PVC ELECTRICAL FITTINGS

KRALOY®

For more than 40 years, Kraloy has been a pioneer in the field of PVC conduit fittings. As the first UL approved manufacturer of PVC fittings, Kraloy's rich history allows us to be an industry leader today.

Kraloy offers a comprehensive offering of PVC nonmetallic conduit fittings. Kraloy conduit fitting products include adapters, couplings, elbows, access fittings, boxes, cover plates, expansion fittings and conduit spacers - virtually any fitting required to complete the PVC conduit system.

Easy installations, the ability to perform in demanding environments and labor savings are the reasons nonmetallic conduit fittings are increasingly the fitting of choice. Kraloy PVC conduit fittings offer both high impact and tensile strength, are nonconductive and are resistant to a wide range of chemicals such as acids, alkalis and salt solutions.

APPLICATIONS

- Residential single & multi family dwellings
- Food processing plants
- Fish processing plants
- Street and highway lighting
- Sewage treatment plants
- Water treatment plants
- Bridges and tunnels
- Communications
- Pulp and paper
- Agricultural
- Airports
- Car washes
- Utilities
- Marinas
- Cable

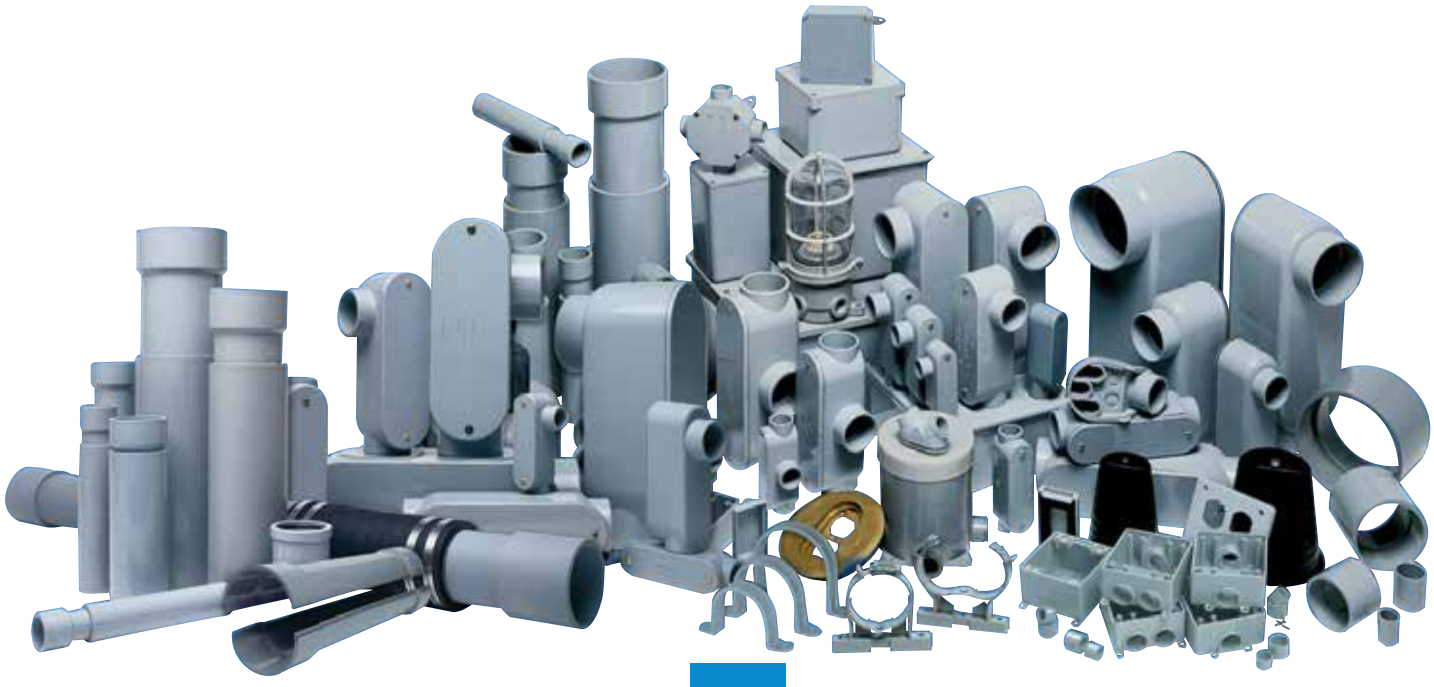
STANDARDS

Underwriters Laboratories

UL50 Enclosures for Electrical Equipment

UL514B Fittings for Cable & Conduit

UL514C Nonmetallic Outlet Boxes, Flush-Device Boxes & Covers



ADVANTAGES

1 LABOR SAVINGS

Compared to yesterday's metal products, PVC reduces labor on typical installations by as much as two-thirds, because it is easy to work with. PVC does not require the labor intensive tools usually associated with steel products, such as vises, threading equipment and reamers.

2 EASY JOINING

All that is required to join your Kraloy fittings with PVC conduit is Kraloy Solvent Cement (see solvent cementing instructions, page 5).

3 STRENGTH

Kraloy PVC fittings offer both high impact and high tensile strength.

4 CORROSION RESISTANT

PVC is resistant to external corrosion and pitting and will not rust. This ensures a lower maintenance cost and a longer performance life.

5 NONCONDUCTIVE

PVC eliminates the most dangerous second point of contact in phase to ground faults. The use of a separate grounding conductor gives a complete and positive ground for the entire system.

6 CHEMICAL RESISTANT

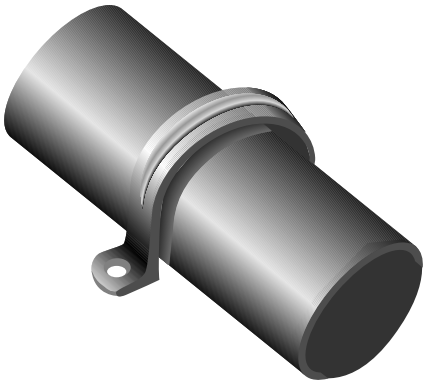
Kraloy PVC fittings are resistant to a wide range of chemicals such as acids, alkalis or salt solutions. For more information on chemical resistance, contact Kraloy customer service.

7 AGING CHARACTERISTICS

After years of exposure to direct sunlight, heat, and extreme weather, Kraloy PVC fittings retain their original properties. They are also resistant to fungi, bacterial action, rodents and termites, providing for a long and trouble free life.

8 FIRE RESISTANCE

As a building material PVC offers outstanding fire performance characteristics. PVC will not burn unless an external flame source is applied, and will not sustain ignition once the flame source is removed. PVC has a flash ignition temperature of 850°F.



SUPPORT

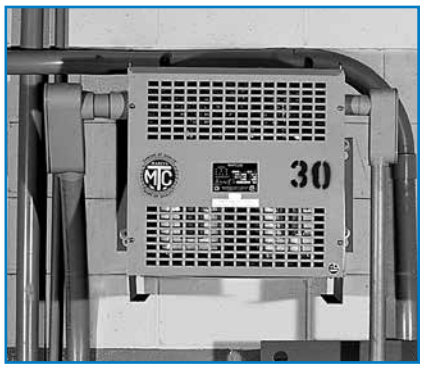
Due to PVC's light weight, support spacing is different than that used with metal conduits. Supporting straps should NOT be firmly tightened, to allow for linear movement. The maximum allowable support spacing, per the National Electrical Code Article 352.30 (B) is as follows:

SUPPORT SPACING

Nominal Conduit Diameter inches	National Electrical Code Max. Support Spacing feet
1/2	2-1/2
3/4	2-1/2
1	2-1/2
1-1/4	4
1-1/2	4
2	5
2-1/2	6
3	6
3-1/2	7
4	7
5	7
6	8

MAX OPERATING TEMPERATURE

The National Electrical Code (NEC) allows the use of rigid nonmetallic conduit (RNC) and fittings in locations where ambient temperatures are not in excess of 122ºF.



CUTTING

Kraloy Rigid PVC Conduit can be easily cut on the jobsite by using a hacksaw, carpenter's saw or PVC conduit cutters. For larger sizes of conduit, the use of a mitre box is also recommended to ensure a square cut.

SOLVENT CEMENTING

After cutting PVC rigid conduit, sharp edges or burrs from inside the conduit should be removed with a knife. Thoroughly clean the end of the pipe and inside the fitting with a pipe cleaner. In extreme weather conditions, a primer should be used to prepare the joint for solvent cementing. Apply a generous amount of solvent cement to both surfaces, slide together and give a quarter turn to ensure solvent is spread evenly on the material. Hold together for a few seconds until the joint is made.

Usually the solvent-cemented joint will be strong enough to install immediately, but in low temperatures and high humidity, extra time may be required before moving the pipe to install it permanently. Solvent cemented joints appear to "set up" instantly, but will take 24 hours to cure properly. After this time, the solvent-cemented joint has completely cured and is waterproof. Kraloy cement is available in half-pint, pint, quarts and one-gallon containers.

HANDLING

Solvent cements should be used as received in original containers. Adding thinners to change viscosity is not recommended. If cement is jelly-like and not free-flowing, it should not be used. Containers should be kept tightly covered when not in use.

STORAGE CONDITIONS

Solvent cements should be stored at temperatures between 40°F and 110°F away from heat or open flame. Cements should be used before the expiry date stamped on the container. If new cement is subjected to freezing temperatures, it may become extremely thick. This cement can be placed in a warm area where it will soon return to its original, usable condition. However, if the product is gelled or hardened due to actual solvent loss (when a container is left open too long during use or not sealed properly after use), the cement will not return to its original condition. Cement in this condition has lost its formulation and should be discarded in an environmentally friendly manner.

SAFETY PRECAUTIONS

Solvent cements are extremely flammable and should not be used or stored near heat or open flame. In confined or partially enclosed areas, a ventilating device should be used to remove vapors and minimize inhalation. Containers should be kept tightly closed when not in use, and covered as much as possible when in use. Avoid frequent contact with the skin. In case of eye contact, flush repeatedly with water. Keep out of the reach of children.

COLD WEATHER

Although normal installation temperatures are between 40°F to 110°F, high strength joints have been made at temperatures as low as -15°F. However, the installer must ensure he has adequately softened the joining surfaces with a primer. In addition, cement must be kept warm to prevent excessive thickening and gelation in cold weather.

INITIAL SET SCHEDULE FOR PVC SOLVENT CEMENTS*			
Temp. Range	Pipe Size 1/2" - 1-1/4"	Pipe Size 1-1/2" - 2"	Pipe Size 2-1/2" - 6"
60° - 100°F	2 min.	3 min.	30 min.
40° - 60°F	5 min.	8 min.	2 hrs.
0° - 40°F	10 min.	15 min.	12 hrs.

NOTE: Initial set schedule is the necessary time to allow before the joint can be carefully handled.

*These figures are estimates based on our laboratory tests. Due to the many variables in the field, these figures should be used as a general guide only.

After initial set, the joints will withstand the stresses of a normal installation. (A misaligned installation will cause excessive stresses in the joint). For long runs of pipe, care should be taken not to disturb joints for 1/2 to 1 1/2 hours before handling or burying.

AVERAGE NUMBER OF JOINTS PER PINT OR QUART OF CEMENT					
Nominal Pipe Size Inches	# of Joints per Pint	# of Joints per Quart	Nominal Pipe Size Inches	# of Joints per Pint	# of Joints per Quart
1/2	350	700	2-1/2	40	80
3/4	200	400	3	35	70
1	150	300	3-1/2	30	60
1-1/4	110	220	4	24	48
1-1/2	80	160	5	10	20
2	45	90	6	8	16

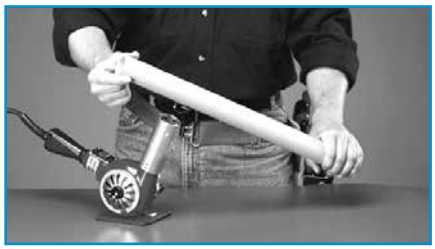
BENDING

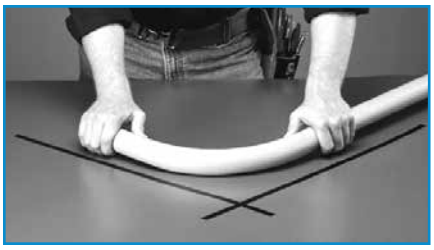
PVC is a thermoplastic material that, when heated, becomes soft and pliable. As a result, its shape can be altered.

A flameless heat source is recommended to heat the pipe. AN OPEN FLAME SHOULD NOT BE USED. An electric unit or an infra-red propane unit is recommended for heating the pipe.

The necessary temperature for bending Scepter Rigid PVC pipe is 260°F. The pipe must be heated evenly over an area approximately ten times the diameter of the pipe before any attempt at bending is made. Bending the pipe when it has not been thoroughly heated will cause the pipe to "kink." With proper care and a little practice, the bend will form easily.

Cooling the pipe with cold air or water will cause "spring back." Allow a few extra degrees of overbending to compensate for this phenomenom. The maximum bending radius shall be six times the internal diameter according to the National Electrical Code.





EXPANSION / CONTRACTION

All conduit pipe and fittings expand and contract with changes in temperature. All materials' expansion and contraction rates are represented by coefficients of thermal expansion.

A general rule of thumb is that for every 100°F temperature change in a 100 ft. run of PVC conduit, the conduit will undergo 3.6" of expansion or contraction.

Use of Expansion Joints

In installations where the expected temperature variation exceeds 25°F expansion joints must be used. An expansion joint consists of two tubes, one telescoping inside another. When installing expansion joints alignment of the piston and barrel is important. Straps should be placed approximately one foot on either side of the joint to ensure that any movement is directed squarely into the joint.

When expansion joints are required the following steps should be followed:

1. Determine number of joints required:

Use the following formula to calculate the total expected expansion in the run.

$$\text{Total expansion} = \frac{\text{Total temp. change °F}}{10} \times \frac{\text{Length of run ft.}}{100} \times .36$$

The expansion joints should then be installed at even intervals throughout the run.

$$\text{Number of joints} = \frac{\text{Total expansion}}{4}$$

Example:

Assume a 200 ft. run of conduit is to be installed in an unheated building where the temperature will vary from 10°F in the winter to 110°F in the summer. The installation will be carried out when the temperature is 60°F.

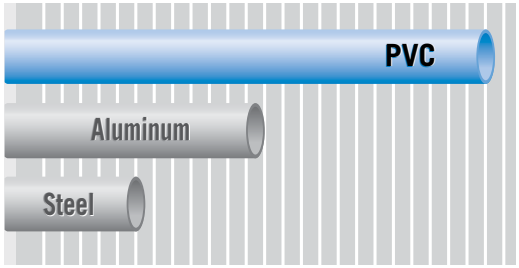
Using step 1 we determine the number of joints required.

$$\text{Total Expansion} = \frac{100\ °F}{10} \times \frac{200\ ft.}{100} \times .36 = 7.2"$$

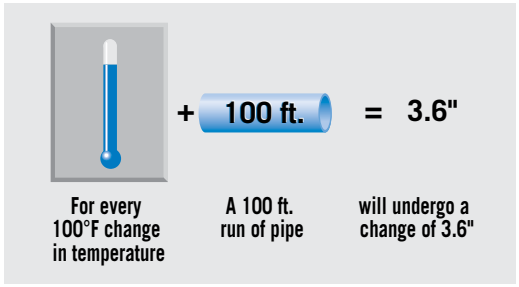
$$\text{Number of joints} = \frac{7.2}{4} = 1.8$$

Note: Always round off to the next highest number. Therefore in this example we see that two expansion joints are necessary.

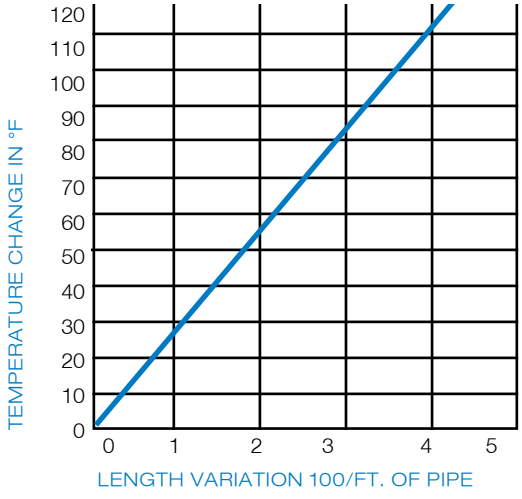
Expansion Comparison



Rule of Thumb for PVC Expansion



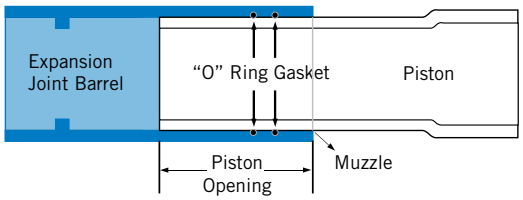
PVC Pipe Length Variation due to Temperature Change (°F) Coefficient = 3.6 x 10-4 in./ft./°F



2. Determine Piston Opening:

The expansion joint must be installed to allow both expansion and contraction of the conduit run. Because installation temperatures may vary, the piston setting must be determined. The correct piston opening is determined using the following formula:

$$\text{Piston (in.)} = \frac{\text{max. temperature (°F) - installing temperature (°F)} \times 4}{\text{temperature change (°F)}}$$



Example:

Using step 2 we determine the proper piston opening.

$$\text{Piston (in.)} = \frac{110\ (°F) - 60\ (°F)}{100\ (°F)} \times 4" = 2"$$

Therefore this piston should be opened 2 inches when the joints are installed.

Size (in)	Compressed Length (in)	Travel (in)
1/2	8.00	4
3/4	8.00	4
1	8.50	4
1-1/4	9.00	4
1-1/2	9.00	4
2	9.25	4
2-1/2	14.25	8
3	14.25	8
3-1/2	14.90	8
4	14.90	8
5	26.00	8
6	26.00	8

Location of Expansion Joints

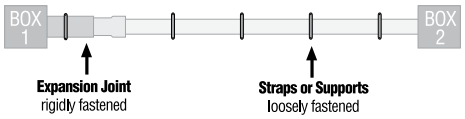
Proper functioning of an expansion joint depends on three procedures:

1. The correct placement of the expansion joint.
2. The proper installation of rigid PVC conduit and the expansion joint.
3. The proper placement and fastening of support straps.

One Expansion Joint - Figure 1

If only one expansion joint is needed between two boxes, the barrel of the joint should be rigidly fastened close to the first box. Rigid PVC conduit should then be loosely supported with straps, allowing the conduit to move freely as it expands and contracts.

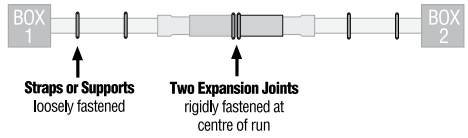
Figure 1



Two Expansion Joints - Figure 2

If two expansion joints are needed, the joints should be firmly fastened back to back at the center of the run. Rigid PVC conduit should be loosely supported with straps, allowing the conduit to move freely as it expands and contracts.

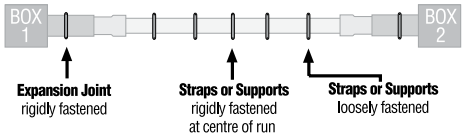
Figure 2



Two Expansion Joints (Alternative) - Figure 3

Alternatively, the center of the run and the two expansion joints (located at the boxes) should be rigidly fastened. All other support straps should be loosely fastened.

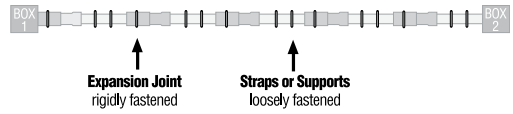
Figure 3



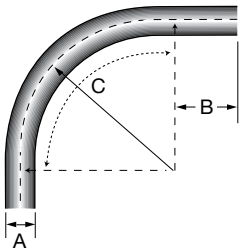
Three or More Expansion Joints - Figure 4

If more than two joints are needed in a very long run, they should be put in a series, one after the other. Each barrel must be rigidly fastened while conduit is loosely supported with straps allowing the conduit to move freely as it expands and contracts. When installed in a series, each section acts independently of the other. Spacing of conduit supports must be in accordance with NEC article 347-8.

Figure 4

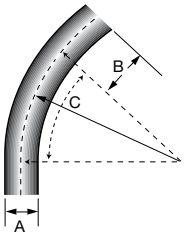


CONDUIT ELBOWS



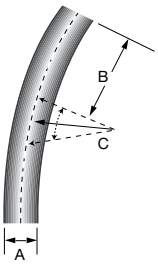
90° Elbows Schedule 40 Standard Radius

Size inches	Part Number	Product Code	A inches	B inches	C inches
1/2	40STD0590	078540	0.840	1.500	4.000
3/4	40STD0790	078541	1.050	1.500	4.500
1	40STD1090	078542	1.315	1.875	5.750
1-1/4	40STD1290	078543	1.660	2.000	7.250
1-1/2	40STD1590	078544	1.900	2.000	8.250
2	40STD2090	078545	2.375	2.000	9.500
2-1/2	40STD2590	078546	2.875	3.000	10.500
3	40STD3090	078547	3.500	3.125	13.000
3-1/2	40STD3590	078548	4.000	3.250	15.000
4	40STD4090	078549	4.500	3.375	16.000
5	40STD5090	078550	5.563	3.625	24.000
6	40STD6090	078551	6.625	3.750	30.000



45° Elbows Schedule 40 Standard Radius

1/2	40STD0545	078552	0.840	1.500	4.000
3/4	40STD0745	078553	1.050	1.500	4.500
1	40STD1045	078554	1.315	1.875	5.750
1-1/4	40STD1245	078555	1.660	2.000	7.250
1-1/2	40STD1545	078556	1.900	2.000	8.250
2	40STD2045	078557	2.375	2.000	9.500
2-1/2	40STD2545	078558	2.875	3.000	10.500
3	40STD3045	078559	3.500	3.125	13.000
3-1/2	40STD3545	078560	4.000	3.250	15.000
4	40STD4045	078561	4.500	3.375	16.000
5	40STD5045	078562	5.563	3.625	24.000
6	40STD6045	078563	6.625	3.750	30.000



30° Elbows Schedule 40 Standard Radius

1/2	40STD0530	078564	0.840	1.500	4.000
3/4	40STD0730	078565	1.050	1.500	4.500
1	40STD1030	068622	1.315	1.875	5.750
1-1/4	40STD1230	078567	1.660	2.000	7.250
1-1/2	40STD1530	078568	1.900	2.000	8.250
2	40STD2030	078569	2.375	2.000	9.500
2-1/2	40STD2530	078570	2.750	3.000	10.500
3	40STD3030	078571	3.500	3.125	13.000
3-1/2	40STD3530	078572	4.000	3.250	15.000
4	40STD4030	078573	4.500	3.375	16.000
5	40STD5030	078574	5.563	3.625	24.000
6	40STD6030	078575	6.625	3.750	30.000