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# NIRON and CoolPro INSTALLATION MANUAL

nupi AMERICAS


NIRON

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For the proper installation of Niron Clima PP-RCT and CoolPro PP-RCT pipe and fittings manufactured by Nupi Americas

This Manual is a prerequisite for Niron and CoolPro Training Courses

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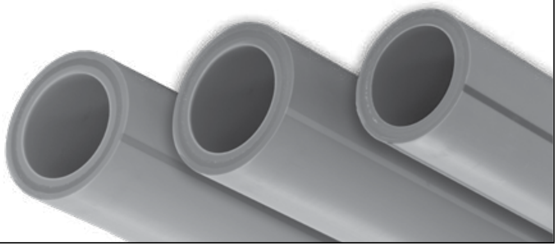

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Section 1

# Introduction to Nupi Americas


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# Introduction

This installers manual has been created to assist the installers of Niron PP-RCT piping materials in achieving a safe and functional piping system that will stand the test of time. Please be sure to read all instructions before beginning the installation. The installers of Niron piping systems must complete a course of training that is administered by an authorized Niron trainer prior to installing Niron PP-RCT piping products.

The Niron Installer's training for each method of joining is designed to teach the proper techniques to achieve reliable, safe and cost effective connections. This will enable the installers of Niron PP-RCT piping products to experience all that Niron has to offer.

Read all manufacturer's instructions thoroughly and be sure to understand them in their entirety before attempting any installation of Niron PP-RCT products. The current version of all Niron instructions are available at www.nupiamericas.com. Be sure to always wear all required proper safety clothing, equipment and accessories and to follow all necessary precautions and warnings. Failure to do so could result in injury to persons, property, the Niron PP-RCT products and in the most severe circumstances could lead to death.

Be sure to verify that the most current version of this manual is being used. You can verify that this is the most current version of this manual by reviewing the version which is posted on our website at www.nupiamericas.com. The specific edition is noted on the cover, and the publication date is noted on the back cover.

## Overview of Niron PP-RCT Piping Systems

Prior to undertaking any installation of Niron PP-RCT piping systems, it is important into understand the nature of the material you will be working with. Niron is made from an advanced thermoplastic material termed PP-RCT. PP-RCT is the most advanced form of PP-R materials (random copolymer polypropylene).

It is highly crystallized with extensive beta crystallization (this is the “C” in PP-RCT). This extensive crystallinity changes the nature of the basic PP-R material into a much better, stronger material. It significantly increases the chemical and oxidative resistance of the material. It also provides superior stability and pressure resistance at elevated temperatures (this is the “T” in PP-RCT). The changes are so dramatic, this material is regarded as a different, better material altogether than a standard PP-R.

Niron PP-RCT pipe and fittings are produced at facilities in both South Carolina and Italy. Niron has been produced and installed around the world for over four decades. The products meet all required national standards and many international standards as well. It is an environmentally friendly material, which has been issued an EPD by an accredited, certified listing agency. Nupi Americas believes in this product and is proud to back its product with an industry-best 30 year warranty.

# Installation Basics of Niron PP-RCT Piping Systems

Niron PP-RCT is a highly beta crystalline formulation of polypropylene. The material is a copolymer of propylene and ethylene (>90% propylene) of the random copolymer type. The beta crystallization is achieved by means of a patented process during the pelletizing of the raw material. The extensive beta crystallization allows the material to have exceptional stability and high pressure resistance at elevated temperatures. The material is also further compounded with anti-oxidants to result in excellent resistance to oxidative attack. Compared to other standard grades of copolymer PP material, Niron PP-RCT can essentially be considered a different, superior class of material unto itself.

Niron PP-RCT Clima pipe is extruded in a multilayer process with a middle Powercore™ Layer that has added fiberglass. The Powercore™ Layer results in dimensional stability when subjected to temperature changes, and helps to stiffen the pipe and lessen the frequency with which it needs to be supported.

Given the exceptionally good chemical resistance of the pipe, it is highly solvent resistant. As such, the material cannot be solvent cemented. Instead, the material is readily joined by several types of heat fusion methods. The material can be heated, forced together under pressure, and the resulting mixture of molecules then recrystallize into a homogeneous material once it is cooled. The heat fusion welds, when properly made, are stronger than the corresponding pipe and fittings that are joined together. This is unlike most piping materials where the joint is often the weakest link in the system.

## Installation Basics of Niron PP-RCT Piping Systems continued

Niron PP-RCT, while being the most advanced polypropylene material ever developed, is also quite forgiving when being welded to other, lesser grades of polypropylene. Niron PP-RCT can readily be welded to other grades of PP-R, PP-B, Impact Copolymer PP, and PP-H materials. Note however that Niron PP-RCT cannot be welded to dissimilar thermoplastics such as HDPE, PVDF or any vinyl materials. Further, it cannot be solvent cemented to PVC, CPVC or ABS using all-purpose solvent cements.

## Storage and Handling

Niron pipe and fittings should be carefully inspected upon receipt. Nupi Americas allows one week from the date of receipt of an order to report lost, missing or damaged materials from the shipment.

Niron PP-RCT pipe is shipped in bags, the bagged pipes up to 8” diameter are shipped in crates. If bags are torn or partially removed, the pipes should be re-covered using the bags and taped. Pipes can also be covered by tarps or stored inside away from the harmful effects of the sun’s ultra-violet rays.

Larger diameter pipes are often shipped stacked on flatbed trucks and covered with tarps. The pipes should be carefully removed from the trucks and stacked carefully. Handle the pipes with care and do not over stack the pipes (see Nupi Technical Note on storage and handling of pipes for more details).

Store fittings in their original packaging until they are ready to be installed. Some fittings are individually bagged and others are bagged in multiple units. Keep fittings in their original bags and in their original boxes until they are ready for use.

Avoid inserting sharp objects into the pipe (e.g. such as a fork lift blade) when unloading or moving pipe.

Be careful not to drop the pipe, especially during cold weather. Cracks can develop when the pipe is dropped during cold weather and can go undetected if they are on the interior of the pipe.

## Storage and Handling continued

If pipe or a fitting is cracked, gouged or excessively scraped, do not use the pipe or fitting. Replace the piece with an undamaged pipe section or fitting.

Keep pipes covered that are stored outside. If tarps or plastic bags are removed during installation, please be sure to re-cover them.

Be careful not to drive directly over Niron Clima pipes.

## Wall Thickness / Range of Sizes

Niron Pipes differ than that of typical IPS sizes, so attention should be paid to the actual outside diameters. The following chart indicates the sizes and wall thickness classes (SDR) that the pipes are available in:

| NIRON CLIMA SDR 7.3 | | | | | | |
|---|---|---|---|---|---|---|
| Nominal Diameter (inches) | Actual O.D. (inches) | Wall Thickness (Inches) | | Nominal Diameter (inches) | Actual O.D. (inches) | Wall Thickness (Inches) |
| ½ | 0.79 | 0.11 | | 3½ | 4.33 | 0.59 |
| ¾ | 0.98 | 0.13 | | 4 | 4.92 | 0.67 |
| 1 | 1.26 | 0.17 | | 6 | 6.30 | 0.86 |
| 1¼ | 1.57 | 0.22 | | 8 | 7.87 | 1.08 |
| 1½ | 1.97 | 0.27 | | 10 | 9.84 | 1.35 |
| 2 | 2.48 | 0.34 | | 12 | 12.4 | 1.70 |
| 2½ | 2.95 | 0.40 | | 14 | 13.98 | 1.92 |
| 3 | 3.54 | 0.48 | | | | |

| NIRON CLIMA SDR 9 | | | | | | |
|---|---|---|---|---|---|---|
| Nominal Diameter (inches) | Actual O.D. (inches) | Wall Thickness (Inches) | | Nominal Diameter (inches) | Actual O.D. (inches) | Wall Thickness (Inches) |
| 1 | 1.26 | 0.14 | | 4 | 4.92 | 0.55 |
| 1¼ | 1.57 | 0.17 | | 6 | 6.30 | 0.70 |
| 1½ | 1.97 | 0.22 | | 8 | 7.87 | 0.87 |
| 2 | 2.48 | 0.28 | | 10 | 9.84 | 1.09 |
| 2½ | 2.95 | 0.33 | | 12 | 12.4 | 1.38 |
| 3 | 3.54 | 0.39 | | 14 | 13.98 | 1.55 |
| 3½ | 4.33 | 0.48 | | | | |

| NIRON CLIMA SDR 11 | | | | | | |
|---|---|---|---|---|---|---|
| Nominal Diameter (inches) | Actual O.D. (inches) | Wall Thickness (Inches) | | Nominal Diameter (inches) | Actual O.D. (inches) | Wall Thickness (Inches) |
| 1¼ | 1.57 | 0.14 | | 8 | 7.87 | 0.72 |
| 1½ | 1.97 | 0.18 | | 10 | 9.84 | 0.89 |
| 2 | 2.48 | 0.23 | | 12 | 12.4 | 1.13 |
| 2½ | 2.95 | 0.27 | | 14 | 13.98 | 1.27 |
| 3 | 3.54 | 0.32 | | 16 | 15.75 | 1.43 |
| 3½ | 4.33 | 0.39 | | 18 | 17.72 | 1.61 |
| 4 | 4.92 | 0.45 | | 20 | 19.69 | 1.79 |
| 6 | 6.30 | 0.57 | | | | |

| NIRON CLIMA SDR 17 | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Nominal Diameter (inches)** | **Actual O.D. (inches)** | **Wall Thickness (Inches)** | | **Nominal Diameter (inches)** | **Actual O.D. (inches)** | **Wall Thickness (Inches)** |
| 2 | 2.48 | 0.15 | | 12 | 12.4 | 0.73 |
| 2½ | 2.95 | 0.17 | | 14 | 13.98 | 0.82 |
| 3 | 3.54 | 0.21 | | 16 | 15.75 | 0.93 |
| 3½ | 4.33 | 0.25 | | 18 | 17.72 | 1.04 |
| 4 | 4.92 | 0.29 | | 20 | 19.69 | 1.16 |
| 6 | 6.30 | 0.37 | | 22 | 22.05 | 1.30 |
| 8 | 7.87 | 0.46 | | 24 | 24.80 | 1.46 |
| 10 | 9.84 | 0.58 | | | | |

## Comparison of Various SDRs

**SDR 7.3**
**T = O.D./7.3**

**405 psi @ 73°F**
**224 psi @ 140°F**
**150 psi @ 180°F**

**SDR 9**
**T = O.D./9**

**321 psi @ 73°F**
**177 psi @ 140°F**
**120 psi @ 180°F**

**SDR 11**
**T = O.D./11**

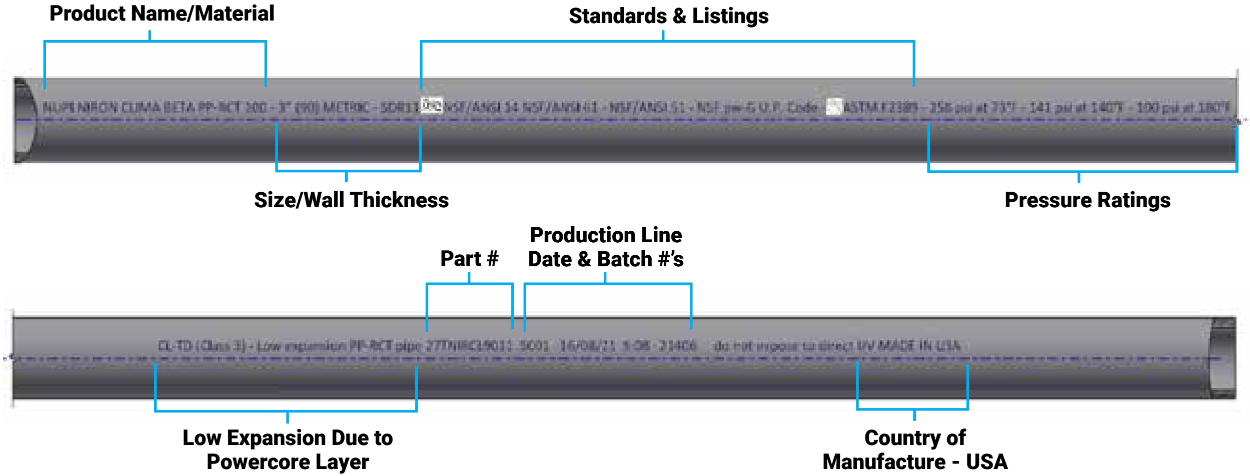
**258 psi @ 73°F**
**141 psi @ 140°F**
**100 psi @ 180°F**

**SDR 17**
**T = O.D./17**

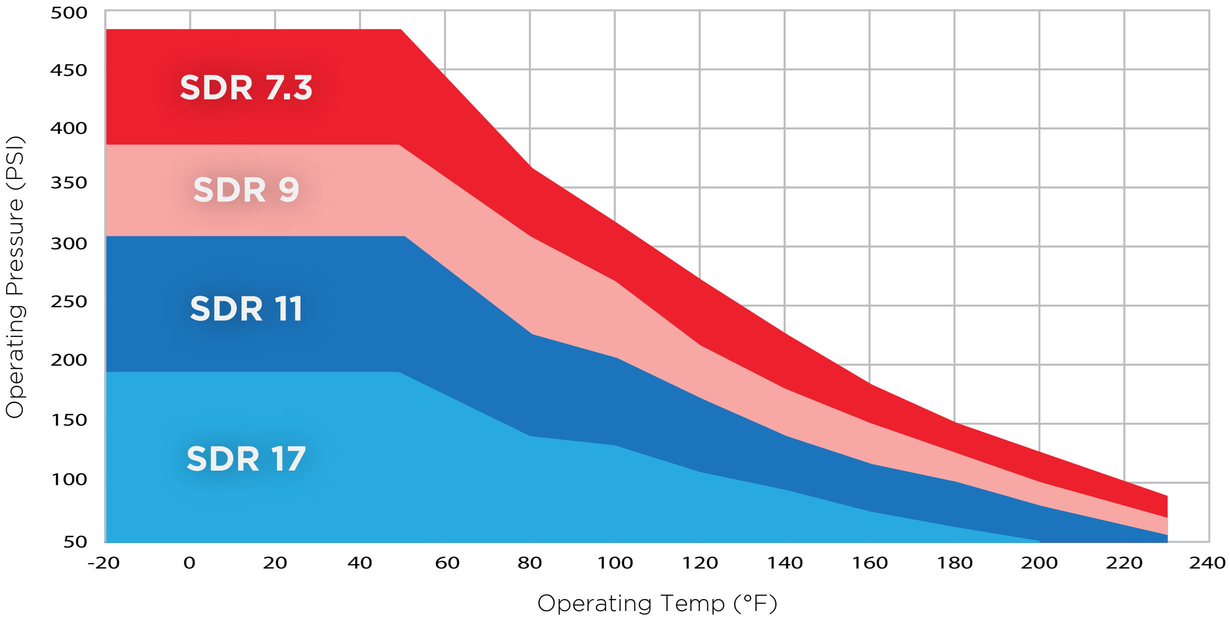
**162 psi @ 73°F**
**89 psi @ 140°F**
**60 psi @ 180°F**

## Pipe Labeling

**The following is an example of the pipe markings on Niron Clima PP-RCT Pipe (3″ Niron Clima SDR11 shown):**



## Pressure ratings of Niron Clima PP-RCT Pipe (in psi)



## NIRON Clima PP-RCT SDR 7.3 SERIES

**Color:** Steel Grey

**Size Range:** ½" (20 mm) through 14" (355 mm)

**Style of Pipe:** Three Layer Extrusion

**Inner Layer:** Solid PP-RCT (Borealis beta RA-7050 Grey PP-RCT)

**Powercore Layer:** PP-RCT w/added fiberglass (Borealis beta RA-7050 Grey PP-RCT + Fiberglass)

**Outer Layer:** Solid PP-RCT (Borealis beta RA-7050 Grey PP-RCT)

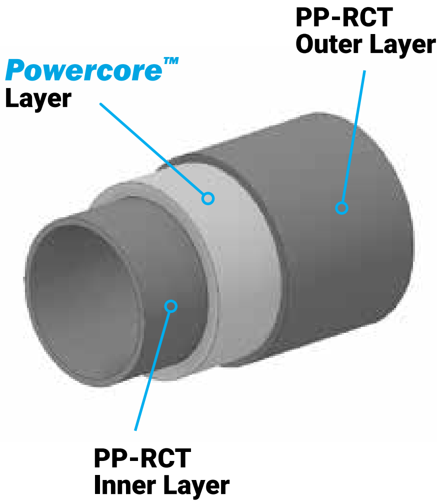
**Maximum Operating Pressure at 50°F:** 485 psi

**Maximum Operating Pressure at 140°F:** 225 psi

**Maximum Operating Pressure at 180°F:** 150 psi

**Listings:** NSF PW, 14, 61, & 51, UPC, IPC, CSA, IAPMO, ICC-ES

**Typical Applications:** Potable Hot/Cold Water, Potable Hot Recirculating Water, Hydronic Heating, Radiant Heating



# NIRON Clima PP-RCT SDR 9 SERIES

**Color:** Steel Grey

**Size Range:** 1" (32 mm) through 14" (355 mm)

**Style of Pipe:** Three Layer Extrusion

**Inner Layer:** Solid PP-RCT (Borealis beta RA-7050 Grey PP-RCT)

**Powercore Layer:** PP-RCT w/added fiberglass (Borealis beta RA-7050 Grey PP-RCT + Fiberglass)

**Outer Layer:** Solid PP-RCT (Borealis beta RA-7050 Grey PP-RCT)

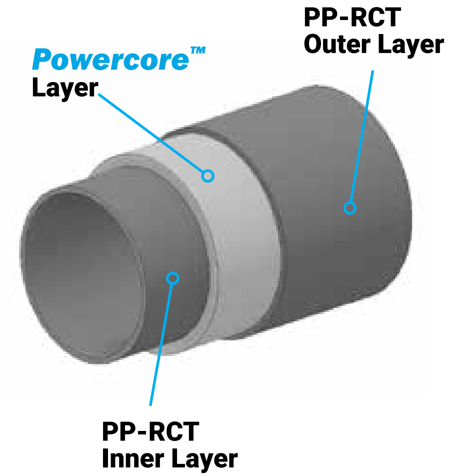
**Maximum Operating Pressure at 50°F:** 385 psi

**Maximum Operating Pressure at 140°F:** 177 psi

**Maximum Operating Pressure at 180°F:** 120 psi

**Listings:** NSF PW, 14, 61, & 51, UPC, IPC, CSA, IAPMO, ICC-ES

**Typical Applications:** Potable Hot/Cold Water, Potable Hot Recirculating Water, Hydronic Heating, Radiant Heating



# NIRON Clima PP-RCT SDR 11 SERIES

**Color:** Steel Grey

**Size Range:** 1¼" (40 mm) through 16" (400 mm)

**Style of Pipe:** Three Layer Extrusion

**Inner Layer:** Solid PP-RCT (Borealis beta RA-7050 Grey PP-RCT)

**Powercore Layer:** PP-RCT w/added fiberglass (Borealis beta RA-7050 Grey PP-RCT + Fiberglass)

**Outer Layer:** Solid PP-RCT (Borealis beta RA-7050 Grey PP-RCT)

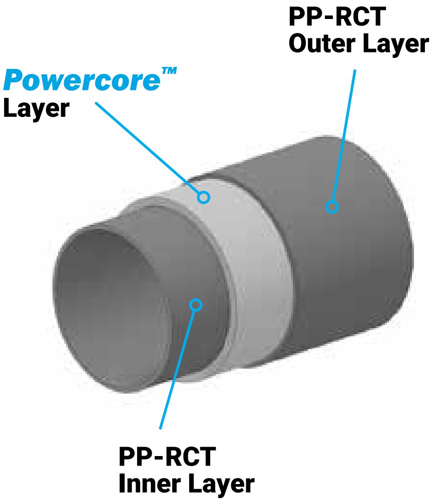
**Maximum Operating Pressure at 50°F:** 305 psi

**Maximum Operating Pressure at 140°F:** 141 psi

**Maximum Operating Pressure at 180°F:** 100 psi

**Listings:** NSF PW, 14, 61, & 51, UPC, IPC, CSA, IAPMO, ICC-ES

**Typical Applications:** Potable Cold Water, Hydronic Heating, Radiant Heating, Chilled Water, Condenser Water, Cooling Water, Chemical Process Piping



# NIRON Clima PP-RCT SDR 11 SERIES, cont.

**Color:** Steel Grey

**Size Range:** 18” (450 mm) through 20” (500 mm)

**Style of Pipe:** Single Layer Extrusion

**Unicore Layer:** PP-RCT w/added fiberglass (Borealis beta RA-7050 Grey PP-RCT + Fiberglass)

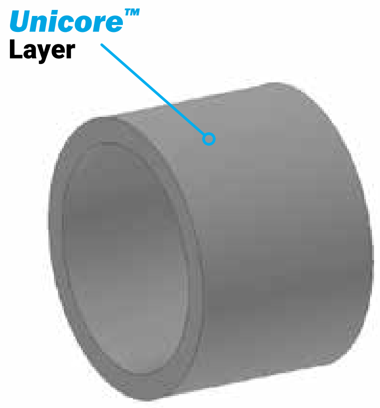
**Maximum Operating Pressure at 50°F:** 305 psi

**Maximum Operating Pressure at 140°F:** 141 psi

**Maximum Operating Pressure at 180°F:** 100 psi

**Listings:** NSF PW, 14, 61, & 51, UPC, IPC, CSA, IAPMO, ICC-ES

**Typical Applications:** Potable Cold Water, Hydronic Heating, Radiant Heating, Chilled Water, Condenser Water, Cooling Water, Chemical Process Piping



## NIRON Clima PP-RCT SDR 17 SERIES

**Color:** Steel Grey

**Size Range:** 2” (63 mm) through 16” (400 mm)

**Style of Pipe:** Three Layer Extrusion

**Inner Layer:** Solid PP-RCT (Borealis beta RA-7050 Grey PP-RCT)

**Powercore Layer:** PP-RCT w/added fiberglass (Borealis beta RA-7050 Grey PP-RCT + Fiberglass)

**Outer Layer:** Solid PP-RCT (Borealis beta RA-7050 Grey PP-RCT)

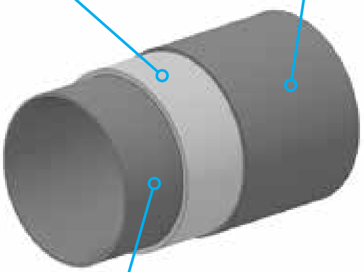
**Maximum Operating Pressure at 50°F:** 195 psi

**Maximum Operating Pressure at 140°F:** 89 psi

**Maximum Operating Pressure at 180°F:** 60 psi

**Listings:** NSF PW, 14, 61, & 51, UPC, IPC, CSA, IAPMO, ICC-ES

**Typical Applications:** Potable Cold Water, Chilled Water, Condenser Water, Cooling Water, Chemical Process Piping



# NIRON Clima PP-RCT SDR 17 SERIES, cont.

**Color:** Steel Grey

**Size Range:** 18” (450 mm) through 24” (630 mm)

**Style of Pipe:** Single Layer Extrusion

**Unicore Layer:** PP-RCT w/added fiberglass (Borealis beta RA-7050 Grey PP-RCT + Fiberglass)

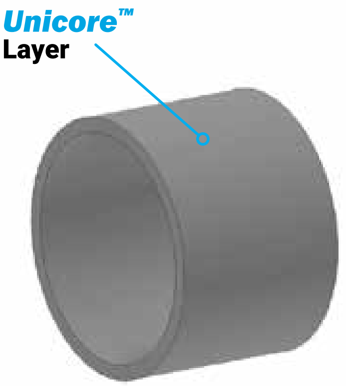
**Maximum Operating Pressure at 50°F:** 195 psi

**Maximum Operating Pressure at 140°F:** 89 psi

**Maximum Operating Pressure at 180°F:** 60 psi

**Listings:** NSF PW, 14, 61, & 51, UPC, IPC, CSA, IAPMO, ICC-ES

**Typical Applications:** Potable Cold Water, Chilled Water, Condenser Water, Cooling Water, Chemical Process Piping



## NIRON Clima Cool-pro™ PP-RCT SDR 7.3 SERIES

**Color:** White Outer Layer

**Size Range:** ½" (20 mm) through 14" (400 mm)

**Style of Pipe:** Three Layer Extrusion

**Inner Layer:** Solid PP-RCT (Borealis beta RA-7050 Grey PP-RCT)

**Powercore Layer:** PP-RCT w/added fiberglass (Borealis beta RA-7050 Grey PP-RCT + Fiberglass)

**Outer Layer:** 30 Year UV Resistant White PPR

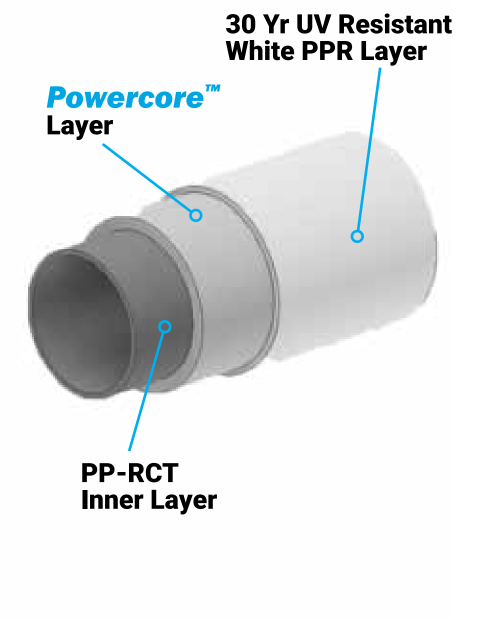
**Maximum Operating Pressure at 50°F:** 485 psi

**Maximum Operating Pressure at 140°F:** 225 psi

**Maximum Operating Pressure at 180°F:** 150 psi

**Listings:** NSF 14 & 51, UPC, IPC, CSA, IAPMO, ICC-ES

**Typical Applications:** Condenser Water, Cooling Water, Compressed Air, Chemical Process Piping



# NIRON Clima Cool-pro™ PP-RCT SDR 11 SERIES

**Color:** White Outer Layer

**Size Range:** 1¼" (40 mm) through 16" (400 mm)

**Style of Pipe:** Three Layer Extrusion

**Inner Layer:** Solid PP-RCT (Borealis beta RA-7050 Grey PP-RCT)

**Powercore Layer:** PP-RCT w/added fiberglass (Borealis beta RA-7050 Grey PP-RCT + Fiberglass)

**Outer Layer:** 30 Year UV Resistant White PPR

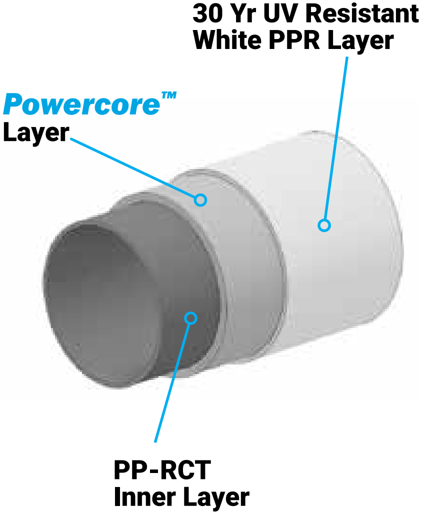
**Maximum Operating Pressure at 50°F:** 305 psi

**Maximum Operating Pressure at 140°F:** 141 psi

**Maximum Operating Pressure at 180°F:** 100 psi

**Listings:** NSF 14 & 51, UPC, IPC, CSA, IAPMO, ICC-ES

**Typical Applications:** Condenser Water, Cooling Water, Compressed Air, Chemical Process Piping



# NIRON Clima Cool-pro™ PP-RCT SDR 11 SERIES, cont.

**Color:** White Outer Layer

**Size Range:** 18” (450 mm) through 20” (500 mm)

**Style of Pipe:** Single Layer Extrusion

**Unicore Layer:** 30 yr UV-Resistant white PPR w/added fiberglass

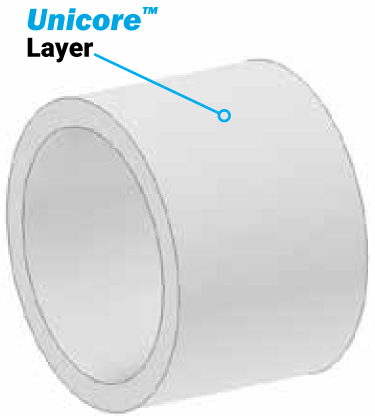
**Maximum Operating Pressure at 50°F:** 305 psi

**Maximum Operating Pressure at 140°F:** 141 psi

**Maximum Operating Pressure at 180°F:** 100 psi

**Listings:** NSF 14 & 51, UPC, IPC, CSA, IAPMO, ICC-ES

**Typical Applications:** Condenser Water, Cooling Water, Compressed Air, Chemical Process Piping



# NIRON Clima Cool-pro™ PP-RCT SDR 17 SERIES

**Color:** White Outer Layer

**Size Range:** 2” (63 mm) through 16” (400 mm)

**Style of Pipe:** Three Layer Extrusion

**Inner Layer:** Solid PP-RCT (Borealis beta RA-7050 Grey PP-RCT)

**Powercore Layer:** PP-RCT w/added fiberglass (Borealis beta RA-7050 Grey PP-RCT + Fiberglass)

**Outer Layer:** 30 Year UV Resistant White PPR

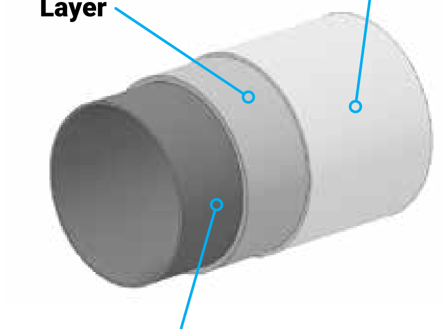
**Maximum Operating Pressure at 50°F:** 195 psi

**Maximum Operating Pressure at 140°F:** 89 psi

**Maximum Operating Pressure at 180°F:** 60 psi

**Listings:** NSF 14 & 51, UPC, IPC, CSA, IAPMO, ICC-ES

**Typical Applications:** Condenser Water, Cooling Water, Compressed Air, Chemical Process Piping



# NIRON Clima Cool-pro™ PP-RCT SDR 17 SERIES, cont.

**Color:** White Outer Layer

**Size Range:** 18" (450 mm) through 24" (630 mm)

**Style of Pipe:** Single Layer Extrusion

**Unicore Layer:** 30 yr UV-Resistant white PPR w/added fiberglass

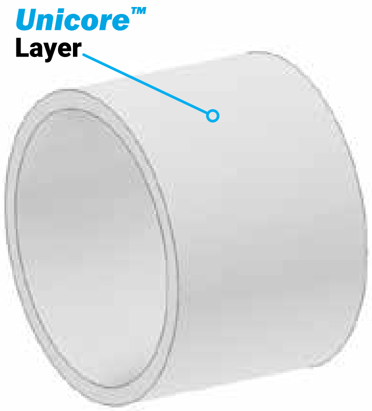
**Maximum Operating Pressure at 50°F:** 195 psi

**Maximum Operating Pressure at 140°F:** 89 psi

**Maximum Operating Pressure at 180°F:** 60 psi

**Listings:** NSF 14 & 51, UPC, IPC, CSA, IAPMO, ICC-ES

**Typical Applications:** Condenser Water, Cooling Water, Compressed Air, Chemical Process Piping



## NIRON PURPLE PIPE SDR 11 SERIES

**Color:** Purple Outer Layer

**Size Range:** 1" (32 mm) through 10" (250 mm)

**Style of Pipe:** Three Layer Extrusion

**Inner Layer:** Solid PP-RCT (Borealis beta RA-7050 Grey PP-RCT)

**Powercore Layer:** PP-RCT w/added fiberglass (Borealis beta RA-7050 Grey PP-RCT + Fiberglass)

**Outer Layer:** Purple PPR

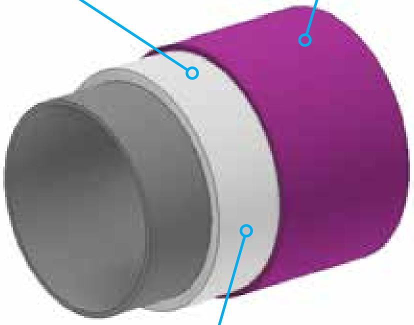
**Maximum Operating Pressure at 50°F:** 305 psi

**Maximum Operating Pressure at 140°F:** 141 psi

**Maximum Operating Pressure at 180°F:** 100 psi

**Listings:** Pending

**Typical Applications:** Recycled Water, Reclaimed Water



## NIRON PURPLE PIPE SDR 17 SERIES

**Color:** Purple Outer Layer

**Size Range:** 2” (63 mm) through 10” (250 mm)

**Style of Pipe:** Three Layer Extrusion

**Inner Layer:** Solid PP-RCT (Borealis beta RA-7050 Grey PP-RCT)

**Powercore Layer:** PP-RCT w/added fiberglass (Borealis beta RA-7050 Grey PP-RCT + Fiberglass)

**Outer Layer:** Purple PPR

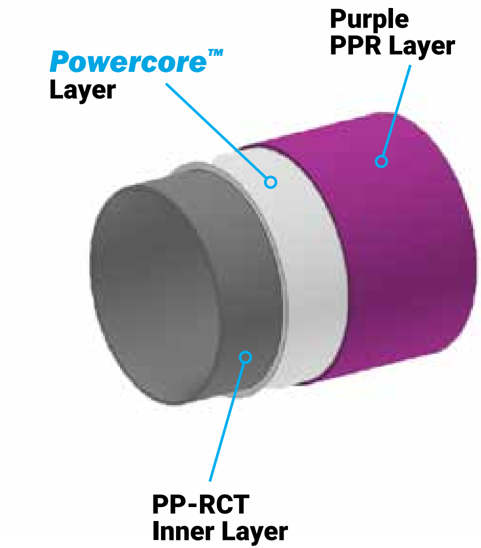
**Maximum Operating Pressure at 50°F:** 195 psi

**Maximum Operating Pressure at 140°F:** 89 psi

**Maximum Operating Pressure at 180°F:** 60 psi

**Listings:** Pending

**Typical Applications:** Recycled Water, Reclaimed Water



## NIRON SOCKET FUSION FITTINGS

- Injection Molded as a Unitary Part in PP-RCT material
- Size Range: ½” through 4”
- Fittings are made to match the pressure rating of the thickest pipe
- Fittings are weldable to every available SDR in the given size
- Complete labeling is indicated on the packaging
- Some labeling is included on the part
- Keep fittings in original packaging prior to installation

# MOLDED BUTT FUSION FITTINGS

- Injection molded as a unitary part in PP-RCT material
- Available in sizes 2” through 20”
- Available in many fitting types with long spigots up to 12”
- Injection molded with short spigots 14” through 20”
- Butt Fusion fittings are made in each Pipe SDR

# FABRICATED BUTT FUSION FITTINGS

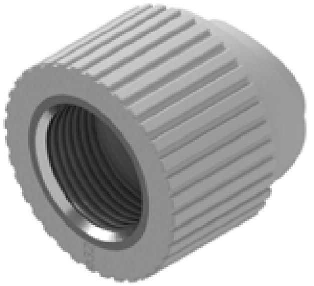
- Fabricated from Niron PP-RCT Pipe to match the required SDR
- Standardly available in 12” through 24”; Smaller sizes also available
- 90’s are available in long radius (1.5D) as well as extra long radius patterns
- All fabricated fittings are manufactured using heat fusion techniques to match the pressure rating of the pipe

## ELECTROFUSION FITTINGS

- Injection Molded in sizes ½" through 10"; Couplings available ½" through 24"
- Each fitting type can be welded to any of the various SDRs of pipe
- Pressure Ratings of the part vary by size. The proper fitting should be selected to match the required pressure rating of the pipe SDR
- Fittings and Couplings are all provided with a fusion bar code label
- Fittings through 4" and all couplings have a unitary circuit. Tees have a unitary circuit on the main and a plain spigot on the branch (no wire)
- Fittings 6" and above are made with individual circuits on each outlet.
- Fitting and coupling connector pins are 4.0 mm size

# INSTABRANCH FITTINGS

- Injection Molded as a Unitary Part in PP-RCT material
- Size Range: 1¼"by ½" (40 mm by 20mm) through 24" by 4" (630 mm by 125 mm)
- Fittings are made to match the pressure rating of the thickest pipe
- Fittings are weldable to every available SDR in the given size
- Available with male and female threaded outlets and PEX adapters
- When parts are welded to SDR 17 Pipe in sizes 2" through 3½, system pressure rating is reduced
- Complete labeling is indicated on the packaging
- Some labeling is included on the part
- Keep fittings in original packaging prior to installation



## ELECTROLET FITTINGS

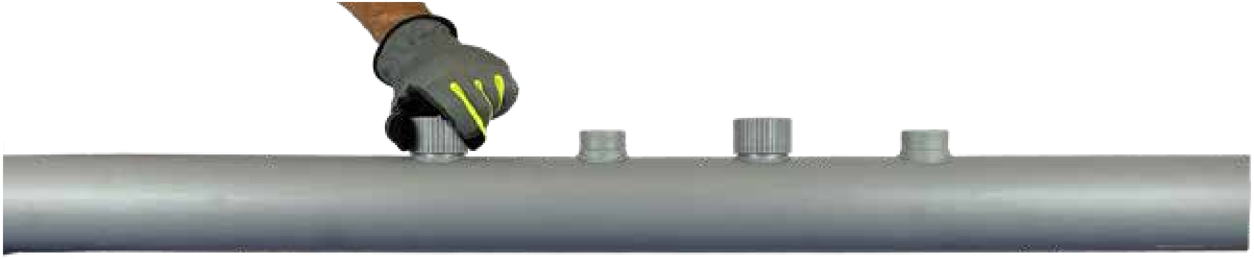
- Injection Molded in sizes 1¼" through ¾" (40 mm by 25 mm) through 24" by 8" (630mm by 200mm)
- Each fitting type can be welded to any of the various SDRs of pipe
- Pressure Ratings of the part vary by size, the proper fitting should be selected to match the required pressure rating of the pipe SDR
- Fittings are all provided with a fusion bar code label
- Available with male and female adapters, PEX adapters and valve outlets
- Fitting and coupling connector pins are 4.0 mm size

Section 2

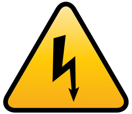
# Thermofusion

# THERMOFUSION

Niron PP-RCT piping is a very robust, solid thermoplastic piping system.  The PP-RCT material is highly solvent resistant, and therefore, solvent cementing (gluing) cannot be used to join the material.  The material can be permanently welded using heat to produce unitary joints. This section covers the various heat fusion methods that can be used for welding Niron PP-RCT Pipe and Fittings.



# Before You Begin / Safety Precautions

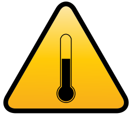

Electrical Warning


OSHA Steel-Toed Shoes


Hart Hard where required


Safety Glasses


Heat Resistant Gloves


Careful around hot irons


Follow Nupi Guidelines

## Cutting Niron PP-RCT Pipe Manually

Niron PP-RCT should be cut by a method which does not damage the pipe, and which results in as square a cut as possible. After each cut, inspect the pipe ends to be sure that no cracks have occurred, especially during cold weather.

Use a ratchet cutter with a sharp pointed blade for small diameter Niron pipe. A dull blade, like the one shown above, or a blade that is not pointed can ovalize the pipe and cause stress or micro-cracks.

Wheel type plastic tubing cutters with a sharp blade that is taller than the wall thickness of the pipe to be cut can also be used.

Pipe should be supported while cutting using a pipe stand, or by using another method of support.

## Cutting Niron PP-RCT Pipe Using Power Cutting Tools

When cutting Niron PP-RCT pipes with power cutting equipment, use a carbide blade that has 60-100T (teeth per 12 inch).

Band and reciprocating saws also can be used. The blades with band and reciprocating saws that are designed for plastic pipe tend to be narrower and make a finer cut.

## Deburring / Cleaning and Surface Prep

Inspect the ends of the pipe after cutting for damage on the end of the pipe, as well as the inside and outside surfaces. If cracks or other damage are detected, mark and remove the damaged area.

Using an appropriate deburring tool, remove any burs and frayed edges along the pipe cut. Also be sure to remove any of the shavings and pipe fragments from the interior of the pipe.

If the outside of the pipe has dirt, grease or grime, remove with isopropyl alcohol and a clean lint free cloth. The IPA should be 91% concentration by volume or greater.

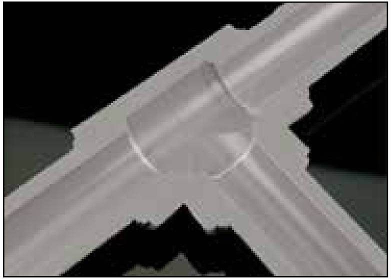
A proper finished cut pipe piece with square, clean cut is shown above .

# Heat Element Socket Fusion

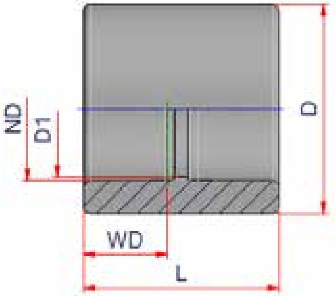
The socket fusion process involves the forced insertion of a plain pipe end into a tapered socket. The socket of the coupling is designed to be smaller than the o.d. of the pipe and is further tapered resulting in an interference fit. As such, the pipe cannot be dry fit into the socket. It is this interference fit which causes a forced mixing of molten material that is an integral part of the fusion process.

The outside surface of the pipe is heated inside of a mandrel over a length that is slightly less than the mating socket. The inside surface area of the socket is also heated by a male mandrel that is inserted into the socket. This heating takes place for a specific period of time for each size combination, which have be developed through years of R&D.

When the pipe and inside of the sockets are melted, this allows the pipe to be inserted into the socket and overcome the interference fit. In the process the outer layer of the pipe is removed and the inside layer of the coupling is also displaced. This allows fresh, virgin material to be intermixed under pressure, forming a permanent weld that after it is allowed to cool and re-solidify is stronger than the pipe or fitting.



## Socket Dimensions




| Size nom | Size mm | D1 | D | WD | L |
|---|---|---|---|---|---|
| 1/2 | 20 | 0.71 | 1.14 | 9/16 | 1.38 |
| 3/4 | 25 | 0.79 | 1.38 | 5/8 | 1.54 |
| 1 | 32 | 1.18 | 1.81 | 1-1/16 | 1.69 |
| 1-1/4 | 40 | 1.46 | 2.21 | 1-3/16 | 1.89 |
| 1-1/2 | 50 | 1.85 | 2.76 | 1-5/16 | 2.13 |
| 2 | 63 | 2.36 | 3.47 | 1-1/16 | 2.44 |
| 2-1/2 | 75 | 2.76 | 3.98 | 1-3/16 | 2.80 |
| 3 | 90 | 3.31 | 4.92 | 1-5/16 | 2.91 |
| 3-1/2 | 110 | 4.19 | 6.30 | 1-7/16 | 3.23 |
| 4 | 125 | 4.57 | 6.30 | 1-9/16 | 3.58 |

## Socket Fusion Heating Mandrels

The process of socket fusion requires a matching die pair of male and female shaped heating mandrels. The mandrels are sized specifically to match to socket dimensions for each given size. Niron sockets are manufactured to comply with ASTM F2389 required socket dimensions. For this reason, installers of Niron PP-RCT should use mandrels that are designed for ASTM F2389 dimensions from an approved tool manufacturer. Consult Nupi if there are any questions as to whether a given tool set may be used to perform socket fusion on Niron PP-RCT pipe.


Prior to using heating mandrels, the mandrels should be cleaned with isopropyl alcohol and a clean cloth prior to their being heated up. Be sure the alcohol has thoroughly evaporated before heating the mandrels.

## Heating Elements (Irons)

The smallest sizes of heating elements used to perform hand held socket fusion with Niron PP-RCT components are designed to allow two or more sizes to be mounted to the irons.

1/2”- 2” Ritmo Welder

1/2”- 4” Ritmo Welder

Do not carry the heating iron by the power cord

Be sure to have a steady electrical source to insure proper heating of the iron.

# Socket Fusion Safety Precautions

Wear approved heat resistant gloves.

After use, place the heating iron in its protective case.


A warning sign should be placed near the work area to provide a warning about the use of the hot tools.

The electrical cord should be kept from contacting the hot surface.

Be aware of your surroundings and the proximity of other people, especially when moving and handling the heating irons.

Socket Fusion is performed at 500°F and as such the heating iron can cause serious burns. Be sure to wear proper gloves.

Never use water to cool the heating iron or mandrels as it can damage the iron and mandrels.

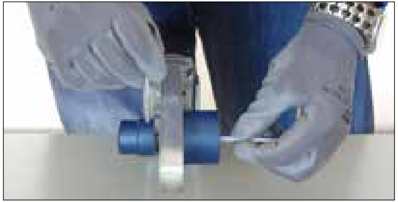
# Socket Fusion Safety Precautions

Keep from placing the heating iron near flammable substances or near surfaces that can be melted.

Always carry or handle the heating iron by its handle and while wearing heat resistant gloves.

Never leave the heating iron unattended while it is in use. Be aware of the high heat and risk of serious burns.

Keep the heating iron in its own case. Do not store multiple heating irons in the same case as it could damage of one or more of the heaters.



Wait until the heater bushing mandrels are cooled before changing sizes. Always use heat resistant gloves, even while they cool, to avoid contact with your bare hands.

Once cooled,clean a dirty/contaminated heating iron, or mandrels, with isopropyl alcohol and a clean, lint-free cloth. Alcohol must be thoroughly evaporated before using again.

# Tool Assembly / Pipe Preparation

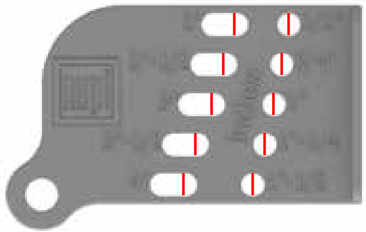
When powering the heating iron, be sure to use a dedicated source of power. Other devices which can draw power can create fluctuations in the power supply and this must be avoided. Use of a low gauge extension cord can allow power to be delivered over long distances if needed.

Loosely set the fusion bushings (mendrels) prior to heating up the iron. Once the heating iron is heated, the heater bushings can be tightened (be sure to use heat resistant gloves).


Check the temperature on the interior of the heater bushings using an infrared or digital thermometer. The temperature for socket fusion for all thermoplastic materials is standardized at 500°F (+/-18°F). Note that constant fluctuations in temperature are often an indication of a power supply problem.

# Pipe Depth Marking

Nupi Americas provides a marking tool which is specific to each given size. It is suggested to mark the pipe every 90° at four points around the pipe to insure the depth marking can be read no matter the orientation of the pipe. The tool can also be rotated to alternatively mark a complete circle around the pipe.



The marking tool for Niron consists of small circles for sizes 1/2" through 2" and oval-shaped holes for sizes 2-1/2" through 4". The actual depth of insertion is where the vertical red lines are shown (to the midpoint of the small circles and to the midpoint of the first circle of the oval-shaped holes). When the bead forms, part of the mark will be visible.

It is highly recommended to achieve as square a cut as possible. However, if the pipe is cut at a slight angle (i.e. less than 5% difference in distance from side to side), the pipe should only be marked on the long side to prevent over-insertion of the pipe. This will leave a slight internal gap in the bottom of the socket. However, this will not affect joint strength. It will also avoid over inserting which will cause an overly large internal bead that can cause a large pressure

## Socket Fusion Parameters / Fusion Chart

| Size | Depth of Insertion | Heating Time | | Max Change-over (seconds) | Cool Down Time | |
|---|---|---|---|---|---|---|
| | | SDR 11 / 9 / 7.3 | SDR 17 | | Clamped (sec.) | Total (min.) |
| 1/2" (20 mm) | 9/16" | 5 | NA | 4 | 6 | 2 |
| 3/4" (25 mm) | 5/8" | 7 | NA | 4 | 10 | 2 |
| 1" (32 mm) | 11/16" | 8 | NA | 6 | 10 | 4 |
| 1 1/4" (40 mm) | 13/16" | 12 | NA | 6 | 20 | 4 |
| 1 1/2" (50 mm) | 15/16" | 18 | NA | 6 | 20 | 4 |
| 2" (63 mm) | 1-1/16" | 24 | 10 | 8 | 30 | 6 |
| 2 1/2" (75 mm) | 1-3/16" | 30 | 15 | 8 | 30 | 6 |
| 3" (90 mm) | 1-5/16" | 40 | 22 | 8 | 40 | 6 |
| 3 1/2" (110 mm) | 1-7/16" | 50 | 30 | 10 | 50 | 8 |
| 4" (125 mm) | 1-9/16" | 60 | 35 | 10 | 60 | 8 |

## Socket Fusion Chart Description of Terms

### SIZE

This column lists the "nominal" size of the pipe as it is referred to in plans and drawings in inches. It is also how the pipe size is marked on the pipe markings and fitting labels. Next to the nominal inch size is the actual o.d. in millimeters in parenthesis. This size is also indicated on the pipe markings and is included as part of the fitting part number. Note that the actual o.d. is allowed by the ASTM F2389 standard to exceed this size within a specified amount.

### DEPTH OF INSERTION

This is the fusion depth of the socket and it is the amount that the pipe will be inserted into the socket after each are heated. This depth is controlled by the length of the heating bushings (mandrels). Allowances should be made for this depth for cutting during planning after determining the difference between the center-to-end dimension of the fitting and the socket depth.

### HEATING TIME FOR SDR 11, SDR 9 AND SDR 7.3

This is the time for proper heating of the interior of the socket as well as the exterior of the pipe when working in a temperature range of 40°F to 100°F for thick walled pipe. The time of heating begins once the pipe and fitting are both fully inserted onto the heater bushing.

### HEATING TIME FOR SDR 17

This is the time for the socket welding of SDR 17 pipes. Note that these times are less than that of the previous column

## Socket Fusion Chart Description of Terms

**TRANSITION TIME**

This is the time allowed to complete the task of removing the pipe and fitting from the heater bushing and the insertion of the pipe fully into the socket of the fitting/coupling. If this time is exceeded, there is a risk of an incomplete insertion and a cold weld. When this occurs, do not use the fitting, as it must be cut out and replaced with a properly made weld.

**COOL DOWN TIME**

This is the minimum amount of time that the pipe must be cooled before it can be stressed or pressurized. The pipe should be held in position for the time in the first column with the heading "Clamped" to allow it to begin to solidify. The pipe and fitting/coupling does not have to be held for the remainder of the required "Total" cooling period.

*NOTE:*

*When installing Niron PP-RCT pipe in temperatures below 40°F, a longer heating time should be used. A longer heating time may also be used for situations where pipe is difficult to insert fully to the depth of insertion in a certain fitting within the transition time.*

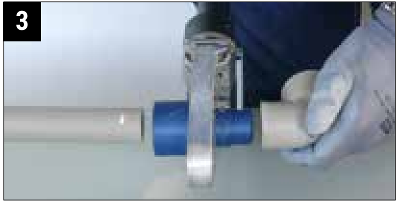
# Socket Fusion Step by Step Manual Socket Fusion Instructions

Socket fusion requires the outside surface of the pipe and inside surface area of a socket to be heated, after which the pipe with molten outer surface is forced into the socket with molten inner surface. When performed properly the resulting weld is stronger than the pipe or fitting.

To accomplish this, it is important to use the proper heating mandrels. These can be sourced through Nupi or purchased from an approved tool manufacturer. Be sure to source tools designed for ASTM F2389 sockets.


After cutting and deburring the pipe, sizes through 2” (63mm) size must be beveled with a 15° bevel. After beveling, the pipe surface should be cleaned with isopropyl alcohol and a clean, lint-free cloth.


Mark the depth of insertion on the pipe surface. It is suggested to mark the pipe at four locations at 90° orientations. It is highly recommended to use a cold ring installed at the depth of insertion mark.

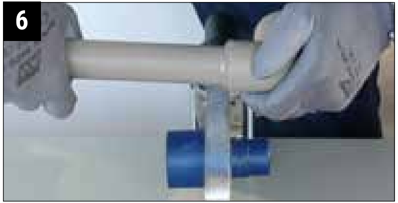



Insert the pipe and fitting into/onto the heater bushings. It is helpful to use a short piece of 2x4 lumber on the fitting side to start the pipe first before pushing the fitting on.

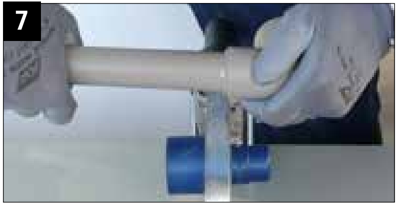

Stop pushing when the center stop is reached and begin counting the heating time for the given pipe SDR. A round, consistently shaped bead should form around the entire circumference.

# Socket Fusion Step by Step Manual Socket Fusion Instructions


After the heating time is completed, remove the pipe and fitting from the heating bushings. It is helpful to have the handle held or clamped during this process.




Safely remove the heater plate from the joint area and immediately push the pipe into the fitting until the two round beads meet. This must be done within the Transition Time.




After insertion, minor adjustments can be made to the alignment to insure that the joint is straight/level. This can be done within the first 5-10 seconds after joining.


It is necessary to hold the pipe in place for the time shown in the column titled “clamped”. After the full Cooling Time has occurred, the joint is ready to be tested and placed into service.

It is important not to twist the pipe or fitting during any of the steps of insertion onto the tool, removal from the tool, insertion of the pipe into the socket or during adjusting/leveling. Doing so can result in a defective weld.

## Larger Diameter Fusions Using Spider Tool Or Bench Top Unit



McElroy Spider Tool


Bench Socket Fusion Tool

*When fusing pipe that is larger than nominal 2" (63 mm), it is highly recommended to use a device which provides alignment and mechanical assistance. Two such tools are pictured here. Note that other tools also are available by additional approved tool manufacturers that provide these functions.*

### McElroy Spider Tool

The McElroy Spider tool is designed to clamp onto the pipe and fitting and can be used for welding on a bench configuration or for joining on pipes that are supported in the air. The device requires the heating element to be handled manually, but it overcomes the larger forces necessary to push molten pipes into molten sockets in larger sizes. It also provides for excellent insurance of alignment during welding.

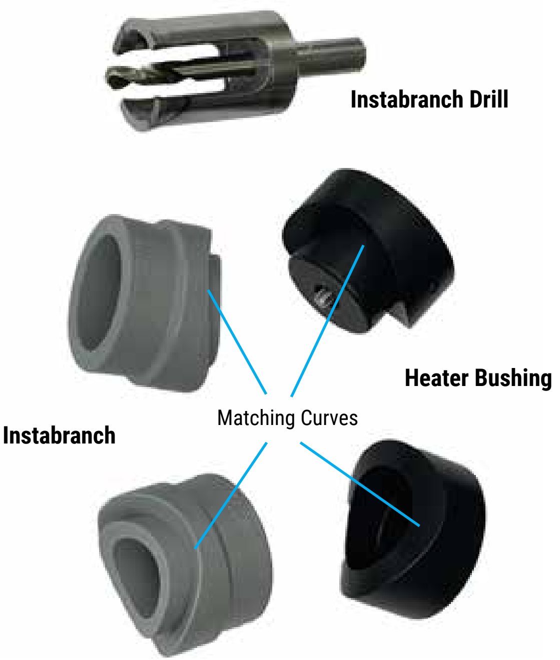
### Bench Socket Fusion Tools

When welding in a prefabrication bench setting, bench tools offer alignment, depth of insertion control while also utilizing a heating element that is mounted to the equipment. These bench tools allow for fabrication of larger parts to be performed by a single installer.

# Instabranch Welding

Reducing branches can be instantly added into the sidewall of a larger diameter pipe using a modified socket fusion technique known as Instabranch Welding and using our Niron Instabranch™ and Instaheader™ Welding Socklets. This technique can save installation cost and also present a faster way to accomplish branch reductions.

Alignment tools are available to allow for drilling of the hole in perpendicular relation to the pipe, and also for aligning the Instabranch or Instaheader Welding Socklet so that it is level and plumb when installed into the pipe. The alignment tools also allow for a control over the insertion pressure and depth of insertion while performing the weld. For these reasons, the use of alignment tools are highly recommended whenever installing an Instabranch or Instaheader.



# Instabranch and Instaheader Joining Instructions

The process for installing and Instabranch/Instaheader fitting involves first boring a hole, then heating the pipe surface/hole and fitting and then mating the melted fitting against the pipe surface and hole under minimal pressure required to cause a uniform set of beads to form. Two important issues should be noted:

1. Any material that is removed to form the hole which remains in the pipe must be vacuumed out of the pipe so it will not cause problems with the pipe when it is placed in service.
2. The hole needs to be slightly smaller than the O.D. of the spigot portion of the underbelly of the Instabranch/Instaheader. It is recommended to use a Nupi drill bit, or one made by an authorized tool manufacturer to insure the proper size of the drill bit in relation to the fitting being installed.

The drill bits manufactured by Nupi are designed to cause most of the shavings to be expelled to the exterior of the pipe, rather than to fall into the hole. The remainder of the shavings will fall into the pipe and must be later removed by a shop vac with an appropriate size hose that can reach into the hole.

It is critical to achieve a properly sized hole in order to result in a branch line that will result in full pressure rating when completed. For this reason, it is highly recommended to use a drill bit manufactured by Nupi for the appropriate combination, or one made by an authorized tool manufacturer.

# Instabranch and Instaheader Joining Instructions


Install the Instabranch heater bushings (die pairs) onto the heater the same as you would install socket fusion bushings


Check the temperature of the heater bushings using an infrared pyrometer prior to welding.


Mark the pipe at the centerline of the hole location. Be sure to double check the measurement and orientation of the hole prior to marking.


Scrape/peel the external surface of the pipe in the area where the Instabranch/Instaheader will be fused. The area should first be marked, and should extend outside of the fusion zone by min. ½".


Use the guide bit to initiate the hole and to assure the proper position. Make sure to drill so that the drill bit is square (perpendicular) to the pipe.


The drill bit from Nupi is designed to pull the cut material out of the pipe so that the majority of the cut material does not fall into the hole. The remainder should be vacuumed out with a shop vac.

# Instabranch and Instaheader Joining Instructions


For smaller sizes, it is better to first use a board or dowel to help push the heater bushing into the hole prior to starting the fitting in order to avoid overheating the fitting. Be sure to match the curvature.


Insert the fusion heater bushing into the hole and the fitting into the heater bushing on the opposite side. Apply just enough pressure to keep the heater bushing in contact with the PP-RCT pipe.


A uniform bead should appear around the fitting and around the pipe surface. Light pressure being applied will keep the bead from becoming excessive.

Be sure to use the correct heater for the size heater bushings being installed. The heater bushing should not be installed onto a heater which is undersized, or it will result in the inability to be heated to the correct temperature in an even manner.

# Instabranch and Instaheader Joining Instructions


If the proper pressure has been applied, the fusion head will make a uniform melt pattern around the hole.


After the heating is completed, remove the heater and place the fitting into the hole, being sure to match the curvature. Use sufficient pressure to maintain contact and to cause a uniform bead to form around the opening.


You have a few seconds to make minor adjustments (to level and square-up the fitting).

# Instabranch and Instaheader Joining Instructions

13

Allow the part to reach the full cooling time before it can be placed into service. The cooling time is the same as that of a socket fusion fitting of equal size to the branch.

14

Although the proper size combination of branch should be used, it is o.k. to use an Instabranch on a larger main pipe size having a wall thickness of 1 inch or more. Be sure to tilt the fusion head from side to side to insure melt into the wall of the pipe.

Be sure to use the correct heater for the size heater bushings being installed. The heater bushing should not be installed onto a heater which is undersized, or it will result in the inability to be heated to the correct temperature in an even manner.

## Machine Assisted Instabranch and Instaheader Welding

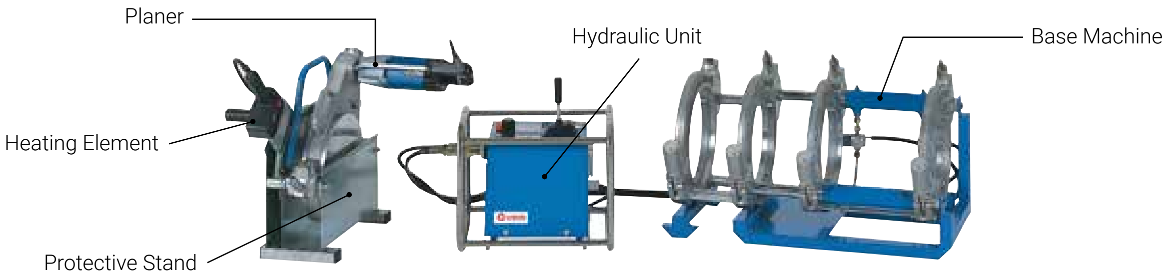
Several manufacturers of tools offer a tool for the welding of Instabranch and Instaheader parts into a main pipe for the purposes of fabricating a reducing branch. These machine-assist tools are designed to allow the Instabranch and Instaheaders to be installed perfectly aligned (perpendicular) with the hole, while also allowing the depth of insertion and fusion pressure to be controlled. The use of these tools is highly advisable whenever it is practical or possible to use the tools, especially in position in the field where controlling alignment, depth of insertion and fusion pressure can be exceedingly difficult.

A McElroy hornet tool is pictured here clamped onto the pipe and into position.

A machine-assist tool allows the branch to be aligned perpendicular to the main. Pictured here is a Ritmo Up 125 Machine.

## Heat Element Butt Fusion

Heat Element Butt fusion is a fusion process that involves forcing plain ends of pipe and/or spigot fittings which have been prepared by planing (facing) together under a controlled amount of pressure and held for a defined period of time to result in a “butt weld”. The primary elements are heat, pressure and time. A butt fusion machine is needed to control the alignment, allow for the planing (facing) of the pipe ends, to control the required fusion pressure and also to allow the heat to be applied for the required time. In some machines, there are CNC controls added to automatically control the times of the various steps in the process.




**Widos 4600 Hydraulic Machine**

**Typical Hydraulic Butt Fusion Machine Indicating Various Components**

# Butt Fusion Step-By-Step Overview

The key steps to be followed for butt fusion are as follows:

Mount the parts into the Machine

Clamp the parts to be welded

Plane the Parts

Bead-up (Initial Welding)

Heat Soak Time

Final Welding / Cooling

# Butt Fusion Instructions


Set up the machine being used following all guidelines from the machine manufacturer.


Insert the correct size pipe inserts for the pipe size being welded.


Inspect the heater plate and clean if needed. Set the temp to 410°F (+/- 18°F).

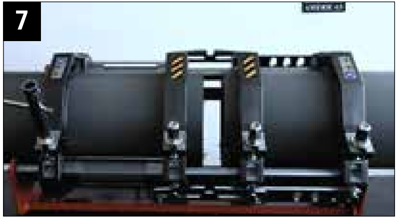

Cut the pipe at least ¼" longer than the intended final length. This measurement should be at the shortest dimension if there is an uneven cut.

Make sure that the power supply is adequate for the machine being used. Be sure to wear protection gear and follow all safety recommendations of the specific machine from the machine manufacturer.

# Butt Fusion Instructions


Clean the pipe ends prior to facing (planing). The pipe ends should be free from any dirt, dust, grease or other contaminants. Wipe with isopropyl alcohol (91% or greater conc.) and clean, lint-free cloths.


Prior to facing (planing) also clean the facer so it is free from any dirt, dust, grease or other contaminants. Wipe with isopropyl alcohol (91% or greater conc.) and clean, lint-free cloths.

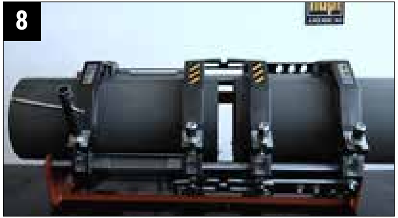



Set the components to be fused into the clamps. Where possible, use both sets of clamps when working with a machine that has a double clamp set-up. Adjust as needed.

Note: During welding, some loss of length (¼ inch or more) will occur due to the weld bead formation and this should be taken into account when measuring the required take-off length. The loss of axial length should be noted and tracked (this can vary by size, wall thickness, machine type used, etc.) , and the amount to be accounted for should be adjusted to increase accuracy.

Nupi supports the butt fusion of its Niron PP-RCT piping systems in all SDR's beginning at nominal 2" (63mm) with a full range of butt fusion fittings. Smaller pipes may also be butt fused, although butt fusion fittings are available starting at 2" size.

# Butt Fusion Instructions



Position the components so that there is approximately an inch of material extended out from the edge of the clamp. There has to be enough room to accommodate the facer (planer). Mark the position where the desired finish point of planing (facing) will be.

If fittings are to be welded, reconfigure the machine as required by the machine set-up for the specific model being used. On many trench-style machines, the second set of clamps can be removed entirely so that the machine becomes a single clamp set-up on one side.

Tighten all clamps so that the clamps are just tight enough to prevent movement of the pipe and/or fittings when fusion pressure is applied. Do not over-tighten. Bring the ends of the parts together being sure to keep hands away from the movement of the pipes/fittings.

# Butt Fusion Instructions


If proper axial alignment is not achieved, reposition the pipes so that the desired alignment is achieved. In many installations it is desirable to align the print lines on pipe to pipe connection to make pipe inspection easier.


Check the radial alignment of the faces of the parts being welded. It is helpful to use your finger or a pen to see if there are any high/low spots. If there is misalignment, make the necessary adjustments to the tool by tightening the clamps to result in a better alignment.


After aligning, open the carriage and position the facer into the tool in the locked position. Turn on the facer and allow it to develop its full speed before bringing the pipe ends into position.

# Butt Fusion Instructions


While the facer is rotating, bring the parts together against the facer. Increase the pressure until ribbons of shavings are produced from the facer. Use just enough pressure to cause the ribbons to be produced.


When the pipe is properly faced, complete ribbons of shavings that represent several continuous revolutions of pipe will have been produced from both sides and the marked ending point of facing has been reached. When this is achieved open the carriage while the facer is still rotating.


Remove the facer from the butt fusion machine.

# Butt Fusion Instructions

17

After facing, bring the pipes together to be sure there are no gaps. If a gap greater than the thickness of a sheet of paper remains, reface as necessary to close any remaining gaps. If facing is complete, re-clean the pipe ends a final time with 91% or greater Isopropyl Alcohol.

18

Determine the drag pressure by increasing the pressure slowly until the carriages begin to move. There are many variables that can affect drag pressure so it should be checked every time.

19

Determine the total weld pressure which consists of the machine hydraulic weld pressure plus the drag pressure added together. The machine pressure can be found from the tables for the machine or from this manual. Machine pressure will vary by diameter, SDR and the specific model of machine being used. Set the combined pressure on the unit.

*Note: When using a manual, non-hydraulic machine, the “weld force” in pounds force is the required units to use with the machine. The “weld force” also depends on the diameter and SDR. Drag pressure becomes irrelevant as it is accounted for automatically to reach the required “weld force”.*

# Butt Fusion Instructions

20

Separate the carriages and place the heater plate into position. The temperature for welding polypropylene is 410°F (+/-) 18°F. Be sure to set the temperature of the heating plate to this temperature before inserting it into position.

21

Bring the pipes together against the heater plate to the total weld pressure described on the previous page. This is the pressure applied against the heater plate to develop the initial bead formation.

22

Keep the pipes in position against the heater plate under the total pressure until the required initial bead height is achieved at all points around the circumference of both pipes. The initial bead height is shown in the welding tables for each diameter and SDR.

# Butt Fusion Instructions


After a bead is formed around the entire circumference of both sides to the minimum of the required bead height, reduce the pressure to the drag pressure plus 10% of the machine pressure.


Keep the components against the heater plate at the drag pressure plus 10% of the machine pressure for the entire duration of the heat soak time.


Separate the carriages and remove the heater plate. If the heater plate is not attached to the frame of the machine and designed to slide out of the way, be sure to have a safe and secure place to position the heater plate.

Failure to heat the pipes for the full duration of the required heat soak time, or exceeding the heat soak time by a significant amount can result in welds that can fail at a later point in time.  It is important to observe the required heat soak time as closely as possible.

# Butt Fusion Instructions

26

After removing the heater plate, bring the heated component ends together within the required transition time. Bring the pipe to the total weld pressure (the same pressure as in the initial heating) within the required pressure build-up time.

27

Observe the require cooling time with the parts under the total weld pressure. It is important to observe the proper minimum time.

28

After the minimum cooling time has been achieved, release the pressure on the tool. The clamps can then be unclamped. Do not attempt to release the clamps prior to when the pressure is released, or injury or damage can result from doing so.

## Welding Two Different Wall Thicknesses

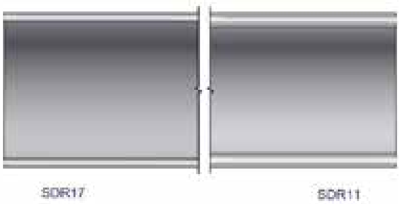
Generally you should avoid welding pipes that are of two different SDRs unless it is unavoidable. If this must be done, it is always preferable to machine or route the end of the thicker pipe to match that of the component with the thinner SDR. If that is not possible, pipes with different SDRs can be butt welded together, providing the following modifications are observed:

Use the lower welding pressure of the two pipes (this will always be the thinner SDR, that is, the pipe having the SDR which is a higher number).

Use the longer time of the two pipes (this will always be the thicker SDR, that is, the pipe having the SDR which is a lower number).

The bead height to be achieved should be the average of the bead heights required of the two pipes The pipes must be a difference of one SDR. SDR 7.3 can be directly butt welded to SDR 9, SDR 9 can be directly butt welded to SDR 11 and SDR 11 can be directly butt welded to SDR 17. If it is required to butt weld a pipe to a significantly different SDR (e.g. SDR 7.3 to SDR 17), then the pipe end of the thicker pipe must be routed to match the SDR of the thinner pipe and a standard weld can be performed.

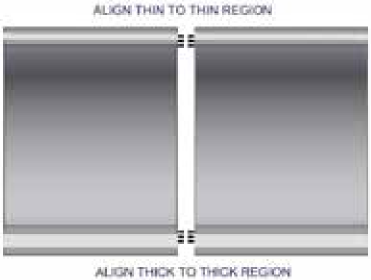
*NOTE: The pressure rating of the finished weld will be limited to the lowest pressure rating of the two components being welded together, that is, the pipe and/or fitting with the highest SDR.*



## Alignment of Internal Diameters

Because of the nature of polypropylene extrusion, gravity causes it to sag when extruded, especially in larger pipes with thicker walls. As such, the pipe can be thicker at the bottom and thinner at the top by a nominal amount. The minimum required thickness is always met at the top of the pipe. If anything, the pipe will exceed the required pressure ratings , so there is no concern over the pressure rating of the pipe.

The issue also does not bring about any concerns due to added head loss or reduction in flow capacity of the pipe. The only issue that should be addressed when pipe has this condition is the match-up of the pipes during butt fusion. The pipes should be aligned such that the thin points are aligned and the thick points are also matched up. This can be accomplished readily by paying attention to matching the print lines of the pipe. Aligning the print string will help greatly in the aligning of the walls so the relative thicknesses match each other. If the pipes are aligned sufficiently, this will help to produce a weld bead which has a more consistent appearance after welding.



## McElroy Machine Pressure

McELROY

918-836-8611
www.mcelroy.com

This table is based on information available to Nupi Americas at the time of printing of this Installer's Manual. The information is subject to change by the tool manufacturer. As such, the installer should always consult with the tool manufacturer to be sure to use the most current information available for the specific model of machine being used.

*Note: Be sure to add drag pressure to the machine pressure for any hydraulic machine to achieve total required pressure.*

| Niron Clima & Cool Pro Size (actual OD mm) | SDR | McElroy Machine Pressures (psi) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Polygon low force | Acrobat 160 | Acrobat 250 | Acrobat 315 low force | Acrobat w/ Quikfit | Rolling 250 low force | Rolling 412 & 618 low force | TracStar 250 low force | TracStar 412 & 618 low force | TracStar 630i medium force |
| 2" (63 mm) | 11 | 23 | 26 | 26 | - | - | 14 | - | 14 | - | - |
| 2" (63mm) | 9 | 28 | 31 | 31 | - | - | 17 | - | 17 | - | - |
| 2" (63mm) | 7.3 | 33 | 37 | 37 | - | - | 20 | - | 20 | - | - |
| 2.5" (75mm) | 11 | 33 | 36 | 36 | - | - | 20 | - | 20 | - | - |
| 2.5" (75mm) | 9 | 39 | 44 | 44 | - | - | 24 | - | 24 | - | - |
| 2.5" (75mm) | 7.3 | 47 | 52 | 52 | - | - | 28 | - | 28 | - | - |

| Niron Clima & Cool Pro Size (actual OD mm) | SDR | McElroy Machine Pressures (psi) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Polygon low force | Acrobat 160 | Acrobat 250 | Acrobat 315 low force | Acrobat w/ Quikfit | Rolling 250 low force | Rolling 412 & 618 low force | TracStar 250 low force | TracStar 412 & 618 low force | TracStar 630i medium force |
| 3" (90 mm) | 17 | 32 | 35 | 35 | - | - | 19 | - | 19 | - | - |
| 3" (90 mm) | 11 | 47 | 53 | 53 | - | - | 28 | - | 28 | - | - |
| 3" (90 mm) | 9 | 56 | 63 | 63 | - | - | 34 | - | 34 | - | - |
| 3" (90 mm) | 7.3 | 68 | 75 | 75 | - | - | 41 | - | 41 | - | - |
| 3.5" (110 mm) | 11 | 71 | 78 | 78 | - | - | 43 | 22 | 43 | 22 | - |
| 3.5" (110 mm) | 9 | 84 | 94 | 94 | - | - | 51 | 27 | 51 | 27 | - |
| 3.5" (110 mm) | 7.3 | 101 | 112 | 112 | - | - | 61 | 32 | 61 | 32 | - |
| 4" (125 mm) | 17 | 61 | 68 | 68 | - | - | 37 | 19 | 37 | 19 | - |
| 4" (125 mm) | 11 | 91 | 101 | 101 | - | - | 55 | 29 | 55 | 29 | - |
| 4" (125 mm) | 9 | 109 | 121 | 121 | - | - | 66 | 35 | 66 | 35 | - |
| 4" (125 mm) | 7.3 | 130 | 145 | 145 | - | - | 79 | 42 | 79 | 42 | - |
| 6" (160 mm) | 17 | 100 | 111 | 111 | - | - | 60 | 32 | 60 | 32 | - |
| 6" (160 mm) | 11 | 149 | 166 | 166 | - | - | 90 | 48 | 90 | 48 | - |
| 6" (160 mm) | 9 | 179 | 198 | 198 | - | - | 108 | 57 | 108 | 57 | - |

# McElroy Machine Pressure

| Niron Clima & Cool Pro Size (actual OD mm) | SDR | McElroy Machine Pressures (psi) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Polygon low force | Acrobat 160 | Acrobat 250 | Acrobat 315 low force | Acrobat w/ Quikfit | Rolling 250 low force | Rolling 412 & 618 low force | TracStar 250 low force | TracStar 412 & 618 low force | TracStar 630i medium force |
| 6" (160 mm) | 7.3 | 214 | 237 | 237 | - | - | 129 | 68 | 129 | 68 | - |
| 8" (200 mm) | 17 | 127 | - | 174 | 106 | - | 94 | 50 | 94 | 50 | - |
| 8" (200 mm) | 11 | 189 | - | 259 | 159 | - | 141 | 74 | 141 | 74 | - |
| 8" (200 mm) | 9 | 226 | - | 310 | 190 | - | 168 | 89 | 168 | 89 | - |
| 8" (200 mm) | 7.3 | 270 | - | 371 | 227 | - | 201 | 106 | 201 | 106 | - |
| 10" (250 mm) | 17 | - | - | 271 | 166 | 131 | 147 | 78 | 147 | 78 | - |
| 10" (250 mm) | 11 | - | - | 405 | 248 | 195 | 220 | 116 | 220 | 116 | - |
| 10" (250 mm) | 9 | - | - | 484 | 296 | 233 | 263 | 139 | 263 | 139 | - |
| 10" (250 mm) | 7.3 | - | - | 580 | 355 | 279 | 314 | 166 | 314 | 166 | - |
| 12" (315 mm) | 17 | - | - | - | 264 | 207 | - | 124 | - | 124 | - |
| 12" (315 mm) | 11 | - | - | - | 394 | 310 | - | 184 | - | 184 | - |
| 12" (315 mm) | 9 | - | - | - | 471 | 370 | - | 220 | - | 220 | - |

| Niron Clima & Cool Pro Size (actual OD mm) | SDR | McElroy Machine Pressures (psi) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Polygon low force | Acrobat 160 | Acrobat 250 | Acrobat 315 low force | Acrobat w/ Quikfit | Rolling 250 low force | Rolling 412 & 618 low force | TracStar 250 low force | TracStar 412 & 618 low force | TracStar 630i medium force |
| 12" (315 mm) | 7.3 | - | - | - | 563 | 443 | - | 264 | - | 264 | - |
| 14" (355 mm) | 17 | - | - | - | - | 263 | - | 157 | - | 157 | 32 |
| 14" (355 mm) | 11 | - | - | - | - | 393 | - | 234 | - | 234 | 48 |
| 14" (355 mm) | 9 | - | - | - | - | 470 | - | 280 | - | 280 | 57 |
| 16" (400 mm) | 17 | - | - | - | - | 334 | - | 199 | - | 199 | 41 |
| 16" (400 mm) | 11 | - | - | - | - | 499 | - | 297 | - | 297 | 61 |
| 18" (450 mm) | 17 | - | - | - | - | 423 | - | 252 | - | 252 | 52 |
| 18" (450 mm) | 11 | - | - | - | - | 632 | - | 376 | - | 376 | 77 |
| 20" (500 mm) | 17 | - | - | - | - | 523 | - | - | - | - | 64 |
| 20" (500 mm) | 11 | - | - | - | - | 780 | - | - | - | - | 95 |
| 22" (560 mm) | 17 | - | - | - | - | 656 | - | - | - | - | 80 |
| 24" (630 mm) | 17 | - | - | - | - | 830 | - | - | - | - | 101 |

# Widos Machine Pressure

678-766-1250
www.widoswelding.com

This table is based on information available to Nupi Americas at the time of printing of this Installer's Manual. The information is subject to change by the tool manufacturer. As such, the installer should always consult with the tool manufacturer to be sure to use the most current information available for the specific model of machine being used.

*Note: Be sure to add drag pressure to the machine pressure for any hydraulic machine to achieve total required pressure.*

| Niron Clima & Cool Pro Dnom (Actual OD in mm) | SDR | Widos Machine Pressures (bar) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Maxiplast | W4400 | W4600 | W4900 | W4955 | W5100 | W5500 | W6100 |
| 2" (63 mm) | 17 | 18 | 3 | - | - | - | - | - | |
| 2" (63 mm) | 11 | 24 | 5 | - | - | - | - | - | |
| 2" (63 mm) | 9 | 29 | 5 | - | - | - | - | - | |
| 2" (63 mm) | 7.3 | 33 | 6 | - | - | - | - | - | |
| 2.5" (75mm) | 17 | 22 | 4 | 2 | - | - | - | - | |
| 2.5" (75mm) | 11 | 33 | 6 | 3 | - | - | - | - | |
| 2.5" (75mm) | 9 | 40 | 8 | 4 | - | - | - | - | |

| Niron Clima & Cool Pro Dnom (Actual OD in mm) | SDR | Widos Machine Pressures (bar) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Maxiplast | W4400 | W4600 | W4900 | W4955 | W5100 | W5500 | W6100 |
| 2.5" (75mm) | 7.3 | 46 | 9 | 5 | - | - | - | - | |
| 3" (90 mm) | 17 | 33 | 6 | 3 | 3 | 3 | - | - | |
| 3" (90 mm) | 11 | 49 | 9 | 5 | 4 | 4 | - | - | |
| 3" (90 mm) | 9 | 57 | 11 | 5 | 5 | 5 | - | - | |
| 3" (90 mm) | 7.3 | 68 | 13 | 6 | 6 | 6 | - | - | |
| 3.5" (110 mm) | 17 | 49 | 9 | 5 | 4 | 6 | - | - | |
| 3.5" (110 mm) | 11 | 71 | 13 | 7 | 6 | 6 | - | - | |
| 3.5" (110 mm) | 9 | 84 | 16 | 8 | 7 | 7 | - | - | |
| 3.5" (110 mm) | 7.3 | 101 | 19 | 9 | 8 | 8 | - | - | |
| 4" (125 mm) | 17 | 62 | 11 | 6 | 5 | 5 | - | - | |
| 4" (125 mm) | 11 | 92 | 17 | 8 | 7 | 7 | - | - | |
| 4" (125 mm) | 9 | 108 | 20 | 10 | 9 | 9 | - | - | |
| 4" (125 mm) | 7.3 | 128 | 24 | 12 | 10 | 10 | - | - | |
| 6" (160 mm) | 17 | 99 | 18 | 9 | 8 | 8 | - | - | |
| 6" (160 mm) | 11 | 148 | 27 | 13 | 12 | 12 | - | - | |

# Widos Machine Pressure

| Niron Clima & Cool Pro Dnom (Actual OD in mm) | SDR | Widos Machine Pressures (bar) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Maxiplast | W4400 | W4600 | W4900 | W4955 | W5100 | W5500 | W6100 |
| 6" (160 mm) | 9 | 176 | 32 | 16 | 14 | 14 | - | - | |
| 6" (160 mm) | 7.3 | 212 | 39 | 19 | 17 | 17 | - | - | |
| 8" (200 mm) | 17 | - | - | 14 | 12 | 12 | 5 | 5 | |
| 8" (200 mm) | 11 | - | - | 20 | 18 | 18 | 8 | 8 | |
| 8" (200 mm) | 9 | - | - | 25 | 22 | 22 | 9 | 9 | |
| 8" (200 mm) | 7.3 | - | - | 29 | 26 | 26 | 11 | 11 | |
| 10" (250 mm) | 17 | - | - | 22 | 19 | 19 | 8 | 8 | |
| 10" (250 mm) | 11 | - | - | 32 | 28 | 28 | 12 | 12 | |
| 10" (250 mm) | 9 | - | - | 38 | 33 | 33 | 14 | 14 | |
| 10" (250 mm) | 7.3 | - | - | 45 | 40 | 40 | 17 | 17 | |
| 12" (315 mm) | 17 | - | - | - | 30 | 30 | 13 | 13 | 11 |
| 12" (315 mm) | 11 | - | - | - | 44 | 44 | 19 | 19 | 15 |
| 12" (315 mm) | 9 | - | - | - | 53 | 53 | 22 | 22 | 18 |
| 12" (315 mm) | 7.3 | - | - | - | - | - | - | - | - |

| Niron Clima & Cool Pro Dnom (Actual OD in mm) | SDR | Widos Machine Pressures (bar) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Maxiplast | W4400 | W4600 | W4900 | W4955 | W5100 | W5500 | W6100 |
| 14" (355 mm) | 17 | - | - | - | - | 38 | 16 | 16 | 13 |
| 14" (355 mm) | 11 | - | - | - | - | 56 | 24 | 24 | 19 |
| 14" (355 mm) | 9 | - | - | - | - | 67 | 28 | 28 | 23 |
| 16" (400 mm) | 17 | - | - | - | - | - | 20 | 20 | 17 |
| 16" (400 mm) | 11 | - | - | - | - | - | 30 | 30 | 24 |
| 18" (450 mm) | 17 | - | - | - | - | - | 26 | 26 | 21 |
| 18" (450 mm) | 11 | - | - | - | - | - | 38 | 38 | 31 |
| 20" (500 mm) | 17 | - | - | - | - | - | - | 32 | 26 |
| 20" (500 mm) | 11 | - | - | - | - | - | - | - | - |
| 22" (560 mm) | 17 | - | - | - | - | - | - | - | 32 |
| 24" (630 mm) | 17 | - | - | - | - | - | - | - | 41 |

## Ritmo Machine Pressure

863-679-8655
info@ritmoamerica.com
www.ritmoamerica.com

This table is based on information available to Nupi Americas at the time of printing of this Installer's Manual. The information is subject to change by the tool manufacturer. As such, the installer should always consult with the tool manufacturer to be sure to use the most current information available for the specific model of machine being used.

*Note: Be sure to add drag pressure to the machine pressure for any hydraulic machine to achieve total required pressure.*

| Niron Clima & Cool Pro Dnom (Actual OD in mm) | SDR | Ritmo Machine Pressures (bar) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Gamma 160 | Basic/Delta 160 (PSI) - .30" sq "V1-V2" | Basic/Delta 200 (PSI) -0.49" sq "V0" | Basic/Delta 250 (PSI) - .91" sq "V0" | Basic/Delta 315 (PSI) - 1.04" sq "V0" | Basic/Delta or COMPACT 355 (PSI) - 2.19" sq "V0" | DELTA 500 (PSI) - 3.47" sq "V1" | DELTA 630 (PSI) - 3.17" sq "V1" |
| 2" (63 mm) | 17 | 71 | 50 | 32 | - | - | - | - | - |
| 2" (63 mm) | 11 | 104 | 78 | 48 | - | - | - | - | - |
| 2" (63 mm) | 9 | 123 | 92 | 57 | - | - | - | - | - |
| 2" (63 mm) | 7.3 | 147 | 110 | 68 | - | - | - | - | - |
| 2.5" (75mm) | 17 | 100 | 74 | 46 | 25 | - | - | - | - |
| 2.5" (75mm) | 11 | 146 | 108 | 67 | 36 | - | - | - | - |
| 2.5" (75mm) | 9 | 176 | 130 | 80 | 43 | - | - | - | - |

| Niron Clima & Cool Pro Dnom (Actual OD in mm) | SDR | Ritmo Machine Pressures (bar) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Gamma 160 | Basic/Delta 160 (PSI) - .30" sq "V1-V2" | Basic/Delta 200 (PSI) -0.49" sq "VO" | Basic/Delta 250 (PSI) - .91" sq "V0" | Basic/Delta 315 (PSI) - 1.04" sq "VO" | Basic/Delta or COMPACT 355 (PSI) - 2.19" sq "VO" | DELTA 500 (PSI) - 3.47" sq "V1" | DELTA 630 (PSI) - 3.17" sq "V1" |
| 2.5" (75mm) | 9 | 176 | 130 | 80 | 43 | - | - | - | - |
| 2.5" (75mm) | 7.3 | 209 | 156 | 96 | 51 | - | - | - | - |
| 3" (90 mm) | 17 | 143 | 107 | 66 | 35 | 31 | - | - | - |
| 3" (90 mm) | 11 | 211 | 157 | 97 | 52 | 46 | - | - | - |
| 3" (90 mm) | 9 | 251 | 187 | 115 | 62 | 55 | - | - | - |
| 3" (90 mm) | 7.3 | 300 | 224 | 138 | 74 | 65 | - | - | - |
| 3.5" (110 mm) | 11 | 314 | 234 | 144 | 77 | 68 | - | - | - |
| 3.5" (110 mm) | 9 | 378 | 280 | 172 | 92 | 81 | - | - | - |
| 3.5" (110 mm) | 7.3 | 450 | 335 | 206 | 111 | 98 | - | - | - |
| 4" (125 mm) | 17 | 273 | 204 | 126 | 67 | 59 | 28 | - | - |
| 4" (125 mm) | 11 | 407 | 303 | 187 | 100 | 88 | 42 | - | - |
| 4" (125 mm) | 9 | 485 | 361 | 223 | 119 | 105 | 50 | - | - |
| 4" (125 mm) | 7.3 | 580 | 432 | 267 | 143 | 126 | 60 | - | - |
| 6" (160 mm) | 11 | 667 | 497 | 306 | 164 | 145 | 68 | - | - |

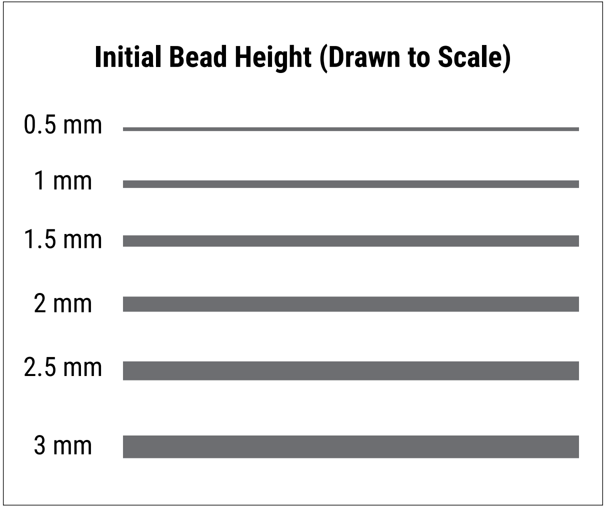
# Ritmo Machine Pressure

| Niron Clima & Cool Pro Dnom (Actual OD in mm) | SDR | Ritmo Machine Pressures (bar) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Gamma 160 | Basic/Delta 160 (PSI) - .30" sq "V1-V2" | Basic/Delta 200 (PSI) -0.49" sq "VO" | Basic/Delta 250 (PSI) - .91" sq "V0" | Basic/Delta 315 (PSI) - 1.04" sq "V0" | Basic/Delta or COMPACT 355 (PSI) - 2.19" sq "V0" | DELTA 500 (PSI) - 3.47" sq "V1" | DELTA 630 (PSI) - 3.17" sq "V1" |
| 6" (160 mm) | 17 | 449 | 334 | 206 | 111 | 124 | 46 | - | - |
| 6" (160 mm) | 11 | 667 | 497 | 306 | 164 | 145 | 68 | - | - |
| 6" (160 mm) | 9 | 795 | 591 | 365 | 195 | 172 | 81 | - | - |
| 6" (160 mm) | 7.3 | 950 | 708 | 437 | 234 | 206 | 98 | - | - |
| 8" (200 mm) | 17 | - | - | 323 | 173 | 153 | 72 | 46 | - |
| 8" (200 mm) | 11 | - | - | 554 | 256 | 226 | 107 | 67 | - |
| 8" (200 mm) | 9 | - | - | 570 | 305 | 269 | 127 | 80 | - |
| 8" (200 mm) | 7.3 | - | - | 682 | 366 | 322 | 152 | 96 | - |
| 10" (250 mm) | 17 | - | - | - | 269 | 237 | 112 | 71 | - |
| 10" (250 mm) | 11 | - | - | - | 399 | 352 | 166 | 105 | - |
| 10" (250 mm) | 9 | - | - | - | 477 | 421 | 199 | 126 | - |
| 10" (250 mm) | 7.3 | - | - | - | 571 | 504 | 238 | 150 | - |

| Niron Clima & Cool Pro Dnom (Actual OD in mm) | SDR | Ritmo Machine Pressures (bar) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Gamma 160 | Basic/Delta 160 (PSI) - .30" sq "V1-V2" | Basic/Delta 200 (PSI) -0.49" sq "VO" | Basic/Delta 250 (PSI) - .91" sq "V0" | Basic/Delta 315 (PSI) - 1.04" sq "V0" | Basic/Delta or COMPACT 355 (PSI) - 2.19" sq "V0" | DELTA 500 (PSI) - 3.47" sq "V1" | DELTA 630 (PSI) - 3.17" sq "V1" |
| 12" (315 mm) | 17 | - | - | - | - | 378 | 179 | 113 | 124 |
| 12" (315 mm) | 11 | - | - | - | - | 558 | 264 | 167 | 183 |
| 12" (315 mm) | 9 | - | - | - | - | 668 | 316 | 199 | 219 |
| 12" (315 mm) | 7.3 | - | - | - | - | 800 | 378 | 239 | 262 |
| 14" (355 mm) | 17 | - | - | - | - | - | 227 | 143 | 157 |
| 14" (355 mm) | 11 | - | - | - | - | - | 335 | 212 | 232 |
| 14" (355 mm) | 9 | - | - | - | - | - | 401 | 253 | 278 |
| 16" (400 mm) | 17 | - | - | - | - | - | 480 | 181 | 199 |
| 16" (400 mm) | 11 | - | - | - | - | - | - | 269 | 294 |
| 18" (450 mm) | 17 | - | - | - | - | - | - | 230 | 252 |
| 18" (450 mm) | 11 | - | - | - | - | - | - | 340 | 373 |
| 20" (500 mm) | 17 | - | - | - | - | - | - | 284 | 312 |
| 20" (500 mm) | 11 | - | - | - | - | - | - | 420 | 460 |
| 24" (630 mm) | 17 | - | - | - | - | - | - | - | 494 |

## Initial Bead Height

The height of the initial bead achieved will make a big difference to the final weld size after the fusion is complete and to the overall integrity of the weld. The development of the initial bead height should be carefully and closely monitored during this critical step. Once the initial bead height is developed at all points on the circumference on both sides of the heater plate, it is important to immediately reduce the pressure to the welding pressure required during the heat soak phase. The pressure required during the heat soak phase is always 10% of the initial and final pressures. This will help to minimize the overall bead size achieved and will help to achieve a successful weld. On the right side of this page, all of the initial bead sizes reported in the “Butt Fusion Heating and Cooling Times Table” are drawn to full scale.



## Butt Fusion Heating and Cooling Times

| OD | OD | SDR | Bead Height | Heat Soak | Transition Time | Time of Pressure Build-Up | Cooling Time. <59°F | Cooling Time (59°F - 77°F) | Cooling Time (77°F - 104°F) | Standard Cooling Time |
|---|---|---|---|---|---|---|---|---|---|---|
| (Inch) | (mm) | | (mm) | (mins) | (seconds) | Seconds | (mins) | (mins) | (mins) | (mins) |
| 2 | 63 | 17 | 0.5 | 00:43 | 5 | 6 | 03:31 | 04:20 | 05:31 | 02:54 |
| | | 11 | 0.5 | 01:07 | 6 | 7 | 04:57 | 06:09 | 07:56 | 04:07 |
| | | 9 | 0.5 | 01:21 | 6 | 7 | 05:50 | 07:17 | 09:27 | 04:53 |
| | | 7.3 | 1 | 01:39 | 6 | 8 | 06:59 | 08:45 | 11:24 | 05:52 |
| 2.5 | 75 | 17 | 0.5 | 00:52 | 5 | 6 | 04:01 | 04:58 | 06:21 | 03:19 |
| | | 11 | 0.5 | 01:19 | 6 | 7 | 05:42 | 07:07 | 09:14 | 04:47 |
| | | 9 | 1 | 01:36 | 6 | 8 | 06:46 | 08:29 | 11:03 | 05:41 |
| | | 7.3 | 1 | 01:57 | 7 | 9 | 08:08 | 10:14 | 13:22 | 06:52 |
| 3 | 90 | 17 | 0.5 | 01:02 | 5 | 6 | 04:38 | 05:45 | 07:25 | 03:51 |
| | | 11 | 1 | 01:34 | 6 | 8 | 06:40 | 08:21 | 10:52 | 05:36 |
| | | 9 | 1 | 01:54 | 7 | 9 | 07:56 | 09:59 | 13:03 | 06:42 |
| | | 7.3 | 1 | 02:19 | 7 | 11 | 09:34 | 12:04 | 15:50 | 08:06 |

# Butt Fusion Heating and Cooling Times

| OD | OD | SDR | Bead Height | Heat Soak | Transition Time | Time of Pressure Build-Up | Cooling Time. <59°F | Cooling Time (59°F - 77°F) | Cooling Time (77°F - 104°F) | Standard Cooling Time |
|---|---|---|---|---|---|---|---|---|---|---|
| (Inch) | (mm) | | (mm) | (mins) | (seconds) | Seconds | (mins) | (mins) | (mins) | (mins) |
| 3.5 | 110 | 17 | 0.5 | 01:15 | 6 | 7 | 05:28 | 06:49 | 08:49 | 04:34 |
| | | 11 | 1 | 01:54 | 7 | 9 | 07:56 | 09:59 | 13:03 | 06:42 |
| | | 9 | 1 | 02:17 | 7 | 11 | 09:30 | 11:59 | 15:42 | 08:02 |
| | | 7.3 | 1 | 02:47 | 8 | 13 | 11:29 | 14:32 | 19:07 | 09:46 |
| 4 | 125 | 17 | 1 | 01:25 | 6 | 8 | 06:05 | 07:36 | 09:52 | 05:06 |
| | | 11 | 1 | 02:08 | 7 | 10 | 08:54 | 11:12 | 14:40 | 07:31 |
| | | 9 | 1 | 02:35 | 8 | 12 | 10:40 | 13:28 | 17:42 | 09:03 |
| | | 7.3 | 1 | 03:08 | 9 | 15 | 12:56 | 16:23 | 21:34 | 11:00 |
| 6 | 160 | 17 | 1 | 01:47 | 7 | 9 | 07:31 | 09:27 | 12:20 | 06:21 |
| | | 11 | 1 | 02:42 | 8 | 12 | 11:07 | 14:04 | 18:29 | 09:27 |
| | | 9 | 1 | 03:14 | 9 | 15 | 13:23 | 16:58 | 22:21 | 11:24 |
| | | 7.3 | 1.5 | 03:54 | 10 | 19 | 16:18 | 20:41 | 27:18 | 13:54 |

# Butt Fusion Heating and Cooling Times

| OD | OD | SDR | Bead Height | Heat Soak | Transition Time | Time of Pressure Build-Up | Cooling Time. <59°F | Cooling Time (59°F - 77°F) | Cooling Time (77°F - 104°F) | Standard Cooling Time |
|---|---|---|---|---|---|---|---|---|---|---|
| (Inch) | (mm) | | (mm) | (mins) | (seconds) | Seconds | (mins) | (mins) | (mins) | (mins) |
| 8 | 200 | 17 | 1 | 02:13 | 7 | 10 | 09:10 | 11:34 | 15:09 | 07:46 |
| | | 11 | 1 | 03:18 | 9 | 15 | 13:40 | 17:20 | 22:50 | 11:38 |
| | | 9 | 1.5 | 03:57 | 10 | 19 | 16:30 | 20:57 | 27:40 | 14:05 |
| | | 7.3 | 2 | 04:43 | 11 | 24 | 20:08 | 25:36 | 33:52 | 17:13 |
| 10 | 250 | 17 | 1 | 02:43 | 8 | 13 | 11:14 | 14:12 | 18:41 | 09:32 |
| | | 11 | 1.5 | 04:01 | 10 | 19 | 16:52 | 21:25 | 28:17 | 14:23 |
| | | 9 | 2 | 04:47 | 11 | 24 | 20:24 | 25:57 | 34:19 | 17:26 |
| | | 7.3 | 2 | 05:40 | 13 | 30 | 24:56 | 31:45 | 42:04 | 21:21 |
| 12 | 315 | 17 | 1 | 03:21 | 9 | 16 | 13:55 | 17:38 | 23:15 | 11:51 |
| | | 11 | 2 | 04:54 | 11 | 25 | 21:00 | 26:43 | 35:21 | 17:57 |
| | | 9 | 2 | 05:46 | 13 | 31 | 25:28 | 32:26 | 42:58 | 21:48 |
| | | 7.3 | 2.5 | 06:46 | 15 | 37 | 31:11 | 39:45 | 52:43 | 26:44 |

## Butt Fusion Heating and Cooling Times

| OD (Inch) | OD (mm) | SDR | Bead Height (mm) | Heat Soak (mins) | Transition Time (seconds) | Time of Pressure Build-Up Seconds | Cooling Time. <59°F (mins) | Cooling Time (59°F - 77°F) (mins) | Cooling Time (77°F - 104°F) (mins) | Standard Cooling Time (mins) |
|---|---|---|---|---|---|---|---|---|---|---|
| 14 | 355 | 17 | 1.5 | 03:44 | 9 | 18 | 15:34 | 19:45 | 26:04 | 13:16 |
| | | 11 | 2 | 05:24 | 12 | 28 | 23:33 | 29:59 | 39:42 | 20:09 |
| | | 9 | 2.5 | 06:20 | 14 | 34 | 28:35 | 36:25 | 48:17 | 24:29 |
| 16 | 400 | 17 | 1.5 | 04:09 | 10 | 20 | 17:25 | 22:08 | 29:14 | 14:52 |
| | | 11 | 2 | 05:57 | 13 | 32 | 26:25 | 33:39 | 44:36 | 22:38 |
| 18 | 450 | 17 | 2 | 04:35 | 11 | 23 | 19:29 | 24:46 | 32:45 | 16:39 |
| | | 11 | 2.5 | 06:30 | 15 | 35 | 29:36 | 37:44 | 50:02 | 25:22 |
| 20 | 500 | 17 | 2 | 05:01 | 12 | 26 | 21:33 | 27:25 | 36:17 | 18:26 |
| | | 11 | 2.5 | 07:01 | 16 | 39 | 32:48 | 41:49 | 55:29 | 28:07 |
| 22 | 560 | 17 | 2 | 05:30 | 13 | 29 | 24:01 | 30:35 | 40:30 | 20:34 |
| 24 | 630 | 17 | 3 | 08:10 | 14 | 32 | 26:54 | 34:17 | 45:26 | 23:03 |

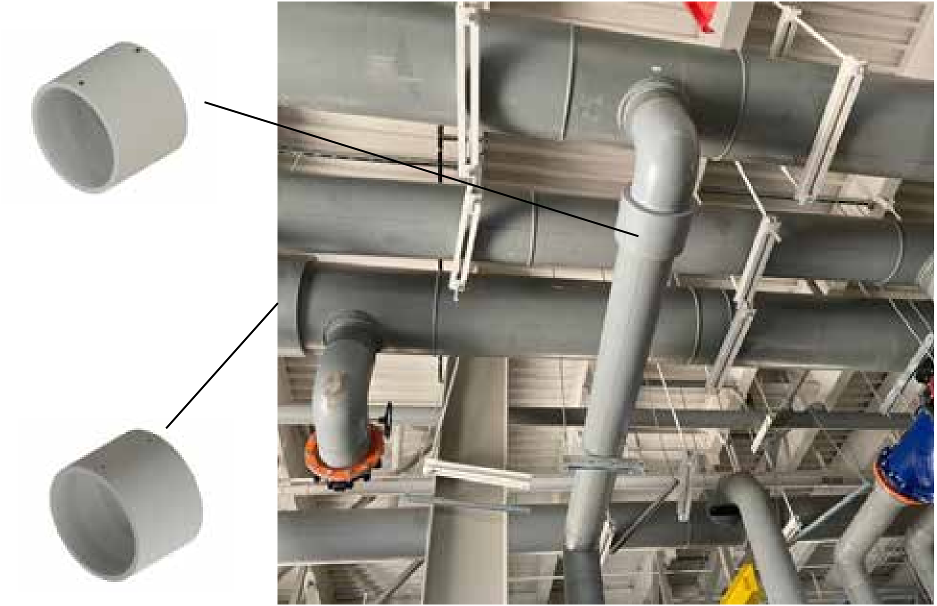
## Electrofusion

Electrofusion is a fusion process which uses heat and inter-facial pressure to result in a full pressure weld.  Heat is introduced by a different means than that of socket or butt fusion.  Rather than introducing heat through direct conductive transfer against a heating mandrel or plate, heat is introduced by means of an embedded resistance wire which is molded or embedded beneath the surface of a coupling or fitting.  It is a highly engineered method of welding which has been refined by Nupi over many years of research and experience to result in a repeatable and reliable process.

The procedure of making an electrofusion weld requires the preparation, cleaning and marking of the pipe surfaces as well as the cleaning of couplings/fittings.  It also requires the use of an electrofusion processor to scan and deliver the required voltage for the specified welding duration. It is highly recommended to use the electrofusion processors that are offered by Nupi as they are designed to deliver the proper energy required, and to also make adjustments in time based on the ambient temperature where the parts are being welded.

Pipe surfaces must be srcaped to remove oxidation and impurities. Nupi offers a variety of tools that are engineered for this purpose. Fittings and pipe must be kept in alignment for welding. If pipes and fittings are not fully supported, or they are misaligned, use an alignment tool to maintain alignment.

# Electrofusion



Electofusion couplings can be used as part of a hybrid system to make difficult welds in the air.

Electrofusion couplings can be installed at a fraction of the cost of flanges.

# Electrofusion Procedure

## The key steps to be followed for Electrofusion are as follows:


It is critical for the electrofusion procedure to insure that pipes are cut with a square cut. After cutting, debur the edges of the pipe.


Open the bag containing the coupling or fitting to be fused. Do not open the bag prior to this step.


Measure then the depth of insertion for the specific fitting.

# Electrofusion Procedure

## The key steps to be followed for Electrofusion are as follows:


Mark the pipe end(s) for the depth of peeling. This should be the depth of the coupling/fitting measured plus ½".


Using a peeling tool that is designed for the size, peel the surface of the pipe(s) to a minimum depth of 0.2mm (about the thickness of a sheet of paper).


Clean the surface of the pipe with isopropyl alcohol (91% or greater concentration) and a clean, lint-free cloth.

When using a hand peeler be sure to produce actual ribbons of material 0.2 mm thick and avoid merely scratching the surface.

# Electrofusion Procedure

After cleaning, mark the depth of insertion that has been measured.

Clean the inside surface of the fitting with iso-propyl alcohol (91% or greater concentration) and a clean, lint-free cloth

Avoid touching the inside of the fitting and the exterior of the pipe to avoid contaminating the surface with oils or impurities.

# Electrofusion Procedure

## The key steps to be followed for Electrofusion are as follows:


Insert the pipes into the coupling/fitting up to the depth of insertion mark. Ideally, the pipes should be able to be inserted with a light press fit. However, pipes and fittings/couplings are allowed to have some clearance within a tolerance determined by Nupi.


If necessary to overcome an interference fit, and to achieve a light press fit, the pipe can be peeled with additional peels.

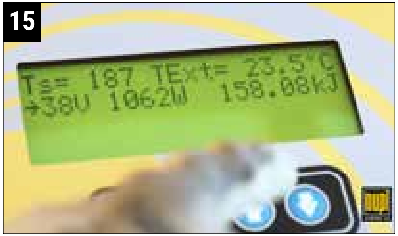

Check the alignment of the pipes and couplings. If the pipes are not well supported, or out of alignment, use an alignment jig.

# Electrofusion Procedure




Attach the leads of the electrofusion processor to the pins. The pins should fit with light resistance.


Scan the welding bar code on the coupling/fitting. Note that the top bar code is the welding code and the bottom code is an optional traceability code.




Verify the welding parameters (voltage & time) are the same as reported on the machine as they are written above the bar code.

# Electrofusion Procedure

## The key steps to be followed for Electrolet Welding are as follows:


Once you confirm all parameters start the welding procedure.


Upon completion of the welding cycle, be sure to mark the last three digits of the serial code of the machine and the weld number onto the coupling/fitting using a sharpie.


After completion of the weld, and after the serial number/weld number has been marked, the leads can be disconnected. The part must be allowed to cool prior to being stressed.

# Electrolet Welding Procedure


Select the position on the pipe where the electrolet branch will be installed. Mark the position by tracing around the electrolet base with a sharpie.

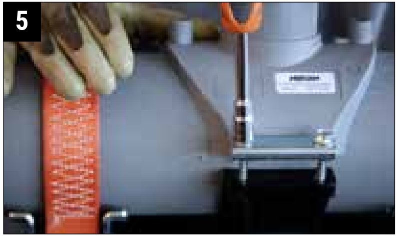

When using a manual scraper to perform scraping, mark cross lines with a sharpie inside the electrolet outline. Be sure to completely remove the cross lines and to produce ribbons of material at least 0.2 mm thick.


Scrape the entire surface area outlined plus an additional ½" in all directions.

# Electrolet Welding Procedure

## The key steps to be followed for Electrolet Welding are as follows:


Clean the scraped surface of the pipe and the concave surface of the Electrolet using isopropyl alcohol (min concentration = 91%) and a clean, lint-free cloth.




Assemble the Electrolet into the desired position for welding.


When using the style of Electrolet with a rigid black underclamp, tighten the screws until the threaded fastener extends through the underclamp by a minimum of 1/8 inch.

# Electrolet Welding Procedure


When using the style of Electrolet which uses a belt, tighten the belt until the Electrolet is tight and secure against the surface of the pipe with no air gaps.


Connect the electrofusion machine leads to the pins on the Electrolet.


Scan the bar code on the Electrolet and check the parameters on the machine.

# Electrolet Welding Procedure

## The key steps to be followed for Electrolet Welding are as follows:


Start the welding process. When the welding is finished the leads can be disconnected.


Mark the pipe adjacent to the Electrolet with the last three digits of the serial code of the machine and the weld number.


At the end of the cooling cycle, drill the hole using the appropriate size drill or hole saw that is as tight to the I.d. of the riser.

# Electrolet Welding Procedure




Remove any debris left over from cutting, using a shop vac if necessary.


Attach the plug removed from the hole to the saddle using a plastic tie for inspection at system start-up.


The branch spigot is now ready to be connected to the next component.

# Electrolet Welding Procedure

## The key steps to be followed for Electrolet Welding are as follows:

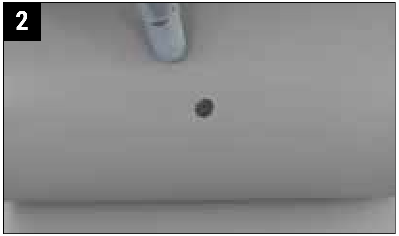

The rigid underclamp or belt can be removed, or it can be left in place.


An example of an Electrolet branch with belt.


An example of multiple Electrolet branch fittings installed onto Niron PP-RCT pipes.

## Repair Welding (for repair of nail or screw holes)


Use the Niron 2-sided Repair Plug. Be sure the pipe has been drained prior to starting.




Enlarge the hole to either ¼" or ⅜" using a suitable drill bit.


Insert the male heater bushings into the hole and the repair plug into the female bushing.


After 5 seconds of heating, remove the heater plate and insert the repair plug into the hole.


Allow for 1 minute of cooling time. Then the plug can be trimmed using a ratchet cutter.


The finished appearance of the repair after the procedure has been completed.

Section 3

# Miscellaneous Installation and Connection Details

# Miscellaneous Installation and Connection Details

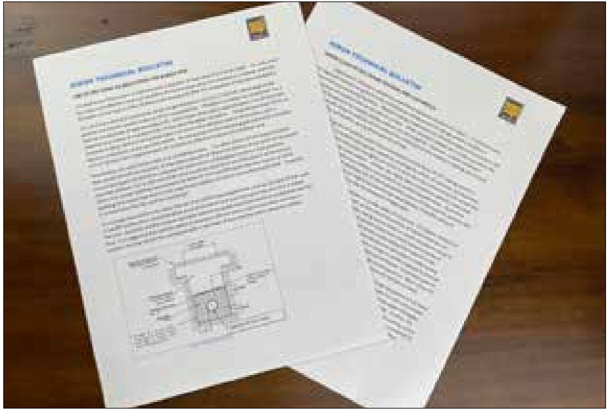
The previous section of this manual focused on the major joining methods for Niron PP-RCT piping. To install a complete system, there are many other connection details, support requirements, expansion compensation methods, insulation requirements, burial details, pressure testing, etc. that are all part of completing an installation. This section covers all of those requirements.

Nupi offers a full array of design and technical assistance to assist in the completion of a system. Further, Nupi offers complete prefabrication capabilities, as does some of its distribution partners. To understand these capabilities or to answer specific questions, please consult the Technical Department of Nupi Americas at its Early Branch, SC facility, or visit us online at www.NupiAmericas.com.

## Niron Technical Notes

Due to the large variety of installations, many aspects of design and installation cannot be covered in a single manual. Further, the best practices often are refined over time and the design and installation methods for PP-RCT are subject to change. For this reason, many aspects of design and installation are covered in specific Technical Notes. The Niron Technical Notes provide further details in some cases than the information that is covered in the Design and Installation Manual, as well as in this Installers Manual.

Nupi maintains a library of Niron Technical Notes which can be accessed on our website (www.nupiamericas.com ), or by consulting the Nupi Technical Department at our Early Branch, SC headquarters. We encourage you to explore what is available in these various Technical Notes, which may cover specific questions you are interested in. You can sign up to receive automatic updates and the publication of new Technical Notes by means of entering your e-mail on the website page for technical notes.

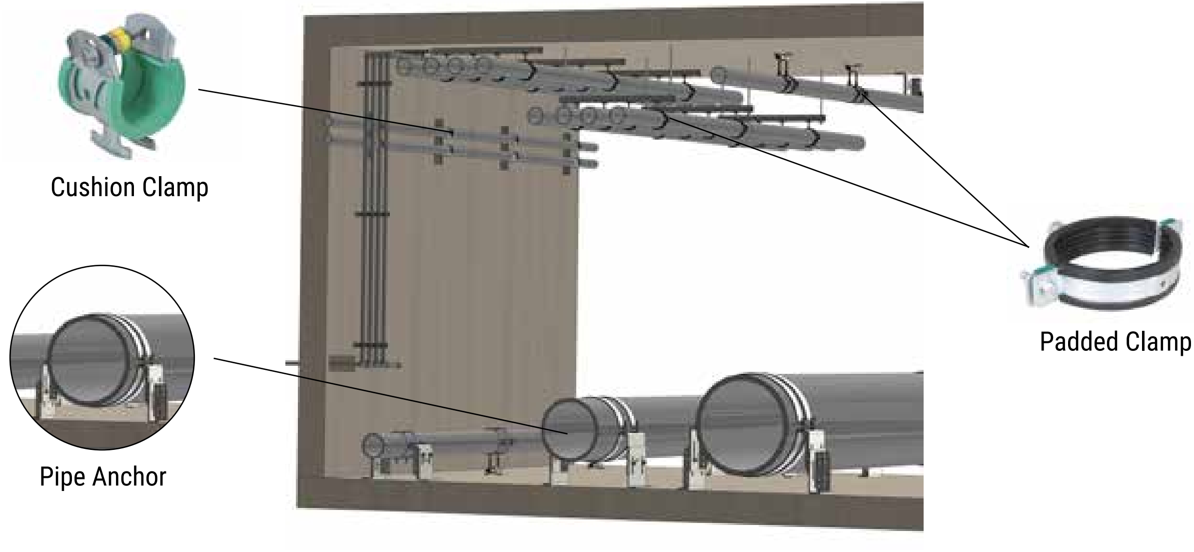


## Pipe Supports

When installing Niron PP-RCT piping aboveground, you should be aware that although Niron is referred to in nominal inch sizes, the actual O.D.s are different than standard IPS piping. In sizes of 3” and below, Niron Clima PP-RCT piping has a bigger O.D. than IPS piping. For this reason, standard IPS clamps should never be used on Niron PP-RCT piping. This can be especially problematic in hot water lines as PP-RCT piping will swell diametrically. This will result in exceptionally high stresses if an IPS clamp is tightened around a 3” or less diameter Niron PP-RCT pipe. High stresses are never a good thing in any pipe, and it is something that can and should be avoided with Niron PP-RCT Piping.

The best type of supports to be used together with Niron PP-RCT are padded clamps which are sized for Niron PP-RCT pipe. Niron O.D.s match that of metric sized piping, and there are padded supports which are sized for metric pipes. A typical padded support is similar to those shown in the following pages, which are made by Walraven. Such supports can be installed to function as hangers that are not tightly clamped to the pipe and thereby function as a guide. They also can be tightened down to serve as a pipe clamp (anchor). One major advantage of the padded supports is that the elastomeric padding substantially reduces vibration, which in turn helps to make Niron PP-RCT exceptionally quiet. Niron PP-RCT is a low noise material to begin with, and the padded supports reduce the noise level to a an even lower level, than any other material available on the market today.

## Pipe Anchors, Guides and Supports




*All supports, anchors, guides shown here are Walraven.*

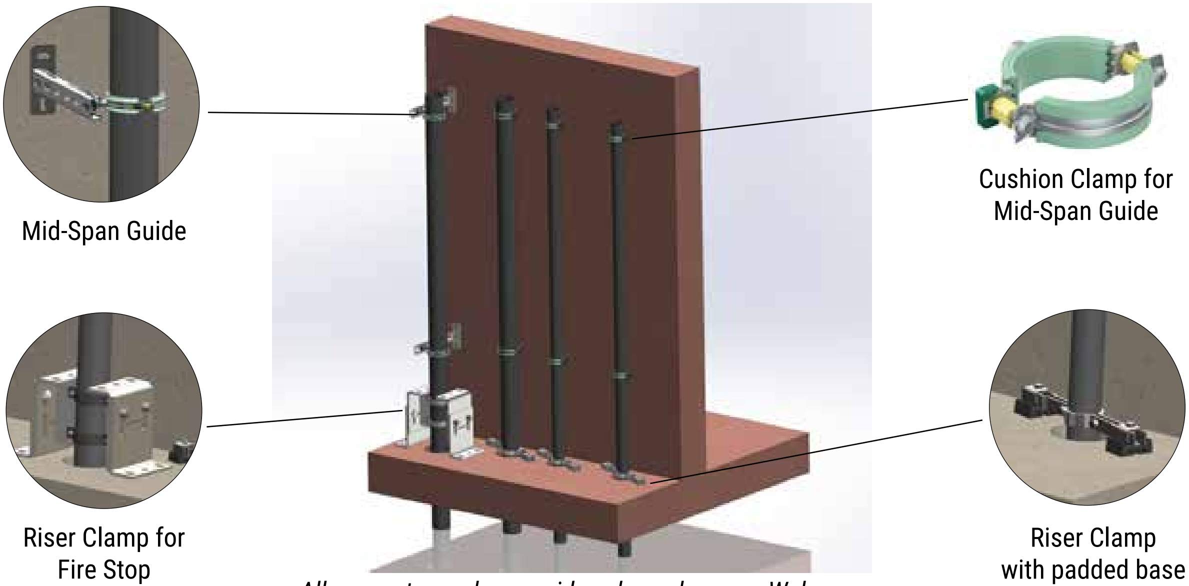
## Pipe Anchors, Guides and Supports

Anchors are supporting devices which restrain the pipe to prevent any form of movement of the piping system at the point of anchor attachment. Anchors are used whenever it is desired to keep the pipe from moving. However, they also serve to break up the total amount of axial pipe which is free to move in order to utilize expansion/contraction alleviation devices (e.g. loops, offsets, changes of direction, expansion joints). Anchors will force the pipe to grow/shrink away from the anchor point and towards the means of expansion/contraction alleviation.

Pipe guides are any type of pipe support or hanger which provides vertical support of the pipe, while allowing the pipe to move axially and providing some restraint against bending. Guides are to be used whenever expansion alleviation devices are utilized, especially in close proximity to the expansion alleviation device. This way the piping system can be directed from an anchor point to grow into (or shrink from) the expansion loop or joint, etc., while preventing against outward bending and twisting of the pipe.

Simple supports are those devices such as trapeze supports, roller supports, etc. which provide vertical support, while also allowing the piping system to freely move in the axial direction. Note that a trapeze support that is fixed with a u-bolt loosely surrounding the pipe to prevent outward movement of the pipe will cause the trapeze support to function as a pipe guide.

## Riser Pipe Anchors and Guides




*All supports, anchors, guides shown here are Walraven.*

## Recommended Support Spacing for SDR 7.3

| Recommended Support Spacing in feet for Niron FG Red/Niron Clima SDR 7.3 Piping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Design Temp | ½" 20mm | ¾" 25mm | 1" 32mm | 1¼" 40mm | 1½" 50mm | 2" 63mm | 2½" 75mm | 3" 90mm | 3½" 110mm | 4" 125mm | 6" 160mm | 8" 200mm | 10" 250mm | 12" 315 mm |
| 70°F | 4 | 4.5 | 5 | 6 | 6.5 | 7.5 | 8 | 8 | 9 | 10 | 10 | 10 | 10 | 12 |
| 80°F | 4 | 4 | 4.5 | 5.5 | 6 | 7 | 7 | 7.5 | 8 | 9 | 9.5 | 9.5 | 9.5 | 11 |
| 100°F | 4 | 4 | 4 | 4.5 | 5 | 6 | 6 | 6.5 | 7 | 8 | 9 | 9 | 9 | 10 |
| 120°F | 4 | 4 | 4 | 4 | 5 | 5.5 | 6 | 6 | 7 | 7.5 | 8 | 8 | 8 | 9 |
| 140°F | 4 | 4 | 4 | 4 | 4.5 | 5.5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 7.5 | 8 | 8.5 |
| 160°F | 4 | 4 | 4 | 4 | 4.5 | 5 | 5.5 | 6 | 6 | 6 | 6.5 | 6.5 | 7 | 7.5 |
| 180°F | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 5.5 | 5.5 | 6 | 6 | 6.5 | 6.5 | 7 |
| 200°F | 4 | 4 | 4 | 4 | 4 | 4.5 | 5 | 5 | 5 | 5.5 | 6 | 6 | 6 | 6.5 |

## Recommended Support Spacing for SDR 9

| Recommended Support Spacing in feet for Niron FG Red/Niron Clima SDR 9 Piping | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Design Temp | ¾" 25mm | 1" 32mm | 1¼" 40mm | 1½" 50mm | 2" 63mm | 2½" 75mm | 3" 90mm | 3½" 110mm | 4" 125mm | 6" 160mm | 8" 250mm | 10" 200mm | 12" 315mm | 14" 355 mm |
| 70°F | 4.5 | 5 | 6 | 6.5 | 7.5 | 8 | 8 | 9 | 10 | 10 | 10 | 10 | 11 | 11 |
| 80°F | 4 | 4 | 5.5 | 5 | 7 | 7 | 7.5 | 8 | 9 | 9.5 | 9.5 | 10 | 11 | 11 |
| 100°F | 4 | 4 | 4.5 | 5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 7.5 | 8 | 8 | 8.5 | 8.5 |
| 120°F | 4 | 4 | 4 | 5 | 5.5 | 6 | 6 | 7 | 7 | 7 | 7.5 | 7.5 | 8 | 8 |
| 140°F | 4 | 4 | 4 | 4.5 | 5.5 | 5.5 | 6 | 6.5 | 6.5 | 6.5 | 7 | 7.5 | 7.5 | 7.5 |
| 160°F | 4 | 4 | 4 | 4.5 | 5 | 5.5 | 6 | 6 | 6 | 6.5 | 6.5 | 7 | 7 | 7 |
| 180°F | 4 | 4 | 4 | 4 | 5 | 5 | 5.5 | 5.5 | 5.5 | 6 | 6.5 | 6.5 | 7 | 7 |
| 200°F | 4 | 4 | 4 | 4 | 4.5 | 5 | 5 | 5 | 5.5 | 5.5 | 6 | 6 | 6.5 | 6.5 |

# Recommended Support Spacing for SDR 11

| Recommended Support Spacing in feet for Niron FG Red/Niron Clima SDR 11 Piping | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Design Temp | 1¼" 40mm | 1½" 50mm | 2" 63mm | 2½" 75mm | 3" 90mm | 3½" 110mm | 4" 125mm | 6" 160mm | 8" 250mm | 10" 200mm | 12" 315mm | 14" 355 mm | 16" 400mm | 18" 450 mm | 20" 500 mm |
| 70°F | 6 | 6.5 | 7.5 | 8 | 8 | 9 | 10 | 10 | 10 | 10 | 12 | 13.5 | 15 | 16 | 16 |
| 80°F | 5.5 | 6 | 7 | 7 | 7.5 | 8 | 9 | 9.5 | 9.5 | 9.5 | 11 | 13.5 | 15 | 16 | 16 |
| 100°F | 4.5 | 5 | 6 | 6 | 6.5 | 7 | 8 | 9 | 9 | 9 | 10 | 11 | 14 | 15 | 15 |
| 120°F | 4 | 5 | 5.5 | 6 | 6 | 7 | 7.5 | 8 | 8 | 8 | 9 | 10 | 12 | 13 | 13 |
| 140°F | 4 | 4.5 | 5.5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 7.5 | 8 | 8.5 | 9.5 | 11 | 12 | 12 |
| 160°F | 4 | 4.5 | 5 | 5.5 | 6 | 6 | 6 | 6.5 | 6.5 | 7 | 7.5 | 8.5 | 10 | 11 | 11 |
| 180°F | 4 | 4 | 5 | 5 | 5.5 | 5.5 | 6 | 6 | 6.5 | 6.5 | 7 | 7.5 | 9 | 10 | 10 |
| 200°F | 4 | 4 | 4.5 | 5 | 5 | 5 | 5.5 | 6 | 6 | 6 | 6.5 | 7 | 8 | 9 | 9 |

## Recommended Support Spacing for SDR 17

| Recommended Support Spacing in feet for Niron FG Red/Niron Clima SDR 17 Piping | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Design Temp | 2" 63mm | 2½" 75mm | 3" 90mm | 3½" 110mm | 4" 125mm | 6" 160mm | 8" 250mm | 10" 200mm | 12" 315mm | 14" 355 mm | 16" 400mm | 18" 450 mm | 20" 500 mm | 22" 560 mm | 24" 630 mm |
| 70°F | 6 | 6.5 | 6.5 | 7 | 8 | 8 | 8.5 | 9 | 9 | 9 | 9.5 | 10 | 10 | 10.5 | 10.5 |
| 80°F | 5.5 | 5.5 | 6 | 6.5 | 7 | 7 | 7.5 | 8 | 8 | 8.5 | 8.5 | 9 | 9.5 | 10 | 10 |
| 100°F | 5 | 5 | 5 | 5.5 | 6 | 6 | 6.5 | 6.5 | 7 | 7 | 7.5 | 8 | 8.5 | 9 | 9 |
| 120°F | 4.5 | 5 | 5 | 5.5 | 5.5 | 6 | 6 | 6.5 | 6.5 | 6.5 | 7 | 7.5 | 8 | 8.5 | 9 |
| 140°F | 4.5 | 4.5 | 4.5 | 5 | 5.5 | 5.5 | 6 | 6 | 6 | 6 | 6.5 | 7 | 7.5 | 8 | 8.5 |
| 160°F | 4 | 4.5 | 4.5 | 4.5 | 5 | 5 | 6 | 6 | 6 | 6 | 6.5 | 7 | 7.5 | 8 | 8 |
| 180°F | 4 | 4 | 4 | 4.5 | 4.5 | 5 | 5.5 | 5.5 | 5.5 | 5.5 | 6 | 6.5 | 7 | 7.5 | 7.5 |
| 200°F | 3.5 | 4 | 4 | 4 | 4.5 | 4.5 | 5 | 5 | 5.5 | 5.5 | 5.5 | 6 | 6.5 | 7 | 7.5 |

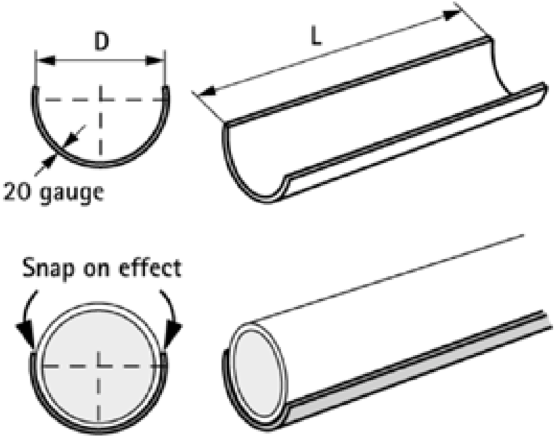
## Use of Support Channels

In some retrofit applications, it is necessary to use existing hanger spacing that was installed for metallic piping such as copper and steel. In order to increase support spacing in these instances, the installer may use metallic support channels. The distance of the support channel can be added to the hanger spacing in order to arrive at a longer spacing distance. For example, if the spacing to be met is 8 feet on centers, a support channel 2 ft long can be used if the support spacing required for the Niron Clima PP-RCT pipe is 6 feet on centers at the given temperature.

Support channels have to be thick enough to be able to support the weight of the pipe filled with water at the design temperature. Support channels should fit the pipe without adding a compressive force around the pipe. Further, they should be smooth and should not contain any sharp edges or burrs. If the support channel is positioned in a pipe guide, it should be fixed to the pipe on either side of the guide so that the channel can move axially with the pipe. If it is positioned at an anchor point, the anchor should prevent both the support channel and the pipe from moving.

*These commercially available support channels are made of a thin gauge metal and come in standard 20 ft. lengths. They can be cut to desired length as needed. Custom channels can be made thicker, as required by the application. (Support channel shown is by Walraven.)*

# Use of Support Channels




*The support channels should be positioned inside of the cushion clamps or hangers. (Support channels shown, including illustrations, are by Walraven.)*

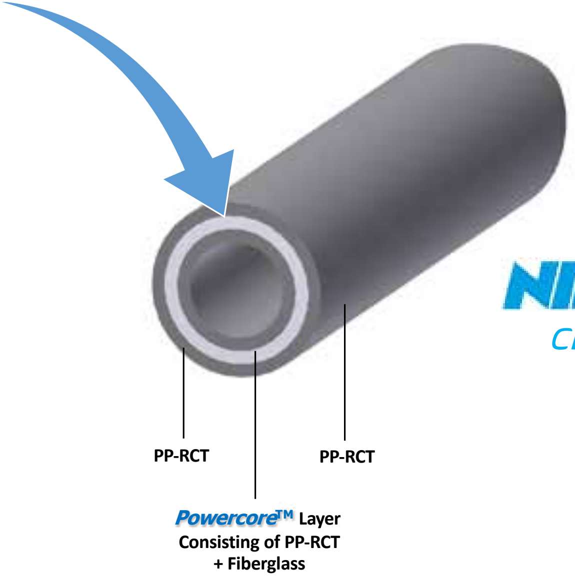
## Thermal Expansion and Contraction

Thermal expansion and contraction of materials occur whenever a material changes temperature. The amount of thermal expansion or contraction depends on the amount of temperature change and the thermal expansion coefficient of the material. Although Niron Clima pipes have a low magnitude of expansion/contraction compared to other plastics, it remains important to account for expansion and contraction in longer runs of pipe. In most cases, if the pipe is treated in the same manner as one would plan for metallic pipes in the same application, the expansion and contraction of Niron Clima PP-RCT will be properly compensated.

Typically, any straight runs that are greater than 35 feet in length and which do not have changes of direction at the ends of the pipes should be reviewed as to whether any additional expansion compensation devices should be added to the run of pipe, depending on the magnitude of temperature. Expansion and contraction alleviation is typically not required in short runs if the temperature change is 40°F or less. This would mean that any hydronic heating systems, potable hot water systems or chilled water systems should have their layouts reviewed to determine if added expansion alleviation is required beyond what is already inherent in the layout if the run of straight pipe is 35 feet or more between fixed points.

The Powercore™ middle layer in Niron Clima pipe contains added fiberglass which restrains thermal expansion and contraction of the PP-RCT material by up to 75%. It also increases the moment of inertia of the material, which helps to stiffen the pipe, while also adding strength to the pipe wall.

**Powered by Powercore™**



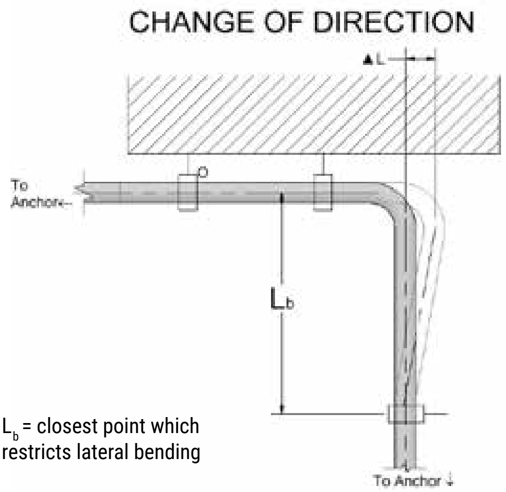

NIRON CLIMA

## Expansion Alleviation Methods

To control linear expansion and contraction, the expansion/contraction should be isolated into manageable amounts, and dealt with in a safe manner. The layout should always use whatever natural expansion alleviation exists in the design, so as to avoid additional means which can add head loss and added cost to the installation. However, if added compensation is needed, then additional means must be provided to keep the pipe and/or fittings from failing at a later point in time. If the installation involves long straight runs, expansion compensation should be included every 120 feet of isolated section on the straight run (between consecutive anchor points). Note that many installations contain natural changes of direction that can accommodate a significant amount of thermal expansion and contraction. The typical means of expansion compensation are: Change of Direction, Offset, Loop, Joint, Sliding End and Linear Restraint. Details of each method are presented in the following pages.

## Change of Direction

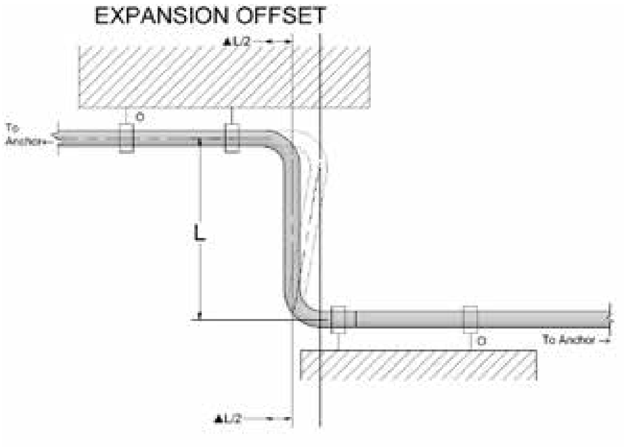
Elbows are inherently more capable of bending than pipe. The growth/shrinkage of straight pipe can be alleviated by the bending of the elbow.




$L_b$ = closest point which restricts lateral bending

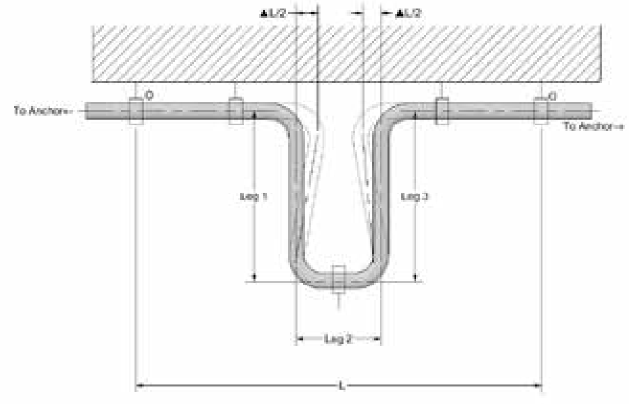
## Expansion Offset

Offsets can be incorporated into a design to take advantage of consecutive changes of direction. Offsets can accommodate double the amount of growth/shrinkage that a single change of direction can accommodate.



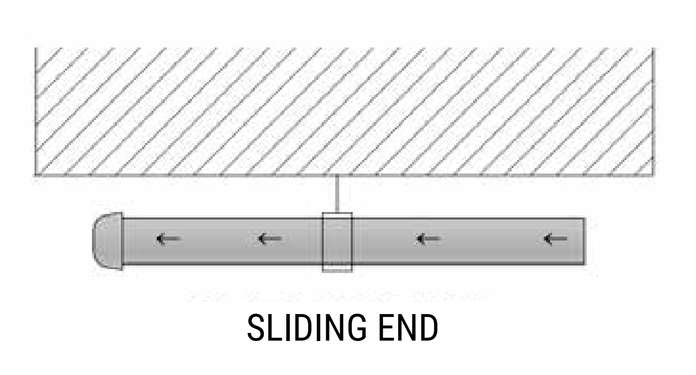

## Expansion Loop

Expansion loops consist of four consecutive elbows to form a U shaped configuration. Essentially it is two expansion offsets that are installed back to back. The reason a loop is used, as opposed to an offset is whenever the pipes are required to be kept in the same centerline, a loop must be used. Expansion loops utilize the natural bending that occurs and like an offset, it offers double the amount of expansion/contraction compensation that a single change of direction can provide.



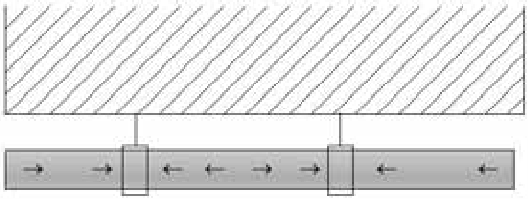

## Sliding End

In situations where the pipe ends in a cap and is free to move in space, the “sliding end” which is created can accommodate thermal expansion from the fixed point to the cap. The sliding end must have enough space before the location of the nearest wall or obstruction to allow it to move freely.



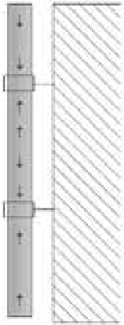

## Linear Restraint

Niron PP-RCT can be restrained from thermal expansion if the amount of bending is limited to prevent the pipe from failure due to buckling. This is a common method for vertical pipes (risers) in buildings. The pipe can be restrained at each floor, or every other floor by means riser clamps and the pipes can then also be fixed with a mid-floor guide to prevent excessive buckling (Niron Clima PP-RCT pipes must be guided at a minimum of no more than 1.5 times the required horizontal support spacing required for the diameter and SDR involved at the design temperature).



RESTRAINED PIPE

RESTRAINED RISER



## Flanges

Niron Flanges can be used to join Niron to pumps, valves, equipment, dissimilar materials or simply to be used as a break point in the piping system for field erection. Niron PP-RCT flanges consist of two separate parts, a flange adapter which is the interior of the part made entirely from PP-RCT material, and a loose backing ring that is designed to contain the holes for the fasteners and which applies sealing force to the back face of the flange adapter. The backing ring is loose so that it may be able to be rotated so as to align the holes as required. Niron backing rings have a hole pattern which matches that of ANSI/ASME B16.5 150# hole patterns.

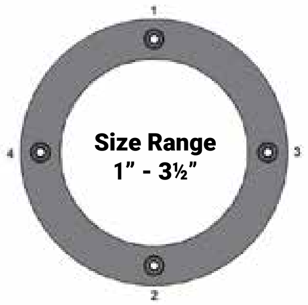
Nupi recommends the use of a full face 1/8th inch thick EPDM gasket together with its flanges. It is further recommended to use a “Low-Stress” gasket, such as the one that Nupi sells as part of its Niron product line. The low stress gasket reduces the required torque to seal the gasket. With thermoplastic flanges, it is beneficial to use the lowest required torque possible to seal the flange, as this will result in the lowest stress being imposed on the flanges. Lower stress on the flanges will result in less of a chance of the flange loosening up over time due to creep in response to the stress.

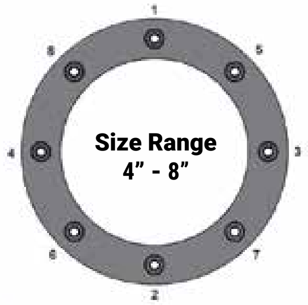
The tightening of the bolts should follow a criss-cross pattern, the exact pattern of varies according to the number of holes (see the diagrams on page 3.23). Using a torque wrench, the bolts should be torqued initially to ¼ of the final torque rating. Then, following the same criss cross pattern, the bolts should be torqued another ¼ of the torque to 50%, then a third time to 75%, and then again a final time to achieve the full torque. The bolts should be re-torqued within 24-48 hours after initial torque, and then again after the piping system undergoes significant temperature changes.

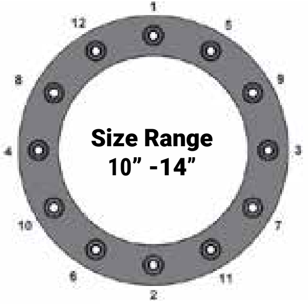
Refer to our detailed Technical Note regarding flanges for further details such as torque ratings for a variety of gaskets, bolt lengths (which vary based on style of backing rings used) and other details. Nupi also has an installation video which discusses the installation of flanges.

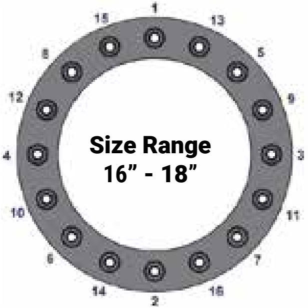


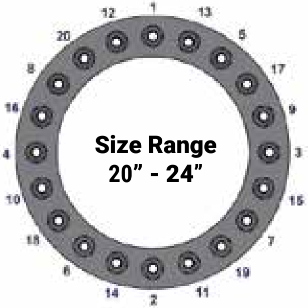

# Bolt Tightening Sequence For ANSI B16.5 150# Backing Rings



# TABLE For Criss-Cross Bolt Torque Pattern for Flanges Shown On Previous Page

| NUMBER OF BOLTS | CRISS-CROSS PATTERN TIGHTENING SEQUENCE |
|---|---|
| 4 (1" through 3½") | 1-2-3-4 |
| 8 (4" through 8") | 1-2-3-4 >> 5-6-7-8 |
| 12 (10" through 14") | 1-2-3-4 >> 5-6-7-8 >> 9-10-11-12 |
| 16 (16" through 18") | 1-2-3-4 >> 5-6-7-8 >> 9-10-11-12 >> 13-14-15-16 |
| 20 (20" through 24") | 1-2-3-4 >> 5-6-7-8 >> 9-10-11-12 >> 13-14-15-16 >> 17-18-19-20 |

## Torque Ratings for Niron Energizer Gaskets *(For torque ratings of other gaskets see Niron Flange document)*

| Flange Size | 1st Round (25% Torque) | | 2nd Round (50% Torque) | | 3rd Round (75% Torque) | | Final (100% Torque) | |
|---|---|---|---|---|---|---|---|---|
| | Minimum | Maximum | Minimum | Maximum | Minimum | Maximum | Minimum | Maximum |
| Inch | Ft-lbf | Ft-lbf | Ft-lbf | Ft-lbf | Ft-lbf | Ft-lbf | Ft-lbf | Ft-lbf |
| 1 | 2 | | 3 | | 5 | | 7 | |
| 1 1/4 | 2 | | 4 | | 6 | | 8 | |
| 1 1/2 | 2 | | 5 | | 7 | | 10 | |
| 2 | 4 | | 9 | | 13 | | 17 | |
| 2 1/2 | 6 | | 12 | | 18 | | 24 | |
| 3 | 6 | | 13 | | 19 | | 26 | |
| 3 1/2 | 5 | | 9 | | 14 | | 18 | |
| 4 | 4 | | 7 | | 11 | | 14 | |
| 6 | 9 | | 19 | | 28 | | 37 | |
| 8 | 13 | | 26 | | 39 | | 52 | |
| 10 | 12 | | 24 | | 36 | | 48 | |
| 12 | 16 | 18 | 32 | 35 | 48 | 53 | 64 | 70 |
| 14 | 23 | 25 | 46 | 51 | 69 | 76 | 93 | 102 |
| 16 | 20 | 22 | 41 | 45 | 61 | 67 | 81 | 89 |
| 16BV | 23 | 25 | 45 | 50 | 68 | 74 | 90 | 99 |
| 18 | 29 | 32 | 57 | 63 | 86 | 95 | 115 | 126 |
| 20 | 27 | 30 | 54 | 60 | 82 | 90 | 109 | 120 |
| 24 | 28 | 31 | 57 | 62 | 85 | 94 | 114 | 125 |

## Joining to Butterfly Valves

Niron flange adapters have been designed to work with standard butterfly valves. In sizes where the inside diameter of Niron is less than standard weight steel at the point of vane entry to the flange adapter, the flange adapters have been provided with an internal bevel that will allow the vane to open and close as long as the flange is installed squarely to the butterfly valve. The Nupi technical department maintains a CAD library of many valve models as to how they interface with Niron flange adapters. We encourage you to consult with Nupi's technical department prior to installing any butterfly valves to understand if there are any potential issues prior to installing a butterfly valve.

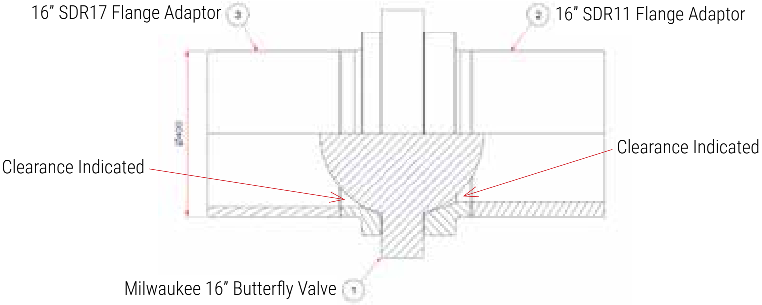
It is important when installing butterfly valves that as early in the project installation as possible, the fit of the flange adapter should be double checked by positioning the flange adapter over the fully opened vane of the valve and making sure it can fully contact the valve seat gasket. The flange adapter should not have to be forced over the vane or this could be problematic after installation, and would indicate that there could be an interference issue. There are some select sizes (e.g. 16", 18") where depending on the valve model, interference might exist, which can necessitate the use of a spacer and additional gasket to solve the issue.

When the Niron flange adapter and backing ring set is installed onto the valve, be sure to install the flange adapter with the valve in the open position. After installing the first flange adapter on one side, be sure to check that the

# Joining to Butterfly Valves

valve can be operated with opening and closing of the valve.

For additional details regarding installing Niron flange adapters and backing rings onto a butterfly valve, please refer to our Technical Note regarding flanges.



## Threaded Adapters

Nupi offers a variety of threaded transition fittings to connect with threaded components and dissimilar material systems. Parts with metallic threads consist of both lead free (<0.25% Pb) in accordance with the Safe Drinking Water Act (SDWA) and standard brass, as well as 316SS materials. These parts are insert molded into the PP-RCT material for a pressure tight seal. The nonmetallic threaded transition fittings are available with polypropylene throughout, included the threads, and are intended for cold water applications and chemical applications only.

The threaded parts are available in both female and male threaded configurations with threads that are NPT according to the ASME B1.20.1 standard. The threaded adapters are available with socket fusion outlets through 4", plain spigot outlets through 4", and also are available in Instabranch fittings (through 2" branch size) and Electrolet fittings (through 4" branch size) with threaded connections. All-polypropylene male and female threaded adapters are available for chemical applications.

- Use teflon tape and be sure that it is NSF listed for potable water. Avoid the use of pipe dope as this can lead to cracking of the brass.

- Do not tighten past one or two turns after hand tightening and never bottom out the threads.

*Long spigot male adapter with lead free brass, hex nuts and NPT threads.*

## Threaded Adapters

- Apply counter pressure to the fitting when tightening.
- Apply a crescent wrench to the hex head on threaded parts that have a hex head.
- For parts without a hex head,, use a strap wrench on the round PP-RCT body of the Niron fitting, or tighten by hand.
- Avoid over-tightening to the point where the metallic insert rotates. If this occurs, the part may leak and it will likely have to be replaced.

SF Female Adapter with Lead Free Brass and NPT Threads

SF Female Adapter with Lead Free Brass, Hex Nuts and NPT Threads

SF Female Adapter with SS and NPT Threads

SF Male Adapter with Lead Free Brass and NPT Threads

SF Male Adapter with Lead Free Brass, Hex Nuts and NPT Threads

SF Female Adapter with SS and NPT Threads

## Transition to Copper Pipe

Nupi offers copper stub out fittings where transitions to copper pipe are required. Typical situations where this is required include connections to toilet flush valves, urinals, shower valves, faucets and in situations where Niron is replacing old copper piping. The connection can be made either using copper sweat or by means of press fit type connections.

The copper portion of the stub out is manufactured on an OEM basis for Nupi by a third party manufacturer. The physical part of the transition utilizes a push-in fitting that Nupi manufactures and results in the transition to PP-RCT on the other side by means of a socket fusion connection. The copper part of the stub out is covered by a warranty of the stub out manufacturer and the remainder of the part, including the connection is covered under the Niron standard warranty. These transitions are available in three sizes, ½”, ¾” and 1” copper pipe diameters.

Copper Stub-Out fittings should be limited to maximum hot water temperatures of 160°F. Exposing the stub out to temperatures above this could damage the seal between the components. Temperatures that exceed 160°F for a potable water system typically do not exist in standard residential or commercial applications. Nonetheless, it is important to observe this limitation.

When soldering (making a sweat connection) on the copper stub out, the copper stub out must be covered with a wet rag to prevent heat transmission to the PP-RCT parts. Further, the interior of the stub out beyond the

## Transition to Copper Pipe

PP-RCT should be plugged to prevent the transmission of heated air which can also damage the parts. Where practicable, a press connection in lieu of a sweat connection should be used to facilitate the transition to the copper or brass components from the copper stub outs.

Niron to Copper Pipe Adapter
½" - 1"

Niron to Copper Pipe Adapter
1¼"

Niron Copper
Stub-Out

Niron Copper
Stub-Out Elbow

## Grooved Mechanical Connections

Where connections to equipment require grooved mechanical connections, Nupi offers a grooved mechanical transition fitting. The fittings are available with a swaged-on metallic sleeve that has a standard groove detail provided in the metallic sleeve. The metallic sleeve is also sized for standard IPS sizes so that standard type grooved mechanical couplings can be utilized. The connections are available in a variety of materials including brass, epoxy coated carbon steel and 304 and 316 grades of stainless steel.

Nupi does not recommend or endorse any grooved mechanical couplings which are designed to directly connect to the PP-RCT material, especially those which contain sharp teeth to facilitate the connection to the PP-RCT piping. Using this type of connection may be done solely at the risk of the contractor electing to use this type of connection. Alternatively, for situations where a grooved mechanical connection is required, Nupi recommends the use of its manufactured transition fittings together with a standard grooved mechanical couplings.

*Note that Nupi does not sell or provide the couplings to be used with this type of transition, and as such, the couplings and the connection are not covered by the Niron Warranty. The coupling and the connection are solely the responsibility of the manufacturer of the coupling and the installing contractor.*

## Grooved Mechanical Connections

Niron Grooved Mechanical Adapters with Grooved Brass Adapter

Niron Grooved Mechanical Adapters with Grooved Epoxy Coated Steel External Sleeve

** Note: Grooved mechanical adapters with grooved stainless steel external sleeve also available.*

## Reducing Bushings, Reducer Couplings, Concentric Reducers and Eccentric Reducers

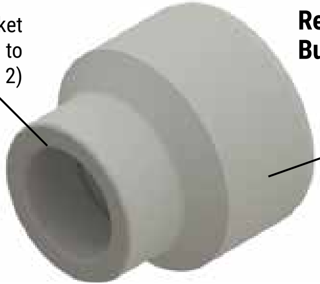
Nupi manufactures a wide array of reducer bushings in socket fusion for our Niron line. A bushing differs from a reducing coupling in that the larger diameter side is the same as a plain spigot of pipe of the same diameter. The smaller diameter side matches the socket fusion socket requirements for the smaller diameter, same as a reducing coupling. This type of reducing component can be used to transition any outlet of each type of socket fusion fitting (or coupling) into a reducing fitting (coupling).

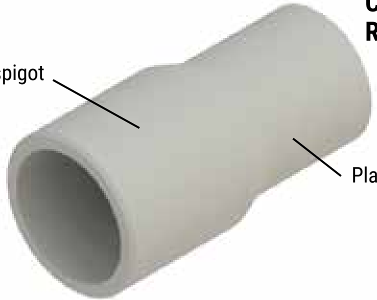
Nupi also manufactures socket fusion reducers (each side having of a socket fusion socket equal to the corresponding pipe size to which it is to be joined to). However, any bushing can be readily converted into a reducing coupling by means of joining a socket fusion coupling to the larger diameter side of the reducing bushing.

For situations involving butt fusion or electrofusion, Nupi manufactures a wide array of concentric reducers. In butt fusion, the reducer must match the SDRs of the pipe to which it is being fused and as such, there are concentric reducers available in every SDR. Nupi can also make custom eccentric reducers. Eccentric reducers are not a standard part of the Niron product offering, so each project where they are required are made to order.

*It should be noted that reductions can also be made by many other means including into the sidewall of a pipe by the use of Instabranches or Electolet fittings. In addition, Nupi offers a wide array of reducing tees and reducing wyes.*

# Reducing Bushings, Reducer Couplings, Concentric Reducers and Eccentric Reducers



## Unions

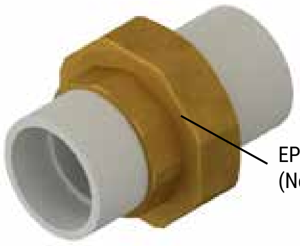
PP-RCT Unions are designed to interconnect two sections of PP-RCT pipe and to offer a break point into a piping system. Similar to a flange in this sense, a union is a common way to accomplish this in smaller diameters. Nupi makes both all-PP-RCT Unions for connections in colder temperature applications, as well as unions with brass nuts for higher temperature applications.

Unions contain an o-ring seal or gasket in the flat mating face of the union. The parts are tightened by means of heavy bulky threads by tightening the union nut. Unions should be supported in close proximity to the union to avoid leaking over time.

When joining the union, be certain to join the pipe into the socket fusion sockets as straight as possible. It is highly recommended to use a bench machine to facilitate this connection for this reason. Unions should be hand tightened and should not be overtightened. If the union nut is torqued excessively, this can lead to creep and eventual leaking at the union. A strap wrench can be used to tighten the union. However, do not tighten the union more than 1/8th of a turn beyond hand tight. Periodically check the union for tightness, especially after exposure to system temperature swings, and re-tighten as necessary.

## Unions


**All PP-RCT Union**
(For Cold Temp. Use)




**Union with Brass Nut**

## Insulation in Aboveground Systems

Nupi recommends the use of non-rigid insulation with its Niron piping systems. The most common type of insulation to be used is fiberglass insulation. Be sure to use insulation which is designed for metric piping, especially for cold water services, as otherwise insulation can contain air gaps which can lead to condensation and can damage the insulation over time. In applications involving return air plenums, be sure to use insulation which has been tested and listed for use with PP-RCT in plenum applications (i.e. the insulation should have an E-84 rating and have been tested for use together with PP-RCT materials). The following chart is the insulation thicknesses required for fiberglass insulation in applications where the ASHRAE 90.1 energy code is required.

| Minimum Insulation Thickness for Niron Clima PP-RCT Piping in Above Ground Installations (According to the ASHRAE 90.1 Energy Code) | | | | | | | |
|---|---|---|---|---|---|---|---|
| Fluid Operating Temperature Range (°F) | Insulation Conductivity | | Nominal Size of Niron Clima PP-RCT Pipe (inches) | | | | |
| | Conductivity BTU-in/h-ft²-°F | Mean Temperature Rating, °F | < 1 | 1 to < 1½ | 1½ to < 4 | 4 to < 8 | ≥ 8 |
| | | | Insulation Thickness, in | | | | |
| 0 | 0.27 to 0.30 | 150 | 2.5 | 2.5 | 2.5 | 3 | 3 |
| 141 to 200 | 0.25 to 0.29 | 125 | 1.5 | 1.5 | 2 | 2 | 2 |
| 105 to 140 | 0.22 to 0.28 | 100 | 1 | 1 | 1.5 | 1.5 | 1.5 |
| 60 to 105 | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. | N.A. |
| 40 to 60 | 0.21 to 0.27 | 75 | 0.5 | 0.5 | 1 | 1 | 1 |
| <40 | 0.20 to 0.26 | 50 | 0.5 | 1 | 1 | 1 | 1.5 |

Note: For aboveground indoor applications, Nupi recommends the use of metric-sized E-84 rated fiberglass insulation, such as that manufactured by Owens Corning. Insulation of this type has thermal conductivities within the range shown on this table.

## Preinsulated Piping – All-Pro™ Pipe and Fittings

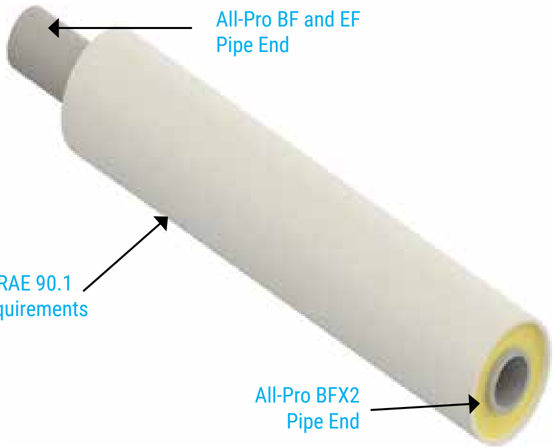
Nupi Americas offers a best-in-class preinsulated piping system, which is trademarked as All-Pro. All-Pro is an all-polypropylene system that consists of carrier components made of Niron Clima PP-RCT materials and which have an outer jacket of PPR. The jacket pipe is an IPS Schedule 40 pipe which has an outer layer consisting of a 30 year UV-resistant white outer PPR material. The system is ideally designed to be installed both aboveground and below ground.

In between the inner and outer layer is a highly efficient Polyurethane foam closed cellular insulation. Given the energy efficiency of the PP-RCT carrier pipe, as well as the PPR outer layer, the resulting system is a thoroughly energy efficient arrangement with exceptionally high R values. The R value in each respective size exceeds that of what is required per the ASHRAE 90.1 Energy Code (compared to steel with fiberglass insulation as required per the code).

All-Pro offers a variety of preinsulated fitting types, including both preinsulated electrofusion fittings (All-Pro EF and EFX2), as well as butt fusion (All-Pro BF and BFX2). The All-Pro BFX2 system allows the system to be simultaneously butt welded, resulting in a jacket connection which is completed at the same time as the carrier pipe and which is also a pressure rated connection. A completed All-Pro BFX2 system enables the system to be installed underground by the directional bore method in a fully pre-insulated condition.

# Preinsulated Piping – All-Pro™ Pipe and Fittings

Meets all ASHRAE 90.1
Energy Code Requirements




All-Pro is available as either All-Pro EF and EFX2 (electrofusion) or All-Pro BF and BFX2 (Butt Fusion). The part shown here is an All-Pro EF Preinsulated Coupling.

All-Pro Preinsulated Pipe is available with end configurations prepared for simultaneous Butt Fusion (BFX2) or for joining by All-Pro BF, EF and EFX2.

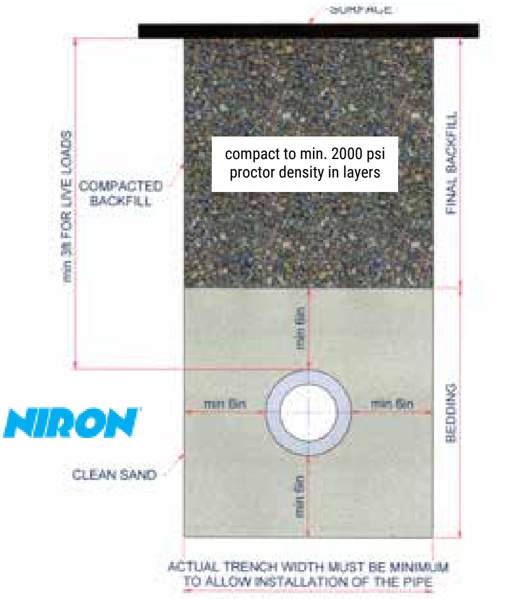
***For additional information regarding All-Pro, please refer to the All-Pro catalogue or consult with an authorized representative of Nupi Americas.***

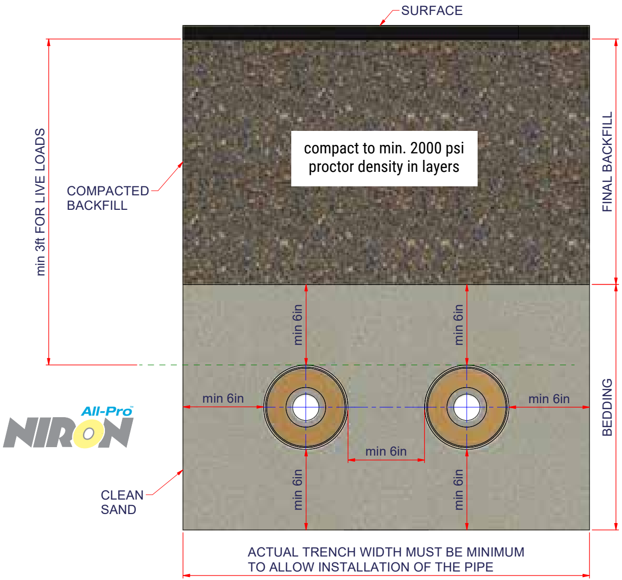
## Burial Considerations

Niron Clima PP-RCT piping systems and All-Pro Pre-insulated pipe systems are exceptional choices for direct buried applications. Unlike steel pipe, the materials in Niron and All-Pro are completely resistant to the effects of water and soil corrosion, so they are not affected in any way and do not require any external protection. Also, both Niron and All-Pro lack the ability to develop sufficient pushing strength to overcome well compacted soil. As a result, they do not require thrust blocking, nor expansion loops when installed underground. This means exceptionally large savings compared to using steel pipe when installing underground.

When burying Niron or All-Pro piping, there are two important steps to follow. The first is that an initial bedding of either sand or similar material (e.g. small smooth pebbles) should be used for at least 6 inches on all sides of the pipe. Secondly, a well-compacted good quality backfill should be placed over the pipe, which is compacted to a proctor density of at least 2,000 psi.

# Burial Considerations



## Directional Bore Considerations

Niron PP-RCT can be installed by the directional bore method. The maximum pulling force is shown in the following table. Be sure to either use a Niron pull-head or one that is made by an authorized manufacturer and which is approved by Nupi for the application. Note that All-Pro BFX2 systems can also be installed by directional bore. For information on maximum pull lengths, consult the Nupi Americas' Technical Note for further information.

| Size | SDR | Maximum Pull Force, FMax. (lbs.) | |
|---|---|---|---|
| | | Clima & Cool-Pro | All-Pro |
| 1/2" (25 mm) | 7.3 | 391 | |
| 3/4" (50 mm) | 7.3 | 1,565 | |
| 1" (32 mm) | 9 | 536 | |
| 1" (32 mm) | 7.3 | 641 | |
| 1 1/4" (40 mm) | 11 | 700 | |
| 1 1/2" (50 mm) | 7.3 | 1,565 | |
| 2" (63 mm) | 17 | 1,164 | 4,894 |
| 2" (63 mm) | 11 | 1,737 | 4,894 |
| 2" (63 mm) | 9 | 2,076 | 4,894 |

| Size | SDR | Maximum Pull Force, FMax. (lbs.) | |
|---|---|---|---|
| | | Clima & Cool-Pro | All-Pro |
| 2" (63 mm) | 7.3 | 2,485 | 4,894 |
| 2.5" (75mm) | 11 | 2,462 | 7,205 |
| 2.5" (75mm) | 9 | 2,942 | 7,205 |
| 2.5" (75mm) | 7.3 | 3,522 | 7,205 |
| 3" (90 mm) | 11 | 3,545 | 7,205 |
| 3" (90 mm) | 9 | 4,236 | 7,205 |
| 3" (90 mm) | 7.3 | 5,071 | 7,205 |
| 3.5" (110 mm) | 11 | 5,296 | 9,380 |
| 3.5" (110 mm) | 9 | 6,329 | 9,380 |
| 3.5" (110 mm) | 7.3 | 7,575 | 9,380 |
| 4" (125 mm) | 11 | 6,838 | 9,380 |
| 4" (125 mm) | 9 | 8,172 | 9,380 |
| 4" (125 mm) | 7.3 | 9,782 | 9,380 |
| 6" (160 mm) | 11 | 11,204 | 11,691 |
| 6" (160 mm) | 9 | 13,389 | 11,691 |

## Directional Bore Considerations

| Size | SDR | Maximum Pull Force, FMax. (lbs.) | |
|---|---|---|---|
| | | Clima & Cool-Pro | All-Pro |
| 6" (160 mm) | 7.3 | 16,027 | 11,691 |
| 8" (200 mm) | 17 | 11,727 | 13,866 |
| 8" (200 mm) | 11 | 17,506 | 13,866 |
| 8" (200 mm) | 9 | 20,921 | 13,866 |
| 8" (200 mm) | 7.3 | 25,042 | 13,866 |
| 10" (250 mm) | 17 | 18,324 | 15,225 |
| 10" (250 mm) | 11 | 27,353 | 15,225 |
| 10" (250 mm) | 9 | 32,689 | 15,225 |
| 10" (250 mm) | 7.3 | 39,128 | 15,225 |
| 12" (315 mm) | 17 | 29,091 | 17,400 |
| 12" (315 mm) | 11 | 43,426 | 17,400 |
| 12" (315 mm) | 9 | 51,896 | 17,400 |
| 12" (315 mm) | 7.3 | 62,119 | 17,400 |

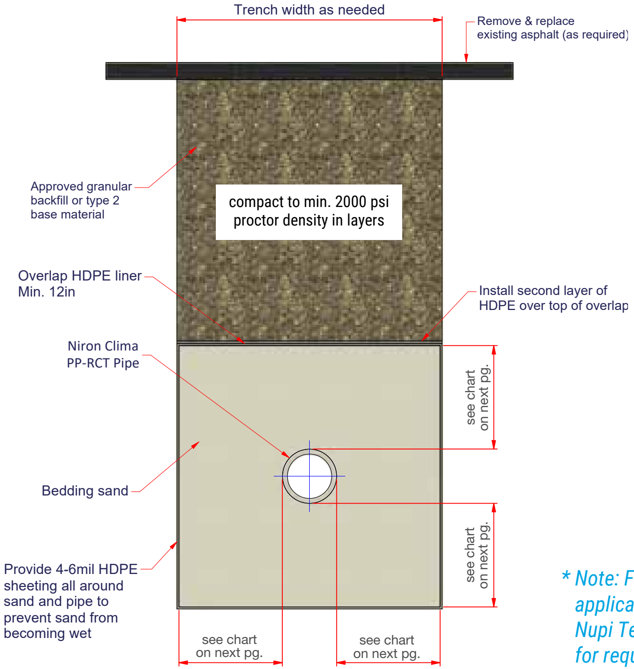
## Sand as Alternative Insulation for Buried Pipe

It is well known that sand is a relatively poor conductor of heat when it is in a dry state. As such, it can be a very cost-effective means of insulation for buried pipes when it is installed in a manner whereby the pipes can be kept in a dry condition both during and after the completion of the pipe installation.

Dry sand has a thermal conductivity which ranges between 0.15 to 0.27 W/(mK), depending on the particle size and the specific make-up of the sand particles. Fiberglass insulation by comparison has a thermal conductivity of approximately 0.03, which means that sand is approximately 5 to 10 times less effective as a means of insulation than comparative fiberglass insulation. Polyurethane foam (PUF), as available in Niron All-Pro Preinsulated Pipe is an even more effective means of insulation with a thermal conductivity as low as 0.023 W/mK. By comparison to the medium grade sand (with a lambda of 0.27 W/mK), PUF is approximately 10-12 times as effective in terms of insulating value.

Nonetheless, dry sand can be used as an insulating means. For every 1.0 inch of PUF foam insulation that would normally be required, an equivalent amount of 10 to 12 inches of dry sand can be placed around the pipe in all directions (Likewise for every 1 inch of fiberglass insulation that would be required, between 5 inches to 10 inches of dry sand would be required around the pipe in all directions). Given that normal bedding requirements for Niron PP-RCT and PPR pipes requires sand as an initial bedding, this means that there is not a significant addition to cost in terms of the sand itself. However, it is imperative that the sand be maintained in a dry condition.

To maintain the sand in a dry state, the use of an HDPE impermeable liner, such as the type of liner used in landfill construction, should be place around the trench and over the top of the sand that is added. The liner should be welded using an extrusion welder along the horizontal seams to completely seal the liner, or sealed by other means. It is suggested that sand be added in maximum 12 inch layers, and if more than one layer is needed, the liner should be overlapped with a new layer of liner and the seams extrusion welded.




** Note: For multiple pipe applications, consult Nupi Technical staff for requirements.*

## Sand as Alternative Insulation for Buried Pipe

| Amount of Sand Required to Meet IECC/ASHRAE Energy Code Requirements (minimum required inches of sand above, below and on both sides): | | | | | |
|---|---|---|---|---|---|
| Fluid Temp (°F) | Niron Nominal Pipe Diameter (inches) | | | | |
| | <1 | 1 to <1½ | 1½ to <4 | 4 to <8 | ≥8 |
| 105-140 | 10 | 10 | 15 | 15 | 15 |
| 141-200 | 15 | 15 | 20 | 20 | 20 |

*(Note: the above values are based on the most conservative equivalent, assuming the least efficient insulating value of dry sand, which results in a required thickness of 10x the corresponding requirement of thickness of typical fiberglass insulation).*

## UV Protection – CoolPro™ Pipe and Fittings

Nupi offers the industry's most advanced system for applications involving uninsulated pipes that are to be installed in direct exposure to UV light. Our CoolPro System involves Niron Clima pipe that is extruded with a 30 year, UV resistant PP, white outer layer. Simply put, this unique formulation allows the pipe to operate at the coolest possible temperature when exposed to direct UV than any other color. And lower temperatures for the pipe mean less heat gain for the fluid being conveyed, which translates to energy savings. However, it also means that the pipe will be subjected to less thermal expansion and will also have more safety factor with respect to its pressure capabilities.

CoolPro fittings are molded using 30 year UV-Resistant white PPR Resin

CoolPro pipe is extruded with an outer layer containing 30 year UV-Resistant white PPR material.

## Painting of Niron PP-RCT Piping

Painting Niron PP-RCT pipe requires a rigorous procedure to be followed. What makes Niron RCT exceptionally good with respect to withstanding chemicals also makes it difficult for paint to adhere to its surface. As such, the surface of the pipe must be thoroughly roughed up using a scotch brite pad.

Once this is complete, clean the surface using isopropyl alcohol and a clean wipe and allow to dry thoroughly. After the pipe has been scuffed, cleaned and allowed to dry, apply a light coat of a suitable plastics adhesion promoter to the roughened, clean surface of the pipe and allow the promoter to dry. Examples of suitable plastics adhesion promoters include products such as PPG SX1050/SXA 1050 and Valspar PR-2. Alternatively, plastic primers which contain a plastics adhesion promoter such as Rust-Oleum Plastic Primer and Krylon Plastics Primer. Allow the adhesion promoter/primer to dry thoroughly.

Now the pipe and fittings can be painted using a suitable plastics Paint such as manufactured by Rust-Oleum and Krylon. The first coat of the Paint that is applied should always be a light coat.

Additional coats of paint may be applied to achieve a more durable surface and also to achieve the desired appearance/color of the pipe. Note that even the most durable paints require maintenance over a number of years. As such, the surfaces may have to eventually be repainted.

## Flushing the System

PP-RCT is a thermoplastic piping system designed to provide a corrosion-free piping system for 50 years or more. As with any piping system, it is recommend to fully flush the system before putting it in service. Because PP-RCT is a thermoplastic material unlike traditional metallic systems it isn't necessary to flush with caustic or disinfectants when intended for use in a non-potable application.

Before putting the PP-RCT piping system in service it is recommend to flush the system to remove any loose particles and debris that may have accumulated during installation. To do so, the manufacture recommends the use of clean clear water. This should continue until no particles, debris or other solid contaminates are found in the water. Although it is our position that it is not necessary, PP-RCT may be sanitized if the local authorities having jurisdiction deems it necessary or if there is concern that the piping may have become contaminated in some way during the course of the installation. Common sanitizing disinfectants used to sanitize metallic systems will not harm PP-RCT materials for the short durations and low temperatures for which sanitizing usually occurs.

## Pressure Testing

NUPI Americas Warranty requires the installed NUPI Americas piping systems pass common testing methods, including the NUPI Americas Pressure Test which is detailed in this document or a Pressure Testing which specifically required by the authority having local jurisdiction. NUPI Americas Testing requires the passing of three tests, 1) Preliminary Pressure Test, 2) Principal Pressure Test, and 3) Final Pressure Test. Pressure testing is to occur immediately after the product's installation and before the product is put into service. Pressure test results shall be submitted to NUPI Americas directly after the completion of the facility's pressure test. As part of the pressure testing program NUPI Americas makes available "Liquid System Pressure Test Submittal Sheets", and "Bldg. Pressure Test Log" as a means of recording and presenting pressure testing results. In additions to submitting these sheets it may also be necessary to submit electronic pdf drawing showing pressure test sections which were tested. Electronic pressure test logs collected from electrofusion machines and similar data collection devices are to be provided with the pressure test forms when electronic pressure test records are available. Electronic fusion records from electrofusion machines, and butt fusion loggers shall also be provided when available. All electronic pressure test recording files and electronic fusion records are to be provided on flash drive storage with pressure test submittal sheets. Please contact NUPI Americas for questions and concerns regarding pressure testing NUPI Americas piping systems. Any exceptions to the NUPI Americas pressure testing procedures, pressure testing policy, and warranty must be provided in writing by NUPI Americas.

## Pressure Testing

During pressure testing the pressurized pipe zones will be evacuated, and only staff involved with the pressure testing the system will be allowed to be present in those areas. Pressure testing shall be conducted with the use of the appropriate PPE gear including, and not limiting safety glasses, gloves, hardhat, and steel toe boots. Under no circumstance shall the pump, or compressors be left operating and unmonitored during the pressure test. Pressures shall be monitored regularly during pressure testing NUPI Americas piping systems.

High Pressure Compressed Air/Gas is not allowed for pressure testing liquid systems. Compressed air/gas systems shall be pressure tested utilizing “NUPI Americas Pneumatic Leak Test For Compressed Air & Gas Systems”, a separate pressure testing document.

Low pressure compressed air leak testing can be conducted in these systems, however the maximum test pressure is 15 psi for all pipe SDRs.

Liquid system shall be tested with water or air over water (water-filled piping, with air as a pressure source and air separated from water). For systems with test pressures greater less than 150 psi, both liquid and air over water test media is allowed. If test pressures exceed 150 psig only liquid test media is allowed.

If using Niron Clima Pipe on the compressed air side of an air over water pressure test, the SDR of the pipe must be SDR 11 or lower, as SDR 17 pipe is not allowed in compressed air piping.

## Determining Test Pressure And Maximum Test Pressures

The “Test Pressure” used in pressure testing a system is dependent on Pipe SDR and the “Operating Pressure” of the system. Table 1 provides “Test Pressure” requirements for NUPI Americas pressure testing. The “Maximum Test Pressure” is the maximum allowable test pressure which a system can be tested to. “Maximum Test Pressures” are also shown in Table 1. Each pipe SDR has its own “Maximum Test Pressure”. Pressure testing pressures shall not exceed the “Maximum Test Pressure”.

For SDR 17 pipe, both the “Test Pressure”, and the “Maximum Test Pressure” is dependent on whether an instabranch was installed in the SDR 17 pipe, and the size of the pipe main in which the instabranch was installed in.

| Highest Pipe SDR Installed In the System | Operating Pressure | Test Pressure (For Liquid) | Maximum Test Pressure1 (Liquid) | Low Pressure Leak Test Maximum Test Pressure[2] Gas) |
|---|---|---|---|---|
| SDR 17 Pipe - With Instabranch Installed in SDR 17 Pipe 3 1/2" (110 mm) and Smaller | 85 psi or lower | 85 psi | 85 psi | 15 psi |
| SDR 17 Pipe - With No Instabranches Installed in Piping, or SDR 17 Pipe that have Instabranches installed in 4" (125 mm) and Larger Sizes | 65 psi or lower | 100 psi | 170 psi | 15 psi |
| | > 65 psi | 150% of Operating Pressure | | |
| SDR 11 | 100 psi or lower | 150 psi | 270 psi | 15 psi |
| | > 100 psi | 150% of Operating Pressure | | |
| SDR 9 | 100 psi or lower | 150 psi | 340 psi | 15 psi |
| | > 100 psi | 150% of Operating Pressure | | |
| SDR 7.3 | 100 psi or lower | 150 psi | 430 psi | 15 psi |
| | > 100 psi | 150% of Operating Pressure | | |

1) Maximum testing pressures allowed at lowest pipe in test section. Utilizing the lowest pipe in the testing zone is extremely important for testing high rises.
2) Low pressure compressed air may be used to detect leaks so that leak areas can be repaired before filling system with water for the required three step pressure test.

## Prior To Pressure Testing

Perform a visual inspection of all fusions to inspect for proper fusions. Proper socket fusion beads shall have 1) a double bead, with beads being uniform, and in contact with one another, or 2) a flat single bead which is pressed tight again the fitting when cold rings have been used. Pipe shall align with the socket fusion and electrofusion fitting. Spray out will not be present on the electrofusion fitting. Butt weld beads will be round, and bead heights consistent when compared pipe to pipe having the same size and SDR. During visual inspection verify all mechanical connections have been installed properly. Check and verify low pressure rated plumbing fixtures are isolated from the pressure test. Remove all fusion equipment from the system before starting the test.

## Pressure Testing Setup For Water And Air Over Water Testing

Install a pressure gauge at the lowest pipe in the test section and conduct the pressure testing with this gauge. The test gauge shall be calibrated to accuracy of 0.5 psi. Pressure relief valves shall be located at the lowest pipe as well. Pressure relief settings set to a relief pressure equal to or less than Table 1's "Maximum Test Pressure", and at least 5 psi above "Test Pressure". Open the highest point in the system to allow air to pass up through the pipe as the pipe fills with water. Drain valves shall be provided at the lowest pipe in the system to drain the system as necessary. Fill out the "Pressure Test Submittal Sheet", clearly indicating piping which is being pressure tested. In some cases, it may be necessary to provide electronic pdf drawing to clearly display the pipe which is pressure tested. Provide a test number for the pressure test in the "Pressure Test Submittal Sheet" if more than one pressure test is to be completed at a facility. When more than one pressure test is conducted at facility fill out the "Bldg. Pressure Test Log" directly after performing pressure tests on the varies pipe sections.

## Pressure Testing

NUPI Americas pressure test method a is three-step pressure test where each test section receives three tests.

***Step One - Preliminary Pressure Test shown in Figure 1,***
***Step Two - Principal Pressure Test shown in Figure 2, and***
***Step Three -Final Pressure Test shown in Figure 3.***

All three tests use the test pressure determined in Table 1. The Low Pressure Compressed Air Leak Test shown below is optional test method, it is not required, but is recommended.

### Low Pressure Compressed Air Leak Test

A non-required leak test called the "Low Pressure Compressed Air Leak Test", can be used to find leaks within the system prior to utilizing the required three-step pressure test. In this test method low pressure compressed air is used to pressurize the pipe to a pressure no higher than 15 psig while a leak finder solution is applied to areas of the piping system. The compressed air will cause the leak finder solution to bubble when a leak is present. This is an optional method which can be used to save time in the pressure testing process as leaks can be addressed before the system is filled with water, thus possibly saving on system drain time if repairs are required.

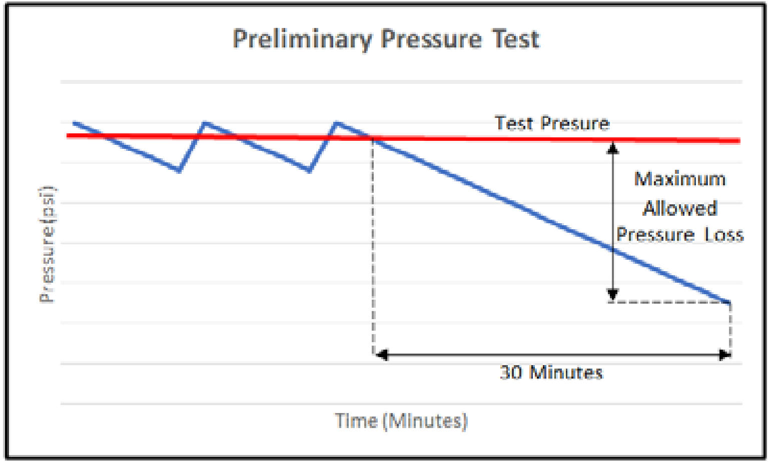
## Pressure Testing

### Method for the Low Pressure Compressed Air Leak Test

1) Pressurize the system to a pressure no higher than 15 psig.
2) Isolate system with shutoff valve.
3) Monitor pressure in the system. If system pressure drops to 0 psig there is leak or an open connection.
4) Check system for open connections.
5) Repressurize system to 15 psig and utilize a leak finder solution to inspect threaded and bolted mechanical connections, as well as valve stems. Bubbling should appear in leak areas with the leak finder solution. Tighten and repair observed mechanical connections where leaks are observed.
6) Repressurize the system to 15 psig
7) Isolate the system with a shutoff valve.
8) Monitor pressure in the system. If system pressure drops to 0 psig, this is an indication that there is a leak in the system.
9) Repressurize the system and utilize the leak finder solution to check for leaks at joints, or areas where pipe may have been damaged. Depressurize system and repair leak areas.
10) After completing this test proceed to the required three-step pressure testing method.

## Step One - Preliminary Pressure Test

1) Bring pressure in the test section up to a pressure just above test pressure, and isolate system. It is common for pressure to expand the pipe and cause pressure within the system to drop.
2) Once system drops below test pressure bring the pressure back up to just above the test pressure, and again isolate the system, allowing pipe expansion to drop the pressure.
3) Bring pressure up to a pressure just above test pressure, allow pressure to drop to test pressure, start stopwatch once pressure reaches test pressure. Allow 30 minutes to pass before reading the final pressure.
4) If pressure drop in Step 3 is greater than the “Maximum Allowed Pressure Loss” in Figure 1, then the system fails test.
5) Throughout Steps 1 through 4, look for leaks. If a leak is observed, drain the system if necessary to make the repair, repair leak area, and restart at Step 1 after repairing leaks.
6) If system had no pressure loss in Step 3, or has a pressure loss less than the “Maximum Allowed Pressure Loss” shown in Figure 1, then the system passes the test, and is ready for testing with the Principal Pressure Test.



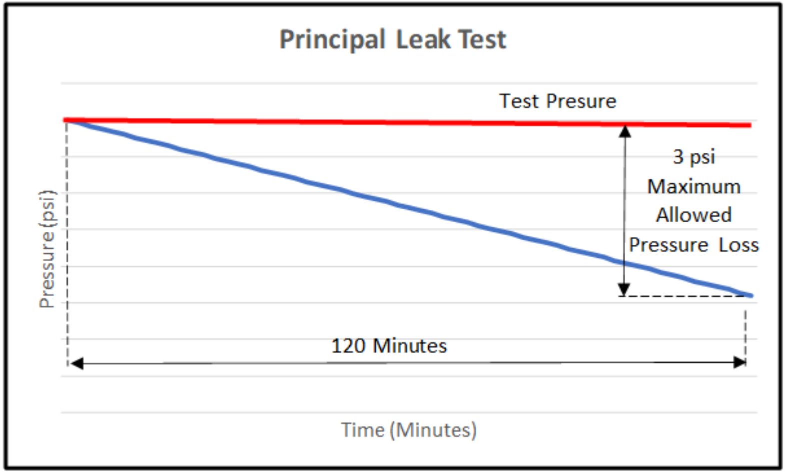

Maximum Allowed Pressure Loss

9 psi for SDR 7.3, SDR 9, & SDR11

6 psi for SDR17

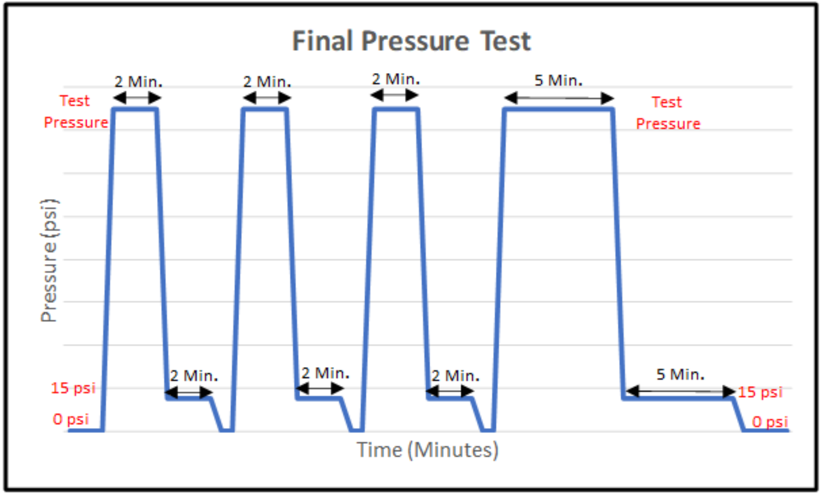
## Step Two - Principal Pressure Test

1) After passing the Preliminary Pressure Test, bring system back up to “Test Pressure”, and isolate system. Observe pressure after 120 minutes, and check system for leaks.
2) If pressure drop after 120 minutes is greater than 3 psi the system fails the pressure test and a leak is present. Repair leak and start over with the Preliminary Pressure Test.
3) If the system passes the Principal Pressure Test proceed to the Final Pressure Test.


Principal Leak Test
Test Presure
3 psi
Maximum
Allowed
Pressure Loss
120 Minutes
Pressure (psi)
Time (Minutes)

## Step Three - Final Pressure Test

1) Release the pressure from the system, but do not drain the system.
2) Bring system up to test pressure for 2 minutes. Reduce the system pressure to 15 psi for 2 minutes.
3) Release pressure from the system, but do not drain the system.
4) Again, bring system up to test pressure for 2 minutes. Reduce the system pressure to 15 psi for 2 minutes.
5) Release pressure from the system, but do not drain the system.
6) Again, bring system up to test pressure for 2 minutes. Reduce the system pressure to 15 psi for 2 minutes.
7) Inspect system for leaks during Steps 2 through 7. Test pressures should not deviate during the 2-minute test intervals. If leaks are observed repair leaks and start pressure test over starting with the Preliminary Pressure Test.
8) Bring system up to test pressure, isolate and hold pressure for 5 minutes. Reduce the system pressure to 15 psi, isolate and hold pressure for 5 minutes.
9) If no leaks are observed and the test pressures do not deviate during the 5-minute test intervals the system passes the Final Pressure Test. Complete the pressure test submittal sheet and return them to NUPI Americas, along with pertinent electronic pdf drawings which show pipe sections tested.


Final Pressure Test
2 Min.
2 Min.
2 Min.
5 Min.
Test
Pressure
Test
Pressure
Pressure (psi)
2 Min.
2 Min.
2 Min.
5 Min.
15 psi
15 psi
0 psi
0 psi
Time (Minutes)

## Pneumatic Pressure Test Maximum Pressure Requirements for Compressed Air Piping

| Niron Pipe | For Use In Compressed Air/ Gas Systems | Operating Temperature | Max. Allowable Operating Pressure of Pipe | Operating Temperature | Max. Allowable Operating Pressure of Pipe | Operating Temperature | Max. Allowable Operating Pressure of Pipe |
|---|---|---|---|---|---|---|---|
| Cool Pro SDR 17 | No | | | | | | |
| Cool Pro SDR 11 | Yes | 73°F | 245 psi | 120°F | 170 psi | 180°F | 100 psi |
| Cool Pro SDR 9 | Yes | | 309 psi | | 215 psi | | 120 psi |
| Cool Pro SDR 7.3 | Yes | | 388 psi | | 270 psi | | 150 psi |
| Flextite | Yes | | 300 psi | | 300 psi | | 300 psi |

**For complete details involving pneumatic testing refer to the Nupi Americas published Technical Note.**

# NOTES

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NUPI AMERICAS
314 Commerce Parkway
Early Branch, SC 29916
Tel. 803-398-3579
Fax 803-398-3639
www.nupiamericas.com

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