LESSO

Standard Operating Procedure for Ring Pressing Installation of Light Gauge Stainless Steel Pipes

Project name:_____ Address:_____

Pipe type: Cold water pipe ☐ Hot water pipe ☐ Direct drinking water pipe ☐

Installation unit:_____ Responsible person (signature):_____

Tel:_____ Date:_____

Statement

I hereby declare that our company only supplies light gauge stainless steel pipe products to buyers, collects relevant national standards and industry standards to prepare cost and installation precautions, and provides them to customers for reference. If there is any unconformity with the provisions of national or industry standards, the technical personnel shall implement the installation in strict accordance with the provisions of national or industry standards.

Executive Standards for Installation:

Stainless steel pipe fitting of ring compression (GB/T33926—2017)

Welded stainless steel pipes for fluid transport (GB/T 12771-2019)

Installation of light gauge stainless steel pipes of building water supply (22S407-2)

Technical specification for light gauge stainless steel pipe engineering of building water supply (T/CECS 153:2018)

Technical specification for connecting light gauge stainless steel pipes of building water supply and drainage (T/CECS 227:2021)

Technical specification for metallic pipeline engineering of building water supply (CJJ/T 154-2020)

Engineering technical code for the light gauge stainless steel pipes (GB/T 29038-2012)

LESSO's Service Department

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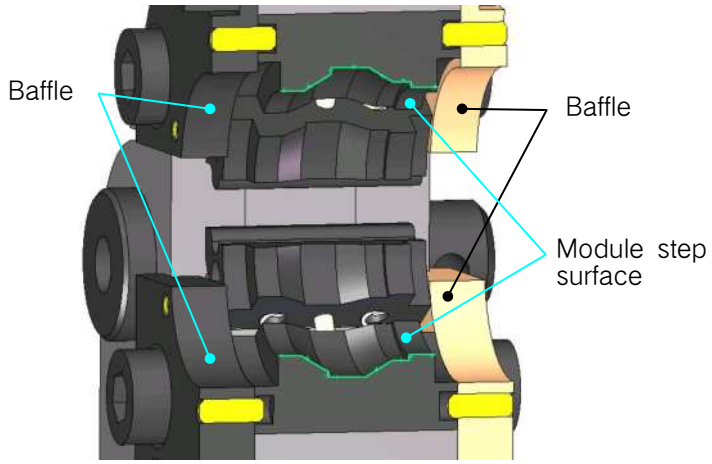
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1. Ring Pressing Installation Process

1.1 Preparations before Ring Pressing

Operation Sequence	Please note
A. Check that the installed pipes' specifications match those of the modules that were used.	Note: The pipes and fittings produced by the company must be installed with specifi installation tools. At the same time, this tool can only be used to install our company's ring-pressing pipe fittings.
B. Check the modules.	 **Figure 1.1 Sectional View of Ring Pressing Module** ◆ Check whether the upper and lower four sliding modules move flexibly and whether there are dirt and particle impurities between modules. ◆ Implementing the forcible ring pressing construction is strictly prohibited when the module is incomplete and missing component.
C. Check the hydraulic pump.	◆ It is strictly prohibited to use a hydraulic pump that works abnormally or leaks. ◆ The hydraulic pump's faults are shown in the attachment, "Common Faults and Solutions of Tools," or you can contact the local dealer for maintenance.
D. Check the pressure gauge	◆ The pressure gauge must be installed on the oil pump. ◆ The pressure gauge must be calibrated once a month. ◆ It is strictly prohibited to use the faulty pressure gauge!

1.2 Cutting Pipe

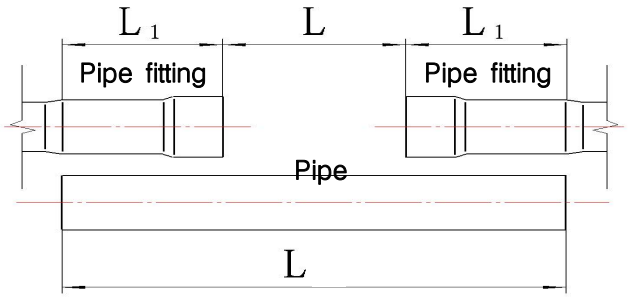
<table>
<tr><th>Operation Sequence</th><th>Please Note</th></tr>
<tr><td>A、Measure the required pipe's length with a measuring tool</td><td>


Figure 1.2.1 Installation Plan

◆ During the pressing connection, there is a small deformation in the pipes on both sides of the pressing part. In order to ensure the sealing strength between the pipe and the pipe fittings, maintain a certain distance between the pipe and the pipe fittings.

Safety Distance Reference Table
<table>
<tr><th>Nominal Diameter</th><th>Safety Distance</th></tr>
<tr><td>DN15-25</td><td>20mm</td></tr>
<tr><td>DN32-50</td><td>50mm</td></tr>
<tr><td>DN65-100</td><td>80mm</td></tr>
</table>
</td></tr>
<tr><td>B、Cut off the pipe</td><td>

Figure 1.2.2 Cutting off pipe with a pipe cutter

◆ Pipe cutting shall be free from significant temperature rise. In addition, a special electric pipe cutter or manual pipe cutter shall be used for cutting pipes for marking out;
</td></tr>
</table>

	◆ It is recommended that you cut the pipe gently in order to avoid flattening it. Make sure the cuts are made perpendicular to the pipe's horizontal plane, free of burrs or ellipses; ◆ If the above special cutting tools are not available on the site, the grinding wheel saw can be used for cutting the pipe, but the following conditions must be met: ① Adopting the grinding wheel saw without iron material; ② He grinding wheel saw should only be used to cut stainless steel pipes and not for cutting other metal pipes.
C、Deburring	 ◆ After cutting, completely remove the burrs at the pipe ends with a specific tool (chamfer tool, file, etc.) and wipe off the dirt in the pipe. Otherwise, the burrs left in the pipe will block the discharge of dirt. The accumulation of dirt will lead to excessive chloride ions and damage to the passivation film on the surface of the stainless-steel product, resulting in corrosion and water leakage after the pipe is installed and put into use.

1.3 Preassembly of the Seal Ring

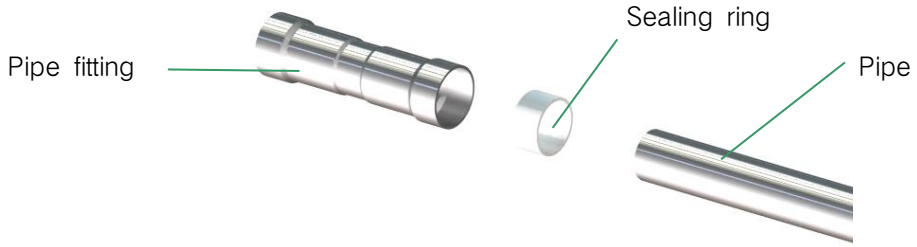
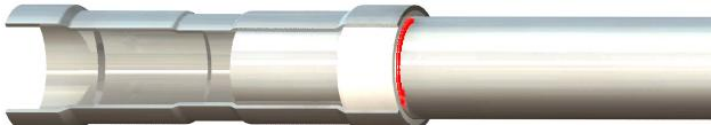
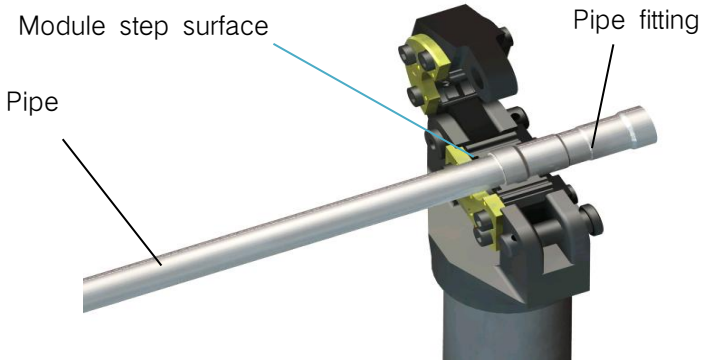
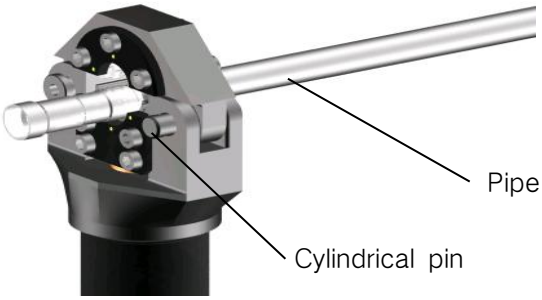


Figure 1.3.1 Ring Pressing Installation Method and Used Materials

Operation Sequence	Precautions
A、Insert the pipe into the bottom of the pipe fitting, and mark the pre-installation position of the seal ring, as shown in the picture on the right.	
B、Pull out the pipe and place the seal ring to the mark, as shown in the figure on the right.	
C、Insert the pipe with the seal ring into the bottom of the pipe fitting again, and make the seal ring flush with the port of the sealing section of the pipe fitting, as shown in the picture on the right.	

- ◆ The seal ring shall be free from sand, damage, or oil stains.
- ◆ If the seal ring cannot be insert smoothly, short amount of water can be applied to the surface of the pipe. Grease is strictly prohibited for lubrication.
- ◆ Twisting the seal ring when insert it on the pipe is not allowed.

1.4 Operation of Ring Pressing Tool

Operation Sequence	Precautions
A、Tool selection	  ◆ The manufacturer's matching pressing tools must be used for installation to ensure the safety and reliability of the pressing joint connection.
B、Place the pipe in the clamp mouth and position the pipe fitting's end on the step of the module seal section.	 ◆ The pipe's direction must be close to the step surface of the module. Do not operate in the opposite direction. ◆ Before the fixed bites the pipe fitting, the pipe and pipe fitting should be vertically supported against the module step surface. ◆ Check and confirm that fittings, pipes, and seal rings are properly installed.
C、Once the jaw is closed, carefully insert the two cylindrical pins before gradually and repeatedly applying pressure.	 ◆ Check the direction of the pliers' head before applying pressure, and do not let the opening and closing direction of the head towards the crowd. ◆ When the cylinder pin is damaged or lost, it should be replaced in time. It is strictly prohibited to replace it with non-standard parts such as screw rods.

Nominal Diameter	Pressing Pressure
DN15-DN50	40MPa-60MPa
DN60-DN100	50MPa-65MPa

D、Pressing

Pressure Parameter Table

◆ **DN15-DN50 Pipe Pressing**

During pressing, gradually pressurize until the tool produces a slight vibration under pressure and the sliding module of the tool is completely closed. The pressure is stabilized for more than 3 seconds before the pressure is released and the pressing process is completed;

◆ **DN60-DN100 Pipe Pressing**

Before pressing, clean up the tool, pull out the connecting snap spring of the ring mold, and then place the arc convex part of the end of the pipe fitting into the U-shaped slot of the ring mold. Then, insert the connecting snap spring and connect the ring seat and the ring mold correctly. The DN60-DN100 pipe must be pressed three times, with the steps shown as follows:

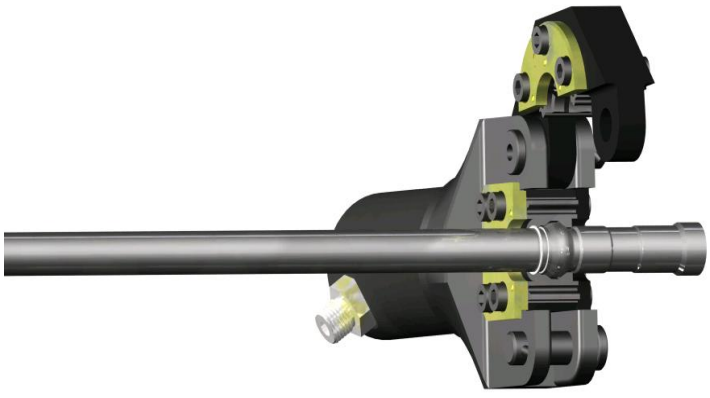
① Gradually pressurize the pressure to 20 Mpa;

② After pressure relief, rotate the pipe or ring mold by about 90°, and then pressurize to 40 Mpa before pressure relief;

③ Turn the pipe or ring mold by about 90° again, and pressurize to 65 Mpa to put an end to the pressing process.

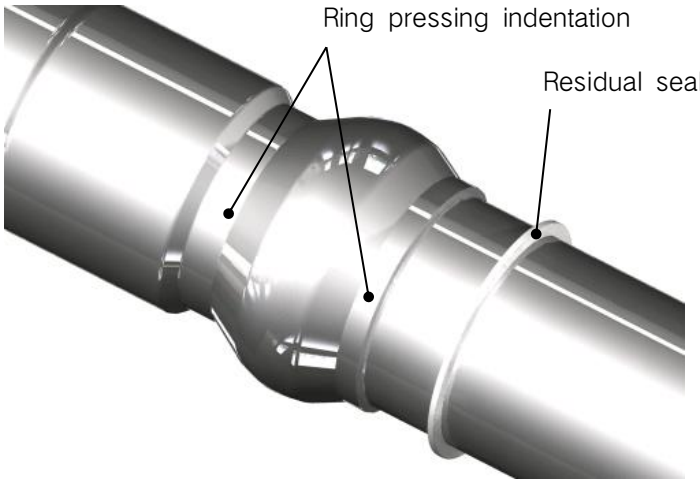
◆ **The pressing process mainly depends on the degree of mold closure. After the mold is closed, it can be considered as the pressing is completed. The pressure reading of the pressure gauge is for reference only.**

E、Remove the ring-pressing pipe after pressure relief.



◆ Wait until all the pressure has been released before opening the pliers' heads.

F、After the installation is complete, check the crimping quality.



Quality check:

① The 360° indentation of the pressing part should be evenly concave and convex;

② The joint between the pipe fitting's end face and the pipe should be tight without a gap;

③ It is easy to remove the residual seal ring exposed at the pressing joint between the pipe fitting's end face and the pipe.

2. Special Treatment after the Pipe Installation

2.1 Product Handling and Storage

Handle pipes with care and do not throw, drop, roll, or drag them to avoid damaging them and disrupting normal product use. Pipes (pipe fittings) shall not be stored in the open air and not be mixed with harmful substances, other metals, and dirt, such as angle iron, steel bars, etc. Improper storage or contact with other metals and corrosive media will lead to corrosion in the product, thus affecting its performance.

2.2 Antiseptic Treatment

① **Through-wall:** During the installation process, the through-wall pipe should be equipped with a sleeve in length not less than the thickness of the wall, and the pipe should not be in direct contact with cement mortar or building cleaning agent. If the cement mortar or building cleaning agent remains on the steel surface for an extended period of time, it may increase the material's corrosion risk.

② **Buried:** Buried pipelines must be treated with antiseptic to prevent stray currents and acid and alkali corrosive substances in the soil from damaging the pipeline's surface. Alternatively, a plastic-coated light gauge stainless steel pipe may be used.

③ **Material selection:** According to the construction characteristics, epoxy resin, foamed polyethylene, perlite, glass wool tube, and shell materials can be used as anti-corrosive materials. It is strictly prohibited to use materials containing soluble chloride ions (halogenated elements or halides) and glue (neoprene glue) for anti-corrosion.

2.3 Moisture-proof Treatment

At the rainy site with high humidity, the insulation layer needs to undergo moisture-proof treatment.

2.4 Freeze Protection Measures

In areas at low temperatures, large temperature differences, or a risk of freezing, insulation materials should be used to wrap pipes and fittings to prevent pipes from cracking and connectors from falling off due to freezing at low temperatures.

2.5 Movable Support

The open-mounted pipeline should adopt stainless steel movable support or pipe clamp. If the supports or pipe clamps made of other metal materials (except copper) are used, rubber and other soft pads should be applied to the two contact surfaces.

2.6 Pipe Flushing

During the cutting, assembly, handling, and other professional cross-construction, impurities, such as metal debris, cutting powder, mortar, concrete blocks, wood chips, and bricks, may enter the pipe, so it is necessary to flush the pipe. The flushing procedures are as follows:

① Water from rivers or underground wells cannot be used for pipeline pressure testing or cleaning; instead, municipal drinking water must be used.

② Determine the locations of water injection and drainage, close the valves unrelated to flushing, and open the pipe valve and exhaust valve.

③ The pipe shall be flushed continuously with the municipal domestic water through the electric booster pump at a water flow speed greater than 1m/s as long as possible until the color and transparency of the water at the outlet are consistent with that of the water at the inlet. To the greatest extent possible, the flushing direction and the working direction ought to be equal.

2.7 Pressure Test

The pressure test should be carried out after the pipe flushing is qualified. The test pressure should be 1.5 times the design pressure and is recommended to be 1.2 MPa. The pressure test procedures are shown as follows:

① Seal the ends of the pressure test pipe and gradually inject water into it to empty the air in the pipe. After the pipeline system is filled with water, check the water tightness;

② After the pipe passes the water tightness check, conduct the pressurization test. Gradually pressurize for not less than 10 minutes;

③ Stop pressurizing after the pressure rises to the specified test pressure, observe for 10 min, and make sure that the pressure drop does not exceed 0.02 Mpa. The pressure should not decrease once the test pressure has been reduced to the working pressure.

④ If finding water leakage or pressure drop exceeding the specified value after the pipeline system is pressurized, check the pipeline and eliminate the cause of water leakage, then repeat the pressure test according to the above provisions until the pipe meets the requirements.

2.8 Startup and Running

After the pipe passes the pressure test, the water should be completely drained, or the water stored in the pipe should be cycled at least once a week. Besides, the pipe can also be flushed instead of water circulation in the pipe mentioned above. Otherwise, the water stationary in the pipe for a long time, the deposition of debris, the chloride in the water, or overproof microorganisms may lead to corrosion to the pipes and fittings, thus resulting in water leakage.

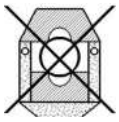
If it is not possible to drain the water in the pipe, the following measures can be taken to avoid water leakage accidents: Air purging: The large compressor for production can be used, or the large container in the device can be used to store gas for intermittent purging. The purging pressure should not exceed the design pressure of the container and pipeline, and the flow rate should not be less than 20 m/s. In addition, the purging gas should not contain oil.

3. Safety Operation Instructions

Note: Read the Safety Operation Instructions carefully. The operator is responsible for any accidental injuries caused by the use of trouble-prone tools, incorrect operation, and insufficient labor protection. If you have any questions about safety precautions and the operation instructions, please get in touch with the company's after-sales service department.



Danger: Unauthorized modification of the ring pressing tool will change the stress position of the tool, generating a hidden danger and even easily leading to an accident.



Caution: It is strictly forbidden to use the ring-pressing pliers head to press the pipe fittings that do not match its model; otherwise, the tool will be damaged, and it may even cause danger to the operator.



Warning: Before operation, check whether the fixing screws and pins of the upper jaw and slider are reliable, and do not use them if they are loose. If the upper and lower sliders are stuck or unable to bounce back, do not use them.



Note: The installation tool will have fatigue deformation to different degrees after long-term use. Before use, the user should carefully check the stress parts, the part of the pliers' pedestal through the pinhole, the part of the upper jaw through the pinhole, the pedestal, the pedestal's root, and the connection between the pedestal and the pliers head for deformation and cracks. Do not use defective tools for construction. If deformation (the deformation of the upper jaw hole and pedestal hole, cylindrical pin bending, wear or concave and convex marks) or fracture occurs during use, release the pressure immediately and stop use. Replace them with new ones, test them, and confirm safety before continuing the operation.



Warning: Before applying pressure, ensure that the two cylindrical pins of the pliers are fully inserted into the pin holes (Figure 3.4).



Warning: Check the direction of the pliers head before applying pressure. Do not let the opening and closing direction of the pliers head towards operators and others.



Caution: Check the pressure gauge before construction; if finding that the pressure gauge works abnormally, stop the operation immediately. During pressurizing operation, pressurize strictly according to the rated pressure of the tool (according to the table and related instructions); overpressure construction is strictly prohibited.

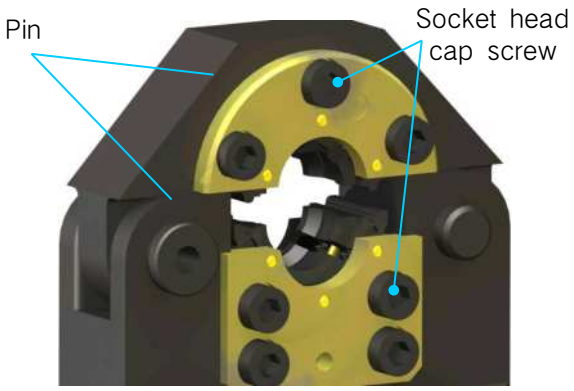


Figure 3.1 Fixed Screw and Pin

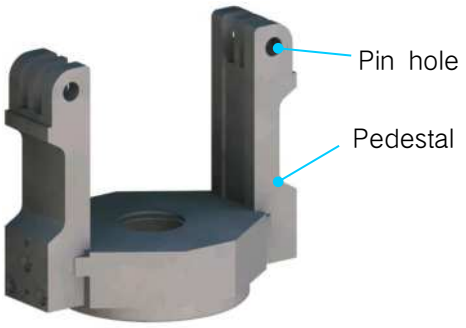


Figure 3.2 Pliers Head

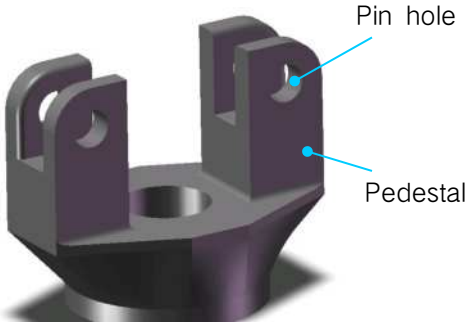
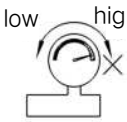


Figure 3.3 Pliers Head



Danger: Increasing the pressure pump's safety pressure without permission may result in the tool being in an overpressured state. The set pressure of the safety valve should be 55 Mpa ±2 Mpa.



Danger: During the ring pressing operation, illegal operations are forbidden through the shoulder, head, or foot.



Danger: It is forbidden to conduct illegal operations such as overpressure, leakage, storage or handling under pressure, or dragging oil pumps and pliers on the ground.



Caution: When working at heights, make sure you take the necessary precautions.

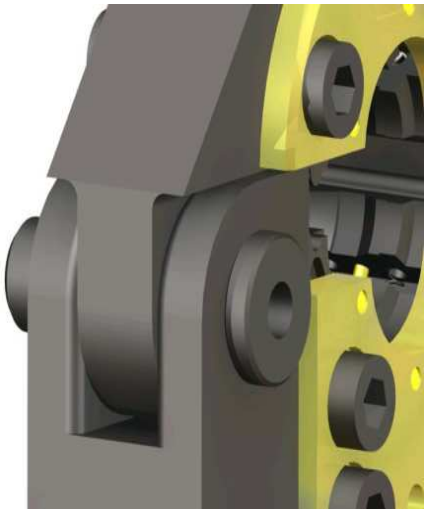


Figure 3.4 Installation Plan

The Safety Instructions are to remind operators to avoid accidents due to violations and overpressure. Other precautions are shown in the Technical Instructions.

The construction personnel of the light gauge stainless steel pipe for building water supply and drainage must meet the following requirements:

① Be familiar with the performance of light gauge stainless steel pipe (pipe fitting) products and the installation technology of light gauge stainless steel products;

② Possess a minimum of one year's experience installing light gauge stainless steel pipes on construction sites.

4. Precautions

A. Please pay attention to the following points when using stainless steel pipes:

1. The water quality of the water piped by 304 (06Cr19Ni10) stainless steel pipes should reach the national tap water standard, namely chloride content in room temperature water <200 ppm; 316 (06Cr17Ni12Mo2) and 316L (022Cr17Ni12Mo2) pipes are suitable for the media or environment with higher corrosion resistance requirements, and the chloride content of water at normal temperature <1000 ppm. It is recommended to use 316 L pipes when transporting hot, soft, or high-chloride water.

2. For applications with much industrial dust and in wet areas, the surface coating treatment is required.

B. Make sure there are no foreign objects inside the pipes and pipe fittings before ring pressing, such as broken pipes, iron filings, oil stains, or other debris.

C. Plastic-lined aluminum alloy pipes should be away from alkali-containing substances (because alkali has a strong corrosion effect on aluminum alloys).

D. Outdoor stainless-steel pipes should not be located below the steel guardrail or the steel flower bed. The stainless steel pipe's surface should be kept clean.

E. Anti-corrosion measures should be taken when the pipe is buried and concealed, or plastic-coated pipes can be used.

F. The spacing between movable supports for light gauge stainless steel pipes or plastic-lined aluminum alloy pipes is shown in the table below.

Maximum Spacing Between Supports for Light Gauge Stainless Steel Pipes

Nominal Diameter	DN15	DN20	DN25	DN32	DN 40	DN 50	DN 65	DN 80	DN 100
Horizontal Pipe	1.0	1.5	1.5	2.0	2.0	2.0	2.5	2.5	2.5
Riser	1.5	2.0	2.2	2.5	2.8	3.0	3.2	3.5	3.5

Maximum Spacing Between Supports for Plastic-Lined Aluminum Alloy Pipes

Nominal Diameter	DN15	DN20	DN25	DN32	DN40	DN50
Horizontal Pipe	0.5	0.6	0.7	0.8	1.0	1.2
Riser	0.7	0.9	1.0	1.1	1.3	1.6

Table 4.1, Table 4.2 Notes:

1. The annular pressing pipeline must be fixed by pipe clamps within 100 mm from each pipe fitting or valve, especially at the transition of the main pipe to the branch;
2. Support must be installed at a distance from each pipe fitting (with coupling) ≤150 mm;
3. The rise at the transverse pipe elbow must be provided with strong support; the fixed support shall be set up at the bottom of the riser.
4. The equipment connection, pipe water distribution point, and the inlets and outlets of the water tank and pool are where the fixed supports need to be installed.

G. The clear distance between the concealed pipe, the bottom surface of the floor, and the wall should be greater than the installation and maintenance sizes, as shown in Table 4.3 below:

Installation, Maintenance and Repair Sizes (mm)

Nominal Dimension	DN15	DN20	DN25	DN32	DN40	DN50	DN65	DN80	DN100
Mounting Dimension (distance between the pipe wall and surrounding)	⩾50	⩾50	⩾62	⩾62	⩾75	⩾75	⩾125	⩾125	⩾125

Note: The dimension is the lowest operating size of the ring pressing tool, and the operation and maintenance sizes should be considered as far as possible during installation.

H. The pipeline should be reasonably equipped with an expansion compensation device and support to control the expansion direction of the pipeline or compensation. When the straight-line segment length of the surface or non-buried concealed light gauge stainless steel pipe exceeds 15 m, compensation measures should be taken in the pipeline axial direction. When the nominal diameter of the pipe is greater than 50 mm, stainless-steel corrugated expansion joints or stainless-steel linear temperature compensators shall be recommended. See the attachment for the detailed thermal compensation value and compensator installation.

I. Precautions for pressure test of pipeline system:

1. The system pressure test must be implemented according to the design or specification; the temporary sealing shall be strictly managed to ensure its reliability and avoid causing safety risks, especially in the case of a gas pressure test due to limited conditions.
2. Discharge extensive amounts of impurities and rusty water at the municipal pipe network's inlet prior to the pressure test to keep them out of the system.
3. The water quality of the pressure test water should comply with the "Sanitary standard for drinking water" (GB 5749).
4. The air in the system must be emptied during the hydraulic test. Water can be injected while discharging the air; pressurization can't be done until the air is discharged.
5. If leakage is found in the system, make a mark and pressurize to check it after pressure relief. Do not operate under pressure conditions.
6. Concealed projects must be subject to the hydraulic test before concealed work construction.
7. After the system pressure test, it should be put into use as soon as possible. Otherwise, it is necessary to carry out continuous, thorough flushing of the pipeline (the entire pipeline is filled with water and then drained more than three times). Finally, the pipeline should be filled with water and maintained at low pressure. Most impurities can be eliminated in this way, and the electrolyte solution's lower concentration can be sustained for an extended period of time.
8. Pipe flushing and disinfection should be carried out in accordance with the Code for Design of Water Supply Engineering.

5. Pipe Maintenanc

A. When the pipe needs to be repaired due to pitting corrosion, the hoop and sealing gasket shall be applied to the leak point for temporary maintenance. Under normal circumstances, the pipe can be replaced and repaired through adjustment coupling.

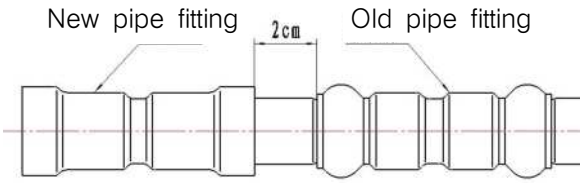


Figure 5.1 Pipe Fitting Spacing Diagram

B. When the pipe needs to be repaired and replaced, cut off the maintenance part, replace the pipe, and implement ring pressing installation. The minimum distance between pipe fittings is 2 cm.

C. Use the adjustment coupling if changing the ordinary coupling is inconvenient. Use the adjustment coupling method:

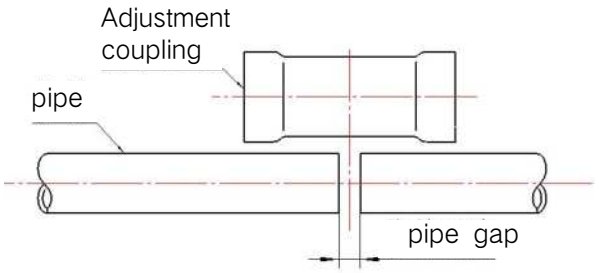


Figure 5.2 Check Location of Adjustment Coupling and Mark It

1. First, check the installation position of the adjustment coupling to roughly align the adjustment coupling with the center line of the pipe gap. The pipe gap must not exceed the length of the locking section of this model's pipe fitting, and the pipe needs to be marked so that the seal ring can be installed. (see Figure 5.2).

2. Preload the seal ring on the pipe and insert it into the adjustment coupling (see Figure 5.3).

3. Adjust the seal rings on both sides of each mark. If the sealing ring is exposed mostly, pay attention to the position of the seal ring during ring pressing to avoid the failure of the ring pressing and sealing due to the sliding of the pipe and the exposure of the seal ring (see Figure 5.4).

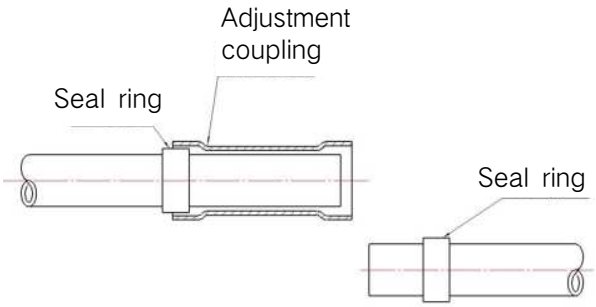


Figure 5.3 Preassemble Seal Ring and Set in Pipe Fitting

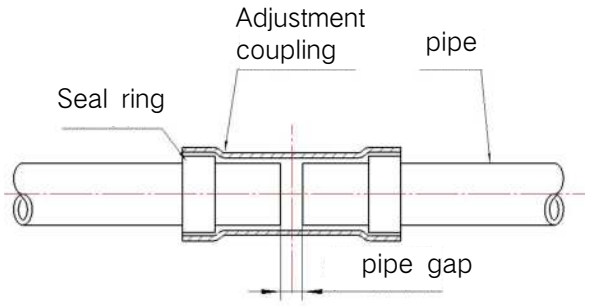
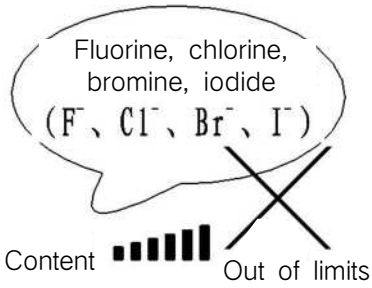
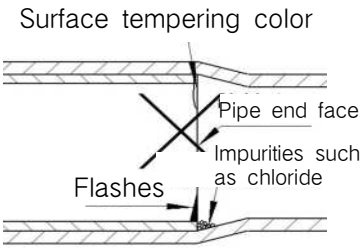


Figure 5.4 Installation Section View of Adjustment Coupling

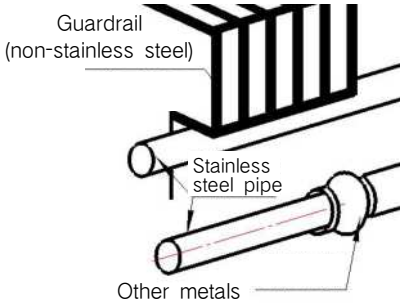
6. Notices for the Pipe's Common Corrosion Leakage



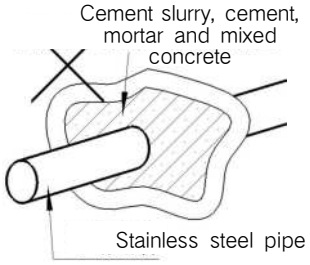
Warning: The water quality of the water piped by 304 (06Cr19Ni10) stainless steel pipes should reach the national tap water drinking standard, namely chloride content less than 200 mg/L in cold water and 50 mg/L in hot water. Furthermore, the pipe is not allowed to transport the water with the contents of fluorine, chlorine, bromine, and iodide exceeding the standard. The transportation of water from seriously polluted rivers or lakes, groundwater, or tap water from reservoirs will cause 304 pipe or pipe fittings corrosion and leakage.



Warning: After the cutting machine cuts off the pipe, if the flashes or burrs on the ends of the stainless steel pipe and the surface tempering color are not removed thoroughly after the pipe fitting is loaded on the ring pressing module and the pipe and pipe fitting are fit, a step is formed, and there is a gap, then impurities such as chloride are easy to deposit in the gap, which is easy to produce gap corrosion.



Warning: Outdoor stainless-steel pipes should not be located below the guardrail or steel flower bed, and try not to connect these pipes with other metal pipes to avoid electrochemical corrosion. Take measures to stop electrochemical corrosion if it cannot be avoided.



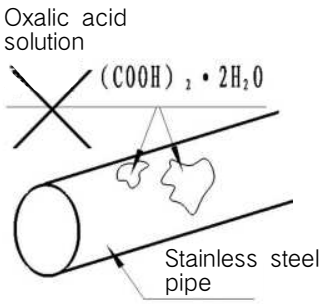
Caution: The light gauge stainless steel pipe should not be in direct contact with cement slurry, cement, mortar, and mixed concrete. In order to prevent the corrosion of chloride to the pipe, the outer wall of the pipe can be covered with plastic film or wrapped with anti-corrosion tape (the chloride content should not be greater than 50*10-6), or the plastic-coated light gauge stainless steel pipe can be selected.



Caution: Stainless steel pipes shall not be laid in the flues, air ducts, drain ditch, elevator shaft, or strong and weak current tube well. In addition, they should not cross the toilet tank or the power distribution room to prevent corrosion leakage.



Caution: The contact surface between the stainless-steel pipe or pipe fittings and the carbon steel components must be blocked with rubber liners greater than 3 mm (thick) or wood block hoop pads to prevent electrochemical corrosion.

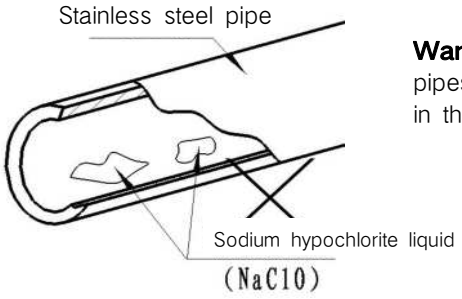


Warning: When cleaning the internal and external bricks, the engineering party shall take care to prevent the oxalic acid solution used from splashing on the stainless-steel pipes and causing corrosion.



Caution: When the stainless-steel pipe is concealed, anti-corrosion measures should be taken on the outer wall of the pipe, such as wrapping anti-corrosion tape or using plastic-coated stainless-steel pipes.

Caution: In the place where the stainless-steel pipe is installed or its surroundings, it is strictly prohibited to build sinks, sink units, and other appliances that are involved in water to avoid forming a corrosion environment due to inadequate installation.



Warning: Sodium hypochlorite liquid used for cleaning stainless steel pipes for direct drinking water should be rinsed in time and not stored in the pipes to avoid corrosion.

7. Requirements for Stainless Steel Pipe Compensation and Installation of Expansion Joint

Due to the expansion and contraction of metal materials, expansion joints must be used to compensate for the deformation caused by the expansion and contraction of the pipe when the linear pipe's length reaches a certain value. The deformation is shown in Table 1.

Table 1 Thermal Expansion of Light Gauge Stainless Steel Pipe (mm/10 m) (Based on Expansion of 0 at 0 ℃)

Temperature	-10	0	10	20	30	40	50	60	70	80	90	100
Expansion	-1.7	0	1.7	3.4	5.2	6.9	8.6	10.4	12.1	13.8	15.5	17.3
Calculation	△L— Pipe expansion a— Linear expansion coefficient, taking 0.0173 mm/ (m℃) for stainless steel pipe △L=a·L·△T L— Pipe's length between two fixed supports △T— Calculated temperature difference (℃)											

Bending natural compensation and compensator can be used to solve the problem of pipe thermal expansion.

1) When the diameter of the indoor light gauge stainless steel pipe is below DN32, the natural compensation measure of bending pipe is preferred. Free arm natural compensation, N-type compensation, Z-type compensation, cross compensation, and ring compensation can be installed horizontally or vertically.

2) For the diameter of light gauge stainless steel pipes equal to or more than DN32, the compensator can be used. Common compensators: waveform compensator, loose compensator, compensator for stuffing box, and so on. The compensator should be firmly fixed to the building.

In the case of the axial and radial displacement caused by expansion and contraction in the pipeline water transmission system, it is recommended that the stainless-steel waveform joint be set for compensation. The wave number of the waveform compensator should be determined according to the pipe's length between pipe supports and the theoretical characteristics of the compensator based on the expansion. The bending deformation, fatigue life, and safety factors should be calculated when selecting the wave number. It is recommended that the specification is 30% more than the calculation value. The specifications and parameters are shown in Table 2. Refer to Article 3.5.16 of the Code for Design of Building Water Supply and Drainage (GB50015-2003).

For pipelines with a diameter of ≤DN100, the outer diameter of the waveform compensator is consistent with the outer diameter and wall thickness of the light gauge stainless steel pipe connected with the stainless-steel clamping pipe fitting, so the connection of the waveform compensator is the same as the installation of the clamping pipe fitting.

For pipelines with a diameter ≥DN100, the waveform compensator can be connected through a standard flange.

Table 2 Specifications and Parameters of Waveform Compensator

No.			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Design Pressure Mpa			0.6						1.0					1.6						
Diameter			32	40	50	65	80	100	32	40	50	65	80	100	32	40	50	65	80	100
Wave Number			12	12	14	10	10	10	12	12	14	10	10	10	12	12	14	8	9	9
Wall Thickness mm			0.3 x 1	0.3 x 1	0.5 x 1	0.5 x 2	0.5 x 2	0.5 x 2	0.3 x 1	0.3 x 1	0.5 x 1	0.5 x 2	0.5 x 2	0.5 x 2	0.3 x 1	0.3 x 1	0.5 x 1	0.5 x 2	0.5 x 2	0.5 x 2
Theoretical Characteristics	Compensation	△x mm	16	16	16	49	51	52	11	11	16.5	41	45	46	9	9	13	30	35	36
		△y mm	8	6	9	25	25	22	6	4	8.5	23	23	20	4.5	3.5	7.5	14	15	14
	Axial Stiffness N/mm		42.8	53.8	159.6	121.6	132.7	150.1	83.8	105.3	158.6	165.2	160.5	180.6	109.1	136.6	229.4	230.1	218.3	244.3
	Effective Area cm2		12	18	25	66	87	121	11	17	25	64	85	119	11	17	24	64	83	117

8. Ring Pressing Tools' Common Faults and Solutions

Note: If the tool is faulty, check whether all components are complete, installed in place, and operated correctly. This description provides simple troubleshooting instructions only. If the fault still exists, contact the dealer immediately. Without maintenance training, it is strictly prohibited to disassemble and repair it.

Symptom	Possible Cause	Solution
Failing to reach the rated operating pressure	A、Check whether the pressure gauge works properly ;	Contact the dealer to replace it
	B、Check whether the pressure relief valve is tightened;	Tighten the pressure relief valve
	C、Check the tool joints for leakage;	Tighten (threaded connection) or replace it
	D、Check whether there is sufficient oil in the oil tank;	Add qualified hydraulic oil
	E、Check whether the check bead at the low-pressure oil inlet works normally;	It is recommended to contact a professional for maintenance
Laborious pressing, too slow recovery of ring pressing pliers head piston	A、Check whether hydraulic oil grade is suitable;	32# hydraulic oil used in winter, 46# hydraulic oil used in summer
	B、If the construction environment is too cold, the oil viscosity will be affected;	Add antifreeze hydraulic oil or 1/3 transformer oil for dilution
	C、Check whether the pipeline is unobstructed.	Replace hydraulic oil regularly

The pressure rod rebounds after pressing	A、The check valve at the low-pressure oil outlet is loose;	It is advisable to seek the assistance of a professional for maintenance.
	B、The check valve at the high-pressure oil outlet is loose;	It is advisable to seek the assistance of a professional for maintenance.
Module closing failure	A、Check whether there are dirty or particle impurities in the gap between modules;	Clear the gap between modules
	B、Whether the pressure can reach the rated value;	Install or replace with a new pressure gauge
	C、Whether the model of ring pressing pliers head is consistent with these of pipe fittings and pipes;	Check all used pipe fittings
Piston failed to get back in place	A、Check whether the pressure relief valve is tightened too early;	Tighten the pressure relief valve after the piston returns in place
Oil supply interrupted of oil pump, accompanied by weak noise	A、Too low oil level, air entry	Inject some oil to increase the oil level
	B、Blockage of the suction inlet	Remove impurities at the suction inlet
	C、The vent valve is closed, and the oil tank is under low-pressure	Open the vent valve

9. Tool Maintenance

Tool maintenance includes tool inspection before use, tool observation during use, and tool maintenance after use. Routine maintenance of tools should meet the following requirements:

1. When the tool is not in use, release the pressure, put the tool in the packing box, and store it in a dry place out of rain. Apply the anti-rust oil to the surface of the module and jaw and conduct regular maintenance.
2. There is a certain anti-rust treatment on the surface of the tool, so the user should try to avoid damage to the surface protective layer resulting from collision and knocking during use. After completing the operation, wipe the tool clean and apply oil for maintenance.
3. Before the first use of the new oil pump and ring pressing pliers head, clean the inside of the oil pump several times with impurity-free diesel or kerosene. Cleaning method: Use the (new) oil pump to pump hydraulic oil into the (new) ring-pressing pliers head. Press the oil into the pliers head until the module closes. When the ring pressing pliers head's components are complete, and there is no load, the pressure is released.

   Repeat the operations a few times.
4. Keep the tool's oil nozzle, piston, and pressure adjusting knob clean to prevent dust and dirt from getting stuck on them.
5. Remove excessive impurities from the tank on a regular basis and filter or replace the oil in the oil pump based on how often the tool is used.

All the personnel participating in the training have mastered all contents of the training above. Please sign it for confirmation:

Field installation unit:_____ **Field installation head:**_____

Construction party tel.:_____ **Responsible person::** _____

Project leader's signature/seal: _____ **Trainer:**_____

Date: