INSTALLATION GUIDE FOR GASKETED JOINT PVC PRESSURE PIPE

(UPVC Pipe & PVC-O Pipe)

Shandong SIFFO Plastic Technology Co.,Ltd

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INTRODUCTION:

This document has been developed by Shandong Siffo Plastic Technology Co., Ltd. for use as a field installation guide. General information regarding the correct installation of gasketed-joint PVC pressure pipe is included. Relevant product standards are:

•International Organization for Standardization (ISO) 1452-2 "Plastics piping systems for water supply and for buried and above-ground drainage and sewerage under pressure - Unplasticized poly(vinyl chloride) (PVC-U) - Part 2: Pipes"

•ISO 16422-2 "Pipes and joints made of oriented unplasticized poly(vinyl chloride) (PVC-O) for the conveyance of water under pressure - Part 2: Pipes"

•The American Water Works Association (AWWA) C900 (4 in. through 12 in., for Water Distribution) and AWWA C905 (14 in. through 48 in., for Water Transmission and Distribution) standards are also for reference.

For more detailed information, consult the pipe manufacturer or refer to ISO 1452-2 and ISO 16422-2, AWWA C605 "Standard for Underground Installation of PVC and PVC-O Pressure Pipe and Fittings, ” and AWWA Manual M23 “ PVC Pipe – Design and Installation. "The Handbook of PVC Pipe: Design and Construction provides additional guidance. For information on this publication, please contact the relevant standards bodies or the SIFFO .

RECEIVING:

Upon delivery of pipe to the job site, it is your duty to conduct a complete inspection. Examine each piece for possible damage, if feasible, and verify quantities against the shipping documents. Please note that ownership of the pipe transfers to the carrier upon leaving the manufacturer. Any damage or shortages must be recorded on the bill of lading. Segregate any damaged materials and promptly notify the shipper.

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UNLOADING AND HANDLING:

You are also responsible for unloading the shipment. EXERCISE DUE CARE DURING UNLOADING. Negligent unloading may lead to product damage or personal injuries. If accessible, use a forklift or a front-end loader fitted with forks. Ensure the forks are sufficiently long to support the bundles. When unloading manually, handle individual pieces separately and use blocking to prevent the pipes from rolling off the truck.

Follow the following precautions:

- DO NOT drop pipe off the truck.
- DO NOT insert a forklift fork into a pipe end to transport.
- Lower the pipe into the ditch. DO NOT drop.

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The table below is provided for use as a guide in selection of handling equipment:

APPROXIMATE WEIGHT OF 20-FOOT PIPE LENGTHS (lbs)

PVC Pressure Pipe *CIOD*

Pipe Size	DR	DR	DR	DR	DR	DR	DR
(in.)	51	41	32.5	25	21	18	14
4	x	x	x	38	x	52	66
6	x	x	x	79	x	110	140
8	x	x	x	140	x	190	230
10	x	x	x	200	x	280	350
12	x	x	x	290	x	390	500
14	x	240	300	390	460	530	670
16	x	310	390	500	590	690	870
18	320	390	490	630	740	860	1100
20	390	480	600	770	910	1100	x
24	550	680	860	1100	1300	1500	x
30	850	1100	1300	1700	2000	2300	x
36	1200	1500	1900	2400	2900	x	x
42	1600	2000	2600	3300	3900	x	x
48	2100	2700	3300	4300	x	x	x

PVC Pressure Pipe *IPS*

Pipe Size	DR	DR	DR	DR	DR
(in.)	41	32.5	26	21	17
4	21	26	32	40	48
6	45	57	70	86	100
8	76	100	120	150	180
10	120	150	180	230	280
12	170	210	260	320	390
14	200	250	310	380	470
16	260	330	410	500	610
18	330	420	520	630	770
20	410	520	640	780	1000
24	590	740	900	1100	1400
30	930	1200	1400	1800	2200
36	1300	1700	2100	2500	3100

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STORAGE:

IFor unitized shipments, unloading by package facilitates storage. Stack packages on adeq uately level ground. When handling individual pieces, position the pipe with fittings aligned . Do not stack pipe over eight feet in height. Keep all pipe and gaskets away from heat sourc es, engine exhaust, oil, and grease to prevent damage.

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TRENCHING:

Ensure excavated material does not obstruct sidewalks, driveways, or utility access points. Adhere to all applicable safety rules and regulations. To protect personnel, use proper shoring and trench boxes in unstable areas, or slope trench walls appropriately in stable, dry soils. When relocating shoring or a trench box, take care not to displace the pipe or disturb the surrounding side-support material. For details on trench terminology and recommended procedures, refer to the "Trench Construction" section.

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DE-WATERING:

Keep the trench as dry as possible unl the pipe has been installed and enough backfill placed to prevent the p ipe from floang. PVC pipe will float if not filled with water or weighted down. The height of loose backfill m aterial required to prevent flotaon of empty pipe is conservavely equal to 1½ mes the pipe diameter.

FIELD CUTTING:

PVC pipe can be cleanly cut using a powered handsaw or an abrasive cutter. Always ensure the cut is perfectly square. Bevel the cut end with a suitable tool—such as a beveler, rasp, or sander—to match the angle and length of the factory-finished end. Finally, redraw the dept h line on the spigot end, using a factory-marked pipe as your reference.

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Place The pipe Into The Trench:

Carefully lower the pipe and fittings into the trench using ropes and skids, slings from a backhoe, or manual handling. Do not drop or throw materials into the trench, and avoid letting any part of the pipe undergo an uncontrolled drop against the trench bottom. Once positioned, the pipe and accessories should be ready for final inspection. Verify that all materials are undamaged before proceeding with assembly.

CLEANING AND INSPECTION:

Gaskets may be supplied separately or pre-installed in the pipe. Please refer to the pipe manufacturer's documentation for more information.

If the gasket is supplied separately, ensure it is clean and dry before inserting it into the socket groove. Before assembly, wipe the gasket groove and spigot clean and dry.

If the gasket is pre-installed in the pipe, wipe the gasket, the groove area behind the gasket, and the pipe spigot end clean. Inspect each gasket to ensure it is evenly inserted into the pipe.

Never remove gaskets from the pipe for cleaning purposes. Many gaskets are not removable; attempting to remove them will damage them.

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LUBRICATION:

Apply lubricant to the beveled surface of the spigot end, extending it to near the center of the pipe liner. Some manufacturers also recommend lubricating the inner gasket surface that will contact the spigot. Use only the lubricant supplied or approved by the pipe manufacturer.

JOINT ASSEMBLY:

Push the lubricated connector end past the washer into the bell housing until the insertion line on the connector is flush with the edge of the bell housing. Do not over-insert.

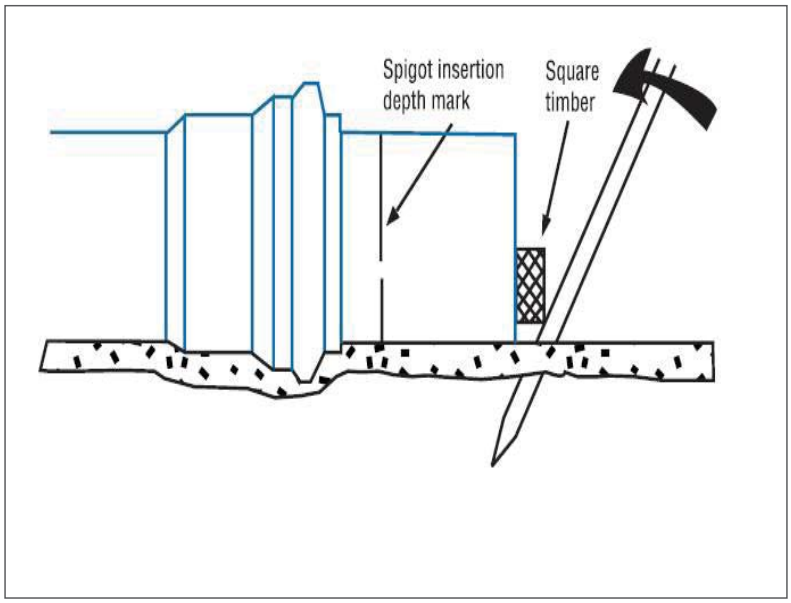
If joint assembly is difficult, disassemble the connection and inspect the gasket. For removable gaskets, replace if damaged. If a non-removable gasket is damaged, cut off the bell end, bevel the newly cut edge, and reassemble using a coupling. Ensure the gasket is correctly seated and that both pipe sections are in straight alignment. Then repeat the standard assembly steps.

Proper assembly is achieved when the insertion line on the spigot aligns with the edge of the bell. If multiple lines are present, insert until only one line remains visible.

The bar-and-block assembly method is recommended, as it allows the installer to feel the applied force and the smoothness of engagement. For larger pipes, mechanical assistance may be necessary to generate sufficient joining force.

When using mechanical devices, take care to insert the spigot only to the proper depth—ma rked by the insertion line—and avoid disturbing previously assembled joints. If the spigot is over-inserted, withdraw the pipe until the insertion line is visible. In all cases, maintaining s traight pipe alignment is essential. Misalignment, over-insertion, or excessive force during assembly may lead to the following consequences:

- rolled gasket
- split bell
- failure to pass acceptance testing (e.g., hydrostatic pressure test)
- over-insertion of previously assembled joints



Manual Bar-and-Block Method

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INSTALLING PIPE THROUGH CASINGS:

When the pipeline route crosses a high-traffic, protected, or landscaped area, installation within a casing may be required. Four key precautions must be followed when pushing the pipe through the casing:

Four Key Considerations During Installation:

1.Install spacers onto the PVC pipe.
2.Minimize friction during the pushing process.
3.Avoid over-insertion of the pipe.
4.Apply a water-permeable seal at both ends of the casing.

Casing Size:
The casing must be large enough to accommodate the maximum outside diameter at pipe bells and any spacer projections, but not so large that the pressurized PVC pipe can whip or snake excessively inside.

Casing Spacers:
Casing spacers are used to maintain proper clearance between the casing and the PVC pipe. They are typically equipped with runners to allow room for bell-and-spigot joints. For specific requirements on spacer quantity and placement, consult the manufacturer.

INSTALLATION OF FITTINGS AND VALVES:

The insertion depth for valves and fittings is generally less than for standard PVC pipe joints. For PVC fittings, consult manufacturer specifications. For metallic fittings, remove the factory bevel from the spigot end with a clean, deburred cut. Insert until the pipe contacts the fitting's internal stop, as outlined in standards such as AWWA C605 and ISO 1452-2.

For thrust restraint, mechanical devices clamping the pipe and fitting can be used, or self-restraining joint systems. Always follow the restraint device manufacturer's specific installation instructions.

TRACER WIRE:

Properly installed tracer wires help locate PVC pipes. Typically, during pipe installation, insulated wires or plastic-coated metal strips are laid on the pipes. The tracer wire is usually located at the riser but is not electrically connected to it.

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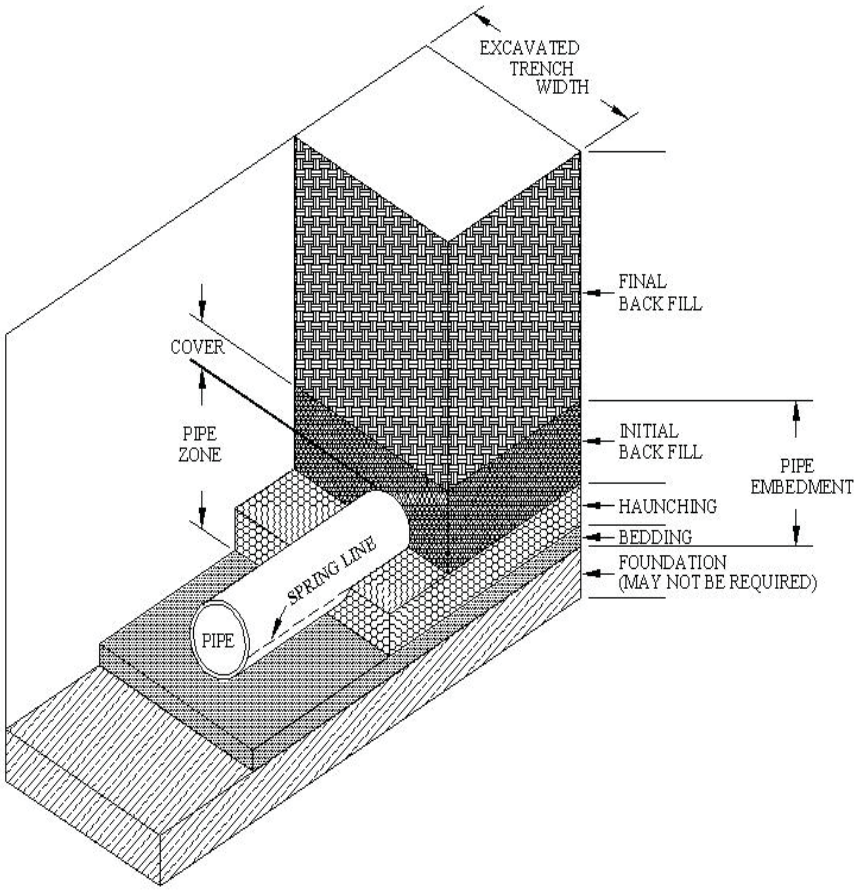
TRENCH CONSTRUCTION:

The terminology used in pipe installation is shown in the trench cross-section diagram below. Using appropriate embedding materials is crucial to minimizing trench components. For pipes with diameters from 4 inches to 12 inches(DN110-DN315 in ISO 1452 standard), the particle size of the material in contact with the pipe must not exceed: ¾ inch for angular rocks and 1.5 inch for round rocks. For pipes with diameters of 14 inches (DN355) and above, the maximum particle size of the material in contact with the pipe is 1.5 inch.



FOUNDATION:

A foundation is required if the trench bottom is unstable. The trench bottom should be over -excavated and backfilled to grade level with suitable compacted material. Where over-excavation is performed, ensure the entire length of the pipe—not only at the joints—is unif ormly supported. Proper backfilling prevents pipe sagging and ensures continuous bearing along the pipeline.

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BEDDING:

Bedding may be used to raise the trench bed to the required grade before laying the pipe. Its purpose is to provide continuous support along the pipe length. Where necessary—for ex ample, in rocky soil—a minimum depth of 4 to 6 inches is generally recommended.

Bell holes should be excavated at each joint to maintain even pipe support. These holes should be only as large as needed to accommodate the joint during assembly.

HAUNCHING:

Properly placing material at the pipe arch reduces voids and enhances pipe support. If using granular material, it can be properly placed using methods such as shoveling. Place the material under the pipe arch and extend at least half the pipe height to provide lateral support. Ensure the material is fully compacted. Never disturb the lateral support when moving baffles or trench boxes.
The strength of the pipe and the expected load will determine whether granular material and/or compacted material at the pipe arch are necessary.

INITIAL BACKFILL:

The material placed from 6 to 12 inches above the pipe crown is termed the initial backfill. This layer serves to shield the pipe during subsequent final backfilling operations. Unless specified differently, suitable native trench material may be used, provided it is free of large rocks, debris, organic matter, and is not frozen.

Machine compaction directly above the pipe should be avoided unless sufficient protective cover has been placed. The required depth of this cover depends on the compaction equipment used—consult the project engineer for specific guidance.

FINAL BACKFILL:

The final backfill is typically specified by the project engineer based on the site design. The selection, placement, and compaction of materials should meet project requirements. In many cases, the material initially excavated can be used for the final backfill.

COMPACTING THE BACKFILL:

According to the construction drawings, compact the arch slope, initial backfill, and final backfill. Note the following:

•When using self-compacting materials (such as crushed stone), ensure that the material d oes not form arches or bridges at the bottom of the pipe. Remove these gaps with a shovel.

•When compacting the material under and on both sides of the pipe, never allow tools or m achines to hit the pipe.

To ensure the structural strength of the pipeline, it is not necessary to compact the initial backfill directly onto the top of the pipeline. However, to ensure road surface integrity and minimize trench components, it may sometimes be necessary to do so.

OVERNIGHT PRECAUTIONS:

At the end of each workday, ensure that all installed pipe ends are capped to prevent dust, debris, and animals from entering the pipes. Backfill as necessary to prevent pipes from floating.

ACCEPTANCE TESTING:

General : When local conditions require immediate backfilling of the trench after pipeline installation, testing can be conducted after backfilling is completed. In all cases, sufficient backfill material should be used (minimum depth of 1.5 times the pipe size) to ensure the safety of the pipeline system during testing.

Testing Procedure: Testing shall be conducted only after the pipeline has been completely filled, flushed, and fully vented of air. The specified test pressure shall be applied using an approved pump system, connected in a manner acceptable to the purchaser. To prevent pipe movement, sufficient backfill must be in place prior to filling and testing. The test pressure must not exceed the limit set by the engineer. If required, this pressure shall be maintained by supplementary pumping for the designated duration, during which the entire system—including all exposed pipe, fittings, valves, and hydrants—must be thoroughl y inspected for leaks. Any visible leaks must be sealed. All defective components shall be re paired or replaced. The test shall be repeated until all specified requirements are satisfied.

Durability test: Unless otherwise specified, the durability of the hydrostatic test shall be 2 hours.

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Test Pressure: The hydrostatic test pressure shall not be less than 125% of the maximum anticipated sustained working pressure at the highest point along the test section unless the pressure exceeds the design pressure limit for any component of the test section. In no case shall the test pressure exceed the design pressure limit for any component, including pipe, valve, fitting, thrust restraint, or other appurtenance.

Test Allowance: The testing allowance shall be defined as the quantity of water that must be supplied to the pipe section being tested to maintain a pressure within 5 psi of the specified hydrostatic test pressure.

Make-up water allowances are provided in the table below:

HYDROSTATIC TEST MAKE-UP WATER ALLOWANCE

(U.S. Gallons per Hour Per 1000 Feet of PVC Pipe)

Pipe Size	Average Pressure in Line (psi)				
(in.)	50	100	150	200	250
4	0.19	0.27	0.33	0.38	0.43
6	0.29	0.41	0.50	0.57	0.64
8	0.38	0.54	0.66	0.76	0.85
10	0.48	0.68	0.83	0.96	1.07
12	0.57	0.81	0.99	1.15	1.28
14	0.67	0.95	1.16	1.34	1.50
16	0.76	1.08	1.32	1.53	1.71
18	0.86	1.22	1.49	1.72	1.92
20	0.96	1.35	1.66	1.91	2.14
24	1.15	1.62	1.99	2.29	2.56
30	1.43	2.03	2.48	2.87	3.21
36	1.72	2.43	2.98	3.44	3.85
42	2.01	2.84	3.48	4.01	4.49
48	2.29	3.24	3.97	4.59	5.18

When testing against closed metal-seated valves, an additional allowance per closed valve of 0.0078 gallon per hour per nominal inch of valve size shall be allowed. When hydrants are in the test section, the test shall be made against closed hydrant valves.

Should the make-up water volume exceed the testing allowance, it is probable that the system has a leak that must be located and repaired.

Having a make-up water volume below the testing allowance indicates a successful test. Since PVC gasketed pipe is a leak-free system, low volumes of make-up water do not indicate a leak. Instead make-up water is necessary to accommodate entrapped air, slight movement of the pipe at thrust restraints, or a small increase in interior pipe volume due to radial expansion.

SPECIAL CONSIDERATIONS:

Changes in Direction:

1. Pipe bending – Some changes in direction may be accomplished without the use of bends, sweeps, or other fittings. Controlled bending within acceptable limits can be accommodated by PVC pipe. A general rule of thumb for the minimum bending radius (R_b) calculation is R_b = 250 OD. Tighter bending radii may be achieved for certain products. Consult the manufacturer for specific product information. In most cases, bending should be accomplished manually. It is not recommended to attempt bending pipes greater than 12” in diameter due to the forces required.

2. Joint deflection – Changes in direction may also be accomplished through joint deflection. Allowable joint deflection is dependent on pipe size and joint design. Joint deflection limits should be obtained from the pipe manufacturer.

3. Combined pipe bending and joint deflection – Either joint deflection or longitudinal bending may be used for changes in direction, BUT NOT BOTH on the same length of pipe.

Cold-Weather Installation: Extremely cold temperatures result in increases in pipe stiffness and tensile strength and decreases in impact strength. The decrease in impact strength requires care in handling during installation in cold temperatures.

Disinfection: For information on the procedures for disinfecting water mains, refer to AWWA C651, “Disinfecting Water Mains.”

Tapping: For information on tapping of PVC pressure pipe, see the Uni-Bell website.

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CHECKLIST:

- Take all precautions necessary to protect workers and materials.
- Plan ahead for fittings.
- Use trench boxes or shoring as required.
- Do not disturb installed pipe when moving trench boxes or shoring materials.
- Properly assemble pipe joints by inserting the spigot end until the insertion line is even with the bell lip.
- Keep the trench bottom as dry as possible.
- For detailed installation recommendations, see AWWA C605 “Standard , ISO1452-2 and ISO 16422 for Underground Installation of PVC and PVC-O Pressure Pipe and Fittings.”
- Consult the pipe manufacturer for specifics regarding gaskets and lubricants.
- Check with the project engineer regarding specifications and procedures.