



Royal GVS-65, Gas Venting System

Royal Pipe Systems has developed **GVS-65 and GVS-90**, complete PVC and CPVC pipe systems designed for use as Type BH, Class IIA and B gas venting systems with temperature ratings of up to and including 65°C (G VS-65) and 90°C (GVS-90). Royal GVS-65 and GVS-90 have been third party certified to ULC S636. GVS-65/90 require zero clearance to combustible construction.

These systems include fittings, pipe, solvent cement and primer. Only GVS-65/90 components may be used as part of these systems-do not use fittings, pipe, solvent cement or primer from any other manufacturer with the Royal GVS-65/90 systems. Do not mix pipe, fittings or joining methods from different manufacturers.

GVS-65 pipe and fittings (PVC) are white in colour. GVS-65 (PVC) solvent cement is grey in colour and GVS-65/90 primer is purple.

GVS-90 (CPVC) pipe and fittings are grey in colour. GVS-90 (CPVC) solvent cement is orange in colour and GVS-65/90 primer is purple.

Prior to the start of installation, all components must be examined for possible damage due to shipping.

Proper joint construction is essential for safe installation and operation. The joint construction procedure included in these instructions shall be followed exactly as written for assembly of Royal GVS-65/90. Check for proper joint construction when joining pipe to fittings.

These venting systems must be free to expand and contract and must be supported in accordance with these instructions. Check for unrestricted vent movement through walls, ceilings and roof penetrations.



Installation shall comply with the latest edition of CAN/CSA-B149.1 including supplements, the gas appliance manufacturer's installation instructions and local building codes, and shall be undertaken by qualified personnel.

All system installations shall be inspected by a qualified inspector prior to being placed into operation and at least once per year after start of operation, as per the authority having jurisdiction.

Vent piping which penetrates fire separations in buildings shall be properly firestopped in accordance with the applicable standards.

Prior to installation of these systems, the authority having jurisdiction (such as gas inspection authority, municipal building department, fire department, fire prevention bureau, etc.) should be consulted to determine the need to obtain a permit.

Acceptance of these systems is dependent upon full compliance with the installation instructions.

The safe operation of a system is based on the use of parts supplied by the manufacturer and the performance of the system may be affected if the combination of these parts is not used in actual building construction.

All framing of openings in walls, roofs, ceilings and floors shall be as per the applicable code.

Venting:

All installations of vent piping shall be according to CAN/CSA-B149.1 and the gas appliance manufacturer's installation instructions, and shall comply with all other

applicable codes. Vent piping which runs through unconditioned spaces must be insulated.

Horizontal:

Horizontal piping must slope back towards the appliance with a minimum slope of 20mm per 1000 mm to allow condensate to drain toward the appliance. Consult the appliance manufacturer's installation instructions for further details regarding the installation of condensate drain fittings.

Horizontal piping must be supported by 3/4" steel straps, placed a minimum of every 1.2 metres. Supports must be installed such that movement due to expansion and contraction can occur.

Vertical:

In the case of vertical piping in a multiple storey structure, the pipe shall be supported at its base and at the floor level of alternate storeys above the base by anchors that can bear the weight of pipe above it.

Expansion and Contraction:

Pipe products expand and contract with changes in temperature. This variation in length depends on the coefficient of thermal expansion of the pipe material. Different pipe diameters or wall thicknesses do not change the rate of thermal expansion or contraction for each pipe material.

The Coefficient of Thermal Expansion for PVC is as follows:

3×10^{-5} in (expansion/contraction) / in (pipe length) / °F (change in temperature),

5.4×10^{-5} mm (expansion/contraction) / mm (pipe length) / °C (change in temperature)

The following tables give values for expansion/contraction for different changes in temperature and lengths of PVC pipe runs.

Expansion/Contraction of PVC (mm)										
Δ T (°C)	Length of Pipe Run (m)									
	2	4	6	8	10	12	14	16	18	20
5	0.54	1.08	1.62	2.16	2.70	3.24	3.78	4.32	4.86	5.40
10	1.08	2.16	3.24	4.32	5.40	6.48	7.56	8.64	9.72	10.80
15	1.62	3.24	4.86	6.48	8.10	9.72	11.34	12.96	14.58	16.20
20	2.16	4.32	6.48	8.64	10.80	12.96	15.12	17.28	19.44	21.60
25	2.70	5.40	8.10	10.80	13.50	16.20	18.90	21.60	24.30	27.00
30	3.24	6.48	9.72	12.96	16.20	19.44	22.68	25.92	29.16	32.40
35	3.78	7.56	11.34	15.12	18.90	22.68	26.46	30.24	34.02	37.80
40	4.32	8.64	12.96	17.28	21.60	25.92	30.24	34.56	38.88	43.20
45	4.86	9.72	14.58	19.44	24.30	29.16	34.02	38.88	43.74	48.60
50	5.40	10.80	16.20	21.60	27.00	32.40	37.80	43.20	48.60	54.00

Expansion/Contraction of PVC (in)										
Δ T (°F)	Length of Pipe Run (ft)									
	5	10	15	20	25	30	35	40	45	50
5	0.01	0.02	0.03	0.04	0.05	0.05	0.06	0.07	0.08	0.09
10	0.02	0.04	0.05	0.07	0.09	0.11	0.13	0.14	0.16	0.18
15	0.03	0.05	0.08	0.11	0.14	0.16	0.19	0.22	0.24	0.27
20	0.04	0.07	0.11	0.14	0.18	0.22	0.25	0.29	0.32	0.36
25	0.05	0.09	0.14	0.18	0.23	0.27	0.32	0.36	0.41	0.45
30	0.05	0.11	0.16	0.22	0.27	0.32	0.38	0.43	0.49	0.54
35	0.06	0.13	0.19	0.25	0.32	0.38	0.44	0.50	0.57	0.63
40	0.07	0.14	0.22	0.29	0.36	0.43	0.50	0.58	0.65	0.72
45	0.08	0.16	0.24	0.32	0.41	0.49	0.57	0.65	0.73	0.81
50	0.09	0.18	0.27	0.36	0.45	0.54	0.63	0.72	0.81	0.90

The Coefficient of Thermal Expansion for CPVC is as follows:

- 3.8 x 10⁻⁵ in (expansion/contraction) / in (pipe length) / °F (change in temperature),
- 6.8 x 10⁻⁵ mm (expansion/contraction) / mm (pipe length) / °C (change in temperature)

The following tables give values for expansion/contraction for different changes in temperature and lengths of CPVC pipe runs.

Expansion/Contraction of CPVC (mm)										
	Length of Pipe Run (m)									
Δ T (°C)	2	4	6	8	10	12	14	16	18	20
5	0.68	1.36	2.04	2.72	3.40	4.08	4.76	5.44	6.12	6.80
10	1.36	2.72	4.08	5.44	6.80	8.16	9.52	10.88	12.24	13.60
15	2.04	4.08	6.12	8.16	10.20	12.24	14.28	16.32	18.36	20.40
20	2.72	5.44	8.16	10.88	13.60	16.32	19.04	21.76	24.48	27.20
25	3.40	6.80	10.20	13.60	17.00	20.40	23.80	27.20	30.60	34.00
30	4.08	8.16	12.24	16.32	20.40	24.48	28.56	32.64	36.72	40.80
35	4.76	9.52	14.28	19.04	23.80	28.56	33.32	38.08	42.84	47.60
40	5.44	10.88	16.32	21.76	27.20	32.64	38.08	43.52	48.96	54.40
45	6.12	12.24	18.36	24.48	30.60	36.72	42.84	48.96	55.08	61.20
50	6.80	13.60	20.40	27.20	34.00	40.80	47.60	54.40	61.20	68.00

Expansion/Contraction of CPVC (in)										
	Length of Pipe Run (ft)									
Δ T (°F)	5	10	15	20	25	30	35	40	45	50
5	0.01	0.02	0.03	0.05	0.06	0.07	0.08	0.09	0.10	0.11
10	0.02	0.05	0.07	0.09	0.11	0.14	0.16	0.18	0.21	0.23
15	0.03	0.07	0.10	0.14	0.17	0.21	0.24	0.27	0.31	0.34
20	0.05	0.09	0.14	0.18	0.23	0.27	0.32	0.36	0.41	0.46
25	0.06	0.11	0.17	0.23	0.29	0.34	0.40	0.46	0.51	0.57
30	0.07	0.14	0.21	0.27	0.34	0.41	0.48	0.55	0.62	0.68
35	0.08	0.16	0.24	0.32	0.40	0.48	0.56	0.64	0.72	0.80
40	0.09	0.18	0.27	0.36	0.46	0.55	0.64	0.73	0.82	0.91
45	0.10	0.21	0.31	0.41	0.51	0.62	0.72	0.82	0.92	1.03
50	0.11	0.23	0.34	0.46	0.57	0.68	0.80	0.91	1.03	1.14

The following are suggestions for accommodating expansion/contraction with PVC/CPVC pipe:

- Pipe supports should be installed loosely enough to allow linear movement of pipe.
- Properly designed offsets should be used to accommodate expansion/contraction for long pipe runs.
- Pipe should not be anchored rigidly in walls or against joists-pipe must be allowed to move freely at every support location.

Vent Termination:

General:

The venting system shall terminate in accordance with the requirements of CAN/CSA B149.1, the gas appliance manufacturer's installation instructions and the local building code.

A venting system shall not terminate (CAN/CSA B149.1):

- less than 7 ft above a paved sidewalk or a paved driveway that is located on public property;
- within 6 ft of a mechanical air-supply inlet to any building;
- above a meter and regulator assembly within 3 ft horizontally of the vertical centerline of the regulator vent outlet to a maximum vertical distance of 15 ft;
- within 3 ft of any gas service regulator vent outlet;
- less than 1 ft above grade level;
- within 6 in (inputs up to and including 10,000 Btuh), 12 in (inputs from 10,000 Btuh to 100,000 Btuh inclusive) and 3 ft (inputs exceeding 100,000 Btuh) of a window or door that can be opened in any building, of any non-mechanical air-supply inlet to any building, or of the combustion air inlet of any other appliance;
- underneath a veranda, porch or deck unless they are open on a minimum of two sides under the floor, or if the distance between the top of the vent termination and the underside of the veranda, porch or deck is greater than 1 ft.

Horizontal:

Horizontal vents should pass through the exterior wall of the building. Horizontal vent termination shall be according to Figure 1 or Figure 2 (if adequate vertical clearance is not available), or using the Royal GVS-65 Side Wall Vent Kit.

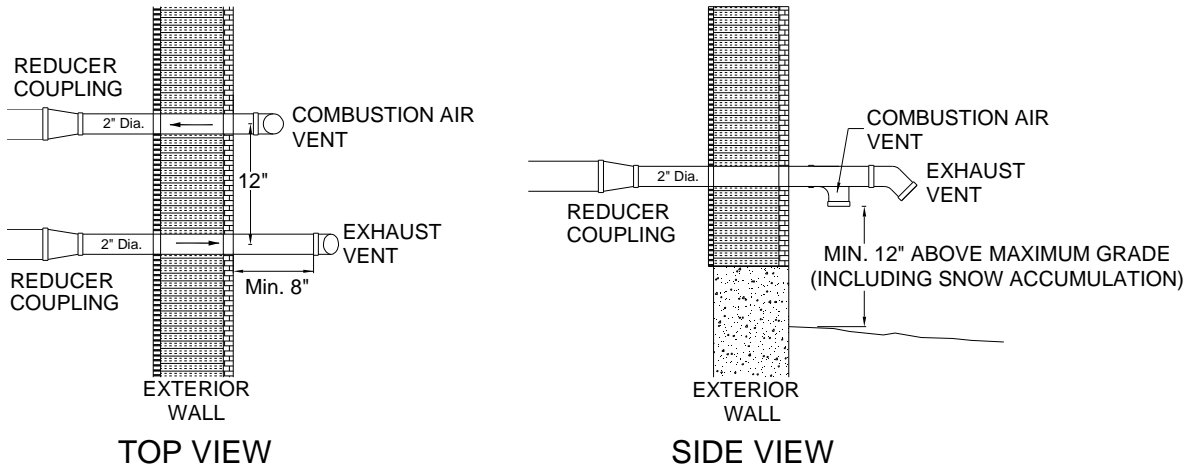


Figure 1

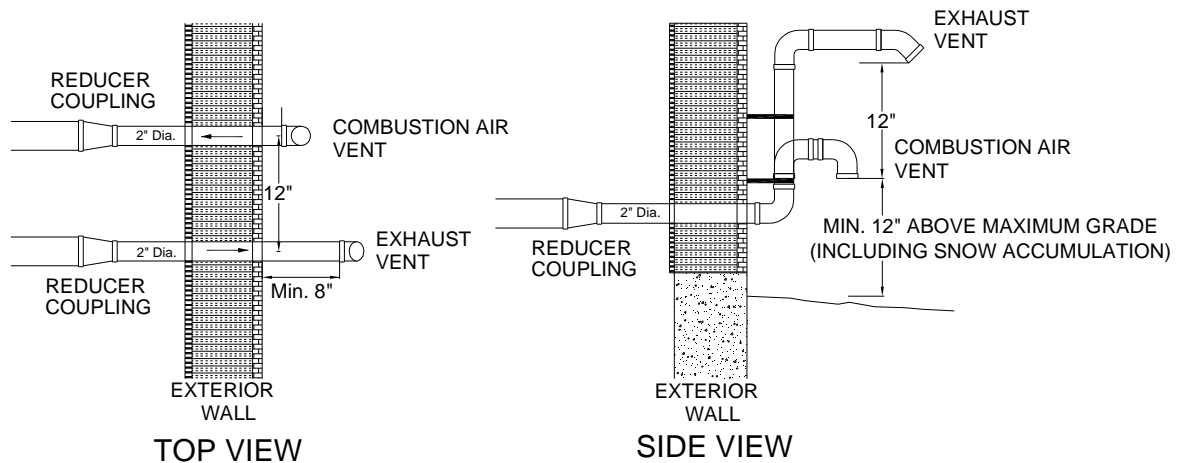


Figure 2

Royal GVS-65 Side Wall Vent Kit:

Royal offers a vent termination kit to be used with our Class IIA (PVC) gas venting system for horizontal vent terminations. This kit is available for 2" and 3" horizontal vent terminations.

This vent kit is to be used with Category IV condensing furnaces only. Do not use with Category I, II or III furnaces.

The vent kit provided includes:

- 1-Vent Terminal Base
- 1-Vent Termination Cap
- 4-#8 x 1" SS Screws
- 4-#8 x 2" SS Screws
- 4-Plastic Screw Anchors
- 1-Instruction Sheet

Side Wall Vent Kit Installation:

- 1 Determine the best location for the vent terminal. In addition to all applicable codes, consider the following:
 - a. Minimize the length of pipe and fittings in the piping. Consult the appliance installation manual to determine maximum length of pipe and fittings allowed.
 - b. Terminal kit should be positioned where vent vapors will not damage plants, shrubs, building materials, air-conditioning equipment, or where the vapors might be objectionable.
 - c. Terminal kit should be located where it will not be affected by wind gusts, snow build up, leaves or other debris that will inhibit the function of the vent exhaust or intake.

2. Vent may be oriented in any direction as long as it is mounted on a vertical wall (See Figure 3).

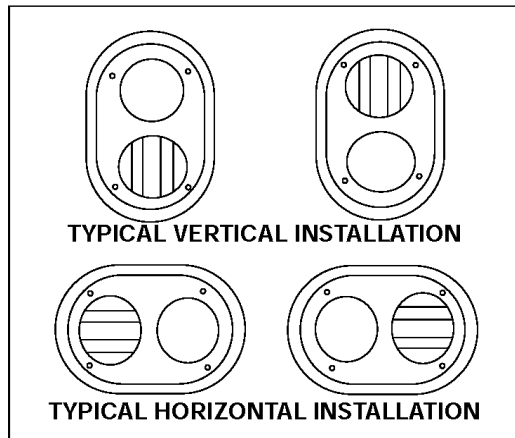


Figure 3

3. If multiple vent kits are being installed, there must be at least 16" horizontal space between the vent caps. To prevent the possibility of condensate freeze-up, do not locate the vent kits above one another.
4. Use the vent base as a template to locate the vent and intake holes and four mounting holes. Cut two 3-7/8" diameter holes for the exhaust and intake pipes. Drill four 3/16" diameter holes for the mounting screws. Insert plastic anchors in holes. Attach vent base to wall with 4-#8 x 2" SS screws.
5. Assemble the vent cap to the vent base with 4-#8 x 2" SS screws.
Do not operate the furnace without the vent cap in place.
Recirculation of combustion products may occur resulting in equipment damage, personal injury or death.
6. Install the exhaust and intake piping through the wall into the vent termination kit. Use RTV silicon sealant to seal the pipe to the vent cap,

- to allow future disassembly and cleaning. **Do not use PVC solvent cement or primer.**
7. Seal gap between pipes and wall with expanding foam or other suitable material.
 8. Extend intake and exhaust pipes to appliance, making sure to attach intake and exhaust to the correct sides of the vent cap. **Use only Royal GVS-65, PVC pipe, fittings, primer and solvent cement.**
 9. Operate appliance for a minimum of 15 minutes to ensure that it works properly and that all piping joints are sealed, to prevent the escape of combustion products into the home.

Figure 4 shows the installation of the side wall vent kit.

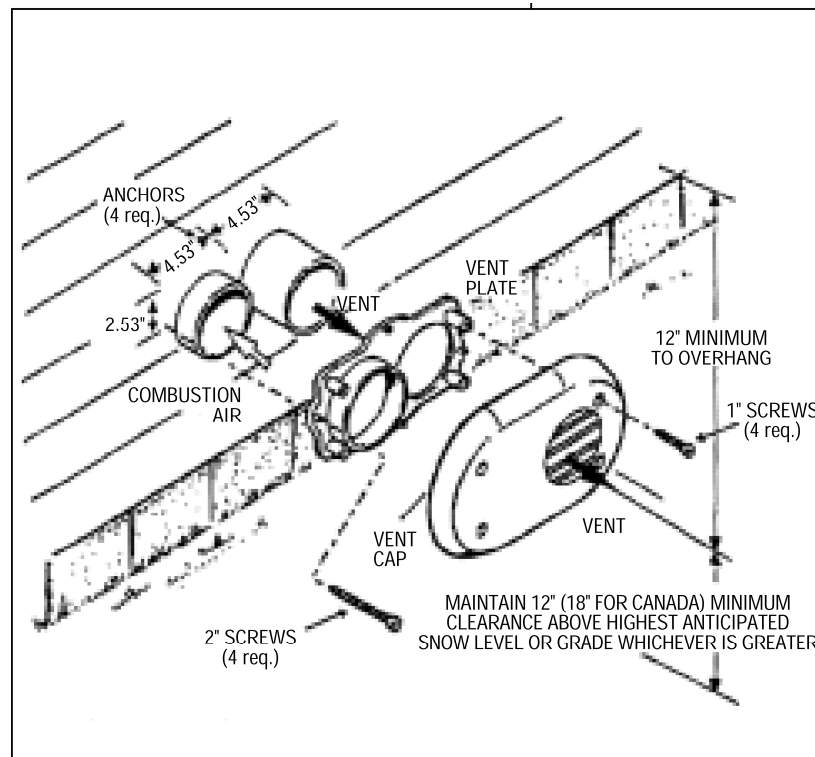


Figure 4

Vertical:

Vent piping can also be installed in a vertical position with the vent terminating through the roof. In this instance, all framing, firestopping and flashing shall be installed as per the local building code.

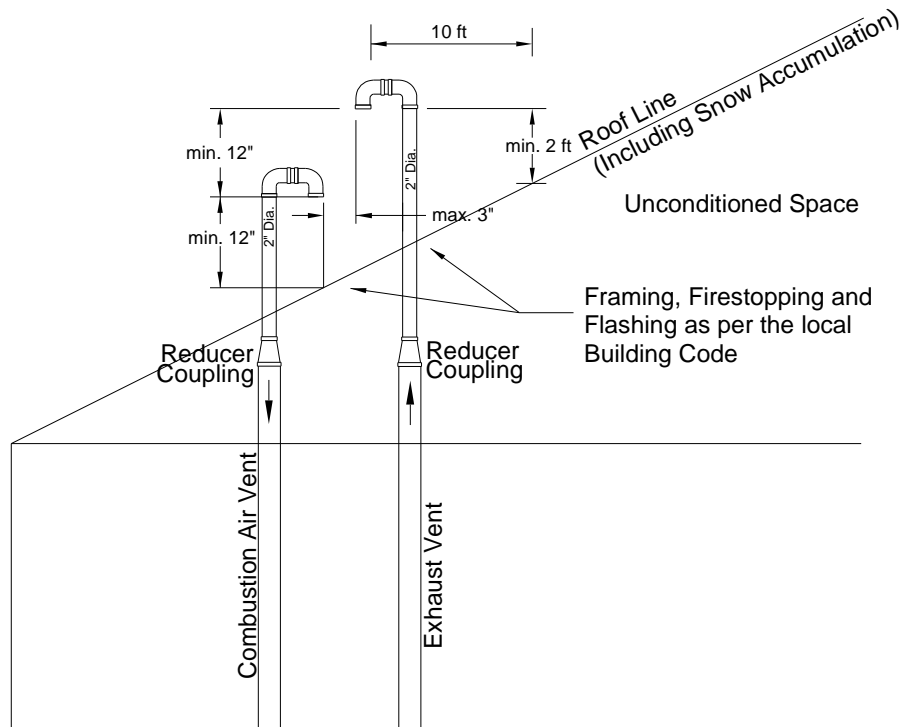


Figure 5

Joint Construction

General:

- Use only Royal Pipe Systems GVS-65/90 primer and solvent cements.
- Use solvent cement and primer prior to expiration date marked on container.
- Above 0°C ambient temperature, joints may be assembled without the use of primer, provided adequate penetration and softening of the pipe/fitting surface can be achieved with solvent cement alone.

Solvent Cementing Procedure, With Primer:

1. Assemble materials for the job, including correct solvent cement, primer and correctly sized applicator.
2. Cut pipe as square as possible using a hand saw and miter box or mechanical saw. Do not use a diagonal cut, as it reduces the bonding area in the joint.
3. If plastic tubing cutters are used, care must be taken to remove any raised bead at the end of the pipe, caused by cutting. A file or reamer may be used to remove the bead.
4. Use a knife, file or reamer to remove burrs from the inside and outside of the pipe end, as these will hinder the integrity of the joint. All sharp edges should be removed from the inside and outside edges of the pipe to prevent the pipe from pushing the solvent cement into the fitting socket, thereby causing a weak spot to form. The pipe end should be chamfered, as shown in Figure 6.

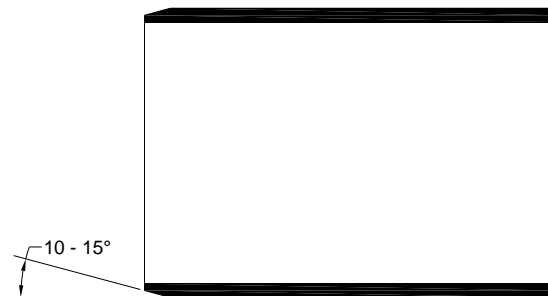


Figure 6

5. All dirt, grease and moisture should be removed from the pipe and socket by thoroughly wiping with a clean, dry cloth.
6. Dry fit pipe and fitting joints prior to cementing. For proper interference fit, the pipe should go easily into the socket approximately 1/3 to 2/3 of the socket depth. If this is not the case, other pipe or fittings should be used.

7. *The applicator should be sized according to the size of pipe and fittings being joined. The brush width of the applicator should be equal to approximately ½ of the pipe diameter.*
8. *Primer is used to penetrate and soften the surfaces so that they will fuse together under a wide variety of conditions. The penetration or softening can be checked by dragging the edge of a knife or sharp object over the coated surface. If a few thousandths of an inch of the primed surface can be scratched or scraped away, proper penetration has occurred. Varying weather conditions affect priming and cementing action and may require more time or repeated applications to either or both surfaces.*
9. *Using the correct applicator size (see # 7), aggressively work the primer into the socket, keeping the surface and applicator wet until the surface has softened, re-dipping the applicator as required. When the surface is primed, remove any puddles of primer from the socket.*
10. *Aggressively work the primer on to the end of the pipe, to a point ½” beyond the depth of the socket.*
11. *Perform a second application of primer in the socket.*
12. *While the surfaces are still wet, the appropriate solvent cement should be applied.*
13. *Using the correct applicator size, aggressively work a full, even layer of cement onto the pipe end to a point equal to the depth of the socket. Do not brush out to a thin paint type layer, as this will dry within a few seconds.*
14. *Aggressively work a medium layer of cement into the fitting socket; avoid puddling cement in the socket. On the pipe end, do not coat beyond the socket depth or allow cement to run down into the pipe beyond the socket.*
15. *Apply a second full, even layer of cement on the pipe.*

16. Immediately, while the cement is still wet, assemble the joint. Use enough force to ensure that the pipe is fully inserted into the socket. Twist the pipe a ¼ turn as it is being inserted.
17. Hold the joint together for approximately 30 seconds to avoid push out.
18. After assembly, inspect the joint to ensure that there is a ring or bead of cement completely around the juncture of the pipe and socket. If there are voids in this ring, sufficient cement was not applied and the joint may be defective.
19. Remove the excess cement from the pipe and socket (including the ring or bead) using a cloth. Avoid disturbing or moving the joint.
20. Handle newly cemented joints with care until initial set has taken place. Follow set and cure times before handling or testing the system.

Solvent Cementing Procedure, Without Primer:

1. Assemble materials for the job, including correct cement and correctly sized applicator.
2. Cut pipe as square as possible using a hand saw and miter box or mechanical saw. Do not use a diagonal cut, as it reduces the bonding area in the joint.
3. If plastic tubing cutters are used, care must be taken to remove any raised bead at the end of the pipe, caused by cutting. A file or reamer may be used to remove the bead.
4. Use a knife, file or reamer to remove burrs from the inside and outside of the pipe end, as these will hinder the integrity of the joint. All sharp edges should be removed from the inside and outside edges of the pipe to prevent the pipe from pushing the solvent cement into the fitting socket, thereby causing a weak spot to form. The pipe end should be chamfered, as shown in Figure 4.

5. All dirt, grease and moisture should be removed from the pipe and socket by thoroughly wiping with a clean, dry cloth.
6. Dry fit pipe and fitting joints prior to cementing. For proper interference fit, the pipe should go easily into the socket approximately 1/3 to 2/3 of the socket depth. If this is not the case, other pipe or fittings should be used.
7. The applicator should be sized according to the size of pipe and fittings being joined. The brush width of the applicator should be equal to approximately ½ of the pipe diameter.
8. The penetration or softening can be checked by applying a normal layer of solvent cement to a scrap piece of pipe and dragging the edge of a knife or sharp object over the coated surface. If a few thousandths of an inch of the coated surface can be scratched or scraped away, proper penetration has occurred. Varying weather conditions affect cementing action and may require more time, repeated applications to either or both surfaces or the use of primer.
9. Using the correct applicator size, aggressively work a full, even layer of cement onto the pipe end to a point equal to the depth of the socket. Do not brush out to a thin paint type layer, as this will dry within a few seconds. Do not coat beyond the socket depth or allow cement to run down into the pipe beyond the socket.
10. Aggressively work a medium layer of cement into the fitting socket; avoid puddling cement in the socket.
11. Apply a second full, even layer of cement on the pipe to a point equal to the depth of the socket.
12. Immediately, while the cement is still wet, assemble the joint. Use enough force to ensure that the pipe is fully inserted into the socket. Twist the pipe a ¼ turn as it is being inserted.
13. Hold the joint together for approximately 30 seconds to avoid push out.

14. After assembly, inspect the joint to ensure that there is a ring or bead of cement completely around the juncture of the pipe and socket. If there are voids in this ring, sufficient cement was not applied and the joint may be defective.
15. Remove the excess cement from the pipe and socket (including the ring or bead) using a cloth. Avoid disturbing or moving the joint.
16. Handle newly cemented joints with care until initial set has taken place. Follow set and cure times before handling or testing the system.

Set Times

Average Initial Set Times		
Temperature Range	1 ½" – 2"	2 ½" to 4"
15° to 40° C	5 min.	30 min.
5° to 15° C	10 min.	2 hrs.
-16° to 5° C	15 min.	12 hrs.

Joint Cure Schedule

Average Joint Cure Schedule		
Relative Humidity 60% or Less	Cure Time	Cure Time
Temperature Range During Assembly and Cure Periods	Pipe Sizes	Pipe Sizes
	1 ½" – 2"	2 ½" – 4"
15° to 40° C	30 min.	1 ½ hrs.
5° to 15° C	45 min.	4 hrs.
-16° to 5° C	1 hr.	12 hrs.

In damp or humid weather allow 50% more cure time.

Estimated Solvent Cement Requirements

Average Number of Joints per Litre of Solvent Cement					
Pipe/Fitting Diameter	1 ½"	2"	2 ½"	3"	4"
Number of Joints	90	60	40	40	30

Estimated Primer Requirements

Average Number of Joints per Litre of Primer					
Pipe/Fitting Diameter	1 ½"	2"	2 ½"	3"	4"
Number of Joints	180	120	80	80	50

Solvent Cementing in Cold Weather:

- Store pipe and fittings in a heated area. Prefabricate as much of the system as possible in a heated area.
- When not in use, store sealed solvent cement and primer between 5°C and 21° C. Do not use open flame or electric heaters to warm cements and primers.
- Take care to remove moisture, ice and snow from the mating surfaces.

Solvent Cementing in Hot Weather:

- At the time of assembly, the surface temperature of the mating surfaces should not exceed 45°C. Shade or shelter the joint surfaces from direct sunlight for at least 1 hour prior to joining and during the joining process. If necessary, swab the mating surfaces with clean, wet rags to reduce the surface temperature (thoroughly dry surfaces before applying primer or cement).
- Make joints during the cooler early morning hours.
- Apply cement quickly and join pipe to fitting as quickly as possible after applying the cement.

- *Keep solvent cement container closed or covered when not in use, to minimize solvent loss.*

Solvent Cementing in Wet Conditions:

- *Mating surfaces must be dry when the joint is made.*
- *Work under a cover or canopy to keep rain off pipe and fittings.*
- *Work quickly after drying the pipe and fitting to avoid condensation.*
- *Allow a longer cure time before the system is tested or used.*

Storage and Handling of Solvent Cement and Primer:

- *Solvent cement and primer contain highly flammable solvents. Follow all specific safety precautions provided on container label and Material Safety Data Sheet.*
- *Keep primer and solvent cement away from heat, sparks and open flame.*
- *Keep containers tightly closed except when in use.*
- *Ensure proper ventilation of work area and avoid inhaling solvent vapours.*
- *Where the possibility of splashing exists, wear proper eye protection or a face shield.*
- *Avoid contact with skin.*