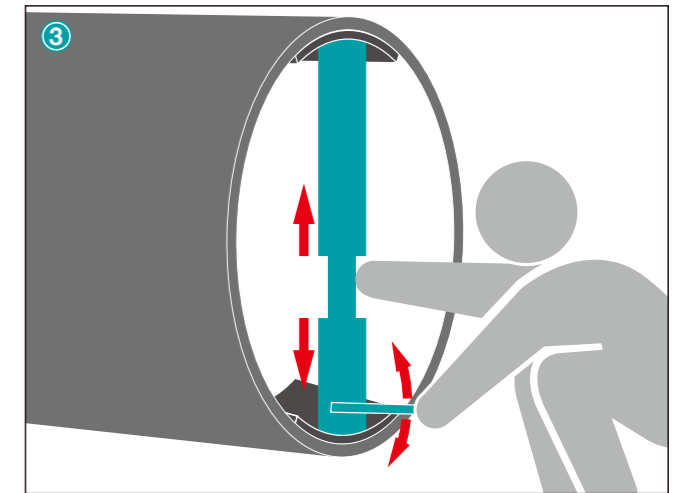
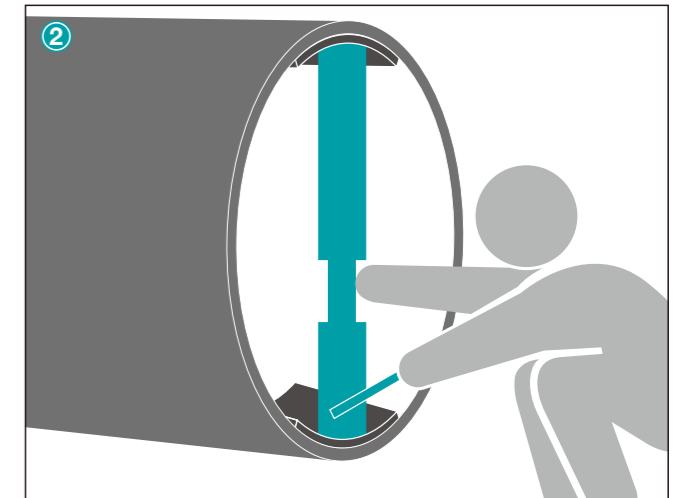
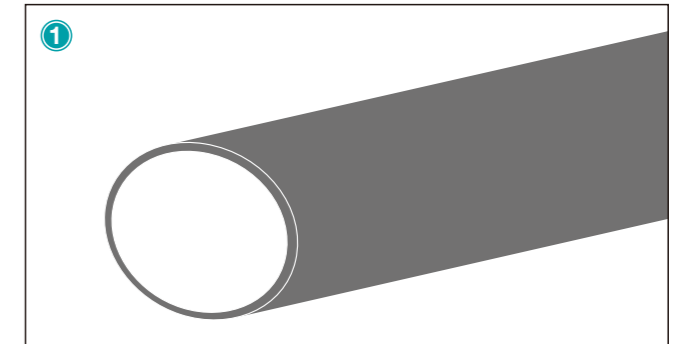
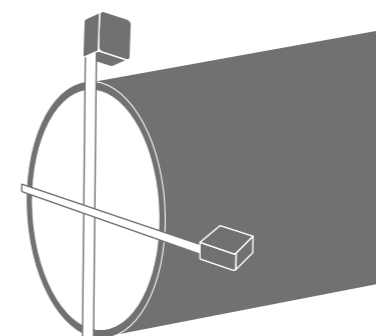


(3) **Gradually** expand the diameter until the diameter slightly exceeds the required dimensions (Picture 3).

*Excessive expansion of the pipe diameter will cause the damage to the mortar lining.

(4) **Release** pressure of the hydraulic jack and measure the diameters in two or more directions and see if they are within the tolerance specified in Table 1 of page 6 (Picture 4). If they are not, repeat (3) and (4).

*This procedure may be repeated several times until a correct circle is obtained.



Repair Material

Select Seal Coat, Epoxy Paint or Cement Mortar depending on the condition of damage of cement mortar lining as per Table 3.

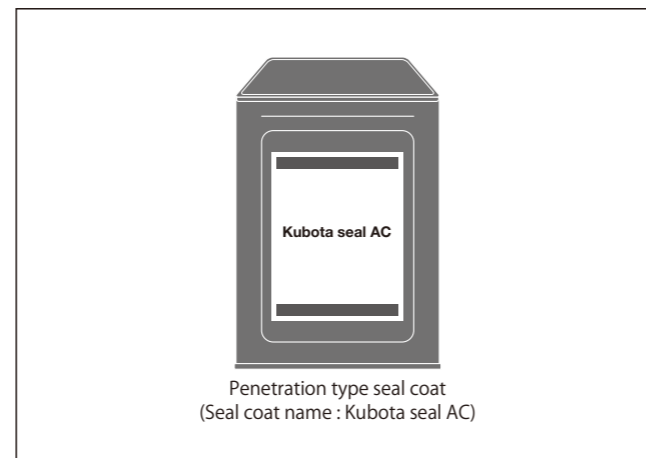
Table 3 Selection of Repair Material

Condition of damage	Repair material
Crack	Seal Coat / Epoxy Paint
Chip	Epoxy Paint
Break	Cement Mortar

Seal Coat

It is recommended to use Kubota providing seal coat for the repair. The seal coat must be approved for DIP by NSF.

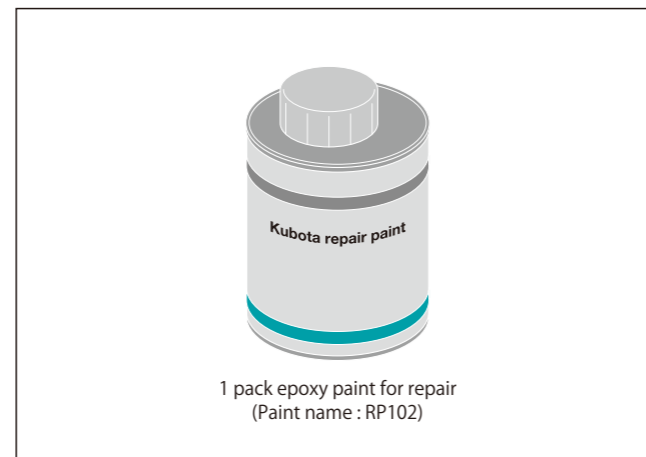
(1)**Stir** thoroughly until resin component is mixed with solvent component well.



Epoxy Paint

It is recommended to use 1 pack epoxy paint provided by Kubota for the good workability. The epoxy paint must be approved for DIP by NSF.

(1)**Stir** thoroughly until resin component is mixed with solvent component well.

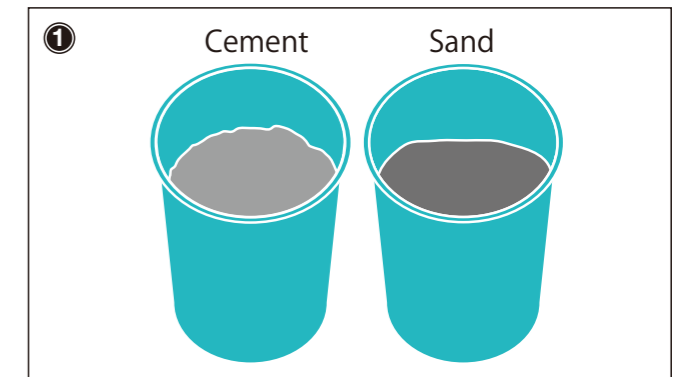


Repair Material

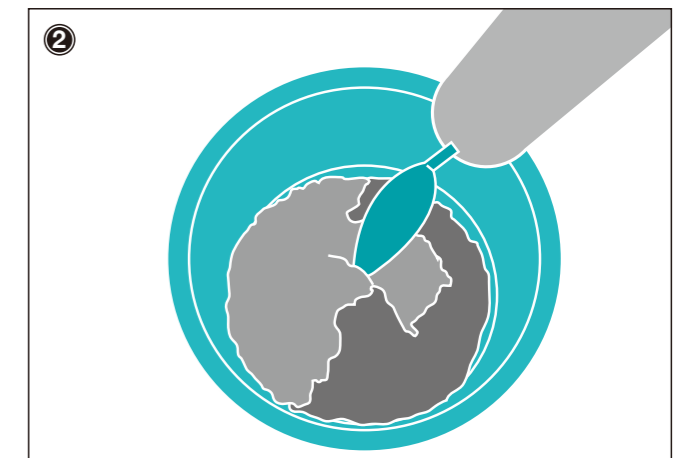
Cement Mortar

It is recommended to select cement of the same quality as that used for the cement mortar lining. (e.g. Portland cement, sulphate resisting cement, etc.)

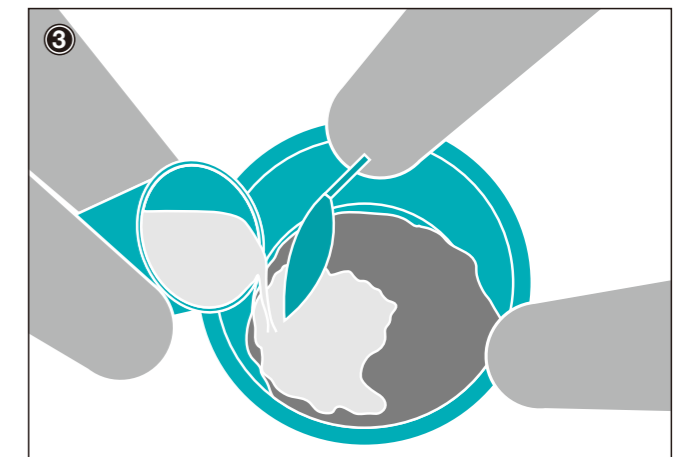
(1)**Prepare** cement and sand in the ratio of 1:1 by weight (Picture ①).



(2)**Mix** them well in a container (Picture ②).

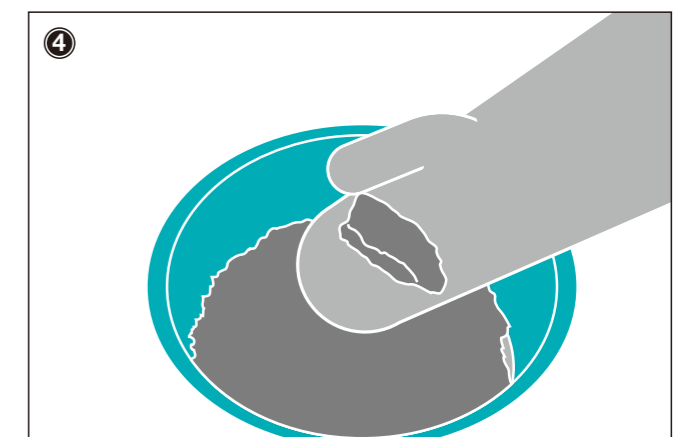


(3)**Add** water in small amounts to the mixture and continue to mix them (Picture ③).



(4)**Keep** mixing until the mixture* becomes such that it can be formed into a lump when grasped firmly in one hand (Picture ④).

*Use the mixture within one hour.

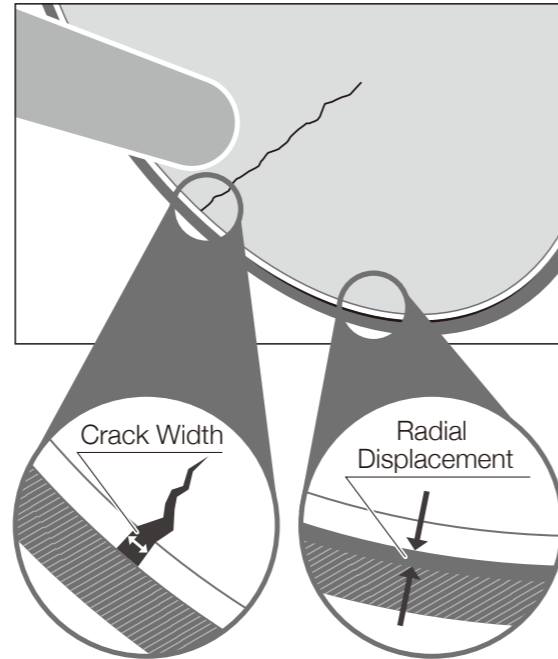


Repair Method

Crack

Inspection

- (1) Inspect the cement mortar lining. When the cement mortar lining has large cracks, deformation of pipe body is expected. In this case, correction of the pipe is necessary prior to the repair of the lining.
- (2) After the concern of deformation is cleared, check the crack width and radial displacement. If the pipe has cracks and radial displacement less than the width specified in ISO 4179 (Table 4), it is not necessary to repair the surface crazing and the small cracks.
- (3) If the cement mortar lining has cracks and radial displacement exceeding the width given in Table 4, Kubota would recommend repairing them.



ISO 4179 (Surface condition of hardened lining)

On contraction of the lining, the formation of the cracks and radial displacements cannot be avoided. These cracks and radial displacements, together with other isolated cracks which may result from manufacture or may develop during transportation, are acceptable if their width does not exceed the values in Table 4. Cracks shall not be detrimental to the mechanical stability of the lining.

It is known that these cracks and radial displacements will close and heal when the lining comes into contact with water due to re-swelling of the lining and continued hydration of the cement.

Table 4
Maximum crack width and radial displacement
(Specified in ISO 4179) (Unit:mm)

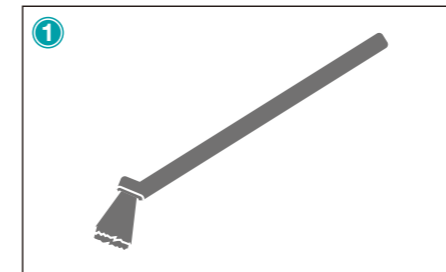
DN	(inch)	For drinking water pipe	
		For drinking water pipe	For waste water pipe
75~ 300	3 ~ 12	0.8	0.6
350~ 600	14 ~ 24	0.8	0.7
700~1200	28 ~ 48	1.0	0.8
1400~2000	56 ~ 80	1.2	0.8
2200~2600	88 ~104	1.5	0.8

Repair Method

Crack

Tools and Equipment

- Brush (Picture ①)



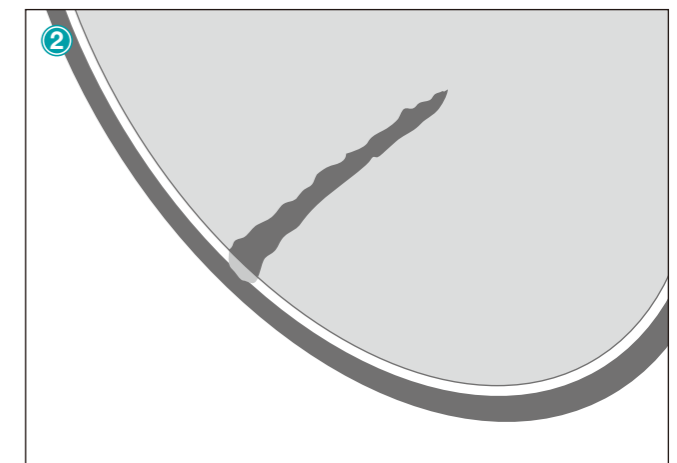
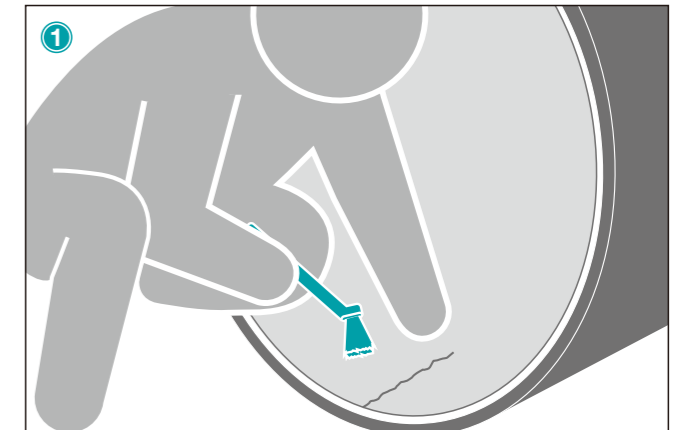
Procedure

- (1) **Clean** the surface of the crack portion with a brush, etc. (Picture ①).

*The area to be painted shall be clean and free from sand, dust, moisture, etc.

- (2) **Apply** the seal coat/ epoxy paint to the cracked area.

*When it is difficult to have enough coating thickness at one time, it is recommended to paint twice.



REPAIR OF INTERNAL LINING

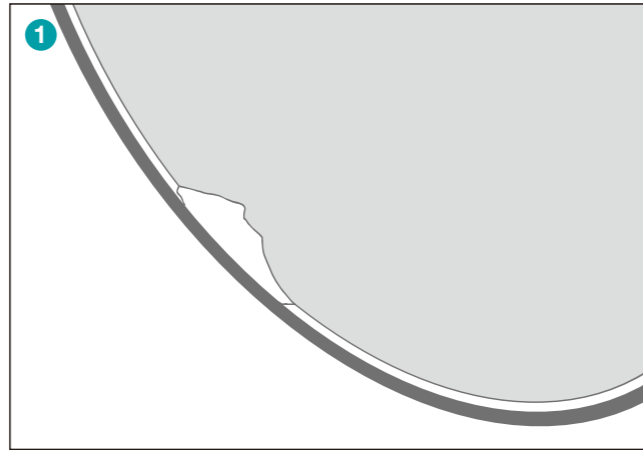
CEMENT MORTAR LINING

Repair Method

Chip

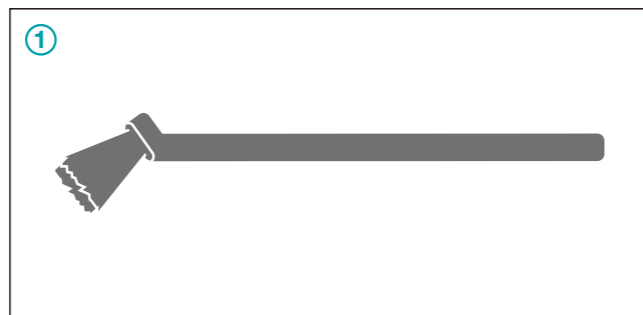
Inspection

Inspect the damaged area carefully and confirm that there is no deformation or crack on the pipe body (Picture ①).



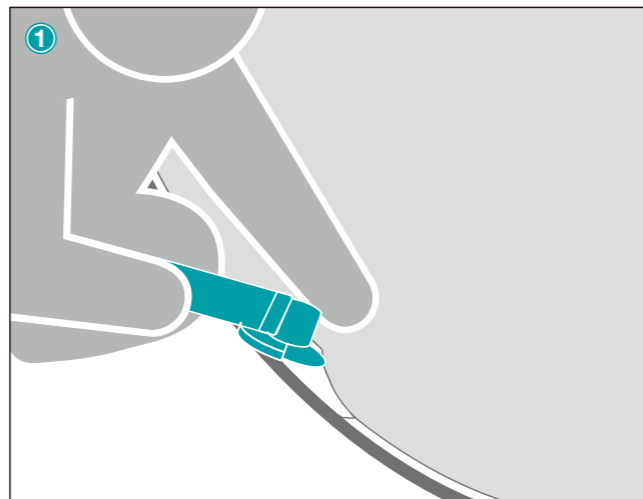
Tools and Equipment

- Brush (Picture ①)
- Portable disc grinder (Picture ②)



Procedure

(1) **Make** the chip portion smooth with portable disc grinder (Picture ①).

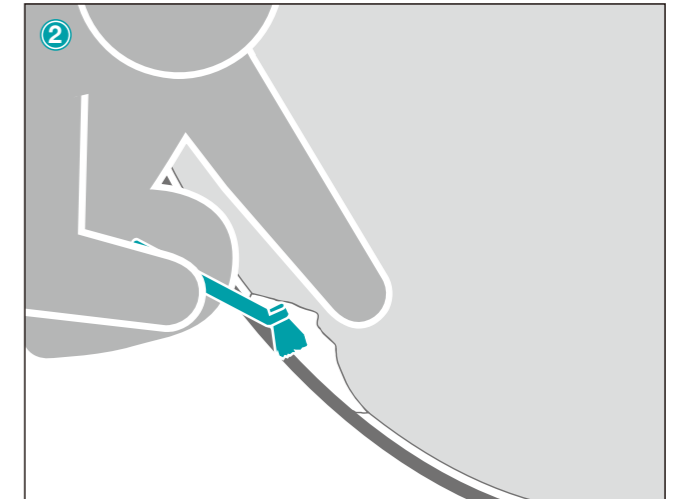


Repair Method

Chip

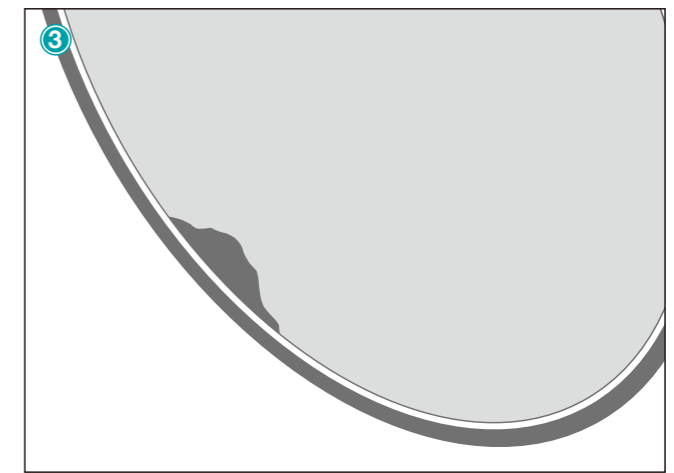
(2) **Clean** the surface of the damaged portion with a brush, etc (Picture ②).

*Remove sand, dust or moisture from the surface.



(3) **Apply** the epoxy coating to damaged portion (Picture ③).

*When it is difficult to have enough coating thickness at one time, it is recommended to paint twice.



REPAIR OF INTERNAL LINING

CEMENT MORTAR LINING

Repair Method

Break (Cement Mortar)

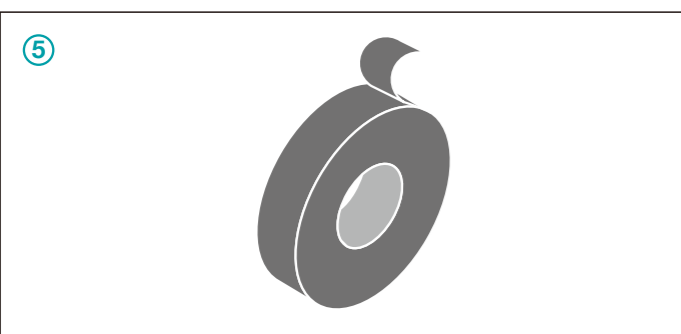
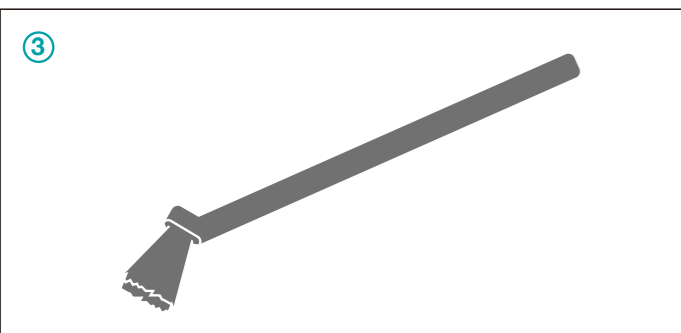
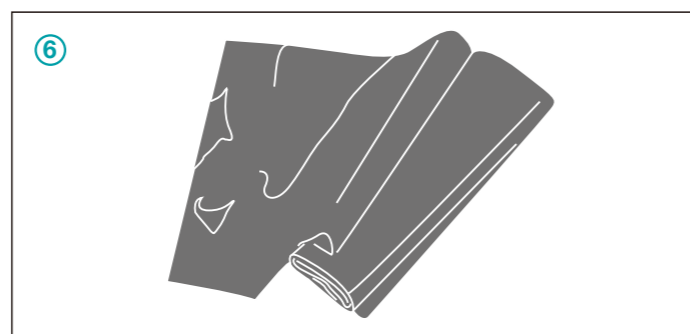
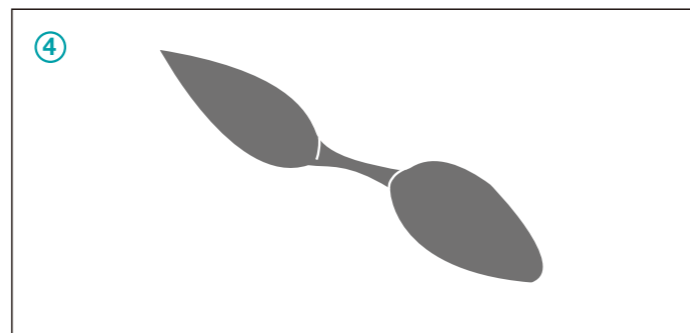
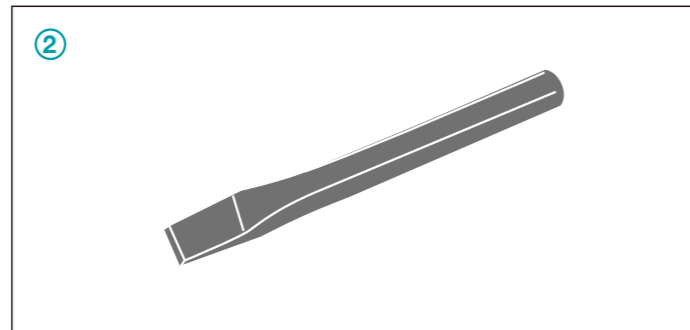
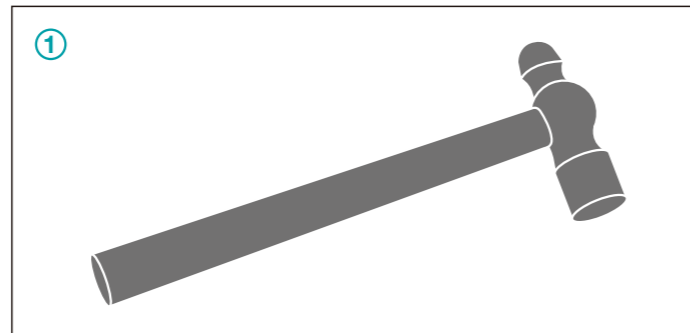
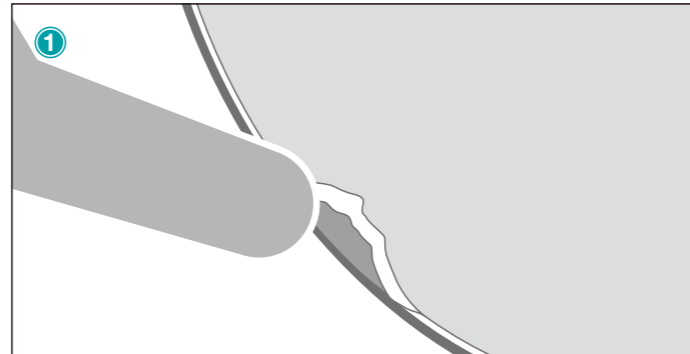
Inspection

Inspect the damaged area well. If the cement mortar lining is severely broken off or bare iron is exposed, cut the pipe to remove the damaged portion or repair with following procedure.

*Cut place should be 1 ft apart from the damaged portion.

Tools and Equipment

- Hammer (Picture ①)
- Chisel (Picture ②)
- Brush (Picture ③)
- Spatula (Picture ④)
- Adhesive tape (Picture ⑤)
- Plastic sheet (Picture ⑥)



Repair Method

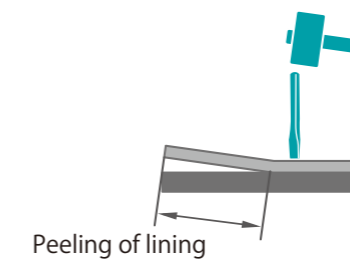
Break (Cement Mortar)

Procedure

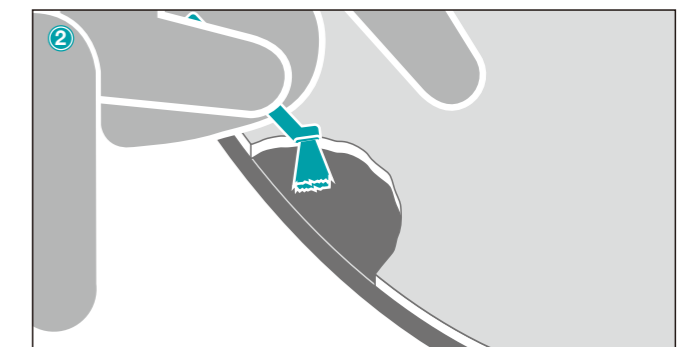
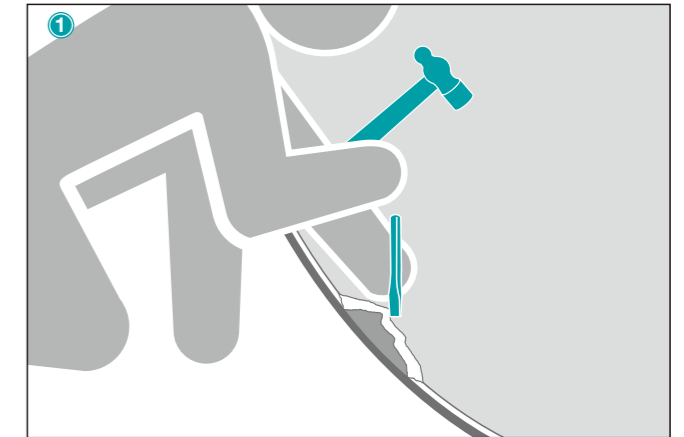
(1) **Cut back** the damaged lining so that the edge of the lining is at right angles to the iron surface (Picture ①).



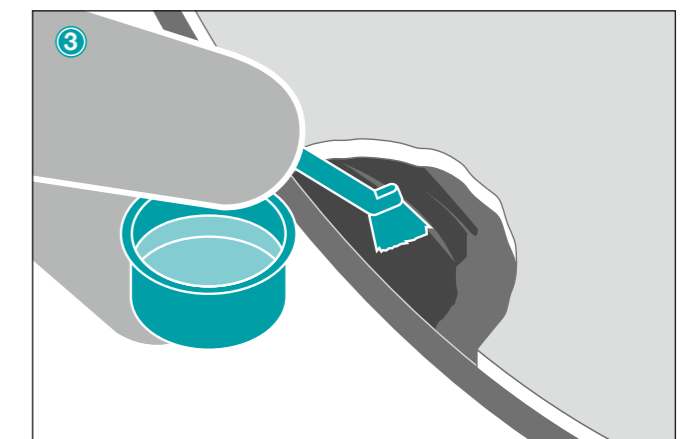
*If the cement lining is peeled off from the iron surface, cut out the affected area.



(2) **Clean** the surface of the damaged portion with a brush, etc (Picture ②).



(3) **Apply** some water to the damaged portion with a brush (Picture ③).



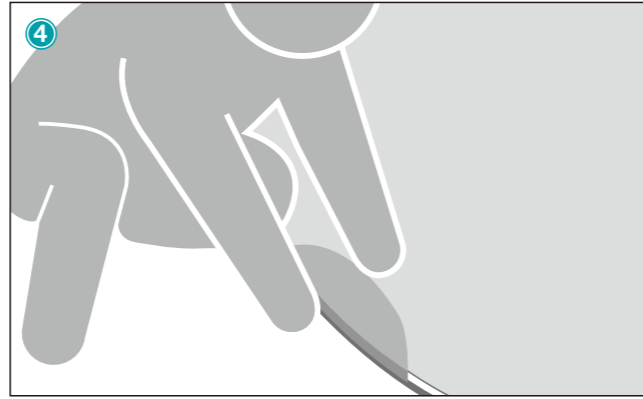
REPAIR OF INTERNAL LINING

CEMENT MORTAR LINING

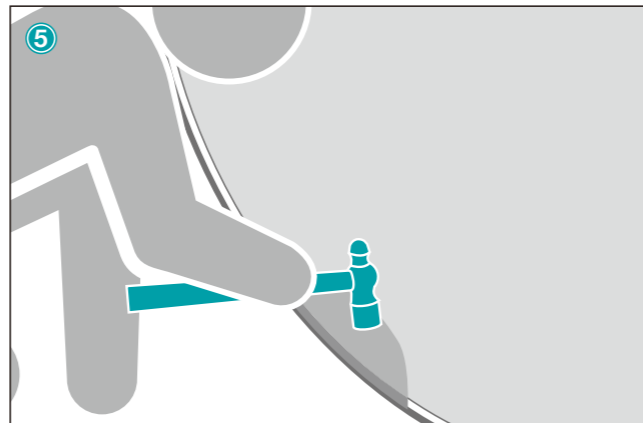
Repair Method

Break (Cement Mortar)

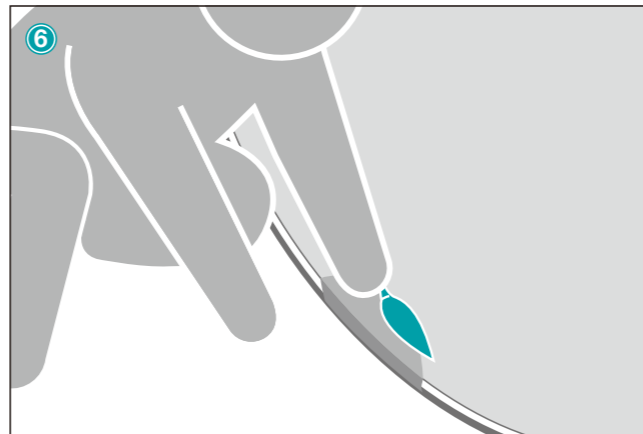
(4) **Fill** the damaged portion with the cement mortar mixture (Picture ④).



(5) **Tap** the filled cement mortar mixture gently with a hammer until it is compacted (Picture ⑤).



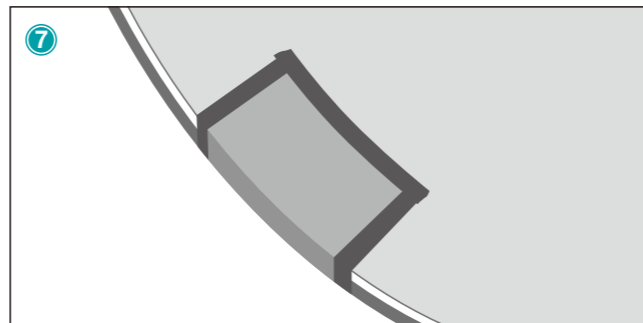
(6) **Smooth** the surface with a spatula (Picture ⑥).



(7) **Curing:**

Cover the repaired portion with a wet towel or wet paper, then seal up with plastic sheet and adhesive tape. Keep it on for more than 24 hours (Picture ⑦).

**Other curing methods may be applied according to the condition on site and the supervisor's decision.*



REPAIR OF INTERNAL LINING

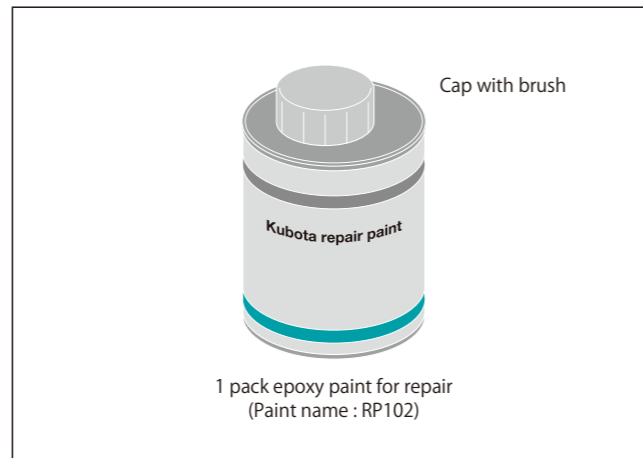
FUSION BONDED EPOXY COATING / SOLVENT FREE EPOXY COATING

Repair Material

Epoxy Paint

It is recommended to use 1 pack epoxy paint provided by Kubota for the good workability. The epoxy paint must be approved for DIP by NSF.

(1) **Stir** thoroughly until resin component is mixed with solvent component well.

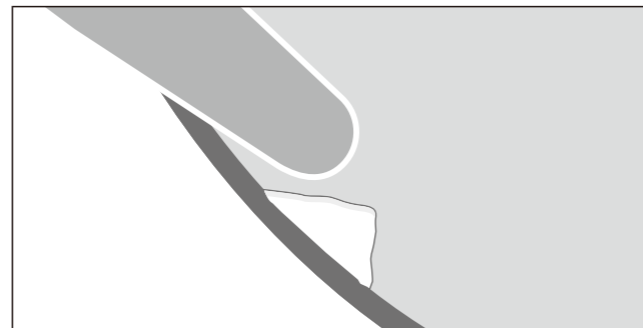


Repair Method

Inspection

Inspect the epoxy coating.

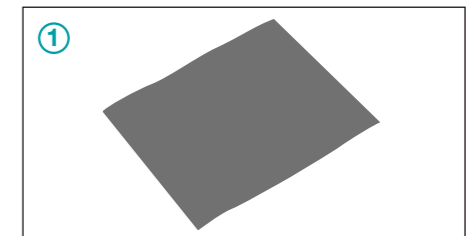
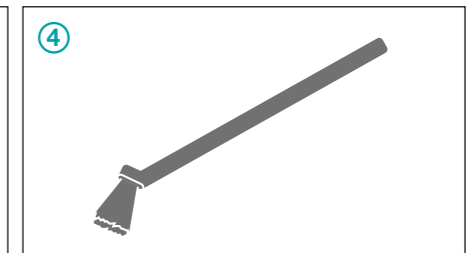
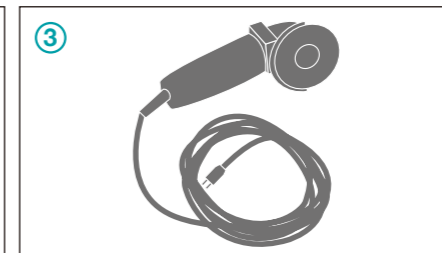
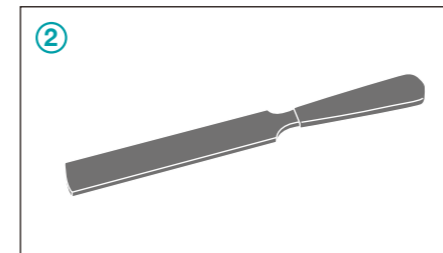
If the epoxy coating is damaged, repair of the epoxy coating is required.



Repair Method

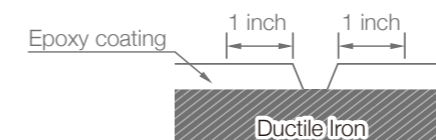
Tools and Equipment

- Sandpaper (Picture ①)
- File (Picture ②)
- Portable disc grinder (Picture ③)
- Brush (Picture ④)



Procedure

(1) **Roughen** the sound coating around the damaged area with a sandpaper, file or portable disc grinder to the extent of 1 inch (Picture ①).



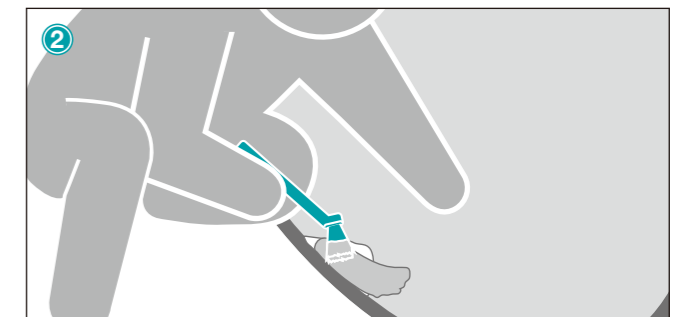
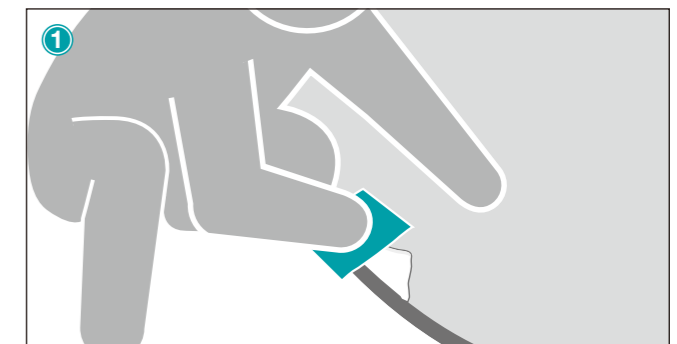
(2) **Clean** the surface of the damaged area with a brush, etc.

*The area to be repaired shall be clean and free from sand, dust, moisture, etc.

(3) **Apply** the epoxy paint to the damaged area (Picture ②).

*Paint several times at intervals to obtain the specified dry film thickness.

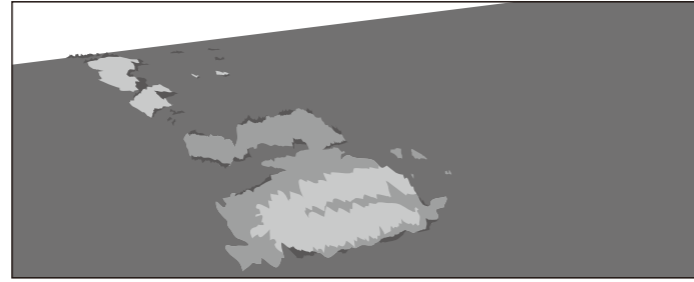
(4) **Inspect** the finished surface (Picture ③).



REPAIR OF EXTERNAL COATING

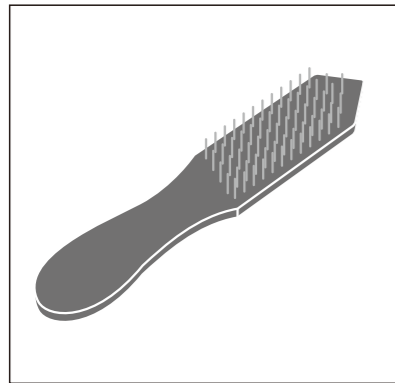
Inspection

Inspect the external coating. If the external coating is damaged, repair of the external coating is required.

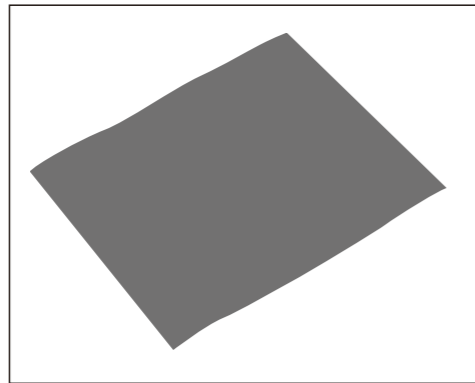


Tools and Equipment

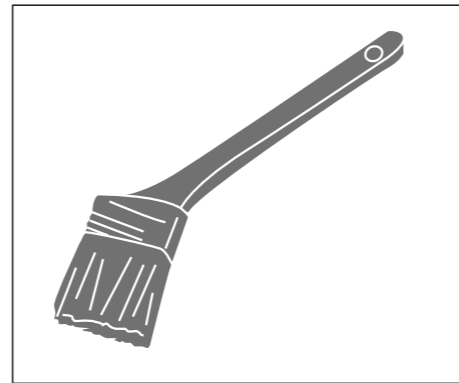
•Wire brush



•Sandpaper



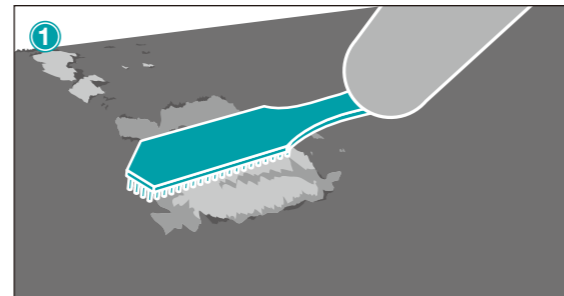
•Brush



Procedure

(1) **Remove** foreign materials and clean the surface (Picture ①).

*If the surface is rusted, use wire brush or sandpaper to remove the rust, then wipe off with a cloth.



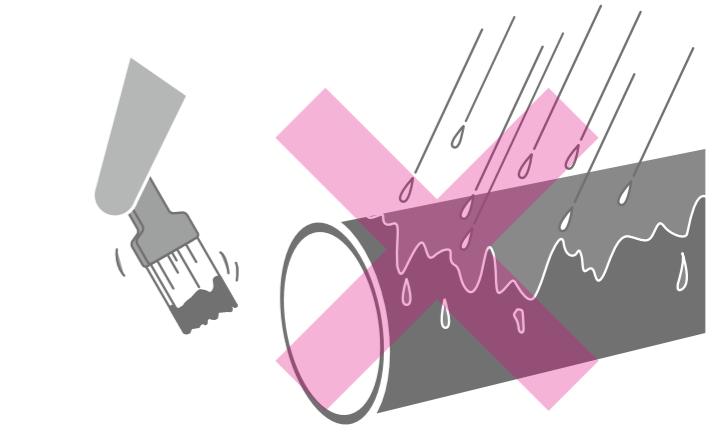
(3) **Apply** the synthetic resin paint to the damaged portion with a brush (Picture ②).

*When bare iron is exposed at damaged portion, use 1 pack epoxy coating provided by Kubota.

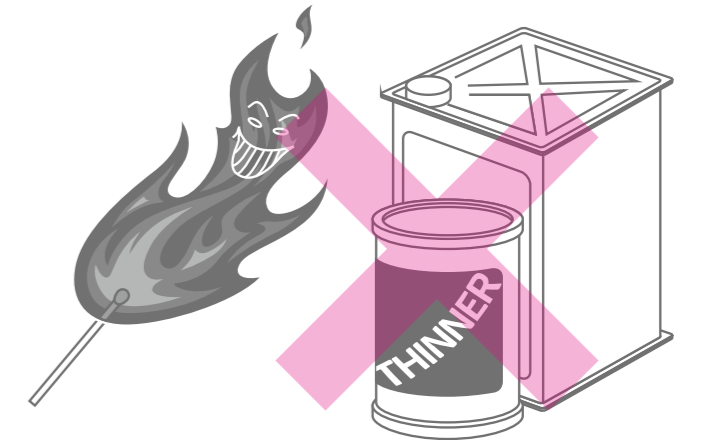


Precautions

(1) **Do not apply** coating when the pipe surface is wet. The coated surface has to be completely dried before installation.



(2) **Keep away** from open flames because the coating material is inflammable.



(3) **Use** the coating material only in well ventilated areas.



(4) **Avoid** contact with the skin and eyes. If contact occurs, wash affected area immediately with soap and water.

